Corbett Creek Water Pollution Control Plant

2021 Annual Performance Report

The Regional Municipality of Durham
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Environmental Compliance Approval (ECA): 7560-9PPRJC Dated November 12, 2014
Environmental Compliance Approval (Air): 1581-9URJFE Dated May 13, 2015

The Corbett Creek Water Pollution Control Plant (WPCP) 2021 Annual Performance Report provides staff, stakeholders and customers a performance overview of the Corbett Creek WPCP. 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 Corbett Creek WPCP, located in the Town of Whitby, is owned and operated by the Regional Municipality of Durham. The plant is operated according to the terms and conditions of the ECA's. Corbett Creek WPCP treats wastewater from the Whitby, Brooklin and Oshawa service areas. The Corbett Creek WPCP services approximately 156,855 residents.
The Corbett Creek WPCP is designed to treat wastewater at an average daily flow rate of 84,350 cubic metres per day (m^3/d). The plant is a MECP Class 4 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 from Whitby, Brooklin and Oshawa through approximately 547 kilometres of sanitary sewers. It is conveyed to the plant by gravity and by several sanitary sewage pumping stations located throughout the collection system.

Preliminary Treatment

Screening: Two mechanically cleaned screens remove rags and large debris that could harm pumps and process equipment. Screenings are compacted for disposal to landfill.

Grit Removal: Heavy suspended material such as sand and small stones (grit) is removed in the two aerated grit tanks. 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 four 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 excess activated sludge from the secondary treatment process is collected by a sweep 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 the primary effluent.

Secondary Treatment

Aeration: The seven aeration tanks are where fine bubbled air is diffused into the wastewater to assist bacteria in removing dissolved and suspended organics, and nutrients from the wastewater.
Secondary Clarifier: The effluent from the aeration tanks is directed to the seven secondary clarifiers where the solids settle quickly 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 effluent stream for pathogen control. Adequate contact time is provided by the three chlorine contact chambers. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged to Lake Ontario through the 1,800 millimetre diameter outfall extending 773 metres 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 digested sludge produced is pumped to the biosolids holding facility. From there the treated biosolids can be utilized on approved agricultural fields or be hauled to Duffin Creek Water Pollution Control Plant (WPCP) for incineration.

Environmental Compliance Approval (ECA)

Under Condition 10.(6) of ECA 7560-9PPRJC 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 plant operated at an average of 62% of its annual average rated flow capacity and received a maximum daily flow of 93,499 cubic metres per day on September 23. The Corbett Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period.

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

- The Corbett WPCP experienced ongoing excess foaming in the primary digesters. Operations reduced the feed rate and mixing times to help reduce the foam. Volatile acid and alkalinity tests were performed regularly to monitor the issue,
- The plant received a defective load of ferrous chloride which plugged the feed pumps and delivery lines. Operations cleaned the lines, pumps, and hired a contractor to clean both ferrous chloride holding tanks. The ferrous chloride feed lines were rebuilt with new strainers,
- During the cold weather months, the plant had issues with nitrification. Operations adjusted flow rates, dissolved oxygen levels, waste and return activated sludge rates, and sodium hypochlorite feed rates to help aid the nitrification process. Ammonia, nitrite, and nitrate tests were performed regularly to help monitor the process,
- The level indicator radar units in the primary digesters failed due to excess foaming and moisture. The units will be replaced in 2022,
- The raw screen compactor auger was worn out and unable to auger the screenings. ‘Absorb all’ material was used to absorb the water and thicken up the screenings to allow the auger to push the material into the disposal bin,
- The COVID-19 pandemic has affected staffing at Corbett WPCP. The hiring process is underway to hire and train new operators.

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:

- Rebuilt scraper arm assemblies for primary clarifiers 1 and 2,
- Rebuilt scraper arms and wheels for secondary clarifier 4,
- Cleaned out final contact chambers biannually,
- Replaced actuators in return activated sludge tunnel and biosolids building,
- Replaced various plug valves with knife gate valves,
- Replaced screens in chemical room,
- Rebuilt dewatering pumps 2 and 3,
- Replaced groundwater pump in Building I.

d) Summary of any effluent quality assurance or control measures;

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,

On-line instrumentation is verified by Water Pollution Control Plant operators using various field or laboratory test equipment.

