Utilities Kingston

CATARAQUI BAY
WASTEWATER TREATMENT PLANT

2020 ANNUAL REPORT

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REPORT CHECK LIST

Annual report submitted for the Environmental Compliance Approval number 3714-9YURZF.

Condition 11(6) the first annual report shall cover the period from the commencement of operation of the sewage works to the end of the calendar year and shall be submitted within sixty (60) days following the end of such reporting period. Each subsequent annual report shall be submitted within sixty (60) days following the end of the calendar year being reported upon.

Condition 11(6)(a) to (l). Each annual report shall contain at least the following information:

- Executive Summary
- Tabulation and comprehensive interpretation of all monitoring data and analytical results collected during the reporting period, and a comparison to the effluent quality and quantity.
- Summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism, or thing forming part of the works.
- Description of all operating problems encountered, and corrective actions taken during the reporting period.
- Tabulation of the volume of sludge generated in the reporting period and an outline of anticipated volumes to be generated over the next reporting period, and an outline of the sludge handling methods and disposal areas to be utilized over the next reporting period.
- Evaluation of the calibration and maintenance procedures conducted on all monitoring equipment.
- Summary of effluent quality assurance or control measures undertaken.
- Summary of any complaints.
- Summary of all by-passes.
- Evaluation for the need for modifications to the works to improve performance and reliability and to minimize upsets and bypasses.

EXECUTIVE SUMMARY

The Cataraqui Bay Wastewater Treatment Plant (WWTP) was compliant with all concentrations, loadings, sampling, and maintenance as required in environmental compliance approval (ECA) number 3714-9YURZF. Additional details can be found in the tables contained in Appendix A.

The average flows through the plant decreased slightly in 2020 to 27,189 $m^{3/}$day.

Plant staff continue to maintain operations during the facility upgrades and have continued with planned and reactive maintenance as well as capital works at both the facility and within the associated collection system. Details regarding these improvements are in the report.

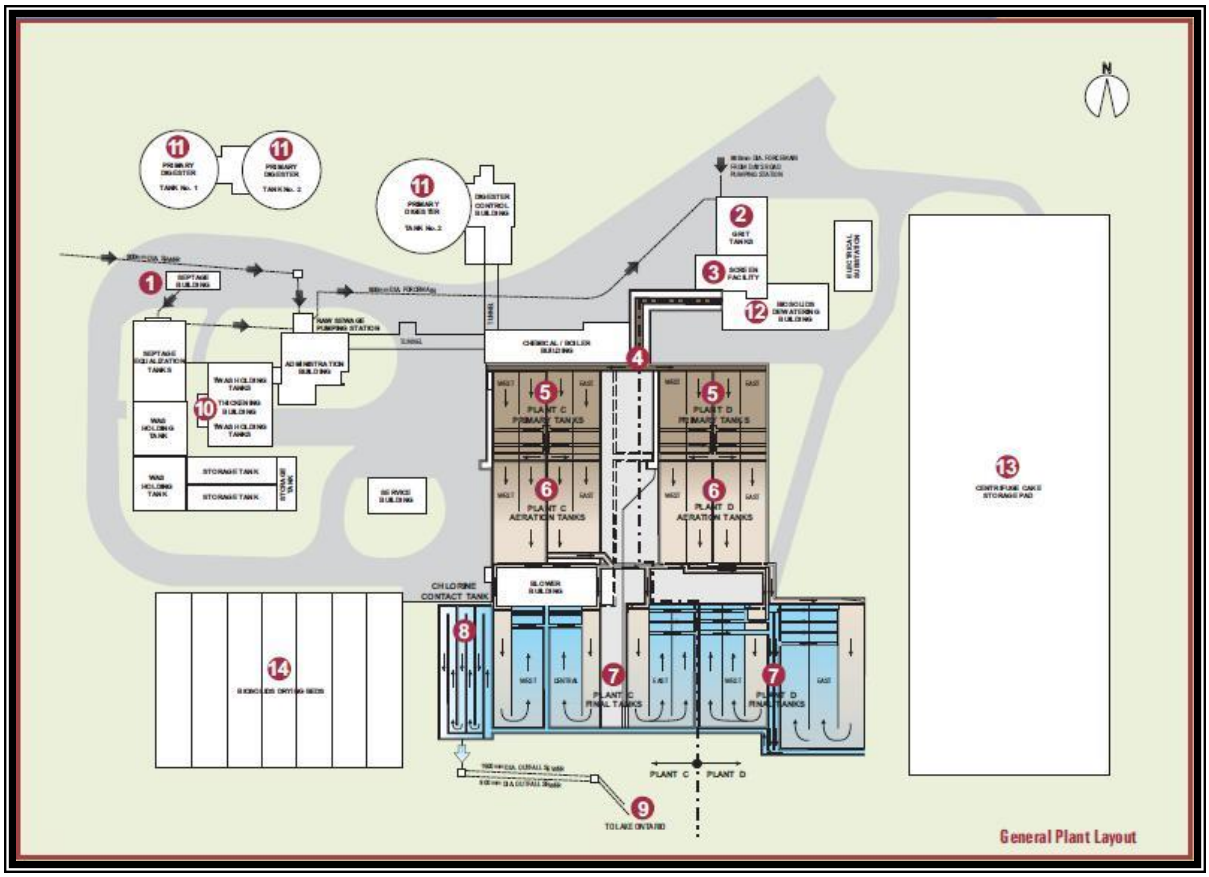
We have continued to provide additional training to staff at the facility to increase their knowledge of the process upgrades currently underway.

