Vision: *The City of Greater Sudbury is a growing, world-class community bringing talent, technology and a great northern lifestyle together.*

Agenda

Operations Committee

meeting to be held

Monday, March 5th, 2012

at 5:30 pm

Committee Room C-11

OPERATIONS COMMITTEE AGENDA

For the 3rd Operations Committee Meeting
to be held on **Monday, March 5, 2012**
Committee Room C-11 at **5:30 pm**

COUNCILLOR JACQUES BARBEAU, CHAIR

Claude Berthiaume, Vice-Chair

(Please ensure that cell phones and pagers are turned off)

Copies of Agendas can be viewed on the City's website at www.greatersudbury.ca/agendas/.

DECLARATIONS OF PECUNIARY INTEREST AND THE GENERAL NATURE THEREOF

PRESENTATIONS

1. Report dated February 22, 2012 from the General Manager of Infrastructure Services regarding Pedestrian Crossing Policy and Recommendations. **6 - 80**
   (ELECTRONIC PRESENTATION) (RECOMMENDATION PREPARED)

   - David Shelsted, MBA, P.Eng., Director of Roads and Transportation
   - Chris Philp, HDR/i Trans

   (The City has retained HDR/i Trans to undertake a best practice review and develop a Pedestrain Crossing Policy for the City. HDR/i Trans has also completed an "in-service" review of existing pedestrian crossings on Elm Street, Ste. Anne's Road, and Brady Street.

   The report summarizes the results of the study and recommends approval of the Pedestrian Crossing Policy for the City.)

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.)

ROUTINE MANAGEMENT REPORTS

C-1. Report dated February 22, 2012 from the General Manager of Infrastructure Services regarding 2011 Water Works Summary Report. **81 - 116**
(RECOMMENDATION PREPARED)

(2011 Water Works Summary Report in accordance with Ontario Regulation 170/03.)

C-2. Report dated February 21, 2012 from the General Manager of Infrastructure Services regarding Traffic Calming Priority. **117 - 126**
(RECOMMENDATION PREPARED)

(This report provides a brief history of the City's Traffic Calming Program and a priority list of projects that qualify for Traffic Calming in 2012.)

CORRESPONDENCE FOR INFORMATION ONLY

C-3. Report dated February 27, 2012 from the General Manager of Infrastructure Services regarding Winter Control Operations Update - 2011. **127 - 129**
(FOR INFORMATION ONLY)

(This report provides information for Council, the updated projected financial results of the 2011 Winter Control Operations, up to and including December 2011.)

C-4. Report dated February 22, 2012 from the General Manager of Infrastructure Services regarding Winter Control Operations Update - January 2012. **130 - 132**
(FOR INFORMATION ONLY)

(This report provides information for Council, on the updated projected financial results of the 2012 Winter Control Operations, up to and including January 2012.)

C-5. Report dated February 22, 2012 from the General Manager of Infrastructure Services regarding Maintenance Management Project Update. **133 - 138**
(FOR INFORMATION ONLY)

(This report provides an update on the Maintenance Management Project.)

REGULAR AGENDA

MANAGERS' REPORTS

R-1. Report dated February 22, 2012 from the General Manager of Infrastructure Services regarding On-Street Parking - Various Locations. **139 - 145**
(RECOMMENDATION PREPARED)

(Staff has been requested to review on-street parking problems that are occurring on residential streets located near Cambrian College and other area schools. This report recommends that parking restrictions be implemented to improve safety.)

ADDENDUM

CIVIC PETITIONS

QUESTION PERIOD AND ANNOUNCEMENTS

NOTICES OF MOTION

ADJOURNMENT

(Two-thirds majority required to proceed past 8:30 P.M.)

BRIGITTE SOBUSH, DEPUTY CITY CLERK

FRANCA BORTOLUSSI, COUNCIL SECRETARY

Request for Decision

Pedestrian Crossing Policy and Recommendations

Presented To:	Operations Committee
Presented:	Monday, Mar 05, 2012
Report Date	Wednesday, Feb 22, 2012
Type:	Presentations

Recommendation

That the Operations Committee adopt the Pedestrian Crossing Policy prepared by HDR Corporation dated February 2012, and;

That the recommendations contained in the Pedestrian Traffic Study – Crossing Review prepared by HDR Corporation dated February 2012 with respect to the pedestrian crossing on Elm Street between the Transit Depot and the Rainbow Value Centre be approved, and;

That the recommendations contained in the Pedestrian Traffic Study – Crossing Review prepared by HDR Corporation dated February 2012 with respect to the pedestrian crossing on Brady Street at Shaughnessy Street be approved, and;

That HDR Corporation complete the development of an educational brochure and that Staff undertake an educational campaign regarding pedestrian crossings all in accordance with the report from the General Manager of Infrastructure Services dated February 22, 2012.

Signed By

Report Prepared By
Dave Kivi
Co-ordinator of Transportation & Traffic Engineering Services
Digitally Signed Feb 22, 12

Division Review
David Shelsted, MBA, P.Eng.
Acting Director of Roads & Transportation
Digitally Signed Feb 22, 12

Recommended by the Department
Greg Clausen, P.Eng.
General Manager of Infrastructure Services
Digitally Signed Feb 22, 12

Recommended by the C.A.O.
Doug Nadorozny
Chief Administrative Officer
Digitally Signed Feb 28, 12

Background

The City's Roads and Transportation Services Division retained HDR Corporation to develop a Pedestrian Crossing Policy to assist the City in determining how and when to implement pedestrian crossings (**see Exhibit A**).

HDR Corporation was also asked to undertake an assessment of three (3) specific pedestrian crossings in downtown Sudbury. The pedestrian crossing locations included as part of the assessment are:

1. Ste. Anne Road crossing at the Radisson Inn
2. Elm Street crossing at the Rainbow Value Centre
3. Brady Street crossing at Shaughnessy Street

The results of the assessments are contained in **Exhibit B, Pedestrian Traffic Study – Crossing Review**.

Pedestrian Crossing Policy

The Pedestrian Crossing Policy has been developed in light of the benefits of improving both driver and pedestrian awareness and understanding of rules of right of way. Research into the development of the policy has included a review of the practices of other jurisdictions, generally accepted and published best practices in Ontario, original research into traffic safety, and legislative references such as the Ontario Highway Traffic Act. However, as this is a City of Greater Sudbury Policy, it has been developed in recognition of the specific roadway environment in the City of Greater Sudbury, existing pedestrian crossing features, and existing driver expectancy with the City.

Some of the key recommendations contained in the policy include the following:

1. Continue to follow the Ontario Traffic Manual Warrants and Methodologies for implementing protected pedestrian crossings using traffic control signals, mid-block pedestrian signals and intersection pedestrian signals.
2. Consider pedestrian grade separation within the context of potential benefits and costs at locations where other forms of protected crossings are warranted, but cannot be reasonably, economically and practically implemented.
3. With the exception of supervised school crosswalks, marked crosswalks will be discouraged.
4. Utilize warning signs, pedestrian refuge islands and other measures such as reflective delineator posts at unprotected crossings to draw driver's attention to the possible presence of pedestrians.
5. Consider removing crosswalk markings at unprotected crossings on high speed or high volume multi-lane roads.
6. Proactively address pedestrian safety needs and establish a program for reviewing pedestrian crossings.

Pedestrian Traffic Study – Crossing Review

The City of Greater Sudbury has been responsive to the need to better accommodate the safety and security of pedestrians in the roadway environment. To this end, the City initiated a pedestrian crossing policy study and reviews of pedestrian safety and accommodation of "in-service roads". This study is an assessment of these specific pedestrian crossings in downtown Sudbury.

It was the objective of the study to assess the appropriateness of the existing forms of pedestrian crossings. The study provides an inventory of existing conditions and identifies opportunities to improve pedestrian crossing safety. For the recommended measures, an implementation strategy is also identified.

It should be noted that this study commenced in 2006. Since then, some of the recommendations identified in the draft report have been implemented. Other changes that have occurred at the study sites since 2006 have also been noted in report.

The following is a summary of the major findings and recommendations for the three (3) existing pedestrian crossing locations:

1. Ste. Anne Road Crossing at the Radisson Inn

It was concluded that the presence of senior and student crossings at this unprotected marked crossing adjacent to a horizontal curve is not desirable. It was also noted that based on current counts that pedestrian and vehicle volumes approach Ontario Traffic Manual warrants for signals at the crossing and that warrants would likely be met during high volume (spring time) conditions. On this basis, it was recommended that traffic control signals be implemented in the vicinity of the existing crosswalk, coordinated with the adjacent driveways.

The pedestrian signals were installed in 2010.

2. Elm Street Crossing at the Rainbow Value Centre

It is concluded that the pedestrian demand of the current crossing is a function of existing land use (Rainbow Value Centre and the Transit terminal) and that there is no simple solution to change pedestrian desire lines. The location of existing signals does not permit a protected (signalized) crossing with adequate sight distance.

It is recommended that the existing unprotected pedestrian crossing point be retained. The zebra markings offer greater benefit in terms of driver awareness of crossing pedestrians than any existing confusion it may represent in terms of pedestrian and driver right of way. Existing pedestrian signage, which addresses the need to alert pedestrians of the fact that they do not have the right of way and encourages caution, should also remain.

It is also recommended that an educational campaign be implemented to remind drivers and pedestrians of the rules of right of way.

3. Brady Street Crossing at Shaughnessy Street

Considering the high pedestrian volumes that cross Brady Street throughout the day, and the strong pedestrian desire line between the numerous pedestrian generators along Shaughnessy Street and City Hall and the Police station, it is recommended that the existing unprotected mid-block crossing be maintained and enhanced to accommodate this desire line. Recommended crossing enhancements to the mid-block crossing include the application of Zebra style pavement markings similar to those used along Elm Street, as well as the addition of "Yield to Traffic" signs at both ends of the crossing.

In order to eliminate jay-walking at random locations across Brady Street, it is recommended that median enhancements be installed along Brady Street to discourage jay-walking and funnel pedestrians to the enhanced pedestrian crossing. Median enhancements can include the installation of a fence and / or planters similar to the median enhancements applied along Elm Street at the Elm Street crossing.

Educational Campaign

As part of the HDR Corporation’s assignment, they will develop an educational brochure regarding pedestrian crossings. In addition to the publication and distribution of the educational brochure it is recommended that Staff, with the support of the Corporate Communications Section, undertake an educational campaign on the rules of right of way. Staff will work with groups such as the Sustainability Mobility Advisory Panel in the promotion of pedestrian safety.

February 2012

Pedestrian Crossing Policy Report

City of Greater Sudbury

Greater Grand Sudbury

Final Report

HDR

EXECUTIVE SUMMARY

A. Introduction

The City of Greater Sudbury has been responsive to the need to better accommodate the safety and security of pedestrians in the roadway environment. To this end, the City initiated a pedestrian crossing policy study and reviews of pedestrian safety on "in-service roads". The study was carried out by HDR | iTRANS in association with Tranplan. This report provides a summary of best practices in pedestrian crossings and policy development for pedestrian crossing facilities in the City of Greater Sudbury.

The pedestrian crossing policies have been developed in light of the benefits of improving driver and pedestrian awareness and understanding of rules of right of way. Research into the development of the policies have included a review of the practices of other jurisdictions, generally accepted and published practices in Ontario, original research into traffic safety, and legislative references such as the Ontario Highway Traffic Act. However, this is a City of Greater Sudbury policy, developed in recognition of roadway environment in the City of Greater Sudbury, existing pedestrian crossing features, and existing driver expectancy within the City.

The Highway Traffic Act indicates that when a pedestrian is about to step from the boulevard onto the roadway there are fundamentally two different forms of pedestrian crossing. The crossing may be either:

- A protected crossing where vehicles must yield to pedestrians, or
- An unprotected crossing where pedestrians must yield to vehicles.

Either form of crossing may be appropriate given a range of pedestrian demand. There is generally a higher degree of concern for pedestrian safety at unprotected crossing points. However, both forms of crossing must be designed to maximize safety.

The policy has been developed in recognition that each site is unique, and that the application of the policies may not be equally applicable in all instances. In many situations opportunities to change the fundamental nature of the pedestrian environment may not be feasible. However it is intended to maximize driver and pedestrian awareness and understanding for the potential of conflicts.

B. Crossing Alternatives

The standard practice for traffic control in Ontario is defined by the ***Ontario Traffic Manuals (OTM)***, **Book 15** for Pedestrian Crossing Facilities (the inaugural publication of which is imminent), **Book 12** for traffic signals and **Book 5** for regulatory signs (including stop signs). The manuals are designed to be used as a guideline by traffic practitioners. The OTM's incorporate current best practices in the Province of Ontario and have recommended thresholds for the implementation of the following protected crossings:

- Traffic control signals at intersections and mid-block
- Pedestrian crossovers (PXO's)

- Intersection pedestrian signals (IPS), and
- All-way stop signs.

An unprotected crossing is a location where there is measurable pedestrian crossing activity, such as 1 pedestrian crossing every 2 minutes for example, but has no designation or traffic control measures to protect the movement. An unprotected crossing may or may not have warning signage. Some jurisdictions supplement unprotected crossings to improve safety. These additional roadway features either increase driver or pedestrian awareness, or simplify the crossing process. These features may include:

- Refuge islands and centre medians
- Bulb outs (curb extensions)
- Textured pavement or high-visibility markings
- Standard warning signage or specialize pedestrian signage (eg: Yield to Traffic)
- Above ground flashing beacons or in-pavement flashers
- Barriers
- Delineators
- Special message signs.

C. Best Practices

Across Canada and in Ontario standard traffic control signals represent the most common feature for accommodating pedestrian crossings of major roadways. Many jurisdictions in Ontario also use a second form of protected crossing in instances where full traffic control signals are not warranted, either IPS' or PXOs. Most jurisdictions use OTM Book 12 warrants and threshold values for implementing traffic signals and pedestrian crossovers, and some utilize the OTM methodology to implement IPS'.

A number of jurisdictions indicate there is a lack of understanding of rules of the road and right of way at pedestrian crossings.

In the management of a roadway, risk and liability exist in perceived negligence, including nonfeasance and malfeasance. To minimize these risks, the City of Greater Sudbury can proactively monitor the safety of operations at pedestrian crossings to identify hazards and plan mitigation, establish policies that are consistent with accepted engineering practice and sensitive to the local environment, and implement improvements that are consistent with the policies / practices or their underlying principles. Practices should avoid ambiguity that may lead to confusion and misinterpretation of traffic control devices.

From the review of survey of current practices, risk, and research into operational characteristics of crossings, the following points were considered in the development of the crossing policy:

- It is desirable to distinguish between protected and unprotected crossings, such that drivers and pedestrians understand who has the right of way.
- Mid-block unprotected crossings with pavement markings may lead unaware pedestrians and drivers to believe that the crossing is protected for pedestrians.
- Pavement marking unprotected crossings may result in inconsistent driver yielding ('courtesy gaps') provided by drivers. This is of particular concern leading to vehicle-vehicle or vehicle-

pedestrian conflicts on 4-lane facilities where driver yielding behaviour in one lane may not be consistent with another.

- At mid-block locations, where the adjacent land uses such as high pedestrian generators and trails create high mid-block crossing demand, signage can contribute to driver awareness and pedestrian caution without making the rules of right of way ambiguous for drivers and pedestrians.
- If implementing protected crossing features (PXO's or IPS') to supplement traffic control signals, they should be done so in sufficient quantity such that pedestrians and drivers are familiar with their operation.
- There are operational concerns with PXO's related to the dilemma zone and clearance requirements.
- There is a trend toward the use of IPS' and a trend away from PXOs amongst Ontario municipalities surveyed.
- IPS' allow for a clearance interval, are an accepted device to complement traffic control signals, and are seen as an appropriate feature for the City of Greater Sudbury.
- Given that there is limited statistical research into the operations of IPS', the City of Greater Sudbury should consider driver workload turning from the side street and potential for vehicle-pedestrian conflicts at any new IPS locations.

D. Recommended Pedestrian Crossing Policy

It is recommended that the City of Greater Sudbury implement the following pedestrian features as warranted based on OTM Book methodologies and thresholds, to accommodate protected pedestrian crossings:

- Traffic control signals at intersections
- Traffic control signals mid-block
- Intersection pedestrian signals, and
- Adult crossing guards.

Where there is a documented safety problem identified (i.e. visibility or measured sight distance constraints, collision trends, or frequent vehicle-pedestrian conflicts) and traffic signals are not warranted, consideration will be given to implementation of traffic control signals and IPS'. In considering IPS applications, the City will have regard for driver workload for sidestreet approaches in the decision to implement and in the design.

Pedestrian grade separation should be considered within the context of potential benefits and costs, at locations where the other forms of protected crossings are warranted but cannot be implemented due to environmental constraints (such as distance of adjacent traffic controls). Grade separations are viable only if pedestrians can be directed to use the facility and sufficient property and capital funds are available.

With the exception of crosswalks for school crossing guards, marked unprotected crosswalks should generally be discouraged. However, the specific characteristics and needs of each location should be carefully considered and appropriate treatments applied to maximize safety. For example, consideration has been given to the delineation of high contrast markings to distinguish pedestrian desire lines in highly urban areas where drivers are aware of very high pedestrian

activity. In these locations, pedestrian signage should acknowledge that pedestrians do not have the right of way over vehicles (e.g. OTM Book 6 Wc-28 sign). In other areas where there is high pedestrian/vehicular activity and/or high vehicle speeds, pedestrian markings at unprotected locations should not be implemented.

At locations where unprotected crosswalks are maintained on two lane, low speed roads (i.e. 50 km/h or less), it is recommended a pedestrian warning sign (Wc-7) be posted in advance of the crossing per OTM Book 6, and that two back to back Wc-7 signs be mounted on each side of the road in the immediate vicinity of the crossing. Additionally, no pavement markings shall be used to denote the crossing on the roadway and existing pavement markings shall be removed.

Pedestrian refuge islands or centre medians will also be considered as a passive feature at unprotected crossing points where lane alignment is not compromised (eg. integrated with centre turn lanes). Other measures such as reflective delineator poles may be considered at the boulevard of unprotected crossing locations in order to draw the driver's attention to potential crossing activity.

The City of Greater Sudbury should consider removing line markings at unprotected crosswalks on high speed or high volume multilane roads, where the crosswalk is not specifically intended to direct pedestrians away from crossing at locations with poor sight lines or unanticipated conflicts. The City should consider the removal of unprotected crosswalks under the following circumstances:

- Where the speed limit is greater than 60 km/h, or
- On a roadway with four or more lanes without a raised median or crossing island that has (or will soon have) an Average Daily Traffic (ADT) total of 12,000 or greater, or
- On a roadway with four or more lanes with a raised median or crossing island that has (or will soon have) an ADT of 15,000 or greater.

The removal of crosswalks should include public notification.

It is recommended that the City of Greater Sudbury proactively address pedestrian safety needs and establish a program of reviews of pedestrian crossings either through on-going traffic operations studies or annual corridor reviews. Compliance with the pedestrian crossing practices should be reviewed, and necessary roadway and traffic control modifications programmed and implemented. Streetlight warrants and maintenance should also be monitored.

Other features may be considered for implementation by the City of Greater Sudbury on a site-by-site basis to enhance pedestrian safety based on the needs of the particular site.

TABLE OF CONTENTS

E. List of Tables

F. List of FIGURES

1. INTRODUCTION

1.1 Project Objectives

The City of Greater Sudbury has been responsive to the need to better accommodate the safety and security of pedestrians in the roadway environment. To this end, the City initiated a pedestrian crossing policy study and reviews of pedestrian safety on "in-service roads". The study was carried out by HDR | iTRANS in association with Tranplan. This report provides a summary of best practices in pedestrian crossings and development of a policy for pedestrian crossing facilities.

The objective of this policy is to assist the City of Greater Sudbury to make rational decisions on how and when to implement pedestrian crossings. It will address issues relating to the type of measures that could be used to assist pedestrians at intersections and mid-block locations and under what conditions it would be appropriate to implement these measures. The guideline is intended as policy on practice for implementing traffic control features rather than a description of design details.

1.2 Study Context

Pedestrian safety is related to the level of awareness of drivers and pedestrians of potential conflicts, the level of pedestrian and driver understanding of who has the right of way where there is vehicle-pedestrian interaction, and the degree of care and disregard for safety. Efforts can be made to address each of these effects on pedestrian safety through public awareness and education. In addition, awareness and understanding of right of way can be enhanced through the design of road and pedestrian infrastructure.

Road designs and use of traffic control measures can help maximize driver and pedestrian awareness of vehicle-pedestrian interaction, minimize distractions and obstructions, and improve understanding of which road user has the right of way. It is engineering practice to select designs that:

- Offer consistency in design approach in order to contribute to driver expectation that is appropriate for the road environment and potential hazards, and
- Is appropriate for the unique characteristics for each individual site.

The pedestrian crossing policies have been developed in light of the benefits of improving driver and pedestrian awareness and understanding the rules of right of way. Research into the development of the policies have included a review of the practices of other jurisdictions, generally accepted and published practices in Ontario, original research into traffic safety, and legislative references such as the Ontario Highway Traffic Act. However, this is a City of Greater Sudbury policy, developed in recognition of roadway environment in the City of Greater Sudbury, existing pedestrian crossing features, and existing driver expectancy within the City.

The policy has been developed in recognition that each site is unique, and that the application of the policies may not be equally applicable in all instances. In many situations opportunities to

change the fundamental nature of the pedestrian environment may not be feasible. However is intended to maximize driver and pedestrian awareness and understanding for the potential of conflicts.

1.3 Forms of Pedestrian Crossing

The Ontario Highway Traffic Act (HTA) defines the rules of the road, including conditions under which pedestrians can cross a road. The HTA identifies the responsibilities and rights of pedestrians and drivers at different forms of pedestrian crossing. Interpretation of rights and responsibility are further defined through case law.

The Highway Traffic Act indicates when a pedestrian is about to step from the boulevard onto the roadway there are fundamentally two different forms of pedestrian crossing. The crossing may be either:

- A protected crossing where vehicles must yield to pedestrians, or
- An unprotected crossing where pedestrians must yield to vehicles.

Protected crossings include those locations where there is traffic control that requires a vehicle to yield or stop, such as a traffic control signal, an intersection pedestrian signal, a pedestrian crossover with flashing lights, a stop sign, or a crossing guard.

An unprotected crossing may or may not have warning signage and in some jurisdictions crosswalk pavements markings. An unprotected crossing may also have no designation or traffic control measures, but are locations where there is measurable pedestrian crossing activity.

Either form of crossing may be appropriate given a range of pedestrian demand. There is generally a higher degree of concern for pedestrian safety at unprotected crossing points. However, both forms of crossing must be designed to maximize safety.

2. TYPES OF PEDESTRIAN CROSSINGS

2.1 Types of Protected Crossings

Protected crossings include those locations where there is traffic control device that requires a vehicle to yield or stop, such as a traffic control signal, an intersection pedestrian signal, a pedestrian crossover with flashing lights, a stop sign, or a crossing guard. The protected crossing options are defined in this section.

2.1.1 Traffic Control Signals

At signalized locations a pedestrian crossing is protected during the WALK and flashing DON'T WALK phase of the cycle. Traffic control signals can accommodate pedestrian crossing through traditional signals at intersections or at mid-block. Warrants and design requirements of traffic control signals are documented in the Ontario Traffic Manual Book 12. Signals are either implemented at intersections, accesses, or mid-block where there are pedestrian desire lines and pedestrian demand is high.

2.1.2 Intersection Pedestrian Signals

An alternative form of traffic control signals that accommodate pedestrian crossing is the Intersection Pedestrian Signal (IPS) or half-signal. It is used in an increasing number of jurisdictions, including: City of Hamilton, City of Burlington, Region of Waterloo, York Region, City of Oshawa and City of Greater Sudbury. Pedestrian crossing is controlled on the main street by standard traffic signal heads. A pedestrian indicates the desire to cross by pushing a button that would activate the signal to stop the traffic on the main street. At all times, the side street traffic is controlled by a "stop" sign and vehicles entering the main street from the side street must yield right of way to all main street traffic and pedestrians.

2.1.3 Pedestrian Crossovers

Protected pedestrian crosswalks in Ontario are defined as pedestrian crossovers (PXOs) and represent protected crossings for pedestrians. Section 140 of the Highway Traffic Act of Ontario requires motorists to yield to a pedestrian in a crossover when the pedestrian is upon the half of the road upon which the vehicle is travelling or when a vehicle is close enough to endanger a pedestrian. The presence of a pedestrian is what triggers the motorist's requirements to yield. Municipalities that operate PXOs include: Town of Milton, Oakville, and Town of Caledon. The City of Toronto operates over 600 PXOs. However many jurisdictions no longer implement PXOs due to safety and cost concerns.

The design of a pedestrian crossover is prescribed in the Highway Traffic Act Regulation 615, Section 20 and in Book 12 of the Ontario Traffic Manuals. The design consists of overhead illuminated signs with flashing amber beacons, regulatory signs at and approaching the crossover and pavement markings on the roadway.

2.1.4 Stop Control

Pedestrian crossings are protected at stop controlled intersections where pedestrians are crossing the minor street at two-way stop controlled intersections and for all legs of an All-Way stop intersection. Vehicles must yield to pedestrians lawfully in these crosswalks.

2.1.5 Crossing Guard

Adult crossing guards provide protection for pedestrians crossing the street. Vehicles must yield to a crossing guard within the crosswalk at both protected and unprotected crossings. Crossing guards are stationed at school crossing locations and school crossing signs are situated in advance of and at the crossing guard location. The crossing is also typically marked with pavement markings.

2.1.6 Pedestrian Grade Separation

Grade separated crossings are protected by the physical separation from vehicles through either an overpass or an underpass. Grade separation provides the highest form of protection for pedestrians, but is also the most expensive option for a protected crossing as it requires more property and a more complex implementation process. In many instances, grade separated crossings require pedestrians to divert their route from more direct connections and may have limited accessibility if the design includes stairs or steep ramps. Grade separation may be recommended if other forms of protected crossing are not appropriate and/or when there are insufficient gaps and obvious safety concerns for pedestrian crossings, due to high traffic volume, high vehicle speeds, or long crossing distance such as high speed freeways and expressways. Grade separation may also be appropriate in developed areas with established vehicular and pedestrian traffic volume, but with limited opportunity for other types of crossing.

2.2 Unprotected Crossings

An unprotected crossing may or may not have warning signage and in some jurisdictions crosswalk pavement markings. A unprotected crossing may also lack designation or traffic control measures, but tend to be at locations where there is measurable pedestrian crossing activity, such as (1 pedestrian crossing every 2 minutes for example).

At 2-way stop intersections, an unprotected pedestrian crossing can be accommodated by the provision of warning signage or a crosswalk across the major road. However crosswalk markings across a major street may give pedestrians the false impression that they have the right of way. Pavement markings at unprotected crossings may encourage pedestrian crossing activity at unprotected locations. For this reason, many jurisdictions do not mark crosswalks where pedestrians do not have the right of way prior to entering the crosswalk. In some instances crossings of the major road are signed to prevent potential confusion about who has the right of way, indicating that pedestrian should yield to traffic on the major road and / or wait for a suitable gap.

Some jurisdictions, such as City of Toronto, City of Hamilton, City of Kingston, supplement unprotected crossings to improve safety. These additional roadway features either increase driver or pedestrian awareness, or simplify the crossing process. These features may include:

- Refuge islands and centre medians
- Bulb outs (curb extensions)
- Textured pavement or high-visibility markings
- Standard warning signage
- Specialized pedestrian signage (eg.: Courtesy Crossing, or Yield to Traffic)
- Above ground flashing beacons
- Barriers to control pedestrian flow, and
- Delineators.

The use of some of these features at unprotected crossing points may also increase pedestrian's sense of security. The safety benefits must be weighed against a potentially more aggressive pedestrian behavior, likelihood of increases in pedestrian crossing activity, and the resultant exposure to conflict with vehicles. Each feature is briefly described below.

2.2.1 Refuge Islands / Centre Medians

The presence of pedestrian islands simplifies the pedestrian crossing movement by providing a safe refuge in the center of the road. Refuge islands reduce the distance required to cross and increase the available gaps for pedestrians. They allow pedestrians to concentrate on crossing one direction of traffic at a time. Pedestrian refuge islands are suitable for wide two-way streets with four or more lanes of moving traffic travelling at higher speeds and are commonly located mid-block. They are useful to persons with mobility disabilities, very old or very young pedestrians who walk at slower speeds.

2.2.2 Bulb Outs (Curb Extensions)

Curb extensions reduce the distance that pedestrians have to walk. With the reduced crossing distance, pedestrians require smaller gaps to cross and pedestrian delays will generally become shorter. The extensions create a traffic calming effect – vehicles slow down, making it safer for pedestrian to cross. They also improve the visibility of pedestrians.

2.2.3 Textured Surfaces / High-Visibility Markings

Textured surfaces and high-visibility (e.g. zebra) markings are ideally suited for crossing in low speed, high traffic volume and pedestrian environments. They increase drivers' awareness of possible crossing at an unprotected crossing. The use of these features such as textured pavement is not preferred at unprotected crossings on high volume roads. Many municipalities use textured crosswalks in downtown areas including the City of Greater Sudbury.

2.2.4 Standard Warning Signage

A number of pedestrian crossing signs are documented in the Ontario Traffic Manuals: Book 5 Regulatory Signs, Book 6 Warning Signs and Book 11 Markings and Delineation. They include

a Pedestrian Ahead sign (Refer to Wc-7, page 109 of OTM Book 6, July 2001). The manuals also list a number of signs that can be used at school crossings.

More recently the use of the florescent yellow-green sign has been used by some jurisdictions, including the City of Kingston, for school crossings and City of Belleville for courtesy crossings.

2.2.5 Special Message Signs

Given the inconsistent understanding of the right-of-way at unprotected crossings, some jurisdictions have implemented special message signs that explicitly identify the right-of-way such as “Yield to Traffic” or “Courtesy Crossing”.

2.2.6 Flashing Beacons

Flashing beacons could be used with the Pedestrian Crosswalk Ahead warning signs to make drivers more aware of the crosswalk ahead and of the need to slow down and drive with caution. Flashing beacons could also be implemented on the Refuge Island when there is a safety concern of vehicles colliding with the refuge island.

2.2.7 Barriers

Barriers or railings placed along the top curb can be used to channelize pedestrians to preferred crossing points and discourage pedestrians crossing at undesirable locations (where sight distance constraint or conflicting flows exist). However, pedestrians who have entered the roadway upstream or downstream of the barrier may also have difficulties exiting the roadway around barriers. In some environments, barriers may be viewed as aesthetically unattractive.

2.2.8 Delineators

Delineator posts can be used to alert drivers to the boulevard increasing their detection of the presence of a crossing. Reflective tape on delineators can significantly improve night visibility of protected and unprotected crossings.

2.3 Design Elements

Table 1 shows the design elements and approximate cost associated with alternative forms of pedestrian crossings.

Table 1: Alternative Pedestrian Facilities

Facility Type	Description of Traffic Control	Cost
Traffic Control Signals	▪ Pedestrian walk / don't walk indicator ▪ Pedestrian crosswalk markings	$100,000 - $200,000
Mid-block Pedestrian Signals	▪ Pedestrian walk/don't walk indicator ▪ Pedestrian crosswalk markings	$80,000 -$120,000
Intersection Pedestrian Signals (IPS)	▪ Pedestrian walk / don't walk indicator ▪ Push button to activate signal to stop traffic ▪ Pedestrian crosswalk markings ▪ Side street traffic is stop-controlled ▪ No parking is permitted on both sides of signals	$80,000 - $120,000
Pedestrian Crossovers	▪ Overhead flashing lights ▪ "Push Button to activate early warning system" ▪ "Pedestrian Advance (Wc-7) ▪ No passing sign ▪ Pedestrian crosswalk markings ▪ No passing solid demarcation between lanes ▪ "X" pavement marking	$60,000
Stop Control Pedestrian Crossing	▪ Pedestrian Crosswalk markings	$1,000 - $3,000
Crossing Guard	▪ School crossing signs and advance warning signs ▪ Crosswalk markings	
Pedestrian Grade Separation	▪ Overpass or underpass ▪ Ramps or elevators; and stairs or escalators ▪ Fencing to direct pedestrians	$500,000
Unprotected Pedestrian Crosswalks	▪ Pedestrian crosswalk markings and signs	$ 2,000

* Note: costs shown are typical 2011prices; actual costs vary based on site conditions

Unprotected crossing facilities typically do not exhibit the same design elements that protected crosswalks provide. This is appropriate. The configuration of protected and unprotected crossings should be significantly different, to allow the public a clear understanding of whether driver or pedestrian has the right of way.

3. IMPLEMENTATION GUIDELINES

3.1 Ontario Traffic Manual

The standard practice for traffic control in Ontario is defined by the ***Ontario Traffic Manuals (OTM)***, **Book 15** for Pedestrian Crossing facilities**,** as well as **Book 12** for traffic signals, **Book 6** for warning signs and **Book 5** for regulatory signs (including stop signs). The manuals are designed to be used as a guideline by traffic practitioners. The OTM books incorporate current best practices in the Province of Ontario and have recommended thresholds for the implementation of:

- Traffic control signals
- Mid-block pedestrian signals
- Pedestrian crossovers (PXO's)
- Intersection pedestrian signals (IPS), and
- All-way stop signs.

