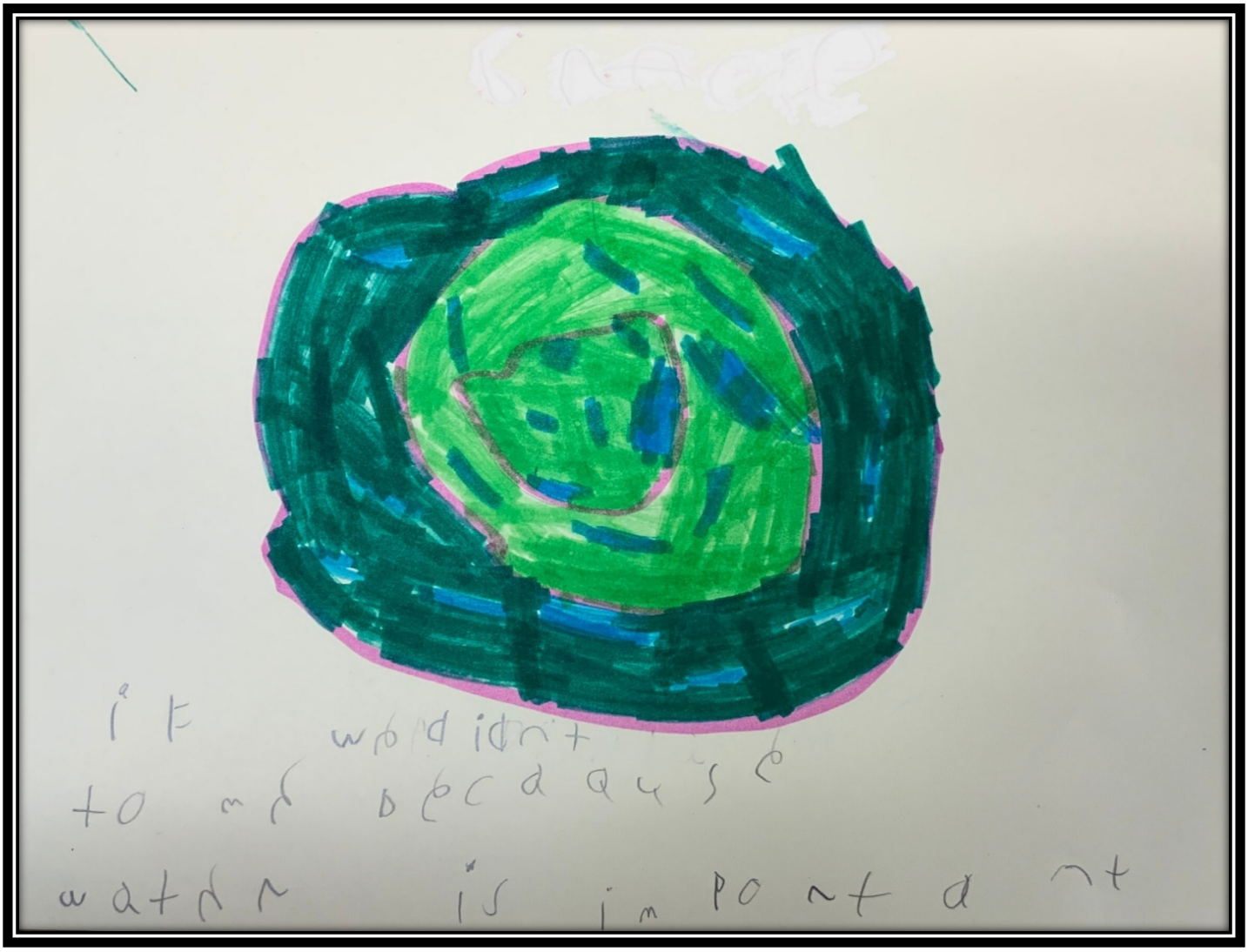
Lake Simcoe Water Pollution Control Plant

2019 Annual Performance Report



The Regional Municipality of Durham
Lake Simcoe Water Pollution Control Plant 2019 Annual Performance Report

Environmental Compliance Approval (ECA): 5292-8CYHTQ Dated June 28, 2012
Environmental Compliance Approval (Air): 8-3041-95-006 Dated February 5, 1996

The Lake Simcoe Water Pollution Control Plant (WPCP) 2019 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Lake Simcoe WPCP. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of 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 Lake Simcoe WPCP located in the Community of Beaverton in the Township of Brock is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECA. This MECP Class 3 wastewater treatment plant utilizes an extended aeration process with tertiary treatment and is designed to treat wastewater at a rated capacity of 4,550 cubic metres per day (m^3/d). The Lake Simcoe WPCP has a service population of approximately 4,121 residents.

