Executive Summary

Introduction and Background

In recent years (2000, 2002, 2005, 2006), the City of Toronto has experienced incidents of basement flooding. Several large storm events caused flooding of many homes throughout the City, erosion in ravines and watercourses, as well as damage to the City's infrastructure, such as roads, bridges, culverts and sewers. In particular, significant basement flooding occurred in separate sewer systems where the original storm sewers were designed to convey a two to five-year storm. As per the engineering practice of the day, there were no specific considerations given to the overland drainage.

The City of Toronto (City) has retained AECOM Canada Ltd. (AECOM) to complete a Basement Flooding Remediation and Water Quality Improvement Master Plan Class Environmental Assessment (MCEA) for Study Area 43 (Area 43) to determine the contributing factors for surface and basement flooding in this study area and recommend solutions to improve the City's sewer system and overland drainage routes in order to mitigate flooding problems. Where feasible, this study also identifies solutions for stormwater quality improvements.

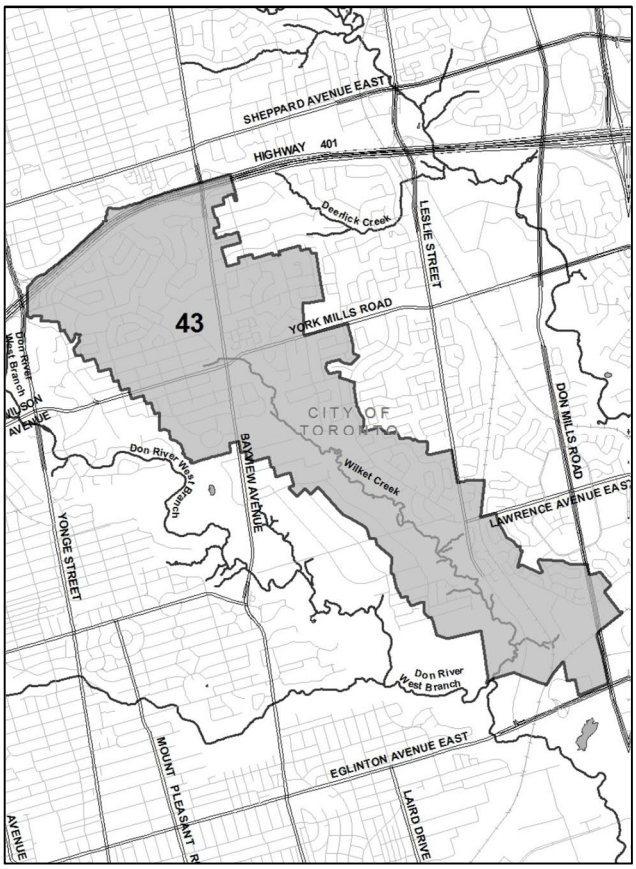

Figure ES-1: Study Area

Study Area 43

Area 43 encompasses nearly 4,500 properties within approximately 854 ha, and experienced significant flooding during the May 12, 2000 storm. Study Area 43, as illustrated in Figure ES-1, is located in the central part of the City (North York), generally along the axis of Wilket Creek, mainly in Ward 15 and a portion of Ward 16. The study area is generally bound by Highway 401 to the north, Eglington Avenue East to the south, Don River West Branch to the west, and Leslie Street/Don Mills Road to the east.

The study area is divided into four flood zones. Flood zones were defined based on flow monitoring sewersheds, as well as the proximity of sanitary outlets to the trunk. Within the flood zones, flood clusters were identified for more in-depth evaluation to substantiate the preliminary causes of flooding in Area 43.

Study Purpose, Objectives and Scope

This study follows the Municipal Engineers Association (MEA) MCEA Master Plan Approach #2 that requires for each identified Schedule B project, the level of investigation (e.g. natural environmental inventories, alternatives identification and evaluation), consultation (e.g. City departments, TRCA, landowners) and documentation (Project File) be sufficient to meet all of the Phases 1 and 2 Municipal Class EA requirements.

The principal objectives of this Master Plan MCEA study are to:

- Characterize the study area in terms of the existing municipal infrastructure and private properties.
- Identify and quantify the causes of basement flooding through dry and wet weather characterization and InfoWorks ICM modelling simulation, including water quality.
- Propose appropriate mitigation practices in view of both the basement flooding mitigation and water quality improvements through development and evaluation of design alternatives following the Class EA process.
- Advance the conceptual design for the preferred alternative to a level suitable for future design and implementation phases.

