Report to: General Committee Meeting Date: December 6, 2022

SUBJECT: Citywide Multi-Phase Sanitary System Downspout Disconnection Program – Wrap-up Report

PREPARED BY: Jack Zi and Shumin Gao

RECOMMENDATION:

1) That the report entitled "Citywide Multi-Phase Sanitary System Downspout Disconnection Program – Wrap-up Report" be received;

2) That the Citywide Multi-Phase Sanitary System Downspout Disconnection Program (DDP) has been successfully completed by investigating and disconnecting downspouts that connected to the sanitary sewer system within the high risk of basement flooding area in Thornhill, Unionville and Markham Village;

3) That the staff recommends to conclude the current DDP for the already identified high risk of basement flooding area in Thornhill, Unionville and Markham Village; and

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

EXECUTIVE SUMMARY:
n/a

PURPOSE:
The purpose of this report is to provide a summary of the Citywide Sanitary System Downspout Disconnection Program (DDP) completion through total six phase's implementation.

BACKGROUND:
The City of Markham has separate sewer systems for stormwater and sanitary flows. Sanitary sewers are designed to convey household and commercial wastewater to Regional wastewater trunk sewers and eventually discharge to the wastewater treatment plant. Sanitary sewers are not sized to convey any stormwater/snowmelt runoff and should only be able to accommodate a small amount of groundwater infiltration.

In older areas of the City, home owners and builders may have occasionally connected the roof downspouts to the sanitary sewer system incorrectly. The connected downspouts to the sanitary sewer system can be considered as a primary contributor for creating elevated sewage flows. The extraneous sanitary inflow ultimately increase the risk of sanitary sewer backups may cause basement flooding during extreme rainfall events.

To mitigate this primary contributor, City of Markham Council through the report dated April 3, 2008, approved the Pilot Downspout Disconnection Program in April 29, 2008.

This pilot program was successfully completed in February 2010 and a staff report to Council was made in September 2010, presenting the results and effectiveness of the successfully pilot program.

As an extension of the pilot program, the DDP was approved by Council on Mar 19, 2013 allowing staff to carry out a City wide multi-phase program in the selected three (3) older areas within the City (built before 1980's) that were identified with higher risk of basement flooding: the Thornhill Area, Unionville Area and Markham Village Area. 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 the City.

The goals of the DDP are to:

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

Based on the flow monitoring data, historical flooding records and other programs/initiatives within the City, the DDP was implemented through a total six (6) phases from 2013 to 2022.

Each phase of the DDP 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 minimum of 12 months' timeframe given to the homeowners to carry out the downspout disconnection works (Additional extension were given since the starting of the COVID-19 Pandemic);
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.

OPTIONS/ DISCUSSION:

1. Program Implementation Timeline

The DDP is delivered in 6 phases. Each phase involves the following elements and timing (see **Table 1**). A map overview is contained in **Attachment A.**

Table 1 - Downspout Disconnection Program Timing

Phase	Year										
	Pre-2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
1	*a*	*b, c*	*d*	♦	*e*	*f*	*f*				
2	*a*	*b*	*b, c*	*d*	♦, *e*	*f*	*f*				
3		*a*	*b*	*b, c*	*d*	♦, *e*	*f*				
4			*a*	*b*	*b, c*	*d*	♦, *e*	*f*			
5A				*a*	*b*	*c*	*c*	♦, *d*	♦, *e*, *f*		
5B						*a*	*b, c*	♦, *d*	♦, *e*, *f*		
6						*a*	*b, c*	♦, *b, c*	♦, *d*	*e, f*	*g*, ♦

a - Modeling and evaluation of the existing flow monitoring data to assess the extent of extraneous flows in an area;
b - Lot survey identifying all downspouts connected to the underground system;
c - Sanitary and storm sewer smoke testing/analysis and reports of all downspouts connected to the sanitary sewer system;
d - Resident notification for disconnection of all downspouts connected to the sanitary sewer system along with providing Financial Assistant Plan (FAP) information;
e - Progressive By-law Enforcement for non-compliance with required corrections;
f - Flow Monitoring of area after identified corrective action completed.
g - Program completion
♦ - Council Updates.

2. The Test Results and Downspouts Disconnection Summary

Source of inflow and infiltration into sanitary sewer system are identified through site investigation. The sources can be grouped into three categories:

1. Private properties with downspout connection directly to City sanitary sewers.

2. Other Sources of Inflow and Infiltration (I/I) which can be on the public or private side: uncapped lateral cleanouts; damaged sanitary manholes; street/private catch basins, or driveway/stairwell/side /rear drains connected to sanitary sewer; sump pump connection; weeping tile connection; etc.

