

<b>TO:</b>	<b>CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON NOVEMBER 21, 2017</b>
<b>FROM:</b>	<b>KELLY SCHERR, P.ENG., MBA, FEC MANAGING DIRECTOR, ENVIRONMENTAL &amp; ENGINEERING SERVICES &amp; CITY ENGINEER</b>
<b>SUBJECT:</b>	<b>WASTEWATER SYSTEM IMPROVEMENTS SUMMARY</b>

**RECOMMENDATION**

That, on the recommendation of the Managing Director, Environmental and Engineering Services and City Engineer, this update on current and historical untreated sewage discharge, as well as past wastewater system improvements and future budgeted works, **BE RECEIVED** for information.

**PREVIOUS REPORTS PERTINENT TO THIS MATTER**

None.

**2015-2019 STRATEGIC PLAN**

The 2015 – 2019 Strategic Plan identifies these objectives under Building a Sustainable City: 1B – Managing our infrastructure; 3E – Strong and healthy environment through protection of the natural environment; 3F – Strong and healthy environment by protection measures against basement flooding.

**BACKGROUND**

**Purpose**

The purpose of this report is to respond to item b) of the following resolution of Municipal Council at its February 14 and 15, 2017 meeting:

- “12. *That the Civic Administration BE DIRECTED to report back to the Civic Works Committee by June 30, 2017 with respect to the following:*
- a) *A report summarizing the Pollution Prevention and Control Plan (PPCP) Phase 1 Report, and providing the status of the PPCP Phase 2 Report, with the later to include details on work to date, findings and next steps for measuring overflows and bypasses; and,*
  - b) *A report providing historical and current data on the amount of untreated sewage being discharged from pollution control plants and other wastewater infrastructure to the Thames River and other waterways, the reason for the aforementioned discharges, a summary of system improvements in the last 10 to 20 years, a summary of system improvements included in the Capital Budget, as well as any other related information that may be educational for both Municipal Council and the public.”*

This report serves to acknowledge the steps the City of London has taken to improve our sewer infrastructure and improve the sanitary servicing system.

**Context**

Sewer system overflows and wastewater treatment plant bypasses have existed in the City of London’s sewage system for over 100 years. These releases from the City’s sanitary sewer system discharge directly into the Thames River and tributary waterways. The cause of these releases is excessive rainfall entering sanitary sewers

during large rain storm events. Releases from the City of London's sanitary sewer servicing system originate from sewers, pumping stations and/or wastewater treatment plants. Overflows from the City's sewer network were constructed to protect homes from basement flooding.

## DISCUSSION

### Sewage Releases to the Natural Environment

Untreated sewage is discharged into the Thames River and other waterways as a result of historical sewer system overflows, bypasses from our pumping stations and bypasses from our wastewater treatment plants.

Overflows provide a localized relief to sanitary sewers that have exceeded their design capacity, whereas bypasses provide relief to pumping stations and treatment systems when incoming flows exceed the design capacity for incoming flows. The following sections provide details on the primary categories of sewage releases: sewer system overflows, wastewater treatment plant, and pumping station bypasses.

### Sewer System Overflows

Sewer system overflows occur when sanitary sewers become overwhelmed during large rainfall events, primarily due to excessive flows from home weeping tiles connected to the sanitary sewer system. During these large rainfalls, sanitary sewer flow is released directly into local waterways to prevent or minimize the likelihood of basement flooding. The following diagram shows how, during a rainfall event, sanitary flow overflows into the storm sewer when capacity is exceeded. Basement backups are minimized by relieving the sanitary sewer of excess flows into the storm sewer.

