



Report to: General Committee

Meeting Date: April 18, 2017

SUBJECT: Citywide Multi-phase Sanitary System Downspout Disconnection Program – Annual Progress Update and Phase 5 Details

PREPARED BY: Gord Miokovic, Manager-System Engineering (Waterworks)
John Lau, System Engineer (Waterworks)

RECOMMENDATION:

1) That the report entitled “Citywide Multi-phase Sanitary System Downspout Disconnection Program – Annual Progress Update and Phase 5 Details” be received; and

2) That Council approve the Phase 5 of 5 program area covering 1,894 properties as follows:

Thornhill Area:

- i. Area bounded by Normark Drive to the north, East Don River to the east, Colonsay Road to the south, and Normark Drive & Inverlochy Boulevard to the west;
- ii. Area bounded by John Street & Chumleigh Crescent to the north, Don Mills Road & Hwy 404 to the east, Simonston Boulevard to the south, and German Mills Settlers Park & Bercy Park to the west;

Unionville Area:

- iii. Area bounded by Carlton Road & Krieghoff Avenue to the north, Main Street Unionville & railway track to the east, Highway 7 & Vasselle Crescent to the south, and Warden Avenue to the west; and

3) That the project be funded in the amount of \$181,000 from the 2017 Capital Project #17221 “Sanitary System Downspout Disconnection Program – Phase 5 of 5”; and

4) That total funding of \$442,382 be returned to original funding source from the following projects:

- \$133,600 from project #14313 “Sanitary System Downspout Disconnection Program – Phase 2 of 5”
- \$84,452 from project #15294 “Sanitary System Downspout Disconnection Program - Ph 3 of 5”
- \$224,330 from project #16238 “Sanitary System Downspout Disconnection Program – Phase 4 of 5”; and

5) That Staff be authorized and directed to do all things necessary to give effect to this resolution.

PURPOSE:

The purpose of this report is to:

- i. Provide a status update on Phase 1 - 4 of the Citywide Multi-phase Sanitary System Downspout Disconnection Program (DDP);

-
- ii. Provide Council with the proposed Phase 5 area details; and
 - iii. Obtain authorization from Council to proceed with the areas chosen for Phase 5 of the program.

EXECUTIVE SUMMARY:

Phase 1:

Phase 1 of the program covered part of Thornhill Area (see **Attachment A**). All testing and downspout disconnection works was completed by October 2015. Through the testing of 2,256 properties, 2,131 properties passed the tests and did not have any I-I concerns. The tests identified the following:

- 21 properties were identified as having downspouts directly connected to the sanitary sewers
- 39 private properties and 9 additional public locations (total 48) were identified as being inflow/infiltration (I-I) sources.
(These other sources included: uncapped lateral cleanouts; damaged sanitary manholes; street catch basins, or driveway and stairwell drains connected to the sanitary sewer; etc.)
- 65 properties were identified as having lateral interactions between the storm and sanitary systems, which indicated that there may be cracks or cross-connections at the service lateral.

Out of the 21 affected properties, only one did not comply with the disconnection and the By-law Department is addressing the issue through the By-law Enforcement process.

For the 48 other I-I source locations (both public & private), the 9 public side I-I sources had been checked and resolved by Waterworks staff. Regarding the 39 private side I-I sources, the list will be consolidated after completion of the Program and discussion with Legal & By-law Department will be carried out to determine how to resolve. **Table 3** on page 9 details the findings and status of these issues.

For the 65 properties with reported lateral interaction, they had been inspected under the Sanitary Lateral Inspection Program. The condition of the service lateral was evaluated and the list of identified defects had been identified. The repairing of the defects has been included in the annual maintenance program and was schedule based on the level of severity.

Post flow monitoring for the Phase 1 area commenced in Spring 2016 for a period of 12 months under the Flow Monitoring Project (#14300).