To accomplish these objectives, this study includes the following scope:

- Background reviews and desktop analyses, including researching various City's databases and records.
- Reviews and analyses of the flow and rainfall data provided by the City.
- Characterization of dry weather and wet weather flow events (including I/I assessment) in order to determine the response of the system to the extent required for modelling and design.
- Preparation and evaluation of a basement flooding questionnaire and targeted resident interviews.
- Verification of foundation drain connections.
- Field investigation program, including inspection of storm outlets and a curb-view survey to verify downspout connections, reverse slope driveways, low points on the road, location and type of maintenance hole/catchbasin covers and overland flow paths.
- Setup, calibration and validation of the InfoWorks model for storm and sanitary systems in view of the dual drainage concept and the interaction between storm, sanitary and overland flow systems, as well as groundwater.
- Completing modelling simulations using ramp-up events and historic flooding events.
- Detailed engineering assessment of the system performance, including flooding mechanism and sequence.
- Development and evaluation of remedial measures to address the flooding issues.
- Selection and documentation of the preferred alternative through the MCEA process, public consultations, agency input and discussions with various City's departments.

Documentation of the overall MCEA process and summary of key study findings are contained in the Area 43 Master Plan Project File. The detailed study findings are documented in Volume II – Technical Appendices in a series of technical memorandums. The technical memorandums prepared as part of this MCEA Study include:

- Technical Memorandum #1: Data Collection, Field Survey and Investigation Program, and Subsurface Soil and Groundwater Assessment.
- Technical Memorandum #2: Rainfall and Flow Monitoring.
- Technical Memorandum #3: Preliminary Assessment Report.
- Technical Memorandum #4: Storm Drainage and Sanitary System Hydrologic and Hydraulic Assessment.
- Technical Memorandum #5: Wet Weather Flow and Water Quality Impact Assessment.
- Technical Memorandum #6: Alternative Evaluation and Preferred Solutions.
- Technical Memorandum #7: Development of Conceptual Designs and Preferred Alternative Preliminary Design.

Communications and Consultation Overview

The City's approach to consultation in undertaking this MCEA Master Plan included communication with appropriate government agencies, Indigenous communities, the local community and the general public throughout the course of the MCEA process. All comments received during the course of the study were responded to by the

Study Team. The following consultation tools were employed during Phase 1 and 2 of the MCEA process to obtain feedback for this study:

- A mailing list of persons/groups interested and/or affected by the study was set up and contact information was collected through the City's Public Consultation Co-ordinator, Notice of Commencement and online survey responses, and the Public Drop-in Events' sign-in sheets.
- Newspaper advertising to notify the community regarding the Municipal Class EA opportunities to participate in the planning process.
- Three study newsletters were created to help inform stakeholders about Area 43, provide details about Public Drop-in Events and answer the most frequently asked questions about the study.
- An online survey was created in order to obtain additional information about the study area (i.e., history of flooding, level of source control measures implemented).
- A webpage on the City's website was created to provide useful information about the study, including invitations to consultation opportunities and the Executive Summary for the Master Plan Report.
- Key stakeholders were identified for individual meetings to advise and provide feedback.
- Two Public Drop-in Events were held within Area 43, thereby providing an opportunity for those with concerns to speak one on one with the Study Team.
- Consultation with Indigenous communities.

Phase 1: Problem and Opportunity Statement

The following Problem and Opportunity Statement has been developed for Area 43:

Problem: Historic flooding within Area 43 was reported for severe storm events, including May 12, 2000; August 19, 2005, July 8, 2013, and October 28, 2015. 134 properties, approximately 3% of all properties reported flooding following these four events, with the majority (71) attributed to the May 12, 2000 storm. Of the 134 flooded properties, 122 were residential, and 11 properties reported flooding in more than one storm events.

The potential causes of flooding within Area 43 are as follows:

- Surcharge of the sanitary sewer caused by Rainfall Derived Inflow and Infiltration (RDII).
- Surcharge of the storm sewer system, which may result in increasing the flow to the sanitary sewer system through potential interaction between the two systems.
- High groundwater table, within basement elevation.
- Accumulation of surface runoff in low-lying areas.
- Backup from outfall or accumulation of sediment in the outflow conduit.
- High overland flow depth above street right-of-way elevation.
- Ditches flowing full caused street and surface flooding.
- Undersized storm sewer or undersized catchbasins resulting in high overland flow.
- Blocked/broken storm and sanitary sewers and manholes.
- Blocked catchbasins.

Opportunity: Determine the primary and most possible causes of basement flooding within the four Flood Zones of Area 43 through a review of available information, including field investigation and site observation, and ultimately identify solutions that reduce the risk of future flooding by making

improvements to the City's sewer system and overland drainage routes within Area 43. Also, aim to improve the quality of stormwater runoff before it is discharged to watercourses.

