Courtice Water Pollution Control Plant

2018 Annual Performance Report

The Regional Municipality of Durham

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

Amendment: Dated April 18, 2007

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

The Courtice Water Pollution Control Plant (WPCP) 2018 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Courtice WPCP. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the 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 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 145,224 residents or 80.4% of the total catchment population.

The Courtice WPCP is designed to treat wastewater at an average daily flow rate of 68,200 cubic metres per day (m^3/d) with a peak flow rate of 180,000 m^3/d. The plant is an MECP Class 4 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 686 km of sanitary sewers in Oshawa and Courtice is conveyed to the Harmony Creek SSPS located at the Harmony Creek WPCP. Approximately 80.4% 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, an Ontario Power Generation (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 lowers 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 (chlorination/dechlorination)

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 metres 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 transferred to the Duffin Creek WPCP for incineration.

Environmental Compliance Approval

Under Condition 10 (6) of ECA #3393-68RLD4 the Region must produce an annual report that contains 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 122,498 m^3/d on April 18, 2018. See tables 3 and 4 for effluent results.

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

There were no operating issues encountered in 2018.

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 2018 included:

- Replaced flights and sprockets on south primary clarifier,
- Replaced air lines in channel of south primary clarifier,
- Rebuilt effluent pump #1,
- Emptied and cleaned digester 200,
- Rebuilt mixer in digester 200,
- Rebuilt recirculation pump on digester 200,
- Replaced miltronics on digester 100,
- Replaced central processing unit on backup generator,
- Rebuilt bar screen #1,
- Replaced actuator on biosolids cell #1,
- Replaced conveyor lining in headworks and
- Replaced final effluent weir 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. 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 was conducted June 26 and November 26, 2018.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted August 1, 2018.
- 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 suspended solids objective of 15 mg/L was exceeded in two of 285 samples (0.7%).

- The total phosphorus objective of 0.8 mg/L was exceeded in 38 of 277 samples (13.7%). This was due primarily to annual clarifier maintenance and one of the digesters being taken out of service for cleaning, resulting in reduced sludge storage capacity.
- The effluent pH was below the minimum effluent objective of 6.5 in 43 of 361 samples (11.9%). The pH meter was calibrated regularly. A new laboratory pH meter has since been purchased.
- The weekly sampling frequency requirement for raw and effluent alkalinity was not met. One of 52 required samples (1.9%) was not collected. Additional ECA training will be provided to plant staff.

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 2018 was 83,952 m^3. An additional 523 dry metric tons were removed during the digester cleanout.

Outline of anticipated volumes to be generated in the next reporting period:

The volume of sludge generated in the next reporting period may be affected by the recommissioning of digesters at the Harmony Creek WPCP and the Courtice WPCP.

Summary of locations to where sludge was disposed:

All digested sludge produced at the Courtice WPCP is pumped to the sludge holding facility. From there 32,772 m^3 (39.0%) was utilized on approved agricultural fields and 51,180 m^3 (61.0%) was transferred to the Duffin Creek WPCP for incineration. An additional 523 dry metric tons were removed by Entec Waste Management Inc. during the digester cleanout.

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 2018.

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

There were no by-passes during the reporting period. There are no anticipated by-passes planned for the next reporting period.

There were no spills during the reporting period.

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

No additional information was requested.

MECP Inspection

This plant was last inspected by the MECP on June 22, 2017.

Table 1 Final Effluent Flows

Month	Total Flow to Plant - metered at the final effluent cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	1,188,618	38,343	69,701
February	1,233,804	44,064	77,559
March	1,243,429	40,111	51,310
April	1,958,227	65,274	122,498
May	1,337,825	43,156	60,157
June	990,548	33,018	37,805
July	1,054,676	34,022	49,051
August	1,207,271	38,944	51,475
September	1,180,290	39,343	50,132
October	1,303,319	42,043	48,806
November	1,852,165	61,739	96,915
December	1,875,851	60,511	77,199
Total	16,426,022		
Average	1,368,835	45,003*	
Minimum	990,548		
Maximum	1,958,227		122,498
ECA Limit		68,200	180,000
Met Compliance		Yes	Yes

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average concentration (conc.) milligram per litre (mg/L)	Biochemical Oxygen Demand (BOD_5) average conc. mg/L	Total Suspended Solids average conc. mg/L	Total Phosphorus average conc. mg/L	Dissolved Phosphorus average conc. mg/L
January	252	413	652	6.2	2.88
February	266	343	604	6.3	2.44
March	336	476	703	5.3	2.61
April	246	297	465	3.7	1.68
May	272	405	585	5.0	2.53
June	351	527	735	6.4	3.74
July	335	423	797	8.8	4.44
August	258	381	642	7.2	3.63
September	244	341	521	6.7	4.01
October	242	392	690	7.0	3.54
November	214	315	454	5.0	2.45
December	285	370	631	5.8	2.28
Average	275	390	623	6.1	3.02
Minimum	214	297	454	3.7	1.68
Maximum	351	527	797	8.8	4.44
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 average conc. mg/L	pH minimum	pH maximum	Temperature degree Celsius average	Alkalinity average conc. mg/L
January	49.45	36.7	7.1	7.8	11.4	299
February	47.73	34.0	7.2	7.7	11.6	292
March	50.70	35.8	5.9	8.0	11.5	333
April	31.08	24.9	6.1	7.5	13.3	288
May	41.26	32.3	6.6	7.5	16.9	297
June	57.18	49.6	6.4	7.3	19.0	333
July	60.18	52.7	6.5	7.5	21.1	335
August	49.18	49.1	6.5	8.2	23.7	366
September	52.03	52.7	6.7	7.5	21.7	402
October	53.95	53.1	5.9	7.9	19.7	356
November	42.10	41.7	6.4	7.9	15.8	360
December	46.20	44.5	7.1	7.9	14.2	362
Average	48.42	42.3			16.6	335
Minimum	31.08	24.9	5.9		11.4	288
Maximum	60.18	53.1		8.2	23.7	402
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes	No*

