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TO:	CHAIR AND MEMBERS BUILT AND NATURAL ENVIRONMENT COMMITTEE MEETING ON NOVEMBER 14, 2011
FROM:	RON STANDISH, P. Eng. DIRECTOR, WASTEWATER AND TREATMENT PLANNING, ENVIRONMENTAL AND ENGINEERING SERVICES
SUBJECT:	FOUNDATION DRAIN DISCONNECTION TO MITIGATE BASEMENT FLOODING

RECOMMENDATION

That, on the recommendation of the Director of Wastewater and Treatment, Planning, Environmental and Engineering Services,

- (a) Civic Administration **BE DIRECTED** to prepare a by-law, for consideration at a future committee meeting, including public participation, requiring foundation drain disconnections in basement flooding prone areas.

PREVIOUS REPORTS PERTINENT TO THIS MATTER
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ETC June 21, 2010, "Measures to Reduce Inflow and Infiltration into Sanitary Sewers".

ETC June 7, 2010, "Voluntary Downspout Extension Pilot Study: Sherwood Forest."

ETC December 7, 2009, "Sherwood Forest Flooding Assessment and Mitigation Works Study – Scope Change – ES2680."

ETC November 16, 2009, "Basement Flooding Report: Follow-up to Flooding Events in February 2009 and May 2009."

ETC August 24, 2009, "Appointment of Consultant for Sherwood Forest Flooding Assessment and Mitigation Works Study."

ETC August 24, 2009, "Grants for Sump Pump, Sewer Ejector and Storm Private Drain Connection By-law".

ETC July 2, 2009, "Smoke Testing of Sanitary Sewers".

BACKGROUND

Purpose:

The purpose of this report is to review and recommend an Inflow and Infiltration (I&I) reduction strategy which includes targeted, mandatory foundation drain disconnections for homes located in areas that are prone to basement flooding. The Sherwood Forest area is used as a case study in this regard.

Executive Summary:

Excessive Inflow and Infiltration into sanitary sewers can overwhelm sewer mains, pumping stations and wastewater treatment plants resulting in basement flooding, sewer bypasses and reduced treatment plant efficiencies.

The social and environmental impacts of excessive I&I are substantial. The urban environment and the health of the Thames River are negatively impacted by basement flooding, bypasses and overflows caused by allowing these extraneous storm water flows into the sanitary sewer

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system. Basement backups and surcharging on streets and private properties have serious economic and social costs, and present serious health hazards.

Regulatory agencies are setting tighter criteria on bypasses and overflows to watercourses. The insurance industry is seeing a dramatic increase in basement flooding claims from overwhelmed sewer mains making this type of home insurance coverage more expensive for the homeowner and harder to obtain for those that have made such claims.

Municipal funded basement flooding solutions in the past have focused on increasing pipe sizes, constructing inline or offline storage and building wastewater treatment plants large enough to accommodate these excessive flow volumes. These are high cost and ineffective solutions that can further burden all wastewater rate payers to provide a solution for a few.

In the City of London the major source of excessive I&I of storm water into our sanitary sewer systems is from private foundation drain connections. The disconnection of foundation drains, a private side solution, will allow the City in a cost effective manner to remove extraneous inflow and infiltration at the source, thereby redirecting storm water flow to where it is supposed to be – in the storm sewer, rather than attempting to upsize the sanitary sewer system to convey and treat both sanitary and storm water flows.

The recommendation on this report is to return to a committee for a with a draft 'foundation drain disconnect bylaw' to be discussed in a public forum.

Context:

Basement flooding is a very serious concern for many homeowners in London and throughout North America. For many homeowners basements are becoming an important living space and can add significant value to the home. The climate is changing and correspondingly the insurance industry has seen a dramatic increase in the frequency and severity of sewer backup damage and claims in municipalities across the country. Claims for water damage have risen from 20% of all claims to over 50% to reach \$1.68 billion/year.

In the City of London excessive inflow and infiltration of storm water into our sanitary sewer systems from private foundation drain connections during severe wet weather events is the major cause of basement flooding.

I&I refers to stormwater runoff, snow melt and/or ground water that enters the sanitary sewer through a variety of means. Although some volume of I&I is accounted for in the design of sanitary sewers, some areas of the City experience much higher levels of I&I for a number of reasons. See Appendix A for a more in depth description of I&I.

High volumes of I&I in sanitary sewers often results in:

- Higher operating costs at sanitary pumping stations and sewage treatment plants, from pumping and processing this extra flow volume;
- Combined sewer overflows in the conveyance system and bypasses at the plants, from too great a flow volume for the conveyance and treatment systems to manage; and,
- Basement flooding, from too great a flow volume for the conveyance system to manage causing sewer backups.

Sherwood Forest Basement Flooding:

The Sherwood Forest area, defined here as the area located west of Wonderland Rd., between Gainsborough Road and Sarnia Road (see Appendix B), is an area in the City of London which has experienced basement flooding. This area was particularly hard hit with an intense rain storm on May 28, 2009. Over the past two years, the City has sent out a survey for the entire area, held a public meeting to inform and educate homeowners, and hired an engineering consultant, to undertake an analysis of flooding causes, which included computer modeling of the sanitary sewer system for the entire Sherwood Forest area.

