Report to Civic Works Committee

To: **Chair and Members**
Civic Works Committee
From: **Kelly Scherr, P.Eng., MBA, FEC**
Deputy City Manager, Environment and Infrastructure
Subject: **Unwanted Water: Addressing Overflows and Bypasses from London's Wastewater Collection and Treatment System**
Date: **April 20, 2022**

Recommendation

That on the recommendation of Deputy City Manager, Environment and Infrastructure, the following report on quantifying the impacts of the City's unwanted water issues **BE RECEIVED** for information.

Executive Summary

Purpose

The purpose of this report is to illustrate to Council the strategies that are being employed to reduce the occurrence of overflows and bypasses from City wastewater collection and treatment facilities. The scale of the rain events that occur will provide context for the magnitude of the infrastructure that would be required to prevent the occurrence of overflows and bypasses. This is the fourth report in the series focused on the problem of unwanted water in the City's wastewater system.

Context

The City's wastewater sewer system is intended to collect household sewage, commercial sewage, and industrial sewage. Wastewater flows from these sources are conveyed through a network of sewers to one of five wastewater treatment plants, sometimes via pumping stations. Each wastewater treatment plant treats the sewage which is then discharged as clean water to the Thames River. All other water, such as rainwater and groundwater, is not intended to enter the wastewater collection system. In the field of civil engineering, these unwanted sources of water are referred to as "inflow and infiltration." For the purposes of this report, the term "unwanted water" is used to describe any water that is not intended to be collected by the wastewater sewer system. Increased unwanted water in the collection system can cause overflows and bypasses of wastewater into the Thames River.

Linkage to the Corporate Strategic Plan

This recommendation supports the following 2019-2023 Strategic Plan areas of focus:

- Building a Sustainable City:
    - London's infrastructure is built, maintained, and operated to meet the long-term needs of our community by replacing aged and failing infrastructure with new materials and sizing new infrastructure to accommodate future development; and
    - Protect and enhance waterways, wetlands, and natural areas.

Analysis

1.0 Background Information

1.1 Previous Reports Related to this Matter

- Civic Works Committee – December 14, 2021 – Quantifying Inflow and Infiltration in London's Wastewater Sewer System
- Civic Works Committee – September 21, 2021 – Sewage Overflows and Bypasses Into the Thames River – Sanitary Cross Connections
- Civic Works Committee – April 20, 2021 – Sewage Overflows and Bypasses Into the Thames River
- Civic Works Committee – April 17, 2018 – London Pollution Prevention and Control Plan - Final Master Plan

2.0 Discussion and Considerations

2.1 What are Overflows and Bypasses?

As has been described in previous reports, unwanted water (from sources like rain and groundwater) enters the sewage collection system via weeping tile connections, combined sewers, or during phases of construction build out. When unwanted water makes its way into the collection system, it can result in extremely high flow rate events that overwhelm the capacity of sewers, pumping stations, and wastewater treatment plants, causing overflows and bypasses. A "wet weather event" occurs when precipitation increases unwanted water in the system.

