

March 25, 2024

District Manager Sarnia/Windsor Office
Ministry of the Environment, Conservation and Parks
Sarnia District Office
1094 London Rd.
Sarnia, ON N7S 1P1

Re: Watford Sewage Lagoons and Warwick Municipal Sewage Collection System Annual Performance Report

Attached is the 2023 Annual Performance Report for the Watford Sewage Lagoons and Warwick Municipal Sewage Collection System. This report has been completed in accordance with Condition No.10 (5) cited in the Environmental Compliance Approval #5913-84FPGL dated July 27, 2010 and CLI-ECA Number: 042-W601 issued August 31st, 2023.

This report was prepared by the Ontario Clean Water Agency on behalf of the Township of Warwick based on the information we have in our records. The report covers the period of January 1st to December 31st, 2023.

If you have any questions, please do not hesitate to contact me. 519-312-0847.

Sincerely,



Terri-Lynn Thomson
Process and Compliance Technician
Ontario Clean Water Agency

Cc Dale LeBritton, OCWA's Regional Hub Manager
Sam Smith, OCWA's Senior Operations Manager
Maegan Garber, OCWA's Safety, Process and Compliance Manager
Amanda Gubbels, Township of Warwick
Andrew Maver, Township of Warwick
Director, MECP

THE TOWNSHIP OF WARWICK
Watford Sewage Lagoons and Warwick Municipal Sewage Collection
System

ANNUAL REPORT
January 1st to December 31st, 2023

Environmental Compliance Approval NUMBER 5913-84FPGL

CLI-ECA Number: 042-W601

Prepared by:



Ontario Clean Water Agency
Agence Ontarienne Des Eaux

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Section 1: Overview

The Watford Sewage Lagoons are located at 7716 Churchill Road, Lot 16 & 17, Concession 6, Warwick Township, County of Lambton.

The Watford Lagoon System operates under Environmental Compliance Approval NUMBER 5913-84FPGL issued July 27, 2010 and the Warwick Municipal Sewage Collection System is operated under CLI-ECA Number: 042-W601.

Collection System

The sewage lagoons receive wastewater from the Warwick sewage collection system, which consists of works for the collection and transmission of sewage. The works are comprised of 15.3 km of separate sewers, sewage pumping stations and forcemains. The Main Pumping station receives all wastewater from the collection system. The station is equipped with two submersible pumps (one duty, one standby). The Stand-by pump station is the old pumping station that is used during emergencies to divert sewage flows from the Main Pumping station during high flow events.

Process Details

The Watford Sewage Lagoon facility consists of four (4) lagoon Cells: One (1) Aerated Cell, one (1) Sedimentation Cell and two (2) Holding Cells. The facility is intended to continually discharge lagoon effluent to the Intermittent Sand Filters (ISF) throughout the summer months. In the winter, lagoons are used for storage. Alum is continuously dosed with the influent coming into the Aerated Cell.

Section 2: Monitoring Data

Sample Collection and Testing

All samples are collected and tested as per the requirements of the Environmental Compliance Approval.

Raw sewage is sampled monthly and tested for BOD₅, total suspended solids, total phosphorus, and total Kjeldahl nitrogen for monitoring purposes.

Final effluent is sampled weekly during discharge and tested for CBOD₅, total suspended solid, total phosphorus, total ammonia nitrogen and E.coli. Temperature and pH are also collected as weekly grab samples. The un-ionized ammonia is calculated using the temperature and pH of the effluent at the time of sampling.

Regular in-house testing is conducted to check plant performance and to make any operational changes as required.

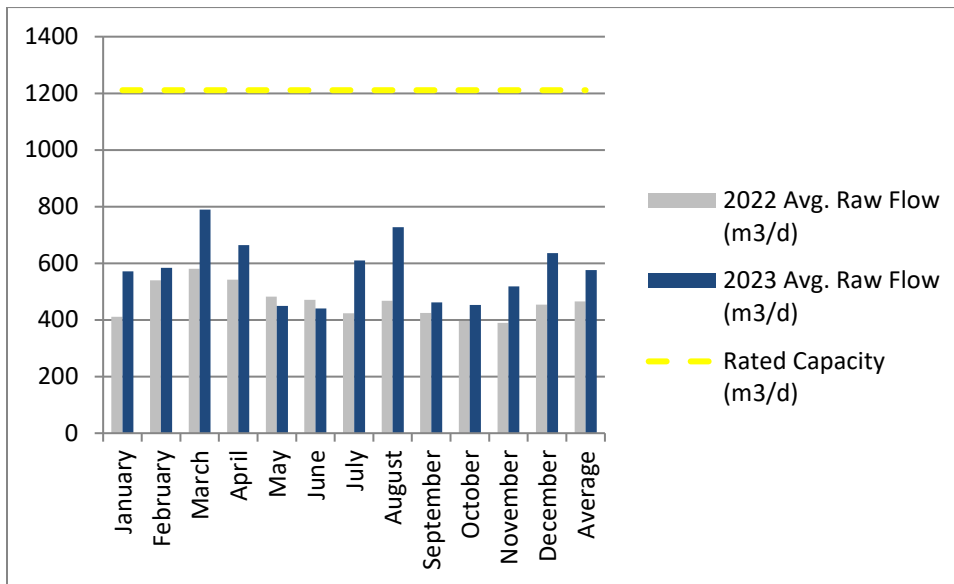
All chemical and microbiological sample analyses were conducted by SGS Lakefield Research during the reporting period. Temperature and pH were conducted by competent operators on site.