The total amount spent under Phase 1 (Capital Project #11328 Roof Downspout Disconnection Program) was \$130,925 and the project is now closed. See **Attachment H** for an outline of costs related to all phases of the DDP.

Phase 2:

Phase 2 of the program also covered part of Thornhill Area (see **Attachment B**). All testing and downspout disconnection works was completed by November 2016. Through the testing

of 2,827 properties, 2,544 properties passed the tests and did not have any I-I concerns. The tests identified the following (Note some properties may have had more than one issue):

- 70 properties were identified as having downspouts directly connected to the sanitary sewers.
- 7 private properties and 30 additional public locations (total 37) were identified as being inflow/infiltration (I/I) sources.
- 215 properties were identified as having lateral interactions which indicate there may be cracks or cross-connections at the service lateral.

Out of the 70 affected properties, three properties (located within the same townhouse complex) did not comply with the disconnection requirement and the By-law Department is addressing the issue through the By-law Enforcement process.

For the 37 other I-I source locations (both public & private), the 30 public side I-I sources had been checked and resolved by Waterworks staff. Regarding the 7 private side I-I sources, the list will be consolidated after completion of the Program, and discussion with Legal & By-law Department will be carried out to determine how to resolve. **Table 4** on page 10 details the findings and status of these issues.

The 215 properties with reported lateral interaction had been inspected under the Sanitary Lateral Inspection Program. The condition of the service lateral was evaluated and the list of identified defects had been identified. The repairing of the defects has been included in the annual maintenance program and was scheduled based on the level of severity.

Post flow monitoring for the Phase 2 area will commence in Spring 2017 for a period of 12 months under the Flow Monitoring Project (#15284).

The total amount spent under Phase 2 (Capital Project #14313, Sanitary System Downspout Disconnection Program - Ph 2 of 5) was \$133,184. The remaining budget of \$133,660 will be returned to source.

Phase 3:

Phase 3 of the program covered the Thornhill Area, the Milliken Area, and the Unionville Area (see **Attachment C**). All testing work was completed by November 2015. Through the testing of 3,690 properties, 3,668 properties passed the tests and did not have any I-I concerns. The tests identified the following:

- 4 properties were identified as having downspouts directly connected to the sanitary sewers.
- 12 private properties and 10 additional public locations (total 22) were identified as being inflow/infiltration (I/I) sources.
- 6 properties were identified as having lateral interactions which indicate there may be cracks or cross-connections at the service lateral.

Phase 3 is currently under the disconnection stage. "Notice of Disconnection" had been sent out to the 4 affected homeowners by registered mail in June 2016 along with the City subsidiary package. A twelve month period was provided for the homeowners to carry out the disconnection works.

For the 22 other I-I source locations (both public & private), the 10 public side I-I sources had been checked and resolved by Waterworks staff. Regarding the 12 private side I-I sources, the list will be consolidated after completion of the Program, and discussion with Legal & By-law Department will be carried out to determine how to resolve. **Table 5** on page 10 details the findings and status of these issues.

For the 6 properties with reported lateral interaction, they have been scheduled for inspection under the Sanitary Lateral Inspection Program between 2018-2020. The condition of the service lateral will be evaluated and any identified defects will be fixed accordingly.

Post flow monitoring for the Phase 3 area will commence in Spring 2018 for a period of 12 months after the completion of the downspout disconnection works.

The budget for Phase 3 (Capital Project #15294, Sanitary System Downspout Disconnection Program - Ph 3 of 5) was \$163,922 and the amount spent/committed to date is \$76,670. \$2,800 of the balance remaining of \$87,252 is committed for the Financial Assistant Plan and the remaining amount of \$84,452 can be returned to original funding source.