Municipalities have generally followed the standards defined by the manuals, while some have adopted modified warrant thresholds to better reflect local characteristics. The City of Greater Sudbury bases its approach on these manuals, however, not all warrants and guidelines presented in this section are necessarily recommended for the City's policy. Specifics of the recommended policy are presented in **Section 6.** They are listed in this report for reference and to guide the process of developing a set of policies specific to the City of Greater Sudbury.

3.2 Signal Warrants

The OTM provided recommended thresholds based on vehicle volume, pedestrian volume, pedestrian delay, and accident frequency. The signal justification for mid-block and intersection locations is based on the following criteria summarized in **Table 2**.

Table 2: OTM Signal Justification Method

Justification	Threshold
Justification 1 – Minimum Vehicle Volumes	The 8 hour average vehicle volume must exceed the following thresholds: Restricted Flow (Urban) Conditions ▪ Total Traffic Volume Entering Intersection: 720 vph (1 lane approach) or 900 vph (2 lane approach); and ▪ Crossing Traffic Volume: 170 vph (full intersection) or 255 (T-intersection). Free Flow (Rural) Conditions ▪ Total Traffic Volume Entering Intersection: 480 vph (1 lane approach) or 600 vph (2 lane approach); and ▪ Crossing Traffic Volume: 120 vph (full intersection) or 180 (T-intersection).

Justification	Threshold
Justification 2 – Delay to Cross Traffic[1]	The 8 hour average vehicle volume must exceed the following thresholds: Restricted Flow (Urban) Conditions ▪ Main Road Traffic Volume: 720 vph (1 lane approach) or 900 vph (2 lane approach); and ▪ Crossing Traffic Volume: 75 vph Free Flow (Rural) Conditions ▪ Main Road Traffic Volume: 480 vph (1 lane approach) or 600 vph (2 lane approach); and ▪ Crossing Traffic Volume[1]: 50 vph
Justification 3 – Volume/Delay Combination	▪ If Justifications 1 or 2 are both satisfied to the extent of 80% or more of the threshold
Justification 4 – Minimum Four-Hour Vehicle Volume	▪ Intended for applications where the intersection experiences excessive delays for four or more peak hours of the day, but do not meet an eight-hour warrant ▪ Signal justification is considered if the plotted point representing the vehicles per hour on both approaches of the major street and the corresponding vehicles per hour on the highest minor street approach falls above the applicable curve illustrated in Figure 1 and Figure 2 ▪ Focused on locations such as: • Commuter-dominated roadways – with heavy demands for two or more hours in each of the AM and PM peak, but considerably reduced for the remainder of the day • Commercial areas – with limited demand in the morning, but substantial four to six hour peak in the afternoon and early evening • Manufacturing, office or industrial areas / accesses – where minor street existing traffic experiences considerable delays when entering the major street during the mid-day and PM peak periods but the AM arrive peak realizes little side street demands
Justification 5– Collision Experience[2]	▪ 5 or more reportable collisions of types preventable by traffic control signals occurred during each of the three preceding twelve month periods ▪ >= 80% of the requirements specified in Justification 1 and Justification 2
Justification 6 – Pedestrian Volume[3]	Pedestrian volume justification is based on an exposure approach (Figure 3): ▪ Pedestrian volume justification (Figure 3): ▪ 8-hour vehicle volume > 7000 and net 8-hour pedestrian volume > 276; or ▪ 8-hour vehicle volume = 2601 to 7000 and net 8-hour pedestrian volume > 476; or ▪ 8-hour vehicle volume = 1440 to 2600 and net 8-hour pedestrian volume > 1000 ▪ Pedestrian delay justification: ▪ Net total 8 hour volume of delayed pedestrians = 75 pedestrians or more

1. The crossing volume consist of the sum of: the number of pedestrians crossing the main road; plus total left turns from both the sideroad approaches; plus highest through volume from one of the side street approach; plus 50% of the heavier left turn traffic
2. On the condition that adequate trial of less restrictive remedies with satisfactory observance and enforcement have failed to reduce collision frequency
3. Pedestrian volume is adjusted by a factor of 2 for senior citizens, disabled pedestrians and children under 12

Most jurisdictions surveyed have been following the guideline prescribed by the manual. Consideration beyond OTM 12 has been given for crossings requiring specialized treatments such as audible signals, countdown signals, timing operations based on lower pedestrian walking speed for seniors and assisted pedestrian crossing or pedestrian grade separation. While there is no warrant for accommodating seniors, a reduction of 0.1 to 0.2 m/sec from typical walking speed assumptions are considered adjacent to seniors' residences or facilities.

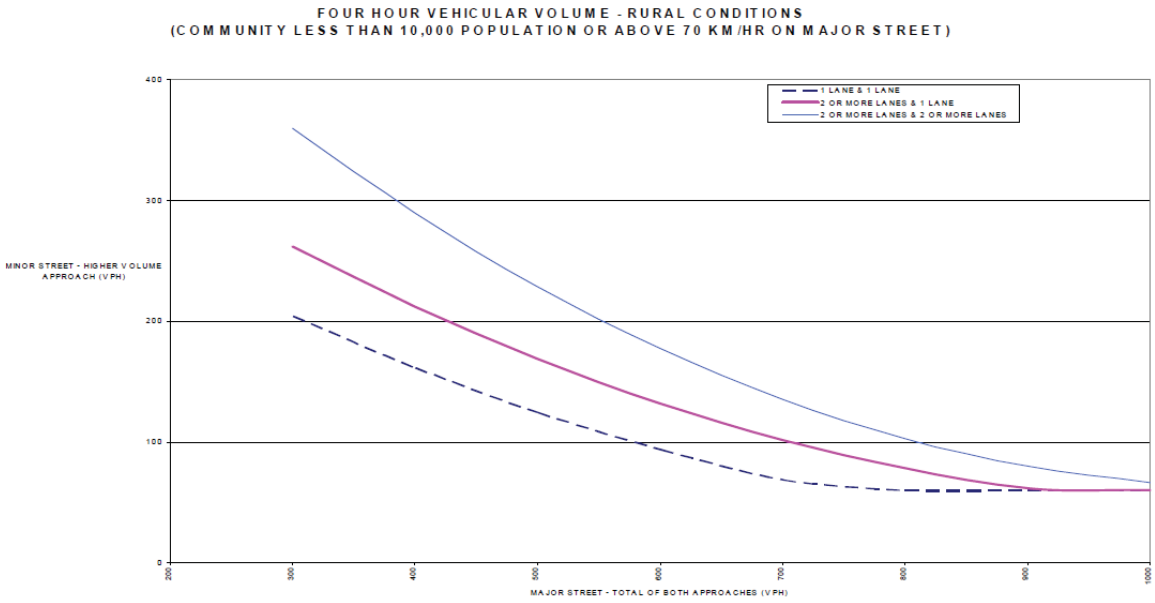


Figure 1: Justification 4 – Minimum Four Hour Justification, Unrestricted Flow

(Source: Figure 19, OTM Book 12, February 2007)

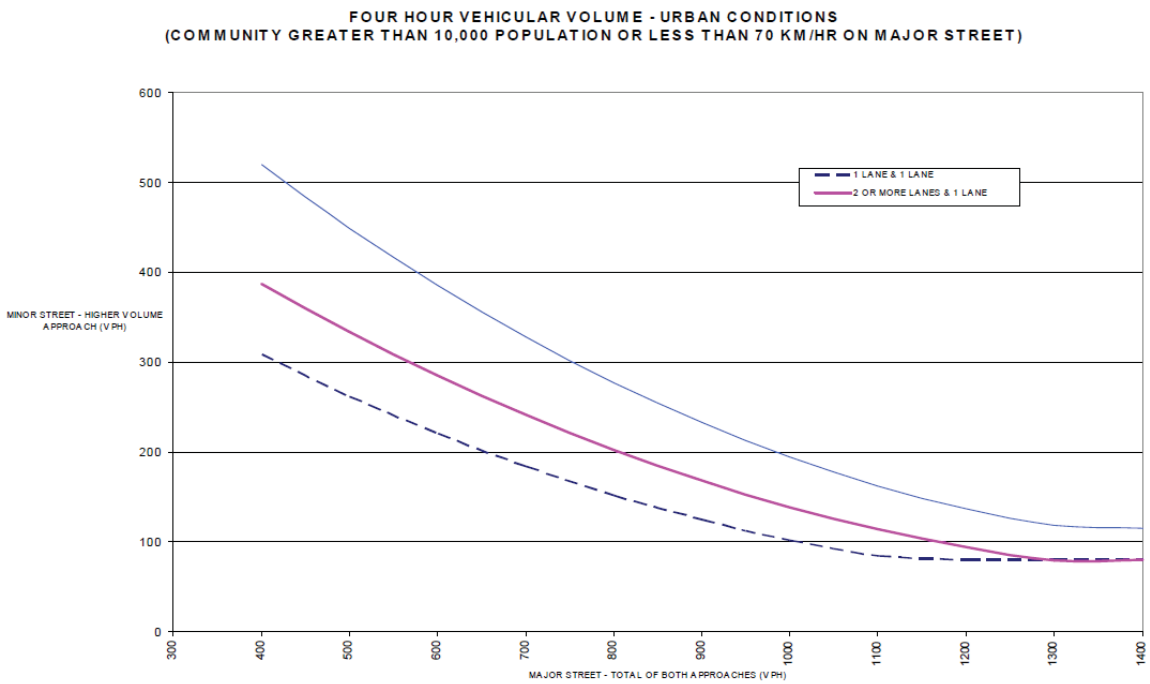


Figure 2: Justification 4 – Minimum Four Hour Justification, Restricted Flow (Source: Figure 20, OTM Book 12, February 2007)

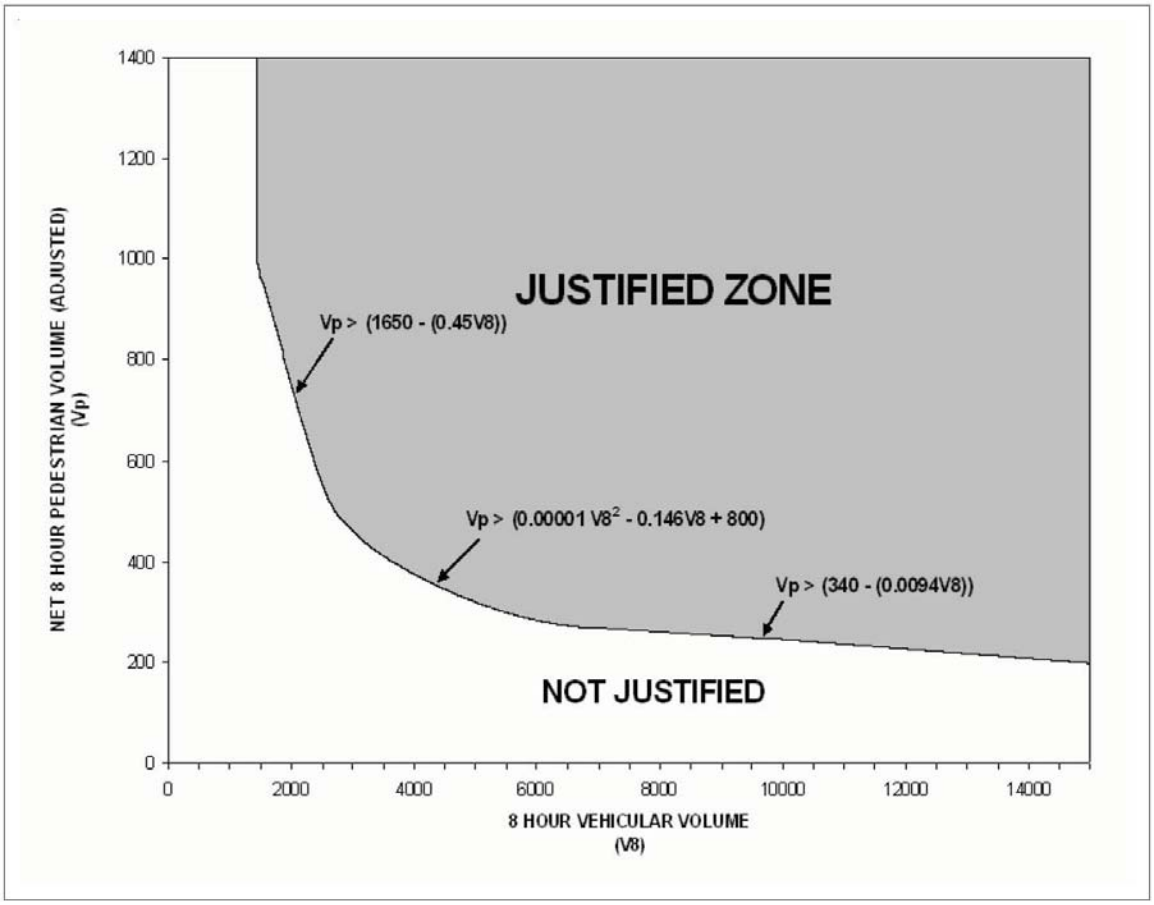


Figure 3: 8 Hour Pedestrian Crossing Warrants

(Source: OTM Book 12, Figure 21 – Justification 6 – Pedestrian Volume)

3.3 IPS Warrants

OTM Method

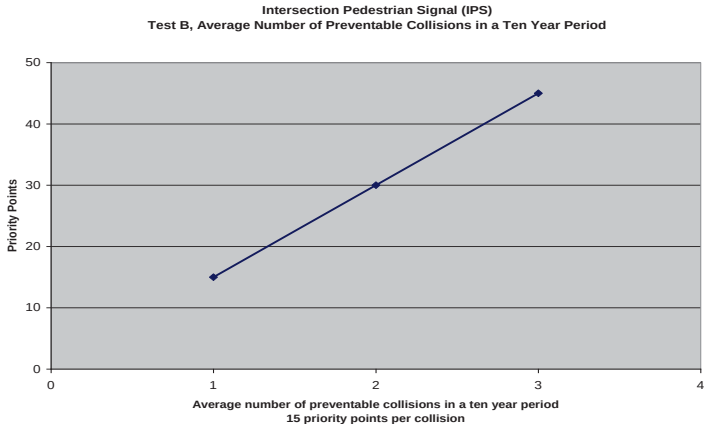
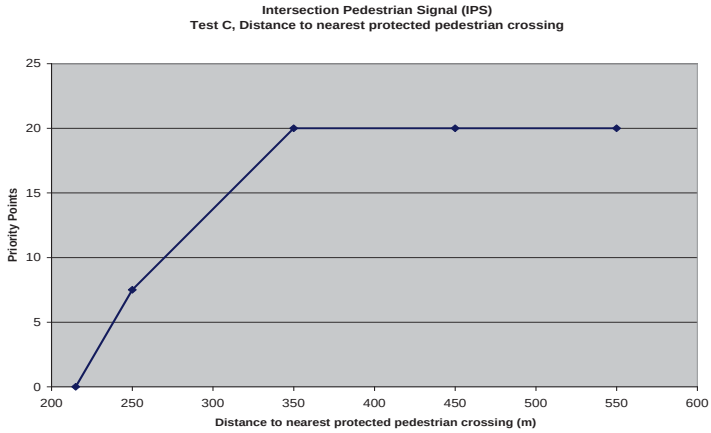
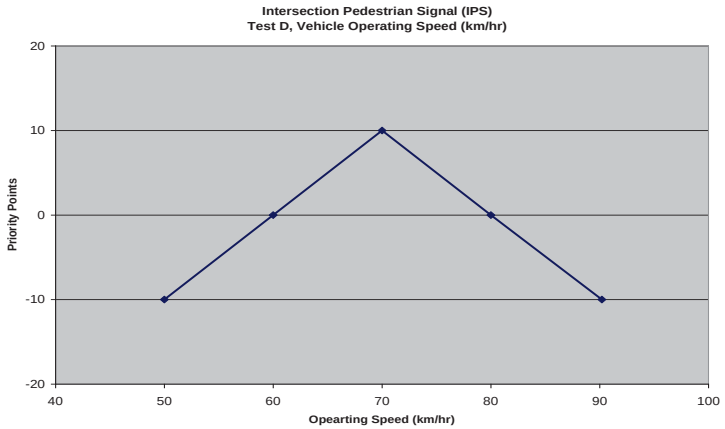
According to the OTM method, "if the pedestrian crossing under consideration is to be at an intersection, justification should be made on the basis of Signal Justification 5 being fulfilled but the crossing vehicular traffic should be so light as to not meet one of the other justifications (1-4)." The City of Greater Sudbury bases its warrant on the OTM method.

Priority Points Method

The City of Hamilton in cooperation with Ministry of Transportation Ontario developed the "priority points" method, which is based on a cumulative scoring of different criteria under consideration. The criteria include combined "pedestrian volume and delay", collision frequency, distance of upstream / downstream of the protected crossing location and vehicle operating speed.

As a minimum, there should be at least **100 pedestrians** entering the main street during the 7 highest hours of the day and there should also be fewer than **5000 vehicles** total per day on the intersecting side street approach. **Table 3** summarizes the priority point system where a cumulative score of 80 is required for warrant.

Table 3: IPS Cumulative Point System

Test A – Pedestrian Volume and Delay[1]	Priority points = $\sqrt{(Avg.delay)(hrVol_{adjusted})}$
Test B – Average Number of Preventable Collisions in a ten year period	
Test C – Distance to Nearest Protected Crossing	
Test D – Vehicle Operating Speed	

1. Pedestrian volume is adjusted by a factor of 2 for assisted pedestrians (senior citizens, disabled pedestrians and children under 12)

The City of Burlington and the City of Hamilton were the pioneers for such devices in Ontario. These municipalities have implemented and monitored the effectiveness of the IPS since 1998.

Other jurisdictions such as the City of Mississauga, City of Pickering, City of Barrie and the Region of York have adopted this control type in some capacity.

Standard practice also includes implementation of pedestrian features within acceptable environmental conditions:

- Minimum distance of 215 metres from nearest traffic control signal or stop sign on a two-way street or 125 metres on a one-way street
- Adequate sight distance must be available for both pedestrians and vehicles for the operating speed of the roadway
- Parking prohibition within 30 metres of the crossing
- Posted speed of less than 60 km/h, and
- Fewer than 5,000 vehicles per day on the intersecting side street approaches.

3.3.1 Comparison of IPS Warrants

The priority points method allows for greater detail by directly assessing pedestrian delay, spacing of protected crossings, and operating speeds. However the priority points method is supportive of IPS implementation on higher speed roads (70 km/hr vs. 60 km/hr roads) and roads with very high volumes that generate long pedestrian delays despite modest pedestrian volumes. The sensitivity of the warrant to the spacing of protected pedestrian crossings is limited to the range of 215 metres to 350 metres. The priority points method also has greater data requirements (pedestrian delay and vehicle speed).

The OTM method provides an IPS warrant methodology that is consistent with traffic signal warrants. The OTM methodology is a generally accepted source in Ontario. The additional data collection associated with the priority points method has not been proven to merit change from the use of the OTM method by the City of Greater Sudbury.

3.4 Advanced Pedestrian Phases

Advanced pedestrian phases give pedestrians an advanced walk signal before motorists receive their “green” indication giving pedestrians a “head start” when entering a crosswalk. The intention is to position pedestrians within the crosswalk and make them more visible to motorists increasing the potential for motorists to yield the right of way. Advanced phases are typically four to six seconds in duration.

There are no standard warrant practices for advanced pedestrian phases, however, they have been used in various municipalities around the world, and are known to be particularly beneficial to pedestrians when crossing roadways with two or more lanes per direction, where there are high levels of pedestrians and high volumes of turning vehicle traffic, and there is a known problem of driver’s not yielding to pedestrians. In some instances, right-turn-on-red prohibitions may be necessary to prevent vehicles from turning into the crossing and blocking pedestrian access to the crosswalk during the advanced phase.

3.5 Pedestrian Scramble Phases

A pedestrian scramble phase gives a walk signal to pedestrians on all approaches simultaneously (including diagonally with some installations), while displaying a red signal indication to all vehicular traffic. While there are no formal warrants for this form of pedestrian crossing control, it requires a dedicated phase within the signal cycle and therefore usually increases the signal cycle time and/or creates longer delays for vehicular traffic. As a result, it is typically only justified at intersections with very large pedestrian movements that wish to cross in all directions (i.e. Calgary sited installations at locations with over 6,000 pedestrians per hour for each of the highest 6 hours of the day). Pedestrian scramble phases do not work well with accessible pedestrian signal devices since they are all activated together.

3.6 Pedestrian Crossover Warrants

The OTM identifies two forms of Pedestrian crossovers, Type 1 and Type 2.

Type 1 pedestrian crossovers are distinctly defined by the prescribed use of regulatory and warning signs, flashing amber beacons and pavement markings. They provide pedestrians with protected crossing opportunities by requiring motorists to yield to pedestrians within the crosswalk. OTM Book 15 states that "a Type 1 PXO may be installed on the basis that pedestrian volumes meet the thresholds of the pedestrian warrant specified in Justification 6 (from OTM Book 12), described in *Section 3.2* of this report, and provided that:

- Type 1 PXO is intended to serve pedestrian traffic crossing roadways with 60 km/h or less posted speed limits and AADT's less than 35,000
- The PXO is not within 200 metres of other signal-protected pedestrian crossings
- There are not more than four lanes of two-way traffic or three lanes of one-way traffic
- Parking and other sight obstructions are prohibited within at least 30 metres of the crossing, and
- If at an intersection, side street vehicular traffic does not meet one of the other justifications (1 through 5) under which full traffic control signals may be installed.

A Type 1 Pedestrian Crossover is illustrated in **Figure 4.**

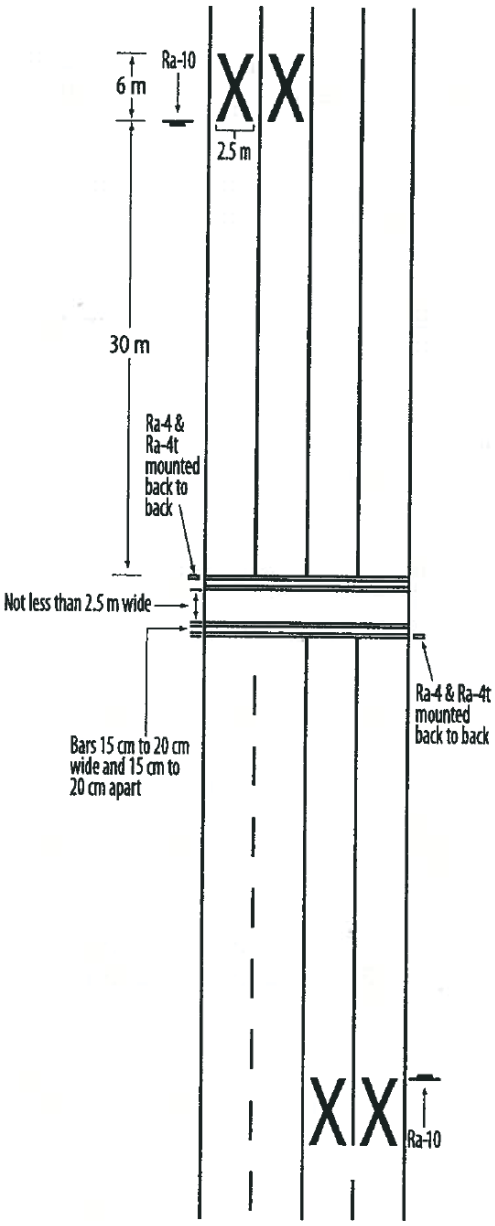


Figure 4: Type 1 Pedestrian Crossover

(Source: Figure 11 - OTM Book 15, December 2010)

Jurisdictions that have PXO's are City of Toronto, Town of Richmond Hill, Town of Ajax, Town of Oakville, Town of Caledon, Town of Markham, Town of East Gwillimbury and Town of Aurora. Recently, the City of Toronto has implemented traffic control signals / mid-block signals in place of PXOs. The City of Greater Sudbury currently does not have any pedestrian crossovers.

Type 2 pedestrian crossovers are a new concept described in OTM Book 15 and require amendments to the Highway Traffic Act before they can legally be implemented. They are defined as "any portion of a roadway, designated by by-law of a municipality, at an intersection

or elsewhere, distinctly indicated for pedestrian crossing by signs on the highway and lines or other markings on the surface of the roadway as prescribed by the Highway Traffic Act regulations". Type 2 PXO's are applied in lower vehicle-volume environments and may be considered as a treatment for accommodating pedestrians at crossing locations where there is a consistent level of pedestrian activity, but the location does not warrant for traffic control signals, IPS or Type 1 PXO's.

The following conditions are required to warrant Type 2 PXO's:

- Maximum of two lanes of traffic
- Sufficient stopping sight distance, 100 metres and 120 metres sight distance required for operating speeds of 50 km/h and 60 km/h respectively
- Sufficient distance to alternate crossings, offering equal or higher level of control (a minimum spacing of 200 metres from an adjacent traffic signal is recommended),
- Grades of less than eight percent, and
- Consistent level of pedestrian activity, typically greater than 10 to 20 pedestrians per hour.

An example of a Type 2 Pedestrian Crossover and its supporting elements are illustrated in **Figure 5**.

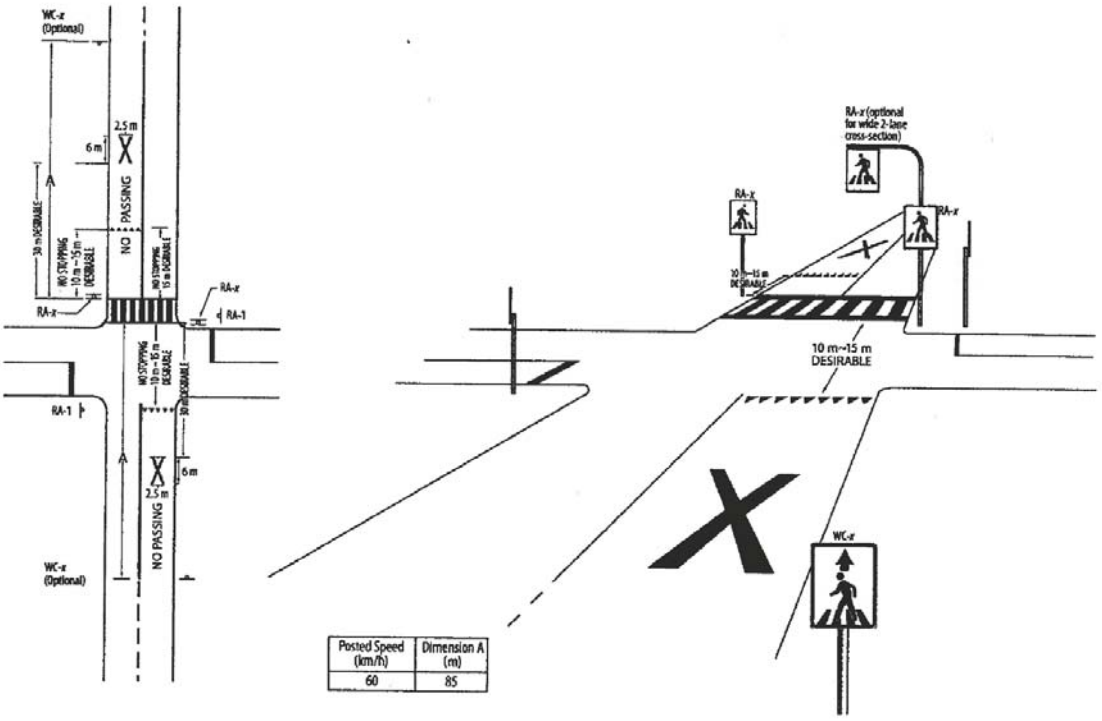


Figure 5: Type 2 Pedestrian Crossover

(Source: Figure 13 – OTM Book 15, December 2010)

The warrants for Type 1 and Type 2 pedestrian crossovers are also suitable for IPS and mid-block signals.

3.7 All-Way Stop Warrants

The City of Greater Sudbury has adopted a modified All-Way Stop policy that is modified from the provincial warrants published in the OTM, since it was determined that the provincial all-way stop warrants were too restrictive. The warrant used is based on the same principles contained in the Ontario Traffic Manual. The main difference is that the traffic volume and collision warrants have been reduced for lower volume collector roads and residential roadways. A summary of the warrant is as follows:

Minimum Volume Warrant

1) Arterial and major collector roadways with Annual Average Daily Traffic volume (AADT) greater than 5,000
   a. Total vehicle volume on all approaches exceeds 500 vehicles per hour for an eight (8) hour period, and
   b. A combined vehicle and pedestrian volume for the minor street is more than 200 per hour for the same eight (8) hours, and
   c. The traffic volume on the intersecting streets is similar and does not exceed a 70/30 split

2) Minor collector roads with an AADT between 1,000 and 5,000
   a. Total vehicle volume on all approaches exceeds 350 vehicles per hour for four (4) hours
   b. The combined vehicle and pedestrian volume from the minor street is more than 140 per hour for the same four (4) hours,
   c. The traffic volume on the intersecting streets is similar and does not exceed a split of 70/30

   Collision Warrant
   d. For both major and minor roadways, All-way stops are warranted when there is an average of four (4) or more collisions over a three (3) year period. Only those collisions that may be corrected with an all-way stop are to be considered.

3) Local roads with an AADT less than 1,000
   a. Total vehicle volume on all approaches exceeds 250 vehicles per hour for a four (4) hour period.
   b. The traffic volume on the intersecting streets is similar and does not exceed a split of 65/35 for four-way control and 75/25 for three-way control.

   Collision Warrant
   c. For intersecting roadways, All-way stops are warranted when there is an average of two (2) collisions per year over a three (3) year period. Only collisions that may be corrected with an all-way stop are to be considered.

3.8 Pedestrian Crossing Guard

The ***School Crossing Guard Review 1992***, published by the Ministry of Transportation (MTO) and the Ontario Traffic Conference (OTC) is the most common guideline used in jurisdictions across Ontario. These municipalities include City of Mississauga, Town of Aurora, Town of

Markham, Town of Richmond Hill and City of Kingston. The guideline outlines the procedures for investigating requests for school crossing guards. The warrants are assessed based on the existence of adequate gaps in traffic to permit students to safely cross the roadway. The procedure involves site investigations, measurement of gaps in traffic, and sight line and stopping sight distance measurements.

The City of Greater Sudbury has adopted this School Crossing Guard criteria for use in their jurisdiction as listed in **Table 3** below.

Table 3: City of Greater Sudbury - Crossing Guard Warrant

A School Crossing Guard will be added at a location within the City of Greater Sudbury when both Criteria 1 (Number of School Children) and Criteria II (Gap Time or Sight Lines) are met.
Criteria I - Number of School Children A minimum of 40 elementary school children cross a two lane street with a regulatory speed limit of 40 km/hour or 50 km/hour or, 20 children crossing a major arterial road with two or four lanes with a regulatory speed limit of 60 km/hour. **Criteria II – Gap Time** Fewer than 5 sufficient time gaps (based on five minute time frames) during the defined periods children go to school, namely before and after school, are available for children to cross a roadway safely. *OR* **Criteria II – Site Lines** Insufficient sight visibility distances are provided for either the child or the driver at a crossing location.
Deleting a School Crossing Location
A school crossing guard location will be deleted when either Criteria III or IV are met. **Criteria III – Number of School Children** The number of elementary school children crossing a two lane street with a regulatory speed limit of 50 km/hour decreases to 20 students or less; or the number of school children crossing a major arterial road with two or four lanes with a regulatory speed limit of 60 km/hour decreases to 10 students or less. **Criteria IV – Gap Time** Street conditions are altered either through design or other external factors which results in an increase in Gap Times such that there are five (5) or more sufficient gaps (based on five minute time frames) during the defined periods children go to school, namely before and after school, which are available for children to cross a roadway safely. *OR* **Criteria IV – Sight Lines** The sight visibility distances improve through design or external factors which are sufficient to provide for the safe crossing of elementary school children at the crossing location.

3.9 Pedestrian Grade Separation

Documented and accepted warrant thresholds for grade separation are not available. Consideration for grade separation is usually based on the lack of alternative crossing options. Such is the case when some form of protected crossing is warranted, but installation of warranted devices are not practical due to limiting constraints such as road geometry/environment or spacing of adjacent traffic control devices. Grade separation may be considered when there is pedestrian volume, high risk of conflict with vehicles, limited opportunities for safe at-grade crossing, and where the road environment and elevations are conducive. Grade separated crossings are only effective where pedestrians can be directed to use the facility and sufficient property and capital funds are available.

3.10 Supplementary Features

The use of supplementary features, such as islands do not have warrant thresholds identified in the OTM, but thresholds have been established by other jurisdictions as shown in **Table 4**.

Crosswalk warrants and implementation guidelines are contained in the Transportation Association of Canada (TAC) Pedestrian Crossing Control Manual. In these guidelines the pedestrian volume is converted into equivalent adult units (EAU's) where children, seniors and the disabled are given preferential treatment to account for their higher vulnerability. Children and the disabled receive a weighting factor of 2 and seniors a factor of 1.5.

