



Town of Markham

SALT

MANAGEMENT

PLAN



NOTICE:

This Plan is modeled on a Salt Management Plan Template developed by Ecoplans Limited and has been prepared for the sole use of the Town of Markham. It may not be adapted for use by anyone else without the prior written approval of Ecoplans Limited.



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Town of Markham

MEMORANDUM

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| To | |
| From | |

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|------------|
| Our file: |
| Your file: |
| Date: |
| |

Subject: SALT MANAGEMENT PLAN

Attached is your copy of the Town of Markham’s Salt Management Plan for use by staff responsible for roadway and asset maintenance. All staff is responsible for ensuring that effective salt management practices, guidelines and procedures are followed and that services are provided in accordance with the policies outlined in this Plan.

This will ensure the effective winter maintenance for the safety of all roadway users in the Town of Markham while striving to minimize the amount of salt entering the environment.

Peter Loukes
 Director of Operations & Asset Management

Commitment to Salt Management Plan

The undersigned are committed to maintaining and implementing the Town of Markham's Salt Management Plan contained in the document.

SIGNATURE:

DATE:

Director of Operations & Asset Management

General Manager of Operations

Manager, Roads Maintenance

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APPENDICES

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INTRODUCTION

1.0 INTRODUCTION

1.1 Overview

The Town of Markham has about 790 kilometers of roads within the framework of a classification system, which provide for the safe, efficient and affordable means of surface transportation for road users. People rely on our roadway network throughout the year for transport to the workplace, to recreation and leisure facilities, for the transport of goods and services, and for emergency and security services.

Snow and ice conditions on the road system have a dramatic impact on public safety, roadway capacity, travel time and economic costs. User safety remains the most important priority within winter maintenance operations, practices and strategies contained in this Salt Management Plan.

Although there is ongoing research into the use of alternatives to road salt in winter maintenance, salt continues to be a cost-effective de-icer. However, because of the adverse effects that salt has on the environment, the Salt Management Plan strives to minimize the amount of salt entering the environment by including best salt management practices, and using new technologies to ensure its most effective use over the road system. At the same time, the Town will continue to search out and use viable and cost-effective new technologies and chemicals to reduce the environmental impacts of winter maintenance activities.

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, lake and stream ecosystems and groundwater. Based on the assessment, Environment Canada is considering declaring road salt to be “toxic” under the Canadian Environment Protection Act (CEPA). The “toxic” designation only means that it is harmful to the environment if used in excessive amounts. Environment Canada has stated that they will not ban road salts, but rather will encourage users to develop their own salt management strategy. ***It must be noted that Health Canada stated that road salts are not harmful to humans.***

Health Canada stated that road salts are not harmful to human health.

Environment Canada has released a “Code of Practice for the Environmental Management of Road Salts”. Road salt users, that meet the minimum requirements of the Code of Practice, have to prepare a Salt Management Plan to better manage their road salt use and report their progress.

The Town of Markham has developed this Salt Management Plan in accordance with Environment Canada’s Code of Practice for the Environmental Management of Road Salts. This will address growing concerns about the effect road salt is having on our natural environment and at the same time continue to provide for road safety by better managing our use of salt.

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1.2 Purpose of the Plan

This Plan is intended to set out a policy and procedural framework for ensuring that the Town of Markham continuously improves the management of road salt used in its winter maintenance operations. The Plan demonstrates the Town's commitment to reducing the environmental effects of excessive salt use, consistent with Environment Canada's stated objectives.

Any modifications to winter maintenance activities must be carried out in a way that provides roadway safety and user mobility consistent with the weather conditions experienced during the snow and ice control season.

This Plan is dynamic – allowing the Town of Markham to phase in new approaches and technologies in a way that is responsive to fiscal demands and the needs to ensure that roadway safety is not compromised.

1.3 Legislative Authority

The policies presented in this Plan are consistent with fulfilling the Town's obligations under provincial and federal legislation.

1.4 Mission, Vision and Goals Statements

The Town's Mission

Working with the community to provide high quality municipal services that meet, if not exceed, the expectations of Town residents and businesses.

The Town's Vision

Markham...the leading Canadian municipality – embracing technological innovation, celebrating diversity, characterized by vibrant and healthy communities – preserving the past, building for the future.

The Town's Goals

Environmental Focus – Fiscal Stewardship – Infrastructure Management – Managed Growth – Quality Community – Economic Development – Organizational Excellence.

1.5 Format of the Plan

Chapter 2.0 of this Plan presents the Policy Direction approved by the Town Council.

Chapter 3.0 of this Plan presents the Winter Maintenance Policies that are relevant to salt management.

Chapter 4.0 of this Plan presents the summaries of Operational Practices and Strategies for Snow and Ice Control as they relate to the effective management of road salt. This chapter is presented as a series of sub-section that can be modified as new policies, procedures and practices are introduced and refined.

Chapter 5.0 of this Plan presents the approach to monitoring the implementation of the Plan and to maintaining and updating the Plan.

1.6 Responsibilities

Director of Operations & Asset Management – Has corporate responsibility for the Town’s Salt Management Plan.

General Manager of Operations – Responsible for ensuring that the Salt Management Plan is developed, maintained, and implemented consistently across the Town.

Manager, Roads Maintenance – Responsible for developing and maintaining the Salt Management Plan and ensuring that it is implemented consistently across the Town.

Fleet Supervisor – Responsible for purchasing, maintaining the winter maintenance fleet in compliance with the Salt Management Plan.

Manager, Asset Management – Responsible for overseeing the maintenance and upgrading of the winter maintenance facilities in compliance with the Salt Management Plan.

Manager, Environmental Leadership – Responsible for monitoring the change in environmental impacts associated with the Salt Management Plan.

Roads Supervisor/Patroller – Responsible for ensuring that winter maintenance activities are carried out in compliance with the Salt Management Plan. Responsible for calibrating the winter maintenance fleet in compliance with the Salt Management Plan.

Winter Maintenance Personnel – Responsible for ensuring that they carry out their winter maintenance duties in accordance with the policies and procedures set out in the Salt Management Plan as directed by their manager.

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POLICY

2.0 POLICY CONTEXT

2.1 Environmental Focus

One of Markham's Corporate Goals is 'Environmental Focus': to protect, enhance and restore Markham's natural features and green spaces as part of a vital and healthy ecosystem.

Markham is committed to preserving environmental and historic areas. Markham plans and creates policies to support this leadership role.

2.2 The Town of Markham’s Operations Department Statement

We are dedicated to achieving the highest quality standards in the maintenance of our road, bridge, sidewalk and drainage infrastructure. We continually improve training and embrace new technologies, while remaining fiscally and environmentally responsible and caring of our customers.

- To provide, within available resources, for the safe, efficient and convenient movement of people and goods across the Town on the local road and sidewalk network.
- To provide effective winter control.
- To provide environmental protection of right-of-ways, watercourses, valleys, and overland flow routes and stormwater management facilities.
- To protect and maintain the Town's natural and artificial drainage system and related infrastructure (storm sewer system, SWM routes, etc.)

2.3 Salt Management Policy

Within the Town of Markham’s overall policy context, the following is the Town’s policy on the use and management of road salt.

- To comply with all applicable federal and provincial legislation regarding the storage and use of snow and ice control products.
- To use road salt in an environmentally responsible manner, and minimize the negative environmental effects of handling, storage and application of salt on the environment.
- In providing the stated Level of Service, the Town of Markham will conserve the use of salt by utilizing cost-effective technologies and practices.

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2.3.1 Salt Management Principles

1. Road safety is a top priority for the Town of Markham.
2. The use of road salt is essential to maintaining roadway safety during the snow and ice control season.
3. The Town of Markham will strive to reduce the amount of salt released to the environment through effective salt management practices.
4. The Town of Markham will show leadership locally, provincially and nationally in the area of road salt management by leading by example and sharing their knowledge and experiences with others.
5. This Salt Management Plan will be updated regularly.
6. The Town of Markham will provide the necessary training and encouragement to its winter maintenance personnel to allow them to be fully contributing partners in achieving an environmentally sound and safe winter maintenance program.
7. Performance will be measured and reported through appropriate public reporting vehicles.

2.3.2 Implementation Guidelines

This Salt Management Plan was developed in accordance with the following policy directions:

General:

- Salt Management Plans will embrace the concepts set out in the Salt Management Guide (TAC, 1999) and Syntheses of Best Practices (TAC, 2003) prepared by the Transportation Association of Canada and subsequent revisions, and Codes of Practice issued by Environment Canada.

On-roadway Use:

- The Town of Markham will operate in accordance with clearly stated and documented level of service policies that promote safety and efficient salt use;
- The Town of Markham will give a priority to salt vulnerable areas when implementing strategies for reducing salt impacts;
- The Town of Markham will apply salt at rates that are consistent with best salt management practices; and
- The Town of Markham will improve the efficiency of salt usage through better use of technology and application equipment.

Sand and Salt Storage:

- The Town of Markham will review current storage practices for salt and sand/salt blends and develop and implement strategies for cleaning up existing sites and minimizing salt loss to the environment from future operations;

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Snow Storage & Disposal:

- The Town of Markham will carry out environmental reviews of snow storage areas to improve site selection and management of practices that impact the environment, including site drainage; and
- The Town of Markham will manage its snow disposal sites in a way that minimizes impacts to the environment.

Training:

- The Town of Markham will implement effective employee training and awareness for supervisors and operators.

Decision-Support:

- The Town of Markham will improve snow and ice control decision-making by increasing staff focus on pavement temperatures; and
- The Town of Markham will improve its ability to monitor and interpret weather forecasts.

Record Keeping:

- The Town of Markham will improve record keeping to enable better tracking of salt use and salt-related impacts; and
- The Town of Markham will develop salt management performance criteria and related monitoring program. These will be integrated into any national salt management reporting program developed by Environment Canada.

2.4 Application

This policy was adopted by Town Council on February 28, 2005 and applies to all employees and contractors involved in Winter Maintenance Operations for the Town.

2.5 Implementation

This Salt Management Plan is activity based and follows an Environmental Management System framework. It includes the following elements:

- Periodic review and analysis of industry practices
- Implementation and documentation of the Plan
- Education and training of staff
- Monitoring and analysis of operations
- Management review and revisions
- Environmental review
- Policy and practices revision

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The implementation and improvement of this Salt Management Plan will promote the continuous development of practices and procedures to improve winter maintenance activities and procedures while striving to reduce the effects of road salt on our environment. The Plan is a dynamic document. It will be reviewed and refined on an on-going basis and embraced at all levels of the organization. All personnel are responsible for ensuring that this Plan is implemented, monitored, improved and updated.

Managers are encouraged to negotiate adoption of the policies and procedures in this Plan by other parties involved in snow and ice control activities including:

- private operators; and
- general contractors.

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***WINTER
MAINTENANCE
STANDARDS***

3.0 WINTER MAINTENANCE STANDARDS

3.1 Introduction

This chapter documents the Town’s snow and ice control standards.

