OPERATIONS COMMITTEE AGENDA

Operations Committee Meeting
Monday, May 14, 2018
Tom Davies Square

COUNCILLOR ROBERT KIRWAN, CHAIR

Evelyn Dutrisac, Vice-Chair

3:00 p.m. OPERATIONS COMMITTEE MEETING
COMMITTEE ROOM C-11

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DECLARATIONS OF PECUNIARY INTEREST AND THE GENERAL NATURE THEREOF

PRESENTATIONS

1. Report dated April 27, 2018 from the General Manager of Growth and Infrastructure regarding Transportation Demand Management Plan for Greater Sudbury. **5 - 157**
(ELECTRONIC PRESENTATION) (RESOLUTION PREPARED)

    - Marisa Talarico, Active Transportation Coordinator

    (This report introduces the Transportation Demand Management Plan for Greater Sudbury and provides a summary of key recommendations for approval. The Transportation Demand Management Plan will provide the City with a framework to promote and facilitate the use of sustainable modes of transportation including walking, cycling, transit and carpooling.)

2. Report dated April 30, 2018 from the General Manager of Growth and Infrastructure regarding Use of Road Deicers. **158 - 336**
(ELECTRONIC PRESENTATION) (FOR INFORMATION ONLY)

    - Randy Halverson, Director of Linear Infrastructure Services

    (This report provides detailed information regarding road deicers used within the City of Greater Sudbury.)

CONSENT AGENDA

(For the purpose of convenience and for expediting meetings, matters of business of repetitive or routine nature are included in the Consent Agenda, and all such matters of business contained in the Consent Agenda are voted on collectively.

A particular matter of business may be singled out from the Consent Agenda for debate or for a separate vote upon the request of any Councillor. In the case of a separate vote, the excluded matter of business is severed from the Consent Agenda, and only the remaining matters of business contained in the Consent Agenda are voted on collectively.

Each and every matter of business contained in the Consent Agenda is recorded separately in the minutes of the meeting.)

CORRESPONDENCE FOR INFORMATION ONLY

C-1. Report dated April 17, 2018 from the General Manager of Growth and Infrastructure regarding Drinking Water Quality Management System . **337 - 341**
(FOR INFORMATION ONLY)

(This report provides the Annual Report regarding the Drinking Water Quality Management System.)

C-2. Report dated April 24, 2018 from the General Manager of Growth and Infrastructure regarding Winter Control Operations Update for March 2018. **342 - 344**
(FOR INFORMATION ONLY)

(This report provides the financial results of the 2018 winter roads operations up to and including the month of March 2018.)

REGULAR AGENDA

MANAGERS' REPORTS

R-1. Report dated April 17, 2018 from the General Manager of Growth and Infrastructure regarding Parking Restrictions - Maki Avenue, Sudbury. **345 - 347**
(RESOLUTION PREPARED)

(Traffic and Asset Management staff received a request from a resident of Maki Avenue asking that the sight lines be reviewed for on street parking in the area of the hill. This report recommends appropriate parking restrictions for Maki Avenue.)

R-2. Report dated April 17, 2018 from the General Manager of Growth and Infrastructure regarding Pedestrian Traffic Signals - Regent Street at Junction Creek Crossing. **348 - 353**
(RESOLUTION PREPARED)

(At the December 2016 Operations Committee meeting, the City of Greater Sudbury endorsed the installation of a protected pedestrian crossing and directed staff to develop a recommended style of crossing and implementation plan in partnership with the Connect-the Creek Partnership. This report provides details on the recommended protected crossing and a brief overview of how the crossing will be implemented.)

MOTIONS

M-1. **Request to Review Sidewalk Patio Program and its Fees**

As presented by Councillor Cormier:
WHEREAS, in collaboration with the Downtown Sudbury Business Improvement Area (BIA), the full sidewalk patio pilot program was launched in January of 2014, and became a permanent program in May of 2015;

AND WHEREAS the program was created with the implementation of a gradual escalating payment fee structure for these patios;

AND WHEREAS in December of 2015, the City implemented a $400 administrative fee for the full sidewalk patio program, to be phased in over a 4 year period, in addition to the other fees associated with the program;

AND WHEREAS a number of the recurring applications for the full sidewalk patio program do not change from year to year;

AND WHEREAS the full sidewalk patio program has been operating for a few years, and Council as well as the BIA, would like to see a review of the program and its associated fees, with a specific emphasis on the administrative fee for recurring applications;

THEREFORE BE IT RESOLVED that the City of Greater Sudbury directs staff to conduct a review of the full sidewalk patio program and its associated fees, with a view to decreasing the overall fees for the program, and to bring a business case forward during the 2019 Budget process for consideration.

ADDENDUM

CIVIC PETITIONS

QUESTION PERIOD AND ANNOUNCEMENTS

NOTICES OF MOTION

ADJOURNMENT

Presented To:	Operations Committee
Presented:	Monday, May 14, 2018
Report Date	Friday, Apr 27, 2018
Type:	Presentations

Request for Decision

Transportation Demand Management Plan for Greater Sudbury

Resolution

Resolution #1

THAT the City of Greater Sudbury adopts the Transportation Demand Management Plan for Greater Sudbury, as outlined in the report entitled “Transportation Demand Management Plan for Greater Sudbury”, from the General Manager of Growth and Infrastructure, presented at the Operations Committee meeting on May 14, 2018.

Resolution #2

THAT the City of Greater Sudbury approves the use of $25,000 from the Cycling Infrastructure capital budget to begin implementation of the Transportation Demand Management Plan for Greater Sudbury, which may be used to develop promotional and educational materials, to move forward with partnerships with community agencies and to support the delivery of TDM-specific events, as an interim measure until a business case can be considered, as outlined in the report entitled “Transportation Demand Management Plan for Greater Sudbury”, from the General Manager of Growth and Infrastructure, presented at the Operations Committee meeting on May 14, 2018.

Resolution #3

THAT the City of Greater Sudbury directs Infrastructure Capital Planning Services staff to prepare a business case for operating funding for Transportation Demand Management related program development and implementation to be considered during the 2019 budget process, as outlined in the report entitled “Transportation Demand Management Plan for Greater Sudbury”, from the General Manager of Growth and Infrastructure, presented at the Operations Committee meeting on May 14, 2018.

Resolution #4

THAT the City of Greater Sudbury directs Infrastructure Capital Planning Services staff to report to the

Signed By

Report Prepared By
Marisa Talarico
Active Transportation Coordinator
Digitally Signed Apr 27, 18

Manager Review
Joe Rocca
Traffic and Asset Management Supervisor
Digitally Signed Apr 27, 18

Division Review
Stephen Holmes
Director of Infrastructure Capital Planning
Digitally Signed Apr 27, 18

Financial Implications
Jim Lister
Manager of Financial Planning and Budgeting
Digitally Signed Apr 27, 18

Recommended by the Department
Tony Cecutti
General Manager of Growth and Infrastructure
Digitally Signed Apr 27, 18

Recommended by the C.A.O.
Ed Archer
Chief Administrative Officer
Digitally Signed Apr 27, 18

Operations Committee in 2019 on the status of implementation of TDM measures, as outlined in the report entitled “Transportation Demand Management Plan for Greater Sudbury”, from the General Manager of Growth and Infrastructure, presented at the Operations Committee meeting on May 14, 2018.

Relationship to the Strategic Plan / Health Impact Assessment

This report refers to providing quality multimodal transportation alternatives to connect neighbourhoods and communities and promote a high quality of life within Greater Sudbury, which are identified in the Strategic Plan under the key pillars of Sustainable Infrastructure and Quality of Life and Place.

Report Summary

This report introduces the Transportation Demand Management (TDM) Plan for Greater Sudbury and provides a summary of key recommendations for approval. The TDM Plan will provide the City with a framework to promote and facilitate the use of sustainable modes of transportation including walking, cycling, transit and carpooling. The TDM Plan and subsequent appendices are provided in Attachment 1.

Financial Implications

If approved, measures to be implemented in 2018 will be funded within existing approved capital budget and staff complement. To support this approach, staff are requesting to re-allocate up to $25,000 from the Cycling Infrastructure capital budget to begin implementation of the TDM Plan, without delay. The re-allocation of this funding will not adversely impact any cycling infrastructure projects planned to be delivered in 2018. Projects planned to be implemented with funds from the Cycling Infrastructure budget include those identified on the approved project list for the Ontario Municipal Commuter Cycling (OMCC) Program and the Pedestrian Traffic Signals on Regent Street at the Junction Creek crossing. Future funding proposals related to the delivery of TDM measures will be brought forward through business cases during future budget processes.

Transportation Demand Management Plan for Greater Sudbury

Background:

Greater Together (2015), the Corporate Strategic Plan for the City of Greater Sudbury contemplates a more sustainable approach to how the City plans and delivers infrastructure. A priority of Greater Together is for the City to provide quality multimodal transportation alternatives for roads, transit, trails, paths and sidewalks that connect neighbourhoods and communities in Greater Sudbury.

The Transportation Master Plan (TMP) was updated in 2016 to better align with these priorities by taking a sustainability-focused approach to optimizing and enhancing the transportation network. The TMP outlines a cycling facility network, and recommends a suite of policy options to support the delivery of pedestrian and cycling infrastructure and a Complete Streets approach in Greater Sudbury. In line with this approach, the TMP recommends that the City prepare a Transportation Demand Management Plan for the community to ensure the infrastructure being delivered is complemented by appropriate policies and programs.

In May 2017, the Operations Committee was presented with an introductory report on transportation demand management, which defined TDM as the application of strategies and policies to influence travel behaviour, with the objective of both reducing overall demand, especially from single-occupant vehicle use, and seeking to influence when and where this demand occurs. The report further outlined the potential benefits of developing a TDM Plan for Greater Sudbury.

In late 2017, the City of Greater Sudbury began working to develop a Community Energy and Emissions Plan, which will be a comprehensive, long-term plan to improve energy efficiency, reduce greenhouse gas emissions and foster local sustainable energy solutions in the community. Transportation is identified as a priority Action Area in the provincial Climate Change Action Plan and the Transportation sector is responsible for contributing more than 35% of greenhouse gas emissions in Ontario today. Moving forward with implementing transportation demand management measures and encouraging more sustainable travel will contribute to reducing emissions in Greater Sudbury.

In January 2018, the City of Greater Sudbury was recognized with a Bronze Bicycle Friendly Community Award from Share the Road Cycling Coalition. By participating in this voluntary evaluation process, staff received valuable feedback on how the community can move towards the Silver level designation. This feedback included a recommendation that the City expand education efforts to more thoroughly engage the schools in Greater Sudbury through active school travel programs and cycling education, which is part of a comprehensive TDM Plan.

Plan Development Process and Public Consultation:

Development of the Transportation Demand Management Plan for Greater Sudbury is made possible by the Canada-Ontario Public Transit Infrastructure Fund (PTIF). WSP was retained by the City of Greater Sudbury in April 2017 to lead the preparation of the TDM Plan.

From May 15 to June 9, 2017, Greater Sudbury residents were invited to complete an online survey to provide the consultant team and City with information on how, why, and where they travel. The survey was completed by nearly 1500 residents, which provided the team with excellent data from which to develop a community profile.

Further resident engagement took place in September 2017, with a Public Consultation Session that was complemented by a Stakeholder Workshop, which brought together staff from various City divisions, major employers, school boards and travel service providers in the community. Members of the Sustainable Mobility Advisory Panel (SMAP) also took part in a workshop style meeting during this period.

The draft TDM Plan was circulated to internal staff in Planning Services, EarthCare Sudbury, Greater Sudbury Transit, Leisure Services and within Infrastructure Capital Planning Services for feedback. The draft TDM Plan was also circulated to members of the Sustainable Mobility Advisory Panel (SMAP) for their feedback prior to finalizing the document. Further details on consultation efforts are included in Attachment 2.

<u>Themes Emerging from Public Consultation:</u>

1. Transit – The transit system needs to be safe and efficient, with more frequent service. An application with real time updates will encourage more people to take transit, as this makes it easier to plan their day.

2. Infrastructure – There is a need for an increase in active transportation infrastructure in Greater Sudbury. From sidewalks, bike lanes, trails, connections to destinations and end-of-trip facilities, residents believe that investment in more infrastructure will give more people the opportunity to be active.

3. Community Partnerships – There is a need in Greater Sudbury to have organizations and the municipality partner in the pursuit of a more sustainable community. Keeping the community up to date with new facilities and trails can act as advertisements for active transportation. Integrating rideshare programs or an Uber-like service into the public transit system could also encourage more people to use the system.

4. Education – More awareness of programs available and education on how to use facilities in Greater Sudbury is necessary. From purchasing tickets to taking bicycles on the bus and how to transfer from one line to the other, education is key in getting residents on the move. More education programs should be available through promotional events.

5. Accessibility – Accessibility was a major concern for those in the stakeholder group. There are many seniors in Greater Sudbury that rely on the transit system for travel and without accessible platforms and service, they are unable to travel. Transit drivers and students should be trained in how to help the elderly or people with disabilities to board a bus, while seniors should be educated on their travel options.

6. Parking – It was suggested that parking measures could be put in place to encourage residents to take more sustainable modes of transportation to work. Having Park and Ride facilities, priority parking for carpoolers, and a carbon tax for those who do drive could deter those who do not have to drive to do so.

Vision and Principles:

The Vision and Principles for the TDM Plan were developed based on feedback received during public and stakeholder consultation. Residents, members of the Sustainable Mobility Advisory Panel, City staff from various Divisions and other community stakeholders including representatives of major employers, local school boards and agencies contributed to the development of this Vision and Principles.

The Vision is what has guided the development of the TDM Plan, and also highlights what may be achieved as a result of implementing the recommendations of the TDM Plan:

> Greater Sudbury is a community that embraces sustainable mobility through efficient use of the transportation network and services to ensure that all residents have equal and equitable access to the services they need, the destinations they want to go to and the people they want to see.

The Principles further guide how Greater Sudbury will achieve this vision. By creating a framework that supports the vision, the principles will guide the City's approach for the delivery of TDM measures and programs. These principles are an important part of the TDM Plan and are necessary to support a more mobile Greater Sudbury:

- Safe – The City will provide residents and visitors within the community with sustainable transportation options that will help people feel safe and secure when they are moving around the city.

- Shift Travel Behaviour - The City will create a set of programs and measures that will encourage residents to use sustainable travel modes throughout the year and over the long-term to develop a culture that embraces sustainable travel.
- Integrated – The City will develop a set of policies, programs and measures that will create a seamless sustainable transportation network to encourage the use of sustainable modes. It will also help interested parties to better define their role and assist in the delivery and promotion of sustainable transportation.
- Effective – The programs, policies and measures developed must be reflective of the community and be cost-effective. They must also lead to measurable results indicating that changes in travel behaviour are occurring.
- Inclusive – A set of TDM based programs and sustainable infrastructure which allows all residents and visitors, regardless of age, ability, gender, or socioeconomic background to travel through Greater Sudbury using any sustainable mode they choose.

TDM Plan for Greater Sudbury:

This section presents a high-level overview of what is included in the complete Transportation Demand Management Plan for Greater Sudbury, which forms part of this report, as Attachment 1.

Chapter 1: Introduction to Transportation Demand Management

The introductory chapter of the document lays the groundwork by defining TDM and outlining the vision and principles for the TDM Plan, as well as the benefits it may bring for Greater Sudbury.

Chapter 2: Background and Data

Chapter 2 introduces a community profile of Greater Sudbury and provides a detailed overview of results of the online survey and public consultation activities. This chapter also highlights best practices in delivering TDM measures and programs and presents a policy analysis of select topics.

Chapter 3: Overview of TDM Programs

This chapter introduces a number of proven TDM measures that the City can use to promote and educate residents and visitors on the personal, environmental and community benefits of choosing sustainable modes of transportation. Measures presented here are organized by target audience and whether they are intended for households, workplaces, schools or are identified as other TDM-supportive programs and infrastructure.

Chapter 4: TDM Promotion, Engagement and Development Tool Kit

Chapter 4 presents a tool kit of approaches that the City can use in the promotion of sustainable travel and engaging residents in discussions about TDM in the community.

Chapter 5: Action Plan

The Action Plan details a set of recommended measures and actions that, when taken together, will raise awareness and support Greater Sudbury residents use of sustainable modes of transportation. This chapter also presents an outline for the development of a comprehensive monitoring program.

Appendices:

The Appendices to the TDM Plan provide additional background information and data that was used to inform development of the plan. A summary of public consultation efforts and partnerships is also presented in the Appendices.

Recommendations of the Transportation Demand Management Plan for Greater Sudbury and Action Plan:

The TDM Plan, as prepared by WSP, makes 21 recommendations to assist the City in developing programs and policies for residents and businesses in Greater Sudbury to better manage their travel demand. These recommendations have been organized into broad categories and are presented in Table 1.

Table 1: Recommendations of the Transportation Demand Management Plan for Greater Sudbury

Community Partnerships	
1.	The City should develop a working relationship with community organizations to implement the measures and programs outlined in this plan to provide the support and encouragement needed to residents that will result in long-term changes in travel behaviour.
2.	The City should develop partnerships with local school boards to develop and deliver programs that will support parents, children and staff in making sustainable travel decisions. The City should consider taking part in the Active and Safe Routes to School program and/or the School Travel Planning program in partnership with the school boards and Green Communities Canada. If the City wishes to apply to be a Silver Level Bicycle Friendly Community, it should work with its partners to pilot a School Travel Planning program at a few of the schools within the City in the short term.
3.	The City should continue engaging the community in reducing the use of single occupant vehicles for everyday travel.
4.	Community groups that have invested in sustainable transportation should continue to be supported and be provided with information. These groups, such as the Friends of Sudbury Transit, Rainbow Routes Association and others have invested in providing residents with information, infrastructure and other supportive measures. The City should work with these groups to provide necessary support measures, allowing them to continue in their encouragement of sustainable transportation use.

5.	The City should continue to further develop existing programs and work with the community to develop new initiatives that align with the City's transportation priorities. The Transportation Master Plan should set the stage for identifying program priorities by analyzing existing transportation patterns and the potential for TDM measures and tools to form the basis of new TDM strategies that make better use of existing infrastructure or provide equivalent levels of mobility and accessibility at a lower cost than large scale physical infrastructure.
TDM Working Group	
6.	The City should develop an internal TDM Working Group to, among other things, help integrate TDM and transit into major construction projects. The internal working group can assist in promoting the use of all sustainable transportation options and the linkages between transit and TDM.
7.	Both transit and transportation staff need to work collaboratively in the delivery of TDM programs. This will include promoting and marketing TDM and transit, encouraging the use of sustainable travel options and working with members of the community to shift travel behaviours.
Outreach, Marketing and Education Programs	
8.	The City should evaluate the full list of municipally delivered programs outlined in Chapter 3 against the new objectives of the Transportation Master Plan to establish funding and policy priorities for future outreach, marketing and education programs. This will allow for strategic alignment between the City's Official Plan policy priorities, TMP and TDM objectives.
9.	To promote the use of sustainable modes, a position should be established to market the TDM programs. Sharing this position with transit would be appropriate as the transit system in Greater Sudbury will form the basis of a sustainable transportation network.
10.	The City should establish a promotional and education program as soon as the proposed Marketing and Communications position is filled.
11.	The City should establish ongoing funding for the implementation of the promotion and education campaign as well as for the proposed Marketing and Communications position. This should also be extended to making the Active Transportation Coordinator role permanent.
Wayfinding	
12.	The City should develop a wayfinding program to indicate the routes that are recommended to travel to key destinations. This program should be introduced when a map is created for the community showing active transportation corridors, major transit terminals, key destinations, steep grades and other barriers. This program can significantly increase the level of cycling in the City whether it is for utilitarian or recreational purposes.
TDM Requirements for Development and Official Plan policy	
13.	The City should update the Official Plan to include policies related to the TDM programs and measures. The amendments should include adding to the objectives in Section 11.1, including: • 11.1 d. to include reference to compact, mixed-use developments that promote the use of sustainable travel options; • 11.1 e. in addition to promote all travel modes, expand to include incentives, encouragement and education; • 11.1 d. also include long-term shift in travel behaviour; • 11.1 e. add connections to transit via walking and cycling to develop a more comprehensive sustainable travel network.

14.	The City should further add to the new Official Plan policy under 11.2.3 to include: "at the discretion of City staff, TDM programs and measures, as well as supportive infrastructure and services may be required within a traffic study."
15.	The transit policies in section 11.3.2 (6) of the Official Plan be expanded to include bicycle lanes, cycle tracks and pathways to improve access to transit stops.
16.	Programs listed under section 11.9 of the Official Plan should be updated and strengthened to reflect the TDM plan. The Official Plan should include not only promoting the use of sustainable travel modes, but also include educating and encouraging the use of sustainable transportation, developing programs for schools, households and workplaces and developing partnerships with groups who could deliver the programs and measures.
17.	The integration of transit with cycling and walking routes to ensure that the development of a sustainable transportation network is developed that will enable the use of more than one mode to travel to a destination or enable the use of one mode in one direction and then another sustainable mode in the opposite direction due to topography, changes in weather or time of day.
18.	Develop a formalized process for incorporating: • TDM soft and hard measures/TDM supportive infrastructure in the existing development applications process as part of a TDM Plan under existing legislation (Planning Act and City by-laws) • TDM Statements, Short and Full TDM Plans into the development process
19.	Lobby the Province for amendments to the Planning Act that would allow municipalities to create enforceable undertakings that would require developers to: • Provide several TDM hard measures in accordance with a new policy that would require a certain TDM standard to be met as part of the urban development process • Provide, support and oversee the implementation and monitoring of TDM soft measures beyond the opening day of developments for a defined time-period
Developing a Multi-modal Network	
20.	The City of Greater Sudbury should develop a network of integrated corridors to support and encourage the use of sustainable modes and ensure that there is a multi-modal sustainable transportation network within the City.
21.	Where possible, the City should continue to provide more than one sustainable option along major transportation corridors.
Collaboration with other Northern Communities	
22.	The City of Greater Sudbury should work with other northern communities to share information, ideas, programs and results as they develop and implement TDM programs and measures within the city.
Monitoring	
23.	Greater Sudbury should develop and implement a monitoring program based on the above for TDM measures to ensure that the goals and objectives of this Plan are met and travel behaviours shift toward more sustainable modes.

The TDM Plan proposes an Action Plan to guide the City in the development and delivery of transportation demand management supportive programs and materials. The early phases of the Action Plan, presented in Table 2, highlights 'quick wins' that are

focused on forming partnerships and building confidence in residents and decision-makers that transportation demand management is an effective approach to make efficient use of our infrastructure. It is anticipated that many of these short-term Action Plan items can be delivered with existing resources.

Table 2: Action Plan for implementation of the Transportation Demand Management Plan for Greater Sudbury

Phase 1: **Short Term / Quick Wins** **(Years 1 and 2)**	**Phase 2:** **Medium Term** **(Years 3 to 5)**	**Phase 3:** **Long Term** **(Years 6 to 10)**
✓ Identify sustainable, long-term staffing resources to implement TDM programs and measures ✓ Identify potential financial and staff resources for marketing and promotion of TDM measures for active transportation and transit ✓ Develop partnerships internally through the TDM Working Group ✓ Develop partnerships externally to deliver T**D**M programs ✓ Develop a proposal for a workplace program ✓ Enhance Official Plan policies ✓ Develop a TDM web page and clearinghouse to provide information to the public ✓ Improve the use of social media to promote sustainable transportation within the community ✓ Create TDM collateral targeting to different community groups (i.e. web content, brochures, handouts, bookmarks, etc.). These groups may include seniors, students and families ✓ Continue to develop active transportation infrastructure	✓ Evaluate short-term projects to assess effectiveness and make improvements ✓ Create a TDM outreach program based on work undertaken in first phase ✓ Work with community groups to encourage long term behaviour changes ✓ Update TIS Guidelines to include TDM-supportive infrastructure ✓ Develop TDM recognition program for new and existing developments ✓ Develop a workplace program that will be delivered to workplaces that have signed up for the program	✓ Update the TDM strategy and implementation plan to ensure it is up to date with current technology, programs and research ✓ Evaluate change in TDM delivery and incorporate into updated strategy ✓ Update outreach and education programs ✓ Continue to deliver the programs established in earlier phases ✓ Review policies within the Official Plan and the Transportation Master Plan that support TDM programs and measures

Phase 1: Short Term / Quick Wins (Years 1 and 2)	Phase 2: Medium Term (Years 3 to 5)	Phase 3: Long Term (Years 6 to 10)
✓ Promote existing and new Active Transportation facilities as they are being implemented within the City ✓ Develop a pilot project to deliver School Travel Plans within the City in partnership with community organizations, the school boards and/or Public Health Sudbury and Districts		

Communications Plan:

To promote the completion of the Transportation Demand Management Plan for Greater Sudbury, staff will work with Corporate Communications to ensure the City webpage for TDM is updated with a copy of the Plan and that this information is promoted to the public via our social media channels.

As programs and measures are planned, developed and implemented, staff will continue to work with Corporate Communications to ensure a fulsome communications campaign is executed so that all residents, visitors and businesses have the opportunity to participate in programs being offered by the City and/or its partners.

Next Steps:

Adoption of the TDM Plan for Greater Sudbury does not commit the City of Greater Sudbury to deliver any or all of the recommended measures as described within the Attachment 1. Staff will continue to refine the details and full cost of implementation of measures of the TDM Plan to develop business cases for consideration and discussion during future budget processes. The TDM Plan is designed to be a collaborative document. City divisions and staff will work together with community partners to identify opportunities for synergies and to access funds from other levels of government.

Wherever possible, TDM measures will be delivered as part of existing City events, programs and services to find cost efficiencies and minimize staff time required. Staff will continue to explore opportunities to form partnerships with community agencies to further leverage and extend any municipal funding to be dedicated to transportation demand management. If approved, funding of up to $25,000 may be used to

implement short-term recommendations to develop promotional and educational materials related to safe cycling and walking, to move forward with partnerships with community agencies and to support the delivery of TDM-specific events.

Staff will monitor the implementation of short-term measures outlined in the TDM Plan and provide an update to Council in 2019 on progress made in shifting the travel behaviour of Greater Sudbury residents towards more sustainable modes of transportation.

Conclusion:

The Transportation Demand Management Plan for the City of Greater Sudbury presents a framework for how the City can move forward with becoming a more sustainable community that promotes a high quality of life for residents and encourages retention of youth and professionals and encourages seniors to relocate to our community, as expressed in Greater Together. Further, the implementation of measures recommended in the TDM Plan will support other corporate strategic objectives such as increasing efficiency of existing infrastructure, reducing greenhouse gas emissions and becoming a more healthy, active and vibrant community.

The City of Greater Sudbury has a unique opportunity to be a leader in the delivery of transportation demand management measures and sustainable transportation infrastructure and services. Residents have expressed interest in pursuing opportunities to integrate sustainable travel modes into their every day commutes, and to capitalize on this interest, infrastructure, incentives, and programs need to be available in a timely manner. Implementing the measures and programs outlined in the TDM Plan and continual monitoring of their success will ultimately lead to more residents choosing to walk, bike, take transit or carpool to access destinations.

Resources Cited:

Transportation Demand Management Plan for Greater Sudbury, Report to Operations Committee, May 15, 2017. Accessed online: http://agendasonline.greatersudbury.ca/index.cfm?pg=agenda&action=navigator&lang=en&id=1142&itemid=13159

Transportation Demand Management Plan for Greater Sudbury

April 2018

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1.0 Introduction to Transportation Demand Management

1.1 Introduction

Greater Sudbury is completing this Transportation Demand Management (TDM) Plan to create a transportation system for the city that fits the goals and objectives of both the Transportation Master Plan (TMP), and the Official Plan (OP). The TDM Plan has been designed to meet the objectives outlined in the TSR.

The Greater Sudbury OP states that a TDM Plan may be required to create a safe, efficient, and convenient transportation system that can support expansion, and is justified by demand. To be sustainable, the system needs to promote all modes of travel and create programs that will promote sustainable transportation throughout the city.

1.2 What is TDM?

Transportation demand management is the application of programs, policies, and services to influence how, why, when, and where people travel. These services are designed to encourage the long-term use of sustainable travel options such as cycling, walking, transit, or carpooling. The focus of TDM services is to get residents out of single-occupancy vehicles and into more sustainable modes of transportation. This will allow residents in Greater Sudbury to better use transportation resources, and create a more even mode share between driving, carpooling, walking, cycling, and using transit.

TDM approaches transportation problems through both people and infrastructure-focused ways. Using programs and measures, residents can be guided towards more mobility options and educated on how to use more sustainable modes of transportation. Through an infrastructure-focused approach, new bike lanes, trails, security, and end-of-trip facilities such as bicycle parking can be provided to encourage commuters to use active and sustainable transportation options for daily travel.

TDM functions at two levels, short-term and long-term. In the short-term, TDM provides education and support for those who are interested in using sustainable modes of transportation, and creates infrastructure for those to travel. In the long-term TDM strategies can be used to encourage better community design, and create a city with mobility options for everyone. Long-term behaviour change is the goal of TDM. This will help to create a community that is more sustainable, connected, and healthier.

1.3 What is a TDM Plan?

A TDM Plan is created for a city to assist in controlling and managing the demand for travel and transportation infrastructure. Planning solely for an increase in car-based road users can be very costly as roads need to be widened, new bridges need to be constructed, and impacts on the environment and community health increase. A TDM Plan is a cost-effective alternative to

increasing road capacity by both working to better manage traffic volumes and transferring road users to different modes of travel. The TDM Plan is made up of strategies and policies that aim to reduce the demand for travel within an area and makes recommendations as to the best solutions for the community. In Greater Sudbury, the public was consulted through to understand the issues that residents have encountered and use this information to determine the best approach to travel management in the community.

A TDM Plan addresses not only transportation issues, but also the effects of increasing travel as well. The Plan for Greater Sudbury considered *why* the community has chosen its modes of travel and how to change years of behaviour and social norms. It is important to look for long-term solutions instead of short-term fixes for these types of problems. TDM Plans aim to change the behaviour of the community to that of a more sustainable one. With initiatives that promote and facilitate the use of alternative or sustainable modes of transportation, a TDM Plan can be a solution for cities that simultaneously addresses public health, environmental issues within the community and the city's general well-being as well. TDM policies link to that of many others and can create a stronger, more vibrant overall community.

1.4 Vision and Principles

Vision

The vision is what guides the development of the plan. It is one that all residents, employees, students, and visitors can be proud of, and which represents the wants and needs of the City. TDM strategies are used to support the vision through policy, city wide programs, and collaborative efforts. The vision is one of a seamless and mufti-modal city that accommodates the needs of all, no matter the age or level of mobility.

> *Greater Sudbury is a community that embraces **sustainable** mobility through efficient use of the transportation network and services to ensure that all residents have equal and **equitable** access to the services they need, the destinations they want to go to and the people that they want to see.*

Principles

The principles guide how Greater Sudbury will achieve this vision. Creating a framework that supports the vision and can guide the approach for delivery of TDM measures and transportation programs is the purpose of the principles. These are an important part of the TDM Plan, and are necessary to support a mobile Greater Sudbury.

Safe - Greater Sudbury will provide the residents and visitors within the community with sustainable transportation options that will help people feel safe and secure when they are moving around the City.

Shift Travel Behaviour – the City will create a set of programs and measures that will encourage residents to use sustainable travel modes throughout the year and over the long-term to develop a culture that embraces sustainable travel.

Integrated – The City will create a set of policies, programs and measures that will create a seamless sustainable transportation network to encourage the use of sustainable modes. It will also help interested parties to better define their role and assist in the delivery and promotion of sustainable transportation.

Effective – The programs, policies and measures developed must be reflective of the community and cost-effective. They must also lead to measurable results indicating that changes in travel behaviours are occurring.

Inclusive – a set of TDM-based programs and sustainable infrastructure which allows all visitors, residents and workers, regardless of age, gender or socio-economic background to travel throughout Greater Sudbury using any sustainable mode they choose. This will allow for greater access to sustainable travel modes without creating large economic or social barriers to accessing transportation services and infrastructure.

1.5 Why Does Greater Sudbury Need This?

TDM is important for Greater Sudbury as it provides a framework for using the transportation system more efficiently and utilizes scarce municipal transportation resources more effectively. As well, promoting the use of sustainable modes of travel will help to increase physical activity, reduce greenhouse gas emissions and improves quality of life.

Shifting to more sustainable modes of transportation can decrease the potential for environmental harm, increase the amount of time people spend being physically active, and take away the stress of commuting through congestion. Greater Sudbury is a community with transportation patterns that are based predominantly on the ownership and use of a private-vehicle. Although the downtown area boasts a transit terminal in the city centre, safety concerns, weather, and lack of infrastructure often deter people from using sustainable modes of transportation for getting around.

Greater Sudbury has a solid basis for the integration and promotion of sustainable modes of transportation. Almost 50% of the population lives within a 10-km radius of their workplace. This is considered a reasonable distance for commuting by bus, or active transportation with good infrastructure. With TDM measures and programs in place, those who live within that distance have the option to commute without the use of a single occupant vehicle.

A strong TDM plan will create a healthier, more sustainable community that can be proud of their transportation system. Using modes other than driving to work allows for more financial and personal freedom. If congestion can be moderated, then the community can feel safer at home and on the road, whether in a car, on a bike, or walking to their destination.

1.6 What are the Benefits?

There are many benefits to implementing TDM programs, measures, and services as a tool for transportation planning. TDM focuses on reducing the number of cars on the road and the amount of time spent in single occupant vehicles. TDM benefits everyone in the community, including residents, businesses, visitors, and students, regardless of preferred mode of travel.

Individual Benefits

On an individual level, TDM can enhance the quality of life through active and sustainable transportation. Being more social in the community and getting more physical activity can help residents live a healthier lifestyle. With multiple travel options, there can be less time spent driving. This can take stress off an individual as they have more time for family or other activities. Using TDM measures to commute to work can also save individuals money as it costs less to carpool or take active modes for travel purposes.

Community Benefits

At the community level, TDM measures can help to create a stronger, more cohesive community. Reduced greenhouse gas emissions create a healthier community through better air and water quality. With travel modes being more evenly distributed there can be a more efficient and effective use of the transportation network and resources. With a community being planned on a more human scale, the transportation system can adapt to become more vibrant and livable.

What are the Benefits to Greater Sudbury?

Health and Safety

- Increased health from use of active transportation and improved community cohesion
- Stress reduction from less time spent driving alone or in congestion

Transportation System

- Reduced congestion and resulting time savings
- Multiple travel options
- More efficient and effective use of the transportation network

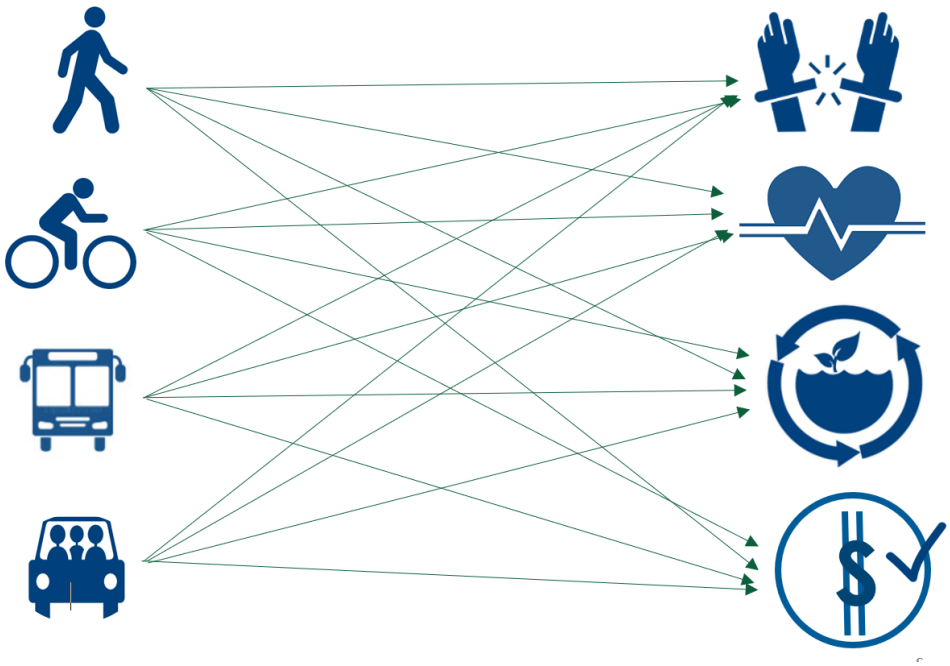
Financial

- Reduced costs of car ownership and maintenance
- Better/more efficient use of municipal financial resources

Environmental

- Improved air and water quality
- Reduced greenhouse gas emissions

The figure below shows how each form of sustainable transportation can generate a return in terms of greater sustainability, health benefits, more travel freedom, and financial savings.



For Greater Sudbury, the benefits for individuals will be lower travel costs and stress levels associated with getting around. Many people that work in the urban centre commute from the outskirts of the city. The availability of carpools in outer neighbourhoods will save residents money on commuting costs to their place of work. For those residents who use public transit within Greater Sudbury, they can save reduce their commuting costs as well, and have the potential to do other things while traveling to work. Active transportation provides many benefits to the user by providing physical activity, reduced costs and improvement to individual and community health through reduced greenhouse gas emissions.

On a community level, more people using sustainable modes will create a safer environment with more people on the street, decrease the amount of greenhouse gas emissions with less drivers on the road and create a more inclusive society through improved accessibility to transportation.

2.0 Background and Data

2.1 Introduction

A TDM Plan requires an understanding of the community, including demographics, modes of travel, current and proposed urban and rural development patterns and what is important to its residents. Without this information, the plan will not be reflective of the community. The success of a TDM Plan depends on understanding the underlying reasons behind a City's mobility trends, and the challenges residents face when travelling throughout the city.

While Greater Sudbury has many of the same issues, concerns, opportunities and challenges that other cities of a similar size have, the TDM Plan will be unique to Greater Sudbury and reflect its strategic goals, character, demographics and topography. Therefore, the analysis of the background information and data is an important component in the development of a plan that will encourage residents to shift their travel behaviours to more sustainable modes on a long-term basis.

2.2 Community Profile

Community Information

Greater Sudbury is the largest city in Northern Ontario, with a population of 165 000 people (Statistics Canada). It is a single tier municipality which was formed in 2001 after the merging of the unincorporated townships, cities and towns that comprised the former Regional Municipality of Greater Sudbury. Greater Sudbury has been recognized worldwide for its environmental efforts in reclamation since the 1970s, specifically the Region's success in regreening and rehabilitating local lakes.

- Average Age: 42 Years
- Median Household Income: $71,687
- Population Density: 50 people/sq km
- Average Household Size: 2.3 people
- 71% English speaking
- 25% French speaking
- 61 % live in single detached houses
- 66 % of population is of working age
- 18% of population is eligible for retirement
- 16% of the population is below the age of 15

Community Data Overview

The following provides an overview of the makeup of the population in Greater Sudbury:

Travel Data

Figure 1 shows the mode chosen in relation to the distance traveled within Greater Sudbury. From the data it is evident that the further a person travels, the more likely they will commute by automobile. Due to the high percentage of those driving, the average resident of Greater Sudbury spends more money on transportation than the average Ontarian. Of interest is that there are the same number people driving less than 2 kilometres to work as those walking the

same distance. Also, of note is that there is no one carpooling less than 6 kilometres from origin to destination.

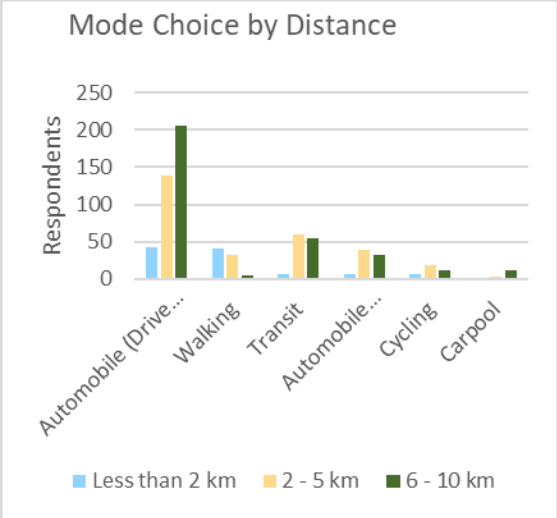


Figure 1: Mode Choice per Distance Travelled

2.3 Survey Analysis

In the spring of 2017 Greater Sudbury residents were invited to complete an online survey to provide the City with information on how, why, and where they travel. This was important for the development of the TDM Plan, as the City was considering new ways to move people, rather than vehicles, throughout Greater Sudbury. The survey was completed by nearly 1500 residents, providing solid data on how residents travel within the community. The response rate for the survey was 0.9% of the total population of the City of Greater Sudbury.

As noted in Figure 2, the results indicated that single occupancy ('drive alone') private motor vehicles are the most common mode (65%) of transportation for residents. However, the survey also provides a positive outlook for sustainable modes: 13% of residents carpool or travel as passengers, 13% take transit, 6% cycle, and 3% noted walking as their primary mode of transportation. Figure 2 also shows the three most common reasons for driving alone: convenience and flexibility, travel time, and lack of other options.

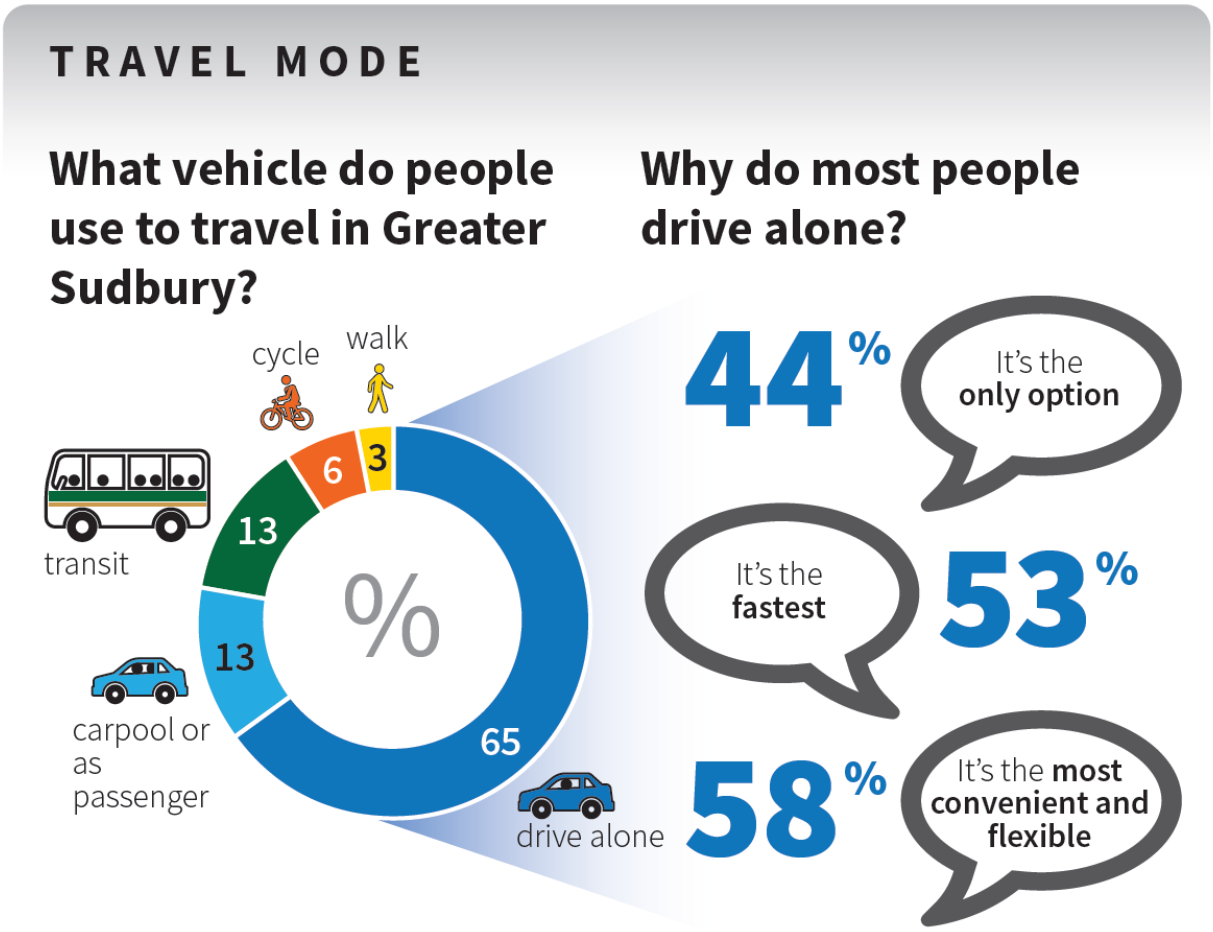


Figure 2: Survey Results – Modal Share and Reasons for Driving

Of those who commute for work on a daily basis in Greater Sudbury, almost half live within 10 km of their workplace (Figure 3). This is considered a reasonable distance to commute by transit, and can be an area of opportunity for the City to encourage residents to use transit more often. Along with shorter commute distances, over half of respondents noted that their commute is 15 to 30 minutes.

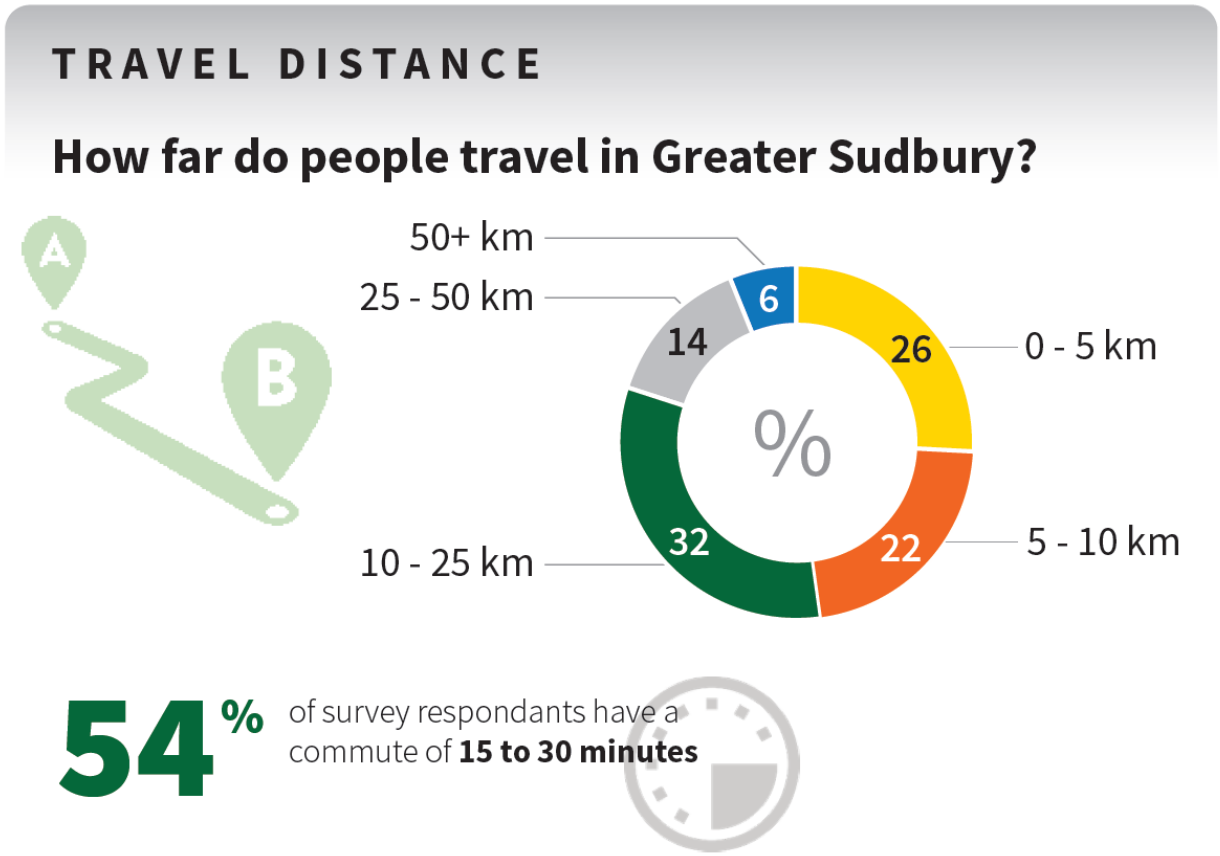


Figure 3: Survey Results – Distance Travelled

When asked specific questions about different modes of transportation, there was a very positive response to **carpooling** within the City. Of those who responded to the survey, **64% did not have access** to a carpooling program at work, but **57%** said they would be willing to carpool with a colleague **if the service was available**. An **expansion of the active transportation** network would increase interest in using active transportation to get to work by **52%.**

At the time the survey was conducted, there was a limited amount of active transportation infrastructure within Greater Sudbury. The survey asked how comfortable residents were with using each mode of active transportation, as shown in Tables 1 and 2 below.

Table 1 – Pedestrian Comfort in Greater Sudbury

	Not at all comfortable	Somewhat uncomfortable	Neutral	Somewhat comfortable	Very comfortable
English	5%	13%	16%	35%	31%
French	5%	13%	14%	31%	38%
Blended	5%	13%	15%	35%	32%

Table 2 – Cyclist Comfort in Greater Sudbury

	Not at all comfortable	Somewhat uncomfortable	Neutral	Somewhat comfortable	Very comfortable
English	50%	29%	9%	10%	3%
French	33%	37%	11%	11%	8%
Blended	47%	30%	9%	10%	4%

Questions about Greater Sudbury's transit system indicated that 78% of respondents did not use transit at all. These statistics give insight into the current state of Greater Sudbury's transportation system, and where there are opportunities for improvement. The full survey results are contained within Appendix B.

2.4 Best Practices Review

To create a TDM plan that will be successful in Greater Sudbury, a review of other plans was undertaken to assist in creating this plan. The best practice review considered the TDM Plans within BC, Halifax, Ajax, Waterloo, Whitehorse, Thunder Bay, and Kitchener to provide insight into successful strategies that Greater Sudbury could implement in order to have a more successful and healthier transportation system. Best practices have been identified and discussed in more detail within Appendix A.

Performance Measures

Performance Measures are commonly used to monitor the outcomes of a given TDM program. Halifax is a notable example as its measure of success is simply measured in terms of the number of users associated with each TDM measure. This can provide a simple and transparent way to understand the success of the program and who is participating.

Northern Communities

Northern communities often have different considerations regarding TDM Plans, infrastructure, weather, and lower densities play major roles in how people travel in these communities.

The Thunder Bay TDM Plan discusses the need for efficiency, and opportunity to broaden access to the downtown through the removal of travel barriers. The City is looking to increase mobility for the aging population, increase the availability of active transportation routes, and thus decrease the need and cost of vehicle ownership. The City's overall focus is to promote a program that will result in a community that is healthy and vibrant, and can create opportunities from the transportation challenges they face today.

The City of Whitehorse created a TDM Plan in 2014 as they noted that maintaining a vehicle-oriented city could need a significant increase in public investment for new infrastructure. The TDM Plan addressed the issues of public health, greenhouse gas emissions, the increased demand for downtown parking, and the aging population as more people retire in the community.

Policy Goals

Some regional municipalities pursue technical transportation network performance objectives while others are focused more on ensuring greater consistency between TDM objectives and existing policy. The Town of Ajax's TDM objectives integrate with other strategic policies and goals. Using simple policy goals allows for the public to understand how the plan works and is measured.

Thunder Bay has also set a precedent in their TDM Plan policies. Focusing on what infrastructure is currently available, the plan set forth to capitalize on what already exists, and promote what is already available to the public. This strategy cuts down on infrastructure costs, and results in more efficient use of current resources. As well, the City has created a program to increase the supply of bicycle parking within the community.

Strategic Development Process

Developing a process to incorporate TDM into the development process can ensure that the use of sustainable transportation is a priority. The Halifax Regional Municipality incorporated TDM policies into the development process as it was *recommended* in the TDM Functional Plan that a developer should work with the municipality to contribute towards TDM programs or infrastructure in return for higher density, extra parking, and so on within the site.

2.5 Policy Analysis

Several federal, provincial, and city policies support the recommendations proposed for Greater Sudbury's new TDM Plan.

The overarching goal of these policies is to create a community that can meet all the needs of the residents regardless of income, culture, or religious beliefs. By creating more travel choices, the City can create an environment that is accessible for everyone, with safe and convenient travel choices. The framework upon which the TDM Plan was written was developed with the support of the City's Official Plan and other supporting policy documents. The detailed policy analysis can be found in Appendix B.

Transit

Policies are included in the Greater Sudbury Official Plan to continue to grow the transit network. Greater Sudbury's focus is on increasing capacity and attractiveness of the system through programs and activities. These policies will help to increase ridership and allow transit to become more accessible.

Community Development

The City of Greater Sudbury will focus intensification within existing urban areas. To support intensification, Sudbury will develop a multimodal transportation system that will increase connectivity and mobility from different communities. The improvement of connectivity between neighbourhoods will enable more people to use the sustainable transportation facilities provided in the city.

Network Connectivity

The Downtown Master Plan focuses on an accessible and connected downtown core that can encourage growth and become a hub for all modes of transportation. The City needs to be accessible to those who need access to vital services. This is especially important for those who cannot drive such as children, students, and seniors.

Sustainability

The *Places to Grow in Northern Ontario Act* suggests that intensification and investment in transportation systems are critical to accommodate a sustainable environment and encourage economic development within the Greater Sudbury Area. A strong transportation system will continue to encourage residents to use sustainable modes to travel rather than single occupant vehicles.

2.6 Consultation

Consultation on the TDM plan took place on Wednesday, September 13 and Thursday September 14, 2017. The purpose of the meetings was to show the public and stakeholders draft concepts that could be incorporated into the TDM Plan and receive feedback on these ideas. The goals of the consultation sessions were: to understand the barriers and issues encountered by the community regarding ease of mobility within the city; to understand why mobility choices are being made; to determine opportunities to increase the use of sustainable modes and to determine the level of support for the encouragement of sustainable travel options. There were three separate meetings: one for stakeholders, one for the Sustainable Mobility Advisory Panel, and one for the public. A detailed report of the consultation process can be found in Appendix C.

Stakeholders

The stakeholder session was held on afternoon of September 14 and consisted of City staff, workplaces and organizations within the community with interests in how people travel and how to shift travel behaviours.

The stakeholders group was given a presentation on current ideas and objectives for the programs and were asked to discuss two questions in smaller groups: (1) Which programs should be recommended for Greater Sudbury, and (2) how their organizations could help implement these programs.

When considering which programs should be available in Greater Sudbury, participants placed focus on transit, active transportation infrastructure, and accessibility, parking, and TDM programs. It was suggested that to promote transit, there should be more incentives to try the service and increasing awareness about the benefit of transit.

Active transportation infrastructure was also an important topic as Greater Sudbury is currently initiating an active transportation network. Stakeholders suggested increased infrastructure such

as bike lanes, more crossings, better connections to destinations, end-of-trip facilities, and bikeshare for those who do not own or cannot own a bike.

Stakeholders also discussed park and ride facilities, carpool parking lots, and priced parking to encourage more people to use sustainable modes rather than drive to destinations alone.

Improving accessibility and developing educational programs were also considered to be important to the TDM Plan by the stakeholder group. With an aging population, it was discussed that a more accessible transportation system would make it easier for seniors and those with mobility challenges to travel within having to drive on their own. The stakeholders also indicated that education programs for students, workers, and residents about the modes of travel available, benefits and incentives should be developed. Programs for work day travel and school age children were thought to be the main groups to focus the education program on.

Sustainable Mobility Advisory Panel (SMAP)

The Sustainable Mobility Advisory Panel is a citizen advisory panel consisting of representatives from local organizations and staff from the City of Greater Sudbury. Their mandate is to "assist staff and council in implementing a vision for a holistic approach to a multi-model transportation system where citizens can walk, cycle, and use public transit efficiently and safely to get to their destinations" (Greater Sudbury Sustainability Mobility Advisory Panel).

During the consultation session, which was held on the evening of September 14, 2017, the organization's members were given personas which represent different demographic groups and were asked to describe what they believed would be their transportation challenges and needs. This exercise was important to understanding the programs and facilities could best help each demographic group, while still meeting the needs of individuals within the community.

There were many important themes which emerged from the discussion. It was mentioned that more infrastructure is needed to encourage residents to use active transportation options, as these modes are considered affordable for students, young adults and seniors, Secure bike parking and end-of-trip facilities were also discussed to help encourage more cycling in the community. It was also discussed that there needs to be more direct transit routes to destinations, such as the post-secondary institutions, health care and seniors' facilities, and major commercial and retail areas. It was also mentioned that during festivals there should be increased service to help more people travel there via transit. For those with families it was discussed that time and money was a priority, and having a transportation system that could decrease the time spent travelling would be appealing to those working in Greater Sudbury. However, it was also mentioned that many people live outside of the city core, and thus, most are inclined to drive.

The Public

Thirteen members of the public attended the meeting on the evening of Wednesday September 13, 2017 (Figure 4). Several display boards were available for participants to review which presented draft ideas for Greater Sudbury's TDM Plan. The members of the public were asked

for feedback on the ideas presented and if there was anything that should be added to the TDM Plan.

The public was also asked for feedback on their vision for TDM in Greater Sudbury, and what they thought could best improve transportation options in the area. Recurring themes were improvements to transit, infrastructure, education, and community partnerships.

The meeting was advertised on the City's website, along with posters throughout the community, and promoted on social media. Where the stakeholder and SMAP meetings were held during the day, the Public Consultation Session was held in the evening to be more accessible to the working population, and was in the downtown core, near City Hall in a central location. Efforts were made to ensure that meeting was made accessible to all, with comment sheets available for those who did not wish to speak at the consultation session, and a project email was made available to those who were unavailable to attend.

Figure 4: Members of the public and stakeholders participate in TDM Plan events

The need for an expanded transit system was apparent as many comments and suggestions indicated that changes and improvements to the transit system would be of great benefit. A widespread network with express buses from outer communities was also suggested as it would encourage more people to use the service to commute directly to the city rather than driving to a park and ride lot to take transit. Expanding the infrastructure for the active transportation network was also considered a priority for those in attendance. An increase in sidewalks, bike lanes, secure bicycle storage, and connections for destination travel would benefit the public as they travel within the city. Also, with an increase in infrastructure the public noted that education on how to use these systems would be important, along with community partnerships to help promote the programs.

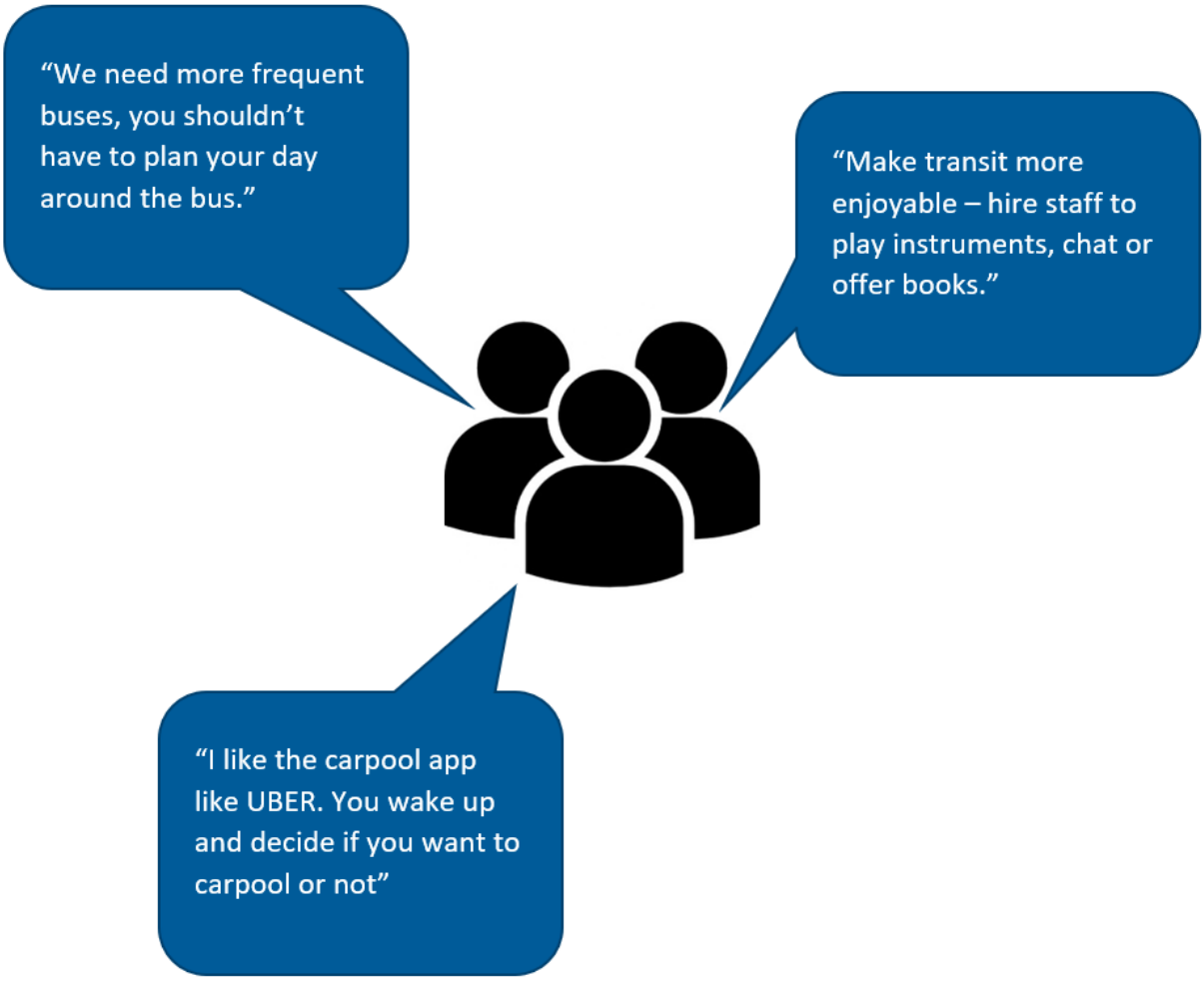


Figure 5: Feedback received from survey respondents

General Themes from Consultation Sessions in September 2017

Transit

The transit system needs to be safe and efficient, with more frequent service. An app with real time updates will encourage more people to take transit as this makes it easier to plan their day.

Infrastructure

There is a need for an increase in active transportation infrastructure in Greater Sudbury. From sidewalks, bike lanes, trails, connections to destinations and end-of-trip facilities, residents believe that investment in more infrastructure will give more people the opportunity to be more active.

Community Partnerships

There is a need in Greater Sudbury to have organizations and the municipality partner in the pursuit of a more sustainable community. Keeping the community up to date with new facilities and trails can act as advertisements for active transportation, integrating rideshare programs or

an uber-like service into the public transit system could also encourage more people to use the system.

Education

More awareness of programs available and education on how to use facilities in Greater Sudbury is necessary. From purchasing tickets to taking bicycles on the bus and how to transfer from one line to the other, education is key in getting residents on the move. More education programs should be available through promotional events.

Accessibility

Accessibility was a major concern for those in the stakeholder group. There are many seniors in Greater Sudbury that rely on the transit system for travel and without accessible platforms and service they are unable to travel. Transit drivers and students should be trained in how to help the elderly or people with disabilities to board a bus, while seniors should be educated on their travel options.

Parking

It was suggested that parking measures could be put in place to encourage residents to take more sustainable modes of transportation to work. Having park and ride facilities, priority parking for carpoolers, and a carbon tax for those who do drive could deter those who do not have to drive to do so.

3.0 Overview of TDM Programs

3.1 What are TDM Programs?

TDM programs are tools that municipalities use to promote sustainable modes of transportation to residents and workers, and educate them on the benefits to themselves, the environment, and their community. These programs will encourage more residents within the City of Greater Sudbury to drive less, and instead take alternatives modes of transportation. This will result in less wear on roads and lower congestion levels within the downtown core and in high traffic suburban areas.

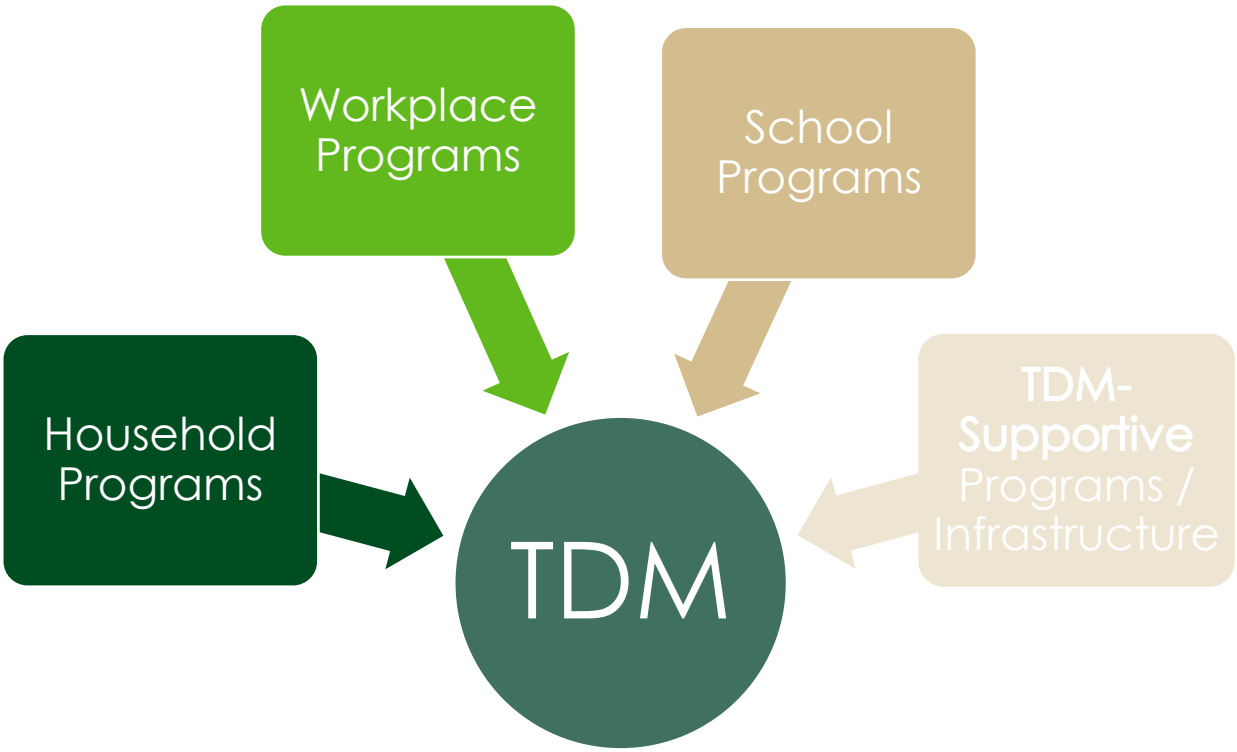
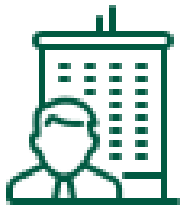


Figure 6: Various TDM Programs

Household

Programs that are directed at households encourage members to use sustainable modes of transportation can decrease travel demand during peak periods. The focus is on taking transit, carpooling, and using active transportation modes. Household travel programs focus on getting the family where they need to go. Using modes other than the car for transportation will encourage children to continue this habit as they grow up.

Workplace



At the business level, TDM benefits both the employer and the employees. Financially, as more people use sustainable modes of transportation to travel, the company will be able to decrease spending on parking infrastructure and support the community through active transportation infrastructure instead. Workplace travel programs focus on encouraging more people to travel to work by other means than the single occupant vehicle (SOV). These programs provide incentives to use carpooling, transit, walking and cycling, and provide disincentives to driving such as higher priced parking spaces.

While many work places have introduced flexibility in the work day, it is not yet universal. Ideally, if workers can meet their obligations and can be more productive with their work day fitting into their life rather than the other way around, it should be studied and explored by human resources departments, business owners and manages to determine the overall benefit to the workplace and the workers. It is acknowledged that not all workplaces or types of jobs can have flexible work hours.

School / Institutional

School travel planning focuses on getting more children to travel to school via sustainable and active modes. A decrease in car traffic around schools will create safer school zones and a healthier environment. Encouraging the use of walking and biking to school over being driven makes school zones safer and less congested. Supplying university students with transit passes will encourage more to take the bus and less to drive.

School-based programs can be provided by several agencies, such as the school boards, non-governmental organizations and local health units, with transportation and sustainable mobility staff acting in a supporting role. The City should be a partner in the development of school travel plans and develop safety initiatives. The support of an Active Transportation Coordinator and other City staff members in the delivery of school-based travel planning programs will help reduce the overall number of trips by motor vehicle and increase the number of sustainable and active trips to and from school. The use of sustainable modes can lead to several benefits including improving the health of children and the community through increased physical activity and reduction in air pollutants; reducing traffic around schools and increased safety so that more children can use active modes.

As has been noted, that the City of Greater Sudbury should increase the level of engagement in schools regarding sustainable transportation options, working with selected partners to increase education about cycling and developing School Travel Plans.

TDM Supportive Programs / Infrastructure

TDM measures cannot be entirely successful in isolation. Not only are complementary measures initiated together, so too are the infrastructure, programs and policies that are needed to achieve modal share targets, increase the health of a community, reduce greenhouse gas

emissions and improve overall quality of life. In fact, the integration of supportive programs, policies and infrastructure with TDM programs is one of the most important components of implementing a TDM plan. For example, if an employer supports their staff in using transit to commute to and from work, the corresponding services and infrastructure are needed at both the origin and the destination. If an employee is unable to access transit services at either end of their trip, then providing a subsidized pass will not increase the use of transit. The same is true for other services such as carpooling. Providing incentives to carpool work best when here is a complementary ridematching program available to employees.

It is important that the partnerships between agencies, employers and other groups develop and grow so that the integration of the various services, infrastructure and programs all come together so that more people can and want to use sustainable travel options more frequently.

Municipally-Delivered Programs

Municipal governments should take a lead role in the delivery of TDM programs. In many cases, the programs are best delivered by municipalities. In Ontario, there is no legislative support for developers to provide any type of TDM program and if they do, municipalities have little ability to follow up and monitor the effectiveness of the program. Therefore, to understand how programs impact travel behaviour and if the behaviour continues for the long-term, the City of Greater Sudbury should undertake some pilot programs, and where appropriate find partners to assist in the delivery and follow-up. Some programs are also most effective when they are included in the implementation of a new transit service, coincide with the opening of an active transportation facility or the introduction of a carshare service. Programs that promote these initiatives are often not provided by private sector employers or property owners and often rely on some level of public sector support, particularly for marketing and awareness purposes.

The measures identified below are best provided by the City. For example, the use of community-based social marketing and individualized travel planning requires that there be services and infrastructure available for people to change their travel behaviours. When a travel planning, program is introduced, the appropriate modes need to be promoted. For example, a community that lacks or has limited transit service should be encouraged to use a ridematching system as an alternative to travelling by single occupant vehicles. A second example of a municipal-led program is the promotion of a new bicycle lane, that when it is built, should be promoted to residents with relevant information from the City about the new facility.

3.2 TDM Measures

The programs listed above are the overarching areas in which TDM measures can be delivered. The TDM measures that will be outlined below can be applied to all the programs, or just one. The diagram below provides an overview of the measures that are recommended to be implemented within Greater Sudbury, with greater detail provided in the descriptions of the measures. While most are applicable to the programs outlined above, a few such as active transportation facilities and integration of travel modes will need to be led by the City and supported by complementary TDM measures and programs.

3.3 Tool Kit

The programs and measures that have been identified above are further explained in the Tool Kit that has been developed. The Tool Kit can be found on the following pages, providing an overview of the types of measures that can be implemented in Greater Sudbury. The tables provide direction on how the measures can be delivered, who will be primarily responsible for delivering each measure, why the measure is needed, the benefits and which of the three programs (Household, Workplace and School) each measure falls within. It should be noted that several of the measures form part of at least two of the programs. Figure 7 outlines some of the more common measures that should be considered for implementation by the City of Greater Sudbury.

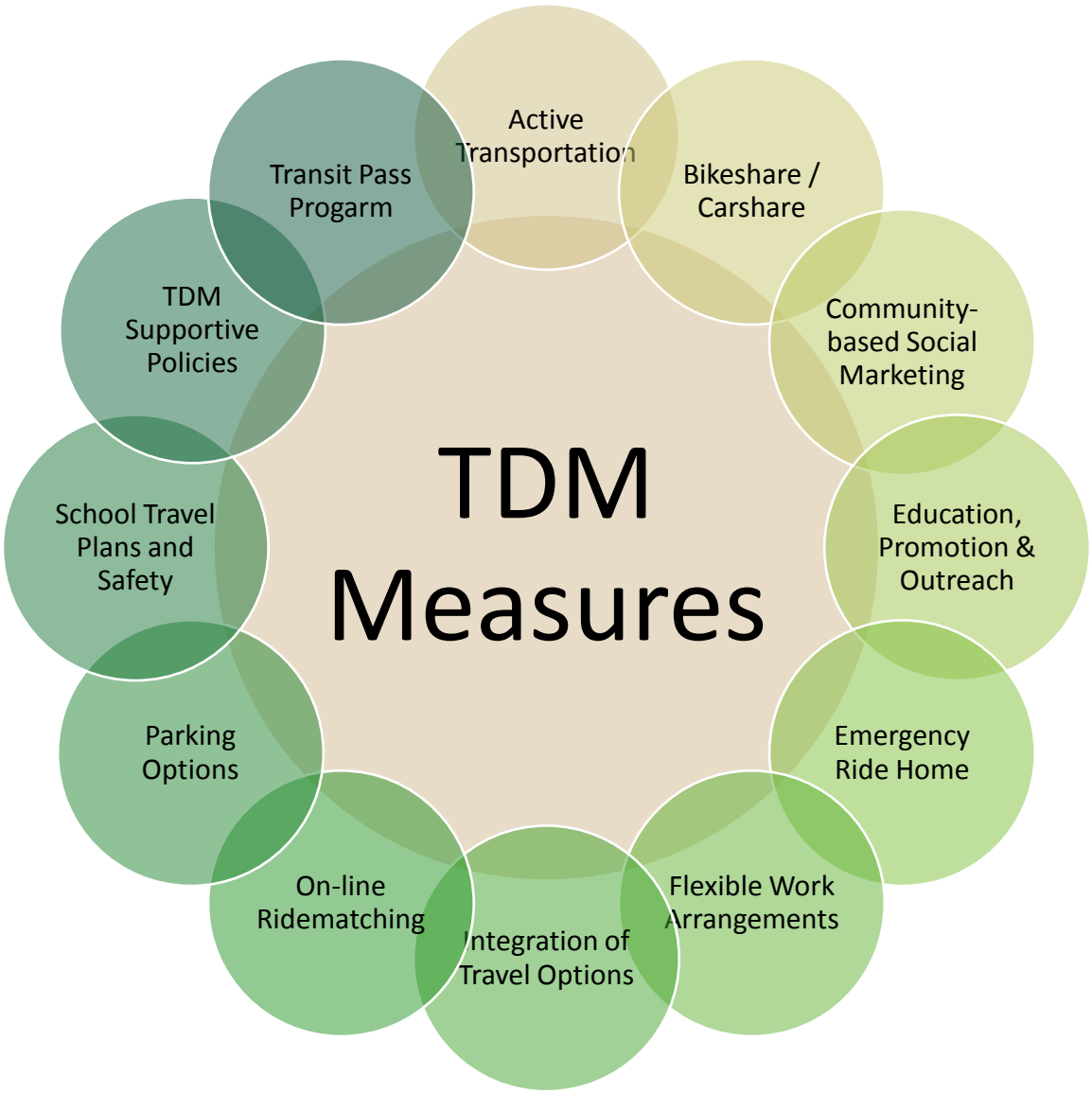


Figure 7: Potential TDM Measures for Greater Sudbury

M.1

Flexible Work Hours

Description:	This program allows workers the option to start and end their work day at different times and travel at off-peak hours.
How will it be delivered?	Organizational policies established within Human Resources and department managers.
Who will deliver it?	Both public and private sector employers.
Why is it needed?	► Flexible work hours allow for a more even spread of peak hour traffic congestion ► It can reduce the need for additional investment in infrastructure as current systems are frequently exceeding capacity
Benefits / Intent:	► Benefits include supporting employee individual needs and lifestyles which can lead to increased retention and effectiveness ► Intent is to reduce the peak travel demand and to lessen the impact of parking in a given area

Flexible work hours reduce both peak hour travel demand on the transportation network and lessen the impact of parking in a given area.

M.2

Telecommute / Telework

Description:	This program allows workers the option to work from home all or part of the time.
How will it be delivered?	► Organizational policies established within Human Resources and department managers. ► Support from others who have undertaken the program and seen positive results. A pilot could be undertaken to study if there are any positive results in select workplaces that permit employees to work at home.
Who will deliver it?	Both public and private sector employers.
Why is it needed?	Telecommuting can be a solution that avoids the need for all employees to commute and thus reduces the number of cars on the road, as well as costs to employers and workers.
Benefits / Intent:	► Supporting the employees' individual needs and lifestyles which can lead to increased retention, effectiveness and recruitment ► Office space reduction may also be a consideration ► Intent includes reducing the demand for travel and lessening parking needs

Telecommute reduces demand for travel and lessens parking needs.

M.3

Compressed Work Week

Description:	A compressed work week allows an employee to work more hours each day which in turn allows for a day off, or reducing their work hours to either 80% or 90%.
How will it be delivered?	Organizational policies established within Human Resources and department managers.
Who will deliver it?	Both public and private sector employers.
Why is it needed?	► Peak loads on the transportation network can frequently exceed capacity. ► Compressing the work week reduces travel during peak periods and avoids the need to travel on non-work days. ► Support employee needs. ► Shift travel away from peak periods. ► Encourage distribution of travel throughout the day, including boosting the use of transit during non-peak travel times.
Benefits / Intent:	► Supporting the employees' individual needs and lifestyles which can lead to increased retention, effectiveness and recruitment ► Office space reduction may also be a consideration ► Intent includes reducing travel demand during peak hours and lessoning the need for parking

Compressed work week reduce travel demand during peak hours.

M.4

Ridematching

Description:	Ridematching enables people to travel together to a common destination, increases vehicle occupancy and reduces the number of vehicles on the road. Ridematching not only matches carpool partners but also transit, walking and cycling buddies to assist those new to using these modes.
How will it be delivered?	Ideally, an online tool should be developed that allows participants to create a profile and find suitable matches. It can be promoted through workplaces, online and through partners or community agencies.
Who will deliver it?	► Public and private sector employers through an online portal that will be developed by the City and partners. ► EarthCare Sudbury has in the past provided support for an online carpool program. Their continued interest in ridematching indicates that they could be a good partner to once again provide an online program. The introduction of a new online ridematching program can be a portal to an integrated sustainable travel network in Greater Sudbury.
Why is it needed?	Increased vehicular occupancy leads to more efficient use of the transportation system.
Benefits / Intent:	► Reduces the number of required parking spaces, therefore reducing costs to employers to supply them and reducing all costs associated with commuting.

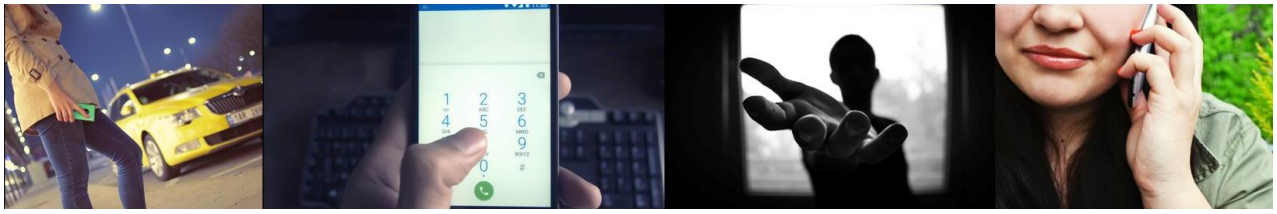
Ridematching reduces commuting costs and demand for parking spaces.

M.5

Guaranteed (or Emergency) Ride Home Program (ERH)

Description:	This is an insurance policy that provides regular users of sustainable transportation the ability to get home in an emergency, when their carpool partner is unavailable, or they have been asked to work unscheduled overtime.
How will it be delivered?	This measure should be delivered through an overall workplace commuter program provided by the employer or mobility management team.
Who will deliver it?	A guaranteed ride home program could be incorporated into the overall ridematching program and be provided by public and private sector employers.
Why is it needed?	► A major barrier to alternative modes of transportation is the uncertainty of getting home in the event of an emergency. ► ERH programs give these people an 'insurance policy' that there will be a guaranteed ride home in case of any emergencies.
Benefits / Intent:	► Increase in sustainable modes of commuters so that they have more transportation security, eliminating the need for a personal vehicle to commute to work ► Intent is to lessen the peak transportation network load as more people choose alternative methods of travel

ERH provides transportation security, eliminating the need for a vehicle to commute to work.



M.6

Transit Subsidy

Description:	Transit pass subsidies are often provided by employers or institutions such as universities and colleges to encourage the use of transit through a reduced rate. The difference between the face value of the pass and the cost passed onto the user may be absorbed by the employer or institution.
How will it be delivered?	These passes would be delivered by the employer to subsidize employee's passes with assistance through a mobility management program.
Who will deliver it?	► Infrastructure Capital Planning Services and Greater Sudbury Transit staff ► Partners including EarthCare Sudbury and other community agencies should also be involved if they assist in the delivery of the passes ► They can also be provided by employers who wish to subsidize passes for workers at major employers and institutions
Why is it needed?	► Discounted transit passes make transit use more attractive, especially compared to driving and the associated cost of gas, parking, insurance and maintenance ► Support transportation needs of students
Benefits / Intent:	► Transit pass subsidy increases transit use and ridership and reduces costs associated with commuting. ► Intent is to have a greater mode shift where sustainable modes already exist.

Transit Pass subsidy increases transit use and ridership, and reduces costs associated with commuting.

M.7

Bicycle Parking

Description:	Bicycle parking provides secure short term (bicycle racks) or long-term (bicycle rooms, lockers, etc) bicycle storage for residents, workers, students and visitors to encourage cycling.
How will it be delivered?	Bicycle parking will be provided as required through the City's zoning by-law requirements. The City will also be developing bicycle parking guidelines for developments / businesses. A bicycle parking program aimed at providing racks where they are needed such as at City facilities and businesses is also planned.
Who will deliver it?	► Greater Sudbury staff ► Racks to be installed by developers to meet zoning requirements in residential areas, commercial and institutional developments
Why is it needed?	► Bicycle parking is a space saving, cost-effective and environmentally friendly alternative to car parking. ► To ensure that there is bicycle parking available at city facilities, workplaces, and within the right-of-way
Benefits / Intent:	► Benefits are safe and secure parking for commuters who cycle to work, or for any other trip purpose ► Bike parking can also increase physical activity and reduce the need for motor vehicle parking ► Intent is to shift some of the mode share from single occupant vehicles to cycling

Bicycle parking promotes safe and secure parking for commuters who cycle to work, or for any other trip purpose.

M.8

Priced Parking

Description:	Priced parking can be used as a catalyst for encouraging people to use sustainable modes particularly when it costs more than transit. The monthly parking rates need to exceed the cost of a monthly transit pass to encourage the use of transit over driving.
How will it be delivered?	Parking policy that is developed by service providers to set rates for parking in off-street lots and structures (for city-owned parking facilities)
Who will deliver it?	► Property owners ► Greater Sudbury Parking Services
Why is it needed?	► Parking is typically highly subsidized leading to overuse and oversupply ► This affects urban efficiency, land values and can create environmental issues ► Priced parking helps to reflect the true economic and financial costs of providing parking and creates more rational travel choices.
Benefits / Intent:	► Benefits include reducing costs to building and employers for parking ► Intent is to create a mode shift, and reduce parking demand as paid parking can often shift people to use more sustainable modes of transportation, especially when pricing is coupled with incentives to use other modes

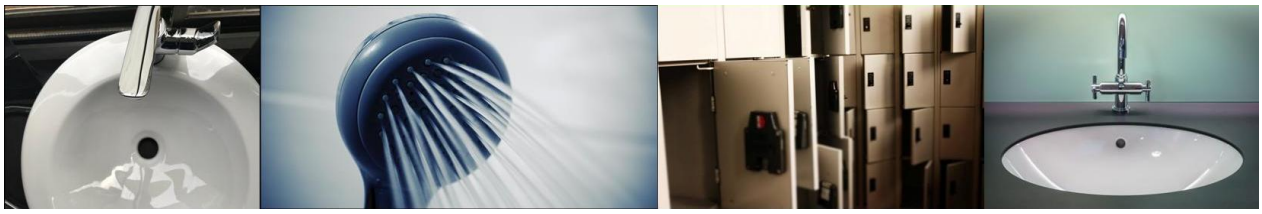
Priced parking aims to create a mode shift, and reduce parking demand as paid parking can shift people to use more sustainable transportation modes.

M.9

End of Trip Facilities

Description:	These are facilities that provide users of active transportation modes in particular the facilities they require such as showers and change rooms. Other facilities may include benches, water fountains, etc.
How will it be delivered?	As required by zoning by-laws and discussions with developers to provide facilities to meet the needs of commercial or residential tenants.
Who will deliver it?	► Planning Services ► Infrastructure Capital Planning Services
Why is it needed?	► TDM supportive infrastructure that supports more mode shift to cycling at relatively low cost.
Benefits / Intent:	► Benefits are that it increases sustainable transportation modes by ensuring that commuters who use active transportation are able to change and clean up before work. ► Intent is to create a mode shift where reasonable alternatives are available.

