Port Darlington Water Pollution Control Plant

2018 Annual Performance Report

The Regional Municipality of Durham

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Environmental Compliance Approval (ECA): 0114-8S8RTA Dated April 24, 2012

Environmental Compliance Approval (Air): 2242-8TFNN3 Dated June 19, 2012

The Port Darlington Water Pollution Control Plant (WPCP) 2018 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Port Darlington 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 Port Darlington WPCP is located in the Municipality of Clarington (Bowmanville) and is owned and operated by the Regional Municipality of Durham (Region). The plant operates in accordance with the terms and conditions of the ECAs.

Port Darlington WPCP treats wastewater from the Bowmanville service area in the Region. Two process trains were added in November 2015 and are treating all incoming wastewater. The four existing trains have been removed from service for refurbishment. The Port Darlington WPCP services approximately 42,932 residents.

The Port Darlington WPCP is designed to treat wastewater at an average daily flow rate of 27,276 cubic metres per day (m^3/d). The plant is an MECP Class 3 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 is collected through approximately 158 km of sanitary sewers in Bowmanville and is conveyed to the Port Darlington WPCP by gravity to a sanitary sewage pumping station located at the WPCP.

Preliminary Treatment

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

Grit Removal: Heavy suspended material such as sand and small stones (grit) is removed in the two vortex grit tanks. The velocity of the wastewater swirling in the tanks is controlled by the velocity of influent flow to 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 this process is dewatered and transported to landfill.

Primary Treatment

The two primary clarifiers utilize the physical process of sedimentation which allows 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 Tanks: The aeration tanks are comprised of two distinct sections. The first section is an anoxic zone, where no oxygen is introduced and allows for potential denitrification. Subsequently, the flow 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 throughout the WPCP.

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 single chlorine contact chamber. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged through the 1,350 mm diameter outfall extending 1,100 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.

Sludge management: All stabilized sludge produced at the Port Darlington WPCP is hauled to the Duffin Creek WPCP for incineration.

Environmental Compliance Approval

Under Condition 10 (6) of ECA #0114-8S8RTA 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 Port Darlington WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at 46% of its annual average rated flow capacity and received a maximum daily flow of 58,196 m^3/d on April 17, 2018. See tables 3 and 4 for effluent results.

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

There were no operating problems encountered in 2018.

c) Summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the Works;

- The Port Darlington WPCP Phase 2 Expansion was substantially complete as of November 14, 2017.
- No major maintenance was completed outside of the expansion and refurbishment scope of work.

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;

- The raw influent flow meter was calibrated on June 25, 2018.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted on August 1, 2018.
- Calibration of the in-house lab pH meter is conducted regularly.

f) A 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 annual average daily flow did not exceed the rated capacity of 27,276 m^3/d during the reporting period.
- The pH objective of not less than 6.5 was exceeded in 11 of 361 samples (3%). The pH meter was calibrated regularly.

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

g) A tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the locations to where the sludge was disposed:

The volume of sludge removed from Port Darlington WPCP in 2018 was 24,948 m^3.

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

There is no increase in sludge volume expected in the next reporting period.

Summary of locations to where sludge was disposed:

All stabilized sludge produced at the Port Darlington WPCP is hauled to the Duffin Creek WPCP for incineration.

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

There were no documented complaints received about the Port Darlington WPCP in 2018.

i) A summary of all By-pass, Spills or abnormal discharge events;

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

There were no spills during the reporting period.

MECP Inspection

This plant was last inspected by the MECP on November 24, 2015.

Table 1 Raw Influent Flows

Month	Total Flow to Plant - metered at the raw influent cubic metre	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	378,302	12,203	20,000
February	391,732	13,990	27,776
March	391,633	12,633	16,236
April	616,207	20,540	58,196
May	402,514	12,984	18,212
June	307,149	10,238	11,106
July	303,695	9,797	12,602
August	306,364	9,883	11,783
September	313,472	10,449	14,426
October	338,848	10,931	13,348
November	425,442	14,181	21,637
December	422,156	13,618	17,579
Total	4,597,514		
Average	383,126	12,596*	
Minimum	303,695		
Maximum	616,207		58,196
ECA Limit		27,276	
Met Compliance		Yes	

*Annual average daily flow

Table 2 Raw Influent Analyses

Month	Carbonaceous Biochemical Oxygen Demand average (avg.) concentration (conc.) milligram per litre (mg/L)	Biochemical Oxygen Demand avg. conc. mg/L	Total Suspended Solids avg. conc. mg/L	Total Phosphorous (TP) avg. conc. mg/L	TP loading kilograms per day
January	149	205	399	8.7	105.7
February	176	217	301	6.5	91.0
March	167	203	387	7.2	91.4
April	138	156	294	4.6	94.3
May	139	173	244	7.4	95.8
June	171	209	250	6.3	64.9
July	169	201	323	5.7	55.7
August	183	222	318	5.6	55.3
September	169	190	256	5.5	57.8
October	163	196	208	5.7	62.0
November	115	158	293	4.5	63.7
December	156	193	259	6.2	84.2
Average	158	194	294	6.2	77.5
Minimum	115	156	208	4.5	55.3
Maximum	183	222	399	8.7	105.7
Sampling Frequency Requirement Met		Yes	Yes	Yes	

