Port Darlington Water Pollution Control Plant

2020 Annual Performance Report

The Regional Municipality of Durham
Port Darlington Water Pollution Control Plant 2020 Annual Performance Report

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) 2020 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. 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 plant treats wastewater from approximately 46,899 residents in the Bowmanville service area. 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
- phosphorus removal,
- secondary treatment,
- disinfection (chlorination/dechlorination), and
- solids management.

Raw Influent Pumping

Wastewater is collected through approximately 157 kilometres of sanitary sewers in Bowmanville and is conveyed to the Port Darlington WPCP by gravity to the raw 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 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 phosphorus level in the final effluent by adding a chemical coagulant, ferrous chloride, into various locations throughout the Water Pollution Control Plant (WPCP). In 2020 ferrous chloride was dosed only in the primary effluent.

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 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.
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 single chlorine contact chamber. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged through a 1,350 millimetre (mm) diameter land section of effluent sewer extending 525 metres (m) to a 1,200 mm diameter marine section of effluent outfall which extends 1,055 m 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.
Sludge Management: All stabilized sludge produced at the Port Darlington Water Pollution Control Plant (WPCP) is hauled to the Duffin Creek WPCP for incineration.

Environmental Compliance Approval (ECA)

Under Condition 10.(6) of ECA #0114-8S8RTA 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 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 53,264 m^3/d on January 13, 2020. See tables 3 and 4 for effluent results.

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

A Request for Pandemic Related Temporary Relief (Alternative Arrangement) for Municipal Wastewater Systems was submitted to the MECP on March 31, 2020. The request was made for relief of influent sampling to assist in managing workload and for the health and safety of staff.

The Director granted relief on April 29, 2020. Port Darlington WPCP returned to normal sampling practices on June 1, 2020.

From June 28 until July 5, the final effluent composite sampler failed to sample. A weekly sample for $CBOD_5$, Total Ammonia Nitrogen, Unionized Ammonia, Total Suspended Solids and Total Phosphorus was not collected or analyzed. The sampling frequency was not met for these parameters. A spare sampler is now available to operations staff to prevent any future reoccurrence.

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 2020 included:

- Dewatered primary sludge tank 5A for inspection and maintenance,

- Serviced waste gas burner,
- Repaired yard hydrant at the recreational vehicle dump station
- Repaired drain in the wet well,
- Serviced all primary sludge valves,
- Replaced all chemical feed pump elements,
- Cleaned raw sludge pumps #7 and #8,
- Completed wear shoe flipping on primary clarifier flight #5a and 5B,
- Completed wear shoe flipping on primary clarifier flight #6a and 6B,
- Changed oil in primary clarifier gear boxes.

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.
- Online instrumentation is verified by Water Pollution Control Plant (WPCP) operators using field or lab test equipment. On-line instrumentation is verified by WPCP operators using various field or lab test equipment.

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

- The raw influent flow meter was calibrated on August 20, 2020.
- Calibration of in-house lab equipment was conducted on September 14, 2020.
- 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 and remain below the objectives specified in the Environmental Compliance Approval.

- 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 20 of 366 samples (5%). The pH meter was calibrated regularly.

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 Port Darlington Water Pollution Control Plant (WPCP) in 2020 was 25,397 cubic metres.

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 was 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;

A summary of complaints received from the public is administered through a central database. No complaints were received in 2020.

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.

Ministry of the Environment, Conservation and Parks (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	562,123	18,133	53,264
February	380,165	13,109	15,434
March	518,497	16,726	24,068
April	414,501	13,817	19,264
May	370,180	11,941	14,037
June	320,389	10,680	11,543
July	323,361	10,431	11,500
August	325,230	10,491	11,692
September	304,948	10,165	11,058
October	327,946	10,579	11,870
November	323,689	10,790	14,206
December	404,476	13,048	15,048
Total	4,575,505		
Average	381,292	12,501*	
Minimum	304,948		
Maximum	562,123		53,264
ECA Limit		27,276	
Met Compliance		Yes	

