Harmony Creek Water Pollution Control Plant

2020 Annual Performance Report

The Regional Municipality of Durham
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Environmental Compliance Approval (ECA): 2407-AK8KJH Dated May 23, 2017
Environmental Compliance Approval (Air): 5562-AM9RPN Dated May 18, 2017

The Harmony Creek Water Pollution Control Plant (WPCP) 2020 Performance Report provides staff, stakeholders and customers a performance overview of the Harmony Creek 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 Harmony Creek WPCP, located in the City of Oshawa, is owned and operated by the Regional Municipality of Durham (Region). The plant is operated according to the terms and conditions of the ECA's.

The Harmony Creek WPCP treats wastewater from the Oshawa and Courtice (Municipality of Clarington) service area. The Harmony Creek WPCP shares its catchment area flows with the Courtice WPCP. The Harmony Creek WPCP services approximately 40,480 residents or 22.1 % of the total catchment population and the remaining 77.9% serviced by the Courtice WPCP.

The Harmony Creek WPCP is designed to treat wastewater at an average flow rate of 34,100 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 through approximately 639 kilometres of sanitary sewers in Oshawa and Courtice and is conveyed to the Harmony Creek WPCP and the Harmony Creek Sanitary Sewage Pumping Station (SSPS). Approximately 77.9% of the influent flow is diverted to the Harmony Creek SSPS and conveyed to the Courtice WPCP. The remaining flow is treated at the Harmony Creek WPCP.

Preliminary Treatment

Screening: One mechanically cleaned screen and one emergency manual screen remove rags and large debris that could harm pumps and process equipment. Screenings are compacted for landfill disposal.
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 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 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 digester 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 clarifier effluent which settles out the phosphorus in the secondary clarifier.

Secondary Treatment

Aeration: The Harmony Creek Water Pollution Control Plant has a flexible aeration system which can operate as two individual aeration tanks or as one large aeration tank. The current configuration is one large aeration tank. The effluent from the primary clarifier flows into the aeration tanks. 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 tank is directed to the two 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 tank 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 chlorine contact chamber. Disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged to Lake Ontario.

Solids Treatment

Anaerobic Digestion: The raw sludge that is collected from the primary clarifier is pumped into the anaerobic digester 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. The methane is used for heating of the digester to offset the natural gas requirements or is flared off.
Sludge Management: All digested sludge produced at the Harmony Creek Water Pollution Control Plant (WPCP) is pumped to the sludge holding facility. From there, the treated sludge can be utilized on approved agricultural fields or be transferred to the Duffin Creek WPCP for incineration.

Environmental Compliance Approval (ECA)

Under Condition 11.(4) of ECA 2407-AK8KJH the Region of Durham 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. The plant operated at an average of 52.2% of its annual average rated flow capacity and received a maximum daily flow of 47,097 m^3/d on January 12, 2020. Tables 1 and 2 summarize the flow and raw wastewater characteristics during the reporting period.

b) Summary and interpretation of all Final Effluent monitoring data and a comparison to the compliance limits condition;

The Harmony Creek WPCP effluent was determined to be compliant with the ECA approval limits during the reporting period. See tables 3 and 4 for effluent results.

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

A request for Pandemic Related Temporary Relief (Alternative Arrangement) for Municipal Wastewater Systems was submitted to the Ministry of Environment, Conservation and Parks on March 31, 2020. The request was made for relief of influent sampling to assist in managing workload and for the health and safety of staff. The Director granted relief on April 29, 2020. Harmony Creek WPCP returned to normal sampling practices on June 1, 2020.

Operations discovered a slight leak of digester gas coming through the seals on the manway hatches of the primary digester roof. Repairs were made by a Technical Standards and Safety Authority certified contractor.

d) 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:

- Rebuilt digester recirculation pump,

- Installed new pump at the Harmony Sanitary Sewage Pumping Station (SSPS),
- Modified base for recirculation pump,
- Repaired seal leak on the manway hatches on the primary digester roof,
- Cleaned out Harmony Creek SSPS,
- Installed new power line from digester to maintenance.

e) 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. All results were found to be within an acceptable range.

f) Summary of the calibration and maintenance carried out on all influent and final effluent monitoring equipment;

- Calibration of the secondary effluent flow meter occurred on August 20, 2020,
- Calibration of the in-house laboratory equipment was conducted regularly.

g) Description of efforts made and results achieved in meeting the design objectives condition;

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 average daily rated flow capacity of 34,100 m^3/d was not exceeded,
- The pH objective of less than 6.5 was exceeded in 9 of 253 samples (3.6%). Calibration of the pH probe is performed regularly.

h) Biosolids Production;

Tabulation of volume of sludge generated;

The volume of sludge generated at the Harmony Creek Water Pollution Control Plant (WPCP) in 2020 was 20,979 m^3.

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

Volume of sludge is expected to increase in 2021 due to the digester being in full operation for 12 months.

Summary of locations to where sludge was disposed:

All sludge produced at this facility was transferred to Duffin Creek WPCP for incineration.

i) 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 2020.

j) Summary of By-passes, Overflows, reportable spills or abnormal discharge events:

A significant winter precipitation event on January 11 and 12, 2020 produced considerable flows resulting in a bypass event at the Harmony Creek Sanitary Sewage Pumping Station (SSPS). 89,400 m^3 of wastewater bypassed the Harmony Creek SSPS during the 33 hour and 30-minute event. All bypassed flow was directed to the bypass channel where it was disinfected before mixing with the Harmony Creek Water Pollution Control Plant effluent in a common channel. The nature of this event was considered extreme and the event was and unavoidable however, operational procedures were reviewed to determine whether a larger portion of the bypass could be mitigated should a similar event occur in the future.

k) Schedule 'B', Section 1 Notice of Modifications and Status Update

No schedule 'B', Section 1 Notice of Modifications were submitted in 2020.

l) Schedule 'B', Section 3 Modifications

No schedule 'B', Section 3 Modifications were completed in 2020.

m) Information Required by Ministry of the Environment, Conservation and Parks (MECP) Water Supervisor

No additional information was requested.