End-of-trip facilities increase sustainable transportation modes by ensuring commuters can change and clean up before work.



M.10

Park and Ride Facilities

Description:	Parking areas that either provide access to transit services for residents who may not have access to service or areas where people can meet up to share rides into their workplace or other destinations.
How will it be delivered?	As part of Greater Sudbury Transit service plans to optimize and expand the transit network through the Transit Action Plan.
Who will deliver it?	► Greater Sudbury Transit Services ► Support can be provided by EarthCare Sudbury and other community agencies
Why is it needed?	► Intended as a feeder to transit to encourage multimodal travel ► Research has shown it is consistently popular but requires a high capital cost per additional ride generated. ► There is also an impact on transit oriented development land use and ridership
Benefits / Intent:	► Benefits include encouraging more people to use transit if there is a way they can get to these facilities. ► Intent is to shift travel from single occupant vehicles to other sustainable alternatives

Park and Ride facilities encourage more people to use transit if there is a convenient and affordable way they can get to these facilities.

M.11

Carpool Parking

Description:	Identify parking spaces for carpools that are located in preferential areas (such as near entrances or underground). As well, where there is paid parking, consider discounted parking rates.
How will it be delivered?	The City of Greater Sudbury will determine suitable locations and land in neighbouring communities to provide the service.
Who will deliver it?	Both public and private sector employers.
Why is it needed?	In order to allow those coming from further away, that may not have access to reliable transit or other forms of transportation. They can park in a common area and encourage carpooling amongst coworkers from that area of the community.
Benefits / Intent:	► Benefits are encouraging more people to carpool together that would normally drive on their own. ► Intent is shift the mode share of people driving far distance to a larger mode share of carpoolers

Carpool parking encourages more people to carpool together to common locations.

M.12

Parking Supply Adjustments

Description:	Changing the amount of parking required for new developments or redevelopments can affect the use of sustainable travel options.
How will it be delivered?	The changes in how parking is provided will be part of the review of parking in the City and will be incorporated into city policy and by-laws where appropriate.
Who will deliver it?	Planning Services
Why is it needed?	Reduces the amount of land needed for parking and mitigates traffic from developments. Allowing more on-street parking can enhance safety for pedestrians but may be negative for cyclists, depending upon the road cross section.
Benefits / Intent:	► Reductions in the capital and operating costs of providing parking ► Intent is to reduce parking supply and increase a mode shift to sustainable options

Changing the parking supply affects the demand for parking. When implemented simultaneously with other travel options, it can be a powerful tool for changing behaviour.

M.13

Carshare / Bikeshare

Description:	Both carshare and bikeshare programs allow residents, workers and visitors to access cars or bicycles on a short-term basis.
How will it be delivered?	► A pilot can be created through a booking system, travel logs or key distribution ► It is more convenient for a third party to deliver the program, however the employer can choose which type of program will fit their workplace the best
Who will deliver it?	► Property managers ► EarthCare Sudbury / Planning Services ► Carshare and bikeshare companies
Why is it needed?	► Single occupant vehicles have a very low utilization rate as they sit in parking lots for long periods of time ► Using shared vehicles will allow that utilization rate to go up and reduce parking demand
Benefits / Intent:	► Benefits include reductions in the amount of single occupant vehicle trips which are needed for workday travel (because they can pick up a shared vehicle during work), greenhouse gas emissions which continues the work undertaken by the City to bring back the natural environment surrounding the urban area. This will also reduce travel and parking costs.

Carshare / Bikeshare reduces amount of single occupant vehicle trips which are needed for workday travel. It also reduces travel and parking costs.

Pictures: SonderBrapa, Wikimedia Commons

M.14

Pedestrian Connections and Amenities

Description:	Pedestrian facilities are important to encouraging walking and the “first / last mile” connections to transit. Any support for pedestrians such as crosswalks and crossovers, benches, shade, even surfaces, smooth transitions, etc. can be included and will increase the use of active modes.	*Enhanced pedestrian and cycling connections can help encourage more active living and reduced transportation costs.*
How will it be delivered?	Policies created by the City that request direct, convenient and accessible connections between buildings and a number of destinations including transit will be delivered through the planning approvals process.	
Who will deliver it?	► City of Greater Sudbury ► Private landowners	
Why is it needed?	Making facilities such as sidewalks, pathways and walkways accessible to all members of the community increases independence, health, social and employment opportunities and community safety. This will also ensure that AODA compliance is met.	
Benefits / Intent:	► Benefits are having direct and well-thought out connections to destinations, transit and other areas that will increase pedestrian use ► Intent is to create a modal shift to active modes of transportation	

M.15

On-Road Active Transportation Infrastructure

Description:	This is any infrastructure within the right-of-way that is designated for the users of sustainable travel options. This includes: sidewalks, multi-use trails, bicycle lanes, cycle tracks, etc.
How will it be delivered?	The City will identify the locations and types of facilities to be developed to serve the needs of the public.
Who will deliver it?	Infrastructure Capital Planning Services Engineering Services Planning Services
Why is it needed?	Considered a prerequisite for creating safe alternatives to driving especially when considering from the perspective of cyclist user groups.
Benefits / Intent:	► Benefits are safer areas for pedestrians and cyclists to participate in active travel. Will also increase safety and comfort leading to more users of these facilities. ► Intent is a modal shift to more active transportation modes.

On-road active transportation infrastructure helps to legitimize cycling as a mainstream mode of transportation.

M.16

Transit Facilities and Routes

Description:	Any stop, shelter, station, terminal, route, information booth, etc. that provides the ability to access transit services and information
How will it be delivered?	As part of Greater Sudbury Transit service plans to optimize the transit network through the Transit Action Plan.
Who will deliver it?	Greater Sudbury Transit Services
Why is it needed?	Having more transit infrastructure and facilities will make transit more attractive, easier to use and encourage more people to use the mode for commuter purposes.
Benefits / Intent:	► With more people taking transit there will be fewer cars on the road and higher mode share for alternative modes of travel. ► Intent is to encourage those who have other forms of travel to use transit instead, thus raising mode share.

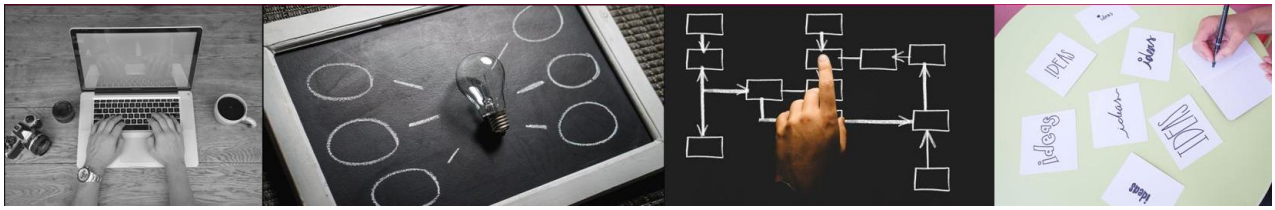
The quality and availability of Transit facilities and routes are key decision factors that are used by residents and visitors to decide how to get around.

M.17

Individualized / Community-based Social Marketing and Travel Planning Programs

Description:	Community-based social marketing uses a set of "tools" which have been identified as being particularly effective in fostering travel behavior change. The tools are most effective when used together.
How will it be delivered?	Programs are typically provided by the City and partners directly to residents. These programs can be delivered door-to-door, at neighbourhood events where people can talk to someone directly or through social media.
Who will deliver it?	► Infrastructure Capital Planning Services ► Corporate Communications and Community Engagement ► This program would be appropriate to be delivered in partnership with another community organization
Why is it needed?	Engagement and education about sustainable transportation options at the household level can lead to a higher probability of long term success.
Benefits / Intent:	► Benefits are more options provided to households and individuals for daily commuting and supports the lifestyle that the individual wants and needs. ► Intent is to increase individualized information of travel alternatives to the households and change travel behaviour.

Community-based social marketing emphasizes direct contact among community members and the removal of structural barriers, since research suggests that such approaches are often more likely to bring about behavior change.



M.18

Community Events

Description:	Any opportunity, such as festivals, farmers' markets, school events, etc. where the information about the use of sustainable travel options can be delivered where residents are already congregating.	*Community events provide unique opportunities to engage both one-on-one with residents as well as communicate to large audiences.*
How will it be delivered?	Staff from the City or community organization can be present at events to provide information about sustainable travel modes and TDM programs. This would reduce the need for specific transportation events to be held which may not have the same response rate.	
Who will deliver it?	► City of Greater Sudbury ► Community Organizations	
Why is it needed?	Community events bring TDM to the people and create opportunities to engage directly.	
Benefits / Intent:	► Benefits are providing information in one laces which saves time and money for providers and allows individuals to see options. ► Intent is to increase information of travel alternatives, and create a mode shift from SOV to alternative modes of transportation.	

M.19

Community App for Transportation Support

Description:	A smart phone app that can be used to find out any information about sustainable transportation options and provide the information on one site.
How will it be delivered?	The app can be available through developers for the use of sustainable travel such as transit schedules, carpooling, and others
Who will deliver it?	► Corporate Communications and Community Engagement ► Information Technology Services ► App Developers
Why is it needed?	Apps create easily accessible 'in your pocket' information for travel options. There is also the option to combine with live information such as parking availability, and downtown congestion.
Benefits / Intent:	► Benefits are provisions of information in a platform that is easily accessible and can enable the user to choose the most efficient mode of transportation for themselves.

Community apps provide a virtual 'one-stop-shop' community information and services, including transportation.

M.20

Education Programs

Description:	Any program whether it is in written form, on a website or through hands-on opportunity or presentation that provides information on the use of sustainable travel. These can include how to fix a bicycle, how to ride a bicycle In traffic, how to use transit, the use of on-line programs and so on.	*Education programs help to better inform residents about their own travel options and also harness the power of word-of-mouth marketing.*
How will it be delivered?	Education about active and sustainable modes can be delivered through printed materials (activity books, brochures), hands-on activities such as training courses and bicycle rodeos, and online through interactive websites.	
Who will deliver it?	► City of Greater Sudbury ► Community Groups ► Other Levels of Government	
Why is it needed?	Similar to other information programs, these create awareness of travel options, educate people and reduce barriers to TDM.	
Benefits / Intent:	► Benefits are that education and training can increase confidence using sustainable modes and result in an overall increase in use. ► Intent is to increase information of travel alternatives and educate about how to use them.	

M.21

Promotional and Awareness Programs

Description:	Programs in which the users are provided information directly as individuals or part of a larger group to encourage them to use sustainable modes. The programs can include incentives, personalized travel plans and other initiatives that are designed to change travel behaviours over the long term.
How will it be delivered?	Programs and materials can be provided through a number of means including many that have been identified such as transportation fairs, or online services such as ridematching.
Who will deliver it?	► City Website ► City of Greater Sudbury ► Community Organizations
Why is it needed?	Similar to other information programs, these create awareness of travel options, educate people and reduce information barriers to TDM.
Benefits / Intent:	► Benefits are an increased awareness of the programs and modes available. ► Intent is to increase information and awareness in the community of alternative travel options.

Promotional programs are an ideal forum to provide information about transportation programs to larger groups.

M.22

Land Use Planning

Description:	Policies that support the use of sustainable modes such as mixed use development, compact communities and higher densities.
How will it be delivered?	Amendments and updates to planning policy documents and master plans to reflect the integration of land use and sustainable transportation planning. The increase in a mix of uses, intensification and developing clear policies around transit-oriented developments and pedestrian-focused communities will help integrate TDM into the planning policies of the city.
Who will deliver it?	► Planning Services
Why is it needed?	The model that has been used for several decades can no longer be supported and it is therefore necessary to look at other built environment planning options to make the use of the land more efficient and to ensure that our transportation systems are sustainable and effective. Therefore, in order to support the use of sustainable modes, changes are needed that no longer cater to only the automobile.
Benefits / Intent:	► Benefits are communities that are not reliant upon the car and are more focused on people and mobility. Innovative policies can place Sudbury in a leadership role.

'The best transportation plan is a good land use plan.'

M.23

School Travel Planning and Support

Description:	These are plans that are developed for individual schools and based on the needs specific to the community. They can also come out of larger policies to encourage the use of sustainable travel within a community to schools. These programs are designed to provide information, education and potential limits on access by private vehicles to school properties through developing safe drop off zones, better AT routes, etc.
How will it be delivered?	The school travel plans are implemented on a school by school basis using the format established through Green Communities Canada. The support for the plans is provided by other groups such as school boards, city staff and regional staff.
Who will deliver it?	► School Boards ► City of Greater Sudbury ► Sudbury and District Health Unit ► Community organizations
Why is it needed?	Schools have peak trip generation (AM and PM peak). Engagement at the school level helps reduce demand for car trips and allows safe alternatives to promote walking and cycling. The City should ensure that they are taking an active role in continuing development of school travel planning programs.
Benefits / Intent:	► Benefits are less pollution, increased physical activity, increased levels of safety.

School travel planning helps to reduce car use and keep children fit and healthy.

4.0 TDM Promotion, Engagement and Development Tool Kit

4.1 Promotion and Engagement

Any TDM program involves promoting the use of sustainable travel options that goes beyond just informing the public about a new activity, infrastructure or a new program. Promotion of TDM measures involves using methods that will encourage long-term and sustained behaviour change and includes working with the public to determine what their needs are, what they are willing to try and how often. The sections below outline various techniques which can be used to encourage residents of Greater Sudbury to shift travel behaviour over the long-term.

Promotion and Engagement Tool Kit

A tool kit is a guide, collection of components, and a source of information that can be used to support the implementation of a program or activity, as well as the completion of new sustainable transportation infrastructure or services. To deliver a program which promotes the use of sustainable transportation and the implementation of a TDM program, the tool kit will need to be flexible and designed in such a way that each component can be used on its own or as part of a larger plan that will include many TDM measures. The tool kit can take on many forms and incorporate any number of components which can be used to:

1. Promote new TDM-supportive infrastructure such as bicycle lanes, bicycle parking, pathways and multi-use trails, amenities, etc.;
2. Promote the use of new sustainable transportation services, such as a new transit route;
3. Educate residents about TDM measures, programs and activities; and
4. Work directly with residents to encourage changes in travel behaviour and provide incentives and an understanding of the benefits of sustainable travel modes.

To look for inspiration as to what could be accomplished in Sudbury over time, Denmark provides a great example of how to change travel behaviours in both the city and regional context. The Danes have been successful in shifting travel behaviour from the car to cycling for a range of trip distances and purposes, though this has occurred over several years. As a small country with a small population (5.7 million, much less than half Ontario's population of 13.6 million), it is not unreasonable to look at some of the programs, policies and cultural changes that occurred to encourage walking and cycling. Many of the ideas can be applied to other sustainable modes such as transit and carpooling.

The country has not always been a sustainable transportation haven. In fact, in the 1960s and 1970s, cycling was battling against the growth in automobile traffic. Like Canada, it was a predominately car-based culture, but the 1970s oil crisis and increased interest in environmental causes led to a shift back to cycling as a means of transportation. Today, sustainable transportation is not only popular, it is widely considered the "norm". The Danish experiment to shift travel behaviours is rooted in a three-pronged action plan, accomplished

through the development of infrastructure, promotion of active modes (all sustainable modes can be promoted in a similar way) and a “normalizing” of the use of sustainable modes through legislation. Table 3 outlines a few key components of travel behaviour change used successfully in Denmark. It should be noted that though these programs were directed specifically at cyclists, some of the activities could be applied to other sustainable modes, such as transit as indicated in the first program in the table below.

Table 3 –Denmark’s Promotional Activities

Infrastructure	Normalization	Promotion
Gradual and continuous expansion of separated bicycling facilities (cycle tracks and pedestrian amenities	Pedestrian and public transports are always given priority. **Motorists must always yield** to pedestrians, people on bicycles and mopeds.	Umbrella organization that coordinates efforts within public and private sectors; Cycling Embassy of Denmark
Excellent year-round maintenance programs		Several programs have been developed over the years to encourage the use of sustainable modes. A few are outlined below.
High fuel costs		Bike to Work Month: This campaign has been running for over 18 years and has been tremendously successful. It takes place during the entire month of May and is centered on workplaces. A central website teams to view their own page and to see the progress of other teams. Many local municipalities build upon the momentum by offering incentives. The purpose is to motivate more people to cycle and support those already doing so.
Strict rules and laws for pedestrian and cyclists	Pedestrians and cyclists can also be fined for not obeying laws. Typically, fines are 1000-1500 DKK ($200-300 CAD) for offences not involving collisions.	

While some ideas are not necessarily easily accomplished at the local level in Canada, many ideas from Denmark can provide a solid basis for an action plan to shift travel to more sustainable modes in Greater Sudbury (see Section 5.0).

Why Promote Sustainable Modes?

Sustainable travel modes are an important part of the transportation system, but they are not typically promoted the way we promote and market the automobile at present. The car is marketed as a status symbol, to be free to go where you want to go and as a direct means to travel to a destination.

Except for programs and technology that promotes the use of carpools and transit, little else is done to routinely promote sustainable travel in Canada. As Greater Sudbury begins its TDM journey, it is important to ensure that all sustainable travel options are promoted, marketed and encouraged to all the city's residents. We cannot assume that if we build it or if we provide it, the community will use it. Therefore, we need to be proactive and innovative through exciting and fun programs.

Just like the opening of a new business, the opening of a trail, bike lane or the start of a new transit or carpooling service is an important opportunity to promote sustainable travel options – for all trips. Cars are seen as a status symbol and represent freedom of movement – the question must therefore be asked: why can't sustainable modes be seen this way? Rather than the latest and greatest car, we can market: how cycling and walking can make you healthier without having to pay high annual fees for gym memberships; how taking transit can reduce stress and enable workers to catch up on emails while traveling; how using a car less can provide you with more money that can be put toward a dream vacation; and how pollution can be lowered around schools when more parents choose to walk their children to school. Connecting the benefits of using sustainable travel and the infrastructure that supports it can help encourage their use and lead to the normalizing of sustainable travel behaviours.

4.2 Tool Kit for Promoting and Encouraging the Use of Sustainable Travel Modes

The 2016 Transportation Master Plan emphasized the need for a TDM plan that meets the needs of the community. A 'Tool Kit' that contains a range of TDM measures that the City can choose from to implement over time, is considered an effective approach to TDM for City. The Tool Kit contains two main benefits: one is a broad overview of the wide range of TDM programs and initiatives that are available to the City, along with some commentary on their relevant costs benefits, and the other benefit is a level of flexibility to implement these TDM measures in accordance with the City's own priorities. The Tool Kit includes the following four categories of measures:

1. **Promotional information and materials to encourage the use of sustainable travel options**
    a. Emphasis on the fun, enjoyable and social aspects of alternatives to single occupant vehicle travel: marketing strategies that make travel options like carpooling and transit exciting.

b. Tackling attitudes around people feeling safe and independent – show residents and visitors how to move through the community using clearly signposted, direct routes and modes
c. Avoiding marketing messages that make people feel obliged or guilty – develop messaging / programs with a subtler aim to change behaviours. Design messages in a way that help to overcome taking part in the programs and using sustainable travel modes.
d. Promote the use of sustainable modes so that people can see themselves using different modes at different times in their lives. Also, include supporting measures and incentives that can make using sustainable travel options more realistic
e. Hold focus groups to learn what a community needs and determine if the approach being taken by the City is the appropriate one.
f. Engage members of the community to act as Ambassadors to provide information about cycling, road safety, transit and generally be a "cheerleader" to encourage the use of sustainable travel options.

2. Funding and promotion of new TDM-supportive infrastructure

a. When new infrastructure is completed and available to the public, it should be promoted and celebrated to allow people in the surrounding neighbourhoods to discover it, use it and determine its value to them. Opening events with municipal staff, elected officials and the public provide the unique opportunity to provide residents with timely and relevant information about the new infrastructure. This can also be used as an opportunity to promote the City's sustainable transportation goals and educate potential users.
b. Set up a process to generate stimulating and interesting media releases and harness the City's existing relationship with media outlets to promote TDM-supportive infrastructure in a cost-effective and informative manner. The news releases can raise the profile of these projects
c. For larger projects or new developments, use CBSM-based travel planning programs to provide local residents with information and support as to how to best utilize travel options on a long-term basis. Combining CBSM-based travel planning programs with new infrastructure or developments has the potential to increase the use of the sustainable travel option(s) due to direct contact, on-going support. This can increase the likelihood that using active modes can lead to sustained changes in travel behaviour. Developing individual travel plans, providing a direct email / phone line for support and regularly taking part in community events will help to keep sustainable travel options at the forefront.

3. Reprioritizing the City's long-term transportation and land use objectives to in a set of comprehensive updates to the Official Plan, as well as tracking progress and achievements

a. As the City implements the TDM plan, progress towards milestones should be tracked and celebrated

b. The City should also promote upcoming programs to ensure that residents understand the long-term planning for implementing TDM within the City and how they will coordinate with other groups and develop partnerships
c. Develop an award program for both employers and residents / employees to encourage them to use sustainable options.
d. Establish a reward program in which local businesses donate rewards for those using sustainable modes.
e. The Official Plan currently contains the objectives to 'support the expansion of the transportation network as demand justifies' as well as 'promote[ion] of all travel modes' (see Official Plan, section 11.1). As the TDM Plan gains more prominence and resources are reprioritized, consider a shift to sustainable transportation principles and policies that prioritize making better use of existing infrastructure and deliberately targeting the growth in non-sustainable modes to reduce the environmental footprint of the City over time.

4. Implementation of programs that support TDM

a. Table 4 below provides an overview of promotional programs that support TDM:
b. The use and promotion of sustainable modes of travel for special events and entertainment areas.

There have been several communities that have incorporated sustainable travel within the development of a special event space, such as Winnipeg, Ottawa and Moncton. Parking is important to attracting people to a site but it can also lead to issues such as congestion and delays. Not only is this a time issue, it also contributes to air pollution and dominance of motor vehicles in each area and can also lead to stress and frustration.

Special event hosts / venues should include promotion of sustainable travel modes when a show, game or event is scheduled. Simplifying the process by including transit fares, shuttle bus services to off-site parking and valet bicycle parking in the cost of a ticket will encourage people to leave their car at home.

Early discussions about the proposed Kingsway Entertainment District indicated that prioritizing modes other than the car will be part of the plan going forward. This is important to the implementation of the TDM plan. At the time of the writing of this report, the development of the initial plans and early discussions were still ongoing but nonetheless, the inclusion of sustainable transportation options is important. However, it is not possible to promote the use of sustainable modes where there is a considerable amount of parking associated with a site.

An example of the power of land use policies and guidelines that reduced parking and allowed for a mixed-use site is Lansdowne Park (TD Place) in Ottawa. As time goes on, it should be looked at as an example of a successful site with limited parking available for events.

Table 4: Promotion Programs

TDM Promotion Tool	Description	Comments
Community-based social marketing	Community-based social marketing (CBSM) can be applied to assessing and defining the audiences within a community and developing an approach to the delivery of communications and promotional materials. CBSM involves the use of a variety of tools to encourage changes in behaviour through personal contact and individualized programs. It encourages the removal of barriers to a potential "new" behaviour using tools such as prompts, commitments, norms and communications. These tools allow for the: ► Segmentation of audience to attract those who are willing to change their behaviour; ► Identification of the barriers to a behaviour; ► Development and piloting of a program to overcome these barriers; ► Implementation of the program across a community; and Evaluation of the effectiveness of the program.	It is therefore important to use the principles of CBSM as well as other innovative approaches to the encouragement of behaviour change to achieve the goals set out in the TDM Plan.
Campaigns and Events	Campaigns and events are opportunities to promote, encourage and educate. Campaigns tend to be longer in duration while events may be one-offs, annual or monthly opportunities to promote the use of sustainable travel options. To attract and inform more people, hosting or attending events is important as going to where the residents are is often more	The longer something lasts and the more it is in the public eye, the more likely it will have an impact on the way residents travel. It has been shown that when campaigns last longer or events are repeated on a regular basis, the result is that more people will stick with the sustainable option than if they were shorter or not as frequent.

TDM Promotion Tool	Description	Comments
	productive than when invited to an event. Examples of campaigns and events: ▶ Bike month or Bike Season (i.e. Summer months) ▶ Bike lending campaign (like in Denmark – see appendix) ▶ Regular competitions between workplaces ▶ Home shows and other public expos ▶ Walk to School Day ▶ Winter Bike to Work Day ▶ Carpool Week ▶ Telework Week	Campaigns and events are excellent opportunities to develop partnerships with community organizations.
Interactive Tools and Workshops	Interactive tools allow for residents to take a hands-on approach to understanding and learning about sustainable travel. They also enable those providing a service or program to encourage people to use sustainable travel options for the long-term. Workshops can include learn to ride a bike programs, how to use the bus, increasing confidence for using active modes etc. Interactive tools can include – online ridematching and buddy programs; maps that show routes, distances and times; schedules for public transit and how to find the right mode for a trip (Mobility as a Service – see below).	Interactive tools can provide support, education and encouragement to use sustainable modes. They can be used to provide hands-on learning opportunities as well as encourage a behavioural shift in how people travel.
Website and Clearinghouse	A website provides information about, and links to all sustainable travel options and ensure that when residents, employers, and visitors are	A “one-stop-shop” can provide the necessary information to support the use of sustainable travel options. If there are several sites dedicated to TDM

TDM Promotion Tool	Description	Comments
	looking for sustainable, affordable and convenient modes of travel, it is available on one site. The clearinghouse will provide all related documents in one place to ensure that the information needed is available. If interactive tools are available, the links should also be included on the website.	initiatives, it will make it more difficult and potentially confusing for people to navigate and find the information they are looking for.
Safety	Safety and awareness campaigns should be used to promote visibility of cyclists, safe practices, buddy systems, etc. Any safety program and the related changes to the infrastructure and services will increase use.	Safety can be incorporated into any of the tools outlined in this table, however, it should be noted separately to ensure that it is an important component of the TDM program.
Collateral	Any materials developed to be distributed to the public to promote the use of sustainable travel options.	These can be effective in promoting events and campaigns and letting the public know about new programs, infrastructure and services. They should not be used on their own but as part of a larger program.
Media – Traditional and Social	Media is changing – the focus is moving from print forms to online news services and social media posts on platforms such as Twitter and Facebook. Developing relationships with media can also provide opportunities for "free" advertising and methods of getting information out in a timely manner.	The use of these platforms is now considered essential to getting the message out, providing support, assistance and feedback and reaching the younger generations such as the Millennials.
Individual Travel Planning	This program provides opportunities to work directly with individuals and groups (generally households) to develop specific travel plans to	Working directly with people has proven to be effective in encouraging changes in travel behaviour. This program can be delivered to households,

TDM Promotion Tool	Description	Comments
	meet their daily transportation needs.	workplaces, post-secondary institutions.
Promote Destinations and How to Get There	Promote getting to destinations such as shopping, workplaces, medical offices, schools, and other places that people need to get to daily. As well, showing routes to common destinations will help people travel around more sustainably.	A lot can be done in partnership with businesses and employers to encourage the use of sustainable transportation to their sites.

Emerging Opportunities to Increase Sustainable Mobility Modal Shares

Mobility Management

Mobility Management is often another term used for TDM, but in many ways, it is more comprehensive and can be used to complement the softer transportation measures that make up TDM measures and programs. Building upon the work undertaken in the community-based social marketing programs outlined above, Mobility Management considers the need to understand the users of the transportation system to further depict the reasons why they use a specific mode.

This enables not only the creation of an effective promotional and communications campaign, but provides the types of services and infrastructure needed to make the journey more in line with the needs of individuals, households, workers and visitors. This is not about the transportation infrastructure or services available; it is about the users and understanding their needs, fears, motivations and experiences; about knowing where they go, when they travel and the purpose of the trip; and that transportation can be a facilitator for an individual's lifestyle. When the travel needs of individuals are balanced with strategic objectives and existing infrastructure and services, this results in a win-win opportunity for all.

Therefore, it is important to undertake the development of a program that closely matches and reflects user needs. Looking specifically at individuals can lead to considerable work and little to show for it, however using the idea of personas or user groups can lead to a higher level of success and achieve the goals of this plan and the City.

Mobility as a Service

This is an emerging personalized service approach to transportation that adapts the mobility needs of individuals to a suite of on-demand travel services, usually with the help of technology such as smartphones. Currently, there are few providers with a comprehensive program in place in Canada. Finland is currently leading the way, select US examples exist such as WeDriveU (Texas) and Via real-time ridesharing (Washington DC, Chicago and New York City). The reality is that this will continue to be a field that the City should monitor and learn about and develop systems in which residents, workers and visitors can find the best transportation option

for their travel needs. By promoting the use of such services, the use of sustainable travel is expected to increase over time.

Mobility as a Service (MaaS) is the integration of various forms of transport services into a single mobility service accessible on demand. To meet a customer's request, a MaaS operator facilitates a diverse menu of transport options, be they public transport, ride-, car- or bike-sharing, taxi or car rental/lease, or a combination thereof. For the user, MaaS can offer added value through use of a **single application to provide access to mobility**, with a single payment channel instead of multiple ticketing and payment operations. For its users, MaaS should be the **best value proposition**, by helping them meet their mobility needs and solve the inconvenient parts of individual journeys as well as the entire system of mobility services.

The aim of MaaS is to provide an **alternative to the use of the private car** that may be as convenient, more sustainable, help to reduce congestion and constraints in transport capacity, and can be even cheaper. (From: https://maas-alliance.eu/homepage/what-is-maas/)

Transit Master Plan

The TDM Plan is also the ideal opportunity to respond to several suggestions arising from the Greater Sudbury Transit Action Plan, currently underway. Community Action Network and Transit Stakeholder workshop participants in the phase 1 public engagement responded that improvements to amenities and technology would be welcome to improve the customer experience. The TDM Plan is the ideal opportunity to prioritize the installation of more shelters, benches, charging stations for personal electronic mobile devices, music and art to help promote a shift to sustainable modes. The members of SMAP also reported cycling infrastructure improvements such as bicycle parking in proximity to transit would help to increase more multi-modal travel behaviour across the municipality and assist with last mile journeys.

4.3 Partnerships

There is the potential within Greater Sudbury to coordinate the delivery of TDM programs with partner organizations. This not only provides support and increased outreach opportunities; it also ensures that TDM programs are community-based. With only one staff member (the Active Transportation Coordinator) with the mandate to deliver sustainable transportation programs, infrastructure and services, the inclusion of partners in the development and delivery of TDM programs will benefit the community and ensure that the programs are implemented.

Most successful TDM programs are implemented with through the cooperation of both the municipal officials (including EarthCare Sudbury) and other community-based organizations. The assistance of groups such as reThink Green will be needed to deliver the TDM programs to workplaces and households.

The local school boards and the Sudbury and District Health Unit will be important partners to assist in delivering the programs to schools in Sudbury. They have the knowledge of school programs and the needs of the students to deliver the types of educational and informative programs required to encourage students to travel by sustainable modes.

During the stakeholder consultation session, reThink Green suggested that they take the lead on the delivery of a workplace travel program. There are many ideas listed in Chapter 3 that both reThink Green and the City can work on collaboratively to deliver the workplace program. This should be a short to medium term priority for both.

Other partnerships can evolve over time as the TDM program matures and more groups become aware of the benefits of TDM within Greater Sudbury.

4.4 TIS Guidelines

Greater Sudbury is currently updating its Traffic Impact Study Guidelines (TIS). The updated TIS guidelines include non-auto modes, transit, pedestrians and bicycles. They do not however include the provisions to incorporate infrastructure into new developments to increase the use of sustainable travel options.

This section should include the following to reduce the number of auto-based trips to and from a new development:

1. Provision of bicycle racks and lockers on site (new provisions to be incorporated into the zoning bylaw). These facilities should be located near the main entrances of all buildings (site plan) in well-lit and accessible locations (within 10 to 15 metres of the entrances)
2. Provision of walkways and paths to connect building entrances to transit stops and sidewalks within the right-of-way to encourage the use of cycling, walking and transit (also part of the first / last mile connection)
3. Sidewalks, walkways, paths and trails in subdivisions to ensure that there are options for people to use active modes of travel (guidelines will need to be followed to receive all lines of credit)
4. Bicycle infrastructure to improve commuting within the city, particularly to / from and within new developments
5. Priority parking spaces for carpools should be included within parking lots to encourage the use of carpools and online services
6. Add a TDM Plan to *Documentation and Reporting* section and to Appendix B when required for large scale individual site plans and plans of subdivision.

4.5 TDM and Land Use Planning

The link between land use and transportation planning is well documented. To encourage the use of sustainable travel, not only are programs and promotion needed but the built form of our communities needs to support sustainable transportation initiatives as well. Below are the policies from Greater Sudbury's Official Plan. These policies provide a basis from which to grow

and strengthen the link between supportive land use policies and the promotion of sustainable transportation modes.

Policies from Greater Sudbury's Official Plan:

The following sections within the Official Plan **should be updated** to include increased support for TDM programs and opportunities with the goal of increasing the use of sustainable travel options with Greater Sudbury through compatible land use policies.

Section 11.1 Objectives:

Add an objective that states: Develop a robust TDM program that will shift modal shares to sustainable travel options and encourage long-term travel behaviour change.

Section 11.3 Public Transit

Add a policy to include the first / last kilometre in planning for new communities:

Ensure that all new developments incorporate active transportation infrastructure or connections to infrastructure and services to provide the opportunity for increased use of transit and reduce the dependence upon the private automobile.

Is there a policy on equity – we could use a sustainable transportation network where there are good connections via walking and cycling to transit stops and terminals which will increase the ability of lower wage earners to access employment, school, social activities and shopping, etc.

Section 11.9 – change to a TDM Programs and Transportation Sustainability Section – it will help to highlight the TDM Plan and provide policy to support incorporating TDM into developments

5.0 Action Plan

This chapter builds on the key programs, tools and community profile from earlier in the report to develop the action plan that will implement Greater Sudbury's TDM Plan.

As discussed in Chapter 4, the delivery of tools that will meet the needs of the city to shift travel behaviours and make it an intrinsic part of the community will require a systematic yet flexible approach to the delivery of the TDM program. Each action identified within the Plan will include potential partners or providers, timeline for implementation and a monitoring program.

The TDM action plan includes "soft measures" (e.g. education and promotion) to encourage sustainable travel modes, which are designed to support the services, infrastructure and amenities required for the plan to succeed.

Three different implementation timelines are addressed: "quick win" actions in the first two years, followed by medium-term actions (years 3 through 5) and long-term actions (years 6 to 10).

The chapter concludes with recommendations on monitoring the program's delivery and impacts, and ultimately measuring its success in shifting travel behaviours over time.

5.1 Key Steps

A successful TDM Plan will include several steps that encourage collaboration, innovation and inclusion. The following provides an overview of the steps that should be undertaken.

Establish Partnerships

The success of this action plan will depend on the creation of strong partnerships for program delivery. This will require:

- The identification of partners who can be part of the delivery of specific programs and activities (see the profile of Arlington County's Commuter Services Bureau where employers partner with ACCS to establish in workplace consultations, information fairs and events and conduct individual travel surveys that collect data to show travel patterns).
- Working with organizations who have been or are willing to be involved in TDM to deliver programs.
- Improving social marketing through joint strategies designed to reach a range of audiences.
- Ensuring strong take-up of TDM measures where the ability to drive behaviour change resides with a partner organization.

Partnerships are about synergy and leverage—the notion that 'the whole is greater than the sum of its parts'. Partnerships enable information and support to be provided by colleagues, neighbours and local organizations who know their communities and the people in them. They also permit the efficient distribution of information by using channels that connect to new potential user groups and interested persons.

Community Partnerships

Partnerships are important to the implementation of the City's TDM Plan. Through the City's leadership community organizations, businesses and community groups will have significant roles in the delivery of programs and measures to shift travel behaviours.

Workplaces such as the Sudbury Canada Revenue Agency (CRA) office, Health Sciences North and the City of Greater Sudbury have all shown interest in supporting the implementation of TDM programs and measures. These workplaces, as well as others should be part of a program designed to support workplaces. A workplace program should be created to support, encourage and enable the use of sustainable travel options. Beyond the workplace, partnerships with community groups are vital to provide education, encouragement and support for households and individuals to shift travel to more sustainable modes for daily activities.

Student travel is unique. Children often do not have a choice for how they travel to school. Parents are often the ones who decide if their children will walk, cycle, be driven or take the bus. Travel decisions are often based on household schedules, weather, distance and the desire to ensure that children arrive at school safely. Many parents drive their children to school due to the perception that there are too many cars around schools and the areas are not safe. Partnering with schools and the school boards can help to ensure that parents understand school safety can improve if children can use active and sustainable modes to travel to school.

Recommendations:

- The City should develop a working relationship with community groups working with community organizations to implement the measures and programs outlined in this plan to provide the support and encouragement needed to residents that will result in long-term changes in travel behaviour.
- The City should develop partnerships with the school boards within the city limits to develop and deliver programs that will support parents, children and staff in making sustainable travel decisions. The City should consider taking part in the Active and Safe Routes to School program as well as the School Travel Planning program in partnership with the school boards and Green Communities Canada. If the City wishes to apply to be a Sliver level Bicycle Friendly Community, it should work with its partners to pilot a School Travel Planning program at a few of the schools within the City in the short-term.
- The City should continue to work with the community group to engage the community in reducing the use of single occupant vehicles for everyday travel.
- Community groups that have invested in supported sustainable transportation should continue to be supported and provided with information. These groups, such as the Friend of Sudbury Transit, Rainbow Routes Association and others have invested in providing residents with information, infrastructure and other supportive measures. The City should work with these groups to provide necessary support measures, allowing them to continue in their encouragement of sustainable transportation use.

TDM Working Group

An effective TDM program cannot be managed and delivered by a single individual or staff group. Success will require active support from other city departments and their work programs.

For example, collaboration between transit staff and the City's Active Transportation Coordinator could help improve multimodal "first and last mile" connections to transit hubs.

Similarly, Engineering Project Managers for major infrastructure projects could work with the Active Transportation Coordinator to mitigate negative traffic impacts and improve travel choices for residents during disruptions. The formation of a working group, which includes representatives of several departments and meets regularly to exchange information and coordinate actions, can help facilitate these partnerships and support a more robust TDM program.

This working group would be complementary to the Sustainable Mobility Advisory Panel.

Recommendations:

- The City should develop an internal TDM Working Group to, among other things, help integrate TDM and transit into major construction projects. The internal working group can assist in promoting the use of all sustainable transportation options and the linkages between transit and TDM.
- Both transit and transportation staff need to work collaboratively in the delivery of TDM programs. This will include promoting and marketing TDM and transit, encouraging the use of sustainable travel options and working with members of the community to shift travel behaviours.

Staffing

The implementation of the TDM Plan will require an increase in staffing to allow for the delivery of programs and measures throughout Greater Sudbury. The additional staff will be able to coordinate activities, outreach, and promotion; work with other city departments; and develop partnerships with outside organizations.

For the delivery of the TDM Plan, there are two recommended positions. One is the transition of the Active Transportation Coordinator from a contract to a full-time position. The other position is the addition of a marketing and promotion expert who would be responsible for both transit and TDM. A staff member who specializes in marketing and promotion can provide the necessary materials and activities to encourage the use of sustainable transportation modes, coordinate work between transit and transportation and establish partnerships. These changes can lead to integration of sustainable modes, including the encouragement of more multi-modal transportation options such as the "first mile/last mile" connections between transit and origins or destinations.

Increasing the number of full-time staff as outlined above will help to increase the City's ability to encourage the use of sustainable travel modes, engage with residents and develop slogans and branding which will provide the City with increased modal shares towards sustainable travel. While the addition of staff will increase the operating budget, the ability to promote and encourage the use of sustainable travel options and implement the TDM Plan require this investment.

Create outreach, marketing, and education programs

Social marketing programs and traditional media and communications outlets are important to the success of TDM measures. The success of each TDM measure needs to be supported through education about how and why sustainable transportation options should be part of daily activities. Without a substantial program to increase the awareness of sustainable transportation, the goal of increase mode share will not be reached. Developing a program that incorporates the uniqueness of Greater Sudbury, such as providing incentives to outlining communities. As well, utilizing more than one mode to travel to and from a destination should also be promoted, particularly in areas where the topography impedes travel by active modes. The inclusion of a marketing position will increase the ability of the City to successfully increase the use of sustainable travel options.

There are several ideas that the City could incorporate into a promotion, education and encouragement program. While many are aimed at cyclists, they can be adapted to encourage the use of all sustainable modes. These programs include educational programs that can be aimed at people of all ages, abilities and income. As well, the City and its partners should work on a safe roads campaign that will ensure the more vulnerable of road users feel safer along Greater Sudbury's road network.

Recommendations:

- The City should evaluate the full list of municipally delivered programs outlined in Chapter 3 against the new objectives of the Transportation Master Plan to establish funding and policy priorities for future outreach, marketing and education programs. This will allow for strategic alignment between the City's Official Plan policy priorities, TMP and TDM objectives.
- To promote the use of sustainable modes, a position should be established to market the TDM programs. Sharing this position with transit would be appropriate as the transit system in Greater Sudbury will form the basis of a sustainable transportation network.
- The City should establish a promotional and education program as soon as the proposed Marketing and Communications position is filled.
- The City should establish ongoing funding for the implementation of the promotion and education campaign as well as for the proposed marketing and communications position. This should also be extended to making the Active Transportation Coordinator role permanent.

Wayfinding

As Greater Sudbury is building its active transportation network, a wayfinding program should be introduced to provide residents, visitors and workers with directions to key destinations along the network. Wayfinding is another means to encourage the use of active modes by taking the "guess work" out of how to get to a destination in a safe and comfortable manner. Signage with direction arrows, distance and destinations will assist users in using the network and shifting to active and sustainable modes.

The wayfinding program should include the following:

- Consistency in branding
- Ease of use and accessibility
- Connected and continual

The images below are from Sydney, Australia. They provide direction and distance to destinations which enables newcomers to the area, tourists, visitors and residents with the ability to travel confidently around the city using active travel options.

As part of the wayfinding program, the City should also create a map showing the active transportation network and recommended routes to travel around the city. This map could show areas where there are steep grades and where it may not be a comfortable ride for those who are less experienced cyclists. The map can also provide more information such as links to organizations and information about using active travel, where to access transit information, key destinations, types of routes and information about signage and safe cycling. Below is an image of part of the cycling map for Halifax (HRM) as an example of the type of map that could be developed by Greater Sudbury. The full map can be found at: https://www.halifax.ca/sites/default/files/documents/transportation/cycling-walking/BikeMap2015finalJUNE2017.pdf

Recommendation:

- The City of Greater Sudbury should develop a wayfinding program to indicate the routes that are recommended to travel to key destinations. This program should be introduced when a map is created for the community showing active transportation corridors, major transit terminals, key destinations, steep grades and other barriers. This program can significantly increase the level of cycling in the city whether it is for utilitarian or recreational purpose.

Develop TDM Requirements for Developments

An important step for the City will be to integrate TDM more fully into the development application and approval process. Policies within the Official Plan should be enhanced to include support for sustainable transportation and TDM measures. The Official Plan, as it is updated, could also include policies that support mixed-use and more compact development. This type of development could be applied within the urban area as well as in outlying

communities to encourage the use of sustainable travel options and lead to a pedestrian-friendly style of development which supports the use of sustainable transportation.

Recommendations:

- ► The City should update the Official Plan to include policies related to the TDM programs and measures.

Add to the objectives in Section 11.1, including:

- 11.1 d. to include reference to compact, mixed-use developments that promote the use of sustainable travel options;
- 11.1 e. in addition to promote all travel modes, expand to include incentives, encouragement and education;
- 11.1 d. also include long-term shift in travel behaviour;
- 11.1 e. add connections to transit via walking and cycling to develop a more comprehensive sustainable travel network.

- ► The City should further add to the new policy under 11.2.3 to include: “at the discretion of City staff, TDM programs and measures, as well as supportive infrastructure and services may be required within a traffic study.”
- ► The transit policies in section 11.3.2 (6) be expanded to include bicycle lanes, cycle tracks and pathways to improve access to transit stops…
- ► Programs listed under section 11.9 should be updated and strengthened to reflect the TDM plan. The Official Plan should include not only promoting the use of sustainable travel modes, but also include educating and encouraging the use of sustainable transportation, developing programs for schools, households and workplaces and developing partnerships with groups who could deliver the programs and measures.
- ► The integration of transit with cycling and walking routes to ensure that the development of a sustainable transportation network is developed that will enable the use of more than one mode to travel to a destination or enable the use of one mode in one direction and then another sustainable mode in the opposite direction due to topography, changes in weather or time of day.

The City should work with developers to ensure that all new developments are supportive of sustainable transportation and provide options to meet the goals of reducing pollution from transportation, encouraging more active and healthy communities and improving the quality of life for all residents.

Recommendations:

- ► Develop a formalized process for incorporating:
- ► TDM soft and hard measures/TDM supportive infrastructure in the existing development applications process as part of a TDM Plan under existing legislation (Planning Act and City by-laws)
- ► TDM Statements, Short and Full TDM Plans into the development process

- Lobby the Province for amendments to the Planning Act that would allow municipalities to create enforceable undertakings that would require developers to:
- Provide several TDM hard measures in accordance with a new policy that would require a certain TDM standard to be met as part of the urban development process
- Provide, support and oversee the implementation and monitoring of TDM soft measures beyond the opening day of developments for a defined time-period

Developing a Multi-modal Network

The use and promotion of sustainable transportation options should not be done in isolation. In other words, all sustainable modes should be incorporated into the TDM Plan and, how services and infrastructure can be integrated so that there is a seamless transportation system. Connections to transit services have and continue to be a primary focus of the development of a seamless network. Active transportation routes that provide direct connections to transit stations, terminals and stops help to increase the use of transit within a community.

Another way to develop a multi-modal network is through providing more than one sustainable option for travel along a specific route. In Greater Sudbury, designated bicycle facilities have been located along major transit corridors. This could provide an option to travel by bicycle or transit along the same route or to split the mode used by taking the bus one way and cycling or walking the other. This can provide more options for people and reduce reliance upon the private automobile. As well, active transportation facilities should be developed that link neighbourhoods to transit.

Recommendations:

- The City of Greater Sudbury should develop a network of integrated corridors to support and encourage the use of sustainable modes and ensure that there is a multi-modal sustainable transportation network within the City.
- Where possible, the City should continue to provide more than one sustainable option along major transportation corridors.

Collaboration with other Northern Communities

Canada's northern communities have many challenges that those in the south do not. The weather can be harsher, the topography challenging and in many places, the population is aging. As well, congestion is often not a primary reason for developing a TDM plan. A review of two northern communities with TDM plans has provided support for the development of the TDM Plan for Greater Sudbury, which has similar challenges and opportunities to implement sustainable transportation programs, policies and services.

Both Thunder Bay, ON and Whitehorse, YK have developed TDM Plans. Rather than direct efforts at reducing congestion, both plans have focused on improved mobility for all and in particular for seniors, improving health through the encouragement of active modes of travel, reducing greenhouse gas emissions and overall cost savings for both the community and

individuals. These are the same areas that Greater Sudbury has identified as the primary reasons for the development and implementation of the TDM Plan.

Given that there are few northern communities with TDM plans, Greater Sudbury's Active Transportation Coordinator may wish to collaborate with counterparts in Whitehorse and Thunder Bay to exchange information, ideas, programs and results as the City continues to move forward with promoting and encouraging the use of sustainable travel options, and shift residents' travel behaviour.

Recommendation:

- The City of Greater Sudbury should work with other northern communities to share information, ideas, programs and results as they develop and implement TDM programs and measures within the city.

5.2 Action Plan

During the early stages of the action plan, it is worth focusing on "quick wins" that demonstrate success, attract partners, and build confidence in TDM among decision-makers and the public. As outlined in Table 5 below, the measures that should be implemented in the first few years include increasing the amount of sustainable infrastructure, initiating promotion of active transportation facilities, and initiate the hiring of a marketing and communications person who can promote both TDM programs and transit services.

Beyond year 2 of the plan, the programs and measures that will be promoted have been included in the table, however, as the first phase is implemented, it may be necessary to re-evaluate the recommended actions in the medium and long-terms. This could be due to potential funding opportunities, expressions of interest from partners and others to implement programs, and changes in the strategic directions from the next Council for the City of Greater Sudbury. As this plan is a dynamic document, changes are to be expected.

Table 5: TDM Plan Phasing

Phase 1: **Short Term / Quick Wins** **(Years 1 and 2)**	**Phase 2:** **Medium Term** **(Years 3 to 5)**	**Phase 3:** **Long Term** **(Years 6 to 10)**
✓ Identify sustainable, long-term staffing resources to implement TDM programs and measures ✓ Identify potential financial and staff resources for marketing and promotion of TDM measures for active transportation and transit ✓ Develop partnerships internally through the TDM Working Group ✓ Develop partnerships	✓ Evaluate short-term projects to assess effectiveness and make improvements ✓ Create a TDM outreach program based on work undertaken in first phase ✓ Work with community groups to encourage long term behaviour changes ✓ Update TIS Guidelines to include TDM-supportive infrastructure ✓ Develop TDM recognition	✓ Update the TDM strategy and implementation plan to ensure it is up to date with current technology, programs and research ✓ Evaluate change in TDM delivery and incorporate into updated strategy ✓ Update outreach and education programs ✓ Continue to deliver the programs established in earlier phases

externally to deliver TDM programs ✓ Develop a proposal for a workplace program ✓ Enhance Official Plan policies ✓ Develop a TDM web page and clearinghouse to provide information to the public ✓ Improve the use of social media to promote sustainable transportation within the community ✓ Create TDM collateral targeting to different community groups (i.e. web content, brochures, handouts, bookmarks, etc.). These groups may include seniors, students and families ✓ Continue to develop active transportation infrastructure ✓ Promote existing and new Active Transportation facilities as they are being implemented within the City ✓ Develop a pilot project to deliver School Travel Plans within the City in partnership with community organizations, the school boards and/or Public Health Sudbury and Districts	program for new and existing developments ✓ Develop a workplace program that will be delivered to workplaces that have signed up for the program	✓ Review policies within the Official Plan and the Transportation Master Plan that support TDM programs and measures

Recommendation:

► The City should continue to further develop existing programs and work with the community to develop new initiatives that align with the City's transportation priorities. The Transportation Master Plan should set the stage for identifying program priorities by analysing existing transportation patterns and the potential for TDM measures and tools to form the basis of new TDM strategies that make better use of existing infrastructure or provide equivalent levels of mobility and accessibility at a lower cost than large scale physical infrastructure.

5.3 Financial Implications

It is recommended that a projects budget be created of at least $50,000 for the first phase. This will cover costs for early projects, programs, and other start-up costs. The funds are expected to come from a strategic initiative or from various departments within the city.

The delivery of a TDM program can be very cost-effective compared to other transportation programs. The short, medium and long-term financial resource implications of this TDM Plan have been estimated. The recommended timelines for delivery could be altered due to budgeting constraints, funding opportunities or changes in the direction provided by City Council.

Table 6: Financial Implications

Program	Delivery Agent	Duration	Estimated Cost	Level of Effort
Short-Term				
City workplace promotion for sustainable travel	Active Transportation Coordinator with Community Partner	Ongoing	$2000.00 (printing and staff time)	Approximately 5 hours per week
Promotional materials and incentive programs	Active Transportation Coordinator	Ongoing	$1500 - $3,000 annually (e.g. for printing and staff time)	Approximately 10 hours per month
Community events	Active Transportation Coordinator, community groups, City departments, etc.	As needed	$5,000 annually for advertising and staff time	Approximately 5 to 10 hours per month
TDM/transit Promotion and Marketing Position	City of Greater Sudbury	Full-time	$95,000 annually (including benefits)	35 hours per week
Website and Social Media	Active Transportation Coordinator and marketing staff	On-going	$5000	5 hours per week
Workplace program development	Active Transportation Coordinator and marketing staff	On-going	$5000	10 hours per month
Partnership development	Marketing staff, Active Transportation Coordinator	On-going	$2000	5 to 10 hours per month
Policy development	Active Transportation Coordinator and	As required	$1000	2 to 5 hours per month

Program	Delivery Agent	Duration	Estimated Cost	Level of Effort
	planning staff			
School Travel Plan Pilot Program	Active Transportation Coordinator, School Boards, Community organizations, Sudbury staff, Sudbury and Region Public Health Unit	1 school years (planning to begin in June)	$5000.00 – for materials, incentives and promotion. Staff time is assumed to be included in regular hours	5 to 10 hours per week (max)
Medium to Long-Term				
TDM– supportive amenities (e.g. bike racks)	Active Transportation Coordinator, marketing staff member community groups, property owners, etc.	Ongoing	$2,000 to $10,000 annually	5 to 10 hours per month
Individual travel planning	Active Transportation Coordinator and marketing staff member with community groups and consultants	One-year pilot program plus planning and evaluation periods	$100,000 to $300,000 (look for funding from outside sources) to hire consultant and for staff time	10 to 30 hours per month (including consultant and others)
Develop new programs and continue implementation of existing programs	Active Transportation Coordinator and marketing staff with community groups and consultants	On-going	$5000	5 to 10 hours per week
Monitor and evaluate programs	Active Transportation Coordinator	Annually	$2000	20 hours
Review and update policies and strategies	Active Transportation Coordinator and Planning Services Division	As required	$2000	5 to 10 hours
Sustainable, full-time staff	City of Greater Sudbury	Upgrade the Active Transportation	$105,000 annually (total compensation	35 hours per week

Program	Delivery Agent	Duration	Estimated Cost	Level of Effort
resources		Coordinator to a permanent position	including benefits)	
Update TDM Plan after 5 years	Active transportation Coordinator	Once every five years	$10,000 (in-house); $25,000 (consultant)	200 hours total

5.4 Monitoring

Why monitor?

Monitoring the impacts of TDM initiatives is a key to their long-term success. The purpose of monitoring is to identify changes in transportation behaviour and progress over time. It is a continuous process that involves both quantitative and qualitative measurements, and requires baseline data that provides a starting point for measuring change.

Monitoring the success of past TDM measures supports the implementation of future measures by enabling adjustments when progress is insufficient. Regular monitoring updates on the TDM plan can also maintain accountability by giving residents information that shows how travel being influenced in their neighbourhoods and across the City.

Figure 8 illustrates the key elements of a monitoring program. It is recommended that the City develop a monitoring program with the following in mind (as shown in Figure 14 below).

A thorough monitoring program would include the following:

- Data to be collected by type and source.
- A timeline for data collection.
- General and/or specific program goals or targets.
- Collection of data as per the timeline established.
- Analysis of data with regards to program goals and targets.
- Planned interventions for programs that do not meet target expectations.

Figure 8: Monitoring Program Components

What to monitor?

To achieve the above properties of a monitoring program there are several things to consider as shown in Figure 9, the data requirements, the methods of reporting and the analysis of the data in comparison to baseline information.

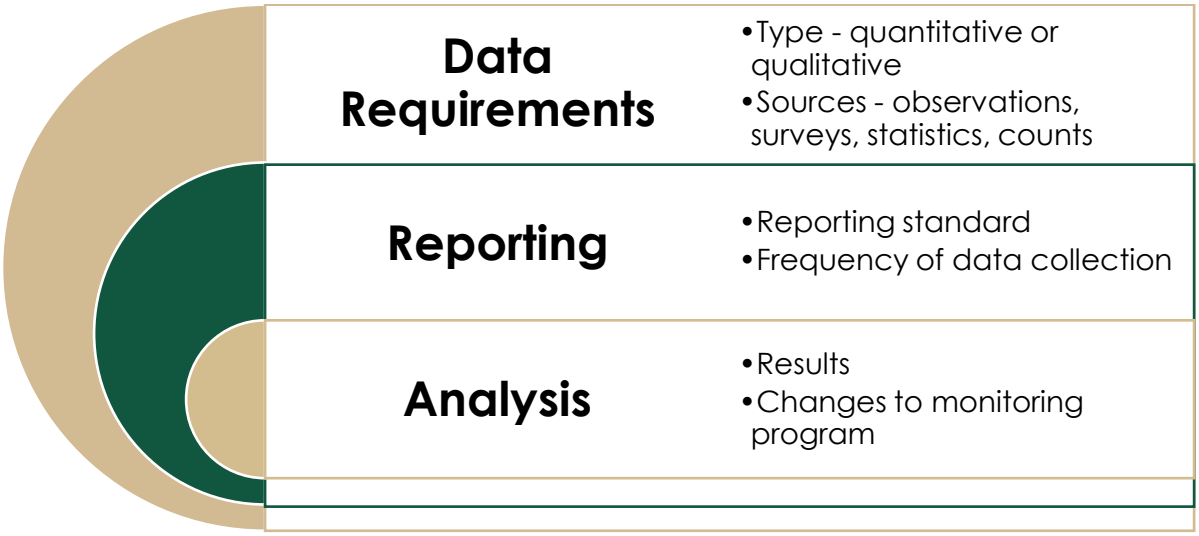


Figure 9: Factors of a Successful Monitoring Program

The features of a monitoring plan are best determined by the nature of the program being monitored, the program's established goals and targets, and the types of available data.

A toolkit has been developed with measures for these programs that will identify where problems lie and where more attention needs to go to mitigate these areas of concern. Each component of the toolkit is discussed in the following pages and includes the following data:

- *Intersection turning movement counts*: to be undertaken at key times and peak periods at both times following the parameters of the City of Greater Sudbury
- *Vehicle classification and occupancy counts*: to be undertaken at key times and peak periods to determine the changes in vehicle use and occupancy. These counts will need to be conducted manually at key screenlines in the City.
- *Parking usage* (structured, lots, on-street): turnover rates and parking duration to determine short vs. long-term parking utilization
- *Use of transit*: to be undertaken in partnership with Greater Sudbury Transit to establish boarding trends
- *Use of bicycle parking facilities*: mid-morning, mid-day and mid-afternoon counts on pre-determined dates
- *Annual report:* develop an annual report outlining the monitoring programs and changes over time

The various monitoring activities are outlined in the following table, with details provided in subsequent sections. It is important that at least for the first few years the City follow the Monitoring Plan Activity Framework as outlined below and undertake counts on a regular basis to determine how successful the TDM programs are at shifting travel behaviour as they are being introduced. It should be noted that additional monitoring activities can be added as the programs evolve.

Table 7: Possible Monitoring Activities

Element	Application			
	What	Where	When	Who
Intersection turning movement counts	All turning movements	Intersections along perimeter and within development	March and October (same week each year)	City of Greater Sudbury
Vehicle classification and occupancy counts (all modes)	Classification of all modes and occupancy counts for all modes	At intersections to be determined depending upon the project	March and October (same week each year)	City of Greater Sudbury
Off-street parking usage	Parking occupancy	Parking garage and surface parking	Monthly – weekday, Saturday and Sunday	City of Greater Sudbury

Element	Application			
	What	Where	When	Who
On-street parking usage	Parking occupancy	On all streets within the site with on-street parking	March and October	City of Greater Sudbury
Transit usage (ridership)	Ridership on identified routes for Weekdays, Saturdays and Sundays Transit passengers boarding and alighting	On identified routes	Each booking (APC)	City of Greater Sudbury
Transit service supply	Scheduled trips on specified routes	All stops adjacent to the site	Each booking (APC)	City of Greater Sudbury
Use of on-site bicycle racks	Number of cyclists traveling to a specified location	All surface permanent bicycle racks	Three times per year – May, July and September	City of Greater Sudbury
Survey	Users of a specific service or program	At location where implemented or City-wide	When program implemented and about 6 months later. If a pilot, a survey at the end will be required	Program provider and / Active Transportation Coordinator
Annual Report	Cover all aspects of TDM program	City of Greater Sudbury	Annually	Active Transportation Coordinator

Recommendation:

- Greater Sudbury should develop and implement a monitoring program based on the above for TDM measures to ensure that the goals and objectives of this Plan are met and travel behaviours shift toward more sustainable modes.

5.5 Conclusions

The TDM Plan for Greater Sudbury will provide opportunities to increase the mobility of the residents, workers and visitors for daily travel and activities. As the city continues to evolve the design of streets to accommodate active modes of transportation; increases awareness of the need to be more physically active; works with partners to encourage the use of transit and

carpooling the result will be an overall shift in behaviour toward more sustainable transportation modes.

The implementation of the TDM Plan will evolve as well. It is not designed to be static and the priorities within the plan will change as the community changes, land use policies evolve and the community embraces sustainable travel options. Therefore, it is important to monitor the programs and measures provided and make changes as necessary to continue to meet the travel needs of the community. Greater Sudbury is a unique community and the plan is also unique. The residents are engaged and will play a role in the delivery of programs.

Finally, the City of Greater Sudbury has a unique opportunity to be a leader in the delivery of TDM and sustainable transportation infrastructure and services. Residents have expressed interest in furthering sustainable transportation opportunities. The survey results indicate that many feel sustainable transportation options may work for them provided incentives; support programs and alternatives are available. Therefore, implementing the programs and measures outlined in this report and, continual monitoring of their success will help lead to a more positive opinion of sustainable travel options and lead to increased utilization.

Appendix A: Background and Data

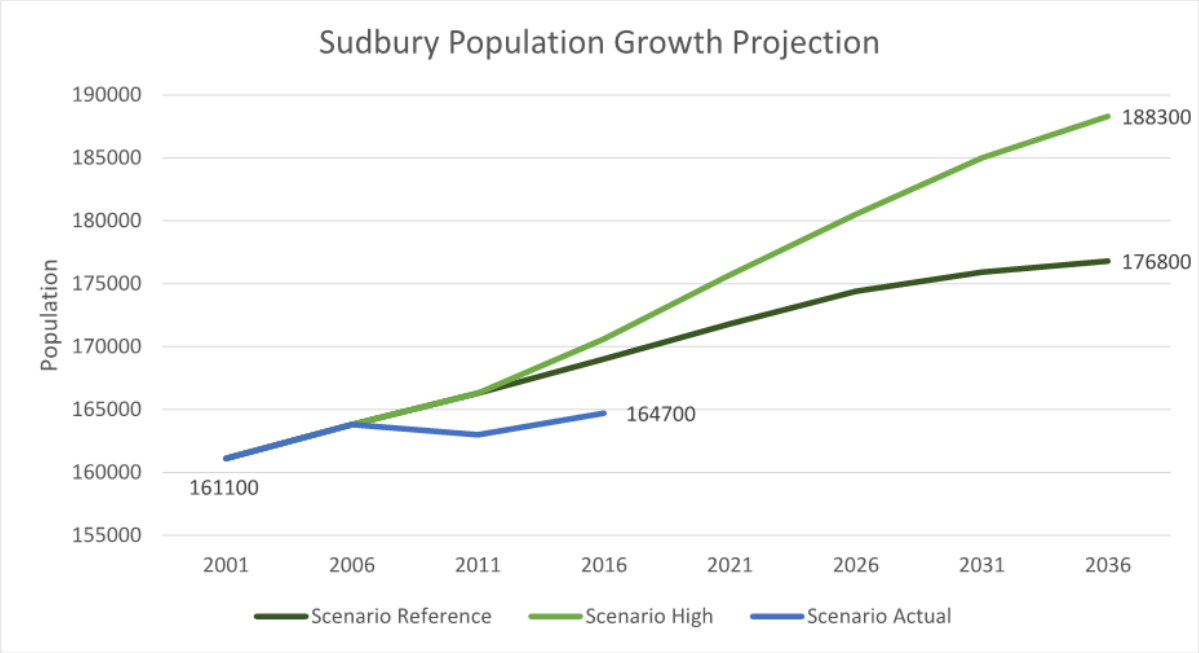
April 2018

1.0 Community Profile

Understanding the composition of the community and how residents travel provided useful insights into how the TDM Plan should be developed and delivered. This section provides a profile of the community ranging from population and demographic characteristics, to housing and modes of travel.

1.1 Population Growth Scenarios

A population growth study report was undertaken in 2013 by Hemson Consulting. The report outlines positive immigration and economic opportunities which are expected to drive population growth in Greater Sudbury to 2036. Population is expected by grow by 6% over the next 20 years. This is in contrast to the census data which indicates a more modest rate of growth. However, the Places to Grow Plan (provincial) and immigration indicate that Greater Sudbury is due for an increase in its population. The graph below indicates the different growth rates (high and low based on the Hemson report and the actual historical rates based on the census data). In all three scenarios, the population is found to be increasing. This growth will require the development of a TDM Plan to accommodate additional trips and the economic opportunities that are expected to arise over time.

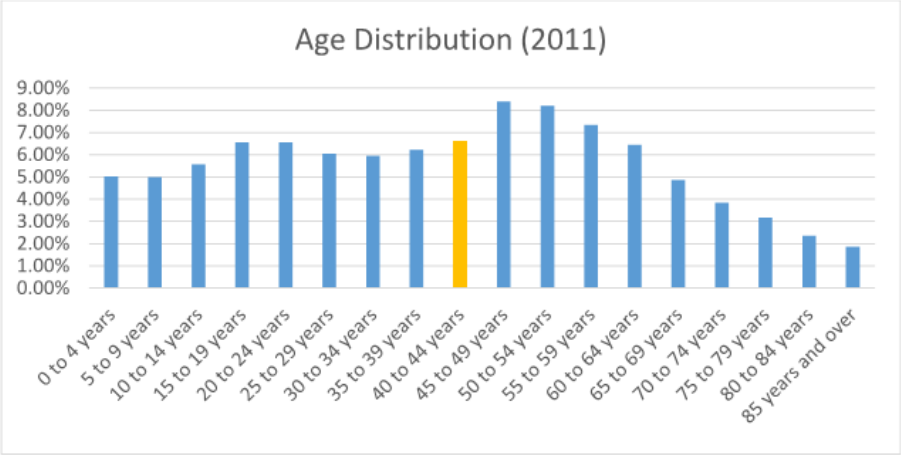


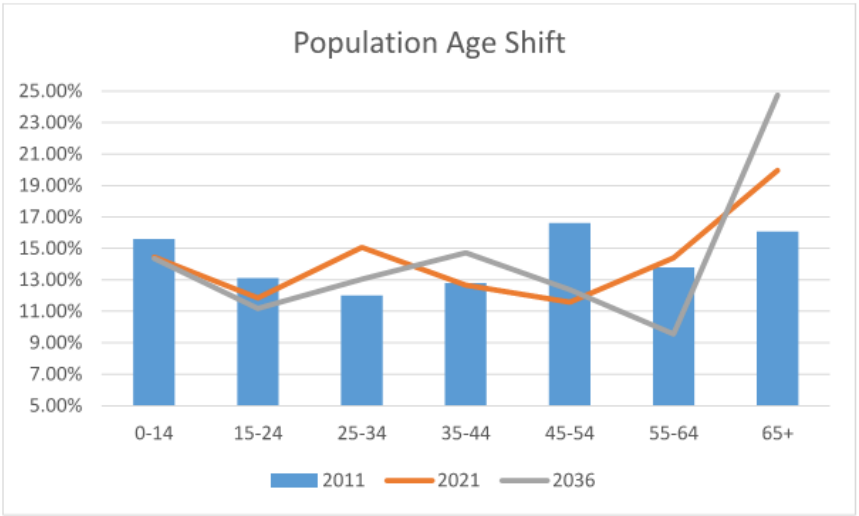
Sources: Reference and High Scenario: Hemson Consulting Ltd – Growth Outlook to 2036, City of Greater Sudbury, Actual: Statistics Canada – 2016 Census Profile

1.2 Greater Sudbury will have an increasing working age and senior populations

The average age of the population of Greater Sudbury was 42.3 years old compared to the Canadian national average of 40.6 years old from the National Household Survey 2011, indicating that Greater Sudbury's population is slightly older than the national average. The existing population distribution peaks at ages 45-54, and is expected to age over time. The Hemson report indicates that the population structure of Greater Sudbury will shift with bi-modal age peaks. There will be an increase in number of younger working age individuals primarily due to immigration and the existing aging population living longer into their senior years.

The current population and future projections indicate the types of activities that will be undertaken and that will impact the number of trips and the modes of transportation used. Below is a chart that outlines the projected age distribution within Greater Sudbury to 2036.





Source: Hemson Consulting Ltd – Growth Outlook to 2036, City of Greater Sudbury, Statistics Canada – 2011 Census Profile

1.3 Single Detached Houses are the primary dwelling type

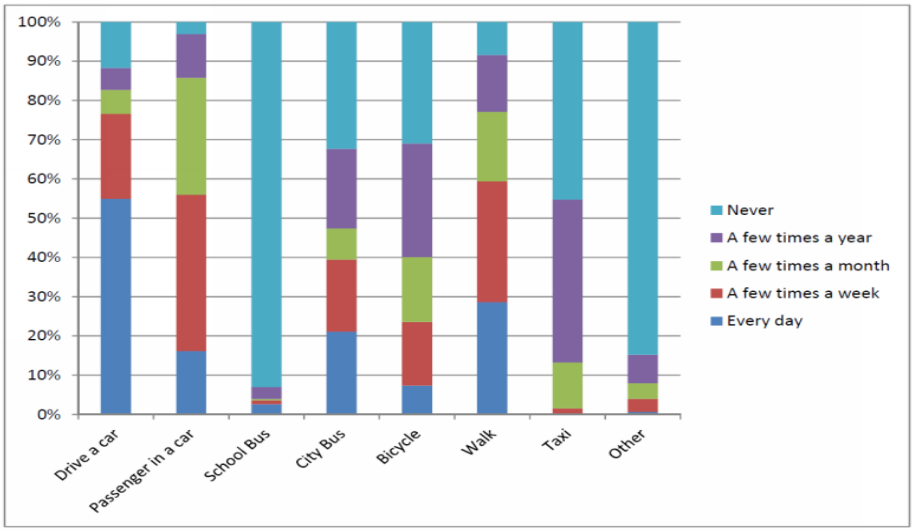
Greater Sudbury's land use structure is a mix of urban and rural communities and enterprise & industrial use. Residential density is generally low, meaning most households are single detached homes. In fact, 65% of households in Greater Sudbury are comprised of either 1 or 2 people, while larger families are less common. The dwelling preference and average household size of 2.6 can help explain the propensity for single occupancy vehicles as a main mode of transportation. According to Census Canada data, there are 42,215 single-detached residential units in Greater Sudbury, which represents 62.3% of all households in Greater Sudbury (the total number of dwellings are 67,770) Source: Statistics Canada – 2011 Census Profile

1.4 Greater Sudbury is well-educated and linguistically diverse

At least 78% of residents of Greater Sudbury have attained a minimum of high school education. 25% of the population has completed post-secondary education such as University, College or Trades school. 98.7% of residents have knowledge of English, and 65.9% indicated that English is their mother tongue.

1.5 Travel Patterns in Greater Sudbury

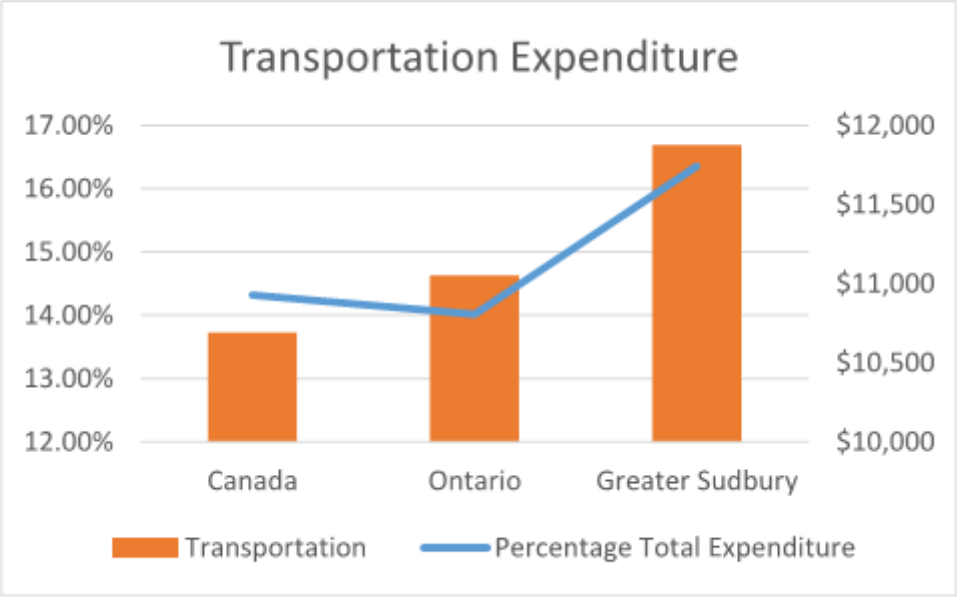
The 2017 Transportation Study Report determined that the typical number of PM peak trips for Greater Sudbury was approximately 27,000 in 2011. Transit ridership in 2013 was estimated at 11,800 trips per day. In 2012 there were 123,689 registered vehicles in Greater Sudbury which equates to a rate of 0.75 vehicles per capita. While transit has seen moderate growth in Greater Sudbury, the automobile remains the main form of transportation. In the Transportation Study Report, a survey was completed regarding modal usage. Unsurprisingly 75% of respondents said they made single occupant trips several times a week. Sustainable modes such as transit and cycling are either not used or used infrequently. There is opportunity to shift this behaviour.



Source: 2017 City of Greater Sudbury Transportation Study Report

1.6 Transportation Expenditures are high relative to Ontario and Canada

The average household in Greater Sudbury spends more money on transportation than the Canadian and Ontario Averages. The expenditure is greater based on an absolute dollar spend, and relative to total household expenditure. This may be due to geography and urban layout of Greater Sudbury resulting in longer commutes to school, residences and employment. An opportunity exists to leverage TDM to reduce transportation costs for individuals and for households in Greater Sudbury. Reduction in travel costs may make TDM programs and initiatives attractive to residents.

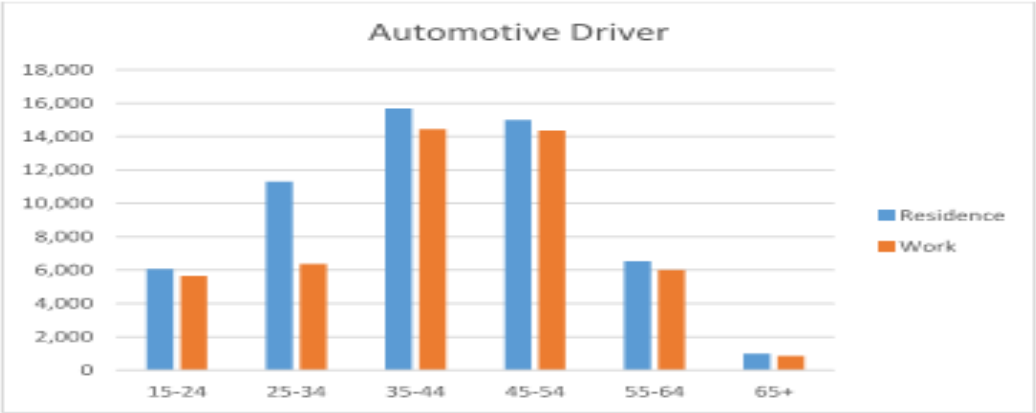


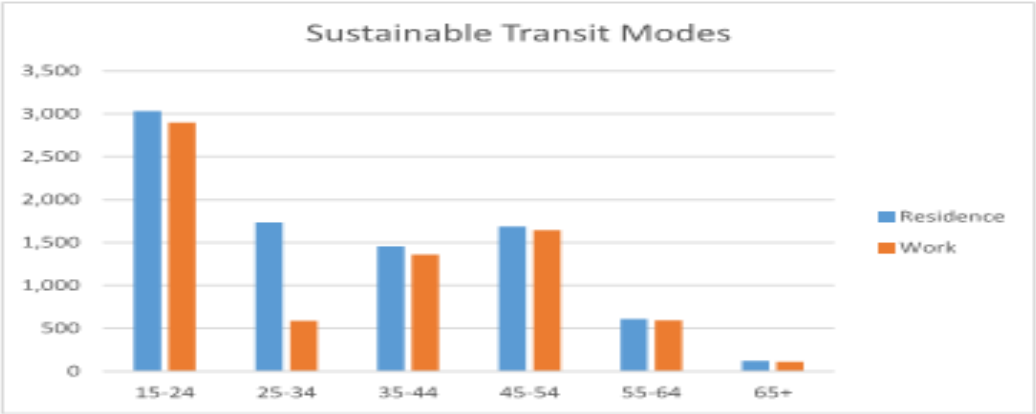
Source: Immigration Greater Sudbury – Greater Sudbury Statistics

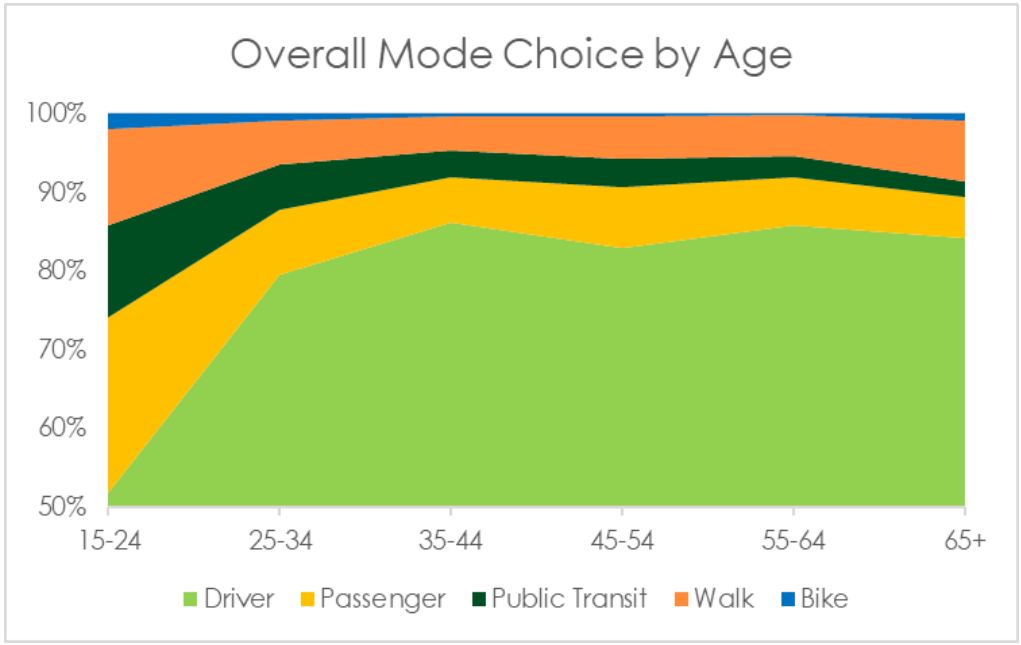
1.7 Younger People have a higher tendency to use sustainable modes of transportation

The 2006 Census identified a number of transportation patterns in Canada. As indicated in the Travel Preferences Survey from the 2017 Transportation Study Report, single occupant automobile is the dominant mode. This is consistent with the 2006 Census finding. Throughout all age groups, single occupant vehicle usage had a larger mode share than all sustainable modes combined. The largest user base of sustainable modes of transportation are ages 15-24 with over 25% of the population using sustainable modes of transportation. This may be due to the financial costs of owning and operating an automobile and that age group only starts to enter the work force at that age. After age 25, the mode split is fairly uniform indicating that transportation habits tend to establish themselves during the working years. There may be opportunity to attract the increasing younger generation to try sustainable modes of transportation, and to sustain and extend these travel patterns later into their careers where

alternatives exist. At present, as shown below, the main mode of travel, regardless of age is still as a car driver.







Source: Statistics Canada – 2006 Census

2.0 Policy Review

Transportation Demand Management (TDM) in Greater Sudbury is supported by a wide range of policies at the federal, provincial and regional level. This framework provides the policy direction for the vision, goals and objectives of Greater Sudbury's TDM Plan. In this section, the most relevant policies at each level of government (and beyond) are reviewed and analyzed with regard for their relevance to the TDM plan.

The Federal Sustainable Development Act is a guiding policy that directs sustainable development and planning across Canada. The Province of Ontario builds on the Federal Sustainable Development Act through the Provincial Policy Statement highlighting land use goals specific to Ontario. Furthermore a specific land use plan for Northern Ontario was developed within Ontario's Places to Grow program. These documents acts as a broad land use framework from which the TDM plan can draw to ensure the goals and objectives are consistent with these policies.

A number of policy documents have been developed by the City of Greater Sudbury that have an impact on how people travel. The Official Plan outlines the land use policies for the City, and the Corporate Strategic Plan includes values that can be applied to the development of the TDM Plan. The Transportation Study Report highlights specific recommendations for TDM upon which this TDM plan will be built. Associated local policies will be drawn and referenced to ensure TDM is implemented in a way that is consistent with the strategic priorities of Greater Sudbury.

The full list of policies and documents are outlined in **Table 1**. Further detail about each policy and their specific impacts on active transportation policy recommendations are outlined in **Tables 2 - 4.**

Table 1: Policies Relevant to the Greater Sudbury TDM

Jurisdiction	Policy
Government of Canada (Federal policy support)	Federal Sustainable Development Act (2008)
Province of Ontario (Provincial policy support)	Provincial Policy Statement (2014)
	Ministry of Transportation Cycling Strategy (2013)
	Accessibility for Ontarians with Disabilities Act (2005)
	Transit Supportive Guidelines (2012)
	Places to Grow: Growth Plan for Northern Ontario (2011)
	French Language Services Act (1990)
The City of Greater Sudbury (Local policy support)	Official Plan (2014)
	Corporate Strategic Plan (2015)
	Healthy Community Strategic Plan (2010)
	The Greater Sudbury Transportation Study Report (2017)
	Downtown Master Plan (2012)
	Sustainable Mobility Advisory Plan Strategic Plan (2016)
	Strategic Parking Plan for the City of Greater Sudbury (2011)

Table 2: Federal Policy Support

Policy Document	Policy Description	Relevance to the Greater Sudbury TDM
Federal Sustainable Development Act (2008)	The Federal Sustainable Development Act (FSDA) requires the Government of Canada to develop a sustainable development strategy, providing a framework through which to conduct sustainable planning and reporting within the federal public service. Its guiding principles focus on clean air and water, natural protection, and shrinking the environmental footprint of government. The strategy aims to produce: • An integrated view of federal actions and results to achieve environmental sustainability. • Effective measurement and monitoring of sustainability progress to Canadians. • Equal footing of environmental with economic and social considerations in federal decision-making.	While not binding on any other level of government, the FDSA sets a policy precedent at the federal level. It asks provincial and municipal governments to incorporate sustainability into their actions and policy development. The FDSA's guiding principles for upholding environmental integrity and considering the environmental costs of proposed actions will be strongly considered and reflected within Sudbury's TDM Plan.

Table 3: Provincial Policy Support

Policy Document	Policy Description	Relevance to the Greater Sudbury TDM
Provincial Policy Statement (2014)	The Provincial Policy Statement (PPS) lays the foundation for the regulation of land use and development within the province of Ontario. It provides policy support for appropriate and context-sensitive urban and rural development, environmental and resource protection, and social equity in planning matters. An overarching vision for Ontario's land use planning system is	The PPS promotes land use patterns that support "a mix of … transportation choices that increase the use of active transportation and transit before other modes of travel". Specifically, the PPS requires the following: • Design of "healthy, active" communities that support active transportation and existing, planned, or future transit services (1.1.3.2; 1.5.1), and reduce lengths and numbers of vehicle trips (1.6.7.4). • Provision of facilities for people and goods that meet projected needs (1.6.7.1). • Use of transportation-demand management strategies to make efficient use of existing and planned infrastructure (1.6.7.2). • Connectivity within and among systems and

Policy Document	Policy Description	Relevance to the Greater Sudbury TDM
	articulated in the PPS, stating that the "long-term prosperity and social well-being of Ontarians depend on maintaining strong communities, a clean, healthy environment and a strong economy."	modes (1.6.7.3). • Integration of transportation and land use considerations at all stages in the planning process (1.6.7.5) • Long-term corridor planning, and mitigation of their negative impacts (e.g. pollution, noise) (1.6.8). • The PPS provides direction for the development of policies that reflect provincial objectives.
Ministry of Transportation Cycling Strategy (2013)	In September 2013, the Ontario Ministry of Transportation (MTO) published #CycleON, Ontario's Cycling Strategy. The strategy acknowledges the importance of developing cycling facilities to help reduce greenhouse gas (GHG) emissions, ease gridlock, benefit the economy, increase tourism, and increase the health and quality of life for all Ontarians. Key elements of the Province's vision include: • Development of a safe cycling network that connects the entire province: • Continuing to reduce collision and injury rates and injuries; • Empowering everyone from occasional cyclists to daily commuters to feel safe when they get on a bicycle in Ontario. The strategy is intended as a guide to make sure this vision is achieved.	The Cycling Strategy outlines a 20-year vision for cycling in the province, with proposed cycling infrastructure, educational components, and legislation. This strategy, in concert with other provincial documents, aims to promote and strategically develop sustainable transportation infrastructure province-wide. The key directions of the policy promote active and healthy communities, improving cycling infrastructure and road safety and promoting cycling awareness. The strategic directions inform the active transportation portion of the TDM plan.
Accessibility for Ontarians with Disabilities Act (2005)	The Accessibility for Ontarians with Disabilities Act (AODA) was passed on June 13, 2005, and is a Provincially legislated policy that calls on the business community, public sector, not-for-profit sector and people with disabilities or	The TDM Plan recommendations will comply with the AODA for both hard and soft TDM measures. The "Built Environment" component is relevant towards the planning, design and construction of facilities and infrastructure that support TDM. The "Transportation Standards" section requirement incorporated through the planning and delivery of transportation services.