Flows

Detailed monthly flow information is summarized in Appendix A.

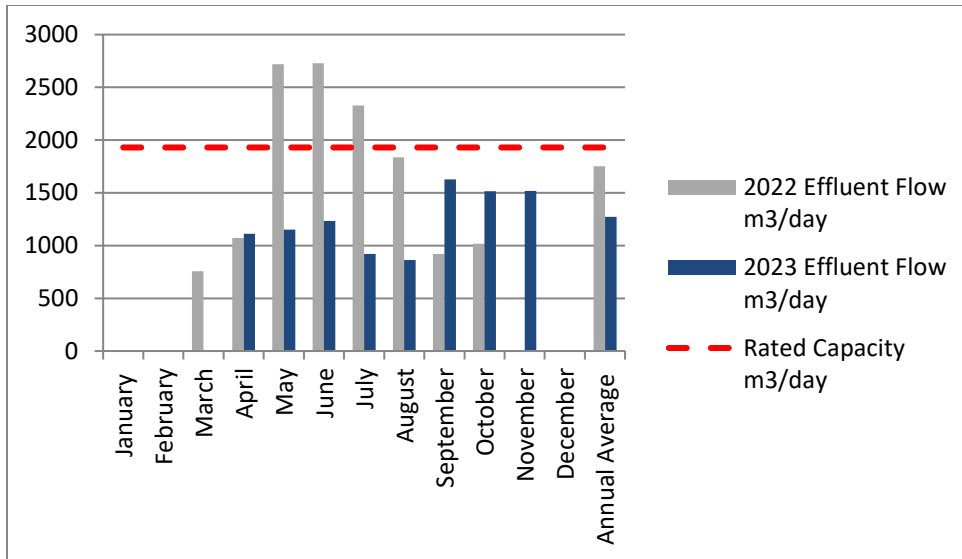
The total raw flow entering the system in 2023 was 210,231m³. The annual average daily raw flow for 2023 was 576m³/day, or 48% of the plants rated design capacity of 1,211m³/day. The average daily flow has increased 24% when comparing 2023 to 2022, refer to Chart 1. There were seven instances where the raw flow exceeded the rated design capacity. These events were caused by heavy rain.

Chart 1: Average daily raw flow for 2023 compared to 2022.



The total effluent flow discharged through the Intermittent Sand Filters (ISF) in 2023 was 211,459m³. The annual average daily effluent flow was 1,274m³/day. The lagoon is approved to be discharged through the ISF from April 1st to November 15th when ambient temperatures are equal to or above 4 degrees Centigrade. Three filter beds operate one at a time with a rated capacity of 1,930 m³/day per filter bed. Overall, the average daily flow discharged was 27% lower in 2023 compared to 2022. Refer to Chart 2 for average daily effluent flows discharged through the sand filters. The average daily flows were exceeded nineteen times in 2023. These exceedances were the result of timer adjustments and increasing the flow through the filters to ensure adequate storage capacity in the lagoons.

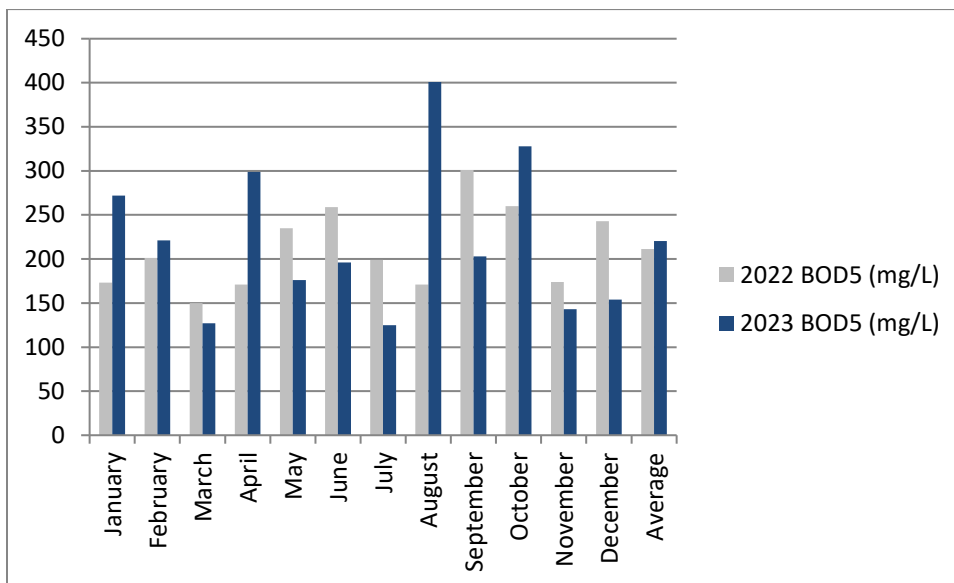
Chart 2. Average daily effluent flows discharged through the ISF from the lagoons in 2023 compared to 2022.



