



NORTH TORONTO TREATMENT PLANT

2023 Annual Report



April 2, 2024

EXECUTIVE SUMMARY

The North Toronto Treatment Plant (NTTP) is one of four wastewater treatment facilities operated by the City of Toronto. This facility, located in the Don Valley, has a rated capacity of 45.5 ML/day, normally operates at a controlled flow rate, and serves an equivalent population of approximately 183,000. The North Toronto Treatment Plant discharges to the Don River and operates under Environmental Compliance Approval (ECA) No. 7459-B6QPM2 issued June 21, 2019.

The average daily influent flow rate in 2023 was 14.7 ML/day. Influent concentrations of Biochemical Oxygen Demand (BOD₅), Total Phosphorus (TP) and Total Suspended Solids (TSS) averaged 233 mg/L, 5.3 mg/L and 334 mg/L, respectively.

North Toronto Treatment Plant achieved the following effluent quality and loading rates in 2023 in comparison to ECA limits:

| Parameter | ECA ¹ | 2023 Final Effluent |
|------------------------------------------------------------|------------------|---------------------|
| Total Suspended Solids (SS) | 25.0 mg/L | 9.1 |
| Carbonaceous Biological Oxygen Demand (CBOD ₅) | 25.0 mg/L | 3.2 |
| Total Phosphorus (TP) | 1.0 mg/L | 0.5 |
| Escherichia Coli (E. Coli) ² | 200 CFU/100mL | 22 |
| pH | 6.0-9.5 | 7.5 |
| Total Residual Chlorine (TRC) (Dechlorination) | 0.02 mg/L | 0.012 |
| TSS Loading Rate | 1,137.5 kg/day | 133.5 |
| CBOD ₅ Loading Rate | 1,137.5 kg/day | 47.1 |
| TP Loading Rate | 45.5 kg/day | 7.7 |

¹ Referenced from ECA No. 7459-B6QPM2 issued on June 21, 2019.

² Arithmetic mean of monthly geometric mean data.

Sludge (raw sludge and waste activated sludge) generated at the North Toronto Treatment Plant is conveyed by gravity via the North Toronto Sanitary Trunk Sewer (STS) and the Coxwell STS to the Ashbridges Bay Treatment Plant (ABTP) for further treatment and disposal. The daily average of 561 m³/day at 0.55 % Total Solids (TS) sludge was transferred in 2023.

Ferrous chloride consumption for phosphorus removal totalled 75.8 tonnes as iron (Fe). Total sodium hypochlorite (12% w/v) consumption for effluent disinfection totalled 109.1 m³. Sodium bisulphite (SBS) (38% w/w) consumption for effluent de-chlorination totalled 55.8 tonnes.

The plant continued with various capital projects. Notable projects included the construction of various process upgrades and the construction of a new server room. A variety of scheduled,

preventative, predictive and reactive maintenance was performed, including annual calibration of effluent monitoring equipment.

Total annual consumption for potable water and hydro was 107,892 m³ and 2.32 M kWh, respectively.

Direct operating costs for 2023 totalled \$2.37M. In 2023, the North Toronto Treatment Plant had 10 employees. As of December 31, 2023, there was one lost time incident and seven lost time days due to work related injuries.

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GLOSSARY OF ABBREVIATIONS

| | |
|---------------------|---------------------------------------------------------------------------------|
| AAC | Annual Average Concentration |
| BOD5 | Five-Day Biochemical Oxygen Demand |
| CBOD5 | Five-Day Carbonaceous Biochemical Oxygen Demand |
| CEU | Continuing Education Units |
| CFU | Colony Forming Units |
| E. Coli | Escherichia Coli |
| ECA | Environmental Compliance Approval |
| Fe | Iron |
| kg | kilogram |
| kWh | Kilowatt-hour |
| MAC | Monthly Average Concentration |
| MGMD | Monthly Geometric Mean Concentration |
| MWh | Megawatt-hour |
| m ³ | Cubic metre |
| m ³ /day | Cubic metre per day |
| mA | Milliamps |
| mg/L | Milligrams per litre |
| mL | Millilitre |
| ML | Megalitre (million litres) |
| MECP | Ministry of the Environment, Conservation and Parks |
| Q | Flow Rate |
| RAS | Return Activated Sludge |
| SBS | Sodium Bisulphite |
| SBS (P) | Sodium Bisulphite Presence |
| scm | Standard Cubic Metres |
| SS | Suspended Solids |
| TRC | Total Residual Chlorine |
| TP | Total Phosphorus |
| TS | Total Solids |
| TSS | Total Suspended Solids |
| TVS | Total Volatile Solids |
| TWAS | Thickened Waste Activated Sludge |
| µg/L | Micrograms per litre |
| WAS | Waste Activated Sludge |
| % w/v | Percent concentration of components of solution expressed as weight by volume |
| % w/w | Percent concentration of components of a solution expressed as weight by weight |

Definitions

Bypass: A bypass is defined as a diversion of sewage around one or more unit processes within the plant with the diverted sewage flows being returned to the plant treatment train upstream of the final effluent sampling location, and discharging to the environment through the plant outfall.

Overflow: An overflow is defined as a discharge to the environment from the plant at a location other than the plant outfall downstream of the final effluent sampling station.

Spill: A spill is defined within the meaning of Part X of the Environmental Protection Act. "Spill", when used in reference to a pollutant, means a discharge,

- a) into the natural environment,
- b) from or out of a structure, vehicle or other container, and
- c) that is abnormal in quality or quantity in light of the discharge.

