Courtice Water Pollution Control Plant

2022 Annual Performance Report

The Regional Municipality of Durham
Courtice Water Pollution Control Plant 2022 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) 2022 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 132,400 residents or 66.6% of the total catchment population and the remaining 33.4% 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 66.6% 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, a 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 2022, 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 Management

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 biosolids, water, carbon dioxide, methane, and hydrogen sulphide.
The supernatant is returned to the head of the plant for further treatment and the digester gas 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 53.8% of its annual average rated flow capacity and received a maximum daily flow of 93,731 cubic metres per day (m^3/d) on February 17, 2022. See tables 3 and 4 for effluent results.

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

Thick scum and grease on the primary clarifiers travelled to the anoxic zone causing scum and foaming issues. A combination of both increased wasting and increased return activated sludge resolved the issue.

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:

- Rebuilt sump pump 1 in digester building,
- Installed new grinder on digester/recirculation line,
- Replaced motor on sodium bisulphite exhaust fan,
- Installed new auger and liners on rag conveyor,
- Replaced anoxic mixer 201,
- Installed multiple relays for substation,
- Installed new motion sensor on grit conveyor,
- Installed new power supply for programmable logic controller (PLC) 6000,
- Installed new breaker on head works 1 sump pump,
- Repaired motor for blower 6404,
- Installed new level indicator on sodium bisulphite tank 1,
- Installed new anoxic mixer 103,
- Rebuilt sodium hypochlorite pump,
- Installed drain valve actuator at biosolid truck station 2,
- Replaced feed valve, mechanical seal, rotor and stator on return sludge pump 1201,
- Installed back pressure valve on sodium hypochlorite pump 103,
- Installed new motion sensor on grit pump 4101,
- Installed new air flow meter on grit system,
- Installed new auto dialer,
- Replaced sodium hypochlorite pump 101,
- Replaced headworks blower 3 motor,
- Rebuilt hot water pump 5201,
- Replaced check valves on sodium hypochlorite pump 103,
- Replaced uninterruptible power supply battery on digester PLC,
- Repaired sink hole in substation,
- Tightened chain and replaced wear strips and shoes on primary clarifier 1,
- Replaced all programmable logic controller batteries,
- Replaced flights, shoes and strips on north cell secondary 100,
- Replaced expansion joints on aeration blowers 2 and 3,
- Installed new generator feed protection relay,
- Replaced selector switch on sodium bisulphite panel 3101.

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 May 30, 2022.

Calibration of in-house lab equipment was conducted on July 27, 2022.

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 36 out of 345 samples (10.4%).
- The total ammonia nitrogen summer objective of 8 mg/L was exceeded in 1 of 145 samples (0.7%).
- 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 2022 was 81,828 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 as well as transferred to Duffin Creek Water Pollution Control Plant (WPCP) for incineration.

Receiving facilities included:

Agricultural Fields – 34,520 m^3 or 42.2%

Duffin Creek WPCP – 47,308 m^3 or 57.8%

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.

There was one odour complaint received by the Plant Superintendent on September 24, 2022. There were no abnormal operating conditions at the time of the complaint. Technical Support investigated the surrounding area and determined the source of the odour to be north of the Courtice WPCP. 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.

The Ministry was notified that on June 2, 2022, during an inspection on the boilers, the contractor discharged an estimated 2,913 imperial gallons of boiler water containing sodium nitrite to the parking area. The boiler water did not go beyond this on-property location. The boiler water was vacuumed and discharged via the septic receiving station. There were no adverse impacts observed to the environment or the treatment process. The Region will be working with contractors performing similar work in the future to ensure that adequate spills response plans exist prior to conducting work. Due to prompt response by regional staff in addressing this spill, no modifications to existing plant procedures or processes are required.

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* - cubic metre	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	1,160,492	37,435	41,971
February	1,264,486	45,160	93,731
March	1,676,846	54,092	84,809
April	1,381,043	46,035	53,085
May	1,181,243	38,105	51,436
June	1,071,830	35,728	54,978
July	853,638	27,537	42,135
August	870,189	28,071	35,667
September	828,609	27,620	32,953
October	924,738	29,830	42,237
November	914,770	30,492	46,870
December	1,265,256	40,815	77,666
Total	13,393,140		
Average	1,116,095	36,694**	
Minimum	828,609		
Maximum	1,676,846		93,731
ECA Limit		68,200	180,000
Met Compliance		Yes	Yes

