Corporation of the City of Quinte West

Frankford Wastewater Treatment Plant

2023 Annual Performance Report

A Natural Attraction

Executive Summary

The Frankford Wastewater Treatment Plant (FWWTP), assigned MOE Identifier number 110000267, is located at 174 North Trent Street. The facility operates in accordance with Environmental Compliance Approval number 5056-AE9QVC, issued on January 10, 2017.

The WWTP is a Class II Treatment Plant, and has a rated capacity of 2,800 cu.m/day. The facility is described as an extended aeration activated sludge treatment plant with tertiary treatment. The process comprises two circular treatment facilities with integrated extended aeration tanks, aerobic sludge digestion, aerobic sludge storage tanks, and interior circular secondary clarifiers. Secondary effluent enters the tertiary filter building through a filter inflow distribution channel before receiving tertiary treatment through two dual media gravity effluent filters. Final effluent is disinfected using UV irradiation before final discharge to the Trent River via outfall downstream of Dam 4. The Frankford Wastewater Collection System consists of three (3) Sewage Pumping Stations; two located on the West side of the Trent River, and one located on the East side of the Trent River.

In accordance with the ECA, an annual report shall be prepared by March 31 of the year following the end of the period being reported upon. This annual report contains the following information as per Reporting Condition of the ECA:

- *A summary and interpretation of all monitoring data and a comparison to the effluent limits outlined in Condition 7, including an overview of the success and adequacy of the Works;*
- *A description of any operating problems encountered and corrective actions taken;*
- *A summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the Works;*
- *A summary of any effluent quality assurance or control measures undertaken in the reporting period;*
- *A summary of the calibration and maintenance carried out on all effluent monitoring equipment;*

- *A description of efforts made and results achieved in meeting the Effluent Objectives of Condition 6;*
- *A tabulation of the volume of sludge generated in the reporting period and any steps taken to address the complaints;*
- *A summary of all by-pass, spill or abnormal discharge events;*
- *A copy of all Notice of Modifications submitted to the Water Supervisor as a result of Schedule B, Section 1, with a status report on the implementation of each modification;*
- *A report summarizing all modifications completed as a result of Schedule B, section 3; and,*
- *Any other information the Water Supervisor requires from time to time.*

Summary and Interpretation of Monitoring Data

Final Effluent Parameter Monitoring - with Limits									
Month	**[CBOD5]** *(mg/L)*	**[TSS]** *(mg/L)*	**[TP]** *(mg/L)*	**[TAN]** *(mg/L)*	**GMD E.Coli** *(cfu/100mL)*	**Acute Lethality RBT**	**Acute Lethality DM**	**pH - MIN**	**pH - MAX**
	Limit: 25.0mg/L; Objective: 15.0mg/L	*Limit: 25.0mg/L; Objective: 15.0mg/L*	*Limit: 0.25mg/L; Objective: 0.20mg/L*	*See TAN section for Limits*	*Limit: 200 cfu/100mL; Object.: 150 cfu/100mL*	(% Mortality) Non-lethal	(% Mortality) Non-lethal	*Limit: 6.0*	*Limit: 9.5*
January[1]	12.3	19.1	0.31	1.9	2.0	0	0	7.03	7.27
February	2.0	2.8	0.03	0.2	2.0			6.90	7.26
March[2]	3.6	11.4	0.11	0.1	2.0			6.89	7.27
April[3]	7.0	53.4	0.54	0.5	2.0	0	0	6.80	7.06
May[4]	7.3	30.8	0.33	0.4	2.0			6.93	7.35
June	2.0	2.0	0.03	0.1	2.0			7.01	7.20
July	2.0	2.0	0.03	0.1	2.0	0	0	6.96	7.17
August	2.0	3.0	0.03	0.1	2.0			6.50	7.27
September	2.0	2.3	0.03	0.1	2.0			6.84	7.16
October	2.0	2.0	0.03	0.1	2.0	0	0	6.39	7.06
November	2.0	2.0	0.03	0.1	2.0			6.56	7.11
December	2.0	2.3	0.03	0.1	2.0			6.57	7.00
Annual Avg	**3.9**	**11.1**	**0.13**	**0.3**	**2.0**			**6.78**	**7.18**

[1] Suspected sampling collection error on January 11 accounts for high levels of CBOD5, TSS, TP and TAN
[2] Two Bypass events in March account for the high levels of CBOD5, TSS and TP
[3] Bypass event in April accounts for the high level of CBOD5, TSS, TP and TAN
[4] Bypass event in May accounts for the high level of CBOD5, TSS, TP and TAN

Final Effluent parameter monitoring - without Limits				
	Unionized Ammonia (mg/L)	**Hydrogen Sulphide** (mg/L)	**Dissolved Oxygen** (mg/L)	**Temperature** (deg.C)
January	0.009	0.02	9.45	8.8
February	0.001	0.02	9.13	8.3
March	0.001	0.02	9.32	8.4
April	0.001	0.02	8.70	11.1
May	0.001	0.02	8.11	13.6
June	0.001	0.02	7.70	17.3
July	0.001	0.02	7.28	20.2
August	0.001	0.02	7.67	20.3
September	0.001	0.02	7.52	19.9
October	0.001	0.02	7.79	17.7
November	0.001	0.02	8.68	13.3
December	0.001	0.02	8.77	11.8
Annual Avg	**0.002**	**0.02**	**8.34**	**14.2**

Monthly Average Effluent Waste Loadings

Month	**CBOD5** *(kg/d)*	**Total Suspended Solids** *(kg/d)*	**Total Phosphorus** *(kg/d)*	**Total Ammonia Nitrogen** *(kg/d)*
	Limit: 70.0 kg/d	*Limit: 70.0 kg/d*	*Limit: 0.70 kg/d*	*See TAN section for Limits*
January[5]	38.2	59.2	0.95	5.8
February	6.2	8.6	0.09	0.6
March[6]	12.2	37.9	0.35	0.3
April[7]	27.1	206.8	2.11	1.9
May[8]	23.5	99.7	1.06	1.3
June	5.0	5.0	0.08	0.3
July	4.4	4.4	0.07	0.2
August	4.2	6.4	0.06	0.2
September	3.3	3.7	0.05	0.2
October	3.2	3.2	0.05	0.2
November	3.3	3.3	0.06	0.2
December	4.5	5.1	0.07	0.2
Annual Avg	**11.3**	**36.9**	**0.42**	**0.9**

[5] Suspected sampling collection error on January 11, 2023 accounts for high levels of CBOD5, TSS, TP and TAN
[6] Two Bypass events in March account for the high levels of CBOD2, TSS and TP
[7] Bypass event in April accounts for the high level of CBOD5, TSS, TP and TAN
[8] Bypass event in May accounts for the high level of CBOD5, TSS, TP and TAN

