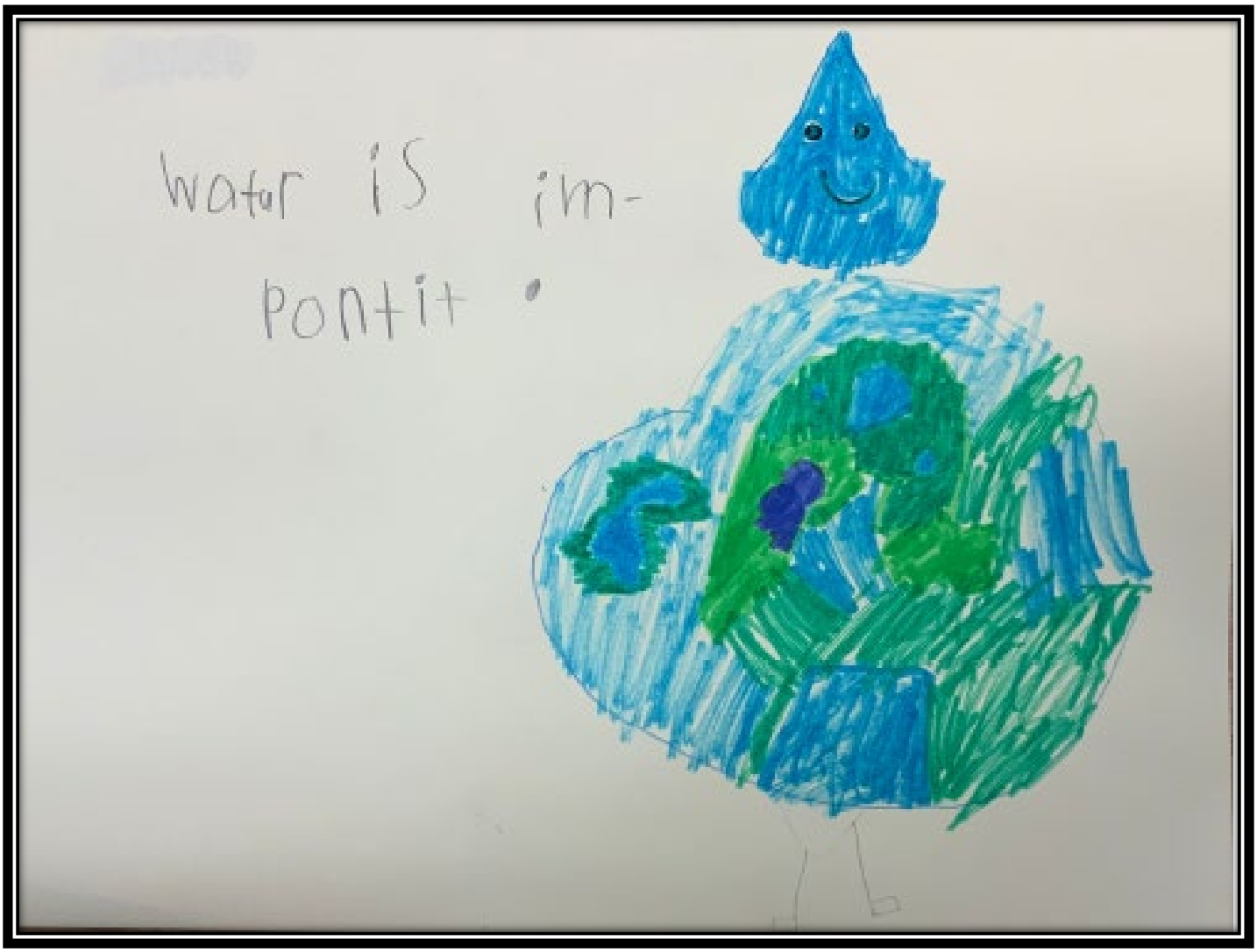
Harmony Creek Water Pollution Control Plant

