TO:	**CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON WEDNESDAY, JUNE 8, 2016**
FROM:	**JOHN BRAAM, P.ENG MANAGING DIRECTOR - ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER**
SUBJECT:	**FLOODING MATTERS WORK PLAN PHASE I (INVESTIGATION)**

RECOMMENDATION

That on the recommendation of the Managing Director - Environmental & Engineering Services & City Engineer, the following actions BE TAKEN with respect to Phase I of the Flooding Matters Work Plan:

a) this report **BE RECEIVED** for information;
b) the Civic Administration **BE DIRECTED** to report back on sump pump subsidy program communication enhancements; and,
c) the Civic Administration **BE DIRECTED** to report back on any further research or answer any questions before consulting with the public.

PREVIOUS REPORTS PERTINENT TO THIS MATTER

CWC Report of 2015-12-01, Item 10, Flooding Matters Work Plan Proposal

CWC Report of 2015-10-06, Item 6, Flooding Matters, Terms of Reference

CWC Report of 2015-07-20, Item 5, Update on Rainfall Event of June 23, 2015

CWC Report of 2014-09-22, Item 9, Update on Rainfall Event of September 10, 2014

CWC Report of 2012-08-22, Foundation Drain Disconnection to Mitigate Basement Flooding

BNEC Report of 2011-11-14, Foundation Drain Disconnection to Mitigate Basement Flooding

2015 – 19 STRATEGIC PLAN

This report and its recommendations support the Strategic Plan under Building a Sustainable City – Strong and healthy environment, by finding new ways to help residents protect their basements from flooding.

BACKGROUND

Purpose:

The purpose of this report is to satisfy a recommendation presented to the Civic Works Committee on December 1, 2015, requiring Civic Administration to report on information gathered through an investigation of flooding causes as part of Phase I of the Flooding Matters, Work Plan Proposal.

Context and Summary:

In response to Council direction on December 8, 2015, Civic Administration devised a project charter that identified and assigned resources encompassing a number of experts from various service areas across the Corporation. In addition, consultation with external experts representing the insurance industry and academia from local institutions took place to gain a better understanding of climate change, the impacts of severe weather events on private property owners and common challenges citizens face with respect to insurance coverage.

This report is comprised of elements representing the accumulation of individual efforts from members of the project team. Conclusions drawn and recommendations for consideration in this report stem from the investigations completed under the three major themes identified in the December 1, 2015 Civic Works Committee report: Homes, Hotspots and Programs. (Reference Appendix 'A')

Based on the research undertaken, this report concludes with generic approaches for discussion with the Civic Works Committee. The Civic Works Committee may consider the merits of these approaches now, or in the future with further information, it being noted that the legal and financial feasibility of the approaches have not been researched. The Committee may consider directing staff to report back on any further research or answer any questions before an approach is packaged for public comment.

Program and/or communication improvements of interest should be identified at this time for staff to report back on implementation implications.

Research conducted under this Phase I investigation confirms that municipalities across the country are experiencing more frequent high intensity, short duration rainfall events. The Institute for Catastrophic Loss Reduction (ICLR) suggest that "extreme rainfall is expected to increase in frequency and severity". The City of London is not immune to such severe weather events. In fact, just as recent as last year, (June 2015), the City of London experienced two back-to-back heavy rainfall events, producing up to 92mm of rainfall in localized areas of the city over a short period of time, noting that the historical average for the entire month of June is 81mm. The aftermath of this extreme weather event was 559 flooding calls from distressed citizens. It should be noted that while the City encourages citizens to report on basement flooding occurrences, many elect not to divulge such related information. Staff's suspicions are that perhaps 2 to 3 times the number of flooding calls received may actually reflect the true number of properties impacted by this intense rainfall event. The information on actual flooded basements is also not available from insurers.

The outcome of such extreme weather events requires extensive citizen time, effort and expenses to reinstate private property such as finished basements and manicured landscaping. The Institute for Catastrophic Loss Reduction estimates that "preventable damage to homes and infrastructure in Canada as a result of extreme rainfall presently exceeds $2 billion a year". The Insurance Bureau of Canada (IBC) states that in 2013 alone, insurers paid out a record high of $3.2 billion to policy holders specific to flooding claims.

The IBC has also informed us that first time and repeat flooding insurance claims are on a dramatic rise, citizens are putting pressure on all levels of government and the insurance industry to develop and impose insurance regulations similar to current auto insurance legislation. These pressures may in fact be greatest at the municipal level as Councillors and Civic Administration are more likely to deal directly with citizen frustration. The City of London's Municipal Council is empathetic to its citizens and on December 8, 2015 endorsed a 'Work Plan' requiring Civic Administration to undertake an investigation that explores various elements specifically associated with high intensity, short duration rainfall events.

Putting Flooding Matters in Perspective

Private property basement flooding caused by sewer backups resulting from excess Inflow and Infiltration (I&I – reference Appendix 'B') during high intensity short duration rainfall events account for, on average, approximately 25% of the annual basement flooding calls received by the City. This percentage can spike depending on the nature of the storm event; depending on annual rainfall, the range is from 5 to 55% (reference Appendix 'C'). Should a broader area, longer duration storm occur, then a significant spike in calls can also be expected. Of the 25%, the majority can be directly attributed to private side residential weeping tiles connected to the City's sanitary sewer system. Such weeping tile connections were common practice for homes built during the period of 1920's to 1980's. It is estimated that 50,000 of these private side connections exist in the City of London today.

