Newcastle Water Pollution Control Plant

2020 Annual Performance Report

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

Environmental Compliance Approval (ECA): 3-2189-87-946 Dated July 26, 1994
Amendments Dated;
June 21, 2006
May 10, 1998
June 11, 1996

Environmental Compliance Approval (Air): 8-3083-93-006 Dated March 22, 1993

The Newcastle Water Pollution Control Plant (WPCP) 2020 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Newcastle 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 Newcastle WPCP is located in the Municipality of Clarington (Newcastle) and is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECAs.

The plant treats wastewater from approximately 11,607 residents in the Newcastle service area. The Newcastle WPCP is designed to treat wastewater at an average flow rate of 4,086 cubic metres per day (m^3/d) with a peak flow rate of 12,300 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 storage.

Raw Influent Pumping

Wastewater collected through approximately 42 kilometres of sanitary sewers in Newcastle is conveyed to the Newcastle WPCP by gravity and by two sanitary sewage pumping stations located in the collection system. The Rudell Sanitary Sewage Pumping Station was taken out of service August

2020. The flow has been diverted to a new trunk sewer line that has been constructed under Highway 401 and the Canadian National Railway.

Preliminary Treatment

Screening: One automatic, mechanically cleaned screen and one emergency manual screen remove paper products and large material that could harm pumps and process equipment. Screenings removed in this process are transported to landfill.
Grit Removal: Heavy suspended material such as sand and small stones (grit) is removed in the aerated grit tank. The velocity of the wastewater rolling in the tanks is controlled by the quantity of air added to produce conditions that 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 primary clarifier utilizes 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 sweep arm mechanism which pushes the sludge into a hopper. The sludge is then pumped to the sludge holding tank for transportation to the Courtice Water Pollution Control Plant (WPCP), the Port Darlington WPCP or the Duffin Creek WPCP. Any material floating on the surface of the clarifier is also removed to the sludge holding tank.

Phosphorus Removal

The phosphorus removal system lowers the total phosphorus level in the final effluent by adding a chemical coagulant, aluminum sulphate, into various locations within the plant. In 2020 aluminum sulphate was dosed only in the channel between the aeration tanks and the secondary clarifiers.

Secondary Treatment

Aeration Tanks: The two aeration tanks are each 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 clarifier.

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 900 millimetre (mm) diameter outfall extending 130 metres (m) to a 600 mm diameter pipe which extends another 800 m into Lake Ontario.

Sludge Management: All sludge produced at the Newcastle Water Pollution Control Plant (WPCP) is stored in a sludge holding tank. The sludge is shipped to the Courtice WPCP, the Port Darlington WPCP or the Duffin Creek WPCP for anaerobic digestion.

Environmental Compliance Approval (ECA)

Under Condition 17.(1) of ECA #3-2189-87-946 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 Newcastle WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. The plant operated at an average of 75% of its annual average rated flow capacity and received a maximum daily flow of 13,825 m^3/d on January 12, 2020. See tables 3 and 4 for effluent results.

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

Influent wastewater sampling was reduced from March 24 to June 1 to assist in managing workload and for the health and safety of staff.

Foaming issues occurred in the aeration tank which travelled into the center ring of the secondary clarifier. Higher than normal sludge volumes were discovered in the primary clarifier. A combination of both increased wasting and sludge haulage resolved the issue.

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:

- Replaced motor on the sodium hypochlorite pump.

d) Summary of any effluent quality assurance or control measures undertaken in the reporting period;

In-house laboratory 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 WPCP operators using field or laboratory (lab) test equipment.

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

- Calibration of the raw influent flow meter was conducted on September 29, 2020.
- Calibration of in-house lab equipment was conducted on August 4, 2020.
- Calibration of the in-house lab pH meter was 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 (ECA).

- The average daily rated flow capacity of 4,086 m^3/d was not exceeded. The maximum rated flow rate of 12,300 m^3/d was exceeded for one day due to high rainfall.
- The total chlorine residual monthly average objective was exceeded on eight of 12 occasions (67%). Sodium bisulphite dosing is monitored and increased as necessary to ensure low total chlorine residual.

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 Newcastle Water Pollution Control Plant (WPCP) in 2020 was 9,986 cubic metres (m^3) at an average concentration of 3.3% total solids. See table 5 Sludge Quality and Disposal.

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

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

Summary of locations to where sludge was disposed;

The plant sludge volume of 8,062 m^3 (81%) was hauled to the Duffin Creek WPCP for incineration, 1,748 m^3 (18%) to Port Darlington WPCP and 176 m^3 (2%) to the Courtice WPCP for anaerobic digestion.

