Hamilton

2021 SALT MANAGEMENT PLAN

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INTRODUCTION

The City of Hamilton has approximately 6,500 lane kilometers of roadways within the framework of a classification system, which provides for the safe, efficient and affordable means of transportation for pedestrians, cyclists and motorists.

Road salt (primarily sodium chloride) is the conventional deicing/anti-icing chemical for maintaining winter safety because of its cost, effectiveness and ease of handling. The amount of salt used is a function of level of service policies, budgets, the transportation network, weather conditions and operational practices.

In 2001, Environment Canada released an assessment report stating that road salts were entering the environment in large amounts and were posing a risk to plants, animals, lake and stream ecosystems and groundwater. Prior to this assessment, road salts were placed on the Canadian Environmental Protections Act’s Priority Substance List (CEPA PSL) at the recommendation of the Minister’s Expert Advisory Panel in order to assess the effects of road salts. Based on the assessment, Environment Canada recommended that road salts be considered “toxic” under the Canadian Environment Protection Act (CEPA 1999). Toxic meaning 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. **Health Canada identifies that road salts are not harmful to humans.**

Elevated concentrations of sodium and chloride in groundwater can make the water taste salty and render it unusable as a drinking water. Residents of rural Hamilton use groundwater for their public and private drinking water supplies and are being impacted by road salt use. Furthermore, individuals on salt-restricted diets are unable to drink or cook with water with elevated sodium concentrations, or water with lower concentrations that what causes the water to taste salty.

Purpose of Plan

This plan is intended to set out a policy and procedural framework for ensuring that the City of Hamilton continuously improves the management of road salt used in its winter maintenance operations. The plan demonstrates the City’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.

The plan should:

- contain best management practices to protect the environment from the negative impacts of road salts;
- include all areas where road salt is used such as roads, cycling infrastructure, sidewalks and pathways; and
- apply to all winter maintenance personnel – both staff and hired contractors

The plan is dynamic and allows the City to phase in new approaches and technologies in a way that is responsive to fiscal demands and the need to ensure that roadway safety is not compromised.

A successful Salt Management Plan is based on the following principles (Transportation Association of Canada, 2013):

- It is activity based, with each activity being assessed at the outset against clearly established standards and/or objectives to determine how that can be carried out with minimal environmental impact;
- Deficiencies in current operations are identified and corrective action established and implemented;
- Required actions are documented in policies and procedures and communicated throughout the organization – including contractors hired to deliver snow and ice control;
- Activities are recorded, monitored, audited and reported periodically to assess progress and identify areas for further improvement; and
- Gaps between actions and desired outcomes are identified and corrective actions are developed and implemented, with necessary modification being made to policies and procedures and appropriate training.

Legislative Context

As stated within the Municipal Act 2001, c.25 s. 44 (1) any City that has jurisdiction over a highway or bridge shall keep it in a state of repair that is reasonable in the circumstances, including the character and location of the highway or bridge.

CODE OF PRACTICE: Environmental Management of Road Salts

The Ministry of Environment, Conservation and Parks (MECP) released a “Code of Practice for the Environmental Management of Road Salts” (Environment and Climate Change Canada 2004). As part of the Code of Practice, the City of Hamilton maintains a Salt Management Plan (SMP) and reports on the status annually. The content of this SMP is consistent with recommendations for SMP content found in the Code of Practice and assesses current City practices against industry best practices.

Source Water Protection

The Clean Water Act, 2006 ensures clean, safe and sustainable drinking water for Ontarians, but by protecting sources of municipal drinking water including lakes, rivers and well water. Source Protection Plans (SPP) contain policies that recommend or require actions to be taken to address activities identified as threats to drinking water.

The Clean Water Act defines “vulnerable areas” as:

a) a significant groundwater recharge area,
b) a highly vulnerable aquifer,
c) a surface water intake protection zone, or
d) a wellhead protection area.

Source Water Protection continued...

The City of Hamilton lies within the Halton-Hamilton source protection region (SPR), the Grand River source protection area and the Niagara Peninsula source protection area. Each has a source protection plan, approved by the MECP, which contain policies to manage or prohibit the identified threats to drinking water sources. Reference document for the Hamilton and Halton Region Source Protection Plan.

The source protection plans include the following policies relating to road salt use applicable to the City of Hamilton:

Source Protection Plan Policy	How is this addressed in the SMP?
1 SMP must identify the location of wellhead protection areas, issue contributing areas, and intake protection zones.	The location of wellhead protection areas, issue contributing areas, and intake protection zones is found within all three SPR’s. Refer to Appendix “B” and “C”.
2 The municipalities shall amend their SMP’s to enhance best management practices in identified vulnerable areas.	This SMP assesses current practices against recommended best management practices and identifies opportunities for improvement. This SMP is reviewed annually and updated approximately every five years.
3 The municipalities shall advise the Source Protection Authority of revisions to the SMP when completed and provide a status update by February 1st of each year until completed.	The Source Protection Authority will be updated on the status of annual SMP reviews.

Salt Vulnerable Areas

The Code of Practice: The Environmental Management of Road Salts, Environment and Climate Change Canada (ECCC), 2004, defines “vulnerable area” as an area particularly sensitive to road salts where additional salt management measures may be necessary to mitigate the environmental effects of road salts in that area. ECCC has the target of 96% of road organizations having salt vulnerable areas identified and action plans prepared by 2024.

The SPP’s identifies areas of vulnerability specifically relating to municipal drinking water sources as well as “highly vulnerable aquifers”. The municipal drinking water sources are in Lynden, Carlisle, Freelton and Greensville.

For more information on vulnerable areas delineated under the Clean Water Act, 2006 please visit the MECP link.

The Municipal Act, 2001

The Municipal Act, 2001 (Section 44 (1)) provides that a municipality must keep its highways “in a state of repair that is reasonable in the circumstances”. Here is the link to The Municipal Act, 2001, O. Reg. 239-02 made under the Act which further prescribes maintenance standards for municipal highways.

POLICY, SCOPE AND COMMITTMENT

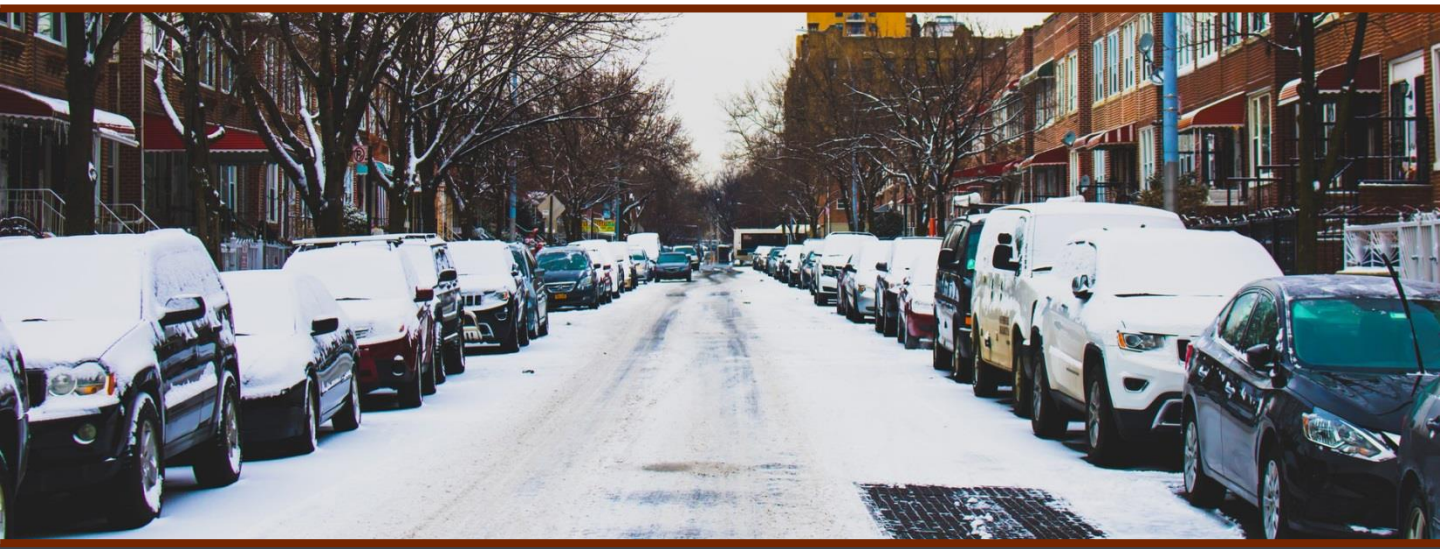
The City of Hamilton’s Road Maintenance Policy

The City of Hamilton will provide a safe, reliable, efficient and environmentally responsible road maintenance service within the City in accordance to Council-Approved report PW-18096(a) Maintenance Standards for Municipal Highways Policy (please refer to Appendix “A” and accepted standards).

Salt Management Policy

The following is the City of Hamilton’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; and
- In providing the stated Maintenance Standards for Municipal Highways Policy, the City of Hamilton will conserve the use of salt by utilizing the most current and cost-effective technologies and practices.



The City of Hamilton’s Strategic Plan

Community Engagement & Participation
Hamilton has an open, transparent and accessible approach to City government that engages with and empowers all citizens to be involved in their community.

Economic Prosperity & Growth
Hamilton has a prosperous and diverse local economy where people have opportunities to grow and develop.

Healthy & Safe Communities
Hamilton is a safe and supportive city where people are active, healthy, and have a high quality of life.

Clean & Green
Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Built Environment & Infrastructure
Hamilton is supported by state of the art infrastructure, transportation operation, building and public spaces that create a dynamic City.

Culture & Diversity
Hamilton is a thriving, vibrant place for arts, culture, and heritage where diversity and inclusivity are embraced and celebrated.

Our People & Performance
Hamiltonians have a high level of trust and confidence in their City government.

Scope

This Salt Management Plan applies to public roads, bicycle infrastructure, sidewalks and pathways for which the City undertakes winter maintenance.

Salt Management Principles

- Road safety is a top priority of the City of Hamilton;
- The City of Hamilton will strive to reduce the amount of salt release to the environment through effective salt management practices;
- The City of Hamilton will show leadership locally, provincially and nationally in their area of road salt management by leading by example and sharing their knowledge and experiences with agencies; and
- The City of Hamilton will provide the necessary training and encouragement to its winter maintenance personnel

Commitment

This original policy was adopted by Hamilton City Council on March 31, 2003 and applies to all employees involved in winter maintenance operations. The same commitment will be made by all employees within the winter maintenance operations with the approval of this most recent Salt Management Plan update.

Communication

The City is committed to informing all levels of the organization and the public on its road salt management policies and practices, including this plan. See Appendix “A” regarding the City’s operational response guidelines.

Plan Review and Update

The Salt Management Plan will be reviewed annually for:

- Planning and implementation of identified opportunities for improvement;
- Consistency with corporate and Maintenance Standards for Municipal Highways Policy and procedures; and
- Incorporation of feedback

A comprehensive review and update will occur every five years. This will include a re-evaluation of continuous improvement goals and updates of best and current City of Hamilton practices.

Implementation

This Salt Management Plan is activity based and follows an Environment Management System framework consistent with the City’s Environmental Management Policy.