In decades past, solutions to localized basement flooding occurrences was to relieve overwhelmed sanitary sewers by cross connecting them to the storm sewer system. When the sanitary sewer becomes overwhelmed the excess flow travels through the cross connection and into the storm sewer system and then into the Thames River. Basement flooding problem solved; however the City is left with these legacy cross connections that send untreated wastewater to the Thames, although it may be very diluted. To improve the health of the Thames River, eliminating these cross connections may also be part of citywide basement flooding solution.

Even if the overloaded sanitary sewers do not reach the point of backing up into peoples basements, the sheer volume of flow that reaches City pumping stations and treatment plants is significant in that this excess flow must then be pumped and treated resulting in operating costs that are not necessary. As flow volume increases it can become too great for those facilities to process resulting in overflows and bypasses at those locations. Again, past thinking was that this was preferable to having the excess flow in sanitary sewers backup into homeowner's basements; a matter of public health over environmental health.

The balance, 75% of the annual basement flooding calls received by the City, are related to a range of isolated issues such as private drain connection (PDC) collapses or obstructions, weeping tile blockages/collapses, sump pump failures, and/or internal plumbing failures. In the City of London the individual private property owner owns the entire length of sanitary pipe, from where it leaves the house to the point where it connects to the sewer main on the street. The majority of these basement flooding issues relate to the condition of the privately managed pipe and is attributed to aging infrastructure. The City, as custodians of the sewer systems, has a renewal program of 1.2% of the system each year; the private pipe has a completely reactionary program initiated by failure of the pipe. The differences between the two approaches suggest an ever increasing PDC failure rate, and an increase in flooded basements and repairs (internal and external) by the owner.

While basement flooding causes are considered a private property/ownership matter, homeowners continue to place high expectations on municipal governments and civic administrators to resolve their problems.

Property owners have been reactive to their basement flooding. This evidence is easily illustrated given that only 3% (approximately 1,500 homes) of the estimated 50,000 homes which have a weeping tile connection to the sanitary system have been addressed through the City's voluntary Basement Flooding Grant Program over a 30 year period that the program has been offered (0.3% per year). Homeowners who have, or may experience basement flooding often don't realize that the root of their flooding challenges originate on their own property. A significant communication gap exists about causes and responsibilities.

As previously noted, this report is the product of Municipal Council's direction to form a Working Group that would undertake an investigation of flooding matters specific to high

intensity, short duration rainfall events. The balance of this report reflects the results of the Working Group's Phase I investigation.

DISCUSSION

The Work Plan for Phase I includes reporting on research and analytical work as set out below:

- Homes – proactive -- insurance coverage
    - Connect with the insurance industry to gain a better understanding of their risk model.
    - Why are some residents having a difficult time maintaining their insurance?
    - What is the insurance industry's tolerance for repeat flooding incidents?
    - How might the City support their risk model to the benefit of homeowners in maintaining insurance coverage?

- Hotspots – proactive identification
    - Without stigmatizing, where are the known localized flooding areas recorded to date that are a direct result of high intensity, short duration rainfall events?
    - What are the options for a weeping tile disconnect strategy?
    - What are the common elements associated with known flooding locations?
    - Are there similar non-affected locations, (neighbourhoods) that exhibit similar attributes? (potential implementation of proactive strategies)
    - Has some form of engineering (i.e. modelling) been implemented to address these localized areas? Were conclusions drawn and if so, can they be applied to other localized areas, or applied city wide.
    - Can a standard risk assessment matrix be developed to study known localized flooding areas, accept and prioritize new localized flooded areas?
    - Which ones are of high priority for further analysis?

- Programs – other cities
    - What are the best strategies, methods, programs and communication tools used by others?
    - How do we compare?

- Programs – effective communication
    - Should the City establish a protocol for broadcasting potential flood warnings, independent of weather sources such as the Ministry of Environment?
    - Are there legal implications associated with such warnings?
    - Can the City do a better job communicating post severe weather event information? If so, what kind of information is important to the citizens and what forums are most effective?

Each of these four topics are summarized below, in turn.

HOMES – proactive insurance coverage

What we did:

In order to gain an appreciation for the insurance industry, its underwriting processes, level of customer service in terms of products available for purchase and its more recent challenges with respect to flooding as a result of more frequent high intensity rainfall events, the Working Group arranged to meet with the Insurance Bureau of Canada

(IBC). Through a presentation in early January, IBC was able to provide the Working Group with a better understanding of the inner workings of the insurance industry. Answers to the questions and concerns Councillors and Civic Administration repeatedly face when confronting frustrated citizens following an extreme rainfall event were addressed in IBC's presentation. Further, IBC's presentation provided City staff with a full appreciation for the complexities associated with providing insurance coverage and the lack of coverage Councillors and Civic Administration repeatedly hear about, particularly when citizens are making multiple claims for flooding damage as a result of high intensity rainfall events.

Here is what we learned:

Flooding has become the largest contributor to catastrophic losses worldwide. Warmer global temperatures are causing greater frequency and severity of flooding events. The need for flood insurance is increasing. The challenge for the insurance industry is to spread out the risk among the insurance companies while increasing the overall number of policyholders to balance the increasing risk.

