Courtice Water Pollution Control Plant

2021 Annual Performance Report

The Regional Municipality of Durham
Courtice Water Pollution Control Plant 2021 Annual Performance Report

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) 2021 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). The plant treats wastewater from approximately 123,503 residents or 66.5% of the total catchment population and the remaining 33.5% of the flow was treated at the Harmony Creek WPCP.
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 a MECP Class 4 conventional activated sludge treatment plant that utilizes the following processes to treat wastewater;

- raw influent pumping,
- preliminary treatment,
- primary treatment,
- phosphorus removal,
- secondary treatment,
- disinfection (chlorination/dechlorination), and
- solids management.

Raw Influent Pumping

Wastewater collected through approximately 643 killometres of sanitary sewers in Oshawa and Courtice is conveyed to the Harmony Creek SSPS located at the Harmony Creek WPCP.

Approximately 66.5% of the Harmony Creek WPCP influent flow is diverted to the Harmony Creek Sanitary Sewage Pumping Station (SSPS) and conveyed 6.4 kilometres in a 1,050 millimetre diameter forcemain to the Courtice Water Pollution Control Plant (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, and surrounding businesses and industries.

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 the 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 is also removed to the digester.

Phosphorus Removal

The phosphorus removal system lowers the total phosphorous level in the final effluent by adding a chemical coagulant, ferrous chloride, at various locations within the plant. In 2021 ferrous chloride was dosed only in the aeration tanks.

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 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.
Secondary Clarifier: The effluent from the aeration tanks is directed to the two secondary clarifiers where the solids settle 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.

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 millimetre 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 supernatant 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 Water Pollution Control Plant (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 (ECA)

Under Condition 10.(6) of ECA #3393-68RLD4 the Region must produce an annual performance report that contains 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 Courtice WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at 53.5% of its annual average rated flow capacity and received a maximum daily flow of 105,218 cubic metres per day (m^3/d) on September 23, 2021. 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 2021.

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 2021 included:

- Replaced sodium hypochlorite 103 check valves
- Replaced Return Activated Sludge pump 1102 rotor and stator
- Replaced batteries on all automatic samplers
- Repaired ferrous pump 103 rotor cavity, lobes and hose element
- Rebuilt secondary clarifier 200, wear strips, sprockets, flights, and bushings
- Repaired decanting valve on biosolids storage cell 3
- Repaired cast piping on biosolids loading station 1
- Maintained effluent strainer 1
- Inspected Return Sludge Pump (RSP) 1101
- Replaced feed valve on ferrous pump 101
- Maintained RSP 1202 check valve
- Replaced union on sodium bisulphite pump 3101
- Replaced fittings, check valve seats and springs on sodium hypochlorite pump 103
- Replaced fittings on sodium bisulphite pumps 101 and 103
- Water jetted inside of piping to remove struvite for the digester heat loop
- Replaced check valves on sodium hypochlorite pump
- Changed liners on grit screw conveyor
- Replaced swivel pipe joints in biosolids loading station 1 and 2
- Replaced impeller and mechanical seal on return activated sludge pump 1102
- Replaced coupler on aeration blower 2
- Maintained grit channel blower 5101

d) Summary of any effluent quality assurance or control measures undertaken in the reporting period;

- In-house laboratory (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 an acceptable range.
- On-line instrumentation is verified by Water Pollution Control Plant (WPCP) operators using various field or lab test equipment.

e) Summary of the calibration and maintenance carried out on all effluent monitoring equipment;

- Calibration of the effluent flow meter was conducted December 2, 2021.
- Calibration of in-house lab equipment was conducted on August 30, 2021.
- 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 and remain below the objectives specified in the ECA.