Discussion:

The completed analysis of area characteristics, survey results, sewer flow monitoring data, and computer modeling of the Sherwood Forest subdivision has revealed the following:

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- Most of the homes were constructed before 1985; therefore, foundation drains were connected directly to the sanitary sewer (providing a direct path for storm water flows into the sanitary sewer).
- Soil type in this area is clay, which does not readily absorb water.
- Poor lot grading, which has settled or has been altered over the years, allowing water to flow toward home foundations, rather than away.
- Many eaves trough downspouts have been noted to outlet at the base of the home, rather than being extended some distance way from the foundation.

The above characteristics combine to produce a high volume of storm water inflow into the sanitary sewers. During a heavy rainfall event, the sanitary sewers can become overwhelmed with storm water and surcharge, or back up, into basements. Solutions to eliminate this issue are complex and expensive.

Following the May 2009 storm, reported flooding was generally concentrated within four areas in the subdivision (see Appendix C).

There are three fundamental ways to address the issue of basement flooding in this subdivision. The advantages and disadvantages to each method will be addressed in greater detail later in the report:

- 1) Current Grant Program: The City currently has the Grants for Sump Pump, Sewage Ejector and Storm Private Drain Connection By-law in place that provides 75% funding, up to certain limits, for the disconnection of foundation drains, sump pump and backwater valve installation. Homeowners who are concerned about basement flooding can take advantage of this grant program to protect their basements from future flooding.
- 2) Public Side Solution: Upsize sanitary sewers (replace exiting pipes with bigger pipes and/or provide storage) to convey additional wet weather flow volumes. This must include ensuring downstream capacities exist to pump and treat these additional wet weather flow volumes, without causing overflows and bypasses at other locations in the sewer system.
- 3) Private Side Solution: Simply removing extraneous wet weather flow at the source. The most effective way to do this is to disconnect residential foundation drains from the sanitary sewer system.

It is noted that there are other less drastic methods to improve conditions (such as extending roof downspouts, improvements to lot grading, use of rain barrels, etc), however, through the City's past experience it has been determined that these minor improvements will not make enough of an impact to provide basement flooding relief to homeowners.

Advantages and Disadvantages:

- 1) Current Grant Program

As a result of the May 2009 storm event, approximately 95 cases of basement flooding in the Sherwood Forest Area were ultimately reported to the City. The basement flooding was due to surcharging of the sanitary sewers adjacent to these properties during a very intense rainfall event.

Since May 2009, 13 applications have been received and approved for this same area to provide grants to homeowners to perform remedial flooding protection measures in an effort to reduce the possibility of future basement flooding due to a surcharged sanitary sewer.

Advantages

- Lowest cost solution.
- Rate funded program, up to 75% of costs to certain limits, already in place to protect homeowners from surcharged sanitary sewers.

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- With this existing rate funded grant program in place no further action is required by the City, save for running, advertizing and managing the program.

Disadvantages

- Regardless of the 75% rate funded grant opportunity not all homeowners are taking advantage of the program to protect their property. The program has been well advertized in general and discussed in detail at public meetings.
- In general, when a homeowner experiences basement flooding they consider it to be a City problem and expect the City to fix it at no cost to them.
- A homeowner who experiences multiple basement flooding events usually has trouble getting home flooding insurance.
- A homeowner with a 'dry' basement that has foundation drains connected to the sanitary sewer is a contributing cause of flooding of their neighbours homes but has no incentive to disconnect their foundation drain.

2) Public Side Solution

A City infrastructure solution was arrived at through computer modeling and analysis which would help to protect homeowners from future basement flooding events. This alternative includes pipe upsizing on Sherbourne Rd., Lawson Rd., Blanchard Cr., Blanchard Rd., Limberlost Rd., Olympic Cr., Ardsley Cr., and requires an in-line storage pipe along Sherwood Forest Square. The total cost associated with this work is currently estimated to be in the order of \$10 Million. This figure does not include additional operating costs associated with the downstream pumping and treatment of these additional flows.

Advantages

- No work is required on private property; therefore homeowners may feel less burdened by this option.

Disadvantages

- High cost solution – This places a burden on the rate based capital budget and requires the City to defer spending funds in other areas of the City.
- No guarantees – pipe upsizing and storage only provides protection up to a certain sized rain event. If a larger event (or back to back events) happens, basement flooding may still occur.
- Additional long term costs – since no flow is removed at the source, the City is forced to convey, pump, and treat additional stormwater flow in the sanitary sewers, which puts further strain on pumping stations and treatments plants. It is also noted that these larger pipes will still deteriorate and will have to be replaced at a higher cost (than the current smaller pipes) at some point in the future.
- Inefficient pipe lifecycle replacement – Most of the sanitary sewers in this subdivision are less than 30 years old; pipes normally have an 80-100 year life. We would not be maximizing the life of the sewer pipes or the road; which makes the expenditures much less efficient.
- Impact to homeowners – while it is noted that there would be no direct private property impact to homeowners, pipe replacement would require full road closures for months at a time with impacts to property access, and other construction related inconvenience that goes along with every construction project.