Raw Sewage Monthly Average Concentrations				
	Monthly Average BOD5 Concentration *(mg/L)*	**Monthly Average Total Suspended Solids Concentration** *(mg/L)*	**Monthly Average Total Phosphorus Concentration** *(mg/L)*	**Monthly Average Total Kjeldahl Nitrogen Concentration** *(mg/L)*
January	63.8	152.8	1.3	8.9
February	82.0	112.5	1.4	13.4
March	77.0	118.4	1.5	10.8
April	50.8	94.5	1.6	9.8
May	86.4	125.8	1.4	8.7
June	46.3	106.3	1.2	11.0
July	53.5	110.3	1.3	12.9
August	53.6	70.0	0.7	11.9
September	106.5	169.8	2.4	20.0
October	96.0	154.3	1.4	17.1
November	46.8	63.4	1.0	16.5
December	57.0	70.5	1.0	15.1
Annual Avg	**68.3**	**112.4**	**1.3**	**13.0**

	Facility Influent Flow Monitoring			**Facility Effluent Flow Monitoring**		
Month	**Average Daily Influent Flow** *(cu.m/day)*	**Month Max Daily Influent Flow** *(cu.m/day)*	**Total Influent Flow** *(cu.m/month)*	**Average Daily Effluent Flow** *(cu.m./day)*	**Month Max Daily Effluent Flow** *(cu.m./day)*	**Total Effluent Flow** *(cu.m./month)*
	Rated Capacity: 2800 cu.m./day	*Peak Rated Capacity: 9000 cu.m./day*				
January	2990	5143	92690	3100	5469	96092
February	2994	4875	83827	3111	4996	87112
March	3214	5547	99631	3338	5742	103464
April	3761	5268	112838	3874	5511	116209
May	3135	6696	97180	3236	7215	100313
June	2409	3423	72279	2513	3604	75399
July	2073	2450	64255	2214	2640	68641
August	1985	2558	61528	2122	2756	65783
September	1574	1793	47209	1666	1918	49990
October	1493	1578	46290	1593	1740	49380
November	1563	1757	46875	1625	1843	48756
December	2163	3144	67052	2254	3228	69882
	Annual Avg = 2,446 cu.m./day	**Annual Max = 6,696 cu.m./day**	**Total Annual = 891,654 cu.m.**	**Annual Avg = 2,554 cu.m./day**	**Annual Max = 7,215 cu.m./day**	**Total Annual = 931,019 cu.m.**

Summary of Bypass, Spill, or Abnormal Discharge Event(s)

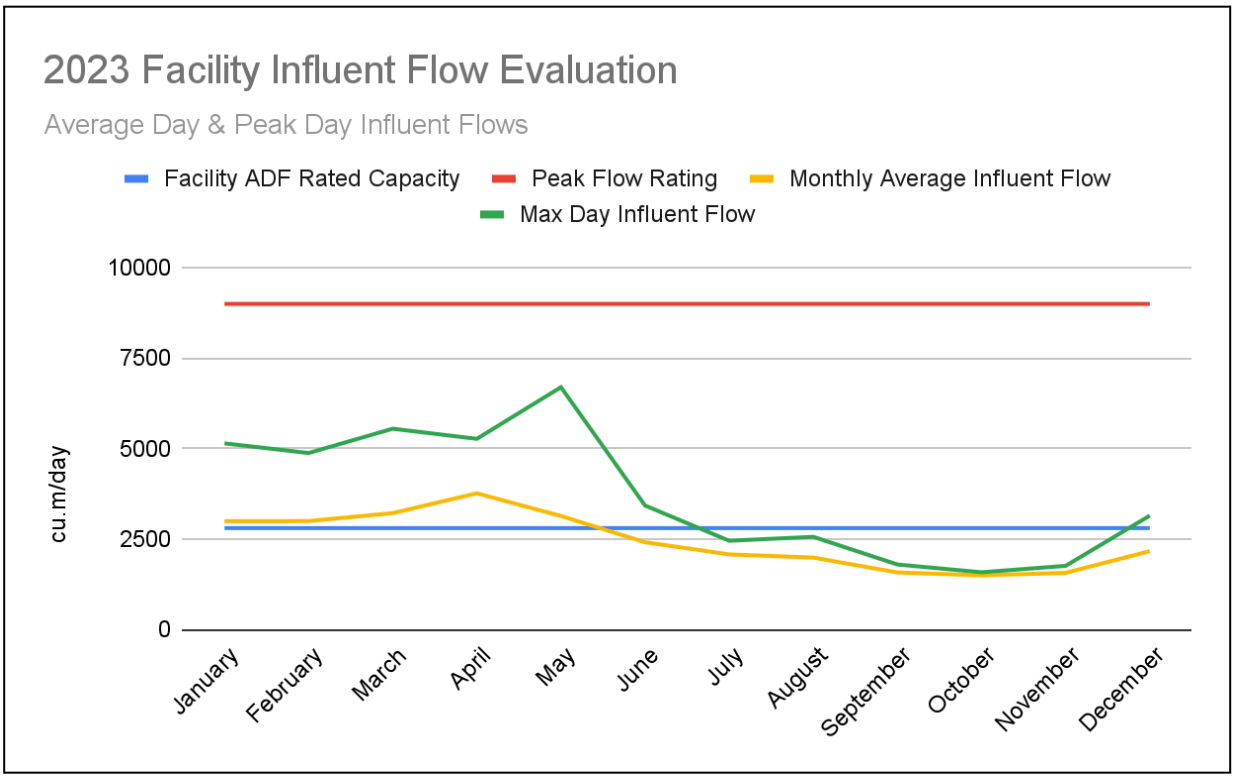
Month	Date	Duration	Event Type	Volume (cu.m)
January	16-19	65 hours	Planned partial Tertiary Bypass to conduct backwash bridge maintenance on tertiary filters	1788
February	1	1.5 minutes	Spill of sludge storage tank occurred during maintenance on sludge loading pump local electrical controls	0.2
March	14	5 hours	Planned partial Tertiary Bypass to conduct repairs on the tertiary filter backwash bridge	126
	25-31	145 hours	Unplanned partial Tertiary Bypass due to rapid seasonal temperature change and heavy precipitation	6,351
April	17-18	25 hours, 15 minutes	Unplanned partial Tertiary Bypass due to heavy precipitation and emergency repairs on Clarifier 1	808
April - May	30-6	129 hours, 21 minutes	Unplanned partial Tertiary Bypass due to heavy precipitation, remained in planned partial tertiary bypass for critical maintenance on Clarifier 1	7,7078

Summary of Operating Problems throughout Monitoring Period

During the reporting period the plant experienced issues with the backwash bridge on the Tertiary Filters, and the internal arm carrier structure on Clarifier 1. Operators completed critical maintenance on this infrastructure to rectify these issues during the first half of the reporting period. However, along with increased seasonal flows, as noted in the section prior, both issues attributed to bypass events.