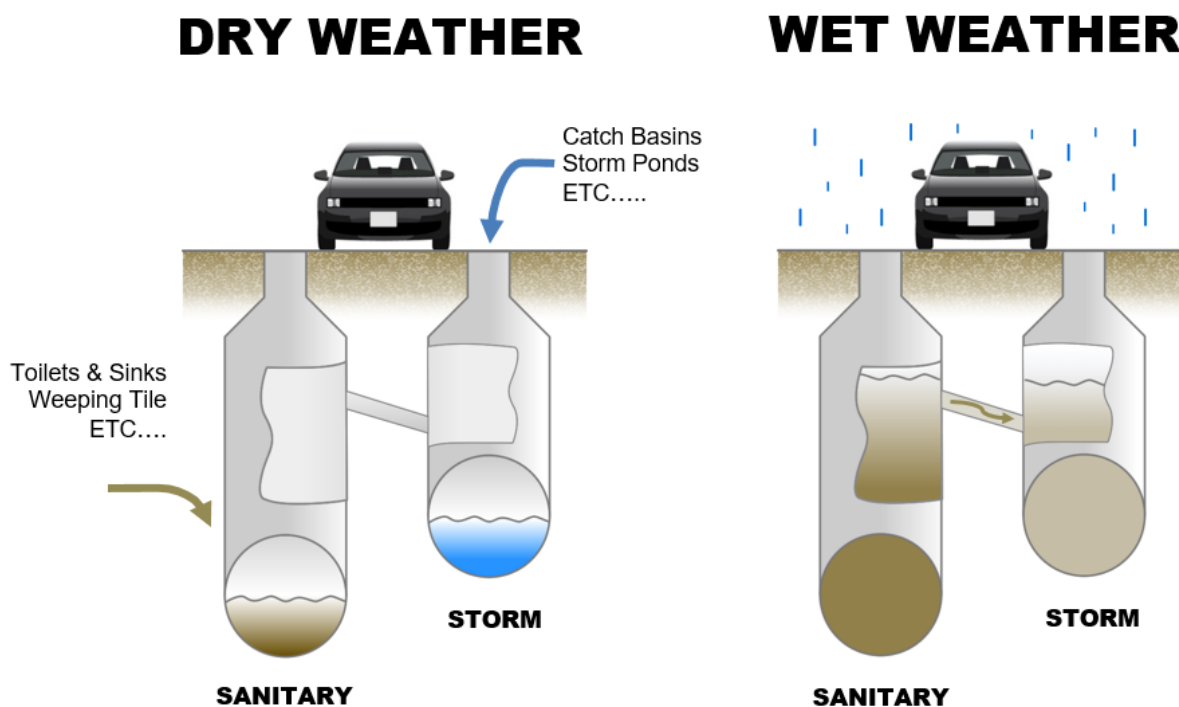


Figure 1: Sanitary sewer overflow during a wet weather event

### Wastewater Treatment Plant and Pumping Station Bypasses

Bypasses occur at our pumping stations and treatment plants when capacity is exceeded. At treatment plants, when capacity is exceeded, sewage is directly discharged into the City's waterways as either raw sewage or partially treated flow. Operations staff at the treatment plants attempt to maximize the amount of sewage that can be partially treated before directly discharging raw sewage. During wet weather events, secondary treatment capacity is maximized with the remaining flows subject to primary treatment where feasible, until these flows are also exceeded. Bypasses

primarily occur when the flows exceed the capacity of equipment and unit processes, in an effort to minimize impacts to the facility and upstream basement flooding.

### Causes of Overflows and Bypasses

Overflows and bypasses occur when sanitary sewers become overloaded during heavy rain events when too much rainwater enters the sanitary system. The primary cause of this is the direct connection of weeping tiles (foundation drains) to the sanitary system. It is estimated that there are approximately 50,000 homes within the City of London that have weeping tiles directly connected to the sanitary sewer. These flows can overwhelm the sewer system during heavy rainfall events, which in turn can cause basement flooding through floor drains and basement plumbing fixtures, as well as sewer system overflows and treatment plant and pumping station bypasses.

The majority of untreated flow discharged into our waterways is a result of bypasses from pumping stations and treatment plants. The primary causes of a bypass are due to heavy precipitation and exceeded design capacity. The primary reasons for initiating a bypass are to avoid danger to public health and to avoid severe property damage.