The major activities related to winter maintenance are:

- salt and sand storage;
- salt spreading;
- sand spreading;
- snow plowing; and
- snow removal and disposal.

3.2 Level of Service Policy

For the purposes of road patrolling, snow plowing, sanding, ice control and snow removal the Town roads have been classified into six classes based on primary use and traffic volumes.

The Town’s Level of Service (LOS) is documented in Schedule “A” of the Winter Control Program for Street Operations (dated 1995). The LOS has been reviewed to ensure the Town continues to provide a level of service that exceeds O.Reg. 239/02 - Minimum Maintenance Standards for Municipal Highways (MMSMH). Appendix A contains the most recent copy of the “Schedule A” and will be updated each time the document is reviewed and reaffirmed.

The level of service in “Schedule A” is designed to meet the needs of the community from the perspective of driver and pedestrian safety and the provision of emergency service. The LOS policy is driven by both the technical requirements of winter operations and the need to address the socio-economic concerns of an urban municipality.

3.3 Material Application Rates

3.3.1 Salt

The Town currently spreads salt at rates similar to the MTO application rate tables. Table B.1 in Appendix B presents a summary of the Town’s current application rates for dry salt for various conditions requiring snow or ice control that occur within the Town. As application rates are refined and the use of pre-wetting¹ and anti-icing² technology increases additional rates will be added to the table.

^{1/} Pre-wetting is the application of a liquid to a solid material just prior to application to the road surface. Applying a liquid to the solid material helps the solid material “stick” to the road surface and not bounce away onto the shoulder. Liquid applied to a solid chemical also begins the process of brine formation and allows the chemical to act quicker.

^{2/} Anti-icing is a proactive snow and ice control strategy whereby straight brine is sprayed directly on the road in advance of a storm. The term can also refer to early application of chemical in any form early in a storm to prevent the formation of the snow/road bond.

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Operators have the flexibility to adjust the settings to accommodate specific conditions. For example, applications rates may be reduced for black ice and frost conditions and increased on steep grades.

3.3.2 Abrasives

A mixture of sand and road salt to prevent freezing of the sand (blended sand) is used as an abrasive to improve traction and provide some ice and snow control on Town roads. Sand is purchased, delivered and mixed with road salt at the yard by a contractor. Road salt is currently blended with sand at a rate of approximately 5% by volume. Blended sand is applied at ratios ranging from 5% to 75% salt to sand.

The Town of Markham currently spreads abrasives at rates similar to the MTO application rate tables. Table B.2 in Appendix B presents a summary of the current application rates for abrasives for various conditions requiring snow or ice control that occur within the Town. As application rates are refined and the use of pre-wetting and anti-icing technology increases additional rates will be added to the table.

Because of the variety of conditions that can be encountered, within this Plan, Road Supervisors are allowed full control regarding frequency and timing of applications.

3.3.3 Liquids

The Town of Markham has not introduced the use of liquids for pre-wetting or anti-icing. As liquids are introduced and liquid application rates set, they will be summarized in Table B.3 in Appendix B.

3.4 Snow Removal, Storage and Disposal

As a result of snow plowing operations, snow accumulates at the side of roads as windrows. In most cases this is not a concern. However in some locations where snow storage is a problem, the accumulated snow must be removed. Snow removal operations are started when windrows reach volumes that create a nuisance or hazard to pedestrians and motorists, or to maintain capacity for subsequent snowfalls. Snow disposal must be handled properly to ensure that the operations do not cause adverse effects to the environment.

The Town loads, hauls and disposes of approximately 3600 tonnes of snow each season. Snow is hauled to and disposed of at two Town controlled sites using a mix of Town and contractor equipment.

One site is adjacent to an old gravel production area and has an asphalt pad. It is used as a material de-watering area in the summer. Drainage from the site is somewhat directed toward a catch basin the outlet of which is overland to ditches or a scrub brush area near by.

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The other newer site is the closed north end of Eleventh Concession (by the 407) approximately 100 m x 15 m in area. The road has a gravel cross-section with open ditches on both sides. The area is very level with limited runoff. There is agricultural land to the south and west, Highway 407 right of way north and vacant land to the east.

The Town does not have Snow Removal and Disposal Guidelines.

3.5 Sidewalk and Parking Lot Snow Clearing

The Town does clear snow from all sidewalks along Town and Regional roads, pedestrian crossings and around bus shelters. They are plowed and blended sand (at 5%) is applied. The Town coordinates with a contractor for the clearing of plowed snow windrows for approved seniors.

Both the Roads and Parks Departments have responsibilities for parking lots and read lanes. The Parks Department handles the plowing of Town Facility Parking Lots. A 75% salt/25% sand mix is applied. Parks has been trying “Artic Blast”, supplied by Kissner Salts & Chemicals, at the entrances to some facilities. Approximately 5,600 kg was used last season.

The Roads Department handles the Municipal Parking Lots and rear lanes. Parking Lots and rear lanes are plowed and straight salt is applied for snow and ice control. On occasion a 75% salt/25% sand blend is used.

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***OPERATIONAL
PRACTICES &
STRATEGIES***

4.0 OPERATIONAL PRACTICES AND STRATEGIES

4.1 Overview

This chapter of the Plan presents a discussion of each of the key operational practices and strategies related to the effective management of road salt during winter maintenance activities.

Each subsection has a summary that presents a discussion of the objectives, environmental considerations, current situation, framework goals, responsibilities, performance measures and references (documents or tables). Table 4.1.1 explains the intent of each category.

It is important to recognize that the Plan is dynamic and will take time to implement. Therefore, the purpose of this section is to establish the goals of the Plan and a strategy for achieving these goals.

In the Responsibilities sections references to the “Director” means the “Director of Operations & Asset Management”

TABLE 4.1.1

| SUBJECT | |
|--------------------------------------|--|
| OBJECTIVE | This section states the salt management objective that is to be achieved. |
| ENVIRONMENTAL CONSIDERATION | It is important that people understand the rationale behind the need to make changes. This section identifies briefly the environmental considerations that make it important to address the subject area. |
| CURRENT SITUATION | This section identifies the status of the subject area at the time of initial implementation of the Plan or following any update of the Plan. |
| GOALS | The Plan must have clearly stated goals and timetables. This section states the goals and timetable for each subject area. |
| IMPLEMENTATION CONSIDERATIONS | Explanation of reasoning behind the goals and timetable factoring in resource issues. Also consider opportunities such as partnerships. |
| RESPONSIBILITIES | The Plan must have people assigned the responsibility to implement the elements of the Plan. This section assigns those responsibilities for each goal. |
| PERFORMANCE MEASURE | It is important to monitor and measure the progress of implementing each element of the salt management Plan. This section will establish the criteria for measuring performance. There should be a performance criterion for each goal. |
| REFERENCES | This section identifies any reference documents or tables related to this element of the Plan or that provide more detailed direction regarding implementation of the salt management strategy. |

4.2 Management Practices

4.2.1 Level of Service

| LEVEL OF SERVICE | |
|--------------------------------------|---|
| OBJECTIVE | <p>To ensure that the Level of Service (LOS) policy is reviewed and that any revisions are approved by senior management and communicated to winter maintenance personnel. The LOS policy must be clear, functional and understandable to operations personnel and the layperson (e.g. public and politicians). It should make it clear what is to be achieved and what will not be achieved (e.g. there may not be continuous bare pavement conditions throughout a storm).</p> <p>Typically the LOS policy will explain the intended:</p> <ul style="list-style-type: none"> ▪ Initial response time; ▪ Cycle frequency; and ▪ End of storm condition. |
| ENVIRONMENTAL CONSIDERATION | <p>The prescribed level of service is the foundation for the winter maintenance program and has a significant impact on salt used to achieve the standard. It is also very important in being able to demonstrate due diligence in the event of a claim against the road authority.</p> |
| CURRENT SITUATION | <ul style="list-style-type: none"> • Each road in the Town network has been assigned to one of five classes of road (Arterial, Primary, Secondary, Local & Laneways). • The Towns “Level of Service” is documented in Schedule “A” of the Winter Control Program for Street Operations (date 1995). A copy is attached as Appendix A. |
| GOAL | <ul style="list-style-type: none"> • Review the LOS policy in light of other similar road authorities and the minimum maintenance standards (O.Reg. 239/02 - Minimum Maintenance Standards for Municipal Highways (MMSMH)). • Consider the potential impacts of introducing new technologies. • Revise the LOS policy if required. • Obtain management and Council endorsement of the revised LOS Policy. • Implement the revised policy. • Review routes after changing LOS policy. • Inform staff, management and the public on the intentions and expectations in service delivery. • Monitor and report on compliance with the LOS policy annually. |
| IMPLEMENTATION CONSIDERATIONS | <p>Changes in LOS expectations will impact the cost of service. For example, if you increase the cycle time, you may decrease the equipment needs, which reduces cost.</p> |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for leading the development and approval of the LOS policy.</p> <p>Manager, Roads Maintenance - Responsible for ensuring compliance with the LOS policy.</p> <p>Winter Maintenance Personnel - Responsible for complying with the LOS policy.</p> |

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| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Completion of a revised LOS policy. • Presence of a written LOS policy that has been endorsed by Council and senior staff. • Compliance with the LOS policy throughout the organization. |
| REFERENCE | Refer to LOS and Application Rate Policies. |

4.3 Equipment

Good salt management is dependent upon having equipment that permits operators to place:

- the **right material**;
- at the **right time**;
- at the **right amount**;
- in the **right place**; and
- **keep it there** long enough to do the job.

Proper equipment is also important for tracking salt usage and being able to measure progress in reducing excessive salt use.

Effective annual calibration along with ongoing monitoring and recalibration are important equipment maintenance practices.

Technologies such as ground-speed oriented electronic controllers with data loggers and variable spreader settings can improve salt use. Techniques such as pre-wetting and anti-icing are also proven methods for reducing salt use.

Spreaders need to be washed to prevent corrosion. However, improper management of washwater can lead to environmental impacts.

The following action plans relate to fleet allocation, upgrading and maintenance.

