CATARAQUI BAY
WATER POLLUTION CONTROL PLANT
2024 ANNUAL REPORT

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1 EXECUTIVE SUMMARY

During 2024, the facility was compliant with all but one of the conditions outlined in condition 7 of Environmental Compliance Approval (ECA) number 2497-CYPPUP. The non-compliant month and effluent parameter is described in the following sections of this report.

The average daily flow through the plant was 25,890 m3/day.

There were no bypass events at Cataraqui Bay. There were three spills to the environment of digester gas, due to pilot light issues with flare stack.

Upgrades to the treatment facility are now considered to be complete and the facility is operating under the new ECA listed above. Planned and reactive maintenance as well as capital works at both the facility and within the collection system were undertaken in 2024. Details regarding these improvements are in the report.

2 PLANT DESCRIPTION AND TREATMENT PROCESS

The following is a process overview and description of the treatment steps taken at the Cataraqui Bay Water Pollution Control Plant (WPCP).

2.1 SCREENING

The first step in the treatment process is screening, where large particles and floating debris such as wood, rags and plastics are removed from the raw wastewater. There are two active 6 mm diameter perforated plate fine screens each in a 2 m wide channel. Screenings are conveyed to a common wash/compactor prior to being discharged in a screening disposal bin. A coarse bar screen is located in a third manual bypass channel, as well as a fourth channel containing an overflow weir (hydraulic bypass of the screens) for emergency purposes only.

2.2 GRIT REMOVAL

The second step of preliminary treatment is grit removal. During this process, heavier solids in the wastewater settle, while the organics that require treatment stay in suspension and move on to the next step of the treatment process. The system is made up of two vortex grit removal tanks equipped with a paddle mixer, and a slurry pump in each tank. The grit is pumped to two grit classifiers used to de-water the grit slurry and discharge the grit into grit disposal bins.

2.3 PRIMARY TREATMENT CHEMICAL FEED

Immediately after the grit vortex tanks, the coagulant Ferric Chloride is added to the stream of wastewater. Chemically assisted coagulation is used to improve the removal of Phosphorous and Suspended Solids in the wastewater. Two chemical storage tanks feed two chemical feed pumps used to dose Ferric Chloride paced to the flow of liquid.

2.4 FLOW SPLITTING

The screened and de-gritted wastewater discharges into a channel where the flow is divided into two parshall flume flow meter channels. The flow is then split into a primary inlet channel leading to four identical primary clarifiers. Centrifugal blowers provide aeration to the primary influent channel to prevent settling in the channels.

2.5 PRIMARY CLARIFIERS

Four primary clarifiers make up the primary treatment system. Heavier organics settle by gravity to the bottom of the primary clarifiers. This forms a sludge blanket on the bottom of the tank. The settled sludge is collected by collector flights and scraped into a hopper at the end of the tank.

Floating scum and grease is removed by surface skimmers located near the end of each clarifier. The settled sludge, and scum and grease, is then pumped to digestion facilities for further treatment.

2.6 BIOLOGICAL AERATED FILTERS

Primary effluent flows down a channel to a Primary Effluent Pumping Station (PEPS) composed of two wet wells and four submersible pumps. Primary effluent is pumped to the Biological Aerated Filter (BAF) Influent Channel. A supplemental alkalinity feed system is required to ensure adequate nitrification while maintaining an acceptable pH in the BAF effluent water. The alkalinity feed system is made up of four storage tanks, and two chemical feed pumps, and is dosed just after the discharge from the PEPS. The BAF is made up of six available cells with a common influent channel which then runs down to the bottom of each cell and filters upwards through two unique sets of media. The two types of media are: polystyrene beads, and K5 hard plastic honeycomb disks. The media is held in place below the top deck of the filter with nozzles which let filtered water out and hold the floating media in. In the filter the wastewater is aerated, this encourages growth of microorganisms which consume carbon dissolved in the wastewater, as well as reducing ammonia and phosphorus. The media is meant to provide a location for microorganisms, referred to as biomass, to grow, the media also helps to filter any suspended materials.