A snapshot of the annual volume of untreated wastewater from pumping stations and treatment plants is shown in the figure below. A full range of monthly data from 2008 to 2017 is shown in Appendix 'A', Wastewater System Releases: 2008 to 2017. Two large events, a snow melt and a large rainfall, are also highlighted in detail in Appendix 'A'.

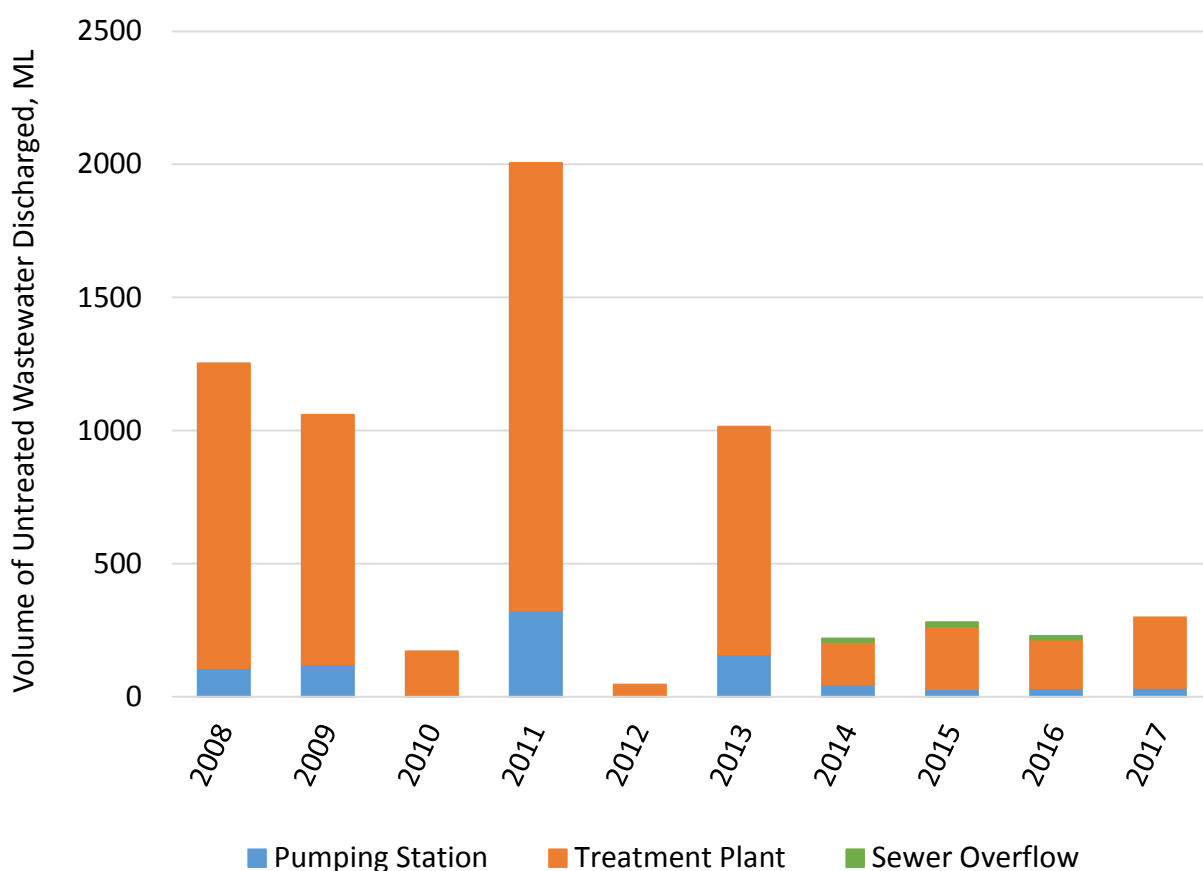


Figure 2: Annual volume of untreated wastewater from pumping stations, treatment plants and sewer system overflows from 2008 to 2017. *Sewer Overflow data available from 2014 onwards.*

### Wastewater System Improvements Summary

As requested in the February 14 and 15, 2017, council resolution, projects included in the wastewater capital budget, between 2008 and 2017, related to wastewater system improvements, have been compiled. From January 2008 to April 2017, a total of \$480,800,000 was spent on projects dedicated to improving the City of London's wastewater system, including reducing overflows and bypasses. A summary of dollars spent during this time is shown below.