The current structure of the insurance industry is such that it is comprised of a conglomeration of private companies with no single regulatory body. Subsequently, property owners are often in doubt when it comes to purchasing flood insurance and understanding what is covered at the time of a loss. Individual property insurance policies differ from one insurer to the next, where some include coverage in their policy and others require an endorsement. Historically insurers have not provided insurance for damage caused by overland flooding, (i.e. surface water flooding), or flooding caused by surges or changes in groundwater. Generally, the only type of flood insurance available for property owners to purchase is coverage for damage caused by a sewer backup, or the escape of water from within the property such as a broken potable water pipe, or a leaky roof.

In response to changing patterns in claims, a few insurers are beginning to introduce insurance for overland flood damage; but, not in areas where flooding occurs frequently. Insurers will increase the availability of insurance when they know they can spread out the risk. Increasing the availability of flood insurance will require more insurers to enter the market. To accomplish this property owners and municipalities will need to find effective ways of communicating with the insurance industry, informing them of improvements that have been made that reduces exposure to flood damage.

While property insurance is still optional at this time, the general public is placing greater pressures on all levels of government that would require implementation of mandatory insurance requirements, similar to auto insurance imposed on vehicle owners. For a number of reasons this public movement has not been well received by the insurance industry. Subsequently, the advancement of this initiative has been extremely slow despite mounting citizen pressure.

One of the greatest issues associated with the relationship between basement flooding and insurance coverage is the property owner's lack of understanding of their insurance coverage. The language used to define terms and conditions within insurance policies appear complex to property owners and are often misunderstood. A common analogy used to describe this complexity includes two neighbours living side-by-side who are covered by the same insurance provider, negatively impacted by the same severe weather event; yet realize distinct differences in financial compensation to satisfy their property damage claims.

The aftermath of such extreme weather events is more than often devastating. One common element associated with frustrated citizens impacted by a significant rainfall event is the lack of coverage, particularly with citizens that issue multi flooding claims. Insurance companies typically consider first time basement flooding occurrences as "sudden and accidental". Full compensation is generally awarded to remedy ensuing damages. However, multiple claims are considered by the insurance industry as

“ongoing maintenance”. Property owners claiming flooding damages a second time may only realize partial or reduced coverage. Property owners experiencing multiple occurrences may not receive any compensation, or at best some coverage under hefty premiums and significant deductibles.

Of interest to this report, staff have noted at least one insurance company that includes limited coverage for solutions to the problem, in addition to damage repair.

Things to Consider in our Plan:

Municipalities do not have regulatory or any type of control over the industry. Can the City provide a customer service role through improved education avenues?

How can a municipality influence a claim (insurer and/or insured) such that repairs include a problem resolution? Deferring the problem can lead to future claims and ultimately a loss of coverage.

How can our infrastructure investments become recognized by the insurance industry in their risk evaluations?

Recommendations for Consideration:

- The City should continue to dialogue with the insurance industry and higher levels of government as appropriate until a viable solution is realized whereby insurers are able to manage their risk and associated cost through even distribution measures,
- Utilize available communication avenues to educate property owners on general insurance information. These communication forums may become a conduit for effective information exchanges between citizens and the insurance industry. Potential funding to support educational initiatives may be available through government funding related to climate change.
- Communicating local City/citizen efforts may influence local insurance underwriters to consider amendments to their current policies. More specifically, City/citizen efforts should effectively reduce insurer risks. In turn and proportionately, citizens should recognize financial benefit through reduced insurance rates and deductibles.
- Embed pertinent flooding information inside “Homeowner Letters” delivered to property owners who are impacted by Capital construction projects. Suggested information for consideration includes flooding mitigation improvements specific to the project, the City’s Basement Flooding Grant Program, a reminder to undertake routine backwater valve check/maintenance and a courtesy reminder to stress the importance of confirming flooding insurance coverage with their home insurance provider.

HOT SPOTS – proactive identification

There are many reasons why a basement can flood. Older homes are often more susceptible to overland and infiltration flooding occurrences due to physical lot grading changes and the deterioration of foundation conditions over time. However, sanitary sewer backup due to storm or ground water entering the sewer, specific to high intensity rainfall events, represents about 25% of basement flooding occurrences in London. This evidence is based on the history of the flooding calls received, participation in the voluntary Basement Flooding Grant Program and performance evidence gathered in the Sherwood Forest Weeping Tile Disconnection pilot project.

The complexity associated with basement flooding issues requires the development of an appropriate basement flooding solution that not only encompasses respective property owners directly impacted by extreme rainfall events, but encourages all property owners to participate in City led flooding mitigation initiatives, including those who are contributing to basement flooding conditions. Civic Administration have noted

through first hand experiences that property owners who are contributing to basement flooding conditions, but are not necessarily susceptible to basement flooding conditions are less likely to willingly participate in such flooding mitigation projects.

Causes of basement flooding are more often (75%) isolated cases such as a blockage in a private drain connection (PDC), non-functional (plugged) weeping tile, or poor lot grading leading to overland flow issues.

Why do sewers become overloaded?

Sanitary sewers become overloaded during heavy rainfall events when too much storm water enters the sanitary system. The primary cause of this in London is generally related to direct connection of weeping tiles (foundation drain) to the City's sanitary infrastructure. Homes generally built between the 1920s and 1980s are likely to have their weeping tile connected to the sanitary sewer. Subdivisions built post 1985 have sump pits and sump pumps in the basement which collect weeping tile flow. It is estimated that there are approximately 50,000 homes in London with weeping tile directly connected to a City sanitary sewer. These weeping tile flows can overwhelm sanitary sewers during significant rainfall or snowmelt events, which in turn can back up into basements through floor drains and basement facilities. The City has maintained records of all homes that have participated in the voluntary Basement Flooding Grant Program since its inception in 1985. To date, approximately 3% of the 50,000 homes that have weeping tiles connected to their sanitary PDC have participated in the voluntary program.

