Courtice Water Pollution Control Plant

2017 Annual Performance Report

The Regional Municipality of Durham

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Environmental Compliance Approval (ECA): 3393-68RLD4 Dated January 28, 2005

Environmental Compliance Approval (Air): 7446-6AGNQZ Dated April 30, 2005

The Courtice Water Pollution Control Plant (WPCP) 2017 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Courtice WPCP in 2017. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). 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 Courtice WPCP is located in the Municipality of Clarington (Courtice) and is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECAs.

The Courtice WPCP treats wastewater from the Oshawa and Courtice service areas in the Region. The Courtice WPCP receives the majority of its flow from the Harmony Creek catchment area via the Harmony Creek Sanitary Sewage Pumping Station (SSPS), servicing approximately 140,168 residents or 78.9% of the total catchment population.

The Courtice WPCP is designed to treat wastewater at an average daily flow rate of 68,200 cubic meters per day (m^3/d) with a peak flow rate of 180,000 m^3/d. The plant is an MOECC Class Four 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 treatment.

Raw Influent Pumping

Wastewater collected through approximately 679 km of sanitary sewers in Oshawa and Courtice is conveyed to the Harmony Creek SSPS located at the Harmony Creek WPCP. Approximately 78.9% of the Harmony Creek WPCP influent flow is diverted to the Harmony Creek SSPS and conveyed 6.4 km in a 1,050 mm diameter forcemain to the Courtice WPCP.

In addition, an existing small service area in Courtice is serviced by gravity to the Courtice WPCP which includes the Durham York Energy Centre, OPG office building and the OPG Darlington Generating Station.

Preliminary Treatment

Screening: Two automatic, mechanically cleaned screens remove paper products and large material that could harm pumps and process equipment. Screenings removed in the process are compacted for landfill disposal.

Grit Removal: Heavy suspended material such as sand and small stones (grit) is removed in the two aerated grit tanks. 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 the process is dewatered and transported to landfill.

Primary Treatment

The two primary clarifiers utilize the physical process of sedimentation which allows the 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 digesters for further treatment. Any material floating on the surface of the clarifier (scum) is also removed to the digester.

Secondary Treatment

Aeration Tank: The aeration tanks are comprised of two distinct zones. The first is an anoxic zone, where no oxygen is introduced and allows for potential denitrification. Subsequently, the wastewater leaves the anoxic zone and enters the aerated zone where fine bubbled air is diffused into the wastewater to assist bacteria in removing dissolved and suspended organics, and nutrients. Biological activity is controlled to assimilate the organic material.

Secondary Clarifier: The effluent from the aeration tanks 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 tanks and the excess activated sludge is wasted to the primary clarifiers.

Phosphorus Removal

The phosphorous removal system is intended to lower the total phosphorous level in the final effluent by adding a chemical coagulant (ferrous chloride). Ferrous chloride can be added at various locations within the plant.

Disinfection

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 two chlorine contact chambers. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged through the 1,676 mm diameter outfall extending 770 meters into Lake Ontario.

Solids Treatment

Anaerobic Digestion: The raw sludge that is collected from the primary clarifiers is pumped into the anaerobic digesters 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 water is returned to the head of the plant for further treatment and the methane is used to meet the heating requirements of the digesters and for heating areas of the treatment facility.

Sludge management: All digested sludge produced at the Courtice WPCP is pumped to the sludge holding facility. From there the treated sludge can be utilized on approved agricultural fields or be shipped to Duffin Creek WPCP for incineration.

Environmental Compliance Approval

Under Condition 10 (6) of ECA #3393-68RLD4 the Region must produce an annual report that must contain the following information:

a) Summary and interpretation of all monitoring data and a comparison to the effluent limits, including an overview of the success and adequacy of the works.

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 Courtice WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at 66% of its annual average rated flow capacity and received a maximum daily flow of 119,994 m^3/d on May 7th, 2017.

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

There were no operating issues encountered in 2017.

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 2017 included:

- Replaced mechanical seal on digester pump #4201,
- Installed new transducer in sludge cell #2,
- Replaced direct current module on grit pump #4101,
- Installed new ferrous chloride pump,
- Replaced belts on blower #3,
- Replaced all digester mixer belts,
- Installed new pressure lids on both digesters,
- Installed Phosphax phosphate analyzer,
- Installed new mixer in anoxic zone #102,
- Replaced motor on chlorine analyzer,
- Cleaned north chlorine contact chamber, and
- Cleaned both ferrous chloride tanks.

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. All results were found to be within 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 and the secondary clarifier flow meters was conducted in April and September 2017.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted in July 2017.
- Calibration of the in-house lab pH meter was 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, remaining below the ECA compliance limits.