Phase 4:

Phase 4 of the program covers the Markham Area (see **Attachment D**). The testing work was completed by November 2016. The disconnection stage is expected to start in June 2017. Through the testing of 2,305 properties, 2,186 properties passed the tests and did not have any I-I concerns. The tests identified the following (Note some properties may have had more than one issue):

- 6 properties were identified as having downspouts directly connected to the sanitary sewers.
[Notice of Disconnection will be sent out to the affected homeowners in June 2017.]
- 13 private properties and 31 additional public locations (total 44) were identified as being inflow/infiltration (I/I) sources.
[Waterworks staff will investigate and fix the identified 31 public side I-I sources in 2017. Regarding the 13 private side I-I sources, the list will be consolidated after completion of the Program. Discussion with Legal & By-law Department will be carried out to determine how to resolve. **Table 6** on page 11 details the proposed actions for these issues.]
- 103 properties were identified as having lateral interactions which indicate there may be cracks or cross-connections at the service lateral.
[The sanitary service lateral of the identified properties with lateral interaction will be inspected under the annual Sanitary Lateral Inspection Program between 2017-2021.]

The approved budget for Phase 4 (Capital Project #16238, Sanitary System Downspout Disconnection Program - Ph 4 of 5) was \$300,000 and the amount spent/committed to date is \$71,470. The actual number of properties requiring downspout disconnections was less than original estimates and the flow monitoring work can now be completed under the annual Flow Monitoring program, therefore an amount of \$224,330 will be returned to source. The remaining funds of \$4,200 are committed for the Financial Assistant Plan.

For a detail summary comparison on the Phase 1 to Phase 4 findings, please see **Attachment I**.

Phase 5:

Phase 5 of the program is being proposed to cover the Thornhill and Unionville Area (see **Attachment E**). Phase 5 will run from 2017-2021 with a total estimated cost of \$181,000 under Capital Project #17221, Sanitary System Downspout Disconnection Program Phase 5 of 5.

After Phase 5 program, all currently identified areas with higher risk of wastewater based basement flooding will be covered. Requirement of any future phases of the program will be evaluated base on the results of the Environmental Assets Flow Monitoring Project, with the earliest potential future phase occurring in 2020. Funding for any future phase will be requested as part of the respective years' capital budget process.

The DDP is just one of the programs/initiatives to mitigate sanitary system inflow/infiltration (I-I) issues. The other initiatives include sewer and lateral inspection & lining, plugging and sealing manholes, design standard changes.

BACKGROUND:

The DDP is an extension of the Pilot DDP completed in 2012. The goal of the program is to:

- Reduce the risk of wastewater based basement flooding;
- Reduce the flow in the sanitary sewer system by reducing extraneous inflow;
- Enforce the City of Markham Sewer By-Law #2014-71 which does not permit storm water entering the wastewater collection system.

The identification of higher risk areas within the City and the phasing of the program were determined by taking into account wastewater flow modeling, wastewater flow monitoring, past flooding incidents reported to the City and all other on-going programs/initiatives within Markham. These identified higher risk areas are shown on **Attachment F**.

Under the pilot program, smoke testing and water testing had been used to identify the direct connections of downspouts into the sanitary sewer system. Based on the Phase 1 test results, it was noticed that smoke testing proved to be a more efficient and cost effective process in finding sources of I-I contribution than water testing. In order to improve the cost effectiveness of future phases of the DDP, Council had approved the elimination of water testing in the program under report "Citywide Multi-phase Sanitary System Downspout Disconnection Program – Phase 1 Progress Update and Phase 2 Details" dated March 14, 2014. With this change, a larger area was covered under each phase of the program while reducing overall program cost.

Each phase of the DDP now involves the following elements:

- i. Modeling and evaluation of the existing flow monitoring data to assess the extent of extraneous flows in an area;
- ii. Public Communication and Education Plan;
- iii. Multi-step Site Investigation Approach:
 1. Lot survey identifying all downspouts connected to the underground system;
 2. Sanitary and storm sewer smoke testing of all downspouts connected to the underground system;
- iv. Resident notification for follow-up action required along with Financial Assistant Plan (FAP) information;
- v. A 12 months timeframe is given to the homeowners to carry out the downspout disconnection works;
- vi. Follow-up corrective action inspection;
- vii. Progressive By-law Enforcement for non-compliance with required corrections;
- viii. Flow Monitoring of area after identified corrective action completed.

