



DILLON
CONSULTING

CITY OF WINDSOR

Short-Term Solutions Summary of Recommendations

Sewer and Coastal Flood Protection Master Plan –
Supplementary Report

Page is intentionally blank

Table of Contents

1.0	Introduction	1
1.1	Project and Report Overview.....	1
1.2	Causes of Surface and Basement Flooding.....	2
1.3	Objectives.....	2
2.0	Review of Other Municipalities	4
2.1	Private Property Improvements.....	4
2.1.1	Basement Flooding Protection Programs and Sewage Ejector Pumps.....	4
2.1.2	Green Infrastructure and Low Impact Development.....	5
2.1.3	Window Well Protection.....	5
2.1.4	Sump Pumps - Back-up Power and Pump Capacity.....	5
2.1.5	Lot Grading.....	5
2.1.6	Other Household Management Strategies.....	6
2.1.7	New Municipal Policies.....	6
2.2	Public (Right-of-Way) Infrastructure Improvements.....	6
2.2.1	Inlet Control Devices.....	6
2.2.2	Sanitary Rain Catcher, Plugs and Watertight Lids.....	6
2.2.3	City's Stormwater Management (SWM) Design Standards.....	6
2.3	Implementation Approaches.....	7
3.0	Feedback from Residents	8
4.0	Input from City Administration	12
5.0	Recommended Solutions	13
5.1	Overview.....	13
5.2	Municipal Policies.....	13
5.2.1	Mandatory Use of Sewage Ejector Pumps for New Residential Development.....	13
5.2.2	Mandatory Downspout Disconnection for New Development.....	14
5.2.3	Stormwater Surcharges and Green Infrastructure Credits.....	14
5.2.4	Sanitary Rain Catchers and Manhole Sealing.....	14
5.2.5	Infrastructure Maintenance and Assessment.....	15
5.2.6	Design Standards.....	15
5.2.7	Sewer System Backflow Prevention and Sewer System Interconnections.....	17
5.3	Subsidy Programs.....	17

5.3.1	Basement Flooding Protection Subsidy	18
5.3.2	Mandatory Downspout Disconnection.....	18
5.3.3	Mandatory Foundation Drain Disconnection Subsidy.....	19
5.4	Collaborative Improvements	20
5.4.1	Green Infrastructure/Low Impact Development (LID) Measures	20
5.4.2	Lot Grading.....	21
5.4.3	Other Household Management Strategies	21

6.0 First Steps 1

6.1	Sanitary Sewer Rain Catcher Program.....	1
6.1.1	Estimates of Inflow Reduction	3
6.1.2	Potential Impact of Sealing Sanitary MH on Surface Flooding.....	4
6.2	Pilot Projects	4
6.3	Mandatory Foundation Drain Disconnection Program (FDD).....	4
6.4	Enhanced Educational Program	5

Tables

Table 1:	Summary of Short-Term Solutions Objectives.....	3
Table 2:	1:100 Year ERCA Flood Elevations for MH Sealing.....	2
Table 3:	Short-Term MH Sealing Area Breakdown.....	3
Table 4:	Estimates Inflow Reduction from Sanitary MH Sealing.....	4

Appendices

C	Figure 1: Rain Catcher Retrofit Priority Areas
---	--

Introduction

In recent years, Windsor has experienced several significant rainfall events, including the record-breaking August 28, and 29, 2017, storm, which resulted in wide-spread basement and surface flooding. Arising from this rainfall event, the City's Mayor presented an eight-point plan to address the flooding risks, which included an accelerated schedule for completion of the Sewer and Coastal Flood Protection Master Plan.

On November 6, 2017, City Council approved that Dillon Consulting Limited (Dillon) be retained to complete Phase 2 of the Sewer and Coastal Flood Protection Master Plan (SMP) (CR660/2017). The SMP will follow Approach No. 2 of the Municipal Class Environmental Assessment (EA) Master Plan process, which provides a recognized framework for engaging the public and agencies in considering alternative solutions that would reduce the risk of flooding.

Dillon is serving as the lead consultant for this project. We are partnering with AMG Environmental Limited, who will complete the flow monitoring program, and Aquafor Beech Limited (Aquafor Beech), with whom we will collaborate in expanding the baseline model, evaluating the sewer and overland drainage network, and developing alternative basement and surface flooding solutions.

Project and Report Overview

The SMP will identify both short-term and long-term alternative solutions that will reduce the risks and impacts of basement and surface flooding in the City of Windsor. It will also consider the impacts of climate change, low impact development (LID) best management practices, and water quality. A comprehensive public and agency engagement program forms an important element of this project, both to inform the public and also to obtain valuable input to the evaluation and selection of the preferred solutions. The final report will serve to document the planning and design process that was undertaken, including a recommended implementation strategy.

This report provides details summarizing the following related to short-term flooding solutions:

- A review of measures and implementation strategies from other municipalities;
- A summary of the feedback received from residents of Windsor;
- Input received from City administration; and,
- Recommendations, including first steps for implementing the proposed measures.

1.2 Causes of Surface and Basement Flooding

To provide context for the short-term flooding solutions, it is important to understand the sources and causes of flooding. Conditions that may result in surface and/or basement flooding from wet weather events (rain or snow) include:

- High intensity, short duration, or long duration rainfall events that produce high runoff and infiltration;
- Saturated or frozen ground conditions that result in increased runoff;
- Snowmelt, including ice blockage that may limit overland drainage; and,
- Shoreline flooding from the high lake and river levels.

There are three major causes of basement flooding:

- Overland flooding caused by a more intense rainfall than the sewer can manage or by improper grading that results in surface water entering homes through windows, doors, etc.;
- Groundwater infiltration caused by groundwater entering the basement through cracks in the basement walls and floor, or by weeping tiles/foundation drain flows that exceed the sump pump capacity; and,
- Sewer back-up caused by excessive wet weather flows entering the sanitary system. The contributing flows are greater than the sanitary or combined sewers capacity, resulting in water surcharging back through the home's sanitary plumbing (floor drain, shower drain, etc.).

1.3 Objectives

The short-term solutions address multiple objectives of the Sewer Master Plan. The objective-based approach is a holistic, multi-disciplinary approach that integrates environmental, social, economic and technical perspectives in decision making. The objectives were generated through a combination of public and technical input. The input was gathered from:

- The project's first public information centre (PIC #1) (June 12-14, 2018);
- The 2016 flooding survey completed by City staff; and,
- The 2018 Partners for Action flood survey.

A summary of the short-term solution objectives is summarized in **Table 1**. The short-term alternative solutions will meet several or potentially all of the objectives.