3) Private Side Solution

This alternative would use a city wide by-law, enforced in specific areas which have received flooding and identifies the number of homes which would be required to disconnect foundation drains from the sanitary sewer in order to provide an appropriate level of protection for the neighbourhood. The more homes that are disconnected the greater the protection would be. This would involve the installation of a backwater valve, sump pit and sump pump in the homeowner's basement. To alleviate concerns associated with surface flooding or icing issues, a storm private drain connection (PDC) would also be constructed to allow sump pump discharge to be directed to the storm sewer. In the Sherwood Forest area, it has been

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determined that 162 homes would be required to disconnect their foundation drains to achieve the required reduction in storm inflow into the sanitary sewer. Total costs are estimated to be in the order of \$2 Million. It is proposed that the City would construct and fund 100% of the costs for the installation of those items mentioned above, and also provide an allotment of \$1,000 to each homeowner to cover future operating and maintenance costs for the sump pump. This alternative also includes costs to resurface all roads where multiple pavement cuts have been made for storm PDC connections.

Advantages

- Lower cost – At an estimated 20% of the cost of the City infrastructure alternative, the City can better apportion expenditures in other areas of the City which have needs, and ultimately place less of a burden on the sewer rates and rate payers.
- Flow removed at source – By removing the extraneous storm flow from the sanitary sewer, the need for additional pumping and treatment capacity is eliminated, therefore freeing peak flow capacity at pumping stations and plants for growth or other needs. Additional long terms costs associated with the above are also eliminated.
- Greater degree of protection against flooding – since this option does not have to convey or store flows, there is less flooding risk associated with the 'next big storm'. A larger rain event in the future would simply mean that more flow is directed to the storm sewers
- Effective management of assets – The existing sewers have nothing physically wrong with them. By eliminating the need to upsize, the City can allow the sewers to realize their full lifecycle potential, which helps save costs. (Analogous to avoidance of replacing 40 year shingles 5 years into their life.)
- Use of storm PDCs – This alternative proposes that all sump pump discharge be directed into a storm PDC. This eliminates potential future issues associated with sidewalk/road icing, or saturated lawns, which have been experienced in other areas of the City.

Disadvantages

- Homeowner impacts – this option requires a sump pit and sump pump to be installed in homeowner's basements. Future maintenance associated with the sump pump will also be the homeowner's responsibility. It is anticipated that the City will receive some push back from homeowners. However, the inconvenience to the homeowner is considered to be worthwhile considering the benefits to the entire community and environment. The City is proposing to pay for 100% of the installation costs, as described above, plus provide an allotment of \$1,000 to cover operating and maintenance costs of the sump pump.
- Equality to homeowners – under this proposal, not all homeowners will be required to disconnect foundation drains; rather only those ones which are considered necessary by the City. Homeowners without fronting storm sewer will be exempt as the City will not be able to construct a storm PDC to collect sump pump discharge.

It is noted that homeowner responsibility and maintenance of a sump pump is not uncommon. Generally, every home built after 1985 has been constructed with a sump pit and sump pump; therefore, anyone who lives in a home built after this date already has this responsibility.

How Did We Choose Which Homes Need to Disconnect?

As it has been noted, a number of flow monitors were installed in the Sherwood Forest subdivision prior to the May 2009 rain event. These flow monitors captured the amount of wet weather flow inside the sewer during the May 2009 event and a number of subsequent rainfall events. Subsequently an 'all pipe' computer model of the subdivision was created. The flow monitoring data was used to 'calibrate' the model so that the modelled flow would reflect real life data. The sewer model allows us to run rain event simulations which will predict the number and location of homes susceptible to basement flooding. The model was then used to simulate 5, 10 and 25 year design storm events to assess the sensitivity of basement flooding and to compare to actual reported basement flooding calls. It was determined that the 25 year design storm accurately reflected the flooding reported during the May 2009 event.

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In order to reduce the susceptibility of flooding, a percentage of I&I (to represent disconnection of foundation drains) was removed from the model, and the model simulations were re-run to represent new surcharged levels which would show which properties would still be susceptible. Through many iterations and model runs using different I&I reduction percentages, an optimal disconnection volume was arrived at for each of the four identified flooding areas. This was applied to actual number of lots located in the susceptible flooding areas to identify which lots need to be disconnected. Lots without fronting storm sewer were exempted, because it has been determined that sump pump discharge will have to be directed to the storm sewer to avoid creating winter icing problems, commonly seen in other areas of the City where sump pump discharge is to surface only.

The focused foundation drain disconnection approach has identified 162 lots which need to be disconnected (see Appendix C). In simple terms – the more homes that are disconnected the greater the level of protection from future severe rainfall events. Model simulation runs with these lots disconnected shows that flooding susceptibility for all homes in the Sherwood Forest subdivision is greatly reduced up to and beyond the 25 year design storm event. Disconnecting additional homes would also provide greater benefits in reducing I&I flow operating costs (lower pumping and treatment costs, reduced bypasses and overflows) however; it is not determined to be of financial benefit for the City to fund these additional disconnections connections at this time. Homes not identified will continue to be eligible for the 75% sump pump grant program should they chose to disconnect.