Phase 2: Alternative Solutions

To minimize basement flooding occurrences and control wet weather flows, several alternative surface and basement flooding remedial measures were considered and screened. The measures are divided into four categories:

- Source control measures.
- Local measures.
- Remedial measures applicable to the sanitary sewer systems.
- Remedial measures applicable to the storm drainage systems.

All alternative remediation measures attempt, where possible, to avoid conflicts with exiting storm, sanitary and combined sewers, as well as avoid conflicts with existing watermains larger than 300 mm and construct only within the right-of-way (ROW).

To evaluate the alternatives for each Flood Zone, comparative criteria were established and applied for each area. The criteria were based on four categories: natural environment, social environment, technical considerations and cost considerations. The alternatives, including 'Do Nothing' in few instances, were scored numerically for each of the four categories, as follows:

- Neutral or positive impact or relatively low cost – Score 3
- Neutral impact or relatively medium cost – Score 2
- Negative impact or relatively high cost – Score 1

For each alternative, the overall scoring signified the overall comparative impacts. The evaluation results also considered whether the alternative allows the sewers to meet the performance standard for the basement flooding study (i.e. acceptable high ground water levels, etc.), and whether there are possible service connections to the sewer (i.e. the sewer in a road ROW with adjacent properties).

In general, when a conveyance improvement (e.g., upsizing a series of pipes) was identified in the alternatives, unless it was a very short replacement option (i.e. less than 150 m) and within the ROW, an in-line storage option within the right of way was also identified as an alternate solution.

Preferred Solutions – Project Descriptions

Based on the evaluation of the various alternatives for Phase 2, and following consultation with agencies, City Divisions and the public, the following are the study's key findings, accepted by the City:

- 81 Schedule A+ projects including:
  - New and larger storm and sanitary sewers
  - Sections of large diameter storm and sanitary sewers to provide storage during heavy rain storms
- 8 Schedule A projects including:

- New and larger storm and sanitary sewers
- Sections of large diameter storm and sanitary sewers to provide storage during heavy rain storms
- Catchbasin control installation: inlet control device and high capacity inlets

All of the identified projects will be constructed within an existing road allowance or utility corridor. As such, all recommended projects fall under Schedule A or A+ as per the MCEA manual and are considered pre-approved with public notice prior to occur construction for Schedule A+ projects.

Surface and Basement Flooding Remedial Measures: Source and Local Measures

In all cases, the following general remedial measures form part of the preferred solution:

- Downspout from sloped roofs that are currently directly connected to either the storm or sanitary sewer, as determined from visual evidence of downspouts directing flow below the ground, are disconnected at the ground and directed to an appropriate surface discharge point. The preferred alternative assumes that 75% of all downspouts from sloped roofs are disconnected across the entire study area (and further discussed in the following sections). The model approach to sloped roof disconnection was applied uniformly across individual catchments to achieve 75% roof disconnection rate. As such, the overall effective rate of roof disconnection resulted in greater than 75% in some clusters:
  - Flood Zone 1 – increased roof disconnection from 66% to 81%
  - Flood Zone 2 – increased roof disconnection from 59% to 79%
  - Flood Zone 3 – increased roof disconnection from 59% to 78%
  - Flood Zone 4 – increased roof disconnection from 79% to 86%
- Discharge from flat roofs should be disconnected as feasible. In many instances, this will require private plumbing and building modifications. The City should encourage this through public education and incentives. In areas where it is not feasible to discharge drainage from flat roofs to the surface, the objective should be to achieve internal separation of roof drainage from sanitary flows, outletting the roof drainage to a storm private drain connection (PDC). While disconnection of flat roofs is a long-term objective, it is not considered as part of the modeling of potential remedial solutions.
- Private side measures: backflow prevention should be encouraged to be implemented on all storm and sanitary PDC's on properties with historic flooding and complaints of flooding. Private side measures are not discussed in the following sections.
- Private side measures: sump pumps should be encouraged to be installed for foundation drains in areas subject to historic flooding or in areas where the system is vulnerable to storm or sanitary surcharge.

Surface and Basement Flooding Remedial Measures: Sanitary Sewer System

The preferred sanitary sewer system improvements for each Flood Zone are as follows:

- ***Flood Zone 1***
  - SAN 1-1a (Alternative A): 43 m of 300 mm SAN on Fifeshire Road.
  - SAN 1-2a (Alternative A): lower 397 m of 250 mm sanitary sewers (multiple branches) on Lord Seaton Road and Upper Canada Drive. The existing sewer has adequate hydraulic capacity, but it is a shallow pipe. Recommendation is to reconstruct the pipe at a lower elevation. This is the only feasible solution to correct the shallow pipe issue; the only other alternative is the do nothing alternative.
  - SAN 1-3b (Alternative B): do nothing. There are no connections to the sanitary sewer, and no history of flooding in the area.