Lake Simcoe WPCP treats wastewater from the Community of Beaverton service area utilizing the following processes;

- raw influent pumping,
- preliminary treatment,
- phosphorus removal,
- secondary treatment,
- tertiary treatment,
- disinfection and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 24.8 kilometres of sanitary sewers in Beaverton and is conveyed to the WPCP by gravity and two sanitary sewage pumping stations (SSPS); Harbour Street and Cedar Beach located in the collection system. Flow from the two SSPS are combined in the raw sewage inlet channel.

Preliminary Treatment

Screening: There are two screen channels in the screen room for the removal of paper products and large material that could harm pumps and process equipment. One channel contains an automatic,

mechanically cleaned bar screen and the other is equipped with a bar rack to provide screening on an emergency basis. Screenings are removed in this process and transported to landfill for disposal.
Grit Removal: Vortex grit removal is provided to remove sand and small stones (grit) for protection of mechanical equipment from unnecessary wear and reduce formation of heavy deposits in pipelines, channels and process tanks. The vortex grit tank uses centrifugal force to separate the grit from the wastewater. Grit is collected in the lower portion of the grit tank and is pumped to a grit classifier for dewatering. The dewatered grit is conveyed to the grit/screenings bin for landfill disposal.

Phosphorus Removal

The phosphorous removal system lowers the total phosphorous level in the final effluent by adding a chemical coagulant (aluminum sulphate) as part of the treatment process. Aluminum sulphate can be added at multiple locations within the plant.

Secondary Treatment

Aeration Tanks: Preliminary effluent flow is directed to two aeration tanks. Surface mechanical aerators mix air into the wastewater to assist bacteria in removing dissolved and suspended organics and nutrients from the wastewater.
Secondary Clarifier: The effluent from the aeration tanks is directed to two secondary clarifiers where solids settle quickly as activated sludge leaving a clear effluent. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the head of the aeration tanks and the excess activated sludge is wasted to the aerobic digester.

Tertiary Treatment

Tertiary Clarifier: The secondary effluent is directed to the tertiary clarifier. The helical flow pattern in the clarifier separates the solids from the liquid, the effluent flows over to the tertiary sand filter and the thickened sludge is pumped to the aerobic digester.
Tertiary Sand Filter: Effluent flow from the tertiary clarifier flows into an automatic cleaning sand filter. The automatic backwash is initiated by an increase in head pressure or a programmed timer. The backwash water is returned to the beginning of the plant for further treatment.

Disinfection

Ultra Violet (UV) Irradiation: The effluent flow from the sand filter is then directed to the UV channel for disinfection. The flow passes two banks of UV lamps connected in series before being discharged to Lake Simcoe through the 400mm diameter outfall extending 314 metres into Lake Simcoe.

Solids Treatment

Aerobic Digester: Activated sludge from the secondary clarifiers is pumped to an aerobic digester for stabilization. A mechanical mixer and a fixed header diffused aeration system provide oxygen for the

microorganisms. The mixer and diffusers are turned off to allow solids to settle for removal and the supernatant to be decanted and flow by gravity to the raw sewage pumping station.
Sludge Management: Stabilized biosolids from the digester are transported to Duffin Creek WPCP for further treatment and incineration.

Environmental Compliance Approval

Under Condition 9.(5) of ECA # 5292-8CYHTQ the Region must produce an annual performance report that must contain 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. Table 2 summarizes the raw wastewater characteristics during the reporting period.

The Lake Simcoe WPCP effluent was compliant with the approval limits during the reporting period. The plant operated at 40.2% of its rated capacity and received a maximum daily flow of 5,120 m^3/d on April 27. Tables 3-5 provide a tabulation of effluent results.

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

One of the two aeration tanks was out of service between January and June 2019. Maintenance work on the draft tube and impeller was postponed until spring as tank was frozen and could not be cleaned out in winter.

c) 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:

- replaced the air handling unit in the secondary building basement, and
- rebuilt the aeration tank draft tube and impeller with a new splash plate.

d) 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. Results were found to be in a comparable range. On-line instrumentation is verified by WPCP operators using various field or laboratory test equipment.

e) Summary of the calibration and maintenance carried out on all effluent monitoring equipment;

- Calibration of the effluent flow meter occurred on May 29 and October 22.
- Calibration of the in-house laboratory equipment was conducted on August 27.
- Verification of the pH meter is conducted regularly.