Abnormal Discharge: A discharge of a pollutant designated by the regulations at a location designated by the regulations shall be deemed to be in a quantity or with a quality abnormal at the location. R.S.O. 1990, c. E.19, s. 91 (2).

$$\text{Loading} \left(\frac{\text{kg}}{\text{day}} \right) = \text{Concentration} \left(\frac{\text{mg}}{\text{L}} \right) \times \text{Flow} \left(\frac{\text{ML}}{\text{day}} \right)$$

$$\text{Percent Removal} (\%) = 1 - \frac{\text{Concentration (Final)}}{\text{Concentration (Initial)}}$$

$$\text{Aeration Loading} = \left(\frac{\text{kg cBOD}}{\text{m}^3 \text{ aeration capacity}} \right) = \frac{(Q_{\text{Primary Effluent}} + Q_{\text{RAS}}) \times [\text{cBOD}_5]_{\text{primary effluent}}}{V_{\text{aeration Tanks}}}$$

$$\text{Solids Capture} (\%) = \frac{\text{Centrifuge Feed TS} - \text{Centrate TSS}}{\text{Centrifuge Feed TS}} \times 100$$

1 INTRODUCTION

The North Toronto Treatment Plant is one of four wastewater treatment facilities operated by the City of Toronto under the responsibility of the Wastewater Treatment section of Toronto Water. The facility is located at 21 Redway Road, in the Don Valley on a 27.2 ha site serving a sewershed of approximately 3,060 ha. This area contains an estimated connected population of 183,000¹. The North Toronto Treatment Plant operates at a controlled flow rate and has a rated capacity of 45,500 m³/day, or 45.5 ML/day. Wastewater in excess of the controlled rate is diverted to the North Toronto Trunk Sewer and then conveyed by gravity to the Ashbridges Bay Treatment Plant via the Coxwell STS.

Major treatment processes include screening and grit removal, primary treatment, secondary treatment, phosphorus removal, effluent disinfection and de-chlorination. Treated effluent is discharged to the Don River. Co-settled sludge (raw sludge and waste activated sludge) is transferred via the North Toronto Sanitary Trunk Sewer (STS) and the Coxwell STS to the Ashbridges Bay Treatment Plant (ABTP) for further treatment and disposal. Numerous auxiliary systems are required for proper operation of many plant processes including: potable water, process water, heating, ventilation and air conditioning (HVAC), SCADA, odour control, electrical power distribution, and chemicals.

The Ministry of the Environment, Conservation and Parks (MECP) has classified the North Toronto Treatment Plant as a Class III wastewater treatment facility under Regulation 129/04. The facility operates under Environmental Compliance Approval (ECA) No. 7459-B6QPM2 issued June 21, 2019.

This report is a summary of plant operations and performance in 2023. Highlights of the report include a discussion on effluent quality and summaries of process operations, maintenance, chemical and utility consumption, capital projects, operational costs and human resources.

¹ Population estimated by sewershed delineation and 2021 census data

2 PLANT PROCESS OVERVIEW

A description of the plant process is included below. A plant process flow diagram is available in Appendix A. Additional information on the plant's process can be found on the City of Toronto website².

2.1 Influent

Wastewater from the Forman-Yonge Combined Trunk Sewer and Millwood Combined Trunk Sewer flows to the plant via a common sewer.

2.2 Preliminary Treatment

Raw wastewater enters the Headworks for grit and screenings removal. There is one automatic climber type bar screen that removes rags and large pieces of debris. Grit channels located downstream of the screen remove sand, gravel and similar heavy inorganic material by gravity separation. The removed grit and screenings are hauled to a sanitary landfill site.

2.3 Primary Treatment

Primary Treatment occurs in the Primary Clarification Tanks, where the flow velocity of the wastewater is reduced to allow heavier solids to settle to the bottom. There are four Primary Clarification Tanks. Sludge collectors in the tanks sweep the settled sludge, called primary or raw sludge, into sludge hoppers at the bottom of the tank. Floating solids, called scum, are drained periodically from the top of the tanks. The primary sludge and scum are then pumped out via the North Toronto STS and the Coxwell STS to the Ashbridges Bay Treatment Plant for further treatment. The primary effluent, continues to secondary treatment.

2.4 Secondary Treatment

The primary effluent receives secondary treatment through a conventional, suspended biomass activated sludge process in the Aeration Tanks. After entering the aeration tanks, the primary effluent mixes with return activated sludge (RAS) to form mixed liquor. RAS is removed from the Final Clarification Tanks and contains micro-organisms that naturally occur in wastewater and facilitate its degradation. In the presence of oxygen, these micro-organisms break down organic material in the mixed liquor. Air is supplied to the Aeration Tanks through four electrically driven blowers. There are a total of eight Aeration Tanks each

² <https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/>

equipped with ceramic fine bubble dome diffusers. Ferrous chloride is applied to the distribution conduits to the Aeration Tanks for phosphorous removal.

The mixed liquor from the Aeration Tanks flows to five large Final Clarification Tanks, where the activated sludge is allowed to settle. A controlled quantity of this sludge is returned to the Aeration Tanks as RAS in order to maintain a sufficient biomass concentration. The excess is removed as waste activated sludge (WAS), a portion of which is diverted to the Primary Clarification Tanks to co-settle with the raw sludge.

2.5 Final Effluent

Sodium hypochlorite is used to disinfect and kill pathogens in the final effluent. Sodium bisulphite (SBS) is added after disinfection to remove excess chlorine from the wastewater (i.e. dechlorinate); helping to protect the aquatic environment. The final effluent is discharged into the Don River. The plant uses direct measurement of Total Residual Chlorine (TRC) in the final effluent for monitoring and compliance.