MECP Inspection

This plant was last inspected by the MECP on January 26, 2016.

Table 1 Final Effluent Flows

Month	Total Flow to Plant metered at the secondary clarifier – cubic metre (m^3)	Average Day Flow cubic metre per day (m^3/d)	Maximum Day Flow m^3/d
January	583,154	18,811	47,097
February	545,787	18,820	20,887
March	667,290	21,525	25,374
April	559,959	18,665	21,940
May	561,235	18,104	22,283
June	486,805	16,227	19,194
July	500,063	16,131	19,092
August	593,230	19,136	20,323
September	490,688	16,356	18,601
October	493,845	15,930	16,570
November	470,467	15,682	20,103
December	563,460	18,176	20,035
Total	6,515,983		
Average	542,999	17,803	
Minimum	470,467		
Maximum	667,290		47,097
ECA Requirement		34,100	
Met Compliance		Yes	

Table 2 Raw Influent Analyses

Month	Biochemical Oxygen Demand Average (avg.) Concentration (conc.) milligrams 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	163	179	3.0	31.52
February	103	151	3.2	30.48
March	131	119	2.7	26.54
April	118	160	3.6	35.28
May	139	239	4.7	41.45
June	163	254	5.0	43.18
July	178	208	4.9	48.13
August	174	217	4.7	44.55
September	163	228	5.0	51.98
October	168	235	5.1	46.10
November	173	215	5.0	44.70
December	159	186	4.1	38.34
Average	153	199	4.2	40.19
Minimum	103	119	2.7	26.54
Maximum	178	254	5.1	51.98
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	Total Phosphorus (TP) avg. conc. mg/L	TP loading kg/d	Total Ammonia Nitrogen avg. conc. mg/L
January	5.3	100.1	14.1	266.0	0.43	8.1	1.63
February	5.1	96.7	6.4	120.0	0.46	8.7	0.98
March	3.5	75.3	6.5	139.9	0.41	8.8	1.23
April	2.8	52.3	6.8	126.9	0.44	8.2	0.39
May	2.9	52.5	6.1	110.4	0.53	9.6	0.70
June	4.3	69.4	4.5	73.6	0.47	7.7	1.76
July	2.5	40.3	3.6	58.6	0.66	10.6	2.57
August	1.8	34.4	3.3	62.5	0.75	14.3	0.57
September	2.3	36.8	3.6	59.3	0.70	11.5	1.19
October	3.0	48.2	5.6	89.5	0.40	6.4	0.91
November	4.2	66.5	4.4	68.3	0.52	8.2	0.76
December	3.9	71.6	4.7	85.1	0.44	8.0	0.95
Average	3.5	61.9	5.8	103.3	0.52	9.2	1.14
Minimum	1.8	34.4	3.3	58.6	0.40	6.4	0.39
Maximum	5.3	100.1	14.1	266.0	0.75	14.3	2.57
ECA Limit	25.0	852.5	25.0	852.5	1.0	34.1	
ECA Objective	15.0		15.0		0.8		
Within Compliance	Yes	Yes	Yes	Yes	Yes	Yes	
Sampling Frequency Requirement Met	Yes		Yes		Yes		Yes

Table 3 Final Effluent Analyses continued

Month	Unionized Ammonia Average (avg.) concentration (conc.) milligrams per litre (mg/L)	Total Chlorine Residual avg. conc. mg/L	pH minimum	pH maximum	Temperature degree Celsius avg.
January	0.01	0.00	6.8	7.5	12.1
February	0.00	0.00	6.6	7.4	11.9
March	0.00	0.00	6.7	7.4	13.5
April	0.00	0.00	6.6	7.4	12.9
May	0.00	0.00	6.4	7.1	15.9
June	0.00	0.00	6.3	6.9	18.5
July	0.01	0.00	6.2	7.2	21.8
August	0.00	0.00	6.7	7.1	21.5
September	0.01	0.00	6.7	7.5	20.4
October	0.01	0.00	7.1	7.5	18.5
November	0.01	0.00	7.1	7.6	16.6
December	0.00	0.00	7.0	7.6	14.8
Average	0.00	0.00			16.5
Minimum	0.00	0.00	6.2		11.9
Maximum	0.01	0.00		7.6	21.8
ECA Limit		0.02	6.0	9.5	
ECA Objective		0.01	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	Geometric Mean Density
January	9	41
February	10	20
March	6	4
April	5	8
May	4	1
June	8	4
July	10	1
August	8	4
September	9	2
October	9	2
November	8	2
December	10	4
ECA Limit		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 (L)	Sodium Bisulphite (L)	Hydro kilowatt hour	Natural Gas cubic metres
January	19,552	11,303	2,214	619,041	24,266
February	20,530	11,973	2,234	495,778	22,256
March	17,992	11,727	2,607	535,626	23,248
April	18,039	12,567	2,218	491,270	22,826
May	21,696	13,137	1,863	443,684	17,073
June	20,850	10,943	1,819	354,287	7,365
July	26,127	12,658	2,546	346,710	3,225
August	31,159	15,202	2,546	341,386	2,717
September	21,705	16,613	3,205	341,975	3,476
October	39,941	20,218	5,114	390,524	7,440
November	26,854	16,070	4,608	399,117	7,574
December	17,884	16,793	4,634	482,968	13,415
Total	282,328	169,204	35,608	5,242,367	154,881