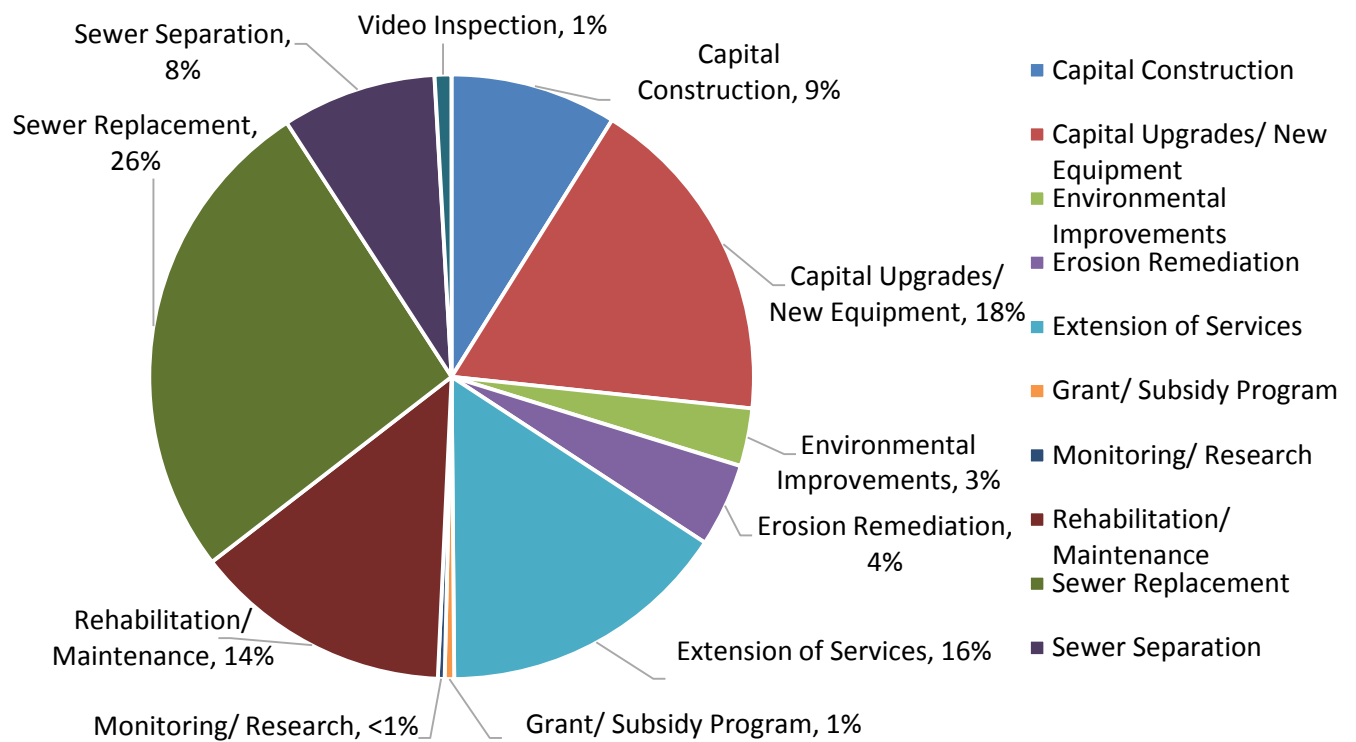


Figure 3: Actuals spent from 2008 to 2017 on wastewater system improvements.

### Reducing Sewer System Overflows

The City of London is committed to system improvements for its sanitary and combined sewer infrastructure. Since 2008, over \$40 million has been spent on separation of combined sewers and the mitigation of sewer system overflows, as shown in further in detail in Appendix 'B', Combined Sewer Replacement Information. In total, 49 km of sanitary sewer has been replaced since 2008, some of which had previously been combined sewer. Construction of separate storm and sanitary sewers effectively reduce the volume of storm drainage diverted to the sanitary sewer system and prevent/reduce sewer system overflows to the Thames River. Appendix 'B' also highlights the areas within the City that remain to be separated, as well as sections of combined sewer that have been replaced since 2013.

