Port Darlington Water Pollution Control Plant

2022 Annual Performance Report

The Regional Municipality of Durham
Port Darlington Water Pollution Control Plant 2022 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) 2022 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 49,040 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. In 2022, 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 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.
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 26,933 cubic metres per day (m^3/d) on February 17, 2022. 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 2022.

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 2022 included:

- Reconfigured Secondary 5 and 6 Return Activated Sludge discharge lines,
- Cleaned out aeration tank 5 and diffusers,
- Maintained and cleaned aeration blowers 1, 2 and 3.

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 November 15, 2022.

Calibration of in-house laboratory equipment was conducted on November 18, 2022.

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 monthly total ammonia nitrogen objective of 12.0 mg/L (November to May) was exceeded for three months (March 12.2 mg/L, April 16.6 mg/L and May 12.5 mg/L)). During this period one of the aeration tanks was taken out of service to allow for reconfiguration of the return activated sludge discharge lines. Once the work was completed the ammonia levels stabilized and were below the seasonal objectives.

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 2022 was 23,164 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 2022.

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* - cubic metre	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	377,638	12,182	13,960
February	401,428	14,337	26,933
March	492,453	15,886	22,733
April	423,124	14,104	16,064
May	394,165	12,715	16,364
June	372,949	12,432	16,368
July	355,362	11,463	16,729
August	354,531	11,436	18,506
September	329,848	10,995	12,255
October	334,370	10,786	11,961
November	324,596	10,820	14,795
December	444,271	14,331	25,603
Total	4,604,735		
Average	383,728	12,616**	
Minimum	324,596		
Maximum	492,453		26,933
ECA Limit		27,276	
Met Compliance		Yes	

*Metered at the raw influent

**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	218	305	6.3	59.79
February	148	240	5.5	55.64
March	138	180	4.1	44.37
April	116	219	5.4	51.09
May	146	200	5.5	52.99
June	178	243	5.7	57.90
July	145	210	5.4	53.14
August	139	200	5.4	58.15
September	151	233	5.5	55.44
October	193	280	6.0	64.96
November	190	264	6.0	57.63
December	175	216	5.0	51.95
Average	161	233	5.5	55.25
Minimum	116	180	4.1	44.37
Maximum	218	305	6.3	64.96
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	8.1	0.22	2.7		0.44
February	3.0	7.9	0.19	2.8		3.54
March	3.3	6.8	0.43	4.0		12.21
April	2.9	5.1	0.50	4.8		16.61
May	2.2	4.7	0.41	4.8		12.46
June	2.7	8.1	0.28	4.6	3.24	
July	2.5	5.1	0.17	4.1	4.87	
August	2.3	8.7	0.23	3.9	2.51	
September	2.2	9.4	0.35	4.0	3.86	
October	2.5	7.6	0.31	3.9	2.29	
November	1.9	6.7	0.51	4.1		3.56
December	2.6	6.6	0.38	4.2		7.47
Average	2.7	7.1	0.33	4.2	3.35	8.04
Minimum	1.9	4.7	0.17	2.7	2.29	0.44
Maximum	3.9	9.4	0.51	4.8	4.87	16.61
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	6.6	7.6	9.4
February	0.0	0.00	6.8	7.6	10.3
March	0.0	0.00	7.1	7.7	11.0
April	0.1	0.00	7.2	7.7	12.8
May	0.0	0.00	6.9	7.6	15.7
June	0.0	0.00	7.0	7.6	17.3
July	0.0	0.00	6.9	7.3	20.1
August	0.0	0.00	6.8	7.3	21.1
September	0.0	0.00	7.1	7.5	19.5
October	0.0	0.00	7.0	7.9	16.9
November	0.0	0.00	6.7	7.5	15.5
December	0.1	0.00	7.2	7.9	12.5
Average	0.0	0.00			15.2
Minimum	0.0	0.00	6.6		9.4
Maximum	0.1	0.00		7.9	21.1
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	9
February	8	3
March	10	1
April	8	2
May	9	5
June	9	10
July	8	3
August	9	7
September	9	10
October	8	1
November	9	1
December	9	1
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	377,638	43,870	1,508	5,734	305,339	100,081
February	401,428	42,969	1,126	5,079	265,413	85,076
March	492,453	34,406	960	5,752	285,838	78,328
April	423,124	27,284	699	5,431	263,455	55,200
May	394,165	30,181	709	5,655	271,481	40,544
June	372,949	42,377	1,039	5,612	298,427	25,863
July	355,362	44,269	1,154	5,626	309,889	27,703
August	354,531	35,153	1,161	5,654	315,710	23,412
September	329,848	32,612	1,119	5,385	284,077	24,824
October	334,370	30,339	1,143	5,564	288,472	43,341
November	324,596	31,514	1,134	5,346	285,709	49,913
December	444,271	26,538	1,190	5,513	299,165	72,644
Total	4,604,735	421,512	12,941	66,351	3,472,975	626,929

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

Month	*Escherichia coli* (*E.*	*E. coli Colony Forming Units per 100 millilitre (CFU/100ml) Results Range*	Total Coliform Number of Samples	Total Coliform Results Range
January	15	Non-Detect (ND)	15	ND - 5
February	15	ND - 1	15	ND - 280
March	19	ND - 1	19	ND - 130
April	15	ND - 3	15	ND - 5
May	17	ND - 1	17	ND - 2
June	18	ND	18	ND - 3
July	16	ND - 4	16	ND - 24
August	18	ND - 2	18	ND - 420
September	15	ND - 2	15	ND - 11
October	16	ND - 1	16	ND - 5
November	18	ND	18	ND - 5
December	15	ND - 1	15	ND - 56