Final effluent flow between July 30 and 31 was estimated as the flow meter was out of service to replace a circuit board.

f) Description of efforts made and results achieved in meeting the effluent objectives;

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

- The effluent objective for carbonaceous oxygen demand was exceed in 1 of 53 samples (1.9%)
- The effluent objective for total suspended solids was exceeded in 8 of 309 samples (2.6%)
- The effluent objective for total phosphorus was exceeded in 4 of 308 samples (1.3%)
- Results for total suspended solids and total phosphorus were monitored and adjustments were made to the treatment process.
- Objective exceedances occurred between February and May when the plant had only one aeration tank in service. The second tank was brought back into service in June as repairs could not be performed in the winter season.

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

g) Biosolids Production;

Tabulation of Volume of Sludge Generated:

The volume of sludge removed from Lake Simcoe WPCP in 2019 was 3,168 m^3.

Outline of Anticipated Volumes to be Generated in the Next Reporting Period;

There is no increase of sludge volume expected in the next reporting period.

Summary of Locations to Where Sludge was Disposed;

All sludge produced was transported to Duffin Creek WPCP for incineration.

h) 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.

i) Summary of all By-pass, Spill or Abnormal Discharge;

No by-passes, spills or abnormal discharges occurred during the reporting period.

j) Status Update of Initial Effluent Characterization;

The initial effluent characterization report was submitted to MECP in 2015.

k) Information required by Ministry of the Environment, Conservation and Parks District Manager;

No additional information was requested.

Ministry of the Environment, Conservation and Parks (MECP) Inspection

This plant was last inspected by the MECP on March 6, 2019. No compliance items were identified in the report. The MECP did however, recommend that the Region continue to use best efforts to ensure the effluent of the WPCP meets the objectives outlined in the ECA.

Table 1 Effluent Flows

Month	Total Plant Flow metered at the final effluent in cubic metre (m^3)	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	45,104	1,455	2,700
February	36,395	1,300	2,593
March	56,643	1,827	3,339
April	106,890	3,563	5,120
May	115,450	3,724	5,093
June	67,233	2,241	3,512
July	48,763	1,573	3,561
August	27,248	879	1,140
September	27,790	926	1,321
October	34,039	1,098	2,997
November	47,497	1,583	3,089
December	55,046	1,776	3,292
Total	668,100		
Average	55,675	1,830	
Minimum	27,248		
Maximum	115,450		5,120
ECA Limit		4,550*	
Met Compliance		Yes	Yes

*Annual Average

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand (BOD_5) average (avg.) concentration (conc.) milligram per litre (mg/L)	BOD_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 avg. loading (kg/d)	Alkalinity $CaCO_3$ mg/L
January	70	102	67	98	2.0	3	280
February	72	94	71	93	2.3	3	267
March	62	114	61	112	2.0	4	258
April	35	123	54	193	0.9	3	261
May	37	138	64	237	1.0	4	277
June	41	93	68	152	1.3	3	290
July	83	131	124	194	2.8	4	251
August	121	106	110	97	3.6	3	263
September	171	158	111	103	3.6	3	265
October	123	136	96	105	3.3	4	283
November	75	119	71	113	2.0	3	276
December	60	106	62	111	1.7	3	291
Average	79	145	80	146	2.2	4	272
Minimum	35	93	54	93	0.9	3	251
Maximum	171	158	124	237	3.6	4	291
Sampling Frequency Requirement Met	Yes		Yes		Yes		Yes

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average concentration (conc.) milligram per litre (mg/L)	Total Ammonia Nitrogen (TAN) average conc. mg/L	TAN loading kilogram per day	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	21.60	14.6	21	6.7	7.1	9.0
February	22.05	16.6	22	6.6	7.0	8.4
March	19.90	13.8	25	6.7	7.5	8.6
April	8.49	4.8	17	6.9	7.6	8.5
May	11.27	7.1	26	7.0	7.4	11.3
June	12.80	8.6	19	7.0	7.5	14.4
July	26.10	17.1	27	7.0	7.5	17.9
August	34.73	24.7	22	6.9	7.2	17.9
September	36.48	25.0	23	6.9	7.1	17.2
October	31.32	23.3	26	6.7	7.4	14.9
November	23.35	15.1	24	6.9	7.6	12.2
December	16.92	12.7	23	7.3	7.5	10.0
Average	22.08	15.3	28			
Minimum	8.49	4.8	17	6.6		8.4
Maximum	36.48	25.0	27		7.6	17.9
Sampling Frequency Requirement Met	Yes			Yes	Yes	