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. There was one odour complaint from a nearby resident who, while walking in the area noticed an odour. It was determined that due to the seasonal tank changes and major repairs being carried out on the Make-up Air Unit some odours may have been produced. The equipment has since been repaired.

i) A summary of all By-pass, Spills or Abnormal Discharge events;

Ministry of the Environment, Conservation and Parks (MECP) approved by-passes of the chlorine contact chamber were conducted on April 1 and October 15 for cleaning. The MECP York Durham District Office supervisor was notified once the by-pass was complete.
There were no spills during the reporting period.

j) Proposed Alterations, Extensions or Replacements;

The Region is investigating innovative ways to upgrade the plant. The plant upgrade is scheduled to begin in Spring 2022 and will involve refurbishing and/or replacing components of the WPCP to increase optimization, including sewage sludge pumps, collection mechanisms, chemical feed systems and more. Sustainability will be addressed throughout the project by using more efficient equipment including blowers and aeration system controls that will reduce power consumption of the aeration system by approximately 10 to 20 per cent.

k) Information Required by MECP Water Supervisor;

Table 7 provides a bacterial analysis of the Newcastle Water Supply Plant raw water for 2020.

MECP Inspection

This plant was last inspected by the MECP on November 16, 2017.

Table 1 Raw Influent Flows

Month	Total Flow to Plant -metered at the raw influent cubic metre	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	141,445	4,563	13,825
February	93,963	3,240	3,903
March	128,869	4,157	5,749
April	100,951	3,365	4,255
May	92,614	2,988	3,543
June	78,220	2,607	2,795
July	76,822	2,478	2,863
August	78,308	2,526	2,909
September	72,591	2,420	2,647
October	79,073	2,551	2,881
November	75,731	2,524	3,089
December	98,722	3,185	3,916
Total	1,117,309		
Average	93,109	3,053*	
Minimum	72,591		
Maximum	141,445		13,825
ECA Limit		4,086	12,300
Met Compliance		Yes	No

*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	110	143	2.9	25.40
February	148	175	3.7	33.10
March	116	135	3.3	29.37
April	*	111	4.1	*
May	*	171	4.5	*
June	184	234	5.0	44.12
July	135	205	4.9	44.93
August	145	163	4.9	43.36
September	148	192	5.4	46.58
October	203	212	5.2	45.03
November	185	226	4.8	43.76
December	169	198	4.3	36.58
Average	156	180	4.4	39.78
Minimum	110	111	2.9	25.40
Maximum	203	234	5.4	46.58

*Reduced sampling due to COVID-19

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand (CBOD5) average (avg.) concentration (conc.) milligram per litre (mg/L)	CBOD5 loading kilogram per day (kg/d) year to date avg.	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d year to date avg.	Total Phosphorus (TP) avg. conc. mg/L	TP loading kg/d monthly avg.	Total Ammonia Nitrogen (TAN) avg. conc. mg/L summer	TAN avg. conc. mg/L winter
January	2.9	13.03	6.1	27.81	0.20	0.9		0.64
February	4.7	14.66	9.9	31.15	0.55	2.2		1.88
March	3.5	14.68	9.2	33.46	0.52	2.1		0.92
April	3.7	14.09	6.4	30.45	0.35	1.3	0.61	
May	2.4	12.86	5.4	27.32	0.25	0.9	2.33	
June	2.9	11.75	6.4	25.39	0.25	0.9	0.47	
July	1.7	10.27	5.2	23.26	0.21	0.7	0.27	
August	1.7	9.27	6.2	22.21	0.19	0.6	0.76	
September	1.4	8.45	5.8	21.22	0.30	1.0	1.26	
October	3.4	8.56	9.7	21.76	0.43	1.3	3.09	
November	3.5	8.66	9.3	22.03	0.40	1.2	3.76	
December	4.1	9.08	9.0	22.57	0.31	0.9		0.38
Average	3.0	9.08	7.4	22.57	0.33	1.0	1.57	0.96
Minimum	1.4	8.45	5.2	21.22	0.19	0.6	0.27	0.38
Maximum	4.7	14.68	9.9	33.46	0.55	2.2	3.76	1.88
ECA Limit	25.0	102	25.0	102			15	20
ECA Objective	15.0	61.29	15.0	61.29	1.0	4.1	10	15
Within Compliance	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes		Yes		Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Total Kjeldahl Nitrogen average (avg.) concentration (conc.) milligram per litre mg/L	Total Chlorine Residual avg. conc. mg/L	Nitrate plus Nitrite avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	1.79	0.01	10.6	6.6	7.3	12.5
February	3.42	0.01	11.1	6.9	7.2	11.6
March	2.09	0.01	10.0	6.9	7.2	11.8
April	2.08	0.00	12.8	6.6	7.3	12.9
May	4.22	0.00	13.1	6.4	7.2	14.8
June	1.95	0.00	15.7	6.5	7.5	17.4
July	1.53	0.00	17.0	6.6	7.1	20.5
August	2.08	0.01	15.9	6.6	7.3	21.1
September	2.55	0.01	16.3	6.5	7.0	20.1
October	4.79	0.01	15.6	6.4	6.9	17.3
November	4.80	0.01	16.6	6.4	7.4	15.6
December	1.82	0.01	14.8	6.6	7.3	13.3
Average	2.73	0.00	14.3			15.7
Minimum	1.53	0.00	10.0	6.4		11.6
Maximum	4.80	0.01	17.0		7.5	21.1
ECA Limit		0.04				
ECA Objective		0				
Within Compliance		Yes				
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes	Yes	Yes