Policy Document	Policy Description	Relevance to the Greater Sudbury TDM
	their representatives to develop, implement and enforce mandatory standards. This policy is a first of its kind in Canada to apply to both the private and public sectors. These accessibility standards are the rules that local governments, agencies and businesses in Ontario should follow to identify, remove and prevent barriers to accessibility.	Soft TDM measures such as outreach or consultation require actions to meet AODA policies. Due diligence is required to ensure outreach, communication and participation is accessible to all of the public.
Ministry of Transportation Transit-Supportive Guidelines (2012)	The Ministry of Transportation's Transit Supportive Guidelines encourage transit-friendly planning and design throughout the province. More specifically, the Guidelines provide direction on land-use planning, urban design and operational procedures that enhance connectivity to transit based on current best practices. The document is intended to be a guide for planners, developers, and others involved in developing more sustainable and transit-supportive communities in Ontario.	These Guidelines provide direction on how to integrate all modes of transportation when designing for transit to create more complete streets. The document provides guidelines for the improvement of transit facilities including design recommendations. The guidelines compliment the TDM plan which will incorporate physical measures in the guide with other strategies in Greater Sudbury.
Places to Grow: Growth Plan for Northern Ontario (2011)	This Plan is a strategic framework that will guide decision-making and investment planning in Northern Ontario over the next 25 years. It contains policies to guide decision-making about growth to promote economic prosperity, sound environmental stewardship, and strong, sustainable communities that offer a high quality of life.	Greater Sudbury is identified in the plan as a strategic core area that will attract more investment and urban intensification. Strategic core areas are encouraged to use multi-use land use, accommodate higher densities The strategic framework for Infrastructure (Section 5.3) highlights investment areas that will improve both transportation and municipal systems. The goals for transportation systems can be found in Section 5.3.2 below: Section 5.3.2: Optimize capacity, efficiency and safety of existing transportation systems Meet the needs of existing and emerging priority economic sectors Enhance connectivity among transportation modes Reduce emissions and other environmental impacts associated with transportation

Policy Document	Policy Description	Relevance to the Greater Sudbury TDM
French Language Services Act (1990)	The purpose of the policy is to preserve and protect the rights of Francophones in Ontario. The act ensures that provincial government services are provided in the French. The act guarantees Francophones in 23 designated regional areas to be able to receive services and information in French.	The City of Greater Sudbury is one of the regional areas that guarantee the rights of Francophones. Municipalities may pass a by-law which designate that municipal services shall be offered in both French and English. Greater Sudbury has implemented this policy in By-law 2001-81A.

2.1 Summary of Policy Highlights

TDM builds upon government policies for all levels. Transportation connectivity and effective urban land use planning are key themes that run through all the policies. The TDM Plan is a vital part of creating active and sustainable communities, and will help accommodate the intensification and changing urban landscape of the City of Greater Sudbury.

The Federal Sustainable Development Act (FSDA) asks that environment and sustainability be core considerations. Ontario's provincial policies build on the FSDA to promote integrated land use planning and improved transportation systems. The Provincial Policy Statement calls for healthy and active communities, better use of existing and planned infrastructure and improved connectivity province wide. These goals are reflected in the Ministry of Transportation's Cycling Strategy and Transit-Supportive Guidelines. Economic development features prominently in the Places to Grow plan for Northern Ontario. Intensification and investment in transportation systems is critical to accommodate sustainable environmental and economic development.

The Federal and Provincial policies have been incorporated into Greater Sudbury's policies and strategic plans. The City of Greater Sudbury will focus on intensification and densification of urban areas. To support intensification, Greater Sudbury will develop a multimodal transportation system that will increase connectivity and mobility from different communities. This will be achieved through investment in transit and active transit infrastructure and implementation of programs to reduce dependency on automobiles for basic transportation needs. The expected outcomes of the policies are to improve the sustainability of the local and regional economy, increase accessibility and connectivity of transit systems and to improve the health and quality of life for all residents and visitors of Greater Sudbury.

The Accessibility for Ontarians with Disabilities Act (AODA) and French Language Services Act (FLSA) are auxiliary policies that are not directly related to TDM. However, the AODA and FLSA need to be followed in the development and delivery of TDM programs.

3.0 Best Practices Review (Case Studies)

To create a TDM plan that will work for Greater Sudbury, ideas from other plans are required to provide a framework, but they also need to be analyzed in light of the profile established for the community and the policies within which the City operates. Each TDM plan is unique to the community, site, region or city for which it has been created.

3.1 Definitions

Transportation Demand Management, sometimes also known as Travel Demand Management or TDM has a wide variety of definitions. The Institute of Transportation Engineers (ITE 2016) recently reviewed a range of contemporary definitions and identified that there are a number of common themes which exist in TDM:

Strategy Development Process

A review of TDM strategies specifically related to regional cities demonstrated that TDM strategies are not confined to dense urban areas. Canadian mid-size cities and regions including Capital Region of BC, Halifax, Ajax, Waterloo and Kitchener all pursue some form of TDM strategy. Most TDM Strategies pursue the common planning approach of defining goals and objectives and identifying appropriate measures to achieve the goals and objectives. Some TDM plans include performance measures and a monitoring system. The role of the municipality and the individual initiatives differ, however the underlying goals and objective tend to remain the same.

The Capital Regional District of Vancouver Island (population 383,360) for instance noted the following in its Regional TDM Plan:

> *The Sub-Committee recognized that the role of a Regional District in TDM was, potentially, quite different from the role of a municipality or business. The regional district can support TDM at different scales – from inter-regional network planning, to regional growth and sustainability strategies, to corporate commute programs. The recommendations in this report are arranged in terms of scale – from broad region-wide strategic initiatives to workplace program.'*

The BC Capital Region regional strategy identified that there is a need to 'clearly define focus area of application and scale Regional district can support TDM at different scale to city-based municipality'. The Town of Ajax used a gap analysis to gain a better understanding of why people were not adopting sustainable travel to the same extent as elsewhere in the GTHA.

There is an increasing trend to incorporate TDM considerations into the development approvals process. The City of Greater Bendigo in Australia (2016 population 110,562) has recently incorporated its Integrated Transport and Land Use Strategy into its existing land use bylaw and associated development regulations. This includes the requirement to consider the provision a

basic level of TDM infrastructure requirements in areas with greater accessibility in exchange for reduced minimum parking requirements.

In 2016, ITE found the following elements were common to most TDM strategies:

- Improve transportation options
- Incentives (policy that 'pushes' or 'pulls' travellers to alternative options or discourage travel altogether)
- Land Use Management
- Implementation Programs

Policy Goals

Policy goals were reviewed to understand how regional municipalities express their TDM objectives in terms of policy goals.

Some regional municipalities pursue technical transportation network performance objectives such as peak load management, presumably as a traffic congestion measure. Others are focused more on ensuring greater consistency between TDM objectives and existing municipal policy.

The Town of Ajax's TDM policy objectives are remarkable for their simplicity and for combining technical performance criteria with simple to understand concepts:

- Reduce [need for and impact of travel]
- Remode [change mode of travel]
- Re-time [change time of travel]
- Re-route [change route traveled]

Policy goals are typically overseen by a TDM Coordinator or a Transportation Management Association.

Performance Measurement

Performance measurement uses measures to monitor the outcomes of a given TDM program. A combination of qualitative and quantitative measures is common.

The Regional Municipality of Halifax is a notable example as its measure of success is simply measured in terms of the number of users associated with each TDM measure. Other, more complex performance measures can be defined with the use of census data and other sources.

The City of Greater Bendigo's Integrated Transport and Land Use Strategy adopts 15 transportation and land use targets around five categories: '*Connect, Health, Moving, Engaging, Inspiring'*. The simplicity and compactness of these targets makes them easier to understand, monitor and achieve.

Performance measurement is often dependent on the amount of resources that can be dedicated to collecting data associated with travel behaviour. TDM programs often rely on surveys to measure this.

Application to Greater Sudbury

As noted at the beginning, contemporary TDM has now evolved to be understood as a means to achieve multiple community planning goals including sustainability, resource efficiency, road safety, reductions in vehicle costs to households and public health. The following benefits could be realized by Greater Sudbury upon adoption of a TDM plan:

- TDM can reduce the need for new roads in Greater Sudbury
- TDM helps to make personal travel decisions more efficient for residents
- TDM can maximises return on infrastructure spending and makes the most of existing assets in Greater Sudbury
- TDM is a versatile and dynamic management tool that can shape future travel in Greater Sudbury
- TDM initiatives have multimodal benefits for residents and the region
- TDM can works at scale of individual, but its benefits extend to whole community
- TDM strategies are relatively low cost and are comparatively cost effective in meeting policy objectives and generate good cost/benefit ratios

Source: Adapted from Black and Schreffler (2010)

The existing demographics, the relative compact nature of the urbanized part of Greater Sudbury demonstrate that TDM has the potential to translate into a more well-connected, healthy, active and prosperous Greater Sudbury for residents and visitors alike.

3.3 Development Review Process and TDM

City of Hamilton, Ontario

In June 2015, Hamilton developed a report outlining how to integrate TDM into development approvals and the Transportation Impact Studies (TIS). The report indicates that TDM is a necessary component of urban development as developers have influence over the urban form and community design over time. This in turn often impacts the modes of transportation chosen by residents and workers. To encourage developers to voluntarily incorporate TDM measures, a number of benefits to the developer are listed, such as by having more TDM measures, there will be a need for less parking and this will save developers money.

The report provided an outline of the types of uses and the TDM measures that should be considered as part of the development approvals process. These lists evolved into a checklist to be used in the evaluation of TDM initiatives for new developments. As well, the measures can be included in the development of TDM reports to be included in the TIS. The City of Hamilton has created three types of reports, which are outlined below:

1. **TDM Memo** – this report is used for developments that generate a low number of additional trips during the peak (between 20 and 50). It is generally bout one page in

length and discusses existing “TDM” opportunities nearby as well as what can be provided on the site. It is primarily designed to indicate the services and supporting infrastructure that is and will be available.

2. **Standard TDM Report** – this report is used for developments that will generate at least 50 additional trips during the peak period. This can be a separate plan or a chapter in a TIS document. The applicant is required to provide the projected reductions in trips resulting from the TDM measures that are to be included on the site. It also includes a sample table of contents
3. **Detailed TDM Report** – this report is used for large developments such as new subdivision, shopping malls, and large employment areas. As its name suggests, this plan is much more detailed. It also includes an outline of the initiatives and the projected trip reduction targets and steps that should be included for future monitoring and evaluation of the TDM Plan.

The guidelines also include a tool and where to include information on each measure as well as the type of information needed and why it is required. Finally a checklist that is to be used with all development applications is included in the report.

Town of Ajax, Ontario

The Town released its TDM Plan in 2015 and included an appendix for TDM and Development. This plan is remarkably similar to the Hamilton document discussed above. It provides an outline of the types of programs based on use and also delineates the type of TDM plan based on the number of trips generated. Rather than three options, the Town only has two, which are discussed below:

1. Memo – The memo will be requested for developments that generate less than 50 additional peak period trips. The memo will include listing existing nearby opportunities such as transit service or active transportation infrastructure and available information about them.
2. TDM Plan – This is for developments that will generate more than 50 additional trips during the peak travel period. It will also be used for development in special study areas, ones that could have a noticeable impact on the surrounding community and when a reduction in the amount of parking is requested by the applicant. The plan should include the following on and off site-related measures (which is essentially a check list) where appropriate:
    a. Consideration of land use (density / compactness of the site, AT routes and parking located at the rear of the buildings);
    b. Walking and cycling – sidewalks / walkways connect the site to transportation network; bicycle parking and end of trip facilities;
    c. Transit – connections directly to transit and availability of weather protection
    d. Parking – opportunities for reduced parking requirements, unbundling parking, paid parking along roadways, carpool parking and shared parking
    e. Carshare and Bikeshare – accommodate parking for carshare and find opportunities for bikeshare

f. Wayfinding – this includes the development of signage plans, travel planning tools, integrate with school travel planning
g. Education, incentives and promotion – this includes providing opportunities in the development, requiring a Smart Commute membership (employers), transit passes, discounted carshare memberships, and so on
h. Projected trip reduction study
i. Site plan
j. Monitoring and evaluation plan

Halifax Regional Municipality (HRM), Nova Scotia

HRM took a different approach to the inclusion of TDM in the development process. The TDM Functional Plan outlined a methodology that involved a more regional approach to the inclusion of TDM in the development process and for it to be delivered in a coordinated and comprehensive manner rather than on an ad-hoc basis. The plan recommends that staff work with developers to augment additional TDM services with regional needs so that the regional municipality is the coordinator rather than individual developers. The developers are eligible to provide HRM with contributions toward a TDM program in return for parking variances, density bonusing, etc. The use of a collaborative approach enables stronger partnerships between HRM staff and the development community as well as addressing the larger issues surrounding transportation and traffic in the municipality.

City of Whitehorse, Yukon

The City of Whitehorse, Yukon created a TDM Plan in 2014 in order to address the future potential for congestion as population continues to grow, and encourage sustainable transportation as a workable and affordable alternative. Whitehorse is unique in that the City has a very large network of trails and active transportation routes that connect the city and its neighbouring communities. The City recognizes that maintaining a vehicle-oriented city will result in significant increase in public investment for roads facilities, private expenditure in vehicles, a loss of opportunities to improve health and will create dependency on those who can drive to transport others.

Whitehorse is instead focused on a creating a city that is highly mobile, where people are well connected through the street network and increasingly choose to walk, bicycle, use transit, and carpool because of safety, convenience, and comfort.

The major issues that the TDM Plan seeks to address are public health and obesity in the City, GHG emissions, the increasing demand for parking in the downtown, the increased cost of vehicle ownership, an aging population as more residents are choosing to retire in Whitehorse, traffic congestion as the population of the City increases, and the increasing cost of infrastructure.

The City already has over 150 km of motorized trails and 700 km of multi-use trails, which is considered a very large network for similar sized northern towns. This provides the City with the unique opportunity to promote the facilities they already have, instead of focusing on building

more. They City is focusing on promotion of TDM options, improving transit, and supplying alternative modes for employees. The goals of the TDM Plan is to have a 50% mode share for single occupant vehicles by 2036.

It is noted throughout the Plan that increasing road facilities for vehicles is a costly option that is to be mitigated through the TDM Plan. With promotion and an increase of travel options within the town, there should be an increase of sustainable modes and decrease in single occupant drivers.

The plan is to be addressed though six strategies.

1. Coordinating TDM implementation and promotion options through hiring a TDM coordinator and creating travel plans for residents within the City.
2. Improving active transportation options within in the City by increasing the amount of current facilities and maintaining what is already there.
3. Improving transit through a long-term transit plan, and expanding service and transit pass programs.
4. Supporting employees to use sustainable modes to travel to and from work through programs such as the guaranteed ride home program, and priority parking.
5. By maximizing existing vehicle infrastructure in order to increase capacity without increasing the need for new infrastructure,
6. Encouraging supportive land use by unbundling parking and having a LEED credit program.

These strategies are to be implemented by the City through a collaborative approach with the City at the forefront of the Plan.

City of Thunder Bay, Ontario

Thunder Bay's TDM Plan focuses on transportation system efficiency and opportunity. The vision sets out that the TDM strategies will create a stronger and more diverse economy through broadening access to the downtown and removing travel barriers. It will create a higher quality of life through an increase in health, and expanding travel options for those who can't drive to meet their daily needs. The City will be cleaner, greener, and more beautiful through limiting the use of green space for roads ways and reducing environmental harm,, and will be a better-run city through being a role model to other communities and maximizing return on investment.

The main goal for Thunder Bay is to maximize efficiency of the current transportation system in order to create more opportunities for all residents. The benefits that the Plan has focused on are the improved mobility for the aging population, increases in health levels through active transportation, reduced pollution, attractiveness through tourism with an expanded AT network, and the reduced costs associated with vehicle ownership.

The City has the opportunity to improve active transportation as more than 50% of the population lives under 5 km from their place of work. This can allow for the city to focus on these shorter trips, and thus justify increasing their transit and active transportation networks in order to promote more sustainable work day travel.

The Plan was developed though input from the City staff and stakeholders and research of best practices in the TDM field. Meetings with stakeholders such as the City's Health Unit, EcoSuperior, and Transit and Planning started the consultation process, with representatives from education, health care, cultural and commercial agencies, and local representatives were considered next in order to ensure the TDM Plan was created for the needs of the community.

TDM will be prompted through four different strategies; leadership, outreach, marketing, and performance measurements. At each step these strategies involve the City, and focus on different aspects of the plan and the community. For the first strategy, the City will become a community leader in integrating TDM supportive concepts into their practices such as encouraging City Staff to use TDM programs provided. The second, the City will partner with those who can motive residents and work with employees and businesses to encourage other work-place travel programs along with school and community organizations. The City's marketing strategy will focus on providing incentives to overcome barriers, and performance measurements will be used to assess how programs are changing behaviours and collecting results from the initiatives.

The City's overall focus is to promote a program that will result in a stronger community that is healthy and vibrant, and can create opportunities from the transportation challenges they face today.

Application to Greater Sudbury

There are two very different approaches to the integration of TDM measures into new developments. The first two examples, Hamilton and Ajax essentially use check lists for the integration of TDM into the new development process. While this can ensure that a number of measures are incorporated into a plan, there is a good chance that not all measures will be considered. TDM plans cannot be undertaken in a "cookie-cutter" manner. They need originality and thought to ensure that the appropriate program and related services and infrastructure are incorporated into the planning process to ensure that the targets for shifting travel behaviours are realized.

The identification of different types of reports will encourage developers to consider TDM measures as they will not feel they are burdened with having to develop an extensive plan for a small or single use site. However, the types of programs, measures and supportive infrastructure need to be determined through a collaborative approach using a tool kit of measures.

On the other hand, HRM developed a program that would give more control of the delivery of TDM programs and measures to the City. However, the development of supportive infrastructure is to be provided through the developer and included within development applications. HRM does not have a check list nor is it prescriptive in its approach to the requirements for a TDM plan. As stated above, the municipality wants to develop a positive partnership to ensure the overall transportation directions are met.

Based on the review of the above TDM plans, it is recommended that the development of a tool kit to provide information on the descriptions and applicability of TDM measures to sites within Greater Sudbury should be created.

A key disadvantage of a checklist is that it is considered that it will only serve to limit collaboration amongst the various parties and potentially result in TDM plans that do not meet the needs of a site or a larger community. As part of the TIS, the type of TDM plan requested and implement should be commensurate to the anticipated impact that the development will have on the road network and surrounding community. Furthermore, it is seen as the most promising opportunity to build upon the existing infrastructure, services and complement existing measures already available. Therefore, the TDM reports will be developed and scaled using a similar framework to those discussed in the Ajax and Hamilton reports.

Appendix B: Consultation

April 2018

1.0 Introduction

The consultation program for the TDM Plan was divided into two phases. The first was the public survey which was available in May/June 2017 and second was the formal consultation sessions held in mid-September 2017. Both phases of the consultation process were considered very successful as the input received provided support for the development of the TDM Plan, enabling the creation of a Greater Sudbury-focused approach.

Below are summaries of both phases of the consultation program. The first section is a synopsis of the survey results and the second is a summary of the three consultation sessions held in September 2017.

2.0 Survey Analysis

The City of Greater Sudbury issued a survey to understand how residents travel, why they choose the modes they do and what could alter their travel behaviours. The survey was available in both French and English. While most results were the same, there were some differences. Many of the respondents to the French language survey indicated that they were teachers for instance.

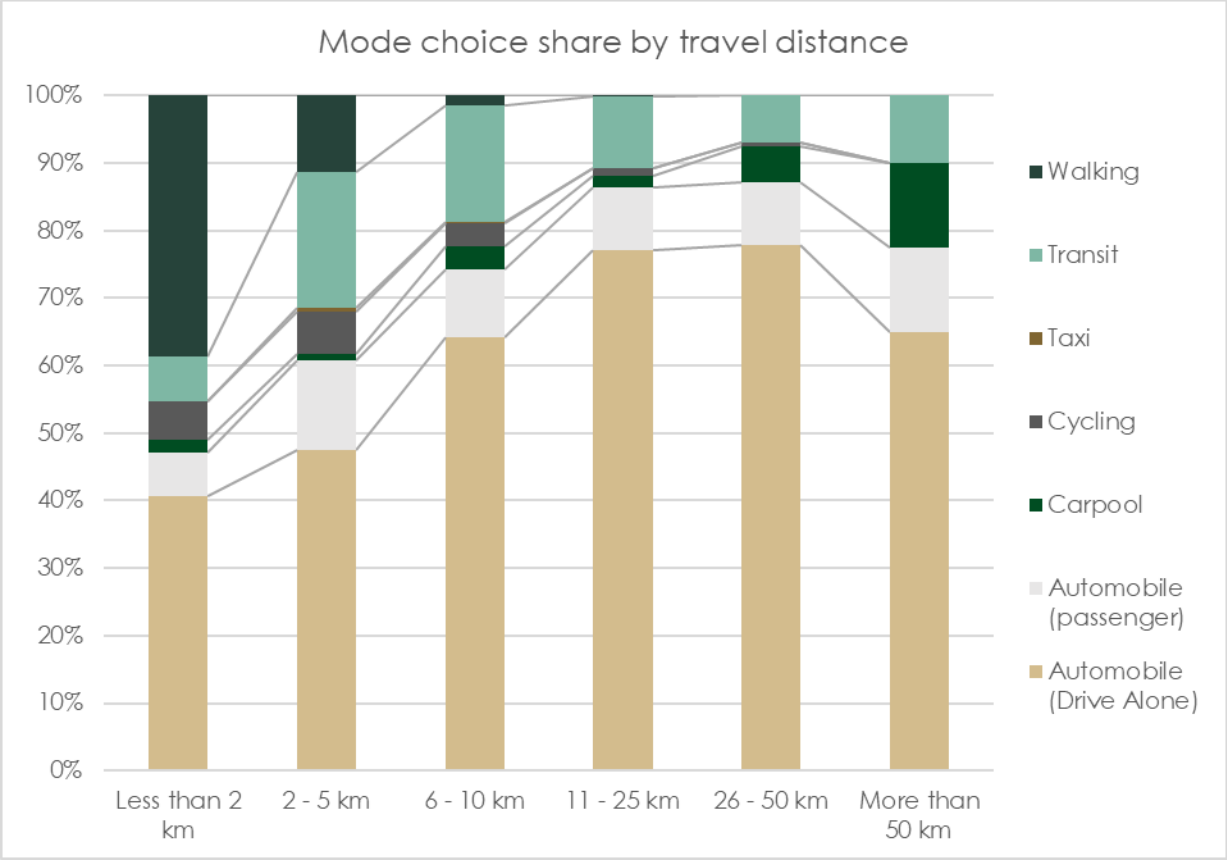
The survey had a total of 1477 respondents, of which 86% responded to the English language survey, and 14% answered the French language survey. The response rate for the survey was 0.9% of the total population of the City of Greater Sudbury, which is considered a high response rate for a TDM survey. However, as they survey was self-selecting, the responses cannot be considered to be statistically significant but they nonetheless do provide an overview of the current travel behaviours in the city. Below are highlights from the survey and an analysis of some of the results. The survey results have been used in the development of the TDM Plan for Greater Sudbury.

2.1 Mode Share and Travel Choice

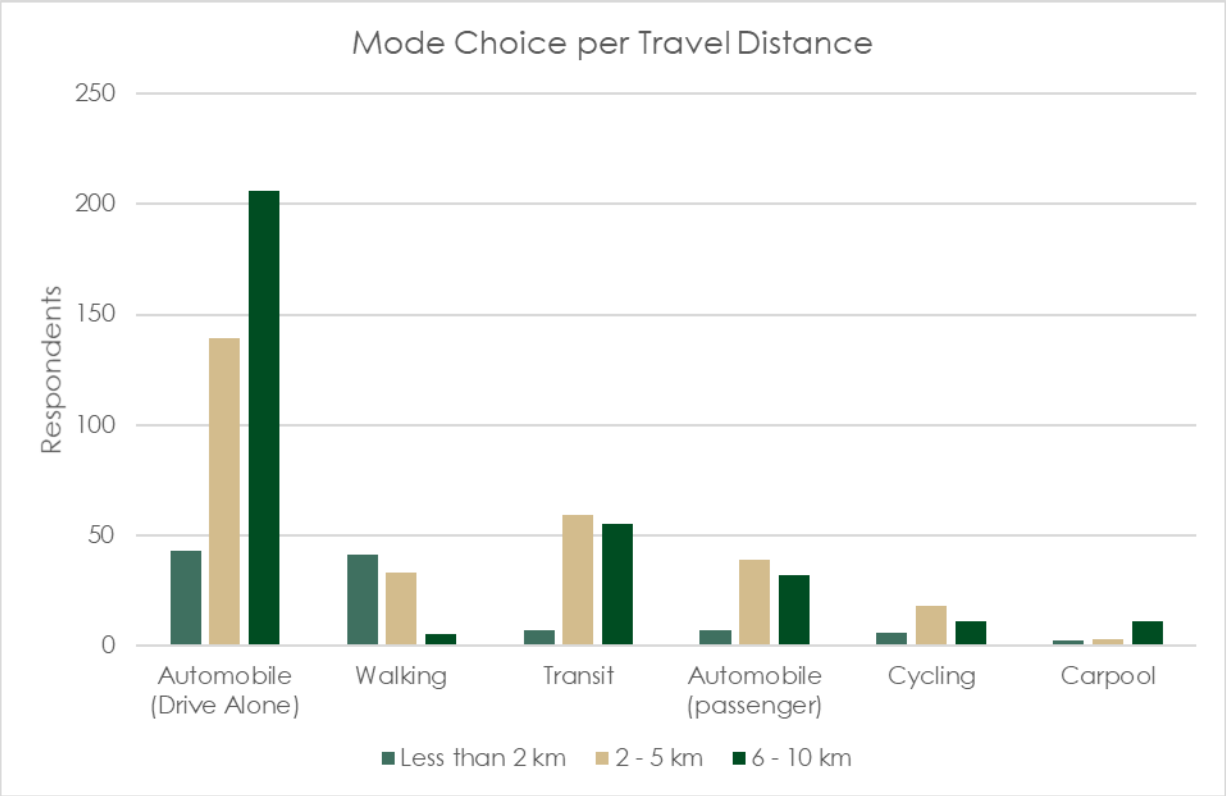
The first questions within the survey asked respondents about their commute, their primary travel choice and why they chose that particular mode. The review of the overall survey results indicated that 61% of respondents chose to drive alone (single occupant vehicle trips [SOV]) as their primary mode of travel. As well, 68% of the survey respondents own at least one vehicle per household, while 58% of households have access to at least one bicycle. The results are shown below:

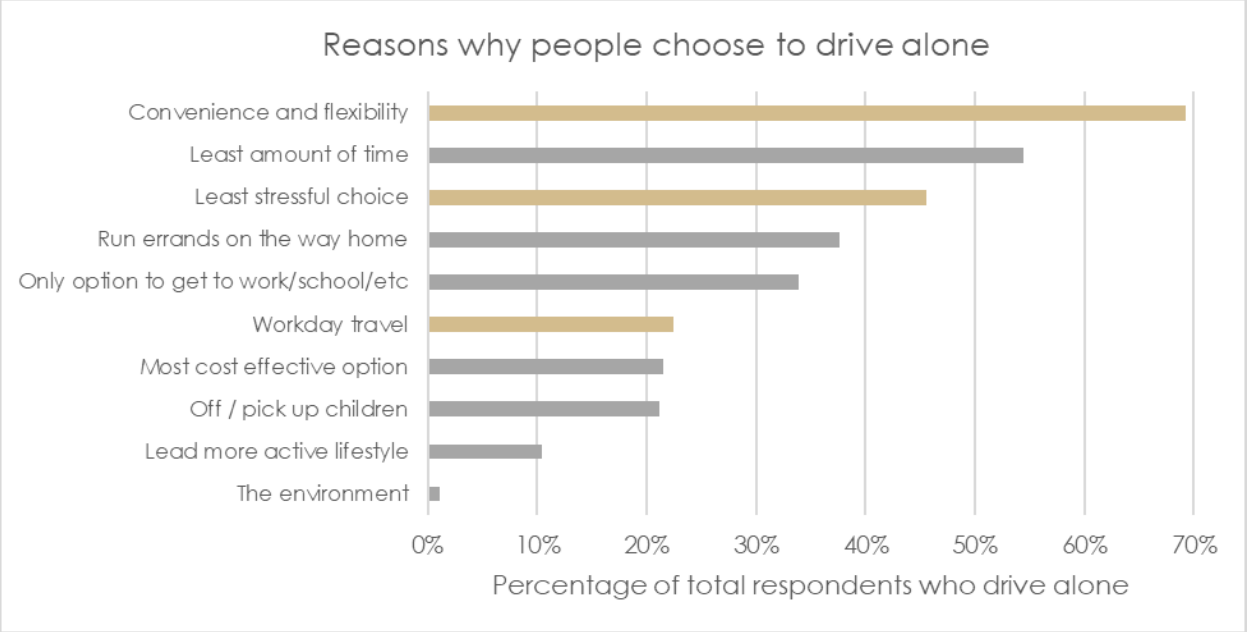
	English language Survey	French language Survey	Average
Car Ownership	1.7 cars per respondent	2.1 cars per respondent	1.7 cars per respondent
Bicycle Ownership	1.6 bikes per respondent	2.3 bikes per respondent	1.7 bikes per respondent

The graph below indicates that single occupant vehicle trips are the dominant mode choice for residents of Greater Sudbury, except at distances of less than 2km where walking is equal to SOV travel. Single occupant vehicle travel is the largest mode for all distance categories (refer below) for travel in Greater Sudbury. Once travel distances exceed 5km, the SOV mode achieves a mode share of over 50%. At distances of less than 2km, the walking mode is almost equal to the SOV mode. This indicates that Greater Sudbury currently has a reasonable walkability. For medium distances transit maintains a mode share of over 20%.



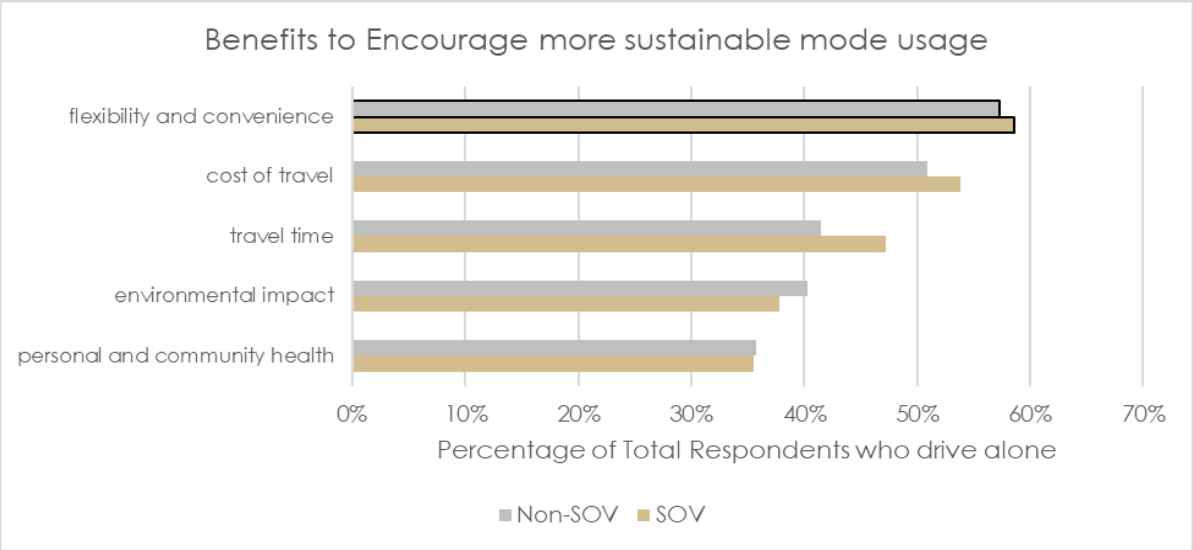
As shown below, the use of single occupant vehicles increases considerably as the distances get longer. There is an opportunity to shift shorter distance trips made by SOVs share to sustainable modes. Distances of less than 2km may be considered walkable, distances less than 5km may be considered as a reasonable cycling distance, and within 10km can potentially be achieved with a multi-modal combination of walking, cycling and transit. Understanding why people drive alone is important to changing travel behaviour. In Greater Sudbury people stated that they chose to drive alone due to time concerns and the flexibility that personal vehicles offer.


Mode Choice per Travel Distance
250
200
150
100
50
0
Respondents
Automobile (Drive Alone)
Walking
Transit
Automobile (passenger)
Cycling
Carpool
Less than 2 km
2 - 5 km
6 - 10 km


Reasons why people choose to drive alone
Convenience and flexibility
Least amount of time
Least stressful choice
Run errands on the way home
Only option to get to work/school/etc
Workday travel
Most cost effective option
Off / pick up children
Lead more active lifestyle
The environment
0%
10%
20%
30%
40%
50%
60%
70%
Percentage of total respondents who drive alone

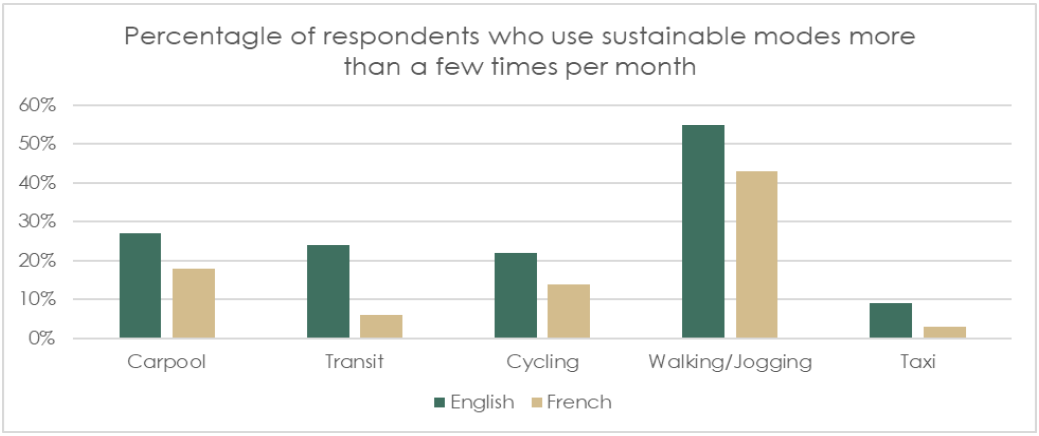
2.2 Encouraging Sustainable Travel Behaviours

Of the respondents who said that they primarily drive alone, most indicated that convenience & flexibility, time and stress were the three most common considerations. Private vehicles appear to offer significant benefit because they may provide freedom and flexibility. However less than 50% of respondents said that they chose to drive to run errands, pick-up or drop off children, or for workday travel. It is possible that the convenience and flexibility of travel may in some part refer to spontaneous or unplanned trips (i.e. run to the coffee shop, or to visit a friend).



The flexibility and convenience of travel is the most important factor to encourage residents to increase the usage of sustainable modes. This indicates that sustainable modes need to be able to provide a comparable level of flexibility and convenience that a car would provide in order to bring about a sizeable transportation shift. It is important to note that environmental impacts and health were seen as being greater benefits to using a sustainable mode over SOV trips.

Respondents indicated that flexibility, and convenience and cost are major factors towards sustainable mode usage.

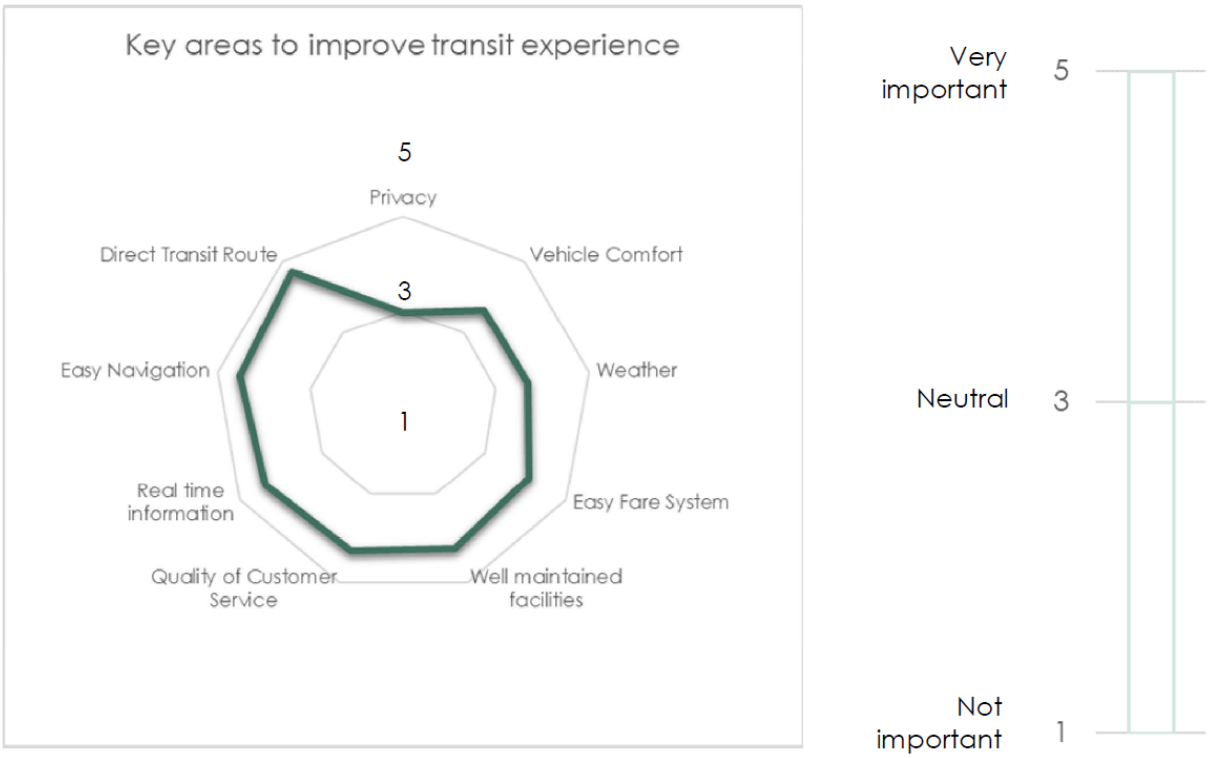


The overall level of use of sustainable modes in Greater Sudbury is considered low. This is not surprising given the respective mode shares and the 61% of respondents whose primary mode is single occupant vehicle. Walking and jogging is the most prevalent sustainable mode that is used on more than a few times per month, i.e. on a non-incidental basis.

Other modes such as carpool, transit and cycling are fairly equally infrequently used. The nature of how the communities have developed and the topography of the area were also indicated as reasons for why sustainable modes were not used as frequency as private vehicles.

2.3 Transit

Focusing on high quality navigation, customer service, and information can transform the transit experience:



The chart shows the level of importance that various factors have on the public transit experience. The edges of the diagram are the different factors that survey respondents were asked to rate. Where the blue line approaches the edge (near 5), this indicates that the factor is considered very important. When the line is closer to the middle of the shape, it indicates that respondents did not think that factor was as important.

Improving public transit is considered important to residents. Of those who completed this question, most indicated that changes to scheduling and improvements to the customer experience were needed. Survey respondents also indicated that easy navigation, real time information and quality customer service would help to improve the transit experience. Information, service and maintaining transit facilities could be quick wins that elevate the transit

experience in Greater Sudbury. The most important factor that survey respondents indicated was that they would like to see more direct transit routes. More monitoring initiatives and understanding travel patterns could help Greater Sudbury plan more connected and utilized transit routes.

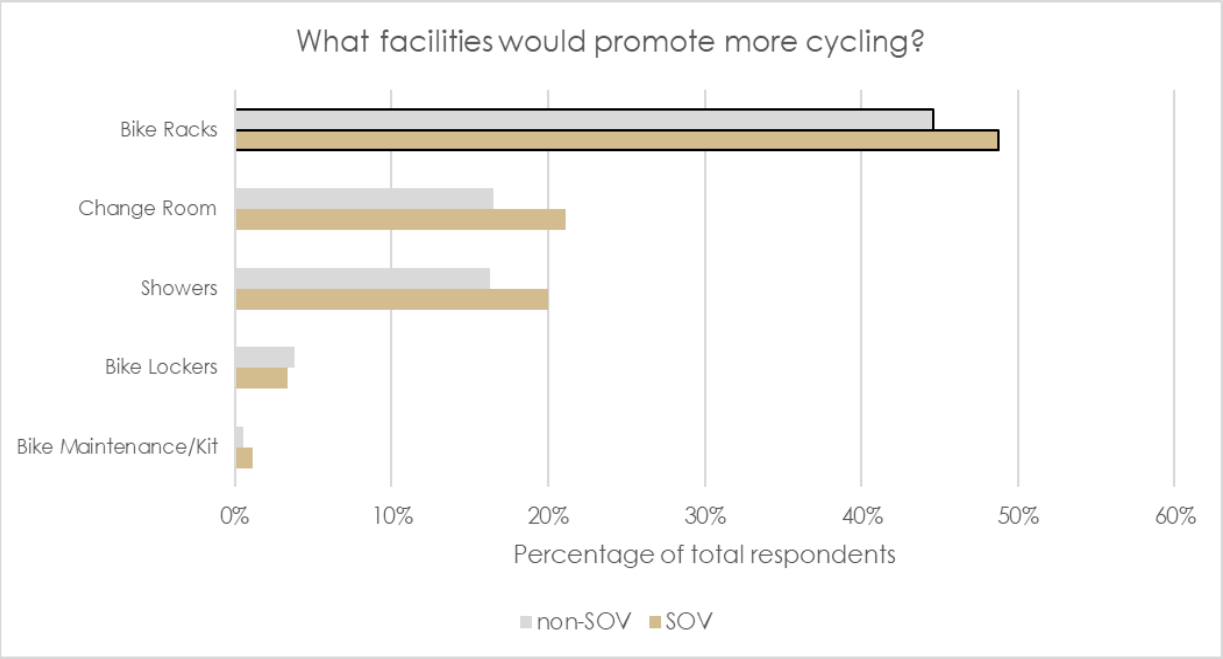
2.4 Cycling

Residents of Greater Sudbury are not comfortable cycling

Cycle Comfort	Not at all	Somewhat uncomfortable	Neutral	Somewhat comfortable	Very comfortable	Score out of 10
English	50%	29%	9%	10%	3%	3.75
French	33%	37%	11%	11%	8%	4.51
Blended	47%	30%	9%	10%	4%	3.86

Respondents indicated that they are not generally comfortable cycling in Greater Sudbury. Only 14% of total respondents indicated that they were somewhat or very comfortable with cycling. This may point to a lack of cycling education and a perception that there is inadequate cycling infrastructure in Greater Sudbury. French language speakers are less likely to use sustainable modes of transportation; however those that do are slightly more comfortable with cycling.

Bike racks are the preferred end of trip facility to promote cycling



The survey reveals that the installation of additional bike racks may be an effective way of encouraging cyclists and that it is a barrier towards cycling at present. Installation of bicycle parking facilities such as bike racks could be considered as part of a TDM Supportive Infrastructure for new developments policy. It should be noted that bike racks are overwhelmingly preferred to bike lockers. Change rooms and showers were rated fairly equally as supportive end of trip facilities.

2.5 Walking

Residents of Greater Sudbury more comfortable walking than cycling

Walking Comfort	Not at all	Somewhat uncomfortable	Neutral	Somewhat comfortable	Very comfortable	Score out of 10
English	5%	13%	16%	35%	31%	7.51
French	5%	13%	14%	31%	38%	7.69
Blended	5%	13%	15%	35%	32%	7.53

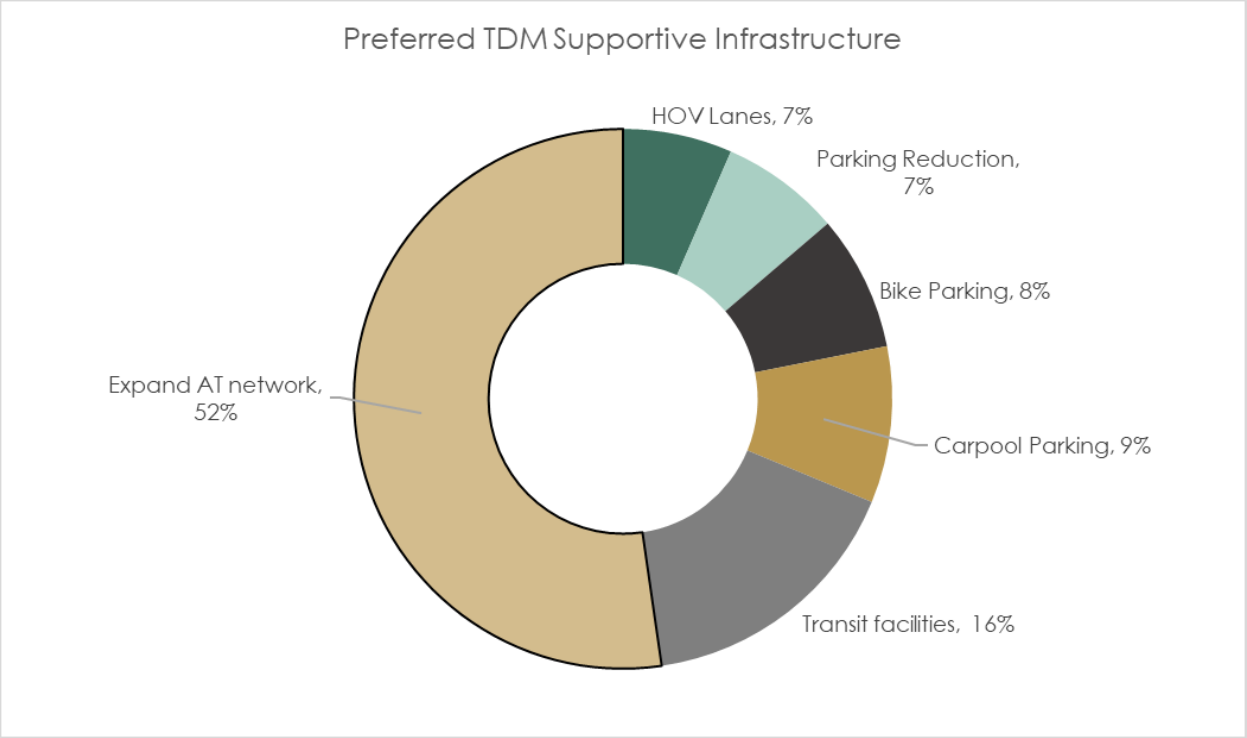
Respondents indicated that they are much more comfortable walking in Greater Sudbury compared to cycling. The higher score is not surprising given that more respondents indicated that they walked as a transportation mode than they cycled. This may also indicate that the adequacy of existing active transportation infrastructure and the associated perceptions concerning that infrastructure are different for pedestrians and cyclists.

Respondents value facility improvements and increased connectivity to improve walkability in Greater Sudbury

The chart shows the level of importance that various factors have on walkability in Greater Sudbury. The edges of the diagram are the different factors that survey respondents were asked to rate regarding what Greater Sudbury could do to improve the walking experience. Where the blue line approaches the edge (near 5) indicates that the factor is very important. When the line is closer to the middle of the shape, it indicates that respondents did not think that factor was as important.

Facilities and connections are the most important factor that respondents identified to improve the walkability of Greater Sudbury. Facilities and connections refers to more continuous trails and sidewalks that link destinations and attractions. Improved street lighting and crossing conditions will help improve the safety and usability of the pedestrian facilities and Greater Sudbury and further promote walking.

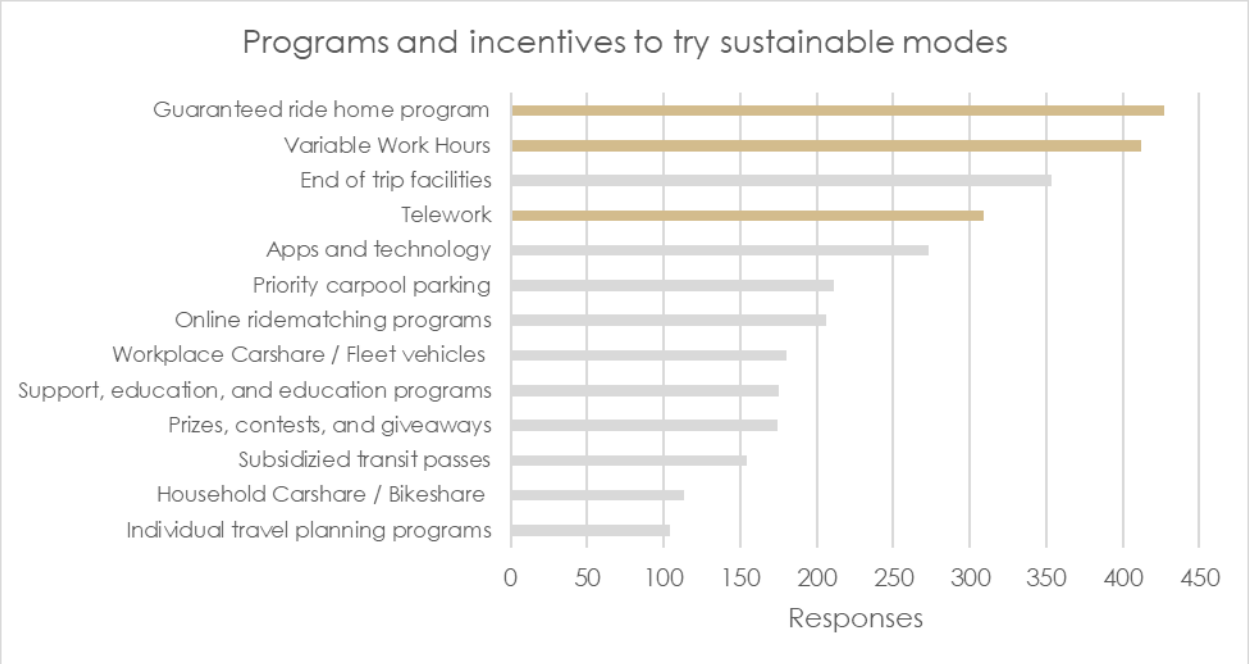
Over 52% of responses indicated that AT network expansion is the most favourable TDM supportive infrastructure



Improvements to the existing active transportation network and related facilities were by far the most preferred TDM supportive infrastructure that respondents indicated would be most likely to increase their usage of sustainable modes. Over three quarters of all respondents indicated that they wanted to see additional measures related active transportation and cycling. As noted earlier, improving the active transportation network may help bolster the walking share and promote cycling, particularly for low to medium distances.

2.6 Workplace Programs

Workplace programs coupled with a guaranteed ride home program may be successful influencing travel choices



The survey respondents indicated that workplace-related programs such as variable/flexible work hours accompanied with a guareenteed ride home program could encourage people to consider using sustainable modes. Carpool matching programs, incentives and bikeshare were considered not as attractive. Despite modest transit ridership and a desire to reduce cost of travel, subsidized travel passes are not considered popular. Improvements to the transit system may need to be made before transit passes become an effective TDM program.

English Survey	Does your workplace have flexible work hours	Does yorur workplace have a telecommute program	If your employer had telecommute and/or flexible work hours, would you take sustainable modes at least once a week?
Yes	33%	21%	58%
No	67%	79%	42%

French Survey	Does your workplace have flexible work hours	Does yorur workplace have a telecommute program	If your employer had telecommute and/or flexible work hours, would you take sustainable modes at least once a week?
Yes	10%	9%	48%
No	90%	91%	52%

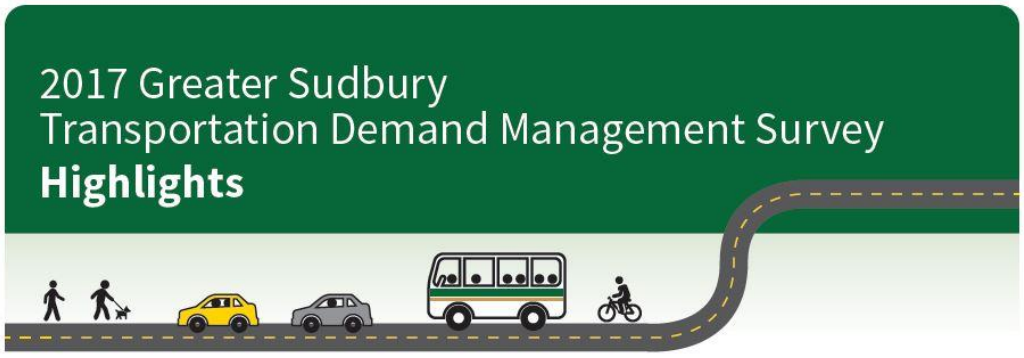
Survey results show that flexible work hours and telecommute programs are not common in Greater Sudbury. French language speakers are less likely to be able to access flex hours and

telecommuting. As shown below, if employers were to introduce a guaranteed ride home program, the results show that over 50% of respondents would be interested in participating.

Guaranteed Ride Home	English	French	Blended
Yes	65%	62%	64%
No	33%	35%	33%

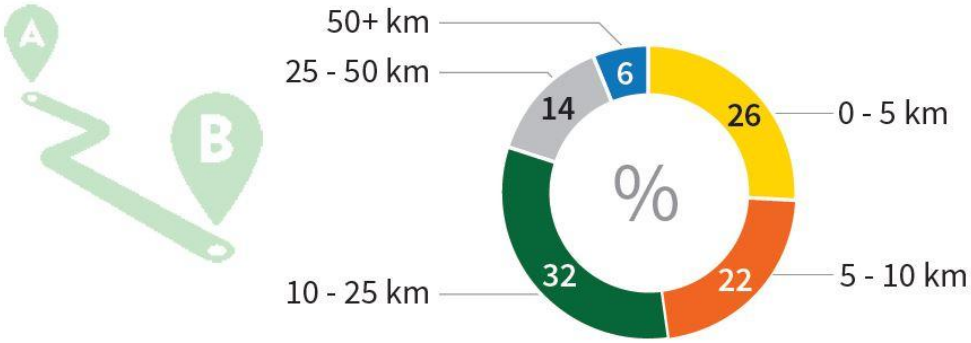
The guaranteed ride home program received an equal level of positive response from English and French surveys. On the whole, the ride home program was received better than telecommute and variable work hours, which is consistent with the TDM programs and incentives that respondents were interested in. Interest may stem from the guaranteed ride home providing the user with additional convenience and flexibility where and when it is needed most.

2.7 Infographics



TRAVEL DISTANCE

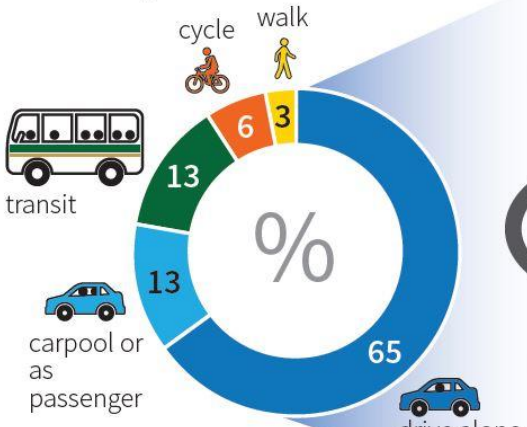
How far do people travel in Greater Sudbury?



54% of survey respondants have a commute of **15 to 30 minutes**

TRAVEL MODE

What vehicle do people use to travel in Greater Sudbury?



Why do most people drive alone?

44% It's the **only option**

53% It's the **fastest**

58% It's the **most convenient and flexible**


OTHER FINDINGS
49% do not cycle
68% are not comfortable cycling in Greater Sudbury
52% would consider walking and cycling if the active transportation routes were improved and expanded
66% are comfortable walking in Greater Sudbury
78% do not use transit
57% would be willing to carpool with a colleague
64% do not have access to carpooling at work
66% would carpool if there was a Guaranteed Ride Home program

3.0 Survey Questions

1. Are you a resident of the City of Greater Sudbury?

2. What is your average one way commute distance?

3. How much time are you willing to spend on your commute?

4. What is your primary mode of transportation?
    a. Drive alone
    b. Passenger
    c. Transit
    d. Carpool
    e. Cycling
    f. Walking
    g. Taxi

5. Why is this your preferred choice of transportation?

6. How frequently do you use the following sustainable modes of transportation?

7. What benefits would help you consider sustainable modes of transportation?
    a. Reducing your daily travel time
    b. Reducing the cost of travel
    c. Reducing the environmental impact
    d. Improving your personal and community health
    e. Improving the flexibility and convenience of transportation

8. Do you have a flexible work schedule?

9. Does your current workplace permit employees to telecommute?

10. If your employer allowed for a flexible work schedule would you consider using an alternative mode of transportation at least one a week?

11. Do you currently take public transit?

12. If you do not currently use or are uncomfortable with public transit, can you explain why?

13. How long does it take to walk to the nearest transit stop from your place of residence?

14. How important are the following for using public transit?
    a. Transit system is easy to navigate

b. Transit vehicles are comfortable
c. Privacy is important during my commute
d. Weather is an important factor in choosing transit
e. Buying transit fares is convenient and easy
f. The transit facilities are well maintained and include shelters, benches, and other amenities
g. Availability of real-time transit information
h. Directness and length of the transit routes
i. Quality of customer service

15. Do you currently cycle?

16. Why do you cycle?

17. Which of the following end of trip facilities for cycling are available at your workplace or school?
    a. Bike racks
    b. Bike lockers
    c. Change room
    d. Showers
    e. Bike maintenance/shop/kit

18. Please indicate how comfortable you feel cycling in Sudbury.

19. What would make you consider cycling more often?
    a. Improved and expanded trail network
    b. Dedicated bike lanes on road
    c. More amenities
    d. More parks/open space
    e. Proximity to destinations
    f. Improved way finding and signage
    g. Improved lighting
    h. Better road crossings
    i. Cycling advocacy and safety outreach and programs
    j. Cycling education at workplaces and schools

20. What purpose do you walk for?
    a. Health/fitness
    b. Commute/school/work
    c. To run errands
    d. For recreation
    e. To reduces environmental impacts
    f. Other

21. Please indicate how comfortable you feel walking in Sudbury

22. What would make you consider walking more?
    a. More facilities
    b. Better connections
    c. More amenities
    d. More parks/open space
    e. Proximity to destinations
    f. Improved way finding and signage
    g. Better road crossings
    h. Improved road lighting conditions

23. Does your workplace have a carpool matching program and/or carpool parking?

24. Who would you likely carpool with?

25. Carpooling can reduce the number of vehicles on the road, reduce commuting costs and stress. How do you feel about carpooling as an options for the journey to work, thinking of it in the context of the following statements? (Strongly agree - strongly disagree)
    a. It is convenient for the driver
    b. It is convenient for the rider
    c. Carpooling would disrupt my schedule
    d. It is easy to find a carpool partner
    e. Carpooling can reduce transportation costs
    f. Carpoolers should receive additional perks

26. Would you consider carpooling if your employer offered a guaranteed ride home program that would provide you with a means to get home in an emergency?

27. What TDM supportive infrastructure would increase your likely hood of using sustainable modes?
    a. Expanded AT network and neighbourhood connection
    b. Bicycle parking facilities
    c. High occupancy vehicle lanes
    d. Parking reduction
    e. Transit facilities such as shelter, benches, lighting

28. What programs and incentives would encourage you to try sustainable modes of transcription such as transit, cycling, walking, carpooling, and variable work arrangements?

29. How should the City of Greater Sudbury deliver outreach for TDM initiatives?

30. Integrating sustainable transportation opportunities into new developments is becoming increasingly more common. What is your opinion about the following and how they can be part of the overall integration of sustainable transportation and land use planning?

31. What are the first three digits of your postal code?

32. What age demographic does your household fall into? (age)

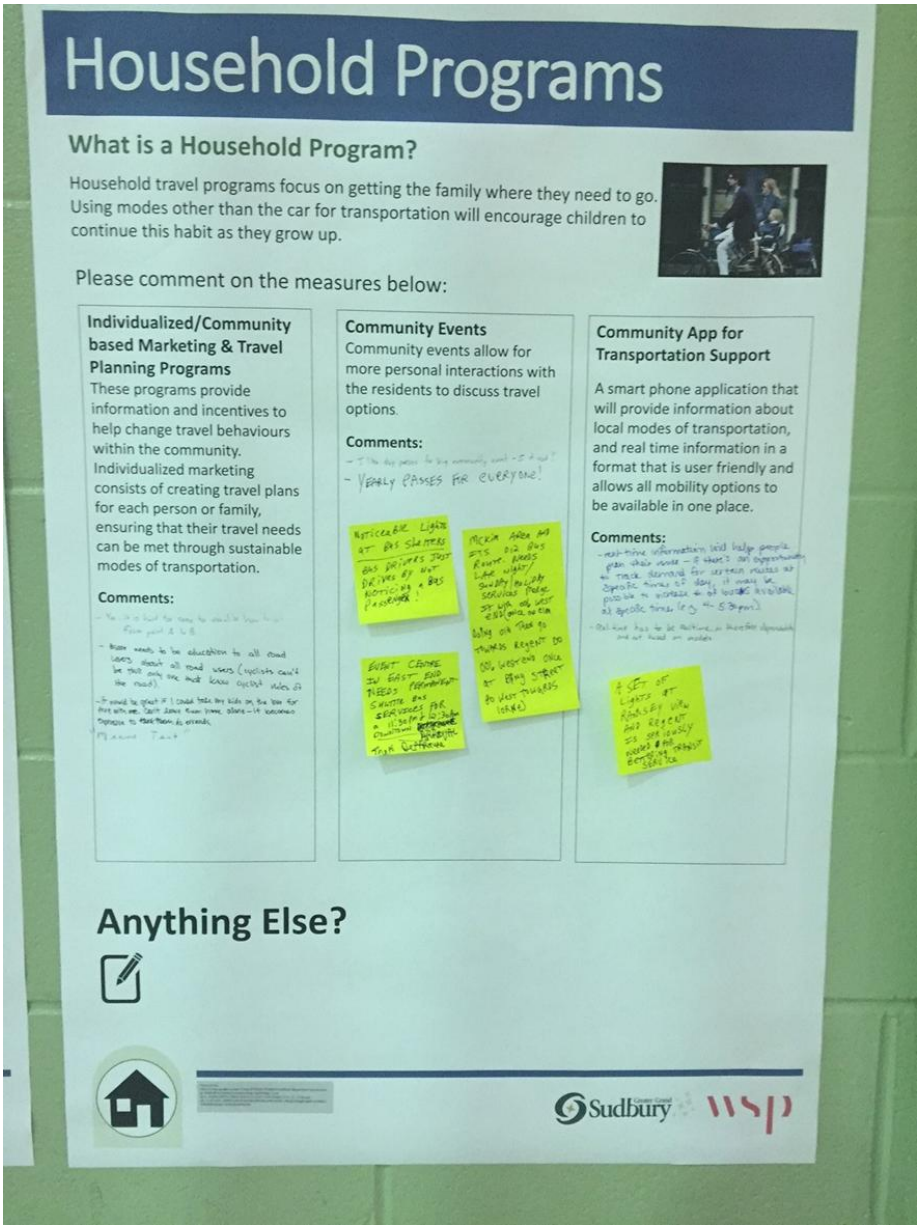
33. How many vehicles does your household own or have access to?

34. How many bicycles does your household own or have access to?

4.0 Public and Stakeholder Consultation Sessions

The Greater Sudbury public and stakeholder consultation sessions took place on September 13 and 14, 2017. The purpose of these meetings was to provide stakeholders and the public with draft concepts for the TDM vision and principles, as well as potential programs and measures. Feedback was requested and various formats were used to assist the study team in gaining insight from participants.

There were three separate meetings: the public session which was a drop in Public Open House, an invited stakeholder meeting, and a meeting with the Sustainable Mobility Advisory Panel (SMAP). The following summary gives detail on the three meetings and discusses the main topics brought to light at each.



4.1 Stakeholder Workshop

An invitation and reminder was sent out to Stakeholder involved in the project to inform them of what the project was and why they were being asked to participate. Those who will be helping to run the program, sustainability groups, and organizations that will advocate for it were invited to participate in the Stakeholder Workshop. The invitations were also highlighted what would be asked at the meeting and provided contact information for any questions.

The reminder sent out to the stakeholders notified them of the meeting and encouraged organizations to send a representative where necessary. Below is the list of stakeholders who were invited to attend:

- Friends of Sudbury Transit
- Rainbow Routes Association
- Sudbury Cyclists Union
- Sudbury Cycles
- Sudbury and District Health Unit
- Greater Sudbury Police Services
- Sudbury Chapter of CARP (Canadian Association for Retired Persons)
- EarthCare Sudbury (partnership between Greater Sudbury and 150 community partners)
- Coalition for a Liveable Sudbury
- Greater Sudbury Chamber of Commerce
- Green Sudbury
- Major Employers
- Learning for a Sustainable Future
- Rainbow District School Board
- Rethink Green – Faith Commuter Challenge (between faith groups)
- Sudbury and District Health Unit
- Sudbury Catholic District School Board
- Conseil scolaire de district catholique du Nouvel-Ontario
- Downtown Sudbury BIA

Dear Stakeholder

The City of Greater Sudbury is developing a **Transportation Demand Management (TDM) Plan** to encourage the use of sustainable travel options by residents of Greater Sudbury. In April 2017, the City retained WSP Canada Group Limited to work with Greater Sudbury staff and residents to create a plan that supports the use of cycling, walking, transit, carpooling and shifting of work arrangements to reduce stress on the roads and improve the environment and quality of life for all who live, work and visit Sudbury.

A key component of the development of the TDM Plan is a consultation and engagement program to gather input from businesses, stakeholders and residents to ensure a collaborative process is undertaken in the development of the plan.

You have been identified as a **key stakeholder** whose input will help shape the delivery of sustainable transportation programs and services within the community. Staff from the City of Greater Sudbury and WSP would like to extend this invitation to you to participate in a 1.5 hour workshop to:

- Provide an overview of the project and the timelines for completion
- Discuss potential TDM programs and how they can be implemented
- Discuss collaboration and partnerships between you and the City of Greater Sudbury to effectively implement TDM initiatives

The meeting is scheduled to be held on **Thursday September 14, 2017** between **1:30 p.m. and 3:00 p.m.** It will be held at **St. Andrew's Place** (111 Larch Street, Sudbury, ON) in the 111 Lounge, located on the main floor. Please email **Marisa Talarico** (marisa.talarico@greatersudbury.ca), Active Transportation Coordinator by Sept 11, 2017 to confirm your attendance.

If you are unable to attend the Stakeholder Workshop, there are other options for your input into the TDM Plan:

- You can attend the Public Consultation Session on September 13, 2017 between 6:00 and 8:00 pm. This session will be held at St, Andrew's Place, Activity Hall (Second Floor) 111 Larch Street and
- You can contact Marisa Talarico or Roxane MacInnis, Project Manager, WSP Canada Group Limited via the contact information below:

Marisa Talarico
(Active Transportation Coordinator, City of Greater Sudbury)
1800 Frobisher Street,
P.O. Box 5000, Station A
Sudbury, On P3A 5P3
marisa.talarico@greatersudbury.ca
705-674-4455 Ext. 3646

Roxane MacInnis
(WSP Canada Group Limited Project Manager)
1145 Hunt Club Road,
Ottawa, ON, K1V 0Y3
roxane.macinnis@wsp.com
613-690-1153

Figure 1: Stakeholder Invitation

Stakeholder Workshop

THIS Thursday!

Final Reminder!

You have been identified as a **key stakeholder** whose input will help shape the delivery of programs and services to encourage more people to walk, cycle, take transit or carpool within our community.

If you are unable to attend the session yourself, **we strongly encourage you to send a delegate,** as your organization's participation in this session is invaluable to the success of this plan.

Join us at the **1.5 hour workshop**, where we will:

- Provide an overview of the project and the timelines for completion
- Discuss potential TDM programs and how they can be implemented at your organization
- Discuss collaboration and partnerships between your organization and the City of Greater Sudbury to effectively implement TDM initiatives

What: Transportation Demand Management Plan Stakeholder Workshop
When: 1:30 - 3:00 pm on Thursday, September 14, 2017
Where: St. Andrew's Place, 111 Lounge (Main Floor)
111 Larch Street

If you have not already done so, please email **Marisa Talarico** (marisa.talarico@greatersudbury.ca), Active Transportation Coordinator to confirm your attendance.

Figure 2: Reminder to Stakeholders

The purpose of the stakeholder workshop was to gain information from different organizations in the community that have an invested interest in the opportunity or may be important to promoting the program throughout the community. Having stakeholders is vital to the program as they have local knowledge and experience in their fields. This helps to grow the knowledge base and ensure that all groups are represented.

Stakeholders were asked two questions after their presentation. (1) Which programs should be recommended for Greater Sudbury and (2) how their organizations could help implement these programs. The following is a summary of the main themes brought up in discussion.

QUESTION ONE

Question one asked which TDM programs recommended would be successful within Greater Sudbury. There were five main themes that came to light. Priorities were placed on: transit, cycling infrastructure, accessibility, parking, and programming.

Theme 1: Transit

Under transit it was suggested that there should be incentives for people to try the bus. There are negative connotations with riding the bus in Greater Sudbury that need to be dealt with before more people will ride the bus. The experience should be enjoyable, not scary.

Comments centered on getting children and students to use the busses more. Putting an emphasis on those who are not able to drive yet. Getting youth to learn how to ride the bus may be able to encourage them as they grow to continue this trend. Giving school-age-children free passes for the month of September and encouraging them to take the bus instead of getting a ride was a common idea. It was also suggested that large employers in the area should either discount or provide free transit passes as it was noted that a transit pass is expensive for the service it provides.

Theme 2: Need for more cycling infrastructure

The need for more cycling infrastructure was a reoccurring theme at the stakeholders meeting. From bike parking to safer routes it has been suggested that Greater Sudbury is currently not very cyclist friendly. Although there are trails, they do not go to destinations and are mostly used for recreation. There was interested for more secure bike parking at destinations, end-of-trip facilities such as showers and change rooms, bike shares available for those who may not own a bike, and the integration of the cycling system with others to become more multi-modal.

Theme 3: Accessibility

Accessibility was of major concern to those in the stakeholder group. There are many seniors that live in Greater Sudbury that can be very isolated without the use of transit. Concerns were focused around seniors having to live further away from services or in an area not services by transit due to financial reasons. It was suggested that bus drivers should be expected to give assistance to those who are unable to board the bus by themselves. As well, providing information for those who are elderly or disabled on how to use the bus, where the stops are, and the benefits of taking the service was considered important.

Theme 4: Parking

Parking was seen as an area for improvement to the stakeholders. It was suggested to have park and ride facilities placed at transit lines, and carpool parking lots to encourage more people to take sustainable modes of transportation. It was also suggested that priced parking would be a good alternative in the downtown where parking is abundant. Charging more for parking or requiring a “congestion tax” for those who drive could encourage more people to take transit instead of driving.

Theme 5: Programs

There was positive response to programs suggested in all three categories (work, school, home). Less focus was placed on having the program; instead the emphasis was more on the promotion and awareness of programs. Programs encouraged were flexible work schedules, guaranteed ride home, carpooling initiatives, employee transit passes, car and bike share, and discounted parking. Most of the programs chosen were those in the work-programs section, with a focus on using transit for students to commute to school. Promotion focused on getting awareness out, offering programming and awareness for residents and clients in the area, and educating the residents on how to take transit.

QUESTION TWO

Question two asked how the stakeholders organization could collaborate with the city to implement these TDM initiatives, and what other partnerships they thought were important in the implementation process. Priorities were placed on having a strong partnership with the City, the School Board, and recreational facilities.

School board

It was noted that working with the school boards is important to get students involved in TDM. With the support of the board there can be more emphasis put on using transit, taking the school bus or active transportation to school instead of having students driven by parents. Having the principals and parents involved in these programs would also be helpful as they are likely the ones to carry out programs and will need support from the board to do so.

Government

Working with the City will be a vital part of implementing these programs as they will be the ones implementing the TDM Plan. It will also be important to partner with other government agencies as well, such as Ministry of Transport Ontario and Health Services in Greater Sudbury. These organizations can continue to support and provide services for the programs with different options and education.

Recreational Facilities

Partnering with recreational facilities in the area will be important as they can advertise for TDM and active transportation as well as providing a destination for people commuting. Having partners such as the YMCA Sudbury included in programs can help to expand advertising and awareness in the community. This could also be the same for local hockey rinks and recreation

centres. Having priority parking for carpoolers at arenas could help to manage parking problems and encourage more people to travel together.

Coalition for a Liveable Sudbury

The Coalition for a Liveable Sudbury (CLS) is an organization consisting of citizens and community groups who share the common vision of Greater Sudbury as a “green, health, and engaged community”. The goal of the coalition is to strive towards a sustainable, livable, and vibrant community through having a voice for citizens who want to help make change in the community. The coalition advocates, researches, raises awareness, and has a network for those who also believe in the principles of a Liveable Greater Sudbury.

The organization submitted feedback on the public meeting through the project email. Their main comments covered the topic of environmental sustainability, the potential to increase service and facilities for sustainable modes, the focus on school and work programs, the need to engage the community, and have measureable goals and priorities.

Within these topics they stressed that transportation should be safe, accessible, and convenient for all ages to use including youth and seniors. Influencing youth to use sustainable modes now will be able to influence their behaviours later in life. CLS stressed that this was another important aspect that should be a focus for school travel planning.

CLS also stressed that implementing a TDM Plan creates an opportunity to increase transit service and create more liable community that can access destinations without the use of the automobile. Having accessible sidewalks, bike lanes, and transit is important for these communities to change their travel habits.

4.2 Sustainable Mobility Advisory Panel (SMAP)

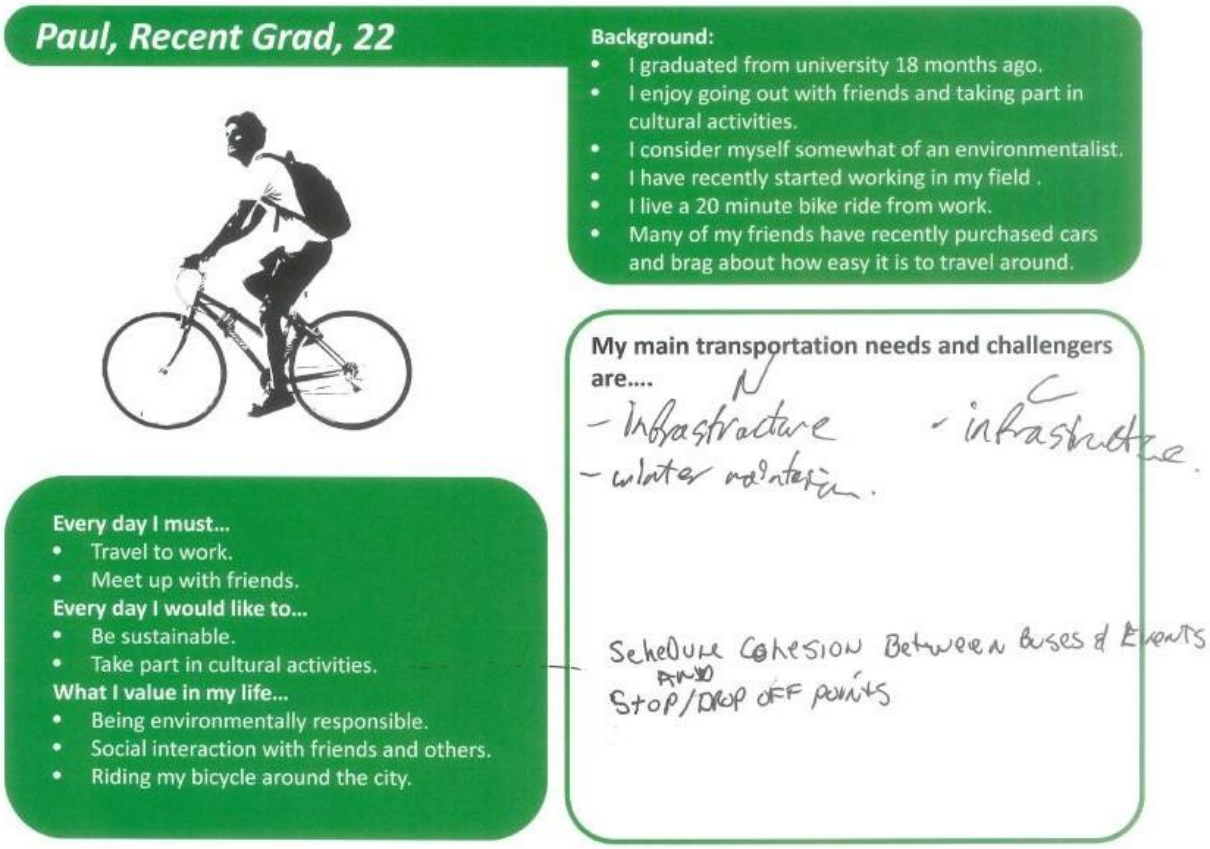
SMAP is a panel that works with council and city staff in order to create and implement a vision for Greater Sudbury that includes having a multi-modal transportation system where any means of transportation can be used safely and efficiently to get to a destination. The primary objectives of the panel are to aid council and community partners in implementing recommendations to active transportation, advocating for pedestrians, cyclists, and transit uses, and other non-motorized modes of transportation, and develop recommendations to encourage sustainable transportation within the City.

As important advocate for sustainable transportation and mobility, SMAP was invited to participate in a workshop to discuss the creation of the new TDM Plan. At the workshop SMAP was given personas of different people who could live in Greater Sudbury and asked to define what their transportation challenges and needs are. The activity was used for the purpose of considering specific people within the transportation network and how their lifestyles can influence their different transportation needs and choices. Participants were asked to consider what the needs are for different types of travelers, and how travel fits into their lifestyles. By identifying the main transportation needs and challenges, this provided the basis to consider how the person can change their behaviour.

The following is a summary of what was suggested for the different types of travelers:

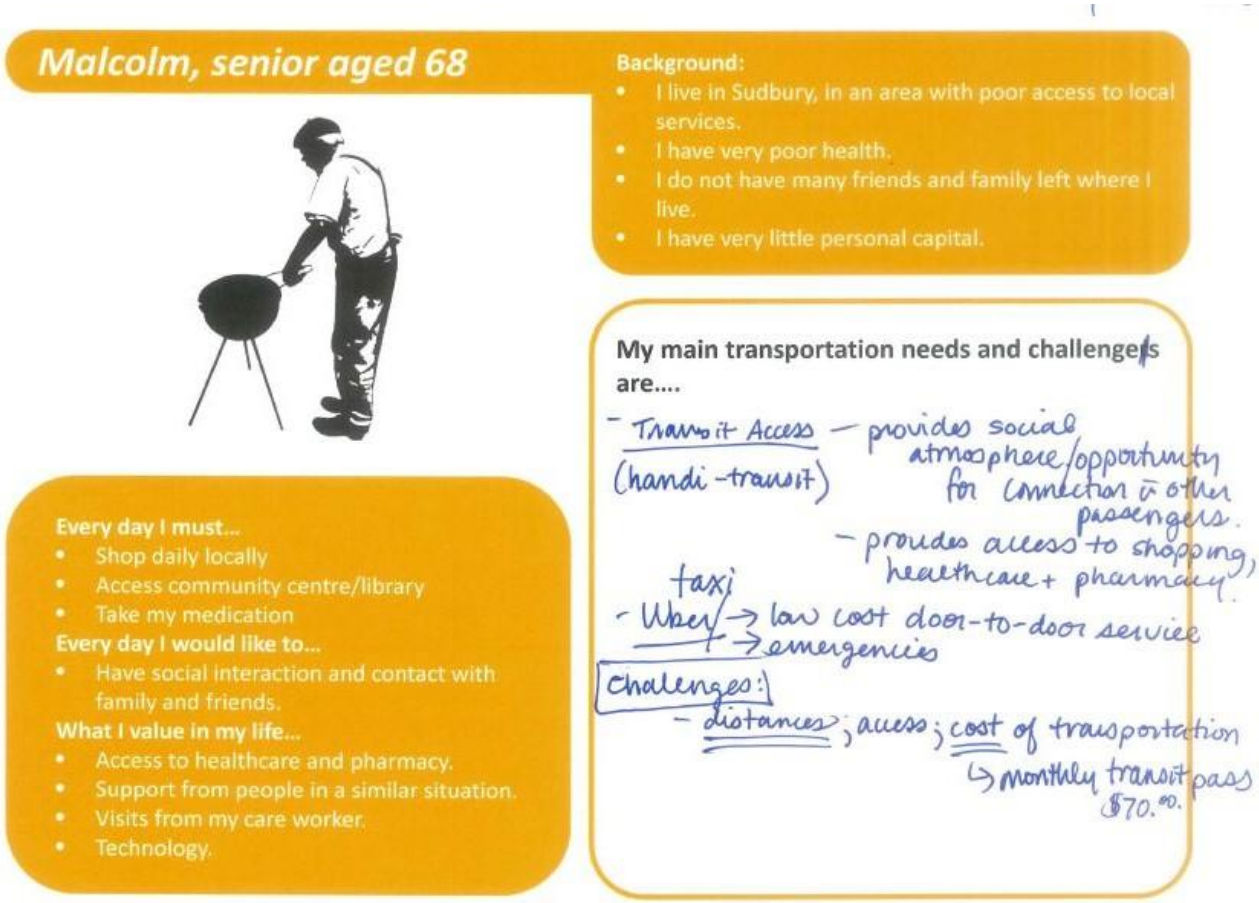
Recent Grad, 22

For recent grads, challenges and needs discussed were that transit schedules should line of with events so it is easier for the public to participate in activities and festivals within the City. It was also discussed that there are many challenges for someone who wants to commute by bike as there is little infrastructure in Greater Sudbury for active transportation. Bike lanes and end-of-trip facilities would allow for more people to commute this way.



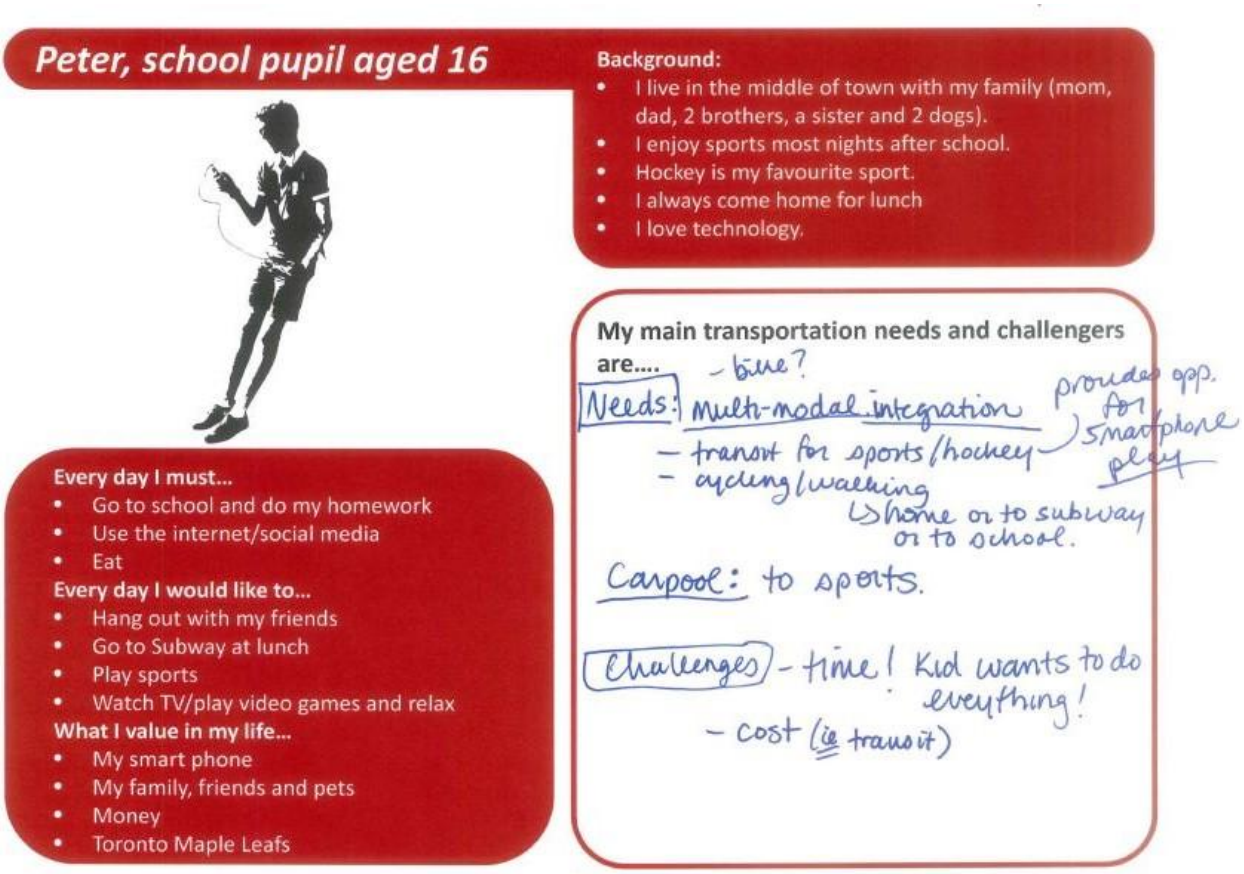
Senior, 68

As a senior in Greater Sudbury, there are many challenges when it comes to mobility. In order to be mobile and participate in the community the transit system is vital. Having discounted transit passes for seniors would allow them to travel more freely and continue to participate in the community. As accessibility is often an issue, there should be for information for how seniors can use the bus safely and conveniently. Winter conditions were discussed as there is often unsafe conditions in the winter. Addressing the issues of cleared sidewalks and roads would improve the quality of life for all those using active transportation for commuting.