What we did:

A review of current data was undertaken as part of this Phase I, Flooding Matters investigation. Based on available information, an analysis specific to basement flooding due to high intensity rainfall events was undertaken. Flooding maps for past events have been produced based on empirical evidence; however, Civic Administration is somewhat cautious in using this data, recognizing that inaccuracies exist due to the fact that many basement flooding occurrences go unreported.

A hydraulic model has been used in the past to assess some of the variables associated with basement flooding, including, sewer capacity and wet weather sewer flows, and to identify the number of existing weeping tile disconnections required to reduce sewer flows sufficient enough to prevent basement flooding in a localized geographical area. This effort has been associated with a specific project at a specific location / area where variables are reduced in number or are quantifiable.

In addition to widely varying hydrologic conditions, there are many other variables that affect a sewer system response: soil moisture conditions, soil type, ground temperature, seasonal moisture conditions, local sewer conditions, private drain conditions, lot grading, subdivision age, depth of sewers, etc. Such conditions can also be the determining factor as to whether a particular storm causes a sewer to surcharge, or not. These "sensitivities" are widely variable across the City.

Here is what we learned:

The identification of hotspots relies heavily on the data fed into an analysis to derive accurate conclusions. High intensity, short duration rainfall events are considered a product of climate change and are being studied intensely by the science community, globally. Locally and as opportunity permits through post-event data collection processes, new data continues to populate the City's extensive data repository enabling staff to develop some hypotheses for consideration, undertake empirical analysis and derive supporting conclusions about a particular event.

One of the complexities associated with high intensity, short duration rainfall events is their inconsistent attributes. For example, these significant weather events are typically

localized, so the opportunity for staff to confirm data through multiple significant rainfall events specific to a defined geographical area may not present itself for years. One thing is for certain, moderate staff time is required to enhance and maintain an accurate data base appropriate for use in engineering analysis.

The voluntary Sherwood Forest Weeping Tile Disconnection initiative required significant effort to document and analyze local conditions to the extent that solutions could be modelled and designed. Such effort to measure and document “sensitivities” at the local level is not reasonable for the purposes of identifying hotspots, particularly given that high intensity rainfall induced basement flooding is in the minority.

Aside from the sensitivity issues contributing to the complexities of basement flooding, comes perhaps the single, greatest challenge confronting Civic Administration, the property owner. Anecdotal evidence clearly reveals that not all property owners who have experienced basement flooding are contacting the City, nor are they taking advantage of the City’s Basement Flooding Grant Program. This is valuable missing data that could greatly assist in identifying hotspots better.

Empirical evidence exists that suggests at least three initial hotspots to consider engineering actions on, giving staff enough justification to apply staff resources and capital. Geographically, a ring of subdivisions that developed as the city grew outward between the 1920s and 1980s have been more prone to basement flooding.

Things to Consider in our Plan:

Can more actual basement flooding statistics be derived from the insurance industry or home owners?

How does the fact that overloaded sewers are a minority cause of basement flooding affect its priority, it being noted that overloaded sewers is a primary cause of sewer overflows.

Should the causes of three-quarters of basement flooding, private asset management, be considered a priority?

Recommendations for Consideration:

- Discuss data sharing with insurance companies
- Develop a communications plan to promote more self-reporting of basement flooding.
- Consider communication and mitigation strategies for the majority of reasons that basements flood.
- Continue to document events well and use the information to update priorities.

PROGRAMS – other cities

The primary intent of the time and effort invested under this section of the Phase I investigation was to draw comparisons between customer service levels, municipal flooding related initiatives, communication strategies and municipal flooding mitigation programs (i.e. backwater valves, sump pump grant programs, weeping tile disconnection programs).

What we did:

An extensive online survey was conducted to gather an appreciation for how other municipalities are coping with private property flooding issues potentially resulting from high intensity, short duration rainfall events. In order to achieve a reasonable sample, a cross section of large, medium and smaller municipalities were surveyed from across the country including a few neighbouring American cities. Telephone calls were

conducted to gather more information on specific initiatives presently not offered by the City of London, but seemingly indicated as successful.

Here is what we learned:

Conclusions drawn from the investigation confirm the literature relating to the impact of climate change on municipalities. More specifically, Canadian municipalities continue to be impacted by high intensity, short duration rainfall events on a more frequent basis and the City of London is not immune to such extreme weather events. Further, the number of primary flooding mitigation measures offered to Canadian citizens appears to be limited to just four. These solutions are commonly offered to citizens through grant programs, often referred to as compassionate grant programs. These four primary solutions include weeping tile disconnections, sump pump installation, backwater valve installation and disconnection of downspouts. Of the municipalities surveyed, the City of London offers what appears to be the greatest number of remedial flooding solutions to its citizens including those living in single family residential homes, condominium corporations and non-profit housing co-operatives. While these typical grant programs and other property owner incentives offer exceptional service delivery, a moderate level of staff time and effort is required to engage property owners and ensure program effectiveness.

