Niagara Region

Public Works
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MEMORANDUM

PWC-C 3-2020

Subject: Combined Sewer Overflow Reporting

Date: February 11, 2020

To: Public Works Committee

From: Jason Oatley, Manager, Quality and Compliance Wastewater

This memo has been prepared in response to the following Councillor Information Request made at Public Works Committee held on December 3, 2019:

> *Provide information respecting the number of overflows and bypasses which occurred in Regional wastewater systems in 2019. Chair Bradley.*

Key Facts:

- Overflows and bypasses occur when the wastewater collection, conveyance and treatment systems capacity is exceeded by wet weather flow and extraneous flow, entering the system during significant rainfall and thaw events.
- Sources of extraneous flow are understood to be originating from both public and private property sources.
- Overflows and bypasses were intentionally designed into the system to protect against sewer backups, basement flooding and to prevent impacts to treatment plant chemistry which can alter the quality of the effluent released to the environment
- Regional and Municipal wastewater systems are, and were, designed to balance affordability of construction and maintenance versus dry and wet weather performance
- Niagara Region operates and maintains11 Wastewater Treatment Plants (WWTPs), 112 Sewage Pumping stations and 300 km of gravity trunk sewer main and forcemain
- There are approximately 269 locations where overflow and bypasses can occur within the Regional and Municipal wastewater systems
- In 2019, approximately 2,323 million litres of combined sewage was discharged to the environment during significant wet weather and thaw events. This represents approximately 3% of the total wastewater treated. 79,589 million litres, at wastewater treatment plants for 2019.
- The bypass/overflow volumes outlined in this report pertain to those associated with Regional infrastructure. Total overflow volumes for local municipal infrastructure,

typically located at points remote to the WWTP and pump stations within the sanitary collection system, are not readily measurable nor quantifiable. These volumes are not included within the totals in this report.

- The largest volumes of overflow occur as bypasses at Regional treatment plants. The majority of overflow discharged on an annual basis from these facilities receives disinfection prior to release to the environment.
- Niagara Region's latest Water and Wastewater Master Plan Update has specific policies, guidelines and funding directed at the reduction of wet weather flow to the wastewater system to reduce overflows to the environment and basement flooding.
- Niagara Region is working cooperatively to develop, implement and fund strategies to reduce wet weather flow in both municipal and regional wastewater systems.

Background:

Niagara Region operates 11 wastewater treatment plants (WWTPs) in seven municipalities. These plants receive sewage flows from the municipal and regional gravity trunk sewer system and over 112 sewage pumping stations (SPS). The local municipalities own and operated the majority of the sanitary sewer systems.

In general, excess flows that cannot be treated at a WWTP are called "bypasses" while excess flows that escape the collection system are termed "overflows". A sewer designed to convey both stormwater and wastewater is a combined sewer. Sewers that convey only sanitary sewage are considered sanitary sewers. Sanitary systems that receive increased flow during rainfall events but are otherwise separated are considered "partially or nominally separated".

Number of locations where overflows can occur:

Table 1 below is a listing of the number of known bypass and overflow locations by municipality. Generally speaking, overflows can occur at these location under significant rainfall and/or thaw events. The Regional locations in Table 1 include both the WWTPs and pump station overflows whilst the municipal locations are generally associated with the municipal wastewater collection system.

Location	Regional	Municipal	Total
Fort Erie	8	4	12
Grimsby	7	5	12
Lincoln	3	0	3
Niagara Falls	10	19	29
Niagara	5	1	6
Pelham	1	1	2
Port Colborne	7	1	8
St. Catharines	11	121	132
Thorold	7	25	32
Wainfleet	0	0	0
Welland	2	30	32
West Lincoln	1	0	1
Totals	**62**	**207**	**269**

Table 1-CSO and Bypass Locations

What causes the overflows?

Almost all wastewater treatment facilities in Ontario are designed to overflow when their operational capacity is exceeded due to wet weather flow. The primary causes of overflows and bypasses are the introduction of excessive peak wet weather extraneous flows to the systems. Extraneous flows are those flows due to significant wet weather events and /or seasonal high groundwater that exceed the capacity of the collection systems and facilities. WWTP bypasses/overflows are designed to protect the sensitive internal biological and chemical processes that are used to treat the sewage properly. The amount of precipitation, surface run-off and snow thaw has a great impact on the flow within the sanitary sewer system.