- ***Flood Zone 2***
  - SAN 2-1a (Alternative A): 150 m of 375 mm and 139 m of 525 mm SAN on Owen Boulevard/Bayview Avenue/Easement. (Note: Project Outside the Road ROW)
  - SAN 2-2a (Alternative A): 293 m of 375 mm SAN on York Mills Road/Bayview Avenue.
  - SAN 2-3a (Alternative A): 53 m of 250 mm SAN on Heathcote Avenue and 153 m of 375 mm SAN on Rollscourt Drive.
  - SAN 2-4b (Alternative B): 17 m of 600 mm SAN and 142 m of 1800 x 900 mm inline storage on Dempsey Crescent.
  - SAN 2-5d (Alternative D): 190 m of 2400 x 1500 mm inline storage on Harrison Road, 101 m of 250 mm and 3 m of 600 mm SAN on Sandfield Road/Misty Crescent.
  - SAN 2-6b (Alternative B): do nothing. There are no connections to the sanitary sewer, and no history of flooding in the area.
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- ***Flood Zone 3***
  - SAN 3-1b (Alternative B): 66 m of 900 mm inline storage on Tudor Gate.
  - SAN 3-2b (Alternative B): 89 m of 1050 mm inline storage on Sandfield Road.
- ***Flood Zone 4***
  - SAN 4-1d (Alternative D): 316 m of 1650mm inline storage on Banbury Road, 53 m of 200 mm SAN on Alderbrook Drive, and 346 m 300-375 mm SAN on Lawrence Avenue E/ Blaine Drive/Brian Cliff Drive, disconnected shallow pipe running through private properties from Brian Cliff Drive to Blaine Drive.
  - SAN 4-2a (Alternative A): 630 m of 450 mm SAN on Don Mills Road/Barber Greene Road.
  - SAN 4-3b (Alternative A): 2 m of 525 mm SAN on Easement east of Leslie Street and 157 m of 1200mm inline storage on Barber Greene Road.
  - SAN 4-4a (Alternative A): 163 m of 450 mm SAN on Leslie Street/Easement.
  - SAN 4-5a (Alternative A): lower sanitary sewers on Leslie Street.
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Surface and Basement Flooding Remedial Measures: Storm Drainage Systems

The preferred storm drainage system improvements for each Flood Zone are as follows:

- ***Flood Zone 1***
  - STM 1-6b (Alternative B): 11 m of 600mm, 65 m of 675 mm, 323 m of 750 mm, and 140 m of 900mm STM sewer on Montressor Drive, and high capacity inlet at sag location.
  - STM 1-7b (Alternative B): Inline storage – 236 m of 1350 mm on Fifeshire Road and 222 m of 3000 x 1500 mm on Carluke Crescent.
  - STM 1-8b (Alternative B): Do Nothing. STM1-8b is hydraulically related to STM1-7b.
  - STM 1-9b (Alternative B): New 90 m of 450 mm STM diversion sewers on Toba Drive. 85 m of 450 mm, 47 m of 750 mm, 75 m of 900 mm, and 71 m of 1050 mm STM on Fifeshire Road.
  - STM 1-10a (Alternative A): 57 m of 600 mm, 70 m of 600 mm and 9 m of 750 mm STM sewers, and ICD on 7 existing catchbasins (CBs) on Fifeshire Road.
  - STM 1-11a (Alternative A): 62 m of 900 mm STM sewers on Chieftain Crescent and ICD on 13 existing CBs on Zaharias Court.
  - STM 1-12a (Alternative A): 52 m of 450 mm, and 213 m of 1200 mm STM sewer on Fenn Avenue and Knollwood Street and ICD on 15 existing CBs.
  - STM 1-13a (Alternative A): 103 m of 450 mm, 97 m of 600 mm, 140 m of 1500 mm, 113 m of 2100 mm STM sewers on Foursome Crescent, Danville Drive and Seneca Street. Additional inlet capacity at sag location, and ICD on 13 existing CBs on Foursome Crescent.