It includes the following elements:

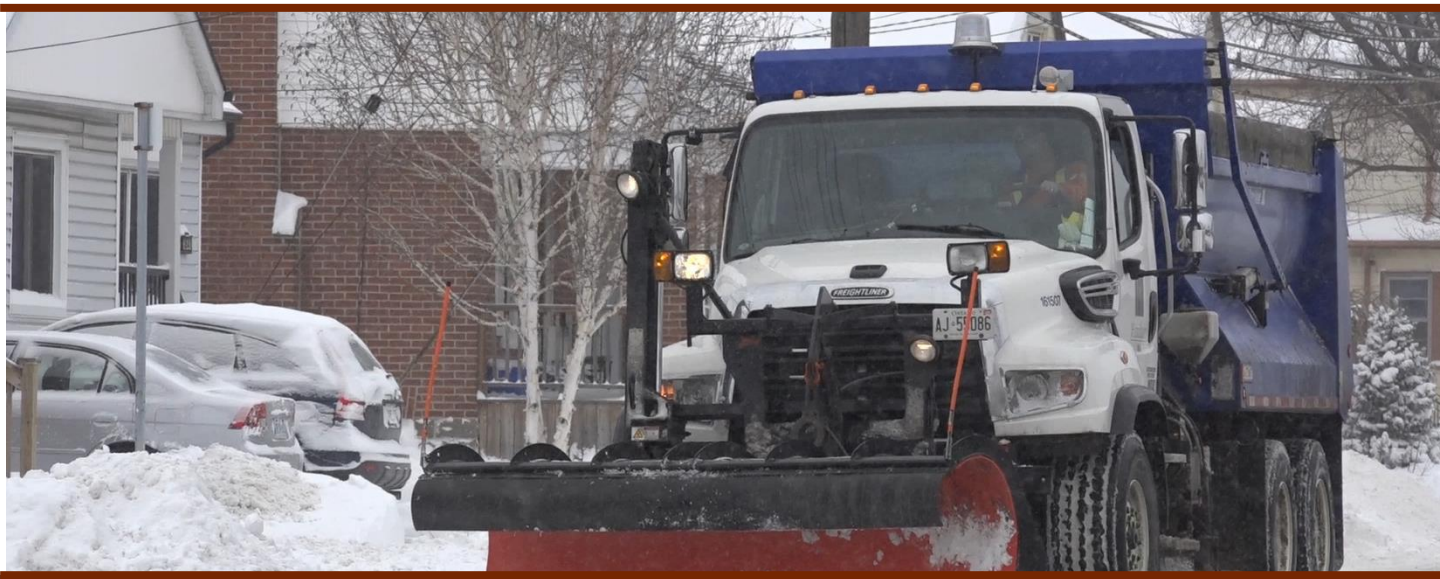
- Periodic review and analysis of industry practices;
- Implementation and documentation of the plan;
- Education and training of staff;
- Monitoring and analysis of operations;
- Management review and revision;
- Environmental review; and
- Policy and practices revision

The implementation and improvement of the Salt Management Plan will promote the continuous development of practices and procedures to improve winter maintenance activities and procedures while striving to reduce the environmental effects of road salt use. 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 involved with the winter control program 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
- General Contractors



WINTER MAINTENANCE STANDARDS

Road Salt Use and Discharge

The following is a list of the main activities and operations undertaken by winter maintenance through which road salts may be released to the environment:

- Application of road salt or liquid salt (brine, fusion) to roads, sidewalks and pathways:
- Application of abrasives (sand), which are mixed with road salt, to roads, sidewalks and pathways;
- Snow storage and disposal, and handling and storage of rock salt, brine, fusion and abrasives

Maintenance Standards for Municipal Highways

As part of the update to the Salt Management plan the City will also be creating a Winter Control Plan (WCP) in the future. This Plan will provide a detailed outline for virtually all aspects of winter control operations within the road corridor.

The City shifted to a 3 shift model for the 2021/2022 winter season. This allowed for 24/7 coverage, Monday through Friday, and increased response times to winter events.

Appendix “A” and Appendix “B” represents the City’s current Council-approved Maintenance Standards for Municipal Highways Policy PW18096(a). These revised polices were approved by City Council on February 10, 2021.

Significant Weather Event

Pursuant to By-law No. 18-347, the General Manager of Public Works or his/her designate may declare the beginning and end of a significant weather event for the purposes of O. Reg. 239/02 Minimum Maintenance Standards (MMS) for Municipal Highways, under the Municipal Act, 2001.

The definition of a significant event is an approaching or occurring weather hazard with the potential to pose significant danger to users of the highways within a municipality.

During the course of a declared significant weather event, the standard for addressing winter maintenance is to monitor the weather in accordance with O. Reg 239/02 s 3.1 of the MMS and to deploy resources to address the issue starting from the time that the municipality deems appropriate to do so. Once the significant weather event is declared to have been concluded, the municipality shall address the issue pursuant to the regular standards for maintenance. The ability to declare a “significant weather event” allows supervisory staff to effectively plan and maximize resources in anticipation of and/or during a significant weather event when all resources may be exhausted.

CONTINUOUS IMPROVEMENT PRACTICES AND STRATEGIES

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 objective, rationale, best practices, improvements and performance measures.

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.

WINTER MAINTENANCE EQUIPMENT & TECHNOLOGIES

Objective

To assist winter maintenance personnel understand: snow and ice control strategies and methods available to them; pavement and weather conditions that exist, that are forecasted and that need to be acted upon; equipment and material availability, capability and limitations.

Rationale

To optimize salt use, it is important to look continually at new and innovative technologies as they are a valuable option.

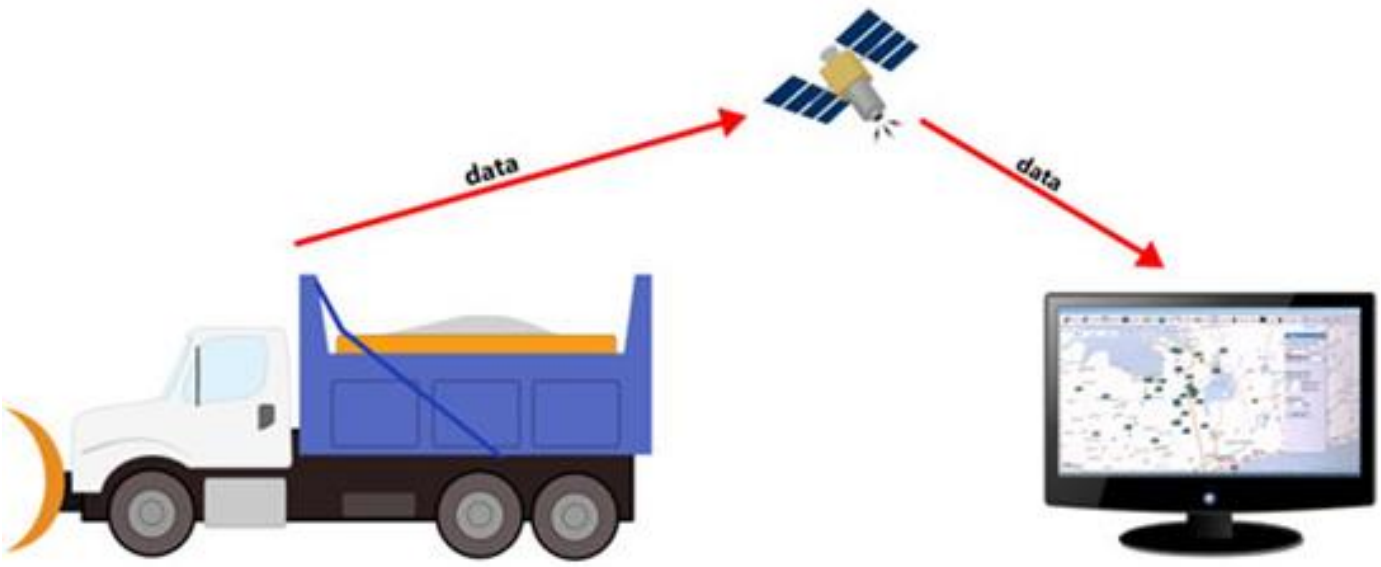
MOECC “Guidelines on Snow Disposal and De-icing Operations in Ontario

Best Practice	Current City Practice
Reduce salt application rates to the minimum amount necessary to successfully do the job.	Solid and liquid application rates are periodically reviewed and compared with other agencies.
Employ rate-controlled distribution equipment which consistency applies de-icing material regardless of vehicle’s speed.	All City and contracted spreaders are equipped with electronic controllers. Salt application rates are: 65, 95, 130, 170, and 320 kg per Lane km
Where salt/sand mixtures are applied, incorporate into the admixture only enough salt to achieve the desired results.	Sand mix is supplied at 3 sand to 1 salt ratio. Specific Class 3’s (Non-Residential) are treated with this mixture as identified in the Council-approved Maintenance Standards for Municipal Highways Policy.
Consider special protective measures when de-icing chemicals are applied to places in proximity to very salt-sensitive areas.	The SMP has been updated with environmentally vulnerable areas, identified in Appendix “C”. All affected winter control routes have the environmentally vulnerable areas identified, and training is provided on our Source Water Protection Plans.

TAC Syntheses of Best Practices

Best Practice	Current City Practice
Snow and ice control decision-making should be based on pavement temperatures rather than air temperatures.	Majority of Plow trucks, pick ups and crew cabs have mounted Infrared Thermometer (IRT) devices, which are used to monitor surface and air temperature to aid in storm response.
Direct Liquid Applications (DLA) techniques are utilized in priority areas including roads in vulnerable areas.	DLA routes have been established and implemented in many areas throughout the City, and criteria sheets are utilized for deployment measures. Appendix “D” for DLA map.
Equip all spreaders with electronic spreader controls that can be accurately calibrated, regulated to ground speed and generate salt-use data in order to optimize salt use.	All City and contracted spreader units are equipped with electronic controllers with ground speed activators.
Automatic Vehicle Location (AVL) equipment is used to provide operational support and enhance the monitoring of salt usage.	All winter control in-house and standby contracted road snow clearing equipment is tracked using AVL. Public facing “Where’s my plow” site.
Provide annual training on the operation and maintenance of all winter maintenance-related equipment.	The City provides training to staff on all new and existing winter equipment.
Winter response procedures aim to prevent the bond of snow and ice to the road, and to mechanically remove as much snow and ice as possible.	Mechanical removal is utilized whenever practical to prevent the bond of snow and ice to the road.

Opportunities for Improvement	Achievement Measures
Develop and implement a calibration policy to ensure spreaders are re-calibrated mid-season and following repairs.	Calibration procedure to be established and implemented for City Staff twice per year, once in October and once in January. **Timing:** 2022
Review current spreader controller and current AVL/GPS for material usage and route specifications.	Compare reports from both providers, ensure accuracy and review route needs. **Timing:** 2022



TRAINING

Objective

A comprehensive salt management training program that demonstrates the purpose and value of new procedures and ensures that personnel are prepared and competent to carry out their duties.

Rationale

To achieve effective implementation of a road salt management plan. Staff and contractors responsible for winter maintenance must obtain the knowledge and understanding of road salt management. Education/training provides the opportunity to learn new ideas, technologies, and skills to enhance existing road salt management practices.

Environment Canada’s Code of Practice (2017)

Best Practice

The Salt Management Plan should contain a training program for all personnel when managing or performing winter maintenance activities involving the use of road salt.

Current City Practice

The City presently conducts annual winter control training and ensures that Area Maintenance Contract (AMC) contractor also completes annual training which includes winter operations, material applications, equipment review and the importance of following the Salt Management Plan.

Best Practice	Current City Practice
Up to date files are maintained of all training provided.	Paper-based and some electronic training records are maintained. The City is looking to implement a document control system that will improve the consistency, storage and planning of training provided to staff.
Deliver an annual training program for operators/staff to ensure that the appropriate learning goals are taught, reinforced and tested.	The City annually delivers a variety of winter control training and onboarding initiatives and refresher training to operators based on their knowledge and experience.
Training programs include testing or a minimum passing grade for verification of knowledge transfer and to provide a medium to assess the quality of the instruction and the analysis of the results.	Training initiatives include a testing component, where appropriate. Evaluations and training are completed on all new staff. Existing staff complete refresher evaluation in a 5 year rotation to ensure best practices are instilled.

Best Practice	Current City Practice
Develop a storm response guide to support decisions related to storm event to endure a consistent and effective snow and ice response.	Storm response decisions are made based on storm response guide currently in practice (refer to Appendix "A")
An emergency response program exists that includes a communication response protocol and spill response plan on roads and at the yards is including in existing training program.	Spills reporting procedures forms part of the supervisory staff's onboarding training process. The City's vehicle refueling policy also includes spill procedures. Communications protocol is already established to notify the public, Council as required
Conduct pre and post storm analysis to identify opportunities for improvements and ensure compliance with snow and ice policies.	Pre and post storm event meetings are held, on forecasted and completed significant winter events with staff, to plan/review event responses, successes and opportunities for improvement.

Opportunities for Improvement	Achievement Measures
Plan snow plow routes to ensure road section and intersections are not double salted.	Conduct an end of season review of route structure and look for areas of service optimization and possible salt reduction. **Timing:** 2022
Implement extensive winter training for all contractors, seasonal and full-time staff	Enhance current winter training to include demonstrations, hands-on and skills knowledge testing. **Timing:** 2022

SALT MANAGEMENT PLAN

Objective

To provide a resource through which a municipality commits to implementing salt best management practices as it fulfils its obligation to provide a safe, efficient and cost-effective transportation system.