Operating and Maintenance Funds for Homeowner:

It is recognized that homes chosen for weeping tile disconnection may incur additional operating costs associated with utilization of a sump pump. Since these homeowners have not installed a sump pump by their own choosing, the City has determined it would be reasonable to provide these homeowners a onetime allotment of \$1,000 following the installation of a backwater valve and sump pump. This money is intended to cover all operating and maintenance costs associated with a sump pump, including electricity and sump pump replacement for a period of approximately 10 years. This is considered to be a generous approximation of future sump pump operating costs.

Selective Enforcement of Proposed By-law:

Wastewater and Drainage Engineering (WADE) staff met with Legal Department and By-law Enforcement staff to discuss options for the creation of a 'Disconnect By-law'.

It was determined that a selectively enforced citywide bylaw was the most appropriate choice.

It is therefore recommended that in accordance with the City of London Policy Manual that should such a 'Disconnect By-law' be drafted for Council's consideration that the enforcement of it would follow Policy 13(2)(a)(iii) - enforcement by the "selective enforcement method" (See Appendix D).

How will the by-law be enforced?

These details can be addressed in detail through the draft by-law and reported back to committee, should the recommendations of this report be approved.

In general terms, *The Municipal Act* permits municipalities to pass by-laws to address drainage and flood control. The Act allows municipalities to issue Orders to discontinue activities and if the Orders are not complied with, the Municipality may undertake the works at the expense of the property owner and collect the associated fees in the same manner as municipal taxes. Since the required works are inside a privately owned structure it is unlikely that this would occur.

The City may also apply for a set fine (under \$1,000) in order to issue Provincial Offence Notices (fines). The City also has the option to issue Part 3 charges resulting in Court decisions on a charge and any associated fine amounts.

For comparative purposes, Municipal Law Enforcement Officers (MLEOs) issue very few fines related to Clearing of Land violations, but rather take actions to clear debris off property and bill

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the property owner. In 2010, over 600 properties were cleared of debris under the direction of MLEOs.

Financing:

There is currently \$490,000 of uncommitted dollars in the ES2680 – Sherwood Forest Flooding Remediation account.

An additional \$1.2M has been allocated in the 2012 Wastewater and Treatment (WWT) Capital Budget.

Under the three alternatives discussed above the project financing would be as follows:

1) Current Grant Program:

The current balance of \$490,000 would be reallocated and the 2012 request for an additional \$1.2M would be cancelled.

2) Public Side Solution:

No change would be made to the 2012 budget request of \$1.2M. Additional engineering work would be completed to confirm project costs and if additional funds were needed this would be budgeted in the 2013 WWT Capital Budget and the project would be implemented in 2013 as well.

3) Private Side Solution:

The WWT 20 Year Financial Plan would have to be reviewed to determine when and how the estimated \$10M solution could be budgeted. A review on a construction phasing strategy for this work would likely be a part of the budgeting review.

Community Information:

Should the recommendation of this report be approved a community information program will be critical for a successful program.

We would propose that elements of that program would include the following:

- General Sherwood Forest area Open House – no ‘presentation’, people could attend at the time they want and for as long as they need, staff present to discuss options on a one-to-one basis.
- Separate open house for those areas that are required to have foundation drains disconnected.
- One on one visits and or discussions with each homeowner that is required to have foundation drains disconnects.

Conclusions:

The considerations above make it very difficult to justify the Public Side (pipe upsizing and storage) solution. The costs alone make it prohibitive to proceed. Therefore, it is recommended that Civic Administration draft a by-law for this committee’s consideration to require foundation drain disconnection in basement flooding prone areas.

A private side solution will allow the City to remove extraneous inflow and infiltration at the source, thereby redirecting storm water flow to where it is supposed to be – in the storm sewer, rather than attempting to upsize the sanitary sewer to convey and treat both sanitary and storm water flows.

In Appendix E there are two news clippings that have been included to make two points. One, other municipalities are creating by-laws to assist in reducing basement flooding of private properties. Two, public side only solutions to reduce basement flooding of private properties can be quite costly.

It is Civic Administration’s firm belief that it is much more advantageous in both the short term and the long term to remove flow at the source, rather than accept and attempt to convey and treat it.




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Acknowledgements:

This report was prepared within the Wastewater and Drainage Engineering Division with assistance from Kyle Chambers, P.Eng, Environmental Services Engineer; the City Solicitors Office and Orest Katolyk, Manager of By-law Enforcement.

PREPARED BY:	RECOMMENDED BY:
	
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REVIEWED & CONCURRED BY:	
	
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October 28, 2011

Attach: Appendix A – Inflow and Infiltration Description
Appendix B – Map of the Sherwood Forest Area
Appendix C – Four Areas of Concern
Appendix D – Excerpt from the City of London Policy Manual, Chapter 13
Appendix E – Recent News Clippings

c.c. John Braam, P.Eng., City Engineer

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APPENDIX "A" Inflow and Infiltration Description

What is Inflow and Infiltration (I&I) and why is it a problem?