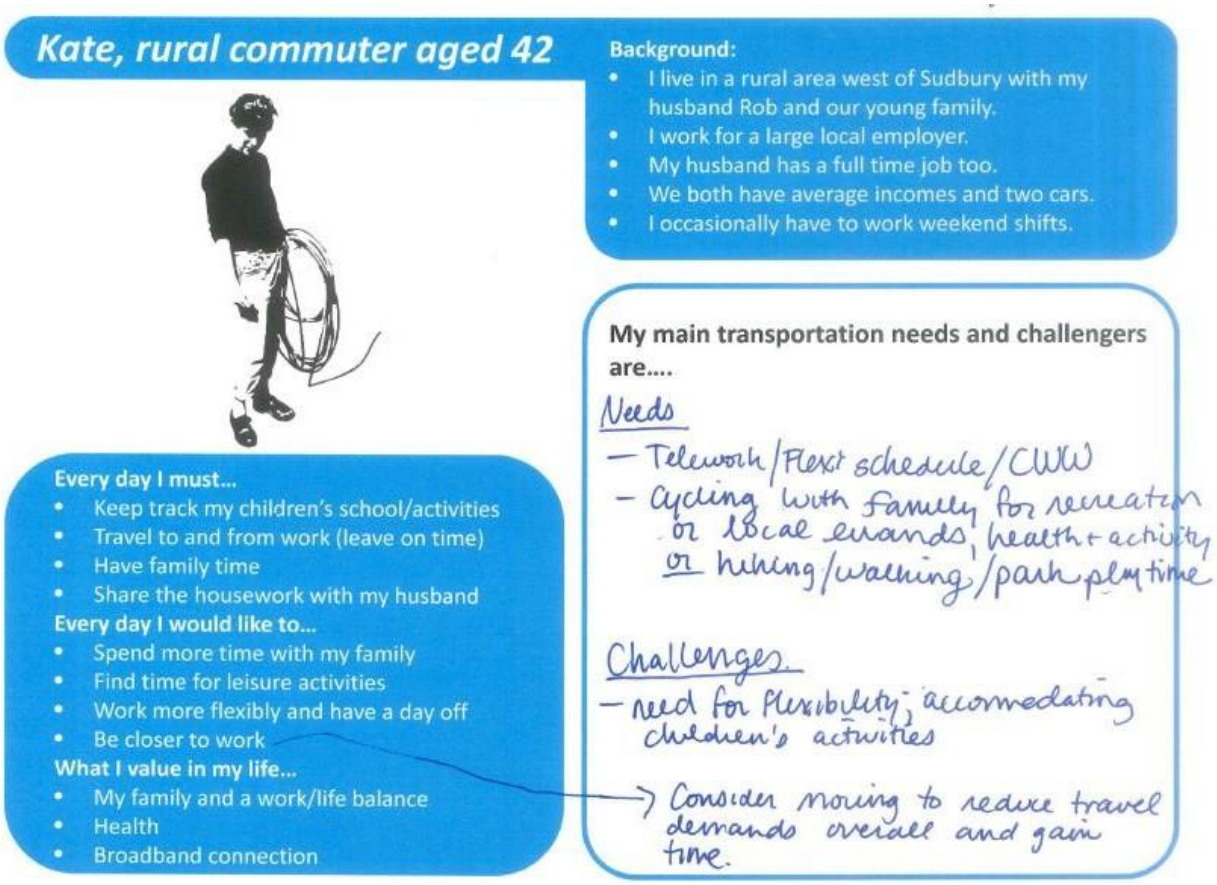
School aged pupil, 16

It was discussed that as a student having a multi-modal system is very important. Using active transportation and transit together can allow for more mobility and easier access to destinations. It was suggested that for students it is likely that the cost of a pass that would be a barrier and then knowledge of how to use the transit system. Schools should take car in supplying students with discounted or free passes and educate students on how to use the trail network and transit.



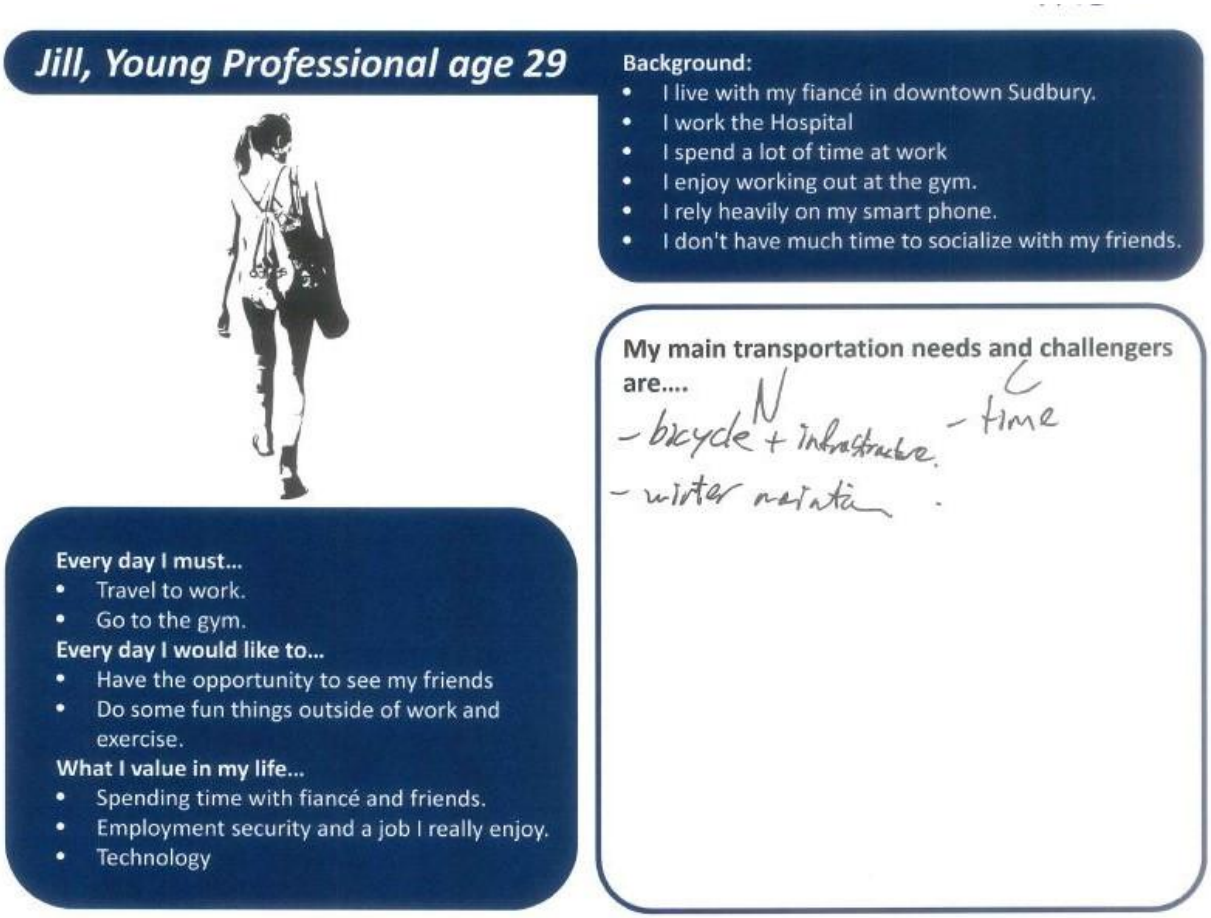
Rural commuter, 42 mother with young family

Living in rural Greater Sudbury and working in the City creates many transportation issues. Challenges consist of having to transport kids to activities, and having to spend a significant amount of time commuting. It was suggested to consider teleworking or asking for a flexible schedule if one lives far from work. One could also move close to work/children's school/activities in order to be able to use transit or active transportation to commute instead.



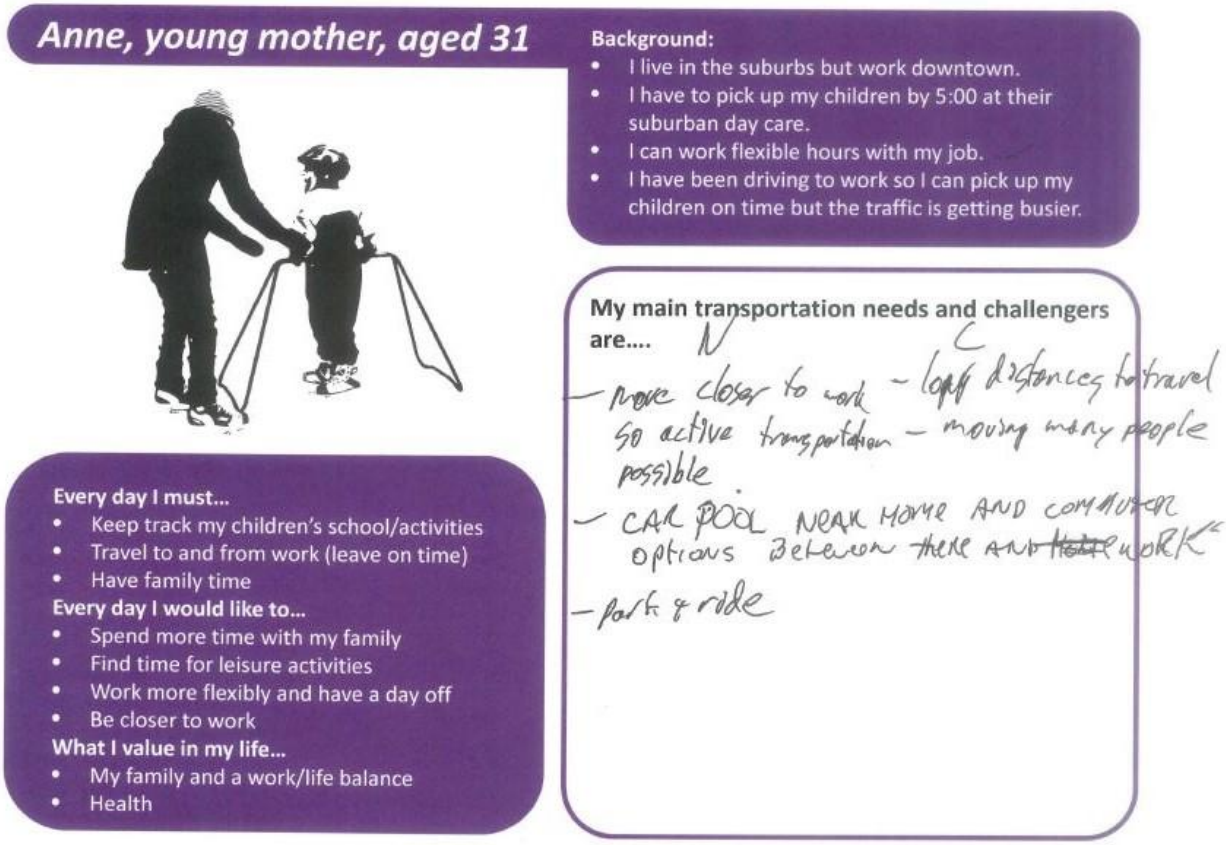
Young professional, 29

As a young professional one the biggest challenges is finding time for hobbies and socialising. Finding a balance taking transit or active transportation can help to cut down on time spent commuting, and can help to keep you active. Having an efficient transit app can also help people new to the system be more confident using it.



Young mother, suburban commuter, 31

There are many challenges that come with being a young mother in Greater Sudbury and transportation can greatly hinder the amount of time to spend with family. Having a flexible work schedule can allow you to commute to work on off-peak hours and avoid congestion. A discounted transit pass could provide a great incentive for those who are looking into other transportation options. Having safe active transportation connections to downtown from suburban neighbourhoods could also help those who would like to spend more time with family as this can provide valuable bonding time and allow children to have exercise at the same time.



Vision and Principles

SMAP was also asked to comment on the Vision and Principles for the TDM Plan. Of the suggestions for Greater Sudbury's Vision, SMAP focused on the Plan being **Sustainable, Efficient**, and **Equitable**, along with **Accessible**, **Effective**, and **Affordable**.

The Principles focused on by SMAP were; **Safe**, **Shift Travel Behaviour**, **Integrated**, **Effective**, **Inclusive**, and **Equal Access**. Mobility as a Service, Support, Motivation, Urban Forma, and Promotion were also suggested but at less of a priority.

Vision for Greater Sudbury's Transportation Demand Management Plan

Vision:

Below are some key words that could be used in the development of a vision for the TDM Plan. The vision will be a forward looking statement that will be positive and be in line with other visions related to transportation and sustainability in Greater Sudbury.

Please choose **three (3)** key words for the Vision.

RESULTS:

7	Sustainable
5	Efficient
5	Equitable
4	Accessible
2	Effective
1	Affordable

Principles:

To further define the vision and set out key guiding direction or principles, **five** of the words listed below (or others that may be added) should be used for the headings for each statement outlining a principle. The principles should reflect the vision statement and provide a framework for the delivery of TDM measures and sustainable transportation programs.

Please choose **five (5)** key words for the Principles.

RESULTS:

6	Safe
6	Shift Travel Behaviour
5	Integrated
5	Effective
4	Inclusive
4	Equal Access
2	Mobility as a Service
2	Support
2	Motivation
1	Urban Form
1	Promotion

4.3 Public Open House

Thirteen (13) members of the public attended the meetings on Wednesday, Sept 13, 2017. The boards were presented with draft ideas for Greater Sudbury's TDM Plan, and attendees were asked for feedback on the ideas: whether they were liked, disliked, or if there was anything the attendees wanted to add. Many comments suggested that people would like to spend less time travelling

The public was asked for feedback on their vision for Greater Sudbury, and what they thought could best improve transportation options in the area. Reoccurring themes were improvements to transit, infrastructure, education, and community partnerships.

The meeting was advertised on the City's website, Facebook page, via email and other venues using the notice shown below (Figure 4) Where the stakeholder and SMAP meetings were held during the day, the Public Consultation Session was held in the evening to have as much participation as possible, and was located in the downtown core, near City Hall, which is accessible by multiple modes of transportation. Efforts were made to ensure that meeting was made accessible to all, with comment sheets available for those who did not wish to speak at the consultation session, and a project email available to those who were unavailable to attend.

The City of Greater Sudbury is developing a **Transportation Demand Management (TDM) Plan** to encourage the use of sustainable travel options by residents of Greater Sudbury. In April 2017, the City retained WSP Canada Group Limited to work with Greater Sudbury staff and residents to create a plan that supports the use of cycling, walking, transit, carpooling and shifting of work arrangements to reduce stress on the roads and improve the environment and quality of life for all who live, work and visit Sudbury.

A key component of the development of the TDM Plan is a consultation and engagement program to gather input from stakeholders and residents to ensure a collaborative process is undertaken in the development of the plan.

Staff from Greater Sudbury and WSP will be hosting a **Public Consultation Session** to receive feedback on the proposed vision and programs for the TDM Plan. The session will begin at 6:00 and continue to 8:00 and **will be set up for drop in and casual discussions** with project team staff during that time.

The Public Consultation Session will be held at:

St. Andrew's Place
Activity Hall (Second Floor)
111 Larch Street
Wednesday September 13, 2017
6:00 to 8:00 p.m.

If you are unable to attend the Public Consultation Session, please feel free to contact the following project team members for further information:

Marisa Talarico
(Active Transportation Coordinator, City of Greater Sudbury)
1800 Frobisher Street,
P.O. Box 5000, Station A
Sudbury, On P3A 5P3
marisa.talarico@greatersudbury.ca

Roxane MacInnis
(WSP Canada Group Limited Project Manager)
1145 Hunt Club Road,
Ottawa, ON, K1V 0Y3
roxane.macinnis@wsp.com
613-690-1153

Figure 4: Public Notice

Below are the general themes that emerged from the comments provided by those who attended the Public Consultation Session. As indicated, the public was most concerned about transit, infrastructure, education on the programs, and community partnerships.

Transit

The public had a vision for Greater Sudbury's transit system that included an efficient, safe system with frequent service. A more widespread network with express busses would make it easier for people to get to work on time and commute longer distances via transit. Having a safer system with help button at bus stops and more security at transit stations would increase feelings of safety with using the system. A transit app or portal with real time updates would allow riders to see if their bus is late and plan accordingly instead of being late for work or activities.

Infrastructure

There is an obvious need for more sustainable transportation infrastructure in Greater Sudbury. It has been mentioned many times that there is a desire for an increase in sidewalks, bike lanes, streetlights, urban furniture, and bike storage. There is also a need for end-of-trip facilities so that those wanting to commute via active transportation can do so with ease. Currently many people do not feel safe biking or walking within Greater Sudbury and an increase in infrastructure and a more connected network could encourage more residence to get out and get on the move.

Education

More education on how to use other modes of transportation could help increase the mode share for sustainable modes of transportation. Educating all road users on the rules of the road will make roads safer for cyclist and pedestrians. It was suggested that having programs on how to cycle on city streets could encourage more people to do so, particularly for those who are unsure about the rules of the road. A better digital platform for all modes of transportation could not only encourage those who are unaware of the facilities but also provide the ability to try a new mode of commuting.

Community partnerships

Having more community partnerships can encourage more locally driven campaigns in neighbourhoods and create a more inclusive environment where residents want to use sustainable modes of transportation. Keeping the community up to date with new facilities and trails can act as advertisements for active transportation as residents will want to try out new facilities. Integrating rideshare program or uber into the public transit system could also help to encourage more people to use the system.

Feedback

Seen below are the Public Consultation Session Boards, which were used interactively to show the public the direction the project is headed and initial ideas. The public was encouraged to comment directly on the boards, and to add any additional information they believed would be helpful. Examples of this are seen below in Figures 5, and 6. The complete sets of consultation boards are included at the end of Appendix B.

4.4 Other Input

Input received from individuals through the project email was mostly from seniors concerned with accessibility for those in wheelchairs. This includes having bus stops cleared during the winter and having audio visual messages on the busses to indicate stops. Having more service and a senior discounted or free day was also mentioned.

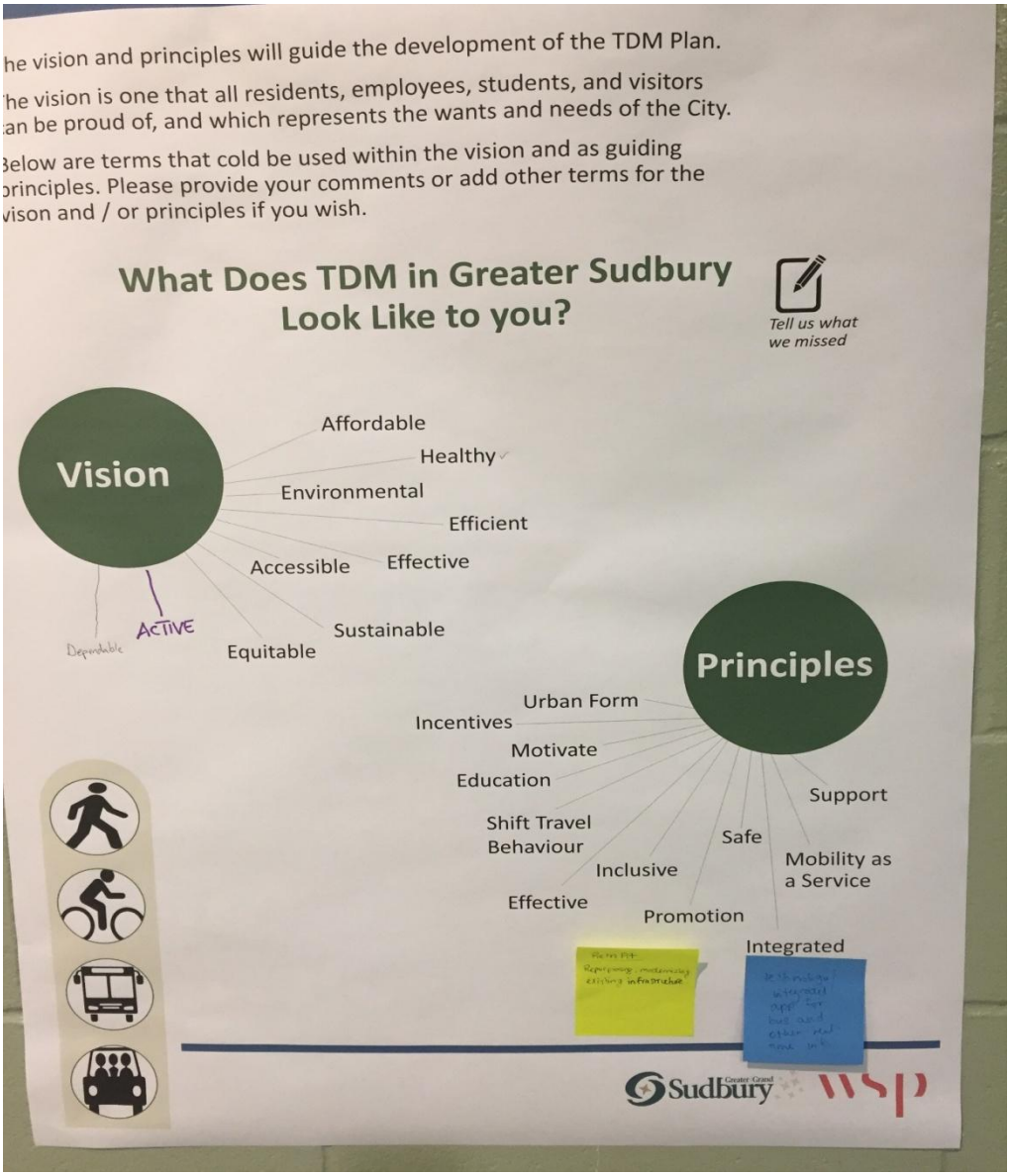


Figure 3: Feedback on Vision and Principles - Public Consultation Session

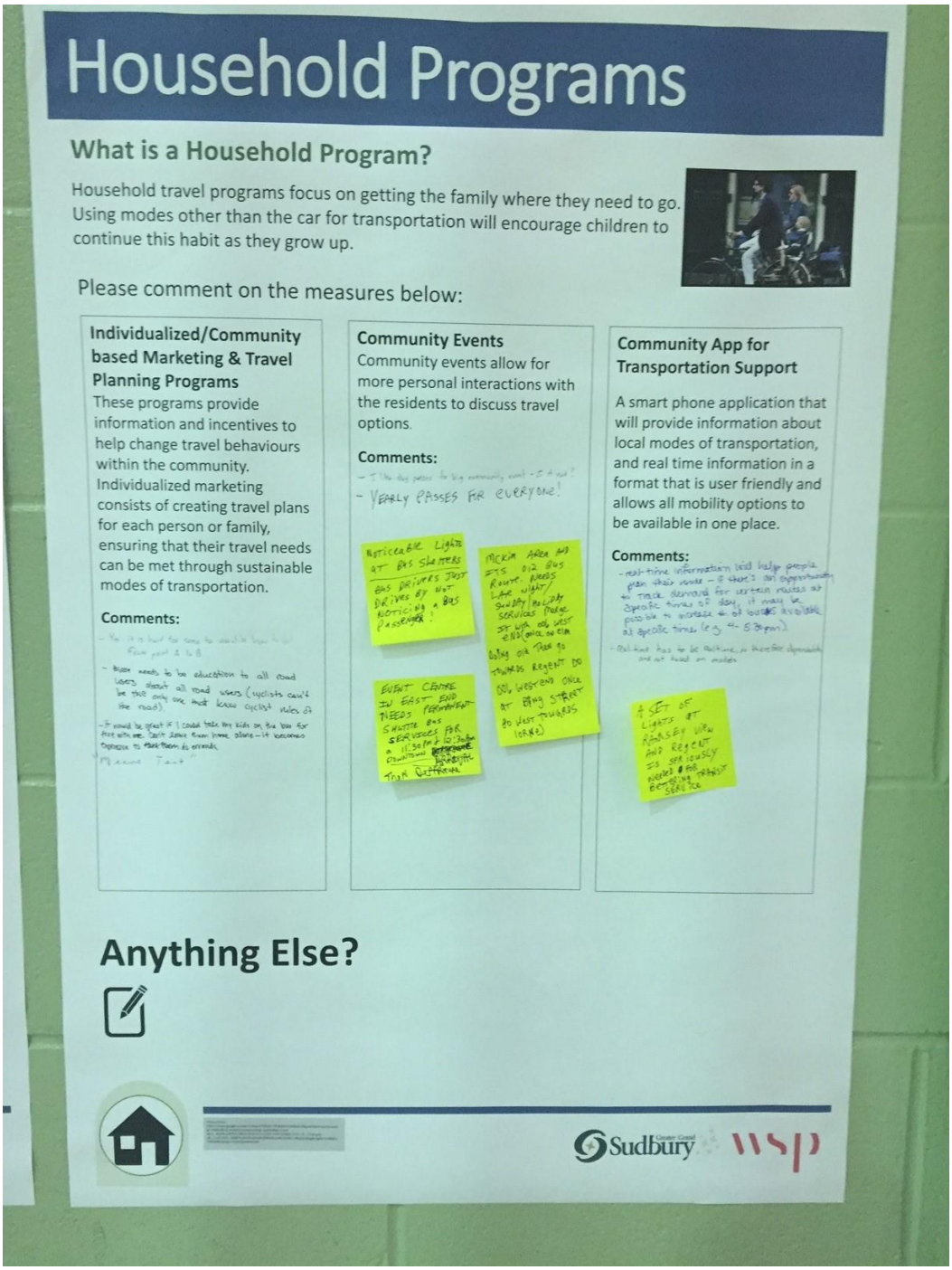


Figure 4: Comments on Household Programs and Measures

Appendix C: Partnerships

April 2018

1.0 Introduction

There are many opportunities for the City of Greater Sudbury to partner with organizations and different groups within the community in order to produce a successful TDM Plan. Without the support of the community, TDM is likely not to be successful, which makes it a vital part of developing the Plan.

In this appendix, five main organizations are discussed for their potential partnerships with the City. The organizations all have the overarching goal for environmental sustainability though a prosperous and vibrant community. In order to achieve this, many of these organizations have already implemented programs that are TDM focused and support the current plan to encourage more people to take sustainable modes of transportation.

There is a potential for the City to begin to take a role in the leadership of these programs and help promote and better coordinate what has already been established. There are some Workplace, Community, and School based programs that have been developed throughout the community organizations but they are not consistent and therefore not maximizing a full level of participation. Having the City's backing on these programs would help to increase the rate of participation and the level of funding that can be provided.

2.0 Rethink Green

Rethink Green is an organization that brings together ideas, partners and resources to build a more sustainable community in Greater Sudbury. With the vision for the community to continue striving towards sustainability through their well-being of the global and local environment, and health and happiness of the residents, the organization aims to empower members through capacity building events, resources, knowledge, collaboration, and community education opportunities.

As a registered non-profit, the organization is sustained through public and private grants, along with revenue from its social enterprise business incubator, The Forge. Bringing together the grass-roots community, non-profits, business, and the government to partner for a more sustainable Greater Sudbury. Rethink Green focuses on education workshops, engagement, and network working to create a dialogue on local and global environmental issues.

ReThink Green has developed a Strategic Plan that considers has a future plan called “Green is the new normal”. The Plan intends to normalize sustainability goals for businesses and organizations within Greater Sudbury over the next 5 years. Through the development process, ReThink Green established a large network of partners and resources that will be a valuable asset to the City’s TDM Plan as well. Partner networks include The CoLab Network, the Coalitional for a Liveable Sudbury, Green Communities Canada, and local NGO’s.

RETHINK GREEN BRINGS TOGETHER IDEAS, PARTNERS, AND RESOURCES TO BUILD A MORE SUSTAINABLE COMMUNITY.

1.1 Programs

ReThink Green has many programs through which they engage with the community to promote sustainable choices. This is a great opportunity for the city as there is already a network established in the community through the group. Programs offered by the organisation are; Green Economy North, Engagement Organizing, Commuter Challenge, The Forge, Shared Platforms, Green Connect.

Commuter Challenge

Within the Commuter Challenge reThink Green puts on three programs throughout the month of June to promote sustainable commuting. There is a Workplace Commuter Challenges (workplace program), Faith Commuter Challenge (community based program) and Walk and Wheel to School Challenge (school based program).

Workplace:

The City could get more involved in encouraging staff and community members to participate in the commuter challenge during this week in June. RTG already takes most responsibility in signing up work places and providing education for those who need it. They also collect the data in order to assess how the City's traveling trends have changed from year to year. This is a great opportunity for the City as the program is already running. The City should consider partnering with the program to encourage more businesses to participate including city staff and clients.

Community-based:

The Faith Commuter Challenge encourages faith groups to participate in sustainable transportation for a week in June. It encourages friendly competition among member of the various groups to see who can travel the most with sustainable modes. Having community based programs such as this is an opportunity for the City to encourage sustainable modes as local and day to day travel on top of workplace travel. Many people don't consider how easy it is to walk to the nearby church and tend to drive instead. This program should be considered as an investment for the City and a future partner in TDM.

School-based:

The Walk and Wheel to School Challenge encourages children across Greater Sudbury to take sustainable modes to school each day during the week of the program. Health Kids Greater Sudbury adds up the kilometres traveled to see improvements from year to year and continue to encourage the children to use these modes. Incentives are provided for this program. This is another opportunity for the City to partner with already established programs to continue the promotion and education of sustainable modes and TDM already in Greater Sudbury.

3.0 Coalition for a Liveable Sudbury (CLS)

The Coalition for a Liveable Sudbury is an organization consisting of citizens and community groups who share the common vision of Greater Sudbury as a “green, healthy, and engaged community”. The goal of the coalition is to strive towards a sustainable, livable, and vibrant community through having a voice for citizens who want to help make change in the community. The coalition advocates, researches, raises awareness, and has a network for those who also believe in the principles of a Liveable Greater Sudbury.

The organization currently has over 650 members that are involved in different stages and programs throughout the organization, with 41 member associations. Groups that are part of the CLS include that of the Canadian Citizen Climate Lobby, Eat Local Sudbury, Minnow Lake Restoration Group, and the Ontario River alliance, to name a few. The CLS is also a member of 6 other groups: EarchCare Sudbury, Green Infrastructure Ontario Coalition, Ontario Environmental Network, Ontario Healthy Community Coalition, ReThink Green, and the Water Guardians Network.

CLS runs a program called Earth Crew, which consists of volunteers who want to make a difference in the community. The program involves monthly activities such as tree planting, trail clean ups, and community garden workshops. They are also a large supporter of transportation demand management.

There is an opportunity here to involve the city with the programs run by CLS. Having the Earth Crew help in creating new trails and green spaces could provide a cost effective way for the city to create more active transportation infrastructure. The coalition is part of many different organizations. It is considered a good way to spread the promotion of TDM throughout the community, having the coalition promote and education its members of the benefits and current programs that it can provide to help individuals continue to participate in the City’s programs.

Being a large advocate for transportation demand management, this is a good source for the City to use in the engagement process to ensure that the plan covers what residents of Greater Sudbury are looking for in their travel modes. Having a partner that is involved in the City and has the same goals in mind will increase the success of the TDM Plan and any programs that

come from it. The City should consider using The Coalition for a Livable Sudbury as a resource and partner in their pursuit of a more sustainable community.

4.0 EarthCare Sudbury

1 EarthCare Sudbury

The EarthCare community partnership is an umbrella organization that has been forging local environmental action on behave of the entire Greater Sudbury community since 2003. The partnership is a formal commitment to being more sustainable; the commitment and strategic plan was created by the member organizations and represents their commitment to making Greater Sudbury more sustainable. The three goals of the Plan are to enhance the environmental health of Greater Sudbury, encourage members of the community to take environmental responsibility, and to share the knowledge and experience that the organization can provide to its citizens.

The organization is focused on a comprehensive and integrated approach through monitoring and community engagement in order to promoting more citizen participation in becoming sustainable. Focusing on its four strategic pillars: active living, the natural environment, civic engagement, and economic growth, EarthCare is a valuable partner to the City in creating and implementing a TDM Plan that can be both successful and beneficial to the community.

The Strategic Plan covers many aspects of creating a healthy environment including air quality, the use of energy, food, green buildings, land use planning, the natural environment, and youth and the environment. The Plan discusses the objective and actions for each aspect, and how the community and individuals can help to achieve it.

This comprehensive plan is an important piece of policy when considering Greater Sudbury's environment, and how the community can get involved. The organization hosts many different programs, one of them being a carpooling program for the City.

Carpooling Program

EarthCare's Carpooling Program focuses on finding carpool partners for those commuting from out of town, or further away from their destinations. The aim of the program is to reduce greenhouse gas emissions and traffic congestion in the City. There are also a number of designated park-and-Ride parking lots throughout the City, for those who are carpooling to or from work. This program is valuable to the City and creates the opportunity to promote more carpooling in Greater Sudbury.

EarthCare Terre à coeur SUDBURY 2010 EarthCare Sudbury Action Plan
Becoming a Sustainable Community

5.0 Nickel District Conservation Authority

Greater Sudbury's conservation organization is a watershed stewardship agency with the main goal of ensuring healthy interaction between watershed, the natural environment, and the local economy. The Nickle District Conservation Authority provides services for 9150 sq km of watershed area within Greater Sudbury.

With climate change impacting the natural environment in Greater Sudbury, conservation areas are becoming more focused on areas of preserving the natural environment, partnering with other expertise, and moving towards a more "Green" Greater Sudbury. Although the conservation authorities are mainly concerned with issues that pertain to water, the Nickle District is committed to ensuring the community continues to be resilient and sustainable as well.

Conservation areas are often important contributors to community engagement programs and educate the residents on how important the environment really is. This creates an area of opportunity for the City to partner with these areas in order to raise awareness with more people about how transportation can affect the environment. The Friends of Lake Laurentian is a volunteer based initiative that supports environmental programs within the conservation area. Partnering with organizations that have a large volunteer base like the Nickel Districted Conservation Area can generate a large engagement base for the City, and involve more people with different views on the subject.

6.0 Rainbow Routes Association

The Rainbow Routes Association is dedicated towards the advancement and promotion of non-motorized trails and routes within the City. The purpose is to create a more vibrant city where people can live healthy, active lives, with affordable recreation and transportation opportunities.

Their 2020 Strategic Plan is focused on infrastructure development, promotion of routes, partnerships, and operations with a stronger volunteer network. They have three main TDM initiatives; the Commuter Challenge, Bike Valet and Walk Sudbury.

Any organization that already has TDM programs in place is an opportunity for the City to partner with when implementing the TDM Plan. Pre-established programs can increase in popularity with backing from the city and increase the success rate.

7.0 Future Partnerships

Future partnerships are imperative towards the development of a TDM program. It can often be difficult to engage smaller partners at the beginning of the program, but as it grows and becomes a part of the city other organizations will begin to reach out and support the Plan. These smaller organizations such as youth and seniors groups, student associations, and recreation facilities, are part of the urban fabric of a city and can be an important piece to encouraging and promoting new programs within the city. They are more likely to reach people from all demographics and backgrounds, and together, can have a meaningful impact on the community.

Smaller partnerships are often a way to have more one-on-one communication with residents about new programs available to them. While larger organizations can provide funding, promotion, and education for the program, smaller, more intimate organizations often have more of an impact on the lives of individuals, and can create the support that families and individuals need when starting and throughout the duration of a TDM program.

Future partnerships include that of:

- Youth Groups
- Seniors Groups
- Faith Groups
- Recreational facilities (YMCA)
- University Student Societies

It is important for the city to involve these groups in the future as the project continues to grow and needs more support from within the community. Involving different demographics in TDM programs is vital for the program to continue in the future and to ensure that as children grow they take these skills and lessons with them. This ensures that Greater Sudbury can grow their base in TDM and keep the community participating.

Presented To:	Operations Committee
Presented:	Monday, May 14, 2018
Report Date	Monday, Apr 30, 2018
Type:	Presentations

For Information Only

Use of Road Deicers

Resolution

For Information Only

Relationship to the Strategic Plan / Health Impact Assessment

This report refers to operational matters.

Report Summary

The report describes the City's road deicing operation.

Financial Implications

This report has no financial implications.

Signed By

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Use of Road Deicer

Background

Road deicing is a necessary part of winter maintenance. Deicing is the process of applying solids or liquids to a road surface to help melt snow/ice that accumulates during a winter event. There are many types of deicers that are used in North America to manage snow/ice. The most popular deicer is sodium chloride more commonly referred to as road salt (see table 1 for a comparison of what other Municipalities are using for chemical deicing). Road salt is an effective substance for deicing but can be detrimental to the environment. To mitigate its harmful effects, City operations has adopted a Salt Management Plan (SMP) which provides valuable information on the effective use for road salt.

In 2005 the City of Greater Sudbury retained BMA Management Consultants to undertake an Internal Audit of winter maintenance activities/practices utilized at the City. The review included but wasn't limited to an analysis of staffing, contracting, yards/deployment centres, fleet management, budget and actual expenditures, work practices, road classifications, service standards, storm tracking and responses as well as performance management. The report provided an overview of existing practices, analyzed opportunities to create efficiencies and improve service delivery, review best practices utilized in Ontario as well as to make recommendations for the delivery of winter control services. One of the key recommendations contained within the BMA report was the need for the City to develop a SMP. In response to this recommendation, the City retained Conestoga-Rovers & Associates to develop its first SMP in September 2005. Since that time, City staff have arranged to have the SMP updated periodically with the latest update completed in 2016 (see Appendix A for a copy of the latest SMP).

The main goal of the SMP was to optimize the use of salt without compromising road safety. As noted in the latest version of the plan "the SMP sets out a policy and procedural framework to ensure the City of Greater Sudbury's (City's) Roads Operations Section (Roads Operations) continuously improves the effective delivery of winter maintenance services and the management of road salt used in winter maintenance operations, as outlined in Environment Canada's Code of Practice for the Environmental Management of Road Salts (April 2004)". The SMP is meant to be a dynamic document that allows staff to evaluate and implement new approaches and technologies in winter maintenance activities in a fiscally responsible manner.

The SMP contains the following key principles:

- Periodic review and analysis of industry practices;
- Implementation and documentation of the SMP;
- Education and training of staff;
- Monitoring and analysis;
- Management review;
- Environmental review; and
- Practices and policy revision.

The principle objective of the SMP is summarized in the following policy statement; "The City of Greater Sudbury will take the actions necessary to provide effective winter maintenance to ensure the safety of road users in keeping with applicable legislation and accepted standards while striving to minimize adverse impacts to the environment. Road Operations will meet these commitments by:

- Adhering to the procedures contained within the SMP;
- Complying with applicable laws and regulations;
- Reviewing and upgrading the SMP periodically and incorporating new technology and development as appropriate;
- Committing to ongoing winter maintenance staff training and education; and
- Monitoring on an annual basis, the present conditions of the winter maintenance program, as well as the effectiveness of the SMP".

On June 30th, 2005 BMA Management Consultants made a presentation to Council outlining their findings. Subsequent to their presentation, resolution 2005-284 was approved by Council and reads as follows:

"**THAT** the BMA Internal Audit Winter Maintenance Report be adopted in principle;
AND THAT the report be made public and posted to the City's website;
AND THAT an implementation plan be developed by the General Manager of Infrastructure and Emergency Services."

The most significant developments in our current winter control policy occurred in 2007 when Council resolved to adopt the SMP and implement a number of service changes that were recommended, most notably;

- Increasing the design plow times on class 4 to 6 roadways from 8-12 hours to 24 hours;
- Reduction of one shift on arterial and collector salt routes (class 1 to 3) and the reintroduction of first 8 in 24 (employees are required to report to their first 8 hour shift at any time during the 24 hour period, Monday to Friday) reporting for City Employees which would split into 2 shifts for storm response to provide 24 hour coverage; and
- Changing a number of roads currently treated with salt to roads treated with sand.

Since 2007, staff has initiated many operational changes following the principles of continuous improvement as identified in the SMP, including;

- Staff training;
- Periodic review/revisions to the SMP;
- Use of automatic spreader controllers;
- Calibration of equipment (see table 2 and 3 for City/MTO application rates);
- Installation of onboard brine systems;
- Pre-wetting salt;
- Direct liquid application;

- Pavement and air temperature sensors;
- Value added meteorological services (VAMS, see table 4 for an example) and Road weather information systems (RWIS);
- Use of GPS and AVL technology; and
- Snow removal, disposal and management of snow dumps.

In 2015, the City adopted the Source Water Protection Plan which was subsequently signed by the Ministry of Environment and Climate Change (MOECC). Since completion, City staff has implemented and/or is working on the following items;

- Improved monitoring of road salting activities;
- Improve signage in the Source Water Protection areas; and
- Reviewed salt/sand storage and handling at the various CGS depot operations.

In 2017, CGS commissioned a Risk Management Plan (RMP) for the Frobisher Facility and a Salt Optimization Plan (SOP). Copies of each of these plans can be found in Appendix B and C respectively, of this report. The RMP for the Frobisher Facility suggested that there were two measures available to the CGS to manage the significant threat of road salt storage within the Ramsey Lake intake protection zone. They include;

- "Maintain Site operations and implement Best Management Practices (BMPs) with monitoring to evaluate the effectiveness of BMPs;
- Maintain Site operations and implement Best Management Practices (BMPs) with monitoring to evaluate the effectiveness of BMPs. Relocate the winter maintenance material storage to a new site, located outside of any area where road salt storage and handling is deemed a significant threat, preferably within an area of low salt vulnerability as identified in the CGS Salt Optimization Plan."

The RMP for the Frobisher Facility concluded "that considering the additional costs associated with relocating the depot, in association with the benefits provided by the low-lying down gradient swamp which provides salt attenuation and a buffer from salt travel, redeveloping the existing Site using BMPs (i.e., build a dome for the pickled sand, install a monitoring network) would be the most economical and practical option."

The SOP on the other hand has been commissioned to assess the potential risk/vulnerability to environmental receptors with the application of road salt with the CGS road network. To establish the plan, our Consultant compiled data contained from the following data sources;

- Source water protection (SWP);
- Wellhead protection areas (WHPAs);
- Intake protection zones (IPZs);
- Highly vulnerable aquifers
- Significant/sensitive groundwater recharge areas;
- Lake trout and fish spawning areas; and
- Wetlands, and provincially tracked species sensitive to salt application.

By combining and weighing each environmental receptor/vulnerable area cumulatively, areas and roadways within the CGS can be rated as low to high receptor risk related to salt exposure. Based on the identification of the salt vulnerable areas and their intersection with roadways, recommendations are provided to minimize the impact of salt onto these environmental receptors and provide direction to the CGS Road Operations staff and SWP Group (Working Group) to maintain a safe road network while protecting the environment. CGS has developed this SOP in an effort to remain proactive with its SMP initiatives and as a requirement of the MOECC.

The SMP considers best practices for road salting as developed by the Transportation Association of Canada's (TAC) Salt Management Guide. Within the guide TAC has studied alternative products and supports the use of road salt. Other products studied by TAC include (see appendix D for details);

- Calcium Chloride
- Potassium Chloride
- Magnesium Chloride
- Calcium Magnesium Acetate
- Potasium Acetate
- Sodium Acetate
- Urea
- Glycols
- Methanol
- Sodium Formate
- Organic Compounds (sugar by-products)

Alternatives to road salt are generally prohibitively expensive, not appropriate for use on public roadways, unproven in a large scale operation and in many instances an alternative form of salt.

Another recommendation contained within the SMP suggests City staff should participate in a user group of Municipal operators to identify trends in the industry and compare practices of other Municipalities to ensure that practices utilized by the City closely mimic practices used by other Municipalities. Up until recently, the City maintained active membership in the Ontario Road Salt Management Group (ORSMG) which was sponsored by the Ontario Good Roads Association (OGRA). Unfortunately the ORSMG disbanded last summer but was quickly replaced by another group whose mandate will include bringing together various Municipalities/agencies from across Ontario to continue the discussion on winter maintenance and other road activities. The second meeting of the new group is scheduled for this month and City staff will be participating.

Finally, CGS is currently undertaking a study of a number of watersheds across the City. The main purpose of the study is to establish an implementation plan for storm water best management practices. Based on the principles of the SMP, Roads Operations staff will need to consider the recommendations of the sub-watershed plan when performing winter maintenance activities.

Conclusion

As noted earlier in this report, the CGS has adopted a SMP which sets out a policy and procedural framework to ensure the City of Greater Sudbury's (City's) Roads Operations Section (Roads Operations) continuously improves the effective delivery of winter maintenance services and the management of road salt used in winter maintenance operations. The priority areas for continuous improvement identified in the most recent version of the SMP (2016) and RMP for the Frobisher Facility recommends that the CGS take steps to improve salt storage and handling at its existing sites. Over the coming months, staff will be presenting alternatives and recommendations to Council to address Infrastructure facility needs which includes the construction of new sand/salt handling facilities.

Tables

Table 1 Comparison of Chemical Deicers in use at various Municipalities/Agencies
Table 2 City of Greater Sudbury Salt/Sand Application Rates
Table 3 Ministry of Transportation Salt Application Rates
Table 4 Value Added Meteorological Report (VAMS)

Table 1 - Use of deicers/winter sand on Roadways

Municipality/Agency	Do you use a chemical deicer to maintain your roadways? (1) (all/some/none)	Type of Deicer?	Do you use winter sand to maintain your roadways? (all/some/none)	Do you pre-wet your roadway deicer? (Yes/No)	Pre-wetting solution?	Do you perform a Direct Liquid Application (DLA) to your roadways? (Yes/No)	DLA Solution?
CGS	some	sodium chloride	some	Y	salt brine	Y	salt brine
City of Timmins	some	sodium chloride	some	N	n/a	N	n/a
City of Sault Ste. Marie	some	sodium chloride	some	N	n/a	N	n/a
City of North Bay	some	sodium chloride	some	Y	calcium chloride	Y	calcium chloride
City of Thunder Bay	some	sodium chloride	some	Y	calcium chloride	N	n/a
Region of Peel	All (only responsible for arterials)	sodium chloride	none	Y	salt brine or mag. chloride	Y	salt brine or mag. chloride
Region of York	all	sodium chloride	some	Y	salt brine	Y	salt brine
Region of Niagara	all	sodium chloride mag. chloride (pilot)	all (in colder temps)	Y	salt brine	Y	salt brine
City of Hamilton	some (85%)	sodium chloride	some	Y	sugar-beet juice product	Y	salt brine
City of Barrie	some	sodium chloride and treated salt	some	Y	salt brine and "Magic-0"	Y	salt brine
Ministry of Transportation	all	sodium chloride	some	Y	salt brine, mag. chloride or calcium chloride (depending on climate)	Y	salt brine, mag. chloride or calcium chloride (depending on climate)
Greater Toronto Airport Authority	all	sodium chloride or "Mountain Melt Deicer" (on terminal roofs only)	none	Y	salt brine	Y	salt brine
City of Mississauga	all	Mag. chloride treated salt	none	N planning to next year	salt brine when implemented	Y	salt brine

Note: (1) The use of chemical deicers is based on the assumption that the weather (air temperature) is conducive to their use.

Table 2 – CGS Salt/Sand Application Rates

Storm Response Guide							
Current Temperature	Current Pavement Condition	Current Precipitation	Possible Action	Salt/Sand Application Rates			
				Class 1 to 3 Roads			Class 4 to 6 Roads
				Brine (Litres)	Salt (Kg/2-Lane KM)	Sand (Kg/2-Lane KM)	Sand
0'C and above	Wet	Snow	Plow and Sand or Salt	65	60 to 90	Nil*	100 to 310
		Freezing Rain	Sand and Salt	65	150	Nil*	310
-4'C to 0'C	Wet	Snow	Plow and Sand or Salt	65	90 to 115	Nil*	100 to 310
		Freezing Rain	Sand and Salt	65	150	Nil*	310
-12'C to -4'C	Snow Packed	Nil	Plow and Salt	65	115 to 150	Nil*	Nil*
	Snow Packed	Snow	Plow and Sand or Salt	65	150	Nil*	100 to 310
	Dry	Snow	Plow and Sand or Salt	65	150	Nil*	200 to 310
Below -12'C	Snow Packed	Nil	Plow and Sand	Nil	Nil	200 to 310	200 to 310
	Dry	Snow	Plow and Sand	Nil	Nil	200 to 310	200 to 310

* Section Manager or designate may change protocol at their discretion based on actual road and weather conditions

Table 3 – MTO Salt Application Rates

Precipitation	Road Surface Temperature Range (°C)		
	Warmer than -5	-5 to –10	-10 to -18
Frost	50	70	70
Light Snow	70	100	130
Heavy Snow	130	130	170
Freezing Rain	130	170	170

Table 4 – Value Added Meteorological Report (VAMS)

MeteoGroup Weather Services Canada Precipitation Forecast for Sudbury

MeteoGroup

Issued at Sat, Apr 28, 2018 07:00 EDT

NO ENVIRONMENT CANADA WARNINGS IN EFFECT FOR GREATER SUDBURY AND VICINITY AT TIME OF ISSUE

SATURDAY Blowing snow during the day, probability of precipitation 90%. Winds northerly 25km/h. Cloudy with flurries ending in the evening, clear overnight, probability of precipitation 50%. Winds northerly 20km/h.
SUNDAY Sunny during the day. Winds northwesterly 20km/h. Clear during the night. Winds light.

Day	Sat, Apr 28 2018																								Sun, Apr 29 2018																								Mon					
Period	Morning						Afternoon						Evening						Overnight						Morning						Afternoon						Evening						Overnight					
Local Time [24hr]	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5
Snow																																																				
Flurries	X	X	X	X			X	X	X		X	X	X																																								
Blowing snow																																																				
Sky Condition	MAINLY CLOUDY									CLOUDY															SUNNY																								SUNNY					
Sunshine (% period)	10									0															100																								20					
Local Time [24hr]	6 - 9				9 - 12				12 - 15				15 - 18				18 - 21				21 - 0				0 - 3				3 - 6				6 - 9				9 - 12				12 - 15				15 - 18				18 - 21				21 - 0				0 - 3				3 - 6			
Snowfall (cm)	0.9				0.3				0.7				0.1				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0			
POP (%)	90				80				90				80				50				30				20				20				20				10				10				10				10				10				0				0			
Air Temperature (°C)	-4				-4				-2				0				1				-1				-3				-6				-7				-2				4				9				9				6				3				1			
Dew Point (°C)	-5				-7				-7				-7				-7				-8				-9				-10				-10				-11				-9				-8				-8				-5				-4				-4			
Relative Humidity(%)	90				83				70				60				56				59				67				74				80				51				36				30				31				46				59				68			
Wind Direction (8-pt)	N				N				N				N				N				N				N				N				NW				NW				NW				NW				W				W				W				W			
Wind Speed (km/h)	26				28				28				26				22				19				19				19				19				19				19				19				17				11				11				9			
Wind Gusts (km/h)	49				53				53				51				47				38				35				36				35				36				36				36				34																			
Wind Chill (*)	-11				-12				-9				-6				-5				-7				-9				-12				-14				-7				0												3				0				-2			

Day	Mon, Apr 30 2018																								Tues, May 01 2018																								Wed					
Period	Morning						Afternoon						Evening						Overnight						Morning						Afternoon						Evening						Overnight					
Local Time [24hr]	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5
Showers																																																			X
Snow																																																			
Flurries																																																			
Sky Condition	SUNNY									SUNNY															VARIABLY CLOUDY																								CLOUDY					
Sunshine (% period)	100									20															50																								10					
Local Time [24hr]	6 - 9				9 - 12				12 - 15				15 - 18				18 - 21				21 - 0				0 - 3				3 - 6				6 - 9				9 - 12				12 - 15				15 - 18				18 - 21				21 - 0				0 - 3				3 - 6			
Rainfall (mm)	0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.2			
Snowfall (cm)	0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0				0.0			
POP (%)	10				10				0				10				20				20				10				20				20				20				20				20				20				20				20				30			
Air Temperature (°C)	2				8				13				15				13				9				6				5				6				12				15				16				15				13				12				12			
Dew Point (°C)	-4				-2				-2				-1				0				1				2				3				4				6				7				7				7				8				8				8			
Relative Humidity(%)	67				49				37				35				40				57				73				82				83				67				58				55				59				71				75				78			
Wind Direction (8-pt)	W				SW				S				S				S				S				S				S				S				S				S				S				S				S				S				S			
Wind Speed (km/h)	9				11				15				19				19				13				11				11				11				15				19				22				20				19				19				19			
Wind Gusts (km/h)									30				37				37				31																30				38				41				40				35				35				35			
Wind Chill (*)	-1																						3																																									

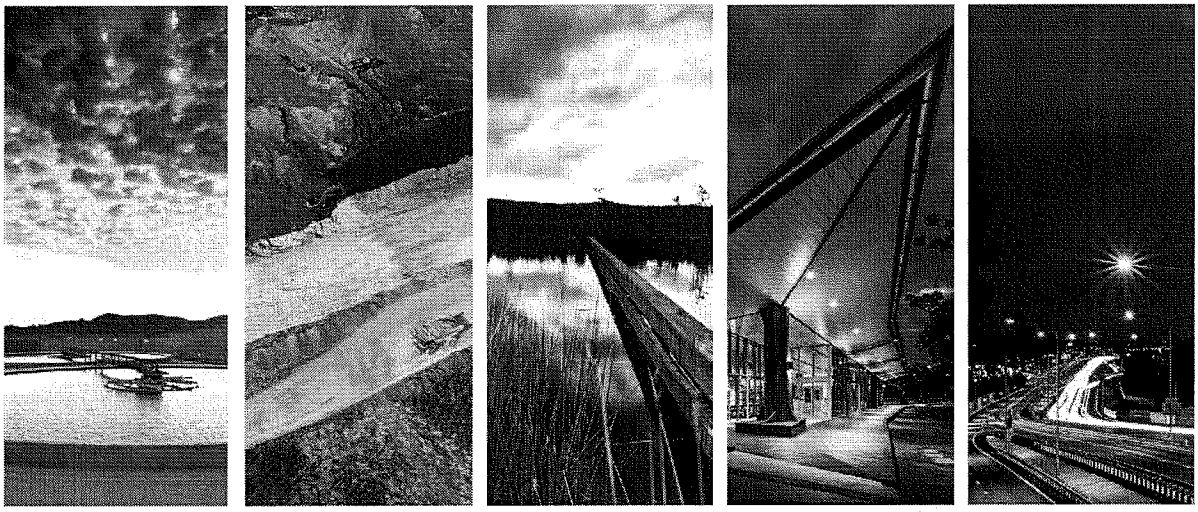
MONDAY Sunny during the day. Winds light. Clear during the night. Winds light. High 15, Low 5.
TUESDAY Variably cloudy during the day. Winds southerly 15km/h becoming 20km/h. Variably cloudy in the evening with showers developing overnight. Winds southerly 20km/h. High 16, overnight Low 12.
WEDNESDAY Cloudy with light rain during the day, probability of precipitation 80%. Winds southerly 20km/h becoming southwesterly 25km/h. Mainly cloudy during the night, probability of precipitation 40%. Winds light. High 16, Low 7.
THURSDAY Cloudy with light rain during the day, probability of precipitation 80%. Winds light. Cloudy with light rain during the night, probability of precipitation 80%. Winds light. High 10, overnight Low 6.
FRIDAY Cloudy with light rain during the day, probability of precipitation 70%. Winds northerly 15km/h shifting to westerly 20km/h. Variably cloudy in the evening, becoming mainly clear overnight, probability of precipitation 40%. Winds westerly 20km/h becoming 15km/h. High 12, Low 4.

36 Hour Pavement Forecast

-2C	-1C	-1C	0C	1C	2C	2C	3C	4C	4C	4C	4C	3C	2C	2C	1C	1C	0C	-1C	-2C	-2C	-3C	-4C	-4C	-4C	-3C	0C	4C	7C	10C	12C	14C	15C	15C	14C
07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Sat 28 Apr																		Sun 29 Apr																	

Icing rain (i.e. freezing rain) | Ice/Snow on the road | Frost/Black Ice | Water/Snow on the road | Melting Snow | Wet road | Damp/Dew | Dry road | Error

Forecast provided by MeteoGroup Weather Services Canada Inc. © 2018



2016 Salt Management Plan

City of Greater Sudbury

GHD | 96 White Oak Drive Sault Ste. Marie Ontario P6B 4J8 Canada

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WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

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1. Purpose of this Document

This Salt Management Plan (SMP) sets out a policy and procedural framework to ensure the City of Greater Sudbury's (City's) Road Operations Section (Road Operations) continuously improves the effective delivery of winter maintenance services and the management of road salt used in winter maintenance operations, as outlined in Environment Canada's *"Code of Practice for the Environmental Management of Road Salts"* (April 2004) (Code of Practice).

Wintertime conditions can adversely impact public safety, limit road usage, increase travel time, and increase economic costs. By following the objectives stated in Environment Canada's Code of Practice, Road Operations works to ensure environmental protection while maintaining public safety during adverse road conditions. With proper monitoring and reporting, the recommendations made within the Code of Practice will result in improved safety and benefits to the environment, as well as potential benefits to Road Operations including improved efficiency and material usage savings.

This SMP also follows the Transportation Association of Canada's, Syntheses of Best Practices for Road Salt Management. Additional recommendations follow the Ministry of Transportation's (MTO's) Maintenance Manual for highway maintenance operations.

The SMP is meant to be dynamic allowing the municipality to evaluate and phase-in any changes, new approaches, and technologies in winter maintenance activities in a fiscally sound manner. At the same time, any modifications to municipal winter maintenance activities must ensure that roadway safety is not compromised. The following principals will be used for the continual improvement of the SMP:

- Periodic Review and Analysis of Industry Practices and Academic Research
- Implementation and Documentation of the SMP
- Education and Training of Staff
- Monitoring and Analysis
- Management Review
- Environmental Review
- Practices and Policy Revision

Managers are encouraged to negotiate adoption of the policies and procedures in the SMP to build a consensus with other parties involved in snow and ice control activities.

1.1 Salt Management - Objective

Road Operations is committed to continuously improving winter maintenance operations in a cost effective manner while ensuring public safety. This dynamic approach will allow Road Operations to optimize the use of winter maintenance materials containing chlorides on municipal roads while striving to minimize negative impacts to the environment. Road Operations staff will strive to provide safe winter road conditions for vehicular and pedestrian traffic as set out in the level of service

policy and within the resources established by City Council. Any deficiencies noted in current operations will be identified and corrective actions established.

1.2 Policy Statement

The City of Greater Sudbury will take the actions necessary to provide effective winter maintenance to ensure the safety of road users in keeping with applicable legislation and accepted standards while striving to minimize adverse impacts to the environment. Road Operations will meet these commitments by:

- Adhering to the procedures contained within the SMP
- Complying with applicable laws and regulations
- Reviewing and upgrading the SMP periodically and incorporating new technologies and developments as appropriate
- Committing to ongoing winter maintenance staff training and education
- Monitoring on an annual basis, the present conditions of the winter maintenance program, as well as the effectiveness of the SMP

2. Description of the Winter Maintenance Program

Road Operations is the authority responsible for maintaining the City's road system and sidewalks including conducting winter maintenance activities. The City is divided into five sections comprising the South, Southeast, Southwest, Northeast, and Northwest sections (see Figure 1). Each section has a designated central operations depot through which the section is managed. With the exception of the South and Southeast sections, each section also has additional, strategically-located, satellite depots where salt and/or sand stockpiles are maintained. The Southeast central operations depot, located at 1800 Frobisher Street, is also Road Operations' central headquarters (HQ) for the entire City. Each section also has one or more snow storage sites. The various winter maintenance depots and snow storage sites are shown on Figure 2. Details regarding the winter maintenance depots and snow storage sites are listed on Tables 1 and 2 respectively.

Winter conditions in Sudbury require plowing snow removal from roads and sidewalks. Road Operations uses road salting and sanding techniques, including pre-wetting the salt with a salt brine solution, to maintain a standard of safety on roads and walkways during the winter season, providing Sudbury's residents and visitors with safe, convenient, and affordable access to work, leisure, and other services.

The major winter maintenance activities conducted within the City of Greater Sudbury are as follows:

- Snow plowing
- Salt and sand spreading
- Salt and sand storage

- Snow removal and storage
- Sidewalk plowing and de-icing

Road Operations is responsible for conducting winter maintenance on roadways, sidewalks and bridges including the following:

Paved roads	2,448.2 lane kilometers (km)
Surface treated roads	621.7 lane km
Unpaved roads	625.9 lane km
Sidewalks	325 km maintained of a total of 440 km
Bridge Decks	55

The City's roadways are classified according to Ontario Regulation (O. Reg.) 239/02 *"Minimum Maintenance Standard"*, Municipal Act, 2001. Road classification (Class 1, 2, 3, 4, 5 and 6) is determined based on the posted/regulated speed limit and the annual average daily traffic (AADT).

Predetermined routes for plowing, sanding, and salting are followed. Salt and sand route maps and details are available at each section's central operations depot. The City's road inventory is included in Appendix A. City plowing/salting routes are provided on the City's website[1].

2.1 Level of Service Policy

Road Operations establishes a Level of Service (LOS) Policy for each road classification based on the requirements of O. Reg. 239/02 and direction from City Council. The LOS Policy defines winter storm response triggers and response times for corresponding winter maintenance activities. Changes to the LOS are reviewed and approved by City Council by resolution and are implemented by Road Operations.

The LOS policy currently meets or exceeds the Minimum Maintenance Standards (MMS) for snow accumulation and icy roads, as specified in O. Reg. 239/02. The City's LOS policy is summarized on Table 3. A comparison of the City's LOS with that of other northern municipalities is provided on Table 4.

2.2 Winter Patrol

The City's winter maintenance season commences on November 1st and is completed on April 30th. Road Operations winter maintenance program operates 24 hours a day, 7 days a week throughout the winter maintenance season. Winter Patrol and City's contract staff consists of the following operators: snowplows, snow loaders, salt/sand trucks, 4x4 plows, graders, sidewalk plows, anti-icers, as well as Forepersons (patrollers).

Road Forepersons work one 12-hour shift per day from 12:00 am to 12:00 pm plus overtime, as required on weekdays. On weekends, they are on 24-hour instantaneous call-out. All other winter service person personnel are also on 24-hour instantaneous call-out.

1 http://www.greatersudbury.ca/living/roads/winter-maintenance/salt-routes/

The Foreperson is responsible for mobilizing winter maintenance operators to ensure that roads are cleared in a timely fashion and remain in compliance with established service standards. The Forepersons are familiar with local conditions in their patrol area, and complete a "Road Patrol Record" during each shift. Summer and winter Road Patrol Record forms are provided in Appendix B.

The City's By-Law Department supports Road Operations winter patrol activities through vehicle ticketing and towing where operators report that vehicles block winter control operations.

2.3 Staffing and Hours of Work

Road Operations assigns an employee to each vehicle used for winter operations. Each vehicle is assigned a route for sanding/salting and/or plowing.

Road Operations adheres to the hours of work as set out in the Highway Traffic Act, O. Reg. 4/93 and the Employment Standards Act (ESA). When a driver has completed the standard eight hours of driving time, they are either spelled off by the next incoming employee or can remain to work overtime. Multi-function operators work on set shifts of midnight ("Shift A") and noon ("Shift B") during weekdays. All other winter control personnel commence work at 8:00am or on a first eight in twenty-four basis.

2.4 Winter Materials Used Annually

The Road Operations' winter maintenance program uses directly applied salt, as well as pickled sand (sand mixed with salt) for snow and ice control purposes. Pre-wetting of salt with a brine solution is also utilized. Direct liquid application (DLA) is used on bridge decks.

Current practice for application of road salt is dependent on temperature, upcoming weather conditions, and the amount of snow on the road. Sand is applied to City streets according to the same priority order as salt, in accordance with the LOS Policy. Road Operations' Storm Response Guide included on Table 5 includes general application rules. Sidewalks, which have been plowed, are sanded as necessary to maintain safe pedestrian walkways.

2.4.1 Salt

Based on 13 years of data (2003 to 2015), Road Operations uses an average of 19,876 tonnes of bulk coarse highway salt (NaCl) per season. Salt is delivered to the various depots, where it is placed into storage sheds or domes on impermeable floors. Annual salt usage records for the past 13 winter seasons are shown on Table 6, broken down by section.

Salt is applied to Class 1 to 3 roadways within the City in priority order in accordance with the LOS Policy. Pickled sand, rather than salt is applied to Class 4 to 6 roadways.

2.4.2 Pickled Sand

A mixture of sand and salt is used on roadways to improve traction. Sand is mixed with salt at a rate of five percent salt by volume to prevent the sand from freezing. Based on 11 years of data (2005 to

2015), Road Operations uses an average of 55,856 tonnes of sand per season. Annual sand usage records for the past 11 winter seasons are shown on Table 7, broken down by section.

Currently, all pickled sand is stored outside, uncovered at various depots throughout the City's five sections. This creates an ongoing concern regarding the potential for salt to leach from the sand during the course of the year.

2.4.3 Brine

Each section's central operating depot has a brine-making machine except for the Southwest section for which brine is produced at the Naughton depot where the salt is stored. The average brine concentration is 23 percent NaCl by weight. The brine is mixed in tanks and pumped into spreading equipment to pre-wet the salt during or just prior to application.

2.5 Equipment - Winter Maintenance Fleet

Road Operations maintains a variety of equipment including plows, spreaders, and combination units. All plows and new spreaders are equipped with ground speed electronic spreading controls. As discussed in the Section 2.4.3 (Brine), Road Operations' winter maintenance program currently uses salt pre-wetting with brine.

Road Operations conducts spreader calibration, annually prior to the winter season and before any new equipment is put into service, to determine the salt application rate.

The current winter maintenance fleet breakdown is as follows:

Equipment	Current Percentage of Overall Fleet
Electronic spreader controllers	90%
Pre-wetting equipment	60%
Direct liquid application	1%
Infrared thermometers	100%
GPS	100%
Other (Sidewalk plows with spreaders)	50 %

2.6 Operations Facilities

As previously discussed in Section 2.0 (Description of the Winter Maintenance Program), Road Operations maintains five sections within the City. Each section has a central operation depot where the following operations are conducted:

- Salt and sand storage
- Brine manufacturing (except at the Southwest section depot)
- Administrative functions
- Vehicle and equipment storage, maintenance and repair

With the exception of the South and Southeast sections, each section also has an additional satellite depot(s) strategically located within the section. Operations conducted at the satellite depots include salt and/or sand storage. Several depots also have snow dump areas, which are further discussed in Section 2.7.

Road Operations currently operates nine (9) active winter maintenance depots, which includes five (5) central operations depots and the main HQ, located at 1800 Frobisher Street, in the Southeast section. The depot locations are shown on Figure 2 and listed on Table 1. Figures 3.1 to 3.9 show the site layout of each active winter maintenance depot.

2.7 Snow Removal and Disposal

Street and sidewalk plowing operations create piles of snow, which accumulate along the sides of roadways. Snow banks are cut back and removed on an as-needed basis, when their size poses a sight line hazard to pedestrians and motorists at road intersections or threatens to impede traffic by encroaching into roadways.

Snow removed from roadways and sidewalks is deposited in various designated snow storage areas located throughout the City. Road Operations currently operates and maintains five snow storage sites, shown on Figure 2 and listed on Table 2. Figures 4.1 to 4.5 show the site layout of each active snow disposal site.

In selecting a site to establish a snow dump, Road Operations attempts to find locations that are centrally located within the service area, easily accessible, and separated from residential areas and from potentially vulnerable areas including watercourses.

The City's main snow dump site, located in the South Section on the east side of LaSalle Boulevard north of Nolin Creek, is used to dispose of snow removed from City streets and sidewalks as well as for snow removed from parking lots by private contractors. The site is secured with a key-card operated gate to prevent illegal dumping and is leased from the property owner.

Snow dump maintenance includes spring inspection and cleanup. Following snow melt, litter, debris and any other wastes are collected from all snow dump sites for appropriate disposal at a license landfill site. Road Operations does not currently conduct soil, surface or groundwater monitoring programs at any of the snow dump sites.

2.8 Weather Monitoring

Given the City's extensive land coverage and diverse topography, it is often affected by a variety of changing weather patterns. To obtain the most accurate weather descriptions/predictions, Road Operations relies on a number of resources including online RADAR imagery provided by

Environment Canada (http://weatheroffice.ec.gc.ca). Forepersons monitor weather forecasts provided by MeteoGroup weather forecasting service three times daily.

Road Operations supplements road patrol information with observations from municipal staff and customized weather forecasts (updated three times/day from the MeteoGroup) to determine an effective winter storm response and allocation of resources. Staff also monitors pavement temperatures by means of on-board infrared thermometers, which are mounted on the road patrol and supervisor trucks. Road Operations uses a Vaisala Road Weather Advisor, a Road Weather Information System (RWIS) installed on Municipal Road 8 in Levak to monitor and track air and pavement temperature and moisture, etc. Road Operations also has access to MTO's RWIS data and pavement temperature forecasts for the provincial highways located in various areas within the municipality. Historical weather data for the City can be obtained at the Southeast (Frobisher) section's central operating depot.

There are many ways for a municipality and its staff to receive notice that a winter storm event has commenced. In order to meet the requirements for Minimum Maintenance Standards, response is required (upon receipt by a member of staff, council, or the public). After becoming aware of a storm event, the personnel receiving notice immediately informs the public works supervisor (and/or patroller) and an appropriate response is initiated.

2.9 Communications

All winter maintenance vehicles are equipped with two-way communications (radios, cell, etc.). For all of the five sections, Road Operations HQ (311) serves as a hub for in/outgoing calls from staff, emergency services, and the general public during business hours. Outside of business hours, Northern Communication provides contact and answering services.

City Police inform Road Operations of any traffic accidents that may have been created by road conditions and City Transit informs Road Operations of areas of concern that could affect transit service. Calls are also received from other City staff as well as: school bus operators, and the public. This type of communication is typically logged into the City's (Active Citizen Requests) ACR system. ACRs are categorized by type (i.e. slippery/icy road, sidewalks, or stairs; plowing required on roads, sidewalks, stairs or cul-de-sacs; and snow banks blocking sight lines) and by year. Road Operations tracks the number of ACRs received in order to manage complaints, inquiries and questions about Road Operations Services.

Road Operations has taken a pro-active position with regard to winter maintenance rather than a reactive one. Road Operations operates a Traffic Studio, an automated, GPS-assisted storm response monitoring system. The Traffic Studio application monitors the progress of winter maintenance during a storm and displays results to supervisory staff. Traffic Studio is operational when there are eight or more centimeters of snow accumulation, or if there is an ice event. Traffic Studio was implemented fully during the 2015/2016 winter season.

Communications regarding the policies and procedures included in the SMP are relayed to Road Operations staff through annual mandatory training programs.

External communication with the general public ranges from media press releases to information posted on the City's web site regarding winter maintenance services and salt management practices. Individual inquiries are also addressed.

2.10 Training

Prior to the winter season, which commences on November 1, staff meet to discuss the strategy for winter maintenance, assign the spreading/plow responsibilities, and to review the safety issues.

A Road Operations staff member and/or external agency (such as OGRA) acts as training coordinator for the department. Winter control training includes video and power point presentations, as well as, hands-on instruction in operating the various types of winter maintenance equipment. Multi plow truck, grader, and loader truck operators receive a minimum of forty hours of practical, hands on field instruction and evaluation regarding the rules and regulations for operating winter maintenance equipment, health and safety considerations, and equipment operation. Management staff has received MTO RWIS training.

Monthly health and safety training is provided for all staff as per safety-related topics covered by the Occupational Health and Safety Act. Minimum required health and safety training requirements includes: WHMIS; cold stress; safe driving; 3-point contact; overhead wires; personal protective equipment; slips, trips, and falls; and workplace harassment.

Other training materials will be added and/or deleted as they become available and/or obsolete.

2.11 Record Keeping

Record keeping is important to evaluate the effectiveness of the SMP. Records produced as part of the SMP include:

- Training records
- Operator logs
    - Crew cards documenting operator daily activities such as hours worked, route taken, vehicle used, quantities of materials used, and details of work performed
    - Patrol records documenting the weather and road/sidewalk conditions and the type of winter event (e.g. drifting snow, ice covered, frost, slush) as well as details regarding any accidents that may have been noted.
- Electronic controller data
- Snow dump usage data
- Salt purchasing records
- Stockpile issue records documenting what type and how much materials was loaded onto a particular truck at a specific time
- Complaints received (Annual Complaints Reporting)
- Weather trends, historical data

- Calibration reports for winter maintenance vehicles and equipment
- Documentation of any corrective actions taken
- Structural inspection reports for salt domes/storage facilities

Road Operations maintains up-to-date records of training provided to staff. These include any certifications and course descriptions needed to maintain a record of each worker's competency. The records include the date, time, duration and subject of the training, as well as the source of the training and trainers. Records are maintained summarizing the percentage of staff trained in salt management at each level of the organization.

Road Operations winter maintenance staff complete operator logs detailing the date, shift, truck number, and the amount of salt and/or sand used on a particular route. Road Operations personnel track salt purchases to determine bulk usage.

With the use of infrared pavement thermometers, pavement temperature trends are recorded in daily logs, along with pavement conditions, weather conditions and winter treatment strategy. Road Operations also records storm statistics including the date and type of winter event encountered (i.e., local storm, minor storm, major storm). The RWIS also track and record weather information as well as pavement conditions.

3. Continuous Improvement Practices and Strategies

The current winter maintenance policies and practices form the baseline or benchmark upon which improvements can be made to manage the use of road salt more effectively and in turn its impact on the environment.

Beneficial improvement options and recommendations for upgrading salt management practices and strategies from year to year are assessed on the following:

- level of service policy
- equipment upgrading
- equipment calibration
- equipment washing
- material delivery, storage and handling
- record of material usage
- salt pre-treatment alternatives
- weather and pavement temperature forecasting
- storm response
- winter patrol
- training
- snow removal and disposal

- emergency response procedures (plan in place) training
- technical review of existing and new technology for Environmentally Sensitive/Vulnerable Areas
- communication strategy
- anti-icing and alternative anti-icing solutions (direct liquid application)

SMP summary table showing the current status for each of the above listed practices along with their recommendation is provided in Appendix C. The recommendations are made in accordance with the Ontario Good Roads Association (OGRA) SMP template and will assist with further developing Road Operations' winter maintenance policies, practices, and procedures. Road Operations has already implemented partially or fully (partially or fully) some of these recommendations.

4. Monitoring and Updating

An annual review of the SMP by management and staff will occur at the end of each winter season. As a result of this review, the SMP will be updated periodically to include any changes in department policy, strategies, and new techniques or equipment to be used in the upcoming winter season.

Tracking specific indicators and comparing these to the baseline that was benchmarked at the outset of the program will confirm progress of the implementation and effectiveness of the SMP. Any change from the established baseline needs to be analyzed to assess the degree of progress made. Monitoring should also take into account the type of winter experienced (winter severity index) to ensure that realistic conclusions are being drawn. Areas of monitoring should include the following:

- Annual Reports
- Salt Management Plans
- Road Operations Salt Storage Facilities
- Training
- Salt Management
- Vegetation Management
- Environmentally sensitive/vulnerable areas
- Surface Water Management

The following excerpt from the Transportation Association of Canada's (TAC's) Synthesis of Best Practices for Road Salt Management explains the need for monitoring and updating equipment and technology, training, and record keeping.

To optimize salt use, it is important to look continually at new and innovative technology as it becomes available. Some salt use "optimization factors" to consider when making equipment choices include:

- *Improved information and decision making tools will allow equipment, personnel and salt to be better utilized and salt applications better timed*
- *Efficient mechanical control of snow and ice will minimize the amount of snow and ice to be controlled by chemicals*
- *Proper equipment choices will help operators to place the exact amount of salt required at the precise location where it is needed, at the right time*
- *Chemical applications should occur at a time that prevents bonding of snow or ice to the surface*
- *Keeping good records of snow and ice control actions taken, along with material usage and a record of changing road conditions, will improve planning and budgeting and limit an organization's liability*
- *The safe and effective use of any equipment requires operators to be properly trained; this is particularly important when introducing new equipment and techniques*

4.1 Annual Reports

In accordance with Environment Canada's Code of Practice, a Monitoring and Measuring Progress report should be compiled and submitted to Environment Canada by June 30 each year (following the winter season).

Road Operations has submitted a report to Environment Canada on an annual basis since the adoption of the Code of Practice for the Environmental Management of Road Salts in 2005. It is recommended that Road Operations continue to submit annual reports as required under the Code of Practice.

4.2 Salt Management Plans

Road Operations contracted GHD to develop the first salt management plan in 2005 and has updated the SMP on a three-year cycle since that time. It is recommended that Road Operations continue to update the SMP on a regular schedule.

4.3 Road Operations Salt Storage Facilities

All road salts managed by Road Operations are stored under cover on impermeable surfaces. Pickled sand, however, is stored outdoors in uncovered piles. Housekeeping practices employed by Road Operations include sweeping up tracked salt. Road Operations does not have any runoff collection systems or a formal plan for managing salt-impacted drainage. Road Operations contracts with a structural specialist to conduct inspections of salt storage facilities as required.

It is recommended that Road Operations conduct regular inspections of all salt storage facilities, including structural integrity of the salt domes and storage sheds, the integrity of the paved pads

beneath and in front of salt storage structures, the amount of salt staining/tracking in front of the salt storage structures, and the integrity of brine storage tanks. It is recommended that, where possible, sand mixed with salt be stored under cover and that Road Operations implement storm water management at sites where rainwater and snowmelt water have the potential to wash salt into waterways.

4.4 Training

Road Operations should monitor the extent to which staff is performing with respect to expected learning goals. This review should be completed on an ongoing basis through observations of staff behaviour. Driving habits, accident reports, and absences are several of the deficiencies identified by Road Operations training staff. A plan to re-train staff in the appropriate areas should be developed.

It is current Road Operations practice to maintain documentation of the training received by staff members including sign off sheets indicating attendance at specific training events including health and safety meetings and practical training courses. As discussed in Section 2.10, Road Operations provides staff with training in accordance with the Transportation Association of Canada's best management practices.

4.5 Salt Management

Road Operations monitoring efforts for should focus on the following areas, which can adjusted as required.

- amount of salt and pickled sand being placed for each route
- inventory of fleet equipped with electronic spreaders
- inventory of fleet equipped with pre-wetting or direct liquid options
- record keeping of equipment calibrations

Road Operations currently records all salt purchases and shipments. The amount of salt used during the year is monitored and reconciled at year end. It is standard procedure for spreader operators to record the amount of salt used for each route. Monitoring is also used in the pickling of sand at a ratio of five percent salt to sand, decreased from the previous six percent.

Road Operations currently implements the following recommended practices:

- Use of electronic spreader controls on 90% of the winter maintenance fleet
- Use of pre-wetting equipment on 60% of the winter maintenance fleet
- Use of various road weather information systems to obtain accurate weather information/predictions
- Use of pavement temperatures to assist in winter maintenance decisions
- Implementation of an equipment calibration program

It is recommended that any new winter maintenance equipment purchased be outfitted with the electronic spreader controls and pre-wetting capability. Pavement temperature monitoring equipment and electronic spreader controls should be checked and calibrated regularly to ensure they are in good working order. Calibration should be documented and records kept for confirmation purposes.

4.6 Vegetation Management

Road Operations should conduct regular visual monitoring for impacts to vegetation from salt spray or drainage from snow disposal sites. It is recommended that an annual inspection of vulnerable areas be conducted to observe and record impact to vegetation, if any, and to observe and record whether changes to the winter maintenance program have resulted in any change with regard to vegetative stress.

4.7 Environmentally Sensitive/Vulnerable Areas

It is important to understand the impacts of the City's winter maintenance policies and practices on environmentally and agriculturally sensitive areas. Environment Canada's Code of Practice outlines the following areas of concern for consideration when identifying vulnerable areas:

- Areas draining into bodies of water, such as:
  - lakes and ponds with low-dilution and long residence times
  - watercourses that experience the cumulative effects of a dense network of highways/roads
- Provincially significant wetlands adjacent to roadways
- Areas draining into small, moderately deep lakes
- Areas where the addition of road salts has the potential to raise the chloride concentration, after mixing, to levels that could harm local fish or fish habitat
- Areas adjacent to salt sensitive vegetation
- Areas where the addition of road salts has the potential to harm the integrity of a life cycle (e.g., spawning grounds, nursery, rearing, food supply, migration areas for birds, etc.)
- Areas where the addition of road salts has the potential to harm a habitat necessary for the survival or recovery of a wildlife species listed on the List of Wildlife Species at Risk (Schedule 1 of the Species at Risk Act)
- Areas draining into sources of drinking water (surface water or ground water, including wells)
- Areas draining into groundwater recharge zones or that have an exposed or shallow water table with medium to high permeability soils

As listed in Annex B of the Code of Practice, additional salt management measures in vulnerable areas may include:

- Using technologies that further optimize the use of road salts
- Using environmentally, technically and economically feasible alternatives to road salts

- Increasing monitoring and measuring of chlorides and/or their impacts
- Locating patrol yard and snow disposal sites outside of vulnerable areas
- Considering location and protection of vulnerable areas in the design of new roads and/or upgrading of existing roads

Appendix D provides details regarding potentially vulnerable water areas within the City, as identified by Road Operations.

Based on a review of the Ministry of Natural Resources and Forestry (MNRF) values maps (i.e., species at risk, significant wetlands, areas of natural or scientific interest), sensitive receptors were not identified within a one kilometer radius of any of Road Operations depots, satellite depots, or snow disposal sites. The MNRF values maps are not an exhaustive source for sensitive receptors and it is recommended that the development of any new Road Operations site where salt, pickled sand or snow will be stored should be evaluated to identify sensitive receptors.

4.8 Drinking Water Resources

The Greater Sudbury Source Protection Plan[2] (Source Protection Plan) identifies six licensed municipal residential drinking water systems, five within the City of Greater Sudbury and one outside of the City. The drinking water systems located within the City comprise 22 municipal groundwater wells and three surface water sources (Ramsey Lake, Wanapitei River, and Vermillion River).

The Source Protection Plan was developed in accordance with Ontario Regulation 287/07 under the Clean Water Act and was approved by the Ministry of the Environment and Climate Change (MOECC) on September 19, 2014. The Source Protection Plan, which took effect on April 1, 2015, was developed to address specific threats to drinking water quality by identifying areas where water resources are vulnerable to contamination, identifying existing drinking water issues, and by assessing threats to drinking water quality. The Source Protection Plan identifies wellhead protection areas (WHPAs) and intake protection zones (IPZs) established for each drinking water system and also includes policies developed to protect drinking water resources within these vulnerable areas. Maps showing the WHPAs and IPZs including the locations of all source water protection signs are provided in Appendix E. An explanation of how these maps were developed is provided in the Greater Sudbury Source Protection Area Assessment Report[3] (Assessment Report), which is available at http://sourcewatersudbury.ca/en/assessment-report.html

Various activities are prescribed as drinking water threats under Ontario Regulation 287/07 including:

2 Greater Sudbury Source Protection Area Source Protection Plan, Prepared on Behalf of the Greater Sudbury Source Protection Committee, Under the Clean Water Act, 2006 (Ontario Regulation 287/07), Approved September 19, 2014, http://www.greatersudbury.ca/sudburyen/assets/File/Greater_Sudbury_Source_Protection_Area_Approved_SPP_Sept_19.pdf

3 Greater Sudbury Source Protection Area Assessment Report, Approved on September 2, 2014.

- Road salt application
- Road salt handling and storage
- Snow storage

Based on a review of WHPA and IPZ maps, the Suez Depot is located within the WHPA of municipal drinking water wells and a portion of the Frobisher Depot including salt and pickled sand storage areas, is located within the intake protection zone (IPZ-3) for Ramsey Lake. The Source Protection Plan recognizes sodium as a drinking water issue for the Ramsey Lake drinking water system and identifies the application, storage, and handling of road salt, and the storage of snow as significant threats within the Ramsey Lake IPZ-1, an area defined as a circle with a radius of 1,000 metres with its center located at the drinking water intake.

Section 10 of the Source Protection Plan provides the following policies regarding salt and snow management within the City:

- Create and deliver an education and outreach program for residents, businesses, institutions, and contractors who may handle, store or apply road salt or store snow in vulnerable areas.
- Identify vulnerable areas were winter maintenance activities could be a significant threat.
- Optimize the use of road salt and minimize losses.
- Prioritize snow removal and street sweeping and cleaning from primary, arterial and collector roads located in vulnerable areas during or soon after the spring melt.
- Include information about the Source Protection Plan and drinking water source protection in annual staff training programs.
- Conduct risk management planning for parking areas that are greater than or equal to one hectare, where application of road salt and snow storage could be a significant threat.
- Conduct risk management planning for sites located within vulnerable areas where 500 kg or more of road salt is stored. Additionally, store salt and pickled sand under cover and on an impermeable surface, and collect and treat drainage where salt or pickled sand are stored in vulnerable areas.
- Prohibit the future road salt storage 500 kg or more within vulnerable areas.
- Prohibit the future establishment of a commercial or municipal snow storage site within vulnerable areas.