Table 1: Summary of Short-Term Solutions Objectives

Objective	Commentary and Public Feedback
Reduce Potential for Undesirable Surface Flooding	<ul style="list-style-type: none"> Undesirable surface flooding is characterized as ponding within the roadway at depths greater than 0.30 m and surface water directed to private property with the potential to cause damage.
Reduce Potential for Private Property Damage	<ul style="list-style-type: none"> This objective is based upon reducing the potential for damage in homes (generally basements) caused by sewer surcharging (flowing backwards) through service connection.
Reduce Potential for Sewer Surcharging	<ul style="list-style-type: none"> Solutions that will result in a measurable reduction in extraneous flows that contribute to sewer surcharging, from private or public sources.
Resiliency	<ul style="list-style-type: none"> Residents identified solutions should be forward-looking and resilient, considering both: <ul style="list-style-type: none"> The impact of climate change; and, The impact Windsor's growth/intensification will have on infrastructure.
Cost Effective	<ul style="list-style-type: none"> Residents identified that costs should be reasonable based on the benefit of minimizing and managing risk; to define this, a clear purpose of the short-term solutions should be identified to residents. Cost should be affordable. Cost effective solutions will require a combination of both private property measures and public infrastructure improvements.
Ease of Implementation	<ul style="list-style-type: none"> Solutions should be easy to implement and have a reasonable cost, space and time requirements, as well as be accompanied with adequate training and technical support.
Ease of Maintenance	<ul style="list-style-type: none"> Solutions should be relatively easy to maintain. Onerous maintenance requirements should be avoided. Residents identified solutions should be reliable and able to withstand severe weather events.
Tailored and Collaborative	<ul style="list-style-type: none"> Work with homeowners to improve flood resiliency. Identify hot spots within the City and focus on local area improvements as well as the system as a whole. Long-term solutions should provide an acceptable level of service to address severe weather events. Application of the level of service standards will take an adaptive approach, which will warrant the implementation of higher standards for high risk and/or sensitive areas.
Timing	<ul style="list-style-type: none"> Consideration should be given to when the reduction of flooding risk will occur. For example, a solution that takes 20 years to implement would be less preferred than a solution that takes 2 years to implement.

Review of Other Municipalities

As part of this study, a review of other municipalities' measures, subsidies, and programs related to flood protection was undertaken. This review was completed to confirm other municipality's best practices and included five cities in Ontario and four out-of-Province cities.

The Ontario municipalities included in the review were:

- The City of London;
- The City of Hamilton;
- The City of Toronto;
- The City of Ottawa; and,
- The City of Guelph.

The out of province municipalities included:

- The City of Calgary;
- The City of Edmonton;
- The City of Winnipeg; and,
- The City of Vancouver.

Solutions to reduce the risk of flooding require a comprehensive approach involving both private property improvements and public (right-of-way) infrastructure improvements. Implementation of these measures is required to reduce extraneous flow entering the public sewer system, to reduce lot-level runoff contributions and to also protect homeowners against the risk of basement flooding.

2.1 Private Property Improvements

2.1.1 Basement Flooding Protection Programs and Sewage Ejector Pumps

Of the five Ontario municipalities reviewed, four have implemented a grant or subsidy program to assist residents with the costs of installing private home protection measures. An alternative implementation strategy included grants coupled with loans to improve affordability. Only one of the five Ontario cities (London) provides a subsidy for sewage ejector pump installation in their Basement Flood Protection Subsidy program. For comparison, only one of the four out-of-Province municipalities had an active subsidy program for basement flooding protection.

Three Ontario municipalities included battery back-up as part of their flooding subsidy or grant. No municipalities included window well protection in the subsidy; however, multiple municipalities included education material for the use of both battery back-up sump pump systems and window well protection.

The rebates for the installation of basement flooding protection measures varied from municipality to municipality, as follows:

- The City of London provides a grant to a maximum of \$5,425 for the same measures recommended to the City of Windsor;
- The City of Ottawa provides a grant for up to \$3,980 for residents who have previously flooded; this does not include a subsidy for a sewage ejector pump;
- The City of Toronto and the City of Hamilton provide grants up to \$3,400 and \$2,000 respectively; these subsidies do not include sewage ejector pumps or battery back-up; and,
- The City of Guelph does not provide a similar grant for basement flood protection.

A comprehensive list of subsidies that are provided by municipalities is available online at the Intact Centre on Climate Adaption website at www.intactcentrecclimateadaption.ca/programs/home_flood_protect/resources/.

2.1.2 Green Infrastructure and Low Impact Development

All of the municipalities provide information on their website to support resident implementing low impact development measures on private property. Common educational material included building a rain garden at your home and installing rain barrels. Less detailed information about other LIDs including bioswales, permeable pavers and rainwater harvesting was also available from select municipalities. Subsidies and educational material for green roofs were more common in larger urban municipalities with high density and high rise buildings.

2.1.3 Window Well Protection

In the review, most municipalities had limited information or public educational material related to window well protection. When information was found, residents were recommended to protect window wells from surface water. Protection measures included adding covers and sealing existing wells/covers. None of the municipalities reviewed included a subsidy for residents to install window well protection.

2.1.4 Sump Pumps - Back-up Power and Pump Capacity

Four of the five Ontario municipalities recommended the use of a back-up power supply for sump pumps. Further, of those four, two municipalities included a subsidy for battery back-up power supplied in their subsidy programs. None of the municipalities reviewed provided recommended sump pump discharge rates (capacity).

2.1.5 Lot Grading

Four of the five Ontario municipalities reviewed provided public educational material to residents regarding improving lot grading and directing surface water away from a home's foundation. The majority of the out-of-Province municipalities had similar information. Content and level of detail of educational material varied between each municipality. The City of Edmonton had compressive information for the

public, including multiple easy to understand pamphlets, various demonstration videos, and many example photos and diagrams.

2.1.6 **Other Household Management Strategies**

Other household management strategies focused on public education, identifying the proper use of sewage systems, and how to maintain drainage/flood protection measures at your home. All municipalities provided educational materials to varying degrees.

2.1.7 **New Municipal Policies**

Policies impacting residents were reviewed. Most Ontario municipalities had existing basement flooding protection subsidies and water use by-laws. Use of appropriate sewer outlets was enforced through by-laws.

2.2 **Public (Right-of-Way) Infrastructure Improvements**

2.2.1 **Inlet Control Devices**

Many of the sample municipalities have identified inlet control devices (ICD) as a method of preventing surcharging in a storm, where surface ponding would provide additional detention storage. ICD control devices were recommended by the City of Toronto to limit the flow entering the storm system to reduce the risk of basement surcharging where gravity service connections exist. ICD's are typically used to control peak flows for storm events up to the 1:100 year occurrence.

2.2.2 **Sanitary Rain Catcher, Plugs and Watertight Lids**

Three of the five Ontario municipalities recommend watertight sanitary sewer lids when located within a local low point (sag) or a flood plain. This measure is for new construction or rehabilitation of sanitary sewer manholes. The City of Toronto identifies where significant sections of sanitary sewers are provided with watertight covers; extended vents will be required at every third maintenance hole to prevent excessive sulphide generation. The elevation of the vents will be above the regional flood elevation. Many municipalities recommend reducing the number of sanitary manholes within sags where possible.