Thresholds for the use of bulb outs, textured pavement at pedestrian crossings/high visibility markings, specialized pedestrian signage, flashing beacons, barriers or delineators are not available.

Table 4: Supplementary Control Features Warrants

Traffic Control Feature	Threshold	Source
Refuge Island	100 pedestrians over peak 8 hours of the day Documented pedestrian safety concerns	City of Toronto
Flashing Beacon	3 collisions per year for 3 years	MUTCD
Crosswalk Lines	For a 2-lane (7.5m) cross-section : Traffic volume > 400 veh/h AND Equivalent Adult Units (EAUs) > 15 /hour [1] For a 4-lane (15 m) cross-section : Traffic volume > 300 veh/h AND Equivalent Adult Units (EAUs) > 15 /hour [1]	TAC

[1] Based on an "analysis period" which consists of the peak hour for traffic and pedestrian volumes combined.

3.11 Removal of Pedestrian Crosswalks

The use of crosswalk markings at unprotected locations offers the benefit of directing pedestrians to a preferred crossing location where alternative protected crossings are not conveniently available. The crosswalk can focus pedestrian activity and direct pedestrians to locations where sight distance is greatest or unanticipated conflicts are lowest.

However, unprotected crosswalks offer disbenefits of potentially encouraging pedestrians to cross at unprotected locations. There is also the potential that pedestrians who do not understand the rules of the road may mistakenly interpret the crosswalk markings as a protected crossing.

As vehicle volumes and speed on the roadway increase the exposure and risk to pedestrians, the disbenefits of unprotected crosswalks outweigh the benefits. According to the *Pedestrian Facilities Users Guide – Providing Safety and Mobility*, March 2002 by the U.S. Department of Transportation, marked crosswalks should not be used under the following conditions:

- Where the speed limit is 60 km/h or higher, and
- On a roadway with four or more lanes without a raised median or crossing island that has (or will soon have) an ADT of 12,000 or greater, or
- On a roadway with four or more lanes with a raised median or crossing island that has (or will soon have) an ADT of 15,000 or greater.

3.12 Pedestrian Crossings at Roundabouts

The OTM Book 15 provides recommendations for the application of pedestrian crossings at Roundabouts. Accommodating pedestrian crossings at roundabouts requires sidewalk connections to the pedestrian crossing, signing, curb depressions, and refuge islands on splitter islands. The following building principles for accommodating pedestrian crossings at roundabouts are outlined in OTM Book 15:

- Pedestrian crossings are provided around the perimeter of the roundabout, with pedestrian access to the centre island strongly discouraged.
- Pedestrian crossings be located one vehicle length (typically 6.0 to 7.5 metres), or a multiple thereof, back from the yield line.
- Aligning pedestrian crossings in a straight, continuous alignment across the entire roundabout, or angling the pedestrian crossing perpendicular to the direction of traffic.
- The width of the splitter refuge island areas used as part of the pedestrian crossing should be at least 1.8 metres wide; while the cut-through width along the length of the refuge island should be the same width as the pedestrian crossing.
- The application of pavement markings and signage, since there is no formal pedestrian right-of-way at roundabouts, unless accompanied by a traffic control device.
- Consideration of the application of the PEDESTRIAN AHEAD (Wc-7) sign.

An example of a roundabout with a pedestrian crossing the recommended signage, as per OTM Book 15, is illustrated in **Figure 6.**

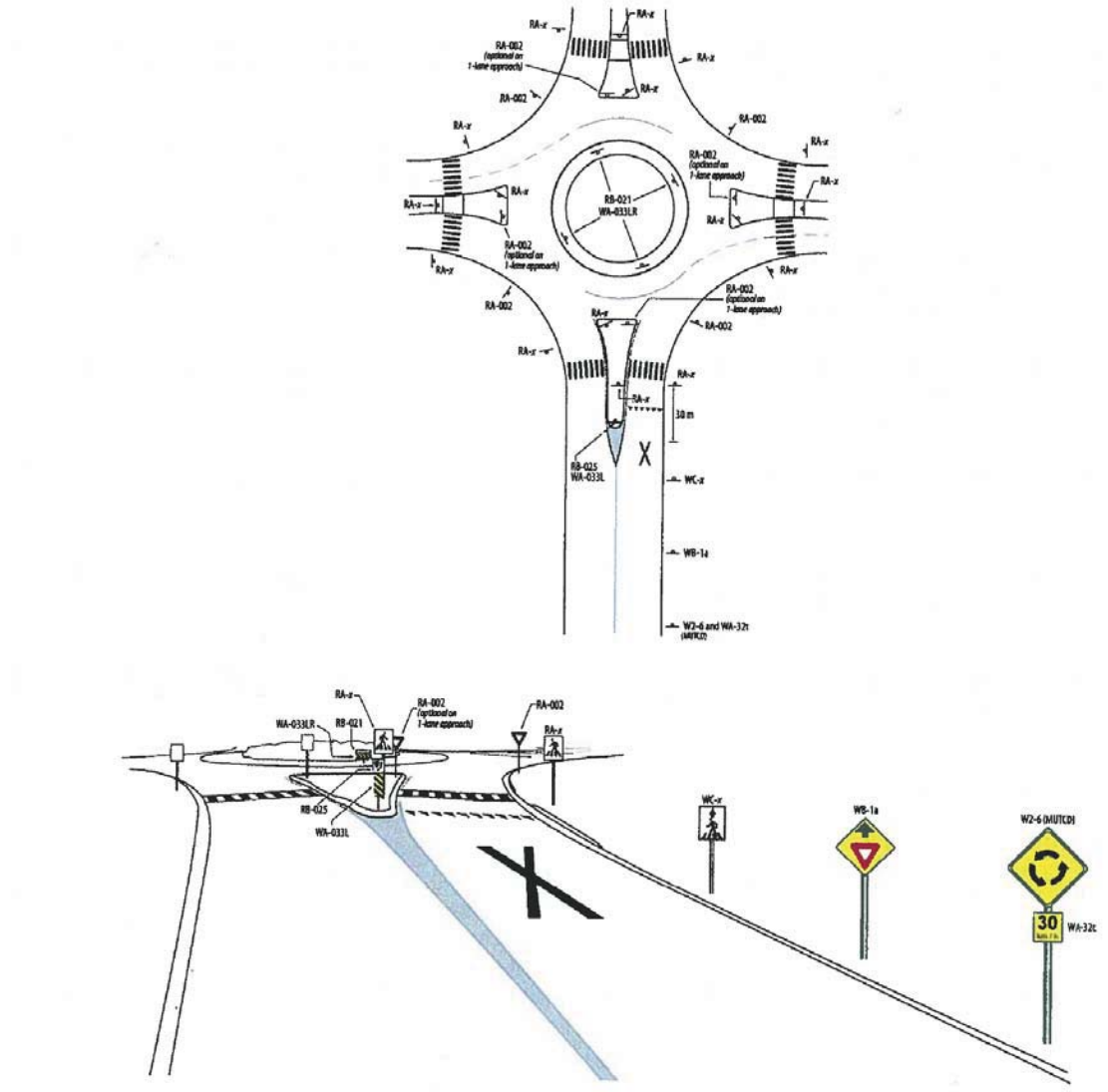


Figure 6: Example of a Roundabout with a Pedestrian Crossing and Recommended Signage

(Source: Figure 23 – OTM Book 15, December 2010)

3.13 Safety and Security

OTM Book 15 identifies various factors to be considered which influence the level of safety for pedestrians in the roadway environment. Those factors include:

- The degree of pedestrian-vehicle interaction
- Vehicle speeds
- Road users' expectancy
- Road users' perception
- Road users' awareness
- Road users' ability (mobility, vision, hearing and cognition), and
- Road users' understanding of the rules of the road.

These factors are further described in **Table 5.**

Table 5: Factors Influencing Safety

Factors Influencing Safety	Related Impacts and Considerations for Treatment of Pedestrian Crossings
Degree of pedestrian-vehicle interaction	The potential for conflicts and collisions is directly affected by the level of interaction between road users. A higher exposure of pedestrians interacting with vehicles (from higher vehicle or pedestrian volumes) will generally result in a higher potential for pedestrian collisions.
Vehicular speed	The higher the vehicular speed at the time of impact, the higher the probability of fatality of pedestrians. Relatively small changes in speed can have a large impact on the severity of a pedestrian crash (particularly between 40 km/h and 60 km/h).[2]
Driver and pedestrian expectancy	Expectancy influences the speed and accuracy of information processing; and conditions that meet or reinforce expectancies help drivers and pedestrians to respond quickly, efficiently and without error. Violations of expectancy increase the chance of inappropriate decisions that lead to conflicts or inability to control vehicles safely.
Perception (visual acuity and visual contrast)	There is an inherent limitation in drivers' or pedestrians' ability to detect objects especially under low visibility conditions. The amount of sight distance available is not the same as the distance at which the driver or pedestrian can detect and identify a conflicting object. Furthermore, the difference between visual acuity and visual contrast should also be considered. Visual acuity is a measure of the ability to identify black symbols on a white background at a standardized distance. The common threshold of "20/20 vision" translates to the ability to read text at 17 metres away for every 2.5 centimetres of text height. Visual contrast on the other hand is the ability to distinguish between various shades of gray. At night, a driver's visual contrast is much more important for detecting pedestrians than visual acuity. Both visual acuity and visual contrast decline continuously with age. In particular vision performance begins to worsen at age 20. The decline in visual acuity increases most rapidly after age 40 for objects perceived while in relative motion to the target (driving), and after age 60 for static objects. [3]
Level of awareness (positive guidance and driver workload)	Humans behave as a single channel processor, which means they are able to conduct one task consciously at a time. A more complex driving environment will therefore require a higher level of mental effort and reduce one's ability to focus upon the driving tasks. Positive guidance serves to consider a driver's workload and reduce the occurrence of

[2] Shinar, David, Traffic Safety and Human Behavior, Elsevier Ltd, 2007, p. 640

[3] Dewar, Robert and Olson, Paul. Human Factors in Traffic Safety, Lawyers & Judges Publishing Company, Inc. p. 146

Factors Influencing Safety	Related Impacts and Considerations for Treatment of Pedestrian Crossings
	multiple potential conflicts. As defined in OTM Book 1C, "Positive Guidance is provided when that information is presented unequivocally, unambiguously and conspicuously enough to meet decision sight distance criteria and enhances the probability of drivers making appropriate speed and path decisions."
Comprehension of crossing requirements	Ambiguity in the form of crossing features can affect the consistency of driver and pedestrian behaviour in yielding right of way. An inconsistency in road user behaviour can lead to reduced safety.
Pedestrians ability	Pedestrians differ in terms of their mobility, and speed, and their ability to perceive and react to potential conflicts, and recognize and understand traffic control devices. Designs for crossing devices should have regard for the needs of all pedestrians (i.e. the elderly, young and persons with a disability). It is also important to note that under the *Accessibility for Ontarians with Disabilities Act, 2005*, design elements as part of pedestrian crossings must meet the mandatory accessibility standards (see **Section 5.3 of OTM Book 15).**
Rules of the Road	The rules of the road under the *Highway Traffic Act* provides the basis that governs and manages competing traffic movements, however, inconsistent interpretation, ignorance, or disregard of the law leads to potential for conflicting actions. A balance of continuous education and enforcement contributes to general population's awareness and understanding, which contributes to the overall safety.

Source: OTM Book 15 – Table 1 – Factors Influencing Safety, December 2010

4. CURRENT PRACTICES IN SUDBURY

Current pedestrian crossing facilities and practices within the City of Greater Sudbury can be summarized as follows:

- Pedestrian crossings were within the jurisdictions of lower tier municipalities prior to the amalgamation of the City of Greater Sudbury.
- The City of Greater Sudbury currently applies guidelines prescribed in the Ontario Traffic Manual for traffic signal control. There are approximately 117 traffic signals in the City of Greater Sudbury.
- The use of intersection pedestrian signals and pedestrian signals is based on the OTM method, using Justification 5 Pedestrian Signals Warrant. There are currently two intersection pedestrian signals and three pedestrian signals in the City.
- There are no pedestrian crossovers installed in the City.
- The use of refuge islands has been implemented at several unprotected crossing locations. Common pedestrian treatments include curb depressions, warning signage, and use of partial zebra markings in lieu of typical crosswalk lines. Crossings of this nature include special message signage instructing pedestrians to yield to vehicular traffic, using “yield to traffic” signs. The City has also undertaken educational campaigns through the dissemination of pamphlets on the rules of road at these crossing.
- The uses of textured crosswalks are found at several all-way stop intersections in the downtown area. There are also painted crosswalk lines in parallel.
- The City has various unprotected crossings that are located at midblock locations, which are used to connect off-road pathways that typically run between properties. Wc-7 signs (refer to OTM Book 6) are placed along the roadway on each approach to the crossing. No warning signage is currently used along the pathway at the midblock crossing.
- There are crossing locations that are marked but unsigned. There is no formalized process for the removal of unsigned painted crosswalks.

5. BEST PRACTICES RESEARCH

5.1 Survey of Current Practices

Across Canada and in Ontario standard traffic control signals represent the most common feature for accommodating pedestrian crossings of major roadways. Many jurisdictions in Ontario also use a second form of protected crossing in instances where traffic control signals are not warranted, either IPS' OR PXOs.

For protected crossings most jurisdictions use OTM Book 12 warrants and threshold values for implementing traffic signals and pedestrian crossovers. There are an increasing number of jurisdictions implementing IPS'. Some utilize OTM methodology to implement IPS' including the City of Greater Sudbury, while other jurisdictions use the Priority Points methodology. Overall there is a trend away from the use of PXOs due to concerns over costs and dilemma zone and lack of a clearance interval.

The City of Toronto, which operates over 600 PXOs, has initiated a policy to review pedestrian crossover locations and to convert PXOs that do not meet environmental criteria to traffic control signals. The City of Ottawa and the Region of Durham have also implemented phase-out strategies.

Other features used by Ontario jurisdictions to accommodate pedestrians include: pedestrian refuge islands, specialized signs for unprotected crossings (Belleville and Kingston "Courtesy Crossings"), and grade separations (Belleville and Oakville). Four of nine jurisdictions indicated that they mark unprotected crossings.

A number of jurisdictions also indicated there is a lack of understanding of rules of the road and right of way at pedestrian crossings.

5.2 Risk and Liability

In the management of a roadway, risk and liability exist in perceived negligence, including nonfeasance and malfeasance. Nonfeasance is a condition that exists when a hazard knowingly or unknowingly exists and no effort is made or planned to be made to correct the problem. Malfeasance is a condition when an effort is made to address a hazard, but poor judgment or implementation is cited for an unsuccessful operation.

To minimize these risks, the City of Greater Sudbury can proactively monitor the safety of operations at pedestrian crossings to identify hazards and plan mitigation, establish policies that are consistent with accepted engineering practice and sensitive to the local environment, and implement improvements that are consistent with the policies / practices of their underlying principles. Practices should avoid ambiguity that may lead to confusion and misinterpretation of traffic control devices.

5.3 Safety Research

As noted, pedestrian safety is related to the level of awareness of drivers and pedestrians of potential conflicts and the level of pedestrian and driver understanding of who has the right of way where there is vehicle-pedestrian interaction. The use of traffic control features for pedestrian crossings must balance the risk (i.e. safety and liability) of encouraging pedestrian crossing activity at unprotected locations where there is potential for conflict, with the benefits of defining a preferred crossing location or alerting drivers to crossing activity.

5.3.1 Protected Crossings

Mid-block Signals

A study in the City of Tuscon (***Implementation of a Program to Reduce Pedestrian-Related Accidents and Facilitate Pedestrian Crossing,*** Glock et al.) reported driver's compliance at mid-block signal locations is as good as driver compliance at traditional signals. In a separate publication, some driver violations were reported (***Alternative Treatments for At-Grade Pedestrian Crossings***, ITE), however this report did not offer a quantitative assessment of the relative frequency of violations. Overall, the right-of-way at mid-block crossings with traffic signals are generally well understood by pedestrians and drivers, and as such, pedestrians and drivers are generally receptive to this type of control measures. Mid-block signals remain an accepted and appropriate crossing feature.

Intersection Pedestrian Signals (IPS or half-signals)

The concern with Intersection Pedestrian Signals has been the familiarity of road users with the signal operation and the "stop" sign compliance of motorists since side street traffic may focus on vehicle gaps rather than pedestrian phase. Failure to complete a full stop during pedestrian phase may result in a conflict. According to the recent research ***A Technical Review of Pedestrian Signals in Canada*** by the Canadian Institute of Transportation Engineers on "stop" sign compliance:

- There is no consistent trend on the observed stop sign violation rates between the 2000 and 2002 surveys. Some locations were subject to increased rates while rates decreased at other locations.
- Those locations with high main street volumes and high side street volumes show high stop sign violation rates.
- The warrant analysis has shown that high motorist non-compliance with side street stop signs has often occurred at locations where a pedestrian signal is operating where a full traffic signal is warranted.

A safety review of collision data for 25 pedestrian signals in Hamilton, Ontario determined that pedestrian collision rates decreased after installation of the intersection pedestrian signals. While vehicle collision rates increased at some locations and decreased at other locations, the average vehicle collision rate over all of the locations studied was lower after the IPS' were installed (***Safety Review of 25 Pedestrian Signals***, City of Hamilton)

A study in Portland, Oregon indicated that the frequency of angle collisions involving side street traffic was not increased, however, red light violations increased due to the long dwelling period on the green signal. (***Alternative Treatments for At-Grade Pedestrian Crossings, ITE***)

Overall, IPS' allow for a clearance interval, is an accepted device to complement traffic control signals, and are seen as an appropriate feature for the City of Greater Sudbury. However, given that there is limited statistical research into the operations of IPS', the City of Greater Sudbury should consider driver workload turning from the side-street and potential for vehicle-pedestrian conflicts at any new IPS locations.

Pedestrian Crossover

No published references quantifying the safety implications of pedestrian crossovers were identified, however previous studies have been raised concerns about PXO operations. Unlike traffic control signals, PXOs do not have a clearance interval (amber phase) during which time drivers can clear the crossing. Without the clearance phase, drivers face a 'dilemma zone' where drivers may have insufficient time to see pedestrians and stop comfortably. In many locations driver stopping behaviour is inconsistent, leading to rear-end vehicle-vehicle collisions. Human factors experts have raised concerns over the conspicuity of flashers, particularly during daytime hours (***Review of Pedestrian Refuge Islands and Split Pedestrian Crossovers***, City of Toronto).

The City currently does not have any PXOs. Past staff reports have noted unfamiliarity among Sudbury drivers and pedestrians as one of the reasons for not installing PXOs. There is no research available that addresses the acceptability of the 'dilemma zone' inherent in PXOs or any benefits of PXOs over alternative crossing features such as IPS' or traffic control signals.

Pedestrian Grade Separation

Studies have shown that pedestrians will not use the overpass or underpass if they can cross at street level in less time (***Canadian Research on Pedestrian Safety, Report No. FHWA-RD-99-090,*** Van Houten). Other important design considerations include accessibility, lighting, drainage, and aesthetics.

Grade separation can be a feasible alternative to at-grade crossings. However the benefits should be assessed relative to costs and in recognition of the likelihood of pedestrians using the grade separation.

A summary of the implications of crossing alternative is summarized in

Table 6.

Table 6: Assessment of Alternative Pedestrian Facilities

Facility Type	Pros	Cons
Traffic Control Signals	▪ Allows for pedestrians to cross during their own "protected phase" ▪ Drivers must yield during pedestrian green phase ▪ Amber phase allows drivers to clear the intersection	▪ Pedestrians susceptible to conflicts with turning traffic ▪ Unwarranted signals can increase delay to traffic ▪ May increase delay to pedestrians ▪ Potential for higher number of rear end collisions
Intersection Pedestrian Signals	▪ Minimize side street delay ▪ Pedestrians cross during own "protected phase" ▪ Amber phase allows drivers to clear the crossing ▪ Lower delay to side street than all-way signals ▪ Does not attract more traffic to the side street as would a conventional signal	▪ Low public familiarity ▪ Side street vehicle focus is on vehicle gaps rather than pedestrian activities ▪ Main street driver confusion may contribute to rear end collision potential ▪ Limited data on the safety implications of IPS ▪ Cost of installation is high
Mid-block Pedestrian Signals	▪ Allows for pedestrians to cross during their own "protected phase" ▪ Drivers must yield during pedestrian green phase ▪ Amber phase allows drivers to clear the intersection	▪ Unwarranted signals can increase delay to traffic ▪ Cost of installation is significant ▪ Potential for higher number of rear end collisions
Pedestrian Crossovers	▪ Drivers must yield after pedestrian activate flashers ▪ Flashing beacon may draw driver attention to a crossing	▪ Beacons not conspicuous during daylight conditions ▪ Lack of amber phase results in a "dilemma zone", drivers may not have time to see pedestrian and stop comfortably ▪ Inconsistent driver behaviour with stopping ▪ Significant costs for installation and on-going maintenance
Pedestrian Grade Separation	▪ Highest form of protected measure	▪ Cost of installation and maintenance ▪ Pedestrians will not use if a more direct route is available ▪ Possible security concerns

5.3.2 Unprotected Crossings

The decision to implement unprotected crossings is a balance between increased driver awareness of crossing activity (on the positive side) and more aggressive pedestrian activity (on the negative side). Painted crosswalks for example, in absence of a crossing guard, stop control, PXO or traffic signals can instill a false sense of security for pedestrians. Extensive research projects have demonstrated how the introduction of unmarked crosswalks has increased vehicle-pedestrian collision frequency (***Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Analysis of Pedestrian Crashes in 30 Cities, Zegeer et. al***.).

Warning signage on the other hand may help alert drivers, without increasing pedestrian aggressiveness. In addition, a variety of treatments as discussed in **Section 2.2** may be considered. The advantages and disadvantages of each type of treatment are summarized in **Table 7.**

Table 7: Summary of Common Supplementary Treatment Options

Facility Type	Pros	Cons
Refuge Island and Centre Medians	▪ Simplifies pedestrians crossing decisions ▪ Reduces walking distance ▪ Reduces pedestrian delays through increases in gap availability	▪ Ineffective under certain conditions ▪ Inconvenience to road maintenance vehicles ▪ Vehicle-curb collisions
Bulb Outs or Curb Extensions	▪ Reduces walking distance ▪ Improves visibility of pedestrians ▪ Traffic calming	▪ Inconvenience to road maintenance vehicles ▪ Vehicle-curb collisions ▪ Reduces on-street parking
Textured Surfaces	▪ Attracts drivers' attention ▪ Identifiable by pedestrians with visual impairment ▪ Traffic calming	▪ Noise impacts ▪ Maintenance cost ▪ May not be as visible as the high-visibility markings ▪ May lead pedestrians to believe they have the right of way if crosswalk is unsigned
High-visibility markings	▪ Attracts drivers attention ▪ Identifiable by pedestrians with low vision	▪ Maintenance cost ▪ May lead pedestrians to believe they have the right of way if crosswalk is unsigned
Standard Warning Signage (e.g. Pedestrian ahead sign)	▪ Heighten driver and pedestrian awareness	▪ Overuse of treatment may result in "novelty effect"

Facility Type	Pros	Cons
Specialize Sign Formats (e.g. Fluorescent yellow-green warning signs)	▪ Attracts drivers attention to crossing activity ▪ More conspicuous at night and at dusk	▪ Overuse of treatment may result in "novelty effect"
Flashing Beacons	▪ Attract driver attention	▪ Inconsistent driver behaviours at crossing
Barriers	▪ Control pedestrian activity and direct pedestrians to preferred crossing point	▪ Pedestrians who enter the road around or over the barriers may become trapped within the roadway and become in conflict with on-coming vehicles
Delineators	▪ Delineator posts can be used to alert drivers to the boulevard ▪ Reflective tape can significantly improve night visibility of formal and informal crossings	
Special Message Signs (e.g. Courtesy Crossing or Yield to traffic)	▪ Clearly identifies right-of-way	▪ Inconsistent driver behaviour and stopping expectation and pedestrian compliance for "Courtesy Crossing"

Research related to some of the more common treatments are summarized. It is not all inclusive as there are many combinations and variations for each treatment.

Refuge Island

As noted, "Pedestrian refuge islands are suitable for wide two-way streets with four or more lanes of moving traffic travelling at higher speeds [50 km/hr or higher]. They are useful to persons with mobility disabilities, very old or very young pedestrians who walk at slower speeds." Research by the Federal Highway Administration entitled ***Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations*** (2002) concluded that the presence of a raised pedestrian island (or median) was associated with a significantly lower pedestrian crash rate at multi-lane sites. These results were in basic agreement with previous studies that found safety benefits for medians and refuge islands. However, the use of refuge or median islands is dependent on the surrounding condition. Research has shown that reductions in pedestrian-related collisions occurred only at sites where refuge islands were constructed on roads adjacent to high pedestrian generators (***Road Safety at Pedestrian Refuges, Lalani)***.

Some municipalities do not install refuge islands, citing maintenance issues.

There is an overall benefit in refuge islands if they are implemented within suitable environmental conditions; and the City has successfully implemented number of them. It is recommended that the City continues the use of pedestrian refuge islands as appropriate. Traffic

conditions at the existing locations should be monitored on a regular basis for any increase in traffic, which may warrant more protective measures.

Curb Extensions

Curb extensions reduce the crossing distance for the pedestrians and also increases visibility of pedestrians. It may be considered where there are mid-block crossing from both sides. Numerous publications document the benefits of curb extensions and their application in urbanized low speed environments.

Curb extensions represent a new alternative feature that the City of Greater Sudbury can consider in urbanized low speed environments.

Textured Surface

Although there has been limited research with respect to the use of textured crosswalk and its safety impact, the use of textured surface is prescribed under the ***Alternative Treatment for At-Grade Pedestrian Crossings, ITE*** and the ***Canadian Guide to Neighbourhood Traffic Calming, TAC.*** However based on observations at unsignalized crosswalks in the City of Belleville and City of Kingston and other jurisdictions, driver behaviour (courtesy gaps) may not be consistent and may contradict the rules of the road.

Textured surface and high-visibility markings are similar in that both styles attract drivers' attention. Zebra style markings have been implemented with the City, and to maintain uniformity, textured surface is not recommended at mid-block locations.

High-visibility Markings

High visibility markings include Zebra style markings. One recent study investigated the safety effects of Zebra markings at two signalized intersections. The study results showed a statistically significant 80% reduction in vehicle-pedestrian conflicts after the implementation of the markings at one of the two sites (***Evaluation of Zebra Crossings***, City of Toronto).

No definitive North American research findings have been presented on Zebra style markings at unprotected crossings. The lack of research neither draws into question nor supports the use of Zebra style markings.

The City of Greater Sudbury has implemented Zebra style markings at fourteen intersections as a trial to enhance the visibility of the crosswalk and improve safety for pedestrians. Many of the trial locations included crossings locations where previous concerns about pedestrian safety were raised, as well as locations with high volumes of pedestrian and vehicle traffic, and a high percentage of seniors and school aged children. The City has received positive responses to the zebra markings, and as budget becomes available, the City has recommended continuing to install the zebra crossing markings at signalized intersections. The City however, has stopped using Zebra style markings at unprotected crossing locations, with the exception of the crossing at the Rainbow Mall, across Elm Street and at some rural school crossings.

Fluorescent Yellow-Green Warning Signs

The use of fluorescent yellow-green signs attracts attention and enables higher frequency of detection and recognition by drivers in comparison to regular yellow warning signs.[4] Its application includes courtesy crossing (City of Belleville) and school crossing (City of Burlington, City of Kingston). Studies have shown that drivers were able to detect and recognize the signs from greater distances than standard yellow warning signs (***Fluorescent Yellow Green Warning Signs for Pedestrians, School and Bicycle Crossings, Kittle)***. A human factors study has also identified that the "novelty effect" does not negate the effectiveness over the long term (***Driver Looking Behavior in School Zones with Florescent Yellow Green and Normal Yellow Signs)***. The City of Kingston has cited a 50% increase in yielding to pedestrians at unprotected crossings.

The results of the City of Kingston study highlights the effectiveness of the sign, but raises questions about increasing ambiguity of right of way rules at unprotected crossings. Therefore, the use of fluorescent yellow-green signs should not be adopted as a means of justifying unprotected crossings.

"Yield to Traffic" Sign

The Province of Ontario is unique in that pedestrians must yield to traffic approaching an unprotected crossing. In some instances signage (Wc-28 in the OTM Book 6) are used to clarify to pedestrians in instances when they do not have the right of way. No research has been completed assessing the effectiveness of these signs; however similar signs have been implemented to address operational issues with pedestrian refuge islands.

5.3.3 Removal of Pedestrian Crosswalks

Studies have shown that marked crosswalks alone have resulted in higher numbers of pedestrian-related collisions at uncontrolled or unsignalized (mid-block and intersection) locations when compared with having no marked crosswalks on multilane (four or more travel lanes) roadways with ADTs of 10,000 or more (***Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations, Zegeer et. al***.). In contrast, there was no difference on two-lane roads and multilane roads with less than 10,000 ADT. As a result of this study, countries such as Great Britain, Germany, Sweden and some Calfornia Cities (Los Angeles) have removed marked crosswalks as a treatment at uncontrolled locations on multilane streets during resurfacing projects with some positive results (***Alternative Treatments for At-Grade Pedestrian Crossing, Lalani et. al)***.

The City of Greater Sudbury may consider the quantitative and qualitative measures identified in **Section 3.11** in justifying crosswalk removal on multilane roads. It is important to consult all the stakeholders in the process and consider all legal ramifications regardless of removal or not. Pedestrians and especially those with mobility needs will have to be accommodated elsewhere if pedestrian crosswalks are removed. Crosswalk markings must be maintained in good condition,

[4] Alternative Treatments for At-Grade Pedestrian Crossings, ITE

and be supplemented with warning signs or other features that will increase drivers' and pedestrians' awareness if pedestrian crosswalks are not removed.

5.4 Conclusions

From the review of survey of current practices, risk, and research into operational characteristics of crossings, the following points were considered in the development of the crossing policy:

- It is desirable to distinguish between protected and unprotected crossings, such that drivers and pedestrians understand who has the right of way.
- Mid-block unprotected crossings with pavement markings may lead unaware pedestrians and drivers to believe that the crossing is protected for pedestrians.
- Pavement Markings at unprotected crossings may result in inconsistent driver yielding ('courtesy gaps') provided by drivers. This is of particular concern leading to vehicle-vehicle or vehicle-pedestrian conflicts on 4-lane facilities where driver yielding behaviour in one lane may not be consistent with another.
- At mid-block locations, where the adjacent land uses such as high pedestrian generators and trails create high mid-block crossing demand, signage can contribute to driver awareness and pedestrian caution without making the rules of right of way ambiguous for drivers and pedestrians.
- If implementing protected crossing features (PXO's or IPS') to supplement traffic control signals, they should be done so in sufficient quantity such that pedestrians and drivers are familiar with their operation.
- There are operational concerns with PXO's related to the dilemma zone and clearance requirements.
- There is a trend toward the use of IPS' and a trend away from PXO's amongst Ontario municipalities surveyed.
- IPS' allow for a clearance interval, is an accepted device to complement traffic control signals, and are seen as an appropriate feature for the City of Greater Sudbury.
- Given that there is limited statistical research into the operations of IPS', the City of Greater Sudbury should consider driver workload turning from the side street and potential for vehicle-pedestrian conflicts at any new IPS location.

6. RECOMMENDED PEDESTRIAN CROSSING POLICY

6.1 Decision Process for the Consideration of Traffic Control Devices

It is recommended that the City of Greater Sudbury implement the following pedestrian features as warranted based on OTM Book methodologies and thresholds, to accommodate protected pedestrian crossings:

- Traffic control signals at intersections
- Traffic control signals mid-block
- Intersection pedestrian signals, and
- Adult crossing guards.

The decision process for determining an appropriate traffic control device to accommodate pedestrians crossing a roadway is dependent on an assessment of pedestrian crossing needs at a particular intersection and the available warrants for traffic control devices. The implementation of traffic control devices must take into consideration the accommodation of pedestrians, while also maintaining the overall continuity and connectivity of the road network.

The process should commence with an assessment of traffic conditions based on field-generated data such as vehicle and pedestrian volumes, delays to crossing pedestrians, roadway geometry, pedestrian desire lines and collision data for example.

Based on this assessment, Justifications 1 through 6 identified in OTM Book 12 should be referred to, to determine if full traffic signals are warranted. If warranted, then an engineering assessment should be undertaken to determine whether the installation of traffic signals is geometrically feasible based on the conditions of that particular site (e.g. signal spacing, adequacy of sight lines, traffic progression, benefit/cost, etc.)

If traffic signals are not warranted, then other pedestrian control measures should be considered such as the use of stop or yield signs, pedestrian crossing enhancements such as pavement marking improvements, or the addition of applicable pedestrian-crossing warning signage.

Other considerations such as grade separation may also be considered if such as crossing is warranted, funding is available for a grade separated crossing, and other recommended pedestrian crossing measures are not feasible.

Additional details on the decision-making and selection process for traffic control devices are provided in Section 3.1.2 of the OTM Book 15. It is recommended that the City of Greater Sudbury follow this decision-making process when considering and selecting appropriate pedestrian crossing facilities.