The following figure depicts Influent Average Daily Flow and month Maximum Daily Flows against the facility Rated Capacity. Seasonal flow increases can be seen in January to May, and reflect the I&I challenges that

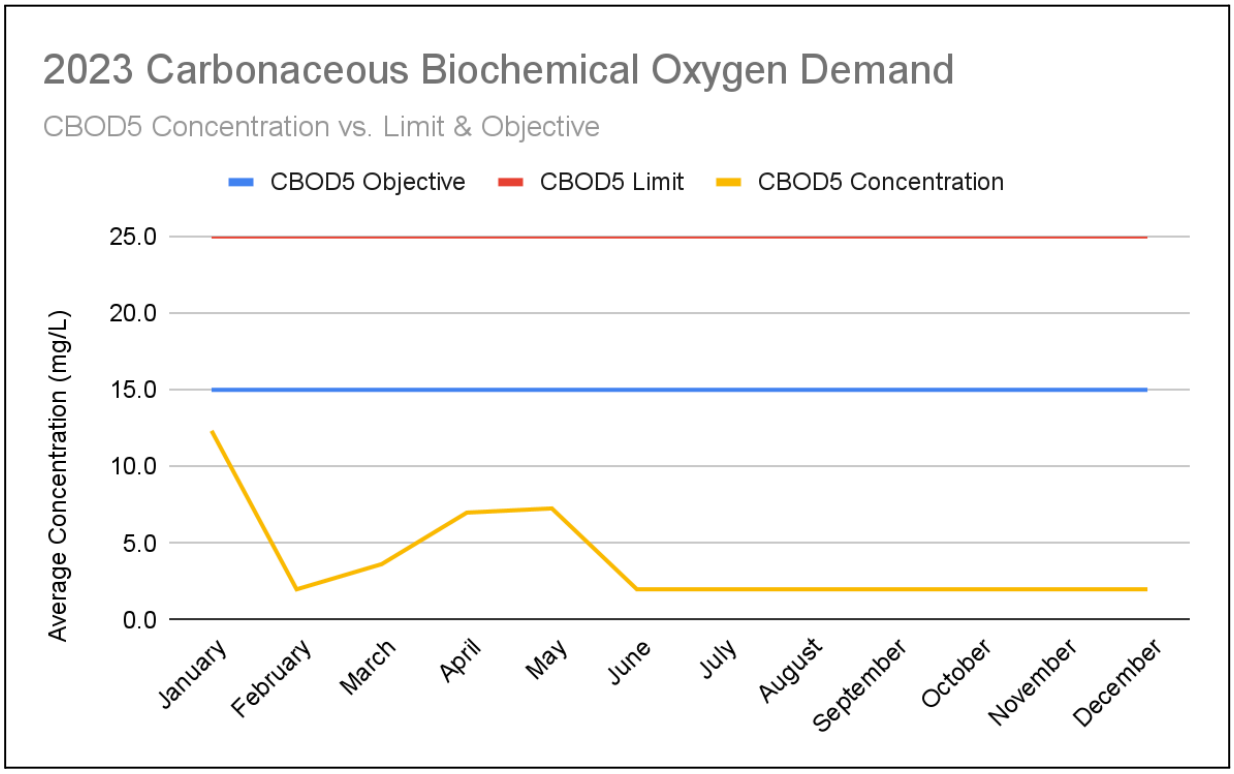
face this system. A heavy rain event on April 30 caused the highest Max Daily flow on May 1 to reach 6,696 m^3/day. In 2023 there was an increase in annual effluent plant flow and a subsequent increase in Average Daily Flow (ADF) by 10%, the 3-year ADF increased by 1%, with the 5-year average increasing to 82% of the rated capacity.

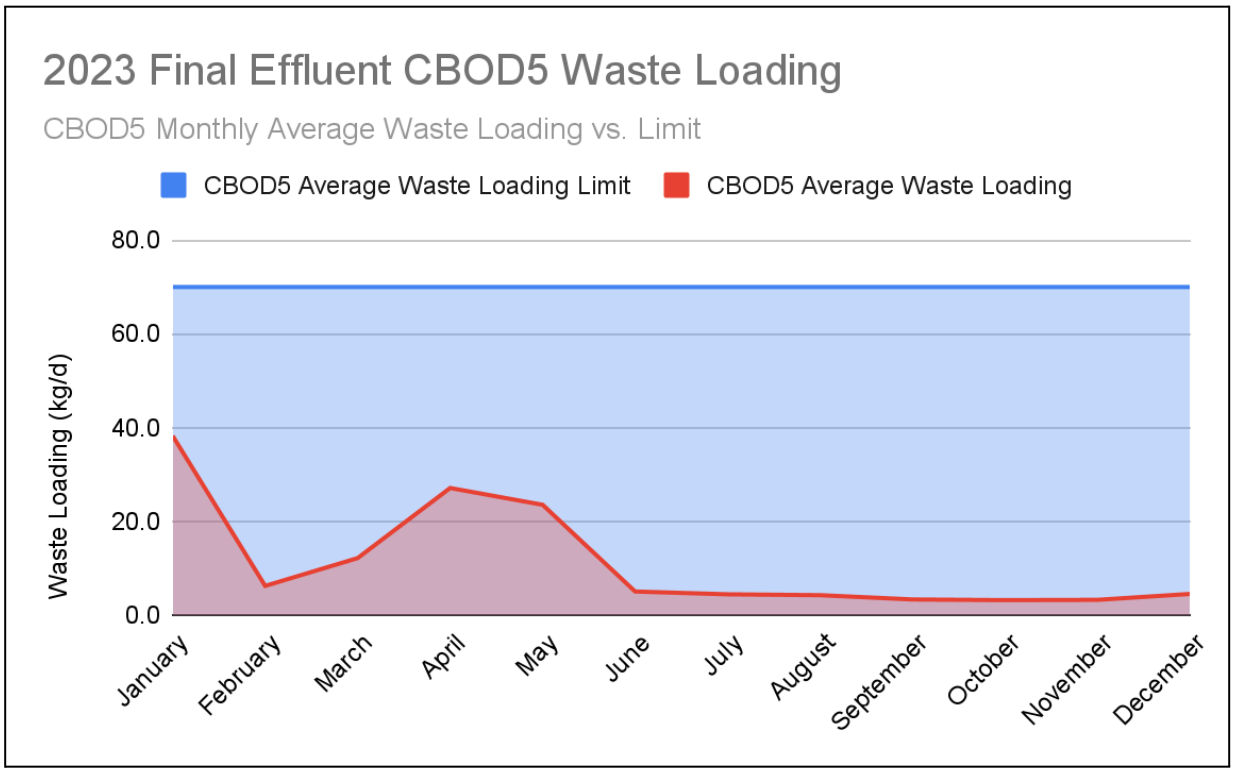


Analysis of Final Effluent Monitoring Dataset

Carbonaceous Biochemical Oxygen Demand (CBOD5) / Biochemical Oxygen Demand (BOD5)