The Pollution Prevention and Control Plan was initiated in 2012 to identify, investigate and reduce these sewer system overflows through the design of a prioritized infrastructure replacement program roadmap. Further details and updates regarding this plan are highlighted in the "Pollution Prevention and Control Plan Update," Civic Works Committee (November 21, 2017) information report.

The Basement Flooding Grant Program provides subsidies to homeowners to disconnect weeping tiles and protect themselves from basement flooding. The following figure highlights the amount of grant program money invested by the City each year and the total number of participants. Participation in the grant program increased following the intense rainfall events in 2015 and 2016, when a significant number of basement floodings occurred. Since 2008, there have been approximately 340 home owners participate and receive funding for the grant program. Recent changes to the program now cover 90 % of the costs of the program, to a maximum upset limit.

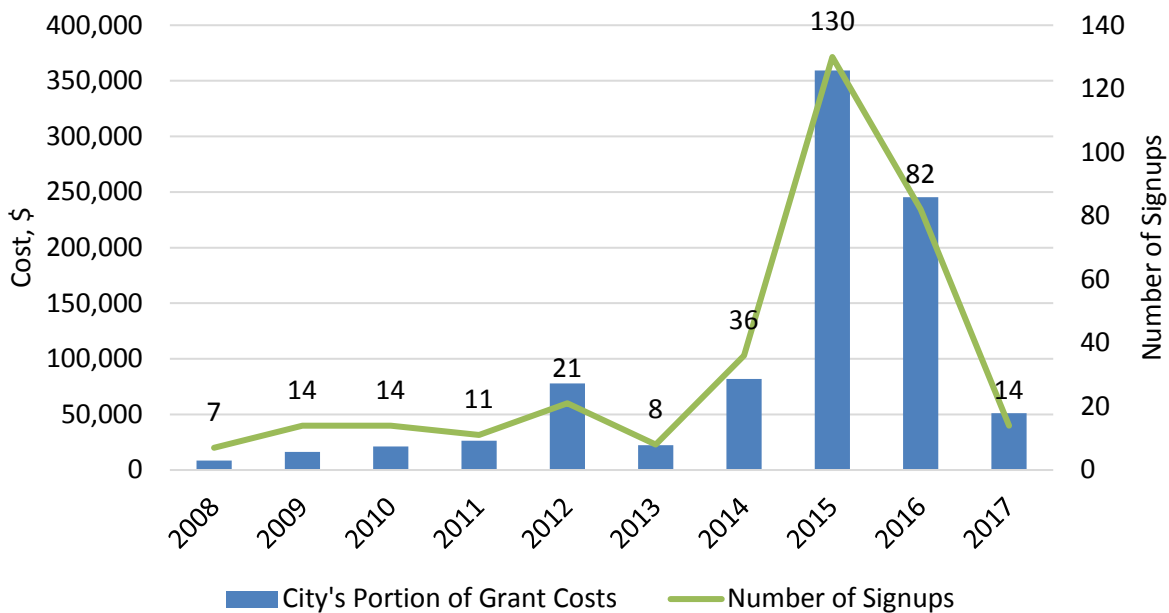


Figure 4: Dollars spent on basement flooding prevention measures and number of homeowner signups to the program

### Reducing Pumping Station and Wastewater Treatment Plant Bypasses

Ensuring our systems are running as efficiently and effectively as possible minimizes the chance of requiring a bypass at our pumping stations and treatment plants. Each year the City invests a large proportion of the annual budget towards capital upgrades and new equipment at treatment plants and pumping stations. On average, this is approximately 27% of the annual budget and has accounted for just under \$140 million from 2008 to 2017, with another \$8.8 million budgeted over the next five years.