2019 Annual Performance Report



The Regional Municipality of Durham
Harmony Creek Water Pollution Control Plant 2019 Annual Performance Report

Environmental Compliance Approval (ECA): 2407-AK8KJH Dated May 23, 2017
Environmental Compliance Approval (Air): 5562-AM9RPN Dated May 18, 2017

The Harmony Creek Water Pollution Control Plant (WPCP) 2019 Performance Report provides staff, stakeholders and customers a performance overview of the Harmony Creek WPCP. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment, Conservation and Parks (MECP). This report demonstrates the commitment of ensuring that the WPCP continues to deliver wastewater services to our customers in an environmentally responsible manner.

Water Pollution Control Plant Process Description

General

The Harmony Creek WPCP located in the City of Oshawa, is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECA's.

The Harmony Creek WPCP treats wastewater from the Oshawa and Courtice (Municipality of Clarington) service area. The Harmony Creek WPCP shares its catchment area flows with the Courtice WPCP. The Harmony Creek WPCP services approximately 34,719 residents or 19 % of the total catchment population.

The Harmony Creek WPCP is designed to treat wastewater at an average flow rate of 34,100 cubic metres per day (m^3/d). The plant is a MECP Class 4 conventional activated sludge treatment plant that utilizes the following processes to treat wastewater:

- raw influent pumping,
- preliminary treatment,
- primary treatment,
- secondary treatment,
- phosphorus removal,
- disinfection (chlorination/dechlorination), and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 691 kilometres of sanitary sewers in Oshawa and Courtice and is conveyed to the Harmony Creek WPCP and the Harmony Creek Sanitary Sewage Pumping Station (SSPS). Approximately 81% of the influent flow is diverted to the Harmony Creek SSPS and conveyed to the Courtice WPCP. The remaining flow is treated at the Harmony Creek WPCP.

Preliminary Treatment

Screening: One mechanically cleaned screen and one emergency manual screen remove rags and large debris that could harm pumps and process equipment. Screenings are compacted for landfill disposal.
Grit Removal: Heavy suspended material such as sand and small stones (grit) is removed in the aerated grit tank. The velocity of the wastewater rolling in the tanks is controlled by the quantity of air added to produce conditions that allow heavy grit material to settle, while keeping the lighter organic material in suspension to proceed to the next process tank. The grit removed in this process is transported to landfill.

Primary Treatment

The primary clarifier utilizes the physical process of sedimentation which allows suspended material to settle to the bottom of the tank as sludge. This raw sludge, along with excess activated sludge from the secondary treatment process is collected by a flight and chain mechanism which pushes the sludge into hoppers. The sludge is then pumped to the anaerobic digester for further treatment. Any material floating on the surface of the clarifier is also removed to the digester. In November of 2016 the primary clarifier was taken out of service to facilitate the maintenance and construction upgrades planned for the anaerobic digester. Flows have been redirected to bypass the clarifier and go directly to the aeration tanks.

Secondary Treatment

Aeration: The Harmony Creek WPCP has a flexible aeration system which can operate as two individual aeration tanks or as one large aeration tank. The current configuration is as one large aeration tank. The effluent from the primary clarifier flows into the aeration tanks. Here fine bubbled air is diffused into the wastewater to assist bacteria in removing dissolved and suspended organics, and nutrients from the wastewater. Biological activity is controlled to assimilate the organic material.
Secondary Clarifier: The effluent from the aeration tank is directed to the two secondary clarifiers where the solids settle quickly to the bottom as activated sludge leaving clear supernatant. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the head of the aeration tank and the excess activated sludge is wasted to the primary clarifier.

Phosphorus Removal

The phosphorous removal system lowers the total phosphorous level in the final effluent by adding a chemical coagulant, ferrous chloride, into the primary clarifier effluent.