Raw Sewage Quality

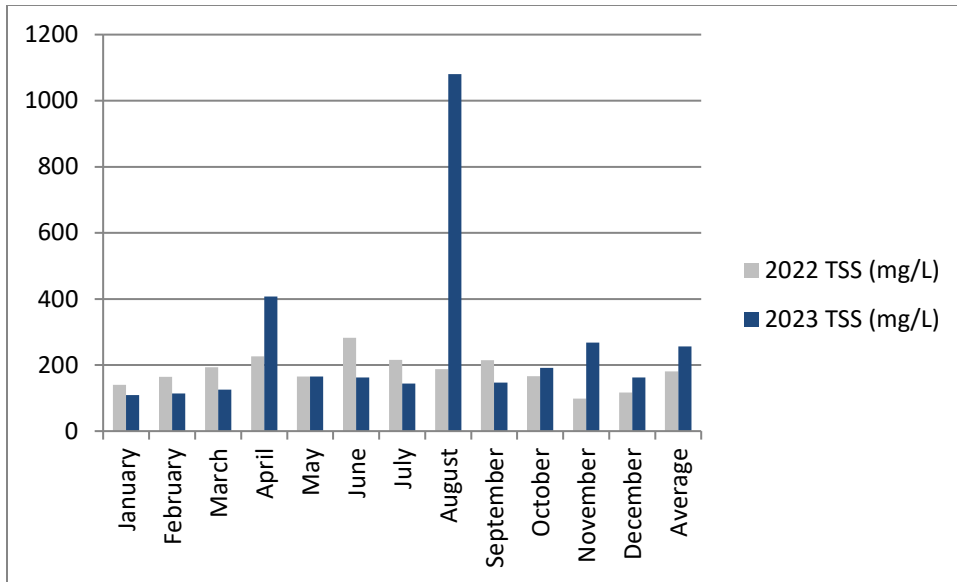
The monthly raw sewage BOD₅ concentrations to the plant averaged 220mg/L during the 2023 reporting year with a maximum concentration of 401mg/L. Refer to Chart 3 for a comparison of BOD₅ concentrations in 2023 and 2022.

Chart 3: Raw sewage BOD₅ monthly concentrations for 2023 compared to 2022.



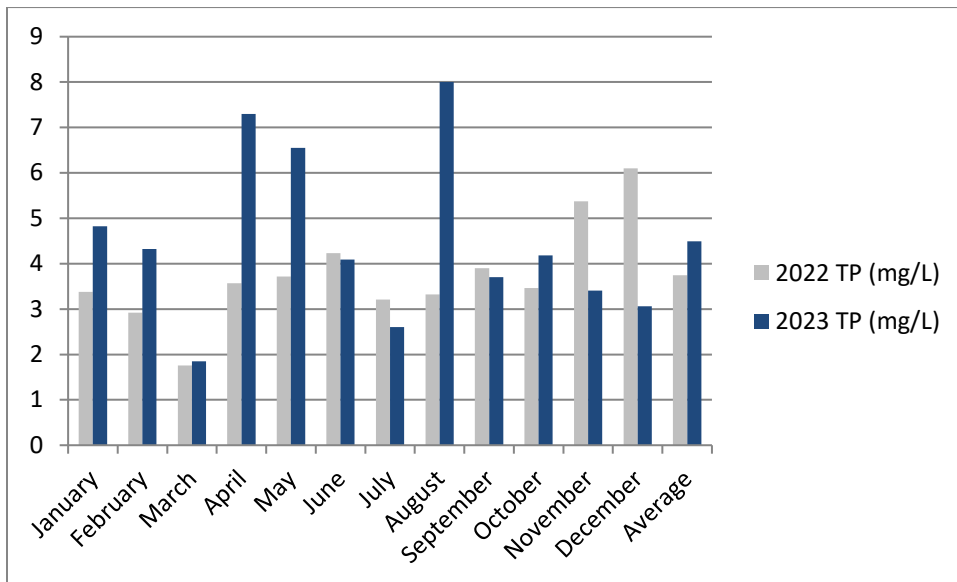
The monthly raw sewage total suspended solid (TSS) concentrations to the plant averaged 256mg/L during the 2023 reporting year with a maximum concentration of 1080mg/L. Refer to Chart 4 for a comparison of TSS concentration in 2023 and 2022.

Chart 4: Raw sewage TSS monthly concentrations for 2023 compared to 2022.



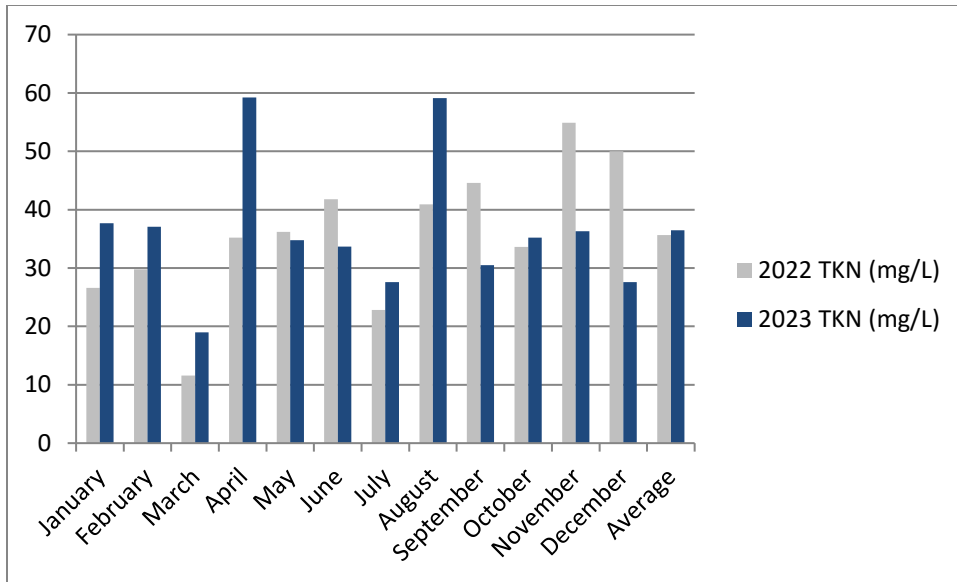
The monthly raw sewage total phosphorus (TP) concentrations to the plant averaged 4.5mg/L during the 2023 reporting year with a maximum concentration of 7.3mg/L. Refer to Chart 5 for a comparison of 2023 concentrations to 2022.