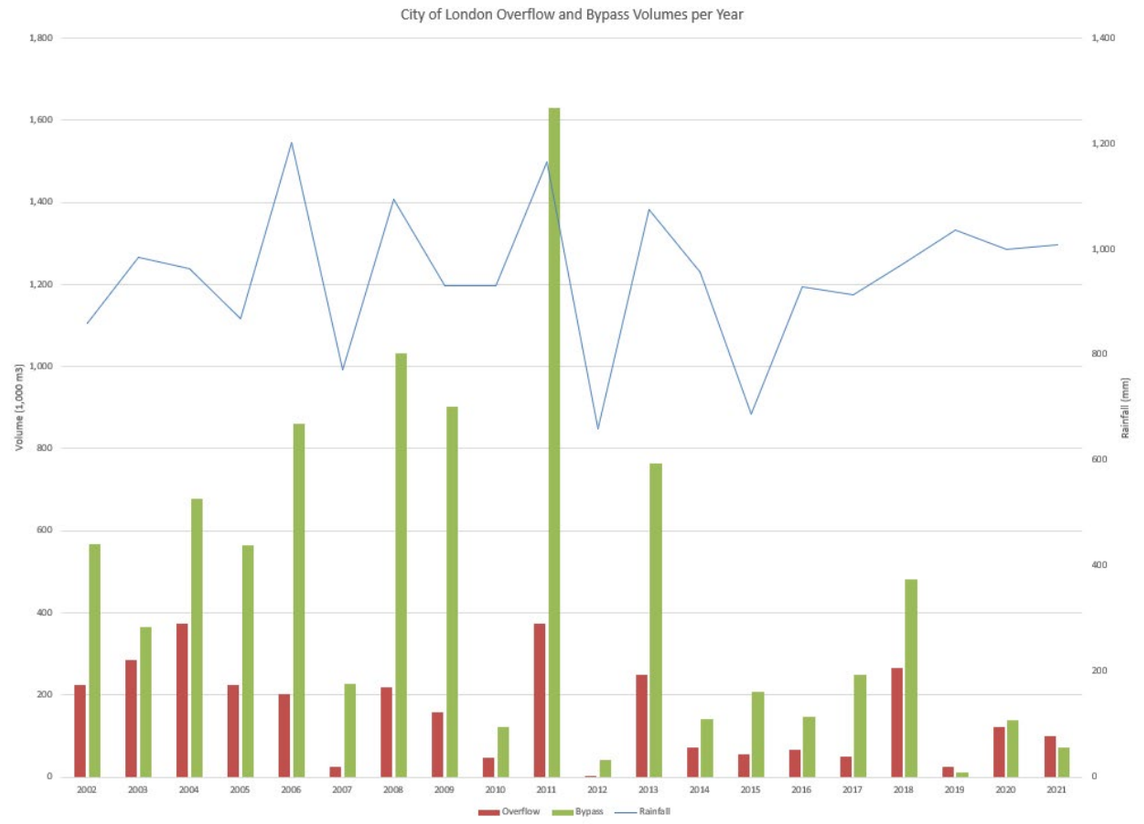
Overflows and bypasses occur during significant rain or snowmelt events (sometimes referred to as "wet weather events") when the wastewater in the collection system receives the greatest amount of unwanted water. In these cases, the flow of wastewater can exceed the capacity of the City's infrastructure to convey or fully treat it. At treatment plants and pumping stations, overflows and bypasses are managed as a last resort to protect public health and prevent property damage. In the sewer system, overflows can also occur throughout the system to protect properties from basement flooding.

It is important to understand the distinction between overflows and bypasses. An overflow is the release of untreated wastewater from either the collection system (i.e., sewers and pumping stations) or a wastewater treatment plant. Bypasses, on the other hand, receive partial treatment and are released from a wastewater treatment plant without having received the full treatment process. In some cases, bypasses are fully treated, but these instances are not the focus of this report.

In setting policy and operational practices for management of wet weather flows, the Wastewater Treatment Operations Division prioritizes the reduction of overflows since those flows receive no treatment prior to release whereas bypasses do receive partial treatment.

2.2 How much does the City Overflow and Bypass?

Overflows and bypasses are publicly reported events. The following graph illustrates the annual overflow and bypass volumes at the City's pumping stations and treatment plants since 2002. The graph shows that following a peak in 2011, overflow and bypass volumes overall have decreased substantially.



It is important to note that when assessing the impact of unwanted water on the City's wastewater infrastructure, the intensity of a given rainfall or snowmelt event is more influential than the annual amount of rainfall. A wetter than average year, in which most precipitation is delivered in frequent, low intensity weather events, could result in fewer overflows and bypasses. By contrast, one significant rain event could trigger the entire annual overflow or bypass volume for the year. This is illustrated in the graph above as no discernible relationship between annual rainfall and overflow or bypass activity is apparent.

Because bypasses and overflows are directly related to the characteristics of a given rain event and ground conditions, it is difficult to predict how active a particular year is going to be for overflows and bypasses or to correlate performance across years by comparing annual precipitation levels. Unfortunately, the expectation is that climate change will likely increase the percentage of rain that falls as part of intense storm events, increasing the likelihood of overflows and bypasses.

2.3 What would it take to prevent all Overflows and Bypasses?

The unpredictable nature of wet weather flow events makes the capture and treatment of all possible flows impractical. Previous reports have described the need to remove the sources of unwanted water. There are also options to improve the feasibility of capture and treatment, particularly when used in conjunction with preventative measures.

Increasing the capacity of treatment plants to treat all flows received is often discussed, however, there are two primary obstacles to this approach. First, properly functioning treatment plants require finely balanced biological processes that are developed over time and require certain amounts of nutrients to remain active. By constructing facilities that are large enough to treat the largest events (representing only a fraction of a percent of the total flows received), plants are oversized to the point where they are no longer as effective at treating daily flows. Overall, this represents a poorer outcome for the environment in the long run. Second, the cost to construct treatment facilities large enough to fully treat all peak flows is in the hundreds of millions of dollars, making it cost prohibitive.