2.7 BACKWASH

The Biological Aerated Filters require regular backwashes to remove excess biomass from the media. Backwash residuals from the filters flows into two backwash residual tanks for temporary storage of the backwash water. The facility has the option to either co-thicken the backwash residuals by adding the backwash water to the primary inlet channel, or to feed the backwash residuals to two gravity thickeners. Alum is added to the backwash water as it is pumped out of the backwash residual tanks. The gravity thickeners are two clarifiers designed to allow solids to settle out and allow the supernatant to flow back and mix with the primary effluent ahead of the primary effluent pumping station. The solids from the gravity thickeners are pumped to a sludge thickening facility. The sludge thickening facility consists of two rectangular holding tanks, two Rotating Drum Thickeners (RDT's), and a polymer system. The thickening system increases the solids concentration of the residuals prior to being pumped to the primary digester. The filtrate from the RDT's is pumped back to the primary inlet channel.

2.8 DISINFECTION

Effluent from the BAF facility flows through a parshall flume to calculate the flow of water into the chlorine contact tank. A chlorine gas system provides chlorine for disinfection prior to entering the chlorine contact tank. The chlorine system is composed of two sets of large and small chlorinators dosing a chlorinated water solution to the BAF effluent stream. Two chlorine contact tanks provide contact time to adequately disinfect the effluent water.

2.9 DECHLORINATION SYSTEM

An effluent dechlorination system using Calcium Thiosulphate removes chlorine from the water prior to discharge into Lake Ontario. The system is made up of two metering pumps, and one chemical storage tank. The Calcium Thiosulphate is dosed into the effluent in the outfall chamber immediately after the final effluent flow meter.

2.10 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. 17 diffusers are installed at the end of each of the outfall pipes and are located 25 m offshore and 16 m below water surface level.

2.11 SLUDGE DIGESTION

Raw sludge, grease and scum, and thickened backwash residuals are pumped to the primary digester in regular intervals throughout the day. The sludge digestion facilities are composed of two anaerobic digesters with an interconnected digester gas system, one digested sludge holding tank, transfer, and mixing pumps, and a heat exchanger. The digesters use recirculated digester gas and sludge piping for mixing. 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, and buildings within the facility. 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.