2.2.3 **City's Stormwater Management (SWM) Design Standards**

All of the municipalities reviewed had identified design standards related to stormwater management. These design standards varied between municipalities but generally included recommendations regarding modelling and design criteria, implementation of LIDs, water quality criteria, quantity control standards, depth of ponding, and hydraulic grade lines criteria. Select municipality's standards included requirements for water balance volumetric controls.

Implementation Approaches

The below list highlights the tools used by other municipalities to implement measures and programs aimed at reducing the risk of flooding:

- A.** Grant or subsidy to residents with a set maximum dollar value and/or a percentage to refund installation costs;
- B.** Education materials or pamphlets including descriptive text, videos, and graphics;
- C.** Loan to help with installation costs;
- D.** Public workshop or demonstration site;
- E.** Warranty plan from a third-party provider;
- F.** Contractor precertification list or licensed Contractor lookup tool;
- G.** Provide municipal staff support to property owners through site visits;
- H.** Sell or provide free supplies or materials;
- I.** Home check-up to identify drainage deficits;
- J.** Stewardship programs to help maintain components of the drainage system;
- K.** By-law or policy enforcement;
- L.** Development charges and rebates; and,
- M.** User pay charges for storm infrastructure with potential credits.

Feedback from Residents

Public consultation related to this master plan allowed residents to provide input regarding the proposed short-term solutions via at multiple avenues. A summary of the key engagement activities related to short-term solution review is outlined below:

- Alternative short-term solutions were presented at the Public Information Centres (PICs) between June 12 and 14, 2018;
 - The public was able to give verbal comments during the events, provide written notes, and/or email comments; and,
 - The display panels from the PICs short-term solutions were presented on the project website for feedback and review.
- Feedback was collected from the project's Stakeholder Advisory Committee; and,
- Preliminary preferred short-term solutions were presented at the second Public Information Centres (PICs) between February 11 and 13, 2020.

Refer to the Master Plan Main Report for more information on comments and materials presented during PICs.

In addition to the above activities specific to the Sewer Master Plan; the City also worked with Partners for Action to complete a survey of residents who had flooded in Windsor. As part of this survey, the City posed questions to the public to obtain input to the Sewer Master Plan.

All feedback and related materials are provided as part of the final Master Plan report. The Presentation Boards from PIC #1 and PIC # 2 is included in the main Master Plan report.

Summary of Residents Feedback

The following summarizes the feedback received during the consultation with the public and stakeholder advisory committee to date, focusing on feedback related to the short-term solutions:

- Through the Partners for Action survey, in particular, 420 responses were received. It can be concluded that there is an awareness of flooding (51% of survey respondents in Windsor believe they live in an area at risk of flooding compared to 6% of Canadians) and an interest to be actively involved in making homes more flood resilient. Many survey respondents and PIC attendees have tried to prepare for flooding by installing sump pumps, disconnecting downspouts, etc., but still had some damage. As a result of flooding, many survey respondents indicated that they have decided to implement flooding mitigations measures in their homes including purchasing a sump pump or backwater valve, raising expensive appliances off the floor and disconnecting downspouts.

- A number of barriers to implementing flood reduction measures were identified by participants, including:
 - **Cost** - Participants indicated they had a concern with the personal level of investment required. At least one person noted that they had just paid to fix up their basement and after the flooding had to redo the work;
 - **Available Space** - Space constraints were cited with the example of having limited space to install rain barrels and roof downspouts outlets;
 - **Lack of Confidence in Solution** - Some participants expressed that they wanted proof that the measures they could install on their property would work effectively and be able to withstand a severe weather event. There were concerns about what would happen in power failure situations and whether the systems could effectively reduce surface ponding on lawns or within roadways in high water situations, noting that drainage is limited due to clay soils and saturated ground conditions. Participants also noted that they did not believe that flooding can be addressed through homeowner measures alone and that there are issues with City standards and infrastructure that need to be addressed;
 - **Complex Processes** - A concern was raised that the process to obtain the City offered a subsidy to help alleviate basement flooding was a time-intensive application process for which no guarantee application is successful; and,
 - **Lack of Information** - It was noted that there is a lack of information on flood reduction opportunities and insurance processes. It was also found that property owners often didn't understand how their private drains worked, where they discharged and what measure they could take to prevent flooding or water damage.
- Participants expressed that a one-size-fits-all solution would not be appropriate and that flood solutions need to be tailored to specific needs and be effective in the future. In particular, it was suggested that flood solutions need to consider the following:
 - The effects of climate change;
 - How growth/intensification of Windsor will impact infrastructure. Updating development standards to include a requirement for retention ponds for any major construction projects was cited as an example;
 - Hot spots within the City as areas to focus local area improvements in addition to solutions for the system as a whole;
 - The City's existing infrastructure needed to be assessed as it did not seem able to manage a severe weather event;
 - There is concern that new development is adding additional strains on an already overloaded system. Restrictions or conditions need to be applied to new development to ensure that new development doesn't impact new development;
 - New home builds should include measures to mitigate risks of basement flooding such as sewage ejector pumps;
 - A long-term solution to manage severe weather events is desired; and,

- The Stakeholder Advisory Committee had the following comments regarding the potential short-term solutions list:

Stakeholder Advisory Committee Short-Term Solution Comments:

1. Downspout Disconnection and Basement Protection Programs:
 - Concerned that downspout disconnection has limited value in reducing the impact of flooding;
 - Focus implementation of programs and policies within problem areas;
 - Consider increasing the BFP maximum rebate values to represent actual costs better and expand the program;
 - Consider developing a preferred vendor list to improve reliability and trust;
 - Include an allowance for City staff or a plumber to investigate existing home plumbing systems; and,
 - Consider mandating the type/size of sump pump, particularly in low lying areas to make sure it is adequate.

2. New Development:
 - It is not practical to implement a development freeze; however, new development should consider:
 - Implementing development standards/policies to encourage LID use;
 - Consider capacity constraints of downstream drainage systems;
 - Consider scaling the type/extent of basements permitted; and,
 - Type/size of home drainage system (sump pump) installed is adequate and reliable (battery back-up).

3. Sewer Surcharges:
 - Incentivize LIDs through a potential storm sewer surcharge; and,
 - Mixed responses regarding implementing a storm sewer surcharge. Concerns that funds will not be allocated appropriately and added cost to homeowners is not desirable.

4. Maintenance and Homeowner Accountability:
 - Give residents information on sewer location, condition, age, and outlets. Better stewardship if residents know about the infrastructure that serves them;
 - Maintenance information for private property protection measures; and,
 - Clarify and inform residents of the measures that help to satisfy insurance companies in regards to flooding risks to re-qualify residents for flood protection insurance coverage.

5. Public Infrastructure:
 - Maintain improved existing sewer systems and stormwater facilities already in place; and,
 - The measures in the subsidy program are most appropriate for typical flooding situations.

6. Transparency:
 - Public education is key;
 - Need to demonstrate to people that there is an improvement/benefit to installing these measures;
 - Make sure the information provided to people is suitable/realistic. Maintain trust; and,
 - Clarify that policies/programs only work in conventional rainfall situations.