Rationale

The amount of salt used is driven as per the local service level policies, the transportation system, snow fighting strategies, techniques and weather conditions. Local weather conditions require salt management initiatives be developed and implemented locally by each organization.

Environment Canada's Code of Practice (2017)

Best Practice	Current City Practice
The Salt Management Plan (SMP) should include communication activities necessary to inform the organization and the public of the management plan and related policies and procedures.	The original SMP was created and communicated to various stakeholders including Council in 2003. The current updated SMP will be presented to Council through a report in Q4 of 2021, with updates posted on the City's web page for the public to view.
The development of SMP's, based on a review of existing road maintenance operations, identification of means and goal-setting to achieve reduction of the negative impacts of salt releases.	SMP is assessed against leading practices to identify opportunities for operational improvements and to monitor effectiveness of existing practices in protecting the environment from the negative impacts of road salt.
The SMP should ensure monitoring of actions to measure the plan's effectiveness.	The City tracks annual salt usage and has implemented technology supported by AVL and onboard computer spreaders and loader scales to provide detailed tracking of salt application by route.

Best Practice	Current City Practice
A communication plan is in place for communicating the Salt Management Plan (SMP) to internal and external stakeholders.	The current updated SMP will be presented to Council through a report in Q4 of 2021, including posting the updated SMP to the City's web page for the public to view.
Each salt management includes monitoring and reporting on implementation of the plan. These results should be reported annually to the senior executive responsible for the SMP.	Winter operations are reviewed annually, and report compiled and shared with senior management. Salt usage and season winter specifics are reported yearly to Environment Canada

Good Practice for Winter Maintenance in Salt Vulnerable Areas

Best Practice	Current City Practice
Ensure compliance with Accessibility for Ontarians with Disabilities Act, 2015 (AODA)	AODA review to ensure compliance as well as, training of staff annually.
Having accurate information about current and forecasted weather condition and pavement conditions.	The City has a contract with a weather service to provide year-round reports with forecasted conditions as well as various internet weather webpages.
Usage of onboard pre-wetting on all equipment to reduce scatter, activate the salt, enhances the melting capacity and reduces salt usage.	The City uses two pre-wetting products that are used by both internal staff and contractors. Both are a salt brine mixture. All City Large Combo units have pre-wetting tanks and application capabilities.

Opportunities for Improvement	Achievement Measures
Review the “Good Practices for Winter Maintenance in Salt Vulnerable Areas”.	Document to be reviewed by management every two years to remain current with technological and legislative changes. **Timing**: 2023
Review and adjust Salt Management Plan (SMP) as required annually.	Implement an annual review of the SMP and full comprehensive review to be completed every 5 years. **Timing:** 2026

GOOD HOUSEKEEPING PRACTICES

Objective

To ensure that best practices for storage and handling of salt, sand/salt blends and liquid materials are geared towards reducing unnecessary salt loss to the environment.

Rationale

Improper handling of salt materials at maintenance facilities can result in significant amounts of salt being lost to the environment. Good housekeeping practices can help reduce this loss.

ENVIRONMENT CANADA'S CODE OF PRACTICE (2017)

Best Practice	Current City Practice
Priority should be given to allocating the new equipment to service areas adjacent to salt vulnerable areas and reallocating less salt-efficient equipment to less sensitive areas.	The City has a general 10-year life cycle for winter equipment and prior to replacement a complete review of best practices, new technologies and equipment needs are reviewed. All new purchases of spreaders include the ability to use liquids for pre-wetting applications.
Train all operators before the start of the winter season on both the theory of road salt management and the practical aspects.	All new staff receive training which is completed in a week-long onboarding session. This includes source water protection presenters, heath and safety related items, operational needs, material handling and documentation, theory and practical training with plow/spreader and loader equipment. Existing staff receive refresher training including source water protection, material handling, practical evaluation with plow/spreader and loader equipment.

GOOD PRACTICE FOR WINTER MAINTENANCE IN SALT VULNERABLE AREAS

Best Practice	Current City Practice
Road salt should be stored indoors on an impermeable pad.	All City yards currently store salt indoors. Annual review of condition of impermeable land needs to be implemented.
Brine tanks should be housed on an impermeable pad with sides high enough to contain the contents of tank in the event of a spill or leak.	All City operated yards have brine tanks stored on impermeable pads and with sufficient containments in the event of a spill or leak.

Opportunities for Improvement	Achievement Measures
Review containment measures for pre-wet storage.	Structure and measures to be reviewed every two years to remain current with legislative changes. **Timing**: 2022
Review runoff and potential management measures in Salt Vulnerable Areas	Analysis and costing to be provided for managing runoff safely according to Best Management Practices. A surface water assessment should be completed to identify all potential effects to natural features as a result of paved areas. **Timing:** 2024

SNOW REMOVAL AND DISPOSAL

Objective

To ensure snow removal and disposal operations follow provincial standards while complying with Council appointed levels of service.

Rationale

A review of disposal operations can lead to adopting methods that minimize negative environmental impacts.

ENVIRONMENT CANADA’S CODE OF PRACTICE (2017)

Best Practice	Current City Practice
Public safety is a priority. Organizations must ensure that the hazards caused by accumulated snow are efficiently and safely addressed.	City’s snow dump facility at 1199 Upper Ottawa Street is fully fenced and appropriate signage posted. Additionally for 2021 the installation and monitoring of video cameras will be set up.
Melt water must be managed in compliance with local water quality regulations and in a manner that protects surface and groundwater resources.	The City has one fully regulated snow management facility (1199 U. Ottawa St). Additional sites are required in the lower City and are currently being reviewed.

GOOD PRACTICE FOR WINTER MAINTENANCE IN SALT VULNERABLE AREAS

Best Practice	Current City Practice
Primary purpose of snow storage and disposal sites is to manage snow that would otherwise be a hazard to the public or impair winter maintenance operations.	The City has an engineered snow management facility that meets all applicable environmental requirements.

Opportunities for Improvement	Achievement Measures
Review all snow disposal sites to ensure they are located so as to minimize the adverse effects to the environment.	Review potential locations and implementation of a fully regulated snow management facility within 2 years of acquiring a site. **Timing**: 2022-2026
Implement snow disposal monitoring to minimize adverse environmental effects of their operations.	Create a snow disposal site monitoring plan. **Timing:** 2023
Identify location for snow disposal site in lower City.	Research and find suitable location in lower City, purchase of land, build to meet full environmental requirement and standards. **Timing:** 2023

PERFORMANCE METRICS

Performance measures should be used to determine whether the objectives of the salt management plan have been met. Achievement, year over year, will be measured against the benchmark year described as “Current Winter Maintenance Program” in this salt management plan.

Some of the indicators will include:

Monitoring the severity of the winter season

- Total annual cm of snow accumulation;
- Total number of days with measurable snowfall;
- Total number of days with freezing rain;
- Total number of continuous winter event responses; and
- Total number of spot winter event response.

Monitoring the salt used

- Tonnes of salt purchased annually; and
- Total tonnes of salt applied annually per system km.

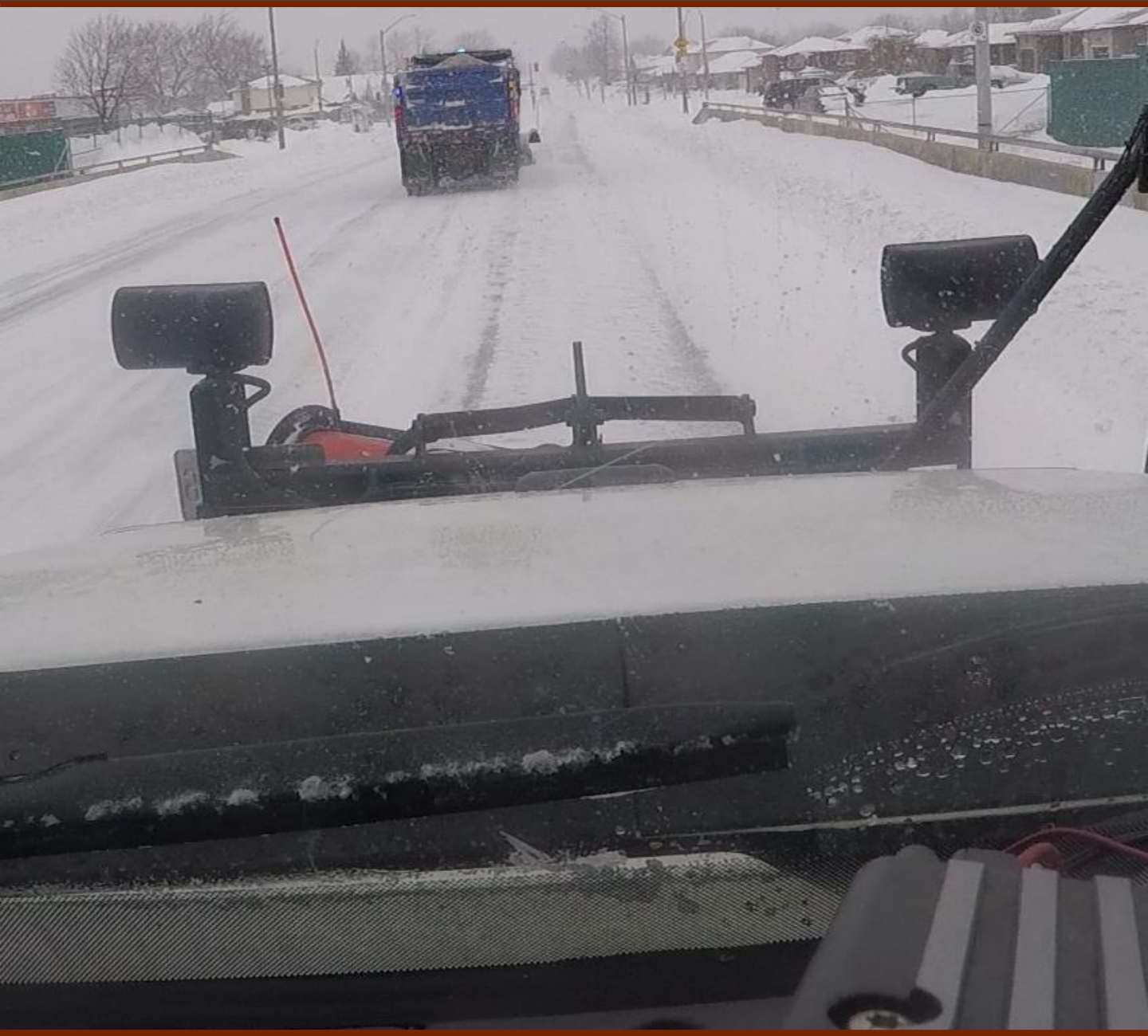
Ensuring customer satisfaction

- % of winter event responses that meet or exceed the level of service policy;
- Total number of complaints received regarding winter operations; and
- % of complaints that resulted in a response.

Measuring the success of the plan

- % of the goals set out in the plan that were met.