Chart 5: Raw sewage TP monthly concentrations for 2023 compared to 2022.



The monthly raw sewage nitrogen concentrations (as presented by TKN) to the plant averaged 36.5mg/L during the 2023 reporting year with a maximum concentration of 59.2mg/L. Refer to Chart 6 for a comparison of 2023 concentrations of TKN to 2022.

Chart 6: Raw sewage TKN monthly concentrations for 2023 compared to 2022.



Effluent Limits

Detailed analytical data is attached to this report as Appendix A. The following table provides a summary of monthly average effluent result ranges compared to the compliance limits outlined in the Environmental Compliance Approval.

Summary and Comparison of Compliance Data

Table 1. Monthly average effluent ranges, maximum monthly averages and monthly average waste loadings compared to ECA limits.

Parameter	Monthly Average Effluent Limit (mg/L)	Monthly Average Waste Loading Limit (kg/d)	Monthly Average Effluent Ranges (mg/L)	Monthly Average Waste Loading Ranges (kg/d)	Exceedances
CBOD ₅	10	12.1	2 – 3	1.7 – 4.6	None
Suspended Solids	10	12.1	<2 – 4.5	0.88– 3.0	None
Total Phosphorus	0.7	0.85	0.48 – 0.69	0.23– 0.39	None
Total Ammonia Nitrogen	3.0	3.6	<0.1 – <0.1	0.09 – 0.16	None
pH*	6.0-9.5		6.70-8.36		None
E. coli**	100 cfu/100mL		1.57 – 39.67		None

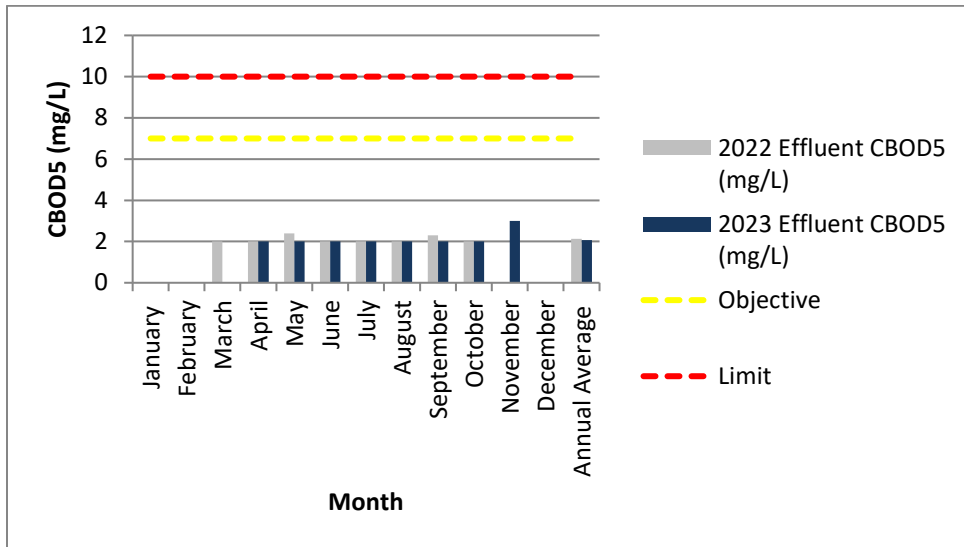
*pH is expressed as minimum and maximum values, not monthly average

**E. coli is expressed as geometric mean

Discussion of Monitoring Data as Compared to the Effluent Limits

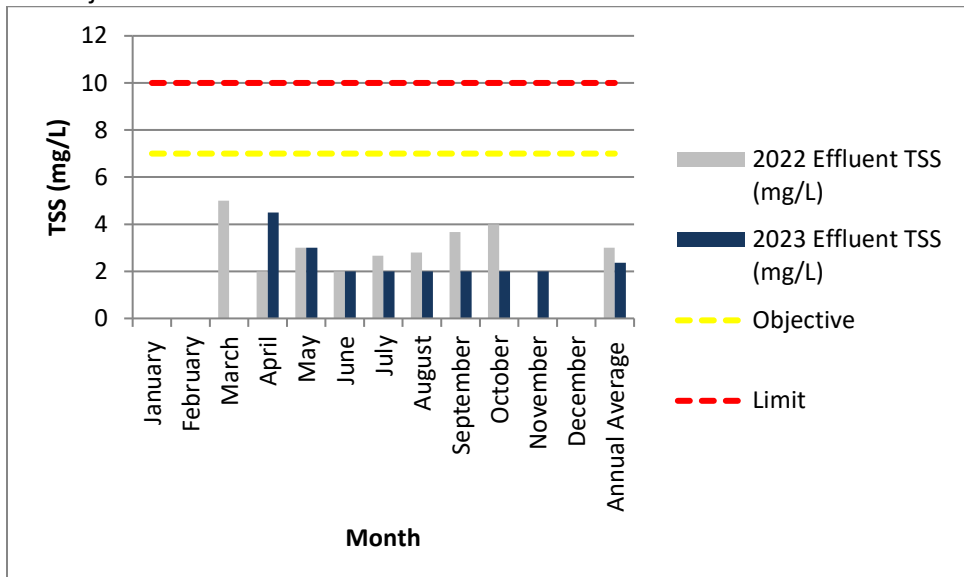
The annual average effluent CBOD₅ concentration for the 2023 reporting year was 2.07mg/L with a maximum monthly average concentration of 3.0mg/L (refer to Chart 7). The maximum monthly average loading of CBOD₅ was 4.6kg/d. There were no monthly average objective or limit exceedances in 2023, refer to Table 1 for a list of monthly average effluent limits.

