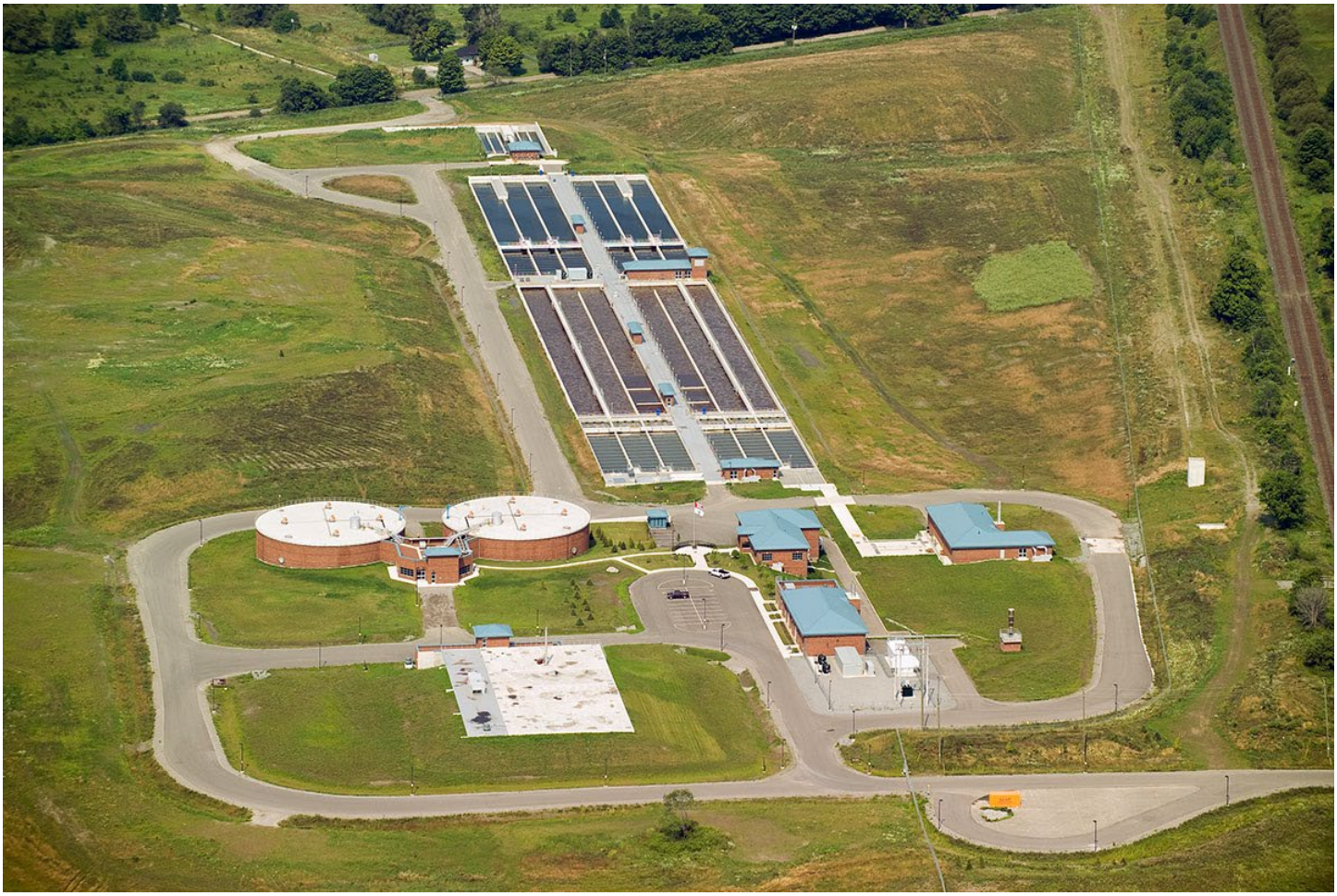
Courtice Water Pollution Control Plant

2024 Annual Performance Report



The Regional Municipality of Durham
Courtice Water Pollution Control Plant 2024 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) 2024 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 most of its flow from the Harmony Creek catchment area via the Harmony Creek Sanitary Sewage Pumping Station (SSPS). The plant treats wastewater from approximately 148,076 residents or 72.4% of the total catchment population and the remaining 27.6% of the flow is 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 an 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)
- Solids management

Raw Influent Pumping

Wastewater collected through approximately 666 kilometres of sanitary sewers in Oshawa and Courtice and is conveyed to the Harmony Creek SSPS located at the Harmony Creek WPCP. Approximately 72.4% 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 digesters.