Examples of activities offered in other municipalities that differ from the London program:

- Public drainage workshops (City of Kingston) – this is accomplished through a hired firm.
- Flood prevention video (City of Saskatoon)
- Embedding the Insurance Bureau of Canada contact information inside the City's basement flooding web page (City of Edmonton)
- Mandatory downspout disconnection (City of Toronto)
- Mandatory weeping tile disconnection (Town of Fort Erie)
- Free root removal program – up to 3 times within a 24 month period (City of Windsor)

Things to Consider in our Plan:

The City of London's flooding program is comprehensive, but uptake is low. How can the City improve current property owner participation?

Are there approaches other than compassionate grant programs?

Recommendations for Consideration:

- In cooperation with the Insurance Bureau of Canada, develop and post information on the City's web containing specific FAQ's around home insurance
- Consider additional Councillor/Civic Administration participation in local radio and television talk shows – pre wet weather season may prove to be most effective
- Consider additional opportunities/participation in local events – kiosks in the annual Western Fair, Annual Home & Garden Show, emergency preparedness events, etc.
- Produce additional literature, (information booklets, brochures, etc.) that can be provided in local events noted above
- Increase the City's grant rebate to provide greater property owner incentive to participate – currently the City offers a 75% rebate up to a defined (maximum) dollar value for various remedial flooding products. Increase the grant allowance on all or select remedial flooding products
- Continue to support academics who are leading initiatives related to climate change. Examples include:
    - The Institute for Catastrophic Loss Reduction (Western University)
    - Home Adaption Audit Program (University of Waterloo)
    - Partners for Action (University of Waterloo)

- Conduct City, or third party led drainage workshops for public participation (Drainage 101). These workshops would consist of primary stakeholders and field experts including but not limited to City of London staff, licensed plumbers, the Insurance Bureau of Canada
- Provide property owner information specific to backwater valve maintenance
- Provide additional staff to support enhanced programs
- Produce and provide free of charge, PDC video reports for property owners who are affected by Capital reconstruction programs.
- Create an opportunity for property owners to review PDC video reports with City staff
- Consider mandatory, proactive private plumbing work (weeping tile disconnection) as part of Capital infrastructure projects
- Consider Low Impact Development (LID) strategies on new and retrofit construction initiatives
- Consider an extension of special weather forecasts provided by Environment Canada. This paid service is used extensively to support the City's winter operations program. Extending this service may provide Corporate Communications staff more time to prepare, (and issue when appropriate), weather communications through effective media avenues

Programs – Communication

As information was gathered and conclusions were drawn over the course of the Phase I investigations, two common themes had become apparent to the Working Group. First, Municipal Council and Civic Administration face significant challenges to convince property owners, directly and indirectly impacted by flooding, to voluntarily invest in flood mitigation measures on their property. The reality is that most property owners do not have a good understanding of their plumbing and associated basement flooding risks. Most property owners are unaware of plumbing issues until they actually experience basement flooding. Second, one of the most effective means of resolving this significant challenge with private property owners can be accomplished through effective communication delivery. In other words the City should recognize a direct correlation between private property owner participation and effective education.

One conclusion repeatedly realized by the Working Group was the importance of public education through effective communication means. This single common denominator is a certain way to connect with the citizens of London and educate them on how to reduce the overall risks associated with private property flooding issues.

Recommendations for Consideration:

Further to some of the more traditional means of delivering effective and proactive messaging to property owners in the city, new technologies continue to improve ways of making better City/customer connections. In the spirit of improving our communication delivery, a communication plan should immediately be developed to help Londoners understand the risks and the preventative measures they can take, pertaining to flooding during high intensity rainfall events. This communications plan would incorporate both proactive and reactive information with specific focus on the following four areas:

- General awareness
- Pre event
- During the event
- Post event.

General awareness: This is a campaign to inform homeowners about downspout disconnections, backwater valves, window wells, grading around foundations, City subsidies

- Tools: City spokesperson (needs key messages), advertising, social media, media, brochures, posters, website, video, info package (print and email versions) for Councillors

Pre event: An intense, short duration campaign to warn Londoners about impending or possible high intensity rain events and the actions they can take to prevent flooding. Also emphasizes where/how to get information during the event

- Tools: social media, website, template news release, news conference if warranted,

During the event: A campaign to inform Londoners where and how City crew are responding and where to get information (ES #); what roads/areas are closed

- Tools: social media, template news release, website

Post event: A neighbourhood-specific campaign to inform homeowners how to avoid basement flooding in future.

- Tools: Brochures, door to door info packages, help line, focused public meetings

Surface Flooding

The City manages an annual Capital program, Minor Surface Flooding and Erosion (ES3040), to alleviate surface flooding and erosion problems affecting private property, which are outside the scope of the City's Basement Flooding Grant Program. This section of the report is intended to discuss the future use of this funding and how this program could be brought into better alignment with other City subsidy programs, more specifically, the Basement Flooding Grant Program.

Surface Flooding of Private Property

Private surface flooding can be separated into two categories. The first category includes flooding on private property that is caused by surface water between various private lands. The second category includes properties where at least a portion of the overland water originates from City lands (roads, parks, etc.).

Surface Water Not Involving City Lands

This category of flooding may be caused by a number of different factors including: site grading, obstructed rear yard swales and catch basins; uncontrolled roof drainage; and other drainage/landscaping issues. Recently the City's Stormwater Engineering Division created a handout for landowners who have experienced surface flooding caused by drainage from other private properties. The handout discusses common causes of flooding and what steps may be taken to try and alleviate or resolve the problem.