The average daily rated flow capacity of 68,200 m^3/d was not exceeded. The rated peak flow capacity of 180,000 m^3/d was not exceeded.

The total phosphorus objective of 0.8 mg/L was exceeded in 24 of 281 samples (8.5%). This was due primarily to insufficient ferrous chloride dosing. Ferrous chloride feed was increased as required. A Phosphax phosphate analyzer was installed to optimize phosphorous removal.

The pH objective of not less than 6.5 was exceeded in nine of 363 samples (2.5%). The pH meter was calibrated regularly.

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

g) Tabulation of volume of sludge generated:

The volume of sludge removed from Courtice WPCP in 2017 was 81,640m^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:

Duffin Creek WPCP – 49,412 m^3 or 60.5%

Agricultural Fields – 32,228 m^3 or 39.5%

h) Summary of any complaints received during the reporting period and any steps taken to address the complaint:

No complaints were made regarding the treatment plant in 2017.

i) Summary of all by-pass, spill or abnormal discharge events.

There were no by-passes during the reporting period. On March 15th, 2017 there was a spill from the forcemain that conveys wastewater from the Harmony Creek WPCP SSPS to the Courtice WPCP. The spill was due to a gate valve obstruction during general maintenance of an air relief valve on the forcemain. This event was reported to the MOECC Spills Action Centre and the local MOECC district office. Standard operating procedures for spills were followed. The spill was cleaned up and no further action was required by the MOECC Spills Action Centre or the local MOECC district office.

j) Any other information the District Manager requires from time to time.

No additional information was requested.

MOECC Inspection

This plant was inspected by the MOECC on June 22nd, 2017. No action items were identified in the report.

Table 1 Raw Influent Flow

Month	Total Flow to Plant - metered at the final effluent m^3	Average Daily Flow m^3/d	Maximum Daily Flow m^3/d
January	1,610,653	51,957	75,160
February	1,320,878	47,174	66,549
March	1,592,590	51,374	92,650
April	1,846,878	61,563	119,905
May	1,900,976	61,322	119,994
June	1,574,741	52,491	102,357
July	1,281,876	41,351	58,042
August	1,105,088	35,648	40,821
September	1,062,987	35,433	41,429
October	1,037,043	33,453	41,410
November	1,024,806	34,160	42,708
December	1,062,731	34,282	38,095
Total	16,421,249		
Average	1,368,437	44,990*	
Minimum	1,024,806		
Maximum	1,900,976		119,994
ECA Limit		68,200	180,000
Met Compliance		Yes	Yes

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	$CBOD_5$ avg. conc. mg/L	BOD5 avg. conc. mg/L	TSS avg. conc. mg/L	TP avg. conc. mg/L	DP avg. conc. mg/L
January	263	483	450	5.1	1.93
February	296	440	564	6.1	2.17
March	192	258	431	4.2	4.55
April	185	220	362	3.0	1.66
May	153	205	401	3.2	1.63
June	276	319	479	3.9	1.89
July	397	454	676	5.5	2.57
August	379	483	631	6.8	2.96
September	357	444	746	6.4	3.23
October	319	395	594	7.1	3.69
November	271	419	690	6.7	3.43
December	332	454	685	6.6	3.41
Average	285	381	559	5.4	2.76
Minimum	153	205	362	3.0	1.63
Maximum	397	483	746	7.1	4.55
Sampling Frequency Requirement Met		Yes	Yes	Yes	Yes

Table 2 Raw Influent Analyses continued

Month	TKN avg. conc. mg/L	TAN avg. conc. mg/L	pH min.	pH max.	Temp. avg. °C	Alkalinity avg. conc. mg/L
January	51.28	25.5	6.6	8.1	14.4	272
February	51.00	29.1	6.9	8.4	13.5	308
March	34.06	25.6	6.3	8.7	13.0	236
April	31.95	20.9	6.8	8.4	15.1	320
May	32.83	19.9	6.8	8.4	16.7	257
June	36.48	20.6	6.8	8.6	19.1	268
July	41.78	24.2	6.9	7.7	20.4	298
August	49.66	27.9	6.9	8.0	20.4	290
September	53.95	31.6	6.8	7.5	20.9	259
October	52.65	42.5	6.4	7.4	19.0	312
November	65.66	39.9	6.7	7.4	15.4	357
December	60.18	42.4	6.0	7.9	12.4	305
Average	46.79	29.2				290
Minimum	31.95	19.9	6.0		12.4	236
Maximum	65.66	42.5		8.7	20.9	357
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes	No*