Additional recommendations for various types of traffic control devices for the City of Greater Sudbury are provided in the following subsections.

6.2 Traffic Control Devices

6.2.1 Traffic Control Signals

For the installation of traffic control signals at intersections, mid-block locations, it is recommended that the City of Greater Sudbury implement these features as warranted, based on the OTM Book methodologies and thresholds.

6.2.2 Intersection Pedestrian Signals

For the installation of Intersection Pedestrian Signals (IPS), it is recommended that the City of Greater Sudbury implement these features as warranted, based on the OTM Book methodologies and thresholds. IPS's should particularly be considered at locations where there is a documented safety problem (i.e. visibility or measured sight distance constraints, collision trends, or frequent vehicle-pedestrian conflicts) and traffic signals are not warranted. In considering IPS applications, the City will have regard for driver workload for sidestreet approaches in the decision to implement and in the design. The decision to install unwarranted signals should weigh the benefits against the negative impacts.

6.2.3 Pedestrian Grade Separation

Pedestrian grade separation should be considered within the context of potential benefits and costs, at locations where the other forms of protected crossings are warranted, but cannot be implemented due to environmental constraints (such as distance of adjacent traffic controls). Grade separations are viable only if pedestrians can be directed to use the facility and sufficient property and capital funds are available.

6.2.4 Unprotected Crosswalks

With the exception of crosswalks for school crossing guards, marked unprotected crosswalks should generally be discouraged. However, the specific characteristics and needs of each location should be carefully considered and appropriate treatments applied to maximize safety. For example, consideration has been given to the delineation of high contrast markings to distinguish pedestrian desire lines in highly urban areas where drivers are aware of very high pedestrian activity. In these locations, pedestrian signage should acknowledge that pedestrians do not have the right of way over vehicles (e.g. OTM Book 6 Wc-28 sign). In other areas where there is high pedestrian/vehicular activity and/or high vehicle speeds, pedestrian markings at unprotected locations should not be implemented.

At locations where unprotected crosswalks are maintained, warning signage can be implemented as appropriate (OTM Book6 Wc-3, Wc-7 signs or specialized signs) that will increase drivers' awareness of pedestrian activity. Pedestrian refuge islands or centre medians will also be considered as a passive feature at unprotected crossing points where lane alignment is not compromised (e.g. integrated with centre turn lanes). Other measures such as reflective delineator poles may be considered at the boulevard of unprotected crossing locations in order to draw the driver's attention to potential crossing activity.

The City of Greater Sudbury shall consider removing unprotected crosswalks on high speed or high volume multilane roads, where the crosswalk is not specifically intended to direct pedestrians away from crossing at locations with poor sight lines or unanticipated conflicts. The City will consider the removal of unprotected crosswalks under the following circumstances:

- Where the speed limit is greater than 60 km/h, and
- On a roadway with four or more lanes without a raised median or crossing island that has (or will soon have) an ADT of 12,000 or greater, or
- On a roadway with four or more lanes with a raised median or crossing island that has (or will soon have) an ADT of 15,000 or greater.

The removal of crosswalks should include public notification.

On two lane, low speed roads (e.g. 50 km/h or less) in sub-urban areas, where unprotected crosswalks are maintained, it is recommended a pedestrian warning sign (Wc-7) be posted in advance of the crossing per OTM Book 6, and that two back to back Wc-7 signs be mounted on each side of the road in the immediate vicinity of the crossing. Additionally, no pavement markings shall be used to denote the crossing on the roadway and existing pavement markings shall be removed.

6.2.5 Off-Road Pathway Crossings

For off-road pathway crossings, the City should remove the pavement markings used to denote the crossing. Since pedestrian crossing activity would likely continue at these locations, following the removal of the crossing pavement markings, the City should follow the recommendations identified in Section **6.2.4** for two lane, low speed roads, where existing off-road pathway crossings are located.

In addition, “Yield to Traffic” signs, similar to those used at the Elm Street crossing, bollards or gates should be considered on the pathway approaches to the road crossing. Wc-7 signs should continue to be used on each of the roadway approaches. It should also be noted that these locations may also be suitable for the application of RA-x signage, as indicated in OTM Book 15, as a pilot project. OTM Book 15 identifies the application of RA-x signage placed along the roadway between 10 and 15 metres from the pathway crossing (Refer to OTM Book 15; for Proposed HTA, December 2010 - Figure 23).

6.3 Next Steps

It is recommended that the City of Greater Sudbury proactively address pedestrian safety needs and establish a program of reviews of pedestrian crossings either through on-going traffic operations studies or annual corridor reviews. Compliance with the pedestrian crossing practices will be reviewed, and necessary roadway and traffic control modifications programmed and implemented. Streetlight warrants and maintenance should also be monitored.

Other features may be considered for implementation by the City of Greater Sudbury on a site-by-site basis to enhance pedestrian safety based on the needs of the particular site.

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February 2012

Pedestrian Traffic Study
Crossing Review

City of Greater Sudbury

Greater Grand Sudbury

Final Report

TABLE OF CONTENTS

List of Exhibits

1. INTRODUCTION

1.1 Project Objectives

The City of Greater Sudbury has been responsive to the need to better accommodate the safety and security of pedestrians in the roadway environment. To this end, the City initiated a pedestrian crossing policy study and reviews of pedestrian safety and accommodation of "in-service roads". This study is an assessment of specific pedestrian crossings in downtown Sudbury.

It is the objective of the study to assess the appropriateness of the existing forms of pedestrian crossings. It provides an inventory of existing conditions and identifies opportunities to improve pedestrian crossing safety. For the recommended measures, an implementation strategy is also identified.

It should be noted that this study commenced in 2006 with a draft report submitted to the City at that time. Since then, some of the recommendations identified in the draft report have been implemented. Other changes that have occurred at the study sites since 2006 have also been noted in this version of the report.

1.2 Study Context

Pedestrian safety is related to the level of drivers and pedestrian awareness of potential conflicts, the level of pedestrian and driver understanding of who has the right of way where there is vehicle-pedestrian interaction, and the degree of care and disregard for safety. Efforts can be made to address each of these effects on pedestrian safety through public awareness and education. In addition, awareness and understanding of right of way can be enhanced through the design of road signs and pavement markings, and pedestrian infrastructure.

Road designs and use of traffic control measures can help maximize driver and pedestrian awareness of vehicle-pedestrian interaction, minimize distractions and obstructions, and improve understanding of which road user has the right of way. It is engineering practice to select designs that:

- Offer consistency in design approach in order to contribute to driver expectation that is appropriate for the road environment and potential hazards, and
- Are appropriate for the unique characteristics for each individual site.

The City developed draft pedestrian crossing policies in light of the benefits of improving driver and pedestrian awareness and understanding of right of way. The application of the policies cannot be applied in all instances. It is recognized that each site is unique. The sites under review have been identified as a result of configurations that are historical and may have resulted from a combination of land uses and roadway characteristics that are no longer desirable from a pedestrian safety and security perspective. In many situations, opportunities to change the fundamental nature of the pedestrian environment may not be feasible. However through this

study, efforts have been made to maximize driver and pedestrian awareness and understanding for each site.

1.3 Study Scope

This report presents the findings of the pedestrian review for three specific crossing locations in the downtown area, identified below and indicated in **Exhibit 1**:

- Elm Street (west of Notre Dame Avenue between City Centre and Sudbury Transit Terminal)
- Ste. Anne Road (between Ignatius Street and Notre Dame Avenue), and
- Brady Street at Shaughnessy Street

A detailed review of collision history was beyond the scope of this study. However, the City did provide traffic and pedestrian volume and collision data. The study included field visits that included observations of driver and pedestrian behavior and documentation of traffic controls and traffic conditions.

The report provides a site description, a summary of road and traffic conditions, existing traffic control, an assessment of factors that affect pedestrian safety, and opportunities for pedestrian safety improvements. The report assesses the relative merits of safety improvement alternatives and identifies any improvements recommended for implementation.

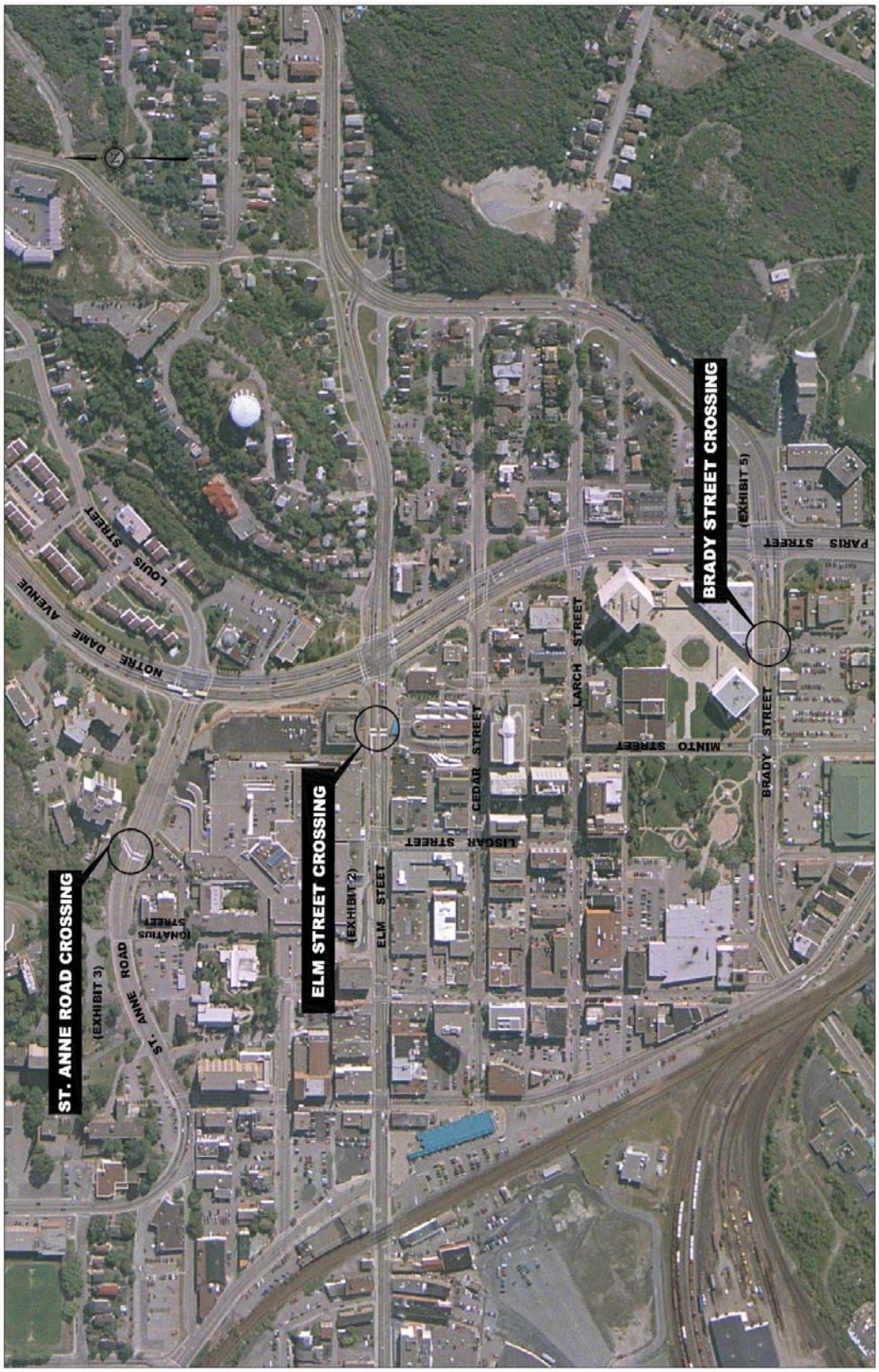

Exhibit 1: Site Locations

2. ELM STREET CROSSING

Exhibit 2: Elm Street Crossing

2.1 Site Description

The Elm Street crossing is an unprotected marked mid-block crossing located between two signalized intersections, Notre Dame Avenue – Paris Street approximately 50 metres to the east and Lisgar Street approximately 100 metres to the west. Elm Street is a 5-lane road with centre left turn lanes at the intersections. The posted speed on Elm Street is 50 km/h and carries a daily traffic volume of 16,000 vehicles. There are sidewalks along both sides on Elm Street with roadway illumination. Parking is prohibited within the vicinity of the crossing.

The surrounding land uses and buildings are illustrated in **Exhibit 2.** They include:

- Rainbow Value Centre (northwest corner of the Elm Street and Notre Dame Avenue – Paris Street intersection)
- Sudbury Transit Terminal (southwest quadrant of the Notre Dame Avenue and Elm Street intersection)
- Public parking lot located west of Sudbury Bus Terminal
- Commercial retail, offices and government buildings
- Residential and senior's home.

There are driveways within the proximity of the crossing:

- The Rainbow Value Centre driveway (35 metres west of the crossing)
- Public Parking lot driveway (35 metres west of the crossing), and
- Bus Terminal driveway (slight offset to the west of the crossing).

A raised median extends approximately 90 metres westerly from Notre Dame Avenue-Paris Street to the Mall entrance driveway with a 3-metre cut-out for the mid-block crossing. Fencing barrier is installed on portion of the median close to the Elm Street / Notre Dame Avenue – Paris Street intersection and the remaining portion has planters constructed. See **Exhibit 3**.

Exhibit 3: Raised Median Extending from Elm Street / Notre Dame Avenue – Paris Street Intersection

There are curb depressions at both ends of the crosswalk. The crosswalk lines are identified through zebra markings. The crossing is signed with "Seniors Crossing" warning signs. There are two signs facing each direction of traffic. There are also "Yield to Traffic" warning signs facing each curb side directed at pedestrians. See **Exhibit 3** and **Exhibit 4**.

The Elm Street / Notre Dame Avenue – Paris Street intersection is west of a vertical crest on Elm Street. The Elm Street / Notre Dame Avenue – Paris Street intersection has a channelized southbound right turn lane that is 'Yield' controlled.

Exhibit 4: Elm Street Crossing

2.2 Traffic Conditions

There is considerable pedestrian activity at the Elm Street crossing. The Rainbow Value Centre and the Sudbury Transit Terminal are both major pedestrian generators and contributors. Significant pedestrian activity is also generated from the surrounding land uses, which includes commercial retail, government buildings, a residential area, and schools. In a peak period count conducted on October 18, 2005, 757 pedestrian crossings were observed from 11:45 am to 1:15 pm.

Crossing opportunities are created naturally by breaks in traffic flows created by signals upstream of the crossing. Courtesy gaps are also provided by drivers stopping at the crossing. As observed on site, drivers do slow down upon detection of pedestrians waiting at the curb side and especially during congested conditions when eastbound queues often extend pass the crosswalk. The median is sometimes used as refuge by pedestrians.

There were 16 mid-block collisions recorded between Paris Street to Lisgar Street from January 1, 2008 to December 31, 2010 (an average of just over 5 collisions per year); one of which involved a pedestrian crossing from the bus depot to the mall.

In January of 2012, the City received another report of a pedestrian being hit at the Elm Street Crossing. The incident involved a pedestrian in a wheel chair. However, a police report and additional details were not known at the time this report was prepared.

2.3 Factors Affecting Pedestrian Safety

Given that the Elm Street crossing is an unprotected crossing, there is an onus on pedestrians to ensure that there is an adequate gap in traffic sufficient for safe pedestrian crossing. Notwithstanding pedestrian responsibilities drivers must exercise reasonable care to avoid a collision with pedestrians. We considered the factors that may affect the pedestrian's ability to make appropriate crossing decisions and / or the likelihood of drivers anticipating and avoiding pedestrians within the crosswalk including:

- Pedestrians' lack of familiarity with the rules of the road and the need to wait for an appropriate gap in traffic (anticipating that all vehicles will stop for pedestrians).
- Pedestrians unable to appropriately assess spacing and speeds of approaching vehicles and opportunities to cross.
- Pedestrians not seeing / anticipating vehicles making the southbound to westbound right turn at the Elm Street / Notre Dame Avenue – Paris Street intersection.
- Drivers making southbound right turn movements at the Elm Street / Notre Dame Avenue – Paris Street intersection who focus on merging with westbound traffic and are not aware of pedestrians in the crosswalk.
- Drivers who are westbound on Elm Street approaching Notre Dame Avenue – Paris Street who's awareness of the pedestrian crossing is limited by the vertical curve in the road and navigation through the signalized intersection.
- Inconsistent driver behaviour where a driver in one lane may yield to a pedestrian, while the vehicle in the adjacent lane may not yield creating a vehicle-pedestrian conflict.
- A driver who's view of pedestrians is obscured by vehicle queues that extend through the crosswalk.
- Outbound bus drivers that do not see / anticipate pedestrians crossing as they are exiting the transit terminal.

If the zebra crossings were not in place, it is anticipated that a large percentage of pedestrians would continue to cross Elm Street mid-block. As such, many of the above factors would continue to be an issue with an unmarked crossing. In addition, without the zebra crossing markings, pedestrian crossing activity may occur within a wider range of locations and drivers may be less aware of pedestrians crossing at any particular location.

2.4 Opportunities for Improved Safety

Consideration was given to a range of alternative crossing configurations and features. Alternatives considered included, but were not limited to:

- Traffic control signals or mid-block pedestrian signals
- Relocation of the marked crossing
- Signage and signal phasing modifications
- Removal of the marked crossing
- Grade separation, and
- No modifications.

Each option was assessed to determine positive and negative impacts on safety and potential for implementation.

2.4.1 Traffic Control Signals

The feasibility of traffic control signals or pedestrian signals were considered at both the existing crossing location and at a relocated crossing location 35 metres to the west, coordinated with the public parking lot driveway. Current pedestrian volumes would meet warrant thresholds for pedestrian signals, but the spacing requirements are not met. Under typical circumstances the introduction of a signal as a protected crossing:

- Simplifies the rules of the road for pedestrians, since the right-of-way at traffic signals is generally understood.
- Drivers are required to yield to pedestrians reducing the likelihood of inconsistent driver behaviour and the effect of vehicle queues through the crosswalk.

However, in either of the locations considered for traffic signals, the distance between a new traffic signals at the crossing and existing adjacent traffic signals would be well below the general practice for spacing of signals (215 metres). Furthermore the OTM Book 12 notes: “Motorists approaching a signal must be able to see the signal indications in sufficient time to react and to take any necessary actions”; and based on a posted speed limit of 50 km/h, the minimum distance from which signal must be clearly visible is 85 metres.

The spacing would be as low as 50 metres to 80 metres, which does not allow for decision stopping sight distance between signals and would not address:

- Pedestrians not seeing / anticipating vehicles making the southbound to westbound right turn at the Elm Street / Notre Dame Avenue – Paris Street intersection.
- Drivers making southbound right turn movements at the Elm Street / Notre Dame Avenue – Paris Street intersection who focus on merging with westbound traffic and are not aware of pedestrians in the crosswalk, and
- Drivers who are westbound on Elm Street approaching Notre Dame Avenue – Paris Street who’s awareness of the pedestrian crossing is limited by the vertical curve in the road and navigation through the first signalized intersection.

Furthermore, in these instances, pedestrians will likely cross with less care given that with a traffic signal or pedestrian signal, crossing pedestrians recognize that they have the right of way.

Very closely spaced signals can also result in driver confusion where drivers may focus on downstream signals rather than the signals at the next intersection. The alternative of programmable signal heads may or may not address this operational issue.

Overall there is a potential for increased exposure to vehicle-pedestrian conflicts.

2.4.2 Removal or Relocation of the Marked Crossing

The option of removing or relocating the marked crossing was considered. Alternatives included a shift to the west side of the transit terminal driveway, and a shift to the east more in line with the Rainbow Value Centre doors.

It is anticipated that, with the removal of the crossing markings and signage, a large number of pedestrians will continue to cross mid-block at the gap in the median. As such, the crossing activity may be less focused within the block and drivers may be less prepared for the crossing activity. Fencing off the whole median is not preferred, as noted in the past staff report on the basis of legality – as pedestrians may still cross and travel along the fenced barrier, resulting in increased exposure time and gaps in the fence are still necessary to allow vehicles to turn.

A shift to the east of the marked crosswalk could result in a marginally more direct connection between Rainbow Value Centre and the Transit Terminal, but offers no tangible benefits. A shift to the east would reduce the distance available for westbound drivers to perceive and react to the pedestrian crossing and related activity following their navigation through the Notre Dame Avenue intersection. Pedestrians would also have less distance and time to judge acceptable gaps.

A shift of the marked crosswalk to the west would allow greater distance for westbound drivers to perceive and react to the pedestrian crossing and crossing activity. It would also remove the interaction and potential conflict between pedestrians in the crossing and buses exiting the transit terminal. However a shift of the crosswalk to the west is less convenient for pedestrian flows between the Rainbow Value Centre and the transit terminal (approximately an additional 40-50 metres). Pedestrians may tend to continue to cross at the most direct route, approximately at the existing crossing location, negating benefits of relocating the marked crossing.

2.4.3 Modifications to Signage and Signal Operation

Existing signage provides clear direction to pedestrians that they do not have the right of way at the crossing and that they are to yield to vehicles. Eastbound and westbound approaching vehicles are made aware of the pedestrian crossing through signage at the crossing. However, vehicles turning from the Notre Dame Avenue – Paris Street intersection to westbound Elm Street have considerable workload.

Southbound right-turning (SBRT) vehicles were previously served by a SBRT channel, requiring them to first yield to pedestrians and find gap in pedestrian flows crossing the west leg of the intersection, then to find a gap in the westbound traffic flows, and navigate the turn immediately

prior to seeing and reacting to the pedestrian crossing. The SBRT channel has since been removed and SBRT movements are now under signal control.

2.4.4 Grade Separation

Grade separation was considered as an alternative crossing measure. Grade separation provides the highest form of protection for pedestrians as it allows the opportunity to completely separate pedestrian movements from vehicular movement. For pedestrians who use the grade separation, it eliminates confusion with the rules of the road and the need to search for vehicular gaps to cross.

A grade separated connection across Elm Street would require cooperation from the Rainbow Value Centre and the Transit department. The crossing would need a clearance of 5 metres, plus construction depth of the floor. Pedestrians would have to climb 1 ½ floors to reach the structure limiting accessibility and convenience. It is questionable whether many pedestrians would use the structure with or without the existing crossing in place.

The structure would involve a span of at least 20-25 metres long and would require an independent support on the Mall and transit terminal sides. Construction costs alone would be in the order of $250,000 to $500,000. While this option would be considered a long-term option, given the accessibility constraints it is questionable whether the benefits would meet the costs associated with a grade separation.

2.5 Conclusions and Recommendations

It is concluded that the pedestrian demand of the current crossing is a function of existing land use (Rainbow Value Centre and the Transit terminal) and that there is no simple solution to change pedestrian desire-lines. The location of existing signals does not permit a protected (signalized) crossing with adequate sight distance.

It is recommended that the existing unprotected pedestrian crossing point be retained. The zebra markings offer greater benefit in terms of driver awareness of crossing pedestrians than any confusion it may represent in terms of pedestrian and driver right of way. Existing pedestrian signage, which addresses the need to alert pedestrians of the fact that they do not have the right of way and encourages caution, should also remain.

As previously noted, the City has removed the existing channelized southbound right-turn lane on Notre Dame Avenue at Elm Street. As such, southbound right-turning (SBRT) motorists now operate under signal-control and can either make a SBRT movement during a southbound green-phase (yielding to pedestrians crossing the west leg of the Notre Dame / Paris Street & Elm Street intersection) or after stopping at a southbound red phase and waiting for an acceptable gap in westbound traffic along Elm Street, to make their turn.

3. STE. ANNE ROAD CROSSING

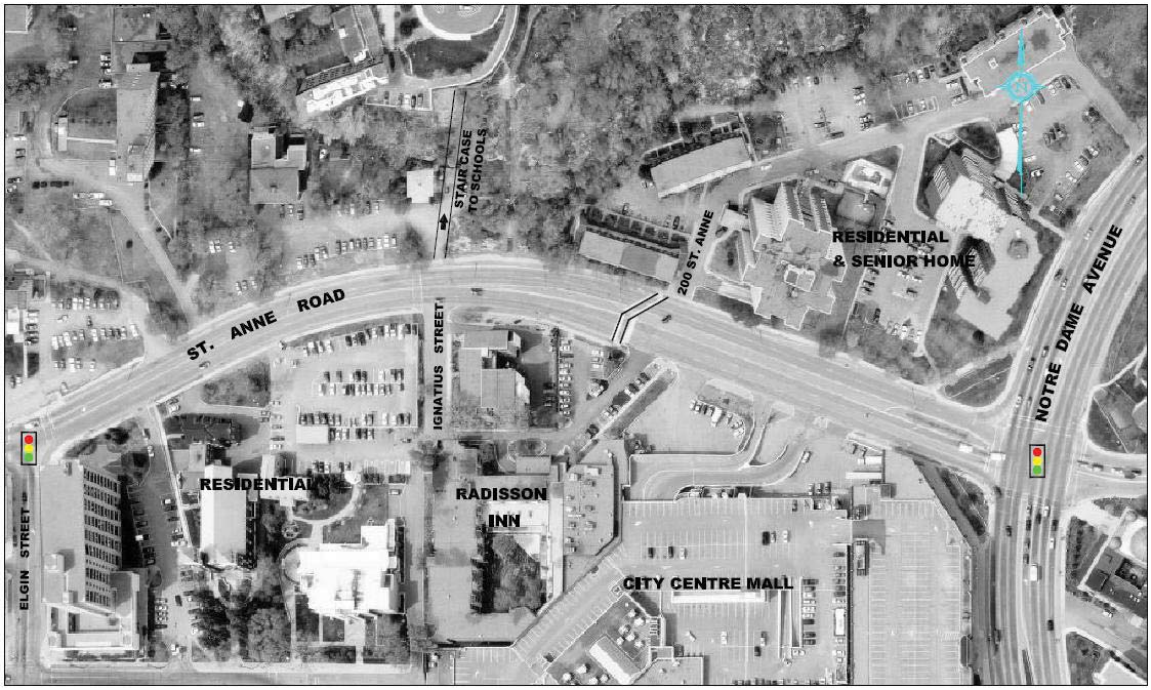

Exhibit 5: Ste. Anne Road Crossing

The original scope of this study included an assessment of the formerly unprotected pedestrian crossing across Ste. Anne Road at 200 Ste. Anne Street, between Notre Dame Avenue and Ignatius Street. This crossing has since been converted into a signalized intersection on Ste. Anne Road at 200 Ste. Anne and the access to the Radisson Inn, as per the recommendation in this report. The following subsections provide a description of the former crossing and issues, which led to the recommendation to signalize the intersection.

3.1 Site Description

The Ste. Anne Road crossing was an unprotected, mid-block crossing located just west of the Radisson Inn / 200 Ste. Anne (Apartment complex) driveways as shown in **Exhibit 5**. The crossing was located approximately 170 metres west of the Ste. Anne Road / Notre Dame Avenue signalized intersection and approximately 260 metres east of the Ste. Anne Road / Elgin Street signalized intersection.

It should also be noted that another marked, unprotected pedestrian crossing is provided across Ste. Anne Road, located immediately west of Ignatius Street.

Ste Anne Road is a 4-lane road from Elgin Street to Ignatius Street and is a 6-lane road from Ignatius Street to Notre Dame Avenue. The transition commences at the beginning of the horizontal curve at Ignatius Street with the introduction of a raised median (from Ignatius Street to Radisson Inn driveway) and centre left turn lane (from the Radisson Inn driveway to Notre

Dame Avenue). The centre left turn lane provides access to 200 St Anne Road (Apartment complex). In addition, an eastbound through lane is also introduced east of Ignatius Street.

Surrounding land use and buildings are illustrated in **Exhibit 5**. They include the following:

- Rainbow Value Centre (southwest corner of Ste. Anne Road / Notre Dame Avenue)
- Residential and senior's home
- Hotels (Radisson Inn)
- Schools.

The former crosswalk extended across the west leg of the Ste. Anne Road / Radisson Inn driveway intersection at the end of the median. Curb depressions were located at both ends of the crosswalk. The crosswalk lines were identified through zebra markings and signed with "Seniors Crossing" warning signs. There were two signs facing each direction of traffic, as well as "Yield to Traffic" warning signs facing each curb side. See **Exhibit 6.**
Exhibit 6: Former Ste. Anne Road Crossing Facing East

There was a painted, but unsigned crosswalk at the west leg of the Ste. Anne Road / Ignatius Street intersection approximately 45 metres west of the subject crossing at the crest of the vertical curve and at the starting portion of the horizontal curve. See Exhibit 7.

Exhibit 6: Former Ste. Anne Road Crossing Facing East

The posted speed on Ste. Anne Street is 50 km/h and carries a daily traffic of 7,100 vehicles. There are sidewalks along both sides on Ste. Anne Street with roadway illumination. Parking is prohibited within the vicinity of the crossing.

There are a number of driveways between the crosswalk and Notre Dame Avenue, connecting from the south side to the Rainbow Value Centre parking lot and loading area.

Exhibit 7: Former Ste. Anne Road / Ignatius Street Crossing (West of Subject Crossing)

3.2 Traffic Conditions

The interaction between the residential area/schools to the north and the Elm Street downtown area to the south results in several pedestrian desire lines along Ste. Anne Road as illustrated in **Exhibit 8**.

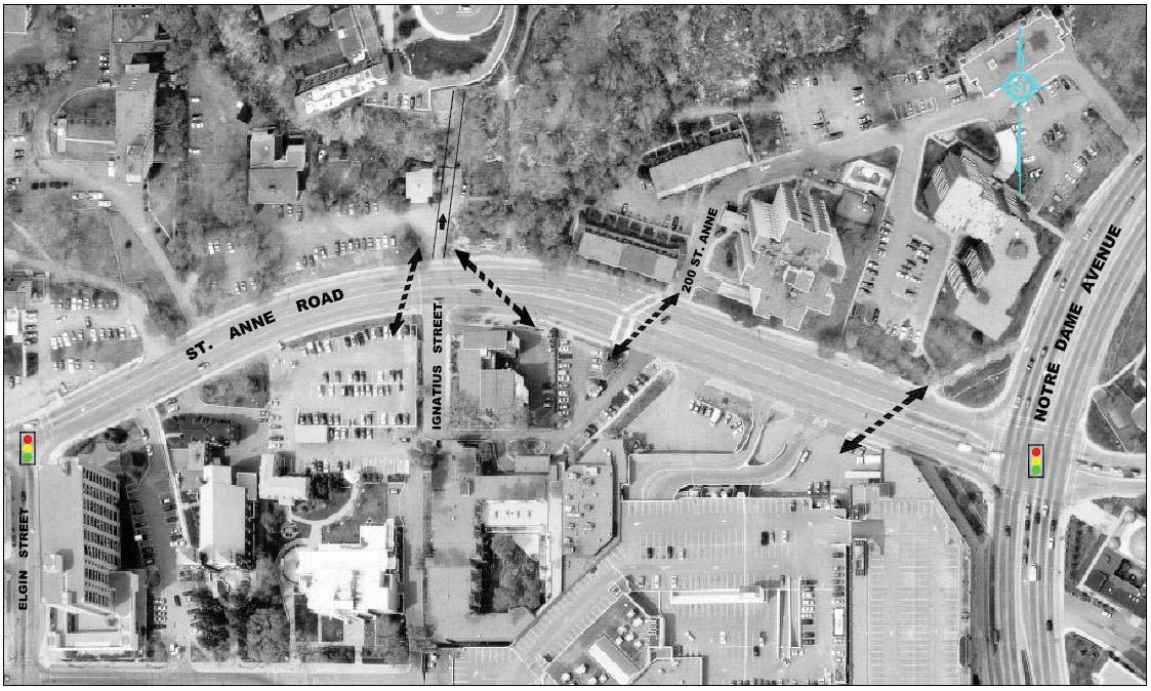

Exhibit 8: Pedestrian Desire Lines

Crossings at the subject crosswalk are generally to/from the 200 Ste. Anne Road (Apartment complex). The pedestrian activity at the crossing as indicated in a June 20, 2003 count shows a pedestrian volume of 55 during the peak hour from 3:15 p.m. to 4:15p.m.

Meanwhile, there is high frequency of mid-block pedestrian activities outside of the marked crosswalks and in particular, at the foothill of the staircase, east of Ignatius Street crossing, leading to the schools on the hilltop on the north side; and at the east end of Ste. Anne Road, where crossing at mid-block between the Seniors home and the Rainbow Value Centre were observed. The daily traffic volume of 7,084 vehicles at Ste. Anne Road is considered low.

There was only one collision reported during the period of January 1, 2008 to December 31, 2010 and it did not involve a pedestrian.

3.3 Factors Affecting Pedestrian Safety

Given that the Ste. Anne Road crossing was an unprotected crossing, there was an onus on pedestrians to ensure that there was an adequate gap in traffic, sufficient for safe pedestrian crossings. Notwithstanding pedestrian responsibilities, drivers must exercise reasonable care to avoid a collision with pedestrians. We considered the factors that may affect the pedestrians' ability to make appropriate crossing decisions and / or the likelihood of drivers anticipating and avoiding pedestrians within the crosswalk including:

- Pedestrians' lack of familiarity with the rules of the road and the need to wait for an appropriate gap in traffic (anticipating that all vehicles will stop for pedestrians)
- Pedestrians not seeing eastbound vehicles due to the vertical and horizontal curvature of Ste. Anne Road

- Drivers eastbound on Ste. Anne Road may not anticipate the crosswalk or be able to see pedestrians due to the horizontal curvature of Ste. Anne Road
- Visibility limitations at night
- Pedestrians unable to judge the adequacy of gaps in traffic for crossing, and
- The level of care taken by student pedestrians and the abilities of senior citizens crossing.