4.3.1 Fleet Allocation/Optimization

| Fleet Allocation/Optimization | |
|--------------------------------------|--|
| OBJECTIVE | To optimize the use of spreaders and plows by efficient routing in accordance with the LOS expectations. |
| ENVIRONMENTAL CONSIDERATION | Duplication of service due to inefficient routes leads to redundant salt use and premature plowing of previously salted roads. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • No computerized winter maintenance route optimization has been done for the Town. • Staff has manually reviewed routes and the equipment has been placed on the most appropriate routes. • The plowing of Town facility and Municipal parking lots is split between the Parks department and the Roads Department. |

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| GOAL | <ul style="list-style-type: none"> As new technologies are implemented, additional roads are built or LOS is changed, affected spreader and plow routes will be reviewed. Assess the need for computerized route optimization. Assess the need for improved coordination in the delivery of snow and ice control at Municipal and facility parking lots. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> The timing of implementing route optimization is contingent upon the availability of equipment. There will be costs associated with acquiring new equipment. There will be facility implications. The Town will reassign Winter Maintenance Personnel including contractors as required. There is an ongoing need for route refinements. |
| RESPONSIBILITIES | <p>General Manager of Operations – Responsible for assessing the need for improved coordination in the delivery of snow and ice control at parking lots.</p> <p>Manager, Roads Maintenance - Responsible for periodically reviewing and optimizing routes, validating the practicality of routes and ensuring equipment is used effectively.</p> <p>- Responsible for developing a resourcing strategy for removing old equipment from service and acquiring the use of new equipment.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> Completion of reviews of routes. Achievement of the LOS for each type of road. |
| REFERENCE | |

4.3.2 Fleet Upgrading

| ELECTRONIC SPREADER CONTROLS | |
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| OBJECTIVE | To equip all spreaders with electronic spreader controls that can be accurately calibrated, regulated to ground speed and will generate pertinent salt-use data. |
| ENVIRONMENTAL CONSIDERATION | Electronic controllers ensure that the chosen and prescribed amount of salt is being placed on the roadway consistently, regardless of speed and provides data that permits salt use to be tracked. |
| CURRENT SITUATION | <ul style="list-style-type: none"> The Town has 7 Town owned units and 13 contracted units to apply material on Town roads. 100% of the units have electronic controls. 8 small (1 tonne capacity) units are used by Roads and Parks crews to plow and apply material to parking lots and rear lanes. 0% of the units have electronic controls. Data for the road applied material is currently stored and available for review and analysis. The data from the electronic controls is regularly retrieved and used to monitor material usage. Contractors retrieve information after every event and send it to the Town once a week. |

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| GOAL | <ul style="list-style-type: none"> • All equipment used to spread sand and salt shall have groundspeed regulated electronic controllers with electronic data retrieval capabilities (including the parking lot units). • Review and update the record-keeping program on an annual basis. Ensure it uses the data supplied from the electronic controllers. • Evaluate the merits of an AVL/GPS³ system, and its integration with the electronic controllers and other equipment, and implement a pilot project by 2006. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Where possible move towards consistency within the fleet. Recognize that some variability will always exist between new and older equipment and future technological improvements. • Budget constraints and delivery schedules for new equipment will affect the pace of the fleet upgrades. |
| RESPONSIBILITIES | <p>Manager Roads Maintenance - Responsible for reviewing and updating the record-keeping program that uses the data supplied from the electronic controllers.</p> <p>Fleet Supervisor - Responsible for ensuring all equipment used to spread sand and salt (liquid and solid, road and parking lots) has operational groundspeed regulated electronic controllers.</p> <p>Roads Supervisor - Responsible implementing a record-keeping program that uses the data supplied from the electronic controllers.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Percentage of in-house and contractor spreaders with electronic controllers. • Percentage of salt spread with spreaders with electronic controllers. |
| REFERENCE | |

| PRE-WETTING AND ANTI-ICING EQUIPMENT | |
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| OBJECTIVE | To improve the effectiveness of salt applied to roadways through the use of pre-wetting of sand and/or salt, and anti-icing techniques. |

³ Automated Vehicle Locating using the Global Positioning System

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| ENVIRONMENTAL CONSIDERATION | Pre-wetting of materials helps to keep the material on the roadway by reducing bounce and blowing and activates the salt more quickly. Studies show that the actual amount of rock salt applied can be reduced when pre-wetting and that pre-wetted abrasives will stay on the road longer to provide traction. Significant reductions in salt use can also be achieved through the use of liquid anti-icing – especially during the fall and spring for frost and black-ice conditions. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town has 7 Town owned units and 13 contracted units to apply material. None of the units have pre-wetting capabilities. • 8 small (1 tonne capacity) units are used by Roads and Parks crews to plow and apply material to parking lots and rear lanes. None of the units have pre-wetting capabilities. • The Town does not do any direct liquid applications (anti-icing). |
| GOAL | <ul style="list-style-type: none"> • Assess and review the results of the pre-wetting and anti-icing experience to-date (in-house and other jurisdictions). • Develop an on-board pre-wetting pilot project to introduce and assess various technologies and strategies by 2006. • Develop a pre-wetting guideline that addresses preferred application rates and expected performance on the road following the pilot project. • Ensure that an optimum number of spreaders (in-house and contractor, road and parking lot) have pre-wetting capabilities. • Identify areas that have a liquid anti-icing priority and integrate this into the equipment plan were possible. • Ensure staff is knowledgeable in liquid use and handling. • Evaluate the merits of alternative liquids or mixtures and identify the most cost-effective long-term supply of the chosen liquid (e.g. in-house production and storage of salt brine vs. importing of proprietary liquids). |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Where possible move towards consistency within the fleet. Recognize that some variability will always exist between new and older equipment and future technological improvements. • Budget constraints and delivery schedules for new equipment will affect the pace of the fleet upgrades. |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for developing an on-board pre-wetting pilot project.</p> <p>Manager, Roads Maintenance - Responsible for developing a pre-wetting guideline that addresses preferred application rates and expected performance on the road.</p> <ul style="list-style-type: none"> - Responsible for ensuring staff is knowledgeable in liquid use and handling. - Responsible for evaluating the merits of alternative liquids and identifying the most cost-effective long-term supply of the chosen liquid. <p>Fleet Supervisor - Responsible for ensuring that the fleet upgrade plan includes pre-wetting capabilities.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Percentage of spreaders with pre-wetting capabilities. • Development of pre-wetting guidelines. • Percentage of staff knowledgeable in liquid use and handling. |

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4.3.3 Equipment Maintenance and Calibration

| SPREADER CALIBRATION | |
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| OBJECTIVE | To ensure that equipment is properly calibrated at the beginning of the snow and ice control season and that the calibration is checked and maintained during with winter. |
| ENVIRONMENTAL CONSIDERATION | Effective placement of salt depends on accurate calibration of spreaders. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Road Supervisors are responsible for equipment calibration (both in-house and contractor equipment). • Equipment calibration is completed before the beginning of the winter season each year. • Calibration is monitored throughout the season using the data from the electronic controllers. • Calibration procedures are documented and records are kept. |
| GOAL | <ul style="list-style-type: none"> • Review and update the calibration procedures each time new equipment is introduced. • Contractor calibrations shall be verified to ensure calibration is adequate and standard procedures have been followed by the start of each season. • All spreaders will be properly calibrated prior to each season. • All routes will be benchmarked (determine the quantity of material applied at a given calibration) to ensure that the correct amount of material is being applied. Information directly from the electronic controllers will be compared to the benchmark to check unit calibrations. Equipment will be recalibrated as required. • Equipment will be recalibrated after any repair that affects the material delivery system. • A calibration history for all spreaders will be maintained and reviewed annually. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • There are limitations to the calibration process, which introduce minor errors. • The calibration procedure should identify when a calibration review will occur. • It is important to acknowledge that a degree of tolerance is acceptable. • Staff availability, weather and seasonal changeovers can affect calibration schedules. |
| RESPONSIBILITIES | <p>Roads Supervisor - Responsible for verifying that contractor calibrations are adequate and standard procedures have been followed.</p> <ul style="list-style-type: none"> - Responsible for developing calibration procedures for in-house equipment and ensuring they are followed. - Responsible for benchmarking usage for all beats and comparing actual usage against the benchmark. - Responsible for investigating any discrepancies and ensuring corrections and recalibrations are done. |

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| PERFORMANCE MEASURE | <ul style="list-style-type: none"> Percentage of spreaders calibrated prior to each winter season. Number of re-calibrations carried out during each winter. |
| REFERENCE | |

4.3.4 Equipment Washing

| EQUIPMENT WASHING | |
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| OBJECTIVE | To ensure that equipment washwater is managed in a way that minimizes discharges to the environment. |
| ENVIRONMENTAL CONSIDERATION | It is not possible to contain the chlorides unless collected in a tank. Vehicle washwater contains de-icing chemicals, oil, grease and grit. If allowed to discharge to ditches or within the yards and camps these contaminants can have adverse effects on the environment. |
| CURRENT SITUATION | <ul style="list-style-type: none"> Spreaders are washed after each storm. In-house units are rinsed outside with a final washing indoors at times. Contractor units are washed outdoors. Outdoor washwater drains away overland to the stormwater system. Indoor washwater is pumped to the sanitary sewer. |
| GOAL | <ul style="list-style-type: none"> Develop a policy on the management of washwater by 2006. Investigate and implement options for managing washwater by 2008. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> Containment and disposal has a cost. Contaminant levels may prohibit use in brine production. |
| RESPONSIBILITIES | <p>Director - Responsible for investigating and developing options for managing washwater for all equipment washing facilities.</p> <p>General Manager of Operations - Responsible for developing an equipment washing and washwater management policy.</p> <p>- Responsible for implementing washwater management at all equipment washing facilities.</p> <p>Roads Supervisor - Responsible for ensuring that equipment washing is carried out in accordance with the policy.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> Development and implementation of a washwater management policy. Percentage of sites with washwater management facilities that are consistent with the policy. |
| REFERENCE | |

4.4 Materials

4.4.1 Material Ordering, and Delivery

| MATERIAL ORDERING AND DELIVERY | |
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| OBJECTIVE | To ensure that the quality of the snow and ice control materials delivered is sufficient for winter maintenance needs. |

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| ENVIRONMENTAL CONSIDERATION | Improper handling and storage of salt and treated sand can increase loss to the environment. Excessive moisture creates clumping of the salt making salt difficult to use. Excessive moisture also interferes with the success of pre-treatment operations. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town has specifications for salt and sand. • The Town does test delivered abrasives to ensure quality. • The Town's specification for brine supply needs to be updated. • Bulk material is delivered outdoors and then moved inside. Material can remain outdoors for up to 1 day. • The Town has a contractor deliver sand, blended it with salt and stockpile it indoors each fall. Town staff bend small quantities if needed. |
| GOAL | <ul style="list-style-type: none"> • Review and, if needed, update the material quality specifications. Include specifications for liquids as they are introduced. • Ensure all bulk material is tested and meets the specifications. • Cover all salt as soon as possible following delivery. • Work with industry and other road authorities to investigate the effectiveness and possible salt usage reduction through the use of a finer grade of salt. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Have a contingency plan for when salt cannot be placed under cover immediately. |
| RESPONSIBILITIES | <p>Manager, Roads Maintenance - Responsible for reviewing and, as needed, updating the material quality specifications.</p> <p>Roads Supervisor - Responsible for ensuring materials are covered as soon as possible following delivery.</p> <ul style="list-style-type: none"> - Responsible for monitoring material deliveries to determine compliance with the material specifications. |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Summary of material quality tests. • Percentage of deliveries that do not meet specifications. • Number of salt deliveries that are stored outside for more than 1 day. |
| REFERENCE | |

4.4.2 Material Application Rates

| MATERIAL APPLICATION RATES | |
|-----------------------------------|---|
| OBJECTIVE | To optimize the amount of chemical, liquid and sand used in winter maintenance operations. |
| ENVIRONMENTAL CONSIDERATION | Any opportunity to reduce the amount of salt and blended sand used will reduce the amount of salt entering the environment, provided that road safety is not compromised. |