- The average daily rated flow capacity of 68,200 cubic metres per day (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 milligram per litre (mg/L) was exceeded in 5 out of 350 samples (1.4%).
- The suspended solid objective of 15.0 mg/L was exceeded in 1 of 356 samples (0.3%).
- The total ammonia nitrogen summer objective of 8 mg/L was exceeded in 2 of 145 samples (1.4%).
- The effluent pH was below the minimum effluent objective of 6.5 in 2 of 365 samples (0.5%).

Best efforts will continue to be applied to maintain results below the objectives.

g) Biosolids Production;

Tabulation of Volume of Sludge Generated;

The volume of sludge removed from Courtice WPCP in 2021 was 75,682 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;

Due to one of the digesters being out of service for maintenance, only primary digestion is occurring before the sludges are pumped to the sludge holding facility. The sludge produced at this facility was applied on agricultural fields and transferred to Duffin Creek Water Pollution Control Plant (WPCP) for incineration.

Receiving facilities included:

Agricultural Fields – 35,290 m^3 or 46.6%

Duffin Creek WPCP – 40,392 m^3 or 53.4%

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 2021.

Courtice WPCP utilizes a meteorological evaluation tower for tracking air temperature, wind direction and speed to assist staff in determining the source and responding to any odour complaints as well as a comprehensive odour tracking procedure in conjunction with surrounding industries and businesses.

i) Summary of all By-pass, Spill or Abnormal Discharge;

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

There were no spills or abnormal discharges during the reporting period.

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

No additional information was requested.

k) Ministry of the Environment, Conservation and Parks (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	1,196,672	38,602	50,541
February	957,113	34,183	42,144
March	1,130,969	36,483	50,543
April	1,196,890	39,896	55,589
May	1,098,247	35,427	46,181
June	759,729	25,324	30,382
July	959,932	30,966	51,545
August	851,324	27,462	35,613
September	1,157,033	38,568	105,218
October	1,271,048	41,002	61,298
November	1,240,960	41,365	48,247
December	1,494,030	48,195	73,799
Total	13,313,947		
Average	1,109,496	36,477*	
Minimum	759,729		
Maximum	1,494,030		105,218
ECA Limit		68,200	180,000
Met Compliance		Yes	Yes

*Annual Average Daily Flow

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand average concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids average conc. mg/L	Total Phosphorus average conc. mg/L	Dissolved Reactive Phosphorus average conc. mg/L	Total Kjeldahl Nitrogen average conc. mg/L
January	212	237	4.6	2.52	44.80
February	233	238	5.5	2.88	50.04
March	215	258	5.1	2.59	48.53
April	185	223	4.4	2.17	43.74
May	194	280	4.5	2.26	44.88
June	236	283	5.3	2.78	51.03
July	202	247	4.5	2.16	44.27
August	202	282	4.8	2.56	47.08
September	209	285	4.9	2.44	45.97
October	188	287	4.8	2.22	43.28
November	194	253	4.7	2.19	44.13
December	193	281	4.2	1.88	41.46
Average	205	263	4.8	2.39	45.77
Minimum	185	223	4.2	1.88	41.46
Maximum	236	287	5.5	2.88	51.03
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes

Table 2 Raw Influent Analyses continued

Month	Total Ammonia Nitrogen average concentration (conc.) milligram per litre (mg/L)	Alkalinity average conc. mg/L	pH minimum	pH maximum	Temperature degree Celsius average
January	33.5	278	7.4	7.9	13.6
February	33.0	261	7.6	7.8	12.5
March	33.6	274	7.2	8.0	14.4
April	27.6	275	7.4	7.9	15.5
May	28.9	268	7.3	8.0	18.1
June	33.3	281	7.2	7.8	19.3
July	27.1	269	7.0	7.8	20.8
August	29.7	263	7.0	7.9	22.2
September	25.7	271	7.4	8.0	20.5
October	25.5	285	7.2	8.0	19.2
November	26.8	281	7.6	7.8	16.5
December	23.8	288	7.3	7.9	15.3
Average	29.0	275			17.3
Minimum	23.8	261	7.0		12.5
Maximum	33.6	288		8.0	22.2
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand 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	1.2	3.2	0.60	0.06	
February	1.4	3.2	0.65	0.12	
March	1.0	4.6	0.63	1.20	
April	1.3	2.3	0.64	1.11	
May	1.2	3.0	0.66		0.88
June	1.1	2.4	0.64		0.47
July	1.0	4.1	0.70		1.72
August	1.0	3.1	0.65		0.62
September	1.0	3.3	0.65		0.47
October	1.0	2.2	0.63		0.24
November	1.0	2.1	0.61	0.17	
December	1.1	3.5	0.62	0.61	
Average	1.1	3.1	0.64	0.55	0.73
Minimum	1.0	2.1	0.6	0.06	0.24
Maximum	1.4	4.6	0.7	1.20	1.72
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	Dissolved Reactive Phosphorus average concentration (conc.) milligram per litre (mg/L)	Unionized Ammonia Nitrogen average conc. mg/L	Nitrate Nitrogen average conc. mg/L	Alkalinity average conc. mg/L
January	0.52	0.0	21.83	71
February	0.53	0.0	25.06	50
March	0.52	0.0	23.54	67
April	0.52	0.0	18.53	86
May	0.57	0.0	21.79	75
June	0.56	0.0	24.77	49
July	0.57	0.0	20.78	85
August	0.53	0.0	21.48	61
September	0.52	0.0	19.89	90
October	0.54	0.0	21.11	89
November	0.54	0.0	20.57	94
December	0.52	0.0	20.51	122
Average	0.54	0.0	21.66	78
Minimum	0.52	0.0	18.53	49
Maximum	0.57	0.0	25.06	122
ECA Limit		0.2		
ECA Objective		0.1		
Within Compliance		Yes		
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Total Chlorine Residual average concentration (conc.) milligram per litre (mg/L)	pH minimum	pH maximum	Temperature degree Celsius average
January	0.00	6.9	7.3	12.4
February	0.00	6.6	7.1	11.1
March	0.00	6.6	7.3	13.4
April	0.00	6.7	7.3	14.7
May	0.00	6.6	7.3	17.0
June	0.00	6.4	7.0	19.0
July	0.00	6.6	7.0	20.6
August	0.00	6.5	6.9	21.7
September	0.00	6.7	7.5	20.6
October	0.00	6.7	7.3	19.6
November	0.02	6.7	7.1	16.9
December	0.00	6.6	7.1	14.5
Average	0.00			16.8
Minimum	0.00	6.4		11.1
Maximum	0.02		7.5	21.7
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	8	9
February	8	39
March	10	11
April	8	27
May	8	12
June	9	46
July	9	56
August	9	16
September	9	35
October	8	12
November	9	20
December	9	4
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 (m^3)	Ferrous Chloride Litres (L)	Sodium Hypochlorite kilograms as chlorine	Sodium Bisulphite L	Hydro kilowatt hours	Natural Gas m^3
January	1,196,672	86,706	3,835.6	6,281	652,615	51,040
February	957,113	85,744	2,945.8	6,029	600,246	36,563
March	1,130,969	105,294	4,213.7	8,269	698,552	33,590
April	1,196,890	89,949	5,354.9	6,833	668,991	12,694
May	1,098,247	96,795	3,783.7	6,812	671,849	8,690
June	759,729	78,385	3,268.3	5,404	628,068	1,771
July	959,932	75,865	3,524.9	6,310	695,381	2,465
August	851,324	79,557	3,230.0	5,511	649,865	1,679
September	1,157,033	70,510	4,045.0	6,704	663,272	1,757
October	1,271,048	87,965	5,335.7	7,608	678,530	5,411
November	1,240,960	81,510	3,815.3	7,307	625,747	23,086
December	1,494,030	89,395	3,638.2	8,023	636,575	39,490
Total	13,313,947	1,027,675	46,991	81,091	7,869,691	218,236