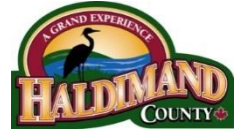


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# HALDIMAND COUNTY

## Report PW-ES-03-2018 Pilot Basement Flooding Mitigation Program Summary



For Consideration by Council in Committee on April 24, 2018

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### OBJECTIVE:

To provide Council with a summary of the work, findings and recommended next steps associated with the Pilot Basement Flooding Mitigation Program (PBFMP) that was carried out in specific areas within the communities of Caledonia and Hagersville.

### RECOMMENDATIONS:

1. THAT Report PW-ES-03-2018 Pilot Basement Flooding Mitigation Program Summary be received;
2. AND THAT Council approve reimbursement of the cost of the backwater valve, to an upset limit of \$1,500 each, to three eligible homeowners who installed a backwater valve prior to the initiation of the Pilot Basement Flooding Mitigation Program and are identified as being in a “High” risk area for basement flooding, as outlined within Report PW-ES-03-2018.

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**Approved:** Donald G. Boyle, Chief Administrative Officer

### EXECUTIVE SUMMARY:

The Pilot Basement Flooding Mitigation Program (PBFMP) was recently completed in the communities of Caledonia and Hagersville. The objective of the pilot program was to investigate and implement measures to reduce inflow and infiltration (I/I) from private sources, into the County’s sanitary sewage collection systems, and lower their risk of future basement flooding events within identified areas of these communities. In Caledonia, eleven of the thirty-one residents agreed to have plumbing/drainage work completed on their property and in Hagersville, three of the seventeen residents agreed to have plumbing/drainage work completed.

The reduced risk of basement flooding for the eleven Caledonia homes and the removal of an estimated daily average flow of 5 m<sup>3</sup> to the sanitary sewer system from the three Hagersville homes, are positive outcomes of the PBFMP.

The results of the PBFMP indicate that there are real challenges with obtaining voluntary participation in the program with feasibility and aesthetic reasons being considered to be two of the largest obstacles.

An effective policy to address inflow from private sources is considered a valuable component of any inflow and infiltration abatement program. It is suggested that staff continue to evolve this program structure in order to remove the obstacles preventing participation and look for opportunities to implement future pilots.

## BACKGROUND:

Inflow and infiltration (I/I) consists of surface water and ground water that enters the sanitary sewage collection system. Inflow occurs when water caused by rainfall or snow melt enters the sewer system through direct sources such as roof downspouts, foundation drain connections, sump pump connections, storm drain cross-connections (these do not conform to Haldimand County Sewer Use By-law #1443/14) and sanitary sewer manhole covers. Infiltration is groundwater that enters through holes and cracks in manhole structures, property service laterals and sewer pipes.

Through Report PW-ES-01-2016 Re: Pilot Basement Flooding Mitigation Program, staff introduced the Pilot Basement Flooding Mitigation Program (PBFMP) in two target residential areas including thirty-one homes in Caledonia and seventeen homes in Hagersville (see Attachment 1). Specific drivers for undertaking the program in Caledonia were multiple reports of basement flooding by homeowners and in Hagersville, evidence of private property sources of inflow. As per Report PW-ES-01-2016 staff also committed to providing Council with a summary of the results of the pilot program including next steps.

At the 2016 Rate Supported Water and Wastewater Budget with Report PW-ES-01-2016 as reference, Council approved the following funding limits per participating home for the pilot program:

Program Component	Rationale	County Funded Upset Limit per Home
Backwater Valve Installation	Protection from sewer system surcharging	\$1,500
Downspout Disconnection	Inflow reduction	\$500
Foundation Drain Disconnection	Inflow reduction	\$2,500

GM Blue Plan Engineering was hired to assist County staff in completing all tasks within the program, based on their involvement in similar program initiatives with other municipalities.

During the program work, an issue was raised at the May 30, 2017 Council in Committee meeting regarding the reimbursement of backwater valves that were installed by homeowners prior to the start of the PBFMP. As a result of Council discussion, staff were given direction through the following resolution:

*“THAT staff be directed to report back to a future Council in Committee meeting regarding reimbursement for backwater valves installed by homeowners at their own cost prior to the start of the Pilot Basement Flooding Mitigation Program in Caledonia and Hagersville.”*

The purpose of Report PW-ES-03-2018 is to provide Council with a summary of the work, findings and recommended next steps associated with the Pilot Basement Flooding Mitigation Program.

