Lake Simcoe Water Pollution Control Plant

2020 Annual Performance Report

The Regional Municipality of Durham
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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) 2020 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 and 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 4,628 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 27.2 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: The vortex grit removal removes sand and small stones (grit) for the 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 phosphorus removal system lowers the total phosphorus 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 (ECA)

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 42.3% of its rated capacity and received a maximum daily flow of 5,364 m^3/d on January 12, 2020. Tables 3-5 provide a tabulation of effluent results.

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

A Request for Pandemic Related Temporary Relief (Alternative Arrangement) for Municipal Wastewater Systems was submitted to the MECP on March 31, 2020. The request was made for relief of influent sampling to assist in managing workload and for the health and safety of staff.

The Director granted relief on April 29, 2020. Lake Simcoe WPCP returned to normal sampling practices on June 1, 2020.

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 2020 included:

- Replaced dissolved oxygen sensor in the aeration tank #1,
- Inspected aeration tank #2,
- Replaced UV tubes and cleaned sleeves,
- Cleaned raw inlet channel, Harbour Street and Cedar Beach SSPS wet wells,
- Replaced uninterruptible power supply (UPS) and serviced pump #2 at Cedar Beach SSPS, and
- Replaced UPS at Harbour Street SSPS.

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 6 and October 7, 2020.
- Calibration of the in-house laboratory equipment was conducted on October 15, 2020.
- Calibration of the balance scale was conducted on March 2.
- Verification of the pH meter is conducted regularly.

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

The Region continually strives to achieve the best effluent quality at all times and remain below the objectives specified in the ECA.

- The total suspended solids objective of 5.0 mg/L was exceeded in 15 of 352 samples (4.3%)
- The total phosphorus objective of 0.12 mg/L was exceeded in 13 of 352 samples (3.7%)

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 2020 was 2,984 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 further treatment and 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 2020.

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.

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	97,368	3,141	5,364
February	41,950	1,447	2,822
March	92,082	2,970	4,313
April	91,695	3,056	4,069
May	48,846	1,576	2,384
June	41,051	1,368	2,213
July	33,414	1,078	1,641
August	50,744	1,637	4,062
September	50,460	1,682	2,729
October	46,932	1,514	2,462
November	51,103	1,703	2,328
December	58,976	1,902	2,558
Total	704,621		
Average	58,718	1,925	
Minimum	33,414		
Maximum	97,368		5,364
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)	Total Suspended Solids (TSS) avg. conc. mg/L	Total Phosphorus (TP) avg. conc. mg/L	Alkalinity calcium carbonate mg/L
January	50	59	1.4	276
February	79	83	2.2	288
March	44	52	1.1	278
April	59	65	1.2	274
May	77	97	2.1	260
June	93	105	2.4	255
July	90	92	3.1	232
August	77	91	2.4	248
September	71	86	2.1	282
October	86	95	2.5	306
November	88	90	2.3	281
December	84	119	2.0	322
Average	75	86	2.1	275
Minimum	44	52	1.1	232
Maximum	93	119	3.1	322
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average concentration milligram per litre	pH minimum	pH maximum
January	13.23	7.0	7.4
February	21.00	6.9	7.2
March	9.42	6.9	7.6
April	15.00	7.0	7.4
May	22.50	6.9	7.5
June	25.32	6.8	7.2
July	28.53	6.9	7.2
August	22.50	6.9	7.2
September	20.44	7.0	7.4
October	25.20	6.9	7.3
November	24.00	7.0	7.2
December	19.56	6.8	7.3
Average	20.56		
Minimum	9.42	6.8	
Maximum	28.53		7.6
Sampling Frequency Requirement Met	Yes	Yes	Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids (TSS) avg. conc. mg/L
January	1.3	6.8
February	1.3	1.8
March	1.0	2.1
April	1.0	1.1
May	1.0	0.9
June	1.0	1.4
July	1.0	0.7
August	1.0	0.8
September	1.0	0.7
October	1.0	0.6
November	1.0	0.9
December	1.0	1.4
Total		
Average	1.0	1.6
Minimum	1.0	0.6
Maximum	1.3	6.8
ECA Limit	10*	10*
ECA Objective	5	5
Lake Simcoe Phosphorus Reduction Strategy		
Within Compliance	Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes

*Monthly Average Concentration

Table 3 Final Effluent Analyses continued

Month	Total Phosphorus (TP) average (avg.) concentration milligram per litre	TP avg. loading kilogram per month
January	0.10	10
February	0.05	2
March	0.05	5
April	0.03	3
May	0.04	2
June	0.05	2
July	0.04	1
August	0.04	2
September	0.06	3
October	0.07	3
November	0.05	3
December	0.05	3
Total		38*
Average	0.05	3
Minimum	0.03	1
Maximum	0.10	10
ECA Limit	0.3**	190*
ECA Objective	0.12	190
Lake Simcoe Phosphorus 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	Unionized Ammonia Nitrogen avg. conc. mg/L
January		0.02	0.0
February		0.03	0.0
March		0.03	0.0
April		0.02	0.0
May		0.02	0.0
June	0.03		0.0
July	0.08		0.0
August	0.05		0.0
September		1.46	0.0
October		0.28	0.0
November		0.03	0.0
December		0.03	0.0
Average	0.05	0.21	0.0
Minimum	0.03	0.02	0.0
Maximum	0.08	1.46	0.0
ECA Limit	5*	15*	
ECA Objective	3	10	
Within Compliance	Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes	Yes

*Monthly Average Concentration

Table 3 Final Effluent Analyses continued

Month	pH minimum	pH maximum	Temperature Degree Celsius average
January	6.8	7.1	7.9
February	6.6	7.0	7.3
March	6.6	8.4	8.6
April	6.6	6.9	9.7
May	6.6	7.0	12.4
June	6.5	7.1	16.6
July	6.5	7.0	21.1
August	6.6	7.0	20.1
September	6.7	7.3	17.8
October	6.9	7.5	14.9
November	7.0	7.2	11.8
December	6.6	7.4	9.8
Minimum	6.5		7.3
Maximum		8.4	21.1
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	8	2
February	8	1
March	8	1
April	4	0
May	4	1
June	10	1
July	8	1
August	9	1
September	9	2
October	8	1
November	9	1
December	9	1
ECA Objective		40 organisms/100ml
Sampling Frequency Requirement Met	Yes	

Table 5 Total Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	7	12
February	8	1
March	8	6
April	4	1
May	4	1
June	10	7
July	8	1
August	9	2
September	9	13
October	8	3
November	9	1
December	9	2
Sampling Frequency Requirement Met	Yes	

Table 6 Energy and Chemical Usage

Month	Aluminum Sulphate litre	Hydro kilowatt hour	Natural Gas cubic metre
January	9,864	63,720	16,099
February	3,991	68,040	17,238
March	11,570	68,040	18,343
April	7,812	74,880	12,743
May	5,714	69,480	33,753
June	4,832	47,880	717
July	4,497	66,240	1,604
August	7,461	73,020	
September	5,703	43,422	
October	5,337	67,510	1,006
November	5,625	60,741	10,809
December	7,140	65,770	14,869
Total	79,546	768,743	127,181