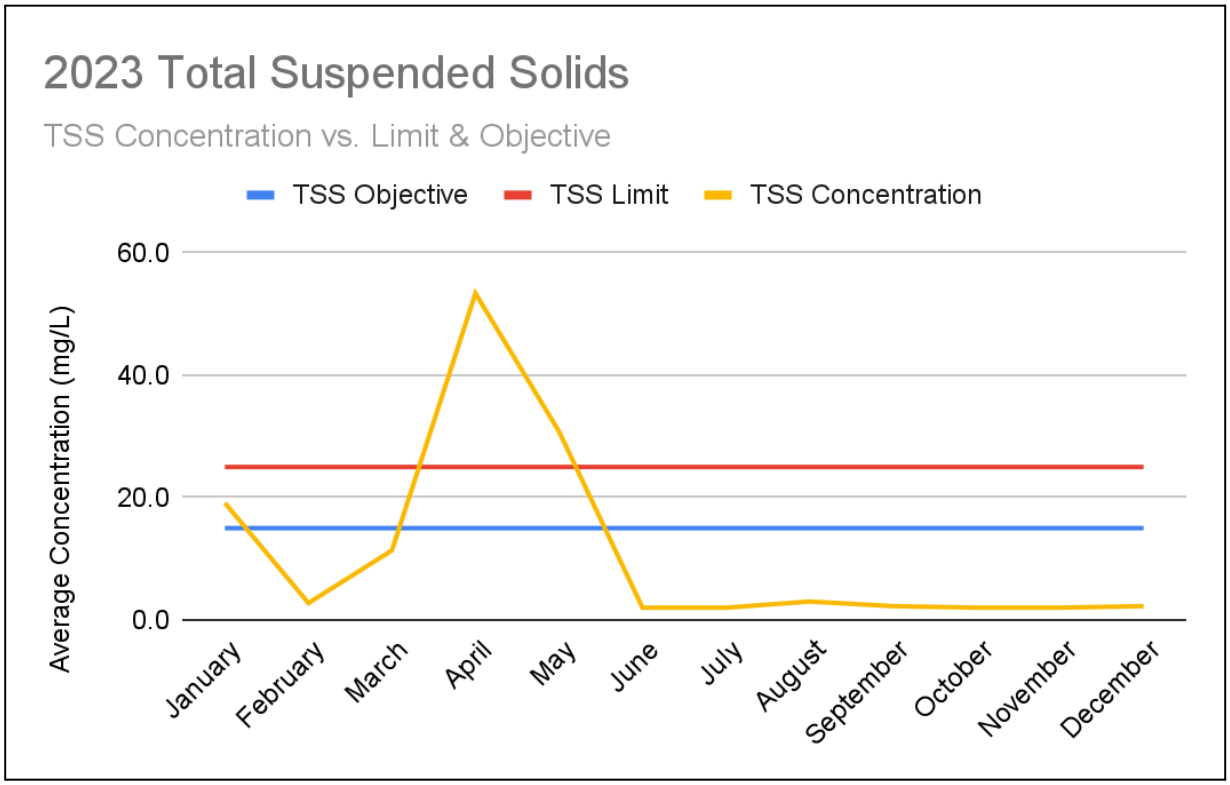
The facility performed adequately to reduce BOD concentrations through the treatment process throughout the entire Reporting Period. Final Effluent Waste Loadings also remained below the allowable limits throughout the Reporting Period. The spikes below can be attributed to the Bypass events outlined in Summary of Bypass, Spill, or Abnormal Discharge Event(s).

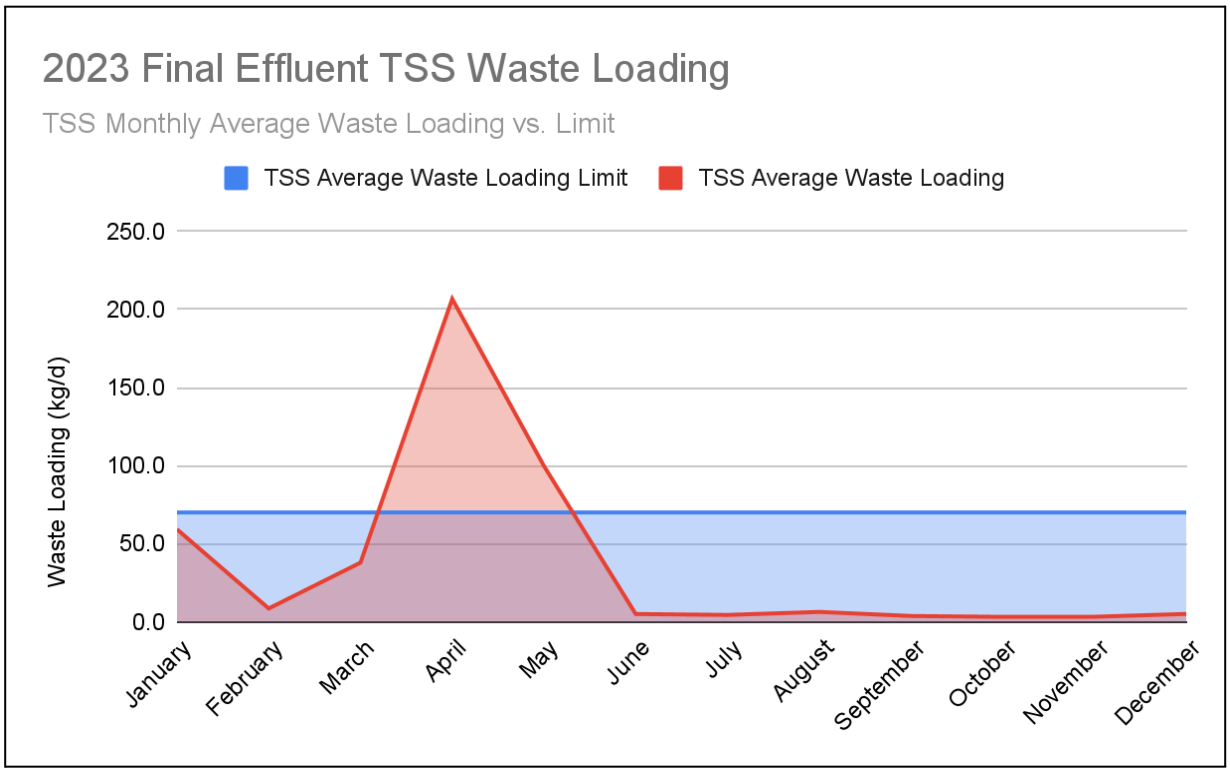

2023 Carbonaceous Biochemical Oxygen Demand
CBOD5 Concentration vs. Limit & Objective
CBOD5 Objective
CBOD5 Limit
CBOD5 Concentration
Average Concentration (mg/L)
25.0
20.0
15.0
10.0
5.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December


2023 Final Effluent CBOD5 Waste Loading
CBOD5 Monthly Average Waste Loading vs. Limit
CBOD5 Average Waste Loading Limit
CBOD5 Average Waste Loading
Waste Loading (kg/d)
80.0
60.0
40.0
20.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December

Total Suspended Solids (TSS)

