2017 Watershed Overview of Wastewater Treatment Plant Performance

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Glossary of Terms

ADF

Average daily flow

cBOD

Carbonaceous 5 day biochemical oxygen demand

GRCA

Grand River Conservation Authority

MECP

Ontario Ministry of the Environment, Conservation and Parks

TAN

Total ammonia nitrogen

TBOD

Total 5 day biochemical oxygen demand

TKN

Total Kjeldahl nitrogen

TP

Total phosphorus

TSS

Total suspended solids

UIA

Un-ionized Ammonia

WWOP

Watershed-wide Wastewater Optimization Program

WWTP

Wastewater treatment plant

EXECUTIVE SUMMARY

Since 2010, the Grand River Conservation Authority (GRCA) has been working collaboratively with municipal partners and the Ministry of the Environment, Conservation and Parks (MECP) to develop a Watershed-wide Wastewater Optimization Program (WWOP). A key program activity is monitoring performance and plant loading, which are used to evaluate the success of the program and track WWTP impacts on the Grand River over time. Available performance and loading data for 28 of 30 municipal wastewater treatment plants were voluntarily reported in 2017. These results were summarized and compared to results from 2012 to 2016.

Treatment Performance

Table 1 shows the final effluent TP flow-weighted average concentrations from 2012 to 2017. The TP flow-weighted concentrations decreased by 9% in 2017 compared to 2016. The TP flow-weighted concentrations decreased by 19%, in 2017 compared to 2012.

Table 1: TP Flow-weighted concentrations, total loading and targets

Year	TP flow-weighted concentration (mg/L)	Total Loading (tonnes per year)	TP flow-weighted concentration target (mg/L)
2012	0.37	35.9	0.24
2013	0.35	37.6	0.24
2014	0.33	36.8	0.24
2015	0.37	36.5	0.24
2016	0.33	33.8	0.24
2017	0.30	32.5	0.24

Table 2 shows the final effluent TAN flow-weighted average concentrations from 2012 to 2017. The summer TAN flow-weighted concentration decreased by 42% in 2017 compared to 2016. The winter TAN flow-weighted concentration decreased by 22% from 2016 to 2017. The overall TAN flow-weighted concentrations decreased by 31% in 2017 compared to 2016. The TAN flow-weighted concentrations decreased by 76%, in 2017 compared to 2012.

Table 2: Flow-weighted summer and winter TAN concentrations, total loading and targets

Year	Winter TAN flow-weighted concentration (mg/L)	Summer TAN flow-weighted concentration (mg/L)	Summer Target (mg/L)	Winter Target (mg/L)	Total Loading (tonnes per year)
2012	5.5	4.3	1	2	951
2013	3.9	3.2	1	2	773
2014	4.6	3.1	1	2	855
2015	3.6	2.1	1	2	560
2016	2.2	1.3	1	2	347
2017	1.7	0.7	1	2	259

Sludge Accountability and Water Balance

A sludge accountability analysis compares the annual amount of sludge reported by a mechanical plant to the amount of sludge projected based on plant loadings and removal. Conducting this analysis can help to determine if monitoring is truly representative. In 2017, sludge accountabilities were reported for 22 plants in the watershed. For ten of the plants, the accountability "closed" within ± 15%. In 2016, 23 plants reported sludge accountability and 11 plants "closed" within ± 15%.

A water balance analysis compares the annual amount of measured net precipitation on the surface area of a lagoon system to the annual amount of projected net precipitation using lagoon level measurements, total influent and total effluent flows of a lagoon system. This analysis can help to determine if the flow measurement devices at a lagoon are accurate. In 2017, water balances were reported for 2 lagoon systems in the watershed. Both of these analyses did close within ±15%.

Grand River Impacts

Table 3 summarizes the impact of wastewater effluent discharges on the Grand River.

Table 3: WWTP Effluent flow as a percentage of Grand River total flow

Parameter	2012	2013	2014	2015	2016	2017
% Annual Average Flow	7%	3%	3%	5%	5%	4%
% August Average Flow	14%	5%	9%	12%	9%	8%

The values in Table 3 are largely a function of precipitation and weather in any given year. In 2017, precipitation was above average. In 2016, precipitation was close to (but lower than) the long-term average. In 2015, precipitation was near the lower end of typical. In 2014, precipitation was close to the long-term average. In 2013, the watershed generally experienced higher than normal precipitation across its central and northern portions. Precipitation in 2012 was near the low end of typical.

Plant Loading

Table 4 summarizes key process loading metrics for 2017 as well as typical values and the minimum and maximum median reported values from 2012 to 2016. The results in the table enable municipalities to compare loadings at their facilities to those at other plants in the watershed, which can be used to determine the impact of industrial discharges and may highlight concerns with unrepresentative sampling of raw influent. For plants that do not measure TBOD in the raw influent it was assumed to be 20% higher than the cBOD measurement.

Table 4: Summary of 2012 to 2017 watershed WWTP performance measures

Performance Measure	Watershed Median 2012 to 2016 (min-max)	2017 Watershed Median	Typical Value
Per capita flow (L/person/day)	294 - 351	**332**	350 - 500
ADF as % of Nominal Design	51% - 66%	**61%**	N/A
Peak day: Annual average flow	2.25 - 2.75	**2.49**	2.5 - 4
Per capita TBOD loading (g/person/day)	65 - 77	**75**	80
Per capita TSS loading (g/person/day)	69 - 93	**78**	90
Per capita TKN loading (g/person/day)	13 - 14	**14**	13
Per Capita TP loading (g/person/day)	1.7 – 2.0	**1.6**	2.1
Raw TSS:TBOD ratio	1.01 - 1.17	**1.08**	0.8 - 1.2
Raw TKN:TBOD ratio	0.17 - 0.22	**0.22**	0.1 - 0.2

Year-to-year variations in many of the flow metrics in Table 4 are largely due to differences in inflow and infiltration (I&I) related to precipitation.

By embracing an optimization approach to reduce the impacts of wastewater effluents on the Grand River, including nutrients, municipal wastewater managers and operators can help to ensure a healthy and sustainable watershed that supports prosperous and growing communities into the future.

Contact

Further information on the Grand River Watershed-wide Optimization Program can be obtained from the Grand River wastewater optimization web page, or by contacting Kelly Hagan, Optimization Extension Specialist at 519-621-2761 Ext. 2295 or Mark Anderson, Water Quality Engineer at 519-621-2761 Ext. 2226