TORONTO

REPORT FOR ACTION

2017 Wet Weather Flow Master Plan Implementation Status Update

Date: April 24, 2017
To: Public Works and Infrastructure Committee
From: General Manager, Toronto Water
Wards: All

SUMMARY

This report advises on the implementation status of the City's 2003 Wet Weather Flow Master Plan (WWFMP) to the end of 2016 and highlights implementation priorities over next five to ten years within the WWFMP's 25 year implementation plan.

Significant progress has been made in advancing the implementation of the WWFMP through City projects, programs, and other initiatives to improve water quality in Toronto's watercourses, beaches and Lake Ontario waterfront, reduce basement flooding, protect City and private infrastructure from erosion impacts, increase public awareness of stormwater issues, and to support other WWFMP objectives. Progress has included the city-wide implementation of Mandatory Downspout Disconnection, the completion of Basement Flooding Environmental Assessment (EA) studies and construction of infrastructure improvements through the Basement Flooding Protection Program (BFPP), the construction and upgrade of stormwater management facilities, and the advancement of the WWFMP's most significant water quality improvement projects such as the Don River and Central Waterfront Project. Watercourse erosion and shoreline management studies and restoration works have also been completed to protect City and private infrastructure.

Over the next five to ten years, the aforementioned projects and initiatives will continue to be priorities to further advance the implementation of the WWFMP. New initiatives will include the release of Green Streets Technical Guidelines, an update to the 2006 Wet Weather Flow Management Guidelines to improve guidance on managing stormwater for new and redevelopment, and a Stormwater Ponds Assessment and Rehabilitation Program, among other initiatives.

RECOMMENDATIONS

The General Manager, Toronto Water recommends that:

1. Public Works and Infrastructure Committee receive this report for information.

FINANCIAL IMPACT

This report has no financial impacts.

DECISION HISTORY

City Council on September 22 – 25, 2003 adopted the "Wet Weather Flow Management Master Plan and Wet Weather Flow Management Policy". The Council decision can be viewed at:
http://www.toronto.ca/legdocs/2003/agendas/council/cc030922/pof9rpt/cl042.pdf

City Council on September 21 and 22, 2011 adopted the recommendations in a staff report titled "Wet Weather Flow Master Plan and Basement Flooding Protection Program Update" that identified WWFMP implementation and funding priorities for the next five to ten years. The Council decision can be viewed at:
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2011.PW7.6

City Council on October 8 to 12, 2013 adopted the recommendation in a staff report titled "Impact of the July 8, 2013 Storm on the City's Sewer and Storm Sewer Systems" that Toronto Water, Transportation Services, Engineering and Construction Services, and City Planning work together to develop green infrastructure standards for the public right-of-way for implementation in Transportation Services and Toronto Water capital projects. The Council decision can be viewed at:
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2013.PW25.7

Public Works and Infrastructure Committee on June 4, 2014 adopted the recommendations in a staff report titled "Contract Award - Request for Proposals No. 9117-13-7210 Professional Engineering Services for the Design and Construction Administration of the Wet Weather Flow System to Control CSO Discharges to the Don River and Central Waterfront". The Committee decision can be viewed at:
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2014.PW29.5

City Council on June 10 -13, 2014 adopted recommendations in a staff report titled "Coordinated Watercourse Management Plan" that confirmed principles and a framework for watercourse management in Toronto, coordinated with the Toronto and Region Conservation Authority (TRCA). The Council decision can be viewed at:
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2014.PW31.14

City Council on June 10 -13, 2014 adopted recommendations in a staff report titled "Ashbridges Bay Landform Project - Erosion and Sediment Control Class Environmental Assessment" to finalize the EA for the Ashbridges Bay Erosion and Sediment Control Class EA, and to proceed with the detailed design of the Ashbridges Bay Landform Project as a joint initiative with the TRCA. The Council decision can be viewed at:
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2014.PW31.15

City Council on March 10 and 11, 2015 adopted recommendations in a staff report titled "Basement Flooding Protection – Infrastructure Upgrades New Study Areas and

Progress Update" to initiate and expedite the completion of new Basement Flooding Protection EA studies for the remainder of the City, specifically identified as Study Areas 42 through 67 on a prioritized basis. The Council decision can be viewed at: http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2015.EX3.1

Public Works and Infrastructure Committee on June 17, 2015 adopted recommendations in the staff report titled "Contract Award - Request for Proposals No. 9117-14-7110 Professional Engineering Services and Program Management Services for Basement Flooding Protection Program. The Committee decision can be viewed at: http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2015.PW6.3

City Council on December 9 and 10, 2015 adopted recommendations in a staff report titled "Funding Options for Paying for Toronto Water's Stormwater Management Capital Program" that Toronto Water develop and formulate a stormwater management funding model premised on the establishment of a dedicated stormwater charge and report back to Executive Committee in the spring of 2017 on a stormwater charge implementation. The Council decision can be viewed at: http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2015.EX10.26

City Council on December 13 and 14, 2016 approved the Recommended 2017 Capital Budget and the 2018 - 2026 Recommended Capital Plan for Toronto Water, which outlined planned expenditures for programs, projects and initiatives to implement the WWFMP, and providing a status update on the Basement Flooding Protection Program and the 5-Year BFPP Project List. The Council decision can be viewed at: http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2016.EX20.22

COMMENTS

Wet Weather Flow Master Plan - Background

In 1987, the International Joint Commission identified Toronto and Region as one of 43 Areas of Concern in the Great Lakes Basin due to impaired beneficial uses and degraded water quality, particularly in the Don River and Toronto's Inner Harbour. A major source of water pollution is stormwater runoff and combined sewer overflows (CSOs), which contain a mixture of stormwater and untreated sewage, and are discharged from outfalls into Toronto's waterways after heavy rains or snowmelts.

In 2003, City Council adopted the Wet Weather Flow Master Plan (WWFMP) - a long-term plan with the goal of reducing and ultimately eliminating the adverse impacts of wet weather flow on Toronto's environment and improving the ecosystem health of its watersheds. The WWFMP has 13 objectives that address four aspects of a healthy ecosystem: water quality, water quantity, natural areas and wildlife, and sewer infrastructure. The 13 objectives can be found at: http://www1.toronto.ca/city_of_toronto/toronto_water/files/pdf/wwfmmp_policy.pdf

The WWFMP was developed based on the principles of managing wet weather flows on a watershed basis and recognizing rainwater as a resource, utilizing a hierarchy of

management solutions starting with source controls followed by conveyance controls and finally end-of-pipe controls. The WWFMP recommended projects and initiatives for implementation within these different types of controls in each of the city's watersheds.

When the WWFMP was adopted by City Council in 2003, it included a 25 year implementation plan valued at $ 1 billion, which identified projects and initiatives for implementation in five year periods, with the first priority being the improvement of water quality along Toronto's waterfront and the City's beaches. This priority supports the Toronto and Region Remedial Action Plan (RAP) under the Canada-Ontario Agreement and the Great Lakes Water Quality Agreement, to improve water quality and to delist Toronto and Region as an Area of Concern. Other key components of the WWFMP's 25-year implementation plan included watercourse erosion management and restoration, basement flooding protection, improved municipal operations, greening new development, and public education.

A summary of Phase One (2003-2007) of the WWFMP's implementation is contained in a summary report titled "Wet Weather Flow Master Plan, the Plan in Action, 5 Year Summary Report" which can be found at http://www1.toronto.ca/city_of_toronto/toronto_water/files/pdf/wwfmp_5yr_implementation_report.pdf

A 2011 WWFMP Update was provided to City Council in a staff report titled "Wet Weather Flow Master Plan and Basement Flooding Protection Program Update", which is referenced in the Decision History of this report.

Wet Weather Flow Master Plan Implementation Status

The implementation of the WWFMP is a collaborative endeavour involving Toronto Water, other City divisions, agencies (e.g. TRCA), and the public. This section of the report presents the progress made in implementing the WWFMP to the end of 2016 and includes expenditures funded through Toronto Water's Capital Budget to support the WWFMP's implementation.

This section highlights recently completed and ongoing projects, programs, and other initiatives by Toronto Water, other City divisions, and TRCA to support the WWFMP's implementation, as follows:

- Water Quality Improvement - Source Controls, Conveyance Controls and End-of-Pipe Projects, as well as Municipal Operations
- Basement Flooding Protection
- Watercourse Management
- Waterfront and Shoreline Management
- Public Education and Outreach
- Evaluation and Monitoring

Toronto Water Capital Expenditures for WWFMP Implementation

Since the adoption of the WWFMP by City Council in 2003 to the end of 2016, Toronto Water capital expenditures for projects, programs, and other initiatives to support the WWFMP's implementation have totalled approximately $624 million.

Table 1 presents Toronto Water capital expenditures based on the various components of the WWFMP. The capital expenditures align with the funding priorities established by City Council in 2011 for the subsequent five to ten year period (i.e., 2012 to 2021) of the WWFMP's implementation. These priorities included the Basement Flooding Protection Program to reduce basement flooding, the Don River and Central Waterfront Project to reduce CSOs and to provide redundancy for the Coxwell Sanitary Trunk Sewer, and the Watercourse Management Program to protect City infrastructure and private infrastructure from watercourse erosion impacts.

Note: Table 1 does not include Toronto Water operating expenditures for WWFMP related initiatives that are discussed in this report, e.g. municipal operations, funding from Toronto Water to Urban Forestry for tree planting through the operating budget since 2008, etc.

Table 1 - Toronto Water WWFMP Related Capital Expenditures (2003 to 2016)

Wet Weather Flow Master Plan Component	**TW Capital Expenditures 2003-2016 ($M)**
Basement Flooding Protection • Basement Flooding Protection Program - Basement Flooding EA studies, design and construction of infrastructure improvements, and the Basement Flooding Protection Subsidy Program	$337.2
Conveyance Controls • Green Infrastructure Demonstration Projects, Road Drainage Improvements (e.g. installation of perforated sewers in Hogg's Hollow area), etc.	$16.4

Wet Weather Flow Master Plan Component	TW Capital Expenditures 2003-2016 ($M)
End-of-Pipe Controls • EA studies, design and construction of stormwater management projects to reduce CSO discharges (e.g. Don River and Central Waterfront Project, North Toronto CSO High Rate Treatment Facility, etc.) and to improve stormwater quality (e.g. Earl Bales Stormwater Pond, Emery Creek Stormwater Ponds, etc.) • Stormwater management facilities rehabilitation (e.g. stormwater ponds assessment and cleaning)	$101.8
Other WWFMP Initiatives • WWFMP related initiatives delivered by TRCA, e.g. stewardship and education, community engagement, regional watershed monitoring, etc. • Wet Weather Flow Monitoring Program	$35.0
Public Education and Outreach • Public education and outreach on stormwater management issues, programs, and projects using a multi-faceted approach to increase public awareness and understanding of stormwater impacts and public actions to reduce these impacts	$6.1
Source Controls • City-wide implementation of Mandatory Downspout Disconnection, tree planting program, etc.	$36.5
Watercourse Management • Stream Geomorphic Systems Master Plan studies, and design and construction of recommended stream restoration projects to protect City sewer and watermain infrastructure from erosion impacts • Toronto and Region Conservation Authority (TRCA) critical erosion protection works at priority sites (e.g. July 8, 2013 storm) to protect private property • TRCA riverine and valley flood management EA studies	$88.9

Wet Weather Flow Master Plan Component	TW Capital Expenditures 2003-2016 ($M)
Waterfront and Shoreline Management • Environmental Assessment and Feasibility Studies with TRCA for the Ashbridges Bay Landform and Humber Bay Landform, and Scarborough Waterfront (East) Individual EA	$2.1
Total Toronto Water Capital Expenditures	**$624.0**

Water Quality Improvement - Source Controls, Conveyance Controls and End-of-Pipe Projects

Projects, programs, and other initiatives have been implemented by Toronto Water and other City divisions to help achieve the WWFMP's water quality objectives based on the WWFMP's hierarchy of (i) Source Controls; (ii) Conveyance Controls; and (iii) End-of-Pipe Controls. In addition, ongoing and new initiatives within (iv) Municipal Operations have been implemented that also help to improve water quality in Toronto's watercourses and Lake Ontario waterfront.