DISCUSSION:**1. Phase 1 to 4 Progress**

Phase 1 covered the Thornhill area (see **Attachment A**) and commenced in May 2013. All testing had been completed by April 2014 and the disconnection works had been completed in October 2015.

Phase 2 covered the Thornhill Area (see **Attachment B**) and commenced in May 2014. All testing had been completed by November 2014 and the disconnection works had been completed in November 2016.

Phase 3 covered the Thornhill Area, the Milliken Area, and the Unionville Area (see **Attachment C**) and commenced by May 2015. All testing had been completed in November 2015 and is currently under the disconnection stage.

Phase 4 covered the Markham Area (see **Attachment D**) and commenced in May 2016. All testing had been completed by November 2016.

Table 1 summarized the final test result for Phase 1 - 3 and the preliminary test result for Phase 4:

Table 1: Test Results

	Total no. of Properties	No. of properties identified with Downspout directly connected to sanitary system	No. of other I-I contribution items identified	No. of lateral interactions identified
Phase 1	2,256	21	48	65
Phase 2	2,827	70	37	215
Phase 3	3,690	4	22	6
Phase 4	2,305	6	44	103
Total	11,078	101	151	389

1.1 Direct connection of downspouts to the sanitary sewer system

Phase 1 had a total of 21 properties identified as having downspouts directly connected to the sanitary sewer system. Out of the 21 properties only one property has not complied with the requirement and the non-compliance is being addressed through the By-law Enforcement process.

Phase 2 had a total of 70 properties identified as having downspouts directly connected to the sanitary sewer system. Out of the 70 properties, three properties (all within the same townhouse complex) did not comply with the requirement and the non-compliance is being addressed through the By-law Enforcement process.

Phase 3 has a total of 4 properties identified as having downspouts directly connected to the sanitary sewer system. "Notice of Disconnection" packages were mailed to the property owners by registered mail in June 2016. A 12 month period was provided to the

homeowners to complete the disconnection works. Post disconnection flow monitoring is expected to commence in the Spring of 2018 for a 12 month period.

Phase 4 identified a total of 6 properties as having downspouts directly connected to the sanitary sewer system. "Notice of Disconnection" will be mailed to the homeowners by registered mail in June 2017 along with the Financial Assistant Plan (FAP) information. The homeowners will be given a 12 month timeframe to secure contractors or undertake the work themselves. Along with being available on the City web site, literature on how to properly and effectively disconnect the downspout will also be provided to the affected homeowners. Following the disconnection of downspouts and the FAP forms being submitted, the work will be inspected by City staff and rebates will be provided. Post disconnection flow monitoring is expected to commence in the Spring of 2019 for a 12 month period.

Table 2 summarized the up-to-date disconnection status.

Table 2: Downspouts Disconnection Status

	No. of properties identified with Downspout connect to Sanitary System	No. of properties completed disconnection	No. of properties outstanding
Phase 1	21	20	1 (Under By-law enforcement process)
Phase 2	70	67	3 (within the same townhouse complex & are under By-law enforcement process)
Phase 3	4	-	4
Phase 4	6	-	6 (Disconnection works will commence in June 2017)
Total	101	87	14

1.2 Other public/private side I-I contribution sources

During smoke testing, apart from downspout connections to the sanitary sewer, other I-I sources were also identified. These sources were located within both public and private properties. **Table 3 to 6** summarizes the different I-I sources and the action taken to date.