Input from City Administration

Development of the recommended short-term solutions was completed in consultation with City staff. The project has a core technical team, including members of City staff. Feedback from this team regarding the short-term solutions was provided throughout the duration of this project. The team's input helped to refine solutions developed through public consultation.

On September 26, 2018, a meeting was held with a larger cross-section of City staff to review the proposed short-term solutions. Departments that provided feedback included:

- Engineering – Infrastructure & Geomatics;
- Operations – Contracts, Field Services & Maintenance;
- Operations – Technical Support;
- Operations – IMS;
- Office of the City Engineer;
- Pollution Control;
- Corporate Projects;
- Building Services; and,
- Environmental Sustainability and Climate Change.

Using this information and working closely with the City administration, the project team has developed solutions to mitigate flooding that includes both short-term and long-term solutions. This is a balanced approach that uses various types of solutions to reduce risks associated with relying on only one type of improvement. This will allow the City to mitigate flooding by implementing some immediate (short-term) solutions to mitigate stresses to the system. At the same time, the City prepares to implement long-term solutions that require additional lead time due to capital cost investment needed and other resources.

Detailed descriptions on how and to what level each short-term solution is recommended for all comprehensive solutions will be detailed in the Technical Volume 2 report.

5.0 Recommended Solutions

5.1 Overview

The recommended implementation strategies for the short-term solutions are based on providing proactive measures that reduce the risk and associated impacts of undesired flooding to the residents of Windsor. The implementation strategies are subdivided into three categories:

- Municipal Policies;
- Subsidy Programs; and,
- Collaborative Improvements.

In addition, recommended first steps to implement the short-term solutions are identified.

5.2 Municipal Policies

5.2.1 **Mandatory Use of Sewage Ejector Pumps for New Residential Development**

It is recommended that the installation of sewage ejector pumps be mandated for all new residential developments with below-grade living spaces or basements. The purpose of a sewage ejector pump is to hydraulically separate the below-grade plumbing fixtures from the sanitary sewer system. Only discharge from plumbing fixtures in the basements would be controlled by the sewage ejector pumps, all plumbing fixtures above grade will drain to the sanitary sewer by gravity. This recommendation was developed to give new homes a more reliable level of protection, requiring less maintenance than backflow preventers. Exceptions to the mandate are to be made at City staff discretion. If it is demonstrated that the outlet sanitary sewer hydraulic grade line will be adequately low enough (i.e. 0.30 m below of foundation) to not surcharge the proposed basement under both existing and future conditions.

A formal program to mandate the use of sewage ejector pumps for new residential development was not implemented by any of the five Ontario municipalities or the out-of-Province municipalities reviewed. However, the Town of LaSalle mandates the use of sewage ejector pumps where it is demonstrated that the sanitary HGL (Hydraulic Grade Line) exceeds basement floor elevations. In which case, sanitary private drain connections are set above the estimated HGL of the associated sanitary sewer. Also, the Town of Tecumseh requires that all new homes are equipped with sewage ejector pumps as an added protection measure against basement flooding.

Prior to implementing this policy, it is recommended public education open house events and/or education material is provided to builders, developers, engineers, consultants, and the like involved with development in the City of Windsor.

5.2.2 **Mandatory Downspout Disconnection for New Development**

New development is currently mandated to provide disconnected downspouts through existing City policies; however, exceptions are common. Reasons for the exceptions are frequently based concerns of disconnected downspout draining over paved walking surfaces (sidewalks, driveways, etc.) and creating ice hazards.

To assist with the implementation of this mandatory policy, the City staff have identified that new standard downspout disconnection details, including pop-up heads that by-pass paved surfaces are being developed internally. This information will be provided to builders, developers, engineers, consultants, and the like, once completed. The details could be provided in mail-outs or emails targeted to the appropriate recipients.

5.2.3 **Stormwater Surcharges and Green Infrastructure Credits**

The City is also undertaking a Stormwater Financing Study. This financing study will form the basis of a future policy related to this matter. Based on public feedback, the project's Stakeholder Advisory Committee, and input from City Administration, the following is provided for consideration:

- To reduce loading to the storm sewer system and to fund the storm sewer systems, the Sewer Master Plan's recommendations are in support of the City implementing a stormwater surcharge policy. On a City-wide scale, it is recommended that a stormwater surcharge policy be developed and implemented:
 - A by-law to charge for the use of the City's stormwater drainage systems should include credits for installation of low impact development infrastructure; and,
 - Comprehensive educational material explaining the details of the stormwater surcharge and credit, as well as alternative green infrastructure strategies should be provided.
- Consideration should be given to assessing surcharge rate proportionally to impervious coverage. There may be a fixed minimum in addition to the proportional impervious area component of the surcharge. This would allow for a tailored surcharge rate based on usage of the sewer systems; and,
- To manage public expectations for the program, simple annual statements shall be published identifying total levies and a breakdown of what the expenditures have funded. The rationale being residents would like transparency and confirmation that the surcharge is funding stormwater related infrastructure and programs.

5.2.4 **Sanitary Rain Catchers and Manhole Sealing**

It is recommended that select sanitary maintenance hole covers within the City be sealed to reduce undesired inflow. This recommendation would include installation of rain catcher devices between the maintenance hole cover and frame. The selection of maintenance holes will be determined based on a prioritization plan, including focusing first on in low-lying areas, as these locations are more likely to

contribute a higher proportion of inflow. More discussion related to the selection process for the sanitary maintenance hole locations is provided in Section 6.1.

Consideration was given to a City-wide program to seal all sanitary maintenance holes; however, to be cost effective, only the areas of highest impact will be sealed immediately. Applicable manholes are detailed in Section 6.1.

It is also recommended that some manholes be sealed with waterproof lockable covers. Manholes that are at low elevations where risks for sanitary back-up spilling onto the road or boulevard surface shall be considered.

5.2.5 Infrastructure Maintenance and Assessment

The City has undertaken an extensive infrastructure and asset condition assessment program for sewer and related infrastructure to guide the decision making of sewer replacement and upgrade projects. Data obtained from this program is being used in the development of the recommended implementation strategy. The recommendations from the SMP will identify and confirm these areas reviewing subsurface (sewer), overland drainage systems, and other drainage components (ponds, pumps, etc.). The City's Operations Department is involved in the SMP and will continue to be consulted to identify opportunities to adjust their maintenance programs, particularly in areas of higher flood vulnerability.

It is recommended that the City implement enhancing maintenance practices to consider areas of higher flood vulnerability including high traffic roadways and sensitive land uses (emergency services, etc.) which are detailed further in Technical Volume 2. The following practices are recommended to be included in the enhanced maintenance program:

- Increasing street cleaning frequency in areas with identified concerns for sewer and/or catchbasin clogging;
- Add maintenance of new LIDs, such as permeable pavements, exfiltration trenches, bio swales, etc. Maintenance practices may include street cleaning, landscaping, sewer flushing and regular inspection including sewer videos;
- Include manholes with rain catchers to the annual spring Vector Disease Control program (mosquito control); and,
- Regular maintenance of stormwater management ponds, municipal drainage, drainage swales to remove overgrowth of vegetation.