Chart 7. The effluent monthly average concentration of CBOD₅ for 2023 and 2022 compared against the limit and objective as identified in the ECA.



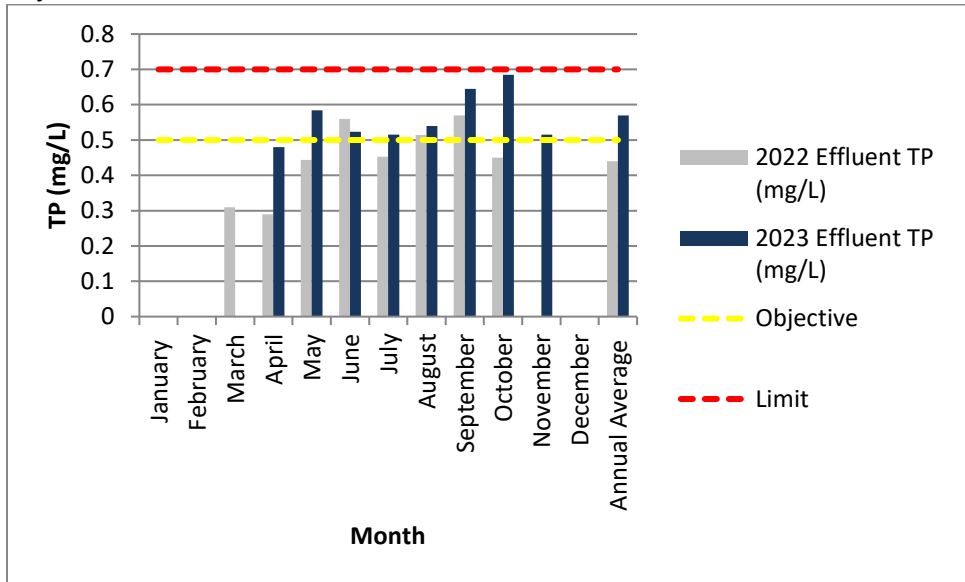
The annual average effluent Total Suspended Solids (TSS) for the 2023 reporting year was 2.36mg/L with a maximum monthly average concentration of 4.5mg/L (refer to Chart 8). The maximum monthly average loading of TSS was 3.0kg/d. There were no monthly average objective or limit exceedances in 2023, refer to Table 1 for a list of monthly average effluent limits.

Chart 8. The effluent monthly average concentration of TSS in 2023 and 2022 compared to the limits and objectives.



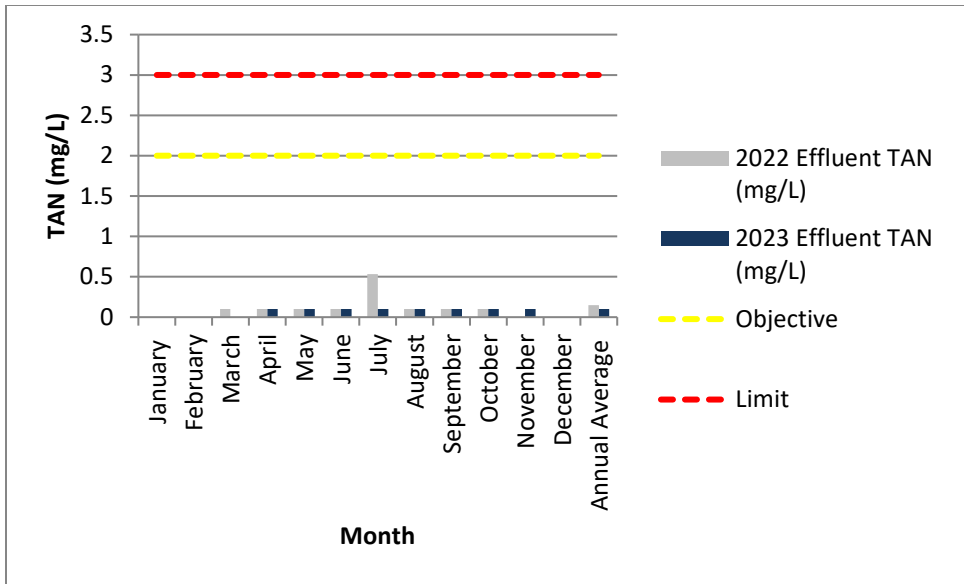
The annual average effluent Total Phosphorus (TP) for the 2023 reporting year was 0.57mg/L with a maximum monthly average concentration of 0.69mg/L (refer to Chart 9). The maximum monthly average loading of TP was 0.39kg/d. There were no monthly average limit exceedances in 2023 but fifteen objective exceedances, refer to Table 1 for a list of monthly average effluent limits and Table 2 for a list of objective exceedances.

Chart 9. The effluent monthly average concentration of TP in 2023 and 2022 compared to the limits and objectives.