There was one secondary bypass event at the Cataraqui Bay WWTP and three bypass events within the Kingston West Sewage Collection System in the 2020 reporting year. All by-pass details are listed in Table 7, the Bypass Summary section of this report. All the bypasses were due to rainfall events.

PLANT OVERVIEW

The following is a process overview and description of the treatment steps taken at the Cataraqui Bay wastewater treatment plant. The descriptions contained within this report relate to ECA number 3714-9YURZF.

A detailed description of the upgraded WWTP will be provided when the facility performance report relates to ECA number 4163-ACPPRK.



Grit Removal

The first step in the treatment process is grit removal. This is accomplished by introducing air into the bottom of the grit channel. The heavier solids in the wastewater settle to the bottom of the tank, while the organics required to be treated stay in suspension and move on to the next treatment step.

Screening

The second operation is the removal of large particles and floating debris such as wood, rags and plastics from the raw water. These items are removed using mechanical screens that rake the debris from the wastewater stream and onto a belt conveyor.

Flow Splitting

The screened wastewater discharges into a channel where a flow splitter divides the flow into two separate channels that lead to both C and D plants. The channels are equipped with motorized gate valves to control the flow rate to each plant.

Primary Settling

The heavier organics settle by gravity to the bottom of the primary clarifiers and form a sludge blanket on the bottom of the tank. The settled sludge is collected by longitudinal collector flights and scraped into a hopper at the end of the tank. The settled sludge is then pumped to digestion facilities for further treatment. As wastewater is discharged from the primary clarifiers, it is dosed with aluminum sulphate for phosphorus removal.

Aeration

Aeration is the biological process that involves the assimilation of organic insoluble and soluble matter by the action of microorganisms. The microorganisms flourish under stable conditions of respiration through air supply and food provided by the primary clarifier effluent. The aeration process effectively removes 95% of the biochemical oxygen demand from the incoming wastewater.

Final Settling

After the assimilation is completed in the aeration tanks, the mixed liquor from these tanks flows into the final clarifiers for solid-liquid separation. The biomass formed in the aeration tanks settles to the bottom of the final clarifiers, where a portion is returned to the head of the aeration tanks to continue assimilation of the food in the primary effluent and the remainder is pumped to sludge thickening facilities.

Disinfection

The supernatant effluent from the final clarifiers is then directed to the disinfection facilities. Chlorine is dosed to the wastewater just prior to entering the chlorine contact tank where disinfection of the final effluent occurs. Just after exiting the chlorine contact tank the wastewater is dosed with calcium thiosulphate for de-chlorinating to ensure no chlorine remains in the water entering the receiving stream.

Outfall

After de-chlorination, the disinfected effluent from the chlorine contact tank is discharged back to Lake Ontario through a 1500 mm and a 900 mm outfall sewer. The diffusers at the ends of the sewer lines are located 25 m offshore and 16 m below water surface level.

Sludge Thickening

The sludge thickening facility consists of two rectangular holding tanks, dual rotating drum thickeners and a polymer system. Sludge is thickened from 0.5% solids to approximately 3.5% solids before being pumped to the digester facilities.

Biosolids Management

The sludge from the primary and final clarifiers as well as the sludge from the thickening process is pumped to the digestion facilities. The digester facilities consist of one primary digester, one secondary digester and a holding tank. In the primary digester, the sludge is heated, mixed and re-circulated under controlled anaerobic conditions. The anaerobic digestion process produces gas and biosolids. The gas produced is rich in methane which is used as fuel for the boiler system which in turn provides heat for the digestion process. The biosolids produced through sludge digestion are dewatered and used on agricultural lands as a nutrient and soil conditioner when weather and crop conditions permit.

Biosolids Dewatering

The biosolids produced through digestion are dewatered by centrifugation. The centrifuged cake produced is land applied when weather and crops permit. The amount of dewatered sludge produced was 3075 mt that was land applied.