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

Calibration of the flow meters was conducted on December 7,

Calibration of in-house laboratory equipment was conducted regularly,

Calibration of the pH meter was conducted regularly.

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

The Region of Durham always strives to achieve the best effluent quality and produce results below the Environmental Compliance Approval (ECA) limits.

- The annual average daily flow did not exceed the rated capacity of 84,350 cubic metres per day (m^3/d),
- The total suspended solids objective of 15.0 milligram per litre (mg/L) was exceeded in 40 of 504 samples (7.9%). Operational variances contributed to high results. Total suspended solids results are monitored daily and adjustments are made to the process as required,
- The total phosphorus objective of 0.8 mg/L was exceeded in 8 of 349 samples (2.3%). Total phosphorus results are monitored daily and adjustments are made to the process as required,
- The total chlorine residual objective of “non-detect” was exceeded in 36 of 365 samples (9.9.%). The ECA states an objective concentration of “non-detect”, however, the instrumentation has a detection limit of 0.0012 mg/L. The detection limit changed to 0.0025

milligram per litre (mg/L) with the new chlorine analyzer instrument. Sodium bisulphite dosing is monitored to ensure low total chlorine residuals,

- The E.coli objective was exceeded in 1 of 12 samples (8.3%). Chlorine residuals are monitored daily and adjustments are made to the process as required.

Atlantic Packaging is undergoing an expansion of their facility including a new wastewater treatment process in 2022. Durham Region is working collaboratively to develop a plan for the commissioning of the new treatment process.

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 Corbett Creek Water Pollution Control Plant (WPCP) in 2021 was 91,668 cubic metres (m^3).

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 sludge produced at this facility was applied on agricultural fields and transferred to Duffin Creek WPCP for incineration.

Receiving facilities included:

Agricultural Fields – 59,280 m^3 or 64.6%

Duffin Creek WPCP – 32,520 m^3 or 35.4%

h) Summary of Complaints and Steps Taken to Address the Complaint;

A summary of complaints received from the public is administered through a central database.

No complaints were received in 2021.

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

There were no by-pass, spill or abnormal discharge events in 2021.

j) Notice of Modifications submitted to Water Supervisor and Status Report of Limited Operational Flexibility;

No modifications under “Limited Operational Flexibility” were conducted.

k) Modifications Arising under section 3 of Schedule A;

No modifications under section 3 of Schedule A were conducted.

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

This plant was last inspected by the MECP on November 15, 2017. The inspection report dated April 4, 2018 recommended to continue to use best practices to meet effluent objectives.

Table 1 Raw Influent Flows

Month	Total Plant Flow metered at the Raw Influent cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	1,623,629	52,375	60,979
February	1,372,008	49,000	54,408
March	1,577,702	50,894	61,980
April	1,603,902	53,463	62,941
May	1,616,288	52,138	57,010
June	1,476,584	49,219	54,811
July	1,600,719	51,636	66,307
August	1,468,046	47,356	50,901
September	1,563,467	52,116	93,499
October	1,665,934	53,740	63,294
November	1,600,144	53,338	59,658
December	1,815,021	58,549	76,562
Total	18,983,444		
Average	1,581,954	52,009*	
Maximum	1,815,021		93,499
ECA Limit		84,350	
Met Compliance		Yes	

*Annual Average Daily Flow

Table 3 Final Effluent Analyses

Month	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) average (avg.) concentration (conc.) milligram per litre (mg/L)	$CBOD_5$ loading kilogram per day (kg/d)	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d
January	2.8	145	4.1	215
February	3.2	159	5.1	251
March	3.8	193	8.1	412
April	1.7	90	4.1	217
May	1.9	98	7.3	379
June	1.7	82	6.6	326
July	1.9	96	7.3	375
August	1.3	61	4.7	221
September	1.7	90	8.1	422
October	1.7	91	8.7	469
November	2.6	136	10.7	573
December	2.5	145	7.4	432
Average	2.2	115	6.8	356
Minimum	1.3	61	4.1	215
Maximum	3.8	193	10.7	573
ECA Limit	25.0	2,108	25.0	2,108
ECA Objective	15.0		15.0	
Within Compliance	Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	