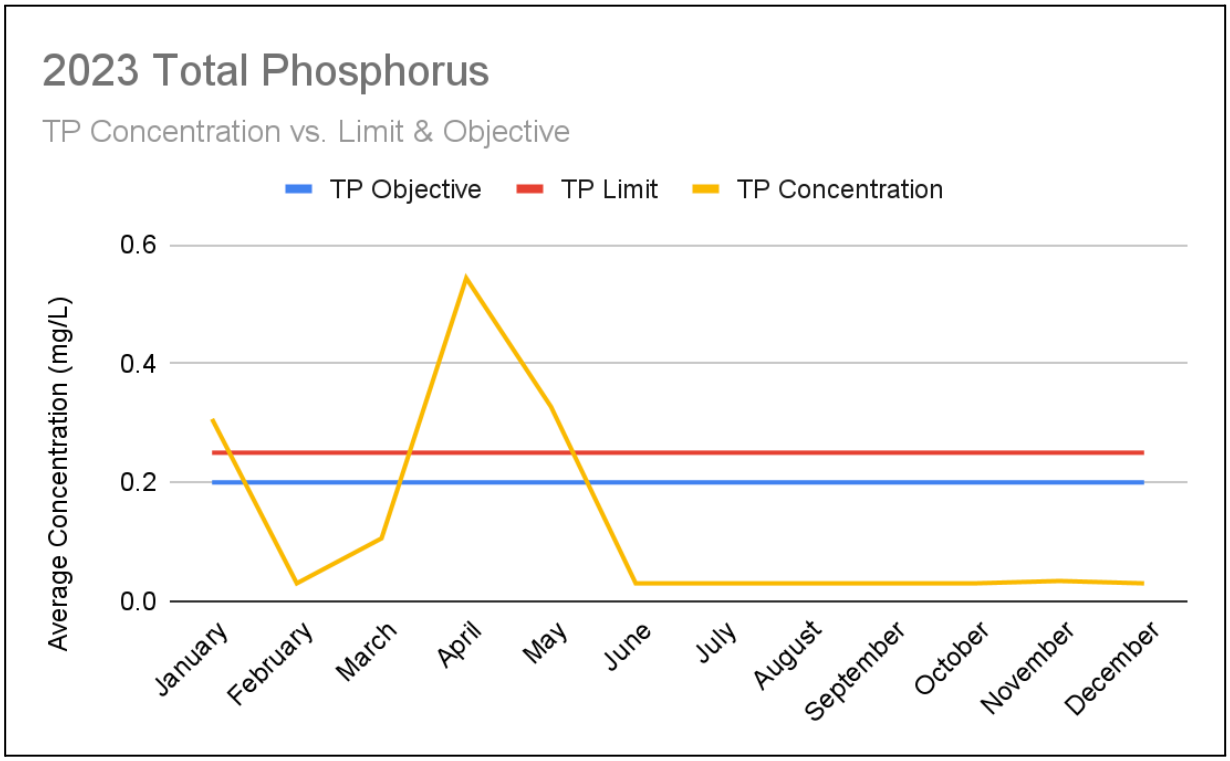
Generally, during Normal Operating Conditions the facility operated well throughout the Reporting Period to maintain compliance with the Effluent Limits and Objectives established in the ECA. However, as seen below in the figures, the facility exceeds TSS concentration for Final Effluent Objective and Limits and subsequent TSS Waste Loading in the months of April and May, due to samples collected during two plant bypass events.

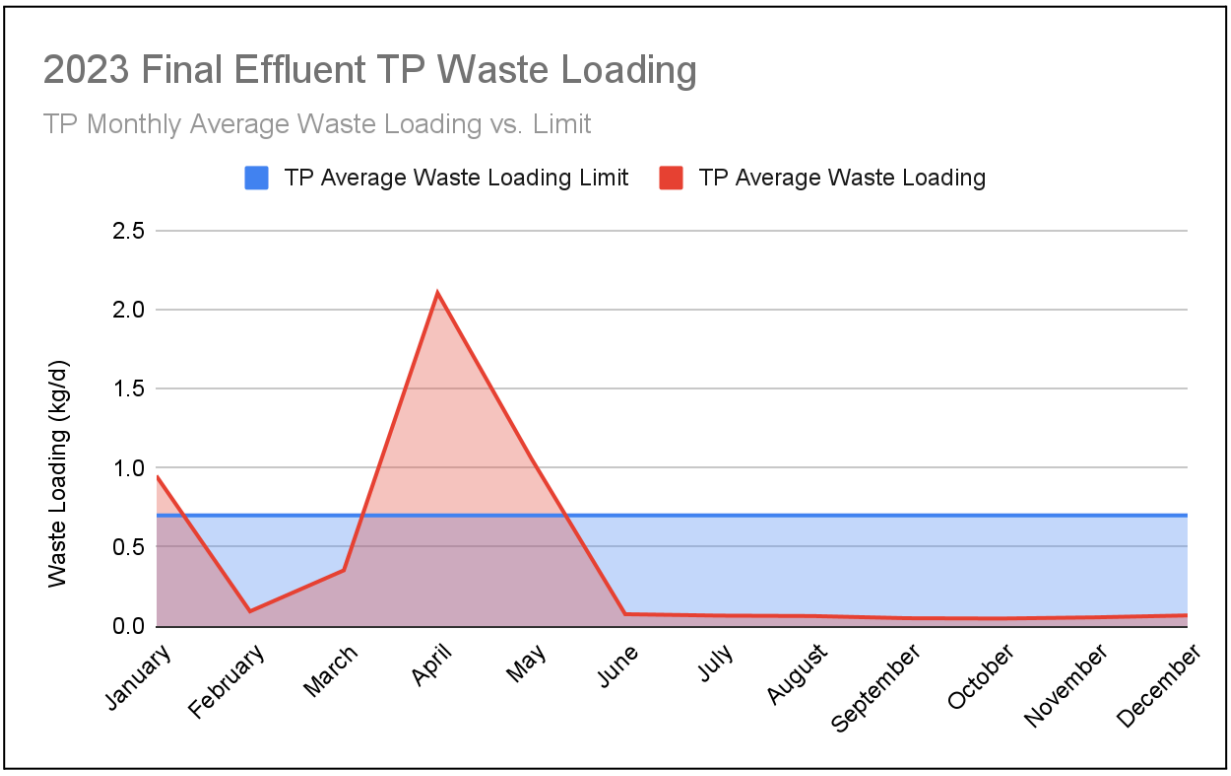




Total Phosphorus (TP)