PLANT PERFORMANCE

The enclosed performance assessment summarizes and confirms the facility's compliance. Refer to appendix A for detailed tables and graphs for various parameter results.

All effluent quality and quantity parameters outlined in conditions 6 and 7 of ECA number 3714-9YURZF were compiled during the reporting period of 2020.

The following tables summarize the results obtained through monitoring of plant performance in accordance with conditions 6 and 7 of the ECA number 3714-9YURZF. Effluent objective and limits for ECA number 4163-ACPPRK will become effective once the facility upgrades are complete.

Table 1: Effluent Results

Effluent Parameter	**Objective** (mg/l)	**2020 Results** (avg.)
$CBOD_5$	15.0	4.9 mg/l
Total suspended solids (TSS)	15.0	5.7 mg/l
Total Phosphorus	1	0.42 mg/l
Total Chlorine Residual	<0.02	0.01 mg/l
E. Coli (Monthly Geometric Mean Density)	200 counts/ 100 ml	26 counts/ 100 ml

Table 2: Effluent Limits

Effluent Parameter	**Concentration Limit** (mg/l)	**Loading Limit from effluent (kg/d)**	**2020 annual average (kg/d)**
$CBOD_5$	25.0	970	123
Suspended solids (TSS)	25.0	970	145
Total Phosphorus	1.0	39	11.4
Total Chlorine Residual	0.02		0.01

Table 3: Monthly Effluent Parameters

Month	CBOD5 max concen/max loading (mg/L_kg/day)	TSS max concen/max loading (mg/L_kg/day)	TP max concen/max loading (mg/L_kg/day)	E. coli (Monthly geometric mean density)
January	12mg/L - 90kg/day	12mg/L 390kg/day	0.89mg/l 34kg/day	65
February	6mg/L-200kg/day	8mg/L 200kg/day	1.07mg/l 24kg/day	200
March	5mg/L-200kg/day	12mg/L 400kg/day	0.61mg/l 26kg/day	11
April	4mg/L-100kg/day	11mg/L 290kg/day	0.89mg/l 23kg/day	26
May	6mg/L-100kg/day	7mg/L 200kg/day	2.53mg/l 200kg/day	5
June	5mg/L-100kg/day	10mg/L 200kg/day	0.91mg/l 24kg/day	20
July	6mg/L-100kg/day	13mg/L 300kg/day	1.42mg/l 31kg/day	3
August	6mg/L-200kg/day	13mg/L 100kg/day	0.81mg/l 14kg/day	45
September	8mg/L-200kg/day	11mg/L 250kg/day	0.81mg/l 19kg/day	27
October	6mg/L-100kg/day	13mg/L 310kg/day	0.72mg/l 17kg/day	89
November	14mg/L-530kg/day	24mg/L 910kg/day	0.83mg/l 30kg/day	90
December	13mg/L-320kg/day	26mg/L 650kg/day	2.4mg/l 71kg/day	23

Table 4: Annual Plant Flows

Parameter	2014	2015	2016	2017	2018	2019	2020
Avg. m^3/day	27145	26147	26072	30042	28963	29251	27189
Max. m^3/day	90801	56583	67405	121860	94957	91976	82297
Design. M^3/day	38800	38800	38800	38800	38800	38800	38800
% (daily/design)	70.0%	67.4%	67.2%	77.4%	74.6%	75.4%	75.4%

Table 5: Annual Effluent Results

Parameter (mg/L)	2014	2015	2016	2017	2018	2019	2020	LIMITS
$CBOD_5$	6	5.3	4.05	3.13	5	4.9	5.3	25
Suspended Solids	6.2	6.5	4.8	5.09	6	5.7	9.2	25
Total Phosphorus	0.61	0.55	0.51	0.55	0.40	0.42	0.68	1.0
Total Chlorine	0.01	0.01	0.018	0.018	0.01	0.01	0.01	<0.02
Acute Lethality	n/a	All Pass	All Pass	All Pass	5 Pass/ 1 Fail	Pass	Pass	Pass

Note: Acute lethality testing was started in 2015.

MAINTENANCE

In 2020 we continued with our preventative maintenance program of vibration testing, oil analysis and electrical surge protection. Preventative maintenance and inspections were performed on most clarifiers during the summer months.

The following bullet points highlight other major projects completed this year.

- Annual infrared scans on HV electrical
- Routine vibration monitoring
- Diesel generator repair & maintenance

CAPITAL WORKS

In October 2016 work began on plant wide upgrades. The original proposed project completion timeline was 4 years (2016-2020). Although the original proposed completion date has passed, the Cataraqui Bay WWTP continues to undergo an extensive process, electrical/instrumentation, and mechanical upgrade.

