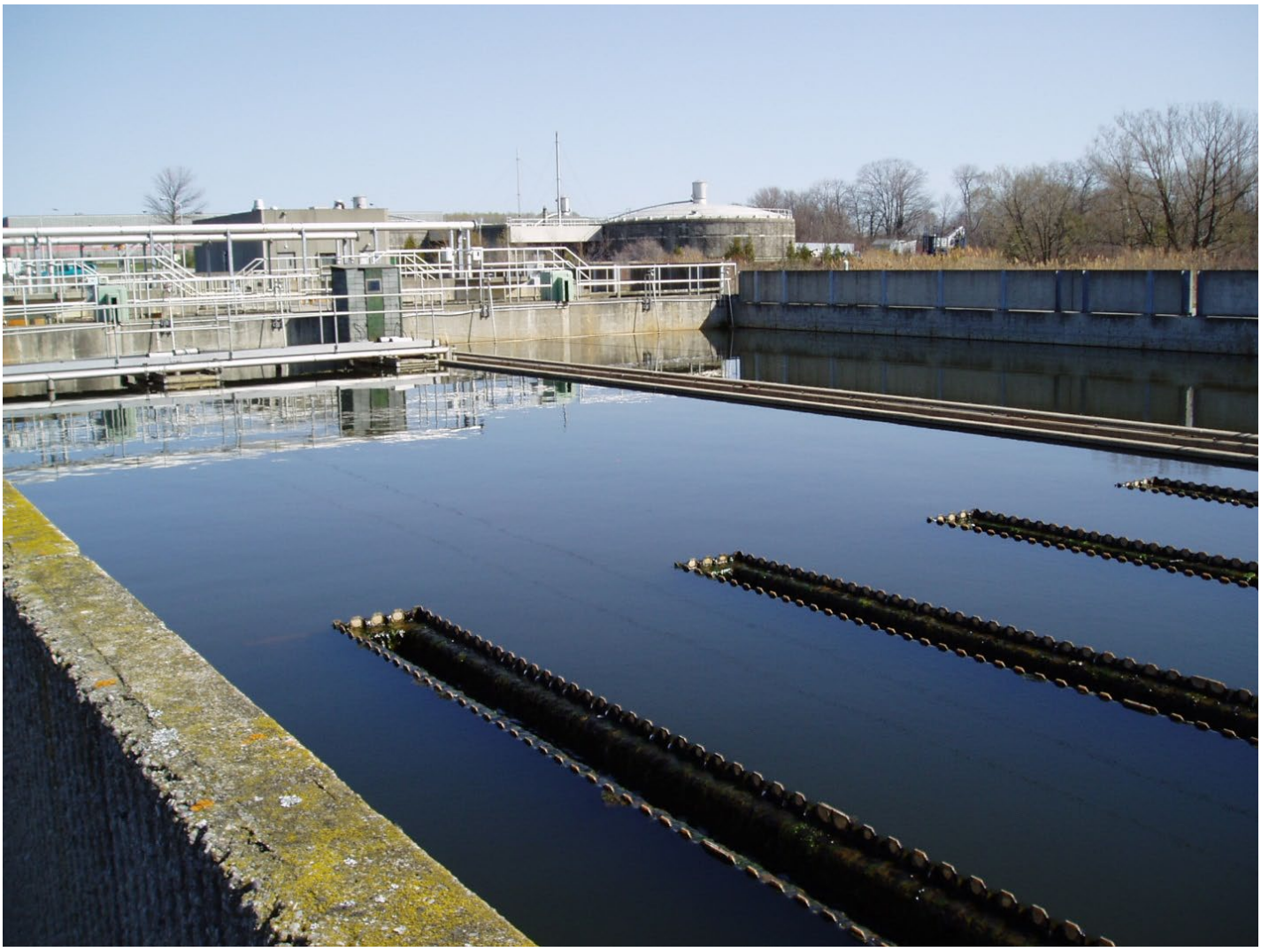
Corbett Creek Water Pollution Control Plant

2024 Annual Performance Report



The Regional Municipality of Durham
Corbett Creek Water Pollution Control Plant 2024 Annual Performance Report

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) 2024 Annual Performance Report provides staff, stakeholders, and customers a performance overview of the plant for the 2024 calendar year. Further, this report fulfills the annual reporting requirements of the Ontario Ministry of the Environment, Conservation and Parks (MECP). This report demonstrates the commitment to ensuring that the WPCP delivers wastewater services to our customers in an environmentally responsible manner.

