Lake Simcoe Water Pollution Control Plant

2022 Annual Performance Report

The Regional Municipality of Durham
Lake Simcoe Water Pollution Control Plant 2022 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) 2022 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 4,842 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 is added into the aeration tank.

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 Management

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 37.3% of its rated capacity and received a maximum daily flow of 4,639 cubic metres per day (m^3/d) on December 31, 2022. Tables 3-5 provide a tabulation of effluent results.

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

Higher than normal Escherichia coli (E. coli) and Total Coliform results obtained between January and March. Cleaning the channels resolved the issue.
Higher than normal total phosphorus results were obtained between July and September due to no flow to secondary clarifier 2 and fluctuating speeds experienced by the return activated sludge pumps. Cleaning the lines with jet force high pressure water restored the flow. The waste activated sludge connector issue was resolved by replacing the potentiometers.

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 2022 included:

Operations

- Replaced degraded piping on the effluent line in the secondary clarifier building,
- Replaced 2 effluent pumps,
- Removed primary lagoon pumps. Replacement anticipated in 2023,
- Removed secondary lagoon pumps. Replacement anticipated in 2023,
- Removed digester mixers. Replacement anticipated in 2023,

- Installed new stairs to the aeration tanks,
- Replaced shop heaters,
- Secondary clarifier 1 weir damaged. Brackets removed, will be repaired in 2023.

Harbour Street sanitary sewage pumping station

- Installed new control panel and fans,
- Replaced degraded piping in the basement,
- Replaced pump 3,
- Installed a new bypass valve for truck haulage.

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 June 16 and November 24, 2022.
Calibration of the in-house laboratory equipment was conducted on October 18, 2022.
Calibration of the balance scale was conducted on May 16, 2022.
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 6 of 362 samples (1.7%)
- The total phosphorus objective of 0.12 mg/L was exceeded in 60 of 363 samples (16.5%)

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 2022 was 4,084 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. No complaints were received in 2022.

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* cubic metre (m^3)	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	43,730	1,378	1,799
February	48,278	1,724	3,484
March	95,876	3,093	4,464
April	82,344	2,745	3,841
May	64,843	2,092	3,120
June	59,947	1,998	4,152
July	40,412	1,304	1,697
August	35,658	1,150	1,529
September	29,174	972	1,195
October	36,482	1,177	1,627
November	35,065	1,169	1,936
December	48,075	1,551	4,639
Total	619,884		
Average	51,657	1,698	
Minimum	29,174		
Maximum	95,876		4,639
ECA Limit		4,550**	
Met Compliance		Yes	Yes

*Metered at the Final Effluent

**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	102	111	3.3	364
February	111	93	2.9	320
March	50	62	1.4	306
April	41	74	1.3	304
May	82	97	2.0	300
June	71	90	1.9	296
July	112	159	3.2	287
August	129	122	3.5	272
September	118	130	3.9	297
October	182	127	3.9	294
November	107	124	3.6	285
December	107	103	2.7	293
Average	101	108	2.8	302
Minimum	41	62	1.3	272
Maximum	182	159	3.9	364
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	32.75	7.2	7.6
February	31.00	7.3	7.6
March	15.42	7.5	7.8
April	15.76	7.3	7.7
May	24.10	7.1	7.5
June	20.23	7.1	7.4
July	36.20	7.0	7.4
August	37.30	6.9	7.2
September	38.88	6.7	7.3
October	41.43	6.9	7.2
November	34.10	6.9	7.4
December	31.25	7.1	7.5
Average	29.87		
Minimum	15.42	6.7	
Maximum	41.43		7.8
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	1.1	1.7
February	1.0	1.8
March	1.0	1.7
April	1.1	3.3
May	1.2	2.0
June	1.0	1.4
July	1.0	1.5
August	1.0	1.5
September	1.0	1.8
October	1.0	1.0
November	1.0	1.1
December	1.0	1.1
Average	1.0	1.7
Minimum	1.0	1.0
Maximum	1.2	3.3
ECA Limit	10*	10*
ECA Objective	5	5
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	0.08	3
February	0.08	4
March	0.04	4
April	0.09	7
May	0.08	5
June	0.05	3
July	0.12	5
August	0.14	5
September	0.12	4
October	0.08	3
November	0.07	2
December	0.04	2
Annual Loading		47*
Average	0.08	4
Minimum	0.04	2
Maximum	0.14	7
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		0.05	0.0
February		0.06	0.0
March		0.12	0.0
April		0.13	0.0
May		0.38	0.0
June	0.07		0.0
July	0.17		0.0
August	0.11		0.0
September		0.23	0.0
October		0.07	0.0
November		0.06	0.0
December		0.04	0.0
Average	0.12	0.13	0.0
Minimum	0.07	0.04	0.0
Maximum	0.17	0.38	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	7.3	7.7
February	6.9	7.2	8.1
March	7.0	7.5	8.5
April	7.1	7.8	9.9
May	7.0	7.6	13.8
June	6.7	7.4	16.5
July	6.6	7.0	19.4
August	6.6	7.1	20.5
September	6.5	7.3	18.6
October	6.6	7.3	16.0
November	6.7	7.3	12.7
December	6.8	7.8	9.7
Minimum	6.5		7.7
Maximum		7.8	20.5
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	9	11
February	8	15
March	9	20
April	8	3
May	9	4
June	9	1
July	8	2
August	10	1
September	8	2
October	9	2
November	9	5
December	8	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	9	58
February	8	108
March	9	163
April	8	19
May	9	11
June	9	2
July	8	4
August	10	2
September	8	5
October	9	7
November	9	18
December	8	3
Sampling Frequency Requirement Met	Yes	

Table 6 Energy and Chemical Usage

Month	Aluminum Sulphate litres	Hydro kilowatt hours	Natural Gas cubic metres
January	6,927	63,746	20,700
February	7,008	63,955	20,576
March	13,013	57,862	22,653
April	12,023	57,990	13,314
May	9,279	52,955	7,666
June	9,794	59,661	1,200
July	4,570	57,661	1,279
August	4,759	56,289	1,320
September	4,503	52,470	1,199
October	5,306	62,579	1,241
November	5,485	51,291	11,735
December	8,801	68,073	16,076
Total	91,468	704,531	118,959