APPENDIX “A”



Maintenance Guidelines for Level of Service for Highways

City of Hamilton Maintenance Guidelines for Levels of Service for Highways				
Maintenance Category	**Maintenance Activities**	**Description**	**Level of Service / Minimum Maintenance Standard**	**Related Reports**
Winter Maintenance	Snow Accumulation - Roadways	Snow accumulation means the natural accumulation of any of the following that, alone or together, covers more than half a lane width of a roadway: Newly-fallen snow Wind-blown snow Slush	The standard* for addressing snow accumulation on roadways: Class 1/Priority 1 (Parkways/Arterials) - 2.5 cm depth - 4-hour response Class 1-5/Priority 1 (Escarpment Crossings) - 5 cm depth - 4-hour response Class 2/Priority 2A (Collectors Primary) - 8 cm depth - 8 hour response Class 2-3/Priority 2B (Collectors Secondary) - 8 cm depth - 8-hour response Class 4-6/Priority 3 (Rural Hard top) - 10 cm - 24-hour response Class 5/Priority 3 (Residential) - 8 cm - 24-hour response Class 6/Priority 3 (Rural Loose top) - 10 cm - 24-hour response.	PW13022 Winter Control Program Service Level Review http://www2.hamilton.ca/NR/rdonlyres/6F5643A3-C6D0-4AE9-942D-05DF5FE9F3DE/0/Mar18Item83_PW13022.pdf PW18096 https://pub-hamilton.escribemeetings.com/filestream.ashx?DocumentId=173914

OPERATIONAL RESPONSE GUIDELINE

Transportation Operations & Maintenance
Roadway Maintenance Winter Control

OPERATIONAL RESPONSE GUIDELINE 2021

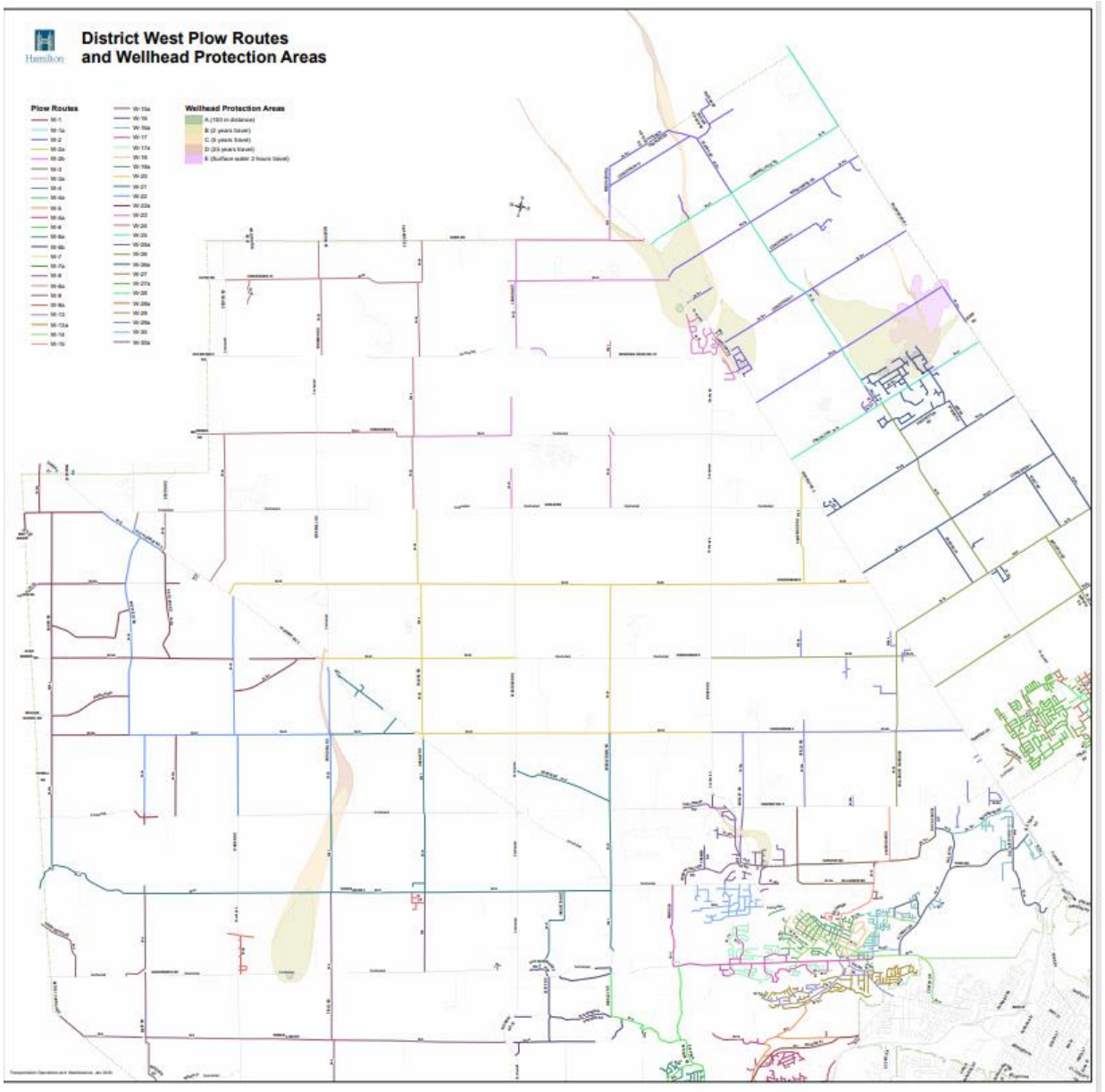
FORECAST		FORECAST		FORECAST	
Accumulation:	15 cm or less	Accumulation:	15 cm to 25 cm	Accumulation:	25 cm plus
Duration:	Less than 12 hours	Duration:	12 to 24 hours	Duration:	Beyond 24 hours
Wind Speed	Less than 20 km/hr	Wind Speed	20-40 km/hr or variable	Wind Speed	More than 40 km/hr
Drifting:	None	Drifting:	Limited in exposed areas	Drifting:	Extreme Anything
Temperature:	Above -15 C	Temperature:	-15 C to -40 C	Temperature:	

PLAN 'A'		PLAN 'B'		PLAN 'C'	
Priority 1 Roads:	No reductions	Priority 1 Roads:	Bare to centre bare	Priority 1 Roads:	Mountain accesses bare/centre bare
Priority 2 Roads:	See approved Level of	Priority 2 Roads:	Reduced to Priority 3	Priority 2 Roads:	Reduced to Priority 3
Priority 3 Roads:	Service Standards	Priority 3 Roads:	Plowing at 15 cm accumulation first pass Final plowing at the end of the storm Duration beyond 24 hours	Priority 3 Roads:	Plowing at 15 cm accumulation first pass Final plowing at the end of the storm Duration unknown

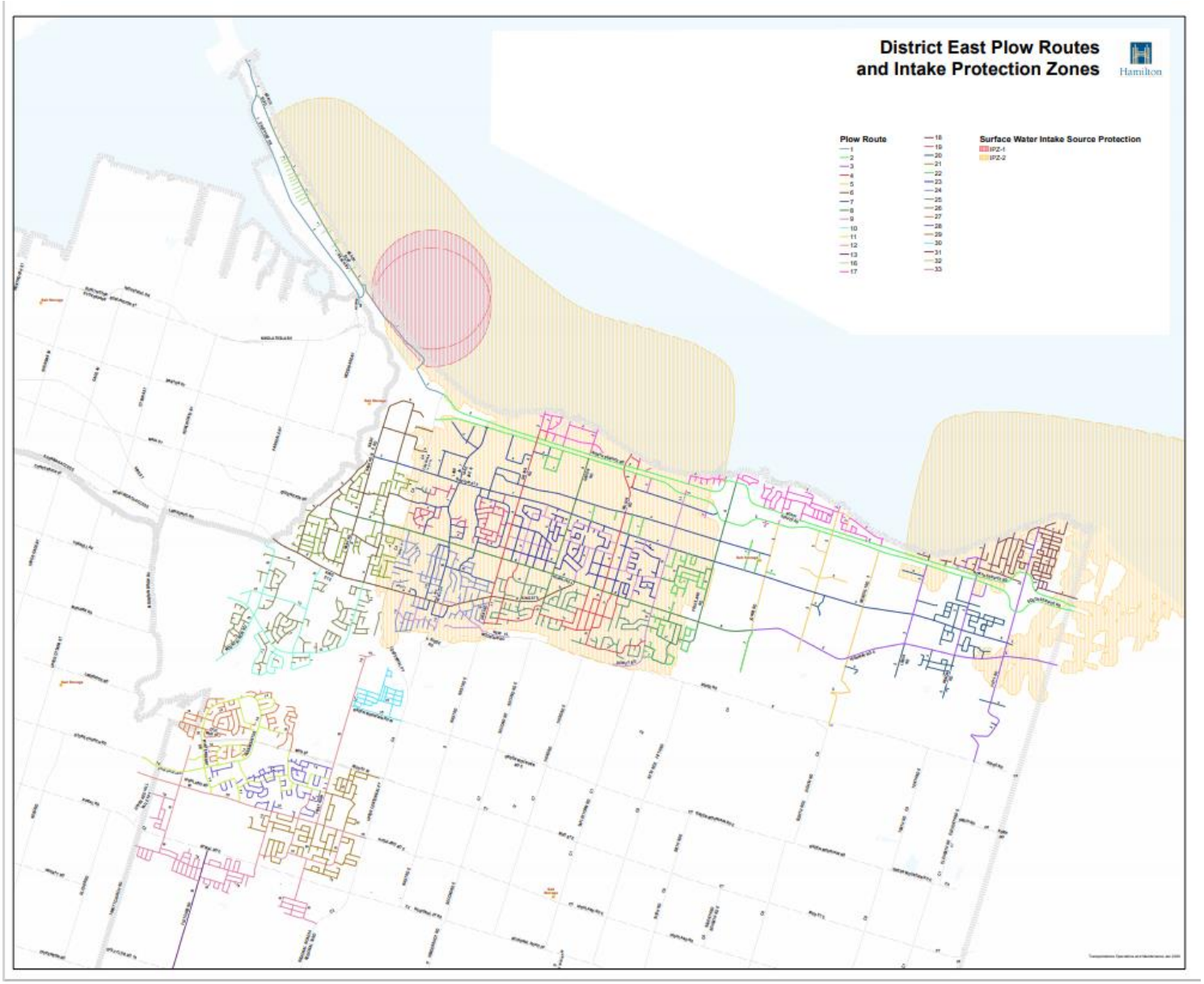
GO TO PLAN 'B' IF:	GO TO PLAN 'C' IF:	GO TO PLAN 'B' IF:
Greater accumulation/duration Wind speed increase with drifting Prolonged freezing rain Simultaneous emergencies Temperature falls Major equipment breakdowns Early/late season storm	Greater accumulation/duration Wind speed increase with drifting Variable precipitation Simultaneous emergencies Snow emergency declared/driving ban Major equipment breakdowns Extreme temperature variations …Go to Plan A if conditions improve	a) Conditions improve

APPENDIX “B”

CITY OF HAMTILTON PLOW ROUTES NEW ENVIRONMENTALLY VULNERABLE AREAS MAPPING



CITY OF HAMTILTON PLOW ROUTES NEW ENVIRONMENTALLY VULNERABLE AREAS MAPPING



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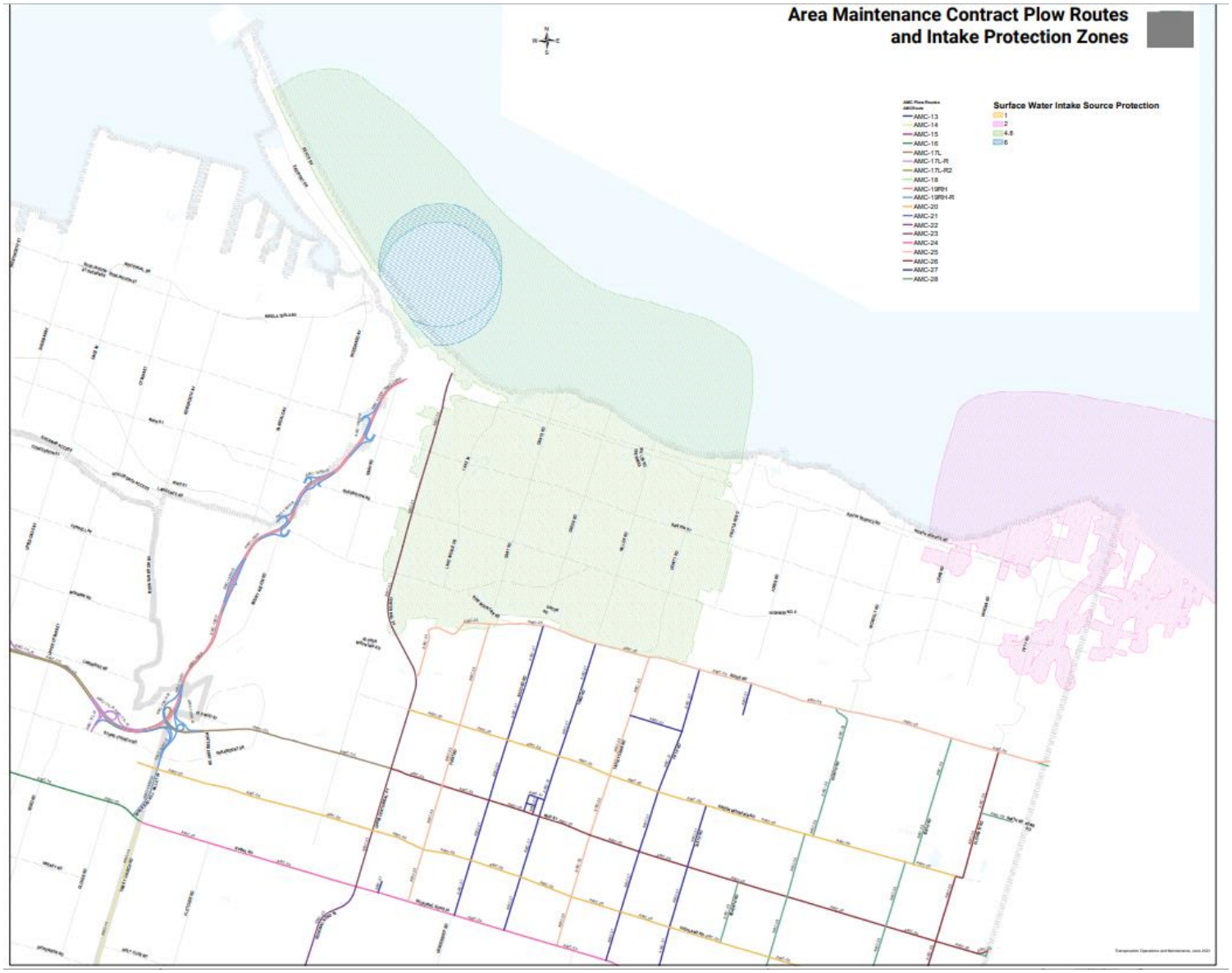