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 2023, 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. This allows for denitrification. Subsequently, the wastewater 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 72.1% of its annual average rated flow capacity and received a maximum daily flow of 136,516 cubic metres per day (m^3/d) on April 4, 2024. See tables 3 and 4 for effluent results.

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

Operating problems encountered and corrective actions taken in 2024 included:

- The plant experienced difficulty maintaining digester temperature due to increased sludge production and flows received from Harmony Creek WPCP. As Harmony Creek WPCP accepts more flow, less sludge will be produced, resulting in better temperature stability.

- The main electrical transformer at the plant malfunctioned. The plant switched to operating the diesel generator. The generator was found to have a coolant leak and had to be shutdown. This resulted in a plant bypass. A rental generator was sourced and was in operation shortly after the generator malfunctioned. A transformer was sourced and used for the duration of the year while the main transformer was being repaired.

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 2024 included:

- Rebuilt return activated sludge pump 1202
- Installed new generator condensate pump
- Replaced gasket in sodium hypochlorite tank 1
- Replaced check valve on primary sump pump 2101
- Installed channel blower 6104
- Replaced motor on cross collector 207
- Replaced 50 Amp breaker on raw sludge pump 1201
- Replaced rubber check valve on primary scum pump 2102
- Repaired Phosphax SC1000 module
- Repaired bar screen 101 outer gearbox cover and coupling on drive motor shaft
- Replaced variable frequency drive on return activate sludge pumps 1101 and 1202
- Installed new check valve on primary scum pump 2102
- Replaced mechanical seals on grit augers 201 and 101
- Replaced secondary 200 wear strip, shoes and flights
- Replaced outlet flange gasket on sodium hypochlorite pump 1102
- Liner replaced in sodium hypochlorite tank 1101
- Cleaned out heat exchanger 5100, 5200, digester and raw sludge lines
- Cleaned out north contact chamber
- Repaired ring radiator on generator
- Installed new motor on cross collector 107
- Installed new chemical flow meter
- Replaced motor on cross collector in secondary 100

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.

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 on November 12, 2024.

Calibration of in-house lab equipment was conducted on January 3, 2024.

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 34 out of 348 samples (9.77%).
- The total phosphorous limit of 1.0 mg/L was exceeded in 14 out of 348 samples (4.02%).
- The total suspended solids objective of 15.0 mg/L was exceeded in 3 out of 351 samples (0.85%).
- The total suspended solids limit of 25.0 mg/L was exceeded in 2 out of 351 samples (0.57%).

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 Water Pollution Control Plant (WPCP) in 2024 was 88,332 cubic meters (m^3).

Outline of Anticipated Volumes to be Generated in the next Reporting Period

Even with the increase in population on a year-to year basis, no significant changes to flows or processing are anticipated. Therefore, no significant changes in sludge generation are expected for the next year.

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 WPCP for incineration.

Receiving facilities included:

Agricultural Fields – 49,644 m^3 or 56.2%

Duffin Creek WPCP – 38,688 m^3 or 43.8%

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. No complaints were received in 2024.

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

There was one by-pass which occurred on July 28, 2024, due to a power failure for a duration of four hours. 14,480 m3 of sewage was by-passed into Lake Ontario.

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

No additional information was requested.