(i) Source Controls

Source controls manage rain where it falls and reduce the quantity of stormwater runoff that is generated in the urban environment. The WWFMP recommended a range of source control measures to manage stormwater at the lot level and reduce stormwater runoff entering the City's sewers. This helps to improve water quality in the city's watercourses and Lake Ontario waterfront, as well as reduce other stormwater impacts on City and private infrastructure that can contribute to basement flooding.

Two key source control initiatives implemented by Toronto Water are the Mandatory Downspout Disconnection Program and the Wet Weather Flow Management Guidelines.

Mandatory Downspout Disconnection Program

The Mandatory Downspout Disconnection Program (MDDP) is one of the City's most important source control initiatives. In 2008, City Council adopted amendments to the Toronto's Municipal Code, Chapter 681, Sewers, to require the City-wide disconnection of downspouts from buildings directly or indirectly to the City's sewer system, unless an exemption has been granted by the General Manager of Toronto Water (e.g., in situations where disconnection would create a hazardous condition or is not technically feasible).

The by-law requirements came into effect across the city in three phases, as follows:

- Phase 1: Approximately 200,000 properties in the area of the city served by combined sewers - November 20, 2011
- Phase 2: Approximately 90,000 properties in study areas identified as basement flooding-prone - December 3, 2013
- Phase 3: Approximately 216,000 properties in the remaining areas of the city - December 3, 2016

In summer 2016, Toronto Water undertook a Downspout Disconnection Field Study to assess the rate of downspout disconnection for each phase of the MDDP. The 2016 field study (involving 15,087 properties) found a high rate of disconnection with an average downspout disconnection rate of 79 percent across the City. Downspout disconnection rates by MDDP phase from the 2016 field study are provided in Table 2. Downspout disconnection rates by City ward from the 2016 field study are provided in Attachment 1.

Table 2 - Downspout Disconnection Rates by MDDP Phase

Phase	**2016 Disconnection Rates**
1	82%
2	82%
3	72%
Total Weighted Average	79%

The 2016 field study also examined the maximum potential disconnection rate in each phase, which takes into consideration property conditions where it is not feasible to disconnect the building's downspout (e.g. insufficient grassed area, walkway/driveway, obstructions, etc.). The 2016 field study identified that the city-wide potential disconnection rate is 84 per cent, which indicates that a 5 per cent increase in the disconnection rate is possible.

Based on computer simulation modelling, it has been estimated that at least 70 per cent of the houses in a given sewershed must be disconnected from the storm sewer system for a significant reduction in sewer surcharging to be achieved. The MDDP has been highly successful in achieving a high rate of disconnection (79 per cent) by employing education and outreach efforts, and without enhanced enforcement.

In order to further increase the disconnection rate and achieve the maximum potential disconnection rate, Toronto Water will continue to employ the multi-year enhanced education, communication, and outreach strategy that was utilized during the implementation of the MDDP. Toronto Water will also undertake focused field studies in wards with low disconnection rates, reduced disconnection rates, or as required for other program considerations.

Wet Weather Flow Management Guidelines

In 2006, the City released the Wet Weather Flow Management Guidelines (WWFM Guidelines), which provide guidance on stormwater management requirements for new and redevelopment and a practical working aid for the design and implementation of stormwater management measures. The Guidelines identify performance objectives for site level stormwater management that address runoff from development sites, flood management, water quality and water balance (or annual runoff volume), and they have been incorporated in the Toronto Green Standard as part of the City's development approvals process. Toronto Water is updating the WWFM Guidelines to provide greater clarity and updated guidance. More information on the WWFM Guidelines Update is provided on page 28.

Other key control initiatives implemented by City divisions in collaboration with Toronto Water include the following:

- *Design Guidelines for 'Greening' Surface Parking Lots* - Released by City Planning in 2007 and updated in 2013, the Design Guidelines for 'Greening' Surface Parking Lots provide design strategies and measures for surface parking lots to help meet Official Plan policies and environmental performance targets of the Toronto Green Standard. Specific stormwater management guidance includes site grading to reduce stormwater flows, integration of trees and vegetation to absorb water, installation of permeable pavement and opportunities to harvest rainwater from rooftops and other hard surface for landscape irrigation.

- *Green Roofs (Mandatory and Voluntary)* - The Green Roof Bylaw, which came into effect in 2010 requires green roofs on new residential, commercial, and institutional buildings greater than 2,000m^2. From 2010 to 2016, 400 new green roofs mandated by the Green Roof Bylaw have been built or were in progress, covering an area of 346,000m^2. The City's Eco-Roof Incentive Program provides grants for the construction of green roofs on buildings not mandated by the Green Roofs Bylaw. As of the end of 2016, 260 projects were completed through the Eco-Roof Incentive Program of which 51 were green roofs with a total area of 20,285 m^2. In addition, eligibility for the Program was expanded to include all new construction projects by Toronto School Boards and not-for-profit corporations.

- *Tree Planting* - In 2006, Urban Forestry, with funding from Toronto Water, commenced a program for tree planting and naturalization efforts, which increases evapotranspiration. As of the end of 2016, Urban Forestry has planted over 29,600 large wire basket trees and approximately 363,000 potted trees and shrubs under the program.

(ii) Conveyance Controls

Conveyance controls reduce the quantity of stormwater runoff that enters the City's sewers through ground infiltration and evapotranspiration and also help to improve stormwater runoff quality. Conveyance control technologies such as pervious storm

sewer pipes, bio-retention units, green bio-swales, and other green infrastructure were advocated for in the WWFMP to help achieve water quality improvement objectives and also to help reduce flooding. The WWFMP also recommended sewer separation of combined sewers on an opportunistic basis, i.e., in conjunction with other road and/or sewer works in combined sewer areas.

Key conveyance control initiatives implemented by Toronto Water with other City divisions that support the WWFMP's implementation and objectives include the following:

- *Green Infrastructure Demonstration Projects (also a source control)* - City Planning, Toronto Water, and Engineering and Construction Services have implemented green infrastructure demonstration projects at various city intersections to provide insights on how to coordinate the installation of these projects and to study their stormwater management and environmental benefits. Examples of green infrastructure demonstration projects include the following:

    - *Queensway Sustainable Sidewalk* - Constructed in 2009, this pilot project involved the installation of soil cells (using Silva Cells technology) under the sidewalk to improve conditions for tree health and root growth, increase the quantity of stormwater runoff that is absorbed into the ground, and improve stormwater runoff quality. A monitoring program is in place to examine the quality, detention and water balance of the stormwater that enters the soil cells, with early evidence showing improvement in the health of the street trees.

    - *Keele Street Bioretention Infrastructure* - Completed in 2013, this project involved vegetation plantings along Keele Street to receive & treat stormwater runoff from the adjacent hard surface, while providing good growing conditions for trees and plants.

    - *Coxwell-Fairford Bioretention Parkette* - Completed in 2015, this project involved the installation of a stormwater bioretention parkette at Coxwell Avenue and Fairford Avenue with tree and vegetation plantings to intercept and treat stormwater runoff (198,000 litres annually), while providing irrigation for plantings and providing an aesthetically attractive amenity and educational opportunity for the local community.

- *Hogg's Hollow Road and Stormwater Management Improvements Project* - this ongoing multi-phase project began in 2011 and involves the reconstruction of local streets in the Hogg's Hollow neighbourhood, including the installation of new storm sewers and some perforated storm sewers, where soil conditions allowed, to provide for improved road drainage and to reduce discharges of collected stormwater to watercourses in the area.

- *Opportunistic Sewer Separation* - the WWFMP advocated for the separation of the City's combined sewers on an opportunistic basis (e.g., through State of Good Repair capital projects) to reduce wet weather flows to combined sewers and help reduce CSOs. Toronto Water has taken a holistic approach to reduce CSOs that involves the implementation of source control programs (e.g. Mandatory Downspout

Disconnection), conveyance controls (e.g. Green Infrastructure Demonstration Projects), and end-of-pipe projects (e.g. Don River and Central Waterfront Project), and well as the application of wet weather flow management policies and guidelines and the enforcement of the City's Sewers Bylaw. Toronto Water has also examined CSO reduction opportunities including sewer separation solutions through Basement Flooding EA studies, which have identified that in many areas the combined sewers have already been partially separated, and in others, sewer separation solutions require large storm sewer infrastructure to collect and convey the separated stormwater to outfalls. One of the City's largest Basement Flooding Protection Projects - the Fairbank-Silverthorn Storm Trunk Sewer Project includes partial sewer separation and is described on pages 29-30.

(iii) End-of Pipe Projects

End-of-pipe controls are the final stage in the WWFMP's hierarchy of stormwater management controls and play a significant role in achieving the water quality objectives of the WWFMP by providing storage and/or treatment for stormwater flows and combined sewer overflows before they are discharged to receiving surface waters from the City's sewer system.

The WWFMP recommended green, end-of-pipe facilities, including stormwater ponds and constructed wetlands, as well as combined sewer overflow facilities, consisting of underground storage facilities and stormwater and combined sewer overflow treatment facilities. The implementation of these end-of-pipe projects support actions under the Toronto and Region RAP to improve water quality and to delist Toronto and Region as an Area of Concern in the Great Lakes Basin.

In the first five year period of the WWFMP (2003-2007), Toronto Water prioritized the implementation of the most significant end-of-pipe projects recommended in the WWFMP to improve water quality along the Lake Ontario waterfront and the city's most degraded watercourses. In this period, Toronto Water commenced requisite EA studies for stormwater management ponds (where there was sufficient land area to construct the recommended facilities) at Earl Bales Park and Bonar Creek, and for the Don River and Central Waterfront Project to reduce stormwater and CSO discharges to the Don River, Taylor-Massey Creek, and Toronto's Inner Harbour.

By 2012, all of the commenced EA studies for WWFMP end-of-pipe projects were completed to advance these projects to the design phase. Detailed information on completed WWFMP EA studies and the implementation status of the WWFMP end-of-pipe projects is provided in Attachment 2 and a map showing the location of these projects is provided in Attachment 3.

In addition to WWFMP end-of-pipe projects in Attachment 2, Toronto Water completed sewer improvement works at Budapest Park in 2013, which involved the installation of larger sewer pipes and a new diversion chamber to reduce the risk of flooding due to CSOs at the park, which occurred in the summers of 2008 and 2010.

Don River and Central Waterfront Project

The Don River and Central Waterfront Project (DR&CW project) is the City's most significant WWFMP end-of-pipe project to improve water quality. The DR&CW project is an integrated wet weather flow management system to capture and treat stormwater discharges and combined sewer overflows from all the combined sewer outfalls to the Don River, Taylor-Massey Creek and Toronto's Inner Harbour.

The DR&CW wet weather flow management system consists of three integrated tunnels (22 km in total) connected to 12 underground vertical storage shafts, 27 connections to outfalls, seven off-line storage tanks, an Integrated Pumping Station at the Ashbridges Bay Wastewater Treatment Plant, and a new wet weather flow high-rate treatment facility to be built on a future landform south of Ashbridges Bay (see page 18 for more information on the Ashbridges Bay Landform Project). The DR&CW project will also help service future growth and provide redundancy for the Coxwell Sanitary Trunk Sewer. A schematic of the DR&CW project components is provided in Attachment 4.

This $1.5 billion project is being implemented in stages over 25 years and once it has been fully implemented, it will virtually eliminate the release of CSO discharges into the Don River, Taylor Massey Creek, and Toronto's Inner Harbour, as well as reduce polluted stormwater discharges. The ultimate impact of this project on improved water quality in these waterbodies will be significant and will also contribute to improved aquatic recreational uses and fish habitat.