- STM 1-14a (Alternative A): ICD on 16 existing CBs on Foursome Crescent.
- STM 1-15a (Alternative A): 93 m of 525 mm STM sewers on Chieftain Crescent and ICD on 8 existing CBs on Lower Link Road.
- STM 1-16a (Alternative A): 93 m of 1050 mm, 242 m of 1350 mm, and 103 m of 1500 mm STM sewers on Masters Road.
- STM 1-17a (Alternative A): 38 m of 600 mm, 38 m of 900 mm and 228 m of 1050 mm STM sewers and high capacity inlet at sag location on Cotswold Crescent.
- STM 1-18a (Alternative A): high capacity inlet at sag location on York Minister Road. A new manhole near York Minister Road and Masters Road. 25 m of 600 mm STM sewer connecting existing 300 mm STM sewer to existing 1050 mm STM sewer.
- STM 1-19a (Alternative A): 13 m of 300 mm, 240 m of 1050 mm, and 242 m of 1200 mm STM sewer on Lord Seaton Road, and new 507 m of 1200 mm STM sewers.
- STM 1-20a (Alternative A): 24 m of 600 mm, 133 m of 750 mm, and 113 m of 1200 mm STM sewers on Fairmeadow Avenue and Lord Seaton Road, and high capacity inlet at sag location.
- STM 1-21c (Alternative C): Inline storage – 107 m of 1500 mm and 133 m of 2100 mm inline storage on Upper Canada Drive. Work includes a new manhole 8 m from MH4613812816 to avoid sanitary and storm sewer conflicts,
- STM 1-24a (Alternative A): ICD on 5 existing CBs on Caldy Court.
- STM 1-25a (Alternative A): 83 m of 450 mm and 46 m of 900 mm STM sewer on the Links Road.
- STM 1-26a (Alternative A): 116 m of 750 mm STM sewer on Balding Court.

- ***Flood Zone 2***

  - STM 2-8b (Alternative B): Inline Storage – 23 m of 600 mm, 88 m of 900 mm, and 51 m of 1050 mm inline storage on Mead Court.
  - STM 2-9b (Alternative B): Do nothing within the easement near Heathoote Avenue and Berkindale Drive.
  - STM 2-10a (Alternative A): 97 m of 375 mm, 95 m of 600 mm, 5 m of 750 mm, 186 m of 900 mm, and 123 m of 1200 mm STM sewers on Bayview Avenue, and ICD on 35 existing CBs.
  - STM 2-11a (Alternative A): 254 m of 1050 mm, 77 m of 1200 mm, 56 m of 1800 mm and 100 m of 2100 mm STM sewers on Rollscourt Drive and Harrison Road, and additional inlet capacity at sag location on Rollscourt Drive.
  - STM 2-12a: 118 m of 450 mm STM sewers on Honeywell Place.
  - STM 2-13a: 89 m of 1800 x 900 mm STM sewers on Sulgrave Crescent.
  - STM 2-15b (Alternative B): Inline Storage –106 m of 1350 mm and 94 m of 1800 x 900 mm inline storage on Daleberry Place and ICD on 8 existing CBs on Oxbow Road.
  - STM 2-16b (Alternative B): Inline Storage – 52 m of 1200 mm, and 454 m of 2400 x 1500 mm inline storage on Gordon Road and Fenn Avenue.
  - STM 2-17a (Alternative A): 114 m of 1200 mm STM sewers on Owen Boulevard.
  - STM 2-18b (Alternative B): Do Nothing.
  - STM 2-19a (Alternative A): ICD on 8 existing.
  - CBs on York Mills Road. High minor loss was identified in the initial hydraulic analysis. Headloss coefficients were assigned by InfoWorks Inference tool in model development. These coefficients were manually adjusted at this location to appropriate values which reduced the minor loss and made remediation unnecessary.
  - STM 2-20a (Alternative A): 137 m of 525 mm, and 92m of 1200 mm STM sewers on Beechwood Avenue and Glenridge Avenue, and ICD on 21 existing CBs.
  - STM 2-21a (Alternative A): 31 m of 750 mm STM sewers on York Mills Road.
  - STM 2-22a (Alternative A): ICD on 13 existing CBs on York Road.
  - STM 2-23a (Alternative A): 67 m of 450 mm STM sewers on Munro Boulevard.
  - STM 2-24a (Alternative A): ICD on 19 existing CBs on Munro Boulevard.
  - STM 2-25a (Alternative A): ICD on 31 existing CBs on Owen Boulevard.

- STM 2-27a (Alternative A): 244 m of 3000 x 1500 mm STM sewers on Seneca Street.
- STM 2-28a (Alternative A): 86 m of 600 mm and 177 m of 1200 mm STM sewers on Versailles Court and Sandfield Road.
- STM 2-29a (Alternative A): 41 m of 1050 mm and 108m of 1500 mm STM sewers on Wilket Road.
- STM 2-30a (Alternative A): 24 m of 900 mm and 32 m of 1200 mm STM sewers on York Mills Road.
- STM 2-31a (Alternative A): 77 m of 600 mm STM sewers on York Mills Road.