For example, the Niagara Falls WWTP is designed to provide both full primary and secondary wastewater treatment for flows up to 135 million litres per day. In addition, the WWTP can can provide primary treatment up to approximately 205 million litres per day when needed. Flows higher than 205 million litres per day do not receive any treatment. For this facility, the normal dry-weather flow is typically 35 million litres per day or approximately 25% of the total capacity of the plant. During rain and thaw events, the Niagara Falls WWTP can receive flows up to 5 times that amount due to the rainwater that enters the sanitary sewer system.

Preliminary treatment removes debris and grit from the wastewater entering the WWTP (objects typically greater than 8-10 mm). Primary treatment removes between 40-50% of the suspended solids from the incoming sewage. Secondary treatment removes the organic matter and phosphorus while disinfection reduces the amount of coliform bacteria present in the discharge to the environment.

Review of overflows and bypasses for 2019

Table 2, attached as Appendix 1, shows the overflows and bypasses that have occurred at Regional WWTPs in 2019. The volume of overflows and bypasses added together is 2,323 million litres. The volume of sewage treated at the Region's WWTPs was 79,589 million. Essentially, more than 97% of the flow was treated at our WWTPs while less than 3% escaped full treatment.

Precipitation and rainfall events are given in Table 3, attached as Appendix 2. From the table, 2019 was roughly similar in precipitation to 2018. The volume of bypasses at the plants were also similar.

Why is this problem still occurring?

- Excess flow entering sewers: New developments are built with separate storm and sanitary sewers which collect stormwater and wastewater respectively. When constructed properly the extraneous flow from new infrastructure is minimal. Developments constructed between approximately 1960 to the late 1980's typically have partially separated systems with road drainage being directed to storm sewers. Partially separated systems can however contribute significant extraneous flow to sanitary sewers via private property connections from foundation drains, sump pumps and other sources.
- In older areas, pre 1960's, municipal sewer systems are combined, meaning that stormwater and wastewater are collected by a single sewer. These sewers are most prevalent in St. Catharines, Niagara Falls and Welland and contribute significantly to both bypasses and overflows.
- Aging Infrastructure: Sewers at the Regional and local municipal level are aging and may allow increasing amounts of rainfall and groundwater to enter normally separated sanitary systems. Niagara Region and local municipalities are proactively monitoring and remediating or replacing sanitary sewers to increase their resiliency to these rainfall extremes.
- Unusual Weather / Climate Change: Extreme precipitation events and high lake levels in recent years have increased the load on the sewer systems. These

increased lake levels translate into higher groundwater levels and the ingress of stormwater into systems adjacent to bodies of water and further compounding the problem by further reducing capacity in these systems that results in more frequent overflow events.

What are the Region and local municipalities to do about reduce sewer overflows?

- Planning Infrastructure: Niagara Region in conjunction with our local municipal partners have recently completed Niagara Region's Water and Wastewater Master Servicing Plan Update. This document provides strategic and tactical guidance to both Regional and Local Municipal staff in the management of capacity within water and wastewater systems at both jurisdictional levels. A key driver of the most recent plan is the reduction of overflows to current Ministry of the Environment, Conservation and Parks (MECP) Guidelines and the eventual elimination of overflow of untreated wastewater to the environment.
- Niagara Region's Water and Wastewater Master Servicing Plan Update speaks specifically to the need for the Region and Local Municipalities to work as a team to address wet weather flow and overflows/bypasses. This is addressed within the plan with policy, guidelines and funding aimed at identifying, measuring, prioritizing and removal of these sources in a collaborative manner.
- Several Pollution Prevention and Control Plan (PPCP) studies have been completed, are underway or are scheduled to be completed for most local area municipalities. These studies are aimed specifically at the reduction of overflow/bypasses via the detailed examination of both local municipal and regional wastewater systems in each municipality. The resulting recommendations from these studies form the basis of capital budgets items both at a regional and municipal level.
- Building combined sewer overflow (CSO) tanks and Infrastructure: Niagara Region and local municipalities have constructed CSO tanks that capture over 30 million litres of combined sewage and direct that volume to treatment at the Region's WWTPs.
- A high rate treatment (HRT) facility in Niagara Falls that has given primary treatment to between 40 and 180 million litres per year to combined sewage that formerly was discharged directly to the Niagara River just downstream of the Falls.
- Developing and using hydraulic models for all wastewater systems region-wide to more effectively manage capacity and overflow reduction,

- Creation of dedicated fund for municipalities to address extraneous flows to the wastewater system to improve capacity and reduce overflows.