The following figure shows the breakdown of the capital costs service areas: stormwater, wastewater treatment and wastewater collection.

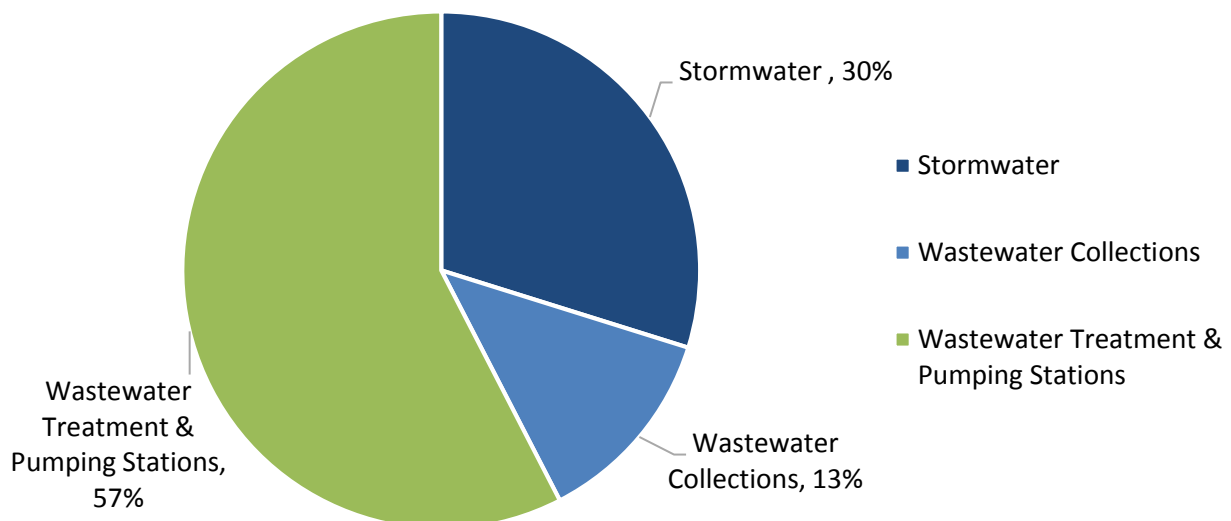


Figure 5: Percent of expenditures on capital improvements by service area between 2008 and 2017.

The largest proportion of work completed was by wastewater treatment on capital improvements accounting for over \$81 million. These projects were primarily upgrades and expansions to existing treatment plants and pumping stations to gain increased capacity and efficiency. Several notable projects include:

- Oxford Wastewater Treatment Plant expansion to increase capacity and reduce the likelihood of bypass;
- Vauxhall Wastewater Treatment Plant upgrades to handle wet weather flows,

including chemically enhanced primary treatment, upgrade to inlet works, chemically enhanced secondary treatment and in-plant flow diversion capabilities (The design of these upgrades was recognized in 2014 with an Award of Merit in the environment category from the Consulting Engineers of Ontario, based on project innovation and environmental benefits);

- Greenway Wastewater Treatment Plant expansion to increase the wastewater treatment capacity from 152 to 170 million litres per day to accommodate growth in the southwest area and downtown core intensification and reduce the need to bypass (on-going);
- Installation of additional pumps to the Wonderland and Hyde Park pumping stations and upgrades to Hunt Club pumping stations to increase capacity;
- Improvements to processes (i.e. sludge thickening upgrades and new aeration tanks at Greenway Wastewater Treatment Plant);
- Upgrades to equipment at the five treatment plants to include new incinerators, pumps, mixers, filtration membranes, UV disinfection, turbo blowers, etc., which increase the efficiency of the plant; and
- Upgrades to equipment at various pumping stations (i.e. mechanical and electrical instrumentation) to maintain operation and reduce bypasses.