2.6 Solids Handling

All primary sludge, WAS, and scum from the Primary and Secondary Clarification Tanks, collectively called sludge, is transferred to the Ashbridges Bay Treatment Plant for further treatment.

3 PROCESS SUMMARY

3.1 Process Parameters

In 2023, the North Toronto Treatment Plant continued to produce a high quality effluent. A summary of key final effluent parameters against the ECA objectives and limits are shown in Table 1. Influent and effluent performance charts are available in Appendix B. Historical performance data is included in Appendix C.

Table 1: Final Effluent Parameters

| Parameter | CBOD ₅ (mg/L) | TSS (mg/L) | TP (mg/L) | TRC ¹ (m`g/L) | E-Coli (count/100mL) | pH Min | pH Max |
|---------------------------------------------|-----------------------------|-------------------------|----------------------|-----------------------------|-------------------------|-----------|--------|
| January | 2.0 | 5.9 | 0.5 | 0.018 | 17 | 7.2 | 7.6 |
| February | 2.0 | 5.9 | 0.5 | 0.020 | 7 | 7.0 | 7.7 |
| March | 4.6 | 8.3 | 0.4 | 0.020 | 40 | 7.2 | 7.9 |
| April | 3.2 | 7.5 | 0.5 | 0.020 | 21 | 7.2 | 8.0 |
| May | 2.7 | 7.3 | 0.5 | 0.020 | 27 | 6.8 | 8.1 |
| June | 2.9 | 9.0 | 0.7 | 0.020 | 22 | 6.8 | 7.9 |
| July | 3.3 | 7.5 | 0.4 | 0.020 | 18 | 6.7 | 8.0 |
| August | 1.5 | 6.6 | 0.6 | 0.020 | 7 | 6.4 | 8.1 |
| September | 6.3 | 16.2 | 0.7 | 0.020 | 53 | 7.2 | 7.8 |
| October | 3.0 | 13.4 | 0.6 | 0.020 | 8 | 7.0 | 7.9 |
| November | 4.3 | 13.8 | 0.5 | 0.020 | 35 | 7.2 | 8.0 |
| December | 2.8 | 7.7 | 0.4 | 0.020 | 9 | 6.8 | 7.9 |
| Annual Average | 3.2 | 9.1 | 0.5 | 0.012 | 22 | 7.5 | |
| Loading (kg/d) ² | 47.1 | 133.5 | 7.7 | N/A | N/A | N/A | |
| Removal Efficiency ³ (%) | 98% | 97% | 90% | N/A | N/A | N/A | |
| ECA Requirements ^{4,5} | | | | | | | |
| Effluent Objective | AAC: 15.0 mg/L | AAC: 15.0 mg/L | MAC: 0.90 mg/L | MAC: non- detect | MGMD: 150 CFU/100 mL | 6.5 - 8.5 | |
| Effluent Limit | AAC: 25.0 mg/L | AAC: 25.0 mg/L | MAC: 1.0 mg/L | MAC: 0.02 mg/L | MGMD: 200 CFU/100 mL | 6.0 - 9.5 | |
| Average Waste Loading Limit ² | AAL: 1,137.5 kg/d | AAL: 1,137.5 kg/d | AAL: 45.5 kg/d | N/A | N/A | N/A | |

¹TRC – Total Residual Chlorine. Reported figure is the monthly maximum for the month. Annual Average is the average of all sample results.

²Loading is calculated based on flow rates as provided in Table 2

³CBOD = 0.8 * BOD assumed for removal efficiency calculations

⁴Referenced from ECA No. 7459-B6QPM2 issued June 21, 2019.

⁵AAC refers to Annual Average Concentration, MAC refers to Monthly Average Concentration, MGMD refers to Monthly Geometric Mean Density, and AAL refers to Annual Average Daily Loading.

Influent and Final effluent concentrations of eleven select heavy metals have been included in Appendix D. Any discharge into City sewers must meet the sewer use By-law limits. Final effluent concentrations are presented to assess the treatment plant's removal capacity.

A summary of the annual average of process parameters over the past three years is shown in Table 2.

Table 2: Process Summary

| Parameter | Units in report | 2023 | 2022 | 2021 |
|--------------------------------|------------------|------|------|------|
| Influent Parameters | | | | |
| Flow ¹ | ML/day | 14.7 | 16.0 | 17.5 |
| Total Annual Flow ¹ | ML | 5358 | 5838 | 6380 |
| Total Suspended Solids (TSS) | mg/L | 334 | 226 | 241 |
| Biological Oxygen Demand (BOD) | mg/L | 233 | 183 | 196 |
| Total Phosphorus (TP) | mg/L | 5.3 | 4.7 | 4.8 |
| Preliminary Treatment | | | | |
| Grit and Screenings | kg/day | 166 | 169 | 291 |
| Primary Treatment | | | | |
| TSS | mg/L | 97 | 126 | 117 |
| cBOD5 | mg/L | 87 | 94 | 91 |
| Secondary Treatment | | | | |
| Aeration Loading | Kg cBOD5/ m3 day | 0.13 | 0.15 | 0.16 |
| Mixed Liquor Suspended Solids | mg/L | 2561 | 2442 | 2258 |
| Solids Handling | | | | |
| Sludge to Ashbridges Bay Flow | ML/day | 0.56 | 0.46 | 0.55 |
| Sludge to Ashbridges Bay TS | % | 0.55 | 0.94 | 0.89 |

¹Based on final effluent flow meters

Influent flow to the North Toronto Treatment Plant decreased by 8.2% in 2023. Influent strength of BOD, TSS, TP, and TKN increased by 27%, 48%, 14%, and 9% respectively.