5.2.6 Design Standards

The City of Windsor is currently updating their Development Manual to incorporate updated sewer and stormwater management design standards. Both the ERCA Regional Stormwater Guidelines (December 2018) and the MECP Draft LID guidelines are available to provide the framework to update the City's design standards. These guidelines should address both the storm, sanitary system and coastal flood protection requirements and should include recommendations for:

- Modelling criteria for proposed sewer systems;
- Providing resiliency under a changing climate;
- Detailed outline of all necessary rain derived inflow and infiltration (RDII) mitigation measures within the public right-of-way including specifications for air testing, sewer cleaning and CCTV inspection;
- Minimum site grades to mitigate coastal flooding risks;
- Design/implementation of LID systems;
- Mandate that all new construction have disconnected roof downspouts, sump pumps with back-up, sewage ejector pumps; and,
- Provide revised minimum RDII allowances and outline the framework for mandatory RDII monitoring program within the sanitary sewer system.

For the City of Windsor, it is recommended these documents serve as a foundation for development standards. The City should develop formal documents to confirm local requirements. In addition, all future development's site servicing must ensure the potential for future flooding is not made worse. This would include the development of residential (subdivisions or medium/high rise buildings), commercial, industrial, or institutional sites where the following is provided:

Storm System:

- Storm System: Demonstrate with hydrologic-hydraulic software the impact of a proposed development on the receiving sewer infrastructure (sanitary, storm and combined sewer system) and confirm no negative impact. Mitigation measures could include traditional quality and quantity control measures; ponds, OGS, etc., but consideration should also be given to LIDs and green infrastructure;
- Volumetric on-site retention of a specific precipitation volume for water balance control must also be achieved. Strategies would include use of LIDs, green spaces, grey water reuse, etc. The exact recommended volumetric retention volume (i.e. 5 mm, 20 mm, 30 mm, etc.) should be confirmed at a later time; and,
- Consideration for the impact of a changing climate and designing resiliency into solutions must be demonstrated.

Sanitary System:

- Consideration for Inflow and Infiltration (I&I) allowances for dry weather conditions that better reflect local construction practices. Development of more detailed and stringent testing and sewer monitoring methods to confirm new developments meet I&I requirements and have been constructed correctly; and,
- Follow recommendations of this SMP for Inflow and Infiltration allowances for wet weather conditions.

Both the water balance and the hydrologic-hydraulic assessment of downstream sewer infrastructure are recommended to reduce flooding risks. The hydrologic-hydraulic assessment criteria consider more extreme wet weather events and confirm that development will not have a negative impact under these conditions. The on-site volumetric retention considers the day-to-day movement of water and provides mitigation measures for common/small storm events to ensure downstream flooding conditions are not aggravated. The rationale for these recommendations is based on designing with holistic consideration of stormwater infrastructure.

5.2.7

Sewer System Backflow Prevention and Sewer System Interconnections

Within the City's municipal sewer system there are two direct sources of excess inflow into the sewer system;

- Sewers System Interconnections; and,
- Storm System Outlets to the River/Lake.

Sewers System Interconnections

Through a detailed review of the sanitary and storm sewer system, through this master plan, a number of interconnections between the sanitary sewer system and the storm sewer systems were found. These interconnections are recommended for removal in the short-term to provide more immediate relief to the separated sanitary system. It is recommended that the City complete a separate study of overflow locations and complete site investigations to confirm the presence and/or conditions of backflow preventers.

Storm Sewer Outlets - Backflow Prevention

During periods of high lake/river water levels, lake/river water backs up into the storm sewer system, which compromises the capacity of the storm sewer outlets and causes long-term surface flooding in low lying areas. As part of the coastal flood protection solution in East Windsor, locations where installation of backflow prevention measures, such as Wa-Stop devices, are recommended. Locations of proposed backflow prevention devices have been identified in the East Riverside Flood Risk Assessment study (Landmark Engineering -2019). It should also be noted that the North West portion of the City, also has low lying areas where these types of devices would also be suitable. Through the future study of that area, the City should determine where these devices should be installed.

5.3

Subsidy Programs

Through public engagement, concerns were raised regarding the personal level of investment needed to implement private property improvements. It is recommended that the City facilitate and fund an enhanced Basement Flooding Protection Subsidy, Foundation Drain Disconnection and Downspout Disconnection programs currently in place. Through the development of long-term solutions, it was found that there is a practical limit associated with the construction of infrastructure to accommodate RDII during major rain events. Therefore, for each area of the City, the solutions developed to mitigate flooding

requires a comprehensive solution that includes a balance of source control, storage, conveyance improvements and downstream outlet or treatment plant upgrades. Also, the relative benefit and inflow and infiltration reductions that will be realized through the implementation of private property improvements could, on a cost perspective, be more efficient.

5.3.1 **Basement Flooding Protection Subsidy**

Consideration should be given to expanding the City's existing Basement Flooding Protection (BFP) subsidy program, including additional measures. The subsidy should continue to assist in completing improvements such as sump pump installation and backflow prevention but also include foundation drain disconnection and downspout disconnection where applicable.

The City should review the current cost allocation provided to residents to confirm that the allocated funds cover the actual costs of the works proposed. The City should increase inspection measures related to the installation of protection measures to confirm Contractors are installing measures properly.

It is recommended that the City develop an Approved Contractor List to aid residents in choosing reputable contractors.

5.3.2 **Mandatory Downspout Disconnection**

It is recommended that the City implement a City-Wide mandatory Downspout Disconnection Policy. It has been identified that due to the urban nature of the Central combined sewers system area that it would be difficult for many residents to disconnect their roof. Therefore, the long-term comprehensive strategy to mitigate flooding in this area does not rely on the full disconnection of the roof; however, it is encouraged that residents disconnect where possible.

A City-wide program will require public cooperation to complete this work. The City will need to develop a program to educate the public, facilitate the completion of this work and enforce this mandatory program. To supplement this strategy, it is further recommended that the existing Downspout Disconnection Program (DDP) have additional marketing targeted at residents with the goal of increasing public voluntary uptake.

The rationale for these recommendations is based on improving sewer performance by reducing inflows, thereby reducing the risk of basement and surface flooding resulting from sewer surcharging. Many municipalities have found that proper downspout discharge, coupled with improved lot grading, is an effective way to reduce private property inflow contribution. The recommendation includes the following:

- That the existing Downspout Disconnection Program (DDP), which is currently provided to residents at no cost, is continued and through additional public education and marketing be expanded with the goal of reaching additional dwellings;

- Disconnection be made mandatory through use of City By-law (this may be accomplished through amendments to existing City By-laws, i.e. 'Property Standards By-law #9-2019' (formerly #147-2011) or the 'Sewer Use By-law #11446, etc.) to select areas as identified in the final version of the Sewer Master Plan;
- Exceptions to the mandate are made subject to City staff approval if:
 - Health and safety concerns are demonstrated; and,
 - If the disconnection can be demonstrated to negatively impact the property or drainage conditions on adjacent properties.