The policies of the Source Protection Plan require the City to optimize the use and management of road salt to minimize loss into the environment and impact on drinking water resources. The SMP helps to minimize the impact of road salt and road salt products on drinking water resources by providing a framework for periodic assessment of the City's winter maintenance program in comparison with up to date industry best practices and research. The SMP includes review and documentation of:

- Salt and snow management practices and strategies
- Winter patrol program

- Level of service
- Quantities of winter maintenance materials used
- Facilities inspections
- Recommendations for beneficial improvement options in various areas

It is recommended that the City implement all policies of the Source Protection Plan. GHD understands that the City is currently in the process of preparing risk management plans as required.

4.9 Surface Water Management

Visual monitoring of runoff from roadways, salt and sand storage sites, or snow disposal sites will provide a means to identify areas of potential environmental impact.

It is recommended that Road Operations staff conduct regular site inspections of snow and sand storage sites to ensure that erosion control measure are in place and functioning properly. Consideration should be given to preparing storm water management plans for the various sites, particularly those that are located close to waterways. This will help to ensure the proper control of surface water to prevent erosion, flooding, and/or the direct discharge of salt laden runoff into waterways. Individual snow storage sites should be monitored annually for usage by measuring the length, width, and height of the snow pile.

5. 2016 Inspection Results

In October 2016, an inspection of the winter maintenance depots and snow dump sites was conducted by GHD. Findings associated with various Road Operations sites are summarized in Appendix F.

- Repair/replace salt dome at St. Clair Depot or consider discontinuing use of the site for salt storage
- Consider placing pickled sand piles under cover with priority given to depots located adjacent to waterways and/or wetland areas such as Frobisher, St. Clair, and Naughton
- Move snow and pickled sand piles away from areas where erosion can carry salt laden sediment and runoff directly into waterways
- Install and regularly inspect/maintain sediment and erosion controls where required
- Keep snow and pickled sand storage separate
- Conduct inspections to ensure that snow storage sites are not being misused for waste disposal
- Conduct regular housekeeping to keep salt within storage structures

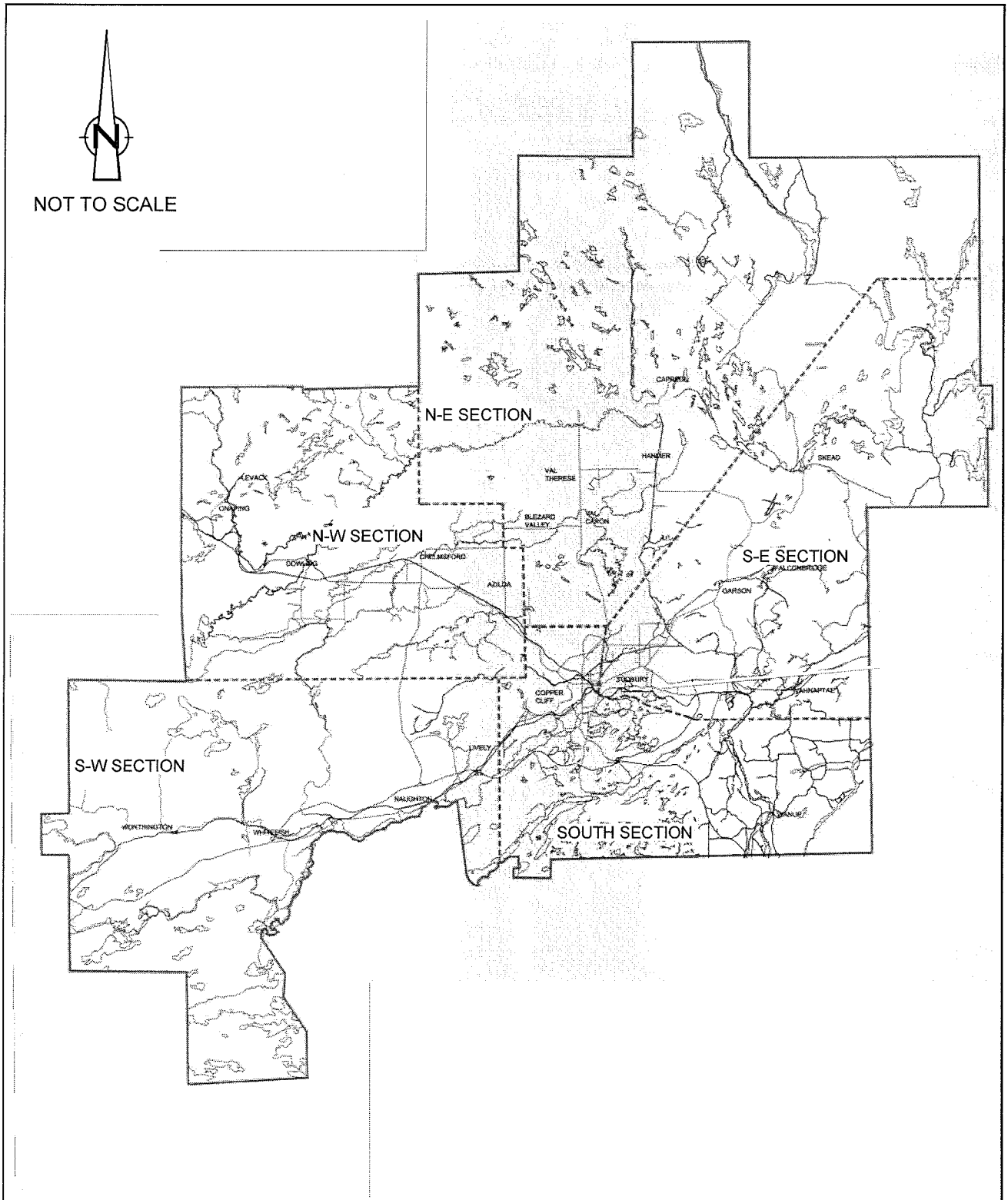
All of Which is Respectfully Submitted,

GHD

Sarah Ackert Ferguson

Sarah Ackert Ferguson, P.Eng.

Robert Bressan, P.Eng.

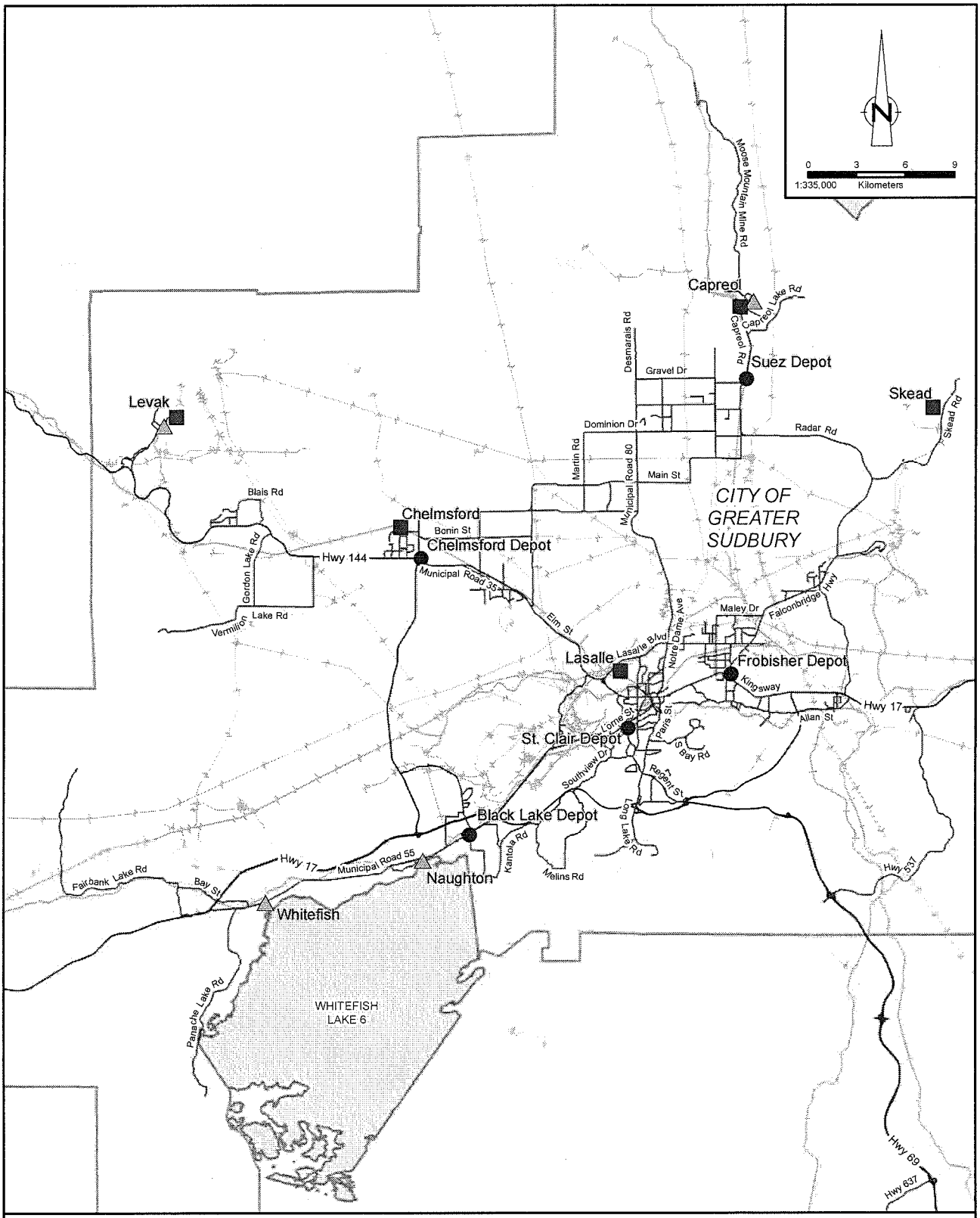


SOURCE: GREATER GRAND SUDBURY INFRASTRUCTURE - NEEDS AND ASSESSMENT STORM DRAINAGE SYSTEM DRAWING.

figure 1

SECTIONAL BREAKDOWN OF GREATER SUDBURY
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

39382-40(006)GN-WA001 JAN 26, 2017



Source: MNRF NRVIS, 2014. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017;
Coordinate System: NAD 1983 UTM Zone 17N

figure 2

LEGEND

- Snow Dumps
- Depots
- Satellite Depot

SITE LOCATION MAP
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

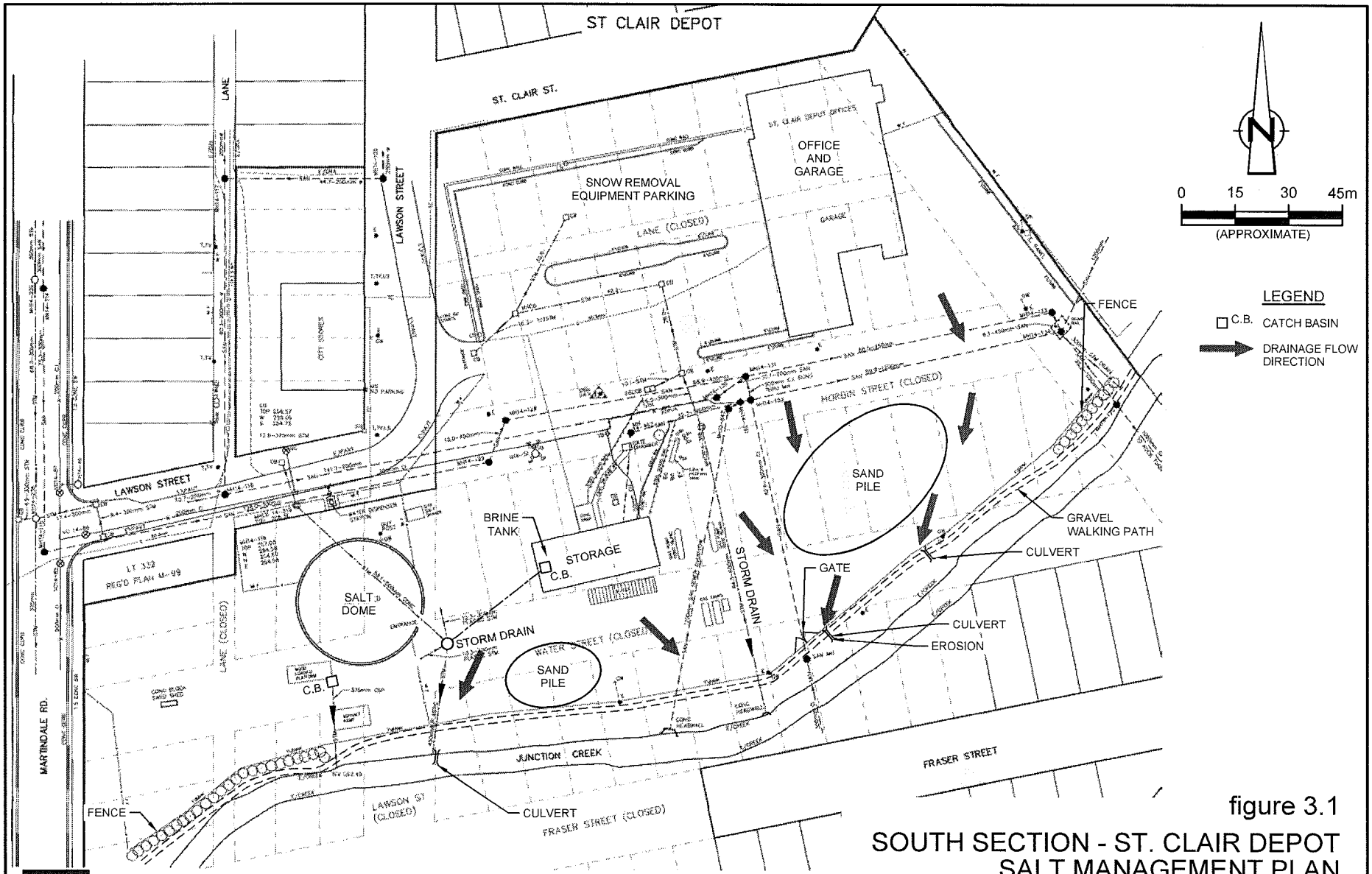


figure 3.1

SOUTH SECTION - ST. CLAIR DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

SOURCE:
PROVIDED BY GREATER GRAND SUDBURY,
DRAWING NAME: SITE PLAN, ST. CLAIR DEPOT,
CAD NUMBER: C5459-1, DATE: 2008-03-06.

39382-40(006)GN-WA002 JAN 26, 2017

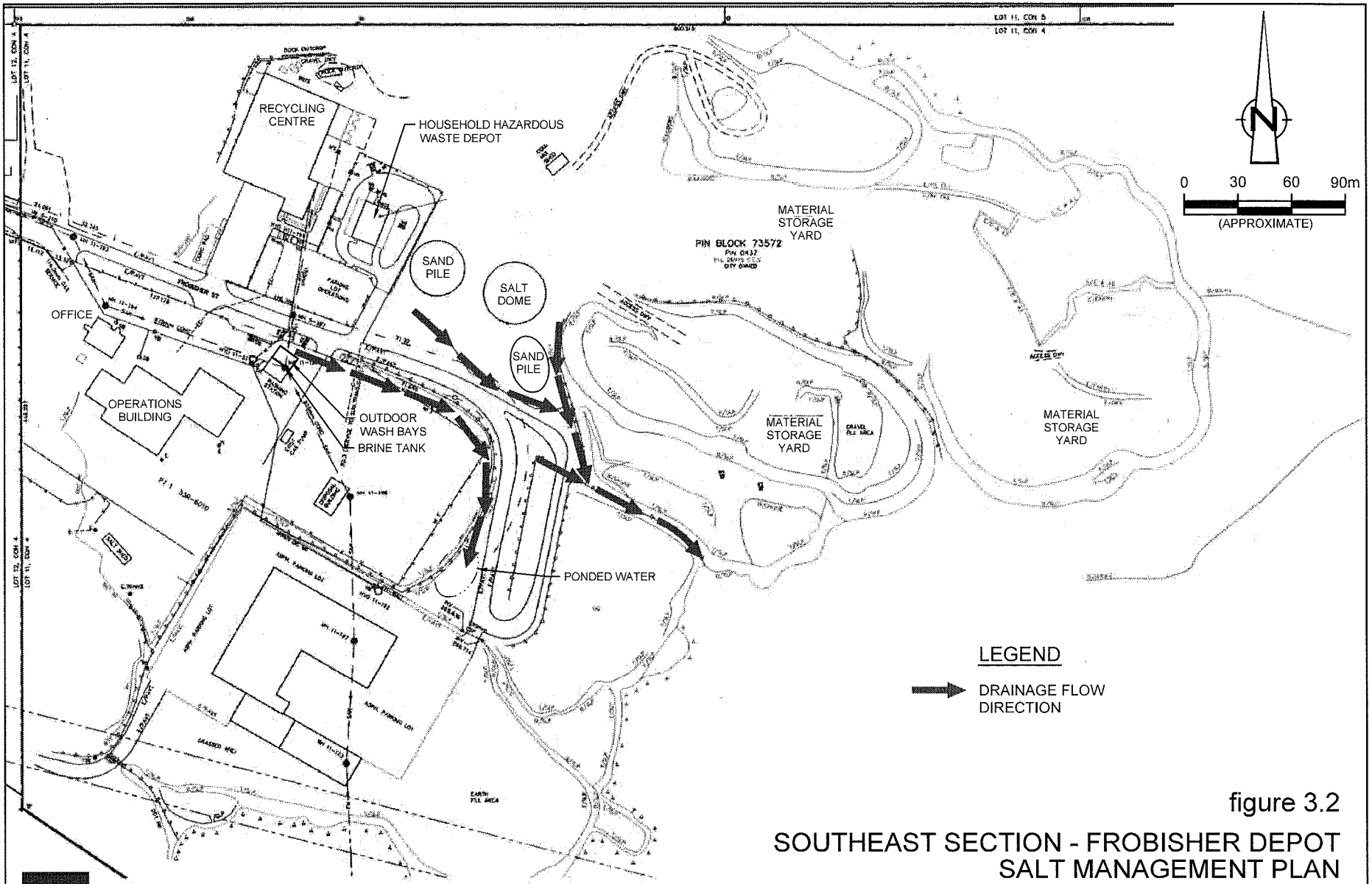


figure 3.2

SOUTHEAST SECTION - FROBISHER DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

SOURCE:
PROVIDED BY GREATER GRAND SUDBURY,
DRAWING NAME: SITE PLAN, FROBISHER DEPORT,
CAD NUMBER: C5458-1, DATE: 2008-03-04.

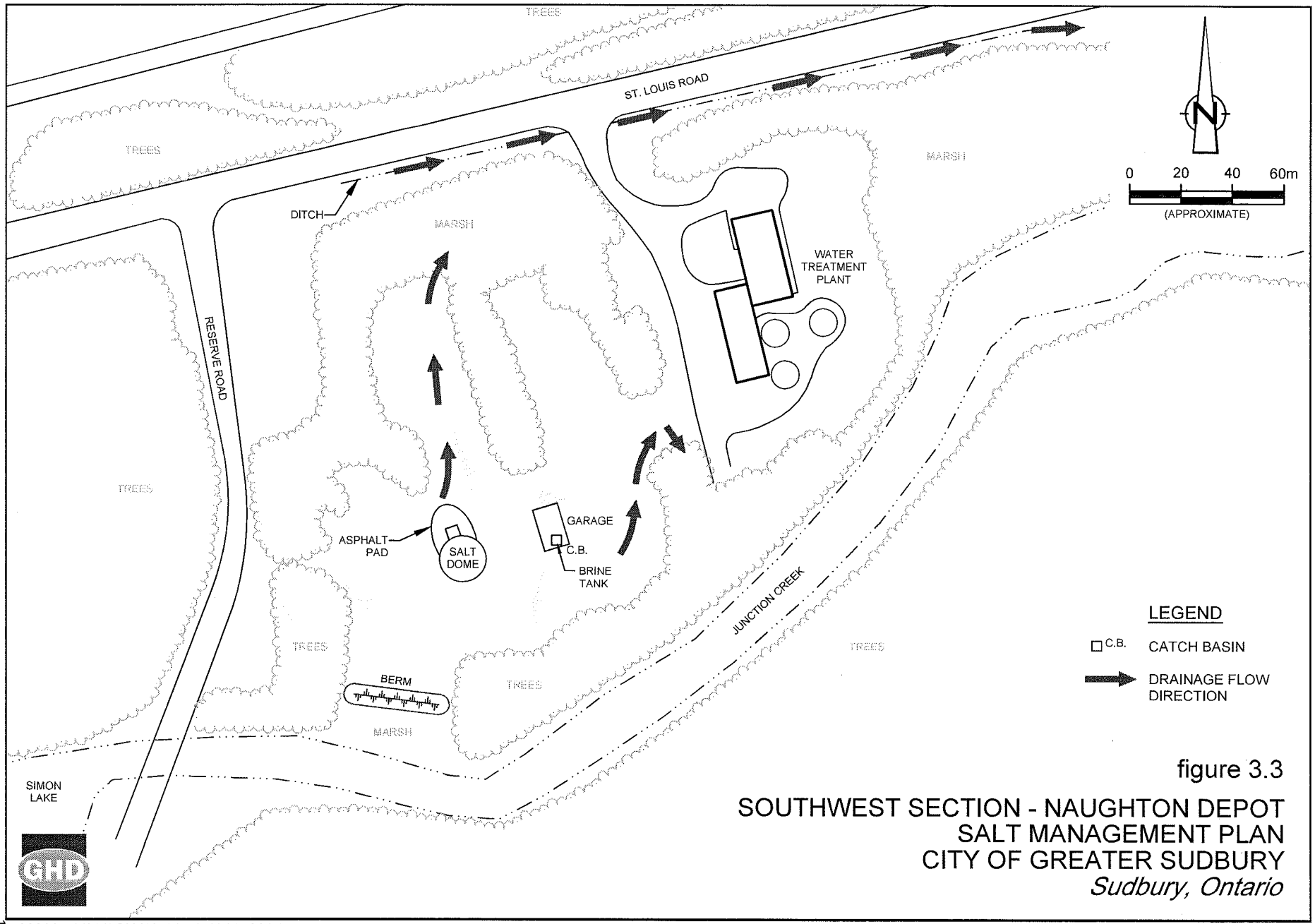


figure 3.3

SOUTHWEST SECTION - NAUGHTON DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

39382-40(006)GN-WA014 JAN 26, 2017

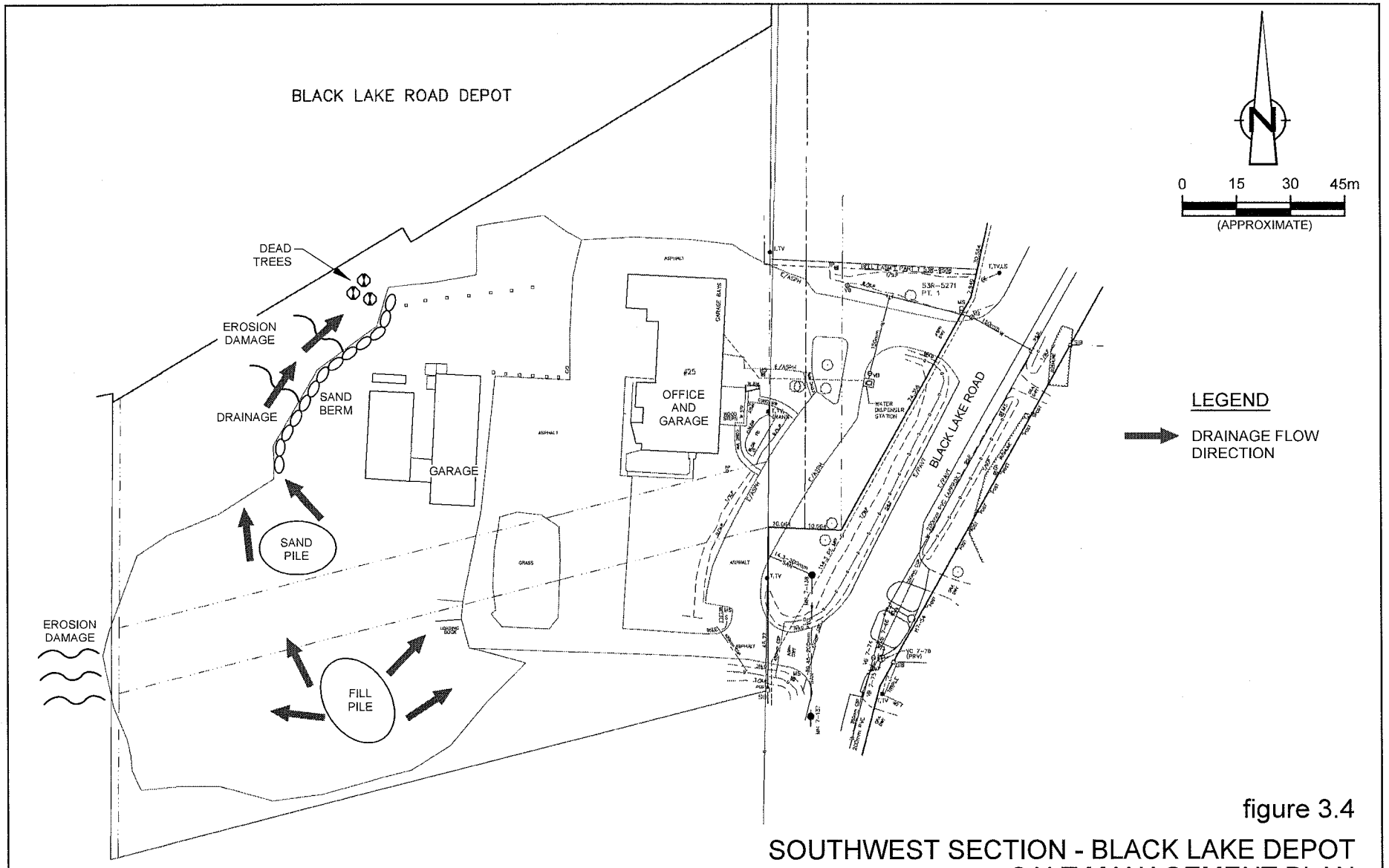


figure 3.4

SOUTHWEST SECTION - BLACK LAKE DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

SOURCE:
PROVIDED BY GREATER GRAND SUDBURY,
DRAWING NAME: SITE PLAN, BLACK LAKE DEPORT,
CAD NUMBER: C5456-1, DATE: 2008-06-27.

39382-40(006)GN-WA010 JAN 26, 2017

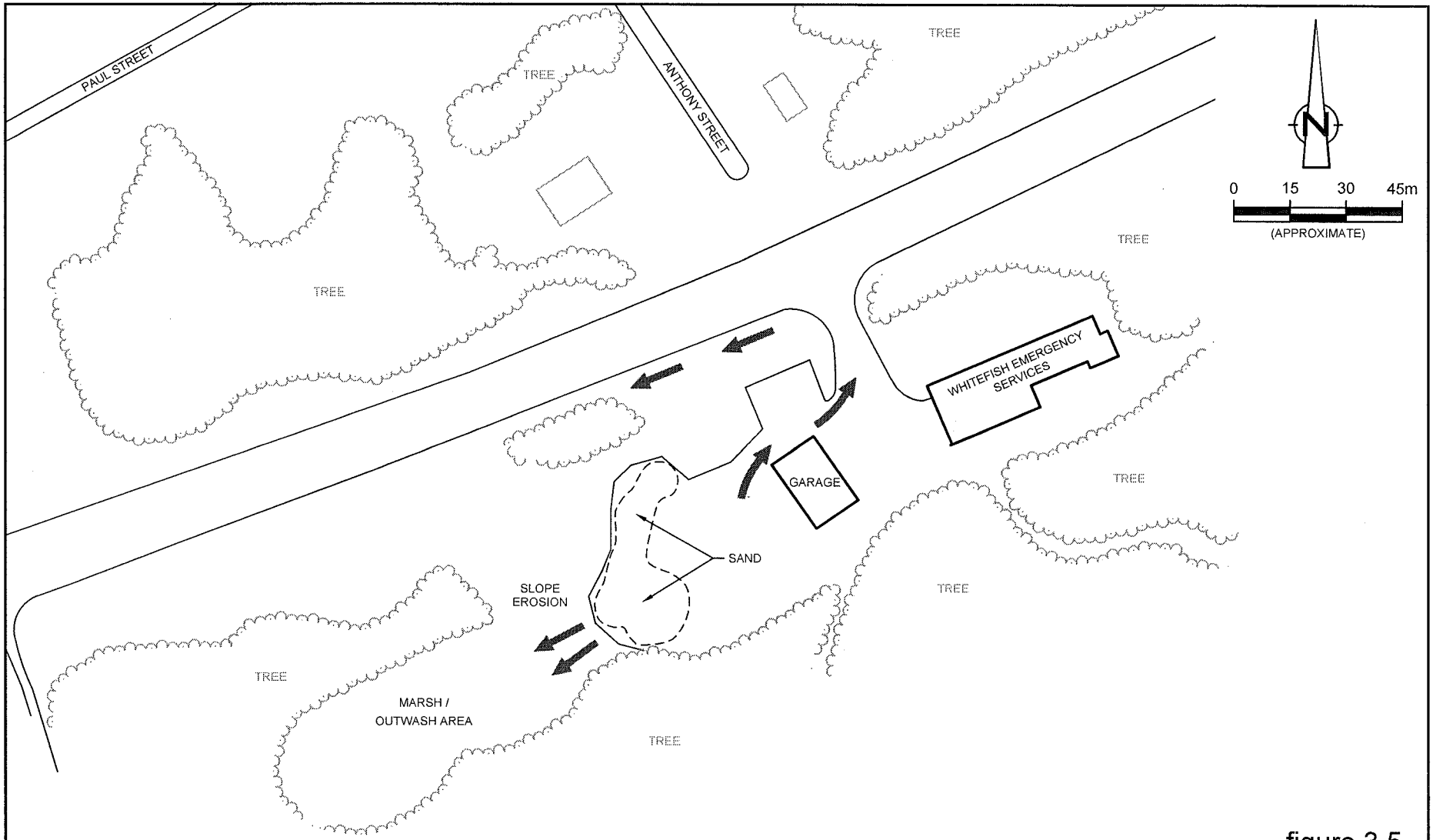


figure 3.5

SOUTHWEST SECTION - WHITEFISH DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

LEGEND

DRAINAGE FLOW DIRECTION

GHD

39382-40(006)GN-WA003 JAN 26, 2017

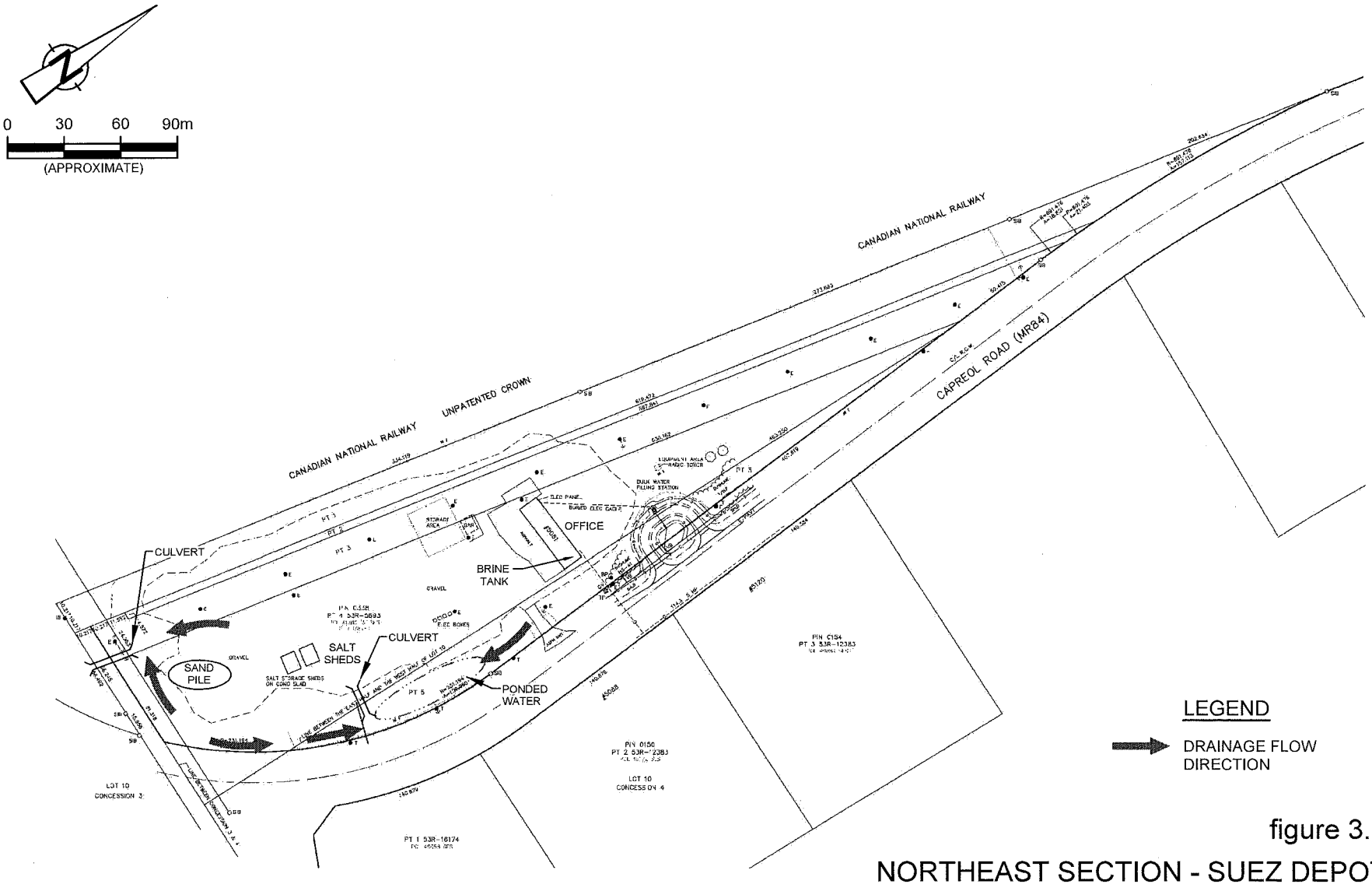


figure 3.6

NORTHEAST SECTION - SUEZ DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

SOURCE:
PROVIDED BY GREATER GRAND SUDBURY,
DRAWING NAME: SITE PLAN, SUEZ DEPORT,
CAD NUMBER: C5455-1, DATE: 2008-06-26.

39382-40(006)GN-WA009 JAN 26, 2017

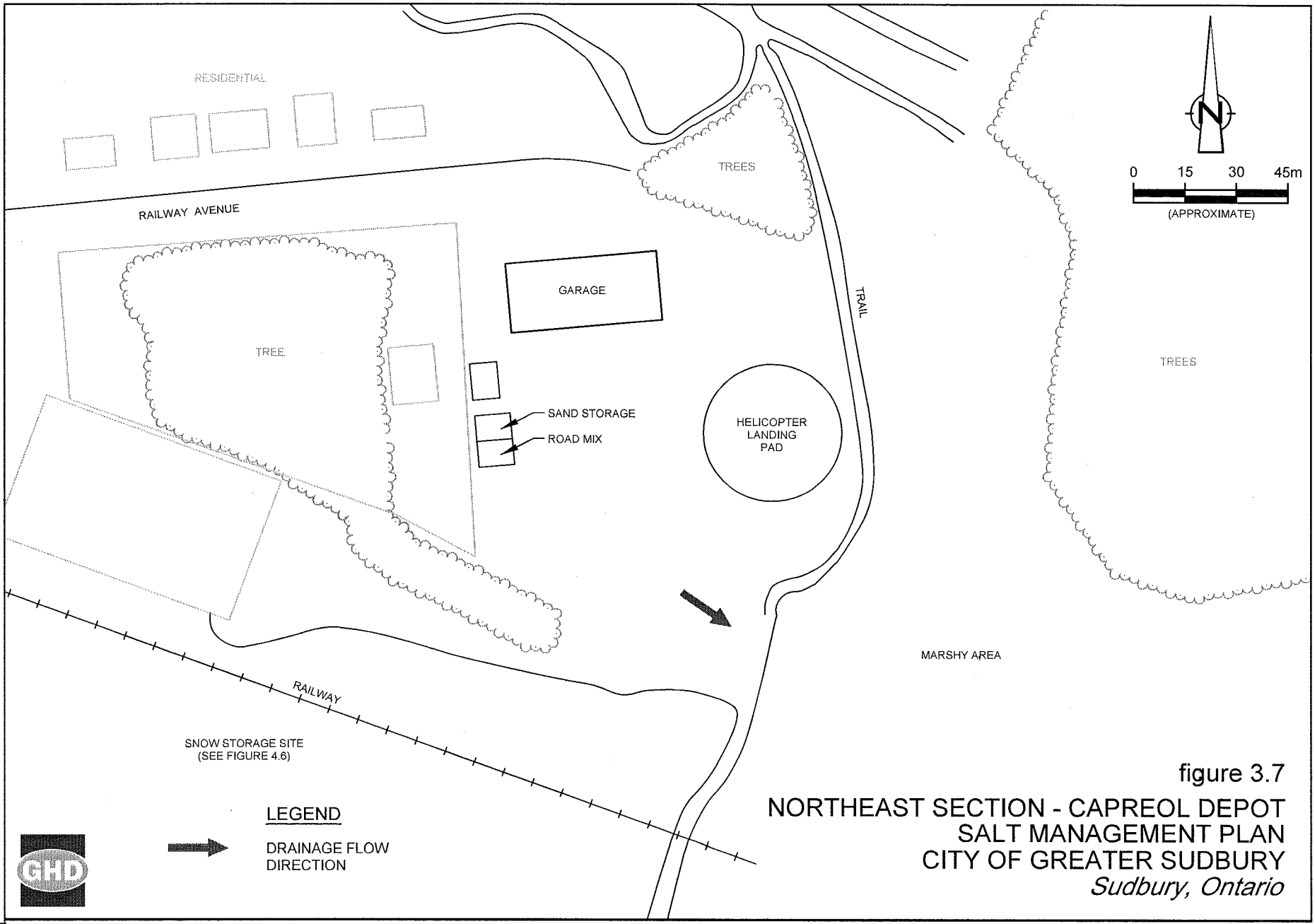


figure 3.7

NORTHEAST SECTION - CAPREOL DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

39382-40(006)GN-WA005 FEB 1, 2017

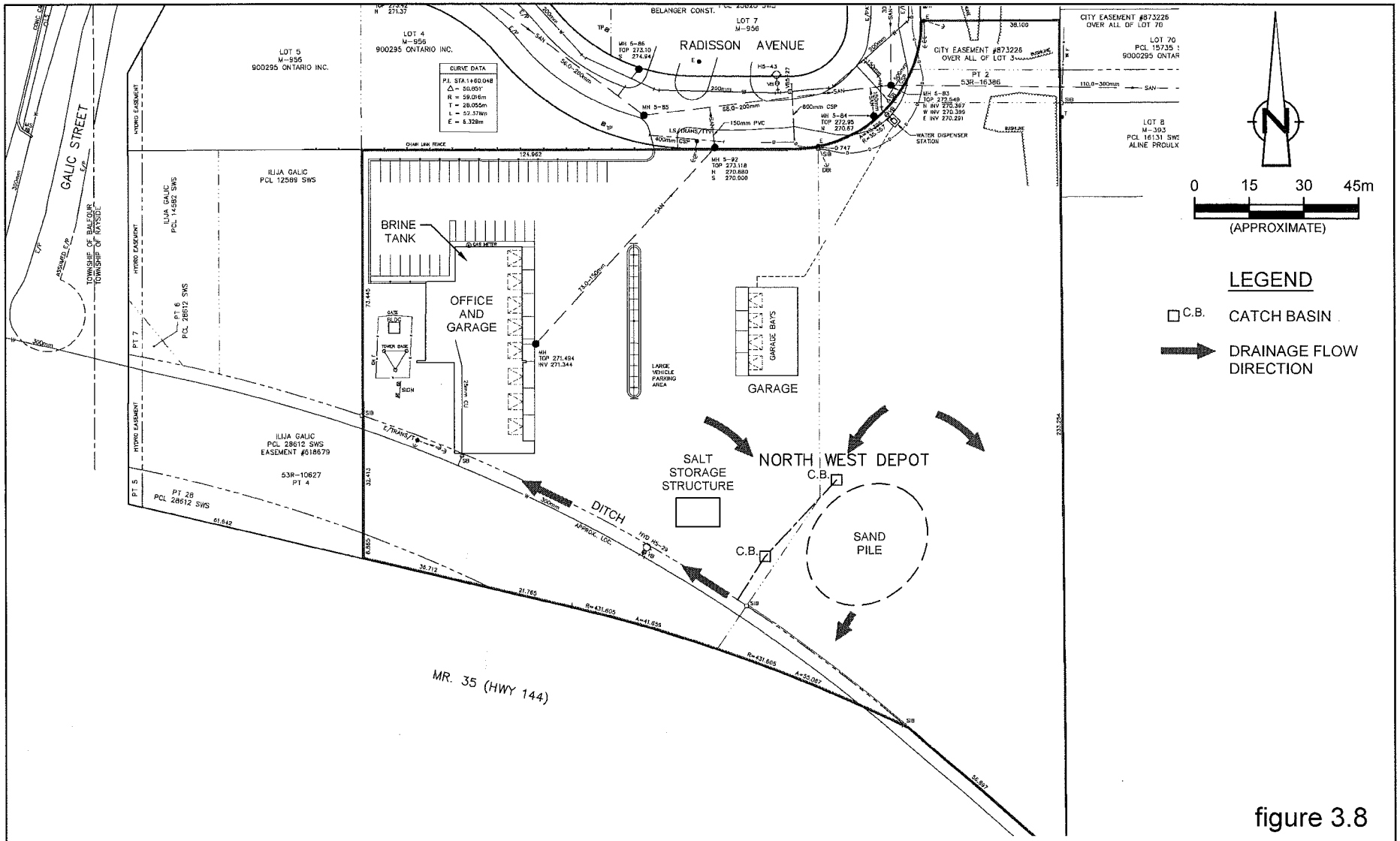


figure 3.8

NORTHWEST SECTION - CHELMSFORD DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

SOURCE:
PROVIDED BY GREATER GRAND SUDBURY,
DRAWING NAME: SITE PLAN, NORTHWEST DEPORT,
CAD NUMBER: C5457-1, DATE: 2008-03-13.

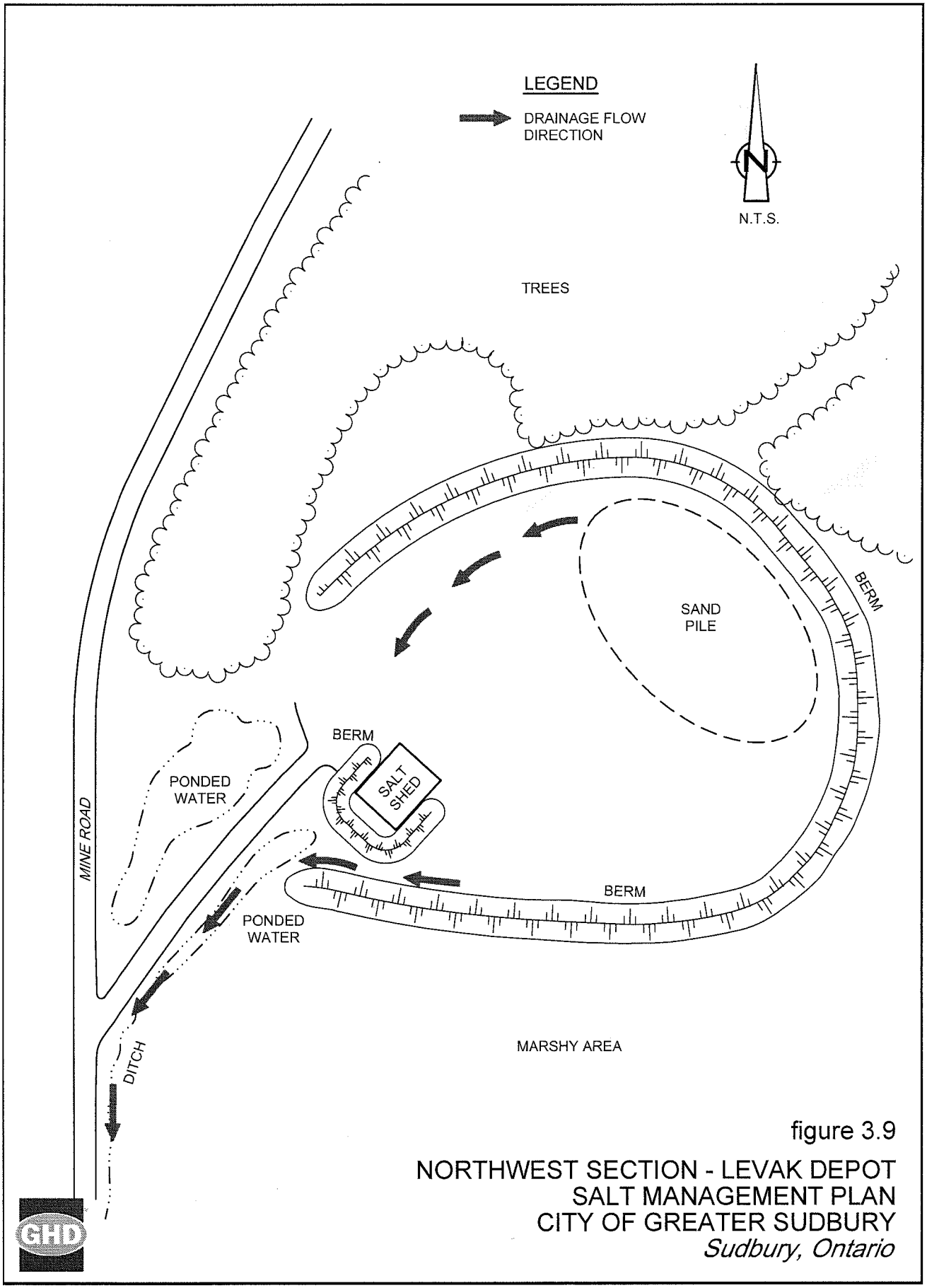


figure 3.9

NORTHWEST SECTION - LEVAK DEPOT
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

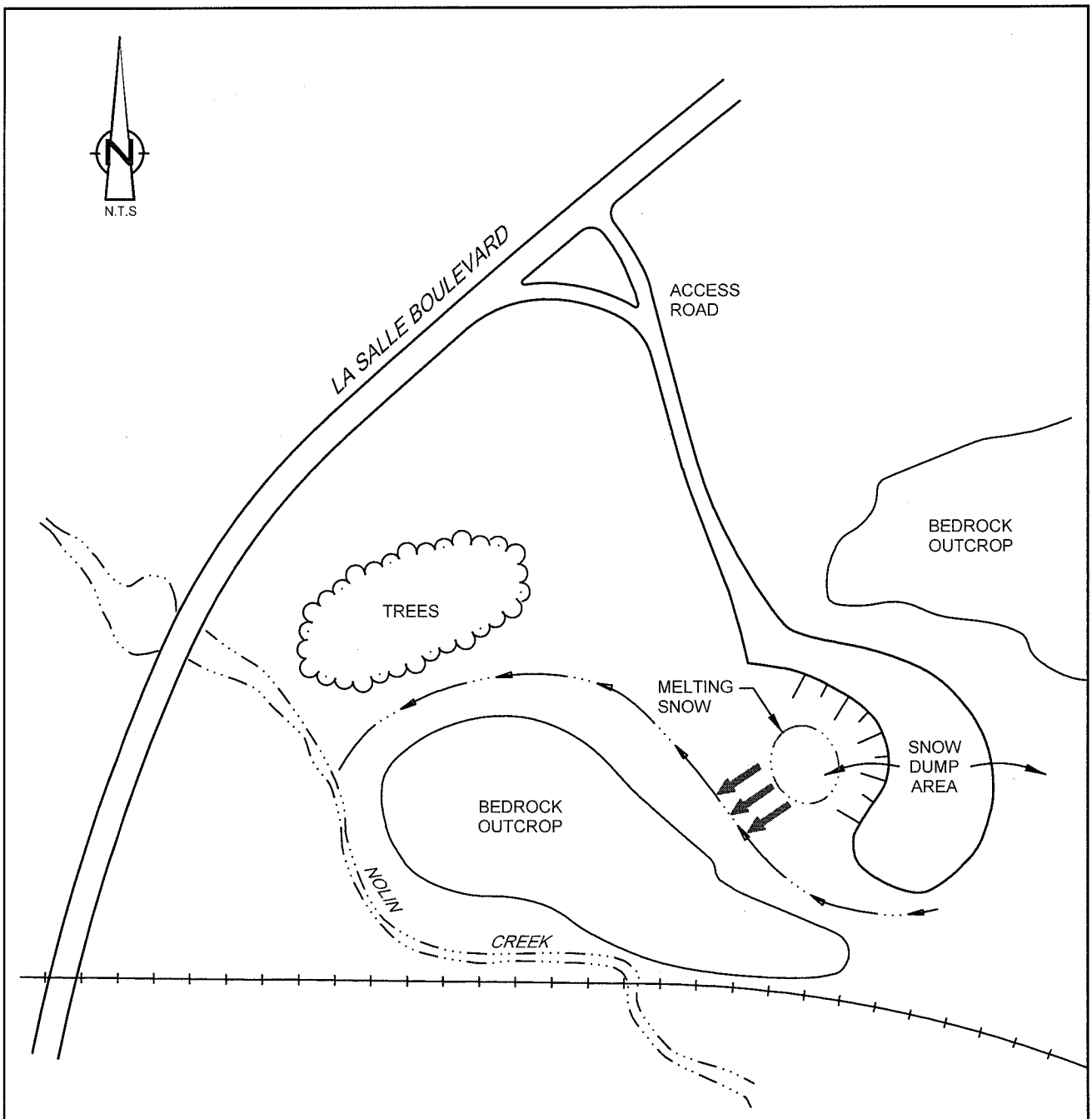


figure 4.1

SOUTH SECTION - LASALLE SNOW STORAGE SITE
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

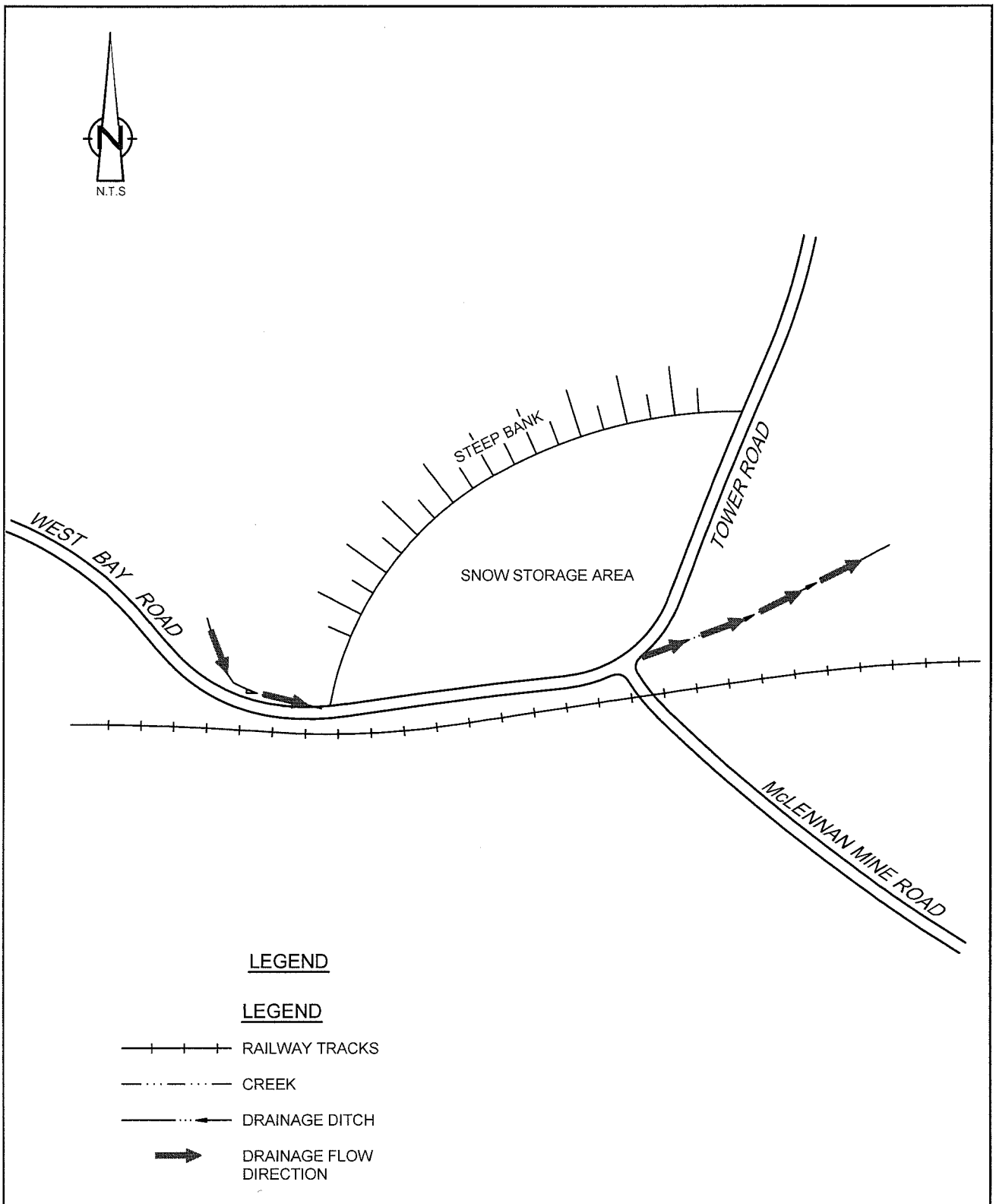


figure 4.2

SOUTHEAST SECTION - SKEAD SNOW STORAGE SITE
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

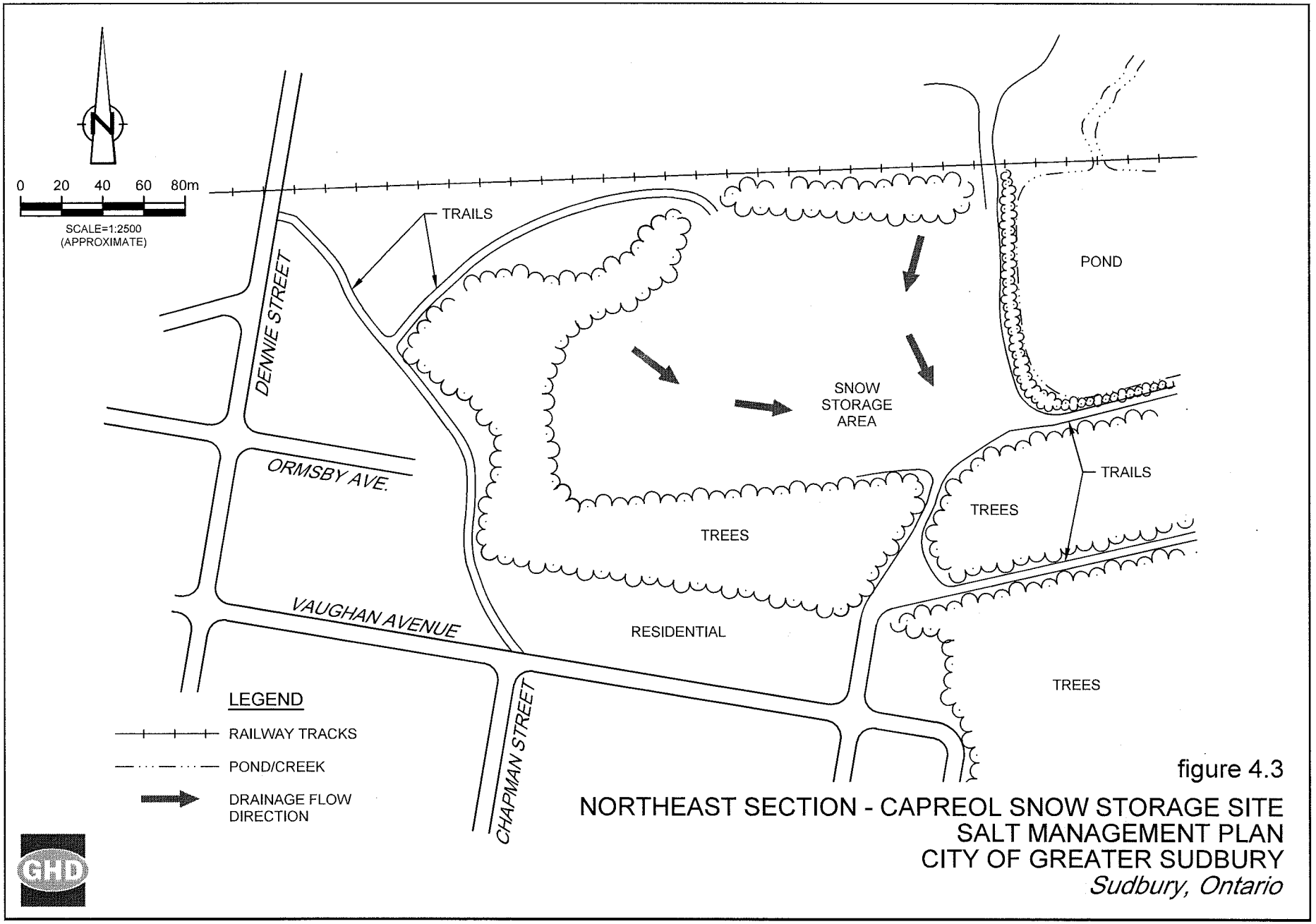


figure 4.3

NORTHEAST SECTION - CAPREOL SNOW STORAGE SITE
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

39382-40(006)GN-WA013 JAN 26, 2017

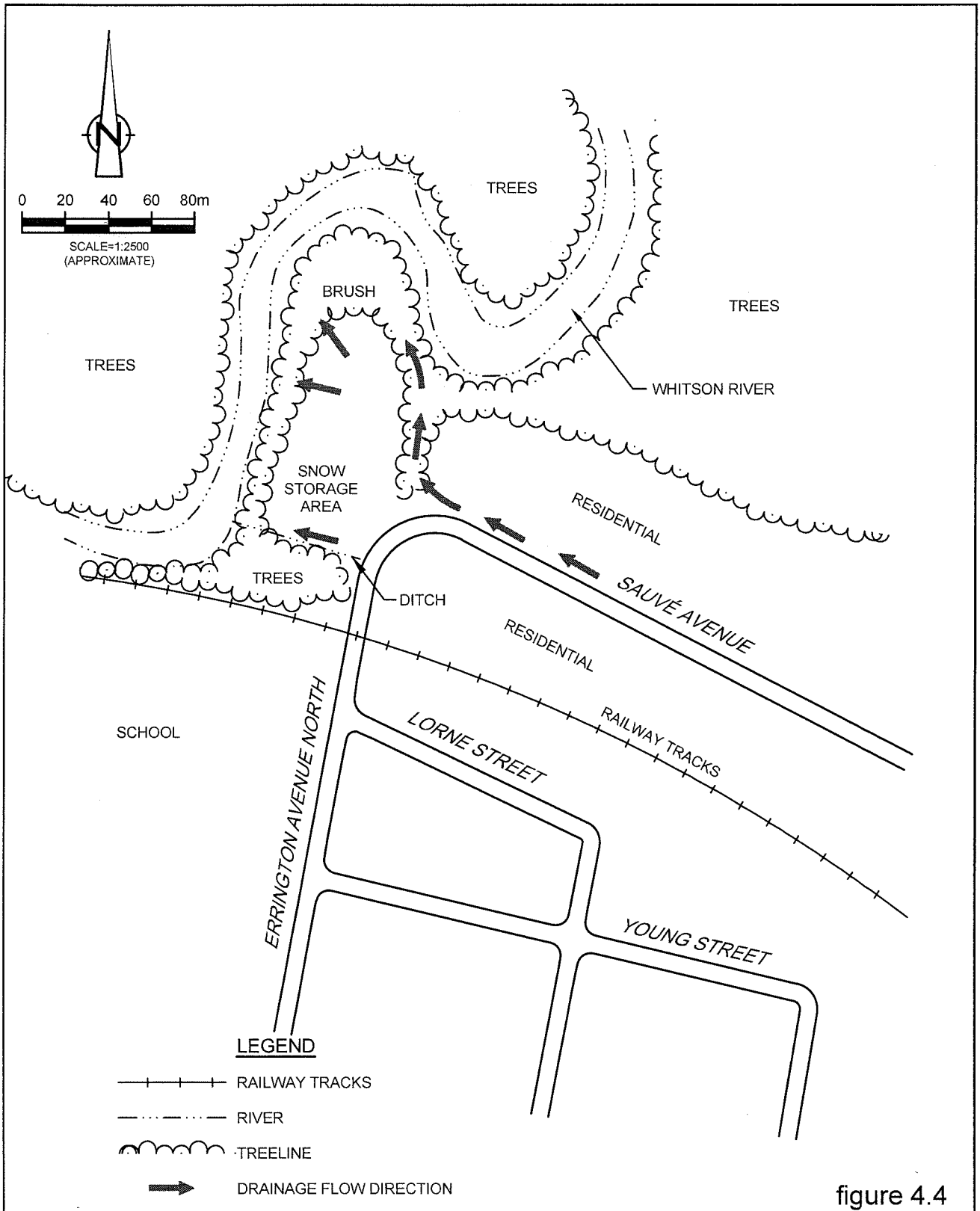


figure 4.4

NORTHWEST SECTION - CHELMSFORD SNOW STORAGE SITE
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

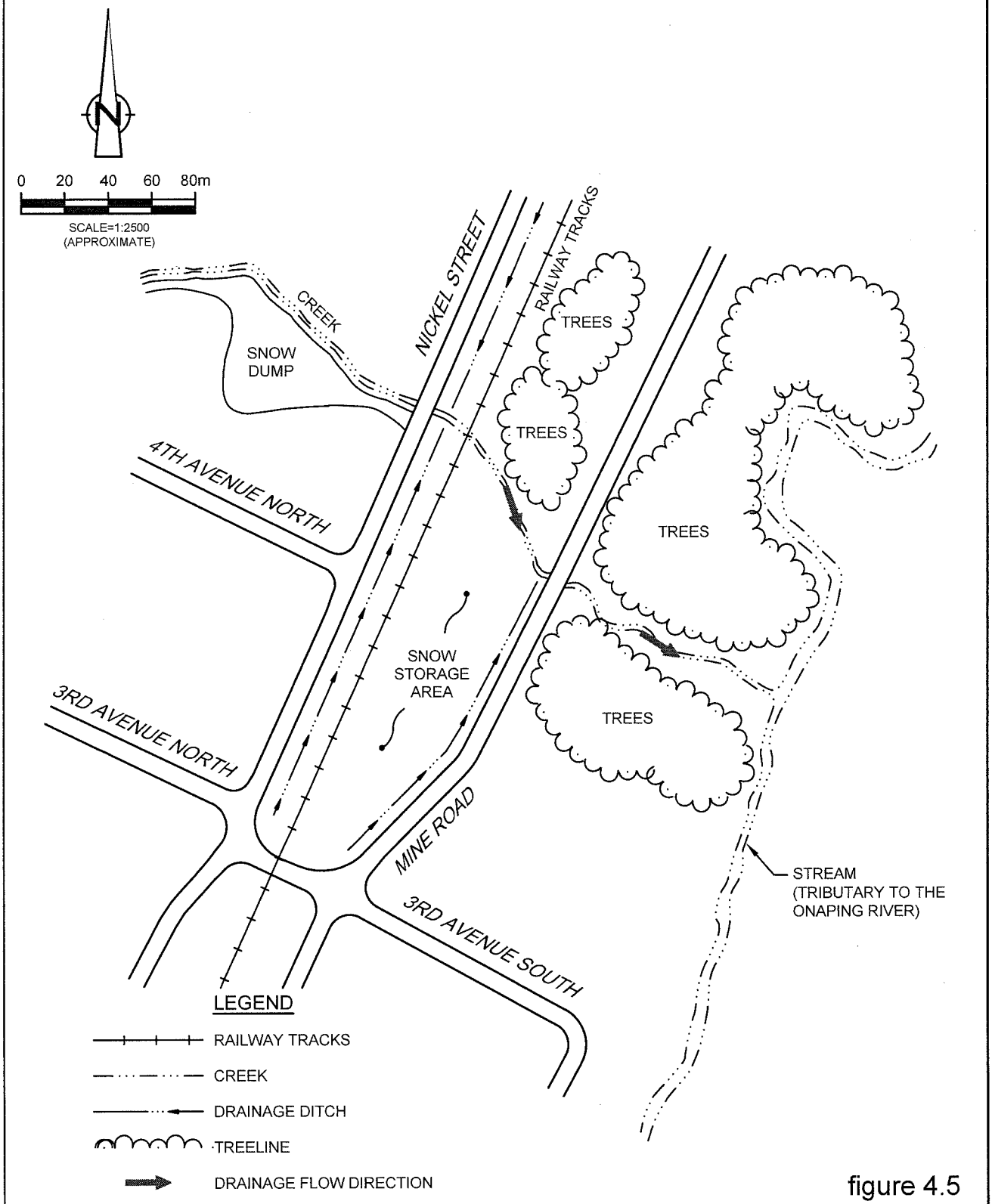


figure 4.5

NORTHWEST SECTION - LEVAK SNOW STORAGE SITE
SALT MANAGEMENT PLAN
CITY OF GREATER SUDBURY
Sudbury, Ontario

Table 1

Road Operations Winter Maintenance Depots By Section
Salt Management Plan
City of Greater Sudbury, Ontario

Section	Depot	Location	Material Storage		Brine Tank	Receiving Water Body	Watershed	Comments
			Salt	Sand				
South	St. Clair [1]	474 St. Clair Street	Y	Y	Y	Junction Creek	Upper Junction Creek	
Southeast	Frobisher [1], [2]	1800 Frobisher Street	Y	Y	Y	Marshy area to the east of the Site	Ramsey Lake	Salt and sand storage just outside of the Lake Ramsey Drinking Water Intake Protection Zone -3
Southwest	Naughton	1425 Municipal Road 55, south side of roadway, east of Reserve Road	Y	Y		Simon Lake / Mud Lake	Lower Junction Creek	
	Black Lake	25 Black Lake Road	Y	Y	Y	Drainage ditch on south side of Municipal Road 55	Lower Junction Creek	
	Whitefish	4895 Municipal Road 55, south side of roadway, between King and Caroline Street		Y		Marshy area to the west of the Site, draining into a tributary of the Vermillion River	Lower Vermillion River	
Northeast	Suez [1]	5081 Municipal Road 84, west side of roadway, north of Suez Drive	Y	Y	Y	Water infiltrates ground surface	Whitson River	Located within a Well Head Protection Area with a vulnerability score of 6
	Capreol	65 Railway Avenue, south side of roadway, south of the Emergency Services building	Y	Y		Large pond/marshy area located east of the Site, which drains into a tributary of the Vermillion River	Upper Vermillion River	
Northwest	Chelmsford [1]	101 Radisson Avenue	Y	Y	Y	Drainage ditches along Municipal Road 35, Radisson Avenue and the NW By Pass	Whitson River	
	Levak	Mine Road, east side of roadway		Y		Marshy area southwest of Site and drainage ditches along Mine Road to the south, draining to a tributary of the Onaping River	Onaping River	

NOTES:
(1) Road Operations Sectional Central Operations Depots
(2) Road Operations Central Head Quarters

Table 2

Road Operations Snow Storage Sites by Section
Salt Management Plan
City of Greater Sudbury, Ontario

Section	Snow Storage Site	Location	Size	Drainage / Receiving Water Body	Watershed	Comments
South	LaSalle	East side of LaSalle Boulevard extension, between Elm Street and Frood Road	25 ha	Water flows into a drainage ditch located on the south side of the site, at the base of the tipping slope, which flows into Nolin Creek	Upper Junction Creek	Main snow dump for the City
Southeast	Skead	West Bay Road at intersection of Tower Road and MacLennan Mine Road	0.2 ha	Water infiltrates the ground surface or flows overland to ditches on the south side of West Bay Road	Lake Wanapitei	Local snow only
Northeast	Capreol	North end of Shaw Street	1.5 ha	Water infiltrates ground surface or flows overland to a large pond/marshy area located east of the Site, which drains into a tributary of the Vermillion River	Upper Vermillion	
Northwest	Chelmsford	Northwest corner of Errington and Sauve Avenue Intersection, Chelmsford, ON.	2 ha	Whitson River located immediately adjacent to the west side of the site	Whitson River	
	Levak	Between Mine Road and the train tracks at 3rd Avenue	3 ha	Drainage Ditch located on the east side of the site, along Mine Road discharges to a small creek north of the Site	Onaping River	

Table 3

Level of Service Policy Summary - Storm Response Triggers, Actions, and Response Times
Salt Management Plan
City of Greater Sudbury, Ontario

Road Winter Maintenance - Snow Events			Service Timelines [1]		City Policy	City Practice
Road Classification	Protocol/Action	Snow Accumulation	Complete Round #1/Initial Deployment	Clear/Material Application		
Class 1 - 3	Apply Brine/Salt	N/A	Within 2 - 4 Hours of Significant Snowfall	-	Yes	Yes
	Plow Roads	5 cm [2]	Within 3 - 8 Hours after 5 cm Threshold	3 - 8 Hours after Storm Ends, If Required	Yes	Yes
	Salt/Brine/Sand Roads	N/A	Within 3 - 8 Hours after 5 cm Threshold	3 - 8 Hours after Storm Ends, If Required	No	Yes
Class 4 - 6	Plow Roads	8 cm [3]	Within 24 Hours after reaching 8 cm Threshold	24 Hours after Storm Ends, If Required	Yes	Yes
	Spot Sand Roads	N/A	Within 24 Hours after reaching 8 cm Threshold	24 Hours after Storm Ends, If Required	Yes	Yes

Road Winter Maintenance - Ice Events			Service Timelines [1]		City Policy	City Practice
Road Classification	Protocol/Action	Ice Detection	Complete Round #1/Initial Deployment	Clear/Material Application		
Class 1 - 3	Salt/Brine/Sand Roads	Detected	Within 2 - 4 Hours of Ice Detection	2 - 4 Hours after Storm Ends, If Required	Yes	Yes
Class 4 - 5	Sand Roads	Detected	Within 12 - 16 Hours of Ice Detection	12 - 16 Hours after Initial Application, If Required	Yes	No
Class 4 - 6	Sand Roads	Detected	Within 24 Hours of Ice Detection	24 Hours after Initial Application, If Required	No	Yes

Sidewalk Winter Maintenance - Snow Events			Service Timelines [1]		City Policy	City Practice
Sidewalk Classification	Protocol/Action	Snow Accumulation	Complete Round #1/Initial Deployment	Clear/Material Application		
Downtown	Plow & Sand Sidewalks	N/A	Midnight to 8:00 am, Weekdays	-	Yes	Yes
Class 1 [4]	Plow & Sand Sidewalks	8 cm [6]	Within 4 - 24 Hours of Reaching 8 cm Threshold	12 - 24 Hours after Storm Ends, If Required	Yes	Yes
Class 2 [5]	Plow & Sand Sidewalks	8 cm [7]	Within 8 - 24 Hours of Reaching 8 cm Threshold	12 - 24 Hours after Storm Ends, If Required	Yes	Yes

Sidewalk Winter Maintenance - Ice Events			Service Timelines [1]		City Policy	City Practice
Sidewalk Classification	Protocol/Action	Ice Detection	Complete Round #1/Initial Deployment	Clear/Material Application		
Downtown	Plow & Sand Sidewalks	N/A	Midnight to 8:00 am, Weekdays	-	Yes	Yes
All Sidewalks	Sand or Salt	Detected	Within 2 - 24 Hours of Ice Detection	2 - 24 Hours after Initial Application, If Required	Yes	No
All Sidewalks	Sand Sidewalks	Detected	Within 24 Hours of Ice Detection	24 Hours after Storm Ends, If Required	No	Yes

NOTES:

(1) Winter Control Supervisors may alter any policy statement to suit actual weather conditions
(2) Accumulation of 5 cm was chosen as a mid point of the MMS depth of the snow accumulation range (2.5 - 8 cm) for Class 1 - 3 roads.
(3) Accumulation of 8 cm was chosen since it was the lesser of the MMS depth of the snow accumulation range (8 - 10 cm) for Class 4 - 6 roads.
(4) Class 1 Sidewalks - Sidewalks located adjacent to Class 1 - 3 Roads
(5) Class 2 Sidewalks - Sidewalks located adjacent to Class 4 - 6 Roads
(6) Accumulation of 8 cm was chosen as a mid point of the MMS depth of snow accumulation range (2.5 - 15) for Class 1 sidewalks.
(7) Accumulation of 8 cm was chosen as a mid point of the MMS depth of snow accumulation range (5 - 15) for Class 2 sidewalks.

Table 4

Storm Response Triggers, Actions, and Response Times - Comparison With Other Northern Municipalities
Salt Management Plan
City of Greater Sudbury, Ontario

Road Authority	Winter Control Category	Road/Sidewalk	Snow Trigger	Response	Other Notes
Sudbury	Snow Plowing - Roads	Class 1 - 3 Roads	5 cm	3 - 8 hr	Roads are salted, 17 Beats (includes 4 Echelon Beats)
	Snow Plowing - Roads	Class 4 - 6 Roads	8 cm	Up to 24 hr	Roads are sanded, 28 Beats
	Snow Plowing - Sidewalks	All Sidewalks	8 cm	12 to 24 hr	Business area plowed throughout the work week, 20 Beats
	Snow Removal	Completed when sight lines at major intersections are hindered or lane widths narrow. Snow is removed in the business sections on average twice per season and as required. Snow Benching in the rural areas is done to increase snow storage. One main snow dump with an average round trip haul time of one hour. Various smaller snow dumps located in outlying areas.			
Timmins	Snow Plowing - Roads	Class 1 - 3 Roads	8 - 10 cm	8 - 12 hr	Roads are sanded
	Snow Plowing - Roads	Class 4 - 6 Roads	8 - 10 cm	8 - 12 hr	Roads are sanded, 13 Total Beats
	Snow Plowing - Sidewalks	All Sidewalks	8 - 10 cm	8 - 16 hr	All sidewalks plowed throughout the work week, 6 Beats
	Snow Removal	Completed when snow banks reach three feet in the business sections, when sight lines are hindered, or when lane widths narrow on any street. Snow removal operations are continuous after December of every year, excluding winter event days. Eight snow dumps are in operation. The farthest haul distance is 4 km and the average round trip haul haul time is 10 minutes.			
North Bay	Snow Plowing - Roads	Class 1 - 3 Roads	MMS	8 - 12 hr	Roads are salted
	Snow Plowing - Roads	Class 4 - 6 Roads	MMS	8 - 12 hr	Roads are sanded, 13 Total Beats
	Snow Plowing - Sidewalks	All Sidewalks	MMS	Up to 12 hr	5 Beats, spot sand all sidewalks
	Snow Removal	Completed when sight lines at major intersections are hindered, lane widths narrow, and in the business sections when snow banks exceed two feet or as required. Largely a complaint/investigation/action driven system is incorporated for snow removal. One snow dump with a round trip distance of 20 minutes.			

Table 4

Storm Response Triggers, Actions, and Response Times - Comparison With Other Northern Municipalities
Salt Management Plan
City of Greater Sudbury, Ontario

Road Authority	Winter Control Category	Road/Sidewalk	Snow Trigger	Response	Other Notes
Sault Ste. Marie	Snow Plowing - Roads	Class 1 - 3 Roads	5 cm	Up to 12 hr	Roads are salted
	Snow Plowing - Roads	Class 4 - 6 Roads	5 cm	Up to 24 hr	Roads are sanded, 17 Total Beats
	Snow Plowing - Sidewalks	All Sidewalks	5 cm	Up to 12 hr	All sidewalks plowed throughout the work week, 9 Beats
	Snow Removal	Completed when snow banks are halfway up the parking meters in the business sections. Snow is removed from all streets when sight lines are hindered or when lane widths narrow. Benching of snow in the rural areas occurs. Seven designated snow dumps in operation. The longest haul distance is 3 km.			
Thunder Bay	Snow Plowing - Roads	Class 1 - 3 Roads	5 cm	Up to 12 hr	Roads are salted
	Snow Plowing - Roads	Class 4 - 6 Roads	5 cm	Up to 72 hr	Roads are salted, 34 Total Beats
	Snow Plowing - Sidewalks	High Priority Sidewalks	5 cm	14 - 36 hr	
	Snow Plowing - Sidewalks	Low Priority Sidewalks	5 cm	Up to 72 hr	15 Total Beats
	Snow Removal	Completed when sight lines at major intersections are hindered, lane widths narrow, and in the business sections as required. Snow removal has not happened anywhere in the City for the past few years (conditions have not warranted). All roads are essentially bare due to City wide salting operation, which minimizes the need for snow removal.			

NOTES:
Information provided by City of Sudbury Public Works Department

Table 5

Storm Response Guide
Salt Management Plan
City Of Greater Sudbury, Ontario

Current Temperature	Current Pavement Condition	Current Precipitation	Possible Action	Application Rates			
				Class 1 to 3 Roads			Class 4 to 6 Roads
				Brine (L/ MT of Salt)	Salt (kg/2-Lane km)	Sand (kg/2-Lane km)	Sand (kg/2-Lane km)
0°C and above	Wet	Snow	Plow and Sand or Salt	65	60 to 90	Nil (1)	100 to 310
		Freezing Rain	Sand and Salt	65	150	Nil (1)	310
-4°C to 0°C	Wet	Snow	Plow and Sand or Salt	65	90 to 115	Nil (1)	100 to 310
		Freezing Rain	Sand and Salt	65	150	Nil (1)	310
-12°C to -4°C	Snow Packed	Nil	Plow and Salt	65	115 to 150	Nil (1)	Nil (1)
	Snow Packed	Snow	Plow and Sand or Salt	65	150	Nil (1)	100 to 310
	Dry	Snow	Plow and Sand or Salt	65	150	Nil (1)	200 to 310
Below -12°C	Snow Packed	Nil	Plow and Sand	Nil	Nil	200 to 310	200 to 310
	Dry	Snow	Plow and Sand	Nil	Nil	200 to 310	200 to 310

NOTES:

The Superintendent or his designate may change protocol at his/her discretion based on actual road and weather conditions
kg - kilogram
km - kilometre
L - litre
MT - metric tonne

Table 6

Summary of Annual Salt Usage - 2003 To 2015
Salt Management Plan
City Of Greater Sudbury, Ontario

Season	*Total salt use per season for each city section (tonnes)* [1]					*Total Salt (tonnes)*
	South	*Southeast*	*Southwest*	*Northeast*	*Northwest*	
2003	4,460	5,379	2,827	2,412	1,503	16,581
2004	4,080	5,321	2,744	3,037	1,334	16,516
2005	4,420	5,266	2,603	2,544	1,279	16,112
2006	5,828	6,900	4,722	3,198	1,735	22,383
2007	5,164	7,125	3,556	3,385	1,918	21,148
2008	10,179	10,700	5,002	5,635	2,898	34,414
2009	3,335	3,387	2,014	2,145	1,166	12,047
2010	4,301	5,630	3,019	3,338	1,887	18,175
2011	3,577	5,005	2,835	2,992	2,021	16,430
2012	4,749	6,226	3,465	3,495	2,499	20,434
2013	7,563	8,728	4,753	4,608	3,457	29,109
2014	5,715	6,757	3,899	3,630	2,624	22,625
2015	3,166	3,519	1,825	2,257	1,649	12,416
Average	5,118	6,149	3,328	3,283	1,998	19,876

NOTES:
(1) Quantities include salt used for brine manufacturing and salt used to pickle sand

Table 7

Summary of Annual Sand Usage - 2005 To 2015
Salt Management Plan
City of Greater Sudbury, Ontario

Season	*Total sand use per season for each city section (tonnes)*					*Total Sand (tonnes)*
	South	*Southeast*	*Southwest*	*Northeast*	*Northwest*	
2005	14,224	12,286	15,183	9,647	11,267	62,607
2006	11,959	8,026	12,844	6,997	7,674	47,500
2007	7,599	7,908	7,408	5,925	6,939	35,779
2008	19,302	15,537	12,114	11,146	16,547	74,646
2009	9,729	7,136	7,304	6,187	6,151	36,507
2010	9,395	9,909	10,035	7,730	9,679	46,748
2011	10,107	11,928	9,684	8,252	9,533	49,504
2012	12,487	11,323	10,351	10,932	8,888	53,981
2013	14,430	16,491	13,061	15,042	12,396	71,420
2014	16,933	15,208	18,031	13,781	12,060	76,013
2015	14,236	12,100	13,308	11,231	8,831	59,706
Average	12,764	11,623	11,757	9,715	9,997	55,856

Appendices

Appendix A
Road Inventory

Inventory by Maintenance Class

12/21/2016

	NE	NW	S	SE	SW	Totals
Class 1						
Lane / Km	51.0	29.2	46.7	32.6	34.9	194.4
%	**26.2**	**15.0**	**24.0**	**16.8**	**18.0**	
Centerline / Km	14.8	7.3	18.6	12.5	8.7	61.9
%	**23.9**	**11.8**	**30.0**	**20.2**	**14.1**	
Class 2						
Lane / Km	28.3	16.9	126.8	117.6	5.5	295.1
%	**9.6**	**5.7**	**43.0**	**39.9**	**1.9**	
Centerline / Km	7.5	6.0	30.6	30.8	2.8	77.7
%	**9.7**	**7.7**	**39.4**	**39.6**	**3.6**	
Class 3						
Lane / Km	69.6	58.2	66.0	97.4	73.9	365.1
%	**19.1**	**15.9**	**18.1**	**26.7**	**20.2**	
Centerline / Km	31.4	28.9	31.3	44.7	36.8	173.1
%						
Class 4						
Lane / Km	234.8	173.6	177.6	151.6	135.7	873.3
%	**26.9**	**19.9**	**20.3**	**17.4**	**15.5**	
Centerline / Km	117.4	86.5	87.7	75.8	67.9	435.3
%	**27.0**	**19.9**	**20.1**	**17.4**	**15.6**	
Class 5						
Lane / Km	242.0	235.2	481.7	473.5	324.3	1756.7
%	**13.8**	**13.4**	**27.4**	**27.0**	**18.5**	
Centerline / Km	123.8	118.1	243.3	238.2	162.9	886.3
%	**14.0**	**13.3**	**27.5**	**26.9**	**18.4**	
Class 6						
Lane / Km	5.8	24.9	6.9	19.0	71.5	128.1
%	**4.5**	**19.4**	**5.4**	**14.8**	**55.8**	
Centerline / Km	3.0	15.0	3.7	9.9	38.7	70.3
%	**4.3**	**21.3**	**5.3**	**14.1**	**55.0**	
Totals						
Lane / Km	631.5	538.0	905.7	891.7	645.8	3612.7
Centerline / Km	297.9	261.8	415.2	411.9	317.8	1704.6

Class 1 / 2	16.2	9.4	35.4	30.7	8.3	100.0
Class 1 / 2 / 3	17.4	12.2	28.0	29.0	13.4	100.0
Class 1 / 2 / 3 / 4	22.2	16.1	24.1	23.1	14.5	100.0
Class 1 / 2 / 3 / 4 / 5	18.0	14.7	25.8	25.0	16.5	100.0
Class 1 / 2 / 3 / 4 / 5 / 6	17.5	14.9	25.1	24.7	17.9	100.0
Class 6 / 5	13.1	13.8	25.9	26.1	21.0	100.0
Class 6 / 5 / 4	17.5	15.7	24.2	23.4	19.3	100.0

Inventory by Planning Class

12/21/2016

	NE	NW	S	SE	SW	Totals
Arterial						
Lane / Km	171.9	57.0	227.0	278.8	91.0	825.7
%	**20.8**	**6.9**	**27.5**	**33.8**	**11.0**	
Centerline / Km	59.0	24.8	62.4	105.2	36.6	288.0
%	**20.5**	**8.6**	**21.7**	**36.5**	**12.7**	
Collector						
Lane / Km	115.4	135.4	139.6	117.6	113.6	621.6
%	**18.6**	**21.8**	**22.5**	**18.9**	**18.3**	
Centerline / Km	57.7	67.4	68.1	57.6	56.8	307.6
%	**18.8**	**21.9**	**22.1**	**18.7**	**18.5**	
Local						
Lane / Km	357.9	334.5	569.8	544.5	444.3	2251.0
%	**15.9**	**14.9**	**25.3**	**24.2**	**19.7**	
Centerline / Km	181.8	170.2	286.9	274.1	225.8	1138.8
%	**16.0**	**14.9**	**25.2**	**24.1**	**19.8**	
Totals						
Lane / Km	645.2	526.9	936.4	940.9	648.9	3698.3
%	**17.4**	**14.2**	**25.3**	**25.4**	**17.5**	
Centerline / Km	298.5	262.4	417.4	436.9	319.2	1734.4
%	**17.2**	**15.1**	**24.1**	**25.2**	**18.4**	

Appendix B
Road Patrol Record Forms

Sudbury Greater Grand

Summer Patrol Record

Weather	
Clear	Time
Partly Cloudy	Time
Overcast	Time
Rain	Time
Fog	Time
Air Temperature:	Time
Pavement Temperature:	Time
Visibility: Good Fair Poor	
Wind: Light Moderate Strong Direction_____	

Date:

Patrolled by:

Truck #:

Hours of Work: _____to_____

On Call ORS:

Condition Codes
× **Needs Service**
A blank space indicates conditions meet standard
Time to be recorded using a 24 hour clock

Accident/Damage	Time
Police Response yes no	Police Report #
Location	
Description	

Highway Patrolled (Area)				Road Classification	Roadway						Signs & Markers		Sidewalks		Bridges		Other	Notes
					Pothole	Shoulder Drop Off	Surface Discontinuities	Debris	Drainage (MH, CB, Sewers & Culverts)	Requires Other Maintenance	Safety Devices	Road Signs	Surface Discontinuities	Requires Other Maintenance	Deck Spalls	Requires Other Maintenance	Other Required Maintenance	
Name	**Time**	**From**	**To**															

Page # _____ **of** _____

Greater | Grand Sudbury

Winter Patrol Record

Weather		Date:
Clear	Time	
Partly Cloudy	Time	Patrolled by:
Overcast	Time	
Rain	Time	Truck #:
Snow	Time	
Freezing Rain	Time	Hours of Work: _____ to _____
Fog	Time	
Visibility: Good Fair Poor		On Call ORS:
Wind: Light Moderate Strong Direction_____		

Condition Codes
× Needs Service
A blank space indicates conditions meet standard
Time to be recorded using a 24 hour clock

Accident/Damage	Time
Police Response yes no	Police Report #
Location	
Description	

Highway Patrolled (area)				Road Classification	Air Temperature	Pavement Temperature	Ambient Condition						Winter Event Condition							Sidewalks		Notes
Name	Time	From	To				Bare & Dry	Bare & Wet	Track Bare	Center Bare	Snow Covered	Snow Packed	Snow Accumulation (cm)	Drifting	Ice Covered	Spot Ice	Black Ice	Frost	Slush	Requires Maintenance (Snow)	Requires Maintenance (Ice)	

Appendix C
Continuous Improvement Practices

Appendix C
Continuous Improvement Practices and Strategies
Salt Management Plan
City of Greater Sudbury, Ontario

Salt Management Plan - (City of Greater Sudbury)							
Continuous Improvement Options (1)	**Forecasted Implementation Schedule**						**Comments**
	Currently Reviewed and Updated As Needed	**Need for Review and Updating**	**Requires periodic review to maintain continuous improvement**	**Currently Implemented or Completed**	**Not Currently Considered**	**To be Implemented (Date)**	
Level of Service Policy - Review & Update			X	X			Council Approved Changes as required
Equipment Upgrading							
Spreading Equipment - equipped with:							
Pavement infrared thermometer	X			X			
Pre-wetting hardware	X			X			
Electronic Controllers	X			X			
GPS			X	X			
Patrol Trucks - equipped with:							
Pavement infrared thermometer				X			
Loader weigh bucket option - Added to all loader vehicles		X		X			Not used very much
Equipment Calibration							
Stipulate application rates for all materials used	X		X	X			
Pre-Winter Season Calibration				X			
Mid-Winter Calibration		X					
Calibration after installation or repair work done on spreading equipment		X		X			
Benchmarking of routes for theoretical amount of required winter materials prior to winter season		X	X				
Record and storage of calibration data for comparison and development of application rates		X	X				
Equipment Washing							
Wash all vehicles indoors		X					
Salt water retention/treatment area installed at all yards		X			X		Long term goal, no implementation date set
Oil/water separators installed at all patrol yards		X					

Appendix C
Continuous Improvement Practices and Strategies
Salt Management Plan
City of Greater Sudbury, Ontario

Salt Management Plan - (City of Greater Sudbury)							
Continuous Improvement Options (1)	**Forecasted Implementation Schedule**						**Comments**
	Currently Reviewed and Updated As Needed	**Need for Review and Updating**	**Requires periodic review to maintain continuous improvement**	**Currently Implemented or Completed**	**Not Currently Considered**	**To be Implemented (Date)**	
Material Delivery and Handling							
Reduction of percentage of salt used in salt/sand mix to min. amount to prevent sand from freezing (2-5%)			X		X		
Salt/sand piles covered to prevent leaching		X			X		
Salt deliveries covered while in transport and delivered in good weather	X			X			
Clean loading pads following transfer of material indoors					X		
Brine transfer from tank to truck conducted on solid impermeable flooring		X			X		
Records kept: Weigh tickets with truck number for each delivery				X			
Timing of transfer of material indoors		X					
Cleaning of loading pad after material transfer					X		
Discontinue summer storage of pickled sand		X			X		
Records of Material Usage							
Record material usage for each route/each truck/each storm event		X		X			Noted on crew cards
Compare material usage to benchmarked usage		X		X			
Adjust material usage based on weather and pavement conditions		X		X			
Use material tracking system to rationalize amount of materials used with the amount ordered and the residual amount at the end of the season		X	X				
Download and compare material usage from electronic spreader controls to that in the material tracking system		X	X				
Record patrols that are performed	X			X			
Record of responses made to winter storm events	X			X			
Weather and Pavement Temperature Forecasting							
Use of a value added meteorological service	X			X			
Use of MTO's RWIS sites pertaining to the Greater Sudbury area	X			X			
Storm Response							
Record of air and pavement temperature during a storm event	X			X			
Record of temperature rising or falling at end of storm event	X			X			
Effect of heat gain during daylight hours along with time of day				X			
Record Traffic volumes with time of day (assists with breaking snow/ice bond with pavement)	X				X		
Record of wind direction	X			X			
Note Frost penetration into pavement base and effects on pavement temperature		X					
Snow fence program for drifting conditions	X			X			

Appendix C
Continuous Improvement Practices and Strategies
Salt Management Plan
City of Greater Sudbury, Ontario

Salt Management Plan - (City of Greater Sudbury)							
Continuous Improvement Options (1)	**Forecasted Implementation Schedule**						**Comments**
	Currently Reviewed and Updated As Needed	**Need for Review and Updating**	**Requires periodic review to maintain continuous improvement**	**Currently Implemented or Completed**	**Not Currently Considered**	**To be Implemented (Date)**	
Winter Patrol							
Patrol coverage as Council directs for the winter season				X			
Patrol coverage 24 hours a day/7 days a week	X			X			
Patrol coverage for the shoulder season before and after the designated winter season to deal with frost and black ice	X			X			
Ensure patrollers are trained and under the supervision of a seasoned winter maintenance supervisor			X	X			
Emergency Response Procedures (Plan in Place)							
Training							
Sufficient training for equipment operators on controls and operating procedures	X		X	X			
Refresher training for operators on basic weather forecasting and tools to determine pavement temperature	X		X	X			
refresher training on basic weather forecasting and tools used to determine pavement temperature	X		X	X			
Operators trained in the application of materials for de-icing and anti-icing in order to obtain maximum effect	X		X	X			
Supervisors and Patrollers trained on basic weather and pavement temperature forecasting, RWIS	X		X	X			
Managers and Supervisors to attend workshops to learn about new technologies, techniques, and the experience of others with various products and materials	X			X			
Health and safety requirements for use of equipment and materials			X	X			
Technical review of existing and new technology	X			X			
Environmentally Sensitive/Vulnerable Areas							
Identify vulnerable areas and areas of natural and scientific interest			X				
Liaise with local potable water supply agencies within the City				X			
Monitor ground water and recharge areas					X		
Locate stockpiles and snow disposal sites outside of vulnerable areas		X					
Communication Strategy							
Prepare and distribute a winter maintenance guideline to the general public to ensure public awareness of the program that is being delivered			X	X			
Prepare an internal handbook for employees that communicates the Council approved winter maintenance policies and procedures and other important information such as, contact lists, shift assignments, etc.		X	X	X			
Provide winter maintenance information on the municipal website			X	X			

Notes:
Options shown are chosen from the Section 3.0 list of Continuous Improvement Practices And Strategies.
Some options will require updating and regular review there after.