Toronto Water and Engineering and Construction Services have advanced the DR&CW project through the completion of the EA study in 2012 and the completion of preliminary design in 2015 for the system of tunnels, shafts, and off-line storage tanks. As of the end of 2016, the detailed design for the first stage of the project – the Coxwell Bypass was in progress. More details on the planned implementation of the DR&CW project over the next five to ten years is provided on page 26.

Stormwater Management Facilities Rehabilitation

The rehabilitation of the City's existing stormwater management facilities is another important WWFMP initiative to ensure that the performance of these facilities in treating stormwater meets their original design.

In the past five years, Toronto Water has developed guidance documents to facilitate the rehabilitation of the City's existing stormwater management facilities. In 2011, Toronto Water developed the "Operation and Maintenance Manual Template for Stormwater Management Ponds" (2011), which summarizes best operations and maintenance practices for stormwater ponds. In 2015, Toronto Water released "Landscape Design Guidelines for Stormwater Management Ponds", which provides guidance on stormwater pond design elements to improve the consistency for the design and performance of stormwater ponds.

During this period, Toronto Water has undertaken stormwater management facility rehabilitation projects involving sediment removal from seven City-owned stormwater

management facilities to reinstate their original design performance. Through these projects, Toronto Water has gained experience and understanding of required procedures and costs for sediment handling, potential innovations available technologically, and environmental mitigation needed for amphibians, reptiles, and fish.

In 2015, Toronto Water commenced a Stormwater Management Pond Condition Assessment and Prioritization Project to prioritize and undertake sediment rehabilitation and cleaning projects for City-owned SWM wet ponds over the next five to ten years (see page 27 for more information).

(iv) Municipal Operations

The WWFMP identified the important role of routine municipal operations in removing suspended solids and associated contaminants from stormwater runoff and reducing contaminant loadings to receiving waters, which helps to achieve WWFMP water quality and other environmental objectives.

Ongoing municipal operations carried out by Transportation Services and Toronto Water in support of the WWFMP include street sweeping, catch basin cleaning, outfall monitoring, among others. City divisions have implemented improvements to ongoing municipal operations through the research of new technologies and other enhancements.

Ongoing municipal operations and initiatives by Toronto Water and other City divisions to improve municipal operations in support of WWFMP objectives include the following:

- *Catch basin cleaning* - Toronto Water cleans catch basins by removing accumulated sediment from the catch basin sumps. Catch basins on arterial roads are cleaned on an annual basis and catch basins on local roads are cleaned every two years. Toronto Water has initiated a pilot project in Scarborough District using a new digital form of data collection to assess the quantity of materials removed. The pilot project will inform a review of service standards and may modify the frequency of cleaning in the future, as well as delineate priority zones across the city. Transportation Services is also in the process of mapping low lying areas and implementing a proactive pre- and post-extreme rain event inspection and cleaning program around catch basins in low-lying street areas.

- *Outfall monitoring* - Started in 2005, the Outfall Monitoring Program involves monitoring of flows from sewer outfalls during dry weather to identify potential sanitary cross-connections and to initiate remedial actions to eliminate these flows. Toronto Water staff have sampled dry weather flow outfalls at all six of the City's subwatersheds and Lake Ontario for parameters such as E.coli bacteria and other nutrients and metals. As of year-end 2016, a total of 767 cross connections have been identified of which 710 have been corrected. This has led to the delisting of a total of 138 priority outfalls that were known to have intermittent yet frequent contaminated discharges.

- *Sewers Bylaw* - The City's Sewers Bylaw sets strict limits on waste discharges and requires certain business sectors to develop and submit a Pollution Prevention Plan to the City of Toronto. In 2014, the City added Hexavalent chromium as a subject pollutant the under the Pollution Prevention Program. In 2014-2015, the Toronto Water undertook stakeholder consultations regarding changes to the Pollution Prevention Program. A report back to City Council is planned on a risk-based approach to minimum reporting thresholds and any proposed amendments to the Sewers Bylaw related to the proposed creation of a subject pollutant threshold reporting list.

- *Street Sweeping* - Transportation Services sweeps arterial roads twice per month, collector roads once per month, and local roads once to three times a year. Transportation Services acquired a new fleet of street sweepers in 2007 and 2008 with improved operational and environmental efficiency to remove silt loading and Particulate Matter (PM 10 and PM 2.5), thereby reducing contaminants from entering the stormwater system (e.g. 6000 tonnes removed pre-2007 and 2008 increased to 17,000 tonnes removed with new sweepers and increased sweeping frequency). Transportation Services has initiated a process to replace its current fleet of street sweepers, which have reached the end of their lifecycle, with a mix of mechanical and regenerative air sweepers that will further enhance air quality and stormwater benefits, operational efficiency, and address City areas where leaf pick-up from the curb occurs.

Basement Flooding Protection

Basement flooding protection has become a greater implementation priority within the WWFMP since 2003 due to severe storm events that have resulted in significant basement and surface flooding in different parts of the City.

The City's Basement Flooding Protection Program (BFPP) is a multi-year program to reduce flooding by making improvements to the City's sewer system and overland drainage routes to provide an enhanced level of protection. The BFPP includes (i) Environmental Assessment Studies, (ii) Implementation of infrastructure improvements, and (iii) the Basement Flooding Protection Subsidy Program (BFPSP) that provides a financial subsidy for property owners to implement flooding reduction measures on their property. The BFPP is one of the City's major climate change adaptation initiatives and supports the Resilient City initiative.

(i) Basement Flooding Protection Program - EA Studies

When the BFPP was established in 2006, it included 31 priority study areas that had experienced flooding from storm events on May 12, 2000 and August 19, 2005. Basement Flooding EA studies began for these areas in 2007 to assess the capacity of the City's existing storm, sanitary, and combined sewer drainage systems, and overland flow routes during severe storms and recommend infrastructure improvements to increase capacity, where required, to reduce future flooding.

By the end of 2012, the BFPP was expanded to 34 study areas due to severe storms in 2008 and 2012 that caused flooding in neighbourhoods outside of the 31 study areas. After the severe storm in July 8, 2013, which resulted in over 4,700 flooding complaints to the City, the BFPP was expanded City-wide to include 67 study areas to be studied on a prioritized basis.

Toronto Water reported to City Council in 2015 on a preliminary schedule for undertaking Basement Flooding EA studies in the new basement flooding study areas. The preliminary schedule estimated the commencement of two to three EA studies every two to three years with the completion of EA studies for all 67 study areas expected in 2028.

As of the end of 2016, Basement Flooding EA studies for 31 study areas (including 29 of the original 31 areas) had been completed. EA studies for 10 basement flooding study areas (Areas 20, 27, 34 to 41) were ongoing with completion expected in 2017 and 2018. Two new EA studies (Areas 43 and 45) are planned to start in 2017. A map showing the status of Basement Flooding EA studies is provided in Attachment 5.

(ii) Basement Flooding Protection Program - Implementation

The BFPP implementation program is delivered by Engineering and Construction Services (ECS) and involves the design (preliminary and detailed) and construction of recommended infrastructure improvement projects from completed Basement Flooding EA studies.

The implementation of the recommended projects from completed Basement Flooding EA studies is prioritized based on a $32,000 per benefiting property threshold, which was adopted by City Council in 2011 to protect the greatest number of properties as soon as possible, within approved budgets, and in coordination with other capital projects in the area. Recommended projects that meet the $32,000 cost per benefitting property threshold at the EA stage and preliminary design stage can proceed to detailed design and construction.

In 2015, a revised delivery model was adopted for the BFPP implementation (Basement Flooding Protection Program Phase 4) to support the City-wide expansion of the BFPP and to accelerate the delivery of capital projects within the BFPP implementation program. Basement Flooding Protection Program Phase 4 is an ECS managed and externally led program management model that began in late 2016.

As of the end of 2016, an estimated $1.659 billion of infrastructure improvements have been recommended from the 31 completed Basement Flooding Protection EA studies. Approximately $551 million of infrastructure improvements under the BFPP were in the design process and approximately $247 million of infrastructure improvements have been constructed as of the end of 2016.

The scope and magnitude of infrastructure improvements constructed under the BFPP has varied widely from small increases to sewer diameters of limited length to very large system upgrades that require pumping infrastructure with automated controls. As of the

end of 2016, approximately 29 kilometres of storm sewer upgrades and 8.2 kilometers of sanitary sewer upgrades have been constructed. Large stormwater storage tanks (e.g. Old Sheppard Park storage tank) and stormwater management ponds in City parks (e.g., dry ponds in Moore Park and Muirhead Park) have been constructed, as well as large storm sewer box culverts (as wide as three metres in diameter) on residential streets.

As of the end of 2016, basement flooding infrastructure projects under construction included storm sewer and some sanitary sewer linear upgrades, as well as a CSO storage tank in Charles Caccia Park that will help provide flooding protection for the area and also reduce combined sewer overflows. Projects in the design phase included storm and sanitary sewer linear upgrades, stormwater management ponds, and the Fairbank-Silverthorn Storm Trunk Sewer Project, which is described on pages 29-30.

(iii) Basement Flooding Protection Subsidy Program

The City's Basement Flooding Protection Subsidy Program (BFPSP) offers property owners of single-family, duplex and triplex residential homes financial assistance of up to $3,400 per property to install flood protection devices, including a backwater valve, sump pump, and pipe severance and capping of the home's storm sewer or external weeping tile.

The BFPSP originated from the Voluntary Private Home Isolation from Public Sewer System Program, which started in 2001 in targeted areas of the city that had experienced basement flooding. The BFPSP was expanded city-wide in 2006 as a result of basement flooding caused in other parts of the City from multiple storm events, including the major storm of August 19, 2005. In 2013, the subsidy was increased from a maximum of $3,200 per property to $3,400 per property.

Since the program's inception in 2006 to end of 2016, the BFPSP has provided over $37 million in total subsidy payments to over 21,500 properties in total, with the average subsidy issued to property owners of $1,700. There has been a considerable increase in residential interest and uptake of the BFPSP over the past five years, with a spike in applications and total expenditures for the program in 2014 due to the July 8, 2013 storm that resulted in over 4,700 flooding complaints reported to the City.

Watercourse Management

The City's Watercourse Management Program, delivered by Toronto Water in coordination with TRCA, is an ongoing WWFMP program to reduce the erosion impacts of wet weather flows on (i) the city's watercourses to protect Toronto Water sewer and watermain infrastructure, and (ii) valley land erosion that impacts private property, and also to address (iii) riverine flooding in Toronto's flood plains. This program supports WWFMP objectives including the reduction of erosion impacts on habitat and property, reducing flooding impacts to life and property, enhancement and restoration of natural features, achieving healthy aquatic communities, and improving water quality in the city's watercourses and Lake Ontario.

(i) Protection of City Sewer and Watermain Infrastructure from Watercourse Erosion

Toronto Water with Engineering and Construction Services undertake Geomorphic Systems Master Plan EA studies that assess risks and recommend stream restoration projects to protect City sewer and watermain infrastructure from future watercourse erosion impacts, both gradual erosion over time and due to severe storms.

As of the end of 2016, Stream Geomorphic Master Plan studies have been completed for Highland Creek, Burke Brook, Newtonbrook Creek, Berry Creek, Mud Creek, Duncan Creek, Wilket Creek, and Taylor-Massey Creek. Using an engineering approach working with natural channel systems, stream restoration projects have been recommended to protect city infrastructure from future erosion impacts, improve channel hydraulics, water quality, aquatic and riparian habitat, incorporate stormwater management, and also provide an amenity to local community.