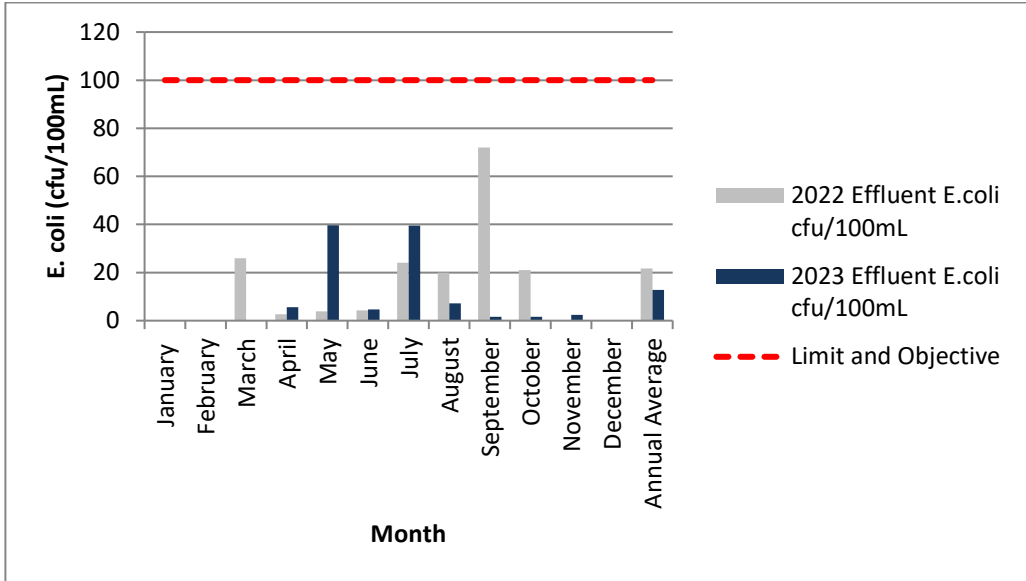
The annual average effluent Total Ammonia Nitrogen (TAN) for the 2023 reporting year was 0.1mg/L with a maximum monthly average concentration of 0.1mg/L (refer to Chart 10). The maximum monthly average loading of TAN was 0.16kg/d. There were no monthly average objective or limit exceedances in 2023, refer to Table 1 for a list of monthly average effluent limits.

Chart 10. The effluent monthly average concentration of TAN in 2023 and 2022 compared to the limits and objectives.



The annual effluent geometric mean for E. coli during the 2023 reporting period was 12.7cfu/100mL with a maximum geometric mean concentration of 39.5cfu/100mL (refer to Chart 11). There were no monthly geometric mean limit exceedances in 2023, refer to Table 1 for a list of monthly geometric mean effluent limits. Note: the objective and limit for E.coli is 100 cfu/100mL.

Chart 11. The effluent monthly geometric mean concentration of E. coli in 2023 and 2022 compared to the limits and objectives.



Acute Lethality to Rainbow Trout and *Daphnia magna* is required to be sampled quarterly during the discharge season. The objective is to operate and maintain the facility such that the effluent is non-acutely lethal to Rainbow Trout and *Daphnia magna* by ensuring that the results in mortality is no more than 50 percent of the test organism in 100 percent effluent. There were three samples obtained during the 2023 discharge season. None of the samples were acutely lethal, refer to table below.

Date	Rainbow Trout % Mortality	<i>Daphnia magna</i> % Mortality
May 8, 2023	0	0
August 8, 2023	0	0
October 27, 2023	0	0

Section 3: Operating Problems and Corrective Actions

The Watford Lagoon system operated well in 2023 with the exception of maintaining effluent total phosphorus concentrations below the objective and ensuring the average daily effluent flow was within the rated capacity of the ISF. Discharge from the system is permitted only when the ambient temperature is above 4°C. During the colder months, effluent is manually discharged when the temperature is above 4°C. During the 2023 reporting period, when temperatures were consistently above 4°C, the system was operating in auto.

In April, a new effluent flow meter was installed on the discharge of the filter dosing pump to more accurately read the discharge off the filters and not capture rain events. This greatly reduced the number of effluent flow objective exceedances during the reporting period. The objective for Total Phosphorus was exceeded many times in 2023. These exceedances were the result of the alum injection line failing and the utilization of a temporary set up so repairs could be facilitated. The temporary line that was set up did not allow for adequate mixing with the influent. The system was back into normal service in November.

The Watford Lagoons were approved for a pilot program for the installation of IPEX Vortex Aerators. This project commenced August 16, 2023 with the installation of one aerator with two more being installed early 2024. The idea of the aerators is to reduce energy consumption while maintaining DO.

Section 4: Maintenance and Repairs

Regular scheduled monthly preventative maintenance is assigned and monitored using the Workplace Management System (WMS) program. The following is a summary of maintenance performed other than WMS work orders:

- Filter 3 sand replacement
- IPEX Vortex Aerator installation (pilot)
- Alum pump repairs
- Filters sprayed for weeds
- Repairs to sewer laterals
- transfer switch repairs
- Alum injector repairs

Items being considered in 2024:

- Weed spraying and phragmites control
- Effluent filter header maintenance
- Pump Station clean outs
- Pump Station Pump Rebuild
- Bar screen installation
- IPEX Vortex Aerators installation (pilot)

Section 5: Effluent Quality Assurance

Effluent quality assurance is evaluated by monitoring parameters and changes throughout the lagoon processes. The operators monitor the lagoons by performing routine tests. These tests include dissolved oxygen, pH, temperature, TSS and TP. As well as monitoring of the alum dosage. Data collected from these tests provides information to the operator to make the appropriate adjustments in the treatment process and take corrective actions before ECA limits are reached. In house testing is done weekly during effluent discharge for pH, temperature, dissolved oxygen, ammonia, total phosphorus and total suspended solids. Sample analyses are performed by SGS Lakefield Research Laboratories.

