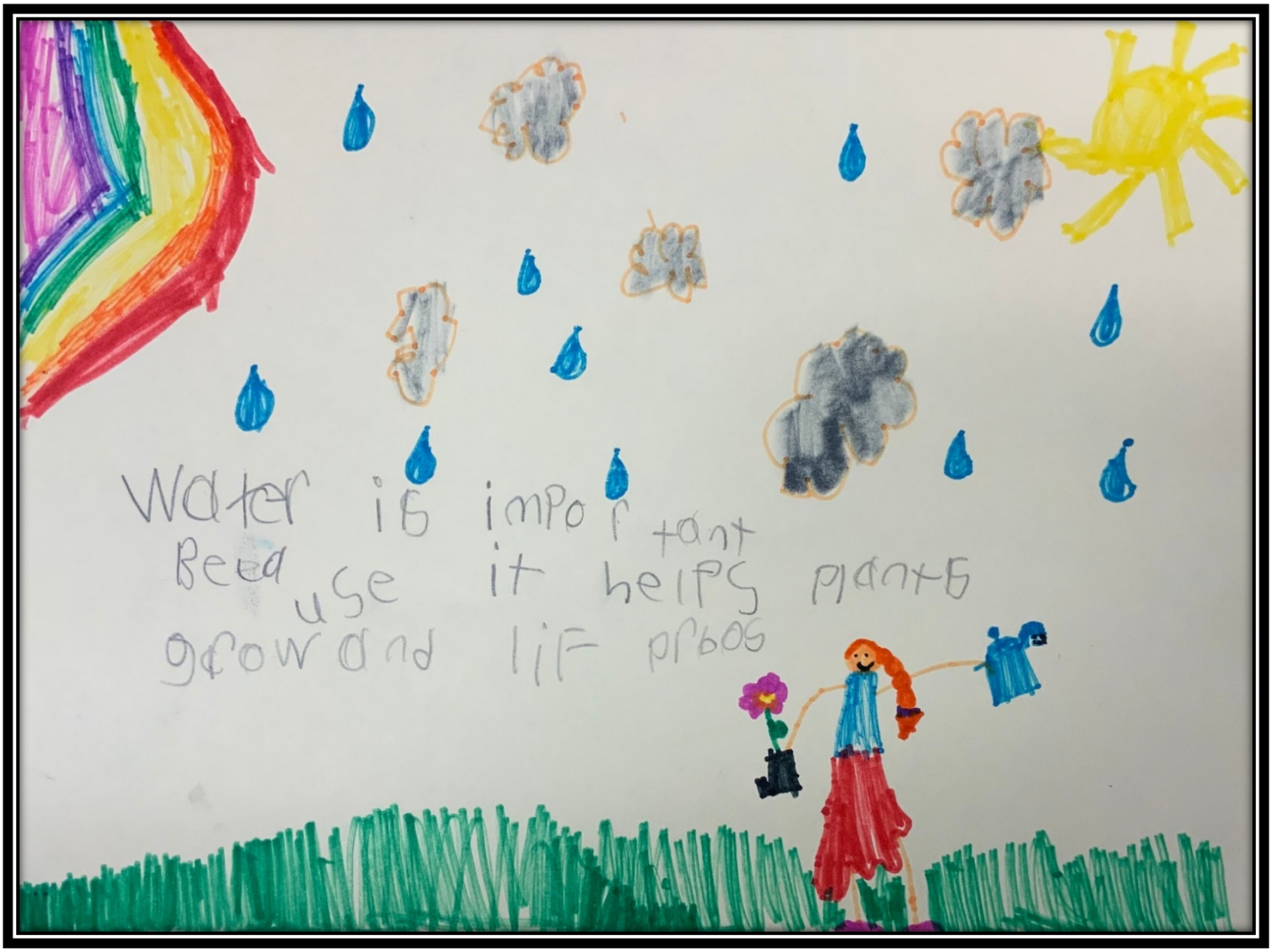
Nonquon Water Pollution Control Plant

2019 Annual Performance Report



The Regional Municipality of Durham
Nonquon Water Pollution Control Plant 2019 Annual Performance Report

Environmental Compliance Approval (ECA): 2207-9LKHLM Dated July 17, 2014

The Nonquon Water Pollution Control Plant (WPCP) 2019 Annual Performance Report provides staff, stakeholders and customers an overview of the performance of the Nonquon WPCP in 2019. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of 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 Nonquon WPCP located in the Community of Port Perry in the Township of Scugog is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECA. This MECP Class 3 wastewater treatment plant utilizes an extended aeration process with tertiary treatment and is designed to treat wastewater at a rated capacity of 5,900 cubic metres per day (m^3/d). The Nonquon WPCP has a service population of 8,322 residents.