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| CURRENT SITUATION | <ul style="list-style-type: none"> • The application rates for salt and blended sand are documented operationally for both road and parking lot applications but have not been part of a policy. See Appendix B for a summary. • Application rates for liquids have not been developed as liquids have not been introduced. • Road application rates for salt are adjusted based on road conditions for pavement temperatures above -12°C. Salt is applied on parking lots at a pre-set rate most of the time. |
| GOAL | <ul style="list-style-type: none"> • Review and update application rates as new technologies are introduced and experience grows. • Develop an approach to adjust application rates for various pavement temperature ranges and winter conditions by 2006. • All operators shall be knowledgeable in the approach adopted. |
| IMPLEMENTATION CONSIDERATIONS | |
| RESPONSIBILITIES | <p>Manager, Roads Maintenance - Responsible for reviewing and updating the material application rates.</p> <p>- Responsible for developing an approach to adjust application rates for various pavement temperatures.</p> <p>Roads Supervisor - Responsible for ensuring the application rates are followed.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Material application rates reviewed or updated. • Tonnes of salt applied through spreading operations. • Litres of brine applied through spreading operations. |
| REFERENCE | |

4.4.3 Sand/Salt Blends

| SAND/SALT BLENDS | |
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| OBJECTIVE | To optimize the amount of salt in sand/salt blends required to ensure the abrasives function effectively in snow and ice control. |
| ENVIRONMENTAL CONSIDERATION | Only enough salt should be added to abrasives to keep the abrasives free flowing under freezing conditions. In some cases, higher sand/salt blends are used to address special circumstances. High amounts of salt in sand/salt blends can result in excessive salt entering the environment for the task. The concept of sand aiding the retention of straight-salt on the road can increase the silt and dust produced. |

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| CURRENT SITUATION | <ul style="list-style-type: none"> Sand/salt blends of various ratios are used to provide traction and some snow and ice control on the roads when the pavement temperature is below -12°C and, on occasions, when hard pack conditions exist. Lower ratio sand/salt blends are not used to achieve bare-pavement. Sand is blended with NaCl at a rate of approximately 5% by volume and stockpiled. A contractor blends and stockpiles the majority of the sand at the yard. Blended sand from 5% to 75% salt is used on the roads and is blended as needed by volume estimating at the time of loading. |
| GOAL | <ul style="list-style-type: none"> To move toward limiting the amount of salt in sand/salt blends to a maximum of 5% by volume. To move toward limiting the use of blended sand to providing improved traction only and significantly limiting the use of higher ratio blends. To move toward using straight salt to provide snow and ice control. To investigate the merits of alternatives to salt for preventing sand from freezing. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> A cross-Canada TAC survey identified the best practice trend is to minimize the amount of salt blended with sand. There may be cultural adjustments needed to prevent operators from sweetening the load. Minimal salt/sand ratios require thorough blending with dry sand. |
| RESPONSIBILITIES | <p>General Manager – Responsible for ensuring the Operations Department moves toward limiting the use of blended sand to providing improved traction only and significantly limiting the use of higher ratio blends.</p> <ul style="list-style-type: none"> - Responsible for ensuring the Operations Department moves toward using straight salt to provide snow and ice control. <p>Manager, Roads Maintenance - Responsible for investigating the merits of alternatives to salt for preventing sand from freezing.</p> <ul style="list-style-type: none"> - Responsible for ensuring the amount of salt in stockpiled blended sand is limited to 5% by volume. |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> Percentage of salt in sand/salt blends. Tonnes of sand used. |
| REFERENCE | |

4.4.4 Material Storage / Handling

| SALT STORAGE / HANDLING | |
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| OBJECTIVE | All snow and ice control chemicals shall be stored and handled inside proper storage structures so as to minimize loss of salt to the environment. |
| ENVIRONMENTAL CONSIDERATION | If not properly stored, de-icing chemicals can be lost to the environment in large quantities because of exposure to precipitation and wind. This loss can be costly due to the actual loss of salt, and can lead to environmental damage. |

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| CURRENT SITUATION | <ul style="list-style-type: none"> • All salt is stored indoors in a dome with an asphalt pad. • Delivered salt is unloaded outdoors and loaded into the storage facility. • The spreaders are loaded outside. • The site drainage is overland. |
| GOAL | <ul style="list-style-type: none"> • All salt shall be stored inside structures on impermeable floors. • All new storage facilities will be designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. • All salt storage facilities shall have drainage water management systems by 2008. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • The timing for the installation of the drainage water management systems is tied to the timing of material storage upgrades. • There are safety considerations related to venting structures when loading salt indoors. • Yard rationalization may impact the phase-in timing. |
| RESPONSIBILITIES | <p>Director - Responsible for arranging for storage facilities as needed.</p> <p>Manager, Roads Maintenance - Responsible for ensuring that all salt storage facilities have drainage water management systems.</p> <p>- Responsible for ensuring all new salt storage facilities are designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards.</p> <p>Roads Supervisor - Responsible for ensuring that all salt is stored indoors on impermeable pads.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Percentage of salt stored indoors on asphalt pads. • Number of new storage facilities designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. • Percentage of salt storage facilities that have drainage water management systems. |
| REFERENCE | TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. |

| BLENDED SAND STORAGE / HANDLING | |
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| OBJECTIVE | All blended sand shall be stored and handled so as to minimize loss to the environment. |
| ENVIRONMENTAL CONSIDERATION | If not properly stored, snow and ice control chemicals in blended sand can be lost to the environment in large quantities because of exposure to precipitation which dissolves it out of the exposed pile. This loss can be costly due to the actual loss of salt, and can lead to environmental damage. |

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| CURRENT SITUATION | <ul style="list-style-type: none"> • All blended sand is stored indoors in a dome with an asphalt pad. • Delivered sand is unloaded outdoors, blended and loaded into the storage facility. • The spreaders are loaded outside. • The site drainage is overland. |
| GOAL | <ul style="list-style-type: none"> • All sand shall be stored inside structures on impermeable floors. • All new storage facilities will be designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. • All sand storage facilities shall have drainage water management systems by 2008. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Staff needs to be conscientious in keeping the blended sand pile pushed back from the structures' doorway. |
| RESPONSIBILITIES | <p>Director - Responsible for arranging for storage facilities as needed.</p> <p>Manager, Roads Maintenance - Responsible for ensuring that all blended sand storage facilities have drainage water management systems.</p> <p>- Responsible for ensuring all new blended sand storage facilities are designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards.</p> <p>Roads Supervisor - Responsible for ensuring that all blended sand is stored indoors on impermeable pads.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Percentage of blended sand stored indoors on impermeable pads. • Number of new storage facilities designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. • Percentage of blended sand storage facilities that have drainage water management systems. |
| REFERENCE | TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards |

| LIQUID STORAGE / HANDLING | |
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| OBJECTIVE | All liquid snow and ice control chemicals shall be stored and handled inside proper storage systems so as to minimize loss of liquid to the environment. |
| ENVIRONMENTAL CONSIDERATION | If not properly stored or handled, liquid chemicals can be lost to the environment in large quantities very quickly. This loss can be costly due to the actual loss of material and the materials ability to quickly move into the environment, and can lead to environmental damage. |

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| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town has not used liquids in the past and does not have any liquid storage. • The Town has two spreader units for the roads with pre-wetting capabilities on order. • A liquid supply has not been determined. |
| GOAL | <ul style="list-style-type: none"> • Ensure all liquid materials are stored in tanks with proper secondary containment. • Evaluate the Town liquid needs and liquid storage requirements by 2005. • All new liquid storage facilities will be designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. • All liquid storage facilities shall have drainage water management systems. • Ensure staff is knowledgeable in the use and handling of liquids. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Staff needs to be aware of the proper handling procedures for liquids as they differ significantly from traditional solid material handling. |
| RESPONSIBILITIES | <p>Manager, Roads Maintenance - Responsible for evaluating the Towns liquid needs and liquid storage requirements.</p> <ul style="list-style-type: none"> - Responsible for ensuring all new storage facilities are designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. - Responsible for ensuring staff is knowledgeable in the use and handling of liquids. |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Percentage of liquids used that were stored in tanks with proper secondary containment for spills. • Number of new liquid storage facilities designed with regard to the principles set out in TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. |
| REFERENCE | TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. |

4.4.5 Good Housekeeping Practices for Maintenance Yards

| GOOD HOUSEKEEPING PRACTICES | |
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| OBJECTIVE | To ensure that practices at salt storage and handling facilities are geared toward reducing salt loss to the environment. |
| ENVIRONMENTAL CONSIDERATION | Improper handling of salt at maintenance facilities can result in significant amounts of salt being lost to the environment. Good housekeeping practices can help to reduce this loss. |

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| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town does not have a Good Housekeeping Policy. • Good Housekeeping Practices are managed by the Roads Supervisor's. • The storage facilities are emptied of material each spring and the Roads Supervisor's conduct inspections of the floors, walls and roofs. • Repairs are the responsibility of the Asset Management group. |
| GOAL | <ul style="list-style-type: none"> • Develop a Good Housekeeping Policy by 2006. • Ensure staff is knowledgeable on the Good Housekeeping practices. • Conduct periodic audits of the yard to ensure Good Housekeeping practices are followed. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Without a guideline to follow, past practices may not meet expectations. |
| RESPONSIBILITIES | <p>Director - Responsible for developing a Good Housekeeping Policy.</p> <p>Roads Supervisor - Responsible for periodically auditing storage facilities.</p> <p>- Responsible for ensuring the Good Housekeeping Policy is followed.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • A Good Housekeeping Policy developed or updated. • Yard inspection report on compliance with the Good Housekeeping Policy. |
| REFERENCE | TAC's Syntheses of Best Practices Road Salt Management - Design and Operation of Road Maintenance Yards. |

4.5 Storm Response

4.5.1 Weather Forecasting

| WEATHER FORECASTING | |
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| OBJECTIVE | To provide timely and accurate weather information to assist in snow and ice control decision-making. |
| ENVIRONMENTAL CONSIDERATION | Effective use of chemicals is dependant upon good snow and ice control decision-making, which in turn depends on consistently accurate and timely weather information. Chemicals can be wasted if information is incorrect or suspect. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town relies on both public weather forecasts and specialty forecasts provide by World Weatherwatch. • The Town has access to precipitation forecasts from World Weatherwatch. • Training in the use of weather and RWIS forecasts and information has not been provided to staff. |

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| GOAL | <ul style="list-style-type: none"> • Make arrangements to obtain appropriate weather forecasts and information before the start of each season. • Ensure staff is knowledgeable in the use of weather forecasts and information. • Investigate alternative sources of weather information to improve staff's pro-active decision-making abilities. • Investigate the use of technology to improve delivery of weather forecasts and information to the decision makers and implement improvements by 2006. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Proactive chemical use is dependent on anticipating a "saltable event". • Inaccuracies are inherent in weather forecasting and a QC/QA standard is appropriate. |
| RESPONSIBILITIES | <p>Manager, Roads Maintenance - Responsible for ensuring appropriate weather forecasts and information are available to staff.</p> <ul style="list-style-type: none"> - Responsible for ensuring staff is knowledgeable in the use of weather forecast and information. - Responsible for investigating alternative sources of weather information to improve staff's pro-active decision-making abilities. |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Percentage of decision-making staff knowledgeable in interpreting weather forecasts and information. • Delivery of appropriate weather forecasts to those that need them. • Accuracy of forecast to experienced weather. |
| REFERENCE | |