3.4 Opportunities for Improved Safety

Consideration was given to a range of alternative crossing configurations and features. Alternatives considered included, but were not limited to:

- Traffic control signals
- Relocation of the marked crossing
- Realign staircase
- Removal of the marked crossing, and
- Modifications to signage.

Each option was assessed to determine positive and negative impacts on safety and potential for implementation.

3.4.1 Traffic Control Signals

The feasibility of traffic control signals or pedestrian signals were considered at both the existing crossing location and locations 70 to 90 metres to the west, coordinated with the Ignatius intersection and driveway. At either location, spacing to the closest intersection would be approximately 170 metres, which would allow adequate time for drivers to perceive and react to signal controls.

Vehicle and pedestrian volumes (expanded to 8 hours) based on the October 2005 traffic count did not meet warrant thresholds based on the OTM 12 Pedestrian Traffic Justification. The pedestrian and vehicle volumes are approximately 90% of the warrant threshold. However, taking into consideration the potential for the re-routing of pedestrians from the adjacent traffic signals and the potential for higher pedestrian demands under spring conditions, it is anticipated that under spring conditions, the need for signals can be justified at the existing marked crossing location.

It is anticipated that at this location the introduction of a signal as a protected crossing will:

- Simplify the rules of the road for pedestrians, since right of way at traffic signals is generally understood
- Help address visibility constraints given the geometry of the roadway
- Improve visibility at night, and
- Provide for greater protection for pedestrians at the signalized crossing (particularly for children and seniors).

It is noted that visibility of signal heads in the eastbound direction may be an issue that would need to be addressed in any signal design.

The operation of the existing accesses adjacent to the crossing would be influenced by the signals. Full traffic signals are preferred over intersection pedestrian signals as traffic signals will reduce the workload of drivers turning from the side street, given the sight distance of the eastbound vehicles due to the horizontal and vertical curvatures of Ste. Anne Road and would allow the incorporation of adjacent accesses.

3.4.2 Maintain or Relocate the Marked Crossing

The option of maintaining or relocating the marked crossing was considered. In addition to the existing location, we considered shifting the crosswalk to the west coordinated with the Ignatius intersection and driveway 70 to 90 metres west of the existing crossing. At either location the crosswalk markings may lead some pedestrians to believe they have the right of way.

A shift of the crosswalk location to the west may reduce sightline constraints caused by the road curvature. However, this is seen as less convenient for most pedestrians, given the observed pedestrian flows.

3.4.3 Realign Staircase

Much of the pedestrian activity on the existing staircase is related to schools situated to the north and northwest of the Ste Anne Road crossing. Students can access Ste Anne Road via a staircase situated approximately 60 metres west of the marked crossing. Consideration was given to realign the staircase, bringing it further east toward 200 Ste Anne Road to permit more direct access to the crossing for the students.

However, the staircase is build into a rock-face along the slope of the hill. Re-alignment of the staircase would require a significant amount of re-construction, including the need to “blast” the rock currently located along both sides of the staircase in order for it to be re-aligned. In addition, the area where the staircase would need to be realigned is located on private property where an existing residential townhouse complex is currently located. This limits the distance that the realigned staircase could be “shifted” to the east to a maximum of approximately 15 metres, without impacting the existing townhouse complex.

This minimal shift to the east would offer minimal benefit to pedestrians using the staircase, as it would still not lead them directly to the pedestrian crossing. It would also inconvenience pedestrians using the staircase that originate from or are destined to locations to the west of the staircase.

Given the amount of disruption and the high-costs associated with blasting the rock to accommodate the realigned staircase, and the minimal benefits it would offer to pedestrians using the staircase, it is not recommended that the staircase be realigned.

It is recommended that the staircase be maintained in its current position, and a sign be installed at the base of the staircase, with the directional arrow pointing to the crossing location at the signalized intersection to the east.

3.4.4 Remove the Marked Crossing

With the removal of the crossing markings and signage it is anticipated that a large number of pedestrians will continue to cross mid-block. However the crossing activity may be less focused and drivers may be less prepared for the crossing activity.

3.4.5 Modifications to Signage

Existing signage includes Pedestrian Ahead warning signs approaching and at the crossing. The signs at the crossing also include Seniors Crossing tab. There are also signs advising pedestrians that they do not have the right of way at the crossing and that they are to yield to vehicles. Modifications to the signage, such as supplemental signs or larger signs are not anticipated to have a significant impact on safety.

3.5 Conclusions and Recommendations

It was concluded that the presence of seniors and students crossing at this unprotected marked crossing adjacent to a horizontal curve is not desirable. It was also noted that based on current counts that pedestrian and vehicle volumes approach OTM warrants for signals at the crossing and that warrants would likely be met during high volume (spring time) conditions. On this basis, it was recommended that traffic control signals be implemented in the vicinity of the existing crosswalk, coordinated with the adjacent driveways.

Prior to the finalization of this study, the Ste Anne Road crossing has since been converted into a signalized intersection on Ste. Anne Road at 200 Ste. Anne and the access to the Radisson Inn, as per the recommendation in this report. The previous crossing has since been removed.

As part of this study, it is also recommended that the existing unsignalized crossing at Ignatius Street, west of the Ste Anne Road crossing be removed along with the curb depressions since this crossing is in close proximity to the new signalized intersection at 200 Ste. Anne and does not serve any significant pedestrian generators.

Also, as previously recommended, the existing staircase should be retained with signs installed at the base of the staircase to direct pedestrians to the new signalized intersection to the east.

4. BRADY STREET CROSSING

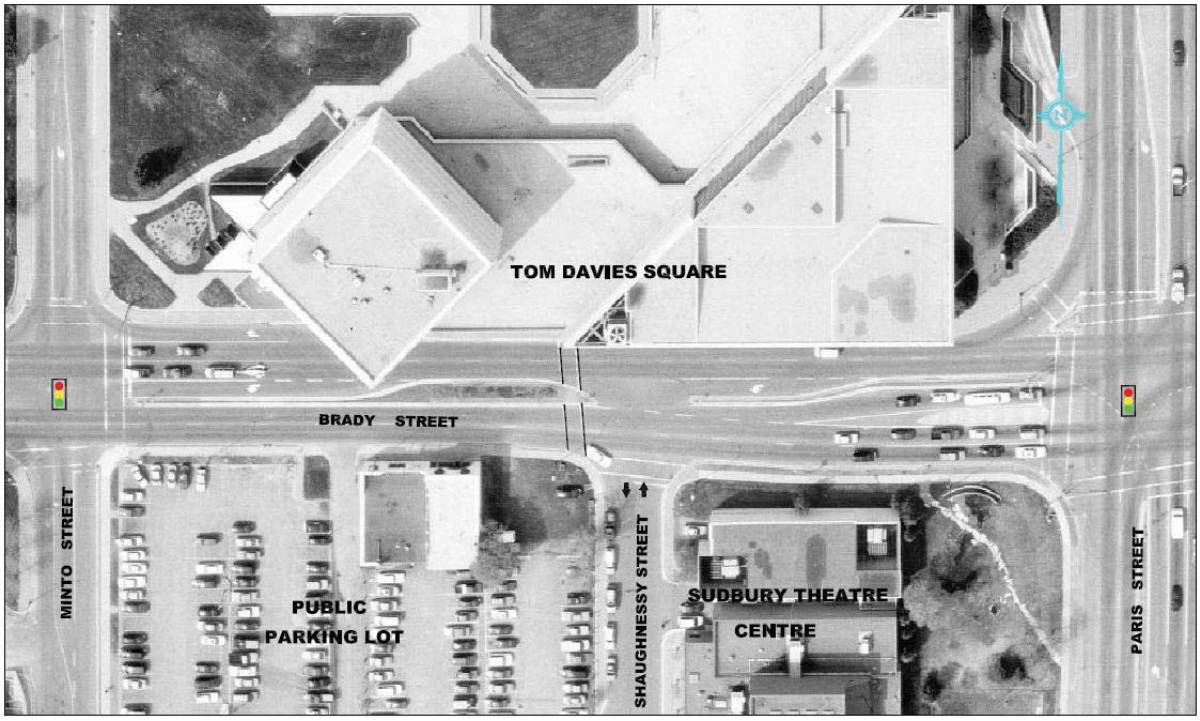

Exhibit 9: Brady Street Crossing

4.1 Site Description

The Brady Street crossing is located on the west leg of the Brady Street / Shaughnessy Street intersection, at approximately 95 metres west of the Paris Street intersection and 90 metres east of Minto Street intersection. The crossing is on the west leg only since there is a centre left turn lane from Shaughnessy Street to Paris Street.

Brady Street is a 4-lane road with a posted speed limit of 50 km/h. Traffic is stop controlled from Shaughnessy Street, while the adjacent intersections are both signalized and coordinated. Sidewalks are constructed on both sides of the roadway. Streetlights are installed along the south side only. The crossing is painted with crosswalk line, but unsigned. The median on the west leg acts as refuge-island within the crosswalk. There are curb depressions at both ends of the crosswalk and at the median. “Pedestrian ahead” warning signs are also placed along Brady Street on the east and west approaches to the crossing.

There is a public parking lot on the southwest corner of Brady Street and Shaughnessy Street. Parking is prohibited along both sides of Brady Street. Surrounding land use and buildings are illustrated in **Exhibit 9**. They include:

- City Hall (north side on Brady Street)
- Sudbury Theatre Centre (south of Brady Street)
- Commercial retail and restaurants (south of Brady Street), and
- Residential land uses.

4.2 Traffic Conditions

Brady Street currently carries 15,900 vehicles in daily traffic volume. Peak hour condition occurs during the weekday PM peak hour from 4:00 p.m. to 5:00 p.m. Queuing extends past the crosswalk from adjacent intersections during peak hours.

The pedestrian volume at this location is moderate to high during peak times (morning, midday and evening peak hours). There were 217 pedestrian crossings recorded during the weekday afternoon peak. Drivers tend not to yield (or give courtesy gaps) to pedestrians waiting to cross the road at the unprotected crossing.

Pedestrian desire lines are mainly between the parking lots and restaurants located along Shaughnessy Street and two destinations on the north side of Brady Street. One destination is the entrance to City Hall, located on the northwest corner of Brady and Paris Streets; east of the existing crossing. The other destination is the Police Station, located on the northeast corner of Brady and Minto Streets east of the existing crossing. Site observations showed than during peak hours, pedestrians tend to use the crosswalk to cross Brady Street. However, during other off-peak times, many pedestrians were observed crossing Brady Street at various locations between Paris and Minto Streets, with many pedestrians not using the crosswalk.

There were 12 collisions recorded between January 1, 2008 and December 31, 2010 (an average of 4 collisions per year) within the vicinity of Shaughnessy Street; one of which involved a pedestrian. That collision took place at a point 20 meters west of Shaugnessy Street.

4.3 Factors Affecting Pedestrian Safety

Given that the Brady Street crossing is an unprotected crossing, there is an onus on pedestrians to ensure that there is an adequate gap in traffic sufficient for safe pedestrian crossing. Notwithstanding pedestrian responsibilities, drivers must exercise reasonable care to avoid a collision with pedestrians. We considered the factors that may affect the pedestrian's ability to make appropriate crossing decisions and / or the likelihood of drivers anticipating and avoiding pedestrians within the crosswalk including:

- Pedestrians' lack of familiarity with the rules of the road and the need to wait for an appropriate gap in traffic (anticipating that all vehicles will stop for pedestrians)
- Pedestrians unable to appropriately assess spacing and speeds of approaching vehicles and opportunities to cross
- Lack of driver awareness of the pedestrian crossing given limited signage and use of standard crosswalk markings
- Inconsistent driver behaviour where a driver in one lane may yield to a pedestrian, while the vehicle in the adjacent lane may not yield creating a vehicle-pedestrian conflict
- A driver who's view of pedestrians are obscured by vehicle queues that extend through the crosswalk
- Pedestrian visibility and illumination at night, and
- Turning traffic from Shaugnessy Street.

It was also observed that when approaching the crossing from the west, it is difficult to see the crossing pavement markings due to a slight vertical curve or "dip" in the road that obscures the crosswalk.

4.4 Opportunities for Improved Safety

4.4.1 Traffic Control Signals or IPS

The feasibility of traffic control signals or pedestrian signals were considered at the existing crossing location. The vehicle and pedestrian volumes based on the most recent traffic count meet warrant thresholds based on the OTM 12 Pedestrian Traffic Justification. Under typical circumstances the introduction of a signal as a protected crossing will:

- Simplify the rules of the road for pedestrians, since right of way at traffic signals is generally understood
- Improve visibility at night, and
- Provide for greater protection for pedestrians at the signalized crossing (particularly for children and seniors).

However, the spacing to the adjacent intersections is less than 100 metres, which will not satisfy OTM Book 12 minimum spacing requirements of 215 metres spacing between signals. Closely spaced signals can result in driver confusion where drivers may focus on downstream signals rather than the signals at the next intersection. As a result, signals are not recommended at this location.

4.4.2 Maintain or Enhance the Marked Crossing

The option of maintaining the marked crossing or enhancing the crossing with zebra markings was considered. Either form of crosswalk markings may lead some pedestrians to believe they have the right of way. They may also result in increased frequency of drivers providing courtesy gaps leading to conflicts where a driver in an adjacent lane may not yield to crossing pedestrians.

4.4.3 Median Enhancements

Enhancement to the existing median along Brady Street was considered in an effort to limit the amount of "jay-walking" across the street and to force pedestrians crossing the street to use the existing Brady Street crossing. Median enhancements could include the addition of added landscaping/ planting or a fence along the median to limit the potential for pedestrians to cross at various locations between Paris and Minto Streets'.

Discussions with City staff indicated that pedestrians crossing at various locations along a roadway was a significant problem at the Elm Street crossing, until a fence and raised median, approximately 1.5m high, with landscaping (plants) was installed along the centre of the roadway, with the only remaining "gap" across Elm Street at the pedestrian crossing location.

A similar treatment could be considered along Brady Street to "channel" crossing pedestrians to the crossing location and/or to the two adjacent signalized intersections east and west of the subject crossing.

4.4.4 Remove the Marked Crossing

Brady Street is a major corridor connecting with the Kingsway, accommodating long distance travel. Other than at the crossing, pedestrian activity in the east end of the corridor is moderate and driver awareness of pedestrian activity may be low. Volumes are above the threshold associated with the removal of unprotected crosswalk markings as indicated in the USDOT publication Pedestrian Facilities Users Guide.

However, with the removal of the crossing markings it is anticipated that a large number of pedestrians will continue to cross mid-block. Further, there is a need to heighten driver awareness of the potential for pedestrians in the area. This is best accomplished by consolidating the pedestrian movements to a single location. A crossing similar to that implemented on Elm Street is therefore recommended.

4.4.5 Modifications to Signage

Existing signage does not include Pedestrian Ahead warning signs approaching and at the crossing. There are also no signs advising pedestrians that they do not have the right of way at the crossing and that they are to yield to vehicles. The provision of signage directing pedestrians to yield to vehicles and use caution would help address the understanding of the right of way.

4.5 Conclusions and Recommendations

Considering the high pedestrian volumes that cross Brady Street throughout the day, and the strong pedestrian desire line between the numerous pedestrian generators along Shaughnessy Street and City Hall and the Police station, it is recommended that the existing unprotected mid-block crossing be maintained and enhanced to accommodate this desire line. Recommended crossing enhancements to the mid block crossing include the application of Zebra style pavement markings similar to those used along Elm Street, as well as the addition of "Yield to Traffic" signs at both ends of the crossing.

In order to eliminate jay-walking at random locations across Brady Street, it is recommended that median enhancements be installed along Brady Street to discourage jay-walking and consolidate pedestrians to the enhanced pedestrian crossing. Median enhancements can include the installation of a fence and / or planters similar to the median enhancements applied along Elm Street at the Elm Street crossing.

To ensure pedestrians use the side of the intersection with the crosswalk, no markings should be shown on the east side of the Brady Street and Shaughnessy Street intersections. Further, Ra-9A signs requiring pedestrians to "Cross Other Side" should be posted across this leg of the intersection. It is also recommended that these "Cross Other Side" signs be regularly enforced.

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Richmond Hill, ON L4B 1J8

Request for Decision

2011 Water Works Summary Report

Presented To:	Operations Committee
Presented:	Monday, Mar 05, 2012
Report Date	Wednesday, Feb 22, 2012
Type:	Routine Management Reports

Recommendation

That the Council of the City of Greater Sudbury accept the 2011 Water Works Summary Report in accordance with Ontario Regulation 170/03; and

That the 2011 Water Works Summary Report be made available for public review on the City's website.

Signed By

Report Prepared By
Scott Ward
Quality Compliance Officer
Digitally Signed Feb 22, 12

Division Review
Nick Benkovich
Director of Water/Wastewater Services
Digitally Signed Feb 22, 12

Recommended by the Department
Greg Clausen, P.Eng.
General Manager of Infrastructure Services
Digitally Signed Feb 22, 12

Recommended by the C.A.O.
Doug Nadorozny
Chief Administrative Officer
Digitally Signed Feb 28, 12

Background:

Attached is the 2011 Water Works Summary Report for Council's information. The Safe Drinking Water Act requires that by March 31st of the following year that a summary report be given to Council which, for each of the systems operated, must:

- List the requirements of any Act, regulation, system approval, or Order that the system failed to meet at any time during the period covered by the report;
- The duration of any such failure; and
- For each failure, provide a description of the corrective action taken.

The summary report must also include the following information for the purpose of enabling Council to assess the capabilities of each system in meeting existing and planned usages. Specifically:

- A summary of the quantities and flow rates of the water supplied during the period covered by the report, including monthly averages, maximum daily flows, and daily instantaneous peak flow rates; and
- A comparison of the summary of the above flows to the rated capacity and flow rates approved in the system approval.

2011 Water Works Summary Report

Large Municipal – Residential Systems

O. Reg. 170/03, Sched. 22; O. Reg. 249/03, s. 24; O. Reg. 253/05, s. 18.

v.1.0

Table of Contents

Executive Summary

The production and delivery of potable water in Ontario is regulated by the Ministry of Environment (MOE) under the Safe Drinking Water Act, 2002, S.O. 2002, c. 32 (formerly the Ontario Water Resources Act). Regulated systems must meet the requirements of the Safe Drinking Water Act, 2002, S.O. 2002, c. 32 and its regulations. Most notably: the Drinking Water Systems Regulation O.Reg. 170/03 sets out treatment and testing requirements for all categories of regulated water systems; O.Reg. 169/03 covers the Ontario Drinking Water Quality Standards; and O.Reg 128/04 covers the necessity for Certification of Drinking Water System Operators and Water Quality Analysts.

Since the implementation of the Act, several amendments to O. Reg. 170/03 have taken place. There are amendments requiring additional resources and costs, such as the Community Lead Testing initiative, while others streamlined legislative requirements to make the new regulations feasible for the vast majority of municipalities.

Among other obligations, O.Reg. 170/03 prescribes the need for all owners of licensed water works to produce an Annual Summary Report as indicated in Schedule 22. This Summary Report is filed annually for the previous calendar year (January 1st through December 31st) and must contain the following information:

- List of requirements of the Safe Drinking Water Act (SDWA), the regulations, the system's approval, drinking water works permits and the municipal drinking water license;
- Any orders applicable to the system that were not met at any time during the period covered by the report. If any failures were identified, specify the duration of the failure and describe the measures taken to correct the situation;
- Summary of quantities and flow rates of the water supplied during the reporting period, including monthly averages and maximum daily flows; and
- A comparison of the summary of quantities and flow to the rated capacities and flows approved in the systems approval, drinking water works permit or municipal drinking water license.

An Annual Report, to fulfill Section 11 of Ontario Regulation 170/03, has been completed separately and details the drinking water quality of all of the CGS owned and operated drinking water systems. This annual report is available for viewing on the City of Greater Sudbury's website (www.greatersudbury.ca)

and notice has been posted that those that do not have access to a computer can use a computer at any of the CGS Citizen Service Centers to view.

The City of Greater Sudbury is listed as the Owner of seven large municipal, residential systems and one independent distribution system. The one distribution system (Vermillion) receives its water from a "donor system" which is operated by Vale. The City of Greater Sudbury is supplied from this "donor system" wherein water is purchased by the CGS from Vale and supplied to consumers through a CGS owned distribution system. The following reports are written to comply with the Condition that each of these facilities produces an Annual Summary Report as per Schedule 22 of O. Reg. 170/03. Table 1 provides a summary of the various water systems throughout the City.

Table 1 - Overview of the City's Water Systems

Name	Owner	Type of Facility	Source of Water	Community Serviced
Sudbury Drinking Water System - Wanapitei	City of Greater Sudbury	Surface water conventional treatment plant, Fluoridation, Corrosion control added, Distribution system	Wanapitei River	Sudbury, Coniston, Wanapitei, Markstay, Garson
Sudbury Drinking Water System - David Street	City of Greater Sudbury	Surface water Membrane Filtration and Ultraviolet irradiation, Fluoridation, Corrosion control added, Distribution system	Ramsey Lake	Sudbury
Sudbury Drinking Water System - Garson	City of Greater Sudbury	Wells with disinfection, Fluoridation, Distribution system	Groundwater	Garson
Dowling Drinking Water System	City of Greater Sudbury	Wells with disinfection and Ultraviolet irradiation, Fluoridation, Distribution system	Groundwater	Dowling
Blezard Valley/ Capreol Drinking Water System	City of Greater Sudbury	Wells with disinfection and Ultraviolet irradiation, Fluoridation, Corrosion control added for supply to Capreol, Distribution system	Groundwater	Valley East, Azilda, Chelmsford & Capreol

Falconbridge Drinking Water System	City of Greater Sudbury	Wells with disinfection, Fluoridation, Corrosion control added, Distribution system	Groundwater	Falconbridge
Onaping /Levack Drinking Water System	City of Greater Sudbury	Wells with disinfection, Fluoridation, Corrosion control added, Distribution system	Groundwater	Onaping & Levack
Vermillion River Water Treatment Plant	Vale	Surface water conventional treatment plant, Fluoridation	River	Vermillion Distribution System
Vermillion Distribution System	City of Greater Sudbury	Distribution System	Vermillion River WTP	Lively, Naughton, Whitefish, Copper Cliff, Walden Industrial Park

Due to the significant impact of the Drinking Water Protection Regulation and continuing Source Water Protection legislation, virtually all of the City's water works have had to undergo some level of upgrading. It should not be assumed that these upgrades are the result of any detected incidents of poor water quality. The upgrades at the City water works are necessary to reduce the risk of potable water contamination as deemed necessary by the MOE. The level of acceptable risk is stipulated through mandatory compliance with O. Reg. 170/03.

The last several years have seen a number of upgrades at most of our water facilities. It is important to understand that this is part of the required process of the Regulations and the MOE's statutory Standard of Care to ensure all citizens have access to and receive safe drinking water. The regulation stipulates that water works owners will continually monitor water works performance, and review levels of treatment versus current standards and emerging technologies. The Ministry of the Environment is responsible for the enforcement of regulations and conducts regular, annual, announced and unannounced, inspections of all of our facilities. MOE inspections "grading" has given the CGS water systems a 99.92% with most of the individual assessments being 100%. The public expects that responsible Owners will be diligent in their duty to care for public water supplies.

The Community Lead Testing Initiative was mandated by the MOE in 2007 and falls under O. Reg. 170/03, Schedule 15.1. Although there have been challenges in garnering enough volunteers for the program, the City is moving forward with the initiative. The City has completed eight periods of lead

sampling to date. Results have been positive and demonstrated that lead is not a concern for the City of Greater Sudbury. There have been issues in the Onaping/Levack system, which is improving with the corrosion control additive and pH adjustment measures. To date, 2370 samples have been collected with 37 private residences and one distribution sample in excess of the standard, representing less than 2% of all samples. The initiative is scheduled to continue through 2012 after which time the City will be able to exercise the new direction the MOE has adopted for lead sampling requirements.

The City is well organized to manage the existing water works systems. Further, staff has been pro-active to ensure all necessary measures are taken to achieve compliance with the Regulations and the various Drinking Water Permits and Licenses. The water works owned and operated by the City have been managed with the standard of care expected by the public and as legislated by the government. All necessary upgrades are being planned and implemented in accordance with applicable standards.

Reviewed by:

Date: Feb. 1/12

Gary Comin
Water Supervisor III

Approved by:

Date: FEB 8 2012

Nick Benkovich
Director, Water and Wastewater Services

SECTION 1 – LEGISLATIVE AND REGULATORY REQUIREMENTS

Regulated systems must meet the requirements of Ontario's *Safe Drinking Water Act, 2002* and its regulations. Most notably, the Drinking Water Systems Regulation sets out treatment and testing requirements for all categories of regulated water systems, including non-municipal and municipal non-residential operations. Related regulations made under the Act:

1.1 O.REG. 128/04 CERTIFICATION OF DRINKING-WATER SYSTEM OPERATORS AND WATER QUALITY ANALYSTS

This Regulation was filed on May 14, 2004 (Last amendment: O.Reg. 466/10). Section 29 lists Operator training requirements and the number of training hours required for operators. Class IV Water Treatment Operators will require 14 hours of continuing education with an additional 36 hours of on-the-job practical training, for a minimum of 50 hours total of annual training. The continuing education that is used to meet the training requirements must be approved by the MOE Director using criteria which includes the following:

a. The training course must have documented learning objectives.

b. The training course must be planned and be provided by a qualified training provider.

c. The training course must include a means to verify that the participants have learned the material covered in the course

d. The training course must cover subject matter that is directly related to the duties typically performed by an operator.

The on-the-job practical training that is used to meet the training requirements must meet a criterion that includes the following:

a. The training must have documented learning objectives.

b. The training must be provided by a trainer with expertise in the subject matter that is being covered.

c. The training must be in respect of subject matter that is directly related to the duties typically performed by an operator

Note: The annual number of hours of training set out in Table 1 may be averaged over the three years during which an operator's certificate is valid but shall not be reduced or prorated for an operator who is employed on a part-time basis.

Table 1 – Annual Training for Operators

Type and Class of Subsystem Where the Operator is Employed	Training Requirements	Minimum Total Hours
Limited Groundwater or Limited Surface Water	7 hours or more of continuing education, with the remaining hours to at least the minimum total as on-the-job practical training	20
Class I Water Treatment or Class I Distribution or Class I Distribution and Supply	7 hours or more of continuing education, with the remaining hours to at least the minimum total as on-the-job practical training	30
Class II Water Treatment or Class II Distribution or Class II Distribution and Supply	12 hours or more of continuing education, with the remaining hours to at least the minimum total as on-the-job practical training	35
Class III Water Treatment or Class III Distribution or Class III Distribution and Supply	14 hours or more of continuing education, with the remaining hours to at least the minimum total as on-the-job practical training	40
Class IV Water Treatment or Class IV Distribution or Class IV Distribution and Supply	14 hours or more of continuing education, with the remaining hours to at least the minimum total as on-the-job practical training	50

O. Reg. 128/04, s. 29, Table

1.2 O. REG. 242/05 COMPLIANCE AND ENFORCEMENT

This Regulation (Last amendment: O.Reg. 328/08) lists the requirements for inspections. What to do when deficiencies and contraventions are found. This regulation also deals with enforcement, investigations and notices required once investigations have been completed.

1.3 O. REG. 172/03 DEFINITIONS OF "DEFICIENCY" AND "MUNICIPAL DRINKING-WATER SYSTEM"

Ontario Regulation 172/03 (Last Amendment: O.Reg. 329/08), provides definitions of words and expressions within the Safe Drinking Water Act and associated Regulations.

1.4 O. REG. 171/03 DEFINITIONS OF WORDS AND EXPRESSIONS USED IN THE ACT

Ontario Regulation 171/03 (Last amendment: O.Reg. 324/08) - Provides definitions of words and expressions within the Safe Drinking Water Act and associated Regulations.

1.5 O. REG. 170/03 DRINKING-WATER SYSTEMS

This Regulation was filed in 2004 (Last amendment: O.Reg. 106/10). This regulation outlines the requirements for:

1) Types of Drinking Water Systems

2) Required reports (annual, summary reports)

3) Retention of records

4) Treatment equipment requirements

5) Types of Treatment

6) Operational Checks, Sampling and Testing

7) Use of accredited laboratories

8) Maintenance and Operational Checks

9) Microbiological Sampling and Testing

10) Chemical Sampling and Testing

11) Reporting Adverse Test Results and Other Problems

12) Corrective Action

13) Engineers' Reports

14) Inorganic Parameters

15) Organic Parameters

1.6 O. REG. 248/03 DRINKING-WATER TESTING SERVICES

Ontario Regulation 248/03 (Last amendment: O.Reg. 416/09) - Drinking-Water Testing Services is the regulation governing accredited laboratories that came into effect October 31, 2004.

1) Lists systems that do not require drinking-water testing license

2) Lists prescribed tests of the Safe Drinking Water Act

3) Lists person(s) to do water quality analysis

4) Lists the types of tests that can be conducted for the sole purpose of carrying out research or Criteria for drinking-water testing services

5) Conditions of drinking-water testing license

6) Handling samples

7) Testing records

8) Laboratory qualifications and accreditation

1.7 O. REG. 169/03 ONTARIO DRINKING-WATER QUALITY STANDARDS

Ontario Regulation 169/03 (Last amendment: O.Reg 327/08). This regulation sets out standards in Schedules 1, 2 and 3 as prescribed drinking-water quality standards. Included in this regulation, what is deemed as compliance standards.

SECTION 2 - PLANT SPECIFIC REVIEW

2.1 Plant Specific Requirements

This Section of the report provides details on measures taken by the City to ensure compliance with Terms and Conditions of the Certificates of Approvals or Licenses, Acts, Regulations or any MOE orders the systems may have been under during the reporting period. This section of the report also provides details on the specifics of the systems, any non-compliance issues along with actions taken by the City to rectify the situations, as well as flow data with comparison to allowable limits. This flow comparison is to allow for a basic overview of the systems performance and allows for review and planning of possible future expansions if required.

A more detailed description of the water works is provided at the start of each sub-section. The description is provided for reference purposes only, and to ensure that the compliance measures remain in context. All non-compliance items and the corrective actions taken are summarized in table format and appended to the particular plant section in this report. The most recent Municipal Drinking Water License and Drinking Water Works Permit that was valid at the time of this report is also listed in the particular plant section.

Sudbury Drinking Water System - Wanapitei
DWS# 210001111

Municipal Drinking Water License: 016-106
Apr 20, 2010
Drinking Water Works Permit: 016-206
Nov 3, 2011

The Wanapitei WTP is a surface water plant, which draws water from the Wanapitei River. Proportionally, the plant supplies approximately 60% of the water for Sudbury; however, most of the water produced is delivered to New Sudbury, Coniston, Wahnapitae, Markstay, and parts of downtown. Garson, west of Falconbridge Rd. and O'Neil Dr., is also supplied by this plant. The plant was constructed in the 1970's at the onset of Regional Government. Since the original construction, the plant has undergone upgrading to enhance treatment efficiency, increase production, and to reduce energy costs. Completed projects in 2011 included: the replacement of a high lift pump and motor at a cost of $84,000. Capital improvements to various infrastructure projects totaled approximately $1,688,000.

The water supply for the plant is the Wanapitei River. The raw water quality is reasonably reliable but is, however, subject to changes in water quality typical of most rivers. The watershed area for the Wanapitei River is vast with much in its natural state.

The river water quality varies depending on seasonal changes and local weather patterns. Some process parameters affected by these changes include:

- Temperature;
- Turbidity; and
- Colour.

The changing raw water quality requires careful observation by the water plant operators to ensure necessary process and chemical adjustments are made to effectively treat the water.

The Wanapitei WTP incorporates conventional technologies to treat the water. The raw water undergoes initial treatment with chlorine dioxide for taste and odor control and/or chlorine for pre-disinfection. Raw water is further subjected to chemical coagulation with alum to form a floc. The coagulated water passes through one of two settling tanks, referred to as reactivators or up-flow convertors, for the flocculation and sedimentation process. The water then passes through one of four, dual media, filter beds. The filtered water is treated with hydrated lime for pH /alkalinity adjustment; with chlorine to maintain disinfection; with fluoride to comply with Sudbury and District Health Unit requirements; and with polyphosphate to reduce corrosion in the distribution system. The final process the finished water undergoes is irradiation by ultraviolet light. The plant is designed to be capable of achieving, at all times, at least 99.99% removal or inactivation of viruses by the time water enters the distribution system.

The distribution system incorporates a large diameter concrete pressure pipe to deliver water to Sudbury and Coniston. The communities are networked with an extensive distribution system including numerous booster stations. The system pressure is regulated by the water level in the Ellis Water Reservoir. Most of the pipes in the distribution system are less than 50 years old and much of the system is plastic pipe.

Water quality throughout the distribution system is monitored through regular sampling in accordance with O. Reg. 170/03.