Final effluent annual average concentration for cBOD, TSS, and TP was 3.2 mg/L, 9.1 mg/L, and 0.5 mg/L, respectively, and met the monthly average effluent concentration specified in Schedule C of the ECA throughout 2023. The final effluent annual average for e. Coli monthly geometric mean density in 2023 was 22 CFU/100 mL and also met the Schedule C compliance limit for each month. Final effluent total residual chlorine analysis did not exceed 0.02 mg/L

in 2023. Furthermore, final effluent pH remained between the range of 6.0 – 9.5 throughout the course of 2023.

The North Toronto Treatment Plant encountered no chronic operating problems and continued to produce a high quality effluent through the continued improvement of operations and maintenance of treatment processes. The plant consistently surpassed the design objectives highlighted in Condition 6 as well as Schedule B of the ECA.

All parameters highlighted in the sampling program specified in Schedule D of the plants ECA meet or exceed the sampling frequency of 3 times/week specified by Condition 9(1)(b), negating the requirement for future sampling forecasts and scheduling. Plant operations were shut down from March 5 to 19, September 5 to 7, and on October 10 to accommodate construction activity related to facility upgrades, and therefore no samples were taken on these days.

3.2 Biosolids Management

All sludge (primary sludge, WAS, and scum) generated at the North Toronto Treatment Plant is transferred to the Ashbridges Bay Treatment Plant for further treatment. The sludge generated during 2023 averaged 561 m³/day (0.55% TS).

The influent flow projection for 2023 will not exceed the rated plant capacity of 45.5 ML/day and is expected to generate a sludge volume that will be +/-5% of the given volume for 2023. The Ashbridges Bay Treatment Plant is designed to manage these additional solids.

3.3 Chemical Usage

Several chemicals are used during the treatment process at the plant. Table 3 outlines the chemical consumption for the current and previous year. Costs listed exclude applicable taxes.

Table 3: Chemical Usage Summary

| Process | Chemical | | 2023 | 2022 | 2021 |
|--------------------|-------------------------------|-------------------------------|--------------|-------------|-------------|
| Phosphorus Removal | Ferrous Chloride as Fe | Dosage (mg/L) | 12.06 | 12.93 | 11.73 |
| | | Consumption (tonnes) | 75.79 | 72.69 | 71.62 |
| | | Cost (\$) | \$93,737.09 | \$83,886.87 | \$79,444.11 |
| Disinfection | Sodium Hypochlorite (12% w/v) | Dosage (mg/L) | 2.44 | 2.00 | 1.92 |
| | | Consumption (m ³) | 109.09 | 97.43 | 102.55 |
| | | Cost (\$) | \$114,780.85 | \$15,688.54 | \$17,416.50 |
| Dechlorination | Sodium Bisulfite (38% w/w) | Dosage (mg/L) | 4.01 | 4.02 | 3.93 |
| | | Consumption (tonnes) | 55.79 | 65.37 | 66.55 |
| | | Cost (\$) | \$33,211.57 | \$15,232.50 | \$14,871.60 |

3.4 Bypasses, Spills, and Abnormal Discharge Events

3.4.1 Bypasses

Treatment bypasses are not required or possible with the current plant configuration. The inflow to the plant is controlled.

3.4.2 Spills

There were no reportable spill events at the North Toronto Treatment Plant in 2023.

3.4.3 Abnormal Discharge Events

There were no abnormal discharge events at the North Toronto Treatment Plant in 2023.

3.5 Complaints

There were no odour or noise complaints received at the North Toronto Treatment Plant in 2023.

3.6 MECP Procedures F-5-1 and F-5-5

Condition 11 (4)(m) of the ECA describes requirements to summarize efforts to achieve conformance with MECP Procedure F-5-1 – Determination of Treatment Requirements for Municipal and Private Sewage Works and MECP Procedure F-5-5 – Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer Systems.

In reference to procedure F-5-1, the plant utilizes the activated sludge treatment process to meet secondary or equivalent treatment and consistently achieves effluent quality at or beyond the objectives outlined in the ECA.

Furthermore, Toronto Water is committed to efforts to control the frequency and volume of CSO discharges and bypass events referenced in Procedure F-5-5. The City is currently implementing a 25 year plan related to its Wet Weather Flow Master Plan (WWFMP), which aims to reduce and eliminate the adverse impacts of storm water runoff and CSO discharges associated with wet weather events. It is expected that the on-going implementation of capital projects related to the City's WWFMP will eliminate CSO discharges and ultimately improve plant effluent.

3.7 Effluent Quality Assurance and Control Measures

Analytical tests to monitor required parameters are performed by the Toronto Water Laboratory which is accredited to ISO/IEC 17025 by Canadian Association for Laboratory Accreditation Inc. Plant operation and performance is monitored by licensed operators as well as by the facility management team. Standard Operation Procedures, emergency plans, equipment preventative and predictive maintenance, and a network of support staff, help ensure a rapid and effective response to issues, and maintain the high quality of the effluent and bio-solids. An Integrated Quality Management System emphasizing environmental, and health and safety objectives is also in the early implementation stages across Toronto Water and is expected to further standardize facility operations and improve facility performance.

4 CAPITAL PROJECTS

Under Toronto Water's capital program, the North Toronto Treatment Plant commenced or continued with the capital works projects and studies listed in Table 4 in 2023.