In addition to the works outlined in the plan at the Regional level our municipal partners are making significant commitments to projects aimed at reducing overflows. Our municipal partners have various programs and policies to identify and remediate private property sources of extraneous flow. Furthermore, the Region and Local Municipalities have planning policies in place to ensure that new subdivisions are properly designed and constructed to minimize the introduction of new sources of wet weather.

CSO tanks and inline storage have been constructed in Niagara Falls, Thorold, St. Catharines, Niagara-on-the-Lake, West Lincoln, Fort Erie, Grimsby and Welland.

In the case of Niagara Falls the Region has awarded over $16 million to assist in reducing CSO impacts to residents, business and the environment. This commitment by the Region to Niagara Falls is the largest provided to any municipality. For instance, in the village of Chippawa, Niagara Region worked with the City of Niagara Falls to construct a 4,300,000 litre CSO tank to help contain some of the wet weather that comes from the village. This tank has drastically reduced the volume of combined sewage that used to be discharged to the Welland River, and ultimately to the Niagara River and Lake Ontario, during wet weather. Also, another project in Niagara Falls involved the construction of a high rate treatment (HRT) facility that provides partial treatment to thousands of litres of combined sewage instead of allowing this combined sewage to simply spill to the environment

In addition to the works listed above, our municipal partners are making significant commitments to projects aimed at reducing overflows through master servicing plans and pollution prevention and control plans (PPCPs)

Respectfully submitted and signed by,

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Jason Oatley, B.Sc., C.Chem.
Manager, Quality and Compliance, Wastewater

Appendix 1 – Table 2: 2016 to 2019 WWTP Overflows
Appendix 2 – Table 3: Precipitation and rainfall events

Appendix 1

WWTP	ML Treated				Total ML Bypassed (System and Plant)				% Flow Bypassed			
	2016	2017	2018	2019	2016	2017	2018	2019	2016	2017	2018	2019
Queenston	83	86	72	77	0	0	0	0	0%	0%	0%	0%
Stevensville Lagoon	482	597	610	630	0	0	0	0	0%	0%	0%	0.0%
N.O.T.L.	1,445	1,665	1,711	2,287	0	0	57	61	0%	0%	3.2%	2.6%
Crystal Beach	1,676	2,159	2,144	2,287	0	1	3	0	0%	0.1%	0.1%	0.0%
Seaway	3,412	4,410	4,592	4,909	0	18	38	0	0%	0.4%	0.8%	0.0%
Anger Avenue (Fort Erie)	4,630	5,475	5,338	5,519	1	72	45	34	0%	1.3%	0.8%	0.6%
Baker Road (Grimsby)	6,238	7,627	7,291	7,620	21	141	88	56	0.3%	1.8%	1.2%	0.7%
Port Weller	10,874	11,713	13,462	14,291	69	723	372	321	0.6%	5.8%	2.7%	2.2%
Port Dalhousie	10,939	12,710	12,810	13,367	86	572	403	272	0.8%	4.3%	3.1%	1.9%
Welland	10,949	12,924	12,645	13,531	432	1,235	1,422	1,206	3.8%	8.7%	10.1%	8.2%
Niagara Falls	13,444	16,310	15,144	15,072	107	834	488	373	0.8%	4.9%	3.1%	2.4%
Total	**64,171**	**75,675**	**75,816**	**79,589**	**716**	**3,597**	**2,915**	**2,323**	**1.1%**	**4.5%**	**3.7%**	**2.8%**

Table 2-2016 to 2019 WWTP Overflows

Appendix 2

WWTP	Total Precipitation (mm)				Number of Precip Events			
	2016	2017	2018	2019	2016	2017	2018	2019
Queenston	519	876	670	748	68	46	52	50
Stevensville Lagoon	768	1,170	1,015	943	83	58	57	64
N.O.T.L.	525	851	790	765	69	47	49	45
Crystal Beach	710	1,009	991	808	74	61	61	61
Seaway	632	956	970	917	77	44	58	60
Anger Avenue (Fort Erie)	768	1,170	1,015	943	83	58	57	64
Baker Road (Grimsby)	488	871	722	747	72	53	45	49
Port Weller	492	840	713	758	68	46	49	54
Port Dalhousie	510	840	713	758	68	46	49	54
Welland	609	1,048	802	882	83	52	54	59
Niagara Falls	521	876	670	748	68	46	52	50

Table 3-Precipitation and rainfall events