Severe storm events on August 19, 2005 and subsequent storms (e.g., July 8, 2013), resulted in the exposure and damage to City sewer and watermain infrastructure. As a result, Toronto Water has prioritized the construction of stream restoration works that focus on infrastructure protection, while also achieving aquatic habitat improvements and other benefits. Emergency restoration works at watercourse erosion sites that pose critical risks to sewer and watermain infrastructure are also prioritized. In addition, PF&R and Transportation Services undertake stream restoration projects to protect other City infrastructure.

As of the end of 2016, priority stream restoration works have been completed for Berry Creek as have significant restoration projects for priority segments of the Highland Creek watershed (e.g., Valley Segment 4/4a and 8), as well as repair works at several locations in Taylor-Massey Creek (e.g. Warden Woods), Burke Brook, Newtonbrook Creek, Duncan Creek, Mud Creek, and other small watercourse sites across the City. Stream restoration projects planned for implementation over the next five to ten years are presented on page 30.

Using an adaptive management approach, Toronto Water is monitoring the performance of implemented stream restoration projects to inform future designs and develop an understanding of the most sustainable and resilient designs for natural channel systems.

(ii) Protection of Private Property from Valley Land Erosion

The July 8, 2013 severe storm resulted in over 450 erosion sites that impacted private property in Toronto, TRCA takes the lead, working with Toronto Water, in assessing risks and prioritizing projects to protect private property, with the first priority being the protection of human life. As a result of the July 8, 2013 storm, Toronto Water increased funding in 2014 and 2015 to TRCA for site-specific erosion control projects to protect private property.

(iii) Riverine Flooding in Flood Plains

The management of riverine flooding in Toronto's flood plains is another component of the Watercourse Management Program that supports WWFMP objectives and falls under the responsibility of TRCA. Riverine flooding occurs in Toronto's valley lands and ravines when the City's creeks and rivers overtop their banks and spill onto the adjacent floodplain.

TRCA's 1959 Flood Plan, was updated in 2013 and was summarized in the 2014 staff report titled "Coordinated Watercourse Management Plan". The staff report identified the prioritization of 17 areas of high flood risk (i.e., 13 flood vulnerable areas and four Special Policy Areas) in the City of Toronto for future flood mitigation studies and remediation projects.

The Rockcliffe SPA at Black Creek is the first Special Policy Area to be studied by the TRCA with an EA study completed in 2014. The EA study recommended works to reduce riverine flooding in the floodplain. Toronto Water is reviewing the TRCA EA's recommendations in conjunction with the City's Basement Flooding Area 4 EA and will be preparing a report back to City Council for the Rockcliffe SPA that will identify the options for reducing flood risks, the limitations of available solutions, and recommend next steps for the implementation of solutions.

Waterfront and Shoreline Management

The WWFMP recommended waterfront and shoreline management works to address beneficial impaired uses along Toronto's waterfront due to water quality, poor sediment quality, loss of fish habitat, and others that contribute to Toronto's waterfront being designated as an Area of Concern in the Great Lakes Basin in 1987.

The implementation of waterfront and shoreline management initiatives under the WWFMP has focused on actions to improve swimming conditions at the City's 11 beaches, undertaking studies with TRCA to advance landform projects at (i) Ashbridges Bay for erosion and sediment control and at (ii) Humber Bay to improve water quality at the City's western swimming beaches. The City has also been working with TRCA on the (iii) Scarborough Waterfront (East) Project, an Individual EA study to address erosion and improve access along the Scarborough Waterfront.

(i) Ashbridges Bay Landform

In 2014, the City and TRCA completed an EA study (Ashbridges Bay Erosion and Sediment Control Class EA) for a landform project immediately south of the Ashbridges Bay Wastewater Treatment Plant (ABTP). The recommended landform includes area for a future Wet Weather Flow High Rate Treatment Facility as part of the Don River & Central Waterfront Project, erosion and sediment control breakwaters to prevent sediment accumulation and to reduce dredging needs at the mouth of Ashbridges Bay,

and for a proposed SWM Wetland Facility as recommended in the 2007 Coatsworth Cut CSO and Outfall Control Class EA. As of the end of 2016, the Ashbridges Bay Landform Project was in the design phase, which is being led by TRCA. The next steps for the implementation of this landform project is provided on page 31.

(ii) Humber Bay Landform

In 2014, TRCA and Toronto Water commenced a Feasibility Study to explore a range of solutions to improve water quality at the Western Beaches, including Sunnyside Beach and Marie Curtis Beach. The Feasibility Study examined a landform solution at Humber Bay (recommended in the WWFMP and called the Humber Deflector Arm) to direct flows from the Humber River away from the western beaches. The Feasibility Study was intended to inform a subsequent EA study for the Humber Bay Landform Project, if it was found that the landform would significantly improve water quality at the City's Western Beaches.

As part of the Feasibility Study, a water quality assessment was undertaken that evaluated two options to improve water quality at the Western Beaches – (i) control of CSO discharges in the Humber River system to achieve Ontario Ministry of the Environment and Climate Change (MOECC) CSO Control targets (i.e. Procedure F-5-5), and (ii) construct a landform (of different lengths) in Humber Bay that would direct the Humber River plume further out into Lake Ontario.

The water quality assessment concluded that the improvement in beach water quality with the construction of a landform at Humber Bay would be insufficient to achieve Blue Flag status at the Western Beaches under most weather scenarios. Based on the findings of the Feasibility Study, Toronto Water will not be proceeding with an EA study for the Humber Bay Landform project at this time.

Toronto Water will focus efforts on improving beach water quality at the Western Beaches through stormwater management projects to improve water quality in the Humber River watershed (e.g. Emery Creek Stormwater Ponds Project) and future projects recommended through current EA studies (e.g. Black Creek Sanitary Drainage Area Improvements Class EA study) to reduce CSOs to the Humber River to meet MOECC Procedure F-5-5 requirements. In the longer-term, there is also a need to address E.coli loadings from storm sewer outfalls within the City of Toronto and urbanized areas north of Toronto in the upstream Humber River watershed.

Other efforts include on-going research led by Environment and Climate Change Canada in support of the Toronto and Region Remedial Action Plan that will assist the City in evaluating other factors that impact beach water quality and result in beach closures at the Western Beaches, such as the role of wildlife and E.coli build-up in beach sand. Waterfront management efforts at the Western Beaches also include an ongoing condition assessment by TRCA concerning the integrity of the break walls at the Western Beaches, which are integral to maintaining swimming conditions.

(iii) Scarborough Waterfront (East) Project - Individual Environmental Assessment

The TRCA is undertaking an Individual EA study for the Scarborough Waterfront (East) Project to address shoreline erosion and improve public access, recreational opportunities, and natural habitat along the Scarborough Waterfront from Bluffer's Park to East Point Park. The EA Terms of Reference was submitted to the Ontario Ministry of the Environment and Climate Change in June 2015 and approved by the Ontario Minister of the Environment in December 2015. The next step for the project is the completion of the Individual EA, which began in 2016. TRCA plans to commence another EA for the Scarborough Waterfront (West) Project from the City's Eastern Beaches to Bluffer's Park in the future.

Public Education and Outreach

Public education and outreach on wet weather flow management issues, programs, and projects is an integral component of the WWFMP's implementation and helps to achieve the WWFMP's objectives.

The City's public education and outreach strategy for the WWFMP uses a multi-faceted approach to increase public awareness and understanding of stormwater impacts on the city's environment, infrastructure, private property, as well as public health. An important component of the strategy is encouraging public actions to understand the issues associated with stormwater and what actions they can take to help to reduce the adverse impacts of stormwater. Community engagement initiatives are also delivered through TRCA that are supportive of WWFMP objectives.

A key focus for the City's public education and outreach initiatives over the past decade has been flooding protection**.** As the City implemented new programs to help reduce flooding (e.g. Basement Flooding Protection Program, Basement Flooding Protection Subsidy Program, and Mandatory Downspout Disconnection), educational campaigns and outreach activities focused on increasing awareness and understanding of extreme storms and urban flooding, the City's programs and projects to reduce flooding, and actions by the public to reduce flooding risks.

Water quality issues are also an important focus for the City's WWFMP education and outreach efforts. These efforts are aimed at increasing public understanding of stormwater discharges and CSO impacts on water quality in the City's watercourses and Lake Ontario, conditions under which CSO and stormwater discharges can occur, City programs and projects to improve water quality, and actions people can take to protect themselves.

Some recent and ongoing outreach and education efforts by Toronto Water, other City divisions, and TRCA that support the WWFMP's implementation include:

- *Multi-media advertising campaigns* (e.g., websites, social media, radio and TTC advertisements, print ads, etc.) to raise awareness of the causes of basement flooding, what the City is doing to reduce flooding, City programs available to the

public (e.g., Basement Flooding Protection Subsidy Program) and other tips to reduce flooding on private property;

- *Stormwater webpage on the City's website* that provides information on the WWFMP, the City's stormwater management programs and projects to improve water quality and reduce basement flooding, and tips for residents to manage rainfall where it falls. The stormwater webpage is at www.toronto.ca/water

- *Brochures, pamphlets and other publications* that are distributed to the public (e.g. Live Green e-newsletter, utility bill inserts, basement flooding information packages, etc.), and are made available at city and community events (e.g. Councillor Environment Days, Public Information Centres for Toronto Water Studies, city festivals, etc.).

- *Toronto Public Health Beach Water Quality Website* that provides daily information on water quality and swimming conditions at Toronto's public beaches based on 24 hour sampling during the swimming season - see www.toronto.ca/health/beaches

- *Signage at the City's Supervised Beaches* that advises of conditions under bacteria levels may be increased, advises of a beach closure posting, and provides the Beaches Water Quality Hotline number (416-392-7161).

- *Signage at unsupervised recreational water areas along the City's Lake Ontario shoreline,* which communicate that the public should not swim or go in the water during or for at least 48 hours after a rainfall, storm or flood and that heavy rainfall can cause CSO and stormwater discharges to Lake Ontario that may make the water unsafe.

- *TRCA Community Engagement Initiative*s, e.g. in the Humber River watershed to raise awareness of green infrastructure and its benefits and for community initiatives including tree plantings, habitat enhancement and educational signage.

Evaluation and Monitoring

The evaluation and monitoring of the WWFMP's effectiveness in achieving its objectives, including water quality improvements in the City's watercourses, beaches, and Lake Ontario waterfront is a long-term effort over the 25 year implementation plan of the WWFMP and beyond.

Current initiatives for evaluating and monitoring the effectiveness of the WWFMP, and more broadly, the delisting of the Toronto and Region Area of Concern (AOC) include: (i) Progress Reports issued by the Toronto and Region Remedial Action Plan (RAP); (ii) Blue Flag Certification for City Beaches; and (iii) a Wet Weather Flow Monitoring Project.

(i) Within Reach 2015 - Toronto and Region Remedial Action Plan Progress Report

The Toronto and Region RAP provides the framework for evaluating and monitoring the WWFMP's effectiveness in achieving objectives for the City's waterfront. In 2016, the Toronto and Region Remedial Action Plan (RAP) released a report titled "WITHIN REACH 2015, Toronto and Region Remedial Action Plan Progress Report".

The 2015 RAP Progress Report highlights key actions and progress made in delisting the Toronto and Region as an Area of Concern in the Great Lakes Basin and summarizes improvements observed in the waterfront since the 2007 Toronto and Region RAP Progress Report. The 2015 RAP Progress Report can be accessed at http://www.torontorap.ca/wp-content/uploads/2016/10/2015-RAP-Progress-Report.pdf.

The 2015 RAP Progress Report identifies that the implementation of remedial and restoration actions has led to significant improvements in water and sediment quality, the amount and condition of terrestrial and aquatic habitats, and the health of aquatic biota and communities. The report highlights actions by the City of Toronto under the WWFMP and other municipalities, agencies, and non-governmental organizations that have contributed to environmental improvements to support the delisting of the Toronto and Region AOC.