Table 4: Capital Projects

| Project Name | Project Description | Project Stage (Dec 31, 2023) | Estimated Completion |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------|
| TNT Process Upgrade | Various process upgrades to secondary treatment systems, supplementary treatment systems, and electrical systems listed in the proposed works in the ECA. | Construction | 2024 |
| TNT Server Room | Construction of a new server room. | Construction | 2024 |

5 MAINTENANCE

Staff from the North Toronto Plant performed a variety of scheduled, preventative, predictive and reactive maintenance on a diverse spectrum of equipment. Equipment availability and reliability ensures operational requirements are achieved.

The annual calibration and maintenance records of flow meters and on-line analysers for regulated parameters was completed in 2023 and found to be within acceptable limits. A summary of effluent monitoring equipment calibration and maintenance performed in 2023 is included in Table 5.

Table 5: Summary of Regulated Monitoring Equipment Calibration and Maintenance

| Calibration and/or Maintenance Record | Completion Date |
|-----------------------------------------------------------------------|--------------------------------|
| Final Effluent pH and Temperature Meter - Calibration | Daily |
| Final Effluent Flow Meter - TNT-DCL-FIT-0002 - Calibration | September 7, 2023 |
| Final Effluent ORP Sensor – TNT-DCL-AIT-0002 – Calibration | September 7, 2023 |
| Residual Sulphite Meter - TNT-DCL-AIT-0001 - Calibration | September 7, 2023 |
| Total Residual Chlorine Benchtop Analyzer - HACH DR3900 - Calibration | December 5, 2023 |
| Chlorine Contact Tank 1 ORP Sensor – TNT-DIS-AIT-0101 - Calibration | September 7, 2023 |
| Chlorine Contact Tank 2 ORP Sensor – TNT-DIS-AIT-0201 - Calibration | September 7, 2023 |
| Influent Autosampler – TNT-PLT-SP-0001 - Verification | Jan 13, Apr 14, Jul 12, Oct 19 |
| Final Effluent Autosampler – TNT-FT-SP-0003 – Verification | Jan 13, Apr 14, Jul 12, Oct 19 |

In 2023, there was a total of 3218 work orders completed; refer to Appendix F for a summary of maintenance activities as per Conditions 11(4)(e) of the ECA. None of the maintenance activities undertaken at the plant fell under Limited Operational Flexibility.

6 UTILITIES

A summary of monthly utility consumption for the previous three years at the North Toronto Treatment Plant is provided in Figure 1. Table 6 below summarizes the total cost and average unit cost for water, and hydro. Total annual consumption for potable water and hydro was 107,892 m³ and 2.32 M kWh, respectively.

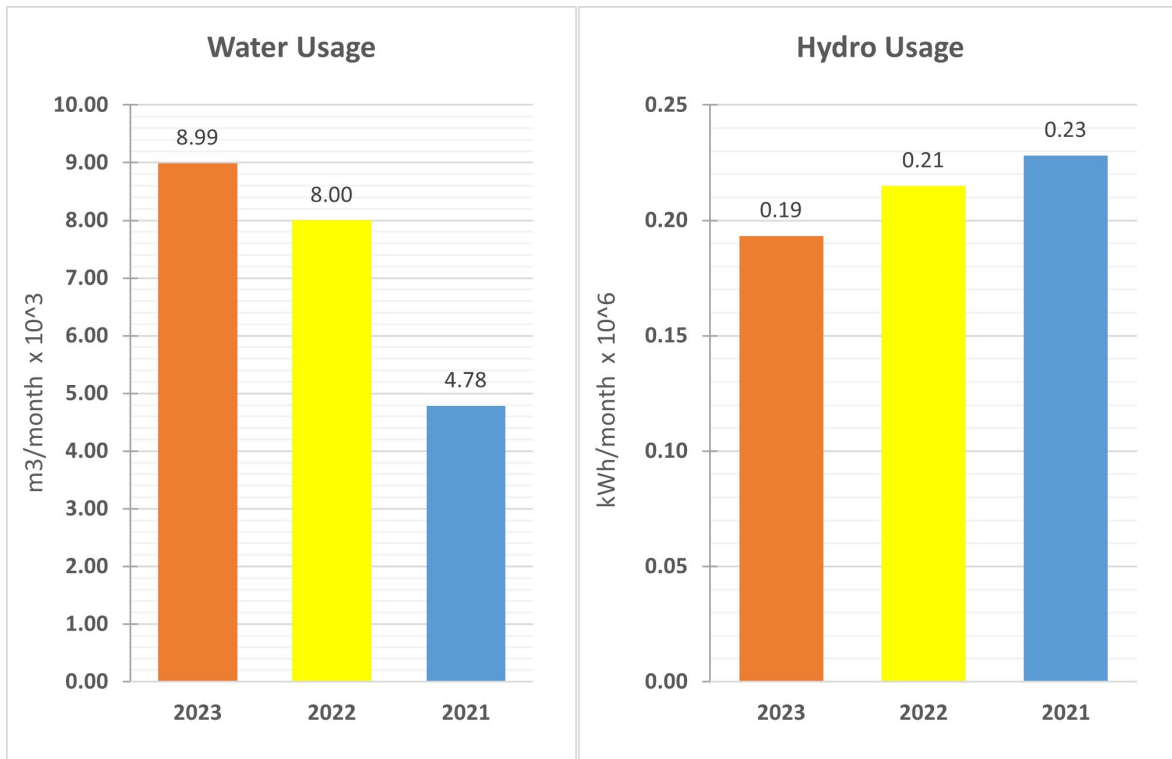


Figure 1: Monthly Utility Consumption (Water, Hydro)