Section 6: Calibrations

Regular scheduled monthly preventative maintenance is assigned and monitored using the Workplace Management System program.

Annual maintenance on the generator was completed in October by Albert’s Generator Service.

SCG Flowmetrix Technical Services Inc. performed the annual calibration on the flow meters in June, 2023.

In house meters for pH and dissolved oxygen are calibrated by OCWA operators as per manufacturer’s instructions.

Section 7: Effluent Quality

Effluent Objectives

The following table represents the effluent result ranges compared to the objectives outlined in the Environmental Compliance Approval.

Table 2. Effluent objectives compared to results along with possible causes/comments.

Parameter	Objective (mg/L)	Effluent Ranges (mg/L)	Objective Exceedances	Exceedance Date	Exceedance Value	Comments/causes
CBOD ₅	7	2 – 4	No	n/a	n/a	n/a
TSSs	7	<2 – 6	No	n/a	n/a	n/a
TP	0.5	0.46 – 0.74	Yes	May 8, 2023 May 16, 2023 May 23, 2023 May 29, 2023 June 6, 2023 August 21, 2023 August 28, 2023 September 5, 2023 September 11, 2023 September 18, 2023	0.57 0.61 0.61 0.63 0.62 0.63 0.62 0.62 0.63 0.59	Alum injection failure, temporary set-up/filter overloading

				September 25, 2023	0.74	
				October 3, 2023	0.73	
				October 10, 2023	0.72	
				October 16, 2023	0.69	
				October 23, 2023	0.60	
TAN	2.0	<0.1 – <0.1	No	n/a	n/a	n/a
pH	6.5-8.5	6.70-8.36	No	n/a	n/a	n/a
E. coli	100 E.coli/100 mL	0- 260	Yes	May 8, 2023 May 16, 2023 May 23, 2023 Jul 4, 2023	109 151 127 260	overloaded filter
Un-ionized Ammonia	*0.020 mg/L	0.001-0.002	No	n/a	n/a	n/a

*Provincial Water Quality Objective

Discussion of Effluent Objectives

All of the objective exceedances were suspected to alum dosing issues and overloading the sand filter. Nineteen objective exceedances occurred in 2023, which is an increase from twelve in 2022. The alum line was repaired in November 2023. Flows to the filters were increased to ensure adequate storage capacity in the lagoons.

Section 8: Biosolids

Sludge settles to the bottom of the lagoon cells. The sedimentation lagoon (Cell C) is where most of the sludge will settle prior to entering Cell A and B. There was no sludge removed during the reporting period from any of the lagoon cells. The amount of sludge produced is estimated based on flows and incoming total suspended solids. For 2023, the sludge quantity was estimated to be 60m³. It is anticipated that a similar amount will be generated in 2024 (approximately 60m³).

Section 9: Community Complaints and Concerns

Multiple complaints were received the evening of August 23, 2023 during a severe rain event that resulted in localized flooding and an overflow of the Standby Pump Station.

Section 10: Bypasses, Spills, and Abnormal Discharges

In August, an overflow occurred at the standby pump station due to a heavy rain event in the area. The overflow from the standby pump station started at approximately 17:55 on August 23, 2023 and ended at approximately 23:55 on August 23, 2023. A sample was obtained from the overflow and analyzed for the effluent parameters listed in condition 9(4) of ECA#5913-84FPGL as the CLI-ECA 042-W601 was not issued till August 31, 2023. The overflow was reported to the Spills Action Centre (SAC), at 18:32. A vacuum truck was called in to assist and four loads of raw wastewater were removed and emptied into the aerated lagoon. An update was provided to SAC at 15:59, to report the stop of the overflow. It is estimated that 2,000 m³ were discharged to Duncan Drain

Section 11: Alterations to the Authorized System

There were no alterations to the treatment system or the collection system in 2023.

Section 12: Summary

Overall, the Watford Lagoons provided effective treatment during the reporting period. There were no non-compliances with effluent limits. There were objective exceedances for total phosphorus, and E. coli. In 2023, the final filter (Filter 3) had the sand replaced, which will help to continue to improve effluent quality along with proper alum dosing, mixing and maintaining a steady flow through the filters.