Nonquon WPCP treats wastewater from the Port Perry service area utilizing the following processes:

- raw influent pumping,
- preliminary treatment,
- phosphorus removal,
- secondary treatment,
- tertiary treatment, and
- disinfection.

Raw Influent Pumping

Wastewater is collected through approximately 49.4 kilometres of sanitary sewers in the Port Perry service area and is conveyed to the Nonquon WPCP by three sanitary sewage pumping stations (SPSS): Water Street, Reach Street and Canterbury Common SPSS.

Influent Pumping Station

Raw wastewater enters the influent pumping station. Any flow in excess of the design flow of 5,900 m^3/d will passively overflow to the inlet chamber and be directed to one of the five equalization lagoons for storage. A gravity sanitary sewer pipe allows for lagoon effluent to be returned back to the influent pumping station during periods of low flows, for full treatment.

Preliminary Treatment

Screening: There are two bar screens in the screening room for the removal of paper products and large material that could harm pumps and process equipment. One channel contains an automatic, mechanically cleaned bar screen and the other is equipped with a manually raked bar screen to provide screening on an emergency basis. A screenings washer/compacter utilizes plant effluent water to wash and compact the screenings. Screenings are removed in this process and transported to landfill for disposal.
Grit Removal: Vortex grit removal is provided to remove sand and small stones (grit) for protection of mechanical equipment from unnecessary wear and reduce formation of heavy deposits in pipelines, channels and process tanks. The vortex grit removal chamber uses centrifugal force to separate the grit from the wastewater. Grit is collected in the lower portion of the grit tank and is pumped to a grit classifier for dewatering. The dewatered grit is conveyed to the grit/screenings bin for landfill disposal.

Phosphorus Removal

The phosphorous removal system lowers the total phosphorous level in the final effluent by adding a chemical coagulant, aluminum sulphate, as part of the treatment process. Aluminum sulphate can be added at multiple locations throughout the plant.

Secondary Treatment

Aeration Tanks: Preliminary effluent flow is directed to two aeration tanks comprised of two distinct sections. The first section is a swing zone equipped with fine bubble diffusers. This zone is capable of being operated as an anoxic zone where no oxygen is introduced and allows for potential denitrification or an aerated zone where fine bubbled air is diffused into the wastewater. It is typically operated as an anoxic zone. The flow leaves the swing 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. Prior to entering the secondary clarifiers the two aeration tanks are equipped with a rotating slotted pipe for removal of any excess activated sludge, the waste activated sludge (WAS) is decanted manually to the WAS chamber and pumped to a storage lagoon.
Secondary Clarifiers: The effluent from the aeration tank is directed to the two secondary clarifiers where solids settle quickly as activated sludge leaving a clear effluent. The activated sludge collected on the bottom of the clarifiers is pumped back to the front of the aeration tanks.

Tertiary Treatment

Tertiary Sand Filter: Effluent from the secondary clarifiers is filtered through four upflow filter cells operated in parallel. The tertiary influent flow is directed to the bottom of the cells and upward through the sand media. The automatic backwash is initiated by an increase in head pressure or on a

programmed timer. The backwash water is returned to the influent pumping station for further treatment.

Disinfection

Ultra Violet (UV) Irradiation: The effluent flow from the sand filter is then directed to the UV channel for disinfection. The effluent passes through two banks of UV lamps connected in series. The treated final effluent is discharged to the Nonquon River.

Storage

Equalization Storage Lagoons: During high flow conditions excess flow from the influent pumping station is diverted to the aerated cell inlet chamber, from here it is directed to one of the five storage cells. During low flow conditions the lagoon effluent can be returned to the influent pumping station for treatment.

Solids Treatment: Waste activated sludge (WAS) is pumped from the WAS chamber to lagoon cell number six for storage and settling, the solid levels are monitored and removed for disposal as needed.

Environmental Compliance Approval

Under Condition 10.(6) of ECA #2207-9LKHLM the Region must produce an annual performance report that must contain 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 plant's ECA. Table 2 summarizes the raw wastewater characteristics during the reporting period.

The Nonquon WPCP effluent was determined to be compliant with the approval limits during the reporting period. The plant operated at 50.2% of its rated capacity and received a maximum daily flow of 6,914 m^3/d on April 20.

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

- In April, the plant experienced high suspended solids and total phosphorus in the final effluent due to the tertiary filter backwash system not working properly. The tertiary filter system was retrofitted and the sand wash mechanism was cleaned to prevent grease accumulation. Biweekly cleaning was initiated.
- Between May and June, the plant experienced high suspended solids and total phosphorus in the final effluent due to ongoing aeration tank upgrades. Sump holes were installed in the aeration tanks and a new grease removal system was installed in the secondary clarifiers. Tanks were taken out of service to facilitate installation.