## ANALYSIS:

The following approach was used to implement the Pilot Basement Flooding Mitigation Program:

- Develop an effective communication plan for homeowners within target areas;
- Create and disburse educational material describing the program and its drivers;
- Investigate and document existing site drainage configurations for all properties within the pilot areas;
- Formulate a qualitative assessment of basement flooding risks for all properties within the Caledonia pilot area;
- Prepare and convey work plans that identify eligible plumbing/drainage modifications to reduce inflow for homeowners within the pilot areas that elected to participate;
- Complete all identified plumbing/drainage modifications for all homeowners within the target areas that elected to participate.

County staff along with GM Blue Plan (GMBP) canvassed each of the thirty-one homes in Caledonia and seventeen homes in Hagersville to introduce the program to each homeowner.

From that canvassing activity, 97% of Caledonia (30 homes) and 94% of Hagersville (16 homes) completed a program introduction discussion with GMBP and a Haldimand County representative while 74% of Caledonia (22 homes) and 65% of Hagersville (11 homes) allowed a private property inspection. All home inspection observations were captured in a project database to document potential sources of I/I on private property. General findings included:

- The majority of downspouts in both Caledonia and Hagersville are not connected to either the sanitary or storm sewer system; most discharge to grade in accordance with best practices.
- Most homeowners in Caledonia were interested in having a backwater valve installed at the County's expense.
- Homeowners in Caledonia were not receptive to the installation of sump pumps where required, to permit the installation of backwater valves, or to eliminate I/I from the sanitary sewer system.
- The majority of homes in Hagersville were built with sump pumps discharging to the sanitary sewer.
- Homeowners in Hagersville have not experienced basement flooding and were generally not receptive to disconnecting their sump pumps from the sanitary sewer.
- The majority of Hagersville homeowners indicated concerns with proposed lot grading/drainage as the reason for not participating in the I/I reduction program.

## Work Plan Development and Implementation

The following table summarizes the number of work plans prepared, the recommended work and the completed work for each of the pilot areas:

Work Activities	Caledonia		Hagersville	
	<i>Recommended</i>	<i>Completed</i>	<i>Recommended</i>	<i>Completed</i>
Disconnect Downspouts	6	2	4	0
Disconnect Foundation Drain From Sanitary Sewer	3	0	7	3
Disconnect Foundation Drain from Storm Sewer	4	0	0	0
Install Backwater Valve	14	11	0	0

Work Plans were generated for the twenty-five homeowners; seventeen in Caledonia (55% of eligible properties) and eight in Hagersville (47% of eligible properties), that elected to participate in the program. Reasons for a drop in program participation at this stage were believed to be a result of:

- Homeowners having difficulty understanding the relation of directly connected downspouts and sump pumps and the additional flow to the sanitary sewer, given that they had no history of basement flooding in their home.
- No eligible work was identified from the property assessment.
- Homeowner concern that lot grading could result in the pooling of water on their property.

Those Work Plans were then reviewed with each of the homeowners and the contractor to discuss site specific details so that the homeowner had a full understanding of the proposed work to be completed at the residence. From these Work Plan reviews, eleven Caledonia residents (35% of eligible properties) and three Hagersville residents (18% of eligible properties) elected to have the identified work completed. Reasons for a drop in program participation at this stage can be attributed to the following reasons:

- Aesthetic - homeowners did not want unsightly sump pumps or backwater valves visible in their finished living spaces, while others simply did not want to disturb existing finishes.
- Operation and Maintenance – homeowners did not want to take responsibility for the operation and maintenance of new sump pumps and backwater valves that were not previously required.
- Financial – in some instances, the required work would have exceeded the County's limit of \$4,500 per property. Homeowners were not willing to pay additional costs, particularly if they had not experienced basement flooding in the past.
- Drainage Issues – Homeowners in Hagersville were reluctant to redirect their sump pumps to the surface citing concerns of poor lot grading and the potential for ponding/icing. GMBP noted that re-grading to improve drainage at some of the subject properties was not possible. GMBP also notes that a number of homeowners in Hagersville were found to have plumbing fixtures connected to their sump pumps, thus increasing sump pump run times and discharges. By correcting non-conforming plumbing configurations, sump pump run times and discharge would potentially decrease, and decrease the potential for ponding/icing. Homeowners were not, however interested in changing the status quo.