Appendix D
Potentially Vulnerable Water Areas

Appendix D Potentially Vulnerable Water Areas City of Greater Sudbury, Ontario

SOUTHEAST SECTION

Sudbury

Lake Ramsey/Minnow Lake

- Downstream from the Sudbury East snow dump site
- May also be impacted by runoff from Hwy 17

Garson

Junction Creek

Coniston Creek

Coniston

Romford Creek

Falconbridge

Boucher Lake

Skead

Lake Wanapitei

- Downstream from the Skead snow dump site

SOUTHWEST SECTION

Panache Lake

- May be impacted by runoff from Regional Road 10, Panache North Shore Road, Hennessy Road, and Ojibway Road

Little Panache Lake

- May be impacted by runoff from Regional Road 10, Stoney Bay Road, Holmstedt Road

Vermilion River system

- May be impacted from pickled salt pile at the Naughton Depot
- May be impacted by runoff from Hwy. 17, Regional Road 55, Regional Road 10, McCharles Lake Road

Junction Creek

- May be impacted by runoff from Fielding Road, Hwy 17 Southwest Bypass, Mikkola Road, Black Lake Road, and Regional Road 55

Meatbird Creek

- May be impacted by runoff from Old Soo Road, Hwy 24, and old Hwy 17 West

NORTHEAST SECTION

Capreol

Vermilion River

- May be impacted by runoff from snow dump site between Ski Hill Road and CN railway
- May also be impacted by runoff from Hwy 84 and Lakeshore Street

NORTHWEST SECTION

Onaping and Levack

Onaping River

- May be impacted by runoff from Hwy 8, Strathcona Mine Road and High Street

Clear Lake

- May be impacted from Hwy 144 and Hwy 8

Chelmsford

Whitson Creek

- Has a high potential for impact as it is crossed by several city streets and Hwy 144

Azilda

Charlebois Creek

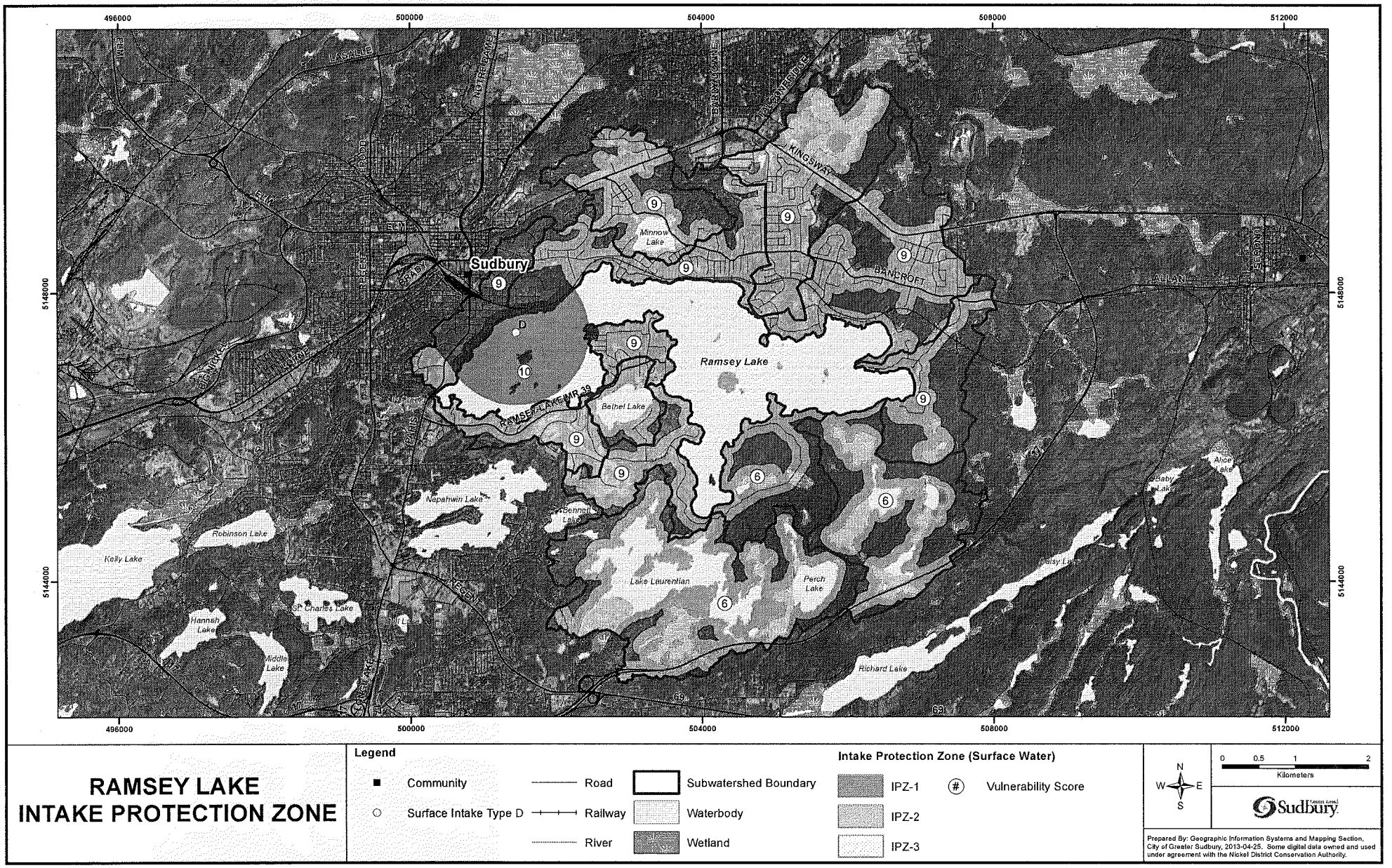
- Has a high potential for impact as it is crossed by several city streets and Hwy 35

SOUTH SECTION

The PWD has classified the following creeks and lakes as vulnerable waterbody areas all of which discharge into the Vermillion watershed:

Nolin Creek
Junction Creek
Ramsey Lake
Lilly Creek
Nepahwin Lake
Robinson Lake
Kelly Lake
Long Lake
Silver Creek
St. Charles Lake

Appendix E
Source Water Protection Maps and Signage



RAMSEY LAKE INTAKE PROTECTION ZONE

Legend

- Community
- Surface Intake Type D
- Road
- Railway
- River
- Subwatershed Boundary
- Waterbody
- Wetland

Intake Protection Zone (Surface Water)

- IPZ-1
- IPZ-2
- IPZ-3
- (#) Vulnerability Score

N W E S

0 0.5 1 2 Kilometers

Sudbury

Prepared By: Geographic Information Systems and Mapping Section, City of Greater Sudbury, 2013-04-25. Some digital data owned and used under agreement with the Nickel District Conservation Authority.

WANAPITEI RIVER INTAKE PROTECTION ZONE

Intake Protection Zones 1 & 2

Legend

- Community
- Surface Intake Type C
- Road
- Railway
- River
- Subwatershed Boundary
- Waterbody
- Wetland

Intake Protection Zone (Surface Water)

- IPZ-1
- IPZ-2
- IPZ-3
- (#) Vulnerability Score

N W E S

0 125 250 500 Meters

Sudbury

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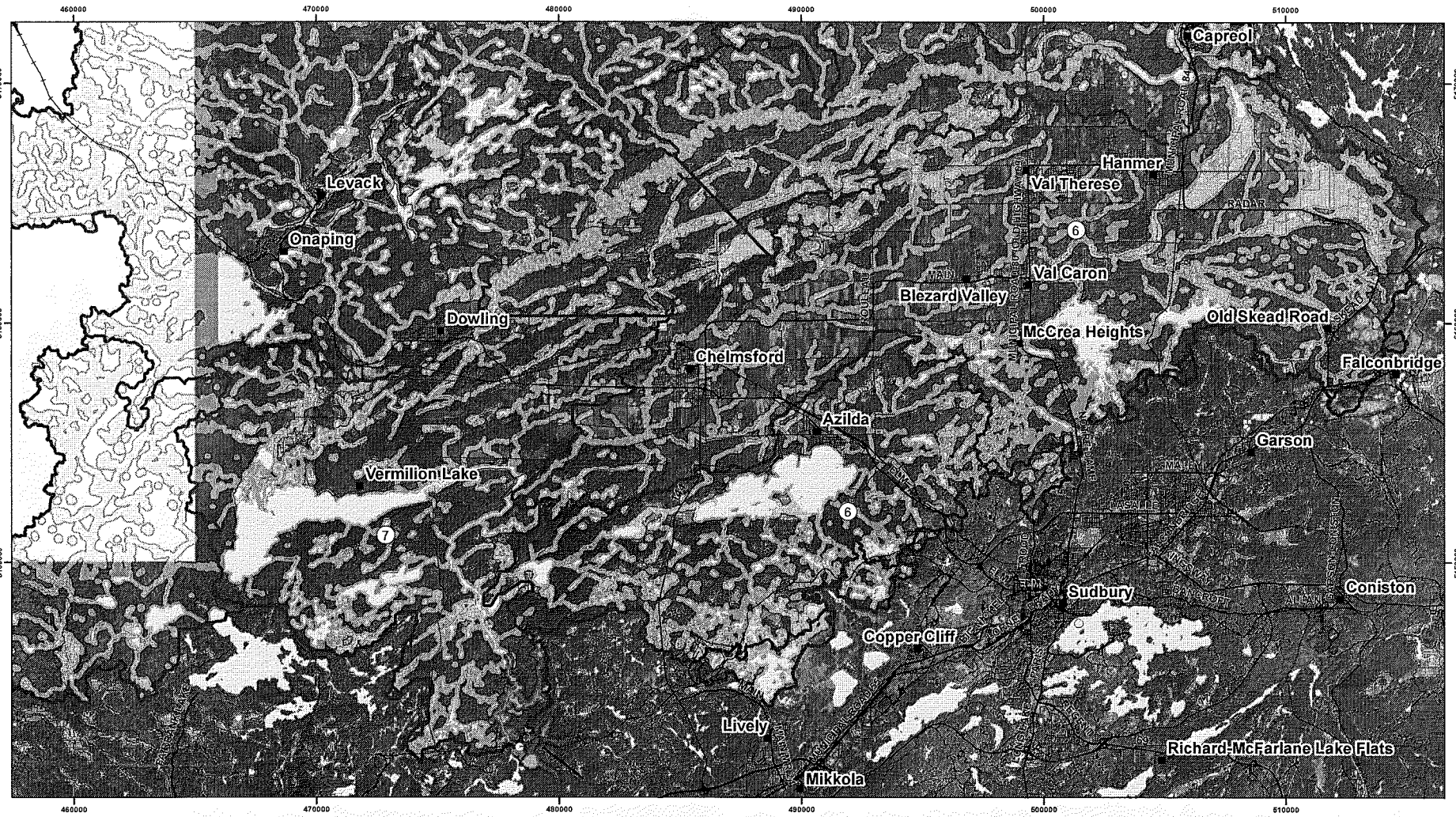

VERMILION RIVER INTAKE PROTECTION ZONE

Intake Protection Zone 1, 2 & 3
(Vulnerability Scores 6 or higher)

Legend

- Community
- Surface Intake Type C
- Road
- Railway
- River
- Subwatershed Boundary
- Waterbody
- Wetland

Intake Protection Zone (Surface Water)

- IPZ-1
- IPZ-2
- IPZ-3
- (#) Vulnerability Score

N W E S

0 1.5 3 6
Kilometers

Sudbury

Prepared By: Geographic Information Systems and Mapping Section, City of Greater Sudbury, 2013-04-25. Some digital data owned and used under agreement with the Nickel District Conservation Authority.

ONAPING WELLHEAD PROTECTION AREAS

Legend

- Community
- ProductionWells
- Road
- Railway
- River
- Waterbody
- Wetland

Wellhead Protection Areas (Groundwater)

- WHPA Vulnerability Score 10

N W E S

0 50 100 200
Meters

Sudbury

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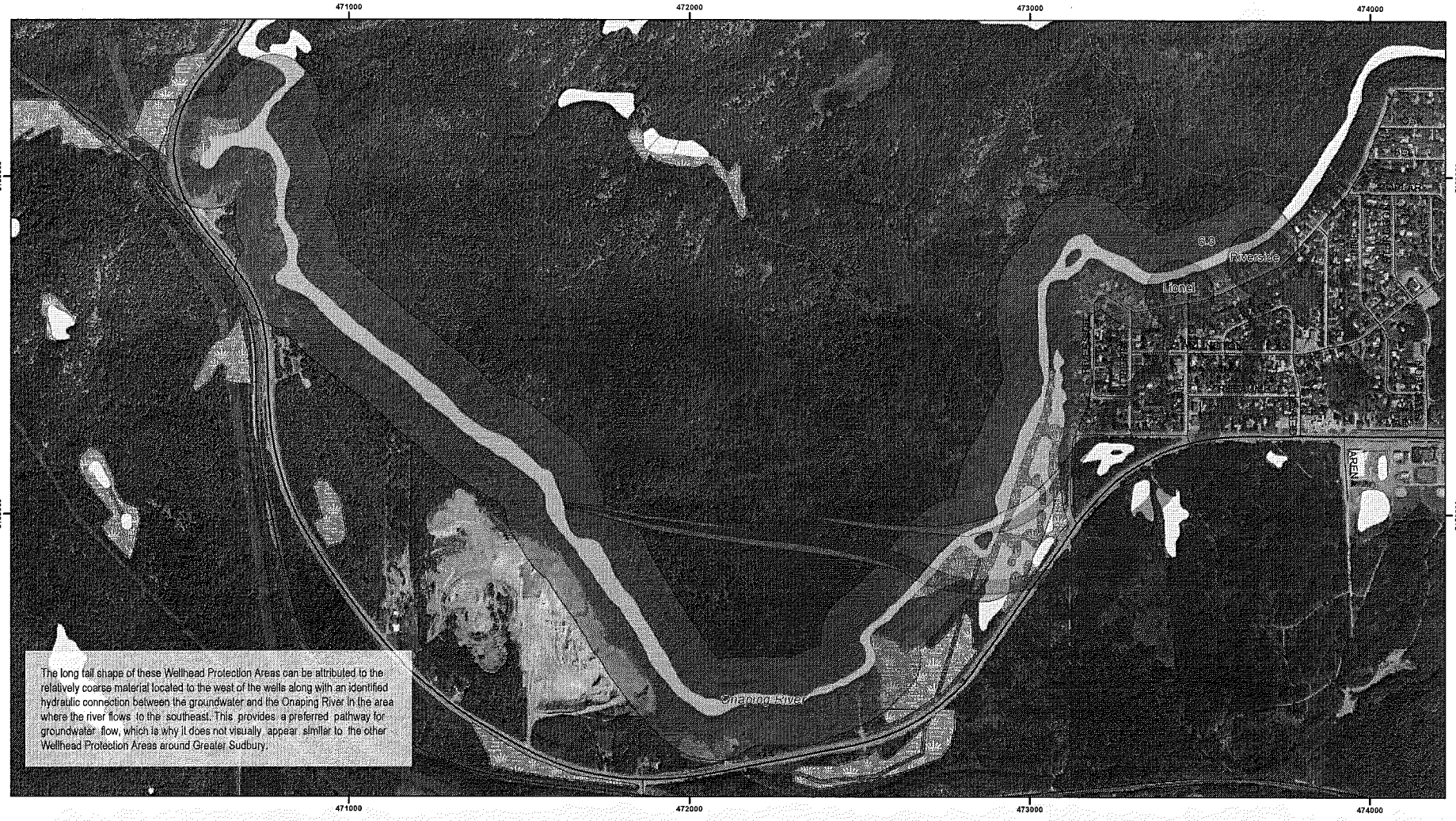

DOWLING WELLHEAD PROTECTION AREAS

Legend

- Community
- ProductionWells
- Road
- Railway
- River
- Waterbody
- Wetland

Wellhead Protection Areas (Groundwater)

- WHPA Vulnerability Score 6.3
- WHPA Vulnerability Score 8
- WHPA Vulnerability Score 10

N W E S

0 125 250 500
Meters

Sudbury

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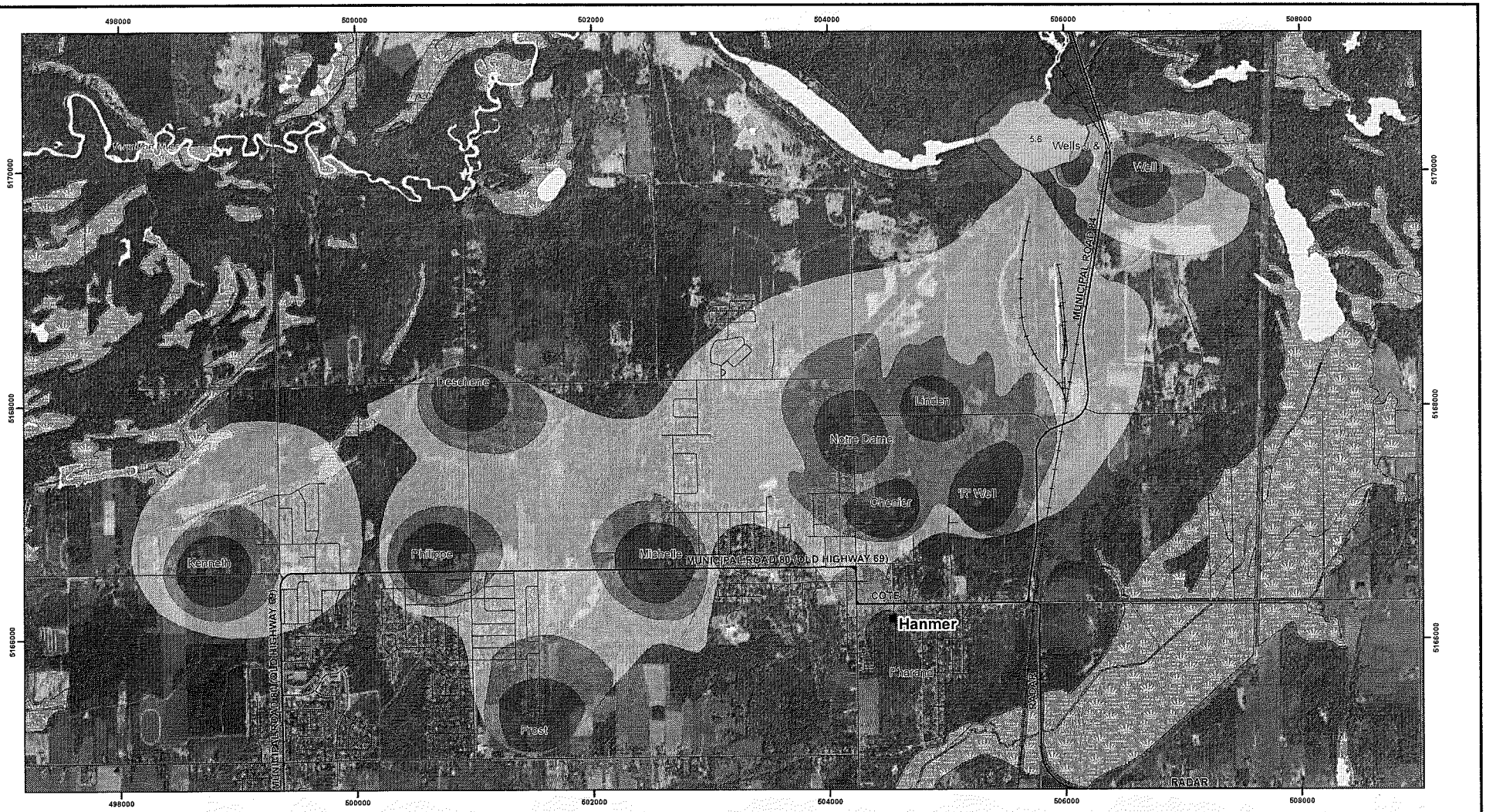

VALLEY AND CAPREOL WELLHEAD PROTECTION AREAS

Legend

- Community
- ProductionWells
- Road
- Railway
- River
- Waterbody
- Wetland

Wellhead Protection Areas (Groundwater)

- WHPA Vulnerability Score 2
- WHPA Vulnerability Score 5.6
- WHPA Vulnerability Score 6
- WHPA Vulnerability Score 8
- WHPA Vulnerability Score 10

N W E S

0 0.25 0.5 1
Kilometers

Sudbury

Prepared By: Geographic Information Systems and Mapping Section, City of Greater Sudbury, 2013-04-25. Some digital data owned and used under agreement with the Nickel District Conservation Authority.

GARSON WELLHEAD PROTECTION AREAS

Legend

- ■ Community
- ● ProductionWells
- Road
- Railway
- River
- Waterbody
- Wetland

Wellhead Protection Areas (Groundwater)

- WHPA Vulnerability Score 2
- WHPA Vulnerability Score 4
- WHPA Vulnerability Score 6
- WHPA Vulnerability Score 8
- WHPA Vulnerability Score 10

N / W / E / S

0 100 200 400 Meters

Greater Grand Sudbury

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FALCONBRIDGE WELLHEAD PROTECTION AREAS

Legend

- Community
- ProductionWells
- Road
- Railway
- River
- Waterbody
- Wetland

Wellhead Protection Areas (Groundwater)

- WHPA Vulnerability Score 6
- WHPA Vulnerability Score 8
- WHPA Vulnerability Score 10

N W E S

0 125 250 500
Meters

Sudbury

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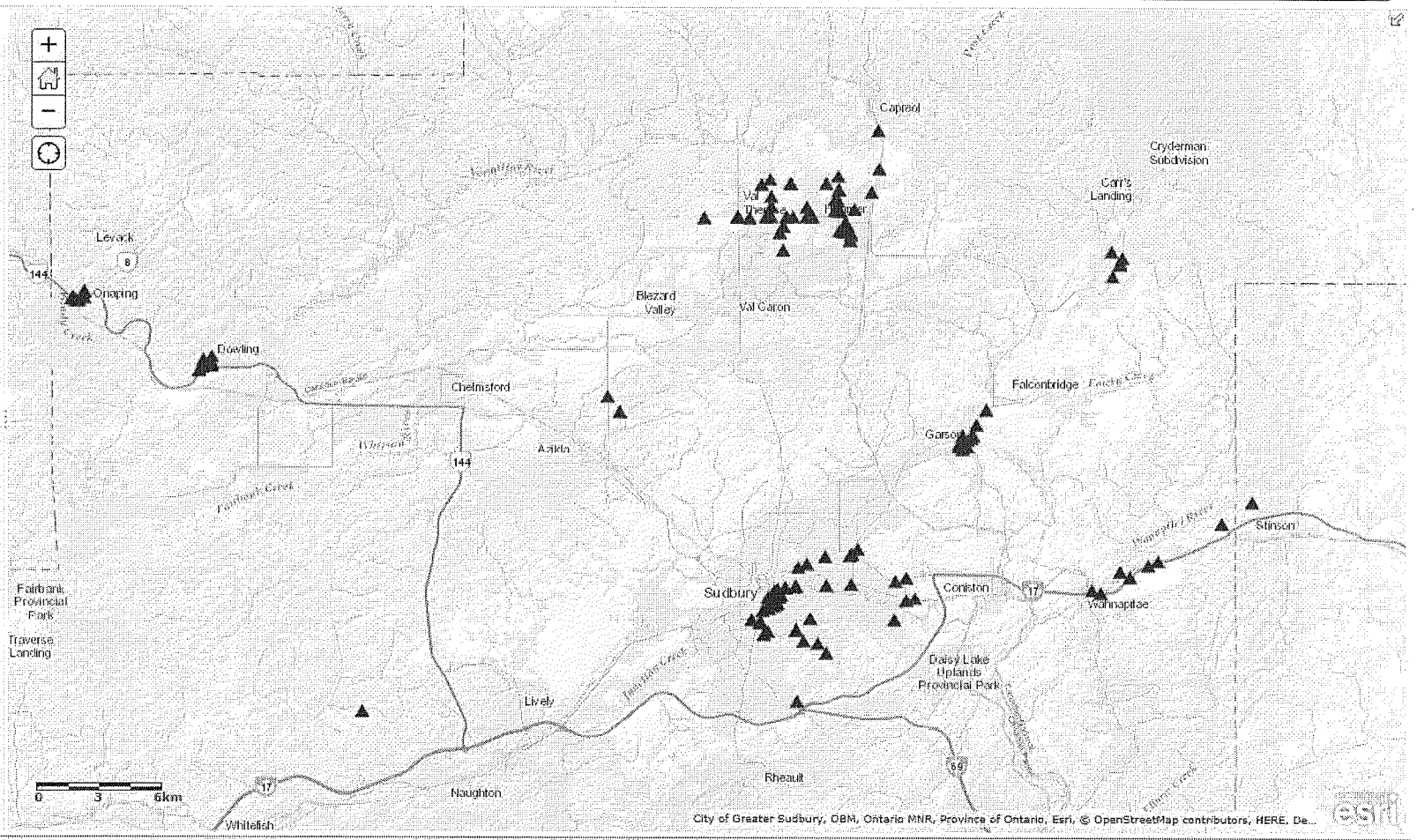
- Source Water Protection / Protection des sources d'eau potable (Layer)
- Topographic



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Appendix F
Inspection Observations - 2016

Appendix F1

Road Operations Snow Storage Site Inspection Observations - 2016
Salt Management Plan
City of Greater Sudbury

Section	Depot	Inspection Observations	Recommended Actions	Activity Level [3]
South	LaSalle	High relief at the Site with a drop off of approximately 25 m along the south side		
		Snow is pushed up to the edge of the slope and down the slope into the valley		
		Silt fencing is placed along the bottom of the slope to prevent sediment and garbage entering stream	Conduct regular inspections to ensure silt fencing in good condition	2
		Garbage and debris observed on the Slope and at bottom	Conduct clean up to remove garbage	1
Southeast	Skead	Snow stored at the base of a steeply sloped, sandy cut		
		The Site is bounded by roadway on all other sides		
		Site is surfaced with gravel		
		Drainage towards the south		
		Site used to store local snow only		
Northeast	Capreol	Ground surface covered with sand		
		Drainage towards the west where water ponds		
		No vegetation observed on Site		
		Snow storage area surrounded by trees to the south, west, and north, no vegetative stress observed		
		Minor debris noted including bricks and garbage		
		Some fill noted including asphalt	Conduct periodic inspections to ensure that the Site is not being used as an illegal dump	1
Northwest	Chelmsford	Site is located on the edge of the Whitson River	Consider discontinuing use of this site for snow storage	3
		Drainage directly into the river	Build a berm around the site to contain and control melt water	2
		No buffer observed between the snow storage area and the river	Use visual markers so that dozer operator does not push snow piles too far	2
		Minor garbage and debris observed	Conduct clean up to remove garbage	1
		Drainage channel observed on the north side of the pile	Install erosion control with in the drainage ditch	2
	Levak	Located between Mine Road and train track/Nickel Street		
		Drainage is to the east to a ditch along Mine Road	Install erosion control at appropriate points along the drainage ditch	2
		Site surface is sand and gravel fill		
		Minor debris noted	Conduct clean up to remove garbage	1
		Overflow site located north of Nickel Street, surrounded by residential land use.	Conduct clean up to remove garbage/conduct regular inspections to ensure site is not used for illegal dumping	1
		- previous complaints of noise during snow disposal	Reduce noise - train operators/post signage	2
		- Site located adjacent to drainage ditch/creek	Install silt curtains at drainage outlets	1

NOTES:
(1) Road Operations Sectional Central Operations Depots
(2) Road Operations Central Head Quarters
(3) Activity Levels:
1 - Activity requires minimal effort/cost to implement.
2 - Activity requires minimal to moderate additional cost/effort to implement and will require short term planning and potential changes to department operations.
3 - Activity requires significant cost/effort to implement and may required long term planning.

Appendix F2

Road Operations Depots Site Inspection Observations - 2016
Salt Management Plan
City of Greater Sudbury

Section	Depot	Inspection Observations	Recommended Actions	Activity Level [3]
South	St. Clair [1]	Wooden salt dome in fair condition, staff reported that previous structural damage was recently repaired	Continue periodic structural inspections	1
		Outdoor sand pile, uncovered	Consider placing sand under cover to prevent salt from washing out	3
		Site is adjacent to creek (Junction Creek)	Consider discontinuing use of Site for salt and sand storage	3
		Surface water flow directed to Junction Creek. Staff report that hay bail sediment control is used.	Install and maintain sediment control.	1
		New brine tank (stainless steel), adjacent floor drains have unknown discharge point	Confirm the discharge location of floor drains.	1
Southeast	Frobisher [1], [2]	Two outdoor sand piles, uncovered, located adjacent to the salt dome on the north and south sides	Consider placing sand under cover to prevent salt from washing out	3
		Salt stored in a wooden salt dome		
		Brine tank on Site, staff report that the tank is inspected and maintained. Floor drains not observed adjacent to brine tank		
		Site is adjacent to a wetland area	Monitor wetland for signs of vegetative stress	2
		Drainage is to the south towards wetland area within the IPZ-3 of Ramsey Lake	Install and maintain sediment control and review SWP requirements	1
		Housekeeping required to sweep up salt outside of salt dome	Maintain housekeeping	1
Southwest	Naughton	Sand is no longer stored at the Site		
		Salt stored in a wooden salt dome with exterior asphalt paving around the entrance/exit	Maintain regular housekeeping to sweep up salt outside of salt dome	1
		New brine tank (stainless steel) in garage. Adjacent floor drain discharges into the ground		
		Site is adjacent to water way (Junction Creek, connecting channel between Mud and Simon Lakes)		
		Berm prevents direct drainage from salt dome area south/west into Junction Creek		
		Surface drainage is currently east towards the Site driveway and into a treed area and north into ditches along the highway (St. Louis Road)		
	Black Lake [1]	Outdoor sand pile, uncovered, located on the west side of the Site	Consider placing sand under cover to prevent salt from washing out	3
		Drainage from the sand pile is towards the north and west		
		A sand berm is located along the north side of the site at the top of the slope down to the highway		
		Erosion crack in the berm along the north side of the Site, where surface water has broken through	Repair berm and erosion crack	2
		Minor vegetative stress at bottom of slope in ditch beside MR55		
	Whitefish	Outdoor sand pile, uncovered, located on the west side of the Site at the top of a steep slope	Consider placing sand under cover to prevent salt from washing out	3
		Sand pile eroding into marshy area west of Site	Move sand pile back from the bank and use erosion control measures	2
		Outwash plane located west of site, no vegetation growing within in outwash area		
		Drainage towards the west, stream flowing westward from outwash area	Place erosion control measure at outlet of outwash area	2
Northeast	Suez [1]	Outdoor sand pile, uncovered, located on the south side of the Site	Consider placing sand under cover to prevent salt from washing out	3
		The site is surrounded by a berm on the east, which wraps around the south side of the property		
		Drainage towards the south and east. Water infiltrates the ground or flows through culverts within the berm and ponds within low lying areas along Capreol Road (MR84)	Maintain sediment control at culvert inlet	1
		Salt stored in two wooden salt sheds	Maintain regular housekeeping to sweep up salt outside of storage sheds	1
		No vegetation on Site, all filled with sand and gravel		
	Capreol	Sand stored within former salt shed		
		Drainage to the east, towards swampy area, no erosion observed		
Northwest	Chelmsford [1]	Tarped salt storage structure located on south side of the Site		
		Some salt staining on the ground in front of the storage structure and on the side	Maintain regular housekeeping to sweep up salt	1
		Outdoor sand pile, uncovered, located east of the salt storage structure	Consider placing sand under cover to prevent salt from washing out	3
		Drainage ditch located adjacent to sand pile	Place erosion control along the south side of sand pile and salt storage structure	1
	Levak	Salt stored in concrete and wooden salt storage shed	Maintain regular housekeeping to sweep up salt	1
		Outdoor sand pile, uncovered	Consider placing sand under cover to prevent salt from washing out	3
		A berm is built up around the north, east and west sides of the site to prevent direct runoff		
		Drainage is to a marshy area to the southwest that discharges to the ditches along Mine Road		

NOTES:
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GUID 39382 (b)

Appendix G
Definitions

Appendix G Definitions

Anti-icing	Means the application of liquid de-icers directly to the road surface in advance of a winter event otherwise known as direct liquid application (DLA).
De-icing	Means the application of solids, liquids, pre-treated material to the road surface after the on-set of the winter event.
Paved Road	Is a road with an asphalt surface, concrete surface, composite pavement, or Portland cement.
Pre-treat	Means the application of liquids (calcium chloride, sodium chloride, etc) to the sand pile or salt pile as the sand or salt is loaded into the storage facility.
Pre-wetting	Means the application of liquids (calcium chloride, sodium chloride, etc.) at the spinner of the truck just prior to application to the road surface.
Surface Treated Road	Is a road with bituminous surface treatment comprised of one or two applications of asphalt emulsion and stone chips over a gravel road.
Unpaved Roads	Is a road with gravel, stone or other loose traveling surface.
Winter Event	Is a weather condition affecting roads such as snowfall, wind blown snow, sleet, freezing rain, frost, black ice, etc. to which a winter event response is required.
Winter Event Response	Is a series of winter control activities performed in response to a winter event.
Continuous Winter Event Response	Is a response to a winter event with full deployment of manpower and equipment that plow/salt/sand the entire system.
Spot Winter Event Response	Is a response to a winter event with only a part deployment of manpower and equipment or with full deployment to only part of the system.
Winter Event Response Hours	Are the total number of person-hours per year (plowing, salting/sanding, winging back, etc.) to respond to winter events.

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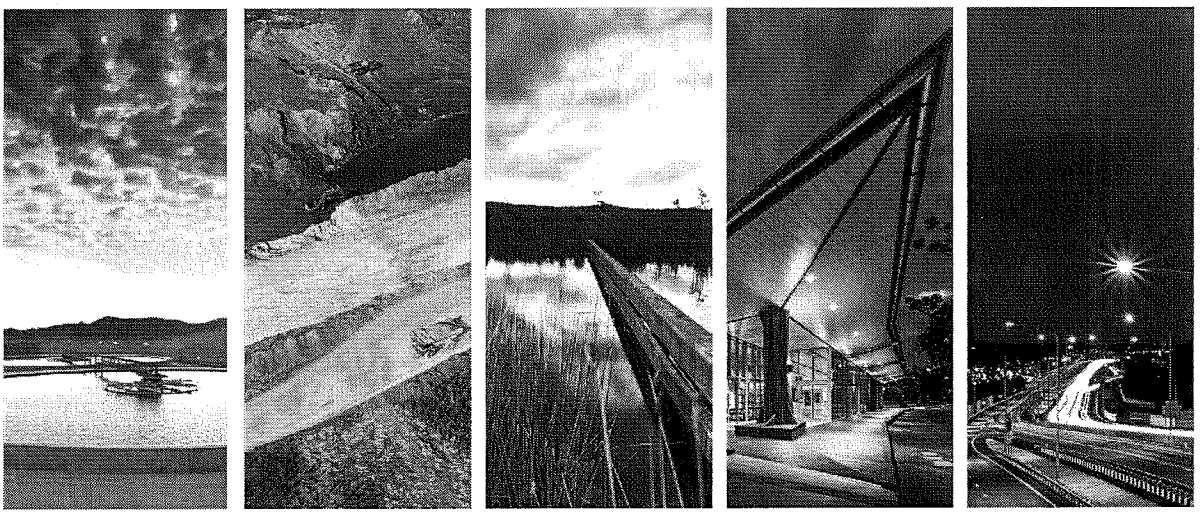

Risk Management Plan Assessment

Frobisher Depot
1800 Frobisher Street
Sudbury, Ontario

City of Greater Sudbury

GHD | 96 White Oak Drive Sault Ste. Marie Ontario P6B 4J8 Canada

039382| 42 | Report No 8 | January 18 2018

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

Executive Summary

GHD completed a Risk Management Plan Assessment (Assessment) for the Frobisher Depot located at 1800 Frobisher Street in Sudbury, Ontario (Site). The Site is an active winter maintenance depot operated by the City of Greater Sudbury (CGS). Winter maintenance activities conducted at the Site include salt and sand storage and handling; brine manufacturing; vehicle/equipment storage, maintenance, and repair; and administrative functions.

Road salt for the winter maintenance season is stored on Site in a covered salt storage dome with a relatively impermeable base. Pickled sand (i.e., sand mixed with salt at approximately five percent by weight) is stored on Site within and outside of the footprint of the former pickled sand dome located adjacent to the salt storage dome. Brine is prepared on demand in a separate building at the site. Application equipment used during the winter maintenance season is loaded at the site prior to deployment to respond to winter events.

Under the Clean Water Act (CWA), road salt handling and storage is a prescribed drinking water quality threat, which may contribute to the issue of rising sodium levels within Ramsey Lake. Based on the specific characteristics of road salt storage and handling at the Site (i.e. greater than 0.5 tonnes of road salt stored/handled) and the intersection of the Site with the Ramsey Lake Issues Contributing Area (ICA), the threat is deemed significant. As such, in accordance with the Greater Sudbury Source Protection Area Source Protection Plan Policy Sa-4E RMP, the Site requires a Source Water Risk Management Plan (RMP) for road salt handling and storage activities.

Surface water samples collected for sodium and chlorides, as part of the RMP Assessment, identified:

- Upgradient/background total sodium concentration of 152 milligrams per litre (mg/L) and chloride concentration of 117 mg/L.
- On-Site total sodium concentrations of 4,010 and 4,170 mg/L, and chloride concentrations of 6,220 and 6,430 mg/L.
- Downstream total sodium concentrations ranging from 181 to 313 mg/L, and chloride concentrations ranging from 322 to 558 mg/L. While total sodium concentrations generally remained the same downstream of Highway 55/Kingsway, chloride concentration generally slowly decreased with travel from 558 to 374/367 mg/L.

As expected, the highest sodium concentrations were observed immediately downstream of the salt depot where the pickled sand and mixing practices remain uncovered and exposed to the elements. Sodium concentrations were lower downstream. The on-Site (downgradient) low-lying swamp provides an excellent salt attenuation and buffer in minimizing the transport of salt from the Site towards the creek and eventually Ramsey Lake. No visual evidence of vegetative stress or deterioration was observed as a result of salt loadings from the Site.

As such, two measures available to CGS to manage the significant threat of road salt storage and handling within the Ramsey Lake ICA include:

- Maintain Site operations and implement Best Management Practices (BMPs) with monitoring to evaluate the effectiveness of BMPs.
- Relocate the winter maintenance material storage to a new site, located outside of any area where road salt storage and handling is deemed a significant threat, preferably within an area of low salt vulnerability as identified in the CGS Salt Optimization Plan.[1]

Considering the additional costs associated with relocating the depot, in association with the benefits provided by the low-lying downgradient swamp which provides salt attenuation and a buffer from salt travel, redeveloping the existing Site using BMPs (i.e., build a dome for the pickled sand, install a monitoring network) would be the most economical and practical option.

1 *"Salt Optimization Plan"*, Prepared by GHD on behalf of the City of Greater Sudbury, November 2017.

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1. Introduction

GHD was retained by the City of Greater Sudbury (CGS) to develop a Risk Management Plan Assessment (RMP Assessment) for its existing Frobisher Depot located at 1800 Frobisher Street in Sudbury, Ontario (Site/Property). GHD was also retained to collect downstream surface water samples to establish a baseline condition in support of the RMP Assessment. A Site location map and Site layout showing the Frobisher Depot are provided on Figures 1 and 2.

CGS owns the Frobisher Depot, which is operated as a winter maintenance depot including road salt handling and storage. The Site is located within the Ramsey Lake Issues Contributing Area (ICA), established due to elevated and rising sodium levels within the lake, which is a major drinking water source for CGS. In accordance with the Greater Sudbury Source Protection Area Source Protection Plan Policy Sa-4E RMP, the Site requires a Source Water Risk Management Plan (RMP) for road salt handling and storage activities.

The objective of this RMP Assessment is to characterize the geological and hydrogeological conditions of the Site and surrounding area with regard to development of the property and to develop Risk Management Measures (RMMs) to mitigate further impacts on the Ramsey Lake Drinking Water System (DWS).

This Report is organized into the following Sections:

Section 1.0 – Introduction: outlines the purpose, objectives and scope of work, and presents the report organization.

Section 2.0 – Methodology: outlines the methodology undertaken to complete the assessment.

Section 3.0 – Background: provides a description of the existing Site conditions, operations, background information and surrounding land uses, including the regional environmental setting, including the physiography, topography, main surface water features surrounding the Site, and the surficial and bedrock geology. GHD's surface water sampling investigation also is presented to provide a baseline assessment of the Site and downstream water quality as it relates to salts and chloride loadings flowing into Ramsey Lake.

Section 4.0 – Risk Management Measures (RMMs): includes information on prevention/mitigation/ management measures, monitoring, and emergency response. Prevention information includes industry standards, regulations, best management practices, policies, etc. that are in place to help prevent contamination from the existing land use, as well as information on how the Site will be maintained to ensure it operates as intended/designed, where applicable.

2. Methodology

Cognizant of the objectives of the Assessment, the following activities were undertaken:

- Review of available background information: topography, physiography, geology and hydrogeology mapping and report information, including the results of the geotechnical and investigations completed on the Site by others.
- Documentation of the Site/Property information including geological and hydrogeological conditions and vulnerable areas (Ramsey Lake ICA).
- Collection and analysis of surface water samples to assess current water quality.
- Compilation of RMMs to be considered for a Source Water RMP.

3. Background

3.1 Site Description

The Site is located within the southeast section of the City of Greater Sudbury, within the Township of Neelon, Lot 11, Concession 4, Parcel 26975 SES, at 1800 Frobisher Street (Figure 2). The Site is irregular in shape and approximately 40 hectares (100 acres) in size.

The Site is located within an area of the City of Greater Sudbury that is mainly comprised of light industrial (M2) and mixed industrial/service commercial (M1) land uses as well as lands zoned "flood plain overlay" (FD). The Site is zoned M2 and is bordered to the north and east by M1 lands as well as FD zoned areas, which are comprised of undeveloped wetland with bedrock outcrops. M1 zoned lands are located west of the Site and M2 lands and Kingsway Road (Highway 55) are located to the south, with mixed residential, commercial, parkland, and FD zoned lands located further south.

The western portion of the Site is developed and has two paved access roads that enter the Site from the west side: Frobisher Street, which comprises the main access road, and a driveway off Kingsway Road (Highway 55). The eastern portion of the Site is undeveloped wetland area with bedrock outcrops.

Buildings/structures located on Site, south of Frobisher Street, include an office/administrative building; operations building/garage; washing station building; the former Transit Services garage/administration building; a fuel UST and associated pumping facility; and a truck weigh scale. The municipal recycling processing building, household hazardous waste building, the salt storage dome, and pickled sand pile are located on Site north of Frobisher Street. In addition, various smaller buildings/sheds are located throughout the Site.

Fill materials (concrete/asphalt grindings/gravel/rock) from historical CGS operations are located within the north central portion of the Site, north and east of the salt storage dome.

Surfaces within the western portion of the Site are mainly asphalt paved, providing roadways and parking areas as well as outdoor equipment storage around the buildings located in that area. The

north central area of the Site is surfaced with sand/gravel fill and the remainder of the Site is vegetated.

The ground surface at the Site generally slopes from north to south. There are no storm drains located on Site other than roadside ditches along Frobisher Street. Storm water runoff flows through ditches and/or overland from the west towards the east into a low area located at the centre of the Site. This low, wetland area is constrained to the south by Kingsway Road (Highway 55) and drains southward via a small creek, which discharges into Ramsey Lake approximately 2.2 kilometres (km) south of the Site. Based on mapping provided in the Greater Sudbury Source Protection Area Source Protection Plan[2] and Junction Creek watershed mapping[3], a small portion of the Site, located within the northwest corner, drains to the west into the Junction Creek watershed.

The Site is serviced with municipal water supply and sanitary sewers.

3.2 Site Operations

CGS has owned and operated the Site as a municipal services depot for more than 40 years. The following activities are currently conducted on Site:

- Storage, maintenance, and repair of municipal road and winter maintenance equipment
- Fuel storage and handling
- Storage and handling of winter maintenance materials (i.e. road salt and pickled sand)
- Salt Brine manufacturing, storage, and handling
- Storage and handling of fill materials (concrete/asphalt grindings/gravel/rock)
- Municipal recycling processing facility
- Household hazardous waste depot

Road salt for the winter maintenance season is stored on Site within a salt storage dome, which has a relatively impermeable concrete base. Pickled sand (i.e., sand mixed with salt at approximately five percent by volume); however, is stored outdoors in uncovered piles located either within the footprint of a former dome on an impermeable pad and/or outside directly on the ground west and south of the salt storage dome. Brine is prepared on demand in a separate building with spill containment at the Site. Application equipment used during the winter maintenance season is loaded at the Site prior to deployment to respond to winter events. Vehicle washing is currently being conducted both indoors and outside.

Housekeeping practices employed at the Site include sweeping up tracked salt as needed and a periodic structural assessment to inspect the structural integrity of the salt storage dome. The Site does not have a runoff collection system or a formal plan for managing salt-impacted drainage.

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2 *"Greater Sudbury Source Protection Area Source Protection Plan"*, Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 19, 2014.

3 *"Flood Response Planning 2012 Junction Creek Watershed"*, https://www.greatersudbury.ca/live/emergency-services/emergency-planning/emergency-management-program/emergency-plans/watershed-maps/junction-creek/

3.3 Source Water Protection Areas

The Ramsey Lake surface water intake is located approximately 4.5 kilometres (km) southwest of the Site. The surface water Intake Protection Zones (IPZs) and vulnerability scores associated with the Ramsey Lake surface water intake are presented on Figure 3.

The Site borders on significant groundwater recharge areas (SGRA) that intersects with a highly vulnerable aquifer (HVA), south and west of the Site.

A large portion of the Site falls within the Ramsey Lake Intake Protection Zone 3 (IPZ-3). IPZ-3 includes the area of Ramsey Lake that may contribute water to the intake and includes a 120-metre setback from the high water mark. Transport pathways (contributing tributaries, storm sewers, and roadside ditches) are also included, and a 120 m setback is applied to these as well.

The vulnerability scores associated with the areas within IPZ-3 were determined by considering the vulnerability of the Ramsey Lake intake as well as that of the contributing areas/watersheds. An area vulnerability factor, a measure of how easily a contaminant would travel from the area to the surface water intake, was assigned to each of Ramsey Lake's sub-watersheds based primarily on land surface cover type and permeability. The area of IPZ-3 Frobisher that intersects with the Site is assigned a Vulnerability Score of 9 based on high levels of urban development within the area and the presence of shallow and exposed bedrock.

Due to elevated and rising sodium levels identified within Ramsey Lake, the Assessment Report, produced in response to legislative requirements under the CWA[4], included the establishment of the Ramsey Lake Issues Contributing Area (ICA). The ICA encompasses the total area where activities may contribute to the identified issue(s), in this case the increasing sodium levels, and includes the entire Ramsey Lake IPZ-3.

Under the CWA, road salt handling and storage is a prescribed drinking water quality threat, which may contribute to the issue of rising sodium levels within Ramsey Lake. Based on the specific characteristics of road salt storage and handling at the Site (i.e. greater than 0.5 tonnes of road salt stored/handled), the threat is assessed as significant within the Ramsey Lake ICA. In accordance with the Greater Sudbury Source Protection Area Source Protection Plan Policy Sa-4E RMP, the Site requires a Source Water Risk Management Plan (RMP) for salt handling and storage activities.

Fuel storage and handling is also a prescribed drinking water quality threat under the CWA, however, it is assessed as a moderate threat within the Ramsey Lake IPZ-3. As such, and in accordance with the Greater Sudbury Source Protection Area Source Protection Plan Policies, an RMP is not required for this activity.

The Site is not located within the well head protection area (WHPA) of any of CGS' municipal supply wells. The nearest WHPA is the WHPA-D (travel time of a groundwater contaminant is less than or equal to 25 years but greater than 5 years) for the Garson wells 1 & 3, located approximately 6.1 km northeast of the Site boundary.

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4 *"Greater Sudbury Source Protection Area Assessment Report"*, Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 2, 2014.

The Greater Sudbury Source Protection Area Assessment Report identifies elevated sodium levels within the Garson wells, however, sodium was not identified as a drinking water quality issue for the Garson DWS due to insufficient available data to determine the presence of a significant increasing trend.

3.4 Site Setting

The CGS is situated within Ecoregion 5E (Georgian Bay) and is located within the southern portion of the Precambrian Shield[5], which is characterized predominantly by exposed and shallow bedrock covered with a discontinuous layer of glacial till. Other landforms include glaciofluvial and galciolacustrine deposits as well as wetland deposits[6].

The topography of the area is generally rolling/undulating with elevated bedrock outcrops and is generally sloped to the south towards Ramsey Lake. The Site ranges in elevation from approximately 273 metres above mean sea level (AMSL) within the northwest corner of the Site to 270 mAMSL within the low, wetland area located adjacent to Kingsway Road (Highway 55). Bedrock outcrops within the area have elevations of 285 to 330 mAMSL.

A discussion of the geology and hydrogeology within CGS is provided in the Greater Sudbury Source Protection Area Assessment Report. These topics are briefly discussed in the following sections.

3.4.1 Geology

Based on regional surficial geology mapping of the area[7], lands in the area of the Site are predominantly underlain by thin discontinuous soils (less than 1 m thick) overlying Precambrian bedrock with low lying areas of peat, muck, and marl wetland deposits. Surrounding lands to the northwest and south are underlain by deposits of the Wanapitei Esker and comprise sand and silt glaciolacustrine and modern fluvial deposits[8].

Based on a review of the MOECC well records[9], the overburden underlying the Site and immediately surrounding areas ranges from less than 2.0 m to greater than 10 m in thickness. Bedrock outcrops to the north and east of the Site. The overburden generally increases in thickness towards Ramsey Lake. Bedrock in the area is described as quartz-feldspar sandstone with minor siltstone, agillite and conglomerate of the Middle Precambrian, Mississaugi Formation with areas of horneblende, gabbro, metagabbro and amphibolite of the Nipissing Diabase[10],[11].

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5 *The Ecosystems of Ontario Part 1: Ecozones and Ecoregions*, Ministry of Natural Resources, 2009

6 Ontario Geological Survey (1999), Surficial Geology Regional Municipality of Sudbury – Map P.3399, Scale 1:100,000

7 Ontario Geological Survey (1999), Surficial Geology Regional Municipality of Sudbury – Map P.3399, Scale 1:100,000

8 Greater Sudbury Source Protection Area Assessment Report, Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 2, 2014.

9 https://www.ontario.ca/environment-and-energy/map-well-records

10 Ontario Geological Survey (1991), Bedrock Geology of Ontario, Southern Sheet – Map 2544, Scale 1:1,000,000.

11 Ontario Geological Survey (1975), Sudbury-Cobalt Geological Compilation Series, Algoma-Manitoulin, Nippising, Parry Sound, Sudbury and Timiskaming District – Map 2361, Scale 1:253,440

3.4.2 Hydrogeology

In general, the hydrostratigraphic framework of the area corresponds to overburden, predominantly comprised of glaciolacustrine deposits, constrained by bedrock outcrops and wetland deposits. Hydrostratigraphic units within the area of the Site include the following:

- Aquifer (unconfined) – glaciolacustrine sand and silt
- Aquitard – wetland deposits
- Aquitard – bedrock (groundwater flow restricted to relatively small, localized fractures)

In general, the hydrogeology of the Site can be described as a thin, discontinuous fine to medium textured glaciolacustrine unconfined aquifer confined by areas of bedrock outcrop and wetland deposits and overlying bedrock aquitard.

Based on a review of the MOECC well records for the area, groundwater depth within the area is variable ranging from 3 to 10 mBGS.

GHD is not aware of any Site-Specific hydrogeological investigations. In the absence of such information, and based on the area topography including elevated bedrock outcrops northwest and southeast of the Site and the general north to south slope of the lower lying glacial deposits and wetland areas on Site, GHD assumes that groundwater flow direction at the Site is generally to the southwards, toward Ramsey Lake.

3.4.3 Salt Vulnerability

CGS recently retained GHD to prepare a Salt Optimization Plan for the City of Greater Sudbury.[12] This effort included an assessment of salt vulnerability throughout the City of Greater Sudbury based on multi criteria analysis of mapped salt sensitive areas including source water protection areas (i.e. WHPA, IPZ, ICA, HVA, SGRA), wetlands, fish spawning areas, Lake Trout lakes and provincially tracked species. A salt vulnerability index map was generated showing area ranging from low to high risk. Based on this assessment, the majority of the Site was assessed as having a low salt vulnerability cumulative score (see Figure 4).

3.4.4 Anthropogenic Transport Pathways

The Site is serviced with below grade utilities (sanitary sewers and water mains) located within the western portion of the Site. CGS personnel were not aware of the existence of any potable water wells or septic systems at the Site. Stormwater generated on Site either infiltrates into the ground surface or moves as runoff towards roadside ditches along Frobisher Street and towards the wetland area located southeast of the Site.

A 150-mm sanitary sewer forcemain conveys sanitary sewage from the residential subdivision south of Highway 55/Kingsway onto the Site where it discharges into an 825-mm sanitary sewer, which traverses the western portion of the Site from close to the southern boundary up to Frobisher Street and then proceeds westward off-Site. A 150-mm water main servicing the on-Site buildings is located within the western portion of the Site. The locations of these utilities are shown on Figure 2.

12 *"Salt Optimization Plan"*, Prepared by GHD on behalf of the City of Greater Sudbury, November 2017.

The sanitary sewer main bedding may provide a preferential pathway for groundwater to move from the area of Frobisher Street to the southern portion of the Site. The main is located approximately 120 m downgradient of the winter maintenance materials storage area at its' closest point; however the rate of groundwater flow at the Site is unknown.

According to CGS personnel, no USTs have been or are presently owned or operated at the Site.

3.5 Previous Investigations

The following background report for the Site was provided by CGS and was reviewed during this assessment:

- *"Preliminary Geotechnical Investigation City of Greater Sudbury 1800 Frobisher Street Sudbury, Ontario"*, prepared by Terraprobe, 2008.

In 2008, Terraprobe conducted a borehole and test pit program at the Site to investigate subsurface conditions including soil type and groundwater presence/elevation. The investigation included advancement of ten (10) boreholes and excavation of seven (7) test pits up to a depth of approximately 6 mBGS all within the western portion of the Site. Most of the investigative locations were located south of Frobisher Street, however one (1) borehole and one (1) test pit were located north of the salt storage dome. Two (2) boreholes were located along the edge of the low-lying wetland area.

Based on the investigation findings, Site soils within the developed area of the Site are described as fill up to 6 m thick overlying native sand and silt to clayey silt. Soils within the low lying wetland area are described as sandy silt to a depth of 1.5 mBGS overlying clayey silt to a depth of 2.3 mBGS overlying silt and clay. The silt and clay was wet and soft to very soft and extended to the full depth of the boreholes advanced within wetland area.

As monitoring wells were not installed as part of the investigation, groundwater depth was assessed based on the soil conditions encountered at the Site and estimated to range from 1.5 to 3.0 mBGS.

3.6 Surface Water Quality Investigation

On October 4 and 5, 2017, GHD collected surface water samples for sodium and chlorides analyses to assess the existing salt runoff contribution towards Ramsey Lake based on the current Frobisher Depot configuration. As part of GHD's surface water assessment, surface water samples were collected from ten (10) sampling locations, which included one (1) upstream/background sample, two (2) on-Site samples, and seven (7) downstream surface water samples collected between Highway 55 (Kingsway) and Korpela Park, located approximately 300 metres prior to discharge into Ramsey Lake.

Surface water samples were collected in accordance with the standard operating procedure (SOP) for collecting surface water samples attached hereto as Appendix A. Surface water samples were collected directly into the laboratory-supplied containers by submersing the inverted bottle into the water and tilting the bottle opening upstream to fill. The sample was collected with the sample bottle completely submerged to minimize the collection of floating debris within the container.

Samples were placed directly into laboratory-supplied containers, packed in a cooler on ice, and submitted under chain-of-custody protocol to AGAT Laboratories (AGAT), an accredited analytical laboratory located in Sudbury, Ontario. The surface water samples were analyzed for total and dissolved sodium, chloride, and total suspended solids (TSS).

The surface water analytical results are presented on Table 1.

A review of the analytical data indicated the following:

- Upgradient/background total sodium concentration of 152 milligrams per litre (mg/L) and chloride concentration of 117 mg/L.
- On-Site total sodium concentrations of 4,010 and 4,170 mg/L, and chloride concentrations of 6,220 and 6,430 mg/L.
- Downstream total sodium concentrations ranging from 181 to 313 mg/L, and chloride concentrations ranging from 322 to 558 mg/L. While total sodium concentrations generally remained the same downstream of Highway 55/Kingsway, chloride concentration generally slowly decreased with travel from 558 to 374/367 mg/L.

As expected, the highest sodium concentrations were observed immediately downstream of the salt depot where the pickled sand and mixing practices remain uncovered and exposed to the elements. The downgradient low-lying swamp provides an excellent buffer in minimizing the transport of salt from the Site towards the creek and eventually Ramsey Lake.

During the Site investigation, GHD did not observe any significant or moderate evidence of vegetation stress or deterioration as a result of salt loadings from the Site.

A copy of the laboratory analytical report is attached as Appendix B.

4. Risk Management Measures

This section provides the risk management measures (RMMs) and best management practices (BMPs) relevant to the road salt storage and handling.

CGS has used the Site for the storage of winter maintenance materials for several decades. Road salt is currently placed within a covered salt storage dome on a relatively impermeable concrete base, whereas pickled sand is currently stored with no cover, as the dome was demolished in or around 2005. The Site was selected based on accessibility and the surrounding commercial / industrial land use. The road salt storage and handling area is situated within the Ramsey Lake ICA and as such additional mitigation measures are needed to address the potential drinking water threat.

Two measures available to CGS to manage the significant threat of road salt storage and handling within the Ramsey Lake ICA include:

- Maintain Site operations and implement BMPs with monitoring to evaluate the effectiveness of BMPs

- Relocate the winter maintenance material storage to a new location outside of any area where road salt storage and handling is not deemed a significant threat/low vulnerability

4.1 Maintain Existing Site Operations and Implement BMPs

The road salt storage and handling facility at the Frobisher Depot is owned by CGS and operated by CGS staff. In 2016, CGS retained GHD to updated the City of Sudbury Salt Management Plan (2016 SMP). As part of that work, GHD conducted a Site inspection and provided the following observations:

2016 Site Inspection Observations.[13]

Observation	Recommended Actions	Activity Level
Outdoor pickled sand piles, uncovered, located adjacent to the salt storage dome	Consider placing sand under cover and on an impermeable base to prevent salt from washing out	3
Salt stored within a wooden salt dome on a concrete paved base.	Conduct regular inspections of the salt storage dome and the paved base to ensure structural integrity.	2
Housekeeping required to sweep up salt outside of the salt dome	Maintain housekeeping. Conduct regular inspections of areas where salt tracking may occur to ensure housekeeping is maintained.	1
Brine tank located on Site. Staff report that the tank is inspected and maintained. Floor drains were not observed adjacent to brine tank.	Conduct periodic inspections of the brine tank to ensure its integrity	1
Winter maintenance material are stored adjacent to a wetland area	Monitor wetland for signs of vegetative stress	2
Site drainage is southwards towards wetland area within the Ramsey Lake ICA	Install and maintain sediment control and review Source Water Protection Plan Policy requirements. Implement stormwater management at the Site.	1, 2

Activity levels referenced above are defined as follows:

1. Requires minimal effort/cost to implement.
2. Requires minimal to moderate additional cost/effort to implement and will require short term planning and potential changes to department operations.
3. Requires significant cost/effort to implement and may require long term planning.

[13] GHD, May 2016. 2016 Salt Management Plan, City of Greater Sudbury.

Other BMPs for road salt storage and handling as provided in the Transportation Association of Canada's (TAC's), Synthesis of Best Management Practices, Road Salt Management[14] were included within the assessment of continuous improvement practices and strategies provided as Appendix C to the 2016 SMP. These strategies and BMP and their implementation status as of the 2016 SMP are included as Table 2.

The Ontario Ministry of the Environment and Climate Change (MOECC) provides guidance regarding storage of winter maintenance materials[15]. Specifically, MOECC recommends that winter maintenance materials (i.e. road salt and other de-icing materials) be stored within permanent structures underlain by an impermeable base and surrounded by a berm/dyke to prevent seepage and runoff resulting in salt losses to the environment.

4.1.1 Recommended Actions

Based on the recommendations made in the 2016 SMP, TAC's Synthesis of Road Salt BMPS and MOECC Guidance, CGS should ensure that the following BMPs are implemented within the Ramsey Lake ICA:

- Salt and pickled sand storage should be conducted under cover on impermeable surfaces
- Enforce and document housekeeping practices
- Ensure that wash water used to clean winter maintenance vehicles and equipment is collected and directed to the sanitary sewer, if possible
- Monitor surface water runoff and groundwater seepage quality to ensure that groundwater and surface water are not impacted by salt losses at the Site

4.1.2 Monitoring

The results of surface water monitoring conducted as part of this RMP assessment (further discussed in Section 3.6) indicated that surface water at the Site and downgradient of the Site is impacted with sodium and chloride, as compared to background surface water sample. Surface water samples collected within the Site and prior to the on-Site swamp/wetland were significantly elevated, which is a result of the lack of BMPs as described previously (i.e., exposed pickled sand operations, outdoor mixing operations). A visual observation did not observe any significant or moderate evidence of vegetation stress or deterioration as a result of salt loadings from the Site.

To ensure the salt management operations and BMPs remain effective, GHD recommends both surface water and groundwater monitoring on a scheduled frequency.

Surface water can be monitored on a bi-annual (spring and fall) frequency to monitor the effectiveness of BMPs in improving surface water quality. Sample locations could be reduced to four locations, which includes an upgradient/background sample, an on-Site sample located immediately downstream of the winter maintenance material storage, at the Site boundary adjacent

[14] Transportation Association of Canada, September 2003. Synthesis of Best Management Practices, Road Salt Management.

[15] Ministry of the Environment, February 2011. Guidelines on Snow Disposal and De-icing Operation in Ontario. PIBS8271e.

to Highway 55, and further downstream at Korpela Park, which is 300 metres prior to discharge to Ramsey Lake.

As there are no monitoring wells installed at the Site, GHD proposes the installation of three monitoring wells at the Site. One monitoring well would be installed upgradient of the salt operations with two downgradient monitoring wells (one immediately south and one further south). These wells would be used to establish sodium and chloride levels within the shallow overburden aquifers and determine the potential for impacted groundwater, if any, to migrate into the SGRA and HVA south of the Site. Given the tight soil formation within the wetlands, the frequency of sampling could commence on an annual basis with a reduction to bi-annual (every two years) should the levels not fluctuate considerably.

For budget purposes, the only capital cost associated with this monitoring would be the installation of four monitoring wells at an approximate cost of $15,000. Annual surface water and groundwater sampling would be approximately $5,000.

Figure 6 provides the proposed monitoring well and surface water sample locations for monitoring the Site conditions and BMPs.

4.2 Relocate Winter Maintenance Material Storage Outside of the Ramsey Lake ICA

The Ramsey Lake ICA covers the majority of the Site. There is no on-Site location where a new storage facility could be constructed outside of the ICA. As such, moving winter maintenance materials outside of the Ramsey Lake ICA will require relocating to a new property or to an existing CGS facility that is appropriately situated.

A new or significantly re-designed winter maintenance depot must consider the entire salt handling cycle including delivery, stockpiling, loading and off-loading, access routes, as well as equipment washing and wash water management. Variables to consider in selecting a new or existing Site for use as a winter maintenance operations facility include:

- Strategic location and existing site services
- Current and potential future surrounding property uses (minimize nuisance effects)
- Salt vulnerable areas on or near the Site (i.e., drinking water sources, groundwater recharge zones, salt sensitive species, and agricultural operations, etc.)
- Space requirements for material storage and handling as well as complimentary operations (i.e., vehicle washing, storage, fueling, maintenance, and repair; brine production and loading; wash water management)
- Availability or constructability of an indoor space for winter materials storage
- Site drainage and stormwater management requirement
- Potential contaminant transport pathways

A proposed new winter maintenance depot must be specifically designed and engineered for salt storage and management including:

- Site operation and management
  - Materials storage and handling practices
  - Stormwater management
  - Vehicle wash water management
  - Access routes
  - Housekeeping
- Security
- Equipment and vehicle management
- Fueling
- Training and record keeping
- Environmental monitoring

Design considerations include the establishment of an area where activities that may result in the creation of salt-laden runoff can be isolated (winter maintenance area) and all runoff from this area should be contained on Site through stormwater management features (e.g., vegetated filter strips, swales, retention pond). The winter maintenance area, swales, and wet pond must be lined with a low permeability layer, and sweeping undertaken surfaces where winter maintenance materials are handled to remove accumulated solids, debris and salt precipitate.

Compared to redeveloping the existing site, relocating the winter maintenance depot will involve significant additional cost and time, including:

- Identifying an appropriate location through the applicable planning process, which must consider the above-noted variables (i.e., potential for creating nuisance noise and traffic or impacting drinking water sources, groundwater recharge zones, species at risk, and agricultural operations, etc.)
- Property purchase and redevelopment (i.e., design and construction)
- Demolition of the existing winter maintenance depot

Should the decision between alternatives be based on cost, relocating the existing depot is considerably more expensive and not recommended.

4.3 Required Plans for Redevelopment or New Reconstruction

With either the reconstruction of the existing Site or a development of any new site, best management practices and plans anticipated include the following:

Operations, Maintenance and Monitoring (OMM) Plan

An Operations, Maintenance and Monitoring Plan should be prepared for any redeveloped or new Site, which would include routine inspection of material storage facilities (structures and asphalt

pads). Potential cracks or damaged areas of asphalt paving will be repaired on an ongoing basis, as required, to minimize the downward migration of surface water.

Storm Water Management (SWM) Plan

A Storm Water Management (SWM) plan should developed for any redeveloped or new Site, which would include sediment removal consisting of vegetated filter strips, vegetated swales, an oil/water separator, wet pond and an engineered outlet structure. These features should be constructed with a low permeability liner to optimize the containment and collection of salt precipitate. The vegetated filter strips and swales will promote particulate removal and plant uptake, the oil/water separator will remove sediments and hydrocarbons, and the wet pond will settle out fine particulates and provide a mixing volume to normalize chloride concentrations and dampen peak concentration discharge.

Operation and maintenance will include the following, as a minimum:

- Inspection of the asphalt deck for cracks, etc. and sealing as required to ensure minimal infiltration.
- Routine sweeping of the asphalt deck to remove deposited salt precipitate and sediments, and disposal off-Site at an approved location.
- Removal of debris and sediments from the level spreader, vegetated filter strip, and vegetated swales and management on Site or disposal at an approved off-site location.
- Regular inspection and cleaning of the oil/water separator at the beginning and end of the snow removal season to maintain optimal removal efficiency.
- Removal and disposal of sediments from the SWM Pond when sediment accumulation levels exceed the designed sediment capture volume/capacity. Plantings that are potentially disturbed during sediment removal activities will be restored where necessary.
- Monitoring of discharge water quality.

This installation will require an environmental compliance approval (ECA). An OMM Plan for all stormwater management controls will be required, which will become part of the stormwater ECA.

Spill Prevention and Contingency (SPC) Plan

If it is anticipated that fuels (petroleum hydrocarbons) and brine may be handled or stored on Site, and that vehicle servicing may also be conducted, a Spill Prevention and Contingency (SPC) Plan should be developed to prevent or reduce the risk of spills of pollutants; and prevent, eliminate, or ameliorate any adverse effects that result from spills of pollutants. The Plan will be developed after the completion of construction activities and prior to site being operational.

Site-Specific Health and Safety Plan (HASP)

A Site Specific Health and Safety Plan (HASP) should be also developed with instruction on maintaining security and site maintenance. This Plan will also be developed and implemented upon completion of the construction activities and prior to the site being operational.

5. Summary

GHD completed a Risk Management Plan Assessment (Assessment) for the Frobisher Depot located at 1800 Frobisher Street in Sudbury, Ontario (Site). The Site is an active winter maintenance depot operated by the City of Greater Sudbury (CGS). Winter maintenance activities conducted at the Site include: salt and sand storage and handling; brine manufacturing; vehicle/equipment storage, maintenance, and repair; and administrative functions.

Under the Clean Water Act (CWA), road salt handling and storage is a prescribed drinking water quality threat, which may contribute to the issue of rising sodium levels within Ramsey Lake. Based on the specific characteristics of road salt storage and handling at the Site (i.e., greater than 0.5 tonnes of road salt stored/handled) and the intersection of the Site with the Ramsey Lake Issues Contributing Area (ICA), the threat is deemed significant. As such, in accordance with the Greater Sudbury Source Protection Area Source Protection Plan Policy Sa-4E RMP, the Site requires a Source Water Risk Management Plan (RMP) for road salt handling and storage activities.

Surface water samples collected for sodium and chlorides, as part of the RMP Assessment, identified:

- Upgradient/background total sodium concentration of 152 milligrams per litre (mg/L) and chloride concentration of 117 mg/L.
- On-Site total sodium concentrations of 4,010 and 4,170 mg/L, and chloride concentrations of 6,220 and 6,430 mg/L.
- Downstream total sodium concentrations ranging from 181 to 313 mg/L, and chloride concentrations ranging from 322 to 558 mg/L. While total sodium concentrations generally remained the same downstream of Highway 55/Kingsway, chloride concentration generally slowly decreased with travel from 558 to 374/367 mg/L.

As expected, the highest sodium concentrations were observed immediately downstream of the salt depot where the pickled sand and mixing practices remain uncovered and exposed to the elements. Sodium concentrations were lower downstream. The on-Site (downgradient) low-lying swamp provides an excellent salt attenuation and buffer in minimizing the transport of salt from the Site towards the creek and eventually Ramsey Lake. No visual evidence of vegetative stress or deterioration was observed as a result of salt loadings from the Site.

As such, two measures available to CGS to manage the significant threat of road salt storage and handling within the Ramsey Lake ICA include:

- Maintain Site operations and implement BMPs with monitoring to evaluate the effectiveness of BMPs.
- Relocate the winter maintenance material storage to a new site, located outside of any area where road salt storage and handling is deemed a significant threat, preferably within an area of low salt vulnerability as identified in the CGS Salt Optimization Plan.

Considering the additional cost and time associated with relocating the depot, in association with the benefits provided by the low-lying downgradient swamp which provides salt attenuation and a

buffer from salt travel, redeveloping the existing Site using BMPs (i.e., build a dome for the pickled sand, install a monitoring network) would be the most economical and practical option.

All of Which is Respectfully Submitted,

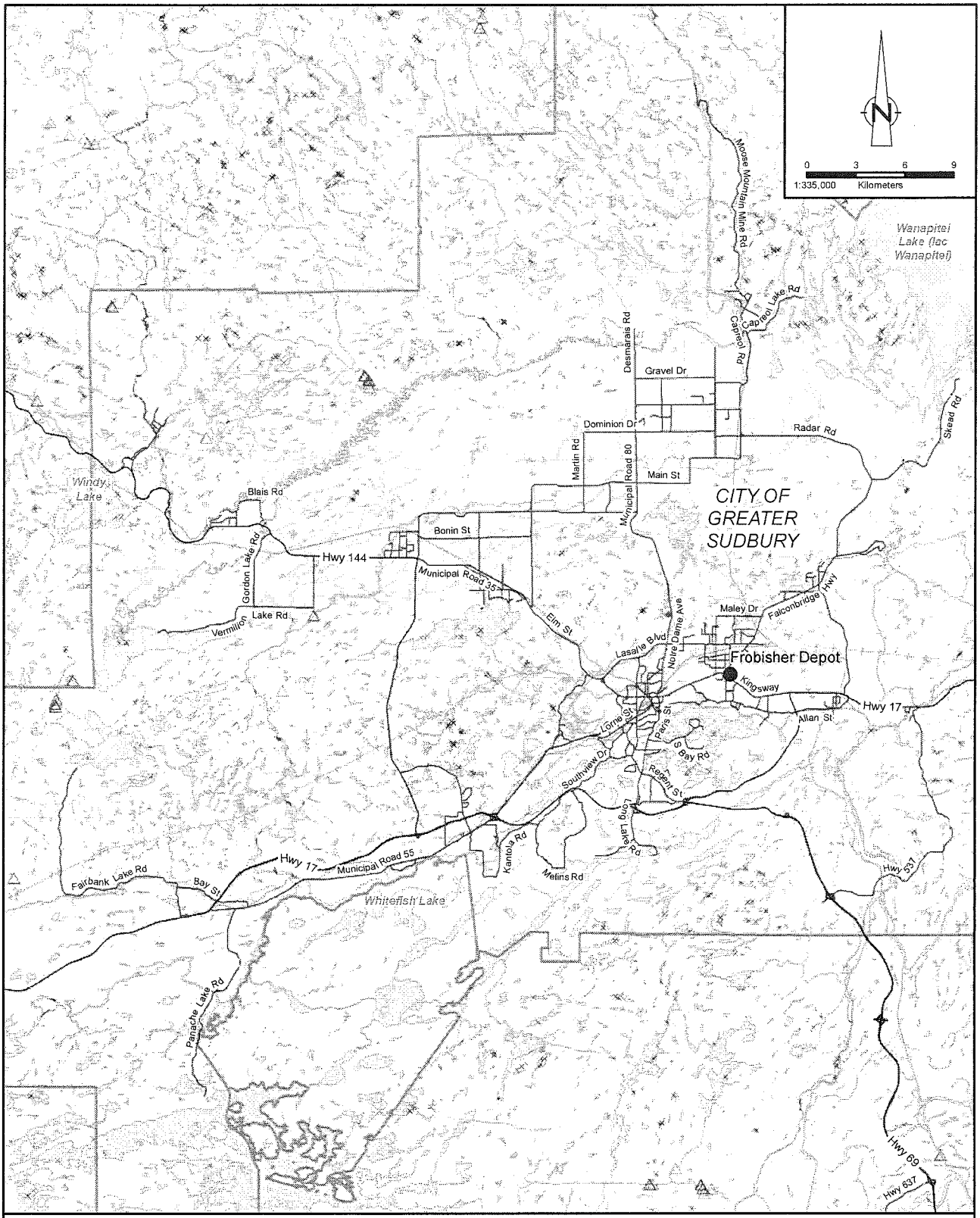
GHD

Robert Bressan, P.Eng., FEC

Sarah Ackert Ferguson, P.Eng.

Andrew Betts, M.A.Sc., P.Eng.