For the past 50-70 years, most North American cities, including London, have constructed two sewers to service developments: one sewer, a storm sewer, is constructed to collect rain and melt water runoff (through catchbasins on the road), and one sewer, a sanitary sewer, is constructed to collect sanitary flow (for discharge of all plumbing fixtures including showers, laundry, toilet, sinks, etc.). Sanitary sewers are not sized for collecting or conveying storm water. The occurrence of storm water or groundwater entering into sanitary sewers is called Inflow and Infiltration (I&I); Inflow is the direct flow of storm water into a sanitary sewer through a direct connection, and Infiltration is the seepage of groundwater into a sanitary sewer through leaks or cracks in the sewer. Infiltration is a function of the condition of the sewers and can be addressed through long term management and rehabilitation/replacement of sewers. Inflow, however, must be addressed in a different manner and should be minimized as much as possible, since it has the potential to contribute very large volumes of extraneous flow.

Where does Inflow come from?

Inflow comes from direct storm water source connections into the sanitary sewer. This can include catchbasins, roof downspouts, and foundation drains. Catchbasins, if found to be mistakenly connected to a sanitary sewer, are redirected to storm sewers at the earliest opportunity. It is illegal, under London's by-law to connect a roof downspout directly to a sanitary sewer, therefore, there is a means to rectify and remove that inflow source if one is found. However, foundation drains connected to the sanitary sewer remain as a major source of inflow which the City currently has no means of controlling. The following provides a brief history of foundation drains, as they apply to the City of London.

When a home is constructed foundation drains, or weeping tiles, are placed around the perimeter of the house at the bottom of the foundation. The purpose of these foundation drains is to collect groundwater (and groundwater only) to take it away from the base of the home before it has a chance to get into the basement through the concrete walls or through the joint between the basement floor and the basement wall (which is not generally water tight). The traditional view was that these foundation drains conveyed only small amounts of water, and so they were connected to the home's sanitary connection pipe. This practice was continued in London until 1985. In 1985, London's by-law was changed and foundation drains were no longer allowed to be connected to the sanitary sewer. Instead, foundation drains were directed to a sump pit and discharged to the outside surface via a sump pump. This change was made as it was found that increasingly higher volumes of inflow were being directed into the sanitary sewers from the foundation drains, and in some cases, causing sanitary sewer surcharging, leading to basement flooding. Various icing and surface water issues associated with sump pump discharges led to another by-law change in 1995. All homes constructed after 1995 are required to discharge all sump pump flow directly into a storm private drain connection (PDC) which is connected directly to the storm sewer.

The following table simplifies the timeline:

Year	Foundation Drains Connected To:
Up to 1985	Sanitary Sewer
1985 – 1995	Sump Pit Discharging to Surface
1995 - Present	Sump Pit Discharging to Storm Sewer

The problem of inflow from foundation drains is increased by the following conditions:

- Lot grading: lots around homes are originally graded so that water flows away from the house. However, over time, settlement can occur, which can direct water towards homes, down the foundation wall, and into the foundation drain
- Clay Soils: Clay type soils do not absorb water; therefore, water travels along the ground, rather than being absorbed.
- Roof Downspouts: Roofs on homes can collect a tremendous amount of water. Roof downspouts are supposed to be extended at least two meters away from the base of

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the home. If downspouts are outletting too close to the home, the water simply infiltrates down to the foundation drains.

- **Smaller Lots:** Some subdivisions have very close lot spacing. This reduces the amount of green space and increases the amount of hard surfaces (roofs, driveways), which reduces the ability for the land to absorb water. Instead, water gets directed along the surface.

Some areas in London have all of the above characteristics: small lots; clay soil, poor lot grading, downspouts exiting too close to the home, and foundation drains connected to the sanitary sewer. During extreme rain events, there is simply too much water being directed to the sanitary sewer from foundation drains.

Other Issues Associated with I&I:

Basement flooding can be considered the worst case outcome associated with too much I&I in the sanitary sewers. However, I&I can pose other problems as well, which are outlined below:

- **Overflows/Bypasses** – London has overflows, or bypass pipes within the sewer system and at every pumping station and treatment plant. If wet weather flows in the sanitary sewer become too great to handle, the excess flow is bypassed directly to a watercourse to prevent basement flooding. These flows are not treated, and therefore may have an environmental impact on the watercourses.
- **Treatment Cost** – All sanitary flow is treated at one of London's six sewage treatment plants. Storm sewers discharge directly to a watercourse. When I&I get into the sanitary sewer, we are forced to treat the additional volumes, which results in an additional unnecessary operational cost. Reduction in I&I equals less flow, which results in lower treatment costs.
- **Lower Sewer Capacity** – I&I takes up space, or capacity, inside the sanitary sewer. Lack of capacity limits the amount of development growth which can be accommodated by the sewer system. Reduction in I&I frees up sewer capacity, which can allow further growth to develop without requiring costly sewer, pumping station, and plant upsizing.

How do we reduce I&I?