4.5.2 Decision-Making Support Technology

| ROAD WEATHER INFORMATION SYSTEMS (RWIS) | |
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| OBJECTIVE | To provide pavement forecast and real-time information from a network of sensors to assist with snow and ice control decisions. |
| ENVIRONMENTAL CONSIDERATION | Snow and ice control decisions that are based on road temperature information, as well as air temperature information and precipitation information are more accurate and result in better salt use. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town winter maintenance staff has had access to precipitation forecast information and forecasts via World Weatherwatch. • The Town has an RWIS data sharing agreement with the Region of York but has not made use of the information. |
| GOAL | <ul style="list-style-type: none"> • Provide RWIS forecasts and information to staff as RWIS sites (MTO, 407 and York Region) become available in and around the Town. • Ensure staff is knowledgeable in the use of RWIS forecasts and information. • Evaluate the merits of installing RWIS sites within the Town, coordinated with the Region of York and MTO sites, by 2006. |

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| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Mobile infrared thermometers validate real-time pavement temperature trends and help track the forecast. • Learning curve and acceptance timeframe justify a phased implementation strategy for RWIS. • Archiving of RWIS data helps in showing due diligence. |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for ensuring RWIS forecasts and information are available to decision-making staff.</p> <p>Manager, Roads Maintenance - Responsible for ensuring staff is knowledgeable in the use of RWIS forecasts and information.</p> <p>- Responsible for evaluating the merits of installing RWIS sites within the Town.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Number of RWIS sites accessed. • Percentage of decision-making staff knowledgeable in interpreting RWIS data and forecasts. • Delivery of clearly formatted pavement forecasts to those that need them. • Accuracy of forecast-to-experienced conditions. • Percentage downtime of RWIS sites. |
| REFERENCE | |

| INFRARED THERMOMETERS (IRT's) | |
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| OBJECTIVE | To provide real-time pavement temperature trends from truck mounted pavement temperature sensors to assist with snow and ice control decisions. |
| ENVIRONMENTAL CONSIDERATION | Snow and ice control decisions that are based on road temperature information, result in better salt use. Real-time information on pavement temperature trends produce more timely decisions on when to deploy and not deploy chemicals. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town has 4 hand held IRT's available to staff. • 9 supervisor and working supervisor vehicles have been outfitted with IRT's. • The accuracy of the IRT's is checked regularly however the units can not be calibrated. • Staff has received training in the use of IRT's. |
| GOAL | <ul style="list-style-type: none"> • Every patrol vehicle shall be outfitted with an IRT by 2005 • Every vehicle equipped with pre-wetting shall be outfitted with an IRT. • Verify accuracy of every IRT annually. • Ensure staff is knowledgeable in the use of IRT's. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • IRT's are to track trends and not absolute temperatures. • Cheaper IRT's have higher failure rates and lower accuracy than more expensive units. • IRT's must be properly mounted to prevent erroneous readings. |

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| RESPONSIBILITIES | <p>Manager, Roads Maintenance - Responsible for ensuring that all patrol vehicles and pre-wetting capable spreaders have IRT's.</p> <p>- Responsible for ensuring staff is knowledgeable in IRT use.</p> <p>Fleet Supervisor - Responsible for ensuring the IRT's are properly mounted and providing accurate information.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Percentage of patrol vehicles with IRT's. • Percentage of pre-wetting capable spreaders with IRT's. • Percentage of staff knowledgeable in the proper use of IRT's. |
| REFERENCE | |

4.5.3 Storm Response Approaches

| STORM RESPONSE APPROACHES | |
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| OBJECTIVE | To understand and document storm response approaches for different storm scenarios and improve upon practices. |
| ENVIRONMENTAL CONSIDERATION | Snow and ice control decisions that vary across the organization may lead to inefficiencies in some response and ultimately results in loss effectiveness of salt use. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town does not have storm response guidelines. • The Roads Supervisor/Patrollers make the decision for the need for a response to conditions. |
| GOAL | <ul style="list-style-type: none"> • Develop an Expert Guide to Snow and Ice Control that uses typical and atypical storm responses by 2006. • As new technologies are introduced, review and update the Expert Guide. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Local field experience is valuable and should be incorporated into the training process as much as possible. |
| RESPONSIBILITIES | Manager, Roads Maintenance - Responsible for developing and updating an Expert Guide to Snow and Ice Control. |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Development and updating of an Expert Guide to Snow and Ice Control. |
| REFERENCE | FHWA, AASHTO, TAC |

4.5.4 Winter Road Patrol

| WINTER ROAD PATROL | |
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| OBJECTIVE | To impact winter road conditions, mobilize appropriate snow and ice control operations, and monitor the storm response. |
| ENVIRONMENTAL CONSIDERATION | Accurate monitoring of winter maintenance activities will support appropriate and effective snow and ice control decisions, leading to efficient use of salt. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • Patrolling is handled by the Road Supervisors, Working Supervisors and Patrollers. • Patrolling is based on meeting the Minimum Maintenance Standards for Municipal Highways. • The Town does not have formally approved guidelines for Patrollers. |

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| GOAL | <ul style="list-style-type: none"> • Develop a Winter Road Patrol Guideline that meets the Minimum Maintenance Standards for Municipal Highways by 2006. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Cycle frequency relates the level of observations to the required resources. This can govern efficient salt decisions. • Patroller training and experience are key success factors. |
| RESPONSIBILITIES | <p>Manager, Roads Maintenance - Responsible for developing and updating the Winter Road Patrol Guidelines.</p> <p>- Responsible for ensuring the Patrollers are knowledgeable in monitoring road conditions and making snow and ice control decisions.</p> <p>Roads Supervisors/Working Supervisors/Patrollers - Responsible for monitoring roadway conditions and weather information and making timely decisions on snow and ice control in accordance with the Winter Road Patrol Guidelines.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Development and updating of a Winter Road Patrol Guideline. • Percentage of Patrol staff knowledgeable in snow and ice control decision-making. • Documentation of roads patrolled during winter conditions. |
| REFERENCE | |

4.5.5 Drift Control

| DRIFT CONTROL | |
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| OBJECTIVE | To reduce snow accumulation on roadways and problems associated with drifting and blowing snow. |
| ENVIRONMENTAL CONSIDERATION | A significant amount of winter maintenance activity is devoted to controlling drifting snow. If a roadway has a lower potential for snow and ice accumulation, then the winter maintenance demands will be correspondingly lower and the need for chemical application will be reduced. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • Approximately 5.9 km of artificial snow fence are installed each season. • The Town has an inventory of snowdrift problem areas and Guidelines for installing snow fencing and drift control. |
| GOAL | <ul style="list-style-type: none"> • Keep the inventory of stretches of road with drifting snow problems up to date. • Ensure staff is knowledgeable in drift control strategies. • Update the Towns Guidelines for installing snow fencing and drift control based on local experience and the TAC Salt Management Guide by 2006. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • There is a cost associated with installing, or arranging for, and maintaining natural or structural snow fencing. • It may take a few winter seasons to determine the optimum snow fence for a given stretch of problem road. • There may be a liability issue due to seasonally installed snow fence debris being left in fields. |

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| RESPONSIBILITIES | <p>Manager, Roads Maintenance - Responsible for updating the Guidelines for installing snow fencing.</p> <p>Road Supervisor - Responsible for maintaining the inventory of stretches of road with drifting snow problems.</p> <p>- Responsible for implementing drift control strategies as needed and monitoring them.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Inventory of stretches of road with drifting snow problems. • Review and updating of the Drift Control Guidelines. • Percentage of staff knowledgeable in proper drift control strategies. |
| REFERENCE | TAC Salt Management Guide |

4.6 Snow and Ice Control Training

| TRAINING | |
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| OBJECTIVE | To ensure that all in-house and sub-contracted staff, including management, supervisors, patrollers and operators, are trained in salt management practices. |
| ENVIRONMENTAL CONSIDERATION | To achieve effective implementation of a salt management program, those people charged with delivering the snow and ice control program must understand the rationale behind the measures being implemented as well as what is expected of them. This can only come through a thorough education / training program, including annual refreshers. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Roads Department has an annual fall training session that covers health & safety issues, operating procedures, plowing techniques, application rates, equipment, etc. • The Parks Department does not have a formal fall training session for winter operations. • Senior management have not typically attended the training sessions. • In-house material and staff are used for training. Some third party material is also used. • Contractors are responsible for providing their own staff training. The Town does have a “briefing session” with the contractors each fall. |
| GOAL | <ul style="list-style-type: none"> • Update the training program to address the subject areas set out in TAC’s Syntheses of Best Practices Road Salt Management - Training, as they become needed or technology changes. • Present the training in the fall of each year to all operators, supervisors and managers. Include staff from both the Roads and Parks Departments. • Consider using third party experts for some of the identified training subject areas. • Obtain written documentation from contractors that they are fulfilling their responsibility for training and adequately addressing salt management. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Trainers must be experienced in adult training principles and be able to adjust their instructional techniques to reach a variety of learners. |

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| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for ensuring all Roads and Parks Department staff are properly trained.</p> <p>Manager, Roads Maintenance - Responsible for ensuring that the winter maintenance contractors have an adequate training program and documentation is provided to the Town.</p> <ul style="list-style-type: none"> - Responsible for updating the training program to include new subject areas and technologies as they are introduced. - Responsible for delivering the Town's winter maintenance training program. <p>All Winter Maintenance Personnel (Operations Department) - Responsible for participating in the training program.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Percentage of supervisors and managers receiving training each year. • Percentage of Operations staff receiving training each year. • Percentage of contractor staff receiving training each year. • Total annual attendance at training sessions. |
| REFERENCE | <ul style="list-style-type: none"> • OGRA and MTO Training materials. • TAC's Syntheses of Best Practices Road Salt Management – Training |

4.7 Snow Removal and Disposal

4.7.1 Snow Removal and Disposal Guideline

| SNOW REMOVAL AND DISPOSAL GUIDELINE | |
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| OBJECTIVE | To ensure snow removal and disposal operations are done efficiently and in an environmentally responsible manner. |
| ENVIRONMENTAL CONSIDERATION | A review of disposal operations can lead to adopting methods that are least harmful to the environment. Environmental issues associated with snow disposal sites include: meltwater quality, litter, dust, aesthetics, and noise. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town loads, hauls and disposes of approximately 3600 tonnes of snow each season. • Both Roads and Parks Department crews load and haul snow. • Snow is hauled to, and disposed of at, two Town controlled sites. • Some site improvements have been made at one site (berms, trees, fencing and litter pickup). • Drainage from both sites is somewhat controlled but still overland to ditches or a scrub brush area. • The Town does not have Snow Removal and Disposal Guidelines. |
| GOAL | <ul style="list-style-type: none"> • Develop Snow Removal and Disposal Guidelines by 2006 • Review existing sites and identify improvements by 2008. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • It may be preferred to design an ultimate Snow Removal Program, and have this as background to a staged implementation plan. |