In some cases there is no reasonable way for a homeowner to avoid surface flooding without the installation of substantial private infrastructure. In these cases, a direct connection to the storm sewer network may be the most feasible option. The best solution may be to install a rear yard catch basin. In most instances this is financially prohibitive to the general homeowner as the cost to install these appurtenances can be in the tens of thousands of dollars.

From a liability perspective, it is also questionable as to what degree the City should be involved in these private drainage matters. It is quite clear in most cases that the City is not responsible for this form of surface flooding; however, historically the City has undertaken several projects to correct these problems. Further direction from Council regarding these situations and the City's role would provide clarity in its future role

regarding these problems. As of September 2014, no further projects involving only private lands have been pursued. It should be noted that projects where commitments were made prior to September 2014 will be completed.

Surface Flooding Involving City Lands

The second major category of surface flooding is the flooding of private lands where at least a portion of the upstream contributing area includes lands owned by the City of London. In these situations, the City may expose liability with respect to flooding damages that could occur on the private properties; therefore, it is logical that the City participate in any related corrective action. Some of these issues are relatively straightforward to solve and can be completed for a nominal amount of money. Others are expensive and better corrected as part of long-term major projects (exp. Life Cycle Road Reconstruction, Road Widening, Park Upgrades).

Recommendations for Consideration:

- Civic Administration seeks further direction from Council regarding City involvement on private property.
- As part of a future report on the Flooding Matters initiative direction be requested from Council on this matter.
- One alternative option would be to split current and future allocated funding in the Minor Surface Flooding and Erosion program and use half of the available funding to develop a new program that mirrors the current Basement Flooding Grant Program. The intent of the new program would be to subsidize rear-yard catch basins or other flooding remedies. This program would require a contribution from the impacted homeowner, which would help support the cost of the initiative.

SYNTHESIS

The research, analysis and related learnings suggest a number of things about London and the basement flooding issue:

London has two types of basement flooding: the majority caused by poor performing / poor condition private infrastructure; and, the minority caused by overloaded sewers during rain events.

The number due to private infrastructure is well documented, but those due to overloaded sewers is known to be underestimated because of a lack of information.

Private plumbing is a significant cause of overloaded sewers.

Overloaded sewers are the primary cause of sewer overflows, adding an environmental priority to this basement flooding cause.

Forecasting where basement flooding hotspots are and setting priorities is inherently difficult and inaccurate given the variability of storms and conditions on the ground.

The vast majority of homes contributing excess flow to overloaded sewers are not impacted.

Reduced excess pipe flow has the potential for the City to realize operating cost savings through reduced pumping and treatment.

The City is investing in trunk sewers, sewer separation, plant capacity and plant performance during peak flow periods to reduce overflows. Over the last 10 years, London has allocated $318 million towards the replacement, rehabilitation

and performance improvement of sewers, pump stations and water recovery plants. In the next 10 years, the City will implement a $517 million investment plan.

Basement flooding due to private infrastructure will increase because there is not an asset management plan for private pipes.

The City has a peer leading program for private plumbing improvement and basement flooding protection; however, uptake is low. At source, proactive programs are being initiated

The insurance industry is evolving as flooding becomes the number one claim.

There are opportunities to better communicate the London problem, responsibilities, and availability of solutions.

There may be alternative approaches to reducing the risk of basement flooding, subject to financial and legal feasibility.

On this last point, in response to mounting public pressure and in the spirit of providing good customer service delivery, a range of approaches may be available for Municipal Council's consideration. Corresponding levels of Councillor and staff time, resources and capital budget needs will vary within the range of potential solutions based on desired objectives.

Considering solutions that involve the most effective investment of time, resources and expense, the City may elect to maintain status quo by keeping its Basement Flooding Grant Program voluntary. Conversely, the City may elect to undertake a more aggressive approach that could see existing weeping tiles disconnected under provisions of a new, mandatory weeping tile disconnection by-law. To give an idea of the order of magnitude of such an approach, if the City were to consider 100% funding as per the Sherwood Forest Pilot for the entire estimated 50,000 existing connections the bill would be in the order of $650M. This is not a reasonable figure because experience tells us that not all footing drains need to be disconnected to reduce the risk of basement flooding, and costs would be lower if the work was done in conjunction with other City work.

Somewhere in the middle of the extremes are potential hybrid solutions that may offer more effective, efficient and economic outcomes. These hybrid solutions might take on the form of a City/property owner partnerships or coordination. An example of a potential hybrid solution might include the development and implementation of a means to provide Council and Administration leverage to seek mandatory weeping tile disconnections on future Infrastructure Renewal Program Capital projects. If such a strategy had been in place in 2015, for example, up to 500 homes would have been disconnected (1/3 of the voluntary disconnections made in the last 30 years) at a faction of the cost, since the reconstruction work was already happening.

A range of approaches is presented below.

Option 1: Maintain Status Quo

Continue to treat basement flooding as a homeowner responsibility with the City providing compassionate grants. There is currently no mechanism to force existing homes to disconnect their weeping tile from the City's sanitary sewer infrastructure.