Key improvements identified in the 2015 RAP Progress Report include phosphorous levels along the waterfront that are no longer an issue and meet RAP targets, substantial reductions in E. coli loadings to the waterfront resulting in declines in beach postings and Blue Flag status for eight of Toronto's beaches, excellent aesthetics of watercourses and the waterfront, cleaner bottom sediments and improved health of benthic communities, aquatic habitat improvements and increased fish diversity in along the waterfront and Toronto's Inner Harbour, and a continued decline of contaminants in fish.

The 2015 RAP Progress Report concludes that the conditions of Toronto's waters, fish, wildlife and habitats have improved in fundamental ways since 1994 due in part to actions under the RAP, and identifies that the completion of future wet weather flow infrastructure projects will further improve environmental conditions to support the delisting of the Toronto and Region AOC.

(ii) Blue Flag Certification for City Beaches

One key evaluation indicator for the WWFMP's water quality objectives is swimming conditions at the City's 11 supervised swimming beaches, which were identified as one of the beneficial impaired uses within the Toronto and Region AOC. The City has taken actions under the Toronto Beaches Plan (2009) to improve swimming conditions and undertakes 24 hour sampling during the swimming season at its 11 supervised swimming beaches.

The Blue Flag Program certifies beaches as "Blue Flag" if they meet standards for water quality, safety, environmental education and information, the provision of services, and

other environmental criteria. In 2005, the City had four Blue Flag Beaches. In 2008, the number of Blue Flag beaches increased to eight, and in 2016, eight of the city's 11 beaches were awarded Blue Flag certification.

(iii) Wet Weather Flow Monitoring Project

Toronto Water has initiated a Wet Weather Flow Monitoring Project to assess water quality changes in the City's watercourses over the long-term, as WWFMP initiatives and the most significant end-of-pipe projects recommended by the WWFMP are implemented in the next ten years and beyond.

Under this project, Toronto Water has installed 14 monitoring stations, as shown in Attachment 6, to monitor stream flows and collect water quality data to characterize wet weather flow conditions for the City's six major watercourses. Samples are collected over three consecutive years on a 10-year recurring cycle to provide meaningful and statistically robust data about water quality changes in receiving water courses. Between 2009 and 2011, baseline samples were collected at 14 monitoring stations and measured data on 39 water quality parameters. The second cycle of sampling will begin in 2018. More information on the Wet Weather Flow Monitoring Project and how it will inform the development of a longer term WWFMP evaluation and monitoring initiative is provided on page 32.

Wet Weather Flow Master Plan Implementation Priorities for the Next Five to Ten Years

Over the next five to ten years, the implementation of the WWFMP will continue to focus on the funding priorities established in the 2011 WWFMP Update to City Council. These priorities include improving water quality in Toronto's watercourses and Lake Ontario waterfront through the implementation of the Don River and Central Waterfront Project and stormwater management projects, reducing basement flooding through the Basement Flooding Protection Program, and managing watercourse erosion to protect City and private infrastructure through the Watercourse Management Program.

Toronto Water's approved 2017 Capital Budget and 2017 to 2026 Capital Plan allocates over $3 billion in expenditures for stormwater management, CSO reduction, watercourse management, and other initiatives to support the implementation of the WWFMP over the next ten years. The Toronto Water Capital Budget allocations by WWFMP component are summarized in Table 3. It is noted that future year budget allocations are premised on the future water rate increases detailed in the Toronto Water 2017 Capital Budget submission.

Table 3 - Toronto Water 10 Year Capital Plan Allocations - 2017 to 2026

Wet Weather Flow Master Plan Component	**2017-2021 ($M)**	**2022-2026 ($M)**
Basement Flooding Protection • Basement Flooding Protection Program - EA studies, design and construction, Basement Flooding Protection Subsidy Program, etc.	$587.4	$960.0
Conveyance and Source Control Projects • Green Streets Technical Guidelines, Green Infrastructure Demonstration Projects, Road Drainage Improvements, etc.	$25.4	$30.0
End of Pipe Projects • Don River and Central Waterfront Project, Stormwater Management Projects, Stormwater Ponds Rehabilitation, etc.	$410.8	$702.0
Other WWFMP Initiatives • WWFMP related initiatives delivered by TRCA, e.g. stewardship and education, community engagement, regional watershed monitoring, etc. • Wet Weather Flow Monitoring Program	$22.9	$25.5
Public Education and Outreach	$3.0	$3.0
Watercourse Management • Stream Restoration Projects and TRCA Critical Erosion Control Projects	$96.3	$124.2
Waterfront and Shoreline Management • Ashbridges Bay Landform Project	$23.1	$17.5
Total Toronto Water Capital Plan Allocations	**$1,168.9**	**$1,862.3**

WWFMP Implementation Issues

There are several issues that have impacted the implementation of WWFMP since 2003 (and since the last update to City Council in 2011) and will continue to do so over the next five to ten years. There are also emerging issues that may impact the implementation of the WWFMP going forward. Current and emerging issues include:

- *Climate Change and Extreme Storms* - extreme weather events impact several program areas in the WWFMP, specifically the watercourse management program, in which weather events might change project implementation priorities;

- *Engineering and Technical Resources* - limited consultant, contractor, and staff resources for undertaking EA studies, flow monitoring, modelling work, and detailed engineering design and construction can impact the implementation timing and costs of the Basement Flooding Protection Program;

- *Environmental Assessments* - need to undertake EA study reviews and addendums for projects not implemented within 10 years of the EA completion, which could impact the timing of design and construction for some WWFMP end-of-pipe projects;

- *Green Infrastructure Implementation* - Design and implementation issues concerning the installation of green infrastructure in a built-up urban municipality can impact the construction of green infrastructure projects;

- *Operations and Maintenance of Stormwater Management Facilities* - need for consistent O&M approach for aging SWM facilities and new green infrastructure to ensure these facilities are performing as designed to treat stormwater; and,

- *Provincial Stormwater Management Initiatives* - the Ontario Ministry of the Environment and Climate Change (MOECC) is developing a Low Impact Development and Stormwater Management Guideline Manual, which may require changes to performance targets in the City's Wet Weather Flow Management Guidelines, and may impact the design and cost of future SWM capital projects.

The 25 year WWFMP Implementation Plan was designed to be a flexible plan that is able to adapt to changing environmental conditions, infrastructure needs, and other factors that can impact its implementation and the achievement of its objectives. Over the next five to ten years, the City will be incorporating new approaches and implementing new projects and initiatives to address the aforementioned issues and to further advance the WWFMP's implementation within the 25 year plan.

WWFMP Programs, Projects and Initiatives - 2017 to 2026 Implementation

This section highlights planned projects, programs, and initiatives for the period 2017 to 2026 to support the implementation of WWFMP priorities including (i) water quality improvement (source controls, conveyance controls, and end-of-pipe projects), (ii) the Basement Flooding Protection Program to reduce basement flooding, and (iii) the

Watercourse Management Program to reduce to protect City and private infrastructure. Projects concerning (iv) waterfront and shoreline management, and (v) future WWFMP initiatives are also highlighted.

(i) Water Quality Improvement - Source, Conveyance, and End-of-Pipe Projects

Over the next five to ten years, key source control, conveyance control and end-of-pipe projects to improve water quality (as well as address water quantity) will include the Don River and Central Waterfront Project, other stormwater and CSO end-of-pipe projects, an Update to the Wet Weather Flow Management Guidelines, and the release of Green Streets Technical Guidelines and implementation of new Green Infrastructure Demonstration Projects. The Toronto Water Capital Plan (2017-2026) allocates approximately $1.17 billion over ten years for these components of the WWFMP.

Don River and Central Waterfront Project

The ongoing implementation of the Don River and Central Waterfront Project (DR&CW project) is a WWFMP priority over the next five to ten years. Information on the DR&CW project, its benefits, and implementation progress to 2016 is provided on page 12 of this report and a schematic of the DR&CW project components is provided in Attachment 4.

Within the 25 year implementation timeframe for the DR&CW project, the next five to ten years will focus on the completion of the first stage of the project (Stage 1) to install the Coxwell Bypass tunnel, which is a 10.5 km deep tunnel from the north end of the Coxwell Sanitary Trunk Sewer to a new Integrated Pumping Station that will be constructed at the Ashbridges Bay Wastewater Treatment Plant.

Construction of Stage 1 is expected to start in 2018 pending the completion of detailed design in 2017 and receiving regulatory approvals. Stage 1 will also include the construction of a 4,500 m^3 storage tank at Sheppard & Leslie to provide relief to the trunk sewer in that area. When Stage 1 is completed, it will provide redundancy for the Coxwell Sanitary Trunk Sewer to allow for the rerouting of sewage flows for maintenance and operational purposes, if required, for the Coxwell Sanitary Trunk Sewer that services over 750,000 residents.

The next stage (Stage 2) of the DR&CW project is the Taylor-Massey-Creek Tunnel, which is currently planned to complete detailed design and begin construction within a ten year time frame, and the following stage (Stage 3) - Offline storage tanks is also planned to begin detailed design within ten years. All other components of the DR&CW are currently in future stages beyond the next ten years. The DR&CW project's implementation (i.e. timing, stages, and infrastructure) is subject to change based on the completion of detailed design, receiving regulatory approvals, capital program funding, and other considerations.

A key element for the successful implementation of the DR&CW project is public education and outreach on CSO issues and how the DR&CW will help to achieve the

water quality objectives of the WWFMP. The DR&CW project will be featured in the City's ongoing WWFMP public and education outreach strategy to communicate stormwater and CSO issues. More information on the DR&CW project is available on the City's website, which will be updated as the project progresses. The project website is www.toronto.ca/drcw-project.

Stormwater and CSO End-of-Pipe Projects

With the planning (i.e. EA studies) completed for the most significant stormwater and CSO end-of-pipe projects within the WWFMP, implementation in the next five to ten years will focus on undertaking the design and construction for the end-of-pipe projects from completed EAs. Attachment 2 provides more details on the implementation status of end-of-pipe projects from completed EAs and Attachment 3 provides a map showing their location. There will also be a continued focus on rehabilitating the City's existing stormwater management facilities.

Over the next five years, design and construction is planned for the Bonar Creek Stormwater Management Facility and construction will be ongoing for the Western Beaches Retrofit Project. Within the next ten years, the implementation of larger stormwater management and CSO control end-of-pipe infrastructure projects is planned to improve water quality along the Etobicoke waterfront, the Scarborough waterfront, and the Don River. These future projects include the Don Valley Stormwater Management Wetlands Project, Etobicoke Waterfront Stormwater Management Facilities, and the Scarborough Waterfront CSO and Stormwater Outfalls Control Project.

As some of these projects are planned to begin construction beyond the ten year lapse of their approved EA studies, Toronto Water will be undertaking EA reviews and addendums (if necessary) prior to the implementation of these projects. Toronto Water will also be completing EA studies that are outside of the WWFMP but complement the objectives of the WWFMP, such as the Black Creek Sanitary Trunk Sewer System Class Environmental Assessment Study. This study began in 2015 and will recommend solutions to service future growth, reduce sewer surcharging and excessive inflow and infiltration of water into the trunk sewer system, and reduce CSO discharges to Black Creek in the Humber River watershed.

The rehabilitation of the City's aging stormwater management facilities will be a continued focus under the WWFMP over the next decade. In the next five years, Toronto Water plans to develop plans for rehabilitation and sediment cleaning of 43 City stormwater management ponds under the Stormwater Management Pond Condition Assessment and Prioritization Project. These rehabilitation projects are planned to be undertaken under a long-term multi-year cleaning program over the next ten years, which will improve the operational performance of these stormwater management facilities in treating stormwater.

Toronto Water also plans to improve trunk sewer operations through the addition of Real Time Control technology to the City's sewer interceptor system. Real Time Control provides active control (i.e., Real Time Control) of the combined sewer system using

pumps, gates, weirs, etc. to regulate and move flows from constrained sections of the system to sections that have capacity. This in turn helps to reduce combined sewer overflow discharges from the sewer system.