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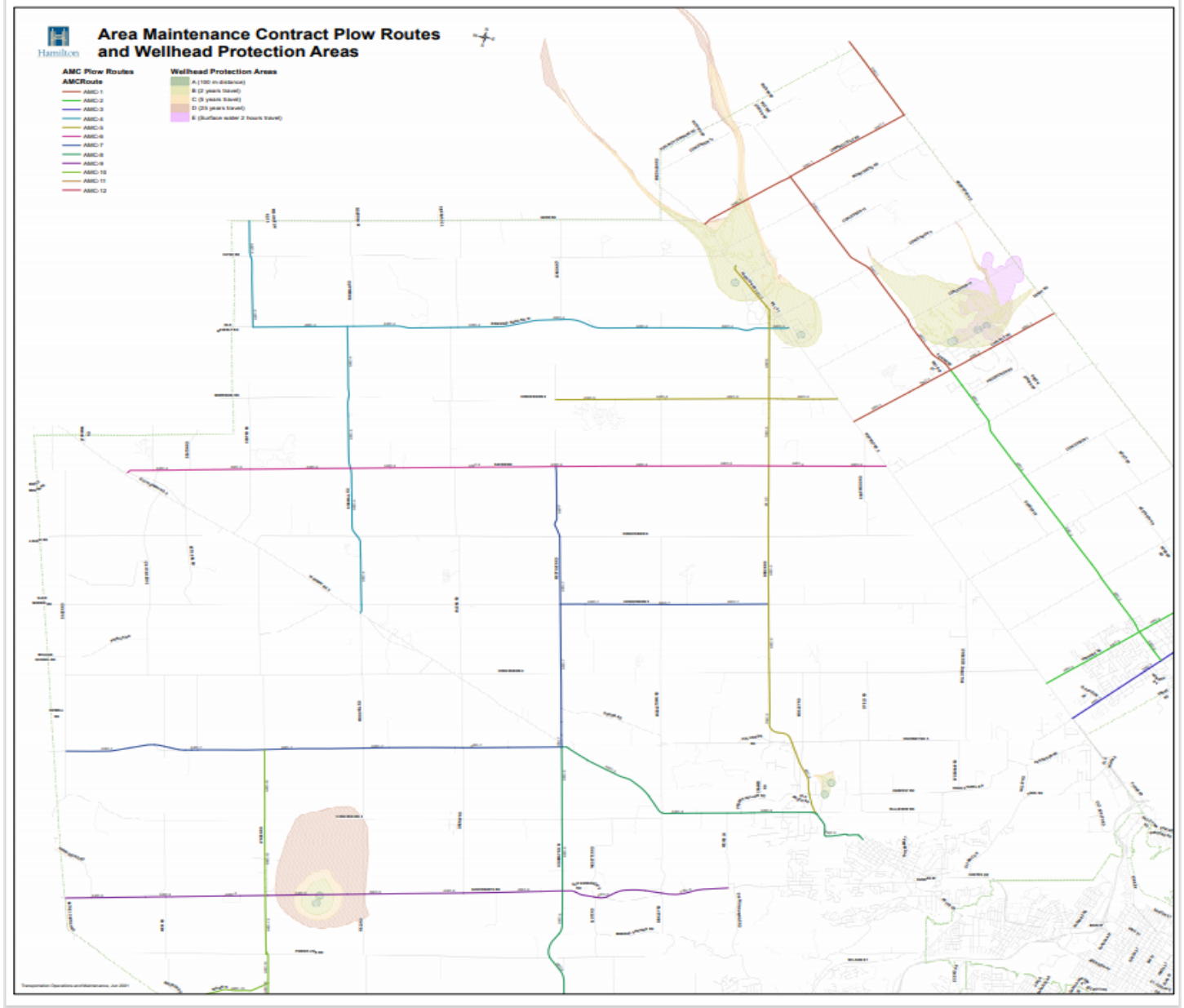
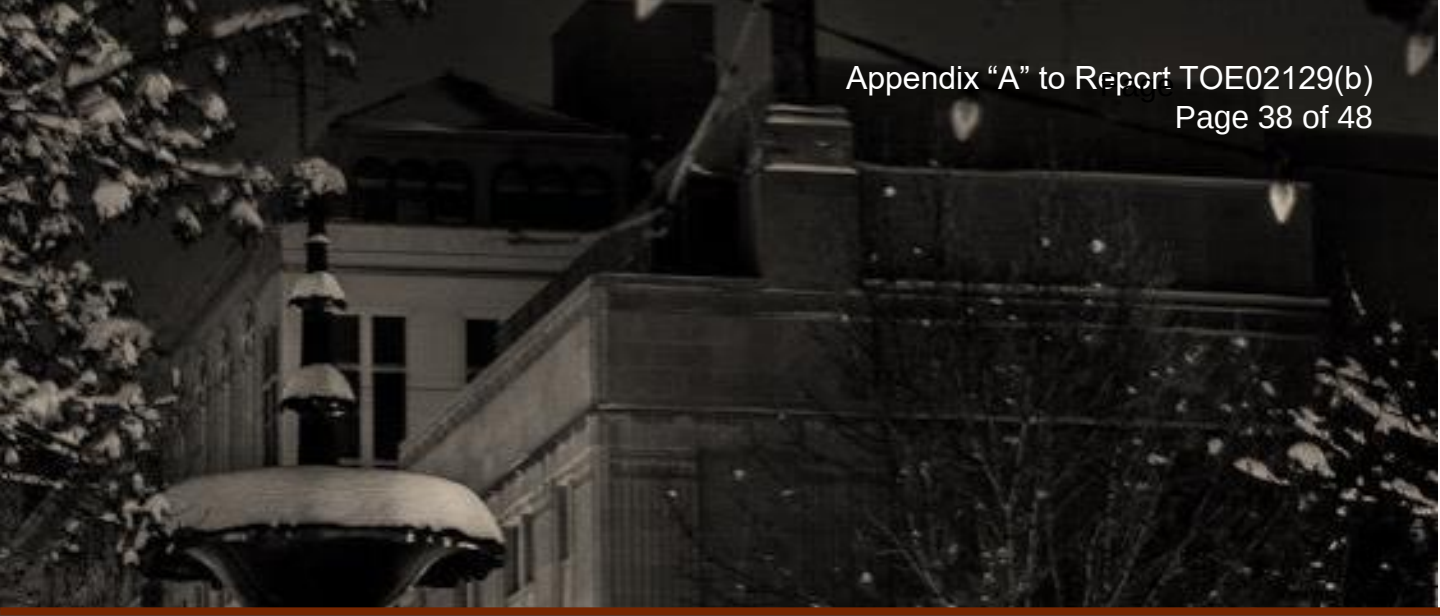
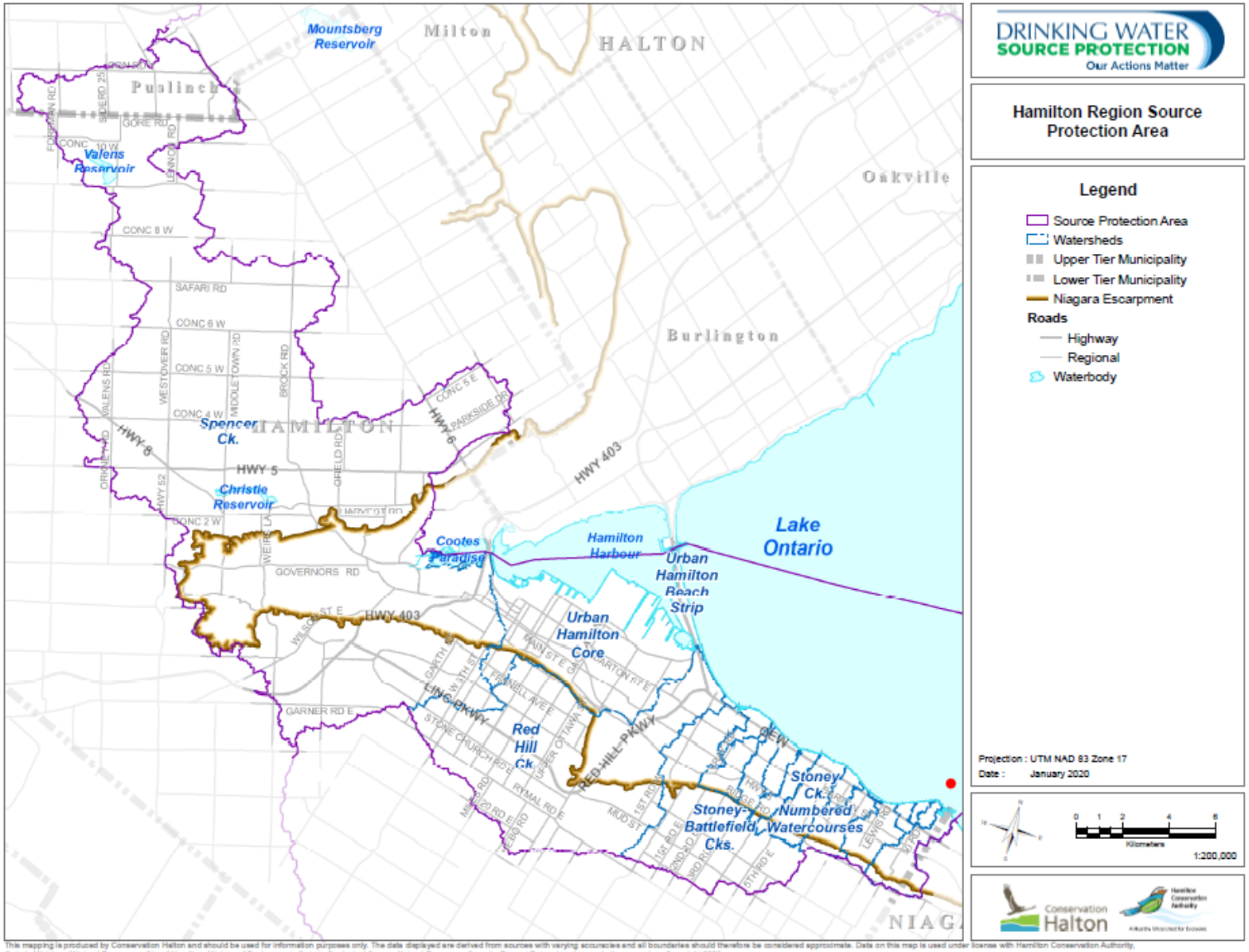