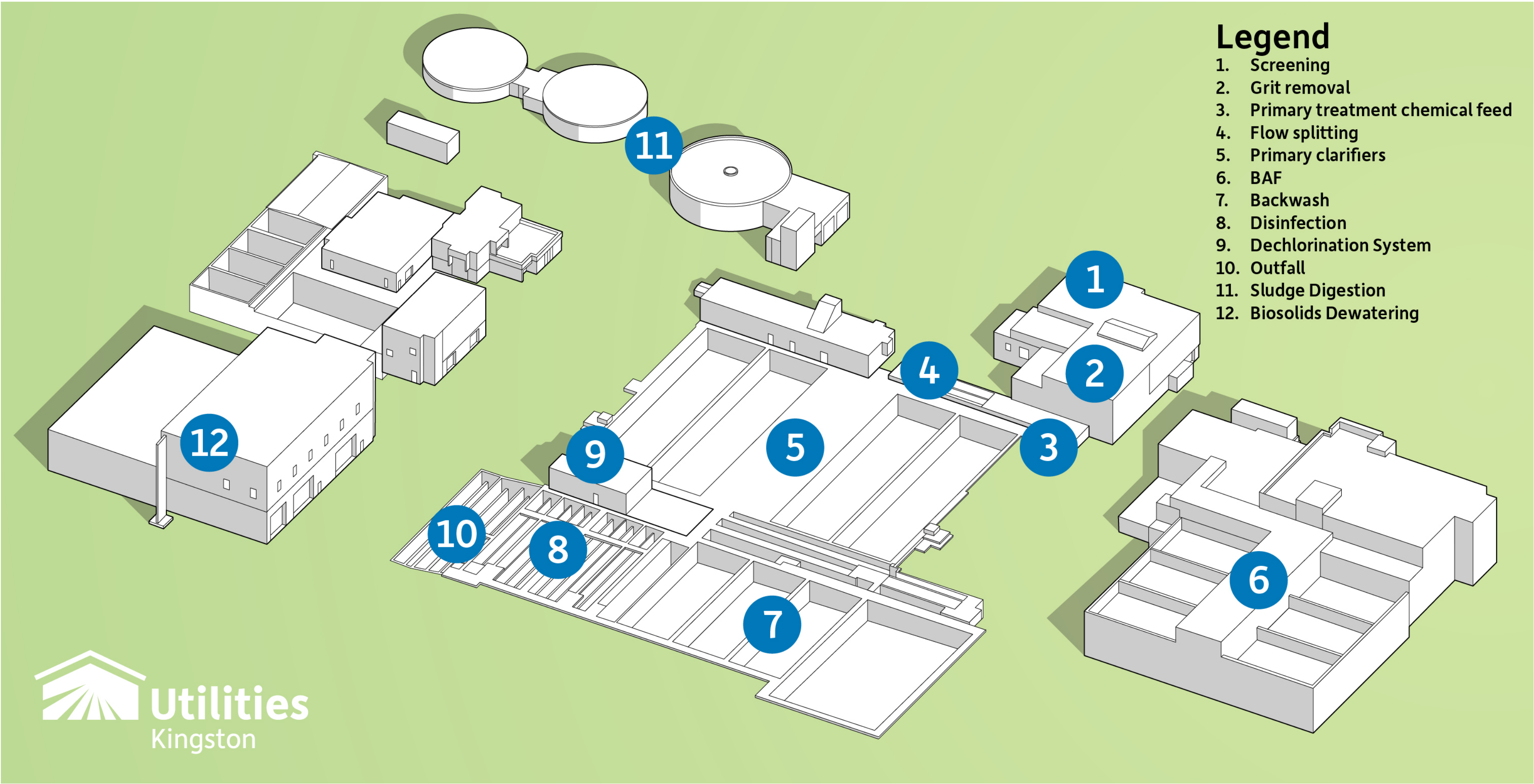
2.12 BIOSOLIDS DEWATERING

The dewatering facility is made up of two sludge feed pumps, a polymer preparation and feed system, two centrifuges with a capacity of dewatering 50 m^3/hour, two screw conveyors, two biosolids storage bunkers, a centrate pumping station, two centrate equalization tanks with two centrate pumps. Liquid biosolids, which are about 1.5-2% solids, are pumped from the holding tank into 2 centrifuges. Polymer is added to the biosolids before it enters the centrifuge, this helps the solids stick together, aiding the dewatering process. The centrifuge spins at a high-speed, forcing solids to the outer drum. This separates the solids, referred to as cake, from the liquid, called centrate. The cake, which now has a solids content of about 24%, is conveyed to a shoot and dropped into the storage bunkers. The centrate, which contains many nutrients and some microorganisms, is returned to the headworks for treatment.

2.13 MISCELLANEOUS

The Cataraqui Bay WPCP has miscellaneous infrastructure required to support continued effective treatment of incoming Wastewater. This includes many controls, electrical power equipment, instrumentation, boilers, and emergency power generation for the entire facility.

Figure 1 – Cataraqui Bay Water Pollution Control Plant General Layout



3 OPERATION

Adequate staffing as well as preventative maintenance, and regular equipment inspections resulted in minimal disruptions to the operation of the plant. Non flushable materials such as wipes, and grease continue to be more prominent in the sewer system resulting in some operational and maintenance challenges. Utilities Kingston continues to implement 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, social media campaigns, bill stuffers, information on back of parking tickets, and bus information signs. This has been an ongoing campaign for many years with positive results. During the summer of 2024, staff educated owners of grease traps on how to properly maintain their equipment. Pamphlets describing the importance of appropriate grease trap maintenance and how it impacts the City's sanitary sewer collection system were delivered to many restaurants across the city.

A new pilot headworks polymer system was brought online in 2024, see Figure 2 for the Notice of Modification to Sewage Works. This polymer system was implemented as a response to the operational difficulties and increased effluent concentrations in 2023. The system has been online since May 2024, and staff have noted improved effluent concentrations during this time. Laboratory data and observations have been monitored closely during this trial period. A decision on whether or not to implement a permanent polymer system is expected to be made in 2025.

The facility began co-thickening the backwash residuals, and shut down the gravity thickeners and backwash thickening process during 2024. These changes coupled with the headworks polymer trial have shown some success and the effluent concentrations have been reduced compared to the 2023 effluent results.

The Calcium Thiosulphate (Captor) line to the final effluent dose location was replaced to eliminate the problems with scale buildup and the labour intensive cleaning schedule required to keep the line in service.

There was a significant release of an unknown substance in the collection system in November that was extremely alkaline. This release led to a reduced capacity to biologically treat the wastewater coming into the plant. The source of the release or details of what the release remain unknown at the time of preparing this report.