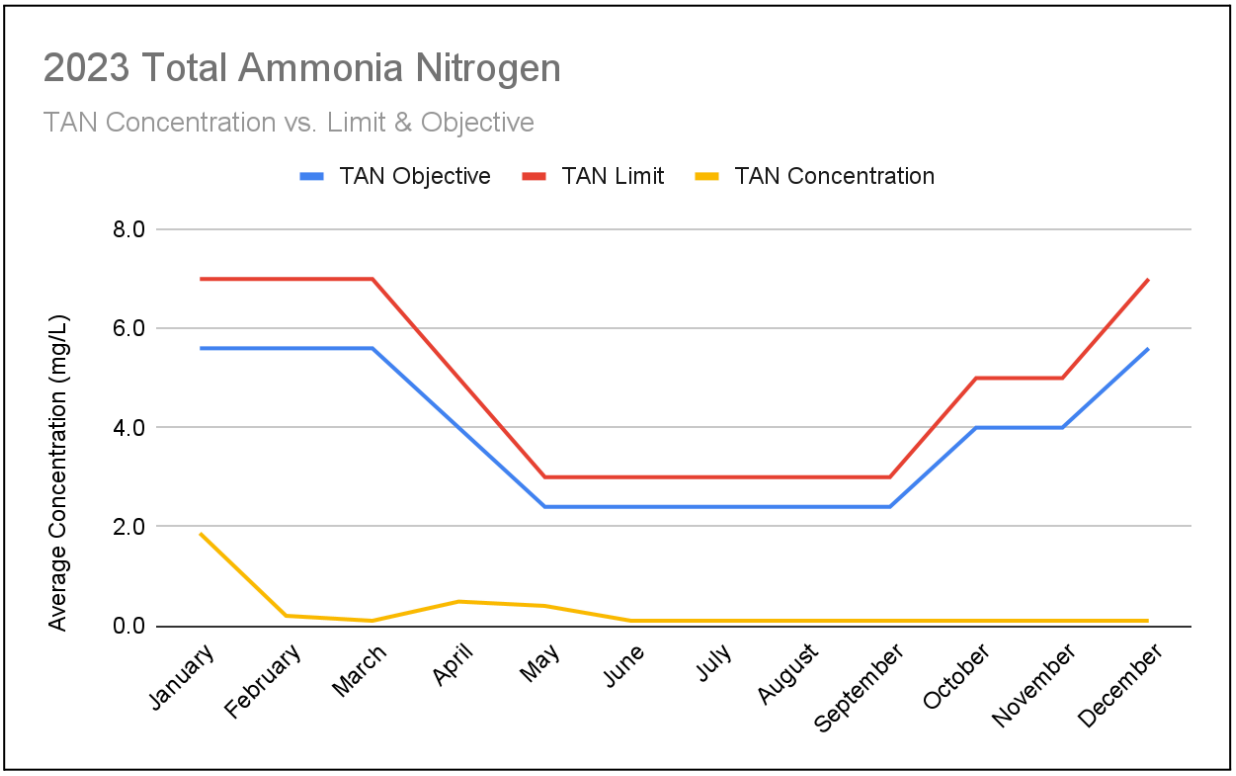
Facility performance was stable during the second half of the Reporting Period in meeting Total Phosphorus Monthly Average Concentrations Objectives and Limits and Effluent Waste Loading Limits. As seen below in the figures, there are exceedances in TP concentration and subsequent TP Waste Loading in the months of January, April and May due to a suspected sampling error and samples collected during two plant bypass events.

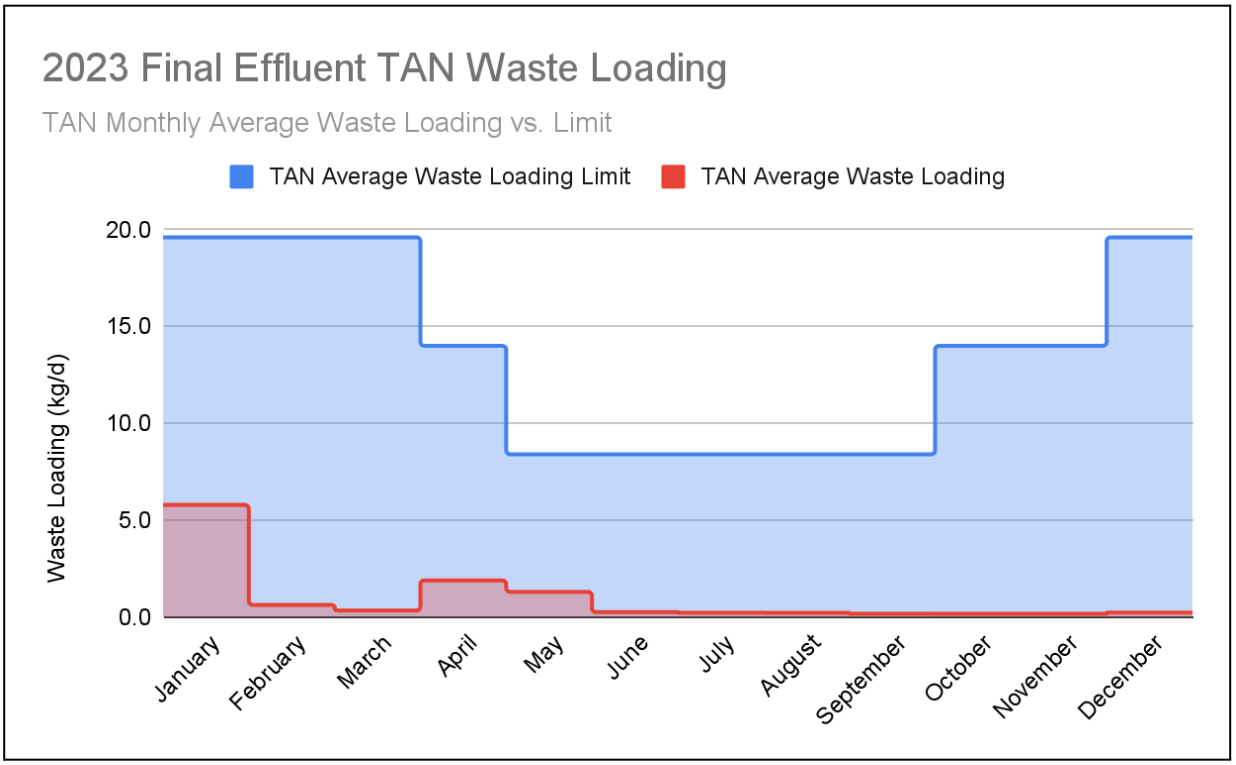

2023 Total Phosphorus
TP Concentration vs. Limit & Objective
TP Objective
TP Limit
TP Concentration
Average Concentration (mg/L)
0.6
0.4
0.2
0.0
January
February
March
April
May
June
July
August
September
October
November
December


2023 Final Effluent TP Waste Loading
TP Monthly Average Waste Loading vs. Limit
TP Average Waste Loading Limit
TP Average Waste Loading
Waste Loading (kg/d)
2.5
2.0
1.5
1.0
0.5
0.0
January
February
March
April
May
June
July
August
September
October
November
December

Total Ammonia Nitrogen (TAN) - Ammonia (NH_3) / Ammonium (NH_4^+)