Disinfection (chlorination/dechlorination)

Chlorine in the form of liquid sodium hypochlorite, is metered into the secondary effluent stream for pathogen control. Adequate contact time is provided by the chlorine contact chamber. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged to Lake Ontario.

Solids Treatment

Anaerobic Digestion: The raw sludge that is collected from the primary clarifier is pumped into the anaerobic digester where anaerobic bacteria reduce the volume of sludge. As a result of digestion the plant produces a more stabilized sludge, water, carbon dioxide, methane, and hydrogen sulphide. The supernatant is returned to the head of the plant for further treatment. The methane is used for heating of the digester to offset the natural gas requirements or is flared off. In November of 2016 the anaerobic digester was taken out of service for maintenance and upgrades. The waste activated sludge (WAS) flows are being directed to the Courtice WPCP through the Harmony Creek SSPS.
Sludge Management: Due to digester maintenance, all sludge produced in the reporting period was pumped to the Courtice WPCP via the Harmony Creek SSPS.

Environmental Compliance Approval (ECA)

Under Condition 11.(4) of ECA 2407-AK8KJH the Region of Durham must produce an annual performance report that contains the following information:

a) Summary and interpretation of all monitoring data and a comparison to the effluent limits;

The raw wastewater flowing into the plant is analyzed for its chemical and physical composition. Monitoring of the raw wastewater is performed in accordance with the conditions in the ECA. The plant operated at an average of 34.0% of its annual average rated flow capacity and received a maximum daily flow of 26,039 m^3/d on April 20, 2019. Tables 1 and 2 summarize the flow and raw wastewater characteristics during the reporting period.

b) Summary and interpretation of all Final Effluent monitoring data and a comparison to the compliance limits condition;

The Harmony Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. See tables 3 and 4 for effluent results.

c) Description of any operating problems encountered and corrective actions taken;

Harmony Creek WPCP ran as an extended aeration treatment plant due to the primary being by-passed for construction upgrades.

d) Summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the Works;

Major maintenance items in 2019 included:

- Harmony Creek SSPS Flygt pump is out for service/replacement,
- pumping station bar screen mechanism failed, sent out for repair, reinstalled and is back in service,
- aging ferrous chloride building and pump room are experiencing structural damage, investigating ways to mitigate damage, and
- construction of the plant upgrades is nearing completion.

e) Summary of any effluent quality assurance or control measures undertaken in the reporting period;

- In-house lab test results are compared to the results of the Regional Environmental Laboratory on comparable samples to determine the in-house accuracy. All results were found to be within a comparable range.

f) Summary of the calibration and maintenance carried out on all influent and final effluent monitoring equipment;

- Calibration of the effluent flow meter occurred on October 11.
- Calibration of the in house laboratory equipment was conducted regularly.

g) Description of efforts made and results achieved in meeting the design objectives condition;

The Region continually strives to achieve the best effluent quality at all times, remaining below the ECA compliance limits.

- The average daily rated flow capacity of 34,100 m^3/d was not exceeded.
- The pH objective of not less than 6.5 was exceeded in 7 of 257 samples (2.7%). Calibration of the pH probe is performed regularly.

Best efforts will continue to be applied to maintain results below objectives.

h) Biosolids Production;

Tabulation of volume of sludge generated;

Due to digester maintenance, all sludge produced in the reporting period was pumped to the Courtice WPCP via the Harmony Creek SSPS.

Outline of anticipated volumes to be generated in the next reporting period:

Sludge treatment is expected to resume in 2020 after maintenance and upgrades on the digester and the digested sludge storage tank is complete.

Summary of locations to where sludge was disposed:

All sludge produced during the reporting period was pumped to the Courtice WPCP via the Harmony Creek SSPS.

i) Summary of any complaints received during the reporting period and any steps taken to address the complaints;

A summary of complaints received from the public is administered through a central database.

