Lake Simcoe Water Pollution Control Plant

2021 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) 2021 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 4,770 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 Raw Influent Analyses 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 40.5% of its rated capacity and received a maximum daily flow of 4,265 cubic metres per day (m^3/d) on September 24, 2021. Tables 3-5 provide a tabulation of effluent results.

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

No operating problems were encountered in 2021.

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

No maintenance was performed on major equipment during the reporting period.

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 an acceptable 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 18 and November 10, 2021.
- Calibration of the in-house laboratory equipment was conducted on October 14, 2021.
- Calibration of the balance scale was conducted on March 25.

- 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 milligrams per litre (mg/L) was exceeded in 7 of 361 samples (1.9%)
- The $CBOD_5$ objective of 5.0 mg/L was exceeded in 2 of 104 samples (1.9%)
- The total phosphorus objective of 0.12 mg/L was exceeded in 72 of 353 samples (20.4%)
- The June - August total ammonia nitrogen objective of 3.0 mg/L was exceeded in 4 of 361 samples (1.1%)
- The September - May total ammonia nitrogen objective of 10.0 mg/L was exceeded in 23 of 361 samples (6.4%)

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 2021 was 3,560 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;

All complaints received from the public are administered and tracked through a central database. Two odour complaints were received from Beaverton residents in 2021. The first complaint was reported on June 10 and the second on June 13. Staff investigated and found no unusual odours at the plant from both dates. The odour could not be confirmed as emanating from the plant. Weekly biosolids haulage from the aerobic digester was increased to reduce retention of biosolids in the plant over the weekends to mitigate potential odours. One complainant acknowledged the odour had dissipated during a follow up call.

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 metres (m^3)	Average Day Flow cubic metres per day (m^3/d)	Maximum Day Flow m^3/d
January	49,177	1,586	1,977
February	31,641	1,130	1,413
March	65,122	2,101	3,599
April	71,003	2,367	3,686
May	60,660	1,957	3,111
June	32,876	1,096	1,755
July	76,074	2,454	3,541
August	62,002	2,000	3,044
September	49,597	1,653	4,265
October	54,035	1,743	3,012
November	52,012	1,734	2,286
December	69,224	2,233	4,141
Total	673,423		
Average	56,119	1,845	
Minimum	31,641		
Maximum	76,074		4,265
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.) milligrams 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	94	106	2.5	339
February	123	111	3.4	312
March	76	82	1.9	293
April	66	82	1.7	305
May	84	90	2.0	309
June	102	114	3.4	274
July	42	61	1.2	286
August	79	86	2.2	256
September	85	78	2.1	271
October	72	77	2.3	302
November	62	64	2.0	307
December	48	65	1.6	340
Average	78	85	2.2	300
Minimum	42	61	1.2	256
Maximum	123	114	3.4	340
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average concentration milligrams per litre	pH minimum	pH maximum
January	24.98	6.8	7.5
February	33.13	7.0	7.5
March	19.74	7.0	7.6
April	19.70	7.3	7.6
May	22.90	6.9	7.7
June	33.02	6.9	7.7
July	11.80	6.9	7.5
August	24.50	6.7	7.2
September	25.53	6.9	8.0
October	21.43	6.6	7.3
November	22.46	6.8	7.5
December	17.45	7.1	7.5
Average	23.05		
Minimum	11.80	6.6	
Maximum	33.13		8.0
Sampling Frequency Requirement Met	Yes	Yes	Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligrams per litre (mg/L)	Total Suspended Solids (TSS) avg. conc. mg/L
January	1.0	0.7
February	3.0	2.5
March	1.5	2.1
April	1.0	1.1
May	1.2	1.3
June	1.0	1.3
July	1.0	1.2
August	1.0	0.9
September	1.0	1.8
October	1.0	1.0
November	1.0	0.9
December	1.1	1.6
Total		
Average	1.2	1.4
Minimum	1.0	0.7
Maximum	3.0	2.5
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 milligrams per litre	TP avg. loading kilograms per month
January	0.05	2
February	0.14	5
March	0.09	6
April	0.07	5
May	0.11	6
June	0.17	6
July	0.07	5
August	0.07	4
September	0.11	5
October	0.06	3
November	0.05	2
December	0.06	4
Total		54*
Average	0.09	5
Minimum	0.05	2
Maximum	0.17	6
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.) milligrams per litre (mg/L) summer	TAN avg. conc. mg/L winter	Unionized Ammonia Nitrogen avg. conc. mg/L
January		0.02	0.0
February		1.65	0.0
March		6.39	0.0
April		9.04	0.0
May		9.39	0.0
June	1.53		0.0
July	0.28		0.0
August	0.21		0.0
September		1.03	0.0
October		0.77	0.0
November		0.08	0.0
December		0.04	0.0
Average	0.67	3.15	0.0
Minimum	0.21	0.02	0.0
Maximum	1.53	9.39	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	6.7	7.2	9.2
February	7.0	7.5	7.5
March	6.8	7.4	9.4
April	7.2	7.7	10.9
May	6.8	7.5	14.1
June	6.9	7.4	17.5
July	7.0	7.4	18.6
August	6.7	7.2	21.7
September	6.9	8.0	19.0
October	6.6	7.4	17.2
November	6.8	7.3	13.2
December	7.0	7.2	11.0
Minimum	6.6		7.5
Maximum		8.0	21.7
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	1
February	8	4
March	10	5
April	8	4
May	9	7
June	9	6
July	8	3
August	9	1
September	9	5
October	8	3
November	9	4
December	9	2
ECA Objective		40 organisms/100ml
Sampling Frequency Requirement Met	Yes	

Table 5 Total Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	8	2
February	8	15
March	10	41
April	8	31
May	9	27
June	9	44
July	8	12
August	9	11
September	9	21
October	8	17
November	9	12
December	9	4
Sampling Frequency Requirement Met	Yes	

Table 6 Energy and Chemical Usage

Month	Aluminum Sulphate litres	Hydro kilowatt hours	Natural Gas cubic metres
January	5,886	65,630	16,342
February	3,886	57,406	23,143
March	7,537	53,641	19,285
April	5,632	44,952	11,991
May	5,736	53,502	14,244
June	4,244	53,147	1,213
July	12,979	57,468	3,720
August	6,447	55,021	998
September	7,622	53,075	1,146
October	7,376	64,092	1,106
November	6,731	59,733	12,066
December	8,978	73,355	14,915
Total	83,052	691,023	120,169