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| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for ensuring the snow disposal sites are properly assessed and improvements identified.</p> <p>Manager, Roads Maintenance - Responsible for developing and updating the Snow Removal and Disposal Guidelines.</p> <p>Roads Supervisor - Responsible for ensuring the Snow Removal and Disposal Guidelines are followed.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Completion of snow disposal site assessments and improvement identification. • Development and updating of the Snow Removal and Disposal Guidelines. |
| REFERENCE | TAC's Syntheses of Best Practices Road Salt Management - Snow Storage and Disposal. |

4.7.2 Snow Disposal Site Selection Criteria

| SNOW DISPOSAL SITE SELECTION CRITERIA | |
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| OBJECTIVE | To ensure that new snow disposal sites or methods are located and selected so as to minimize the adverse effects to the environment. |
| ENVIRONMENTAL CONSIDERATION | Snow disposal sites can impact the environment in many ways. Therefore, proper site selection can minimize these impacts. Criteria should include soil permeability, distance from major water course, vegetation characteristics, ecologically sensitive sites, critical wildlife habitat, operational needs (e.g. haul distances) etc. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The capacity of the existing sites may not be sufficient for the future needs of the Town. • The Town has two snow disposal sites. |
| GOAL | <ul style="list-style-type: none"> • Use TAC's Syntheses of Best Practices Road Salt Management - Snow Storage and Disposal as a guide to developing new snow disposal sites. • Consult the appropriate agencies for necessary approvals. • Evaluate the merits of using snow melters to handle the increase in volume of snow and utilizing the new stormwater management ponds. • Evaluate the need for siting and developing a new snow disposal site to handle the anticipated increase in snow volume. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Haul distances are an important consideration in selecting snow disposal sites. • Chlorides are difficult to contain. Therefore melt water management is predominantly to manage other pollutants. |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for ensuring any new snow disposal sites are properly assessed and developed.</p> <p>Manager, Roads Maintenance - Responsible for assessing and developing any new snow disposal sites.</p> <p>- Responsible for evaluating the merits of using snow melters to handle the increase in volume of snow and utilizing the new stormwater management ponds.</p> |

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| PERFORMANCE MEASURE | <ul style="list-style-type: none"> Percentage of new sites meeting TAC's Syntheses of Best Practices Road Salt Management - Snow Storage and Disposal. Percentage of snow disposal handled by using snow melters. |
| REFERENCE | TAC's Syntheses of Best Practices Road Salt Management - Snow Storage and Disposal. |

4.7.3 Snow Disposal Site Monitoring and Maintenance

| SNOW DISPOSAL SITE MONITORING AND MAINTENANCE | |
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| OBJECTIVE | To ensure that snow disposal sites are monitored and maintained so as to minimize the adverse environmental effects of their operations. |
| ENVIRONMENTAL CONSIDERATION | Snow disposal sites can impact the environment in many ways. Mitigation measures are implemented as part of site design and standard operating procedures. However, the mitigating measures need to be monitored and serviced to ensure that they continue to be effective. Improperly managed melt water can introduce contaminants into a watercourse in contravention of the Fisheries Act and Ontario Water Resources Act. |
| CURRENT SITUATION | <ul style="list-style-type: none"> The Town does not have a snow disposal site monitoring program. Litter pickup site clean-up is completed each spring. A site assessment and remediation at the old fairground dumping site has been completed and the site has been decommissioned. |
| GOAL | <ul style="list-style-type: none"> To establish a pilot monitoring program at a selected snow disposal site by 2006. To maintain the snow disposal sites following TAC's Syntheses of Best Practices Road Salt Management - Snow Storage and Disposal. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> Chlorides are difficult to contain. Therefore meltwater management is predominantly to manage other pollutants. |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for developing a pilot monitoring program at a selected snow disposal site.</p> <p>Roads Supervisor - Responsible for maintaining snow disposal sites following TAC's Syntheses of Best Practices Road Salt Management - Snow Storage and Disposal.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> Pilot snow disposal site monitoring program implemented. <i>More specific monitoring criteria will be developed as part of the pilot monitoring program.</i> |
| REFERENCE | TAC's Syntheses of Best Practices Road Salt Management - Snow Storage and Disposal. |

4.8 Technology Transfer Review

| TECHNOLOGY TRANSFER REVIEW | |
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| OBJECTIVE | To monitor existing available and new approaches and technologies on a continual basis and to recommend pilot studies on the preferred technologies and winter maintenance methodologies. |
| ENVIRONMENTAL CONSIDERATION | New techniques, procedures, and technologies may provide new methods of reducing salt entering the environment. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • Staff attends technology transfer conferences and forums. • Town staff usually attends the OGRA Snow and Ice Colloquium. |
| GOAL | <ul style="list-style-type: none"> • To ensure the latest technologies are studied, reviewed, tested and adopted as appropriate. • To continue to participate in conferences and forums geared to the development of salt best management practices. • Report the implementation of new technologies and practices to Council and the public. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Often, individual technologies will not provide the degree of improvement as compared to the synergies of a broader systems approach. • The results of trials should be documented with proper assessment methodologies. • New technologies should first be introduced and proven in one area of the municipality and then expanded to the rest of the municipality. |
| RESPONSIBILITIES | <p><i>Director</i> - Responsible for ensuring staff are attending and participating in appropriate conferences and forums.</p> <p><i>General Manager, Manager, Roads Supervisor, Winter Maintenance Personnel</i></p> <ul style="list-style-type: none"> - Responsible for attending and participating in appropriate conferences and forums. - Responsible for bringing forward salt management ideas they are aware of in their field of expertise. |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Reports on new technologies and practices prepared for council and the public. |
| REFERENCE | |

4.9 Communications

| COMMUNICATIONS | |
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| OBJECTIVE | To communicate effectively with the public and the media about the importance of road salt to maintaining safe roadways during the winter season and about what the Town of Markham is doing to improve salt management. To inform the public about the current level of service policy. |
| ENVIRONMENTAL CONSIDERATION | An informed public and media are more likely to become effective partners in achieving the goals of the Salt Management Plan. |

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| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town has a Communication Plan that includes a public flyer and an Internet site. • An annual report on winter maintenance activities, in conjunction with the performance measures report, is made to Council. • The Public needs to be made more aware of the hazards during winter driving, slow down and drive according to conditions. • With three levels of government, the City of Toronto and the 407ETR responsible for maintaining the road network in the Town, communication and cooperation between the five operations needs to be improved and expanded. |
| GOAL | <ul style="list-style-type: none"> • Inform the Council, public and local regulatory agencies about the actions being taken by the Town to manage road salt use, and the Town's winter maintenance program annually. • Review the Communication Plan for the Winter Maintenance program and ensure it includes information on the Town's salt management initiatives. • Notify Environment Canada upon completion of the Salt Management Plan and update them annually about the status of Salt Management activities (as per Annex C of the Code of Practice for the Environmental Management of Road Salts). • Foster further cooperation among the five road authorities maintaining roads in and around the Town. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Repetition may be necessary to ensure the message is heard. Safety-first must continually be reinforced. |
| RESPONSIBILITIES | <p>Director - Responsible for developing and implementing an information package and Communication Plan.</p> <ul style="list-style-type: none"> - Responsible for fostering further cooperation among the five road authorities. <p>Manager, Roads Maintenance - Responsible for providing information to all workers on the health effects of salt.</p> <ul style="list-style-type: none"> - Responsible for notifying and providing data to Environment Canada. |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Communication Plan developed and updated. • Appropriate stakeholders are informed of the Town's Road Salt Management initiatives. |
| REFERENCE | |

4.10 Salt Vulnerable Areas

| SALT VULNERABLE AREAS | |
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| OBJECTIVE | To determine if any salt vulnerable areas are potentially impacted by the use of salt. |
| ENVIRONMENTAL CONSIDERATION | Salt vulnerable areas may require unique solutions that may require the use of other strategies/methods or more expensive de-icers to maintain sensitive areas. |

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| CURRENT SITUATION | <ul style="list-style-type: none"> • There are currently discussions ongoing at the national level to determine a definition of salt vulnerable areas. • The Town has many unique environmental features including environmentally significant areas, the Oakridges Moraine and agricultural land. • There has not been an effort to correlate the environmental features to roadways or salt storage sites. |
| GOAL | <ul style="list-style-type: none"> • Monitor Environment Canada's approach to addressing salt vulnerable areas. • Work with other agencies to identify and map salt vulnerable areas by 2008. • Identify strategies to reduce salt impacts to salt vulnerable areas by 2009. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • There is no clear consensus on how to monitor the impacts to vulnerable areas. • Other agencies should help identify salt vulnerable areas. |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for preparing the salt vulnerability mapping.</p> <p>Manager, Roads Maintenance - Responsible for identifying strategies to reduce salt impacts.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Number of salt vulnerable areas identified. • Number of winter maintenance prescriptions developed in response to salt vulnerable areas. • Relative change in impact indicators. |
| REFERENCE | |

4.11 Record Keeping

| MATERIAL USAGE RECORD KEEPING | |
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| OBJECTIVE | To provide an accurate record of how much material was used, where it was used and the reason it was used. |
| ENVIRONMENTAL CONSIDERATION | Effective salt management requires an accurate understanding of how much salt is being used, and where. It is not sufficient to measure gross totals since these can vary widely from year-to-year due to weather fluctuations. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town has electronic controls on its spreaders and all contracted spreaders • The Town does retrieve, use and keep the data from the controllers. • The delivery and restocking of solid bulk materials (sand and salt) is tracked and recorded at the yard. • The spreader operators track salt and sand usage by truck volume on their time sheets. • The number of saltable events and salt use by storm is recorded. • Material use is monitored manually. • Equipment calibration records are completed in the fall and kept. • Material is not reconciled at the end of the season. |