No complaints were received in 2019.

j) Summary of By-passes, Overflows, reportable spills or abnormal discharge events:

There were no by-passes or overflows during the reporting period.

There were no spills during the reporting period.

k) Schedule 'B', Section 1 Notice of Modifications and Status Update

No schedule 'B', Section 1 Notice of Modifications were submitted in 2019.

l) Schedule 'B', Section 3 Modifications

No schedule 'B', Section 3 Modifications were completed in 2019.

m) Information Required by Ministry of the Environment, Conservation and Parks (MECP) Water Supervisor

No additional information was requested.

MECP Inspection

This plant was last inspected by the MECP on January 26, 2016.

Table 1 Final Effluent Flows

Month	Total Flow to Plant -metered at the final effluent cubic metre (m^3)	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	365,913	11,804	14,558
February	304,620	10,879	14,195
March	342,349	11,044	16,122
April	424,333	14,144	26,039
May	330,504	10,661	12,659
June	314,902	10,497	13,248
July	338,998	10,935	13,121
August	317,203	10,232	11,471
September	312,061	10,402	11,759
October	350,258	11,299	18,797
November	384,863	12,829	19,366
December	448,618	14,472	17,844
Total	4,234,621		
Average	352,885	11,602	
Minimum	304,620		
Maximum	448,618		26,039
ECA Requirement		34,100	
Met Compliance		Yes	

Table 2 Raw Influent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading kg/d	Biochemical Oxygen Demand avg. conc. mg/L	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d	Total Phosphorous (TP) avg. conc. mg/L	TP loading kg/d
January	101	1,195	152	191	2,252	4.3	51
February	124	1,349	189	207	2,252	5.1	56
March	108	1,189	187	214	2,363	4.3	48
April	61	868	128	148	2,093	2.7	38
May	84	892	189	132	1,407	3.2	34
June	114	1,198	192	235	2,466	4.8	50
July	121	1,318	219	288	3,149	6.7	73
August	145	1,479	261	334	3,418	7.4	75
September	119	1,238	247	258	2,684	5.6	59
October	160	1,802	325	306	3,457	5.7	65
November	100	1,286	258	235	3,013	3.8	49
December	89	1,293	181	244	3,531	4.4	63
Average	110	1,281	210	233	2,699	4.8	56
Minimum	61	868	128	132	1,407	2.7	34
Maximum	160	1,802	325	334	3,531	7.4	75
Sampling Frequency Requirement Met			Yes	Yes		Yes	

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average avg. conc. mg/L	Total Ammonia Nitrogen average (avg.) concentration (conc.) milligram per litre (mg/L)	Nitrate plus Nitrite mg/L	pH minimum	pH maximum
January	37.24	20.52	0.6	6.9	7.8
February	39.23	21.79	0.4	6.7	7.5
March	38.23	19.42	0.4	6.9	7.6
April	25.18	12.97	1.2	6.9	7.9
May	29.70	16.36	0.7	6.6	7.5
June	35.28	19.72	0.4	7.1	7.4
July	40.70	25.48	0.4	6.7	7.4
August	41.80	25.90	0.4	6.8	7.3
September	50.18	24.60	0.5	6.6	7.3
October	50.56	28.99	0.4	6.7	7.5
November	38.20	23.05	0.4	6.5	7.5
December	41.83	20.67	1.1	6.7	8.0
Average	39.01	21.62	0.6		
Minimum	25.18	12.97	0.4	6.5	
Maximum	50.56	28.99	1.2		8.0
Sampling Frequency Requirement Met	Yes				