- Complexity of Work – in some instances, more extensive work was required, for example:
  - In order to install backwater valves at some homes, the existing plumbing configurations required that the foundation drain be disconnected from the sanitary service lateral and a sump pump installed. One homeowner that was interested in having a backwater valve installed declined to participate in the program in order to avoid the need to install and operate a sump pump.
  - Some homes may not be good candidates for retrofit work; the installation of new sump pumps or backwater valves may require extensive re-routing of existing interior plumbing, causing aesthetic, financial and operation/maintenance concerns for homeowners.

## **Basement Flooding Risk Assessment**

The risk assessment for basement flooding involved comparing basement elevations of all participating homes within the Caledonia pilot area, against a potential surcharging threshold that was defined by basement elevations of the homes that had reported flooding to Haldimand County as a result of the January 13, 2013 rainfall. The findings identified that fourteen properties were considered to be at “High” risk of basement flooding, twelve were considered “Moderate” risk and the remaining five homes were considered to be at “Low” risk for basement flooding.

Of the fourteen properties considered to be at “High” risk, four homeowners had already installed backwater valves as a result of past basement flooding events. Given that these properties would have qualified to have a backwater valve installed under this pilot program, it is recommended by staff that reimbursement, upon receipt for the costs incurred by the homeowner, up to the Council approved limit of \$1,500, be made available under the condition that the homeowner fully participates in the PBFMP and allows for the correction of any non-conforming connections. The financial implications of this recommendation are detailed in the following section of this report.

## **Beneficial Impact Assessment**

The private property retrofit works completed under this program, namely downspout disconnection, foundation drain disconnection and backwater valve installation, are best practices that contribute to the reduction of both I/I and risk of basement flooding. From a qualitative perspective, these works result in the following beneficial impacts:

- Reduced dry weather flow due to groundwater infiltration by disconnection of foundation drains.
- Reduced wet weather flow due to rainfall derived I/I by disconnection of foundation drains and downspouts.
- Reduced I/I volume corresponding to increase in available system capacity that can be allocated to new development.
- Reduced peak wet weather flow, reducing system bottlenecks, increasing conveyance capacity and thereby reducing risk of basement flooding.
- Reduced I/I volume corresponding to reduced treatment costs.
- Reduced wet weather flow corresponding to lower system hydraulic grade line and reduced risk of basement flooding.
- Increased level of protection against basement flooding through installation of backwater valves.

Quantification of the true beneficial impact of the completed work for this project requires the comparison of dry weather flow, wet weather flow and system hydraulic grade line, under pre and post-work conditions with hydraulic model analysis.

Given the lack of post-retrofit flow data, at the time of this report, staff offer the following qualitative assessment of the potential beneficial impact of the completed work:

### **Caledonia**

In Caledonia, three of the inspected homes were found to have foundation drain connections to the sanitary sewer. However, no disconnection work was permitted by the homeowners. The installation of eleven backwater valves out of the twenty-six identified “High and Moderate” risk homes is a positive step towards providing protection against future basement flooding.

### **Hagersville**

In Hagersville, seven of the inspected homes were found to have foundation drain connections to the sanitary sewer, and two with downspout connections to the sanitary sewer. Foundation drains were disconnected from the sanitary sewer at three homes, and no downspouts were disconnected.

All sump pumps identified during inspection were one-third horsepower and could therefore be expected to discharge approximately 2.5 L/s (40 US GPM) based on manufacturer’s mean flow rate specifications. This equates to 9 m<sup>3</sup> of unnecessary flow into the sanitary sewer from one home, within a one hour wet weather event.

Assuming an average roof area of 112 m<sup>2</sup> (1,200 ft<sup>2</sup>), and 80% capture of rainfall, a rainfall intensity of 25 mm/hour will result in downspout discharge of 0.62 L/s per property. This equates to approximately 2 m<sup>3</sup> of unnecessary flow into the sanitary sewer within a one hour wet weather event.