The additional major highlights for capital works in 2020 at the Cataraqui Bay WWTP and associated sewage collection system were:

- Portsmouth Pumping Station upgrade assessment.
- Days Rd Pumping Station design upgrade.
- Continued work on the Wastewater Master Plan assessment.
- A Fats, Oils, Grease monitoring program was initiated to track the frequency at which restaurants are cleaning grease traps, to protect the wastewater collection system and enforce the sewer use by-law.

OPERATIONS

Preventative maintenance and regular process/equipment inspections allow operational problems to be diagnosed quickly and corrective actions to be taken immediately. Non flushable materials such as wipes, and grease have become more prominent in the sewer system resulting in some operational and maintenance challenges. Utilities Kingston is continuing a public education program to make customers more aware of what materials should not be flushed down the sewers. This program has included: radio and newspaper campaigns, through social media such as Twitter and Facebook, bill stuffers, information on back of parking tickets, and bus information signs. This has been an ongoing campaign for the past three years with some positive results.

BIOSOLIDS MANAGEMENT

The dewatering facility is the primary method of solids handling at the Cataraqui Bay facility. The secondary digested sludge is dewatered through a centrifuge and then stored until land application is available during the summer season.

It is too hard to predict exactly where and when we will spread in 2021, as crops and weather will be the major variables that we will be dealing with in the 2021 spreading season. Below are the active C of A's and addresses for the City of Kingston in which spreading can take place.

Table 6: Biosolids Recipients in 2020

C Of A and NASM Plan #	Address	Expiry Date
22853	Huffam Rd.	31/12/2021
22855	Lake Rd.	31/12/2021
22901	County Rd.8	31/12/2021
23007	County Rd. 4	31/12/2021
23047	Palace Rd.	31/12/2021
23048	Multiple farms	31/12/2021
23119	Hamilton Rd.	31/12/2021
23425	Parry/Chambers Rd.	31/12/2022
23525	County Rd. 8	31/12/2022
23641	Hamilton Rd.	31/12/2022
23950	County Rd. 8	31/12/2023
24003	Hamilton Rd.	31/12/2023
24091	Multiple farms	31/12/2023
24326	Greater Napanee	31/12/2024
24327	Greater Napanee	31/12/2024

EQUIPMENT CALIBRATIONS

All of the plant flow meters, online analyzers and lab equipment are calibrated annually by third party contractors. As a result of this proactive approach, the facility saw limited downtime of major equipment and saw very few mechanical or electrical failures this year. Calibration records are available upon request.

COMPLAINTS

In the 2020 reporting year, the Cataraqui Bay WWTP received 3 official complaints related to odour. Due to the WWTP upgrades currently underway, and a change in process, H2S has been detectable to nearby residents. Investigations are underway to reduce the smells via process adjustments. When the facility upgrade is complete, it is expected that odours will be reduced further.

BYPASS SUMMARIES

Table 7 summarizes the locations, volumes and durations of bypass events for the reporting year 2020. Table 8 summarizes the test results from samples taken during the 2020 bypass events.

Table 7: Bypass Events

Date	Location	Start	Duration	Volume	Reason For	Precip
dd/mm/yyyy		Time	(hr + mins)	(m^3)	Bypass	(mm)
11/01/2020-12/01/2020	Cataraqui Bay WWTP (secondary bypass)	22:23	24:27	1875	rain/ rapid snow melt	45.7
11/01/2020-12/01/2020	Crerar Pumping Station	21:30	16:30	170	rain/rapid snow melt	45.7
30/04/2020-01/05/2020	Crerar Pumping Station	23:50	4:00	76	Heavy rain/snow melt	48.2
25/12/2020	Crerar Pumping Station	6:30	7:00	91	Heavy rain/snow melt	20.2

Table 8: Bypass Sampling

Parameter	Units	Cat. Bay STP Annual Avg.
E coli	Cfu/100mL	150000
$CBOD_5$	mg/l	36.75
TSS	mg/l	139
TP	mg/l	3.59
Parameter	**Units**	**Crerar PS Annual Avg.**
E coli	Cfu/100mL	128250
$CBOD_5$	mg/l	3.9
TSS	mg/l	18.5
TP	mg/l	0.34

BYPASS RESULT INTERPRETATIONS

$CBOD_5$, TP & TSS results are much the same as typical raw sewage influent to the sewage plant.

APPENDIX A – MONITORED PARAMETERS RESULTS AND GRAPHS

For further information about this report or any questions regarding accessibility contact Troy Dickerson at *tdickerson@utilitieskingston.com* , or call 613-546-1181 Ext 2 1 9 0.