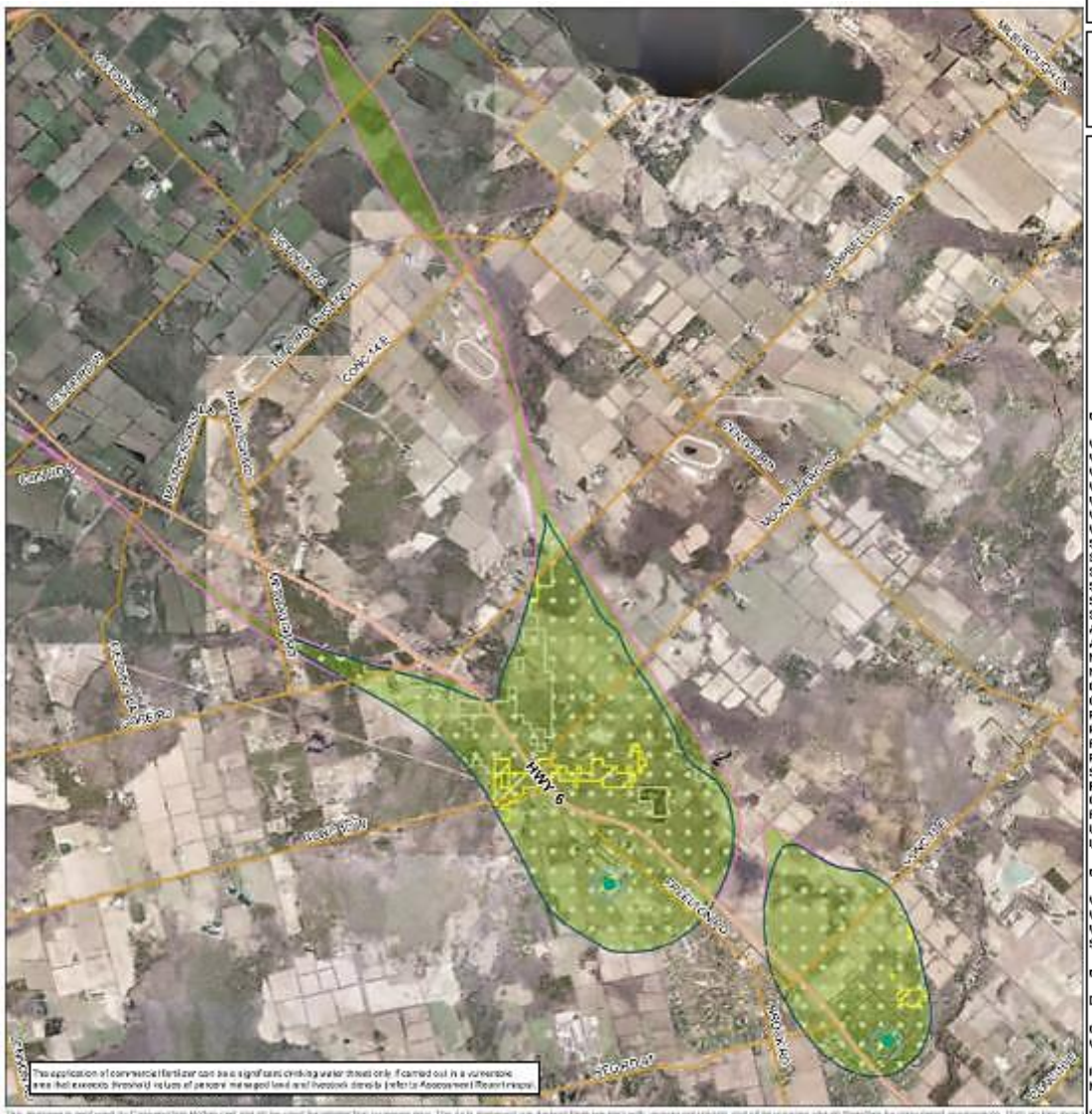


APPENDIX “C”

HALTON-HAMILTON SOURCE PROTECTION REGION MAPPING



DRINKING WATER SOURCE PROTECTION WELLHEAD LOCATION MAPPING



DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

Figure 5

Freelton

Existing and would be significant groundwater threat areas

Legend

WHPA Boundary
- A
- B
- C

GW - Significant Threats - Group 1
GW - Significant Threats - Group 2
GW - Significant Threats - Group 3

Roads
- Highway
- Regional
- Local

Municipal Well

Group 1: (WHPA-A-10, WHPA-B-10)

Waste Disposal Site - Application of Untreated Septage to Land (Chemical and Pathogen)
Waste Disposal Site - Mine Tailings (Chemical)
Waste Disposal Site - Landfarming of Petroleum Refining Waste (Chemical)
Waste Disposal Site - Landfilling (Hazardous Waste) (Chemical)
Waste Disposal Site - PCB Waste Storage (Chemical)
Waste Disposal Site - Storage of Hazardous Waste at Disposal Site (Chemical)
Waste Disposal Site - Storage of Waste Clauses (p),(q),(r),(s),(t),(u) (Chemical)
Sewage - Discharge from stormwater retention pond (Chemical and Pathogen)
Sewage - Sanitary Sewers and Related Pipes (Chemical and Pathogen)
Sewage - Septic System (Chemical and Pathogen)
Sewage - Septic System Holding Tank (Chemical and Pathogen)
Sewage - Sewage Treatment Plant Effluent Discharges (Chemical and Pathogen)
Sewage - Storage of Sewage (Pathogen)
ASM - Application (Chemical and Pathogen)
ASM - Handling and Storage (Chemical and Pathogen)
NASM - Application (Chemical and Pathogen)
NASM - Handling and Storage (Chemical and Pathogen)
Commercial Fertilizer - Application (Chemical)
Commercial Fertilizer - Handling and Storage (Chemical)
Pesticides - Application (Chemical)
Pesticides - Handling and Storage (Chemical)
Road Salt - Application (Chemical)
Road Salt - Handling and Storage (Chemical)
Snow - Storage (Chemical)
Fuel - Handling and Storage (Chemical)
Organic Solvent - Handling and Storage (Chemical)
Runoff Management - Aircraft De-icing Chemicals (Chemical)
Use of land for livestock - Grazing and Pasturing (Chemical and Pathogen)
Use of land for livestock - Confinement Yard (Chemical and Pathogen)

Group 2: (WHPA-A-10, WHPA-B-10, WHPA-B-8, WHPA-C-8)

Waste Disposal Site - Landfilling - Municipal Waste (Chemical)
Waste Disposal Site - Landfilling - Solid Non Hazardous Industrial or Commercial (Chemical)
Waste Disposal Site - Liquid Industrial Waste Injection into Wells (Chemical)
Sewage - Storage of Sewage (Chemical)

Group 3: (WHPA-A, WHPA-B, WHPA-C)

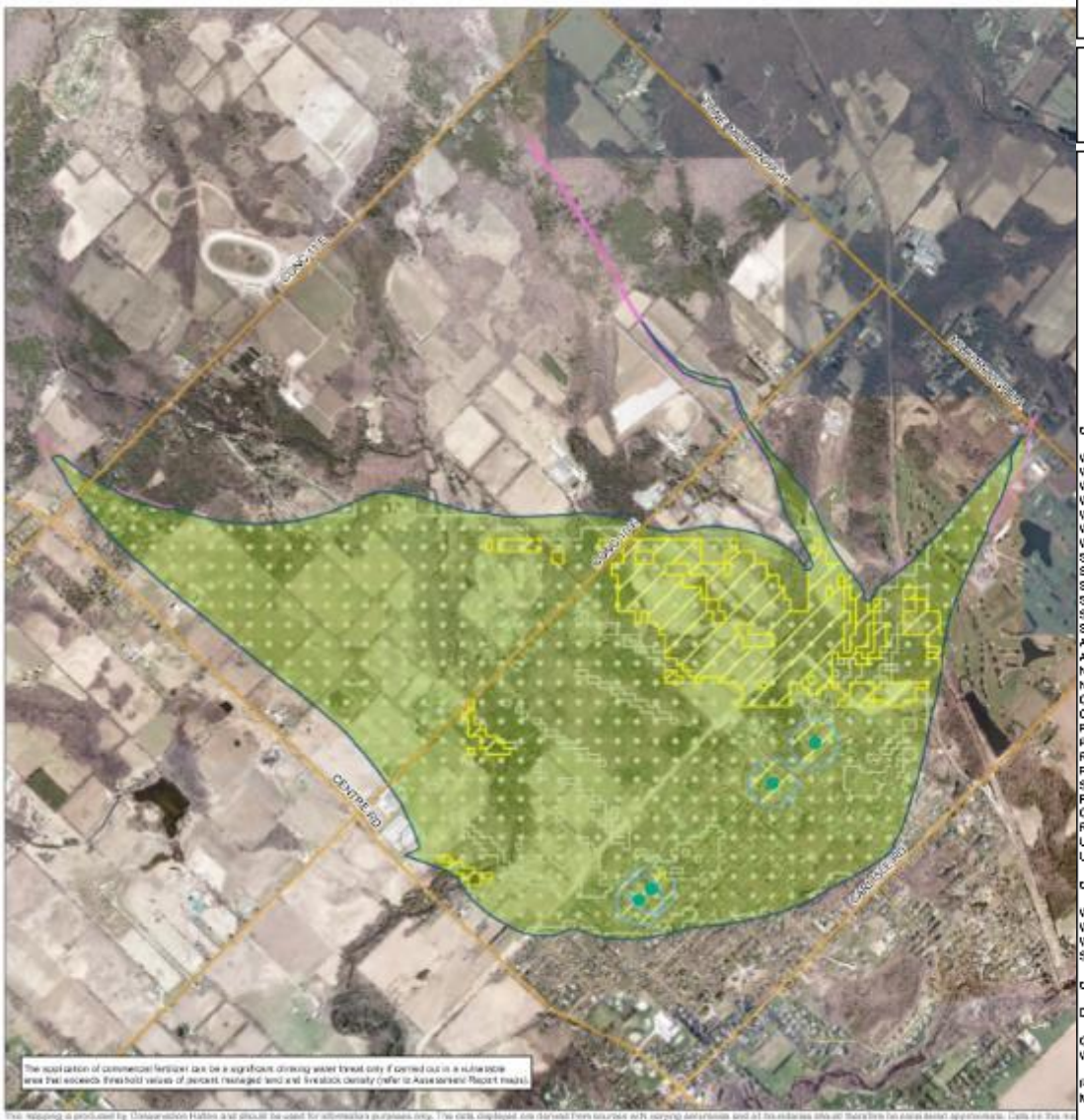
DNAPL - Handling and Storage

GW: Groundwater
WHPA-A-10: Wellhead Protection Area A - Vulnerability Score of 10

Reference: Prescribed threat circumstances as listed in the Ministry of the Environment Table of Drinking Water Threats (2009)

Source: Conservation Halton
Date: August 2015
Projection: UTM NAD 83 Zone 17

DRINKING WATER SOURCE PROTECTION WELLHEAD LOCATION MAPPING



DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

Figure 6

Carlisle

Existing and would be significant groundwater threat areas

Legend

WHPA Boundary
- A
- B
- C

GW - Significant Threats - Group 1
GW - Significant Threats - Group 2
GW - Significant Threats - Group 3

Roads
- Highway
- Regional
- Local

Municipal Well

Group 1: (WHPA-A-10, WHPA-B-10)

Waste Disposal Site - Application of Untreated Septage to Land (Chemical and Pathogen)
Waste Disposal Site - Mine Tailings (Chemical)
Waste Disposal Site - Landfarming of Petroleum Refining Waste (Chemical)
Waste Disposal Site - Landfilling (Hazardous Waste) (Chemical)
Waste Disposal Site - PCB Waste Storage (Chemical)
Waste Disposal Site - Storage of Hazardous Waste at Disposal Site (Chemical)
Waste Disposal Site - Storage of Waste Clauses (p),(q),(r),(s),(t),(u) (Chemical)
Sewage - Discharge from stormwater retention pond (Chemical and Pathogen)
Sewage - Sanitary Sewers and Related Pipes (Chemical and Pathogen)
Sewage - Septic System (Chemical and Pathogen)
Sewage - Septic System Holding Tank (Chemical and Pathogen)
Sewage - Sewage Treatment Plant Effluent Discharges (Chemical and Pathogen)
Sewage - Storage of Sewage (Pathogen)
ASM - Application (Chemical and Pathogen)
ASM - Handling and Storage (Chemical and Pathogen)
NASM - Application (Chemical and Pathogen)
NASM - Handling and Storage (Chemical and Pathogen)
Commercial Fertilizer - Application (Chemical)
Commercial Fertilizer - Handling and Storage (Chemical)
Pesticides - Application (Chemical)
Pesticides - Handling and Storage (Chemical)
Road Salt - Application (Chemical)
Road Salt - Handling and Storage (Chemical)
Snow - Storage (Chemical)
Fuel - Handling and Storage (Chemical)
Organic Solvent - Handling and Storage (Chemical)
Runoff Management - Aircraft De-icing Chemicals (Chemical)
Use of land for livestock - Grazing and Pasturing (Chemical and Pathogen)
Use of land for livestock - Confinement Yard (Chemical and Pathogen)