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	1,963,769	63,347	92,033
February	1,511,909	52,135	61,819
March	1,744,531	56,275	72,247
April	2,357,670	78,589	136,516
May	1,555,598	50,181	64,368
June	1,313,621	43,787	59,796
July	1,373,259	44,299	85,930
August	1,215,030	39,195	60,627
September	1,108,804	36,960	46,618
October	1,187,878	38,319	42,467
November	1,133,405	37,780	43,636
December	1,489,170	48,038	82,884
Total	17,954,644		
Average	1,496,220	49,191**	
Minimum	1,108,804		
Maximum	2,357,670		136,516
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	232	434	3.9	1.75	38.59
February	220	359	4.6	2.06	41.98
March	181	230	4.2	1.69	37.51
April	168	225	3.5	1.45	31.37
May	226	303	4.3	1.99	40.72
June	210	290	4.3	2.31	45.13
July	217	282	4.3	2.22	42.40
August	186	320	4.7	2.42	44.78
September	194	337	5.9	2.90	47.69
October	193	336	5.6	2.89	50.64
November	207	391	6.8	3.07	54.06
December	254	504	8.0	2.53	48.98
Average	207	334	5.0	2.27	43.65
Minimum	168	225	3.5	1.45	31.37
Maximum	254	504	8.0	3.07	54.06
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	24.6	278	7.5	8.2	13.8
February	28.1	280	7.4	7.8	13.3
March	24.6	292	7.4	8.3	13.8
April	19.2	280	7.4	7.9	14.9
May	27.6	272	7.5	7.8	18.9
June	29.1	275	6.7	7.8	20.9
July	28.0	272	7.3	7.8	21.2
August	29.9	272	7.0	7.9	21.7
September	32.2	290	7.3	8.1	21.3
October	32.8	287	7.3	7.7	19.2
November	34.3	286	7.1	7.7	18.1
December	29.7	261	7.3	7.9	15.7
Average	28.3	279			17.7
Minimum	19.2	261	6.7		13.3
Maximum	34.3	292		8.3	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	2.1	21.7	0.73	0.17	
February	1.2	4.8	0.75	0.16	
March	1.0	4.9	0.71	0.20	
April	1.4	7.0	0.71	0.57	
May	1.7	3.4	0.66		0.24
June	1.6	2.2	0.64		0.37
July	1.9	3.3	0.64		0.87
August	1.4	2.0	0.62		0.18
September	1.2	3.4	0.70		0.42
October	1.8	4.3	0.90		0.12
November	1.9	2.6	0.68	0.08	
December	2.0	2.0	0.61	0.68	
Average	1.6	5.1	0.70	0.31	0.37
Minimum	1.0	2.0	0.61	0.08	0.12
Maximum	2.1	21.7	0.90	0.68	0.87
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	0.50	0.0	16.03	130
February	0.61	0.0	17.36	108
March	0.54	0.0	16.36	119
April	0.52	0.0	14.81	146
May	0.52	0.0	19.50	108
June	0.50	0.0	18.49	80
July	0.54	0.0	16.53	102
August	0.53	0.0	17.96	86
September	0.57	0.0	19.53	76
October	0.75	0.0	21.15	68
November	0.57	0.0	17.93	70
December	0.48	0.0	17.17	84
Average	0.55	0.0	17.74	98
Minimum	0.48	0.0	14.81	68
Maximum	0.75	0.0	21.15	146
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	6.8	7.4	13.0
February	0.00	6.7	7.3	12.9
March	0.00	6.9	7.3	13.5
April	0.00	6.9	7.4	14.7
May	0.00	6.8	7.2	18.5
June	0.00	6.6	7.2	20.5
July	0.00	6.7	7.5	21.3
August	0.00	6.8	7.3	21.9
September	0.00	6.5	7.2	21.4
October	0.00	6.6	7.1	19.4
November	0.00	6.7	7.2	17.7
December	0.00	6.7	7.1	14.5
Average	0.00			17.4
Minimum	0.00	6.5		12.9
Maximum	0.00		7.5	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	10	191
February	8	9
March	8	33
April	9	24
May	9	48
June	8	12
July	10	13
August	8	21
September	9	8
October	9	20
November	8	3
December	9	3
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	1,963,769	55,304	6,886	13,231	730,844	49,322
February	1,511,909	70,569	6,838	12,230	689,806	45,021
March	1,744,531	96,315	6,448	13,457	747,981	45,318
April	2,357,670	74,288	5,790	14,703	708,217	32,078
May	1,555,598	118,249	5,086	11,788	732,641	17,757
June	1,313,621	106,421	5,564	10,505	692,616	16,607
July	1,373,259	98,606	4,409	11,037	596,462	17,541
August	1,215,030	87,164	4,009	9,794	450,073	18,189
September	1,108,804	85,862	3,823	9,161	471,917	31,616
October	1,187,878	98,001	4,806	9,832	655,179	51,608
November	1,133,405	104,223	4,138	10,873	657,029	47,473
December	1,489,170	88,971	4,777	11,998	705,651	54,021
Total	17,954,644	1,083,973	62,573	138,609	7,838,415	426,551