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading kilogram per day (kg/d)	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d	Total Phosphorous (TP) avg. conc. mg/L	TP loading kg/d	Total Ammonia Nitrogen (TAN) avg. conc. mg/L
January	6.3	74.4	10.7	126	0.43	5	0.55
February	7.4	80.5	10.9	119	0.49	5	1.85
March	3.9	43.1	6.5	72	0.27	3	2.69
April	4.1	58.0	5.6	79	0.16	2	0.39
May	3.0	32.0	5.3	56	0.16	2	0.36
June	5.0	52.5	8.6	90	0.39	4	0.16
July	4.9	53.6	8.8	96	0.57	6	0.24
August	4.3	44.0	8.5	87	0.71	7	0.30
September	2.5	26.0	5.9	61	0.66	7	0.33
October	2.7	30.5	4.7	53	0.41	5	0.18
November	3.2	41.1	8.1	104	0.29	4	0.20
December	4.6	66.6	12.1	175	0.35	5	0.29
Average	4.3	50.6	8.0	93	0.41	5	0.63
Minimum	2.5	26.0	4.7	53	0.16	2	0.16
Maximum	7.4	80.5	12.1	175	0.71	7	2.69
ECA Limit	25.0	852.5	25.0	852.5	1.0	34.1	
ECA Objective	15.0		15.0		0.8		
Within Compliance	Yes	Yes	Yes	Yes	Yes	Yes	
Sampling Frequency Requirement Met	Yes		Yes		Yes		Yes

Table 3 Final Effluent Analyses continued

Month	Unionized Ammonia average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Kjeldahl Nitrogen average avg. conc. mg/L	Total Chlorine Residual avg. conc. mg/L	Nitrate plus Nitrite mg/L	pH minimum	pH maximum	Temperature degree Celsius avg.
January	0.0	2.60	0.00	19.6	6.5	7.2	11.3
February	0.0	5.49	0.00	18.5	6.5	7.1	12.9
March	0.0	5.19	0.00	16.4	6.6	7.2	12.2
April	0.0	2.17	0.00	14.1	6.8	7.6	13.4
May	0.0	1.74	0.00	16.6	6.6	7.3	14.5
June	0.0	2.38	0.00	17.8	6.6	7.2	17.4
July	0.0	2.15	0.00	17.7	6.5	6.8	20.6
August	0.0	2.12	0.00	16.2	6.5	6.8	21.6
September	0.0	1.93	0.00	16.1	6.2	6.9	20.6
October	0.0	1.71	0.00	18.9	6.3	7.3	18.5
November	0.0	1.89	0.00	17.8	6.3	7.2	15.5
December	0.0	1.93	0.00	15.5	6.6	7.3	11.8
Average	0.0	2.61	0.00	17.1			15.9
Minimum	0.0	1.71	0.00	14.1	6.2		11.3
Maximum	0.0	5.49	0.00	19.6		7.6	21.6
ECA Limit			0.02		6.0	9.5	
ECA Objective			0.01		6.5	8.5	
Within Compliance			Yes		Yes	Yes	
Sampling Frequency Requirement Met			Yes		Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Geometric Mean Density
January	5	120
February	4	9
March	4	10
April	4	27
May	5	79
June	4	120
July	5	54
August	4	23
September	4	30
October	5	10
November	4	74
December	4	63
ECA Limit		200
ECA Objective		150
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Ferrous Chloride litre	Sodium Hypochlorite kilograms as chlorine	Sodium Bisulphite litre	Hydro kilowatt hour	Natural Gas cubic metres
January	19,127	950	1,238	536,887	11,814
February	15,040	773	1,215	533,399	10,720
March	16,362	988	1,262	639,393	9,094
April	18,269	952	1,677	656,495	6,224
May	16,802	774	1,395	590,203	5,362
June	18,339	845	1,322	446,832	3,153
July	17,346	949	1,449	379,032	3,849
August	21,569	826	1,343	365,461	63
September	29,967	843	1,285	366,603	667
October	30,705	870	1,501	421,812	10,739
November	4,712*	940	1,599	506,613	16,477
December	14,829*	1,160	1,767	548,657	37,761
Total	223,067	10,871	17,053	5,991,387	115,923

*The level sensor was out of service Nov. 6-Dec. 13, 2019.