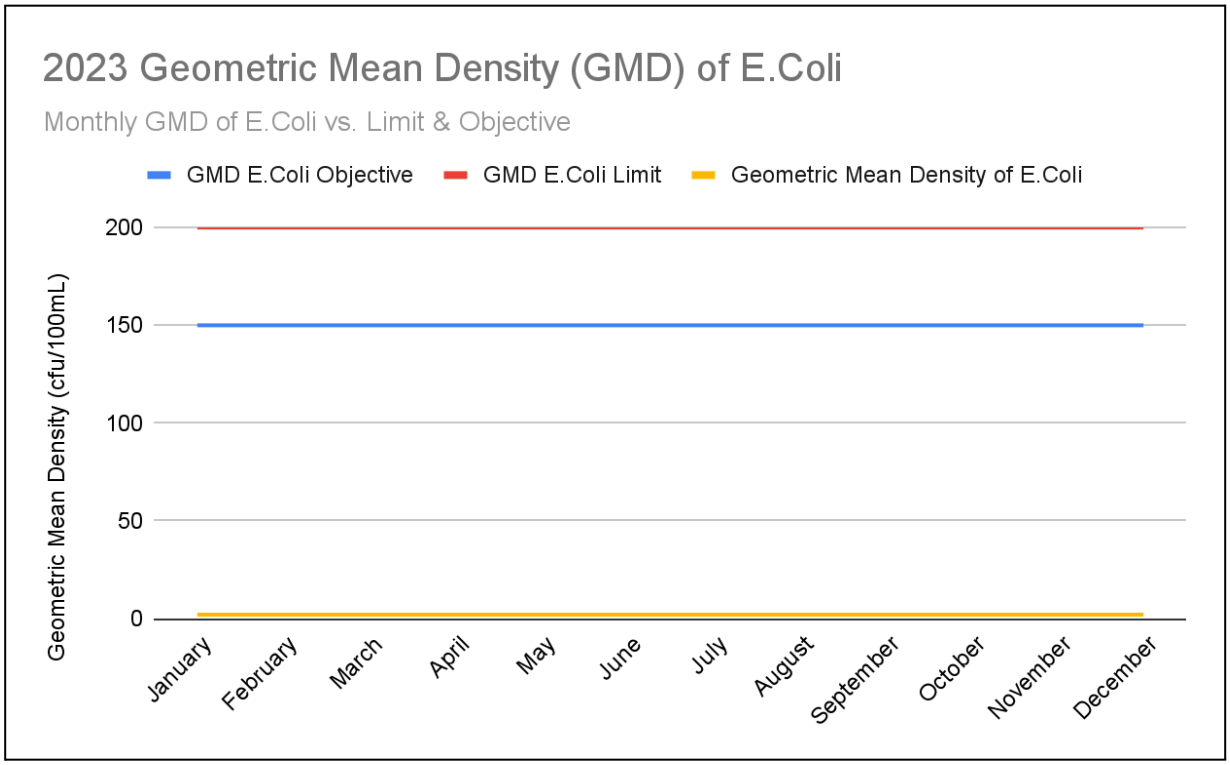
The measure of both Ammonia and Ammonium is called the Total Ammonia Nitrogen (TAN) content. The neutral, unionized form of ammonia (NH_3) is highly toxic to fish and other aquatic life; Condition 9(5) of the ECA requires the Owner to monitor for this. The yearly average unionized ammonia concentration in the Final Effluent was 0.002 mg/L. The facility operated well throughout the entire year such that the Monthly Average TAN Concentrations and Waste Loadings remained below the Effluent Objectives and Limits. Notably, the increase in January is due to a suspected sample collection error on January 11, 2023, while the increases in April and May are attributed to samples collected during bypass events.





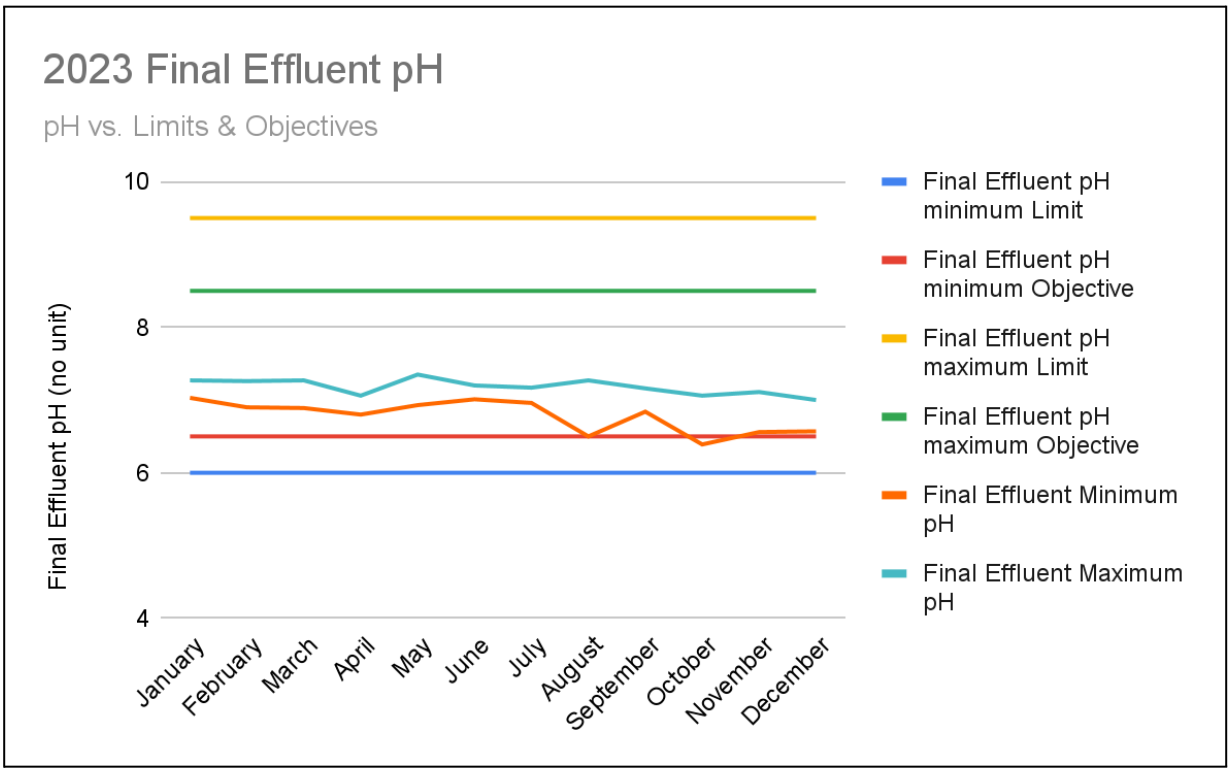
Geometric Mean Density of E. Coli

The Figure below demonstrates the facility's effectiveness in continuously disinfecting its Final Effluent discharge. The UV Disinfection process consists of two banks (one standby) of UV irradiation lamps, each bank having a Peak Rated Capacity of 9000 cu.m/day. Regular weekly sampling results generally measured at the MDL of 2 cfu/100mL. With regular preventative maintenance, the system continues to perform well.



