Port Darlington Water Pollution Control Plant

2017 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) 2017 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Port Darlington WPCP in 2017. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment and Climate Change (MOECC). 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 is operating according to the terms and conditions of the ECAs.

Port Darlington WPCP treats wastewater from the Bowmanville service area in the Region. Two new process trains have been added as of November 2015 and are treating all incoming wastewater. The four existing trains were removed from service for refurbishment. The Port Darlington WPCP services 41,223 residents.

The Port Darlington WPCP is designed to treat wastewater at an average daily flow rate of 13,638 cubic metres per day (m^3/d), with an increased rating of 27,276 m^3/d as of November 14th, 2017 when substantial completion of the plant upgrades and expansion was recognized. The plant is an MOECC Class Three 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 144 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 is intended to lower 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 either the Courtice WPCP or the Duffin Creek WPCP for further processing.

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 98% of its annual average rated flow capacity based on the existing pre-construction plant capacity and operated at 40% of its annual average rated flow capacity after substantial completion of the Phase II expansion. The plant received a maximum daily flow of 51,142 m^3/d on May 6th, 2017. 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 2017.

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

- Due to the construction, 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 in May 2017.
- Calibration of the AutoCat 9000 chlorine analyzer was conducted in July 2017.
- 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 13,638 m^3/d during the reporting period.

The pH objective of not less than 6.5 was exceeded in two of 263 samples (0.8%). 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 2017 was 27,702 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:
Duffin Creek WPCP – 22,182 m^3 or 80.1%
Courtice WPCP – 5,520 m^3 or 19.9%

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 2017.

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.

MOECC Inspection

This plant was inspected by the MOECC on November 24th, 2015.

Table 1 Influent Flows

Month	Total Flow to Plant -metered at the final effluent m^3	Average Daily Flow m^3/d	Maximum Daily Flow m^3/d
January	397,002	12,807	17,888
February	345,052	12,323	21,275
March	415,850	13,415	27,055
April	473,198	15,773	28,661
May	679,823	21,930	51,142
June	437,638	14,588	47,560
July	419,201	13,523	19,875
August	317,896	10,255	11,544
September	289,055	9,635	11,968
October	319,072	10,293	15,499
November	332,037	11,068	13,685
December	337,847	10,898	13,305
Total	4,763,671		
Average	396,973	13,051*	
Minimum	289,055		
Maximum	679,823		51,142
ECA Limit		13,638 / 27,276**	
Met Compliance		Yes	

*Annual average daily flow
**As of November 14th, 2017 the rated capacity is 27,276 m^3/d

Table 2 Raw Influent Analyses

Month	$CBOD_5$ avg. conc. mg/L	BOD_5 avg. conc. mg/L	TSS avg. conc. mg/L	TP avg. conc. mg/L
January	173	228	534	4.0
February	170	283	517	5.0
March	99	131	191	5.5
April	126	150	345	4.0
May	114	163	248	3.1
June	129	171	415	4.9
July	208	241	581	4.9
August	221	272	553	5.5
September	167	217	344	4.9
October	249	294	1,104	6.4
November	206	253	933	6.2
December	130	143	292	7.2
Average	166	212	505	5.1
Minimum	99	131	191	3.1
Maximum	249	294	1,104	7.2
Sampling Frequency Requirement Met		Yes	Yes	Yes

Table 2 Raw Influent Analyses continued

Month	DP avg. conc. mg/L	TKN avg. conc. mg/L	TAN avg. conc. mg/L	pH minimum	pH maximum
January	1.76	39.78	25.8	5.0	8.5
February	2.60	46.65	31.6	7.0	8.5
March	2.47	45.58	30.7	7.5	8.5
April	1.52	34.85	24.9	7.5	8.4
May	0.79	26.50	20.4	7.3	8.5
June	1.29	35.18	36.6	7.0	8.2
July	1.13	39.43	25.6	7.1	8.2
August	1.78	43.34	36.9	7.3	8.4
September	1.95	43.10	36.0	7.1	8.1
October	1.60	47.54	32.3	7.1	8.2
November	1.33	44.45	38.9	7.8	8.4
December	2.54	51.90	46.7	6.9	8.4
Average	1.73	41.52	32.2		
Minimum	0.79	26.50	20.4	5.0	
Maximum	2.60	51.90	46.7		8.5
Sampling Frequency Requirement Met		Yes			