The City has a comprehensive capital sewer replacement and lining program to replace or rehabilitate aging sewers. This goes a long way toward addressing the infiltration side of I&I but does not adequately address the inflow side of the equation. Foundation drains remain a very large contributor to inflow. Currently, London has a voluntary sump pump grant program which is offered to homeowners in flood prone areas. This program disconnects foundation drains from the sanitary sewer, installs a sump pit and sump pump, and install a backflow preventer (valve in sewer connection which closes if flow direction reverses) to protect the homeowner from future sewer surcharges. This program is 75% funded by the City. However, to date, the City has had very low uptake on the program. The other large drawback is that it receives no interest from 'dry' basement owners, even though their foundation drains are contributing equally to the inflow problem.

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The following table outlines what some other municipalities are doing to disconnect foundation drains. Note that Fort Erie is the only municipality in Ontario which has implemented a mandatory disconnect program. Duluth, Minnesota has also implemented a similar program, although Duluth has different regulatory requirements to comply with.

Municipality	Type	Eligible Items	Amount of Subsidy	Upset Funding
London	Voluntary	Sump Pump, Backwater Valve, Storm PDC	75%	
Toronto	Voluntary	weeping tile disconnect, sump pump, backwater valve	80% of the cost of eligible works (to an upset cost limit)	
Hamilton	Voluntary	backwater valve, sump pump, sewer lateral inspection / repair, downspout disconnect		combined maximum of \$2,000 per property
Ottawa	Voluntary	installation of protective plumbing devices, sump pumps, downspout disconnect / flat roof work.	50% - 100% of the cost of eligible works to a maximum	maximum of \$2,500 to \$7,500, depending on scenario
Region of Halton	Voluntary	weeping tile disconnect, sump pump, backwater valve	50% of the cost of eligible works (to an upset cost limit)	
Sudbury	Voluntary	weeping tile disconnect, sump pump, backwater valve	50% of the cost of eligible works (to an upset cost limit)	
Fort Erie	Mandatory	weeping tile disconnect, sump pump, backwater valve, downspout disconnect, sewer later repair	100% of the cost of eligible works (to an upset cost limit)	

Other Means of Addressing I&I, Wet Weather Flow:

While it is recognized that the most effective way of managing I&I is to remove it at the source, there are other, albeit costly, methods of dealing with excessive wet weather flow into the sanitary sewer system. They include:

- Sewer Separation – this applies to older areas of the City which were originally constructed with only one sewer. Catchbasins, a major source of inflow, are connected to the sanitary sewer in these areas. A storm sewer must be constructed in these areas to provide an alternate outlet for the catchbasins. This is very costly, and typically only occurs when the combined sewer reaches the end of its life.

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- Storage – When wet weather flows in the sanitary sewer exceed the capacity of the conveyance system or the pumping station/plant capacity, an alternative to bypassing is to store the additional flows, which are released back into the system at a slower rate after the storm has ended. This solution is also very costly, and still requires the City to treat all of the inflow, as none of the flow is removed, it is simply stored and treated at a later time. Examples of storage solutions in London include twin in line storage pipes which were constructed in White Oaks, and a large overflow pond which was constructed next to the Dingman Pumping Station. However, these very costly solutions have their limitations; a storm (or back to back storms) exceeding the capacity of the storage results in basement flooding or overflows to the adjacent watercourse.
- Rapid Treatment at the Plant – Advances in technology has allowed for more rapid treatment processes at the plant to allow the plant to handle more flow. However, there are still two obvious drawbacks: 1) we must still pay to treat the additional flow since it has not been removed, and 2) the conveyance system must be big enough to carry the flow; if inflow overwhelms the sewers or the pumping station, basement flooding or bypasses can still occur, no matter how rapid the plant can treat the flows.

There is no better solution than to remove the flow at the source. By removing the flow, one does not have to be concerned about pipe upsizing, storage, pumping station upgrades, rapid treatment processes, or additional costs associated with treatment of inflow. Foundation drains remain a major contributor to inflow, and it is anticipated that a mandatory foundation drain disconnection program in basement flooding prone areas will provide a solution to basement flooding that is much more cost effective in both the short and long term.

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APPENDIX B
Map of the Sherwood Forest Area