Figures



Source: MNRF NRVIS, 2014. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017;
Coordinate System: NAD 1983 UTM Zone 17N

figure 1

SITE LOCATION MAP
RISK MANAGEMENT PLAN ASSESSMENT – FROBISHER DEPOT
CITY OF GREATER SUDBURY
Sudbury, Ontario

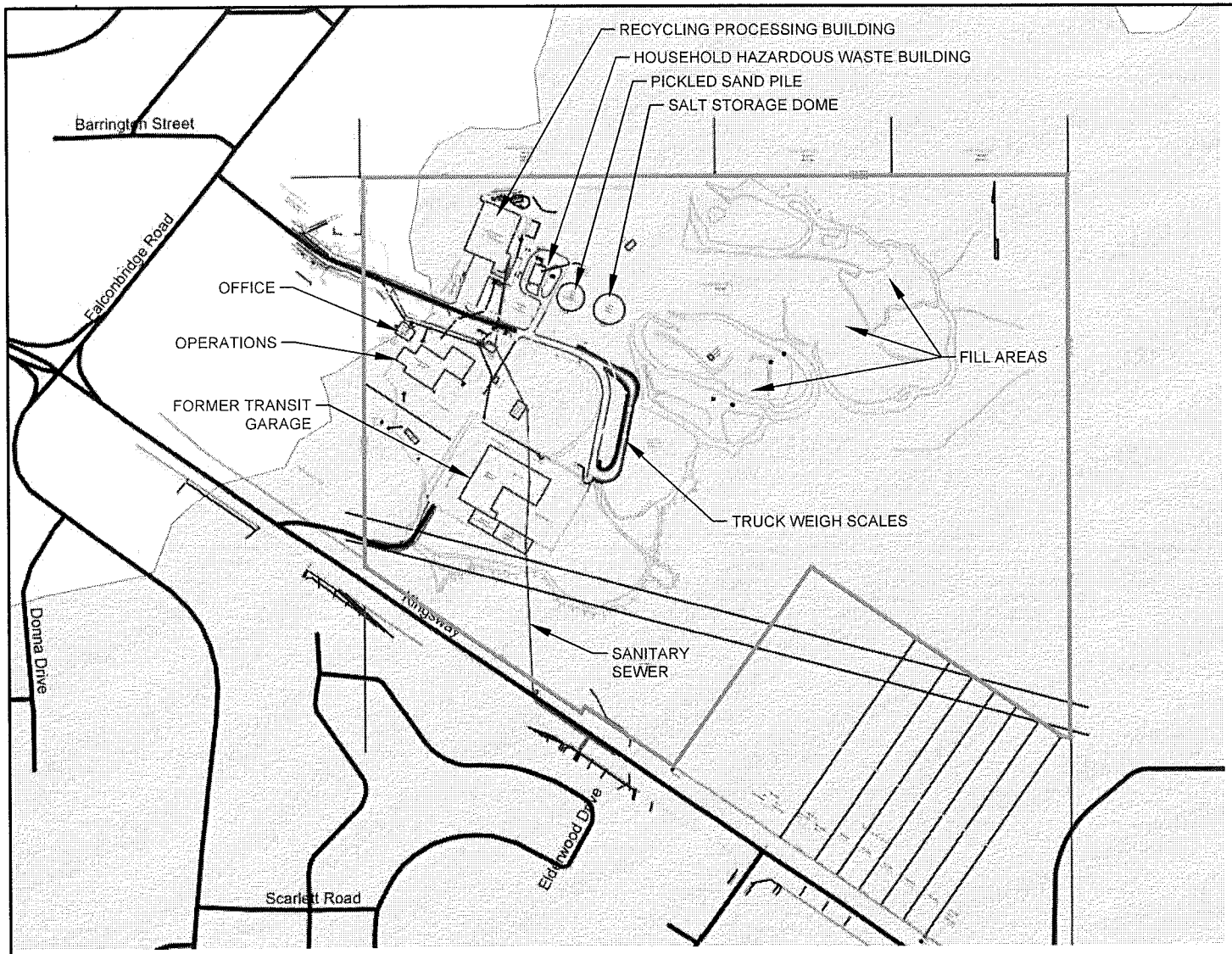


figure 2

SITE LAYOUT
RISK MANAGEMENT PLAN ASSESSMENT - FROBISHER DEPOT
CITY OF GREATER SUDBURY
Sudbury, Ontario

GHD

39382-42(008)GN-WA002 NOV 10, 2017

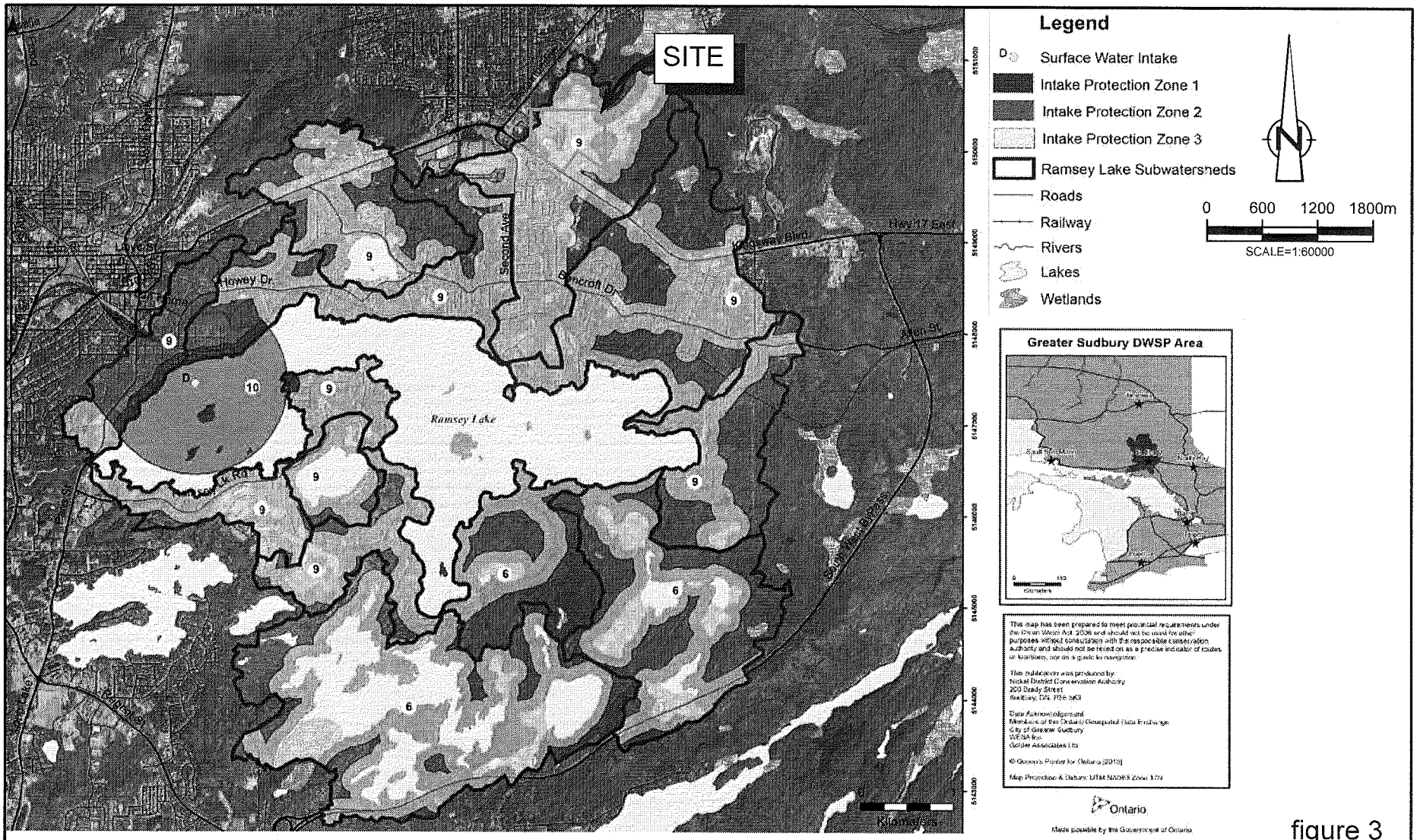
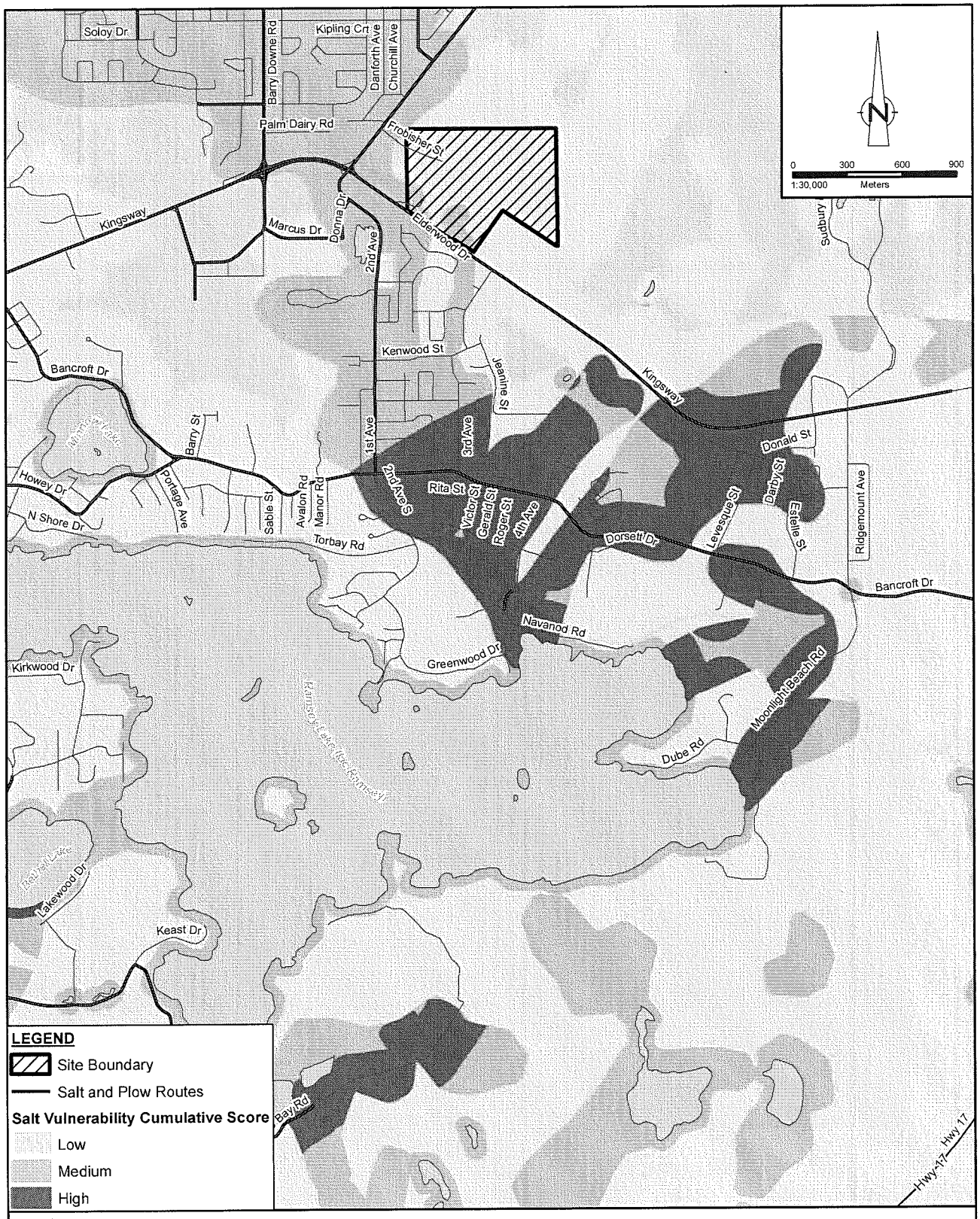


figure 3

RAMSEY LAKE INTAKE PROTECTION ZONES WITH VULNERABILITY SCORING
RISK MANAGEMENT PLAN ASSESSMENT - FROBISHER DEPOT
CITY OF GREATER SUDBURY
Sudbury, Ontario

GHD

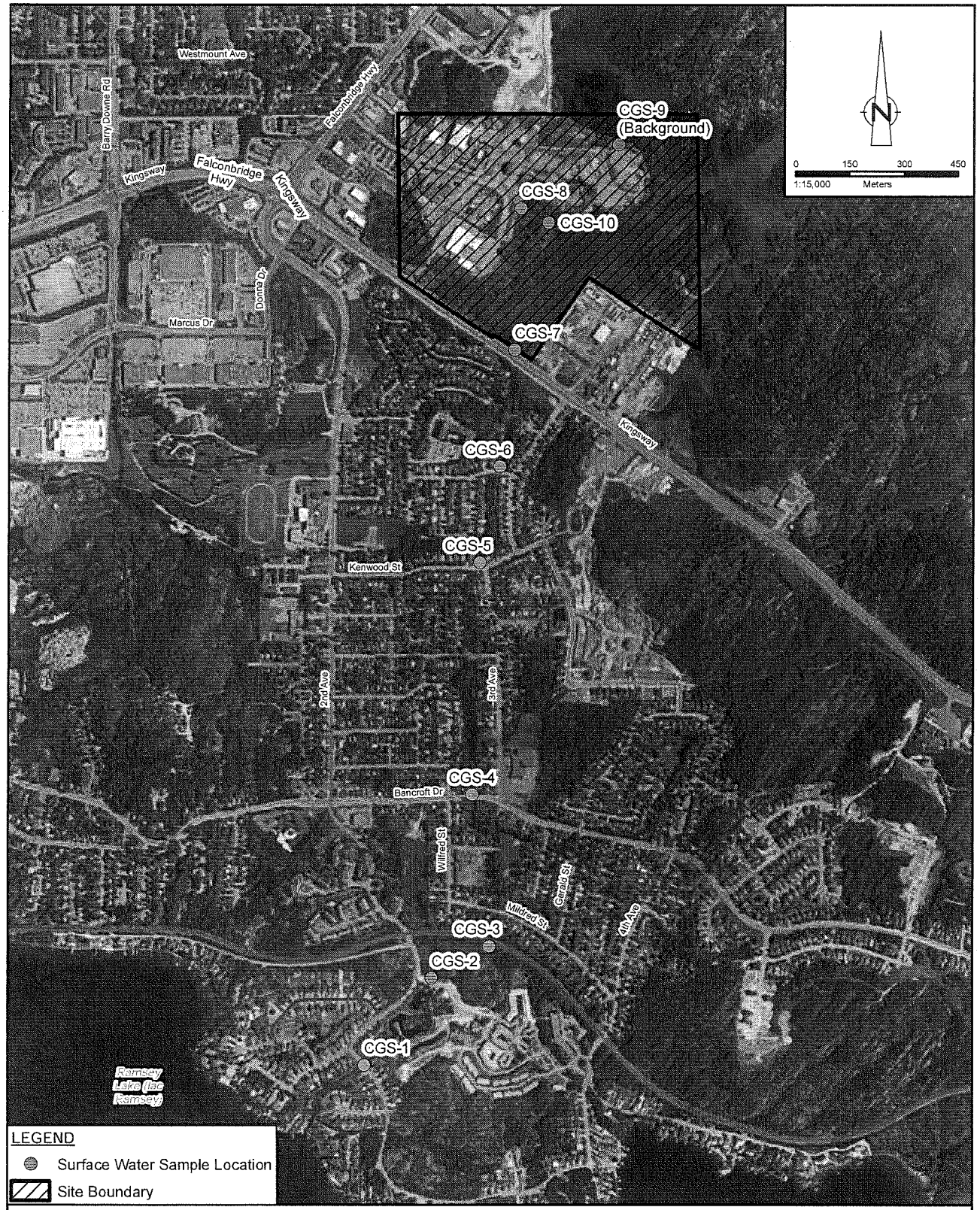


Source: Image ©2017 Google, Imagery date: 08/05/2016
Coordinate System: NAD 1983 UTM Zone 17N

figure 4

SALT VULNERABILITY INDEX
RISK MANAGEMENT PLAN ASSESSMENT – FROBISHER DEPOT
CITY OF GREATER SUDBURY
Sudbury, Ontario

039382-42(008)GIS-OT004 Nov 10/2017

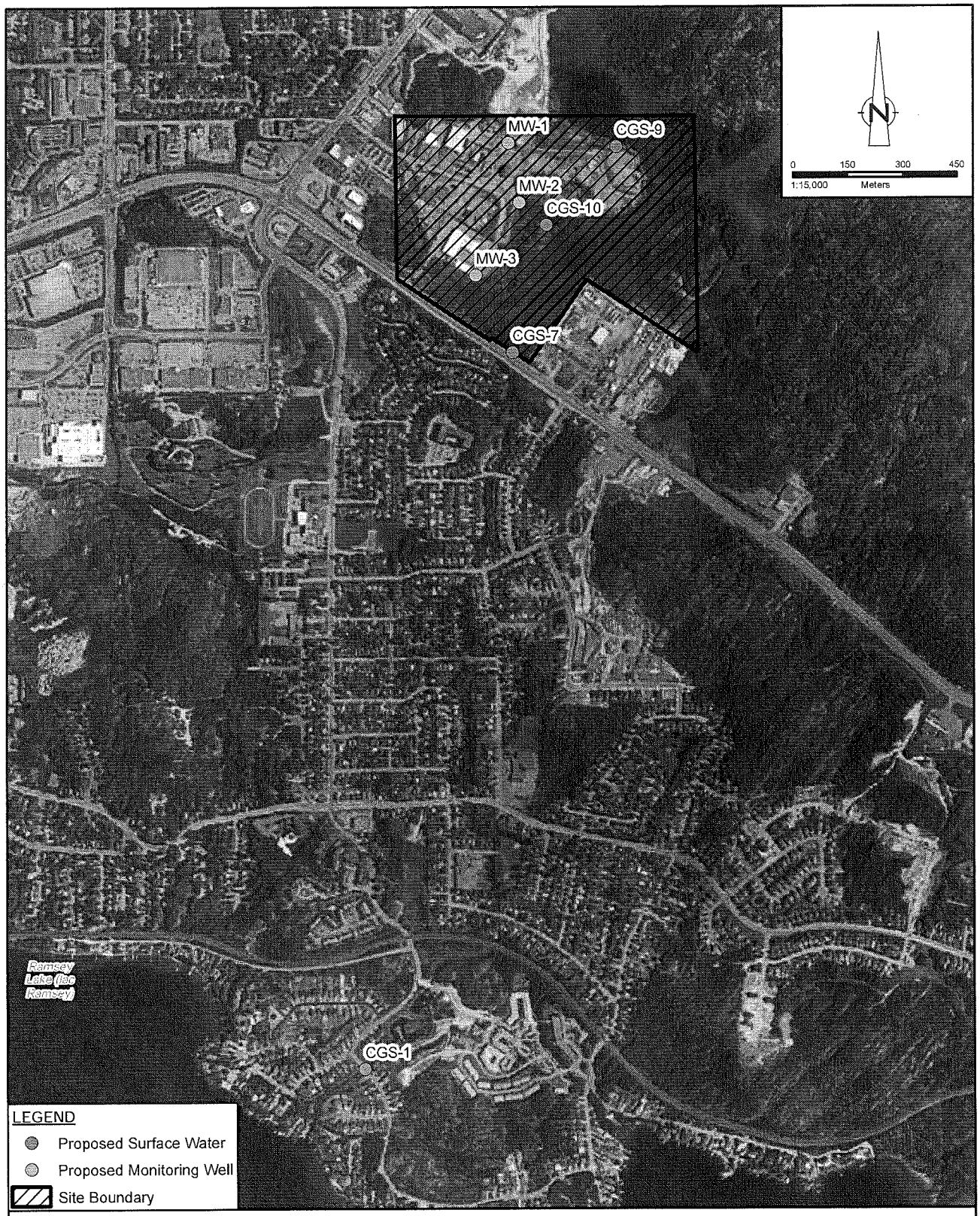


Source: Image ©2017 Google, Imagery date: 08/05/2016
Coordinate System: NAD 1983 UTM Zone 17N

figure 5

SURFACE WATER SAMPLES – OCTOBER 4 & 5, 2017
RISK MANAGEMENT PLAN ASSESSMENT – FROBISHER DEPOT
CITY OF GREATER SUDBURY
Sudbury, Ontario

039382-42(008)GIS-OT002 Nov 10/2017



Source: Image ©2017 Google, Imagery date: 08/05/2016
Coordinate System: NAD 1983 UTM Zone 17N

figure 6

PROPOSED MONITORING PROGRAM
RISK MANAGEMENT PLAN ASSESSMENT – FROBISHER DEPOT
CITY OF GREATER SUDBURY
Sudbury, Ontario

039382-42(008)GIS-OT003 Nov 10/2017

Tables

Table 1

Surface Water Sampling - Analytical Results
Frobisher Depot - Surface Water Sampling
City of Greater Sudbury, Ontario

					Chemical Analysis			
	Location ID	Location Description	Sample Date	Sample Identification	Chloride	Total Suspended Solids	Sodium-dissolved	Sodium - total
Surface Water Samples	CGS-1	Korpela Park (north of Kormak St.)	4-Oct-17	SW-39382-171004-RB-01	374	<10	200	218
	CGS-1	Korpela Park (duplicate)	4-Oct-17	SW-39382-171004-RB-02(1)	367	<10	202	203
	CGS-2	Finlandia Bridge (beneath)	4-Oct-17	SW-39382-171004-RB-03	322	<10	173	181
	CGS-3	CPR Concrete Culvert (south side)	4-Oct-17	SW-39382-171004-RB-04	414	<10	207	210
	CGS-4	Bancroft Drive (north side)	4-Oct-17	SW-39382-171004-RB-05	426	<10	224	225
	CGS-5	Kenwood Street (north side)	4-Oct-17	SW-39382-171004-RB-06	430	<10	238	248
	CGS-6	Highgate Road (north side)	4-Oct-17	SW-39382-171004-RB-07	451	<10	238	247
	CGS-7	Highway 17 Kingsway (north side)	4-Oct-17	SW-39382-171004-RB-08	558	10	282	313
	CGS-8	Depot (standing water)	4-Oct-17	SW-39382-171004-RB-09	6,220	27	3,790	4,010
	CGS-9	Background (north of fill material)	4-Oct-17	SW-39382-171004-RB-10	117	<10	81	152
	CGS-10	Downstream of Depot (stream into swamp)	5-Oct-17	SW-39382-171004-RB-11	6,430	<10	3,680	4,170

Notes:

All units are in milligrams per Litre (mg/L)

(1) Field duplicate sample

Na Sodium

TSS Total Suspended Solids

Table 2

Best Management Practices - Continuous Improvement
Risk Managment Plan Assessment - Frobisher Depot
City of Greater Sudbury, Ontario

Best Management Practices	Currently Reviewed and Updated As Needed	Need for Review and Updating	Requires periodic review to maintain continuous improvement	Currently Implemented or Completed	Not Currently Considered	NOTES
Material Delivery and Handling						
Defined winter maintenance material storage and handling area				✓		
Low permeability pad		✓				
Berm or curb to prevent runoff into surrounding area					✓	
Salt-laden runoff directed to catch basins					✓	There are no stormwater catchbasins on Site
Salt stored inside a permanent, roofed structure				✓		Salt is stored in a dome
Impermeable Floor		✓				Floor is relatively impermeable
Periodic Roof/wall Inspections			✓	✓		Regular inspection are conducted
Periodic Floor Inspections for cracks and leaks		✓				
Indoor Loading Salt into spreaders				✓		
Practices to minimize spillage during loading	✓		✓			
Practices for quick salt spill clean up/housekeeping	✓		✓			
Excess salt returned to storage			✓	✓		
Salt deliveries covered while in transport and delivered in good weather	✓			✓		
Clean loading pads following transfer of material indoors					✓	
Records kept: Weigh tickets with truck number for each delivery				✓		
Timing of transfer of material indoors		✓				
Cleaning of loading pad after material transfer					✓	
Pickled Sand stored inside a permanent, roofed structure					✓	Pickled sand is stored outside
Indoor Pickled sand mixing					✓	
Outdoor mixing in good weather	✓		✓			
Discontinue summer storage of pickled sand		✓			✓	
Equipment Washing						
Wash all vehicles indoors		✓				
Salt water retention/treatment area		✓			✓	
Oil/water separator installed		✓				
Liquid Brine Production, Storage, and Handling						
Are water wells located up-gradient						There are no drinking water wells on Site. The Site and surrounding area are servcies by municipal water supply
Sufficient water supply for brine production				✓		
Seondary Containment					✓	There are no floor drains in the area of the brine tank
Vehicle Impact Protection				✓		The brine tank is located inside a building
Brine transfer from tank to truck conducted on solid impermeable surface		✓			✓	
Periodic Inspections of tank and piping	✓		✓			
Consideration to use washwater or salt impacted drainage for brine production					✓	

Table 2

Best Management Practices - Continuous Improvement
Risk Managment Plan Assessment - Frobisher Depot
City of Greater Sudbury, Ontario

Best Management Practices	Currently Reviewed and Updated As Needed	Need for Review and Updating	Requires periodic review to maintain continuous improvement	Currently Implemented or Completed	Not Currently Considered	NOTES
Records of Material Usage						
Use material tracking system to rationalize amount of materials used with the amount ordered and the residual amount at the end of the season		✓	✓			CGS Fleet has previously experimented with various sensors on its' trucks without a reliable solution to date (comp spread, plow sensores, etc.)
Training						
Sufficient training for equipment operators on controls and operating procedures	✓		✓	✓		
Health and safety requirements for use of equipment and materials			✓	✓		
Environmentally Sensitive/Vulnerable Areas						
Identify vulnerable areas and areas of natural and scientific interest			✓	✓		
Liaise with local potable water supply agencies				✓		
Monitor ground water and recharge areas					✓	
Locate stockpiles and snow disposal sites outside of vulnerable areas		✓				
Communication Strategy						
Prepare an internal handbook for employees that communicates the Council approved winter maintenance policies and procedures and other important information such as, contact lists, shift assignments, etc.		✓	✓	✓		

Appendices

Appendix A
Surface Water Sampling Standard Operating Procedures (SOP)

Technical Memorandum

To:	Tony DeSilva, CGS Road Operations	Ref. No.:	39382-42
From:	Robert Bressan/lb/1	Tel:	705-254-2438
CC:			

Subject: **Surface Water Sampling Procedure - City of Greater Sudbury**

1. Field Procedure for Surface Water Sampling

The purpose of the surface water sampling program is to obtain samples of the creek that are representative of existing surface water conditions. The parameters to be sampled and analyzed include:

- Chloride
- Sodium
- Total Suspended Solids (TSS)

Physical water quality parameters to be recorded in the field at each sampling location as samples are being collected include:

- Conductivity in mS/cm or µS/cm (i.e., specific conductance, conductivity normalized to 25°C)
- Temperature in °C
- pH [unitless]
- Turbidity as NTU
- Dissolved Oxygen (DO) in mg/L
- Total Dissolved Solids (TDS) in mg/L
- Oxidation Reduction Potential (ORP) in mV

Prior Planning and Preparation

The following should be considered prior to conducting surface water sampling:

- Check the weather prior to the sampling date to ensure the appropriate conditions are being sampled. To capture base flow (i.e., dry) conditions, ensure the sample location has not received precipitation within the past three days (72 hours). To capture run-off (i.e., wet) conditions, ensure the sample location has received at least ten millimeters of precipitation within 24 hours of sampling.

- If sample locations are located on private lands, coordinate with the owner for property access prior to the sample event.
- Make proper arrangements with the laboratory with regard to sample containers and sample date.
- Make proper arrangements with field equipment supplier with regard to water quality meter and sample date for equipment pick-up and drop-off (i.e., Maxim Environmental and Safety Inc.). Ensure calibration certificates are provided to ensure equipment is functioning properly. Also, ask to ensure equipment is set to read-out specific conductance for conductivity. Conductivity is a temperature dependent parameter; therefore, the same body of water can have a different conductivity as the temperature increases or decreases. For data comparative purposes, specific conductance is preferred as it is the conductivity of the water body at 25°C. If using a Horiba U-50 series water quality meter, the unit uses an automatic temperature conversion function to calculate conductivity at 25°C at a temperature coefficient of 2 %/°C based on the measured value of the temperature (see section 6.5 of the manual for more information). Ask the supplier for a demonstration on how to use the unit if you are unsure.
- Assemble equipment and supplies prior to sample event (i.e., water quality meter, sample containers, sample coolers, ice, metre stick, waders/overboots, protective gloves, field book/worksheet, pencils/pens, camera/phone for photographs, sample location map/figure, sample work plan, additional equipment if required such as peristaltic pump or t-bars)
- Pre-plan the sampling sequence (i.e., downstream to upstream)
- Working in water presents hazards not encountered in on-land operations. Complete a hazard analysis prior to the first sample event to mitigate risks to the sampler and review with the sampler prior to each sampling event.

Sample Location Selection

Surface water samples should be collected in areas of the creek that have a uniform cross section and flow rate. Mixing is influenced by turbulence and water velocity, therefore surface water samples should be collected in locations immediately downstream of a riffle area (i.e., fast flow zone) to ensure good vertical mixing. To ensure continuity within the sampling program, all surface water samples should be collected at the same location during each sampling event (i.e., install a t-bar at each sampling location) and documented in field notes, including photographs. Wading into the creek increases the chances of disturbance of sediments from the creek bed and therefore should be performed with caution. Surface water samples must be collected with no suspended sediments and should be collected starting at the furthest downstream location to avoid sediment interference with upstream locations. The site should also be clear of immediate point sources (i.e., tributaries and industrial and municipal effects) unless the sampling is being performed to assess these sources.

Sampling Technique

Surface water samples will be collected using the "direct dipping" technique, which involves directly dipping the sample container into the creek, unless the sample container contains preservatives. If a sample container contains preservatives, a pre-cleaned unpreserved sample container should be used to collect the

surface water sample. The surface water sample can then be decanted into the appropriate preserved sample container.

To collect a surface water sample, wade into the water and stand downstream of the sample location, submerse the inverted bottle to the deserved sample depth (typically 15 centimetres below the water surface with the sample container being completely submerged to eliminate the collection of floating debris), and tilt the opening of the sample container upstream to fill. Avoid moving around which could increase the chances of sediment disturbance. If the sample is to be collected in an area where the flow depth is less than one inch, special equipment is required to eliminate sediment disturbance. Surface water samples may be collected using a pre-cleaned shallow container then decanted to the appropriate sample container, or sampling could be performed using a peristaltic pump. A small excavation in the creek bed to create a sump for sample collection can also be considered however, it should be prepared in advance to allow all the sediments to settle prior to surface water sampling.

Once the sample bottle has been filled, secure the lid and place into the appropriate sample bag (if provided) and then into a cooler. After all samples have been collected, the cooler should be filled with ice prior to delivery to the laboratory. If samples will be shipped by via courier to the laboratory, double bag the ice, and line the cooler with a garbage bag sealing ice and samples within the cooler to prevent the occurrence of leaking during shipping. If glass containers are shipped, special attention should be paid to protecting them during shipping. The cooler should be tapped closed with a custody seal in place to maintain chain-of-custody until delivered to the laboratory.

Sample Container Labeling

It is important to ensure all surface water samples are labeled correctly to reflect the sample identification number (i.e., sample ID) associated with the sample location on all sample containers. The laboratory supplying the sample containers will typically provide blank sample labels which can be filled out in the field however, if possible, sample containers/labels can be filled out the day before to save time. Typically, the following information is recorded on each sample container:

- Unique sample ID number
- Sample date and time
- Sampler name or initials
- Analysis requested (i.e., chloride/sodium/TSS)
- Any identifier that can reveal the location to the lab (e.g. WR1 [White River 1]) should be avoided to prevent lab bias in reviewing the sample analysis.

Labels should be written in permanent ink and affixed to the sample container. An example of a unique sample ID would be:

SW-MMDDYY-XXX-001

where:

SW = sample matrix is surface water

MMDDYY = month/day/year

XXX = sampler's first, middle, and last initials

001 = sequential number for the sample event

Chain-of-Custody (COC) is the sequence of possession of an item. A sample is considered to be in custody if it is in the actual possession of a person, in the view of the person after being in his/her actual possession, or was placed in a secure area by that person. The integrity of analytical data is dependent in part on the legally defensible chain of custody of the samples collected. Therefore, COC records must be completed in permanent ink for all samples collected as it documents the transfer of samples for the specified analysis. The COC record must be signed and dated by the sampler when transferring samples. Ask the laboratory how to properly fill out the COC if you are unsure. When shipping samples, the chain of custody is maintained by applying a seal across the cooler lid that must be broken to open the cooler. The receiving laboratory will break the seal and accept the chain of custody has been maintained in transit.

Field Notes for Surface Water Sampling

Use a field book or worksheet to document all surface water sampling activities and record the following at least once per day:

- Name/type of equipment in use for measuring field parameters, date of calibration certificate
- Results of on-site daily calibration test. Note post test-results, and any sensors that fail calibration
- Weather conditions (i.e., dry, raining, overcast) – indicate changes throughout the day

Record the following at each monitoring location:

- Description of surface water sampling location (i.e., location name and surrounding)
- Sampling technique (i.e., direct dipping, peristaltic pump)
- Description of photographs taken
- Physical field parameter values and associated parameter units (i.e., conductivity, pH, temperature, TDS, DO, turbidity, ORP)
- Air temperature and any changes to weather conditions (i.e. starts raining)
- Stream flow directions (i.e., north to south, east to west)
- Creek physical conditions (i.e., width, depth, etc.)
- Visual observations (i.e., presence of tributaries, impoundments, bridges, railway trestles, oil sheen, odours, buried debris, vegetation and canopy cover, algae, fish and other aquatic species, surrounding industrial area, creek and creek bank erosion)
- Unique sample ID including time sample was collected and location

Post Sampling Activities

The following should be performed once sampling has been completed:

- Equipment should be cleaned, allowed to dry completely, and stored
- Sample coolers dropped off at the laboratory with the COC record filled out and attached (check with laboratory for sample drop-off times and after hours procedure)
- File field notes and download photographs
- Compile laboratory results into location specific summaries

Appendix B
Analytical Data – Surface Water Sampling Event (October 4 & 5, 2017)

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GHD LIMITED
651 COLBY DRIVE
WATERLOO, ON N2V1C2
(519) 884-0510

ATTENTION TO: Airesse MacPhee

PROJECT: 039382-42 - City of Greater Sudbury (PO# 73509263)

AGAT WORK ORDER: 17U268416

WATER ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

DATE REPORTED: Oct 13, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Results relate only to the items tested and to all the items tested
All reportable information as specified by ISO 17025:2005 is available from AGAT Laboratories upon request

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17U268416

PROJECT: 039382-42 - City of Greater Sudbury (PO# 73509263)

CLIENT NAME: GHD LIMITED

ATTENTION TO: Airesse MacPhee

SAMPLING SITE:

SAMPLED BY:

Inorganic Chemistry - Surface Water Samples

DATE RECEIVED: 2017-10-05

DATE REPORTED: 2017-10-12

Parameter	Unit	G / S	RDL	Date Prepared	Date Analyzed	SW-39382-171004-RB-01 Water 2017-10-04 8793582	SW-39382-171004-RB-02 Water 2017-10-04 8793584	SW-39382-171004-RB-03 Water 2017-10-04 8793589	RDL	SW-39382-171004-RB-04 Water 2017-10-04 8793594	SW-39382-171004-RB-05 Water 2017-10-04 8793603
Chloride	mg/L		0.50	2017-10-12	2017-10-12	374	367	322	1.0	414	426
Total Suspended Solids	mg/L		10	2017-10-11	2017-10-11	<10	<10	<10	10	<10	<10
Sodium-dissolved	mg/L		0.10	2017-10-12	2017-10-12	200	202	173	0.10	207	224
Total Sodium	mg/L		1.0	2017-10-12	2017-10-12	218	203	181	1.0	210	225

Parameter	Unit	G / S	RDL	Date Prepared	Date Analyzed	SW-39382-171004-RB-06 Water 2017-10-04 8793608	SW-39382-171004-RB-07 Water 2017-10-04 8793613	SW-39382-171004-RB-08 Water 2017-10-04 8793618	RDL	SW-39382-171004-RB-09 Water 2017-10-04 8793623
Chloride	mg/L		1.0	2017-10-12	2017-10-12	430	451	558	10	6220
Total Suspended Solids	mg/L		10	2017-10-11	2017-10-11	<10	<10	10	10	27
Sodium-dissolved	mg/L		0.10	2017-10-12	2017-10-12	238	238	282	2.5	3790
Total Sodium	mg/L		1.0	2017-10-12	2017-10-12	248	247	313	25	4010

Parameter	Unit	G / S	RDL	Date Prepared	Date Analyzed	SW-39382-171004-RB-10 Water 2017-10-04 8793628	RDL	SW-39382-171005-RB-11 Water 2017-10-05 8793634
Chloride	mg/L		0.20	2017-10-12	2017-10-12	117	10	6430
Total Suspended Solids	mg/L		10	2017-10-11	2017-10-11	<10	10	<10
Sodium-dissolved	mg/L		0.05	2017-10-12	2017-10-12	80.8	2.5	3680
Total Sodium	mg/L		1.0	2017-10-12	2017-10-12	152	25	4170

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO (mg/L)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8793582-8793634 Elevated RDLs indicate the degree of sample dilutions prior to analysis in order to keep the analytes within the calibration range of the instruments and to reduce matrix interferences.

Certified By:

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GHD LIMITED

PROJECT: 039382-42 - City of Greater Sudbury (PO# 73509263)

SAMPLING SITE:

AGAT WORK ORDER: 17U268416

ATTENTION TO: Airesse MacPhee

SAMPLED BY:

Water Analysis

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Inorganic Chemistry - Surface Water Samples															
Chloride	8793589	8793589	322	321	0.3%	< 0.10	101%	90%	110%	108%	90%	110%	85%	80%	120%
Total Suspended Solids	8793582	8793582	< 10	<10	NA	< 10	98%	80%	120%	NA			NA		
Sodium-dissolved	8793582	8793582	200	191	4.6%	< 0.05	99%	90%	110%	99%	90%	110%	98%	70%	130%
Total Sodium	8793582	8793582	218	209	4.2%	< 0.5	99%	90%	110%	88%	80%	120%	95%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

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Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
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TEL (905)712-5100
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http://www.agatlabs.com

Method Summary

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 17U268416

PROJECT: 039382-42 - City of Greater Sudbury (PO# 73509263)

ATTENTION TO: Airesse MacPhee

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Total Suspended Solids	INOR-93-6028	SM 2540 D	BALANCE
Sodium-dissolved	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Total Sodium	MET-93-6105	EPA SW 846 3010A & 6010C	ICP/OES

1742684916

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905 712 5100 Fax: 905 712 5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 735092 63
Cooler Quantity: 1
Arrival Temperatures: 7.9 | 8 | 8.2
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Report Information:
Company: GHD
Contact: ROBERT BRESSAN
Address: 96 WHITE OAK DRIVE EAST
SMELT STE. MACLEOD
Phone: 705-254-2438 Fax: 705-254-2439
Reports to be sent to:
1. Email: robert.bressan@ghd.com
2. Email: cristi.macleod@ghd.com

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use ☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

☐ Regulation 558
☒ CCME
☒ Prov. Water Quality Objectives (PWQO)
☐ Other (Indicate One)

Turnaround Time (TAT) Required:
Regular TAT ☒ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: CITY OF GREATER SUDBURY
Site Location: FRUSHER CREEK
Sampled By: ROBERT BRESSAN
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a Record of Site Condition? ☐ Yes ☒ No

Report Guideline on Certificate of Analysis ☐ Yes ☒ No

Invoice Information:
Bill To Same: Yes ☒ No ☐
Company:
Contact:
Address:
Email:

Sample Matrix Legend
B Biota
GW Ground Water
O Oil
P Paint
S Soil
SD Sediment
SW Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ 153 Metals (incl. Hydrides) ☐ Hydride Metals)	ORPs: ☐ B-HWS ☒ CN ☐ Cr6+ ☐ EC ☐ F- ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH3 ☐ TKN ☐ NO2 ☐ NO3+NO2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	TSS	Total Sodium	Dissolved Sodium			
SW-39382-171004-RB-01	004/17	15:25	4	SW	* ALL	N		X												X	X	X				
RB-02		15:38			SAMPLES			X												X	X	X				
RB-03		15:56			WERE			X												X	X	X				
RB-04		16:19			NOT			X												X	X	X				
RB-05		16:49			FIELD			X												X	X	X				
RB-06		17:19			* FILTERED*			X												X	X	X				
RB-07		17:58						X												X	X	X				
RB-08		18:18			DUE TO			X												X	X	X				
RB-09		18:41			FILTER			X												X	X	X				
RB-10		18:58						X												X	X	X				
SW-39382-171005-RB-11		13:06	4	SW				X												X	X	X				

Samples Relinquished By (Print Name and Sign): Robert Bressan — Date: Oct 5/17 — Time: 14:30
Samples Received By (Print Name and Sign): HOLLY SGOUROS — Date: 5 OCT 17 — Time: 1430
Samples Relinquished By (Print Name and Sign): — Date: — Time:
Samples Received By (Print Name and Sign): — Date: 5/10/17 — Time: 9:32
Samples Relinquished By (Print Name and Sign): — Date: — Time:
Samples Received By (Print Name and Sign): — Date: — Time:

Page 1 of 1
N°:

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

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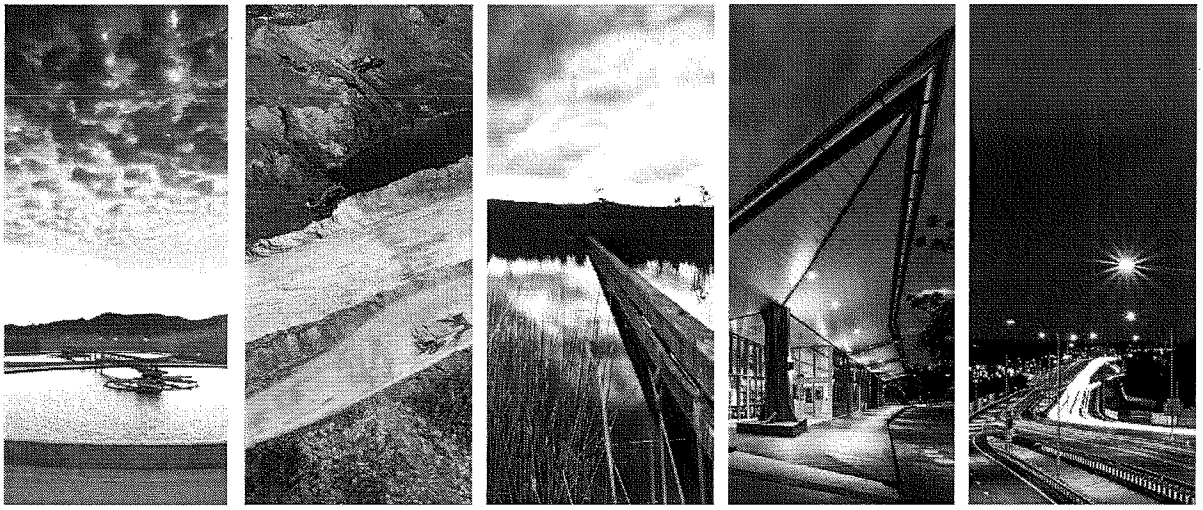

Salt Optimization Plan

City of Greater Sudbury

GHD | 96 White Oak Drive Sault Ste. Marie Ontario P6B 4J8 Canada

039382| 41| Report No 7 | January 18 2018

Executive Summary

This Salt Optimization Plan is a multi-departmental collaborative effort that is striving to optimize the use of road salt within the City of Greater Sudbury (CGS/City) to maintain safe surfaces for pedestrian and vehicular traffic while minimizing the environmental impacts related to the storage, handling, and application of road salt. The Salt Optimization Plan was initially launched as part of a source water protection initiative to protect sources of drinking water from rising sodium and chloride concentrations as per policy number Sa2EF-SA within the Greater Sudbury Source Protection Area Source Protection Plan[1]. and in response to a Ministry of Environment and Climate Change (MOECC) request.

The Salt Optimization Plan assesses the potential risk to environmental receptors within vulnerable areas associated with the application of salt within the CGS. Vulnerable areas incorporated within the Salt Optimization Plan include the following: source water protection (SWP), wellhead protection areas (WHPAs), intake protection zones (IPZs), highly vulnerable aquifers, significant/sensitive groundwater recharge areas, lake trout and fish spawning areas, wetlands, and provincially tracked species sensitive to salt application. By combining and weighing each environmental receptor/vulnerable area cumulatively, areas and roadways within the CGS were rated as low to high receptor risk related to salt exposure (see Figure 11). Based on the identification of intersections of salt vulnerable areas and roadways within the CGS, recommendations are provided to minimize the impact of salt on these environmental receptors (see Table 1) and provide direction to the Working Group to maintain a safe road network while protecting the environment.

CGS developed this Salt Optimization Plan in an effort to remain proactive with its Salt Management Plan initiatives and as a requirement of the Ministry of the Environment and Climate Change (MOECC). By doing so, the City is demonstrating to the community that safe and environmentally conscious road salt management and winter maintenance practices are a priority for the municipality.

1 "*Greater Sudbury Source Protection Area Source Protection Plan*", Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 19, 2014.

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Table 1 Salt Optimization Plan - Recommendations

1. Introduction

This Salt Optimization Plan is a multi-departmental collaborative effort that is striving to optimize the use of road salt within the City of Greater Sudbury (CGS/City) to maintain safe surfaces for pedestrian and vehicular traffic while minimizing the environmental impacts related to the storage, handling, and application of road salt. The Salt Optimization Plan was initially launched as part of a source water protection initiative to protect sources of drinking water from rising sodium and chloride concentrations as per policy number Sa2EF-SA within the Greater Sudbury Source Protection Area Source Protection Plan.[2] and in response to a Ministry of Environment and Climate Change (MOECC) request.

The Salt Optimization Plan assesses the potential risk/vulnerability to environmental receptors associated with the application of salt within the CGS road network. Environmental receptors incorporated within the Salt Optimization Plan include the following geographical information system (GIS) databases: source water protection (SWP), wellhead protection areas (WHPAs), intake protection zones (IPZs), highly vulnerable aquifers, significant/sensitive groundwater recharge areas, lake trout and fish spawning areas, wetlands, and provincially tracked species sensitive to salt application. By combining and weighing each environmental receptor/vulnerable area cumulatively, areas and roadways within the CGS can be rated as low to high receptor risk related to salt exposure. Based on the identification of the salt vulnerable areas and their intersection with roadways, recommendations are provided to minimize the impact of salt onto these environmental receptors and provide direction to the CGS Road Operations staff and Source water Protection Group (Working Group) to maintain a safe road network while protecting the environment.

CGS has developed this Salt Optimization Plan in an effort to remain proactive with its Salt Management Plan initiatives and as a requirement of the Ministry of the Environment and Climate Change (MOECC). By doing so, the City is demonstrating to the community that safe and environmentally conscious road salt management and winter maintenance practices are a priority for the municipality.

2. Project Overview

2.1 Vision

To minimize the environmental impact of road salt application, while maintaining safe surfaces for pedestrian and vehicular traffic.

2.2 Goals/Objectives

The City strives to minimize the impacts of road salt to the environment by encouraging reductions in the use of road salt in areas where this reduction will not impact pedestrian and vehicular safety.

---

2 "*Greater Sudbury Source Protection Area Source Protection Plan*", Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 19, 2014.

It also strives to optimize current winter maintenance practices to achieve an overall reduction in the application of road salt while delivering the expected level of service to its customers. To achieve these goals, best management practices, education and outreach initiatives, and improvements to current technology are considered within this Salt Optimization Plan.

3. Background

3.1 Source Water Protection

Source water protection is a concept that gained status as a result of the Walkerton tragedy and the ensuing inquiry into the related events by Justice O'Connor. Following the inquiry, recommendations were made, and it was determined that the best way to manage our drinking water resources is through a multi-barrier approach; the first of these barriers being protection at the source. The Clean Water Act (2006).[3] was instated to provide legislative guidance and authority to establish this barrier to protect drinking water sources from potential significant threats for current and future generations.

The City has six drinking water systems (listed below) including three surface water intakes and associated water treatment plants and 24 municipal groundwater water wells. Together these sources supply drinking water to 148,000 residents. An additional 12,000 residents are serviced by private drinking water systems. The City's drinking water systems (DWSs) are as follows:

1) Sudbury DWS:
    - Ramsey Lake (surface water intake)
    - Wanapitei River (surface water intake)
    - Garson (three wells)
2) Vermilion River DWS (surface water intake)
3) Valley DWS (13 wells)
4) Falconbridge DWS (three wells)
5) Onaping DWS (three wells)
6) Dowling DWS (two wells)

As a requirement under the Clean Water Act, an evaluation of existing water quality issues and potential water quality threats was conducted as part of the source water protection program as well as a delineation of vulnerable areas (i.e. protected zones around groundwater wells and surface water intakes where pollutants can reach the well or intake within a specific length of time). During the issues evaluation, review of the MOECC's Drinking Water Surveillance Program (DWSP) water quality data for 1991 to 2013 revealed elevated and rising sodium and chloride concentrations within Ramsey Lake. As such, sodium (primarily attributed to the application of road salt, but also the handling and storage of road salt as well as snow storage) was identified as a drinking water

[3] *"Clean Water Act, 2006, S.O. 2006, C.22"*, MOECC, Amendments June 20, 2012.

quality issue within Ramsey Lake vulnerable areas[4]. The application of road salt was also identified as a significant threat for the Wanapitei River DWS. Snow storage was identified as a significant threat to the Valley DWS.

Elevated sodium levels were also identified within the Dowling, Valley, and Garson DWSs, however sodium was not identified as a drinking water quality issue for these DWS due to insufficient available data to determine the presence of a significant increasing trend.

To start addressing the increasing sodium trend and the treats associated with the application, handling, and storage of road salt as well as snow storage, three specified actions are prescribed within the policies of the Greater Sudbury Source Protection Area Source Protection Plan, including:

1) **Policy Sa-6F SA**: Prohibit the establishment of large municipal or commercial snow melt (snow dump) facilities within vulnerable areas where they would be a significant threat.

2) **Policy Sa-5F s57**: Prohibit the handling and storage of road salt within vulnerable areas where this activity would be a significant threat. Within the Ramsey Lake Issues Contributing Area (ICA), this policy applies to road salt storage quantities of 0.5 tonnes and greater.

3) **Policy Sa-2EF-SA**:
   - Identify vulnerable areas where winter maintenance activities could be a significant threat.
   - Optimize the use and management of road salts.
   - Implement practices to minimize salt loss into the environment and impacts to drinking water sources.
   - Prioritize snow removal and street sweeping/cleaning on primary, arterial, and collector roads within vulnerable areas as soon as possible during/after snow melt.

As previously noted, this Salt Optimization Plan was initiated to meet the requirements of Policy Sa-2EF-SA and satisfy the MOECC.

3.2 Salt Management Plan

The Salt Optimization Plan is being established to complement the City's Salt Management Plan (SMP)[5], which was developed in response to Environment Canada's Code of Practice on the Environmental Management of Road Salt. The Code of Practice outlines policies and a procedural framework that ensures the City's continuous improvement of an effective winter maintenance service.

The Salt Management Plan summarizes and provides an overview of the City's current road salt management practices. It speaks to all of the major activities related to winter maintenance,

4 *"Greater Sudbury Source Protection Area Assessment Report"*, Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 2, 2014.

5 *"2016 Salt Management Plan, City of Greater Sudbury"*, Prepared by GHD, May 19, 2017.

operational practices and strategies as well as monitoring and updating requirements stipulated within the plan.

The Salt Optimization Plan fits within the continual improvement framework of the SMP. By offering recommendations on new and innovative ways of best managing the handling, storing and applying road salt, the Salt Optimization Plan keeps in line with the policy statements within the SMP.

3.3 Frobisher Depot Risk Management Plan

The Greater Sudbury Source Protection Area Source Protection Plan prescribes the establishment of risk management plans (RMPs) for activities related to the handling, storage, and application of road salt as well as snow storage within the following areas:

1) **Policy Sa-4E RMP**: Existing road salt handling and storage areas where the activity is a significant threat. Within the Ramsey Lake ICA, this policy applies to road salt storage quantities of 0.5 tonnes and greater.

2) **Policy Sa-3EF RMP**: Existing and future road salt application and existing snow storage for properties with exterior parking lots that are equal to or greater than one hectare, where the activities could be a significant threat and where Policy SA6F-SA does not apply.

As such, significant drinking water threat activities related to the City's winter maintenance program, including those of salt handling and storage occurring at the Frobisher Depot, will be addressed through RMPs.

The Frobisher Depot has a covered salt storage dome with a relatively impermeable base that stores the salt needed for the winter maintenance season. Pickled sand (i.e. sand mixed with salt at approximately five percent by volume) is currently stored outside at the site within the footprint of the former pickled sand dome located beside the salt storage dome. Brine is prepared and stored in a separate building at the site. Application equipment used during the winter maintenance season is loaded at the site prior to deployment to respond to winter events. Portions of the site used for salt and pickled sand storage and handling are located within the Ramsey Lake vulnerable area further discussed in Section 4.3.

The Frobisher Depot RMP, which ensures that all best management practices related to the significant drinking water threat activities are or will be employed on site, is provided under separate cover.

4. Vulnerable Areas

This section of the report is dedicated to a presentation of mapped areas having a known high vulnerability to groundwater and surface water contamination. An understanding of these vulnerable areas and their spatial association will provide further insight into salt vulnerable areas and enable us to make targeted and informed decisions regarding salt reduction strategies.

The Assessment Report produced in response to legislative requirements under the Clean Water Act[6] identified and mapped five (5) primary vulnerable areas for the Source Protection Region:

1) Well Head Protection Areas (WHPAs)
2) Intake Protection Zones (IPZs)
3) Issues Contributing Areas (ICAs)
4) Highly Vulnerable Aquifers (HVAs)
5) Significant/Sensitive Groundwater Recharge Areas (SGRAs)

Mapping for these areas was obtained from Conservation Sudbury.

Three additional vulnerable areas also considered within this document are as follows:

1) Fish Spawning Areas and Lake Trout Lakes/Proposed Lake Trout Lakes
2) Wetlands
3) Provincially Tracked Species

Mapping for these areas was obtained from the CGS GIS Department.

The CGS' boundary and road inventory/network are shown on Figures 1 and 2. CGS Surficial Drainage Areas, which show the tertiary watershed areas within the City limits (i.e. Vermillion, Upper and Lower Wanapitei, Killarney, as well as small portions of the Sturgeon, Spanish, and French watersheds), are shown on Figure 3.

4.1 Well Head Protection Areas (WHPAs)

Well Head Protection Areas (WHPAs) represent vulnerable areas that were delineated as part of the source water protection program, based on the presence of a municipal DWS. WHPAs are areas surrounding a municipal supply well where activities occurring at the surface may have the most impact on the quantity and quality of drinking water obtained from groundwater sources.

The WHPAs delineated for the City's wells include four areas: WHPA-A, WHPA-B, WHPA-C and WHPA-D. WHPA-A is the same for all wells and consists of a 100 meter radius, whereas WHPA-B, WHPA-C and WHPA-D are based on groundwater travel times to the wells and include two, five and 25 year categories. In addition, two of the wells within the Valley DWS (Wells M and J) in addition to both wells in the Dowling DWS are considered to be groundwater under the direct influence of surface water (GUDI) and as such a WHPA-E was established for these wells. The WHPA-E is delineated as an Intake Protection Zone-2 (IPZ-2) with the intake location at the point of interaction between groundwater supply and surface water or, if that is unknown, at the point in surface water that is closest to the well.

The WHPAs for the municipal wells are shown on Figure 4.

6 *"Greater Sudbury Source Protection Area Assessment Report"*, Prepared on Behalf of the Greater Sudbury Source Protection Committee Under the Clean Water Act, 2016 (Ontario Regulation 287/07). Approved September 2, 2014.

4.2 Intake Protection Zones (IPZs)

Intake Protection Zones (IPZs), similarly to the WHPAs, were also delineated around each surfacewater supply source as part of the source water protection program, in this case around the surface water intake structures located within the Wanapitei River, the Vermilion River, and Ramsey Lake. There are three different zones outlined as part of the IPZ delineation process: IPZ-1, IPZ-2, and IPZ-3.

The **Wanapitei River** intake structure is located in the southeast section of the City and is classified as a Type C intake (i.e. located within in a river and flow direction and velocity are unaffected by a water impoundment structure). The Wanapitei River IPZ-1 consists of a 200 metre (m) semi-circle, with the intake at the center point of the semi-circle and a 10 m extension downstream of the intake. Where the zone abuts land, a 120 m setback from the high water mark is included.

The **Vermilion River** intake structure is located within the southwest section of the City and is classified as a Type C intake. The Vermilion River intake is located within a natural basin where water circulates before continuing downstream. The Vermilion River IPZ-1 was modified to reflect local hydrodynamic conditions and consists of a 400 m radius around the intake. Where the zone abuts land, a 120 m setback from the high water mark is included.

The **Ramsey Lake** intake structure is located within the south section of the City and is classified as a Type D intake (i.e. it does not fit into the description of a Type A, B or C intake). The Ramsey Lake IPZ-1 consists of a one kilometer (km) radius around the intake structure, and where the zone abuts land, a 120 m setback from the high water mark is included.

All three IPZ-1 (Wanapitei River, the Vermilion River, and Ramsey Lake) are shown on Figure 5.

The delineation of IPZ- 2 for each surface water intake was conducted based on a two-hour travel time, which is equal to or less than the amount of time it would take a surface water plant operator to shut down the surface water treatment plant in response to a spill event (see Figure 5).

The delineation of IPZ-3 includes the area within the surface water body that may contribute water to the intake and also includes a 120 metre (m) setback from the high water mark. Transport pathways may also be included. The IPZ-3 for Ramsey Lake includes a 120 m setback applied to all contributing tributaries and storm sewers within the watershed. In areas where road side ditches serve as storm drains the protection zone includes a 120 m setback from the road network. IPZ-3 for the Wanapitei and Vermilion Rivers include contributing tributaries extending northwards over 100 km each, to the Arctic Divide.

4.3 Issues Contributing Area (ICA)

As a result of elevated and rising sodium and chloride levels identified within Ramsey Lake, the Clean Water Act required that an additional vulnerable area be identified. This area is called the Issues Contributing Area (ICA). The ICA is outlined by including the total surface area where activities occurring within its boundaries may contribute to the issues identified, in this case the increasing sodium and chloride levels. Given that the application of road salt is a non-point source, the Ramsey Lake ICA was considered as being the entire Ramsey Lake IPZ-3 (Figure 5). No other ICAs were identified within the Greater Sudbury Source Protection Area Source Protection Plan.

4.4 Highly Vulnerable Aquifers

Highly Vulnerable Aquifers (HVAs) were delineated as part of source water protection program by considering characteristics that have an impact on increasing the aquifer's susceptibility to threat activities. According to these characteristics, HVAs are typically those consisting of materials that have high permeability (such as sands and gravels), have a water table level near the surface, and have little to no overlying confining layers. HVAs are found dispersed throughout the City as shown on Figure 6.

4.5 Significant/Sensitive Groundwater Recharge Areas

Significant/sensitive groundwater recharge areas (SGRAs) are those where water falling as precipitation can infiltrate easily into the ground, and become part of an aquifer system. The map of SGRAs was developed as part of the source water protection program using a model and includes areas where the annual recharge volume accounts for 55 percent or more of annual precipitation minus evapotranspiration over the entire recharge area. SGRAs are found dispersed throughout the central portion of the City mainly within Valley East, Dowling, and Onaping areas as shown on Figure 7.

4.6 Fish Spawning Areas

Fish Spawning Areas (FSA) for sensitive species (i.e. Brook Trout, Lake Trout and Walleye) are identified within the City's Official Plan, Natural Heritage Background Study.[7] and were delineated based on information gathered from the Ministry of Natural Resources and Forestry's (MNRF's) Natural Resources and Values Information System (NRVIS) and the Laurentian University Cooperative Freshwater Ecology Unit (CFEU). As shown on Figure 8, there are no FSAs within the City limits.

4.7 Lake Trout Lakes/Proposed Lake Trout Lakes

Lake Trout Lakes (Existing and Proposed) are identified in the City's Official Plan and were identified based on information gathered from the MNRF's NRVIS and the Laurentian University CFEU. Various Lake Trout Lakes/Proposed Lake Trout Lakes are located throughout the City as shown on Figure 8.

4.8 Wetlands

Wetland area are identified within the City's Official Plan and were delineated based on information provided in the MNRF's NRVIS, as well as mapping prepared by City staff based on aerial photo review. There are multiple wetlands located throughout the City, as shown on Figure 9, including the provincially significant Vermilion River Wetland Complex.

7 *"City of Greater Sudbury Official Plan, Natural Heritage Background Study"*, February 2005

4.9 Provincially Tracked Species Sensitive to Salt

Provincially tracked species areas were delineated based on information provided by the MNRF's Natural Heritage Information Centre (NHIC) under the City's MNRF Sensitive Data Use Licence Agreement. The NHIC manages data regarding the locations of species at risk (SAR), other tracked species, and natural areas within Ontario. The dataset for the City includes over 1,000 recorded observations of various birds, fish, snakes, turtles, insects, and plants, which were narrowed down by the application of the following criteria:

- Observations made prior to the year 2000 were excluded
- Observations with no information regarding the observer were excluded
- Species that were not directly affected by salt (i.e. do not live in aquatic or semi-aquatic habitat, or feed primarily on benthic species) were excluded
- Species that are not salt sensitive (i.e. they migrate to/live in salt water during part of the year)

The remaining species observations were mapped using the NHIC data. Figure 10 shows areas where provincially tracked species of interest were identified and is presented in one kilometer grid squares in compliance with the NHIC guidelines relating to data sensitivity.

5. Salt Vulnerability Index

The intent of the index is to provide a relative vulnerability to activities involving road salt application, storage and handling. It can be used to target specific salt reduction initiatives in areas of high salt vulnerability to help address surface and groundwater migration of sodium and chloride.

A multi-criteria analysis was performed on CGS managed plow routes proximate to various sodium-chloride sensitive receptor datasets provided by the MNRF, Conservation Sudbury, CFEU, and CGS. These receptor datasets were assigned weights to reflect their relative sensitivity to sodium-chloride exposure. CGS managed plow routes were buffered by 50 metres in all directions, then intersections were generated between the plow route buffered areas and the weighted receptors. These intersections were aggregated and their weights summed for spatially-common areas. These sums were subjected to a vulnerability classification ranging from negligible to highly vulnerable with the results from the entire CGS presented on an overview figure.

The index was calculated by assigning weighted values to each vulnerable area as follows:

Vulnerability Area/Criteria	Weight
WHPA-A	10
WHPA-B	8
WHPA-C	6
WHPA-D	4
WHPA-E	2
IPZ-1	10
IPZ-2	6

Vulnerability Area/Criteria	Weight
IPZ-3	2
Highly Vulnerable Aquifer	7
Significant/Sensitive Groundwater Recharge Areas	7
Fish Spawning/Lake Trout	2
Provincially Significant Wetlands	4
Non-Provincially Significant Wetlands	1
Salt Sensitive Provincially Tracked Species	5

By overlapping each of the mapped vulnerable areas along with their weighted values, we obtain a map covering the extent of the City by area and road which show a salt vulnerability index ranging from low to high risk (Figures 11a and 11b).

6. Recommendations

To achieve the project's vision of minimizing the environmental impact of road salt application while maintaining safe surfaces for pedestrian and vehicular traffic, recommendations are provided to improve the efficiency of winter maintenance practices. The recommendations are listed in Table 1 and divided into the following categories:

- Baseline understanding
- Level of Service
- Material Tracking and Monitoring
- Technology & Control Techniques
- Pilot Projects
- Education and Outreach
- Future Objectives

Each recommendation is categorized as either a short or long term goal, has an associated priority level (low, medium or high) and includes the group/department responsible for implementation. The implementation status of each recommendation is to be taken as its status at the time of the Salt Optimization Plan publication.

It is anticipated that a working group consisting of various City departments including members of the Source Water Protection Group, Road Operations and Traffic & Transportation staff, will continually review and assess these recommendations on an recurring basis, typically once every five years.

7. Monitoring and Updating

The purpose of monitoring and updating is to provide a basis for continuous improvement and to ensure efforts toward the implementation of the City's Salt Optimization Plan recommendations are ongoing. A review/revision of the status of the recommendations' implementation will therefore be completed at the end of each 5-year period by the working group, at which time, suggestions for new recommendations to be implemented can be added to the plan.

All of Which is Respectfully Submitted,

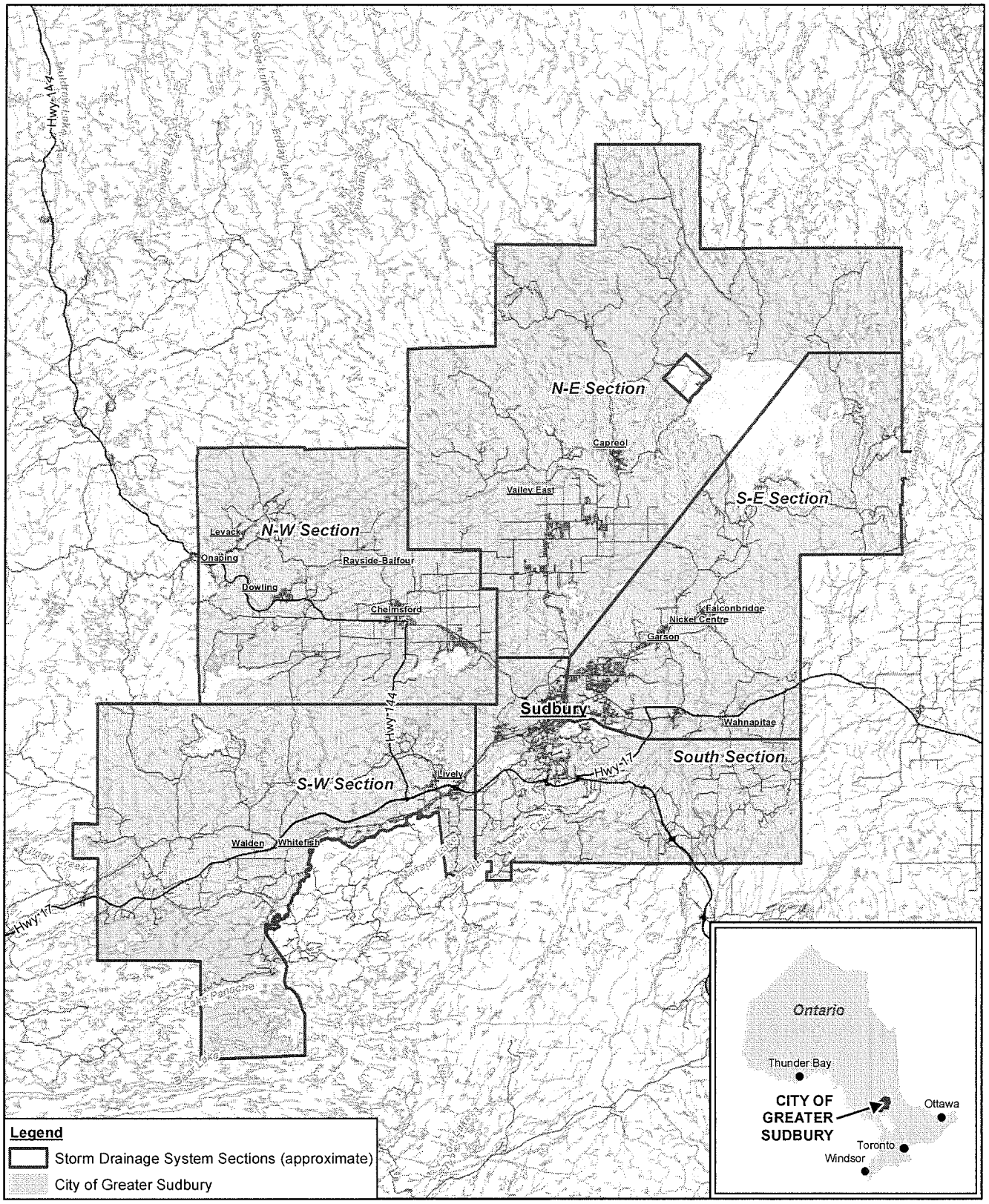
GHD

Robert Bressan, P.Eng., FEC

Sarah Ackert Ferguson, P.Eng.

Andrew Betts, M.A.Sc., P.Eng.

Figures



Source: MNRF NRVIS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017.
City of Greater Sudbury - Infrastructure - Needs Assessment - Storm Drainage System.

0 5 10 15
Kilometers

Coordinate System:
NAD 1983 UTM Zone 17N

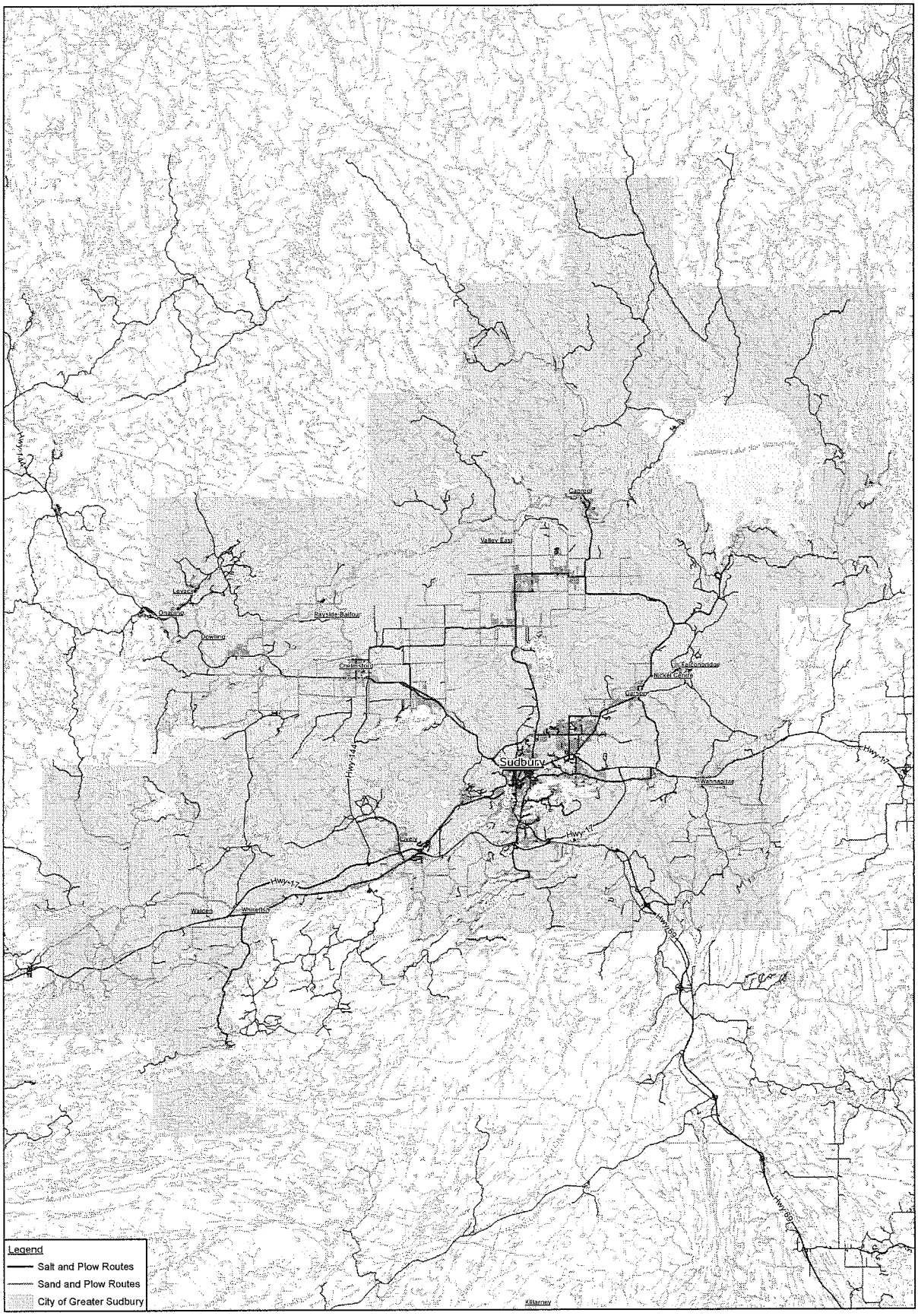
CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

39382-41
Oct 13, 2017

CITY OF GREATER SUDBURY LIMITS

FIGURE 1

GIS File: Q:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA001.mxd



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0 3 6 9
Kilometers

Coordinate System:
NAD 1983 UTM Zone 17N

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SALT OPTIMIZATION PLAN

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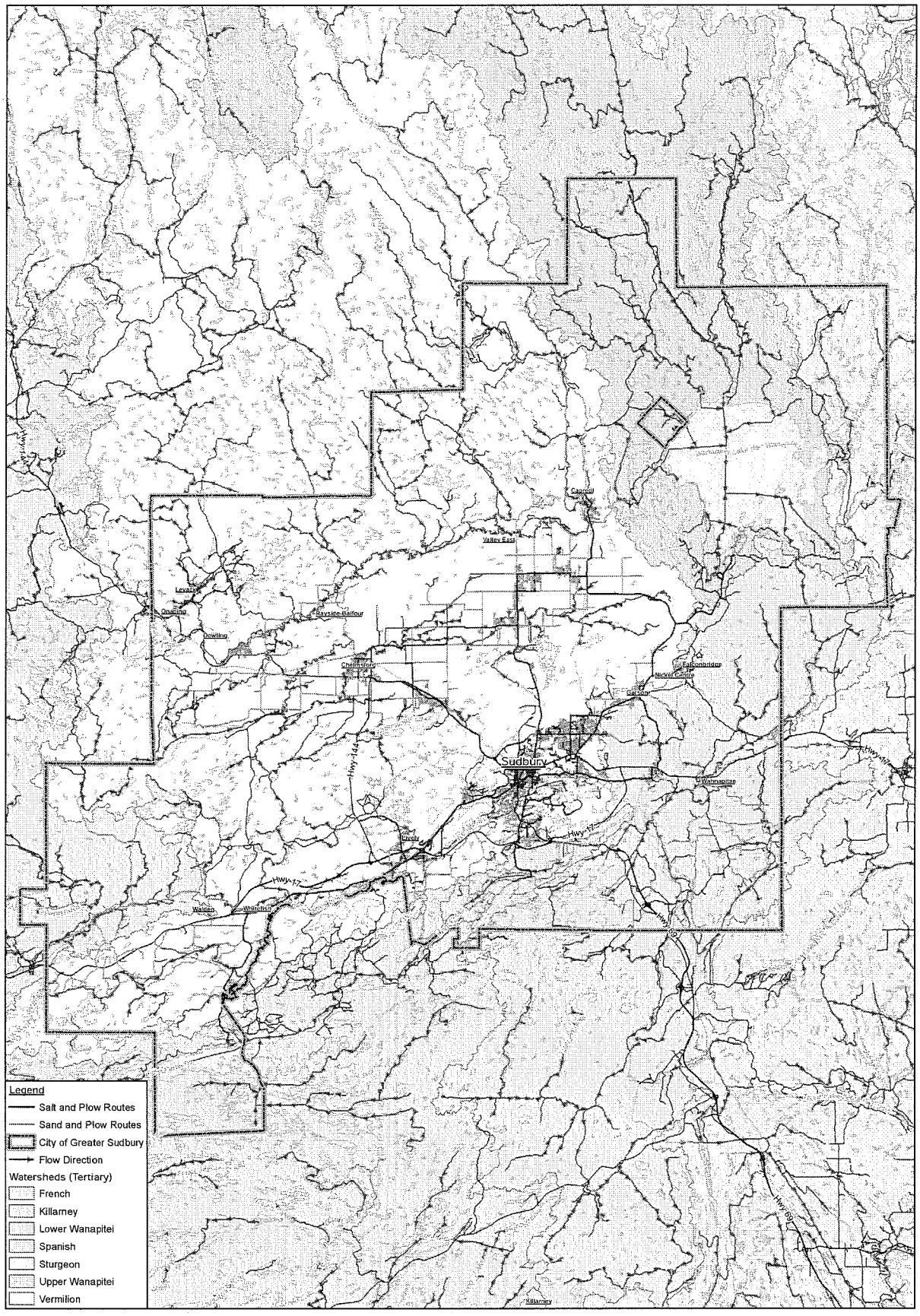
ROAD INVENTORY

FIGURE 2

GIS File: Q:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA002.mxd



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0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

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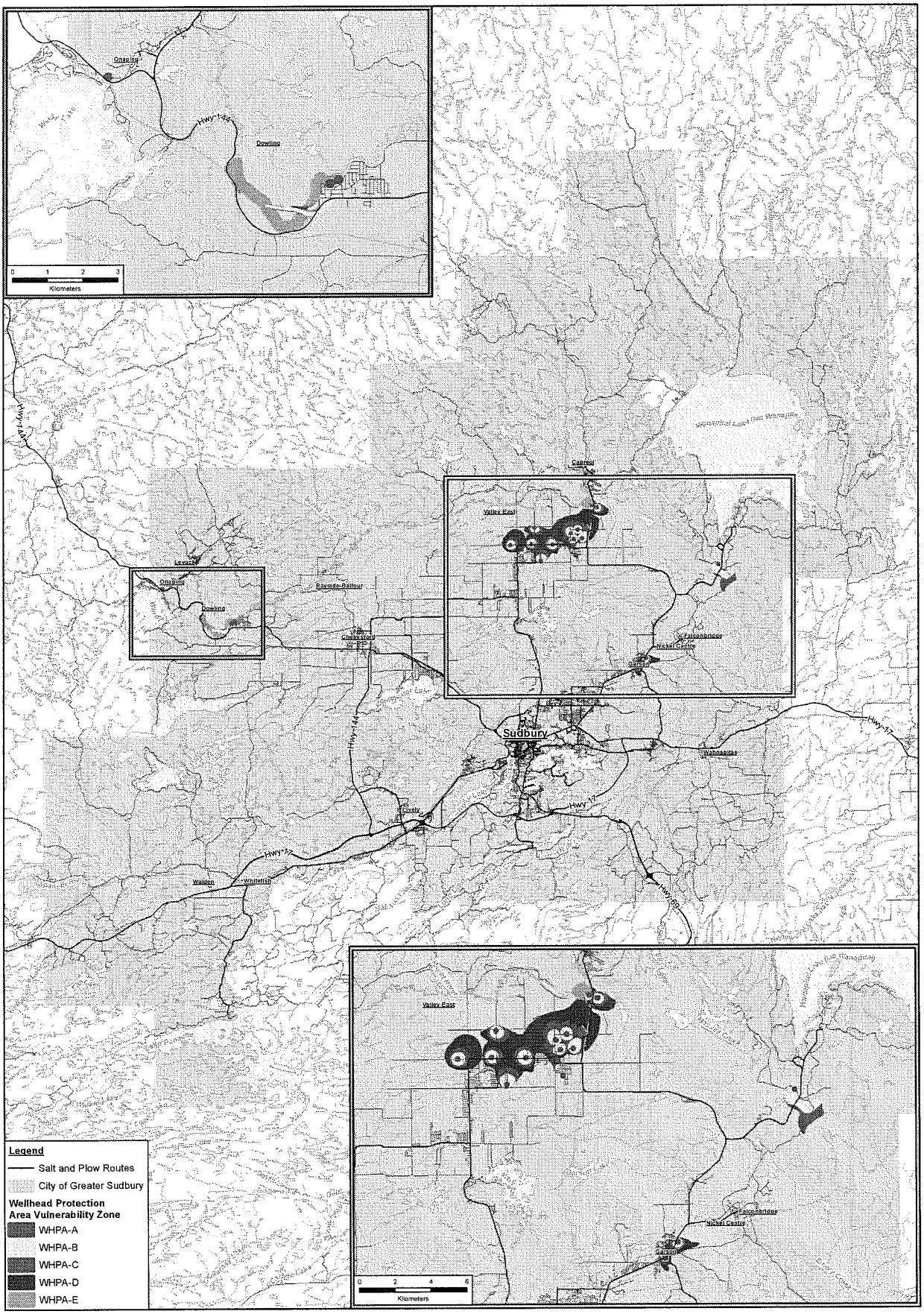
SURFICIAL DRAINAGE

FIGURE 3

GIS File: G:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA003.mxd



Source: MNRF NRVIS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017. City of Greater Sudbury, 2017.