APPENDIX A

Detailed Monthly Compliance and Loading Data

5879 WATFORD WASTEWATER TREATMENT LAGOONS 110001809

	1 / 2023	2 / 2023	3 / 2023	4 / 2023	5 / 2023	6 / 2023	7 / 2023	8 / 2023	9 / 2023	10 / 2023	11 / 2023	12 / 2023	<-Total-->	<-Avg-->	<-Max-->	<-Criteria-->
Flows																
Raw Flow: Total - Raw m ³ /d	17,714.97	16,352.07	24,470.95	19,912.00	13,921.80	13,219.60	18,904.50	22,563.70	13,846.10	14,036.90	15,561.00	19,727.00	210,230.59			0.00
Raw Flow: Avg - Raw m ³ /d	571.45	584.00	789.39	663.73	449.09	440.65	609.82	727.86	461.54	452.80	518.70	636.35		575.97		
Raw Flow: Max - Raw m ³ /d	1,192.57	817.82	2,389.66	2,411.00	620.50	847.00	951.50	4,208.89	618.00	716.50	774.00	990.00			4,208.89	0.00
Raw Flow: Count - Raw m ³ /d	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	365.00			0.00
Eff. Flow: Total - Effluent m ³ /d	0.00	0.00	0.00	9,997.34	21,840.98	36,949.93	6,442.00	26,780.65	48,797.00	46,980.40	13,670.60	0.00	211,458.90			0.00
Eff. Flow: Avg - Effluent m ³ /d	0.00	0.00	0.00	1,110.82	1,149.53	1,231.66	920.29	863.89	1,626.57	1,515.50	1,518.96	0.00		1,273.85		
Eff. Flow: Max - Effluent m ³ /d	0.00	0.00	0.00	1,287.06	3,025.80	1,922.63	1,246.00	1,361.40	2,662.00	2,217.00	2,433.00	0.00			3,025.80	0.00
Eff Flow: Count - Effluent m ³ /d	0.00	0.00	0.00	9.00	19.00	30.00	7.00	31.00	30.00	31.00	9.00	0.00	166.00			0.00
Carbonaceous Biochemical Oxygen Demand: CBOD																
Eff: Avg cBOD5 - Effluent mg/L	0.00	0.00	0.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 3.00	0.00		< 2.07	< 3.00	10.00
Eff: # of samples of cBOD5 - Effluent	0.00	0.00	0.00	2.00	5.00	4.00	2.00	5.00	4.00	2.00	0.00	28.00				0.00
Loading: cBOD5 - Effluent kg/d	0.000	0.000	0.000	< 2.222	< 2.299	< 2.463	< 1.841	< 1.728	< 3.253	< 3.031	< 4.557	0.000		< 2.64	< 4.58	12.100
Biochemical Oxygen Demand: BOD5																
Raw: Avg BOD5 - Raw mg/L	272.00	221.00	127.00	299.00	176.00	196.00	125.00	401.00	203.00	328.00	143.00	154.00		220.42	401.00	0.00
Raw: # of samples of BOD5 - Raw	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00			0.00
Total Suspended Solids: TSS																
Raw: Avg TSS - Raw mg/L	109.00	114.00	126.00	407.00	165.00	162.00	144.00	1,080.00	147.00	191.00	268.00	162.00		256.25	1,080.00	0.00
Raw: # of samples of TSS - Raw	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00			0.00
Eff: Avg TSS - Effluent mg/L	0.00	0.00	0.00	4.50	3.00	2.00	2.00	2.00	2.00	2.00	2.00	0.00		2.36	4.50	10.00
Eff: # of samples of TSS - Effluent	0.00	0.00	0.00	2.00	5.00	4.00	2.00	5.00	4.00	4.00	2.00	0.00	28.00			0.00
Loading: TSS - Effluent kg/d	0.000	0.000	0.000	2.987	1.347	0.881	1.220	1.456	0.923	0.906	1.037	0.000		3.00	2.99	12.100
Percent Removal: TSS - Raw %	0.00	0.00	0.00	98.89	98.18	98.77	98.61	99.81	98.64	98.95	99.25	0.00		98.89	99.81	0.00
Total Phosphorus: TP																
Raw: Avg TP - Raw mg/L	4.82	4.32	1.85	7.30	6.55	4.09	2.80	8.00	3.70	4.18	3.41	3.06		4.49	8.00	0.00
Raw: # of samples of TP - Raw	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00			0.00
Eff: Avg TP - Effluent mg/L	0.00	0.00	0.00	0.48	0.58	0.52	0.52	0.54	0.65	0.69	0.52	0.00		0.57	0.69	0.70
Eff: # of samples of TP - Effluent	0.00	0.00	0.00	2.00	5.00	4.00	2.00	5.00	4.00	4.00	2.00	0.00	28.00			0.00
Loading: TP - Effluent kg/d	0.000	0.000	0.000	0.315	0.262	0.230	0.314	0.393	0.298	0.310	0.267	0.000		0.73	0.39	0.850
Percent Removal: TP - Raw %	0.00	0.00	0.00	93.49	91.08	87.22	80.19	93.25	82.57	83.61	84.90	0.00		87.04	93.49	0.00
Nitrogen Series																
Raw: Avg TKN - Raw mg/L	37.70	37.10	19.00	59.20	34.80	33.70	27.60	59.10	30.50	35.20	36.30	27.60		36.48	59.20	0.00
Raw: # of samples of TKN - Raw	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00			0.00
Eff: Avg TAN - Effluent mg/L	0.00	0.00	0.00	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.00		< 0.10	<	3.00
Eff: # of samples of TAN - Effluent	0.00	0.00	0.00	2.00	5.00	4.00	2.00	5.00	4.00	2.00	0.00	28.00				0.00
Loading: TAN - Effluent kg/d	0.000	0.000	0.000	< 0.111	< 0.115	< 0.123	< 0.092	< 0.086	< 0.163	< 0.152	< 0.152	0.000		< 0.13	< 0.16	3.600
Disinfection																
Eff: GMD E. Coli - Effluent cfu/100mL	0.00	0.00	0.00	5.66	39.67	4.63	39.50	7.16	1.57	1.57	2.45	0.00				100.00
Eff: # of samples of E. Coli - Effluent	0.00	0.00	0.00	2.00	5.00	4.00	2.00	5.00	4.00	4.00	2.00	0.00	28.00			0.00