Sherwood Forest - Study Area

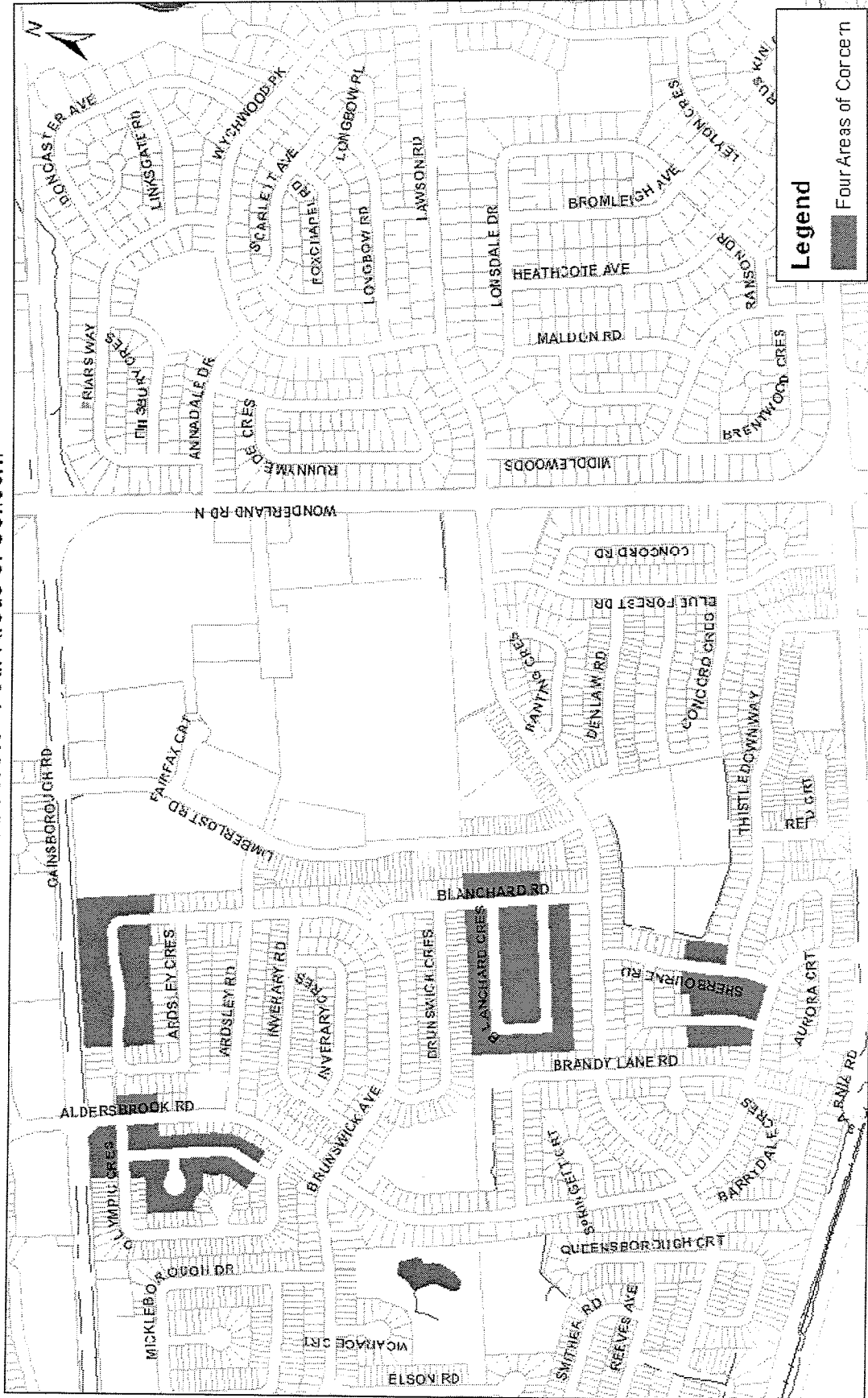


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**APPENDIX C
Four Areas of concern**

Sherwood Forest - Four Areas of Concern



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APPENDIX D

Excerpt from the City of London Policy Manual, Chapter 13, Legal Services

13(1) Legal Services and Accounts

That a Legal Services and Accounts Policy as set out in Appendix 13(1A) be established.

ADOPTED JUNE 20, 1977, AMENDED MAR 2004, APRIL 2005 [13(1) AUG 1999]

13(2) Enforcement by City Personnel

- (a) That the following policy be established with respect to the method of enforcement of those statutes, regulations and municipal by-laws ("municipal laws") which City personnel are responsible to enforce:
- (i) enforcement of the Traffic and Parking By-law and building regulations continue to be carried out by the "general enforcement method" (enforcement over a predetermined beat or route or as part of another predetermined task);
 - (ii) enforcement of all other municipal laws continue to be carried out by the "responsive enforcement method" (enforcement in response to complaints received for the purpose of achieving compliance in each individual situation); and
 - (iii) **enforcement by the "selective enforcement method" (enforcement concentrated significantly on a particular problem in a particular locality, whether or not in a high profile manner, in order to achieve greater compliance by the public in general) be carried out only after assessing, among other things, the availability of City personnel and budgeted funds, the complexity of the contemplated enforcement, the time period during which enforcement has to be carried out, and the degree of compliance likely to be achieved;**
- (b) That with regard to providing the Corporation with municipal law enforcement services outside the normal work day of City enforcement personnel, the Civic Administration be given the discretion, having regard to the availability of trained City personnel and budgeted funds, to use any of the methods of stand by, call out or overtime that are currently available under the City's Collective Agreements;
- (c) That the following policy be established respecting the time for corrective measures and the initiation of enforcement process:
- (i) where a contravention of a municipal law (other than a zoning by-law) is a first offence and can be dealt with by remedial action or abandonment (such as obtaining a licence or discontinuing an unauthorized sidewalk sale), regardless of the source of the complaint, the responsible civic department will not issue an offence notice or lay a charge until the department has given the alleged offender appropriate notice of the contravention and has given the alleged offender a reasonable opportunity to bring the situation into conformity;
 - (ii) where a contravention of a municipal law (other than a zoning by-law) cannot be dealt with by remedial action or abandonment (such as an