Table 3 Final Effluent Analyses

Month	CBOD5 avg. conc. mg/L	TSS avg. conc. mg/L	TP avg. conc. mg/L	TAN avg. conc. mg/L
January	4.8	9.8	0.32	1.36
February	4.8	12.1	0.49	3.92
March	3.3	6.1	0.37	5.28
April	4.3	12.4	0.35	3.98
May	3.5	10.4	0.27	1.27
June	2.7	11.5	0.35	0.11
July	3.5	12.1	0.33	0.24
August	2.5	8.6	0.45	0.13
September	2.8	6.9	0.72	0.22
October	2.9	7.0	0.48	0.14
November	3.9	6.4	0.38	0.47
December	4.0	5.9	0.42	1.56
Average	3.6	9.1	0.41	1.56
Minimum	2.5	5.9	0.27	0.11
Maximum	4.8	12.4	0.72	5.28
ECA Limit	25.0	25.0	1.0	
ECA Objective	15.0	15.0	1.0	14.0
Within Compliance	Yes	Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Unionized NH3 avg. conc. mg/L	TKN avg. conc. mg/L	TCR avg. conc. mg/L	pH minimum	pH maximum	Temp. avg. °C
January	0.0	2.92	0.00	6.7	7.3	14.1
February	0.0	4.81	0.01	6.6	7.5	14.1
March	0.0	6.60	0.09	6.8	7.4	12.7
April	0.0	5.02	0.03	6.8	8.4	15.0
May	0.0	2.76	0.01	6.8	7.5	13.1
June	0.0	1.38	0.00	6.9	7.5	15.4
July	0.0	1.75	0.00	6.9	7.5	18.0
August	0.0	1.45	0.01	6.7	7.4	18.3
September	0.0	1.63	0.01	6.6	7.3	20.0
October	0.0	1.54	0.01	6.4	7.7	17.0
November	0.0	1.85	0.01	6.6	7.4	14.9
December	0.0	3.06	0.00	6.6	7.5	11.7
Average	0.0	2.90	0.02			15.4
Minimum	0.0	1.38	0.00	6.4		11.7
Maximum	0.0	6.60	0.09		8.4	20.0
ECA Limit				5.5	9.5	
ECA Objective			0.5	6.5	9.0	
Within Compliance				Yes	Yes	
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes	Yes

Table 4 Escherichia Coliform Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	1
February	4	1
March	4	1
April	4	1
May	5	15
June	4	21
July	4	2
August	5	12
September	4	4
October	5	8
November	4	14
December	4	4
ECA Limit		200
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 (kWh)	Natural Gas (cubic metres)
January	397,002	33,332	1,064	1,504	265,937	40,396
February	345,052	32,253	688	1,068	239,171	39,485
March	415,850	33,773	676	1,278	297,874	36,406
April	473,198	35,970	882	1,466	289,964	28,586
May	679,823	42,565	1,301	1,579	301,227	24,680
June	437,638	29,376	1,054	1,805	255,140	12,657
July	419,201	27,457	1,129	1,767	269,059	7,930
August	317,896	26,858	1,032	1,429	253,886	8,538
September	289,055	22,901	1,247	1,617	242,694	8,136
October	319,072	28,507	1,495	2,885	263,206	16,049
November	332,037	25,565	1,449	5,490	263,920	35,691
December	337,847	28,245	965	4,988	262,283	34,930
Total	4,763,671	366,801	12,982	26,876	3,204,361	293,484

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

Month	E.coli cfu/100ml (min-max result)	E.coli (number of samples)	Total Coliform cfu/100ml (min-max result)	Total Coliform (number of samples)
January	<1-1	17	<1-82	17
February	<1-1	15	<1-190	15
March	<1-1	18	<1-7	18
April	<1-1	15	<1-22	15
May	<1	18	<1-11	18
June	<1	17	<1-54	17
July	<1-8	16	<1-380	16
August	<1-2	18	1-200	18
September	<1	15	<1-87	15
October	<1-2	17	<1-47	17
November	<1-1	17	<1-35	17
December	<1	14	<1-9	14