4 PLANT PERFORMANCE

The ECA number 2497-CYPPUP lists the limits and objectives for the concentrations of certain effluent parameters, this is shown in Table 2. The effluent objectives listed in this table are the concentrations Utilities Kingston are expected to be below. The effluent concentration limits listed in the table are the concentrations Utilities Kingston are required to be below. As a result of the above mentioned extreme alkaline discharge into the system, the Cataraqui Bay WPCP had one non-compliant monthly average result for Total Ammonia Nitrogen of 14.79 mg/L, with the monthly average effluent concentration above the limit of 8.0 mg/L. This occurred in the month of November. This non-compliant result was reported to the MECP. Operations staff brought the plant back up to full treatment capacity, and by early December nitrification (a biological process that converts ammonia into nitrate) was back to normal. This incident led to several monthly average concentrations of cBOD, and TSS, and an effluent pH reading, being higher than the objectives set out in the ECA. The 2024 monthly average effluent monitoring results can be found on Tables 4 and 5.

In the month of February, the monthly average Effluent Total Phosphorous (TP) concentration was above the objective while remaining below the limit.

The chlorine residual in the final effluent did not exceed the monthly average limit of 0.04 mg/L for any month of the year. No other parameters were above their limit or objective.

The treatment process is monitored through in-house laboratory work on a regular basis throughout each week.

The concentration of raw influent into the plant remains consistent throughout the year, however during the wet seasons concentrations are somewhat reduced. This increase indicates some infiltration of ground water, or potentially illegal sump pump connections to the sanitary collection system. Annual raw influent monitoring results can be seen in Table 3. Raw Influent, and Final Effluent samples were collected and submitted to a third-party laboratory at or above the required frequencies based on the ECA. The average daily flow into the treatment plant was 47.1% of the design capacity (55,000 m3/day). The new plant has a much higher flow design capacity which is reflected in Table 8. Table 8 shows the average annual plant flows for the past 7 years. The monthly flows as well as the peak daily flow from each month are displayed in Table 6.

5 BIO-SOLIDS MANAGEMENT

Cataraqui Bay WPCP processed 56,294.70 m^3 of liquid sludge through the centrifuge. Approximately 3,541.69 Metric Tonnes of sludge cake was stored on site until GFL Environmental applied it to land on licensed agricultural fields.

The location and date of land application of the bio-solids produced largely depends on weather, and the crops being grown on the receiving lands. Table 1 contains the Non-Agricultural Source Materials (NASM) Plan numbers and addresses of receiving lands for bio-solids produced by the City of Kingston.

6 MAINTENANCE

Staff continue to follow a preventative maintenance program in accordance with the manufacturer's recommendations.

Additional Maintenance completed this year:

- Infrared scans of HV electrical were performed across the plant.
- Equipment and motors had routine vibration monitoring conducted.
- The onsite diesel generator was serviced and received routine maintenance.
- BAF Aeration Blower motor was rebuilt.
- Primary Clarifier 4 cross collector gear box rebuilt.
- Digester gas compressor rebuilt.
- Screen brush motor replaced.

7 CAPITAL WORKS

In October 2016 work began on plant wide upgrades. The original proposed project completion timeline was 4 years (2016 - 2020). In 2024 the Cataraqui Bay WPCP project came to an end and the new plant is now fully operational.

Additional capital works on the Cataraqui Bay WPCP include:

- Chlorine analyzers were completely replaced.
- Landscaping around the facility was completed as part of the plant upgrade.
- Digester gas pipework leading to the flare stack was replaced.

8 EQUIPMENT CALIBRATIONS

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

9 COMPLAINTS

In the 2024 reporting year, the Cataraqui Bay WPCP received no official complaints regarding the facility or treatment process.

10 BYPASS AND SPILL SUMMARY

There were no bypasses at the Cataraqui Bay WPCP in 2024.

There were three spill events of un-combusted digester gas to the environment, totaling 853 m^3 that were reported to the MECP in the 2024 reporting year. These spills occurred when the pilot light of the flare stack blew out in high winds. The primary boilers use digester gas to heat the facility, and any extra gas is sent to the flare stack. During these periods where the flare was not lit, any digester gas being sent to the flare was not burnt. The release of unburnt digester gas is considered a spill to the environment. Contractors were hired to assess the flare stack and make adjustments to strengthen the pilot flame. This stronger pilot flame, coupled with modifications to operating procedures, are expected to reduce the frequency of these spills due to the pilot light being blown out.

11 BYPASS RESULT INTERPRETATIONS

As noted above there were no bypasses at the Cataraqui Bay WPCP in 2024. However, it should be noted that bypass discharges have a high bacteria count due to the lack of disinfection. $CBOD_5$, TP, and TSS results are typical raw sewage influent levels. When bypasses occur, best efforts are made to capture the debris contained in any discharges to the lake. After each bypass event, shoreline inspections near discharge points are done to monitor any debris that may come ashore, and clean-up is done if debris is found.