Where challenges with grading or access exist, consideration should be given to using extender hoses and/or pop-up heads (to cross sidewalks) and filling in local depressions with appropriate, cohesive soils. It is not recommended that the costs of pop-up heads, underground piping or grading be added to the DDP, but that residents are presented the option to undertake with personal funding.

The mandatory disconnection in select areas will require an investment and staff effort to ensure that connections are disconnected appropriately and remain disconnected. Public expectation regarding the compliance levels and impacts of disconnection must also be managed. Therefore, implementing a complimentary education campaign identifying the disconnection program and associated benefits are recommended.

5.3.3

Mandatory Foundation Drain Disconnection Subsidy

Another major contributor of RDII into the sanitary sewer system during storm events are improper house plumbing connections. Specifically, in many instances, the home's foundation drain system is connected directly into the municipal sanitary sewer connection. Generally, homes built before 1980, were permitted to drain foundations to the sanitary connection. Standard home building practices have improved since that time; however, it should be noted that there may be instances where homes built after 1980, may have improper connections that were done illegally.

None of the municipalities included in the above desktop review has implemented a mandatory foundation drain disconnection program as part of their flooding mitigation measures. It was found that this type of program has had success in other areas. For example, Ann Arbor, Michigan, has implemented a mandatory disconnection program (Sanitary Sewer Wet Weather Evaluation Project) which resulted in the disconnection of 50% to 99% homes in priority areas. During subsequent storm events, their system analysis has shown a significant reduction in sanitary sewer flow volumes (77% reduction during a major storm event).

Through this master plan, the project team completed various modelling scenarios to determine the benefit of foundation disconnection on the City's sewer system. Each scenario looked at varying degrees of public cooperation relative to disconnecting foundation drains. For example, for the South Windsor

sanitary drainage area, foundation drain disconnection was found to have a cost benefit as it mitigated the need to increase large inline storage sewers

It is understood that disconnection of foundations drains has the most relative impact to homeowners during implementation, and that disconnection will require restoration both inside and outside the home.

Further discussion on the implementation of this program is included below in Section 6.2.

Ann Arbor – Sanitary Sewer Wet Weather Evaluation Project Source:

<https://www.a2gov.org/departments/systems-planning/Documents/Full%20SSWWE%20Report.pdf>

5.4 Collaborative Improvements

5.4.1 Green Infrastructure/Low Impact Development (LID) Measures

The recommendations for green infrastructure and LIDs are focused on public education, as well as in-kind and planning support from the City. The recommendations are as follows:

- Provide a comprehensive education package to the public regarding the use, benefit, installation, and maintenance of private property LIDs;
- General education materials about how lot level protection measures reduce the total inflow to the City's sewer systems;
- Provide LID specific details, including:
 - For rain gardens and enhanced swales, provide size/location recommendations, suggested species of plants, and suggested soil material depth;
 - For rain barrels (which are currently being sold by the City), provide educational material about installing, connecting a downspout, providing a safe overflow, and use for watering. To promote the uptake of rain barrels periodical sell at a discount coupled with a marketing campaign informing residents; and,
 - For trench drainage/exfiltration systems and permeable paving stones, provide general details for constructing. At this time, it is not recommended a specific product or manufacturer be recommended to residents.
- Develop LID pilot project(s) demonstrating the water quality and quantity benefits. The demonstration site(s) will help raise public awareness. There is potential to tie-in with existing LID projects which builds upon the effectiveness of solutions the City has already implemented. Additionally, there can be cross-promotion with the City's online educational material; and,
- Provide in-kind support planning and use of City land's to work with community/non-profit organizations to construct LIDs. The measures may be constructed solely on City public lands or on shared land public/private lands (i.e. split between a right-of-way and public property).

None of the municipalities included in the review provided a homeowner subsidy for installation of LIDs; however, some municipalities gave discounts on sewer surcharge costs (refer to Section 5.2.3).

Information related to LIDs on municipal websites varied greatly, it is recommended that comprehensive information packages pertaining to best practices and how to build LIDs on your property are made available to residents.

5.4.2 Lot Grading

Improper lot grading may be a cause of homeowner's flooding. It is recommended that lot grading be completed in conjunction with a foundation drain disconnection subsidy program. The recommendations for lot grading are focused on public education, and include:

- Providing a comprehensive education package to the public regarding the use, benefits, and how to improve existing grading to provide positive lot drainage. Materials provided on the website could include:
 - Improvements to grading with new fill to direct surface water away from the building's foundation;
 - Basic information related to the installation of swales for rear yard drainage or rear yard catch basins, including recommended slopes;
 - That local low points or areas with settled soils be filled with high cohesion soil (clay or silt) and graded to provide a positive slope away from a building;
 - In conjunction with improved lot grading, the use of LIDs will help reduce the risk of surface water flooding. LIDs could include exfiltration/trench drains, rain gardens, or permeable pavement (if replacing non-permeable pavement); and,
 - Where improvements to lot grading are impractical, the use of window well protection may provide additional protection.

If alterations to grading are to occur, there must be no adverse impacts to adjacent properties.

5.4.3 Other Household Management Strategies

Based on the results of the Partners in Action survey, it was concluded that homeowners have an interest in being actively involved in the implementation of mitigation measures to protect their home. Measures property owners can implement to protect their property from flooding, including actions to take before, during, and after a flooding event. This recommendation for other household management strategies is focused on public education:

- A comprehensive education package will be provided to the public, which will include details including:
 - Understanding your plumbing and maintenance requirements for your sump pump, sewage ejector pump, and backwater valve;
 - Ensuring proper lot grading and obstructions (leaves and yard waste) are removed allowing water to flow away from your home;
 - Inspecting basement walls and floors for cracks that may lead to infiltration;
 - Clearing eavestroughs;

- Not storing valuable items on the ground, instead of installing shelves several feet off the floor or storing in waterproof containers;
- Using water-resistant finishes in basements (tile floors, etc.);
- Properly disposing of fats, oils and grease (FOG) and understanding what not to flush down the drain (i.e. wipes, etc.) to prevent clogging of pipes;
- Minimizing water usage during major storms (i.e. use of washing machine and dishwasher);
- Promoting residents check with insurance providers regarding their personal property flood coverage and available options. Residents should inform insurers of private property measures that reduce the risk of flooding;
- Ensuring water from disconnected downspouts drains away from your foundations and onto grassed areas that drain away from your home; and,
- Providing a public online mapping tool that allows residents to identify the mapped flood plain and their property. Consideration should be given to the age of mapping, where outdated information/mapping should be excluded.
- Creating a demonstration site/house identifying how LIDs, household plumbing systems, and flood protection devices work;
- Providing a Contractor lookup list to check if a Contractor is licensed to complete installation of plumbing fixtures for the BFP and/or a lookup list to identify Contractors who have been pre-certified to install LIDs/green infrastructure;
- Providing a "flood prevention home check-up" where a drainage expert will, at resident's request, go to their homes and review local plumbing and grading then provide recommendations to reduce flooding risks. There would be potential to tie this program in with the BFP on-site work; and,
- Implementing an "adopt a catchbasin" program – program for residents to "adopt a catchbasin" in the City to protect private and public property from flooding. This resident stewardship program would help ensure public property flow routes (curb and gutters) are clear of debris and vegetation.