0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

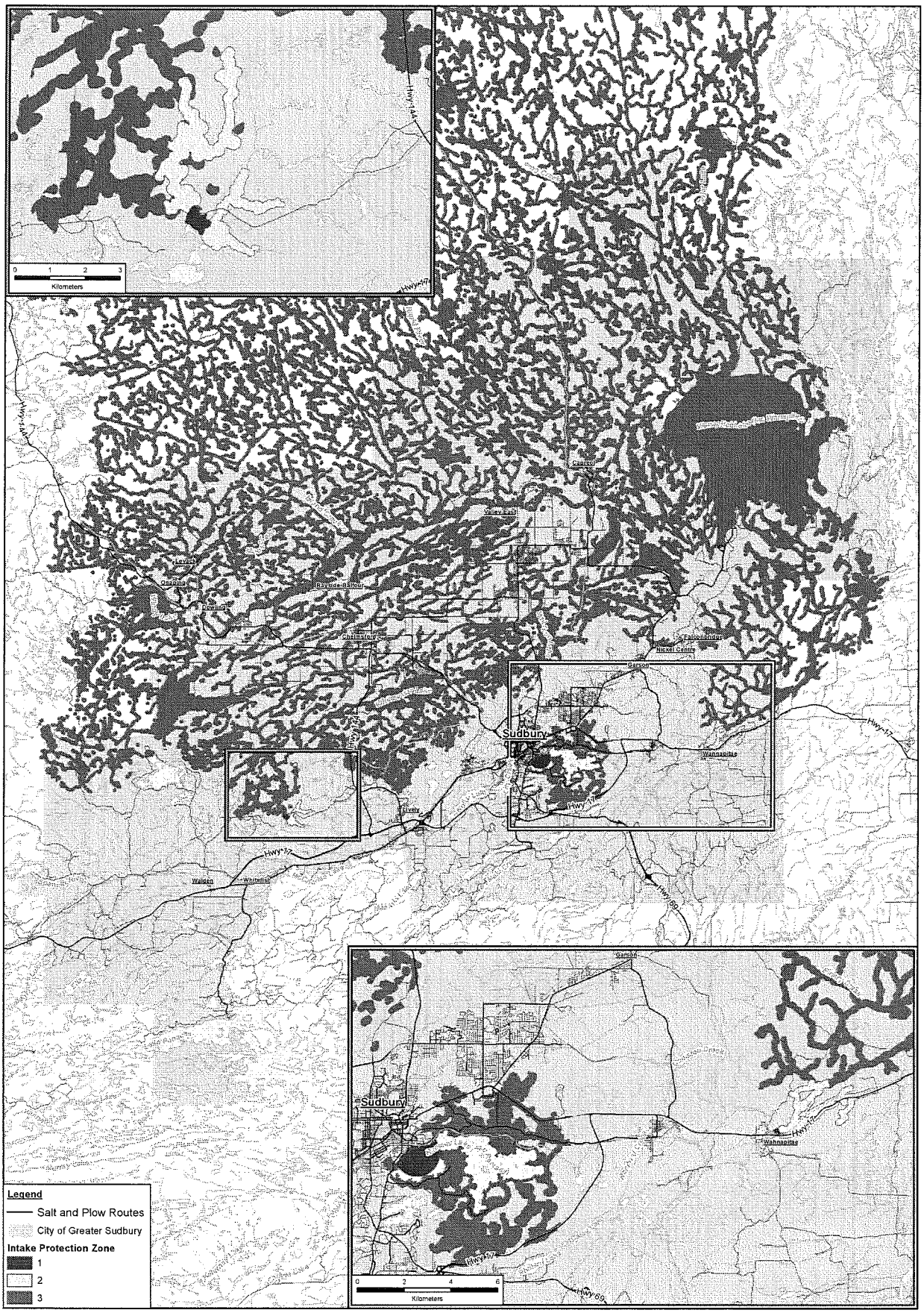
CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

39382-41
Oct 16, 2017

WELLHEAD PROTECTION AREAS

FIGURE 4

GIS File: Q:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA004.mxd



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0 3 6 9
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

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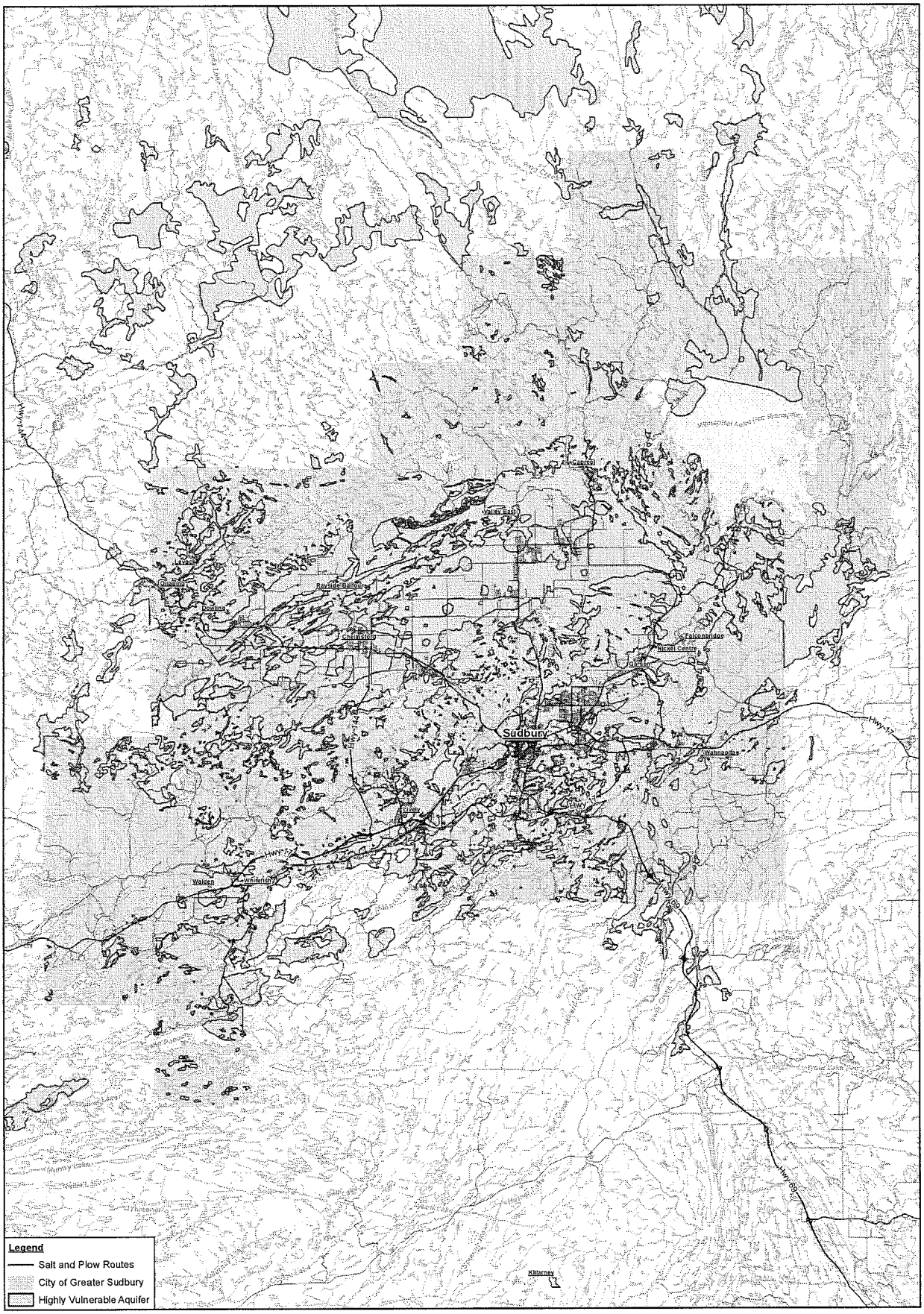
Oct 16, 2017

INTAKE PROTECTION ZONES

FIGURE 5

GIS File: Q:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA005.mxd



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0 3 6 9
Kilometers

Coordinate System:
NAD 1983 UTM Zone 17N

CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

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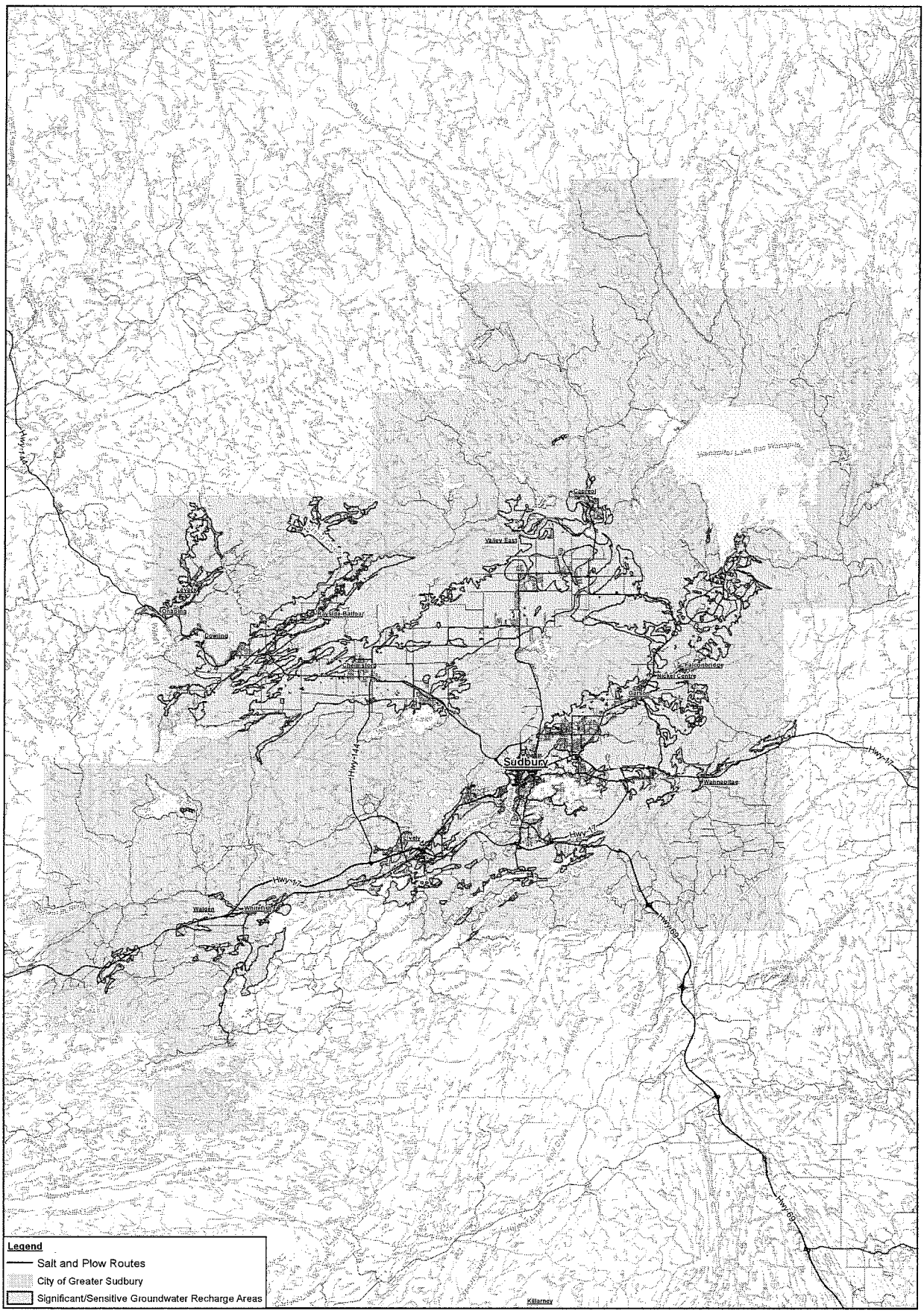
Oct 16, 2017

HIGHLY VULNERABLE AQUIFERS

FIGURE 6

GIS File: Q:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA006.mxd



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0 3 6 9
Kilometers
Coordinate System:
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CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

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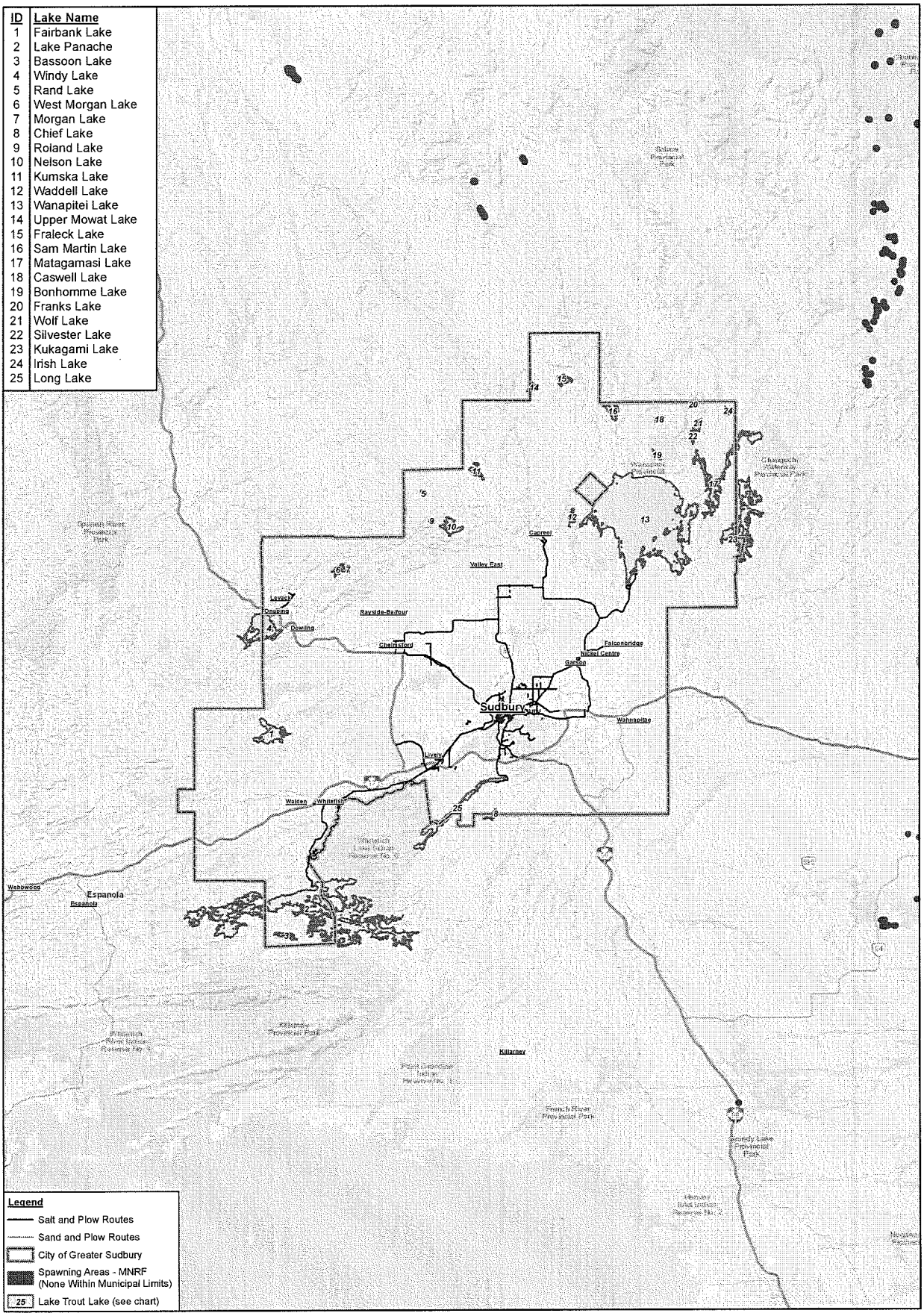
Oct 16, 2017

SIGNIFICANT / SENSITIVE
GROUNDWATER RECHARGE AREAS

FIGURE 7

GIS File: Q:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA007.mxd



Source: MNRF NRVIS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017. ESRI Streets Basemap.

0 5 10 15
Kilometers
Coordinate System:
NAD 1983 UTM Zone 17N

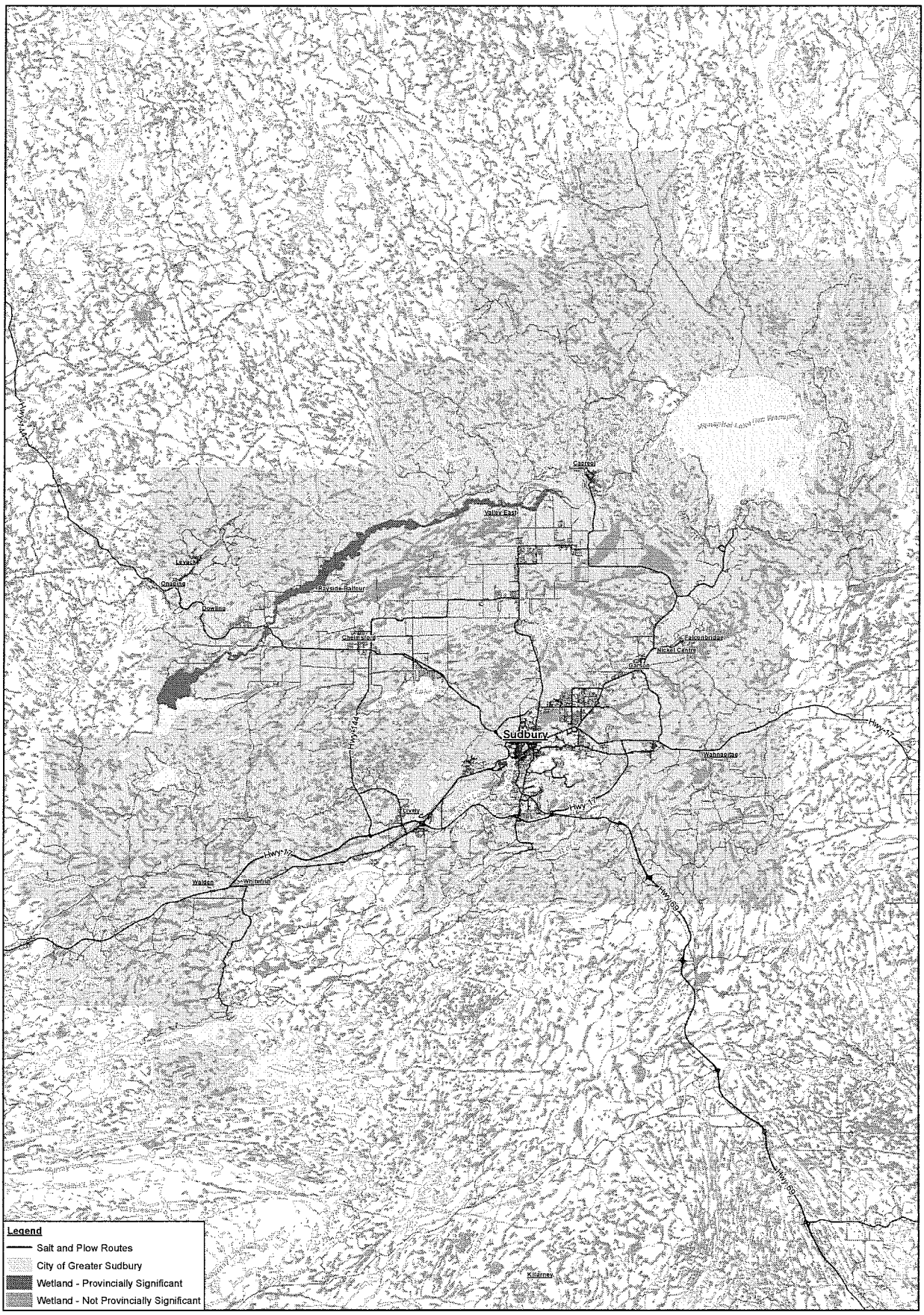
CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

LAKE TROUT LAKES AND
FISH SPAWNING AREAS

39382-41
Oct 17, 2017

FIGURE 8

GIS File: Q:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA006.mxd



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0 3 6 9
Kilometers

Coordinate System:
NAD 1983 UTM Zone 17N

CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

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Oct 17, 2017

WETLANDS

FIGURE 9

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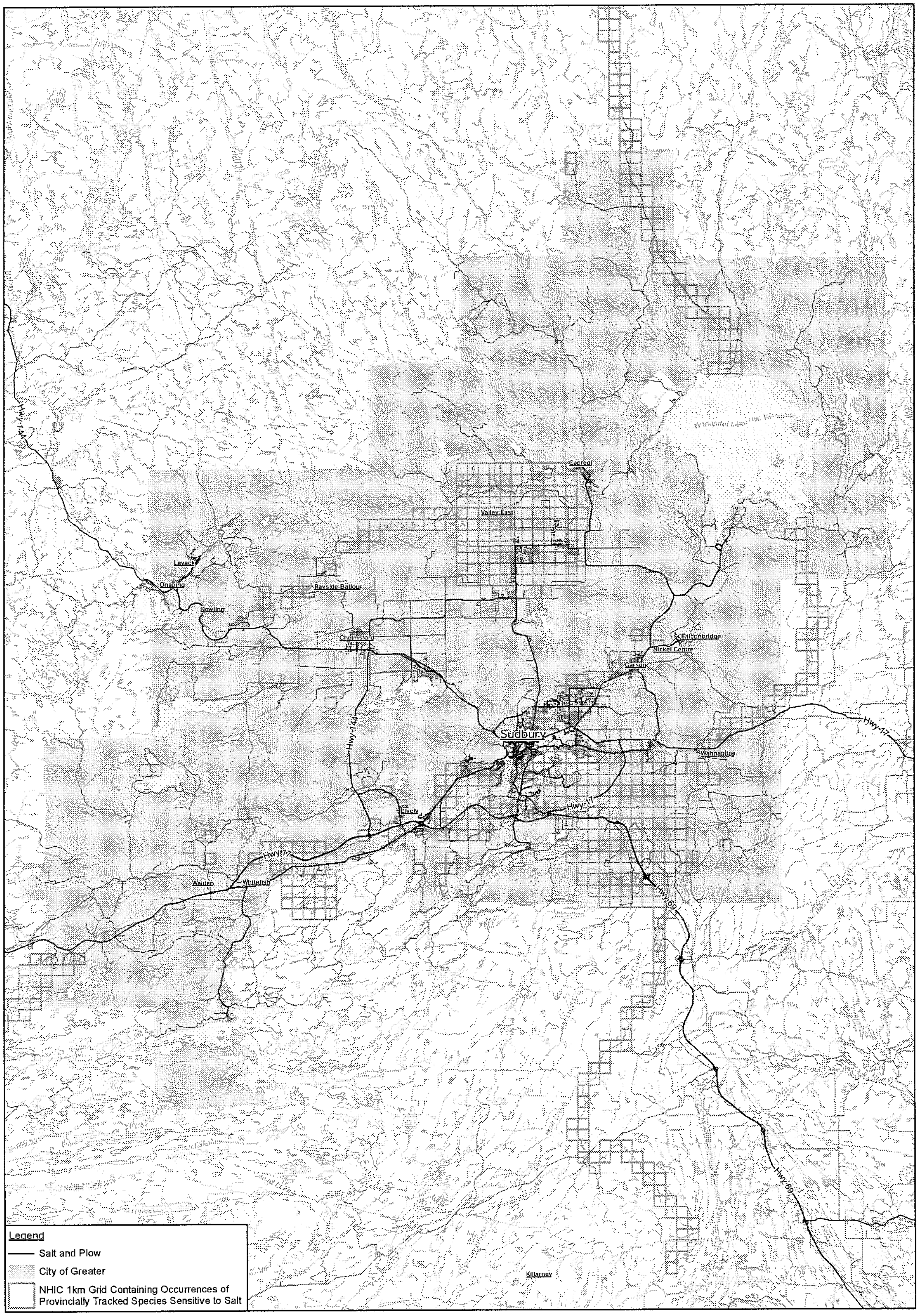

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0 3 6 9
Kilometers

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CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

39382-41
Oct 20, 2017

DISTRIBUTION OF PROVINCIALLY TRACKED SPECIES SENSITIVE TO SALT APPLICATION

FIGURE 10

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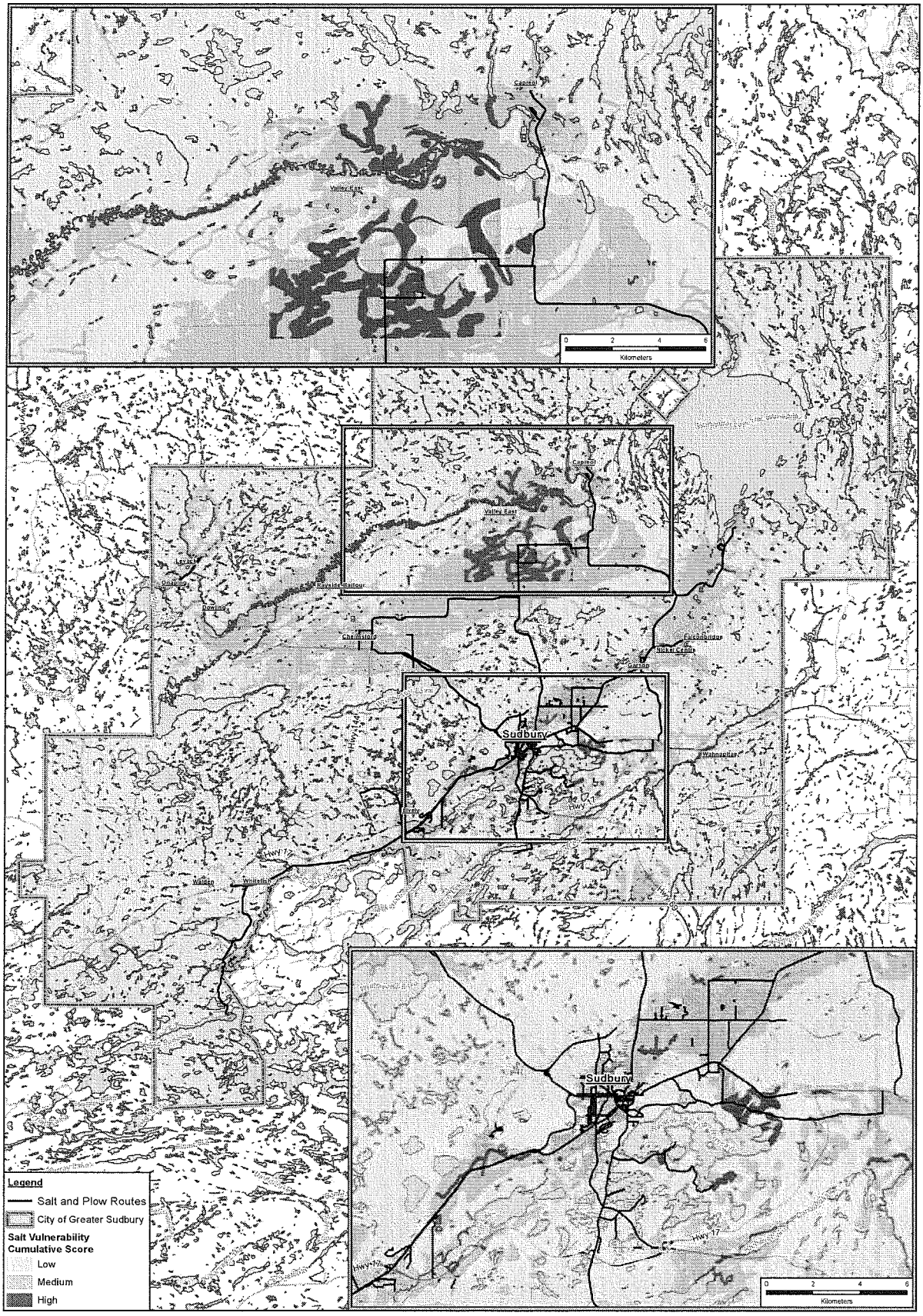

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0 3 6 9
Kilometers

Coordinate System:
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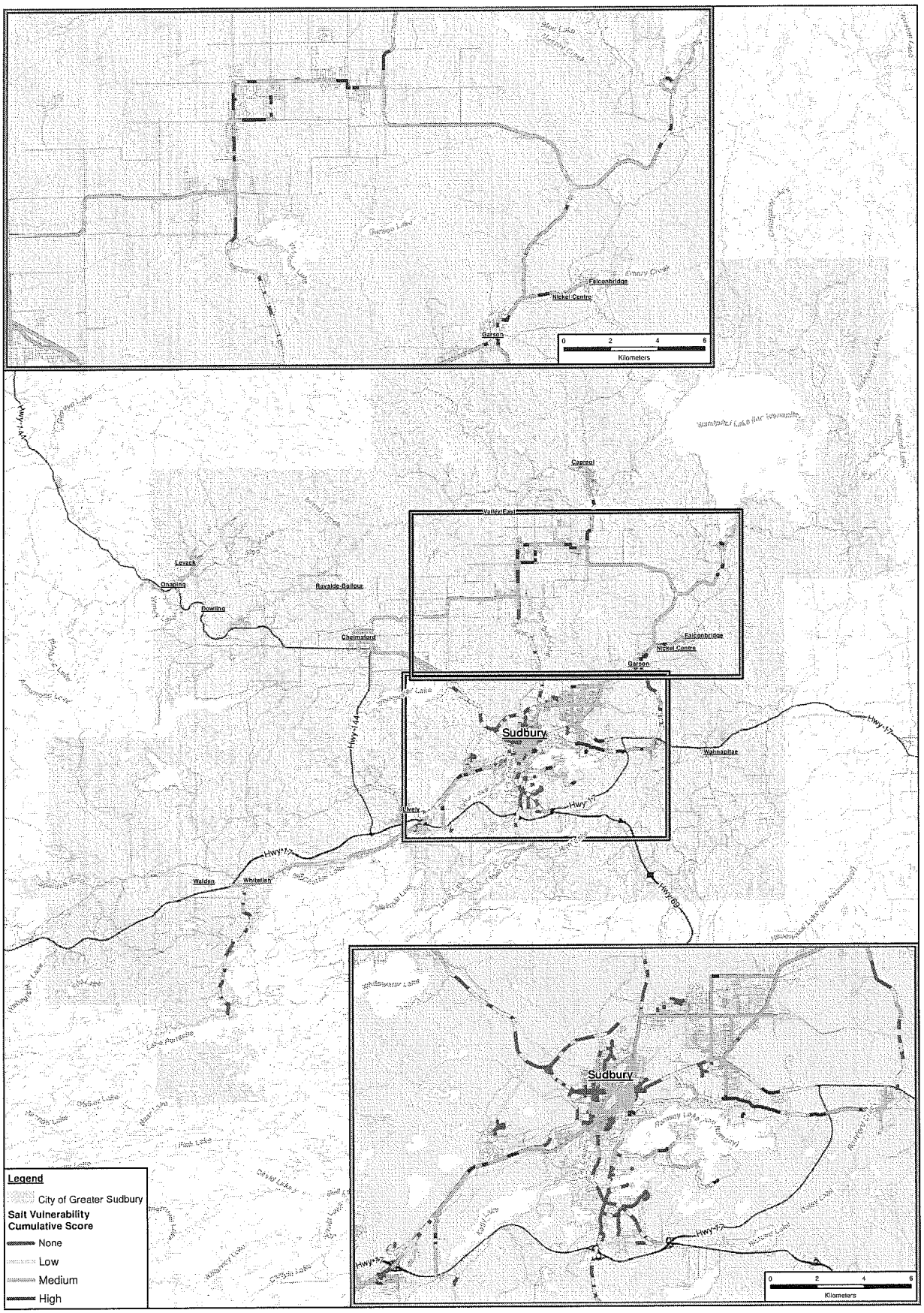
CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

39382-41
Nov 7, 2017

SALT VULNERABILITY INDEX

FIGURE 11a

GIS File: Q:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA011.mxd



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CITY OF GREATER SUDBURY
SALT OPTIMIZATION PLAN

39382-41
Oct 31, 2017

SALT VULNERABILITY INDEX – ROAD NETWORK

FIGURE 11b

GIS File: O:\GIS\PROJECTS\39000s\39382\Layouts\007\39382-41(007)GIS-WA012.mxd

Tables

Table 1

Salt Optimization Plan - Recommendations
City of Greater Sudbury

	Recommendation	Timeframe	Recurrence	Priority	Responsible	Status
Baseline Understanding	Establish a salt vulnerability index based on existing surface and groundwater vulnerable areas including WHPAs, IPZs, SGRAs, HVAs and ESGRAs. Create a salt vulnerability index map with the results to better understand salt sensitive areas to help in better decision-making.	Short Term	Initial with updates when major developments are planned	High	Road Operations with assistance from NDCA/SWPC/GIS	Complete
	Review transportation infrastructure that receives winter maintenance services to better identify system users (i.e., vehicles, bicycles, e-bikes, pedestrians, etc.) and incorporate user data and winter maintenance considerations into the Transportation Master Plan (i.e., sidewalk priority index).	Short Term / Long Term	5 years	Medium	Road Operations and Traffic & Transportation	Future
	Update available traffic count data, and posted speed limits.	Short Term	Annually	High	Traffic	Ongoing
	Update Ontario Minimum Maintenance Standards road classification mapping.	Short Term	Annually	High	Traffic	Ongoing
Level of Service	Establish a level of service for municipal parking facilities that will be included within the Winter Maintenance Operations Plan.	Short Term	Annually	High	Building / Planning	Complete
	Annually review transportation infrastructure that receives winter maintenance services, specifically priority plow (and salt/sand) routes to identify opportunities for improvement. Proposed changes in service will consider all road segments' planning classification (arterial, collector, and local), OMMS class, gradient, zoning and proximity to points of interest (schools, vulnerable sector community, churches and community buildings). Environmental vulnerability of the surrounding area must also be considered.	Short Term	Annually	High	Road Operations	Ongoing
	Establish or look for areas to expand direct liquid application routes with the use of additives.	Long Term	Annually	High	Road Operations	Ongoing
Material Tracking & Monitoring	Create a City-wide map of all surface water sampling locations for chloride/sodium concentrations including historic data where available. Track any changes in chloride/sodium loadings into receiving waters during the spring freshet and use this as a KPI.	Long Term	Annually	Medium/Low	Water/Wastewater Division / GIS / Environmental	Ongoing data collection
	Create a City-wide map of all groundwater sampling locations for chloride/sodium concentrations including historic data where available.	Long Term	Annually	Medium/Low	Water/Wastewater Division / GIS / Environmental	Ongoing data collection
	Develop an institutional partnership with post-secondary institutions to perform ongoing analytics of data captured relating to transportation infrastructure winter maintenance services.	Long Term	As required	Low	Road Operations	Future Ongoing
	Track the volume of anti-icing/de-icing materials used by CGS Fleet.	Short Term	Annually	High	Road Operations	Ongoing data collection
	Develop a snow removal contract template for future Traffic & Transportation Services snow removal contractors.	Long Term	As required	High	Road Operations	Complete
	Update Global Positioning System (GPS) devices used by City plows, sanders and contractor vehicles to incorporate Salt Vulnerable Area maps and track salt application within these areas.	Short Term	As required	High	Road Operations	Future
Technology & Control Techniques	Establish a corporate policy to have all corporate vehicles, including transit vehicles, use snow tires during the winter maintenance season.	Long Term	As required	Low	Fleet	Future
	Obtain additional Road Weather Information System (RWIS) within the City of Sudbury to better understand and respond to weather events.	Long Term	As required	Medium	Road Operations	Complete
	Obtain anti-icing/de-icing material application equipment for City Fleet that is capable of being calibrated.	Long Term	As required	Medium	Road Operations / Fleet	Ongoing
	Calibrate all equipment used for winter maintenance services as per manufacturer recommendations.	Short Term	Annually	High	Fleet	Ongoing
	Obtain multi-purpose types of equipment that can be utilized to better perform winter maintenance services (e.g. sanders with plowing ability, rear- mounted spreader with GPS unit).	Long Term	As required	Medium	Road Operations / Fleet	Ongoing: Fleet Renewal
	Establish a corporate standard to have cameras installed at strategic street signal installation locations to obtain better insight into weather conditions and traffic flow	Long Term	As required	Low	Traffic and Transportation Services	Future
	Develop storm water management plans at maintenance yards and snow disposal facilities that would also help to capture and control salt laden runoff.	Long Term	As required	High	Road Operations	Future

Table 1

Salt Optimization Plan - Recommendations
City of Greater Sudbury

	Recommendation	Timeframe	Recurrence	Priority	Responsible	Status
Pilot Projects	Engage with post-secondary institutions that are currently performing research on winter maintenance practices. Contribute and participate in these research opportunities when able.	Short Term	As required	High / Medium	Communications and Community Engagement / Traffic and Transportation Services	Ongoing
Education & Outreach	Have the Source Water Protection Group present annually at the Snow School held for operators at the beginning of each winter maintenance season.	Short Term	Annually	High	NDCA/SWPC	Future
	Require Smart About Salt Training for all City contractor hires	Short Term	As required	Medium	Road Operations	Future
	Continue encouraging and offering learning opportunities for City staff involved in winter maintenance activities through professional development opportunities and knowledge sharing sessions.	Short Term	As required	High	All departments	Winter debriefs occurring annually
	Hold a promotional campaign to begin at the start of every winter maintenance season and continue throughout the season that will help educate the general public about salt application best management practices and the City's winter maintenance program. May include promotional materials in the local newspaper, informational pamphlets, ads through City run social media outlets, etc.	Short Term	Annually	Medium	Road Operations / Communications and Community Engagement	Future
Future Objectives	Review and assess permissible truck routes through the City for potential changes to optimize the winter maintenance strategy.	Long Term	Annually	High	Road Operations	Ongoing
	Have future updates to the Transportation Master Plan consider ways to optimize winter maintenance activities of proposed road network changes.	Short Term	As required	Medium	Road Operations	Future
	Employ plowing as the primary technique to reduce amount of material applied to the surface.	Short Term / Long Term	Annually	High / Medium	Road Operations	Ongoing
	Review material application rates to identify successes and areas for improvement.	Short Term	Annually	High	Road Operations	Ongoing
	Establish definitions of hills, curves, intersections as ranges (ex. steep hill, very steep hill) within the Winter Operations Plan. Include a clause that winter maintenance within these areas is to be based on operator judgement.	Short Term	Initially	Low	Road Operations / Engineering	Future
	Provide recommendations and guidance to Planning and Engineering Policy and Standards on how winter maintenance can be better considered in site designs.	Long Term	As required	High	Road Operations / Traffic & Transportation / Engineering / Planning	Ongoing
	The City of Greater Sudbury to continue as an active member of Ontario's Road Salt Management Group (ORSMG). The ORSMG has municipal and Environment Canada membership and investigates/pilots state-of-the-art salt management practices and explores new technologies to further enhance road salt management.	Short Term	Annually	Medium	Road Operations	Ongoing

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SODIUM CHLORIDE (NaCl)

Description

Sodium chloride (also known as rock salt) is a naturally occurring mineral.

Health and Environmental Effects

The use of sodium chloride for de-icing can have adverse effects on vegetation, soil and water quality under specific conditions.

Vegetation

Roadside vegetation injury by salt spray and salt laden runoff has been documented and where widespread damage occurs can be a significant problem.

Soil

Infiltration of salt-laden runoff can cause some soil types to be less fertile, less permeable, have higher alkalinity and be more prone to erosion [Gales 1992 pg.141].

Water And Aquatic Life

Chloride ions are highly mobile and can contaminate surface water and groundwater under certain conditions. High chloride concentrations can, under specific conditions, affect water density thereby inhibiting seasonal mixing of lake water. Salt ions may liberate mercury and other heavy metals from lake sediments, although this hypothesis needs further evaluation. The impacts of de-icing salt on aquatic life are not usually significant but very high salt levels can stress aquatic environments.

Human And Terrestrial Wildlife Health

Sodium chloride, in high enough concentrations, can impart an unpleasant taste and odor to drinking water. Elevated salt levels in drinking water can be of concern to those individuals of the sensitive sub-population on sodium-restricted diets for hypertension treatment. On the issue of the health benefits of salt intake reduction, scientific data are becoming increasingly consistent in suggesting at most a small benefit from salt reduction. In many cases reviewed by Taubes [1998], little or no blood pressure benefit (lowering) was achieved by lowering dietary sodium.

The major documented wildlife impact related to road salting is the attraction of larger wildlife (particularly moose) to roadside pools of salt-laden water. Reported cases of ingested salt poisoning of smaller wildlife species are limited in extent and related to a combination of exceptional conditions. Researchers have concluded that saline drinking water for farm animals from road de-icing is not a water quality concern [D'Itri 1992]. If high salt loadings in small roadside ponds result in changes in pond chemistry, stress on breeding amphibians is possible. This potential requires further research.

Compatibility with Automotive and Highway Materials

Road salt use has vehicle and infrastructure implications. Effects occur from corrosion (from salt and other environmental causes) and other damage to surfaces in contact with salt materials

(slush, spray, mist, saline water). Studies in Toronto show that 50% of corrosion occurring on auto body steel was due to salt use during the winter months [Fromm 1984]. De-icing salts also contribute to the corrosion of reinforcing steel in concrete bridge decks and substructures. Costs are incurred to repair damaged surfaces and to develop and install protective measures to reduce salt corrosion. Future maintenance and repair costs can be expected to decline as vehicles, bridges and other infrastructure are constructed with better corrosion resistant materials.

De-icing Performance

The practical working temperature of sodium chloride is down to -9.4°C and its eutectic temperature (the lowest temperature at which the de-icer can suppress the freezing point of water) is -21°C at a mixture of 23.3% rock salt in water. As sodium chloride goes into solution it requires 39 British Thermal Units [BTU] from its surroundings. Sodium chloride is generally considered ineffective below -17°C.

Storage, Handling and Spreading Characteristics

Salt is easy to store, handle and distribute.

Additional Information

A sodium chloride application rate of 113 to 142 kg per 2-lane km is usually sufficient [Jones 1986 pg.111]. Salt costs approximately $33.05 U.S./tonne [Moran 1992, pg.357] which would be $1.86 to $2.34 per lane kilometer.

Sodium chloride is the most popular de-icer as it is inexpensive and highly effective when applied under proper climatic conditions.

CALCIUM CHLORIDE ($CaCl_2$)

Description

Calcium chloride is synthetic liquid brine in its natural state, but it is also available in solid flake and pelletized form. Calcium chloride absorbs moisture from the atmosphere and gives off heat (290 BTU) when converted to liquid so it works in lower temperatures than NaCl.

Health and Environmental Effects

Some contradictory information regarding the environmental effects of calcium chloride was found in the literature. However, many sources report that calcium chloride can have a negative effect on the environment, similar to sodium chloride [Fromm 1984]. Excessive amounts of calcium chloride can produce an oily residue. When in solution calcium chloride has damaging effects on some (materials such as leather, rubber, metals, etc.).

Corrosion

Calcium chloride is more corrosive to metal than sodium chloride [Moran 1992, pg.346]. However, as calcium chloride is effective at lower temperatures it is less harmful to concrete.

De-icing Performance

Calcium chloride is a better de-icer than sodium chloride and it works at lower temperatures (-15°C or less). Its practical working temperature is -31.6°C and its eutectic temperature is -51.1°C at $CaCl_2$ concentration of 29.8% by weight [Kirchner 1998].

Storage, Handling and Spreading Characteristics

Calcium chloride is usually used as a pre-wetting agent, or mixed with sand to prevent freezing at low temperatures. It can also be used as an anti-icer. It is spread using the same technique and equipment as sodium chloride.

Additional Information

Calcium chloride is approximately $1811 per tonne [Moran 1992, pg. 357]. Suggested application rates for anti-icing range from are 28 to 55 kg of calcium chloride pellets per lane kilometer, and some estimates for de-icing range as high as 140 kg per lane kilometer [Kirchner 1998]. This would cost approximately $5 to $10 per lane kilometer for anti-icing or up to $25 per lane kilometer for de-icing.

POTASSIUM CHLORIDE (KCl)

Description

Potassium chloride is a common fertilizer and is often used as a low salt substitute in cooking. It is mined from sylvite deposits in New Mexico and Saskatchewan.

Health and Environmental Effects

Slightly less than sodium chloride. Corrosion similar to sodium chloride.

De-icing Performance

Potassium chloride is less active than NaCl and $CaCl_2$. It has a practical working temperature of -3.8°C and a eutectic temperature of -11.1°C at a concentration of 19.75% by weight in water. Potassium chloride requires 170 BTU's of heat (an endothermic reaction) as it goes into solution.

Storage, Handling and Spreading Characteristics

Potassium chloride is frequently packaged as an additive to other de-icers.

Additional Information

The cost is similar to NaCl.

MAGNESIUM CHORIDE ($MgCl_2$)

Description
Magnesium chloride is a hygroscopic chemical similar to calcium chloride. In its natural state it is a liquid but it is also sold as a solid flake de-icer.

Health and Environmental Effects
Similar to NaCl.

Corrosion
Similar to NaCl. Magnesium chloride is one of the only chemicals that can moderately deteriorate concrete but is listed as "slow to attack concrete" [Kirchner 1998].

De-icing Performance
Magnesium chloride has a practical working temperature of -15°C and its eutectic temperature is -33.6°C at a 21.6 weight percentage in water. Magnesium chloride has the ability to attract and retain moisture from its surroundings, but not as well as calcium chloride.

Storage, Handling and Spreading Characteristics
As a liquid magnesium chloride is used in the same way as calcium chloride to pre-wet road salt, sand and other de-icer mixes.

Additional Information
Magnesium chloride is only 48% active so it must be applied at twice the rate of $CaCl_2$.

CALCIUM MAGNESIUM ACETATE (CMA)

Description

CMA is calcium magnesium acetate, a synthetic powdered mixture of dolomite lime and acetic acid. It was first identified as an alternative to road salt by the U.S. Federal Highway Administration in the late 1970's. Since then extensive research and testing has been conducted on the corrosion impacts, environmental impacts and de-icing efficiency of the substance.

A granulated dry formulation of CMA is typically used for roadway de-icing. However, CMA can also be used in liquid form or combined with salt or sand. Liquid CMA can be formulated in the field from dry CMA and is generally used for anti-icing [Cryotech 1998].

Health and Environmental Effects

CMA is a biodegradable substance and has not been proven to have adverse effect on soils, water or vegetation.

Soils

CMA has no effects on soil compaction or strength and may increase the fertility and permeability of some soils. CMA may contribute nutrients (calcium and magnesium) while displacing iron, aluminum, zinc and copper. [Gales 1992, pg.173].

Water

CMA is biodegradable and exhibits poor mobility in soils, so it is not likely to reach groundwater. It is more hygroscopic than NaCl (greater tendency to absorb moisture) so it is less susceptible to leaching action. Concern has been raised over the potential of CMA to extract heavy metals in soils and cause trace metal contamination of ground water. However, McFarland [1992, pg. 202] found that CMA was not found to mobilize preexisting heavy metals from a variety of roadside soils compared to water or NaCl.

Vegetation

No detrimental effects on roadside plants have been recorded when CMA was tested at concentrations likely to be generated by highway de-icing [NRC 1991, pg. 129].

Aquatic And Terrestrial Wildlife

No deleterious effects on aquatic organisms have been recorded when tested at concentrations likely to be generated by highway de-icing. CMA may reduce dissolved oxygen levels as it decomposes, hence heavy CMA treatments near small poorly flushed or poorly diluted ponds and streams may require special monitoring and further study. CMA smells like vinegar, so unlike salt it is not attractive to animals. It has been used in Scandinavia in deer management areas as a means of preventing vehicle/animal accidents.

Human Health

Some workers have complained of chemical irritation from CMA unless they wear protective clothing [Hanneman 1992, pg. 433]. CMA powder has a tendency to create nuisance dust that may require the use of dust masks and well-ventilated storage and handling areas. However, new pelletized versions are less prone to dusting and blowing, and are better able to penetrate packed snow than the early powdery CMA products.

Corrosion

CMA is less corrosive to metals found in automotive steels, aluminum alloys, stainless steels, combined metals, bridges, roadways, parking garages and other steel and concrete systems than NaCl. The corrosion rates of steel tested in tap water were equal to or slightly higher than those of steel tested in CMA solutions [NRC 1991, pg. 131]. CMA does not contribute to spalling and scalling on new reinforced concrete and does not accelerate corrosion of older chloride contaminated concrete. However, there is insufficient evidence that CMA reduces the rate of corrosion of steel in concrete that is already contaminated with chlorides.

De-icing Performance

Although CMA is effective at the same temperatures as salt it has different performance characteristics. CMA does not melt ice and snow but turns it into an oatmeal texture. It performs best when accompanied by plowing or traffic activity, and when it is applied at the outset of a storm before significant snow and ice accumulation. When applied early CMA is able to mix with the falling snow and inhibit the ability of snow particles to adhere to each other or to the pavement (NRC 1991, pg. 122). CMA does not produce a running brine and so it does not move off the surface like other de-icers, nor can its performance be measured in the same way (penetration, undercutting etc.).

CMA ions are larger than those of NaCl so the rate of diffusion into a liquid film surrounding ice is slower. When applied after the onset of a storm CMA takes longer to start working than NaCl (about 20 min) and is less successful in penetrating heavy snowpack and ice [NRC 1991, pg.114].

Practical Working Temperature is -6°C, and the eutectic Temperature is -27°C at a concentration of 32.5% CMA by weight in water [Kirchner 1998].

Storage, Handling and Spreading Characteristics

When CMA was used in powdered form it was dusty, difficult to handle and there were some reports of CMA spray adhering to windshields and body parts and causing skin irritation [NRC 1991 pg. 120 and 133]. When exposed to moisture CMA frequently cakes and clogs. Some inconvenience has occurred with CMA clogging and sticking to spreading equipment. New pelletized versions have alleviated most of these earlier problems.

CMA needs to be kept dry during storage, preferably in enclosed, well-ventilated shelters. Since CMA is less dense than salt it requires 60% more space [NRC 1991, pg. 123]. Regular salt spreading equipment is used for CMA.

Additional Information

Typical application rates of CMA are 20 to 40 grams per square meter or 70 to 113 kg per lane kilometer [Cryotech 1998]. CMA is lighter than salt. The theoretical amount of CMA relative to salt needed for comparable ice melting is 1.7 to 1 by weight. However Michigan reported having to use about 2.6 times as much CMA as salt to attain dry pavement conditions [Gales 1992, pg. 171].

Cost is approximately $716 U.S. per tonne (based on $650.00 per imperial ton [NRC 1991, pg. 135] which would be $50 to $80 U.S. per lane kilometer. Acetic acid represents about 80% of the cost (of CMA. It is synthesized from natural gas or through fermentation of feedstock (corn, dairy or whey).

To date the prohibitive cost of CMA has limited its principal uses to address particularly sensitive environmental or corrosion situations.

POTASIUM ACETATE

Description

Potassium acetate is a liquid formulation that is generally considered a better ice melter than CMA. It has been used primarily as a runway de-icer but products are also designed for roadway use. Potassium acetate can also be used to coat rail and truck beds, non-porous roofs and road signs to prevent the adhering of snow and ice. Potassium acetate has also been used to keep rail switched open, free manhole covers and truck scales and keep conveyors ice free and as an antifreeze in toilet water [Cryotech 1998].

Potassium acetate can be used as a pre-wetting agent for CMA, road salt, and other solid de-icers and sand. It has also been used as an anti-ice to keep bridge decks from freezing and as a roadway de-icer.

Health and Environmental Effects

Potassium acetate is biodegradable, and decomposes to potassium and acetate which exerts a slight BOD (Biological Oxygen Demand) as it is metabolized to carbon and water. The BOD of Potassium acetate at 2°C is 0.30 gram O_2 per gram. Potassium acetate is toxic to fish at elevated concentrations (LC50 at 1500 mg/L) [Cryotech 1998].

Corrosion

Potassium acetate is generally considered non-corrosive, however it is not recommended:

- for use on low quality or non-air entrained concrete;
- to be in contact with galvanized metals; or
- to be mixed with liquid chloride de-icers like $CaCl_2$ and $MgCl_2$.

De-icing Performance

Potassium acetate has a freezing point of -60°C and a practical working temperature of -26°C [Cryotech 1998].

Storage, Handling and Spreading Characteristics

If potassium acetate is not stored in a clean sealed container it can begin to prematurely biodegrade and exhibit biological growth.

Additional Information

On thin ice liquid potassium acetate can be applied at 50 g/m^2. On thicker ice (2.5 cm) the manufacturer recommends an application rate of 150 g/m^2 [Cryotech 1998].

SODIUM ACETATE (NaAc)

Description

Anhydrous sodium acetate has recently been introduced as an alternative de-icer. Successful trials were conducted over the 1997-98 winter season at Vancouver International Airport. Sodium acetate is a solid spherical pellet. It has been designed for airport runway use but it may also be applied to roads, parking garages and walkways.

Health and Environmental Effects

Sodium acetate readily degrades at low temperatures and has a relatively low biological oxygen demand [Cryotech 1998]. Contact with skin or eyes may cause irritation and inhalation of dust may irritate the upper respiratory tract.

Corrosion

Sodium acetate is not corrosive to metals like chlorides but it is more corrosive than CMA.

De-icing Performance

Anhydrous grade sodium acetate is exothermic so it gives off heat as it dissolves.

Storage, Handling and Spreading Characteristics

Sodium acetate may be spread with existing solid de-icer spreading equipment. It requires flat bulk storage and requires care to avoid caking caused by excessive moisture. Excessive handling may cause dustiness and suitable ventilation is required. It can be pre-wetted with liquid potassium acetate.

Additional Information

Sodium acetate can be applied at about two thirds the rate of urea to achieve similar effectiveness [Cryotech 1998].

Sodium acetate was successfully used at the Vancouver International Airport in 1997/98 on roads, bridges and parking surfaces.

UREA CO $(NH_2)_2$

Description

Urea is a common fertilizer (46% nitrogen) that comes as solid small white pellets or in liquid form. It is synthesized from ammonia and carbon dioxide.

Health and Environmental Effects

Soil

Moran (92) claims no negative effects on soil quality and being a form of nitrogen it may Actually Improve Soil Quality.

Vegetation

Urea is reported as having no negative effects on vegetation [Moran 92]. However, as urea is a common fertilizer overuse will cause vegetation burn.

Water And Aquatic Life

Urea degrades by hydrolysis to ammonia and is subsequently converted to nitrate by nitrifying soil organisms. Ammonia and nitrate are of high environmental concern [Sills 92, pg. 328]. Nitrates stimulate the eutrophication process and can contaminate drinking water. Ammonia is acutely toxic to aquatic life.

Human Health

Biodegradation of urea may result in objectionable odours due to the release of aldehydes.

Corrosion

Urea is less corrosive than the chlorides. For this reason it is a popular runway de-icer. However urea has a detrimental effect upon concrete as it causes severe scaling at 2% wt. concentration [Kirchner 1998].

De-icing Performance

Urea is less active than NaCl and $CaCl_2$. The practical working temperature of urea is -3.8°C and its eutectic temperature is -11.6°C [Kirchner 1998]. Urea requires heat to be effective (an endothermic reaction of 106 BTU).

Additional Information

Urea costs approximately $200/imp ton [Gales 1992]. It must be used in quantities twice as great as NaCl to be as effective (which would be approximately 113 to 142 kg per lane km). Urea costs approximately $22.60 to $28.40 per lane kilometer.

GLYCOLS

Description

Glycols are dihydroxy alcohols similar to the material used in anti-freeze. It is typically found as ethylene glycol or propylene glycol. It is commonly mixed with urea for use as a runway de-icer but it is not commonly used on roadways.

Health and Environmental Effects

Glycols are highly biodegradable under normal conditions and therefore do not persist in the environment.

Human And Terrestrial Wildlife Health

When ingested by humans and animals toxicity can be significant (has an attractive sweet taste). Propylene glycol is less poisonous than ethylene glycol but is a more potent skin irritant and sensitizer. Glycols do not bioaccumulate in organisms. Technical grade ethylene glycol contains the known carcinogen 1,4-dioxane. Biodegradation may result in objectionable odours due to the release of aldehydes.

Water And Aquatic Life

The acute and chronic aquatic toxicity of ethylene and propylene glycol is relatively low [Sills 1992 pg. 326]. Glycols biodegrade rapidly and exert extremely high BOD even in cold temperatures. This can deplete dissolved oxygen in water and negatively affect aquatic life. BOD of diluted ethylene glycol is 5000 mg/l (compared with domestic raw sewage which has a BOD of 200 mg/l) [Sills 1992, pg. 328].

Corrosion

Glycols are non-corrosive liquids.

De-icing Performance

Glycols are effective but short-lived de-icers.

Storage, Handling and Spreading Characteristics

Glycols are liquids and therefore require tanks and spray equipment for application.

Additional Information

Glycol is used in airport runway de-icing at a rate of 4.88 kg/100m^2.

Glycols are more effective when applied as an anti-icer in which case less can be used. Glycol is more expensive than salt.

METHANOL (CH_3OH)

Description

Methanol (or methyl alcohol) is sometimes used as an antifreeze. In its natural state it is a liquid and is commonly used as an important fuel source.

Health and Environmental Effects

Methanol is highly volatile, flammable and toxic [Bryan 1992 pg. 464]. It is lethal to humans and animals if ingested. The break down products of methanol contribute to ozone pollution in the lower atmosphere [Gales 1992 pg. 167]. Methanol is highly volatile so it evaporates before it can deplete oxygen from aquatic environments. However, methanol vapors are toxic and due to its high volatility ambient air quality can easily be degraded.

Corrosion

There is evidence of deleterious effects of methanol on asphalt concrete [Bryan 1992 pg. 464].

De-icing Performance

The eutectic point of methanol is -125°C at 83% concentration by weight in water. This makes methanol particularly effective at low temperatures. Methanol also works much more rapidly than salt.

Storage, Handling and Spreading Characteristics

Methanol's volatility, flammability and toxicity make it very difficult to handle.

Additional Information

Methanol is short lived (it evaporates quickly) and requires re-application within a few hours. It is approximately 5.5 times the cost of salt [Gales 1992, pg. 167].

SODIUM FORMATE (HCOONa)

Description

Sodium formate is produced as a by-product or waste product of other chemical processes. It is a solid de-icer. Very little information is available and much of the available information is contradictory.

Health and Environmental Effects

Both sodium formate and sodium chloride have similar environmental effects relating to sodium (can damage soil structure, and contributes to roadway vegetation burn). Sodium formate has a lower oxygen demand compared to other de-icing compounds.

Compatibility with Automotive and Highway Materials

Sodium formate does not contain chloride and so it is non-corrosive to steel. Some reports indicate that sodium formate has a neutral pH while others indicate a pH of 10 to 12 [Gales 1992, Old World 1998]. Sodium formate causes no more damage to concrete than salt.

De-icing Performance

Sodium formate is similar to salt in terms of de-icing speed, temperature range and endurance of de-icing effect [Gales 1992 pg. 167]. It has a eutectic point of -18°C.

Storage, Handling and Spreading Characteristics

Sodium formate can be applied with conventional equipment.

Additional Information

Sodium formate costs 13 times more than salt [Gales 1992, pg. 167].

ORGANIC COMPOUNDS (SUGAR BY-PRODUCTS)

Description

Sugar byproducts have been developed that may reduce the environmental issues connected with salts and may have longer residual effects when spread on roadways.

The organic compounds used for de-icing are typically byproducts of agricultural operations such as refining sugar beets or corn, or the ethanol distillation process. One of the most common is beet juice (left-over from the process of extracting sugar from sugar beets). Sugar byproducts are not de-icing material. While there is no consensus regarding to what degree beet juice and other sugar by-products depress freezing temperatures, sugar by-products alone are very poor ice melters. Instead, they are treated in alkali to increase the ionic strength of the liquid, which when mixed with brine lowers the freezing point of the de-icing solution. However, Fay [2007] found that, based on preliminary data, there was no significant difference in the ice-melting capacity of the tested chloride-based deicers, and the sugar by-product.

Most commonly, sugar byproducts are blended with brines of magnesium chloride, sodium chloride, calcium chloride and potassium chloride and the mixture is applied to dry roads as an anti-icing agent, or as pre-wetting agent.

Health and Environmental Effects

No long-term research yet exists, but Sugar by-products / brine liquid products are generally believed to be less harmful to infrastructure and the environment. Some commercially available products are recognized by the U.S. Environmental Protection Agency as being safe for human health and the environment. However, aesthetics may be a drawback. For example, beet juice can potentially stain carpets and exteriors.

Corrosion

While sugar by-products / brine liquid sugar by products have the potential to reduce corrosivity of deicers to metal, preliminary research by Fay [2007] indicated chloride-based deicers and the sugar byproduct-based deicer were similarly very corrosive to mild steel.

De-icing Performance

Sugar byproducts are not de-icing material. As such, the performance will depend on the brine with which the sugar byproducts are blended. Johnson [2005] reports that a commercially available sugar by-product / $MgCl_2$ brine liquid has the freezing point of -65° C.

Additional Information

Prices for the types of organic compounds described here are typically more than ordinary rock salt, although generally less is required. However, pilot programs (e.g., City of Montreal, Niagara Region and City of Barrie) are underway at the time of writing to determine if mixtures can reduce the number of applications by sticking longer to roadways, which it could offset its higher price point by reducing labor costs.

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Presented To:	Operations Committee
Presented:	Monday, May 14, 2018
Report Date	Tuesday, Apr 17, 2018
Type:	Correspondence for Information Only

For Information Only

Drinking Water Quality Management System

Resolution

For Information Only

Relationship to the Strategic Plan / Health Impact Assessment

This report supports the 'Responsive, Fiscally Prudent, Open Governance' and Sustainable Infrastructure pillars of the Corporate Strategic Plan

Report Summary

This report has been written to communicate the outcomes of the City's ongoing quality management system implementation and evaluation to Council. The results indicate that the City's operations are in conformance with the Ontario Drinking Water Quality Management System, the Safe Drinking Water Act, and its associated regulations.

Financial Implications

There are no financial implications associated with this report.

Signed By

Report Prepared By
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Digitally Signed Apr 17, 18

Health Impact Review
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Recommended by the Department
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Recommended by the C.A.O.
Ed Archer
Chief Administrative Officer
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For Information Only

Water Wastewater Drinking Water Quality Management System Report

RECOMMENDATION

For Information Only

FINANCE IMPLICATIONS

There are no financial implications

BACKGROUND

As legislated under the Safe Drinking Water Act, 2002, the Ministry of the Environment and Climate Change (MOECC) requires that municipalities, as Operating Authorities of municipal drinking water systems, maintain an accredited Quality Management System (QMS) in order to be allowed to provide reliable drinking water to its residents.

A drinking water quality management system serves as one of several of multiple barriers of protection to ensure the safety of the drinking water supply to customers. An Operational Plan, a series of documents, describes how Water & Wastewater Services complies with the requirements of the standard, and is published on Water & Wastewater Services Intranet home page. Keeping the Mayor, Council and Executive Leadership Team informed about the health of the QMS fulfills several of these requirements, including the Standard of Care article of the Safe Drinking Water Act, and ensures the maintenance of the required accreditation.

The legislated accreditation is a process by which the Quality Management System is audited annually by a third party to ensure that:

- The Operating Authority has a quality management system that conforms to the requirements of the applicable standard – the Drinking Water Quality Management Standard;
- Customers have increased confidence in the products and services provided by Operating Authorities – *i.e.*, the treated water, and the treatment and distribution processes themselves;
- The Operating Authority has ensured the availability of resources necessary to support the operation and monitoring of the processes needed to achieve the planned outcomes; and
- The Operating Authority monitors and controls defined parameters, has implemented effective internal audit and management review processes, and is monitoring, measuring and continually improving the effectiveness of its quality management system.

Water/Wastewater Services has and has maintained an accredited quality management system for all six of the City of Greater Sudbury's drinking water systems since 2010.

OUR COMMITMENT

Quality Management System Policy

The City of Greater Sudbury is committed to providing its customers with safe drinking water and environmentally responsible wastewater treatment services that comply with all applicable legislation and regulations. To ensure that these commitments are fulfilled, the Water & Wastewater Services Division shall maintain and continually improve upon a Quality Management System designed specifically for this purpose.

OPERATIONAL MANAGEMENT RESPONSIBILTIES

It is the role of the operational management team to conduct operations in conformance with the Drinking Water Quality Management Standard. The Quality Management System helps to ensure conformity and compliance with all standards and regulations.

Compliance with the standard is accomplished by:

- Maintaining a Quality Management System as current and consistent with all requirements, and promoting awareness of the Quality Management System throughout the organization;
- Ensuring the Operating Authority meets and maintains competencies for personnel directly affecting drinking water quality, and that personnel are aware of the relevance of their duties with respect to how safe drinking water is affected;
- Evaluating, determining, obtaining and/or providing supplies and services essential for the delivery of safe drinking water, and the infrastructure necessary to operate and maintain the subject systems; and
- Supporting the internal audit and continual improvement functions of the QMS

Auditing and Continual Improvement Process

Internal audits are scheduled annually and are assigned to City of Greater Sudbury employees who have been given *Internal Auditing* training. These employees, along with the QMS Representative, review documentation while conducting their audit, and collect evidence to support any findings. The auditor also reviews results of previous audits (internal and external) in order to follow-up on previously recommendations.

Auditors review documentation and applicable records controlled by the Division, and interview Division staff, to compare how actual processes are occurring in comparison to the requirements of the Standard. During the review and interviews, auditors record information about what was observed, in order to make an informed decision about their findings.

All finding are discussed with division managers and, when necessary, corrective action requests and/or opportunities for Improvements are written out and assigned to appropriate personnel.

KEY RESULTS

Third Party Audit, 2017

In July of 2017 our third party verifications audit was conducted by a licensed consultant, NSF International Strategic Registrations. It resulted with a report stating that the City of Greater Sudbury was approved for another three (3) years as an Accredited Operating Authority for our six (6) Drinking Water Systems.

Internal Audits 2017

In 2017, a total of nine (9) internal audits were conducted. Results from these audits are used to help with continual improvements to our Drinking Water Quality Management System. Internal Audits for 2018 are being scheduled accordingly.

SUMMARY

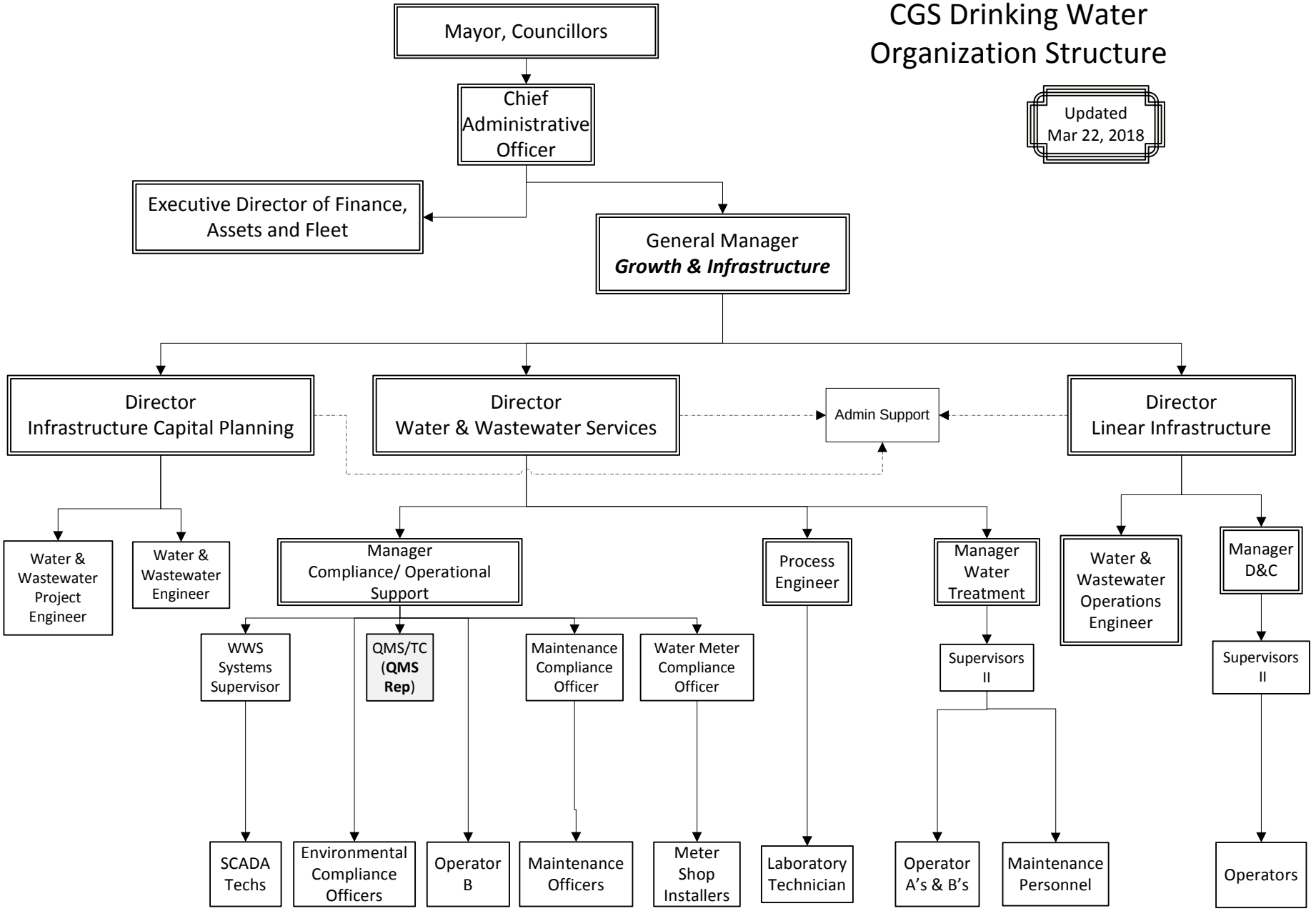
The City of Greater Sudburys' Drinking Water Quality Management System has been re-accreditation for another three years. Water & Wastewater Services personnel are performing regular reviews of the performance of several key indicators for all City drinking water systems, and recommendations are being identified and addressed, leading to continual improvements of the system.

Water & Wastewater Services is committed to communicating with City Council, and is continuing to work hard to improve our Drinking Water Quality Management System, and remain as an Accredited Operating Authority for our drinking water systems.

This report has been written to Council to show confidence in our Drinking Water Quality Management System that we are fulfilling our obligation as per the Standard, and are in compliance with the Drinking Water Standards of Ontario.

CGS Drinking Water Organization Structure

Updated Mar 22, 2018



Presented To:	Operations Committee
Presented:	Monday, May 14, 2018
Report Date	Tuesday, Apr 24, 2018
Type:	Correspondence for Information Only

For Information Only

Winter Control Operations Update for March 2018

Resolution

For Information Only

Relationship to the Strategic Plan / Health Impact Assessment

This report refers to operational matters.

Report Summary

This report provides the financial results of the 2018 winter roads operations up to and including the month of March 2018. The results for the first three months of 2018 is an over expenditure of approximately $0.07 million.

Financial Implications

In accordance with the Reserve and Reseve Fund By-Law, any Roads Winter Control year end under expenditure shall be credited to the Roads Winter Control Reserve Fund provided that the contribution would not place the City into a deficit position, and any year end over expenditure may be funded from this Reserve Fund.

Signed By

Report Prepared By
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Digitally Signed Apr 25, 18

Health Impact Review
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Co-ordinator of Finance (Roads)
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Ed Archer
Chief Administrative Officer
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Background

This report provides the financial results of the 2018 winter roads operations up to and including the month of March 2018. As depicted in Table 1 below, the results for the first three months of 2018 is an over expenditure of approximately $0.07 million. Certain estimates were necessary to account for outstanding invoices.

Table 1
2018 Winter Summary
As at March 31, 2018

	Annual Budget	2018 YTD		
		Budget	Actual	Variance
Administration & Supervision	2,552,012	1,276,870	1,276,870	-
Sanding/Salting/Plowing (City Crews)	4,834,400	2,886,997	2,957,535	(70,537)
Sanding/Salting/Plowing (Contract)	2,206,754	1,465,757	1,520,277	(54,520)
Snow Removal	598,464	487,163	248,601	238,562
Sidewalk Maintenance	1,049,084	681,905	550,997	130,908
Winter Ditching/Spring Cleanup	1,899,528	754,598	827,506	(72,908)
Miscellaneous Winter Roads	4,415,396	1,960,773	2,203,526	(242,753)
Totals	17,555,638	9,514,064	9,585,313	(71,249)

2018 Winter Control Activities

As shown in Table 2 below, the City received approximately 147 centimeters or 89% of the average snowfall from January to March. Also during this period, the City experienced 3 rain events.

Minor over expenditures occurred in sanding/salting/plowing ($0.12 million). Winter ditching activities commenced earlier and additional resources were required for pothole patching related activities in the miscellaneous winter roads category. The over expenditure was partially offset by savings in snow removal activities.

Table 2
2018 Snowfall and Rainfall

	Jan.	Feb.	Mar.	Apr.	Nov.	Dec.	Total
Normal 30 Year Avg. (cm)	60	52	35				147
2018 Actual Snow (cm)	78	33	19				130
% of Actual to Normal	131%	63%	54%				89%
2018 Rain Events	1	2	-				3

Miscellaneous Winter Roads

The annual budget for the miscellaneous winter roads cost centre totals approximately $4.4 million, and the major expenses in this cost centre are outlined in Table 3 below.

Table 3
2018 Miscellaneous Winter Roads

Expense Type	Annual Budget (millions $)
Employee Benefits	$ 1.4
Asphalt Patching	$ 0.9
Internal Recoveries (HR, Finance, IT)	$ 0.7
Standby (Contracted Service)	$ 0.7
Health & Safety	$ 0.2
Other (Road Patrol, Emergency Response, Tool Repair, Property Restoration, etc.)	$ 0.5
Total	$ 4.4

Summary

In summary, winter roads operations for the first three months of 2018 resulted in an over expenditure of approximately $0.07 million. As per the Reserve and Reserve Fund policy, any annual over/under expenditures in winter roads operations may be funded/contributed towards the Roads Winter Control Reserve Fund.

Presented To:	Operations Committee
Presented:	Monday, May 14, 2018
Report Date	Tuesday, Apr 17, 2018
Type:	Managers' Reports

Request for Decision

Parking Restrictions - Maki Avenue, Sudbury

Resolution

THAT the City of Greater Sudbury prohibits parking at all times of the day on both sides of Maki Avenue from 480 metres east of Paris Street to 654 metres east of Paris Street;

AND THAT the City of Greater Sudbury directs staff to prepare a by-law to amend Traffic and Parking By-Law 2010-1 in the City of Greater Sudbury to implement the recommended changes as outlined in the report entitled “Parking Restrictions – Maki Avenue, Sudbury” from the General Manager of Growth and Infrastructure, presented at the Operations Committee meeting on May 14, 2018.

Relationship to the Strategic Plan / Health Impact Assessment

This report refers to operational matters.

Report Summary

Traffic and Asset Management staff received a request from area residents of Maki Avenue asking that sight lines be reviewed for on-street parking in the area of the hill near 193 Maki Avenue. This report will recommend appropriate parking restrictions for Maki Avenue.

Financial Implications

Recommendations of this report may be carried out within existing approved budget and staff complement.

Signed By

Report Prepared By
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Traffic and Transportation Technologist
Digitally Signed Apr 17, 18

Health Impact Review
David Knutson
Traffic and Transportation Technologist
Digitally Signed Apr 17, 18

Manager Review
Joe Rocca
Traffic and Asset Management Supervisor
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Division Review
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Financial Implications
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Recommended by the Department
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General Manager of Growth and Infrastructure
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Recommended by the C.A.O.
Ed Archer
Chief Administrative Officer
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Parking Restrictions – Maki Avenue, Sudbury

Traffic and Asset Management staff received a request from area residents to review sight lines with consideration to on-street parking on Maki Avenue in the location of the hill near 193 Maki Avenue.

Maki Avenue is located in Ward 10 and runs perpendicular to Paris Street. This paved residential roadway has an operating width of approximately 7.0 metres, curb and gutter and a posted speed limit of 40 km/h (Exhibit 'A').

Near the mid-point of the road there is a steep hill and crest which residents are concerned reduces their sight distance. Staff conducted a sight line review of the area and found that the available sight lines do not provide minimum stopping sight distance in the area of concern. Staff also reviewed the collision history between January 1, 2009 and September 1, 2017 and found one reported collision which may have been related to the sight lines.

The primary function of a public road is for the safe movement of traffic. On-street parking may be considered when this criteria is met. Due to the geometry of the hill, motorists' sight distance lines are significantly reduced and the risk of collision is higher when vehicles are parked on the street.

To improve safety, it is recommended that parking be restricted at all times of the day on both sides of Maki Avenue from 480 metres east of Paris Street to 654 metres east of Paris Street.


EXHIBIT A
Nepahwin Lake
No Parking, Both Sides
250 Maki Avenue
193 Maki Avenue
MAKI AVENUE
PARIS STREET
Nepahwin Lake Park
N
0 25 50 100 m
Parking Restrictions
Maki Avenue
March 14, 2018
CK 03.14.18

Presented To:	Operations Committee
Presented:	Monday, May 14, 2018
Report Date	Tuesday, Apr 17, 2018
Type:	Managers' Reports

Request for Decision

Pedestrian Traffic Signals - Regent Street at Junction Creek Crossing

Resolution

THAT the City of Greater Sudbury install mid-block traffic signals on Regent Street, 90 metres north of Wembley Drive;

AND THAT the City of Greater Sudbury directs staff to prepare a by-law to amend Traffic and Parking By-Law 2010-1 in the City of Greater Sudbury;

AND THAT the City of Greater Sudbury utilizes the Cycling Infrastructure capital account to fund the balance of the construction costs for the mid-block traffic signals and trail realignment as outlined in the report entitled “Pedestrian Traffic Signals - Regent Street at Junction Creek Crossing”, from the General Manager of Growth and Infrastructure, presented at the Operations Committee meeting on May 14, 2018.

Relationship to the Strategic Plan / Health Impact Assessment

This report refers to "providing quality multimodal transportation alternatives for roads, transit, trails, paths, sidewalks and connecting neighborhoods and communities within Greater Sudbury" which is identified in the Strategic Plan under the key pillar of Sustainable Infrastructure.

Report Summary

At the December 2016 Operations Committee meeting, the City of Greater Sudbury endorsed the installation of a protected pedestrian crossing and directed staff to develop a recommended style of crossing and implementation plan in partnership with the Connect-the Creek Partnership. This report provides details on the recommended protected crossing and a brief overview of how the crossing will be implemented.

Signed By

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Traffic and Asset Management Supervisor
Digitally Signed Apr 17, 18

Health Impact Review
Joe Rocca
Traffic and Asset Management Supervisor
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Manager Review
Stephen Holmes
Director of Infrastructure Capital Planning
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Division Review
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Financial Implications
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Manager of Financial Planning and Budgeting
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Recommended by the Department
Tony Cecutti
General Manager of Growth and Infrastructure
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Recommended by the C.A.O.
Ed Archer
Chief Administrative Officer
Digitally Signed Apr 17, 18

Financial Implications

The cost to implement the mid-block traffic signals and modify the trail alignment is estimated at $250,000. Greater Sudbury Utilities is contributing $50,000 to the project. An additional $50,000 will be funded from the Junction Creek Waterway Park capital account. This protected crossing is seen as an important link to help complete the Junction Creek Waterway Park and has the potential to create a new commuter cycling route to the downtown core. Based on the potential for commuter cyclists to utilize this route, staff recommend the remainder of the construction costs be funded from the Cycling Infrastructure capital account.

Pedestrian Traffic Signals - Regent Street at Junction Creek Crossing

The City of Greater Sudbury received a proposal from the Rainbow Routes Association requesting mid-block pedestrian signals be installed on Regent Street where it crosses Junction Creek to help provide a safe passage for users of the Junction Creek Waterway Park and employees of Greater Sudbury Utilities who utilize the parking lot on the west side of Regent Street and must cross the road to access the Greater Sudbury Utilities offices. The proposal was submitted on behalf of the Rainbow Routes Association, Connect the Creek Partnership and Greater Sudbury Utilities (GSU).

At the December 5, 2016 Operations Committee meeting, the following resolution was passed:

> THAT the City of Greater Sudbury endorse a protected pedestrian crossing on Regent Street, between Ontario Street and McLeod Street,
>
> AND THAT staff be directed to develop a recommended style of crossing and implementation plan, in consultation with the Connect the Creek Partnership,
>
> AND THAT it be brought back to the April 2017 Operations Committee meeting.

The December 5, 2016 reported entitled "Pedestrian Traffic Signal Request – Regent Street at Junction Creek Crossing" may be read at http://agendasonline.greatersudbury.ca/index.cfm?pg=agenda&action=navigator&lang=en&id=1035&itemid=12329

Since that meeting, City staff have worked closely with the Connect the Creek Partnership and GSU to determine the trail and crossing alignment which maximizes the benefit to users of the Junction Creek Waterway Park (JCWP).

Recommended Style of Crossing

In the province of Ontario, there are two options available to municipalities to provide a protected crossing at a mid-block location; a pedestrian crossover or a mid-block traffic signal. A pedestrian crossover is an area of the roadway, indicated by signs and pavement markings, for the exclusive use of pedestrians to cross the roadway. Cyclists are not permitted to ride through a pedestrian crossover and can be fined $85 for failing to dismount and walk their bike through a pedestrian

crossover. A mid-block traffic signal can be used to provide a protected crossing for both pedestrians and cyclists.

Staff conducted a pedestrian and cyclist count in the area of the GSU parking lot and found that over 55% of the JCWP users were cyclists. This percentage is expected to rise once a protected crossing is installed as more commuters utilize the JCWP to access the downtown core. Due to the volume of cyclists who are expected to use this protected crossing, staff recommend the installation of a mid-block traffic signal.

A concern that was raised at the December 2016 Operations Committee meeting was the impact a protected crossing will have on the capacity of Regent Street in this area. A mid-block traffic signal will provide the flexibility to set specific crossing times based on whether a cyclist or pedestrian is crossing the road and will provide the ability to coordinate traffic signal timing with the adjacent traffic signals.

A drawing showing the preferred trail alignment and traffic signal layout can be found in Exhibit A.

Implementation Plan

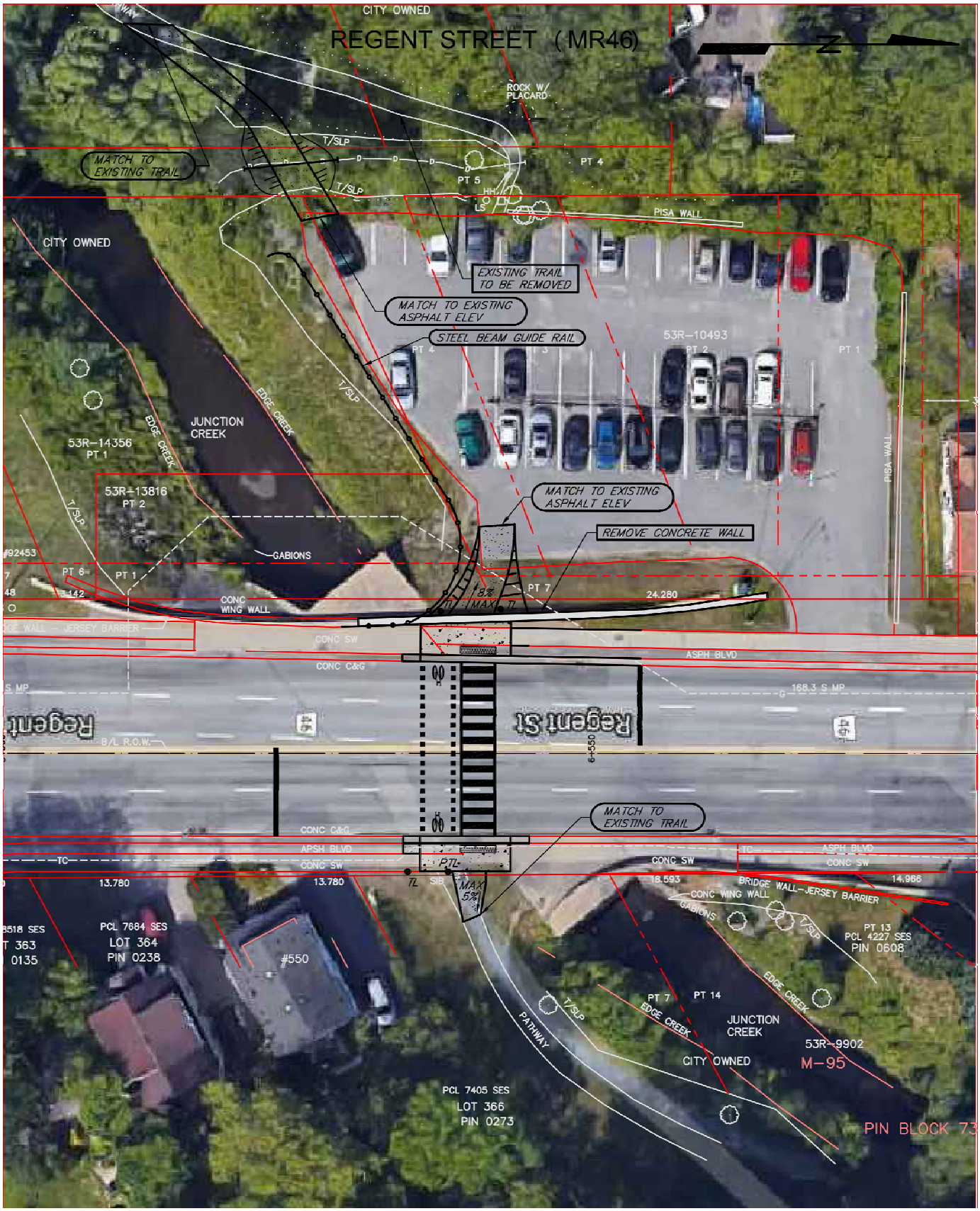
The preferred trail alignment crosses through the southerly portion of the GSU parking lot. The City currently has an easement for the trail along the northerly portion. In order to complete the work shown in Exhibit A, the City is required to secure an easement from GSU. The City will continue to negotiate with Greater Sudbury Utilities in order to secure the easement along the southerly portion of their property for the purposes of a pedestrian and cyclist path. Once the easement is secured, the City's existing easement along the northerly portion will be released.

Upon securing the easement, the construction of the traffic signals and the trail realignment would be completed.

Communication Plan

Prior to implementation the City will issue a Public Service Announcement and inform the public via social media of the new traffic signal and when it will be activated. In addition, staff will work with the Connect the Creek Partnership to organize a media event surrounding the activation of the new traffic signals.

EXHIBIT A


CITY OWNED
REGENT STREET (MR46)
N
ROCK W/ PLACARD
MATCH TO EXISTING TRAIL
T/SLP
PT 5
PT 4
HH
LS
PISA WALL
CITY OWNED
EXISTING TRAIL TO BE REMOVED
MATCH TO EXISTING ASPHALT ELEV
STEEL BEAM GUIDE RAIL
53R-10493
PT 4
PT 3
PT 2
PT 1
EDGE CREEK
JUNCTION CREEK
53R-14356 PT 1
53R-13816 PT 2
MATCH TO EXISTING ASPHALT ELEV
REMOVE CONCRETE WALL
GABIONS
PT 6
PT 1
PT 7
8%
MAX
24.280
CONC WING WALL
CONC SW
CONC C&G
ASPH BLVD
168.3 S MP
Regent St
B/L R.O.W.
6-550
MATCH TO EXISTING TRAIL
TC
13.780
PTL
TL
SIB
MAX 5%
18.593
14.966
BRIDGE WALL-JERSEY BARRIER
PCL 7684 SES
LOT 364
PIN 0238
#550
PCL 4227 SES
PIN 0608
PT 13
PT 14
PT 7
PATHWAY
53R-9902
M-95
PCL 7405 SES
LOT 366
PIN 0273
PIN BLOCK 73

City of Greater Sudbury Charter

WHEREAS Municipalities are governed by the Ontario Municipal Act, 2001;

AND WHEREAS the City of Greater Sudbury has established Vision, Mission and Values that give direction to staff and City Councillors;

AND WHEREAS City Council and its associated boards are guided by a Code of Ethics, as outlined in Appendix B of the City of Greater Sudbury's Procedure Bylaw, most recently updated in 2011;

AND WHEREAS the City of Greater Sudbury official motto is "Come, Let Us Build Together," and was chosen to celebrate our city's diversity and inspire collective effort and inclusion;

THEREFORE BE IT RESOLVED THAT Council for the City of Greater Sudbury approves, adopts and signs the following City of Greater Sudbury Charter to complement these guiding principles:

As Members of Council, we hereby acknowledge the privilege to be elected to the City of Greater Sudbury Council for the 2014-2018 term of office. During this time, we pledge to always represent the citizens and to work together always in the interest of the City of Greater Sudbury.

Accordingly, we commit to:

- Perform our roles, as defined in the Ontario Municipal Act (2001), the City's bylaws and City policies;
- Act with transparency, openness, accountability and dedication to our citizens, consistent with the City's Vision, Mission and Values and the City official motto;
- Follow the Code of Ethical Conduct for Members of Council, and all City policies that apply to Members of Council;
- Act today in the interest of tomorrow, by being responsible stewards of the City, including its finances, assets, services, public places, and the natural environment;
- Manage the resources in our trust efficiently, prudently, responsibly and to the best of our ability;
- Build a climate of trust, openness and transparency that sets a standard for all the City's goals and objectives;
- Always act with respect for all Council and for all persons who come before us;
- Ensure citizen engagement is encouraged and promoted;
- Advocate for economic development, encouraging innovation, productivity and job creation;
- Inspire cultural growth by promoting sports, film, the arts, music, theatre and architectural excellence;
- Respect our historical and natural heritage by protecting and preserving important buildings, landmarks, landscapes, lakes and water bodies;
- Promote unity through diversity as a characteristic of Greater Sudbury citizenship;
- Become civic and regional leaders by encouraging the sharing of ideas, knowledge and experience;
- Work towards achieving the best possible quality of life and standard of living for all Greater Sudbury residents;

Charte
de la Ville du Grand Sudbury

ATTENDU QUE les municipalités sont régies par la Loi de 2001 sur les municipalités (Ontario);

ATTENDU QUE la Ville du Grand Sudbury a élaboré une vision, une mission et des valeurs qui guident le personnel et les conseillers municipaux;

ATTENDU QUE le Conseil municipal et ses conseils sont guidés par un code d'éthique, comme l'indique l'annexe B du Règlement de procédure de la Ville du Grand Sudbury dont la dernière version date de 2011;

ATTENDU QUE la devise officielle de la Ville du Grand Sudbury, « Ensemble, bâtissons notre avenir », a été choisie afin de célébrer la diversité de notre municipalité ainsi que d'inspirer un effort collectif et l'inclusion;

QU'IL SOIT RÉSOLU QUE le Conseil de la Ville du Grand Sudbury approuve et adopte la charte suivante de la Ville du Grand Sudbury, qui sert de complément à ces principes directeurs, et qu'il y appose sa signature:

À titre de membres du Conseil, nous reconnaissons par la présente le privilège d'être élus au Conseil du Grand Sudbury pour le mandat de 2014-2018. Durant cette période, nous promettons de toujours représenter les citoyens et de travailler ensemble, sans cesse dans l'intérêt de la Ville du Grand Sudbury.

Par conséquent, nous nous engageons à :

- assumer nos rôles tels qu'ils sont définis dans la Loi de 2001 sur les municipalités, les règlements et les politiques de la Ville;
- faire preuve de transparence, d'ouverture, de responsabilité et de dévouement envers les citoyens, conformément à la vision, à la mission et aux valeurs ainsi qu'à la devise officielle de la municipalité;
- suivre le Code d'éthique des membres du Conseil et toutes les politiques de la municipalité qui s'appliquent à eux;
- agir aujourd'hui pour demain en étant des intendants responsables de la municipalité, y compris de ses finances, biens, services, endroits publics et du milieu naturel;
- gérer les ressources qui nous sont confiées de façon efficiente, prudente, responsable et de notre mieux;
- créer un climat de confiance, d'ouverture et de transparence qui établit une norme pour tous les objectifs de la municipalité;
- agir sans cesse en respectant tous les membres du Conseil et les gens se présentant devant eux;
- veiller à ce qu'on encourage et favorise l'engagement des citoyens;
- plaider pour le développement économique, à encourager l'innovation, la productivité et la création d'emplois;
- être une source d'inspiration pour la croissance culturelle en faisant la promotion de l'excellence dans les domaines du sport, du cinéma, des arts, de la musique, du théâtre et de l'architecture;
- respecter notre patrimoine historique et naturel en protégeant et en préservant les édifices, les lieux d'intérêt, les paysages, les lacs et les plans d'eau d'importance;
- favoriser l'unité par la diversité en tant que caractéristique de la citoyenneté au Grand Sudbury;
- devenir des chefs de file municipaux et régionaux en favorisant les échanges d'idées, de connaissances et concernant l'expérience;
- viser l'atteinte de la meilleure qualité et du meilleur niveau de vie possible pour tous les résidents du Grand Sudbury.