Wet Weather Flow Management Guidelines Update

An important source control initiative under the WWFMP is an update to the City's 2006 Wet Weather Flow Management (WWFM) Guidelines, which provide guidance on stormwater management requirements for new and redevelopment and identify performance objectives for site level stormwater management.

An Update to the WWFM Guidelines is being developed by Toronto Water for planned release in late 2017/early 2018, pending the completion of the MOECC Low Impact Development and Stormwater Management Guideline Manual, which is being developed by the MOECC in 2017. The updated WWFM Guidelines will provide greater clarity and updated guidance on how new developments in the city should manage stormwater runoff from sites and linear infrastructure.

The updated WWFM Guidelines will include revised water balance, quality and quantity control targets consistent with the MOECC Low Impact Development and Stormwater Management Guideline Manual, as well as other City programs and policies for managing wet weather flow issues (e.g., Basement Flooding Protection Program). The Guidelines will also focus on the use of innovative solutions to reduce stormwater runoff impacts from new development, capital works, and retrofits through the application of green infrastructure and water reuse technologies. Additional guidance will be provided with respect to the acceptability and use of manufactured treatment devices through the adoption of the Canadian Environmental Technology Verification program.

Green Streets Technical Guidelines and Green Infrastructure Demonstration Projects

Over the next five years, the implementation and monitoring of green infrastructure demonstration projects will be advanced to improve stormwater runoff water quality, as well as contribute to healthy trees and plantings in the street right-of-way, and to help reduce flooding. These projects will also support the City's Complete Streets Initiative.

In late 2017, Toronto Water and City Planning plans to release Green Streets Technical Guidelines that will help to facilitate the implementation of green infrastructure on City streets (i.e., Green Streets) in order to manage stormwater in a more sustainable and environmentally holistic manner. The Guidelines will provide technical guidance about green street techniques, design and construction considerations, and maintenance and monitoring considerations to successfully implement green infrastructure in the City's right-of-way and address challenges such as tree impacts, infrastructure conflicts, limited space, the need to retrofit sites based on unique site conditions, etc.

As the Green Streets Technical Guidelines are incorporated into future capital projects in the coming years, Toronto Water and City Planning along with Transportation Services and Engineering & Construction Services, will continue to work in partnership

to implement green infrastructure demonstration projects that provide for water quality improvements and utilize evapotranspiration capabilities of plants and trees to meet water balance needs.. These green infrastructure demonstration projects will support learning and the promotion "at source" stormwater management controls in future road infrastructure projects, as well as provide public education and outreach opportunities (e.g. signage, seating areas, etc.) concerning stormwater management issues, urban drainage and ecology).

(ii) Basement Flooding Protection Program

The Basement Flooding Protection Program (BFPP) is another implementation priority for the WWFMP over the next five to ten years. The Toronto Water Capital Plan 2017-2026 identifies approximately $1.5 billion for the BFPP for the completion of Basement Flooding EA studies and implementation of recommended infrastructure improvements to reduce future flooding, and for the Basement Flooding Protection Subsidy Program.

In 2017 and 2018, nine ongoing BFPP EA studies (Areas 20, 34 to 41) are expected to be completed and EA studies for two study areas (Areas 43 and 45) are planned to begin in 2017, while EA studies for Areas 42, 44 and 62 are planned to begin in 2018. In 2017, Toronto Water is also commencing a review of the basement flooding solutions recommended in Basement Flooding Area 33 in southwest Scarborough under the 2011 Scarborough Waterfront Combined CSO and Stormwater Outfalls Control Class EA and Flood Protection Study. The Technical Review is being undertaken to review the recommended flooding solutions and ensure they will meet the City's enhanced level of service criteria for the storm sewers (1 in 100 year storm) and sanitary sewers (May 12, 2000 storm) before they are implemented.

By 2026, it is expected that EA studies for all 67 study areas will have commenced with completion expected over a 15 year time frame. Toronto Water will report to City Council on any significant changes to the BFPP EA Study Schedule with the annual Toronto Water Capital Budget submission. To address issues that have impacted the completion of Basement Flooding EA studies such as consultant resources and obtaining appropriate flow monitoring information, Toronto Water has a new standalone flow monitoring assignment in place that will help to expand knowledge about sewer system flows in dry and wet weather conditions, and facilitate the completion of future Basement Flooding EA studies.

Within the BFPP Implementation Program, the externally led program management model (Basement Flooding Protection Program Phase 4) for BFPP design and construction assignments, which was adopted in 2015 and initiated in 2016, will help to ensure that the capital delivery of BFPP design and construction assignment will meet planned delivery targets by addressing the issues (e.g. consultant resources, design consistency, etc.) that can impact capital delivery.

One of the City's largest basement flooding protection projects is the Fairbank-Silverthorn Storm Trunk Sewer Project, which is in the engineering design phase. This project includes a new 2.5 kilometre long, 3 metre diameter storm trunk sewer tunnel and the addition of new collector storm sewers on streets with combined sewers to

partially separate the sewer system. This project will reduce basement flooding for over 2,500 properties in Wards 12, 15 and 17 and reduce CSOs to Black Creek through partial sewer separation of combined sewers in the area. Construction of this project is planned to start within the next five years, pending the completion of the engineering design, receiving regulatory approvals, and resolving easement requirements.

Within the next five years, a new initiative will be commenced by Toronto Water to install Inlet Control Devices (ICDs) within catch basins in the City's storm sewer drainage systems to help reduce basement flooding. The ICD initiative will include new communications materials for residents and businesses so that they understand how ICDs help reduce overloading of the sewers during storm events and that more surface water on the street helps to reduce flooding risks.

(iii) Watercourse Management Program

The third implementation priority for the WWFMP over the next five to ten years is the Watercourse Management Program to protect City infrastructure and private property from watercourse and valley erosion impacts, while also providing aquatic habitat and ecosystem health benefits.

Implementation of the program by Toronto Water with other City divisions over the next five to ten years will include the design and construction of recommended stream restoration projects from completed Geomorphic Master Plan Studies and field based inspection programs, as well as emergency erosion control works. TRCA protection works are planned at erosion hazard sites, such as those caused by the July 8, 2013 storm, to address valley wall erosion and failure in order to protect private property and the public.

In the next five years, ongoing stream restoration projects by Toronto Water with other City divisions and TRCA will include works at Duncan Creek, Wilket Creek and Mud Creek (in partnership with Parks, Forestry and Recreation), as well as erosion control works to protect at-risk sanitary sewer manholes, outfalls, sanitary sewer and watermain crossings at various locations across the City. New stream restoration projects are also planned to commence in West Highland Creek (Valley Segment 3), East Highland Creek (Valley Segments 7 and 8), and Mimico Creek with a focus on protecting at-risk City sewer and watermain infrastructure.

Toronto Water plans to commence new Stream Geomorphic Master Plan and Risk Assessment/Prioritization Studies in the next five years for the East Don River, Humber Creek, Mimico Creek, Burke Brooke and West Don, Chapman Ravine, Yellow Creek, the West Humber River, and Taylor-Massey Creek. The projects and studies identified are current priorities in the Watercourse Management Program but are subject to change as new priorities emerge due to storm related impacts on watercourses, City infrastructure, and private property.

With respect to riverine flooding in the city's valley lands, TRCA with input from City divisions will be undertaking an initiative to better understand riverine flood conditions in the city's valley lands using modelling tools and detailed physical data. This initiative

will provide valuable information to the City to help manage operational impacts on transportation (e.g. Don Valley Parkway, GO Transit, and Metrolinx corridors) due to riverine flooding. This initiative will also inform flood mitigation studies and remediation projects in Flood Vulnerable Areas in the city.

Finally, the completion of the Toronto Ravine Strategy, which is being developed by Parks, Forestry and Recreation, City Planning and Toronto Water along with other City divisions and TRCA will guide the future use, management, enhancement and protection of Toronto's ravines and include a common vision and set of principles to guide Toronto's policies, investments and stewardship for ravines. The Strategy will support the rehabilitation and restoration of subsurface Toronto Water infrastructure, provide a structured forum for coordination of capital works within ravines and valley lands, and contribute to improved asset management of infrastructure and ecological services of the natural heritage system.

(iv) Waterfront and Shoreline Management Projects

A significant shoreline management project that is planned for implementation over the next ten years of the WWFMP is the Ashbridges Bay Landform Project (described on page 18). In addition to preventing sediment accumulation and reducing dredging requirements at Ashbridges Bay, the landform is required for the long-term implementation of the Don River and Central Waterfront Project, as it will provide the land base for a future wet weather flow facility that will provide high-rate treatment of CSOs intercepted by the future integrated system of tunnels along the Lower Don River, Taylor-Massey Creek and Toronto's Inner Harbour.

The Ashbridges Bay Landform Project is in the design phase, which is led by TRCA. When the landform design is completed, a report back to City Council is planned to advise on an implementation plan for the landform project including a construction phasing schedule, costs and revenues, and other implementation details. The start of construction for the landform project is expected to begin within the next five years pending regulatory approvals and coordination with other projects at Coatsworth Cut, including a new outfall for the Ashbridges Bay Wastewater Treatment Plant.

(v) Future WWFMP Initiatives

Inflow and Infiltration Reduction Investigations

Inflow and Infiltration (I/I) can have significant impacts on the capacity of the City's sanitary and combined sewer systems and wastewater treatment plants, and can contribute to basement flooding risks. In 2017, Toronto Water will be reviewing the findings and recommendations of completed and ongoing I/I studies and investigations, including the following:

- *Basement Flooding Area 9 I/I Study* - this study was recommended in the completed EA study for this basement flooding study area to investigate sources of excessive I/I into the sanitary sewer system that may contribute to basement flooding. The I/I

study was completed in 2016 and Toronto Water staff will be reviewing the study's conclusions and recommendations to determine the impact on the sizing and costs of the EA recommended basement flooding protection projects; and,

- *Wirral Court Pumping Station I/I Reduction Study* - in 2017, Toronto Water will be completing a Phase 1 Pilot I/I Reduction Study for the area serviced by the Wirral Court Pumping Station to better understand the root causes of extraneous water entering the study area's sanitary sewers.

These I/I studies will inform future studies and investigations to better understand the impacts of rainfall-derived I/I on the capacity of the City's sanitary and combined sewer systems and wastewater treatment plants, as well as basement flooding risks, and to identify effective ways to reduce I/I in specific areas. Initiatives will also be developed to better understand the impacts (e.g. sewer system capacity and water quality) of groundwater I/I to the City's sanitary and storm sewer systems, including the need to manage sump pump connections to the storm sewer system where it is not feasible to discharge to the ground (e.g. large infill housing on small lots).

These investigations and studies will inform future policy directions concerning I/I reduction and the development of a city-wide I/I reduction strategy in the longer-term.

WWFMP Effectiveness and Monitoring Initiative

As the initial 25 year implementation plan for the WWFMP comes to a close in 2028, Toronto Water will develop an evaluation methodology in addition to ongoing monitoring over the next ten years to review the impact of the WWFMP's implementation in achieving objectives including water quality improvement in Toronto's watercourses and waterfront, basement flooding protection, healthy aquatic habitats, and other objectives, including the delisting of Toronto and Region as an Area of Concern in the Great Lakes Basin.

The evaluation methodology will focus on (i) baseline sampling and modelling of water quality in Toronto's Inner Harbour; (ii) Beneficial Use Impairments of the Toronto Remedial Action Plan; (iii) research and monitoring for stormwater management facilities, e.g. Earl Bales Park, green infrastructure, and stream restoration projects; (iv) post-construction monitoring of Basement Flooding Protection Projects; and (v) biological monitoring of benthic and fish communities in Toronto's watercourses.