3. Lateral interactions between the storm and sanitary system 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 indicates that there may be cracks at the lateral pipe or some cross-connection.

The DDP covered a total of 22,765 properties which represents 22.2% of the total properties in the entire City, with a total of 212 downspouts identified to be connected to the sanitary sewer system. **Table 2** below summarized the testing results and downspouts disconnection summary.

Non-compliance properties in the Phase 6 area whose downspout(s) are not disconnected to the sanitary sewer system as of this report date has been passed onto By-law for enforcement.

Table 2: Test Results and Downspouts Disconnection Summary

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5A	Phase 5B	Phase 6	Total
Total no. of Properties	**2,256**	**2,827**	**3,690**	**2,305**	**1,992**	**2,934**	**6,761**	**22,765**
Total no. of properties with Connected DS	21	70	4	6	9	23	27	**160**
Completed no. of properties with Connected DS	21	70	4	6	9	23	25	**158**
Total no. of Connected Downspout Identified	33	83	7	8	46		35	**212**
Total no. of Connected Downspouts Disconnected	33	83	7	8	46		33	**210**
Lateral Interactions Identified	65	215	6	109	58	136	489	**1,078**
Lateral Inspection Completed	65	215	6	109	To be completed before 2025			**395**
Other Sources	19	7	12	11	9	18	45	**121**
Public I/I Sources	9	30	10	34	5	51	70	**209**
Public I/I Sources Rectified	9	30	10	34	To be completed before 2025			**83**

3. Downspouts Disconnection Compliance.

With the Financial Assistant Plan (FAP) from the City, the DDP achieved an exceptional compliance rate of 98.6% and enforced the City of Markham sewer By-Law#2014-71.

4. Peak Flow Reduction from Disconnected Downspouts

The modelling analysis demonstrated that the disconnection of 210 downspouts could reduce the extraneous inflow to the sanitary sewer system by 11.3 L/s during a 2 year design storm event from the three areas. See **Table 3** for modelled peak flow reduction in different areas. A map overview summarizing the modelling results contained in **Attachments B to D.**

Table 3: Modelled Flow Reduction during a 2 year 24hr design storm event*

Area	No. of Disconnected Downspouts	Estimated Disconnected Roof Area (ha)	Modelled Flow Reduction (L/s)
Thornhill	146	0.886	7.80
Unionville	26	0.138	0.26
Markham Village	38	0.237	3.24
Total	210	1.261	11.3

* A storm with 2 years return period has 50% chance of occurrence in any year.

The reduced inflow to the sanitary sewer system could also help maintaining wastewater collection system capacity and freeing up capacity to meet development/growth demands.

Reducing the excessive inflow to the sanitary sewer system could also bring environmental and financial benefits by improving environmental sustainability, reducing energy use and lowering greenhouse gas emissions.

5. Conclusion

The DDP has been successfully completed by investigating and disconnecting downspouts that connected to the sanitary sewer system within the high risk of basement flooding area in Thornhill, Unionville and Markham Village. The staff recommend to conclude the current DDP for these areas.

FINANCIAL CONSIDERATIONS

A Financial Assistant Plan (FAP), was approved by Council on March 19, 2013 under report, "Citywide Multi-phase Sanitary System DDP – Financial Assistant Plan". The intent of FAP is to decrease the financial burden on property owners that need to disconnect the downspouts 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.

The FAP offered a total of $10,573 and helped a total of 58 homeowners in the City disconnecting their downspouts from the sanitary sewer system (see **Table 4** for detailed breakdown).

Table 4: Financial Assistant Plan (FAP) Application Summary

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5A	Phase 5B	Phase 6
No. of Properties with Connected Downspout	21	70	4	6	9	23	27
No. of Properties applied for FAP	5	30	3	4	3	7	6
Financial Assistance Provided	$2,509	$3,909	$685	$162	$537	$2,297	$474

Funding and detail cost breakdown of each phase is provided in **Attachment E.**

HUMAN RESOURCES CONSIDERATIONS

n/a

ALIGNMENT WITH STRATEGIC PRIORITIES:

n/a

BUSINESS UNITS CONSULTED AND AFFECTED:
n/a

RECOMMENDED BY:

Eddy Wu, CMM III, P.Eng
Director, Environmental Services

Alice Lam, P.Eng.
Acting Commissioner, Community Services

ATTACHMENTS:
Attachment "A" – Citywide Multi-phase Sanitary System Downspout Disconnection Program Areas
Attachment "B" – Modelling Results – Thornhill Area
Attachment "C" – Modelling Results – Unionville Area
Attachment "D" – Modelling Results – Markham Village Area
Attachment "E" – Financial Breakdown for Each Phase