*Annual average daily flow

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids avg. conc. mg/L	Total Phosphorus avg. conc. mg/L	Total Kjeldahl Nitrogen avg. conc. mg/L
January	127	196	4.0	35.38
February	191	274	6.8	54.49
March	123	179	4.1	30.31
April	113	189	4.4	38.88
May	184	244	6.1	54.13
June	176	219	5.6	54.59
July	161	228	5.6	56.44
August	163	212	5.6	52.54
September	169	206	5.0	52.99
October	199	263	5.3	54.71
November	184	253	5.9	56.59
December	191	224	5.1	49.07
Average	165	224	5.3	49.18
Minimum	113	179	4.0	30.31
Maximum	199	274	6.8	56.59
Sampling Frequency Requirement Met	Yes	Yes	Yes	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 Phosphorus (TP) avg. conc. mg/L	TP loading kilograms per day year to date avg.	Total Ammonia Nitrogen avg. conc. mg/L summer	Total Ammonia Nitrogen avg. conc. mg/L winter
January	3.9	8.0	0.25	4.5		2.18
February	4.7	9.9	0.30	4.3		1.40
March	5.2	13.1	0.32	4.7		2.23
April	4.7	8.0	0.39	4.9		2.97
May	6.1	10.9	0.46	5.1		1.57
June	5.2	10.0	0.38	5.0	2.51	
July	3.6	5.7	0.31	4.7	0.54	
August	3.6	5.9	0.39	4.6	0.42	
September	3.4	6.6	0.36	4.5	0.38	
October	4.6	8.7	0.40	4.5	0.85	
November	3.8	9.3	0.48	4.6		2.06
December	3.0	7.7	0.26	4.5		0.82
Average	4.3	8.7	0.36	4.5	0.94	1.89
Minimum	3.0	5.7	0.25	4.3	0.38	0.82
Maximum	6.1	13.1	0.48	5.1	2.51	2.97
ECA Limit	25.0	25.0	0.8		14.0	24.0
ECA Objective	15.0	15.0	0.6	16.4	8.0	12.0
Within Compliance	Yes	Yes	Yes		Yes	Yes
Sampling Frequency Requirement Met	No	No	No		No	Yes

Table 3 Final Effluent Analyses continued

Month	Unionized Ammonia average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Chlorine Residual avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	0.0	0.00	6.4	7.8	11.6
February	0.0	0.00	6.5	7.5	12.5
March	0.0	0.00	7.0	7.8	12.3
April	0.0	0.00	6.8	7.5	12.7
May	0.0	0.00	6.6	7.3	14.9
June	0.0	0.00	6.6	7.5	17.6
July	0.0	0.00	6.3	7.4	20.6
August	0.0	0.00	6.3	7.0	21.0
September	0.0	0.00	6.4	7.5	20.7
October	0.0	0.00	6.4	7.9	19.3
November	0.0	0.00	6.2	7.5	16.1
December	0.0	0.00	6.8	7.3	14.2
Average	0.0	0.00			16.1
Minimum	0.0	0.00	6.2		11.6
Maximum	0.0	0.00		7.9	21.0
ECA Limit		0.02	6.0	9.5	
ECA Objective		0.01	6.5	9.0	
Within Compliance		Yes	Yes	Yes	
Sampling Frequency Requirement Met	No	Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	9	3
February	8	2
March	7	4
April	4	1
May	4	13
June	9	7
July	9	6
August	8	11
September	9	9
October	9	9
November	8	4
December	10	2
ECA Limit		200
ECA Objective		100
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Total Plant Flow cubic metre (m^3)	Ferrous Chloride Litre (L)	Sodium Hypochlorite kilogram as chlorine	Sodium Bisulphite L	Hydro kilowatt hours	Natural Gas m^3
January	562,123	28,069	1,140	2,098	280,124	82,368
February	380,165	26,400	672	4,751	274,970	81,385
March	518,497	32,337	946	9,847	276,409	71,239
April	414,501	31,802	731	6,849	262,936	55,608
May	370,180	37,058	1,056	9,479	269,481	40,433
June	320,389	38,886	1,144	5,331	264,944	22,928
July	323,361	39,757	1,491	6,313	275,128	19,737
August	325,230	40,184	1,954	6,096	274,533	18,220
September	304,948	39,671	1,802	8,200	284,129	19,835
October	327,946	40,087	1,651	6,051	299,659	15,296
November	323,689	41,791	1,313	7,936	279,985	48,614
December	404,476	43,898	1,615	4,252	309,005	66,741
Total	4,575,505	439,940	15,515	77,203	3,351,303	542,404

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

Month	*Escherichia coli* (*E. coli*) Number of Samples	*E. coli Colony Forming Units per 100 millilitre (CFU/100ml) Results Range*	Total Coliform Number of Samples	Total Coliform Results Range
January	17	Non-Detect (ND) – Overgrown (OG)	17	ND - OG
February	15	ND	15	ND - 18
March	15	ND -1	15	ND - 59
April	9	ND - 9	9	ND - 88
May	11	ND	11	ND - 47
June	18	ND - 3	18	ND - 11
July	17	ND - 1	17	ND - 290
August	16	ND - 5	16	ND - 210
September	17	ND -1	17	ND - 21
October	16	ND - 1	16	ND - 4
November	16	ND - 1	16	ND - 9
December	16	ND - 1	16	ND - 30