Another strategy to eliminate overflows and bypasses is to construct storage tanks at all major overflow and bypass locations that are capable of capturing and holding wet weather flows. This storage would be utilized until conditions in the collection system permit a gradual release back into the system for conveyance and treatment. This general approach is feasible and will be discussed further in the next section. However, to construct storage facilities at all overflow and bypass locations to capture and hold all possible flow volumes received becomes cost-prohibitive. There may also be technical constraints including space limitations, infrastructure conflicts, slope stability, etc. For example, to capture and store the biggest events at Greenway Wastewater Treatment Plant would require a total volume of 175,000 m^3. That is the equivalent of 70 Olympic swimming pools or 26 tanks, each 23 meters in diameter by 15 meters tall, spread over an area of two CFL-sized football fields. Cost projections for construction of a complete-capture wet weather storage solution could reach into the hundreds of millions of dollars and would require significant property acquisition, including a significant loss of existing park space.

Despite the fact that designing a treatment plant or storage tank system to capture 100% of wet weather flows is impractical, there are elements of these strategies that are carried forward into the City's current practices and plans for future improvements. Removing as many sources of unwanted water as possible, such as weeping tile connections, combined sewers, and infiltration, reduces the volume that requires capture and treatment and increases the economical feasibility of these larger capital projects for capturing remaining flows.

2.4 What is the City doing to prevent Overflows and Bypasses?

While Sewer Engineering is undertaking initiatives to remove sources of unwanted water from the collection system, Wastewater Treatment Operations manages the flows they receive and sets the reduction of overflows and bypasses at treatment plants and pumping stations as a priority. The decision to overflow or bypass is made only as a last resort to protect public health and property.

As previously identified, the priority is placed on reducing overflow activity since those events are untreated flows that enter the river. Given the challenges detailed above with enabling full treatment of all flows received, the strategy that is employed involves implementing high-rate primary level treatment to flows prior to being released into the environment. Primary level treatment removes a significant portion of the solids and biological content, reducing the nutrient load that is introduced to the Thames River. Primary treatment can also be stopped and started as required, making it suitable for intermittent duty in comparison to treatment facilities that do not have this flexibility.

Storage of flows, whether untreated or partially treated, prior to diverting to the environment provides an effective way of reducing the impacts of wet weather events on the environment. By capturing and retaining flows that cannot be fully treated, the volume of overflow and bypass events is directly reduced and the retained flows can be reintroduced to the plants when capacity is available to fully treat them. The biggest challenge associated with storage solutions is space. As a result, storage facilities are typically sized according to the space available rather than by a specific retention volume.

Key locations where the City has constructed storage and primary treatment capability are described in the following list. Typically, the full capacity of each location is leveraged before any overflows occur, except in those most extreme rain events:

- Greenway Wastewater Treatment Plant – 7,800 m^3 of storage, 170,000 m^3/d additional primary treatment capacity in wet weather;
- Vauxhall Wastewater Treatment Plant – 165,000 m^3/d additional primary treatment capacity in wet weather;
- Dingman Creek Pumping Station – 67,000 m^3 of storage, 80,000 m^3/d primary treatment capacity in wet weather;

To illustrate the role that these facilities can play in reducing raw overflows, in 2021 there was a total of 197,866 m^3 of wastewater that exceeded the capacity of the City's pumping stations and plants and would have been an overflow but still received at least primary treatment before being discharged to the Thames River. This compares with the total 64,921 m^3 of raw overflow that occurred, representing a 75% reduction in overflow volume.

The City is currently reviewing more opportunities to construct new storage and enhanced primary treatment facilities to further improve this performance. Many of those projects are identified in the recently completed Wastewater Treatment Operations Master Plan, which can be reviewed at https://getinvolved.london.ca/wastewater-master-plan.

3.0 Financial Impact/Considerations

The Wastewater Treatment Operations Division is currently undertaking many upgrade projects. Whenever possible, the incorporation of wet weather management strategies is considered as part of capital projects. However, in general, most proposed wet weather management strategies are currently unfunded. As identified, the cost to construct overflow and bypass reducing infrastructure could reach into the hundreds of millions of dollars, plus property acquisition. While smaller upgrades will be made under existing capital budgets, additional funding will be required and will be requested during the next multi-year budget process to further reduce overflows and bypasses. The City will also continue to apply to senior government funding grants when available to support funding initiatives.

Conclusion

Overflows and bypasses generate significant concern in the community. The infrastructure required to mitigate and reduce overflow and bypass events via capture and treatment is not simple to build or operate, and the costs are substantial.

Wastewater Treatment Operations manages overflows and bypasses as a last resort for the protection of the public. In conjunction with initiatives to remove sources of unwanted water, capital projects are in progress and more are planned to construct facilities that will further reduce the volume of untreated flow that is released from the City's wastewater collection and treatment facilities. Further action to achieve even greater reductions will be proposed to Council during the next budget cycle.

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