Table 3: Phase 1 Other I-I Sources

Public/Private Side	Other I-I Sources	No. Identified	Actions Taken
Public	Potential catchbasin connected to sanitary sewer	4	Waterworks staff performed CCTV investigation and no cross-connections or defects requiring repairs were identified
Public	Sanitary Manholes Defects (cracks, hole, wrong cover lid)	5	Waterworks staff repaired all the defects
Private	Uncapped Lateral clean out	17	Waterworks staff capped all the lateral cleanouts
Private	Sanitary Manhole in parking lot with open grid cover	1	Waterworks staff replaced the manhole lid
Private	Disconnected downspouts not properly capped	2	Letter send to property owners and the issues have been fixed with follow-up inspection
Private	Driveway drains, private catchbasin, side drain, stairwell drain, and rear drain connections	13	Consolidate to a complete list after Program completion. Discuss with Legal & By-law Department to determine how to resolve the private side issue and whether some type of Council Approved Assistance Program will be required.
Private	Potential sump pump connection	2	
Private	Weeping tile connection	2	
Private	Old oil sump connection	1	
Private	Unknow cement structure connection	1	
Total		48	

Table 4: Phase 2 Other I-I Sources

Public/Private Side	Other I-I Sources	No. Identified	Actions Taken
Public	Potential catchbasin connected to sanitary sewer	21	Waterworks staff performed CCTV investigation and no cross-connections or defects requiring repairs were identified
Public	Sanitary Manholes Defects (cracks, hole, wrong cover lid)	9	Waterworks staff repaired all the defects
Private	Driveway drains, private catchbasin, side drain, stairwell drain, and rear drain connections	6	Consolidate to a complete list after Program completion. Discuss with Legal & By-law Department to determine how to resolve the private side issue and whether some type of Council Approved Assistance Program will be required.
Private	Potential sump pump connection	1	
	Total	37	

Table 5: Phase 3 Other I-I Sources

Public/Private Side	Other I-I Sources	No. Identified	Actions to be Taken
Public	Potential catchbasin connected to sanitary sewer	1	Waterworks staff performed CCTV investigation and no cross-connections or defects requiring repairs were identified
Public	Sanitary Manholes Defects (cracks, hole, wrong cover lid)	9	Waterworks staff repaired all the defects
Private	Uncapped Lateral clean out	5	Waterworks staff capped all the lateral cleanouts in 2016
Private	Driveway drains, private catchbasin, side drain, stairwell drain, roof drain, and rear drain connections	4	Consolidate to a complete list after Program completion. Discuss with Legal & By-law Department to determine how to resolve the private side issue and whether some type of Council Approved Assistance Program will be required.
Private	Weeping tile connection	3	
	Total	22	

Table 6: Phase 4 Other I-I Sources

Public/Private Side	Other I-I Sources	No. Identified	Actions to be Taken
Public	Potential catchbasin/storm manhole connected to sanitary sewer	24	Waterworks staff will performed CCTV investigation in 2017
Public	Sanitary & Storm Manholes Defects (cracks, hole, wrong cover lid)	7	Waterworks staff will repair all the defects in 2017
Private	Weeping tile connection	13	Consolidate to a complete list after Program completion. Discuss with Legal & By-law Department to determine how to resolve the private side issue and whether some type of Council Approved Assistance Program will be required.
	Total	44	

1.3 Lateral interaction between sanitary and storm sewer

Lateral interaction is identified when smoke comes out from the downspouts under both storm and sanitary sewer smoke testing. Since the two systems are fully separate, the smoke identified at the downspouts indicated that there may be cracks at the lateral pipe or some cross-connection which allows the migration of smoke during the testing. The properties identified to have lateral interaction have been added to the Annual Sanitary Lateral Inspection program. This Program inspects and evaluates the condition of the sanitary service laterals, with any defects identified to be fixed accordingly. **Table 7** summarized the scheduled lateral inspection time frame for each phase.