Water Pollution Control Plant Process Description
General

The Corbett Creek WPCP is located in the Town of Whitby and is owned and operated by the Regional Municipality of Durham (Region). The plant is operated in accordance with the terms and conditions of the ECA's noted above. Corbett Creek WPCP treats wastewater from the Whitby, Brooklin and Oshawa service areas. The plant services approximately 171,152 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 an 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)
- Solids management.

Raw Influent Pumping

Wastewater is collected from Whitby, Brooklin and Oshawa through approximately 558 kilometres of sanitary sewers. It is conveyed to the plant by gravity and several sanitary sewage pumping stations located throughout the collection system.

Preliminary Treatment

Screening: Two mechanically cleaned screens and one manually cleaned screen 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) are 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 digesters.

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 that extends 773 metres 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 sulfide. The supernatant is returned to the head of the plant for further treatment.

Sludge Management: All digested sludge is pumped to the biosolids holding facility. From there the treated biosolids can be utilized on approved agricultural fields or are 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 66% of its annual average rated flow capacity and received a maximum daily flow of 129,044 cubic metres per day on April 12, 2024.

- The total phosphorus (TP) average concentration limit of 1.0 mg/L was exceeded in 9 of 12 months (75.0%).
- The total phosphorus average waste loading limit of 84 kg/d was exceeded in 4 of 12 months (33.3%).
- The total suspended solids (TSS) average concentration limit of 25.0 mg/L was exceeded in 10 of 12 months (83.3%).
- The total suspended solids average waste loading limit of 2,108 kg/d was exceeded in 5 of 12 months (41.7%).
- The E. coli limit of 200 CFU/100mL was exceeded in 5 of 12 months (41.7%).

Corbett Creek exceeded the effluent limits for TSS for all months except for February and October. Corbett Creek exceeded the effluent limits for TP for all months except for August, October and December. Regional staff are meeting with the MECP on a regular basis to provide updates on plant issues. Numerous in-house solutions are being implemented by staff and the Region has retained third-party consultants to assist. A final report detailing the compliance issues and corrective actions taken will be provided to the MECP.

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

The following operating problems were encountered in 2024:

- Elevated effluent TSS, TP and E. coli concentrations, with frequent exceedances of the ECA objectives and limits.
- Poorly settling biomass with turbid secondary and final effluent.
- Foam and scum accumulation on the aeration tanks, secondary clarifiers and chlorine contact chambers.
- Low dissolved oxygen concentrations.

- Inconsistent Total Phosphorus (TP) concentrations in the influent.

Many corrective actions were explored and implemented in 2024. Third-party consultants were retained to perform a comprehensive study of plant capacity and influent composition. Dosing of chemicals such as sodium hypochlorite and ferrous chloride were adjusted as needed in response to E. coli and TP results. Stone diffusers were replaced in aeration tanks 7, 8 & 10 to improve oxygen transfer in the bioreactors. A scum collection mechanism was installed to remove scum accumulation in the chlorine contact chamber. Flow rates were adjusted to specific trains to ease the loading on the tanks. A separate Waste Activated Sludge (WAS) holding tank was utilized to improve primary clarifier settling. Regional staff and consultants are continuing to explore options for process improvement.

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 2024 included:

- Replaced diffusers in aeration tanks 7, 8 and 10
- Cleaned out plant 4 wet well
- Rebuilt grit classifier
- Repaired primary clarifier 4 fiberglass ring and replaced rubber
- Replaced SCADA panel in digester complex
- Cleaned plant 2/3 contact chamber regularly
- Refurbished two secondary clarifiers and one primary clarifier with new wheels and springs
- Rebuilt digester recirculation pumps
- Rebuilt building ‘I’ sump pump
- Replaced actuator in building “A”

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.

On-line instrumentation is verified by water pollution control plant (WPCP) 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 May 5, 2024.

Calibration of in-house laboratory equipment was conducted on May 22, 2024.

Calibration of the in-house lab pH meter was conducted regularly.