Based on a typical 200 mm diameter sewer main, the additional foundation drain and downspout flows represent 15% of the total capacity of the pipe. The additional capacity extrapolated over several homes within a neighbourhood may cause the sewer main to exceed capacity limits leading to potential basement flooding, sanitary sewer surcharges to the environment and wastewater treatment plant (WWTP) by-passes to receiving waters. These events will cause the County financial expenditures for insurance claims litigation, infrastructure repairs and costly future treatment plant expansion upgrades.

GMBP estimates that the I/I foundation drain work completed for the PBFMP in Hagersville may reduce the inflow to the sanitary sewer during a heavy wet weather event as much as 27 m<sup>3</sup> of flow (3 residents x 9 m<sup>3</sup>) within a one hour wet weather event or 5 m<sup>3</sup> per day on average.

### **Feedback from Residents**

During the inspection phase, resident feedback in Caledonia was very positive. GMBP received telephone calls from several property owners to book inspections and ask questions about the program. Renfrew Street East residents were very willing to have the backwater valve installed due to flooding concerns on the street.

Resident feedback in Hagersville was neutral with no phone calls to GMBP regarding questions and inspection appointment bookings. Participation in the Hagersville PBFMP had to be greatly encouraged though multiple contact efforts. Staff suspect that this may have been due to the fact that many properties in Hagersville are believed to have non-conforming sump pump connections to the sanitary sewer.

A total of six homeowners, three in each community, declined to participate in the inspection phase of the program. Reasons for declining participation included the following:

- One homeowner in Caledonia indicated that the previous homeowner had installed a backwater valve, and was therefore not interested in participating.
- One homeowner in Hagersville indicated that he/she had never experienced basement flooding, had no sump pump and no connected downspouts.
- Four homeowners did not give specific reasons for not participating.

### **Recommendations for Future Programs to Address Inflow from Private Sources**

The findings from the PBFMP confirm that, in areas of the County, direct connections of downspouts and foundation drains into the sanitary sewer exist and are contributing to the frequency of sewer surcharging events that result in the flooding of basements with sewage, and additional volume of sewage required to be pumped to, and treated at the wastewater treatment plant.

Unfortunately, the results of the PBFMP indicate that there are real challenges with obtaining voluntary participation in the program with feasibility and aesthetic reasons being considered to be two of the largest obstacles.

An effective policy to address inflow from private sources is considered a valuable component of any inflow and infiltration abatement program. It is suggested that staff continue to evolve this program structure in order to remove the obstacles preventing participation and look for opportunities to implement future pilots.

### **FINANCIAL/LEGAL IMPLICATIONS:**

The 2016 Rate-Supported Capital Budget identified an amount for the sanitary sewer rehabilitation PBFMP that was based on a best case scenario of all homeowners in the pilot areas participating and qualifying for all eligible plumbing modifications as well as the installation of backwater valves in the majority of all homes in the Caledonia pilot area.

The forecasted expenditures for the completed remediation work on the homes for Caledonia and Hagersville are \$33,500 and \$16,500 respectively. The lower expenditures reflect a lower participation rate than was hoped for. However, it is important to note that there were several homes in both communities that didn't require any work to be done.

Additional expenditures were realized on the program support component as a result of an increased level of effort in program promotion and contact with homeowners as well as the completion of follow-up site visit investigations relating to private property sanitary and storm sewer CCTV work.

Of the four properties which had backwater valves installed prior to the PBFMP and are subject to the recommendation by staff for reimbursement, one homeowner declined to participate in the program and is therefore no longer considered eligible for possible reimbursement. The cost to reimburse the remaining three homeowners within the Caledonia pilot area for backwater valves that were installed prior to the initiation of the PBFMP is approximately \$3,800.

The recommendation to reimburse homeowners who installed backwater valves prior to the initiation of the PBFMP, is strictly limited to the verified costs up to the approved upset limit, and to the homes within the Caledonia pilot area that were assessed to be at a high or moderate risk of future basement flooding.

The total forecasted expenditures for the PBFMP are within the current approved Rate-Supported Capital budget of \$287,500.

### **STAKEHOLDER IMPACTS:**

Not applicable.

### **REPORT IMPACTS:**

Agreement: No

By-law: No

Budget Amendment: No

Policy: No

### **ATTACHMENTS:**

1. Pilot Basement Flooding Mitigation Program Work Areas – Caledonia and Hagersville.