*Metered at the final effluent

**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	271	563	4.6	2.14	49.13
February	228	395	4.5	2.02	44.74
March	202	368	3.5	1.47	38.71
April	204	385	4.0	1.77	42.29
May	269	501	5.3	2.92	48.43
June	259	338	4.7	2.46	46.04
July	283	381	5.8	2.77	51.94
August	271	471	6.2	2.95	54.00
September	261	407	6.3	3.07	56.24
October	241	420	5.8	2.70	51.99
November	283	502	6.2	3.17	60.38
December	325	510	5.7	2.44	52.07
Average	258	437	5.2	2.49	49.66
Minimum	202	338	3.5	1.47	38.71
Maximum	325	563	6.3	3.17	60.38
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	28.9	284	7.4	8.0	12.7
February	26.1	264	6.8	8.0	13.2
March	22.3	282	7.1	7.8	13.1
April	24.0	277	7.1	7.8	14.6
May	27.1	282	7.2	7.8	17.6
June	27.3	277	6.4	7.8	18.3
July	32.0	280	7.1	7.6	20.4
August	34.1	286	7.1	7.7	21.7
September	34.6	275	6.5	7.6	20.6
October	31.3	288	6.9	7.6	18.5
November	37.1	274	7.3	7.9	17.5
December	30.1	280	7.4	8.0	14.9
Average	29.6	279			16.9
Minimum	22.3	264	6.4		12.7
Maximum	37.1	288		8.0	21.7
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	3.7	0.62	0.42	
February	1.2	3.1	0.61	1.66	
March	1.0	2.6	0.56	1.62	
April	1.3	2.8	0.59	0.54	
May	1.2	3.3	0.66		0.19
June	1.0	3.3	0.75		0.35
July	1.3	4.1	0.82		1.54
August	1.0	3.9	0.78		1.49
September	1.0	3.6	0.61		0.58
October	1.0	3.2	0.58		0.60
November	1.0	2.8	0.58	1.12	
December	1.1	4.5	0.65	0.68	
Average	1.1	3.4	0.65	1.01	0.79
Minimum	1.0	2.6	0.56	0.42	0.19
Maximum	1.3	4.5	0.82	1.66	1.54
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	0.55	0.0	22.17	87
February	0.55	0.0	18.50	93
March	0.48	0.0	17.70	129
April	0.52	0.0	19.70	118
May	0.53	0.0	21.40	92
June	0.71	0.0	19.10	87
July	0.71	0.0	21.50	66
August	0.70	0.0	23.20	54
September	0.52	0.0	22.40	52
October	0.49	0.0	22.20	62
November	0.50	0.0	22.40	57
December	0.51	0.0	20.40	77
Average	0.56	0.0	20.89	81
Minimum	0.48	0.0	17.70	52
Maximum	0.71	0.0	23.20	129
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	6.5	7.1	11.9
February	0.00	6.6	7.1	11.8
March	0.00	6.6	7.3	13.2
April	0.00	6.7	7.3	14.2
May	0.00	6.6	7.4	17.3
June	0.00	6.3	7.3	18.8
July	0.00	6.5	7.2	20.7
August	0.00	6.5	7.0	21.9
September	0.00	6.3	6.9	21.1
October	0.00	6.5	7.0	18.6
November	0.00	6.6	7.1	16.8
December	0.00	6.6	7.1	14.8
Average	0.00			16.8
Minimum	0.00	6.3		11.8
Maximum	0.00		7.4	21.9
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	12
February	8	23
March	10	14
April	8	8
May	9	10
June	9	10
July	8	21
August	9	27
September	9	48
October	8	5
November	9	4
December	9	36
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	1,160,492	81,175	2,882.4	6,451	655,365	79,834
February	1,264,486	72,699	2,607.0	6,664	584,210	65,199
March	1,676,846	70,115	3,514.3	9,411	649,795	42,218
April	1,381,043	78,896	4,000.9	8,103	661,745	17,719
May	1,181,243	89,819	4,519.4	7,752	636,209	3,333
June	1,071,830	94,765	3,904.9	7,314	636,097	2,011
July	853,638	80,377	3,233.3	6,233	656,255	1,869
August	870,189	108,669	3,316.3	6,358	633,918	2,416
September	828,609	97,023	3,253.2	5,742	599,267	561
October	924,738	89,244	3,400.7	6,408	603,499	8,877
November	914,770	88,393	3,396.4	6,496	610,935	23,993
December	1,265,256	106,816	3,415.4	7,921	640,785	52,074
Total	13,393,140	1,057,991	41,444	84,853	7,568,080	300,104