Group 2: (WHPA-A-10, WHPA-B-10, WHPA-B-8, WHPA-C-8)

Waste Disposal Site - Landfilling - Municipal Waste (Chemical)
Waste Disposal Site - Landfilling - Solid Non Hazardous Industrial or Commercial (Chemical)
Waste Disposal Site - Liquid Industrial Waste Injection into Wells (Chemical)
Sewage - Storage of Sewage (Chemical)

Group 3: (WHPA-A, WHPA-B, WHPA-C)

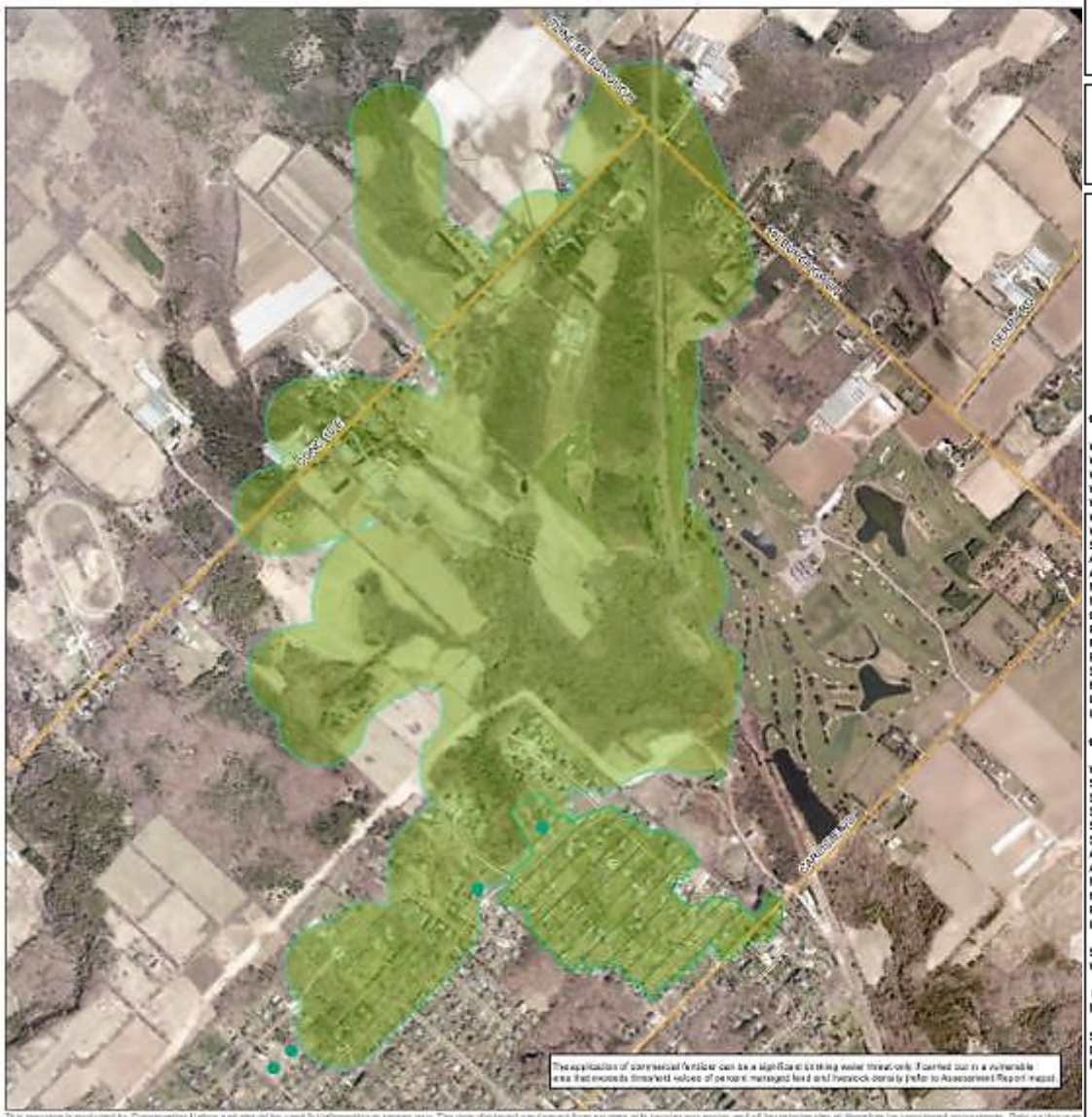
DNAPL - Handling and Storage

GW: Groundwater
WHPA-A-10: Wellhead Protection Area A - Vulnerability Score of 10

Reference: Prescribed threat circumstances as listed in the Ministry of the Environment Table of Drinking Water Threats (2009)

Source: Conservation Halton
Date: August 2015
Projection: UTM NAD 83 Zone 17

DRINKING WATER SOURCE PROTECTION WELLHEAD LOCATION MAPPING



DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

Figure 7

Carlisle

Existing and would be significant surface water threat areas

Legend

WHPA Boundary
- E
- SW - Significant Threats - Group 4
- SW - Significant Threats - Group 5

Roads
- Highway
- Regional
- Local

Municipal Well

Group 4: (WHPA-E-9)

Waste Disposal Site - Application of Untreated Septage to Land (Chemical)
Waste Disposal Site - Mine Tailings (Chemical)
Waste Disposal Site - Landfarming of Petroleum Refining Waste (Chemical)
Waste Disposal Site - Landfilling (Hazardous Waste) (Chemical)
Waste Disposal Site - Landfilling (Municipal Waste) (Chemical)
Waste Disposal Site - Landfilling of solid non hazardous industrial or commercial waste (Chemical)
Waste Disposal Site - Storage of Hazardous Waste at Disposal Site (Chemical)
Sewage - Storage (Pathogen)
ASM - Application (Chemical)
ASM - Handling and Storage (Chemical)
NASM - Application (Chemical)
NASM - Handling and Storage (Chemical)
Commercial Fertilizer - Application (Chemical)
Pesticides - Handling and Storage (Chemical)
Road Salt - Application (Chemical)
Road Salt - Handling and Storage (Chemical)
Snow - Storage (Chemical)
Runoff Management - Aircraft De-icing Chemicals (Chemical)
Use of land for livestock - Grazing and Pasturing (Chemical)
Use of land for livestock - Confinement Yard (Chemical)

Group 5: (WHPA-E-8.1, WHPA-E-9)

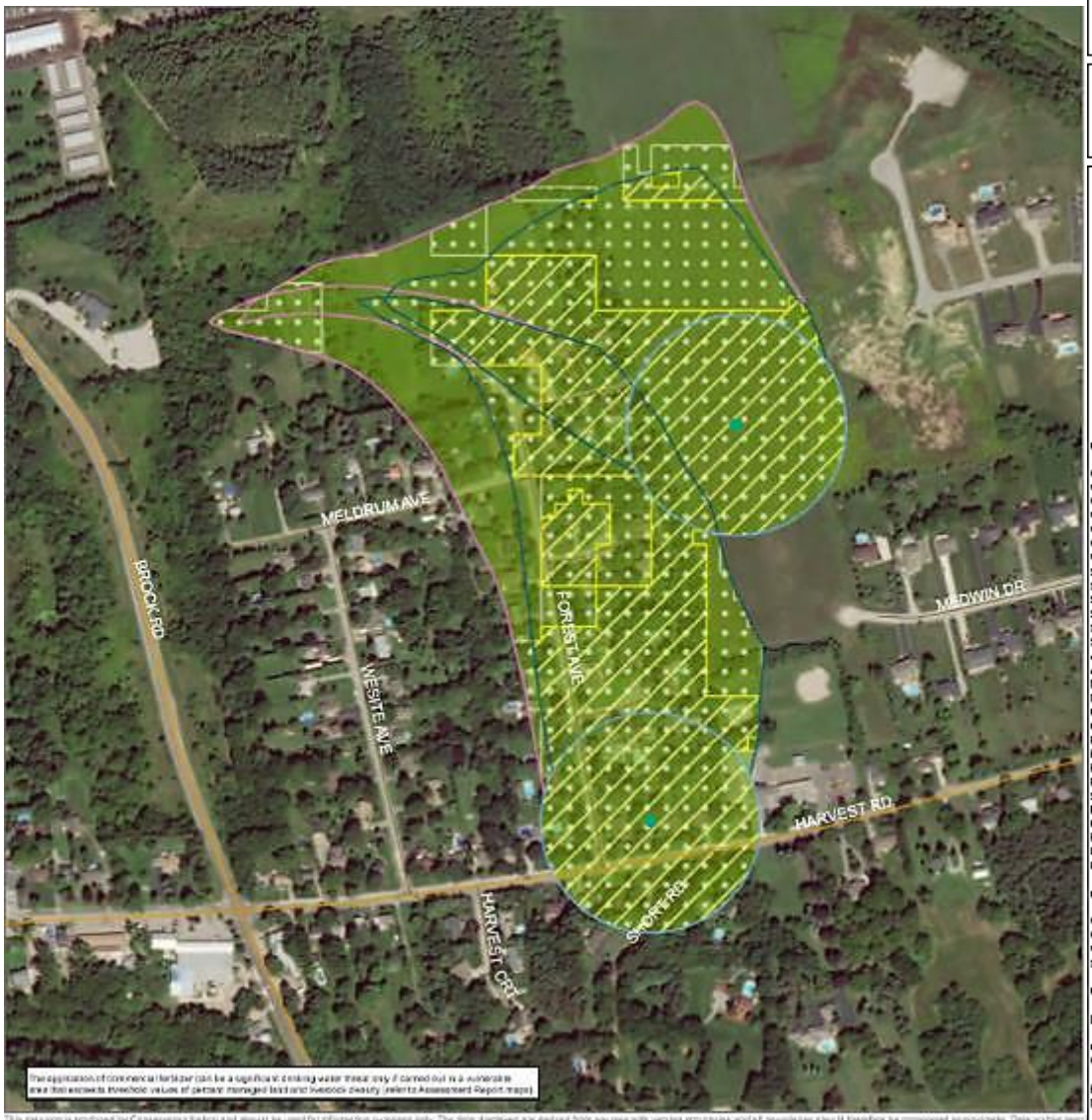
Waste Disposal Site - Application of Untreated Septage to Land (Pathogen)
Sewage - Combined sewage discharge to surface water (Chemical and Pathogen)
Sewage - Discharge from stormwater retention pond (Chemical)
Sewage - Industrial Effluent Discharges (Chemical and Pathogen)
Sewage - Sewage treatment plant bypass discharge to surface water (Chemical and Pathogen)
Sewage - Sewage treatment plant effluent discharges (Chemical and Pathogen)
ASM - Application (Pathogen)
ASM - Handling and Storage (Pathogen)
NASM - Application (Pathogen)
NASM - Handling and Storage (Pathogen)
Pesticides - Application (Chemical)
Use of land for livestock - (Pathogen)

SW: Surface Water
WHPA-E-9: Wellhead Protection Area E - Vulnerability score of 9

Reference: Prescribed threat circumstances as listed in the
Ministry of the Environment Table of Drinking Water Threats (2009)

Source: Conservation Halton
Date: August 2015
Projection: UTM NAD 83 Zone 17

DRINKING WATER SOURCE PROTECTION WELLHEAD LOCATION MAPPING



DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

Figure 11

Greensville
Existing and would be significant groundwater threat areas

Legend

WHPA Boundary
- A
- B
- C

- GW - Significant Threats - Group 1
- GW - Significant Threats - Group 2
- GW - Significant Threats - Group 3