The rationale behind this option is based on a premise that sanitary sewer overloading from extraneous weeping tile flow connections are beyond the City's control. The City is not introducing storm water into the sewer, rather, the source comes from individual weeping tile connections located on private property. It is absolutely imperative that Civic Administration continue to devote time, effort and an effective means to connect

with the property owners. Effective communication means providing property owners with a clear and concise understanding to differentiate property owner and City responsibility. It should be noted however that despite best intentions, this option will not solve neighbourhood basement flooding as property owners tend to remain reactive to flooding occurrences on their own property rather than taking a proactive approach. Finally, the effectiveness of the City's existing program performance (approximately 3% of at risk homes have participated over a 30 year period) suggests change is in order.

Option 2: Modify Current Approach

Option 2 is a modification or passive enhancement of Option 1. Additional staff time and effort should produce positive outcomes with respect to private property flooding resulting from high intensity, short duration rainfall events. Through additional Civic Administration efforts, citizens will become more aware of their potential risks, the advantages of being proactive over reactive and the environmental role and responsibilities they share in reducing their contribution to sewer overflows into basements and natural watercourses such as the Thames River.

This enhanced awareness can be achieved through communication programs pertaining to the City's current Basement Flooding Grant Program. Once again, clear and concise messaging through effective communication avenues is a certain way of defining property owner and City roles and responsibilities. Other enhancement strategies includes the City to leading weeping tile disconnection projects with work on private property (inside residences).

There may be opportunities to identify potential flooding risks as check boxes shown on home inspection reports commonly undertaken prior to the closing of a real estate sale. Developing a means to advise property owners on the importance of updating their home plumbing to current Ontario Building Code standards, especially property owners who occupy older homes, should be considered as well. Expanding the City's current home visit program pertaining to water efficiency to include basement flooding risk is another potential means of modifying or enhancing the City's current practice.

In addition to the City's extensive basement flooding literature currently provided to the property owners and available online, consideration under this option should also be given to referencing third party publications, for example, a current publication produced by the Institute for Catastrophic Loss Reduction.
http://www.basementfloodreduction.com/option1.html

While this option has every potential of producing favourable results, additional resources required to effectively develop and implement the noted program enhancements are anticipated. Additional consideration should also be given to the financial implications of an accelerated enhancement program.

Regardless of the potential and positive outcomes realized from an enhanced program, the decision to undertake proactive flooding prevention measures still resides with the individual property owners. There may be benefits in adopting some the communication recommendations in the interim. Remaining is the difficulty in making plumbing improvements in homes that contribute flow, but are not experiencing the basement flooding.

Option 3: Financial Disincentive

Option 3 places additional financial burden on property owners whose properties contribute to flooding occurrences due to sewer overloading. This option is essentially an effort to accelerate the private weeping tile disconnection program byholding property owners individually responsible for contributing to sanitary sewer overloading conditions.

Under this more aggressive option, a surcharge would be imposed on properties that have weeping tiles connected to the sanitary system. This surcharge would show on monthly water bills.

While this option is built on simple logic, it does pose a number of potential complexities for consideration. The City will need to determine a means for identifying, with certainty, homes with weeping tile connections to the sanitary system. A flat charge identified on water bills could also be given consideration as an alternative to measuring actual flows. Because the source of the flooding occurs on private property, a number of considerations regarding legal implications (ability, potential liabilities) need to be studied. Further, costs associated with the development, implementation and maintenance of such a program should also be given careful consideration if it continued to be 75% funded by the City. Finally, consideration should also be given to public and social impacts.

Option 4: Mandatory Weeping Tile Disconnection

This option is self-explanatory in that either an existing municipal by-law would be amended, or a new by-law developed to impose mandatory weeping tile disconnection. Under this option weeping tile disconnection might occur under initiating conditions, for example:

- When a house is sold;
- Before a new service account is approved;
- When a major renovation is undertaken, or other significant instance.

This approach needs a better understanding of legal ability, legal liability associated with risk, social/public impact and budget impacts; Civic Administration would need to undertake an exercise to determine the feasibility of implementing such measures.

Option 4a: Strategic, mandatory weeping tile disconnection

This subset of Option 4 is a less demanding but more strategic approach to mandatory weeping tile disconnection. In this option the City would target and address the highest risk areas or the most opportunistic ones.

The opportunistic areas could be an expansion of neighbourhood infrastructure reconstruction programs. These programs could also rebuild private infrastructure such that all infrastructure is rebuilt to new standards in neighbourhoods, and sources of extraneous flows removed for the benefit of all.

The advantages of this solution is that the City would have greater control over the effectiveness of a community solution and would allow the City to manage associated costs as well.

The disadvantage associated with this subsection of Option 4 is similar to the other Options noted above, namely property owner resistance. Since work is required on private property (generally within property owner's basements), Civic Administration may find this option administratively and legally challenging to effectively and efficiently implement. Further, preventative or proactive flooding reduction work undertaken on private property, administered by the City as part of a City initiative poses a potential liability in terms of increase claims when new flooding issues arise.

Option 5: Infrastructure Responsibility Conversion

This approach attempts to address the larger part of the basement flooding problem – private infrastructure condition. The City has advanced knowledge, expertise and technology to manage pipe assets in the street. Typically, the homeowner is not aware that they own and are responsible for the lateral connecting their house to the sewer.

Presently, the City may replace a portion of that pipe on public property during infrastructure renewal projects. Even at a discounted price, there is a low uptake on doing more. This leaves a substantial linear measure of aged pipe in service after the City project completes, and an ongoing risk for the owners.

There are City responsibility boundaries that could be considered for change:

- Up to the property (the same as the London drinking water system)
- To the building face

Notwithstanding a legal ownership/responsibility change, others have seen fit to at least rehabilitate the complete lateral in their programs.