Table 7: Sanitary Service Lateral Inspection Status

	No. of properties with Lateral Interaction	Scheduled Inspection Period
Phase 1	65	Completed in 2015
Phase 2	215	Completed in 2015
Phase 3	6	To be carried out in 2018-2020
Phase 4	103	To be carried out in 2017-2021
Total	389	

From the lateral inspection CCTV results, the consultant will indicate any structural defects that warrant repair works and any blockage of lateral which require flushing. The repair and flushing operations will be performed by Waterworks staff under their maintenance schedule.

1.4 Post Flow Monitoring

Post flow monitoring will be undertaken after the required repair works have been completed under each phase. The post flow monitoring will be performed for a 12-month period in order to capture relevant rainfall and flow data. Based on this flow monitoring data, City staff will evaluate the impact the work has had in reducing I-I levels and determine if any further actions are required.

All the remediation works had been completed for Phases 1 and 2. As such, the post flow monitoring works for Phase 1 commenced in Spring 2016 and the Phase 2 flow monitoring will commence in Spring 2017.

2. Phase 5 Sanitary System Downspout Disconnection Program

The following Markham areas are being recommended for Phase 5 of the DDP (see **Attachment E**):

Thornhill Area:

- iv. Area bounded by Normark Drive to the north, East Don River to the east, Colonsay Road to the south, and Normark Drive & Inverlochy Boulevard to the west;
- v. Area bounded by John Street & Chumleigh Crescent to the north, Don Mills Road & Hwy 404 to the east, Simonston Boulevard to the south, and German Mills Settlers Park & Bercy Park to the west;

Unionville Area:

- i. Area bounded by Carlton Road & Krieghoff Avenue to the north, Main Street Unionville & railway track to the east, Highway 7 & Vasselle Crescent to the south, and Warden Avenue to the west; and

These areas cover a total of 1,894 properties. The proposed schedule for Phase 5 is summarized in **Table 8**:

Table 8: Phase 5 Schedule

i. Public Communication and Education Plan – (Overview of the Public Communication and Education Plan is enclosed in Attachment G)	Started in April 2017
ii. Lot Survey	Completed in September 2016
iii. Smoke Testing & Report	May 2017 to May 2018
iv. Resident notification for follow-up action required along with FAP information	June 2018 to May 2019
v. Follow-up corrective action inspection	June 2018 to June 2019
vi. Progressive By-law Enforcement for Non-compliance with required corrections	June 2019 to January 2020
vii. Flow Monitoring of area after identified corrective action completed	April 2020 to April 2021

Annual reports will continue to be presented to Council regarding the progress of the program and to confirm future phase areas.

3. Future Program Areas

After completion of the 5 phases of the DDP, all the currently identified areas will be covered (see **Attachment F**). Staff will continue to monitor and evaluate the City's wastewater flow monitoring data and other information in order to determine if there is any additional areas that have higher risk of wastewater based basement flooding, which require the implementation of the program. Based on the evaluation process, Environmental Services will confirm if there is a need for any future phase of the program by 2020.

FINANCIAL CONSIDERATIONS:

The funding for Phase 5 Program was approved as part of the 2017 Capital Budget under Project #17221 for \$181,000. The following funding allocation breakdown (**Table 9**) is proposed for the program covering 2,305 properties.

Results from phases 1 to 4 identified an average of 1% of all tested properties will take advantage of the Financial Assistance Package. The budget below assumes a 3% uptake on the Financial Assistance Package based on industry standards. Surplus funds, if any, will be returned to source based on test results.

Table 9: Phase 5 Budget Breakdown

Item	Total Budget
<i>Activities:</i>	
<i>Public Communication & Education</i>	\$18,400
<i>Site Investigation</i>	\$96,500
<i>Financial Assistance Plan: Downspout Disconnection & Rain Barrel</i>	\$46,800
<i>Total</i>	\$161,700
<i>Contingency (10%)</i>	\$16,170
Overall Total	\$177,869
Overall Total + Tax	\$181,000

The Financial Assistance Package (FAP), was approved by Council on March 19, 2013 under report, "Citywide Multi-phase Sanitary System Downspout Disconnection Program – Financial Assistant Plan", and covers:

- 80% of the cost of completing the downspout disconnection, to a maximum of \$500, and
- 100% of the cost of a rain barrel purchased by the home owner, to a maximum of \$150.