- ***Flood Zone 3****:*
  - STM 3-4a (Alternative A): 92 m of 600 mm and 271 m of 675 mm STM sewers on Bayview Ridge and Bayview Ridge Crescent, high capacity inlet at sag location, and ICD on 21 existing CBs.
  - STM 3-5a (Alternative A): 92 m of 450 mm STM sewers on Bayview Avenue and ICD on 16 existing CBs.
  - STM 3-6a (Alternative A): 47 m of 900 mm, 73 m of 1050 mm, 88 m of 1200 mm and 192 m of 2100 mm STM sewer on Tudor Gate and Bayview Avenue, and high capacity inlet at sag location on Bayview Avenue.
  - STM 3-8a (Alternative A): 57 m of 1050 mm and 92 m of 1500 mm STM sewers and high capacity inlet at sag location on Alderbrook Drive. STM 3-8a is selected as preferred alternative because it is hydraulically related to STM 4-8a.
  - STM 3-9a (Alternative A): ICD on 21 existing CBs on Banbury Road and Sonata Crescent.
  - STM 3-10c (Alternative C): do nothing. There are no connections to the storm sewer, and no history of flooding in the area.
  - STM 3-11a (Alternative A): 113 m of 1050 mm and 217 m of 1800 mm STM sewers on Sagewood Drive and Cosmic Drive.
  - STM 3-12a (Alternative A): 80 m of 1350 mm STM sewers on Alderbrook Drive.
  - STM 3-13a (Alternative A): 20 m of 750 mm STM sewers and high capacity inlet at sag location on Bridle Heath Gate.
  - STM 3-14a (Alternative A): 50 m of 600 mm, and 155 m of 3000 x 1800 mm STM sewer on Alderbrook Drive.

- ***Flood Zone 4****:*
  - STM 4-7a (Alternative A): 174 m of 525 mm STM sewer on Denewood Crescent and Banbury Road and ICD on 3 existing CBs.
  - STM 4-8a (Alternative A): 83 m of 525mm, 97 m of 600 mm, 90 m of 750 mm and 72 m of 1050 mm STM sewer on Banbury Road.
  - STM 4-9a (Alternative A): 75 m of 450 mm, 84 m of 525 mm, 82 m of 600 mm, 219 m of 750 mm, and 180 m of 900 mm STM sewer on Cheiford Road, Tintarget Road, Wetherfield Place, and Greengate Road.
  - STM 4-10b (Alternative B): Inline Storage – 227 m of 1350 mm and 99 m of 1500 mm inline storage on Banbury Road.
  - STM 4-11a(Alternative A): ICD on 7 existing CBs on Leacroft Crescent.
  - STM 4-12a (Alternative A): 43 m of 450 mm, 65 m of 525 mm, 169 m of 900 mm, and 101 m of 1200 mm STM sewer on Larkfield Drive. ICD on 5 existing CBs.
  - STM 4-13a (Alternative A): 66 m of 750 mm STM sewers on Kirkdale Crescent.
  - STM 4-14a (Alternative A): 44 m of 1500 mm, 147 m of 1800 mm and 39 m of 2100 mm STM sewers on Malabar Place and Leslie Street, and additional inlet capacity at sag location on Malabar Place.
  - STM 4-15a (Alternative A): ICD on 10 existing CBs on Brian Cliff Drive.
  - STM 4-16b (Alternative B): Inline Storage – 181 m of 1500 mm inline storage on The Bridle Path.
  - STM 4-17a (Alternative A): 123 m of 450 mm STM sewers on The Bridle Path.
  - STM 4-18a (Alternative A): 266 m of 675 mm STM sewers on The Bridle Path.
  - STM 4-19a (Alternative A): 150 m of 450 mm STM sewer and ICD on 10 existing CBs on Saintfield Avenue.