For further information about this report or any questions regarding accessibility, contact Tim Bourne at tbourne@utilitieskingston.com or call 613-546-1181 Ext 2190.

12 BIOSOLIDS RECIPIENTS

Table 1 – Biosolids Recipients

Non-Agricultural Source Materials (NASM) Plan	Address
24327	Lot 12 Con 1 South, Town of Greater Napanee
60616	Lot 29-30 Con 3, Town of Greater Napanee
60616	Lot 5-7 Con 1 South, Town of Greater Napanee
25097	Lot 7-9 Con 3, Loyalist Township
60616	Lot 11, 14-15 Con 2 North, Town of Greater Napanee
61937	Lot 14 Con 6 North, Town of Greater Napanee

13 EFFLUENT OBJECTIVES AND LIMITS

Table 2 – Effluent Objectives and Limits

Effluent Parameter	Objective	Limits
CBOD5	15.00 mg/L (Monthly Average)	25.00 mg/L (Monthly Average)
Total Suspended Solids	15.00 mg/L (Monthly Average)	25.00 mg/L (Monthly Average)
Total Phosphorus	0.80 mg/L (Monthly Average)	1.00 mg/L (Monthly Average)
Total Ammonia Nitrogen (TAN) Summer (June 1 to November 30)	6.0 mg/L	8.0 mg/L
Total Ammonia Nitrogen (TAN) Winter (December 1 - May 31)	12.0 mg/L	15.0 mg/L
Total Chorine Residual	Non Detectable	0.04 mg/L
E. Coli	100 CFU/100mL	200 CFU/100mL
pH	6.5 - 8.5	6.0 - 9.0

14 PLANT PERFORMANCE RESULTS

Table 3 – Raw Influent Results

(Monthly Average)

Month	BOD5 (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorus (mg/L)	Total Ammonia Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	pH
January	198.00	118.00	3.00	18.25	30.78	7.54
February	170.00	156.00	3.30	17.25	32.15	7.41
March	162.00	162.00	3.30	19.7	34.63	7.36
April	177.00	135.00	3.00	17.93	31.08	7.4
May	193.00	153.00	3.50	20.82	33.32	7.28
June	207.00	184.00	3.50	23.2	35.9	7.13
July	223.00	234.00	4.40	26.44	40.38	7.26
August	218.00	207.00	4.20	23.1	37.55	7.37
September	186.00	237.00	4.10	25	38.53	7.3
October	221.00	323.00	5.10	26.94	48.24	7.34
November	228.00	218.00	4.80	34.5	48.68	7.4
December	192.00	182.00	3.70	24.65	40.43	7.34
Annual Average	197.92	192.42	3.83	23.15	37.64	7.34

Table 4 – Monthly Effluent Concentrations (Part 1)

(Monthly Average)

Month	CBOD5 (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorous (mg/L)	Total Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)
January	5.10	9.30	0.22	5.21	8.13
February	5.30	10.50	0.83	3.53	5.98
March	2.50	7.40	0.42	1.20	3.13
April	3.60	7.10	0.47	1.56	3.73
May	2.60	5.30	0.63	1.90	3.52
June	2.80	3.80	0.50	0.99	2.73
July	5.40	12.60	0.55	2.24	4.34
August	3.40	8.40	0.58	1.82	3.63
September	3.60	8.80	0.56	5.46	7.13
October	3.60	10.20	0.75	5.09	7.02
November	21.50	22.30	0.52	14.79	27.25
December	4.00	8.50	0.38	4.78	7.58
Annual Average	5.28	9.52	0.53	4.05	7.01

Table 5 – Monthly Effluent Concentrations (Part 2)

Month	Nitrate	Nitrite	E. Coli	pH	Total Residual Chlorine (mg/L)	Acute Lethality (Pass or Fail)
January	15.95	0.16	12	7.44	0.01	PASS
February	17.13	0.29	12	7.30	0.01	N/A
March	18.43	0.55	6	7.24	0.01	N/A
April	17.60	0.55	2	7.30	0.01	PASS
May	19.68	0.25	11	7.29	0.01	N/A
June	23.35	0.36	7	7.27	0.02	N/A
July	21.94	0.41	38	7.25	0.01	PASS
August	23.45	0.54	10	7.32	0.01	N/A
September	19.40	0.94	16	7.45	0.01	N/A
October	25.06	0.59	3	7.48	0.01	PASS
November	20.16	0.47	28	7.38	0.01	N/A
December	19.48	0.28	6	7.23	0.01	N/A
Annual Average	20.14	0.45	13	7.33	0.01	N/A