Table 6: Average Unit and Total Utility Cost

| Utility | 2023 | 2022 | 2021 |
|----------------------------|--------------|--------------|--------------|
| Water Unit Cost (\$/m³) | \$4.62 | \$4.48 | \$4.35 |
| Water Total Cost (\$/year) | \$498,146.28 | \$430,207.33 | \$249,873.73 |
| Hydro Unit Cost (\$/kWh) | \$0.13 | \$0.13 | \$0.14 |
| Hydro Total Cost (\$/year) | \$310,924.90 | \$332,141.38 | \$372,084.59 |

7 ADMINISTRATION

7.1 Operations and Maintenance Costs

The 2023 plant direct operational costs are broken down into five categories: Salaries and Benefits, Materials and Supplies, New Equipment, Services and Rents, and Inter-Divisional Charges. Materials and Supplies is further segregated into Utilities, Machine & Equipment Parts, Chemicals and Other Materials and Supplies. A breakdown of 2023, 2022 and 2021 annual operations and maintenance costs is illustrated in Figure 2. Overall, operational costs increased by 12.9 % from 2022. Approximately 6% of this increase was due to higher chemical costs.

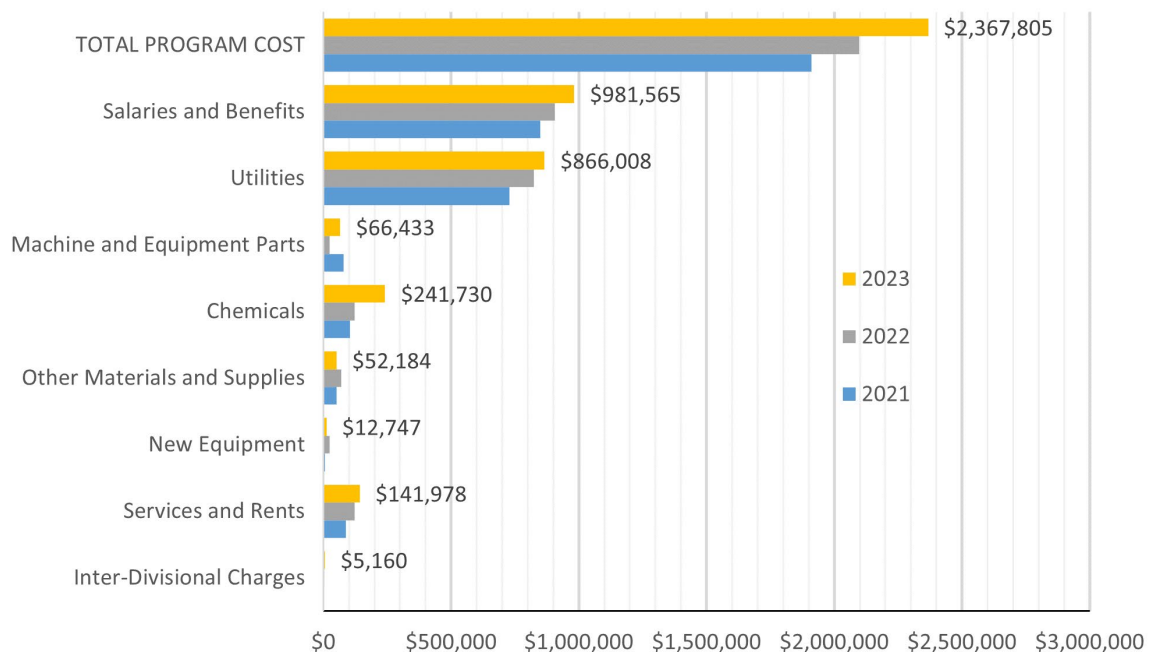


Figure 2: Operations and Maintenance Cost Breakdown

7.2 Human Resources

Plant Staffing at the North Toronto Treatment Plant in 2023 is shown in Table 7.

Table 7: Plant Staffing

| Position | Number of FTE ¹ |
|----------------------------------------------------|----------------------------|
| Area Supervisor, Process Operation and Maintenance | 1 |
| Electrical Instrumentation Control Technician | 1 |
| Plant Technician - Wastewater | 3 |
| Industrial Millwright | 2 |
| Wastewater Treatment Plant Worker | 1 |
| Developmental Plant Technician | 2 |
| Total FTE Positions | 10 |

¹ FTE refers to Full Time Equivalent staff. Seasonal staff are considered 0.5 FTE staff.

7.3 Occupational Health & Safety

Continuous efforts are made to ensure a safe working environment at the North Toronto Treatment Plant. The Joint Health and Safety Committee (JHSC) assists management in resolving issues through regular meetings and monthly workplace inspections. Plant Health and Safety statistics for the North Toronto Treatment Plant are included in Figure 3.

As of December 31, 2023, there was one lost time incident and seven lost time days in 2023 due to work related injuries.