Ignoring whether a cost is public or private, such an approach is less expensive because restoration costs are done once, within one contractor mobilization.

As with other approach changes, the legal ability, liabilities and financial impacts are not fully understood at this time.

CONCLUSIONS

Research conducted under this investigation (Phase I) confirms that municipalities across the country are experiencing more frequent high intensity, short duration rainfall events. While these relatively new weather occurrences cannot be controlled, drainage system response approaches are underway in London. Individual home flooding mitigation measures are also available to affected property owners who are willing to be proactive in reducing their risk.

The outcome of such extreme weather events causes public frustration and requires extensive time, effort and expense to reinstate private property damage. While the insurance sector has traditionally provided sewer related flooding coverage, they have not provided the same for damage caused by overland flooding. Subsequently, citizens are placing greater pressures on all levels of government that would see the implementation of appropriate legislation to protect all private property owners from sewer and overland related flooding occurrences. The insurance industry is evolving. This combined with great variability in coverage suggests a possible role for the City to promote good insurance policy knowledge linked to our programs.

Sanitary sewer backup due to storm or ground water entering the sewer represents one quarter of basement flooding occurrences in London. These occurrences are typically experienced during high intensity, short duration rainfall events. A primary cause of this in London is the result of direct weeping tile (foundation drain) connections to the City's sanitary sewer system. There are approximately 50,000 homes in London with weeping tile directly connected. Flooding via overland flows is also concerning and Civic Administration strives to build its knowledge base founded on customer experiences. New mitigation measures directly related to overland flooding are identified and offered in this report for consideration.

Regardless of the type of flooding, staff continue to observe that the majority of property owners undertaking work on a reactive basis, which is <u>after</u> their basement has been flooded. While education through effective communication delivery should be considered, convincing property owners to invest in flooding mitigation on a proactive basis will remain a challenge.

Alternative approaches to the present compassionate grant program have been discussed at a high level. Legal, liability and financial barriers would have to be considered before feasibility can be confirmed.

The larger part of basement flooding causes in London are private asset condition related. The present asset management strategy is to repair/replace once it fails. This is

not consistent with the strategy used for public assets, suggesting an opportunity to improve and reduce risks.

Finally, and with all of the recommendations and challenges identified in this report, a tool to measure the level the City's investment (time, effort and expense) against resultant outcomes should be developed in order to ensure the customer and Corporate benefits are maximized.

BASIS FOR RECOMMENDATIONS

This report recommends consideration of communication enhancements immediately because it will:

- Raise the discussion level on basement flooding;
- Connect the discussion to insurance protection; and,
- Support present reactive and proactive programs.

In effect, this is Option 2 of the alternative approaches, a good starting point that only needs formulation and costing.

Staff seeks Committee direction on other approaches. Depending on that direction, external resources may be recommended due to present workloads and the need for particular expertise.

ACKNOWLEDGEMENTS

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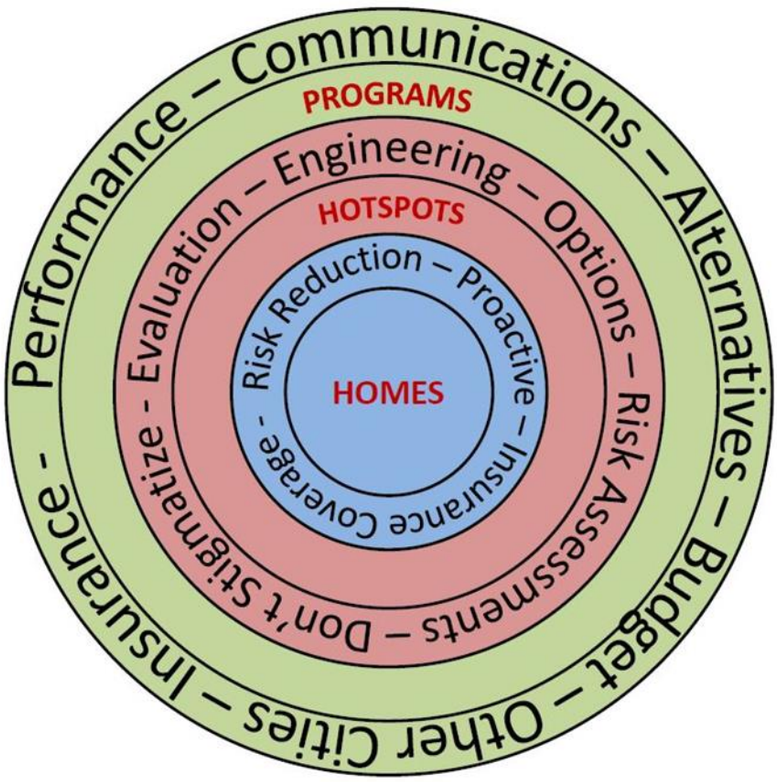
APPENDIX 'A'

WORK PLAN APPROACH MODEL



APPENDIX 'B'

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 no 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 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.

APPENDIX ‘C’

5 YEAR BASEMENT FLOODING SUMMARY CHART

Year	Private	City	Total	% of Calls Attributed to City/Overloaded Sewers
2011	463	96	559	17.2%
2012	315	18	333	5.4%
2013	424	49	473	10.4%
2014	453	235	688	34.2%
2015	348	389	737	52.8%
Total	**2003**	**787**	**2790**	**28.2%**