Table 2 Raw Influent Analyses continued

Month	Total Kjeldahl Nitrogen average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Ammonia Nitrogen avg. conc. mg/L	pH minimum	pH maximum
January	47.84	50.6	7.4	8.4
February	45.58	46.1	6.8	8.1
March	48.33	48.8	7.1	9.0
April	35.58	35.9	6.8	8.5
May	45.26	49.1	7.4	8.3
June	55.03	47.9	7.1	8.2
July	51.84	36.1	7.1	8.4
August	50.73	27.3	7.1	8.4
September	51.65	24.2	6.8	8.6
October	50.80	28.8	7.1	8.5
November	38.85	29.1	7.3	8.6
December	52.13	33.9	7.4	8.6
Average	47.80	38.2		
Minimum	35.58	24.2	6.8	
Maximum	55.03	50.6		9.0
Sampling Frequency Requirement Met	Yes			

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids avg. conc. mg/L	Total Phosphorous (TP) avg. conc. mg/L	TP loading kilograms per day	Total Ammonia Nitrogen avg. conc. mg/L summer	Total Ammonia Nitrogen avg. conc. mg/L winter
January	3.9	11.3	0.51	6.2		0.42
February	3.7	8.2	0.27	3.8		0.62
March	4.1	7.9	0.22	2.8		0.58
April	6.9	11.9	0.28	5.8		1.48
May	3.1	4.5	0.22	2.9		0.48
June	2.4	3.4	0.37	3.8	0.31	
July	2.9	6.1	0.44	4.3	0.72	
August	2.7	8.0	0.50	5.0	0.25	
September	4.0	9.7	0.52	5.4	0.31	
October	2.3	5.8	0.22	2.5	0.14	
November	2.7	6.1	0.17	2.5		0.17
December	5.2	9.8	0.46	6.3		1.90
Average	3.7	7.7	0.35	4.4	0.35	0.81
Minimum	2.3	3.4	0.17	2.5	0.14	0.17
Maximum	6.9	11.9	0.52	6.3	0.72	1.90
ECA Limit prior to May 14, 2018	25.0	25.0	1.0			
ECA Objective prior to May 14, 2018	15.0	15.0	1.0		14.0	14.0
ECA Limit as of May 14, 2018	25.0	25.0	0.8		14.0	24.0
ECA Objective as of May 14, 2018	15.0	15.0	0.6	16.4	8.0	12.0
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 average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Kjeldahl Nitrogen avg. conc. mg/L	Total Chlorine Residual avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	0.0	1.95	0.00	6.7	7.9	11.3
February	0.0	1.97	0.00	6.5	7.9	13.0
March	0.0	1.94	0.00	6.5	7.7	13.1
April	0.0	3.23	0.00	6.4	7.7	13.0
May	0.0	1.74	0.00	6.8	7.7	16.7
June	0.0	1.53	0.00	6.4	7.9	18.4
July	0.0	2.13	0.00	6.2	7.4	21.5
August	0.0	1.72	0.00	6.4	7.5	22.2
September	0.0	2.25	0.00	6.4	7.9	21.5
October	0.0	1.44	0.00	6.1	7.7	17.0
November	0.0	1.44	0.00	7.0	8.2	13.6
December	0.0	4.12	0.00	7.1	7.6	12.7
Average	0.0	2.12	0.00			16.2
Minimum	0.0	1.44	0.00	6.1		11.3
Maximum	0.0	4.12	0.00		8.2	22.2
ECA Limit prior to May 14, 2018				5.5	9.5	
ECA Objective prior to May 14, 2018			0.5	6.5	9.0	
ECA Limit as of May 14, 2018			0.02	6.0	9.5	
ECA Objective as of May 14, 2018			0.01	6.5	9.0	
Within Compliance			Yes	Yes	Yes	
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	8
February	4	4
March	4	1
April	4	12
May	5	6
June	4	7
July	5	6
August	4	3
September	4	47
October	5	8
November	4	34
December	4	11
ECA Limit		200
ECA Objective as of May 14, 2018		100
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 kilowatt hours	Natural Gas cubic metres
January	378,302	28,645	1,333	2,982	288,020	62,427
February	391,732	29,495	1,538	3,685	257,803	41,721
March	391,633	33,083	1,215	4,850	292,413	46,860
April	616,207	35,251	1,925	3,346	294,270	44,833
May	402,514	33,812	1,333	3,158	266,620	16,632
June	307,149	26,054	994	4,888	249,342	11,293
July	303,695	25,659	1,054	4,587	259,165	12,253
August	306,364	25,659	1,148	5,527	254,368	9,028
September	313,472	47,001	1,484	8,084	256,068	22,802
October	338,848	38,595	1,417	4,249	271,125	33,200
November	425,442	22,661	1,398	6,354	274,394	44,377
December	422,156	17,784	1,232	6,580	287,736	58,543
Total	4,597,514	363,698	16,070	58,291	3,251,324	403,969

Table 6 Summary of Raw Water Bacteriological Analyses at the Bowmanville Water Supply Plant

Month	*E. coli* Colony Forming Units per 100 millilitre (CFU/100ml) Range (minimum to maximum result)	*E. coli* (number of samples)	Total Coliform CFU/100ml Range (minimum to maximum result)	Total Coliform (number of samples)
January	<1	18	<1-61	18
February	<1-18	15	<1-1600	15
March	<1	17	<1-35	17
April	<1-3	16	<1-83	16
May	<1	18	<1-4	18
June	<1-2	16	<1-10	16
July	<1-3	17	<1-8	17
August	<1-7	17	<1-39	17
September	<1	15	<1-49	15
October	<1	18	<1-4	18
November	<1-2	16	<1-63	16
December	<1	14	<1-55	14