Port Darlington Water Pollution Control Plant

2021 Annual Performance Report

The Regional Municipality of Durham
Port Darlington Water Pollution Control Plant 2021 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) 2021 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 47,956 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 159 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 2021 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 35,406 cubic metres per day (m^3/d) on September 23, 2021. See tables 3 and 4 for effluent results.

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

There were no operating issues encountered in 2021.

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 2021 included:

- Replaced raw sewage pump 4 force main vent
- Maintained primary digester 1 and 2 mixing pumps
- Replaced secondary clarifier 501A drive motor and shutoff switch

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.
- Online instrumentation is verified by 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 December 2, 2021.
- Calibration of in-house lab equipment was conducted on October 12, 2021.
- 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 cubic metres per day (m^3/d) during the reporting period.
- The pH objective of not less than 6.5 was exceeded in 14 of 365 samples (3.8%). 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 2021 was 22,980 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 2021.

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	384,606	12,407	16,397
February	311,002	11,107	13,734
March	374,157	12,070	16,494
April	439,765	14,659	26,592
May	383,125	12,359	16,578
June	325,589	10,853	13,659
July	364,196	11,748	15,461
August	336,504	10,855	11,864
September	397,990	13,266	35,406
October	441,846	14,253	22,841
November	397,341	13,245	15,322
December	454,680	14,667	20,987
Total	4,610,801		
Average	384,233	12,632*	
Minimum	311,002		
Maximum	454,680		35,406
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	186	224	5.4	48.98
February	180	232	6.7	59.31
March	225	227	5.8	52.84
April	162	237	4.9	48.38
May	180	227	5.2	52.90
June	167	215	5.9	56.18
July	150	237	5.6	54.84
August	141	211	5.8	56.57
September	143	183	4.7	47.58
October	164	191	4.0	43.48
November	158	203	4.4	46.40
December	148	238	4.6	46.82
Average	167	219	5.3	51.19
Minimum	141	183	4.0	43.48
Maximum	225	238	6.7	59.31
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	3.8	7.5	0.24	3.0		1.7
February	2.8	7.2	0.20	2.6		1.63
March	2.7	6.9	0.18	2.5		0.8
April	3.2	6.5	0.17	2.5		0.91
May	3.9	10.9	0.36	2.9		1.29
June	2.6	9.7	0.37	3.1	1.14	
July	1.2	3.0	0.21	3.0	0.24	
August	1.0	5.8	0.27	3.0	0.16	
September	1.3	4.5	0.20	3.0	0.4	
October	1.2	5.4	0.20	3.0	0.63	
November	2.5	5.6	0.32	3.1		0.26
December	4.1	11.1	0.29	3.2		0.16
Average	2.5	7.0	0.25	3.2	0.51	0.96
Minimum	1.0	3.0	0.17	2.5	0.16	0.16
Maximum	4.1	11.1	0.37	3.2	1.14	1.70
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	Yes	Yes	Yes		Yes	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	6.8	8.4	13.8
February	0.0	0.00	6.5	7.3	13.8
March	0.0	0.00	6.4	7.6	13.3
April	0.0	0.00	6.5	7.1	13.5
May	0.0	0.00	6.5	7.3	15.7
June	0.0	0.00	6.2	6.8	18.4
July	0.0	0.00	6.5	7.5	19.4
August	0.0	0.00	6.3	7.4	20.8
September	0.0	0.00	6.7	8.1	19.1
October	0.0	0.00	6.8	7.5	17.8
November	0.0	0.00	6.5	7.5	14.1
December	0.0	0.00	6.8	7.8	12.1
Average	0.0	0.00			16.0
Minimum	0.0	0.00	6.2		12.1
Maximum	0.0	0.00		8.4	20.8
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	Yes	Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	8	2
February	8	2
March	9	3
April	9	16
May	8	14
June	9	19
July	9	26
August	9	46
September	9	53
October	8	42
November	9	83
December	9	29
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	384,606	39,845	1,220	5,909	289,566	66,560
February	311,002	35,092	831	5,444	282,038	76,624
March	374,157	39,888	820	5,090	322,014	70,820
April	439,765	43,344	910	5,361	318,690	61,377
May	383,125	37,447	961	5,570	338,102	38,445
June	325,589	38,376	1,030	5,416	302,353	22,806
July	364,196	42,381	1,110	5,487	298,100	15,285
August	336,504	40,360	1,232	5,651	298,887	24,530
September	397,990	43,555	1,225	5,452	276,819	22,134
October	441,846	45,124	798	5,769	283,993	31,744
November	397,341	32,446	698	5,588	280,873	47,183
December	454,680	44,113	1,175	5,628	305,075	63,676
Total	4,610,801	481,971	12,009	66,365	3,596,510	541,184

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	16	Non-Detect (ND) – 1	16	ND - 75
February	15	ND	15	ND - 4
March	19	ND - 4	19	ND - 14
April	16	ND - 3	16	ND - 5
May	14	ND - 4	14	ND - 14
June	18	ND - 1	18	ND - 13
July	16	ND - 2	16	ND - 16
August	17	ND - 2	17	ND - 34
September	16	ND - 5	16	ND - 14
October	15	ND - 2	15	ND - 11
November	17	ND - 2	17	ND - 59
December	16	ND - 1	16	ND - 88