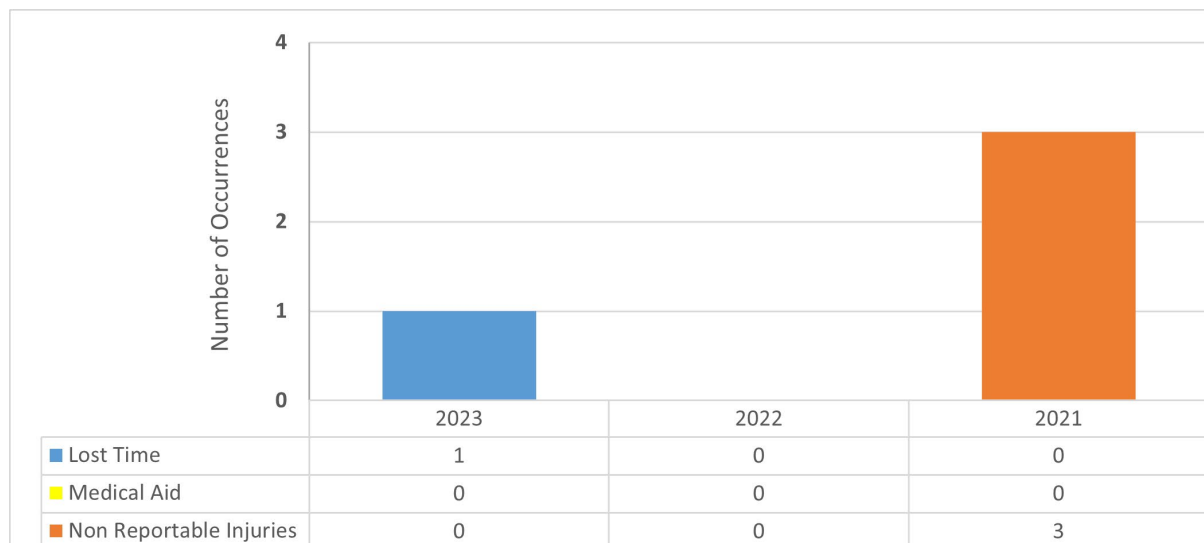


Figure 3: North Toronto Treatment Plant Health & Safety Injury Summary

7.4 Staff Training and Development

The Strategic Planning and Workforce Development unit of Toronto Water facilitates a comprehensive training program for all staff.

Training attended by North Toronto Treatment Plant operations and skilled trades staff in 2023 includes the list of courses shown in Appendix E. Some of these courses were eligible for Continuing Education Units (CEU's) as specified by the Ontario Water and Wastewater Certification Office. Additional training related to the start-up and commissioning of new equipment/systems installed as part of the capital program was provided as required.

7.5 Utility Operator Certification

Toronto Water trains and provides the required resources to ensure all operators achieve and maintain Class IV certifications. In addition, all skilled trade positions are required to achieve and maintain a Class I operator's licence. As part of this initiative, general operational/process training was delivered in order to prepare staff for any certification examination that they need to write. Table 8 summarizes the status of operator certification at the North Toronto Treatment Plant in 2023.

Table 8: Wastewater Treatment Certificates

| Class Level | Number of Licenses |
|--------------|--------------------|
| Class IV | 2 |
| Class III | 2 |
| Class II | 1 |
| Class I | 1 |
| O.I.T. | 2 |
| Total | 8 |

7.6 MECP Correspondence

There were no orders issued by the Ministry of the Environment, Conservation and Parks (MECP).

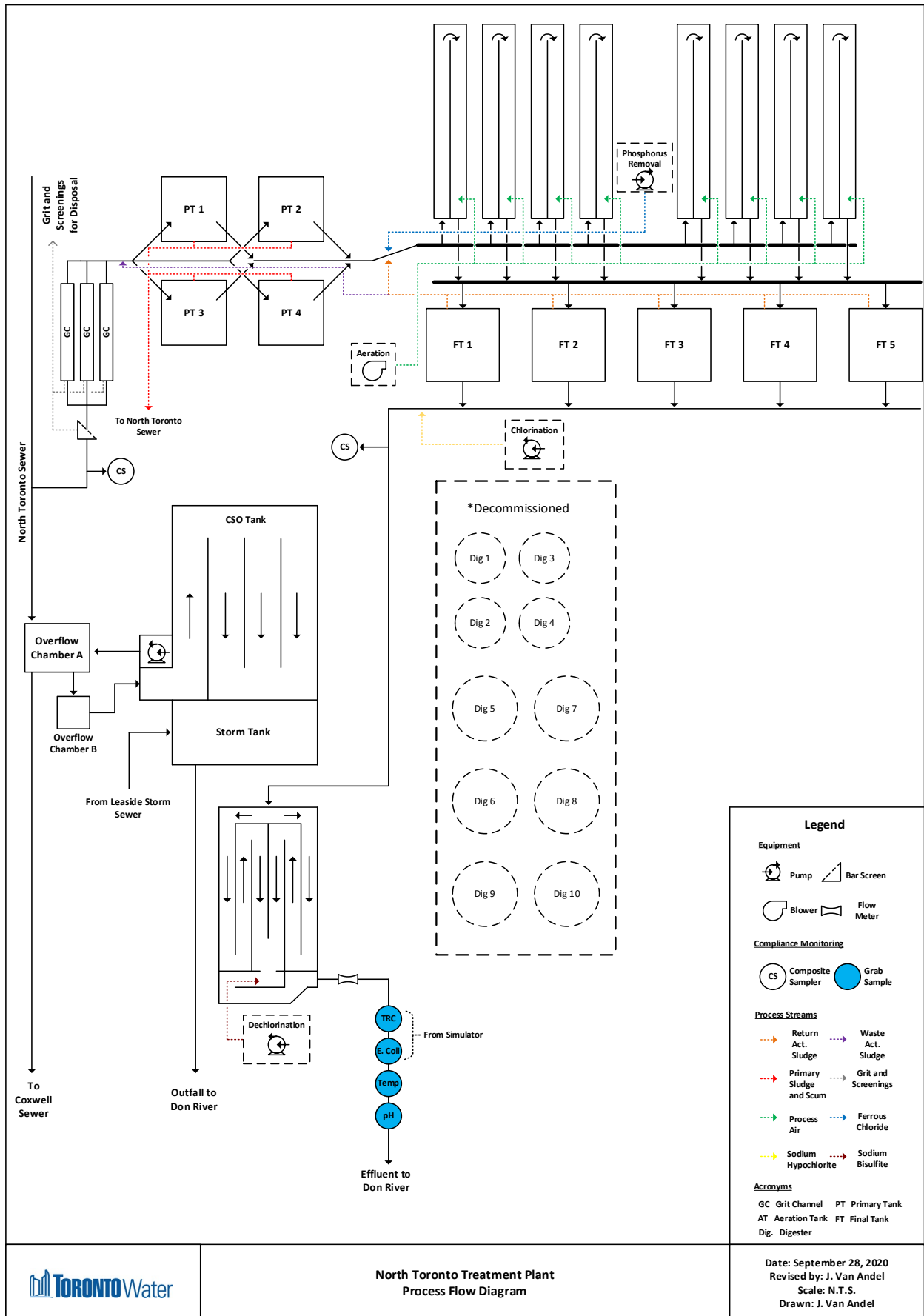
Table 9 summarizes the correspondence submitted to the MECP for the North Toronto Treatment Plant in 2023.