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

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

- The annual average daily flow did not exceed the rated capacity of 84,350 cubic metres per day (m^3/d).
- The carbonaceous biochemical oxygen demand (cBOD) objective of 15.0 mg/L was exceeded in 17 of 243 samples (7.0%).
- The total suspended solids (TSS) objective of 15.0 mg/L was exceeded in 348 of 493 samples (70.6%).
- The total phosphorus objective of 0.8 mg/L was exceeded in 231 of 348 samples (66.4%).
- The total chlorine residual objective of “non-detect” was exceeded in 58 of 364 samples (15.9.%). The ECA states an objective concentration of “non-detect”, however, the instrumentation has a detection limit of 0.005 mg/L. Sodium bisulphite dosing is monitored to ensure low total chlorine residuals.
- The E. coli objective of 150 Colony Forming Units (CFU)/100mL was exceeded in 5 of 12 samples (41.7%). Chlorine residuals are monitored daily, and adjustments are made to the process as required.

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

g) Tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the locations to where the sludge was disposed

The volume of sludge removed from Corbett Creek Water Pollution Control Plant (WPCP) in 2024 was 76,520 cubic meters (m^3).

Even with the increase in population on a year-to-year basis, no significant changes to flows or processing and anticipated. Therefore, no significant changes in sludge generation are expected for the next year.

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

Receiving facilities included:

Agricultural Fields – 41,516 m^3 or 54.3%

Duffin Creek WPCP – 35,004 m^3 or 45.7%

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 2024.

i) Summary of all Bypass, spill or abnormal discharge

- On March 9, approximately 5,124 cubic meters (m^3) of wastewater bypassed primary clarifier 4 during a 22 hour and 29-minute event resulting from heavy precipitation. Bypassed flow was directed into the aeration tank where it received secondary

treatment and disinfection before being discharged to Lake Ontario. Ministry of the Environment, Conservation and Parks (MECP) Incident Report #1-52UO12.

- On March 10, approximately 2,973 cubic meters (m^3) of wastewater bypassed primary clarifier 4 during a 21 hour and 35-minute event resulting from heavy precipitation. Bypassed flow was directed into the aeration tank where it received secondary treatment and disinfection before being discharged to Lake Ontario. MECP Incident Report #1-52U7H5.
- On March 23, approximately 307 cubic meters (m^3) of wastewater bypassed primary clarifier 4 during a 2 hour and 50-minute event resulting from heavy precipitation. Bypassed flow was directed into the aeration tank where it received secondary treatment and disinfection before being discharged to Lake Ontario. MECP Incident Report #1-56RYEF.
- On March 24, approximately 437 cubic meters (m^3) of wastewater bypassed primary clarifier 4 during 2 events totaling 4 hour and 20 minutes resulting from heavy precipitation. Bypassed flow was directed into the aeration tank where it received normal secondary treatment and disinfection before being discharged to Lake Ontario. MECP Incident Report #1-56W7FE.
- On April 12, approximately 25 cubic meters (m^3) of wastewater bypassed primary treatment facilities during a 1 hour and 31-minute event resulting from heavy precipitation. Bypassed flow was disinfected before being mixed with plant effluent and being discharged to Lake Ontario. MECP Incident Report #1-5OUQAL.
- On July 16, approximately 3,073 m^3 of wastewater bypassed primary treatment during the 3 hour and 25-minute bypass event resulting from heavy precipitation. Bypassed flow was directed to the bypass channel where it was disinfected before mixing with plant effluent. MECP Incident Report #1-906QZT.