Table 3 Final Effluent Analyses continued

Month	Total Phosphorus (TP) average (avg.) concentration (conc.) milligram per litre (mg/L)	TP loading kilogram per day (kg/d)	Unionized Ammonia mg/L	Total Ammonia Nitrogen (TAN) avg. conc. mg/L Winter	TAN avg. conc. (mg/L) Summer	TAN Loading kg/day Winter	TAN Loading kg/day Summer
January	0.36	19	0.0	2.22		116	
February	0.49	24	0.0	2.83		138	
March	0.54	27	0.0	3.81		194	
April	0.22	12	0.0	1.69		90	
May	0.37	19	0.0		1.83		95
June	0.30	15	0.0		1.66		82
July	0.35	18	0.0		2.62		135
August	0.31	15	0.0		1.93		91
September	0.35	18	0.0		0.81		42
October	0.38	21	0.0		0.78		42
November	0.37	20	0.0	0.35		18	
December	0.31	18	0.0	0.78		45	
Average	0.36	19	0.0	1.94	1.61	100	81
Minimum	0.22	12	0.0	0.35	0.78	18	42
Maximum	0.54	27	0.0	3.81	2.62	194	135
ECA Limit	1.0	84		24.0	16.0	2,024	1,350
ECA Objective	0.8			18.0	8.0		
Within Compliance	Yes	Yes		Yes	Yes	Yes	Yes
Sampling Frequency Requirement Met	Yes		Yes	Yes	Yes		

Table 3 Final Effluent Analyses continued

Month	Total Chlorine Residual average (avg.) concentration milligrams per litre	pH minimum	pH maximum	Temperature avg. Degree Celsius
January	0.00	6.8	7.3	14.7
February	0.01	6.5	8.0	13.4
March	0.00	6.8	7.4	13.6
April	0.00	6.7	7.4	14.5
May	0.00	6.8	7.5	16.4
June	0.00	6.5	7.2	18.4
July	0.00	6.7	7.6	20.6
August	0.00	6.6	7.5	21.7
September	0.00	6.7	7.2	21.3
October	0.00	6.8	7.3	20.7
November	0.00	6.8	7.2	18.3
December	0.00	6.8	7.2	16.1
Average	0.00			17.5
Minimum	0.01	6.5		13.4
Maximum	0.00		8.0	21.7
ECA Limit	0.02	6.0	9.5	
ECA Objective	Non-detect	6.5	8.5	
Within Compliance	Yes	Yes	Yes	
Sampling Frequency Requirement Met	Yes	Yes	Yes	Yes

Table 4 *Escherichia coli* Sampling

Month	Number of Samples	Monthly Geometric Mean Density
January	8	70
February	11	185
March	9	41
April	9	3
May	8	8
June	9	8
July	9	21
August	9	21
September	9	40
October	8	30
November	9	27
December	9	58
ECA Requirement		200
ECA Objective		150
Within Compliance		Yes
Sampling Frequency Requirement Met	Yes	

Table 5 Energy and Chemical Usage

Month	Ferrous Chloride Litre (L)	Sodium Hypochlorite kilogram as chlorine	Sodium Bisulphite (L)	Hydro Kilowatt hour	Natural Gas cubic metre
January	147,940	9,077	7,897	858,319	17,326
February	159,220	10,389	8,494	787,888	19,367
March	186,050	8,384	9,064	764,348	15,305
April	195,730	6,658	10,590	739,150	14,353
May	177,830	6,643	7,829	740,869	9,858
June	169,290	6,291	8,818	702,359	5,033
July	174,570	6,791	9,832	746,124	7,825
August	143,720	6,586	8,186	756,875	4,564
September	160,912	6,298	8,335	747,824	2,427
October	168,590	6,858	8,178	792,340	3,319
November	168,733	7,436	8,190	758,739	8,651
December	185,860	6,499	9,070	820,016	25,770
Total	2,038,445	87,910	104,483	9,214,851	133,798