- In December, the plant experienced high suspended solids and total phosphorus in the final effluent possibly due to over dosage of aluminium sulphate. Chemical jar testing was conducted to optimize the dosage with influent flows.
- The plant experienced intermittent pH increases on the raw influent between March and November. pH dataloggers installed in the collection system traced the issue back to a local industry. The company responsible entered a compliance program with the Region to control their effluent discharge pH in adherence to the sewer use bylaw.

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 2019 included:

- installed sump pit holes in the aeration tanks,
- installed a new grease removal system in the secondary clarifiers, and
- replaced a level sensor unit and added a splitter box for generator load bank testing at Reach Street SSPS.

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. Results were found to be in an acceptable range.

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

- Calibration of the flow meter was conducted in May 28 and October 21.
- Calibration of the in-house laboratory equipment was conducted on August 27.
- Calibration of the pH meter is conducted regularly.

The final effluent flow meter was determined not to be reading accurately between September 14 and 19. It was replaced with a new unit.

f) Description of efforts made and results achieved in meeting the effluent objectives;

The Region strives to achieve the best effluent quality at all times and produce results below the ECA compliance limits.

The Nonquon WPCP effluent objectives were met in 2019 except for:

- The effluent objective of 8 mg/L for total suspended solids was exceeded in 24 of 312 samples (7.7%).
- The effluent objective of 0.08 mg/L for total phosphorus was exceeded in 36 of 312 samples (11.5%).
- The total suspended solids and total phosphorus exceedances were caused by excessive grease accumulation flowing from the secondary clarifiers into the tertiary filter system. The

exceedances were augmented with aeration and secondary tanks being taken out of service for maintenance. The results were monitored daily. Aluminium sulfate dosage and frequency of filter cleaning were adjusted accordingly.

- The effluent objective of 4.0 mg/L for total ammonia nitrogen was exceeded in 3 of 312 samples (1.0%).

Best efforts will continue to be applied to maintain results below objectives.

g) Biosolids Production;

Tabulation of Volume of Sludge Generated;

There was no removal of biosolids during the reporting period**.**

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;

Waste activated sludge (WAS) is pumped to lagoon cell number six for storage and settling, the solid levels are monitored and removed for disposal as needed.

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 received in 2019.

i) Summary of all By-pass, Spill or Abnormal Discharge;

No by-passes or spills occurred during the reporting period.

j) Copy of all Notice of Modifications and any implementation of Limited Operational Flexibility (Schedule B);

No notice of modifications was submitted in 2019.

k) Report summarizing modifications (Schedule B Section 3);

Modifications were made to the grease removal system on the secondary clarifiers and sump pit holes installed in the aeration tanks.

l) Information required by Ministry of the Environment, Conservation and Parks Water Supervisor;

No additional information was requested.

Ministry of the Environment, Conservation and Parks (MECP) Inspection

The plant was inspected by the MECP on March 5, 2019. No compliance items were identified in the report. The MECP did however, recommend the Region conduct a study to identify and correct storm water infiltration within the collection system as the rated capacity was exceed during 5 days in the spring thaw of 2017 and 12 days in the spring thaw of 2018. The report also recommended the Region continue to ensure best efforts are maintained to achieve the effluent objectives outlined in the ECA.

Table 1 Final Effluent Flows

Month	Total Plant Flow metered at the Final Effluent cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	80,144	2,585	3,001
February	68,855	2,459	3,803
March	93,221	3,007	5,505
April	135,911	4,530	6,914
May	135,276	4,364	5,695
June	76,976	2,483	2,752
July	76,976	2,483	2,752
August	73,888	2,383	2,483
September	70,211	2,340	2,555
October	79,804	2,574	4,376
November	94,442	3,148	3,820
December	97,951	3,160	4,560
Total	1,083,655		
Annual Average	90,305	2,969	
Minimum	68,855		
Maximum	135,911		6,914
ECA Limit		5,900*	
Met Compliance		Yes	

*Annual Average

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand (BOD_5) average (avg.) concentration (conc.) milligram per litre (mg/L)	Total Suspended Solids (TSS) avg conc. mg/L	TSS loading kilogram per day (kg/d)	Total Phosphorus (TP) avg conc. mg/L	TP loading kg/d	Total Kjeldahl Nitrogen avg. conc. mg/L
January	163	243	629	4.4	11	31.38
February	192	272	668	4.8	12	34.83
March	159	244	735	4.4	13	32.00
April	139	163	740	2.9	13	26.03
May	164	169	737	2.7	12	21.76
June	159	246	612	3.6	9	28.13
July	164	210	521	4.0	10	30.20
August	171	188	447	3.9	9	29.70
September	145	183	428	4.2	10	33.65
October	140	204	525	4.2	11	31.20
November	137	191	602	4.0	13	28.23
December	128	205	646	3.6	12	24.62
Average	155	210	621	3.9	12	29.31
Minimum	128	163	428	2.7	9	21.76
Maximum	192	272	740	4.8	13	34.83
Sampling Frequency Requirement Met	Yes	Yes		Yes		Yes