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| <p>GOAL</p> | <ul style="list-style-type: none"> • To optimize the use of all materials. • The Material Usage Tracking system will be reviewed and updated by 2006. The system will track material usage and include weather and road conditions and rationale for treatment strategy. • Information from the time sheets, winter road patrol sheets, diaries, electronic controllers, forecast records and future systems will be retrieved, reviewed and archived as it becomes available. • Salt, sand and future liquid delivery records and end-of-season residuals will be logged to allow for year-end reconciliation of bulk material use. • Periodic comparisons of usage by route will be carried out to identify and address any inconsistencies. • Ensure staff is knowledgeable in material usage record-keeping. |
| <p>IMPLEMENTATION CONSIDERATIONS</p> | <ul style="list-style-type: none"> • Material use is dependent upon the severity of the winter and therefore record analysis needs to normalize for the type of winter. • Material usage records in conjunction with the overall winter maintenance program can serve as a surrogate for a winter severity index. • High sand usage has cleanup and dust implications. |
| <p>RESPONSIBILITIES</p> | <p>Manager, Roads Maintenance - Responsible for updating the Material Usage Tracking system.</p> <ul style="list-style-type: none"> - Responsible for ensuring enough staff time is available to maintain the material tracking system. - Responsible for investigating opportunities to optimize the use of all materials. <p>Roads Supervisor - Responsible for regularly summarizing the data retrieved from the electronic controllers.</p> <ul style="list-style-type: none"> - Responsible for periodically comparing material use across the organization to test consistency. <p>Fleet Supervisor - Responsible for ensuring that the necessary equipment is available and operating to measure the amount of material placed into the spreaders and spread on the road.</p> <p>Winter Maintenance Personnel - Responsible for completing the Material Usage Tracking logs at the end of each day and retaining them with the yard records.</p> |
| <p>PERFORMANCE MEASURE</p> | <ul style="list-style-type: none"> • Tonnes of salt applied through spreading operations. • Tonnes of salt used per lane km. • Tonnes of sand used. • Material reconciliation and summary at the end of the season. (amount at start of season + purchases/production - actual usage = amount at end of season) • Daily records checked for completeness. |
| <p>REFERENCE</p> | |

| STORM RESPONSE RECORD KEEPING | |
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| OBJECTIVE | To provide accurate documentation of changing road and weather conditions, and actions taken during storm response. |
| ENVIRONMENTAL CONSIDERATION | Accurate record keeping and reporting during snow and ice control activities will facilitate a review of storm response and ultimately result in the most effective response in similar situations. This can help to optimize the use of salt. It will also provide information for due diligence defence in the event of a lawsuit by demonstrating prudent judgement with regard to safety and environmental stewardship. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town has and keeps winter road patrol sheets and diaries. • The forecast records are kept. • Storm event response records are reviewed and kept. |
| GOAL | <ul style="list-style-type: none"> • To investigate use of electronic record-keeping. • To develop a Record Keeping Policy that includes both material usage tracking and storm responses by 2006. • To update and convert, to electronic format, the standard methodology used to report/summarize storm response. • Information from the forecasts, time sheets, winter road patrol sheets and diaries will be retrieved, reviewed and archived along with the material usage tracking records. • Ensure staff is knowledgeable in the Record Keeping Policy. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • With the introduction of RWIS and GPS/AVL there will be an opportunity to have a partial electronic record of conditions and response times. • It can document what was known and the rationale for decisions including what was not done (by choice). • Record keeping can be observation and action-oriented. • Storm responses are recorded and maintained in conjunction with material usage records. |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for developing and maintaining a Record Keeping Policy.</p> <p>Manager, Roads Maintenance - Ensure that winter maintenance personnel are provided with the tools to record their actions on an ongoing basis.</p> <p style="padding-left: 20px;">- Perform an ongoing quality audit of records to ensure that proper records are being maintained.</p> <p>Roads Supervisor & Winter Maintenance Personnel - Maintain winter road patrol sheets and diaries showing the actions taken and the rationale for those actions.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Completion of a Record Keeping Policy. • Percentage of staff knowledgeable in proper record keeping. • Accurate and complete record of storm response. • Percentage of representative samples of records in conformance with the policy. |
| REFERENCE | |

4.12 Monitoring Program

| MONITORING PROGRAM | |
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| OBJECTIVE | To monitor the chloride concentrations along rivers, snow disposal sites, salt storage facilities, and selected environmentally sensitive areas to determine the effectiveness of salting reduction strategies. |
| ENVIRONMENTAL CONSIDERATION | By monitoring the effectiveness of the Salt Management Plan mitigation strategies, this may demonstrate improvements to the amount of salt entering the environment. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town currently has no formal program to monitor chloride levels in the environment and relate those levels to winter maintenance activities. • The Town has not carried out a contaminant assessment at their yard. |
| GOAL | <ul style="list-style-type: none"> • Monitor developments on the National level with respect to monitoring requirements for salt management plans. • Conduct an assessment of the yard by 2006. |
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Other parameters may affect interpretation of the data, such as traffic volumes, winter index, climate variations, etc. |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for ensuring the maintenance yards are properly assessed.</p> <p>- Responsible for monitoring developments at the National level with respect to monitoring requirements.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Number of maintenance yards properly assessed. |
| REFERENCE | |

4.13 Emergency Response Program

| EMERGENCY RESPONSE PROGRAM | |
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| OBJECTIVE | To be prepared to respond to emergencies or hazardous situations involving winter maintenance operations and contain and clean-up the situation as required without compromising the Health & Safety of workers |
| ENVIRONMENTAL CONSIDERATION | Environment Canada has done an assessment of road salt and has concluded that the excessive use of road salts can be harmful to the environment. A spill or release involving snow and ice control chemicals may involve the release of a significant amount of salt into the environment. |
| CURRENT SITUATION | <ul style="list-style-type: none"> • The Town currently has an Emergency Response Plan for highway spills. • The Town does not have a formal plan to respond to a spill or release of solid salt or liquid chemical on road and at its maintenance yards. |
| GOAL | <ul style="list-style-type: none"> • Develop a Response Plan for salt spills. • Ensure staff is knowledgeable in the potential hazards and the Response Plan. |

| | |
|-------------------------------|--|
| IMPLEMENTATION CONSIDERATIONS | <ul style="list-style-type: none"> • Communication and coordination with other agencies responsible for Emergency Response will be required. |
| RESPONSIBILITIES | <p>General Manager of Operations - Responsible for developing a Response Plan for maintenance yards.</p> <p>Roads Supervisor - Responsible for coordinating the Response Plan with other agencies.</p> |
| PERFORMANCE MEASURE | <ul style="list-style-type: none"> • Development of a Response Plan. • Percentage of staff knowledgeable in the Response Plan. |
| REFERENCE | |

***MONITORING AND
UPDATING THE
SALT
MANAGEMENT
PLAN***

5.0 MONITORING

5.1 Overview

This chapter of the plan includes table summaries of current practices to allow tracking of the Salt Management Plan Reviews and the implementation of the Plan.

5.1.1 Salt Management Plan Review

An annual management review will take place as part of the plan. During this review the Salt Management Plan will be updated to include changes in departmental policy, as well as to summarize new strategies and techniques deployed. It will also allow the Town to measure and report upon progress towards established goals and standards outlined in the previous chapter dealing with operational practices and strategies.

| Salt Management Plan Review | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Salt Management Plan reviewed | | | | | |
| Salt Management Plan updated | | | | | |
| Salt Management information sent <i>(according to Environment Canada's Code of Practice for the Environmental Management of Road Salts)</i> | | | | | |

The following areas will be included in the annual analysis and review:

- Management Practices
 - Level of service
- Equipment
 - Fleet Allocation/Optimization
 - Fleet Upgrading
 - Equipment Maintenance and Calibration
 - Equipment Washing
- Materials
 - Material Ordering and Delivery
 - Material Application Rates
 - Sand/Salt Blends
 - Material Storage / Handling
 - Good Housekeeping Practices for Maintenance Yards
- Storm Response Summary
 - Weather Forecasting
 - Decision-Making Support Technology
 - Storm Response Approaches
 - Winter Road Patrol
 - Drift Control
- Snow and Ice Control Training
- Snow Removal and Disposal
 - Snow Removal and Disposal Guideline
 - Snow Disposal Site Selection Criteria
 - Snow Disposal Site Monitoring and Maintenance
- Technology Transfer Review
- Communications
- Salt Vulnerable Areas
- Record Keeping
- Monitoring Program
- Emergency Response Program

The following summaries can contribute to future management reviews of the implementation of the Salt Management Plan.

| | | | |
|---|-----------------------|--|-----------------|
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|---|-----------------------|--|-----------------|

5.2 Management Practices

5.2.1 Level of Service

| Level of Service Policy | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| An LOS policy that has been endorsed by senior management. | | | | | |
| Compliance with the LOS policy throughout the organization. | | | | | |

5.3 Equipment

5.3.1 Fleet Allocation/Optimization

| Fleet Allocation/Optimization | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Route reviews completed. | | | | | |
| Achieved the stipulated LOS for each class of road. | | | | | |

5.3.2 Fleet Upgrading

| Electronic Spreader Controls | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of spreaders with electronic ground-speed controllers. | | | | | |
| Percentage of salt placed by spreaders with electronic controllers. | | | | | |

| Pre-wetting and Anti-Icing Equipment | | | | | |
|--|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of spreaders with pre-wetting capabilities. | | | | | |
| Pre-wetting guidelines developed or updated. | | | | | |
| Percentage of staff knowledgeable liquid use and handling. | | | | | |

5.3.3 Equipment Maintenance and Calibration

| Spreader Calibration | | | | | |
|--|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of units calibrated prior to the winter season. | | | | | |
| Number of in-season re-calibrations. | | | | | |

5.3.4 Equipment Washing

| Equipment Washing | | | | | |
|--|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Washwater management policy developed or updated. | | | | | |
| Percentage of sites with washwater management facilities consistent with policy. | | | | | |

5.4 Materials

5.4.1 Material Ordering, and Delivery

| Material Ordering and Delivery | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Summary of quality tests received. | | | | | |
| Percentage of deliveries and production that did not meet specifications. | | | | | |
| Number of salt deliveries that were stored outside for more than 1 day. | | | | | |

5.4.2 Material Application Rates

| Material Application Rates | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Material application rates reviewed or updated. | | | | | |
| Tonnes of salt applied through spreading operations. | | | | | |
| Litres of brine applied through spreading operations. | | | | | |

5.4.3 Sand/Salt Blends

| Sand/Salt Blends | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of salt in sand/salt blends. | | | | | |
| Tonnes of sand used. | | | | | |

5.4.4 Material Storage / Handling

| Salt Storage / Handling | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of salt stored indoors. | | | | | |
| Number of new storages designed in accordance with TAC's Syntheses of Best Practices. | | | | | |
| Percentage of salt storages with drainage water management systems. | | | | | |

| Blended Sand Storage / Handling | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of sand/salt blends stored indoors in impermeable pads. | | | | | |
| Number of new storages designed in accordance with TAC's Syntheses of Best Practices. | | | | | |
| Percentage of blended sand/salt storages with drainage water management systems. | | | | | |

| Liquid Storage / Handling | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of liquids stored in tanks with secondary containment. | | | | | |
| Number of new storages designed in accordance with TAC's Syntheses of Best Practices. | | | | | |

5.4.5 Good Housekeeping Practices for Maintenance Yards

| Good Housekeeping Practices | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| A Good Housekeeping policy developed or updated. | | | | | |
| Number of sites audited for compliance. | | | | | |

5.5 Storm Response

5.5.1 Weather Forecasting

| Weather Forecasting | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of decision-making staff knowledgeable in using weather forecasts. | | | | | |
| Weather forecast delivered in a timely manner. | | | | | |
| Accuracy of weather forecasts. | | | | | |