Non-Compliance with Act, Regulations, Order or Approvals

Table 2 provides a summary of any requirements of the Act, Regulations, Orders, or Approval that the system failed to meet during the 2011 reportable period.

Table 2 - Wanapitei Water Treatment Plant

Item	Non-Compliance	Measure Taken to Ensure Compliance
MOE Inspection Issues	NONE	N/A
MOE Orders	NONE	N/A

2011 Adverse Water Quality Incident Report

Table 3 provides details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre and the Sudbury and District Health Unit.

Table 3 - Adverse Water Quality Incidents

AWQI #	Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
99631	2011/01/08	Total Coliform	3	CFU	Resample/Re-test	2011/01/11
99805	2011/01/26	UV	0	mJ/cm^2	Disinfectant restored/increased	2011/01/26
99882	2011/02/03	UV	0	mJ/cm^2	Disinfectant restored/increased	2011/02/03
100138	2011/03/07	UV	0	mJ/cm^2	Disinfectant restored/increased	2011/03/07
100458	2011/04/08	UV	0	CFU	Disinfectant restored/increased	2011/04/08
100570	2011/03/17	Watermain break			Flushing mains/pipes	2011/08/29
100993	2011/05/23	Security Hatch			Installed security fencing around hatch	2011/05/30
101090	2011/05/30	Hose Bib			Flushing mains/pipes	2011/06/01

103841	2011/10/16	UV	0	CFU	Disinfectant restored/increased	2011/10/16
104331	2011/11/26	Total Coliform	3	CFU	Resample/Re-test	2011/12/02

Annual Flow Summary

Table 4 provides a summary of the quantities of flow rates with a comparison to rated capacities as listed in the systems Municipal Drinking Water License during the 2011 reportable period.

Table 4 - Annual Flow Summary (Sudbury Plants)

	Wanapitei Water Treatment Plant						David Street Water Treatment Plant					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	933,124	30,101	36,220.07	437.37	54,000	67	373,341	12,043	12,383.63	320.30	40,000	31
February	854,579	30,521	35,457.41	431.66	54,000	66	336,205	12,007	12,089.51	177.76	40,000	30
March	949,665	30,634	36,026.59	432.50	54,000	67	369,664	11,925	12,085.40	313.32	40,000	30
April	869,282	28,976	31,138.04	621.64	54,000	58	359,066	11,969	12,075.02	183.84	40,000	30
May	843,894	27,222	29,320.94	420.25	54,000	54	369,061	11,905	12,495.40	317.27	40,000	31
June	853,587	28,453	30,444.49	420.08	54,000	56	416,124	13,871	21,517.43	317.70	40,000	54
July	911,095	29,390	35,083.56	432.83	54,000	65	459,253	14,815	19,547.84	318.53	40,000	49
August	960,757	30,992	35,542.03	440.55	54,000	66	398,568	12,857	16,603.97	317.74	40,000	42
September	889,080	29,636	31,252.75	435.02	54,000	58	408,713	13,624	18,938.45	317.80	40,000	47
October	855,553	27,598	29,347.92	414.88	54,000	54	384,593	12,406	20,273.59	316.35	40,000	51
November	837,653	27,922	31,337.49	497.45	54,000	58	363,114	12,104	16,775.76	316.60	40,000	42
December	825,279	26,622	32,272.80	436.19	54,000	60	367,554	11,857	14,490.25	353.98	40,000	36
Total	10,583,548						4,605,256					

Sudbury Drinking Water System - David Street
DWS# 220003537

Municipal Drinking Water License: 016-106
Apr 20, 2010
Drinking Water Works Permit: 016-206
Nov 3, 2011

The David St. WTP is a surface water plant, which draws water from Ramsey Lake. Proportionally, the plant services approximately 40% of Sudbury, however, most of the water produced at the David St. WTP

is normally delivered to the south, west and downtown areas of Sudbury. The plant is over 100 years old and has undergone numerous upgrades to meet changing needs. The plant completed retrofits with Zenon membrane ultrafiltration technologies and ultraviolet irradiation in 2004 to ensure the treatment system meets the requirements in O. Reg. 170/03. The plant is designed to be capable of achieving, at all times, at least 99.99% removal or inactivation of viruses by the time water enters the distribution system.

The water supply for the David St. WTP is Ramsey Lake. Although this lake is seen as an excellent source of raw water, development around the lake has compromised the security of this water source. Although virtually all septic use has been removed from the watershed, further measures are being reviewed by City staff and the Provincial Source Water Protection Committee to maintain and improve the source water quality.

The City is planning to have the David St. plant remain an integral part of the water works system for many years. For this reason the City has made a significant financial investment in the upgrading of this plant. Projects completed for 2011 included replacing 96 Zenon ultrafiltration modules at a cost of $87,330.

The distribution system supplied by the David Street WTP includes parts of downtown Sudbury, the south and west ends of Sudbury. In addition, the Ellis Reservoir is part of the distribution network for Sudbury. The Ellis Reservoir is a 36.4 million liter, dual cell, water storage facility that is also fed by the Wanapitei WTP. As is common with many older distribution networks, the Sudbury pipe system is prone to line breaks, complaints of discolored water and difficulties maintaining adequate chlorine residual. Watermain related capital projects undertaken in 2011 included work done at the Beech St. bridge, Ramsey Lake Rd. watermain looping and various watermain replacements totaling approximately $919,000.

Water quality throughout the distribution system is monitored through regular sampling in accordance with O. Reg. 170/03.

Non-Compliance with Act, Regulations, Order or Approvals

Table 5 provides a summary of any requirements of the Act, Regulations, Orders, or Approval that the system failed to meet during the 2011 reportable period.

Table 5 - David Street Water Treatment Plant

Item	Non-Compliance	Measure Taken to Ensure Compliance
MOE Inspection Issues	NONE	N/A
MOE Orders	NONE	N/A

2011 Adverse Water Quality Incident Report

Table 6 provides details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre and the Sudbury and District Health Unit.

Table 6 - Adverse Water Quality Incidents

AWQI #	Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
101624	2011/06/27	UV	0	mJ/cm^2	Disinfectant restored/increased	2011/06/27
101969	2011/07/13	Pressure		psi	Resample/Re-test	2011/07/13
102202	2011/07/23	Total Coliform	1	CFU	Resample/Re-test	2011/07/25
102887	2011/08/21	Chlorine residual	0.05	mg/l	No further action required	2011/08/21
103400	2011/09/20	E-Coli / Total Coliform	9/17	CFU	Resample/Re-test	2011/09/21
104334	2011/11/27	Pressure			Resample/Re-test	2011/12/02

Annual Flow Summary

Table 7 provides a summary of the quantities of flow rates with a comparison to rated capacities as listed in the systems Municipal Drinking Water License during the 2011 reporting period.

Table 7 - Annual Flow Summary

	Wanapitei Water Treatment Plant						David Street Water Treatment Plant					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	933,124	30,101	36,220.07	437.37	54,000	67	373,341	12,043	12,383.63	320.30	40,000	31
February	854,579	30,521	35,457.41	431.66	54,000	66	336,205	12,007	12,089.51	177.76	40,000	30
March	949,665	30,634	36,026.59	432.50	54,000	67	369,664	11,925	12,085.40	313.32	40,000	30
April	869,282	28,976	31,138.04	621.64	54,000	58	359,066	11,969	12,075.02	183.84	40,000	30
May	843,894	27,222	29,320.94	420.25	54,000	54	369,061	11,905	12,495.40	317.27	40,000	31
June	853,587	28,453	30,444.49	420.08	54,000	56	416,124	13,871	21,517.43	317.70	40,000	54
July	911,095	29,390	35,083.56	432.83	54,000	65	459,253	14,815	19,547.84	318.53	40,000	49
August	960,757	30,992	35,542.03	440.55	54,000	66	398,568	12,857	16,603.97	317.74	40,000	42
September	889,080	29,636	31,252.75	435.02	54,000	58	408,713	13,624	18,938.45	317.80	40,000	47
October	855,553	27,598	29,347.92	414.88	54,000	54	384,593	12,406	20,273.59	316.35	40,000	51
November	837,653	27,922	31,337.49	497.45	54,000	58	363,114	12,104	16,775.76	316.60	40,000	42
December	825,279	26,622	32,272.80	436.19	54,000	60	367,554	11,857	14,490.25	353.98	40,000	36
Total	10,583,548						4,605,256					

Sudbury Drinking Water System - Garson

DWS# 220003485

Municipal Drinking Water License: 016-106
Apr 20, 2010
Drinking Water Works Permit: 016-206
Nov 3, 2011

The Garson water works is a communal groundwater system consisting of three wells, and servicing the community of Garson. The three wells are:

- Garson Well No.2;
- Garson Well No.1; and
- Garson Well No.3.

Garson Well No.2 is situated within a pumphouse on the east side of Falconbridge Highway at Spruce Street. The system includes a Variable Frequency Drive (VFD) vertical turbine well pump, disinfection with sodium hypochlorite and fluoride injection as mandated by the Sudbury and District Health Unit. There is no standby power at Garson Well No. 2. The City of Greater Sudbury operated the well

pumphouse on behalf of Vale and now, as the sole owner/operator, the water is directly connected to the public distribution network.

The other two wells in Garson, No.'s 1 and 3, are situated on the south side of Falconbridge Road at Orell Street. The two wells are in close proximity to each other but are housed in separate buildings, both of which contain the vertical turbine well pumps. The discharges from the well pumps enter a common building which houses the disinfection and fluoride injection equipment. Completion of the install of the replacement backup generator and facility has been completed. Most work was completed in 2010 but final costs of $13,000 were required for 2011.

The well supply historically provided very good quality water with no record of bacteriological contamination. During preparation of the First Engineers' Report, in March 2001, a hydrogeological assessment was made of each of the wells. It was concluded that it is unlikely that any of the wells are under the direct influence of surface water. The raw water was therefore found to be in general conformance with the ODWS. Notwithstanding the historical good water quality, the aquifer used in the Garson well supply has a recharge area which includes the developed area of Garson. The hydrogeologists noted potential sources of contamination of the water supply that required further study and a plan to provide long-term protection of the groundwater sources. The Source Water Protection Committee has since been formed and the City awaits direction from the Committee.

The community of Garson extends from Skead Road at the north to Garson-Coniston Road at the south. The pipe network is connected to the water supply from Sudbury at the intersection of Falconbridge Road and O'Neil Drive West, therefore the community is serviced from the Sudbury Distribution system West of Penman Avenue. In the event that all of the three wells were to fail, the Garson system is connected to the Sudbury Distribution System by way of a pressure valve and would have water supplied from Sudbury. The pipe network is a combination of new and older pipes and frost penetration can be an issue in Garson.

Water quality throughout the distribution system is monitored through regular sampling in accordance with O. Reg. 170/03.

Non-Compliance with Act, Regulations, Order or Approvals

Table 8 provides a summary of any requirements of the Act, Regulations, Orders, or Approval that the system failed to meet during the 201 reportable period.

Table 8 - Garson Wells and Distribution System

Item	Non-Compliance	Measure Taken to Ensure Compliance
MOE Inspection Issues	Regulatory sample not collected and sample not collected within regulated timeframe	Increased monitoring of sample collection and frequency
MOE Orders	NONE	N/A

2011 Adverse Water Quality Incident Report

Table 9 provides details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre and the Sudbury and District Health Unit.

Table 9 - Adverse Water Quality Incidents

AWQI #	Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
100218	2011/03/15	Free Cl_2	0.03	mg/l	Resample/Re-test	2011/03/21

Annual Flow Summary

Table 10 provides a summary of the quantities of flow rates with a comparison to rated capacities as listed in the systems Municipal Drinking Water License during the 2011 reportable period.

Table 10 - Flow Summary (Garson Wells)

	Garson Well #1						Garson Well #3					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	5,147	166	326.94	40.00	1,572	21	10,146	327	882.58	32.71	3,274	27
February	5,378	192	329.00	14.67	1,572	21	14,430	515	1,287.64	30.97	3,274	39
March	5,508	178	406.72	15.45	1,572	26	11,510	371	1,072.35	30.79	3,274	33
April	4,059	135	361.25	14.69	1,572	23	12,363	412	1,275.75	33.05	3,274	39
May	6,168	199	349.18	14.92	1,572	22	17,865	576	963.63	31.79	3,274	29
June	6,781	226	449.75	15.21	1,572	29	18,250	608	1,219.49	35.35	3,274	37
July	6,947	224	568.51	15.22	1,572	36	16,391	529	1,107.52	35.50	3,274	34
August	7,176	231	527.57	14.62	1,572	34	14,812	478	1,096.49	34.47	3,274	33

September	6,594	220	309.18	14.92	1,572	20	13,402	447	1,194.00	30.96	3,274	36
October	6,103	197	257.88	14.42	1,572	16	12,957	418	944.54	29.74	3,274	29
November	6,224	207	263.11	14.27	1,572	17	16,496	550	1,505.96	31.31	3,274	46
December	6,655	215	294.81	14.45	1,572	19	14,756	476	1,047.85	30.61	3,274	32
Total	72,740						173,378					

Garson Well #2						
	Total Flow m3	**Average Daily Flow m3/d**	**Maximum Daily Flow m3/d**	**Instantaneous Peak Flow L/s**	**PTTW Maximum Flow m3/d**	**% Capacity**
January	27,267	880	1,941.41	31.73	2,981	65
February	17,658	631	1,445.84	33.06	2,981	49
March	22,092	713	1,578.70	31.23	2,981	53
April	24,222	807	1,726.61	31.98	2,981	58
May	20,403	658	1,392.00	34.73	2,981	47
June	24,752	825	1,581.92	37.03	2,981	53
July	29,628	956	1,474.36	32.24	2,981	49
August	24,812	800	1,114.67	32.30	2,981	37
September	23,568	786	1,242.92	31.61	2,981	42
October	21,317	688	1,032.23	32.83	2,981	35
November	18,298	610	1,190.83	32.66	2,981	40
December	20,235	653	1,197.93	33.34	2,981	40
Total	274,252					

Dowling Wells and Distribution System
DWS# 210001665

Municipal Drinking Water License: 016-103
Apr 19, 2010
Drinking Water Works Permit: 016-203
Nov 3, 2011

The Dowling water works is a communal groundwater system, which supplies water to the community of Dowling. The water works includes two wells with well pumphouses, a distribution network of in-ground piping and an elevated water storage tank. The entire water system was developed with subsidy from the MOE in the 1970's. The ownership and operation of the water works was transferred to the Regional Municipality of Sudbury and it is now owned and operated by the City of Greater Sudbury.

The Riverside well and pumphouse includes a vertical turbine supply pump, disinfection with gas chlorine, ultraviolet irradiation along with fluoride injection as mandated by the Sudbury and District Health Unit. The Lionel well and pumphouse has similar facilities plus a diesel generator for standby

power. Both facilities have automatic valving to waste raw water for a few minutes upon start-up of a well pump.

The water supply source for the Dowling wells is an unconfined aquifer of sand and gravel deposits located within the Onaping river watershed. Due to the unconfined nature of the soils and the proximity to the river, the MOE has characterized the water source as potentially groundwater under the direct influence of surface water (potentially GUDI).

Studies were conducted in 2002 with the resulting submission of a GUDI study on July 1, 2002. This study was reviewed and accepted by the MOE and as a result, both wells were deemed to be GUDI with effective in situ filtration. As such, additional treatment and disinfection would be required. The prior recommendations of the consultant included that, while the wells have met the MOE criteria for "potentially under the influence of surface water", adequate natural filtration of the water exists. Based on the conclusions by the MOE, the well systems have had ultraviolet irradiation added to enhance disinfection to comply with the treatment requirements of the ODWS.

The distribution network in Dowling has been relatively reliable and is not exposed to as severe frost depths as other areas of the City. Further, the elevated water storage provides a measure of security to the water system in the event of power interruptions and watermain breaks.

Water quality throughout the distribution system is monitored through regular sampling in accordance with O. Reg. 170/03.

Non-Compliance with Act, Regulations, Order or Approvals

Table 11 provides a summary of any requirements of the Act, Regulations, Orders, or Approval that the system failed to meet during the 2011 reportable period.

Table 11 - Dowling Wells and Distribution System

Item	Non-Compliance	Measure Taken to Ensure Compliance
MOE Inspection Issues	NONE	N/A
MOE Orders	NONE	N/A

2011 Adverse Water Quality Incident Report

Table 12 provides details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre and the Sudbury and District Health Unit.

Table 12 - Adverse Water Quality Incidents

AWQI #	Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
none						

Annual Flow Summary

Table 13 provides a summary of the quantities of flow rates with a comparison to rated capacities as listed in the systems Certificate of Approval during the 2011 reportable period.

Table 13 - Flow Summary (Dowling Wells)

	Lionel Well						Riverside Well					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	6,839	221	694.95	32.99	3,600	19	4,715	152	688.09	32.16	3,600	19
February	5,373	192	698.85	32.58	3,600	19	4,879	174	720.62	31.34	3,600	20
March	5,150	166	690.02	32.16	3,600	19	5,848	189	681.01	31.34	3,600	19
April	5,718	191	693.79	32.99	3,600	19	2,838	95	652.32	32.16	3,600	18
May	7,579	244	717.00	32.99	3,600	20	7,038	227	1,207.23	32.16	3,600	34
June	762	25	514.44	42.06	3,600	14	11,244	375	713.71	31.34	3,600	20
July	4,622	149	667.84	33.40	3,600	19	8,755	282	724.23	30.93	3,600	20
August	10,345	334	746.42	30.52	3,600	21	1,921	62	727.95	30.52	3,600	20
September	3,323	111	743.21	30.10	3,600	21	8,386	280	654.75	30.93	3,600	18
October	6,629	214	735.84	33.40	3,600	20	4,861	157	651.54	30.52	3,600	18
November	4,387	146	662.02	31.34	3,600	18	6,258	209	685.99	30.93	3,600	19
December	620	20	301.55	30.93	3,600	8	10,369	334	810.67	30.52	3,600	23
Total	61,347						77,112					

Blezard Valley /Capreol Well Supply
DWS# 210000737

Municipal Drinking Water License: 016-105
Nov 3, 2011
Drinking Water Works Permit: 016-205
Nov 1, 2011

In 2010, the Blezard Valley and Capreol well supply systems were considered to be one complete system as both of the systems are connected. As such, one Drinking Water System (DWS) number and one Municipal Drinking Water License and Works Permit has been assigned to the entire system. This report will identify the works by geographical area where appropriate.

The Blezard Valley portion of the system is a multi-well groundwater system servicing the communities of Hanmer, Blezard Valley, Val Caron, McCrea Heights, Azilda and Chelmsford. Nine groundwater wells are situated throughout the Valley and each are located in well pumphouses. The communities are interconnected with distribution piping and three water storage tanks located in each of Val Caron, Azilda and Chelmsford.

The water works were originally constructed by the MOE in the 1970's then transferred to the Regional Municipality of Sudbury. With amalgamation, the ownership was transferred to the City of Greater Sudbury. All upgrades from the original MOE system were constructed by the City.

Each well pumphouse contains a vertical turbine well pump, gas chlorine disinfection equipment and fluoride injection equipment as mandated by the Sudbury and District Health Unit. Some of the well pumphouses incorporate standby diesel generators, summarized as follows:

- Well A – Deschene;
- Well B – Kenneth;
- Well C – Phillipe;
- Well D – Frost;
- Well E - Notre Dame; and
- Well I – I Well.

The water supply source is a common groundwater aquifer characterized as a shallow sand and gravel aquifer. This well field extends approximately 7.5 km (west to east) from Val Therese to Hanmer. A preliminary hydrology study performed during the preparation of the First Engineers' Report classified all of the wells as not under the direct influence of surface water. Due to the shallow nature of the aquifer and the lack of a confining clay layer the MOE requested further study.

The GUDI study was submitted in August of 2002. An amended PTTW was received on February 23, 2003. The amended PTTW acknowledged the opinion of the hydrogeology study, which states that the wells are not GUDI. As such, no additional filtration is required and the wells may supply water provided they meet MOE Procedures for Disinfection of Drinking Water.

The wells in the Valley system did not meet chemical disinfection CT (Concentration (mg/L) x Time (minutes)) requirements, therefore, all the wells were upgraded in 2007 to incorporate ultraviolet irradiation to deal with CT issues.

The distribution system in the Valley is very extensive and contains many areas with dead-ends. System pressure is regulated by the level of the three storage tanks. During the reporting period the City operated the distribution system with good control of the chlorine residuals. This is due in part to the age of the distribution network, and the good source of raw water quality.

As previously noted, the Valley well system is a relatively shallow aquifer and the community has developed extensively around the wells. Some of the wells are located immediately adjacent to residential homes, commercial establishments and major arterial roadways. The water quality is beginning to show the effects of urban storm drainage. Further, existing zoning by-laws appear inadequate to protect the wells from further development within the well capture zones. For these reasons, options are being considered to preserve the quality of the water over the long-term. The engineering and geotechnical/hydrogeological investigations for new well supplies are complete and work was started in 2011 for two additional water supply wells.

The Capreol Well portion of the system draws water from two (2) wells to service the community of Capreol. The wells include:

- Well J; and
- Well M.

In the event that these two wells fail and due to the fact that Capreol does not have backup water storage facilities, the Blezard Valley wells can supply water through the Capreol Boosters located onsite at M well. This system, started in 2004, was completed and commissioned in 2007, ensuring a continued water supply to Capreol.

The source of water for the Capreol wells is groundwater. Wells J and M draw from a common unconfined aquifer comprised mostly of sands and gravels. Although neither of the wells have any record of bacteriological contamination, the unconfined nature of the aquifer required these wells to be characterized as potentially groundwater under the influence of surface water (potentially GUDI).

Wells J and M are located within approximately 30 meters of each other on the east side of Greens Lake and west of M.R. No.84. Wells J and M are housed in separate well houses and have vertical turbine well pumps. A common discharge from the wells undergoes treatment in the form of disinfection by gas chlorination, ultraviolet irradiation, and fluoridation, as mandated by the Sudbury and District Health Unit. Corrosion control for the system is accomplished with the addition of a polyphosphate. Both facilities have automatic valving to waste raw water for a few minutes upon start-up of a well pump. Standby power with an automatic transfer switch for Wells J and M is available from a diesel generator located in Well M pumphouse.

A previous PTTW for Capreol required further hydrogeological studies to be conducted in Capreol to determine if the wells were in fact under influence of surface water. The results of the study were necessary to determine if a filtration system would be required to ensure that the water quality remains in compliance with the ODWS at all times. The studies, referred to as GUDI studies, were completed for Wells M and J and submitted to the MOE on June 30, 2002. The response from a review by MOE found these wells to be potentially under influence of surface water with effective in situ filtration and as such required upgrades to meet the ODWS disinfection and log removal criteria. Upgrades have been completed and the system achieves the required log removals and enhanced the disinfection process.

The distribution system in Capreol was developed in conjunction with the growth of the industrial development. Some of the pipe network is therefore, relatively old. The frost depths in Capreol extend to extreme depths during cold winters, which impose additional stresses on the integrity of the distribution system. A second line was added to the distribution system so now two 350 mm water mains run in parallel along MR84 to the Town of Capreol. The distribution system is comprised of PVC, cast iron and ductile piping and serves approximately 3500 residents.

Water quality throughout the distribution system is monitored through regular sampling in accordance with O. Reg. 170/03.

Non-Compliance with Act, Regulations, Order or Approvals

Table 14 provides a summary of any requirements of the Act, Regulations, Orders, or Approval that the system failed to meet during the 2011 reportable period.

Table 14 - Blezard Valley/Capreol Wells Supply

Item	Non-Compliance	Measure Taken to Ensure Compliance
MOE Inspection Issues	NONE	N/A
MOE Orders	NONE	N/A

2011 Adverse Water Quality Incident Report

Table 15 provides details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre and the Sudbury and District Health Unit.

Table 15 - Adverse Water Quality Incidents

AWQI #	Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
99673	2011/01/13	Total coliform	1	CFU	Resample/Re-test	2011/02/14
103071	2011/08/31	Pressure	15.3	psi	No further action required	2011/08/31
103908	2011/10/20	Pressure	10	psi	No further action required	2011/10/20
104448	2011/12/07	Total coliform	1	CFU	Resample/Re-test	2011/12/09

Annual Flow Summary

Tables 16 and 17 provides a summary of the quantities of flow rates with a comparison to rated capacities as listed in the systems Certificate of Approval during the 2011 reportable period.

Table 16 – Annual Flow Summary (Valley Wells)

	Well "A" Deschene						Well "B" Kenneth					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	19,904	642	947.84	18.91	1,797	53	17,167	554	879.47	18.21	2,288	38
February	16,095	575	899.14	18.94	1,797	50	19,100	682	970.73	20.89	2,288	42
March	22,769	734	1,032.42	19.83	1,797	57	17,572	567	1,048.32	20.33	2,288	46
April	20,053	668	884.97	18.88	1,797	49	18,500	617	985.29	20.98	2,288	43
May	22,758	734	1,121.27	19.03	1,797	62	23,467	757	1,326.82	48.56	2,288	58
June	21,227	708	1,009.45	19.00	1,797	56	23,807	794	1,369.93	22.34	2,288	60
July	22,152	715	992.03	18.93	1,797	55	18,765	605	1,034.59	21.96	2,288	45
August	21,260	686	1,010.27	18.98	1,797	56	13,401	432	885.39	18.75	2,288	39
September	18,617	621	944.88	18.80	1,797	53	5,867	196	813.98	20.81	2,288	36
October	1,829	59	414.86	18.32	1,797	23	3,214	104	695.23	21.49	2,288	30
November	2,181	73	269.23	18.96	1,797	15	12,331	411	948.46	22.61	2,288	41
December	1,893	61	293.32	17.98	1,797	16	18,534	598	951.36	23.14	2,288	42
Total	190,738						191,725					

	Well "C" Phillipe						Well "D" Frost					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	27,290	880	1,282.09	24.53	2,288	56	25,620	826	1,268.71	24.42	2,288	55
February	25,404	907	1,227.19	24.52	2,288	54	28,031	1,001	1,925.15	25.65	2,288	84
March	30,002	968	1,401.65	24.58	2,288	61	29,133	940	1,554.01	24.84	2,288	68
April	27,034	901	1,188.87	24.39	2,288	52	41,400	1,380	1,976.04	25.57	2,288	86
May	30,327	978	1,496.46	24.50	2,288	65	44,450	1,434	1,976.90	25.95	2,288	86
June	30,683	1,023	1,812.59	24.50	2,288	79	33,789	1,126	1,929.07	25.55	2,288	84
July	31,657	1,021	1,360.71	24.41	2,288	59	41,523	1,339	1,944.62	25.19	2,288	85
August	25,876	835	1,208.78	24.67	2,288	53	42,668	1,376	1,906.99	25.11	2,288	83
September	28,754	958	1,270.30	24.42	2,288	56	50,715	1,691	1,985.24	25.66	2,288	87
October	30,775	993	1,411.85	24.73	2,288	62	42,986	1,387	1,927.81	25.25	2,288	84
November	30,001	1,000	1,352.58	24.74	2,288	59	35,143	1,171	1,900.35	25.31	2,288	83
December	33,507	1,081	1,358.95	24.56	2,288	59	34,299	1,106	1,898.08	24.89	2,288	83
Total	351,310						449,757					

	Well "E" Notre Dame						Well "F" Linden					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	47,545	1,534	2,552.00	30.56	3,105	82	59,579	1,922	2,407.05	32.00	3,268	74
February	56,126	2,005	2,521.57	30.25	3,105	81	43,038	1,537	2,406.33	31.11	3,268	74
March	50,707	1,636	2,507.96	29.95	3,105	81	62,615	2,020	2,378.64	30.08	3,268	73
April	44,609	1,487	2,510.39	29.75	3,105	81	42,250	1,408	2,373.81	30.63	3,268	73
May	58,517	1,888	2,530.38	30.01	3,105	81	37,677	1,215	2,450.03	36.04	3,268	75
June	64,418	2,147	2,514.14	30.45	3,105	81	41,049	1,368	2,440.42	34.51	3,268	75
July	57,053	1,840	2,533.45	32.72	3,105	82	42,819	1,381	2,338.35	33.89	3,268	72
August	39,204	1,265	1,919.17	30.35	3,105	62	52,703	1,700	2,426.05	30.69	3,268	74
September	34,680	1,156	1,564.14	31.23	3,105	50	44,991	1,500	2,452.58	30.80	3,268	75
October	46,123	1,488	2,787.92	29.76	3,105	90	49,385	1,593	2,454.48	31.34	3,268	75
November	36,690	1,223	2,482.59	35.06	3,105	80	51,498	1,717	2,404.85	30.77	3,268	74
December	39,555	1,276	2,502.29	30.45	3,105	81	64,208	2,071	2,412.39	30.26	3,268	74
Total	575,227						591,812					

	Well "G" Pharand						Well "H" Michelle					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	16,626	536	1,052.13	22.18	2,289	46	22,605	729	1,070.65	30.06	2,289	47
February	16,704	597	1,134.43	22.15	2,289	50	21,202	757	1,017.49	29.57	2,289	44
March	7,786	251	1,138.80	22.30	2,289	50	27,542	888	1,421.47	29.77	2,289	62
April	5,887	196	1,065.58	22.34	2,289	47	19,277	643	977.81	23.02	2,289	43
May	14,997	484	1,186.11	22.36	2,289	52	20,781	670	1,258.68	29.94	2,289	55
June	15,937	531	1,222.15	22.33	2,289	53	19,073	636	1,280.96	66.20	2,289	56
July	20,222	652	1,136.65	22.32	2,289	50	24,351	786	1,126.77	28.78	2,289	49
August	20,268	654	1,050.67	22.69	2,289	46	22,992	742	1,104.12	28.90	2,289	48
September	17,691	590	1,179.41	22.49	2,289	52	24,414	814	1,181.14	29.48	2,289	52
October	20,090	648	1,067.21	23.03	2,289	47	25,543	824	1,183.72	29.81	2,289	52
November	23,414	780	1,253.13	22.48	2,289	55	12,892	430	1,066.18	36.49	2,289	47
December	28,795	929	1,254.38	22.26	2,289	55	26,634	859	1,152.95	29.90	2,289	50
Total	208,417						267,306					

	"I" Well					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	28,803	929	1,171.43	21.35	1,972	59
February	10,580	378	1,164.86	21.12	1,972	59
March	25,588	825	1,168.58	21.01	1,972	59
April	34,169	1,139	1,165.76	24.30	1,972	59
May	21,833	704	1,165.34	21.22	1,972	59

June	25,697	857	1,163.25	22.06	1,972	59
July	30,008	968	1,167.60	20.85	1,972	59
August	32,951	1,063	1,169.60	21.67	1,972	59
September	34,214	1,140	1,166.05	21.41	1,972	59
October	34,307	1,107	1,166.54	21.19	1,972	59
November	33,590	1,120	1,164.06	21.42	1,972	59
December	31,234	1,008	1,161.73	21.70	1,972	59
Total	342,974					

Table 17 - Annual Flow Summary (Capreol Wells)

	"J" Well						"M" Well					
	Total Flow m3	**Average Daily Flow m3/d**	**Maximum Daily Flow m3/d**	**Instantaneous Peak Flow L/s**	**PTTW Maximum Flow m3/d**	**% Capacity**	**Total Flow m3**	**Average Daily Flow m3/d**	**Maximum Daily Flow m3/d**	**Instantaneous Peak Flow L/s**	**PTTW Maximum Flow m3/d**	**% Capacity**
January	31,476	1,015	1,936.20	36.34	3,273	59	15,019	484	1,410.18	29.71	3,927	36
February	34,724	1,240	2,067.67	33.43	3,273	63	11,252	402	1,403.18	29.69	3,927	36
March	26,454	853	1,941.20	33.10	3,273	59	12,205	394	1,818.07	41.08	3,927	46
April	28,811	960	1,811.44	35.61	3,273	55	20,352	678	1,811.49	36.06	3,927	46
May	20,899	674	1,702.94	33.38	3,273	52	26,465	854	1,715.20	32.98	3,927	44
June	11,500	383	1,795.48	32.20	3,273	55	36,177	1,206	1,909.49	46.79	3,927	49
July	21,298	687	1,787.96	35.10	3,273	55	29,225	943	1,966.12	35.05	3,927	50
August	22,434	724	1,892.73	41.18	3,273	58	25,984	838	1,993.25	35.19	3,927	51
September	15,936	531	1,751.24	34.25	3,273	54	24,389	813	1,804.99	38.26	3,927	46
October	19,348	624	1,800.25	33.34	3,273	55	27,440	885	1,774.85	36.68	3,927	45
November	21,511	717	1,625.30	30.72	3,273	50	20,491	683	1,504.86	31.55	3,927	38
December	2,897	93	1,439.95	30.79	3,273	44	13,098	423	1,533.15	41.37	3,927	39
Total	257,288						262,097					

Falconbridge Wells System
DWS# 240000020

Municipal Drinking Water License: 016-101
Sep 14, 2011
Drinking Water Works Permit: 016-201
Sep 13, 2011

In April 2009, the City of Greater Sudbury purchased the Falconbridge Wells and Storage Tank from Xstrata. The Falconbridge well system consists of 3 drilled wells:

- Falconbridge Well No. 5

- Falconbridge Well No. 6, and
- Falconbridge Well No. 7

Each well is equipped with a submersible pump. All three wells share a common treatment building that includes stand-by power, chlorine gas for disinfection, and a corrosion inhibitor. The wells are located north of the Sudbury Airport and were developed by Xstrata. Water is supplied south to the Town of Falconbridge and north via the Western Main to the Greater Sudbury Airport and the Nickel Rim Mine reservoir. There is a booster pump for supplying water to Nickel Rim reservoir when a well pump is not operating. The City sells water to Xstrata and two industrial clients along the South transmission line and fluoridates the water, as mandated by the Sudbury and District Health Unit, before it enters the Falconbridge Municipal distribution system.