First Steps

The City has the opportunity to set the stage to apply all of the above-noted recommendations. Below is a list of all recommendations as well as the administrative 'first steps' the City can take to implement these measures.

To expedite solutions that reduce the risk of flooding, a first steps plan was developed to guide City administration on the implementation of recommended short-term solutions. Short-term solutions have been designated as immediate solutions through the comprehensive implementation plan. The following summarizes the short-term solution that the City should implement as part of the 2020/2021 capital works budget. There are four main opportunities identified to help reduce the risk of flooding including:

- Implementing a program to install sanitary sewer rain catchers in maintenance holes identified as high potential for improvement;
- Implementing a mandatory foundation drain disconnection policy for existing connections to the sanitary sewer system;
- Proceed with the implementation of pilot projects including sewer flow monitoring to confirm the benefit of foundation drain disconnection and public ROW LIDs; and,
- Implementing enhanced education programs to help residents reduce the risk of flooding in their homes.

Sanitary Sewer Rain Catcher Program

As noted above, the installation of rain catchers within existing maintenance holes (MHs) has been identified as an immediate improvement that will provide benefit for the sanitary system by reducing the stormwater inflow entering the sanitary MHs during a storm event. To assist the City in developing a feasible plan for implementation of these units, an assessment was completed to determine where the potential for inflow is highest; therefore, where MH sealing should be prioritized.

Areas where MH sealing should be prioritized, was based on two criteria:

1. Manholes in low lying areas, based on Essex Regional Conservation Authority (ERCA) Flood Elevations; and,
2. Manholes which show the greatest volume of stormwater inflow during various rain events.

LOW LYING MANHOLES

Low lying manholes, are shown based on their elevation relative to ERCA's 1:100 year flood elevations. Where MH rim elevations are lower than the elevations show below (**Table 2**), they were highlighted on **Figure 1 in Appendix C-1**.

Table 2: 1:100 Year ERCA Flood Elevations for MH Sealing

Area	Boundary	1:100 Year ERCA Flood Elevation
Riverside East	Area, East of Riverdale Avenue	176.4
Riverside West	Area, West of Riverdale Avenue	176.1

It should be noted that these MH are generally found in the Riverside area bound by Westminister Boulevard to the east, Tecumseh Town limits to the west and McHugh Street to the south. MHs within or adjacent to other ERCA regulated (flood line) areas within the City, such as the Grand Marais Drain or Littler River Drain where found to be above designed ERCA Flood Elevations.

STORMWATER INFLOW CONTRIBUTION

The second criteria used to prioritize the MH sealing recommendations were based on the results of the recently completed sewer system model. Within the model, the inflow was estimated using hydraulic elements which represent public sanitary sewer MH covers, connected to the overland drainage system. The volume of stormwater entering sanitary MHs is a function of the amount of stormwater ponding over the MHs during a rain event. The model estimated the volume of inflow contribution for MHs based on the assumption that all MHs have covers with two pick holes. The total volume of flow entering the MHs was determined for various storm events, including the 1:5 year, 1:25 year and 1:100 year storms. In the short-term, priority should be given to areas where MHs contribute the greatest inflow into the sanitary system, for the range of storm intensities. **Figure 1** in **Appendix C-1** shows MHs that contribute an estimated volume of flow greater than 2 m³. It is recommended that all MHs located in areas where the stormwater contribution is high be sealed. MHs within combined or dual (both combined and separated systems) sewer service areas were excluded from this analysis. However, consideration for the installation of rain catchers should be considered as part of the long-term Inflow and Infiltration reduction measures to be undertaken by the City.

IMPLEMENTATION OF RETROFIT PROGRAM

Generally, the results show that inflow of stormwater through sanitary manholes into the sanitary sewer is City-wide; however, there are areas showing a higher concentration of MHs that have higher stormwater inflow during wet weather events. Based on this, it is recommended that all sanitary manholes within the highlighted areas be prioritized in the short-term.

Table 3 provides a breakdown of the number of MHs to be sealed within each of the seven delineated areas. A total of 733 MHs are recommended for rain catcher installation.

Figure 1 in **Appendix C-1** shows the extent of each of the priority areas, along with the manholes found to meet the criteria listed above.

Table 3: Short-Term MH Sealing Area Breakdown

Area	Number of MHs to be Retrofitted	Boundaries			
		North	East	South	West
1	296	Riverside Dr	Lauzon Rd	McHugh St	Westminster Ave
2	324	Riverside Dr	Breezewood St	McHugh St	Lauzon Rd
3	42	Tecumseh Rd E	Pillette Rd	Plymouth Dr	Westcott Rd
4	23	Tecumseh Rd E	Meldrum Rd	Grand Marais Rd E	Chrysler Centre
5	48	Dougall Pky	Hwy 401	Hwy 401	Howard Ave
Sum	733				

In addition to those MHs highlighted through this desktop analysis, additional MHs should be sealed based on proximity to other inflow sources. Generally, MHs in the following areas should be sealed:

- In or adjacent to drains or local low lying overland flow routes;
- Within easements or open areas where ponding is frequent; and,
- Within areas retrofitted with ICDs where stormwater ponding within the roadways is encouraged.

The estimated price for the supply and installation of rain catchers ranges between \$200 and \$300 per unit based on recent local tender prices. The City of Windsor may retain a contractor to complete this work, in which case, additional project costs would need to be considered, such as project administration, inspection, manhole cover repair and traffic control. Based on this desktop review and priority list, it is assumed that the MHs recommended to be retrofitted with rain catchers are in good condition and are standard size (based on the City's standard frame and cover AS-304A). It would be critical to complete a field investigation of the highlighted MHs to confirm size, condition and other notable field constraints.

Moving forward, the City should also consider including the installation of rain catchers as part of other infrastructure improvement projects which may include installation of new MHs or the adjustment of existing MHs, particularly in areas identified, through this study, as high risk or low lying.

It should be noted that similar to catch basins, due to standing water within the rain catchers over extended periods of time, the City will need to include manholes in the regular mosquito control program during summer months.

6.1.1

Estimates of Inflow Reduction

Estimates of potential inflow reductions from the modelling assessment completed for the sanitary MH sealing is provided in **Table 4**. The estimates are based on design storm events for the 1:5 year, 1:25 year and 1:100 year return periods for the 5 areas recommended for immediate rain catcher installation. Average inflow sanitary sewer reduction estimates per MH and total system reductions are provided.