* One of 52 required raw alkalinity samples was not collected

Table 3 Final Effluent Analyses
Summary of the final effluent sample analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids average conc. mg/L	Total Phosphorus average conc. mg/L	Total Ammonia Nitrogen average conc. mg/L winter	Total Ammonia Nitrogen average conc. mg/L summer
January	2.0	2.6	0.71	0.10	
February	2.0	2.2	0.70	0.18	
March	2.0	2.2	0.74	0.15	
April	2.1	3.2	0.66	0.98	
May	2.0	3.7	0.83		0.47
June	2.0	4.5	0.74		0.48
July	2.1	3.6	0.71		0.25
August	2.0	4.1	0.53		0.22
September	2.0	2.2	0.69		0.31
October	2.0	2.0	0.70		0.23
November	2.0	2.1	0.67	0.07	
December	2.0	3.1	0.69	0.11	
Average	2.0	3.0	0.70	0.27	0.33
Minimum	2.0	2.0	0.53	0.07	0.22
Maximum	2.1	4.5	0.83	0.98	0.48
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 Ammonia Nitrogen average concentration (conc.) milligram per litre (mg/L)	Total Kjeldahl Nitrogen average conc. mg/L	Dissolved Phosphorus average conc. mg/L	Nitrate average conc. mg/L	Alkalinity average conc. mg/L
January	0.0	0.96	0.66	27.71	66
February	0.0	1.13	0.64	27.37	80
March	0.0	1.15	0.71	25.50	110
April	0.0	1.97	0.61	21.58	129
May	0.0	1.47	0.76	26.15	111
June	0.0	1.66	0.75	29.86	73
July	0.0	1.40	0.65	30.21	44
August	0.0	1.48	0.52	28.93	101
September	0.0	1.31	0.69	28.56	107
October	0.0	1.30	0.71	30.79	104
November	0.0	1.23	0.64	27.74	121
December	0.0	1.14	0.69	29.50	127
Average	0.0	1.35	0.67	27.83	98
Minimum	0.0	0.96	0.52	21.58	44
Maximum	0.0	1.97	0.76	30.79	129
ECA Limit	0.2				
ECA Objective	0.1				
Within Compliance	Yes				
Sampling Frequency Requirement Met	Yes		Yes	Yes	No*

* One of 52 required effluent alkalinity samples was not collected

Table 3 Final Effluent Analyses continued

Month	Total Chlorine Residual average concentration (conc.) milligram per litre (mg/L)	pH minimum	pH maximum	Temperature average degree Celsius
January	0.00	6.2	6.8	12.7
February	0.00	6.4	7.3	12.5
March	0.00	6.6	7.3	12.5
April	0.00	6.0	7.3	13.4
May	0.00	6.4	7.0	16.7
June	0.00	6.2	7.6	19.2
July	0.00	6.4	7.6	21.7
August	0.00	6.3	7.7	23.4
September	0.00	6.3	7.5	22.6
October	0.00	6.0	7.3	20.4
November	0.00	6.2	7.8	15.9
December	0.00	6.9	7.7	14.0
Average	0.00			17.1
Minimum	0.00	6.0		12.5
Maximum	0.00		7.8	23.4
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 coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	4	25
February	4	28
March	5	11
April	4	6
May	5	26
June	4	113
July	4	36
August	5	28
September	4	8
October	4	87
November	5	10
December	4	15
ECA Objective		200
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Total Flow to Plant - metered at the final effluent cubic metre	Ferrous Chloride litres	Sodium Hypochlorite kilograms as chlorine	Sodium Bisulphite litres	Hydro kilowatt hours	Natural Gas cubic metres
January	1,188,618	125,580	2,940	7,139	718,822	9,402
February	1,233,804	66,500	3,234	7,139	647,058	9,316
March	1,243,429	64,960	3,851	8,464	689,492	5,860
April	1,958,227	37,520	3,587	11,629	655,784	5,495
May	1,337,825	81,620	3,263	10,194	666,938	2,509
June	990,548	139,440	2,984	6,955	643,790	3,060
July	1,054,676	121,380	4,336	7,507	693,610	4,495
August	1,207,271	45,920	3,954	8,832	694,362	3,455
September	1,180,290	75,740	4,983	8,758	666,710	6,959
October	1,303,319	89,180	4,689	8,832	699,385	24,507
November	1,852,165	68,040	4,689	10,598	675,548	43,318
December	1,875,851	49,840	4,042	9,347	704,213	49,986
Total	16,426,022	965,720	46,555	105,395	8,155,711	168,362