Details of the cost breakdown are provided in **Attachment H**.

Funds Returning to Source:

Phase 2 Program

The post flow monitoring portion of work is now funded under the Annual Flow Monitoring project and also the number of financial assistance program applications among qualifying properties were not as high as anticipated, as such, the remaining budget in the amount of \$133,660 from Phase 2 Capital Project #14313 will be returned to source.

Phase 3 Program

The post flow monitoring portion of work is now funded under the Annual Flow Monitoring project, as such, the remaining budget in the amount of \$84,452 from Phase 3 Capital Project #15294 will be returned to source.

Phase 4 Program

Based on the number of properties requiring downspout disconnection from the test result being lower than original estimates and the post flow monitoring portion of work now funded under the Annual Flow Monitoring project, the remaining budget in the amount of \$224,330 from Phase 4 Capital Project #16238 will be returned to source.

HUMAN RESOURCES CONSIDERATIONS

Resources are available within the Department.

ALIGNMENT WITH STRATEGIC PRIORITIES:

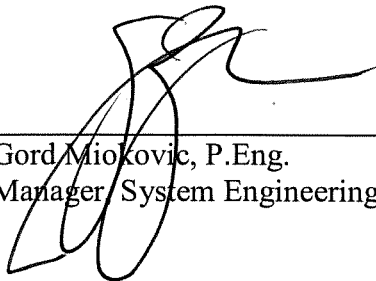
This project aligns with the Building Markham's Future Together Strategic Plan, improving the areas of Managing our Growth, Protecting our Environment and Excellence in Municipal Services. Disconnecting roof downspouts from the sanitary sewer system in accordance with City's By-law, has extensive and long-lasting environmental benefits which include reduced inflow/infiltration into the sanitary sewer system, reduced energy costs for sanitary sewer pumping and treatment, ground water recharge, water conservation, reduced probability of sanitary sewer backups into basements, and reduced sanitary sewer overflows to receiving waters.

BUSINESS UNITS CONSULTED AND AFFECTED:


The Business units which will be affected most by the Sanitary System Downspout Disconnection Program include Environmental Services – Waterworks & Environmental Assets, and By-law Enforcement.

RECOMMENDED

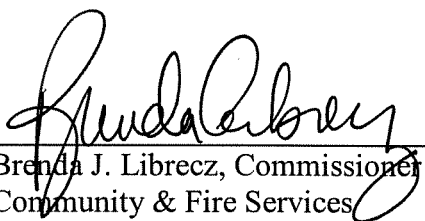
BY:



Gord Miokovic, P.Eng.
Manager, System Engineering



Phoebe Fu, M.Eng., P.Eng., PMP
Director, Environmental Services



Brenda J. Librecz, Commissioner
Community & Fire Services

Q:\Commission Share\Environmental Services\2017\Reports\Council Report - Citywide
Multi-phase Sanitary System DDP Annual Progress Update and Ph 5 Details-Feb 2017.docx

ATTACHMENTS:

Attachment "A" – Phase 1 Area

Attachment "B" – Phase 2 Area

Attachment "C" – Phase 3 Area

Attachment "D" – Phase 4 Area

Attachment "E" – Phase 5 Area

Attachment "F" – Citywide Multi-phase Sanitary System Downspout Disconnection Program

Attachment "G" – Downspout Disconnection Program Phase 5 Communication Strategy

Attachment "H" – Financial Breakdown for Identified Program Areas

Attachment "I" – Phase 1 to 4 Comparative Findings Summary