The distribution network in Falconbridge is relatively old and exposed to severe frost depths. Further, the elevated water storage provides a measure of security to the water system in the event of power interruptions and watermain breaks. Other components of the distribution system include a fluoridation building, booster pumping station and a pressure regulating valve.

Water quality throughout the distribution system is monitored through regular sampling in accordance with O. Reg. 170/03.

Non-Compliance with Act, Regulations, Order or Approvals

Table 18 provides a summary of any requirements of the Act, Regulations, Orders, or Approval that the system failed to meet during the 2011 reportable period.

Table 18 - Falconbridge Wells

Item	Non-Compliance	Corrective Measures Taken
MOE Inspection Issues	NONE	N/A
MOE Orders	NONE	N/A

2011 Adverse Water Quality Incident Report

Table 19 provides details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre and the Sudbury and District Health Unit.

Table 19 - Adverse Water Quality Incidents

AWQI #	Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
100206	2011/03/14	Sodium (missed sample)		mg/l	Resample/Re-test	2011/03/14
104361	2011/11/29	Fluoride	2	mg/l	Resample/Re-test	2011/11/29

Annual Flow Summary

Tables 20 and 21 provide a summary of the quantities of flow rates with a comparison to rated capacities as listed in the systems Certificate of Approval during the 2011 reportable period.

Table 20 – Annual Flow Summary (Falconbridge Wells)

	Falconbridge Well #5						Falconbridge Well #6					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	10,978	354	1,071.60	15.38	4,250	25	7,143	230	867.33	15.53	4,250	20
February	10,532	376	1,031.35	15.28	4,250	24	5,696	203	1,101.61	15.52	4,250	26
March	7,219	233	943.84	15.21	4,250	22	10,744	347	1,000.50	15.87	4,250	24
April	4,764	159	1,000.51	15.12	4,250	24	8,250	275	945.01	15.97	4,250	22
May	11,224	362	996.92	15.14	4,250	23	8,557	276	1,024.58	16.00	4,250	24
June	13,576	453	1,192.10	15.53	4,250	28	11,967	399	1,104.61	15.95	4,250	26
July	16,584	535	1,248.89	15.17	4,250	29	849	27	233.81	16.27	4,250	6
August	8,975	290	1,161.63	15.64	4,250	27	8,158	263	115.77	18.89	4,250	3
September	15,258	509	1,136.44	15.51	4,250	27	8,440	281	1,070.62	15.74	4,250	25
October	6,122	197	1,008.40	15.76	4,250	24	6,158	199	770.34	16.05	4,250	18
November	4,988	166	725.36	15.88	4,250	17	9,173	306	742.56	15.53	4,250	17
December	4,760	154	773.80	15.48	4,250	18	7,514	242	764.65	15.29	4,250	18
Total	114,980						92,649					

Falconbridge Well #7						
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	8,633	278	1,074.32	15.30	4,250	25
February	10,030	358	1,095.11	15.28	4,250	26
March	10,064	325	988.96	15.32	4,250	23
April	13,263	442	1,037.88	15.36	4,250	24
May	7,833	253	973.66	15.36	4,250	23
June	5,281	176	1,259.47	15.27	4,250	30
July	15,833	511	1,165.71	15.32	4,250	27
August	15,298	493	1,162.19	15.45	4,250	27
September	5,250	175	1,086.27	15.39	4,250	26
October	10,221	330	808.44	15.18	4,250	19
November	5,809	194	766.98	15.21	4,250	18
December	8,762	283	787.04	15.26	4,250	19
Total	116,277					

Table 21 – Annual Flow Summary (Falconbridge Fluoridation Facility)

Falconbridge Fluoridation Facility						
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	5,435	175	216.11	10.00	727	30
February	4,819	172	195.81	10.00	727	27
March	5,375	173	192.59	9.38	727	26
April	6,815	227	347.24	10.00	727	48
May	10,621	343	383.44	10.00	727	53
June	11,635	388	519.41	10.00	727	71
July	13,298	429	519.10	10.00	727	71
August	13,009	420	200.99	10.00	727	28
September	11,359	379	433.31	10.00	727	60
October	5,995	193	220.92	7.84	727	30
November	4,538	151	175.40	10.00	727	24
December	5,119	165	210.35	9.90	727	29
Total	98,018					

Onaping/Levack Wells System
DWS# 220003519

Municipal Drinking Water License: 016-102
Sep 14, 2011
Drinking Water Works Permit: 016-202
Sep 13, 2011

In 2010, the Onaping well supply system, Onaping distribution and Levack distribution were considered to be one complete system as all of the systems are connected. As such, one Drinking Water System (DWS) number and one Certificate of Approval has been assigned to the entire system. This report will identify the works by geographical area where appropriate.

The Onaping Potable Water System was constructed in 1971 and owned by Xstrata. In 2009 the City of Greater Sudbury purchased the system from Xstrata and completed all major upgrades required to supply potable water to the communities of Onaping and Levack. The system was commissioned in November of 2009. The new Onaping/Levack system includes three drilled wells:

- Onaping Well No. 3,
- Onaping Well No. 4, and
- Onaping Well No. 5

Onaping Wells 3 and 4 are housed in a single pumphouse and Onaping Well 5 is in a separate building, but all feed into a common treatment building. The treatment building houses one well (Well 5) and provides chlorine gas injection for disinfection, fluoridation, as mandated by the Sudbury and District Health Unit, chemical addition for corrosion control and stand-by power. An elevated storage tank with re-chlorination capabilities, a Pressure Control/Booster building with stand-by power, a Pressure control facility on Fraser Crescent and the distribution piping complete the system.

The Levack distribution system was a recipient of water from the Vale wells in the Levack area but that changed with the acquisition of the Onaping wells and commissioning in November 2009. Water is no longer supplied from Vale and the connection has been terminated. Water is entirely provided by the Onaping wells and both Onaping and Levack distribution systems are connected.

Water quality throughout the distribution system is monitored through regular sampling in accordance with O. Reg. 170/03.

Non-Compliance with Act, Regulations, Order or Approvals

Table 22 provides a summary of any requirements of the Act, Regulations, Orders, or Approval that the system failed to meet during the 2011 reportable period.

Table 22 – Onaping/Levack Wells

Item	Non-Compliance	Corrective Measures Taken
MOE Inspection Issues	NONE	N/A
MOE Orders	NONE	N/A

2011 Adverse Water Quality Incident Report

Table 23 provides details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre and the Sudbury and District Health Unit.

Table 23 - Adverse Water Quality Incidents

AWQI #	Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
none						

Annual Flow Summary

Table 24 provides a summary of the quantities of flow rates with a comparison to rated capacities as listed in the systems Certificate of Approval during the 2011 reportable period.

Table 24– Annual Flow Summary (Onaping/Levack Wells)

	Onaping Well #3						Onaping Well #4					
	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity	Total Flow m3	Average Daily Flow m3/d	Maximum Daily Flow m3/d	Instantaneous Peak Flow L/s	PTTW Maximum Flow m3/d	% Capacity
January	28,861	931	2386.34	30.58	5,184	46	18,365	592	2284.42	32.28	5,184	44
February	12,018	429	2366.13	29.81	5,184	46	14,919	533	2533.45	31.72	5,184	49
March	28,969	934	2398.58	29.81	5,184	46	24,518	791	2425.40	32.25	5,184	47
April	25,328	844	2431.81	29.81	5,184	47	10,283	343	2531.63	31.31	5,184	49
May	27,937	901	2378.51	29.81	5,184	46	12,455	402	2016.97	31.98	5,184	39
June	11,555	385	2353.52	29.81	5,184	45	21,429	714	2379.00	31.84	5,184	46
July	20,541	663	2283.19	29.81	5,184	44	21,984	709	2001.95	31.47	5,184	39
August	22,599	729	2135.91	29.81	5,184	41	5,222	168	1765.38	32.21	5,184	34
September	9,290	310	1881.13	29.81	5,184	36	25,832	861	2021.52	31.68	5,184	39
October	13,336	430	1898.78	29.42	5,184	37	16,306	526	2113.27	30.48	5,184	41

November	13,813	460	1924.10	29.42	5,184	37	16,310	544	2209.12	30.66	5,184	43
December	26,709	862	2300.03	29.42	5,184	44	28,278	912	2493.21	31.06	5,184	48
Total	240,956						215,901					

Onaping Well #5						
	Total Flow m3	**Average Daily Flow m3/d**	**Maximum Daily Flow m3/d**	**Instantaneous Peak Flow L/s**	**PTTW Maximum Flow m3/d**	**% Capacity**
January	20,853	673	2639.10	52.53	5,184	51
February	37,304	1,332	2890.68	55.78	5,184	56
March	12,867	415	2389.42	68.75	5,184	46
April	31,105	1,037	2817.89	48.10	5,184	54
May	20,214	652	2041.00	49.48	5,184	39
June	24,819	827	2065.14	56.46	5,184	40
July	14,676	473	2056.59	55.96	5,184	40
August	29,838	963	2075.46	56.10	5,184	40
September	18,610	620	1921.21	42.12	5,184	37
October	28,674	925	2063.62	42.38	5,184	40
November	27,036	901	2188.75	42.98	5,184	42
December	10,757	347	2643.27	35.14	5,184	51
Total	276,753					

Vermillion Distribution System
DWS# 260006789

Municipal Drinking Water License: 016-104
Apr 19, 2010
Drinking Water Works Permit: 016-204
Nov 3, 2011

The Vermillion distribution system is a standalone distribution system that receives water from a "donor" system. The City of Greater Sudbury purchases water from Vale, the owner of the Vermillion water treatment facility, which acts as the donor for the CGS Vermillion distribution system. Vale has responsibility for the treatment facility and must also comply with O. Reg. 170/03. The Vale water treatment facility is not the subject of this report.

The City owns and operates the distribution network in the communities of Copper Cliff, Lively, Naughton and Whitefish. The system also includes the Walden Water Storage Tank and Walden Metering Chamber. Additional service was provided in 2005 to supply Atikameksheng Anishnawbek, formerly known as the Whitefish Lake First Nation Reserve. The City has obligations to test, maintain and report on this distribution system as part of the MOE regulations.

Water quality throughout the distribution systems is monitored through regular sampling in accordance with O. Reg. 170/03.

Non-Compliance with Act, Regulations, Order or Approvals

Table 25 provides a summary of any requirements of the Act, Regulations, Orders, or Approval that the system failed to meet during the 2011 reportable period.

Table 25 - Vermillion Distribution System

Item	Non-Compliance	Measure Taken to Ensure Compliance
MOE Inspection Issues	NONE	N/A
MOE Orders	NONE	N/A

2011 Adverse Water Quality Incident Report

Table 26 provides details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre and the Sudbury and District Health Unit.

Table 26 - Adverse Water Quality Incidents

AWQI #	Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
none						

Annual Flow Summary – N/A

Request for Decision

Traffic Calming Priority

Presented To:	Operations Committee
Presented:	Monday, Mar 05, 2012
Report Date	Tuesday, Feb 21, 2012
Type:	Routine Management Reports

Recommendation

That the Operations Committee approve the 2011 ranking list for Traffic Calming Eligible Roadways contained in the report from the General Manager of Infrastructure Services dated February 21, 2012; and,

That staff be directed to initiate the public support component for the Traffic Calming process based on the ranking order; and,

That projects from lower in the ranking may be chosen to fully utilize the annual budget; and,

That staff forward the results of the speed studies to the Greater Sudbury Police Services and request increased enforcement on roadways identified with speeding problems.

Signed By

Report Prepared By
Dave Kivi
Co-ordinator of Transportation & Traffic Engineering Services
Digitally Signed Feb 21, 12

Division Review
David Shelsted, MBA, P.Eng.
Acting Director of Roads & Transportation
Digitally Signed Feb 21, 12

Recommended by the Department
Greg Clausen, P.Eng.
General Manager of Infrastructure Services
Digitally Signed Feb 21, 12

Recommended by the C.A.O.
Doug Nadorozny
Chief Administrative Officer
Digitally Signed Feb 28, 12

Background

The City's Traffic and Transportation Engineering Section receives numerous requests each year to install Traffic Calming measures such as speed humps and traffic circles to reduce speeding and improve safety on its roadways. In February, 2008, the City of Greater Sudbury retained IBI Group to develop a Traffic Calming Policy to aid staff in evaluating requests and the application of Traffic Calming devices. This policy was permanently adopted by City Council on May 12, 2010. In 2011, staff initiated a Traffic Calming project for Attlee Avenue. Public support has been received and detailed design of the project is underway. Construction of the traffic calming devices will be completed in 2012.

What is Traffic Calming?

The Institute of Transportation Engineering defines Traffic Calming as "the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behaviour and improve conditions for non motorized street users."

Traffic Calming Warrant

The City's Traffic Calming Warrant is based upon the review of the best practices from 24 jurisdictions throughout North America. In addition, public input was solicited through surveys posted on the City's website and at the Citizen Services Centres. Two (2) stakeholder workshops were also held with City departments and agencies including City Councillors, Police, Fire, EMS, Planning, Roads and Engineering.

The Traffic Calming Warrant consists of an initial screening where a combination of requirements must be met for a site to be eligible for Traffic Calming. The threshold criteria and screening process can be found in the attached Exhibits A and B.

Sites that pass the initial screening are then ranked against each other using a weighted point criteria based on the classification of the road. Each eligible site is awarded points based on its score for each factor, with a maximum score of 100 points. A score of 30 points has been established as a minimum threshold to qualify for traffic calming consideration. The scoring criteria for local and collector roads is outlined in the attached Exhibit C.

Initial Screening and Ranking of City of Greater Sudbury Roads

During 2011, City staff collected collision and traffic data for all requested locations as well as a list of roads where capital roads projects are scheduled to be completed in 2012. The initial screening process was completed for 46 road segments on 35 different roads. Of the 46 road segments reviewed, 14 qualified for the ranking process, and of these, 13 scored more than 30 points. As part of the final ranking process, any abutting road segments that scored greater than 30 points were combined into one project and assigned the highest score, resulting in a total of 7 roadways. See Exhibit D for the list of seven roadways which qualified for Traffic Calming and Exhibit E for the list of road segments which did not qualify.

Final Ranking

Currently the City's annual budget for traffic calming projects is $150,000. Depending on the calming devices chosen, the budget should be enough to complete one major project approximately 1 km in length, or a couple of smaller projects each year.

In addition to the eligible roadways, Exhibit F shows the project length, preliminary cost estimate and indicates whether the road is a transit route or primary emergency services route. It should be noted that the cost estimates may vary greatly depending on the devices preferred by the residents. For example, on a 1 km road, you could paint bike lanes for about $5,000 or construct physical devices for $150,000. Roadways that are not transit routes or primary emergency service routes qualify for vertical traffic calming measures such as speed humps. Speed humps are not only effective in reducing vehicle speed but are also less expensive to construct than many other calming devices.

Also, roadways that are eligible for Traffic Calming and are part of the Roads Capital Program will have recommended traffic calming devices incorporated as part of the design and construction. Kathleen Street is an example of where Traffic Calming was incorporated as part of the capital contract.

As indicated in the Traffic Calming Policy, if a request is rejected at any point in the process, the applicants and affected residents will be informed in writing, and Traffic Calming shall not be reconsidered for the same section of road for two years.

Recommendations

As indicated in the Traffic Calming Policy, Council approval is required for a project or series of projects prior to initiating the public support component. Staff recommends that Council approve the list ranking the eligible roadways. Based on approved budget limitations, staff will initiate the public support component in the order the roadways are ranked. However, some smaller projects may be selected out of order to fully utilize the available capital budget.

Many roads which did not pass the initial screening for traffic calming had 85th percentile speeds that exceeded the posted speed. City staff will compile a list of these roadways and forward it to Greater Sudbury Police Services to be considered for speed enforcement campaigns.

EXHIBIT: A

Traffic Calming Criteria

Criteria	Threshold		Notes
	Local Road	Collector/Tertiary Arterial	
Grade	< 8%		If the grade is equal to or greater than 8%, traffic calming is not permitted
Collision History	≥ 6	≥ 12	Number of collisions within the last three years involving vulnerable road users and/or which may be potentially corrected by traffic calming measures.
Volume	≥ 900	≥ 3,000 vpd (Collector) ≥ 5,000 vpd (Tertiary Arterial)	Two-way AADT Volumes
Speeds	≥ posted speed limit		85th percentile speed
Non-Local Traffic	≥ 30%		'Cut-through traffic'

EXHIBIT: B

Screening Process

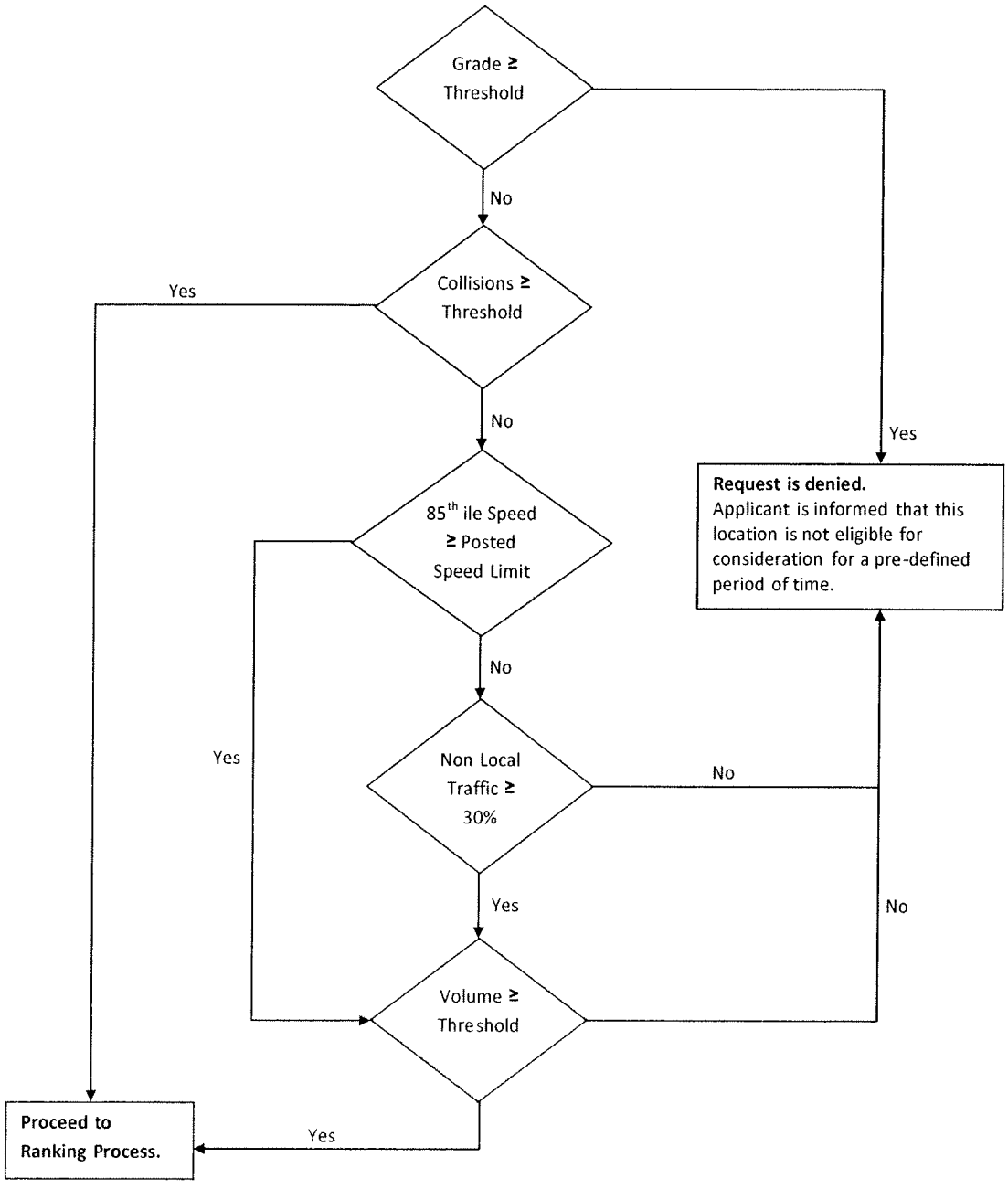

EXHIBIT: C

Scoring Criteria

Local Roads

Factor	Point Criteria	Maximum Points
Collision History	4 points for each qualifying collision in the past three years	20
Traffic Speeds	1 point for each km/h above posted speed limit	15
Non-Local Traffic	3 points for each 10% of non-local traffic above 20% (maximum reached at 60% non-local traffic)	15
Traffic Volumes	1 point for each 50 vehicles above 900	20
Pedestrian Generators	5 points for each school or park within the study area (other Pedestrian Generators may be defined by City staff)	10
Pedestrian Facilities	5 points if there are no sidewalks in the study area	5
Emergency Services and Routes	- 4 points if the study area is a primary Emergency Services route	0
Transit Services and Routes	- 2 points if the study is an existing or planned transit route	0
Block Length	1 point for each 50 metre increment between stop-controlled points	10
Adjacent Land Uses (residential)	1 point for each 20% of residential land use	5
		100

Collector and Tertiary Arterial Roads

Factor	Point Criteria	Maximum Points
Collision History	3 points for each qualifying collision in the past three years	15
Traffic Speeds	1 point for each km/h above posted speed limit	20
Non-Local Traffic	2 points for each 10% of non-local traffic above 20% (maximum reached at 60% non-local traffic)	10
Traffic Volumes	1 point for each 100 vehicles above 3,000 for Collector roads and 5,000 for Tertiary Arterials	20
Pedestrian Generators	5 points for each school or park within the study area (other Pedestrian Generators may be defined by City staff)	10
Pedestrian Facilities	10 points if there are no sidewalks in the study area, 5 if only on one side	10
Emergency Services and Routes	- 6 points if the study area is a primary Emergency Services route	0
Transit Services and Routes	- 4 points if the study is an existing or planned transit route	0
Block Length	1 point for each 50 metre increment between stop-controlled points	10
Adjacent Land Uses (residential)	1 point for each 20% of residential land use	5
		100

EXHIBIT: D

Road Segments Evaluated in 2011 Which Qualify for Traffic Calming

Location	Score	Length (m)	Transit or ES Route?	Preliminary Cost Estimate
Arnold Street (Barbara Street to 400 m West of Skyward Drive)	51.4	515	Yes	$80,000
Churchill Avenue (Falconbridge Highway to Gemmell Street)	41.7	390	Yes	$60,000
Cote Avenue (Highway 144 to Hill Street), Chelmsford	44.8	450	No	$70,000
Errington Avenue (Highway 144 to Main Street)	69.6	1120	Yes	$170,000
King Street (Morin Avenue to Notre Dame Avenue)	33.4	590	Yes	$90,000
Morin Avenue (Dell Street to Tedman Avenue)	50.5	460	Yes	$70,000
York Street (Courtney Hill to Paris Street)	65.0	640	Yes	$100,000

EXHIBIT: E

Road Segments Which Do Not Qualify for Traffic Calming

Street	From	To	Reason Segment is not Eligible for Traffic Calming
Algonquin Road	Regent Street	Maurice Street	Non-Local Traffic Percentage & Volume do not meet the minimum requirements.
Arnold Street	400 m west of Skyward Drive	Moonrock Avenue	Non-Local Traffic Percentage & Speed do not meet the minimum requirements.
Arnold Street	Regent Street	Barbara Street	Scored less than 30 points in the ranking process.
Cedar Green Drive	Falconbridge Road	Racicot Drive	Non-Local Traffic Percentage & Volume do not meet the minimum requirements.
Church Street	Balsam Street	Peter Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Colleen Avenue	Gravel Drive	Ivan Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Countryside Drive	Blyth Road	Countryside Drive	Volume does not meet the minimum requirements.
Dennie Street	Clyde Street	M.R. 80	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Eleventh Avenue	Municipal Road 24	Sixth Avenue	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Jeanne D'Arc Street	Leger Crescent	Hamilton Crescent	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Jeanne D'Arc Street	M.R. 80	Heritage Drive	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Kathleen Street	CP Rail Crossing	MacKenzie Street	Non-Local Traffic Percentage & Speed do not meet the minimum requirements.
Lamothe Street	Hill Street	South End	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Latimer Crescent	Loach's Road	Hunter Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Laurier Street	Lakeview Place	Parkview Drive	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Lavoie Street	Drummond Avenue	Rideau Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Lavoie Street	Rideau Street	Montrose Avenue	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Logan Street	Lorne Street	Tuddenham Avenue	Non-Local Traffic Percentage & Volume do not meet the minimum requirements.
Long Lake Road	Dew Drop Road	Chief Lake Road	Non-Local Traffic Percentage & Volume do not meet the minimum requirements.
Lorraine Street	Lasalle Boulevard	Kent Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Melbourne Street	Lansing Avenue	Kelvin Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Morris Street	Elgin Street	East End	Non-Local Traffic Percentage & Volume do not meet the minimum requirements.
Orell Street	Ravina Avenue	Primrose Drive	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Orell Street	Primrose Drive	Desjardins Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Patricia Street	Melvyn Avenue	Mikkola Road	Non-Local Traffic Percentage & Volume do not meet the minimum requirements.

EXHIBIT: E

Street	From	To	Reason Segment is not Eligible for Traffic Calming
Randolph Road	Fairbank Lake Road	Albert Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Ravina Avenue	Orell Street	60 m West of Monique Crescent	Non-Local Traffic Percentage & Volume do not meet the minimum requirements.
Ravina Avenue	60 m West of Monique Crescent	Primrose Drive	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Ravina Avenue	Primrose Drive	Orell Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Rose Marie Avenue	Lasalle Boulevard	Montfort Street	Non-Local Traffic Percentage & Volume do not meet the minimum requirements.
Rose Marie Avenue	Montfort Street	North End	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
St. Jean Street	Junction Avenue	Aldege Street	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Third Avenue	Philip Street	Anderson Drive	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
Vine Avenue	Gemmell Street	Hawthorne Drive	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.
William Avenue	Gemmell Street	Hawthorne Drive	Non-Local Traffic Percentage, Speed & Volume do not meet the minimum requirements.

EXHIBIT: F

Traffic Calming Final Street Ranking - 2011

Rank	Location	Score	Length (m)	Transit or ES Route?	Preliminary Cost Estimate
1	Auger Avenue (Lasalle Boulevard to Gemmell Street)	74.2	1000	Yes	$150,000
1	Riverside Drive (Regent Street to Broadway Street)	74.2	960	Yes	$145,000
3	Michelle Drive (MR 80 to Ivan Street)	71.6	1100	Yes	$165,000
4	Brenda Drive (Moonrock Avenue to St Charles Lake Road)	69.8	1300	No	$195,000
5	Errington Avenue (Highway 144 to Main Street)	69.6	1120	Yes	$170,000
6	York Street (Courtney Hill to Paris Street)	65.0	640	Yes	$100,000
7	Lansing Avenue (Lasalle Boulevard to Maley Drive)	63.4	1750	Yes	$265,000
8	Grandview Boulevard (Montrose Avenue to Wedgewood Drive)	63.1	290	Yes	$45,000
9	Loach's Road (Regent Street to Lo-Ellen Park School)	59.3	360	Yes	$55,000
10	Kelly Lake Road (Southview Drive to Copper Street)	59.3	490	Yes	$75,000
11	Hawthorne Drive (Barry Downe Road to Auger Avenue)	54.3	860	Yes	$130,000
12	Arnold Street (Barbara Street to 400 m West of Skyward Drive)	51.4	515	Yes	$80,000
13	Morin Avenue (Dell Street to Tedman Avenue)	50.5	460	Yes	$70,000
14	Dublin Street (Attlee Avenue to Arthur Street)	50.3	540	No	$85,000
15	Robinson Drive (Kelly Lake Road to Southview Drive)	49.4	950	Yes	$145,000
16	Balsam Street (Garrow Road to Nickel Street (East Leg))	49.1	1200	Yes	$180,000
17	Hawthorne Drive (Auger Avenue to Claudia Court (East Leg)	48.2	300	No	$45,000
18	Meehan Street (Dennie Street to Coulson Street)	47.4	330	No	$50,000
19	Valleyview Road (M.R. 80 to L'Horizon Secondary School)	47.0	180	No	$30,000
20	Cote Avenue (Highway 144 to Hill Street), Chelmsford	44.8	450	No	$70,000
21	Hillcrest Drive (Brian Street to Mikkola Road)	42.0	710	Yes	$110,000
22	Churchill Avenue (Falconbridge Highway to Gemmell Street)	41.7	390	Yes	$60,000
23	Second Avenue (Highway 17 to Government Road), Coniston	39.8	940	Yes	$145,000
24	Gemmell Street (Attlee Avenue to Downland Avenue)	39.2	200	No	$30,000
25	Edward Avenue (Highway 144 to Falcon Street)	37.3	570	Yes	$90,000
26	Woodbine Avenue (Agincourt Avenue to Roy Avenue)	37.1	450	Yes	$70,000
27	Mackenzie Street (Baker Street to Elgin Street)	35.6	380	Yes	$60,000
28	Douglas Street (Brady Street to Riverside Drive)	34.3	170	No	$30,000
29	King Street (Morin Avenue to Notre Dame Avenue)	33.4	590	Yes	$90,000
30	Copper Street (Martindale Road to Corsi Hill)	32.8	1300	Yes	$195,000
31	Loach's Road (Oriole Drive to Cerilli Crescent)	32.6	660	Yes	$100,000
32	Stonegate Drive (Beatrice Crescent to Attlee Avenue)	31.7	250	No	$40,000

For Information Only

Winter Control Operations Update - 2011

Presented To:	Operations Committee
Presented:	Monday, Mar 05, 2012
Report Date	Monday, Feb 27, 2012
Type:	Correspondence for Information Only

Recommendation

For Information Only

Report attached.

Signed By

Report Prepared By
Shawn Turner
Manager of Financial & Support Services
Digitally Signed Feb 27, 12

Division Review
David Shelsted, MBA, P.Eng.
Acting Director of Roads & Transportation
Digitally Signed Feb 27, 12

Recommended by the Department
Greg Clausen, P.Eng.
General Manager of Infrastructure Services
Digitally Signed Feb 27, 12

Recommended by the C.A.O.
Doug Nadorozny
Chief Administrative Officer
Digitally Signed Feb 28, 12

BACKGROUND

This report provides the projected financial results of the 2011 winter roads operations up to and including December 2011. The projected result for the month of December is a $700,000 under expenditure as shown in Table 1. The full year under expenditure in winter roads operations is approximately $2.3M. Certain estimates were necessary to account for outstanding invoices.

Table 1
2011 Winter Control Summary
For the month Ending: December 31, 2011

	Annual Budget	December			2011 YTD		
		Budget	Actual	Variance	Budget	Actual	Variance
Administration & Supervision	2,171,589	366,318	373,999	(7,681)	2,171,589	2,299,933	(128,344)
Sanding/Salting/Plowing	6,412,850	1,395,727	977,122	418,605	6,412,850	4,798,238	1,614,612
Snow Removal	885,392	180,166	11,301	168,865	885,392	261,333	624,059
Sidewalk Maintenance	825,340	181,574	131,578	49,996	825,340	669,051	156,289
Winter Ditching/Spring Cleanup	1,345,100	11,040	2,216	8,824	1,345,100	1,287,380	57,720
Miscellaneous Winter Roads	3,550,277	570,091	522,272	47,819	3,550,277	3,549,547	730
Totals	15,190,548	2,704,916	2,018,489	686,427	15,190,548	12,865,483	2,325,065

December Winter Control Activities

As shown in Table 2 below, the City received 37 centimetres of snow or 58 percent (%) of the average December snowfall. This translated into a monthly under expenditure of approximately $700,000, due largely to under expenditures in sanding/salting/plowing and snow removal of approximately $400,000 and $170,000 respectively.

TABLE 2 2011 Snowfall							
	Jan.	**Feb.**	**Mar.**	**Apr.**	**Nov.**	**Dec.**	**Total**
Normal 30 year avg. (cm)	64	50	39	18	32	64	267
2011 Actual (cm)	59	32	54	22	1	37	205
% of Actual to Normal	92	64	138	122	3	58	77

Year to Date Winter Control Activities

For the full year 2011, winter roads operations are under budget by approximately $2.3M. Significant under expenditures of approximately $1.6M in sanding/salting/plowing and $600,000 in snow removal activities were realized during this period.

Summary

In summary, winter control operations in the month of December resulted in an under expenditure of approximately $700,000. For the full year 2011, winter roads operations are approximately $2.3M under budget as a result of large under expenditures in sanding/salting/plowing and snow removal.