Table 4 Summary of *Escherichia coli* and Faecal Streptococcus Sampling

Month	Escherichia coli Number of Samples	Escherichia coli Monthly Geometric Mean Density	Faecal Streptococcus Number of Samples	Faecal Streptococcus Monthly Geometric Mean Density
January	9	3	3	15
February	8	2	2	111
March	7	9	2	32
April	4	4	1	8
May	4	1	2	1
June	9	19	2	15
July	9	42	3	16
August	8	54	2	63
September	9	34	2	485
October	9	18	2	134
November	8	4	2	9
December	10	6	3	8
ECA Limit				
ECA Objective		200		
Within Compliance		Yes		
Sampling Frequency Requirement Met	Yes			

Table 5 Sludge Quality and Disposal

Month	Average Sludge Total Solids Percentage	Total Volume Removed cubic metre (m^3)	Total Volume Hauled to Duffin Creek WPCP (m3)	Total Volume Hauled to Courtice WPCP (m^3)	Total Volume Hauled to Port Darlington WPCP (m^3)
January	2.91	960			960
February	3.58	616			616
March	4.09	568	396		172
April	3.88	586	586		
May	4.05	832	832		
June	2.90	1,100	1,100		
July	2.25	968	968		
August	2.27	924	836	88	
September	2.74	924	836	88	
October	2.40	1,100	1,100		
November	4.23	660	660		
December	3.87	748	748		
Total		9,986	8,062	176	1,748
Average	3.26				

Table 6 Energy and Chemical Usage

Month	Total Plant Flow cubic metre	Aluminum Sulphate litre	Sodium Hypochlorite kilograms as chlorine	Sodium Bisulphite litre	Hydro kilowatt hour	Natural Gas cubic metre
January	141,445	8,360	574.4	3,513	96,240	24,317
February	93,963	7,088	253.9	3,583	97,440	14,375
March	128,869	8,600	410.2	4,587	91,200	9,723
April	100,951	7,026	361.9	3,897	92,880	7,590
May	92,614	7,342	340.5	3,670	95,760	783
June	78,220	6,946	281.2	3,254	86,160	891
July	76,822	7,577	402.1	3,701	89,040	17,897
August	78,308	7,867	571.5	3,413	119,698	811
September	72,591	7,215	345.6	3,510	82,933	2,172
October	79,073	8,195	379.9	3,602	106,393	8,086
November	75,731	8,009	575.2	3,576	91,391	1,071
December	98,722	8,092	489.9	3,949	100,658	16,528
Total	1,117,309	92,317	4,986	44,255	1,149,793	104,244

Table 7 Summary of the Raw Water Bacteriological Analyses at the Newcastle Water Supply Plant

Month	*Escherichia coli* (*E. coli*) number of samples	*E. coli* Colony Forming Units per 100 millilitres (CFU/100ml) Results Range	Total Coliform number of samples	Total Coliform CFU/100ml Results Range
January	17	Non-Detect (ND) - 6	17	1 - 380
February	15	ND - 1	15	ND - 36
March	15	ND - 5	15	1 - 340
April	9	ND	9	ND - 160
May	11	ND	11	ND - 58
June	18	ND - 2	18	ND - 20
July	17	ND - 1	17	ND - 46
August	16	ND - 2	16	ND - 24
September	17	ND - 1	17	ND - 18
October	16	ND - 1	16	ND - 6
November	16	ND - 1	16	ND - 4
December	16	ND - 1	16	ND - 65