Other non-wastewater treatment and pumping station projects include extensions of wastewater and stormwater servicing to accommodate growth. In areas of the downtown core and at the City's urban boundary, where growth is occurring, the City has extended servicing to meet the requirement of growth as part of the Growth Management Implementation Strategy (GMIS). This extension of sewers and stormwater facilities has cost an additional \$75.6 million since 2008. Projects include the construction of major trunk sanitary and storm services (i.e. Gordon trunk sewer, Wonderland trunk, Burbrook storm trunk, etc.) and stormwater management facilities.

## **Research and Monitoring**

The City of London has been a leader in watershed-based monitoring and analysis of the Thames River, with relevant data spanning over 40 years. The City currently operates and maintains a network of 15 permanent water quality monitoring sites along the Thames River. In addition, there are 15 sites installed within sub-watersheds of the Thames and a further six temporary locations installed for the collection of supporting data specific to ongoing studies. Parameters include basic water quality chemistry as well as biological testing. Currently, the results of the water quality monitoring program are posted to the City of London website and are available to the public. The City of London also has nine permanent rain gauges located around the city, as shown in Appendix 'C', Rain Gauge and Flow Monitor Locations. There are also nine permanent flow monitors installed around the City of London which monitor sanitary and storm water flows in our sewers. Data from all of these monitors help City staff in understanding and identifying sewer system constraints and effects of wet weather events on our water quality and sewer capacity. Since 2008, approximately \$1.8 million has been spent on research and monitoring, with another \$2 million budgeted over the next five years

## **Future Work**

The City of London is continually improving its system and investing in measures to reduce the frequency and occurrences of overflows and bypasses. Over the next five years, the following projects are planned to further improve our system:

- Accelerated plans to separate 17 km (80 % of the remaining 20 km) of combined sewers by the year 2025, as actioned in the Domestic Action Plan for achieving reduced phosphorus levels (pending senior level government funding);
- Completion of the Pollution Prevention and Control Plan and implementation to reduce sewer system overflows within the system;
- Continued upgrades to Greenway Wastewater Treatment Plant to increase capacity and capabilities to provide initial treatment when bypassing must occur. This expansion includes the conversion of existing final clarifiers into bypass containment tanks. Bypass flows will be stored before bypass which will further

reduce the total volume discharged into the river. In addition, a high rate treatment system will provide primary level treatment to flows above the plant's rated secondary capacity further reducing the impact of bypass events;

- Construction of a two-way forcemain between Vauxhall and Pottersburg Wastewater Treatment Plants to allow operations staff flexibility to temporarily transfer flows to either plant while maintenance and processes are taken out of service for refurbishing and upgrades. This construction will also consolidate sludge thickening operations;
- Construction of flood proofing infrastructure at various treatment plants and pumping stations to ensure flows are discharged during wet weather events when river levels rise;
- South London Wastewater Servicing Environment Assessment which will identify the best ways to provide increased wastewater servicing capacity in the south end and considers the need to include a dedicated septage receiving facility and enhanced peak shaving capability to assist with downstream treatment facilities; and
- Continuation of the infrastructure replacement programs to ensure the City of London's infrastructure remains sustainable.

<b>CONCLUSIONS</b>
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The City of London continues to be a leader in wastewater system improvements. Bypass events will continue to be logged and reported at all pumping stations, treatment plants and priority sewer overflow locations. Improvements and upgrades to our systems continue each year through sewer replacement programs, extension of services, capital construction and upgrades to our extensive monitoring program. The City will continue to improve through using innovative technologies, increasing knowledge and awareness through improved information sharing and continuing programs such as the Basement Flooding Grant Program, combined sewer replacement program, infrastructure renewal program and the Pollution Prevention and Control Plan.

**Acknowledgements**

The following Environmental and Engineering Services Divisions contributed to this report: Wastewater Treatment Operations, Stormwater Engineering, Wastewater and Drainage Engineering, Sewer Operations and Environmental Programs.

This report was prepared within the Wastewater and Drainage Engineering Division by Monica McVicar, E.I.T.

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Cc: Monica McVicar  
 Appendix 'A' – Wastewater System Releases: 2008 to 2017  
 Appendix 'B' – Combined Sewers Replacement Information  
 Appendix 'C' – Rain gauge and Flow Monitor Locations