For Information Only

Winter Control Operations Update - January 2012

Presented To:	Operations Committee
Presented:	Monday, Mar 05, 2012
Report Date	Wednesday, Feb 22, 2012
Type:	Correspondence for Information Only

Recommendation

For Information Only

Report attached.

Signed By

Report Prepared By
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Manager of Financial & Support Services
Digitally Signed Feb 22, 12

Division Review
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Acting Director of Roads & Transportation
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General Manager of Infrastructure Services
Digitally Signed Feb 22, 12

Recommended by the C.A.O.
Doug Nadorozny
Chief Administrative Officer
Digitally Signed Feb 29, 12

BACKGROUND

This report provides the projected financial results of the 2012 winter roads operations up to and including January 2012. The projected result for the month of January is a $500,000 over expenditure as shown in Table 1. Certain estimates were necessary to account for outstanding invoices.

Table 1
2012 Winter Control Summary
For the month Ending: January 31, 2012

	Annual Budget	January		
		Budget	Actual	Variance
Administration & Supervision	2,096,538	354,347	350,335	4,012
Sanding/Salting/Plowing	6,065,348	1,379,259	2,121,353	(742,095)
Snow Removal	929,487	270,464	102,869	167,595
Sidewalk Maintenance	834,440	166,885	272,681	(105,796)
Winter Ditching/Spring Cleanup	1,448,650	33,687	38,617	(4,930)
Miscellaneous Winter Roads	3,814,025	611,628	416,929	194,699
Totals	15,188,488	2,816,270	3,302,785	(486,515)

January Winter Control Activities

As shown in Table 2 below, the City received 98 centimetres of snow or 153 percent (%) of the average January snowfall. Additionally, the City experienced 3 freeze/thaw incidents during the month of January. This translated into a monthly over expenditure of approximately $500,000, due largely to over expenditures in sanding/salting/plowing and sidewalk maintenance.

TABLE 2 2012 Snowfall							
	Jan.	**Feb.**	**Mar.**	**Apr.**	**Nov.**	**Dec.**	**Total**
Normal 30 year avg. (cm)	64	50	39	18	32	64	267
2012 Actual (cm)	98						
% of Actual to Normal	153						

Summary

In summary, winter control operations in the month of January resulted in an over expenditure of approximately $500,000 as a result of large over expenditures in sanding/salting/plowing and sidewalk maintenance.

For Information Only

Maintenance Management Project Update

Presented To:	Operations Committee
Presented:	Monday, Mar 05, 2012
Report Date	Wednesday, Feb 22, 2012
Type:	Correspondence for Information Only

Recommendation

For Information Only

Signed By

Report Prepared By
Shawn Turner
Manager of Financial & Support Services
Digitally Signed Feb 22, 12

Recommended by the Department
Greg Clausen, P.Eng.
General Manager of Infrastructure Services
Digitally Signed Feb 22, 12

Recommended by the C.A.O.
Doug Nadorozny
Chief Administrative Officer
Digitally Signed Feb 28, 12

Background

As outlined in the Council report dated June 3, 2011 from the General Manager of Infrastructure Services (attached), staff has been diligently working on the Maintenance Management Project.

What a new CMMS will provide:

A new computerized maintenance management system based on today's technology offers a considerable increase in functionality relative to the City's current MMMS. The current MMMS facilitates budgeting, payroll, production and expenditure tracking. In addition to these attributes, a new computerized maintenance management system will aid in increasing productivity by providing:

- The opportunity for re-engineering business processes to align with industry best practices.
- Improved asset life and reduced downtime by automatically scheduling preventative maintenance.
- Ability to isolate high volume problem areas to effectively manage resources.
- Ability to interface with other financial and maintenance systems reducing duplication of information.
- Electronic records will provide a more efficient means of researching citizen issues.
- Sophisticated reporting will provide managers with the tools to effectively manage work flow.
- G.I.S. functionality that will harmonize with the corporate initiative on Enterprise G.I.S.
- Improved Citizen Relationship Management with the interface between Service Requests and Work Management.
- Enhancements to work planning, tracking and scheduling.
- Better planning, forecasting, managing, and coordinating of resources.
- Improved budgeting and expenditure tracking.
- Promote communication and planning between departments.
- Availability of historical records.
- Obtain timely and accurate information.

- Mobile /Field computing – The City has one of the largest geographic areas among all municipalities in Canada.

Update

Further to the initial requirements gathering exercise, staff performed reviews of major business processes that can be improved with the implementation of a new computerized maintenance management system (CMMS).

Staff also completed Phase One of building a full enterprise Geographic Information System (GIS) to manage required assets for the CMMS project. Phase Two of the GIS project is underway and will assure that all required assets are indentified and current for the start of the CMMS project.

Staff have been successful at selecting an internal candidate for the position of Project Manager for the Maintenance Management Project. The project manager, Mike Schler, has held several posts in the Information Technology division over the past 30 years. The project manager will lead the project team and report to the CMMS project steering committee comprised of:

-Doug Nadorozny, Chief Administrative Officer

-Greg Clausen, General Manager – Infrastructure Services

-Lorella Hayes, Chief Financial Officer

-Bruno Mangiardi, Chief Information Officer

The project team comprised of staff from across various divisions, a consultant and led by the project manager, developed the requirements for the maintenance management system. These requirements were the foundation for the RFP that was issued by the City on February 1, 2012. The RFP closes on February 28, 2012.

Schedule and Next Steps

March - April - Evaluation of RFP submissions including vendor demonstrations.

May 22 - Report to Steering Committee on selection process and successful proponent.

June 12 - Report to Council for the award of the RFP.

July – August – Contract, statement of work, and preparation for implementation.

Sept. – Start of CMMS project.

The project implementation will be undertaken in three phases with the following proposed dates:

Phase I – Sept/2012 to March/2014

Phase II – Oct/2014 to Oct/2015

Phase III – Mar/2016 to Mar/2017

Budget

The preliminary estimate for the implementation of the Maintenance Management Project is approximately $2.5M. Currently, funds have been committed in the amount of $2.45M. Staff will outline a detailed funding arrangement upon award of the RFP for this project.

For Information Only

Maintenance Management Project

Presented To:	City Council
Presented:	Wednesday, Jun 15, 2011
Report Date	Friday, Jun 03, 2011
Type:	Correspondence for Information Only

Signed By

Report Prepared By
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Manager of Financial & Support Services
Digitally Signed Jun 3, 11

Recommended by the Department
Greg Clausen, P.Eng.
General Manager of Infrastructure Services
Digitally Signed Jun 3, 11

Recommended by the C.A.O.
Doug Nadorozny
Chief Administrative Officer
Digitally Signed Jun 3, 11

Recommendation

For Information Only

Finance Implications

The estimated cost of this project is $2.5 million with $900,000 that has already been set aside from previous years' budgets. The remaining funding will come from future years' capital budgets.

Background

The Municipal Maintenance Management System (MMMS) is a software system that was developed in the 1970's by the former City of Sudbury. The MMMS system was used by the City of Sudbury and Regional Municipality of Sudbury to plan, record and report on work units completed and actual costs versus budgeted units in Public Works (roads, water, wastewater, parks/recreation, solid waste and fleet).The MMMS records production and expenditure data that can be delineated based on geographic area, work activity, or by cost centre. MMMS reports are relied upon by Management to track progress of production and expenditures throughout the year. They are used to establish budgets and staffing levels.

Over the three decades since development, the MMMS system has undergone numerous modifications and has been interfaced with various budgeted and planning systems that the municipality has adopted. However, the technology of the current MMMS is outdated and cannot support current and future corporate initiatives.

There has been one study and one audit performed that have assessed the City's current MMMS. In 2007 KPMG was engaged to study the MMMS. This report highlighted issues such as:

-The high operating cost of the MMMS due to the labour intensive nature of the system.

-The MMMS is based on business processes from the 1970's and has not kept pace with changes in process and technology.

-The reporting formats have not kept pace with the changing information needs of the City.

Recently, the Auditor General's 2010 audit on Miscellaneous Winter Roads Maintenance recommended that "Due to the age of the software and limited ability within MMMS to associate activities and costs to specific road assets or road segments, management should continue to investigate other available programs in the market place that could be used to support budget planning, work order management, productivity tracking and cost analysis to the infrastructure asset level."

What a new system will provide

A new maintenance management system based on today's technology offers a considerable increase in functionality relative to the City's current MMMS. The current MMMS facilitates budgeting, payroll, production and expenditure tracking. In addition to these attributes, a new maintenance management system can aide in increasing productivity by providing:

- Improved asset life and reduced downtime by automatically scheduling preventative maintenance.
- Ability to isolate high volume problem areas to effectively manage resources.
- Database of how and when work orders are performed will reduce paperwork.
- Ability to interface with other financial and maintenance systems reducing duplication of information.
- Electronic records will provide a more efficient means of researching citizen issues.
- Sophisticated reporting will provide managers with the tools to effectively manage work flow.
- G.I.S. functionality that will harmonize with the corporate initiative on G.I.S.

Maintenance Management System (MMS) Project

In the fall of 2010, the City retained Prior and Prior – a management consulting and technology firm practicing exclusively in the municipal sector- to perform requirements gathering. A representative from Prior and Prior met with individual divisions as well as collectively with multiple divisions and departments to gather and document the requirements for a new maintenance management system.

In addition to the requirements gathering, a governance structure has been implemented for the MMS project. The governance of the MMS project consists of a Steering Committee and a Working Group under the leadership of a Project Manager.

The MMS project is large and will affect multiple departments and divisions. As a result an MMS Steering Committee has been assembled to provide high level guidance and corporate direction. The steering committee is comprised of:

- Doug Nadorozny, Chief Administrative Officer
- Greg Clausen, General Manager – Infrastructure Services
- Lorella Hayes – Chief Financial Officer
- Bruno Mangiardi – Chief Information Officer

As well, the project will have a Working Group that will assist the Project Manager as team leads in their respective areas. Working Group members may be included on a full-time or part-time basis as required. The Working Group members have yet to be finalized.

The Working Group will be led by a Project Manager that is to be determined. Due to the anticipated time frames and multi-faceted nature of the project, it is required that an external Project manager with proven experience in this field be retained.

Next Steps

A Project Manager will be required to work exclusively on the MMS project. This position will be posted internally and when a successful applicant selected, he or she will report to the Steering Committee. Due to the magnitude and diverse knowledge required to implement a maintenance management system, a project manager may work and/or consult with experts in this realm as required.

The Project Manager will be responsible for setting an achievable schedule for the R.F.P. for vendor selection, evaluation of the vendors, subsequent award and the implementation of the project. It is expected that the entire project will be implemented in multiple phases in order to manage the project and the resources most effectively and efficiently. The expected time-frame for complete implementation of all phases is approximately 3 years with milestones achieved at intervals along the way.

Budget

A preliminary estimate for the full implementation of a new maintenance management system is approximately $2.5M. Funding in the amount of $900,000 has been set aside during previous years budgets. This approved funding will be enough to start the process as outlined above. This work will allow staff to generate a more accurate cost estimate for the project. Final decisions for capital allocations will come from future Water/Wastewater and Roads capital envelopes via the capital budget process.

Request for Decision

On-Street Parking - Various Locations

Presented To:	Operations Committee
Presented:	Monday, Mar 05, 2012
Report Date	Wednesday, Feb 22, 2012
Type:	Managers' Reports

Recommendation

That parking be prohibited on the both sides of Paquette Street from LaSalle Boulevard to 80 metres north of Lamothe Street, between the hours of 8:00 a.m. and 4:30 p.m., Monday to Friday, and;

That parking be prohibited on the west side of Bulmer Avenue from Lorne Street to Mary Street, and;

That parking be prohibited along the north side of Victoria Street from Regent Street to 80 metres east of Regent Street between the hours of 8:00 a.m. and 4:30 p.m. Monday to Friday, and;

That parking be prohibited along both sides of Pine Cone Road from 725 metres northeast of East Bay Road to 950 metres northeast of East Bay Road, and;

That parking be prohibited on the east side of Pine Cone Road from 950 metres northeast of East Bay Road to 1,100 metres northeast of East Bay Road, and;

That a by-law be passed by City Council to amend Traffic and Parking By-Law 2010-1 in the City of Greater Sudbury to implement the recommended changes all in accordance with the report from the General Manager of Infrastructure Services dated February 22, 2012.

Signed By

Report Prepared By
Dave Kivi
Co-ordinator of Transportation & Traffic Engineering Services
Digitally Signed Feb 22, 12

Division Review
David Shelsted, MBA, P.Eng.
Acting Director of Roads & Transportation
Digitally Signed Feb 22, 12

Recommended by the Department
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General Manager of Infrastructure Services
Digitally Signed Feb 22, 12

Recommended by the C.A.O.
Doug Nadorozny
Chief Administrative Officer
Digitally Signed Feb 28, 12

Background

Paquette Street, Sudbury

The Councillor for Ward 8, Fabio Belli, received requests from area residents to prohibit parking along Paquette Street. Further, Councillor Belli conducted a survey of residents of Paquette Street to determine the preferred option for the parking prohibitions.

Paquette Street is a collector roadway located north of LaSalle Boulevard within Ward 8 (**see Exhibit A**). It is constructed to an urban standard with an asphalt surface width of approximately 10 metres and a sidewalk along the east side of the roadway. An entrance to the Cambrian College campus and to LaSalle

Secondary School is located off of the west leg of the Paquette Street and Lamothe Street intersection. Currently parking is permitted along Paquette Street.

Paquette Street residents expressed concerns with Cambrian College students parking on both sides of the roadway and making it difficult for vehicles to travel safely on the roadway.

The primary function of a public road is for the safe movement of traffic. On-street parking is usually permitted when this criteria is met. However, public roads are not intended to provide free, long term overflow parking for institutions and major commercial areas. Often times parking is prohibited or restricted near these facilities due to resident complaints.

Based on the responses received from the survey of area residents, it is recommended that parking be prohibited on the both sides of Paquette Street, from LaSalle Boulevard to 80 metres north of Lamothe Street, between the hours of 8:00 a.m. and 4:30 p.m., from Monday to Friday. Councillor Belli has indicated his support for this recommendation.

Also, while reviewing the parking concerns on Paquette Street, staff noted that a stop sign was installed at the intersection of Paquette Street and Paquette Street which does not have a by-law to support it. It is recommended that the Traffic and Parking By-law be updated to legitimize this Stop sign.

Bulmer Avenue, Sudbury

City staff received a request from Ward 1 Councillor, Joe Cimino, to have additional no parking signs installed along the west side of Bulmer Avenue as the roadway is too narrow to support parking on both sides. As a result of the request, it was discovered that there is no by-law to support the existing no parking area.

Bulmer Avenue is a collector roadway located north of Lorne Street in the community of Gatchell within Ward 1 (**see Exhibit B**). It is constructed to an urban standard with an asphalt surface width of approximately 10 metres and no sidewalks. Delki Dozzi playground is located at the north end of Bulmer Avenue. There are currently two no parking signs installed on the west side of Bulmer Avenue near each end. Parking is currently permitted along the east side of the road.

To improve safety, it is recommended that parking be prohibited on the west side of Bulmer Avenue from Lorne Street to Mary Street. Councillor Cimino has indicated his support for this recommendation.

Victoria Street

Staff received a complaint, through the Councillor for Ward 1, Joe Cimino, about vehicles parking on both sides of Victoria Street to pick up and drop off children at the Montessori School of Sudbury. The school is located in the southeast corner of the intersection of Regent Street and Victoria Street (**see Exhibit C**).

In this area, Victoria Street is designated as a local road with an asphalt surface width of 10 metres and sidewalks along both sides. The presence of parked vehicles along both sides of Victoria Street for parent pick up and drop off makes it difficult for vehicles travelling in opposite directions to pass each other. This problem becomes worse in the winter as snow banks further narrow the road.

Currently parking is prohibited on both sides of Victoria Street within 20 metres of Regent Street to allow turning movements to occur unimpeded. To improve safety on Victoria Street, it is recommended that

parking be prohibited on the north side of Victoria Street from Regent Street to 80 metres east of Regent Street between the hours of 8:00 a.m. and 4:30 p.m., Monday to Friday inclusive. Councillor Cimino has indicated that he supports this recommendation.

Pine Cone Road

Staff has received a request from an area resident to prohibit parking on both sides of Pine Cone Road near a boat launch. The boat launch is located approximately 900 metres northeast of East Bay Road, and it provides access to Lake Wanapitei (**see Exhibit D**).

In this area, Pine Cone Road is a surface treated local road with gravel shoulders. Currently parking is permitted on both sides of the road. As there is limited parking within the boat launch, people are parking their vehicles on both sides of Pine Cone Road. Due to the narrow width of the road, the presence of parked vehicles on both sides restricts two-way traffic flow and creates safety problems. As you approach the boat launch from the west, there is a sharp horizontal curve that is on a down grade. To improve safety in this area, it is recommended that parking be prohibited on both sides of Pine Cone Road from the boat launch to 225 metres northwest of the boat launch.

South of the boat launch, Pine Cone Road has much better alignment, and some parking could be permitted. Therefore, it is recommended that parking be prohibited on the east side of the road from the boat launch to a point 150 metres south of the boat launch.

The Councillor for Ward 7, Dave Kilgour, has indicated his support from this recommendation.

EXHIBIT: A

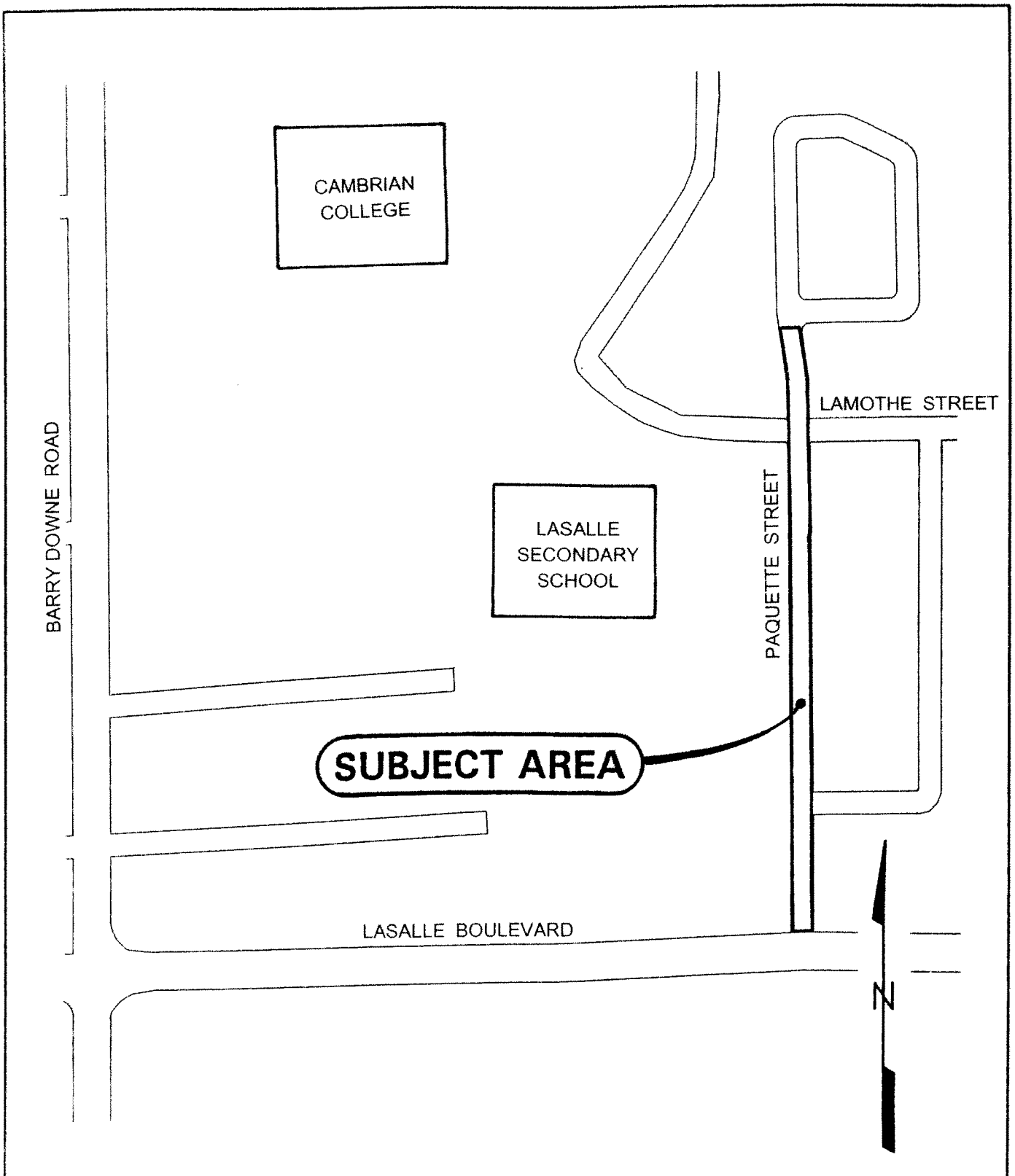
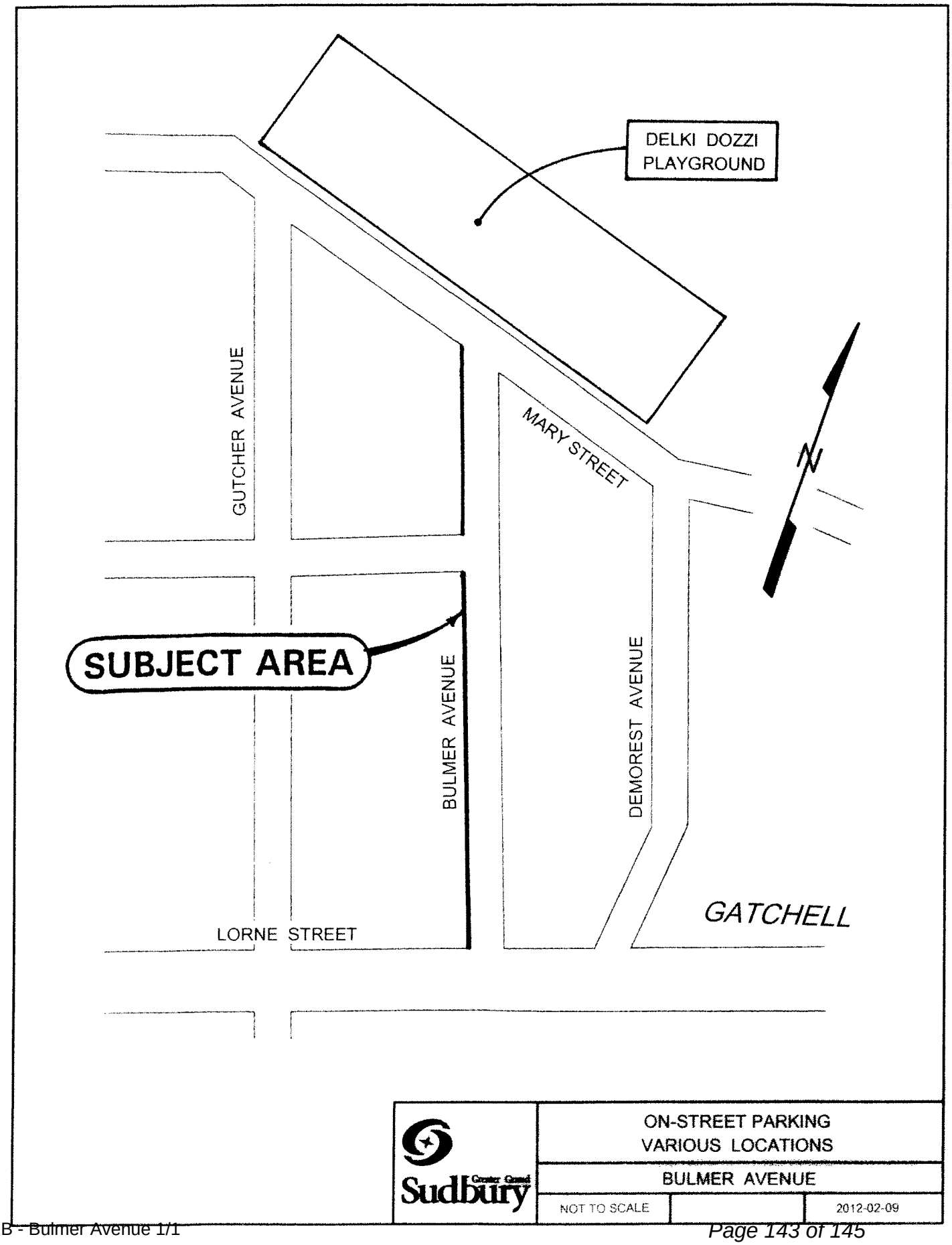

CAMBRIAN COLLEGE
LAMOTHE STREET
BARRY DOWNE ROAD
LASALLE SECONDARY SCHOOL
PAQUETTE STREET
SUBJECT AREA
LASALLE BOULEVARD
N
Greater Grand Sudbury
ON-STREET PARKING
VARIOUS LOCATIONS
PAQUETTE STREET
NOT TO SCALE
2012-02-09

EXHIBIT: B



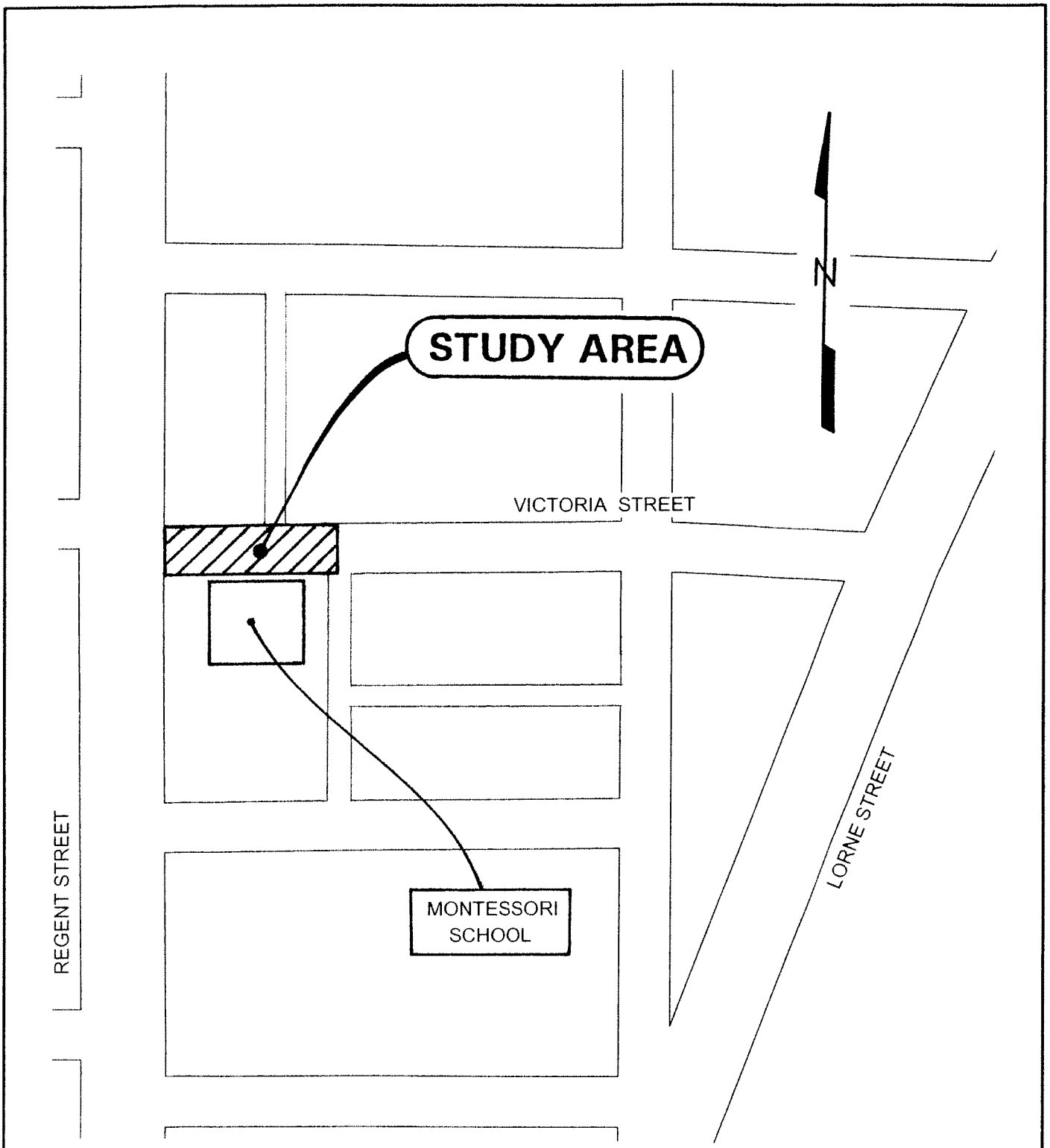
Sudbury

ON-STREET PARKING
VARIOUS LOCATIONS

BULMER AVENUE

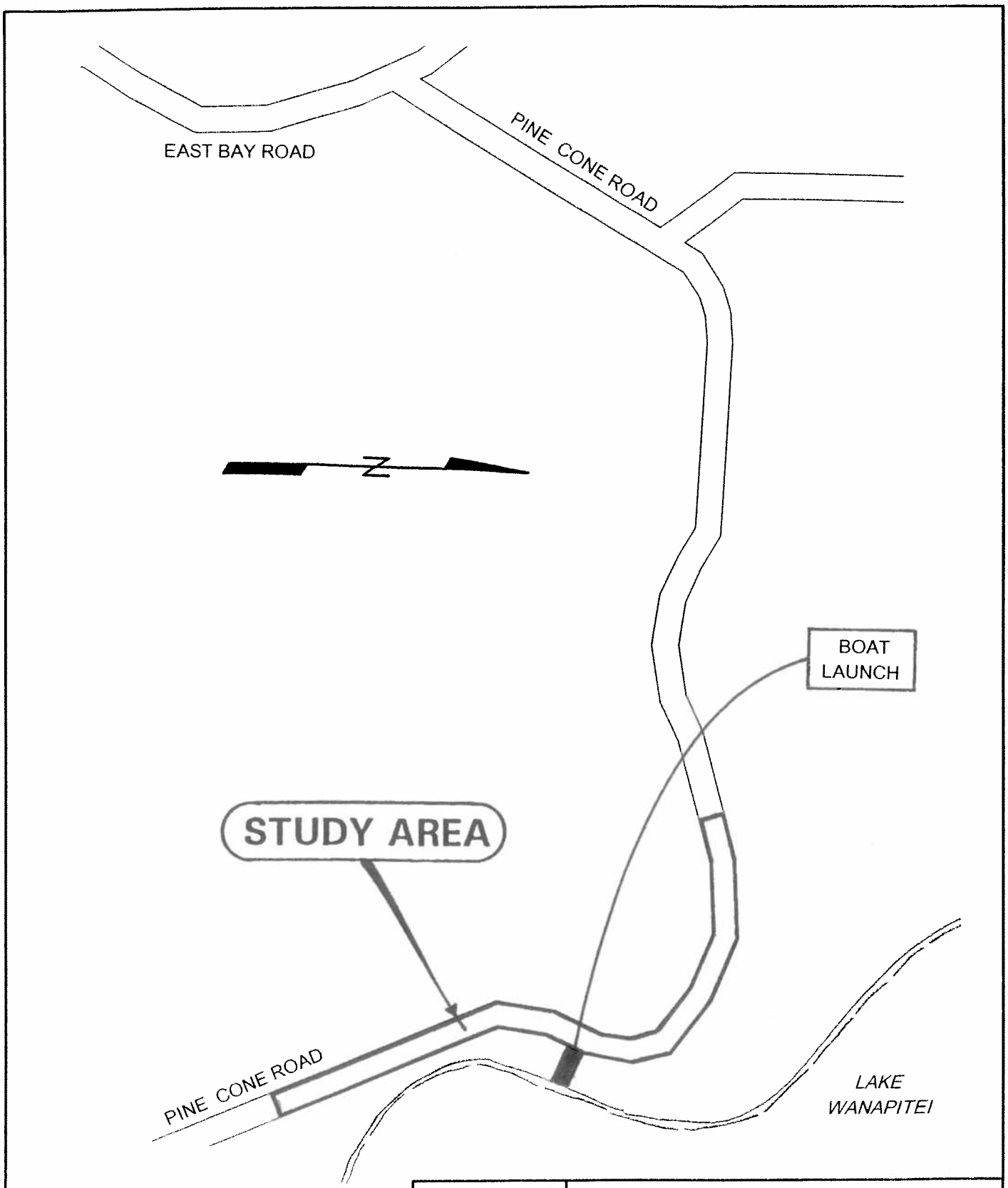
NOT TO SCALE		2012-02-09

EXHIBIT: C



Sudbury	ON-STREET PARKING VARIOUS LOCATIONS
	VICTORIA STREET
NOT TO SCALE	2012-02-13

EXHIBIT: D


EAST BAY ROAD
PINE CONE ROAD
N
BOAT LAUNCH
STUDY AREA
PINE CONE ROAD
LAKE WANAPITEI
Sudbury
ON-STREET PARKING
VARIOUS LOCATIONS
PINE CONE ROAD
NOT TO SCALE
2012-02-13