During this period and beyond, Toronto Water's Wet Weather Flow Monitoring Program will be an ongoing WWFMP initiative to assess water quality trends in Toronto's watercourses as significant end-of-pipe projects and other WWFMP initiatives are implemented. Due to environmental variability in the data, it is anticipated that at least one data set per decade over the next three decades will be required to assess water quality changes in the city's watercourses that are statistically significant.

The effectiveness and monitoring initiative will inform future wet weather flow related initiatives and capital plans beyond the initial 25 year implementation plan for the WWFMP.

Funding for Wet Weather Flow Master Plan Implementation

Stormwater management initiatives under the WWFMP have become a growing component of Toronto Water's Capital Budget. Over $3 billion in expenditures for the implementation of the WWFMP is identified in the Toronto Water 2017 to 2026 Capital Plan, which is currently fully funded from the water rate.

In 2015, City Council directed Toronto Water and Corporate Finance to report back on a stormwater management funding model based on the establishment of a stormwater charge to provide dedicated funding for the City's stormwater management initiatives. In 2016 and 2017, Toronto Water and Corporate Finance have been consulting on the consideration of a stormwater charge with the public, environmental groups, the ICI sector. A report back to City Council on a proposal to implement a stormwater charge is planned for May 2017.

CONTACT

Graham Harding, Director, Water Infrastructure Management, Toronto Water,
Tel: 416-397-4631, e-mail: Graham.Harding@toronto.ca

David Kellershohn, Manager, Stormwater Management, Water Infrastructure Management, Toronto Water, Tel: 416-392-8255, e-mail: David.Kellershohn@toronto.ca

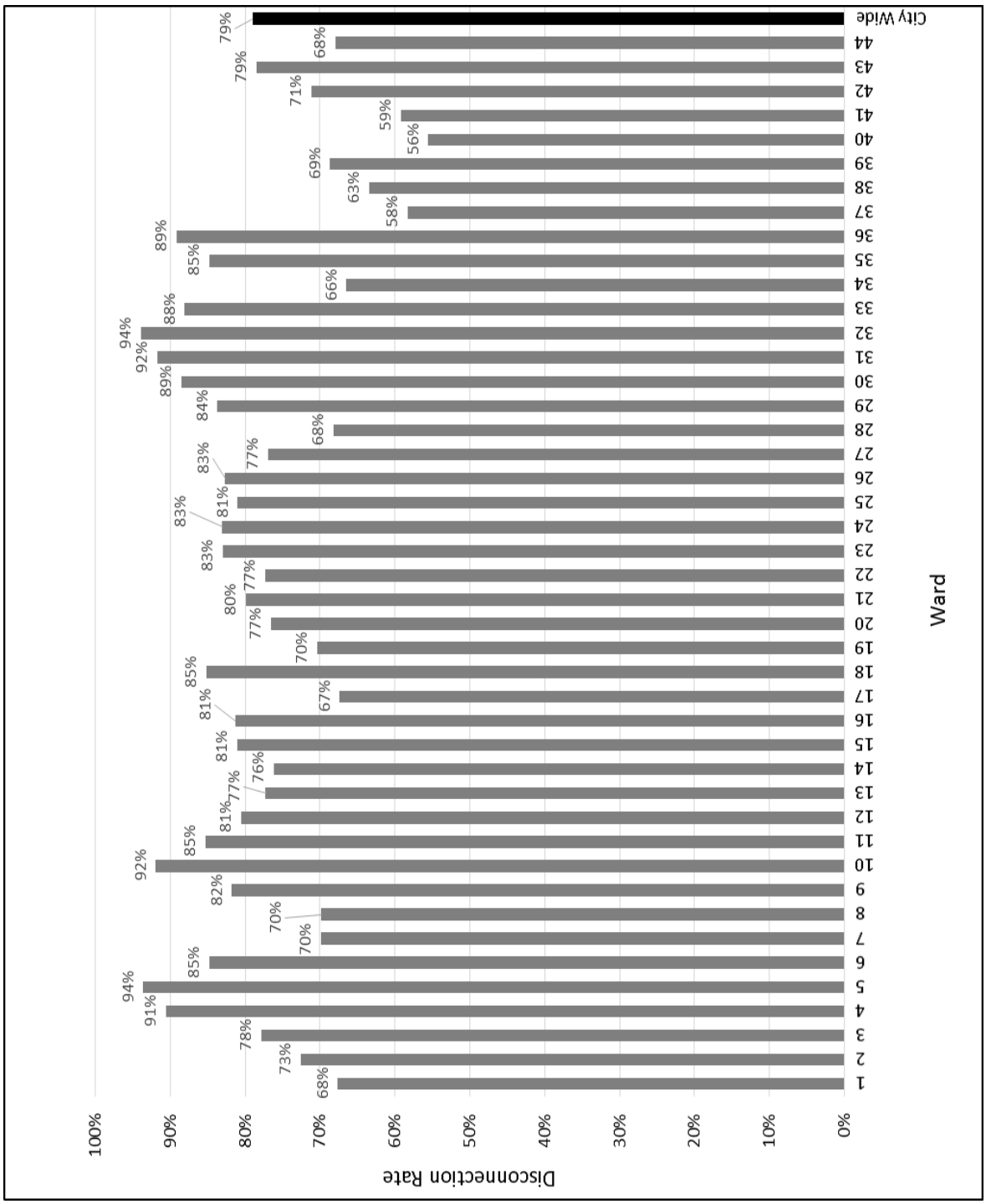
SIGNATURE

Lou Di Gironimo
General Manager, Toronto Water

ATTACHMENTS

Attachment 1 - Mandatory Downspout Disconnection - 2016 Ward Disconnection Rates
Attachment 2 - List of WWFMP End-of-Pipe Projects
Attachment 3 - Map of WWFMP End-of-Pipe Projects
Attachment 4 - Don River and Central Waterfront Project
Attachment 5 - Status of Basement Flooding Protection Program EA Studies
Attachment 6 - Water Quality Monitoring Stations

Attachment 1 - Mandatory Downspout Disconnection - 2016 Disconnection Rates by Ward



Attachment 2 - List of WWFMP End-of-Pipe Projects

End-of-Pipe Project	Project Description	Implementation Status
Completed and Current Projects		
Coatsworth Cut CSO and Storm Outfalls Control Project	The Coatsworth Cut CSO and Storm Outfalls Control Project involves conveyance control improvements including weir adjustments and adding storage in the Coatsworth Cut sewershed to reduce the volume of stormwater and combined sewer overflows discharged from outfalls to Coatsworth Cut. The project also involves a wetland facility south of the Ashbridges Bay Wastewater Treatment Plant.	The EA study was completed in 2008. The conveyance controls and the CSO storage tank at Kingston Road and Dundas Street East were completed in 2012. The implementation of the wetland at Coatsworth Cut is on hold pending completion of the design for the Ashbridges Bay Landform.
Don River and Central Waterfront Project	The Don River and Central Waterfront Project is a system of three integrated tunnels, underground storage shafts, off-line storage tanks and a new wet weather flow high-rate treatment facility to capture and treat stormwater discharges and combined sewer overflows to the Lower Don River, Taylor-Massey Creek and Toronto's Inner Harbour, and thereby achieve significant water quality improvements. The project also includes upgrades to the Don Sanitary Trunk Sewer system to help service future growth and improve operations by providing redundancy for the Coxwell Sanitary Trunk Sewer.	The EA study was completed in 2012 and preliminary design of the entire system was completed in 2015. Implementation of the entire project will take place over 25 years with the first phase of construction - the Coxwell Bypass planned to begin in 2018.

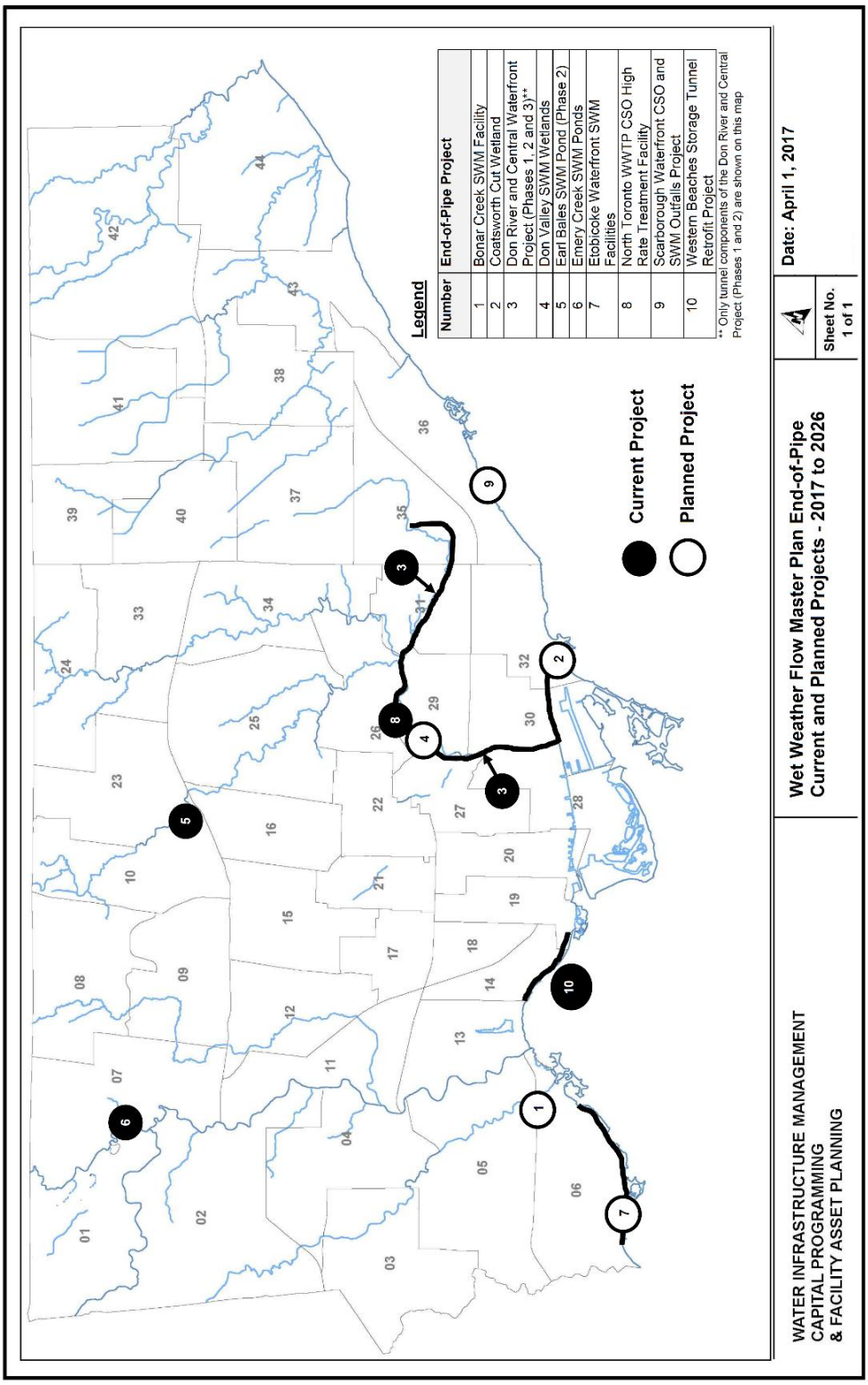
End-of-Pipe Project	Project Description	Implementation Status
Earl Bales Stormwater Management Pond	The Earl Bales Stormwater Management Pond is one of the largest facilities of its kind in Canada. The stormwater pond is located in Earl Bales Park and currently provides stormwater treatment for a 400 hectare drainage area. Key innovations of the project include using the pond water for golf course irrigation in the summer and for snowmaking at the Earl Bales ski hill in the winter. The project's benefits include improving water quality and reducing fish habitat stress in the West Don River.	The EA study was completed in 2006 and construction of the pond was completed in 2011. In 2015, the second phase of the project began, which includes the construction of two new sewer diversion pipes to capture stormwater from an additional 150 hectares. Phase 2 will be completed in 2017 with site restoration to continue to 2019.
Emery Creek Stormwater Management Ponds	The Emery Creek Stormwater Ponds project is a series of three stormwater ponds in the valley lands southwest of Finch Avenue West and Weston Road. The ponds will intercept and treat stormwater flows from the Emery Creek catchment area, which historically has had some of the worst water quality contributions to the Humber River. This project will contribute significantly to improved water quality in the Humber River, and contributes to a healthier environment and improved habitat for aquatic and terrestrial wildlife in the Humber River watershed.	The EA Addendum was completed in 2012. Construction of the project started in 2016 and is planned for completion in 2017.