- STM 4-20a (Alternative A): 16 m of 375 mm, 55 m of 525 mm, 85 m of 600 mm, and 90 m of 900 mm and 84 m of 1800 x 900 mm STM sewers on Saloica Road.
- STM 4-21b (Alternative B): 49 m of 450 mm, 101 m of 900 mm, 75 m of 1050mm, 110 m of 1200 mm, and 465 m of 3000 x 1500 mm STM sewers on Barber Greene Road and easement at Barber Greene Road and Southhill Drive. ICD on 29 existing CBs on Paperbirch Drive. An orifice at the outfall to control post-development flow and velocity. (Note: Project Outside the Road ROW but in existing easement)
- STM 4-22a (Alternative A): 80 m of 375 mm on Broadpath Road and additional inlet capacity at the sag location on Barber Greene Road, ICDs on 9 CBs on Broadpath Road.
- STM 4-23a (Alternative A): 54m of 600 mm and 66 m of 750 mm STM sewers on Overland Drive.
- STM 4-24a (Alternative A): 428 m of 450 mm STM sewers.
- STM 4-25b (Alternative B): Inline Storage – 51 m of 1200 mm, 154 m of 1500 mm inline storage on Tottenham Road.
- STM 4-26a (Alternative A): 92 m of 450 mm STM sewers on Southhill Drive and ICD on 34 existing CBs on Foxden Road, Cottonwood Drive and Southhill Drive.
- STM 4-27a (Alternative A): 187 m of 450 mm STM sewers on Cottonwood Drive.
- STM 4-28a (Alternative A): 248 m of 750 mm, 107 m of 900 mm, 132 m of 1050 mm and 91 m of 1200 mm STM sewers, and additional inlet capacity at sag location on Prince Andrew Place.
- STM 4-29a (Alternative A): 97 m of 900 mm STM sewers on Prince Andrew Place.
- STM 4-30a (Alternative A): 47 m of 300 m, 140 m of 450 mm, 110 m of 750 mm, 389 m of 1050 mm and 235 m of 1200 mm STM sewers on Wren Court, Barber Greene Road, and Don Mills Road. (Note: Project Outside the Road ROW but in existing easement)
- STM 4-31a (Alternative A): 60 m of 600 mm and 59 m of 1050 mm STM sewers on Tottenham Road and Leslie Street.
- STM 4-32a (Alternative A): Lower 91 m of 250 mm STM sewers and ICD on 9 existing CBs on Ternhill Crescent.
- STM 4-33a (Alternative A): Lower 112 m of 450 mm STM sewers on Leslie Street and ICD on 35 existing CBs.
- STM 4-35a (Alternative A): 110 m of 750 mm and 50 m of 900 mm STM sewers on Brookwood Court.

Water Quality Control Measures

The Toronto and Region Conservation Authority (TRCA)/ Credit Valley Conservation (CVC) Low Impact Development (LID) Design Manual provides further design guidelines and costing for these types of water quality control measures. It is noted that these measures were not modelled but implementation of such measures are anticipated to reduce runoff volume and improve water quality. A potential design cross-section is illustrated below (modified from the LID Design Manual) in **Figure ES-2**.

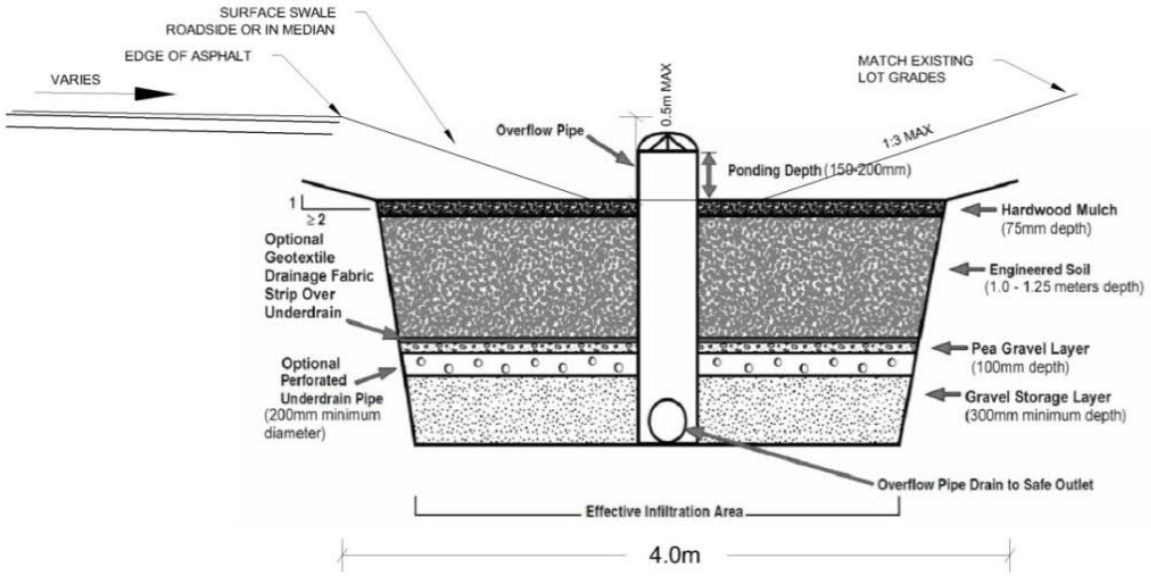

Figure ES-2: Typical Cross-section of Combined Swale and Infiltration Gallery

Potential Impacts and Recommended Mitigation Measures

The recommended preferred solutions will generally be limited to the duration and location of construction. Based on the preferred solutions – project descriptions, construction is expected to have varying environmental effects depending on the type and location of projects (e.g., additional inlet capacity, sanitary sewer replacement/upsizing) being implemented. By incorporating proper best management practices and construction techniques, adverse construction related impacts can be minimized. These measures will be further confirmed and refined during the preliminary and detailed design phases for the projects implemented under the Basement Flooding Protection Program (BFPP).