* 3 of 52 required raw alkalinity samples not collected

Table 3 Final Effluent Analyses

Summary of the final effluent sample analyses

Month	$CBOD_5$ avg. conc. mg/L	TSS avg. conc. mg/L	TP avg. conc. mg/L	TAN avg. conc. mg/L winter	TAN avg. conc. mg/L summer
January	2.2	2.6	0.55	0.07	
February	1.9	2.9	0.66	0.05	
March	2.0	2.5	0.61	0.08	
April	2.0	2.3	0.51	0.10	
May	2.0	2.5	0.60		0.07
June	2.0	3.5	0.63		0.05
July	2.0	2.2	0.64		0.04
August	2.0	2.1	0.66		0.05
September	2.0	1.6	0.65		0.04
October	2.0	2.8	0.69		0.05
November	2.0	2.3	0.63	0.03	
December	2.0	2.0	0.64	0.05	
Average	2.0	2.4	0.62	0.06	0.05
Minimum	1.9	1.6	0.51	0.03	0.04
Maximum	2.2	3.5	0.69	0.10	0.07
ECA Limit	25	25	1.0	24	15
ECA Objective	15	15	0.8	12	8
Within Compliance	Yes	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Unionized NH3 avg. conc. mg/L	TKN avg. conc. mg/L	DP avg. conc. mg/L	Nitrate avg. conc. mg/L	Alkalinity avg. conc. mg/L
January	0.0	1.03	0.49	21.94	93
February	0.0	1.19	0.60	19.94	139
March	0.0	1.26	0.58	22.66	112
April	0.0	1.03	0.49	20.38	147
May	0.0	1.21	0.57	19.50	109
June	0.0	1.21	0.60	19.23	110
July	0.0	0.90	0.61	20.25	99
August	0.0	0.92	0.62	22.25	74
September	0.0	0.95	0.62	24.08	47
October	0.0	1.04	0.61	32.36	63
November	0.0	0.97	0.60	31.10	81
December	0.0	1.03	0.64	29.80	42
Average	0.0	1.06	0.59	23.62	93
Minimum	0.0	0.90	0.49	19.23	42
Maximum	0.0	1.26	0.64	32.36	147
ECA Limit	0.2				
ECA Objective	0.1				
Within Compliance	Yes				
Sampling Frequency Requirement Met	Yes		Yes	Yes	No*

* 4 of 52 required effluent alkalinity samples not collected

Table 3 Final Effluent Analyses continued

Month	TCR avg. conc. mg/L	pH min.	pH max.	Temp. avg. °C
January	0.00	7.0	7.4	14.0
February	0.00	6.2	7.6	13.6
March	0.00	7.2	7.7	13.4
April	0.00	6.9	7.5	14.8
May	0.00	6.8	7.9	15.9
June	0.00	7.1	7.8	17.8
July	0.00	6.6	7.5	20.2
August	0.00	6.6	7.8	21.6
September	0.00	6.5	7.1	21.6
October	0.00	6.1	7.0	19.4
November	0.00	6.5	7.2	15.5
December	0.00	6.3	6.8	14.2
Average	0.00			
Minimum	0.00	6.1		13.4
Maximum	0.00		7.9	21.6
ECA Limit		6.0	9.5	
ECA Objective		6.5	9.0	
Within Compliance		Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 4 Escherichia Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	4	40
February	4	4
March	5	2
April	4	4
May	4	10
June	5	3
July	4	6
August	5	3
September	4	5
October	4	6
November	5	2
December	4	2
ECA Objective		200
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Total Plant Flow (cubic metres)	Ferrous Chloride (litres)	Sodium Hypochlorite (kilograms as chlorine)	Sodium Bisulphite (litres)	Hydro (kWh)	Natural Gas (cubic metres)
January	1,610,653	77,840	4,866	10,304	645,870	12,898
February	1,320,878	68,600	4,175	9,126	654,861	8,541
March	1,592,590	93,520	4,572	10,341	647,150	15,168
April	1,846,878	88,060	4,954	12,254	709,244	3,635
May	1,900,976	91,840	4,586	10,819	668,100	2,453
June	1,574,741	106,400	4,822	10,525	636,359	2,654
July	1,281,876	85,400	4,248	9,494	676,449	2,705
August	1,105,088	110,320	4,175	7,507	669,109	2,010
September	1,062,987	106,400	3,616	6,330	647,301	3,012
October	1,037,043	103,740	3,455	6,440	679,130	2,956
November	1,024,806	85,120	2,867	6,403	654,200	2,772
December	1,062,731	102,826	2,837	6,256	682,860	12,312
Total	16,421,249	1,120,066	49,172	105,800	7,970,633	71,116