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading kilogram per day (kg/d)	Total Suspended Solids (TSS) average conc. mg/L	TSS loading kg/d
January	1.0	1	0.6	1
February	1.0	1	1.1	1
March	1.0	2	1.6	3
April	2.5	9	2.9	10
May	1.0	4	3.2	12
June	1.0	2	1.1	2
July	1.0	2	0.7	1
August	1.0	1	0.8	1
September	1.0	1	0.9	1
October	1.0	1	0.6	1
November	1.0	2	0.7	1
December	1.0	2	0.6	1
Total				
Average	1.1	2	1.2	2
Minimum	1.0	1	0.6	1
Maximum	2.5	9	3.2	12
ECA Limit	10*		10*	
ECA Objective	5		5	
Lake Simcoe Phosphorous Reduction Strategy				
Within Compliance	Yes		Yes	
Sampling Frequency Requirement Met	Yes		Yes	

*Monthly Average Concentration

Table 3 Final Effluent Analyses continued

Month	Total Phosphorous (TP) average (avg.) concentration (conc.) milligram per litre (mg/L)	TP avg. loading kilogram per day	TP avg. loading kilogram per month
January	0.06	0	3
February	0.08	0	3
March	0.08	0	4
April	0.06	0	6
May	0.06	0	7
June	0.03	0	2
July	0.05	0	2
August	0.05	0	1
September	0.07	0	2
October	0.05	0	2
November	0.03	0	1
December	0.03	0	2
Total			36*
Average	0.05	0	3
Minimum	0.03	0	1
Maximum	0.08	0	7
ECA Limit	0.3**		190*
ECA Objective	0.12		190
Lake Simcoe Phosphorous Reduction Strategy	0.15***		190*
Within Compliance	Yes		Yes
Sampling Frequency Requirement Met	Yes		Yes

*Total Annual Loading, kg/year
**Monthly Average Concentration
***Annual Average Concentration

Table 3 Final Effluent Analyses continued

Month	Total Ammonia Nitrogen (TAN) average (avg.) concentration (conc.) milligram per litre (mg/L) summer	TAN avg. conc. mg/L winter	TAN loading kilogram per day	Total Kjeldahl Nitrogen avg. conc. mg/L	Unionized Ammonia Nitrogen avg. conc. mg/L
January		1.94	3	2.80	0.0
February		4.86	6	5.62	0.0
March		4.19	8	5.23	0.0
April		0.72	3	1.61	0.0
May		1.08	4	1.91	0.0
June	0.08		0	0.73	0.0
July	0.03		0	0.63	0.0
August	0.04		0	0.72	0.0
September		0.04	0	0.81	0.0
October		0.02	0	0.68	0.0
November		0.03	0	0.59	0.0
December		0.06	0	0.57	0.0
Average	0.05	1.44	2	1.82	0.0
Minimum	0.03	0.02	0	0.57	0.0
Maximum	0.08	4.86	8	5.62	0.0
ECA Limit	5**	15**			
ECA Objective	3	10			
Within Compliance	Yes	Yes			
Sampling Frequency Requirement Met	Yes	Yes			

**Monthly Average Concentration

Table 3 Final Effluent Analyses continued

Month	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	6.5	6.7	8.5
February	6.5	6.7	7.8
March	6.5	7.1	8.3
April	6.7	7.1	8.8
May	6.7	7.1	12.2
June	6.7	7.3	14.3
July	6.7	7.4	20.3
August	6.6	6.9	19.9
September	6.6	6.9	17.8
October	6.6	7.3	14.7
November	6.8	7.4	11.8
December	6.8	7.6	9.8
Minimum	6.5		7.8
Maximum		7.6	20.3
ECA Objective	6.5	9.0	
Sampling Frequency Requirement Met	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	3
February	4	19
March	4	7
April	4	1
May	5	3
June	4	2
July	5	0
August	4	2
September	4	1
October	5	5
November	4	4
December	5	3
ECA Objective		40 organisms/100ml
Sampling Frequency Requirement Met	Yes	

Table 5 Total Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	35
February	4	114
March	4	82
April	4	6
May	5	43
June	4	9
July	5	1
August	4	16
September	4	3
October	5	17
November	4	29
December	5	15
Sampling Frequency Requirement Met	Yes	

Table 6 Energy and Chemical Usage

Month	Aluminum Sulphate litre	Hydro kilowatt hour	Natural Gas cubic metre
January	3,259	66,600	16,484
February	2,691	61,560	22,889
March	5,113	68,040	10,894
April	9,931	61,200	15,832
May	8,664	72,720	3,356
June	7,642	42,840	1,141
July	4,781	69,480	8,988
August	3,015	54,000	372
September	3,217	63,720	854
October	4,401	56,520	1,105
November	5,201	58,680	11,894
December	6,236	80,280	17,313
Total	64,149	755,639	111,122