Table 4: Estimates Inflow Reduction from Sanitary MH Sealing

Design Storm Event	Average per MH Reduction in Sanitary Inflow per Sealed Lid (m ³)	Total System Reduction in Sanitary Inflow (m ³)
1:5 Year 4 Hour Chicago	2.2	1,600
1:25 Year 4 Hour Chicago	4.6	3,300
1:100 Year 4 Hour Chicago	6.6	4,800

6.1.2 Potential Impact of Sealing Sanitary MH on Surface Flooding

The potential impact on surface flooding from the proposed sanitary MH sealing was reviewed. An assessment using the City-wide sewer model was completed and found no measurable change in the overland flooding system operation. Adding the rainwater volumes identified in **Table 4** to the surface flooding volumes would only have a marginal change to the depth and extent of surface water ponding.

6.2 Pilot Projects

In order to confirm the local benefit of proposed short term solutions, pilot projects that monitor and measure the benefit of solutions is recommended. The programs will be to monitor areas where Foundation Drain Disconnection and Low Impact Development measures have already begun and should continue as the City begins to implement the recommendations of this master plan. As the City gathers monitoring information, it is imperative that the recommended solutions of this study be reviewed and refined based on in-situ monitoring results.

A comprehensive pilot project strategy will be detailed in the Technical Volume 2 report. This strategy will provide City administration guidance on the placement and duration of flow monitoring as well as highlight areas where initial pilot projects would be recommended.

6.3 Mandatory Foundation Drain Disconnection Program (FDD)

As noted above, disconnecting foundation drains from existing sanitary sewer connections will significantly reduce the amount of inflow and infiltration entering the sanitary sewer system. It is recommended that the City implement a comprehensive Foundation Drain Disconnection (FDD) program that facilitates the mandatory disconnection of foundations drains.

Through the sewer model evaluation completed as part of this master plan, priority areas where the implementation of this program should first be applied are defined and detailed in Technical Volume Report 2. Areas will be chosen based on a number of factors, including the age of the homes, results of completed field assessments, City's understanding of plumbing practices in each area and where the estimated inflow and infiltration from rain derived sources is high. The model tested the relative sensitivity of disconnecting the areas and estimated the wet weather flow improvements expected once the full implementation of foundation drain disconnections is complete.

Consideration was given for the implementation of a voluntary foundation disconnection program; however, it is expected that there will be limited participation due to the impacts this more invasive solution has within the required homes. Partial uptake of this type of program will not provide the necessary cost/benefit that would be required to sustain this program. Also, a mandatory program is expected to result in system-wide improvements that will reduce the need to construct large-scale sewer system storage solutions, such as underground storage tanks and/or oversized trunk sewers.

One potential approach for the implementation of this program is based on a subsidy program that will be paid for by the City. The subsidy will provide an allowance to cover the full cost of disconnection, similar to the City's current Basement Flooding Prevention subsidy. Homeowners will be provided a fixed deadline date for the completion of drain disconnections, whereby homeowners who have not completed disconnection will be fined a monthly levy which will be tied to their existing sewer surcharge rates. To facilitate this program, the City will need to provide support staff to complete necessary field inspections of homes and completed plumbing works.

6.4 Enhanced Educational Program

As part of this Master Plan Study, the need to develop an enhanced educational program has been identified. It has been documented through works completed by other municipalities that implementation of private side inflow mitigation measures has a significant impact on the volume of inflow entering the sewer system. As detailed above, there are a number of measures homeowners and home builders can take to mitigate basement flooding and lessen the impacts of their property on the City's sewer infrastructure.

Based on feedback received from the recent public engagement, discussions with City staff, and consultation with the Stakeholder Advisory Committee; the need to develop a comprehensive educational program that includes homeowners, developers, contractors, home builders, etc., needs to be implemented in the short-term to take advantage of the benefits that private side improvements will have.

Most homeowners are not familiar with their internal and/or external plumbing systems and how they are impacted during a rain event. Through consultation with the City, Stakeholder Advisory Committee and review of other municipal strategies, a number of potential educational topics have been identified and summarized below. In addition, educational training will need to be provided to home building contractors, designers and inspectors. Training is required to ensure that new municipal standards and policies, as well as, best management practices are being implemented in new developments within the City.

In order to implement this enhanced education program, the City may consider appointing a new staff member to provide support for the organized execution of this strategy. The following provides a summarized list of educational opportunities recommended through this study.

1. Flood Prevention Home Checkup Program

Develop a program for homeowners to voluntarily request an individual to complete a home visit to provide recommendations related to:

- a. Installation of sewage ejector pumps, where feasible;
- b. Discuss the need for foundation drain disconnection where applicable;
- c. Involvement in Basement Flooding Protection (BFP) subsidy program;
- d. Involvement in the Downspout Disconnection Program;
- e. Recommend household management strategies such as lot grading, internal plumbing improvements, implementation of LIDs, etc.; and,
- f. Information on plumbing and maintenance requirements for sump pumps, sewage ejector pumps, and backwater valves.

2. Open Houses and Pop-Up Events

Hold public events to present educational information to provide practical knowledge and facilitate one-on-one conversations with those impacted by these measures/improvements:

- a. Public In-House Information Center for Contractors and Consultants to provide practical installation information regarding:
 - Sewage ejector pumps;
 - Downspout disconnection for new developments; and,
 - New standard downspout disconnection details that by-pass paved surfaces.
- b. Flood Prevention Information Open House for homeowners, to include:
 - Understanding your plumbing and maintenance requirements for sump pumps, sewage ejector pumps, and backwater valves;
 - Basement flooding protection (BFP) subsidy program;
 - Downspout disconnection subsidy program; and,
 - Household flooding management strategies information.
- c. Public Demonstration Site:
 - Creating a site that exhibits how LIDs, household plumbing systems, and flood protection devices work.

3. City and Project Website

- a. Low Impact Development – Best Management Practices:
 - Provide a comprehensive guideline on the use, benefit, installation, and maintenance of private property LIDs.
- b. Lot Grading Info Sheet; and,
- c. Informational flyer that provides general information on how to protect property from flooding including visual aids and sample photos.

4. Mail-outs to Homeowners:

- a. Downspout Disconnection Pamphlet – Free Program (Spring 2019);
- b. Private Property Low Impact Development (LID) Strategies; and,
- c. Lot grading.

Page is intentionally blank

Appendix C-1

Figure 1: Rain Catcher Retrofit Priority Areas

Page is intentionally blank



CITY OF WINDSOR
SEWER AND COASTAL MASTER PLAN

**SHORT TERM SOLUTION REPORT
SANITARY MANHOLES - RAIN CATCHER
RETROFIT PRIORITY AREAS**

FIGURE 1

- SANITARY MH RECOMMENDED FOR RAIN CATCHER RETROFIT
- SANITARY MH IN ERCA FLOODPLAIN (DETROIT RIVER & LAKE ST. CLAIR)
- RECOMMENDED AREAS FOR (SHORT-TERM) IMMEDIATE RAIN CATCHER INSTALLATION



MAP DRAWING INFORMATION:
DATA PROVIDED BY CITY OF WINDSOR
MAP CREATED BY: SZ
MAP CHECKED BY: LMH
MAP PROJECTION: NAD 1983 UTM Zone 17N



SCALE 1:60,000



PROJECT: 17-6638

STATUS: FINAL

DATE: 06/02/2020