5.5.2 Decision-Making Support Technology

| Road Weather Information Systems (RWIS) | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Number of RWIS sites accessed. | | | | | |
| Percentage of decision-making staff knowledgeable in RWIS. | | | | | |

| | | | | | |
|--|--|--|--|--|--|
| RWIS forecasts delivered in a timely manner. | | | | | |
| Accuracy of RWIS forecasts. | | | | | |
| Percentage downtime of RWIS sites. | | | | | |

| Infrared Thermometers (IRT's) | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of patrol vehicles with IRT's. | | | | | |
| Percentage of pre-wetting capable spreaders with IRT's. | | | | | |
| Percentage of staff knowledgeable in the use of IRT's. | | | | | |

5.5.3 Storm Response Approaches

| Storm Response Approaches | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Storm Response Guide prepared or updated. | | | | | |

5.5.4 Winter Road Patrol

| Winter Road Patrol | | | | | |
|--|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Winter Road Patrol Guidelines developed or updated. | | | | | |
| Percentage of staff knowledgeable in snow & ice control decision-making. | | | | | |
| Documented road patrolling during winter conditions. | | | | | |

5.5.5 Drift Control

| Drift Control | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| An inventory of drifting snow problem areas developed or updated. | | | | | |
| Drift Control Guidelines developed or updated. | | | | | |
| Percentage of staff knowledgeable in snow drift control strategies. | | | | | |

5.6 Snow and Ice Control Training

| Training | | | | | |
|--|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of supervisors trained. | | | | | |
| Percentage of operations staff trained. | | | | | |
| Percentage of contractor staff trained. | | | | | |
| Number in attendance at training sessions. | | | | | |

5.7 Snow Removal and Disposal

5.7.1 Snow Removal and Disposal Guideline

| Snow Removal and Disposal Guideline | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of snow disposal sites assessed. | | | | | |
| Snow Removal and Disposal Guidelines developed or updated. | | | | | |

5.7.2 Snow Disposal Site Selection Criteria

| Snow Disposal Site Selection Criteria | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Percentage of new snow disposal sites meeting TAC's Syntheses of Best Practices. | | | | | |
| Percentage of snow disposal handled by using snow melters. | | | | | |

5.7.3 Snow Disposal Site Monitoring and Maintenance

| Snow Disposal Site Monitoring and Maintenance | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Pilot snow disposal site monitoring program established. | | | | | |
| <i>To be developed as part of the pilot project.</i> | | | | | |

5.8 Technology Transfer Review

| Technology Transfer Review | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Report on new technologies and practices prepared. | | | | | |

5.9 Communications

| Communications | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Communication plan developed or updated. | | | | | |
| Appropriate stakeholders informed. | | | | | |

5.10 Salt Vulnerable Areas

| Salt Vulnerable Areas | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Number of salt vulnerable areas identified. | | | | | |
| Number of winter maintenance prescription developed in response to salt vulnerable areas. | | | | | |
| Relative change in impact indicators. | | | | | |

5.11 Record Keeping

| Material Usage Record Keeping | | | | | |
|--|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Tonnes of salt applied through sanding operations. | | | | | |
| Tonnes of salt used per lane km. | | | | | |
| Tonnes of sand used. | | | | | |
| End of season material reconciliation completed. | | | | | |
| Percentage of daily records completed accurately. | | | | | |

| Storm Response Record Keeping | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Record Keeping policy developed or updated. | | | | | |
| Percentage of staff knowledgeable in proper record keeping. | | | | | |
| Accurate and complete record of storm responses. | | | | | |
| Percentage of records in compliance with policy. | | | | | |

5.12 Monitoring Program

| Monitoring Program | | | | | |
|--|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Number of maintenance yards properly assessed. | | | | | |

5.13 Emergency Response Program

| Emergency Response Program | | | | | |
|---|------|------|------|------|------|
| Progress | Year | | | | |
| | 2005 | 2006 | 2007 | 2008 | 2009 |
| Maintenance Yard Response Plan developed or updated. | | | | | |
| Percentage of staff knowledgeable in the Response Plan. | | | | | |

Appendix A

Schedule "A" of the Winter Control Program for Street Operations

SCHEDULE "A"

**LEVEL OF SERVICE
1995**

Winter Control Program for Street Operations

Definition of Roads Classifications:

- Arterial - carry large volumes of traffic (generally AADT is >5,000 <30,000)
- serve as emergency routes to hospitals and/or fire routes
 - major traffic carrier between principal areas of traffic generation and connect with major Region and Ministry routes.
- Primary - generally collects traffic from secondary, local and distributes to Arterial Roads.
- generally have AADT volumes of 5,000 to 10,000 vehicles
 - main access for residential, commercial and institutional areas, i.e. school, churches
- Secondary - serve as collector for primary roads in residential and industrial developments
- generally have AADT volumes of between 1,000 to 5,000 vehicles
 - roads with severe designs in topographic hills, curves and access points
- Local - carry lower volumes of traffic with direct access to abutting properties
- generally have AADT volumes of less than 1,500 vehicles
 - not intended to carry through traffic
 - access to secondary and/or primary is limited
- Rural - carry low volumes of traffic, land access is primary consideration
- generally have AADT volumes of < 1,000 vehicles.
 - generally associated with agricultural land.

(i)

| | | | |
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Level of Service Per Road Classification

Arterial: Provide the preferred service at all times. All two lane streets and roads shall be salted and/or plowed to achieve a "two lane bare" condition, all four lane roads to a four lane bare condition. Surfaces shall be maintained as bare as possible through the continued use of assigned staff, equipment and materials suited to the conditions.
For each Arterial Route a salting or plowing procedure shall not exceed 3 hours.

Primary: Provide the preferred service between the hours of 7:00 a.m. and 6:00 p.m. All two lane street and roads shall be salted and/or plowed to achieve a "two lane bare" condition, all four lane roads to a "four lane bare" condition. Surfaces shall be maintained as bare as possible through the continued use of assigned staff, equipment and materials suited to the conditions. For each Primary route a salting or plowing procedure shall not exceed 3 hours.

During the time period between 6:00 p.m. and 7:00 a.m. provide a road condition where traffic can move without undue difficulty through localized salting and/or plowing.

Winter material application and plowing may begin prior to 7:00 a.m. in preparation for moving traffic at peak periods.

Secondary: Provide an acceptable service on Secondary roads between the hours of 7:00a.m. and 6:00 p.m. Roads will be sanded and/or plowed as required to achieve centre bare conditions. Between the hours of 6:00 p.m. and 7:00 a.m. roads will be kept in a condition where traffic can move without undue difficulty.

LOCAL ROADS

All local streets are acceptable in a snow packed condition. Plowing will be carried out only when accumulations reach or exceed 7.5 cm. If the snowfall is continuing, plowing will commence once snowfall ceases or accumulations exceed 12 cm. Sanding will be carried out at intersections, on hills, curves and railway crossing as conditions require. The normal plowing operations will take a minimum of sixteen to eighteen hours from the time the storm ceases. Generally the level of service on the arterial, primary and secondary roads will be in progress before operations commence on local roads and streets.

CUL-DE-SACS

All cul-de-sacs are cleared by the snow plow which provides access for residents. A follow-up cleaning operation takes place by the use of front-end loaders or auxiliary equipment which clear the area of the cul-de-sac, piling the snow in the centre. This snow remains unless storage area becomes limited.

| | | | |
|---|-----------------------|--|-----------------|
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WINTER CONTROL MATERIALS AND APPLICATION RATE

-7 c to above

- All Primary roads - apply 365kg per 2 lane km of straight rock salt.
- All Secondary roads - apply 545 kg per 2 lane km of one-one salt/sand mixture.
- All Local streets - apply 545 kg per 2 lane km of sand containing 5% salt.
- All Rural gravel roads - apply 545 kg per 2 lane km of sand containing 5% salt.

Below -7 and Above -12 celcius

Apply 545 kg of one to one salt/sand per two lane km on all arterial, primary and secondary roads.

Below -12 celsius

Apply 545 kg of straight sand per two lane km on all roads. If snow accumulates to a point where plowing is necessary, salting and sanding operations will cease to minimize material usage. Application rates are reduced if conditions are light as determined by the duty supervisor.

| | | | |
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SENIOR CITIZENS & PHYSICALLY CHALLENGED PERSONS

The Town of Markham will clear the windrow of snow placed across the end of the driveway by snow plow equipment, for senior citizens and physically challenged persons, within a reasonable time after the snow plow has passed the driveway (\pm 4 hrs)

To qualify for the Town's assistance program to remove the snow placed in the driveway by the street plow and/or the sidewalk plow, the owners and tenants must satisfy one of the following criteria:

1. Those residents, owners or tenants who are 65 years of age or over and where there is no relative or occupant under 65 residing on the premises; and
2. Those residents, owners or tenants who are less than 65 years of age and determined by the applicant's physician to be physically challenged; and
3. Those residents, owners or tenants who are under 65 years of age and determined by the applicant's physician to be incapable of removing snow from their driveways without danger to their health and where there is not an able-bodied relative under 65 years of age also residing on the premises.

| | | | |
|---|-----------------------|--|-----------------|
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Appendix B

Application Rate Tables

The following tables are a summary of the Town of Markham’s snow and ice control material application rates as used operationally.

| TABLE B.1 – APPLICATION RATES – SALT⁴ (kg / centreline km) | | | |
|--|--------------------|--------------------------------------|--|
| | Light | Normal | Heavy |
| Condition | Frost or Black ice | Typical storm with snow accumulation | Curves, steep grades, extreme conditions |
| Dry Salt | 130-170 | 225 | 320 |
| Pre-wetted Salt* | | | |
| * As liquids are introduced the application rates for pre-wetted salt will set. Table B.3 will have a summary of the corresponding pre-wetting liquid application rates. | | | |

| TABLE B.2 – APPLICATION RATES – ABRASIVES⁴ (kg / centreline km) | | | |
|---|--------------------|--------------------------------------|--|
| | Light | Normal | Heavy |
| Condition | Frost or Black ice | Typical storm with snow accumulation | Curves, steep grades, extreme conditions |
| Sand / Salt Blend | | 425 | 680 |
| Pre-wetted Abrasives* | | | |
| * As liquids are introduced the application rates for abrasives will be set. Table B.3 will have a summary of the corresponding pre-wetting liquid application rates. | | | |

| TABLE B.3 – APPLICATION RATES – LIQUIDS⁴ | | | |
|---|--------------------|--------------------------------------|--|
| | Light | Normal | Heavy |
| Condition | Frost or Black ice | Typical storm with snow accumulation | Curves, steep grades, extreme conditions |
| Liters / two lane km (anti-icing) | | | |
| Ratio (% of dry material)* (pre-wetting)** | | | |
| * The units for the liquid application rates will depend upon the equipment used and the Town’s preference (liters/kg and gm/m ² are also commonly used). ** Tables B.1 and B.2 will have a summary of the corresponding pre-wetted material application rates. | | | |

^{4/} The application rates identified in the tables have been set by the Town. Ecoplans Limited does not warrant that these rates will provide safe driving conditions.