Table 6 – Monthly Flows

Month	Rated Capacity (m3/day)	Average Flow (m3/day)	Approved Peak Flow (m3/day)	Peak Flow (m3/day)
January	55,000	35,954	141,600	66,770
February	55,000	30,439	141,600	39,540
March	55,000	30,171	141,600	43,332
April	55,000	34,946	141,600	80,178
May	55,000	24,235	141,600	31,609
June	55,000	24,325	141,600	32,445
July	55,000	24,245	141,600	43,923
August	55,000	22,316	141,600	33,959
September	55,000	21,851	141,600	44,008
October	55,000	18,547	141,600	21,428
November	55,000	19,202	141,600	26,027
December	55,000	24,448	141,600	36,097
Annual Average	N/A	25,890	N/A	41,610

Table 7 – Annual Plant Flows

Parameter	2018	2019	2020	2021	2022	2023	2024
Average (m3/day)	28,963	29,251	27,189	27,225	29,381	28,707	25,890
Max (m3/day)	94,957	91,976	82,297	51,566	88,225	108,514	80,178
Design (m3/day)	38,800	38,800	38,800	38,800	38,800	38,800	55,000
Design Peak (m3/day)	134,400	134,400	134,400	134,400	134,400	134,400	141,600
Daily/Design (%)	74.6	75.4	70.1	70.2	75.7	74.0	47.1
Max/Peak (%)	70.7	68.4	61.2	38.4	65.6	80.7	56.6

15 NOTICE OF MODIFICATIONS TO SEWAGE WORKS

Figure 2 – Notice of Modification to Sewage Works

Ontario
Ministry of
the Environment

Notice of Modification to Sewage Works

RETAIN COPY OF COMPLETED FORM AS PART OF THE ECA AND SEND A COPY TO THE WATER SUPERVISOR (FOR MUNICIPAL) OR DISTRICT MANAGER (FOR NON-MUNICIPAL SYSTEMS)

Part 1 – Environmental Compliance Approval (ECA) with Limited Operational Flexibility
(Insert the ECA's owner, number and issuance date and notice number, which should start with "01" and consecutive numbers thereafter)

ECA Number	Issuance Date (mm/dd/yy)	Notice number (if applicable)
2497-CYPPUP	12/22/2023	

ECA Owner	Municipality
The Corporation of the City of Kingston	Kingston

Part 2: Description of the modifications as part of the Limited Operational Flexibility
(Attach a detailed description of the sewage works)

Implementation of 3 trials to add polymer to improve the performances of the primary clarifiers and BAF.

A description of the trials is provided in the attached Trial Proposal Report from Northland

Chemical dated January 8, 2024. The performance of the plant for each of the trials will be evaluated.

Description shall include:
1. A detail description of the modifications and/or operations to the sewage works (e.g. sewage work component, location, size, equipment type/model, material, process name, etc.)
2. Confirmation that the anticipated environmental effects are negligible.
3. List of updated versions of, or amendments to, all relevant technical documents that are affected by the modifications as applicable, i.e. submission of documentation is not required, but the listing of updated documents is (design brief, drawings, emergency plan, etc.)

Part 3 – Declaration by Professional Engineer

I hereby declare that I have verified the scope and technical aspects of this modification and confirm that the design:
1. Has been prepared or reviewed by a Professional Engineer who is licensed to practice in the Province of Ontario;
2. Has been designed in accordance with the Limited Operational Flexibility as described in the ECA;
3. Has been designed consistent with Ministry's Design Guidelines, adhering to engineering standards, industry's best management practices, and demonstrating ongoing compliance with s.53 of the Ontario Water Resources Act; and other appropriate regulations.

I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate

Name (Print)	PEO License Number
James K Steele	100067361
Signature	Date (mm/dd/yy)
(signed)	03/04/24
Name of Employer	
J.L. Richards & Associates Limited	

Part 4 – Declaration by Owner

I hereby declare that:
1. I am authorized by the Owner to complete this Declaration;
2. The Owner consents to the modification; and
3. This modifications to the sewage works are proposed in accordance with the Limited Operational Flexibility as described in the ECA.
4. The Owner has fulfilled all applicable requirements of the *Environmental Assessment Act*.

I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate

Name of Owner Representative (Print)	Owner representative's title (Print)
Heather Roberts	Director, Water & Wastewater Services
Owner Representative's Signature	Date (mm/dd/yy)
(signed)	04/04/24

EAB Form December 2, 2013

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