Conclusions and Recommendations

This MCEA covers the processes required to ensure that the proposed study and associated proposed work meets the requirements of the *Ontario Environmental Assessment Act (R.S.O. 1990, c. E.18).* The MCEA planning process requires initial screening for a project of this type, and this initial screening has not identified any significant concerns that cannot be addressed by incorporating established mitigation measures during construction.

The recommended preferred Basement Flooding Protection Program (BFPP) projects resolves the problems identified in this report. With the exception of temporary impacts to property owners for alternatives outside the ROW (SAN 2-1, STM 4-21, STM 4-30), and the potential need for more detailed SUE investigations in future design phases to confirm constructability and cost considerations for additional sewer reconstruction (STM 4-18a, STM 2-11a, STM 2-29a, STM 3-4a, STM 4-9a, STM 4-18a), minor and predictable impacts are anticipated, which are addressed by recommended mitigation measures.

The following conclusions can be drawn from the completion of this study:

- The flow monitoring program resulted in adequate accuracy of model calibration.
- The majority of the flooding has been caused by inadequacies of the storm drainage system, with less flooding arising from the sanitary sewer system.

- Storm sewer surcharge and major system conveyance problems contribute to flood risk in the area. Connected roof leaders continue to represent a potential large source of direct storm discharge into the sewers, contributing to surcharge problems. Once the system starts to surcharge, there are also several parts of the system with shallow storm sewers with little or no tolerance for surcharge.
- Reported basement flooding in scattered homes are believed to be caused by local conditions at the lot level or one-time maintenance issues. Flooding may be a result of poor lot grading, cracked basement walls, entry of stormwater through windows/doors, blocked or broken house drains, cross-connection between the sanitary and storm drains, etc. Homeowners should be encouraged to disconnect downspouts and foundation drains where feasible and employ applicable measures supported by the Basement Flooding Protection Subsidy Program.
- The preferred remedial measures consist of a combination of source control measures and a series of conveyance elements in the storm and sanitary collection systems.
- With the implementation of the preferred sanitary remedial measures, the sanitary sewer system can safely convey the May 12, 2000 design storm event within City criteria with no net increase to peak flows to the Wilket Creek Sanitary Trunk Sewer.
- With the implementation of the preferred storm remedial measures, the storm drainage system can convey both the major and minor systems during the 100-year design storm within City criteria except in cases of shallow storm sewers. For shallow storm sewers, the HGL will be within 1.8 m of ground elevation but the sewers have been upgraded, where necessary, to convey the 100-year flow without surcharging.
- The total base construction costs (TCC) for the recommended improvement works to help address the flooding problems in Study Area 43 is estimated to cost $147.3 million (2019 Canadian dollars), consisting of $18.2 million for sanitary network improvements, $129.1 million for storm network improvements, and $0.85 million for water quality improvements, excluding engineering, contingencies, management reserves, and taxes. Projects identified as high priority with the most benefit to existing received basement flooding reports is $61.3 million.
- The Master Plan MCEA process has been fulfilled through public consultation including two Public Consultation Events, agency consultation, and the submission of this Master Plan Project File. All recommended projects are considered Schedule "A or A+" under the MCEA process.

Considering the above, it is recommended that:

- The City proceeds with short-term local measures including sealing of perforated sanitary maintenance hole covers as identified through field investigation, implementation of inlet control devices, continued promotion of the residential roof downspout disconnection program, and continuation of the City's infiltration and inflow reduction and operations and maintenance programs.
- The City continues promoting the Basement Flooding Protection Subsidy Program. Implementation of the measures included in this program will provide protection to most residences and will enhance the performance and level of protection provided by the remedial measures in the preferred alternative.
- The City proceeds to preliminary and detailed design of the preferred remediation measures and commence implementation, as capital budget permits. Considering the City's prioritizing process based on cost per benefitting properties.
- Mitigation measures including erosion and sedimentation controls, traffic management plans, etc. should be expanded upon during the preliminary and detailed design phase and implemented as part of construction.