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average(avg.) concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading avg. kilogram per day (kg/d)	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading avg. kg/d
January	1.1	3	4.0	10
February	1.0	2	4.5	11
March	1.0	3	3.6	11
April	1.0	5	4.4	20
May	1.6	7	5.3	23
June	1.0	2	6.2	15
July	1.0	2	1.8	5
August	1.0	2	1.5	3
September	1.0	2	2.3	5
October	1.0	3	1.9	5
November	1.0	3	3.2	10
December	1.0	3	7.9	25
Total				
Average	1.1	3	3.9	12
Minimum	1.0	2	1.5	3
Maximum	1.6	7	7.9	25
ECA Limit	5.0*	29.5**	10.0*	59.0**
ECA Objective	4.0		8.0	
Within Compliance	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	

*Annual Average Concentration

**Annual Average Loading

Table 3 Final Effluent Analyses continued

Month	Total Phosphorus (TP) average (avg.) concentration (conc.) milligram per litre (mg/L)	TP loading avg. kilogram per day	TP loading avg. kilogram per month
January	0.03	0	3
February	0.04	0	3
March	0.03	0	3
April	0.04	0	6
May	0.07	0	9
June	0.10	0	7
July	0.04	0	3
August	0.03	0	2
September	0.03	0	2
October	0.03	0	2
November	0.03	0	3
December	0.09	0	9
Total			50.8
Average	0.05	0	4
Minimum	0.03	0	2
Maximum	0.10	0	9
ECA Limit		170kg/Year*	14.2 kg/month May to October**
ECA Objective	0.08		
Within Compliance		Yes	Yes
Sampling Frequency Requirement Met	Yes	Yes	Yes

*Annual Average Loading

**Monthly Average Loading

Table 3 Final Effluent Analyses continued

Month	Total Kjeldahl Nitrogen average (avg.) concentration (conc.) milligram per litre (mg/L)	Un-ionized Ammonia avg. conc. mg/L	pH minimum	pH maximum	Temperature Degree Celsius avg.
January	0.87	0.0	7.0	8.2	11.6
February	1.22	0.0	6.7	7.2	11.0
March	2.89	0.0	6.7	7.1	11.2
April	0.96	0.0	6.9	7.2	12.1
May	1.14	0.0	7.0	7.2	13.9
June	1.01	0.0	6.9	7.3	16.7
July	0.83	0.0	6.8	7.1	19.8
August	0.76	0.0	6.9	7.1	20.3
September	0.87	0.0	6.6	7.2	19.4
October	0.74	0.0	6.8	7.2	17.2
November	0.86	0.0	6.7	7.3	13.8
December	0.72	0.0	6.9	7.1	12.7
Average	1.07	0.0			15.0
Minimum	0.72	0.0	6.6		11.0
Maximum	2.89	0.0		8.2	20.3
ECA Limit			6.0	9.5	
ECA Objective			6.0	9.5	
Within Compliance			Yes	Yes	
Sampling Frequency Requirement Met		Yes	Yes	Yes	Yes

Table 3 Final Effluent Analyses continued

Month	Total Ammonia Nitrogen (TAN) average (avg.) concentration (conc.) milligram per litre (mg/L)	TAN Effluent Objective conc. mg/L	TAN Effluent Limit Monthly avg. conc. mg/L
January	0.1	4.0	5.0
February	0.4	4.0	5.0
March	1.6	4.0	5.0
April	0.2	4.0	5.0
May	0.1	2.4	3.0
June	0.0	1.2	1.5
July	0.0	1.2	1.5
August	0.0	1.2	1.5
September	0.0	1.2	1.5
October	0.0	2.4	3.0
November	0.0	4.0	5.0
December	0.0	4.0	5.0
Average	0.2		
Maximum	1.6		
Within Compliance	Yes		

Table 5 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	5	1
February	4	0
March	4	0
April	4	1
May	5	1
June	4	1
July	5	1
August	4	1
September	4	1
October	5	0
November	4	0
December	5	1
ECA Objective		100 organisms/ 100ml
ECA Limit		200 organisms/ 100ml
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 6 Energy and Chemical Usage

Month	Aluminum Sulphate litre	Hydro kilowatt hour
January	23,050	119,520
February	20,483	81,600
March	22,770	132,960
April	21,976	86,400
May	22,910	80,160
June	20,437	67,680
July	21,230	67,200
August	19,270	67,200
September	18,524	70,560
October	18,150	80,640
November	19,410	96,000
December	19,410	139,200
Total	247,620	1,089,120