Final Effluent pH

As shown in the following chart, the Final Effluent pH remained within allowable limits established in the ECA. The ECA requires the Owner to collect a grab sample of the Final Effluent on a weekly basis and test for pH. The Operators collected some 249 samples of Final Effluent throughout the reporting period, and analyze the pH using in-house equipment.



Acute Lethality to Rainbow Trout and Daphnia Magna

The City contracts all Acute Lethality testing to *Nautilus Environmental.* In each quarter the results from the samples collected yielded 0% mortality in Daphnia Magna at 100% Effluent Concentration and 0% mortality in Rainbow Trout at 100% Effluent Concentration. In accordance with the Wastewater Systems Effluent Regulations, effluent is deemed acutely lethal if there is greater than 50% mortality in Rainbow Trout at full strength effluent.

As Rainbow Trout are susceptible to ammonia, a review of the weekly sample results was conducted, and all sample results measured at or below the MDL each week during each month as outlined in the table below. Further, there were no other indicators in weekly sample results to suggest the Effluent quality was diminished.

Final Effluent Ammonia Results		
Date	**TAN concentration** (mg/L)	**Calculated Unionized Ammonia Concentration** (mg/L)
January 25, 2023	0.1	0.001
April 19, 2023	0.3	0.001
July 19, 2023	0.1	0.001
October 18, 2023	0.1	0.001

Effluent monitoring requirements without Limits

The City is responsible for sampling other parameters that do not have an established Effluent Limit. Those are listed below along with a short interpretation of associated facility performance, and sample results are summarized in the section Summary and Interpretation of Monitoring Data.

- **Hydrogen Sulfide:** Final Effluent sample results consistently measured below the lab MDL for the entire reporting period. In the next ECA amendment, the City will apply to have this monitoring requirement removed due to its redundancy.
- **Dissolved Oxygen**: While the City actively monitors and controls D.O. in the aeration basin to enhance the oxidation process, staff only collect Final Effluent samples for D.O. analysis weekly and analyze this parameter using in-house equipment. A total of 85 samples were collected throughout the Reporting Period and analyzed for D.O. The minimum Final Effluent DO was measured at 6.84 mg/L on July 31. The maximum D.O. was measured at 10.35 mg/L on April 6.
- **Temperature**: 248 samples of Final Effluent were collected throughout the Reporting Period and the temperature was taken using in-house equipment. The minimum measured reading was 7.2 deg.C on February 1, and the maximum measured was 24 deg.C on August 3.

Summary of Maintenance performed throughout Reporting Period

The City continues to support an active Preventative Maintenance (PM) program to ensure the facility is maintained in a fit state of repair. Outside of Preventative Maintenance, the following Reactive Maintenance activities were completed by staff, or outside contractors as identified:

- Ongoing filter backwash bridge maintenance
- Secondary clarifier #1 rotating assembly and support repair
- Digester decant swivel elbow replacement

Biosolids Management Summary

Date Hauled	**Volume Hauled**	**Biosolids Destination**
January	44	GFL Storage Facility (Smiths) ECA# S-3708-42
April	260	Trenton WWTP dewatering and storage
April 18-19	800	Land Application NASM Plan #23774
May 24	124	Land Application NASM Plan #60339
May 29-31	960	Land Application - NASM Plan #23770
July 5	240	Land Application - NASM Plan #24590
September 8-12	1204	Land Application - NASM Plan #24244
November 27	120	Land Application - NASM Plan #60901
November 28-29	920	Land Application - NASM Plan #24243
Total Volume of Sludge generated in 2023 = 4,672 cu.m		

Estimated Sludge generated in 2024 - 5,000 cu.m.

Summary of Effluent Quality Assurance and Control Measures

The City collects samples from Raw Sewage stream, Aeration Tanks, Secondary Clarifiers and Final Effluent on a routine basis throughout the week. The City satisfies its regulatory compliance requirements by submitting a set of samples to an accredited laboratory, SGS Canada Inc. on a weekly basis, normally on Wednesdays. In 2024, these samples will be collected on Tuesdays in accordance with the ECA. The sample results are manually entered into a spreadsheet and evaluated for compliance with the ECA. In addition to these samples, Operators perform in-house analysis for Total Suspended Solids, pH, temperature, alkalinity, dissolved reactive phosphorus, and Final Effluent Dissolved Oxygen. Sample results are entered into a spreadsheet for facility evaluation and process optimization. On an annual basis, the spectrophotometer is calibrated by a third party. Operators calibrate other instrumentation, such as the bench top pH meter, regularly.

Final Effluent Monitoring Equipment Calibration and Maintenance

Works Orders are generated on an annual basis to calibrate the facility Flow Meter. This calibration is completed by a third party contractor. The following figure is a copy of the Calibration Certificate.

Tower Electronics Canada Inc.
Instrument Calibration Certificate

Customer:
The City of Quinte West
7 Creswell Drive
PO Box 490
Trenton, ON K8V 5R6

Calibration by:
Dan Matchett

Standards:
Fluke 289 S/N 96220182 NIST Cal Due April 2024

Instrument Type
Open Channel

Meter Information

Date of Test:	2023-08-29
Location:	Frankford WWTP
Meter Under Test	Final Effluent
Client Tag:	QW00001959
Manufacturer:	Simens
Model:	OCMIII
Serial Number:	PBD/X8060040XV
Totalizer As Found:	11141844M3
Totalizer As Left:	11141895M3
Acceptable Error:	15%
Programming Parameters:	
Max Flow	140.199LPS
Max Head	.415M
Primary Device	Parshall 9"
Calibration Due:	Aug-24

Method of verification
Head Simulation

Units: LPS
Zero: 0.00
Span: 140.20
Totalizer: M3

Flow Test

Head Applied	Sim Flow	Meter Display	Current Output	Disp Error%	mA Error %
0.000	0.000	0.000	3.982	0.000	0.450
0.100	15.801	14.460	5.646	0.956	2.710
0.200	45.630	45.160	9.107	0.335	1.091
0.300	84.854	82.940	13.456	1.365	1.665
0.400	131.774	128.540	18.660	2.307	1.988
			Average Error%	0.99	1.58
			Result:	PASS	PASS

Totalizer Test

Sim Flow Rate	131.774	LPS
Start Totalizer	11141876.000	M3
End Totalizer	11141886.000	M3
Volume Simulated	10.000	M3
Time(Seconds)	77.880	
Calculated Totalizer(MUT)	10.263	
Error%	-2.558	
Result:	PASS	

Comments:
Unit passes verification.
1021mm measured empty distance

Tower Electronics Canada Inc
2687 Hwy 40
K0K 3M0
Wooler On
Canada

Email: Dan@Tecanada.ca
Website: www.tecanada.ca

Calibrations Service Sales
Temporary and Permanent Meter Installations
Instrumentation For Flow Level Pressure.

Notice of Modifications

There were no 'Notice of Modifications' forms submitted to the Ministry during this Reporting Period.

Summary of complaints received throughout the reporting period

There were no complaints received by City staff regarding the Frankford WWTP throughout the reporting period.