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* cubic metre (m^3)	Average Daily Flow cubic metre per day (m^3/d)	Maximum Daily Flow m^3/d
January	1,952,275	62,976	83,544
February	1,654,815	57,063	62,550
March	1,902,787	61,380	72,642
April	2,232,983	74,433	129,069
May	1,825,755	58,895	66,575
June	1,672,862	55,762	67,042
July	1,772,156	57,166	86,116
August	1,598,842	51,576	62,582
September	1,480,080	49,336	53,768
October	1,441,086	46,487	50,401
November	1,353,312	45,110	49,494
December	1,531,406	49,400	64,347
Total	20,418,359		
Average	1,701,530	55,941**	
Maximum	2,232,983		129,069
ECA Limit	N/A	84,350	
Met Compliance	N/A	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 (TSS) avg. conc. mg/L	Total Phosphorus (TP) avg. conc. mg/L	Total Kjeldahl Nitrogen (TKN) avg. conc. mg/L
January	154	174	6.0	43.56
February	166	252	5.8	48.88
March	178	188	4.8	41.15
April	191	240	3.7	38.56
May	220	239	5.3	45.75
June	199	237	6.1	54.13
July	176	229	5.3	48.14
August	159	148	5.7	42.80
September	206	344	7.6	56.60
October	201	326	7.5	58.25
November	193	241	7.3	56.13
December	181	192	5.6	47.14
Average	185	234	5.9	48.42
Minimum	154	148	3.7	38.56
Maximum	220	344	7.6	58.25
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 kilogram per day (kg/d)	Total Suspended Solids (TSS) avg. conc. mg/L	TSS loading kg/d
January	5.4	343	42.6	2,682
February	4.0	227	21.3	1,215
March	5.3	324	30.0	1,844
April	7.1	526	53.5	3,983
May	10.4	613	83.3	4,907
June	11.2	623	73.2	4,080
July	12.0	687	87.5	4,999
August	6.2	319	29.8	1,535
September	5.9	293	26.9	1,328
October	3.9	181	14.3	664
November	5.4	242	31.5	1,422
December	4.6	227	25.2	1,242
Average	6.8	379	43.2	2,419
Minimum	3.9	181	14.3	664
Maximum	12.0	687	87.5	4,999
ECA Limit	25.0	2,108	25.0	2,108
ECA Objective	15.0		15.0	
Within Compliance	Yes	Yes	No	No
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	1.61	101	0.0	2.0		128	
February	1.10	63	0.0	5.4		305	
March	1.07	66	0.0	2.7		165	
April	1.09	81	0.0	2.8		211	
May	2.35	138	0.0		2.7		157
June	1.88	105	0.0		3.4		190
July	1.88	107	0.1		4.6		264
August	0.99	51	0.0		1.7		90
September	1.12	55	0.0		0.8		40
October	0.83	39	0.0		0.7		34
November	1.21	55	0.0	0.5		24	
December	0.56	28	0.0	0.6		29	
Average	1.31	73	0.0	2.3	2.3	144	129
Minimum	0.56	28	0.0	0.5	0.7	24	34
Maximum	2.35	138	0.1	5.4	4.6	305	264
ECA Limit	1.0	84		24.0	16.0	2,024	1,350
ECA Objective	0.8			18.0	8.0		
Within Compliance	No	No		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	7.1	7.5	16.4
February	0.00	7.1	7.7	16.3
March	0.00	6.6	7.4	16.5
April	0.00	7.1	7.9	15.4
May	0.00	7.1	7.8	19.0
June	0.01	7.1	7.4	21.0
July	0.01	7.2	7.6	22.1
August	0.00	7.1	7.6	22.7
September	0.00	7.0	7.3	22.9
October	0.00	6.9	7.5	20.9
November	0.00	6.9	7.6	20.1
December	0.00	7.0	8.0	19.4
Average	0.00			19.4
Minimum	0.00	6.6		15.4
Maximum	0.01		8.0	22.9
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	9	33
February	9	14
March	8	86
April	14	478
May	9	652
June	7	106
July	11	1,710
August	9	214
September	10	301
October	10	26
November	8	84
December	9	33
ECA Requirement		200
ECA Objective		150
Within Compliance		No
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	174,460	12,505	15,549	903,738.18	18,515
February	247,410	11,525	15,957	867,235.61	17,852
March	244,730	9,947	16,657	863,625.93	13,376
April	240,800	13,967	19,173	824,970.13	15,889
May	187,981	12,942	15,344	827,244.00	9,249
June	166,390	14,108	14,960	796,333.37	5,654
July	195,460	13,702	15,406	783,512.08	5,501
August	187,530	11,141	13,614	790,631.75	3,238
September	195,990	12,030	13,350	806,612.07	3,580
October	211,900	10,482	11,538	833,548.52	5,365
November	212,300	9,146	11,932	826,713.36	7,935
December	252,980	12,400	10,315	897,225.92	21,750
Total	2,517,931	143,895	173,795	10,021,391	127,904