End-of-Pipe Project	Project Description	Implementation Status
North Toronto Wastewater Treatment Plant CSO High Rate Treatment Facility	The North Toronto Wastewater Treatment Plant CSO High Rate Treatment Facility Project involves retrofits to CSO and stormwater storage tanks at the North Toronto Treatment Plant to provide enhanced chemical treatment of CSOs and increased treatment capacity. This project contributes to improved water quality in the Lower Don River by decreasing CSO volumes and enhancing CSO treatment.	Construction is substantially completed in 2016 with the facility to be commissioned in 2017.
Western Beaches Storage Tunnel Retrofit Project	The Western Beaches Storage Tunnel was constructed in 2002. The four kilometre long tunnel, with 3 storage tanks, that intercepts wet weather flows from eight CSO outfalls and two stormwater outfalls to improve water quality in the City's western beaches. The Western Beaches Storage Tunnel Retrofit Project involves the replacement of the pumping station and other existing equipment for the facility to improve its operation.	The detailed design work for the retrofit project is near completion and the tender for construction is planned for 2017.
Planned Projects		
Bonar Creek Stormwater Management Facility	The Bonar Creek Stormwater Management Facility is a future project that will include new stormwater management pond adjacent to Mimico Creek and sewer interceptor to collect stormwater discharges from a 365 ha drainage area that is not currently treated. The stormwater pond will treat stormwater discharges to improve water quality in Bonar Creek and Mimico Creek.	The EA study was completed in 2010. Detailed design of the project will start in 2017 with construction planned to begin in 2019, in conjunction with the extension of Legion Road.

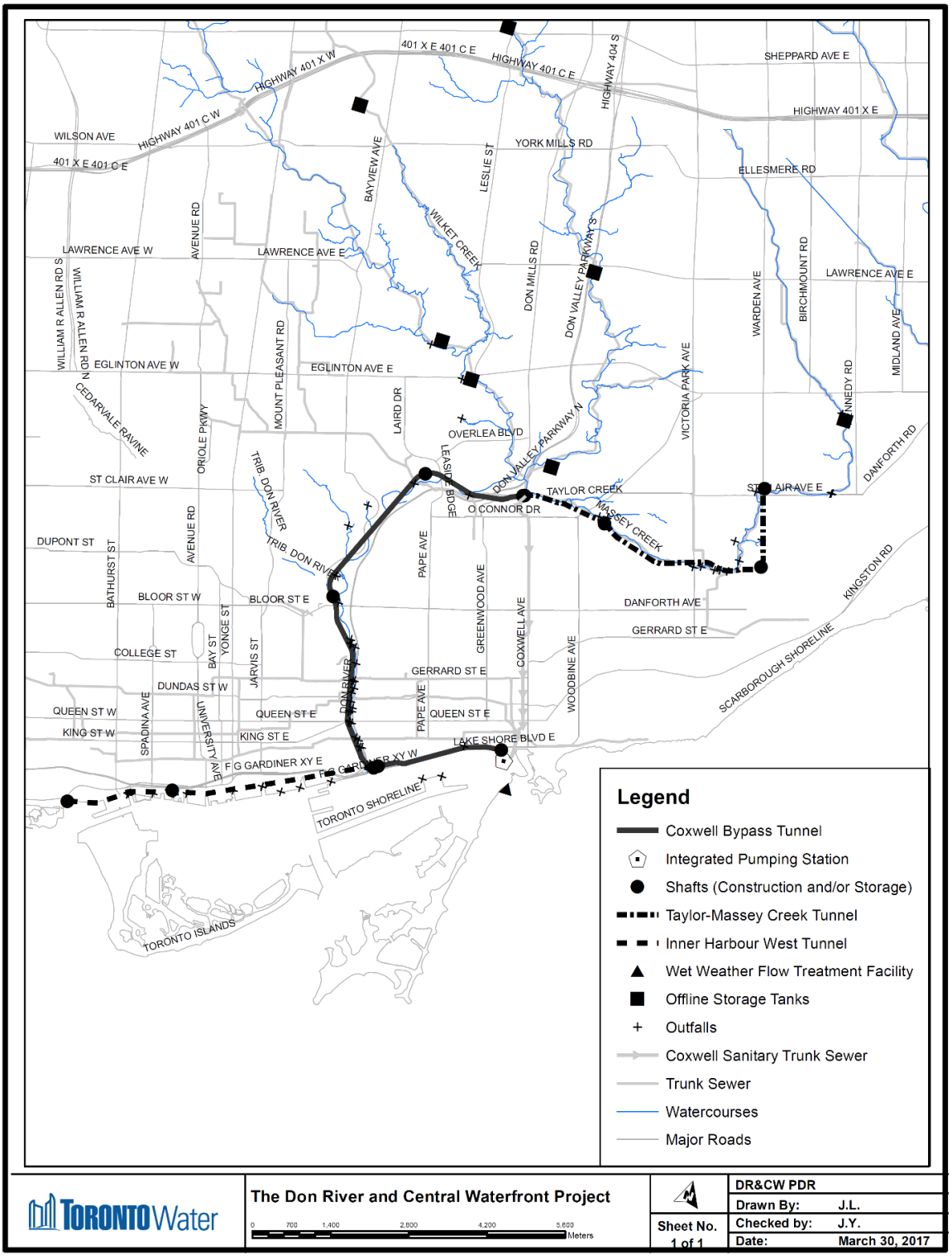
End-of-Pipe Project	Project Description	Implementation Status
Don Valley Stormwater Management Wetlands	The Don Valley Stormwater Management Wetlands Project is a project for future implementation. The EA recommended three stormwater management wetlands and other improvements (e.g. slope stabilization, tree planting, and erosion control) along the Don Valley Parkway (DVP) from the Gardiner Expressway to Taylor-Massey Creek to reduce the impact of stormwater runoff from the DVP and help improve water quality in the Don River.	The EA study was completed in 2009. Implementation of the project is planned within the 10 year Wet Weather Flow Program.
Etobicoke Waterfront Stormwater Management Facilities	The Etobicoke Waterfront Stormwater Management Facilities is a future project to improve quality of stormwater discharges to the Etobicoke waterfront. The EA study recommended the construction of a stormwater interceptor pipe that will direct flows from 27 of 30 outfalls along the Etobicoke waterfront to an underground treatment shaft to be located in Samuel Smith Park. Oil/grit separators are recommended for three outfalls.	The EA study was completed in 2013. Implementation of the project is planned within the 10 year Wet Weather Flow Program.

End-of-Pipe Project	Project Description	Implementation Status
Scarborough Waterfront CSO and Stormwater Outfalls Control Project	The Scarborough Waterfront CSO and Stormwater Outfalls Control Project is a future project to improve water quality along the western Scarborough Waterfront The EA study recommended source controls, conveyance controls and seven end-of-pipe underground storage facilities to store and treat stormwater and CSOs that are discharged from outfalls along the western Scarborough waterfront. The EA study also recommended flood protection projects to reduce basement flooding and surface flooding at five locations within the study.	The EA study was completed in 2011. The basement flooding works were added to the Basement Flooding Protection Program in 2012 for future implementation. Implementation of the water quality improvement works is planned within the 10 year Wet Weather Flow Program.

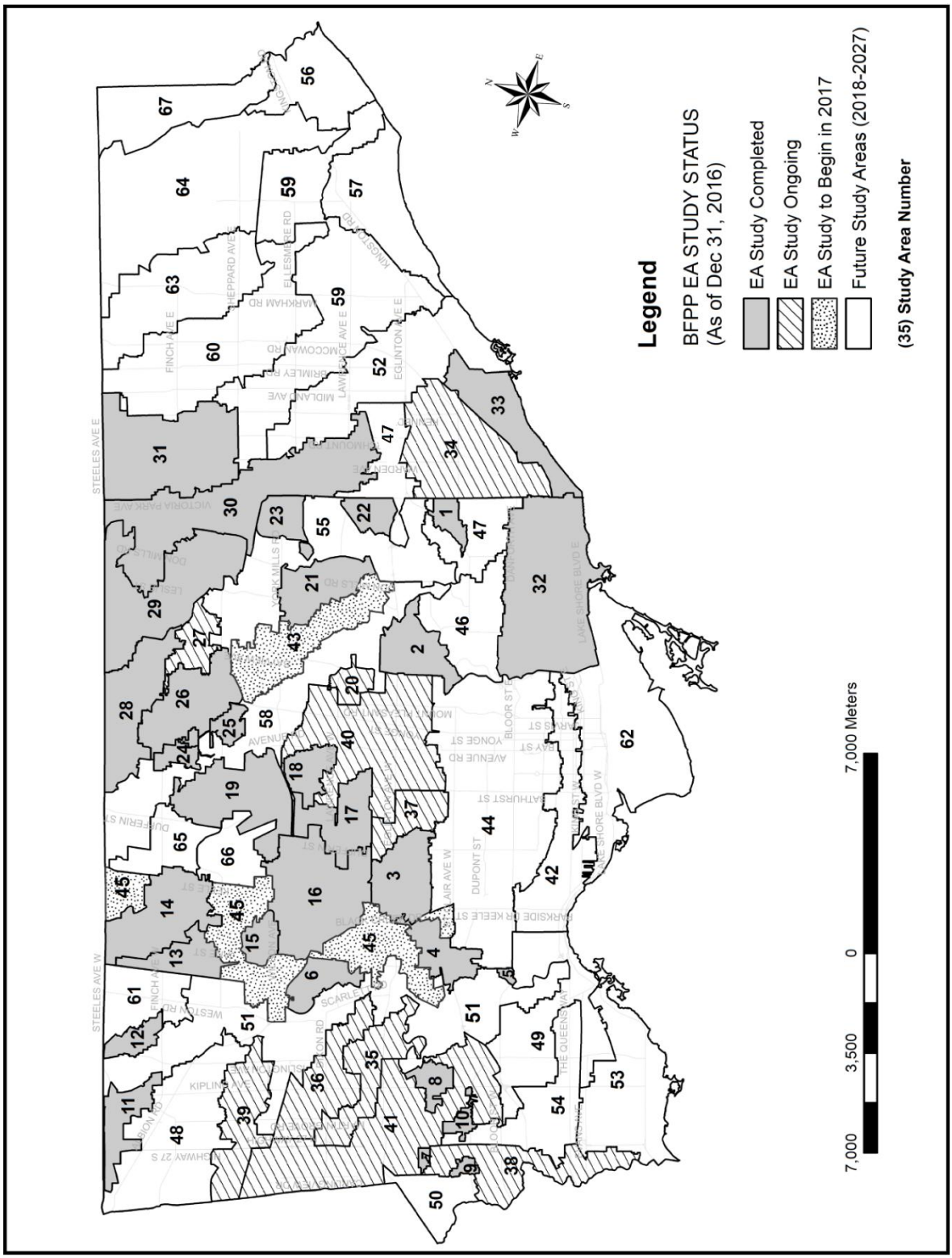
Attachment 3 - Map of WWFMP End-of-Pipe Projects



Attachment 4 - Don River and Central Waterfront Project



Attachment 5 - Status of Basement Flooding Protection Program EA Studies



Attachment 6 - Water Quality Monitoring Stations