Roads
- Highway
- Regional
- Local

Municipal Well

Group 1: (WHPA-A-10, WHPA-B-10)

Waste Disposal Site - Application of Untreated Septage to Land (Chemical and Pathogen)
Waste Disposal Site - Mine Tailings (Chemical)
Waste Disposal Site - Landfarming of Petroleum Refining Waste (Chemical)
Waste Disposal Site - Landfilling (Hazardous Waste) (Chemical)
Waste Disposal Site - PCB Waste Storage (Chemical)
Waste Disposal Site - Storage of Hazardous Waste at Disposal Site (Chemical)
Waste Disposal Site - Storage of Waste Clauses (p),(q),(r),(s),(t),(u) (Chemical)
Sewage - Discharge from stormwater retention pond (Chemical and Pathogen)
Sewage - Sanitary Sewers and Related Pipes (Chemical and Pathogen)
Sewage - Septic System (Chemical and Pathogen)
Sewage - Septic System Holding Tank (Chemical and Pathogen)
Sewage - Sewage Treatment Plant Effluent Discharges (Chemical and Pathogen)
Sewage - Storage of Sewage (Pathogen)
ASM - Application (Chemical and Pathogen)
ASM - Handling and Storage (Chemical and Pathogen)
NASM - Application (Chemical and Pathogen)
NASM - Handling and Storage (Chemical and Pathogen)
Commercial Fertilizer - Application (Chemical)
Commercial Fertilizer - Handling and Storage (Chemical)
Pesticides - Application (Chemical)
Pesticides - Handling and Storage (Chemical)
Road Salt - Application (Chemical)
Road Salt - Handling and Storage (Chemical)
Snow - Storage (Chemical)
Fuel - Handling and Storage (Chemical)
Organic Solvent - Handling and Storage (Chemical)
Runoff Management - Aircraft De-icing Chemicals (Chemical)
Use of land for livestock - Grazing and Pasturing (Chemical and Pathogen)
Use of land for livestock - Confinement Yard (Chemical and Pathogen)

Group 2: (WHPA-A-10, WHPA-B-10, WHPA-B-8, WHPA-C-8)

Waste Disposal Site - Landfilling - Municipal Waste (Chemical)
Waste Disposal Site - Landfilling - Solid Non Hazardous Industrial or Commercial (Chemical)
Waste Disposal Site - Liquid Industrial Waste Injection into Wells (Chemical)
Sewage - Storage of Sewage (Chemical)

Group 3: (WHPA-A, WHPA-B, WHPA-C)

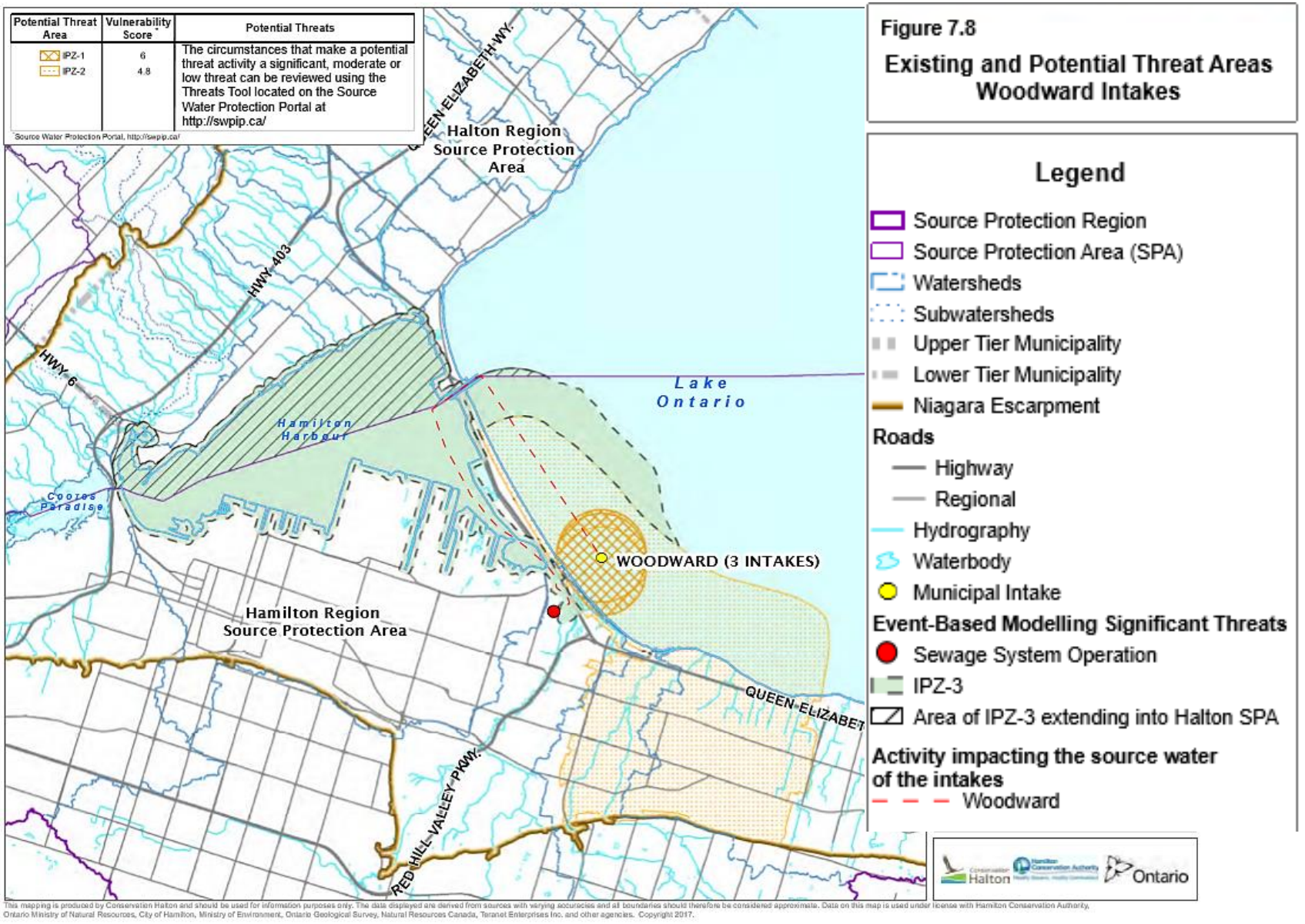
DNAPL - Handling and Storage

GW: Groundwater
WHPA-A-10: Wellhead Protection Area A - Vulnerability Score of 10

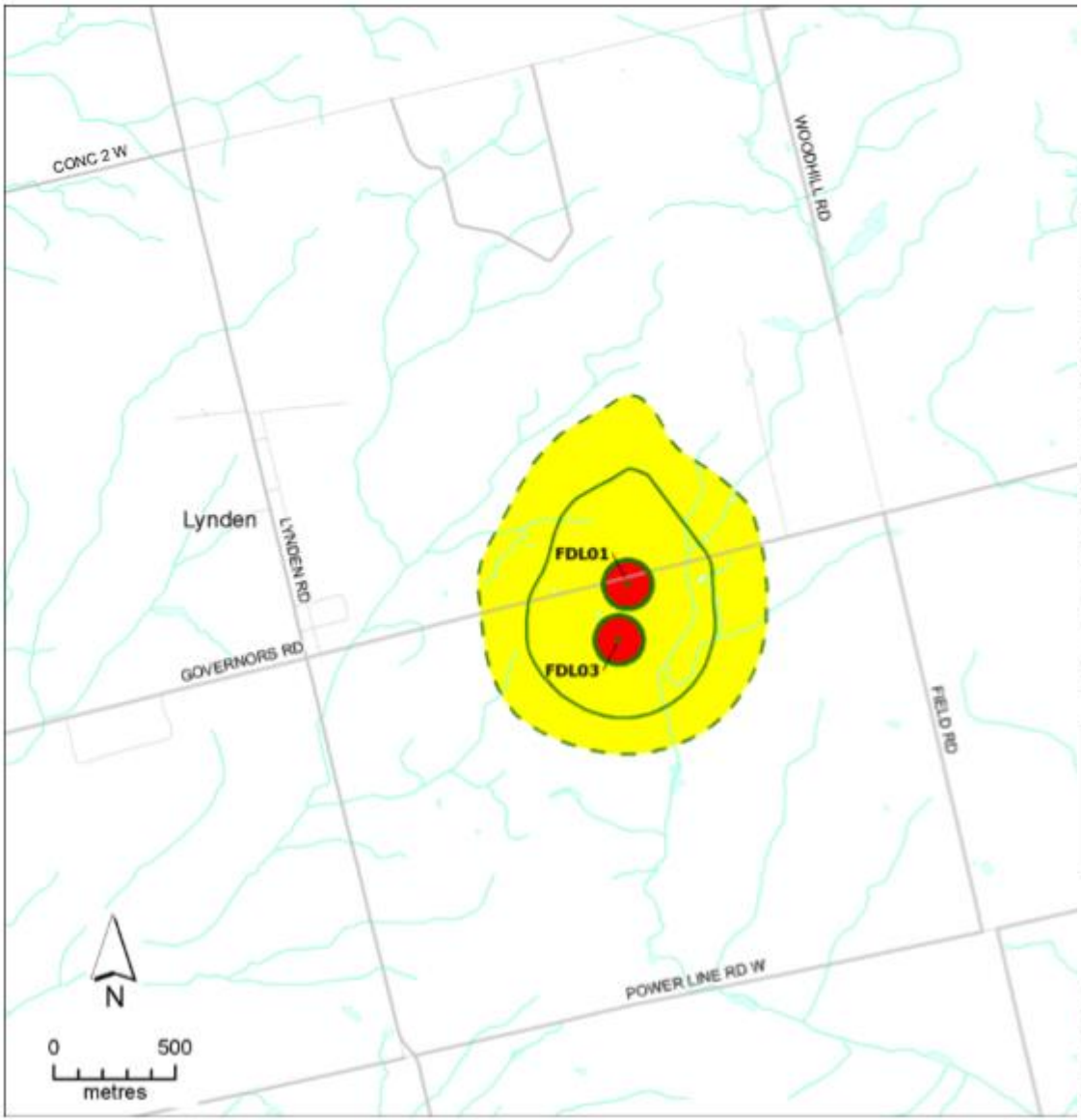
Reference: Prescribed threat circumstances as listed in the
Ministry of the Environment Table of Drinking Water Threats (2009)

Date: August 2017
Projection: UTM NAD 83 Zone 17

DRINKING WATER SOURCE PROTECTION WELLHEAD LOCATION MAPPING



DRINKING WATER SOURCE PROTECTION WELLHEAD LOCATION MAPPING



DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

Significant Drinking Water Threat Policy Applicability

	Significant Drinking Water Threat Policy Categories	Vulnerability Scores on Map		
		10	8	2,4,6
1.	Waste Disposal			
2.	Sewage Systems			
3, 4.	Agricultural Source Material			
6, 7.	Non-Agricultural Source Material*			
8, 9.	Commercial Fertilizer*			
10, 11.	Pesticide			
12, 13.	Road Salt*			
14.	Storage of Snow			
15.	Fuel			
16.	DNAPLs			
17.	Organic Solvents			
18.	Aircraft De-icing			
21.	Livestock Area			
Local Threat	Oil Pipelines			

Note: This table provides a summary of the activities listed in the Clean Water Act (2006) that apply as Prescribed Drinking Water Threats (PDWT) within the Non-GUDI Wellhead Protection Zones shown on this map. For details refer to the text of the Source Protection Plan and the Ministry of the Environment Drinking Water Threats Tables.
*Application of Commercial Fertilizer, Non-Agricultural Source Material, and Road Salt may not be a significant drinking water threat in some areas due to the % managed land, livestock density, and/or % impervious surface calculations for these areas. See the text of the plan for further details.

Well
Road
Minor River
Lake / Main River

Wellhead Protection Zones:
WHPA-A
WHPA-B
WHPA-C

Ontario

Grand River Conservation Authority

1. Updated July 20, 2018
2. Larger scale mapping of some map layers, including roads and vulnerability scores, is available at www.sourcewater.ca.
3. This map is for illustrative purposes only. Information contained hereon is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.

APPENDIX “D”

DIRECT LIQUID APPLICATION ROUTE MAP


Hamilton