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unlawful discharge into a sewer), the responsible department shall issue an offence notice or lay a charge forthwith for contravening the municipal law;

- (iii) where a contravention of a zoning by-law is a first offence and appears to the responsible department to be inadvertent or unintentional, regardless of the source of the complaint, the department not lay a charge until the department has given the alleged offender written notice of the contravention and has given the alleged offender a reasonable opportunity to bring the situation into conformity; and
- (iv) where a contravention of a zoning by-law appears to the responsible department to result from a conscious disregard of the zoning by-law, regardless of the duration of the contravention, the department lay a charge forthwith for contravening the by-law;
- (d) That offences under municipal laws (except zoning by-laws and the property standards by-law) be prosecuted by issuance of offence notices rather than continuing with the present practice of laying information and serving summonses to Court, it being noted that those offences, where the nature of the offence or the number of previous similar offences justifies, would still be prosecuted by the laying of an information and it being further noted that because of their complexity, zoning by-laws would continue to be prosecuted by the laying of an information and the serving of a summons;
- (e) That the City Solicitor's Office continue with the practice that, once a charge is laid, the charge be continued through to and including the conviction stage unless there is a technical reason for not doing so and any steps initiated by the offender after a charge is laid be considered in relation to penalty, not to the withdrawal of the charge, and that the withdrawal of a complaint to the affected department, after a charge has been laid, will have no relevance to the continuation of the prosecution of the charge;
- (f) That the repetition or continuation of a offence on which a first conviction has been obtained be dealt with by the laying of further charges and, on conviction, the seeking of increased fines, rather than relying exclusively on prohibition orders and proceedings for contempt of Court; and
- (g) That, subject to the terms of the POA Transfer Agreement, the City Solicitor's Office be authorized to continue, for the foreseeable future, with the previous position taken by the department with the local Crown Attorney's Office that the Department will not assume prosecution of charges laid by non-City personnel.

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APPENDIX E News Clippings

This article has been included to highlight that other Canadian municipalities are considering using regulations to reduce basement flooding in selective areas.

Montreal to set new building rules to prevent flooding

The Gazette May 16, 2011

After recent flooding along the Richelieu River, Montreal is putting new building regulations in place to prevent homes flooding on the island.

Photograph by: Tim Snow, The Gazette

MONTREAL — The city of Montreal will introduce a new set of regulations this summer that it says will help minimize property damage in the event of future flooding on the island.

Sixteen boroughs have agreed to adopt the new rules, which will require the owners of certain properties to install backflow prevention valves (also known as “check valves”) and a pumping system that will force water away from their buildings in the event of a major flood.

Any property owner who does not comply with the new regulations could be subject to a fine of between \$300 and \$700 on a first offence. The rules will apply only to:

1. Buildings that have flooded in the past.
2. Buildings where there is ongoing renovation work being carried out in the basement.
3. Buildings under construction.

The regulations come into effect on July 1 in Ahuntsic-Cartierville, Anjou, Côte des Neiges-Notre Dame de Grâce, Lachine, LaSalle, Île Bizard-Ste. Geneviève, Mercier/Hochelaga-Maisonneuve, Montreal North, Outremont, Rosemont-Petite Patrie, St. Laurent, St. Léonard, Verdun, Ville Marie, and Villeray-St. Michel-Park Extension. They take effect in Pierrefonds-Roxboro on Sept. 1.

Along with the changes to municipal regulations, the city says it will continue to upgrade the municipal water and sewage systems to prevent water main breaks and reduce the chance of overflow in sewers during major rainstorms.

“Because of changes to our climate, the frequency of (heavy rains) will likely to continue to increase,” said a release issued Friday. “All North American cities are confronting this phenomenon ... and no sewer system is built to offer zero risk of overflow.”

To read the official announcement from the City of Montreal (in French), click [here](#).

For more information on the new regulations, visit www.ville.montreal.qc.ca/eaudemontreal

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Read more:

<http://www.montrealgazette.com/Montreal+building+rules+prevent+flooding/4785202/story.htm#ixzz1McEi7GhW>

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This article has been included to highlight the high cost of public side basement flooding remediation measures.

Council committee approves flood-investigation plan

The Ottawa Citizen May 17, 2011

OTTAWA — Council's environment committee approved a five-phase plan to investigate the flooding of nearly 1,500 Glen Cairn basements after 100 millimetres of rain fell during a major rainstorm on July 24, 2009.

The city has earmarked a total of \$32 million for anti-flood measures in the Kanata and Stittsville areas, some of which have already started. The recommended plan includes \$3.6 million for pond cleaning and expanding the Glen Cairn stormwater pumping station, \$8.8 million to improve the Glen Cairn storm drainage system and \$4.6 million to improve the Hazeldean sanitary pumping station.

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Read more:

<http://www.ottawacitizen.com/news/Council+committee+approves+flood+investigation+plan/4799120/story.html#ixzz1MnmBoHHI>