Table 9: Correspondence submitted to the MECP

| Date | Type | Description | Resolution | Resolution Date |
|------------------------------------------------|------|---------------------------|------------|-----------------|
| Notification on Construction of Proposed Works | | | | |
| N/A | N/A | No notifications in 2023. | N/A | N/A |
| MECP Inspection | | | | |
| N/A | N/A | No inspections in 2023. | N/A | N/A |

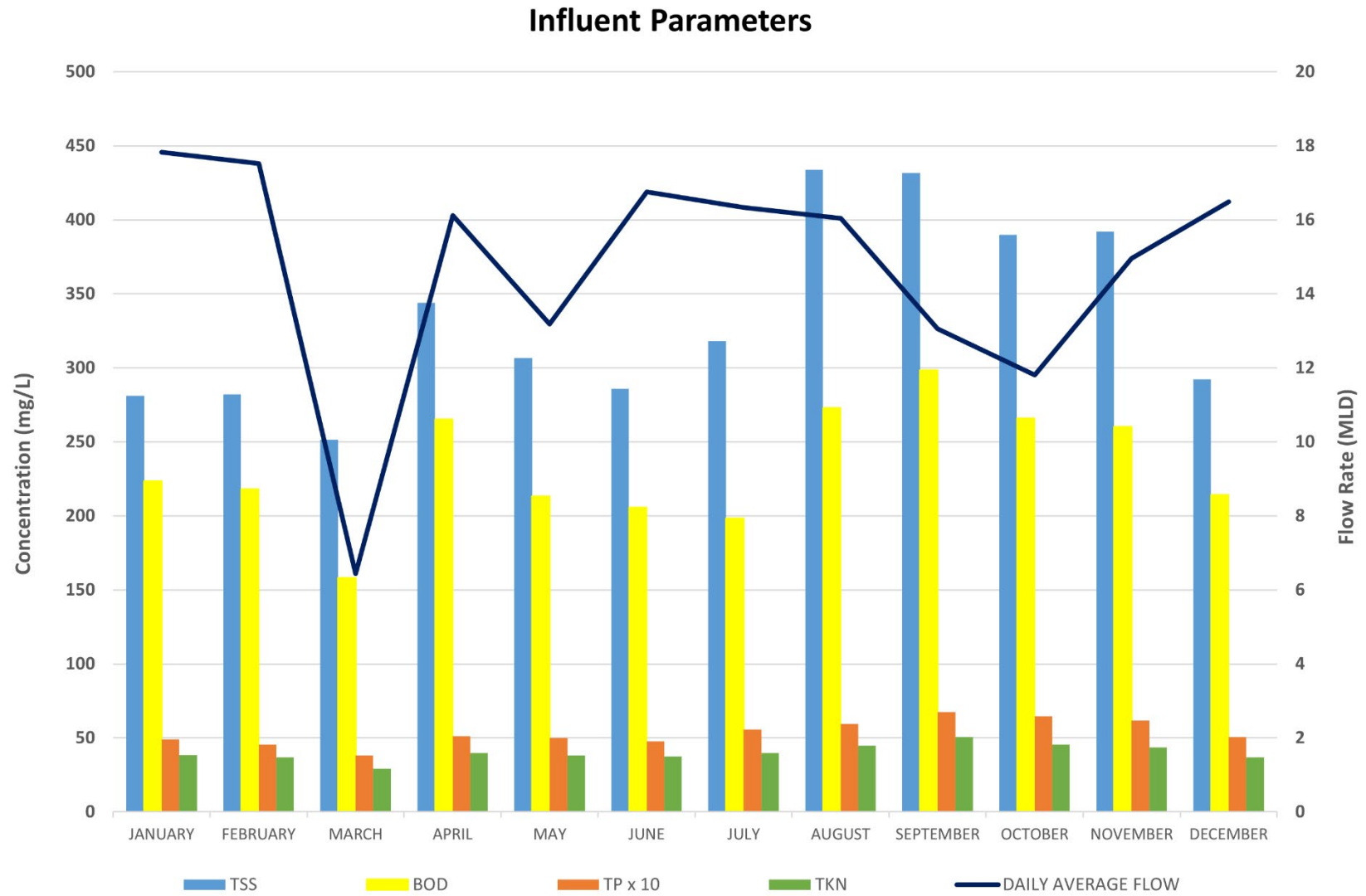
APPENDIX A – Plant Schematic

APPENDIX A – Plant Schematic



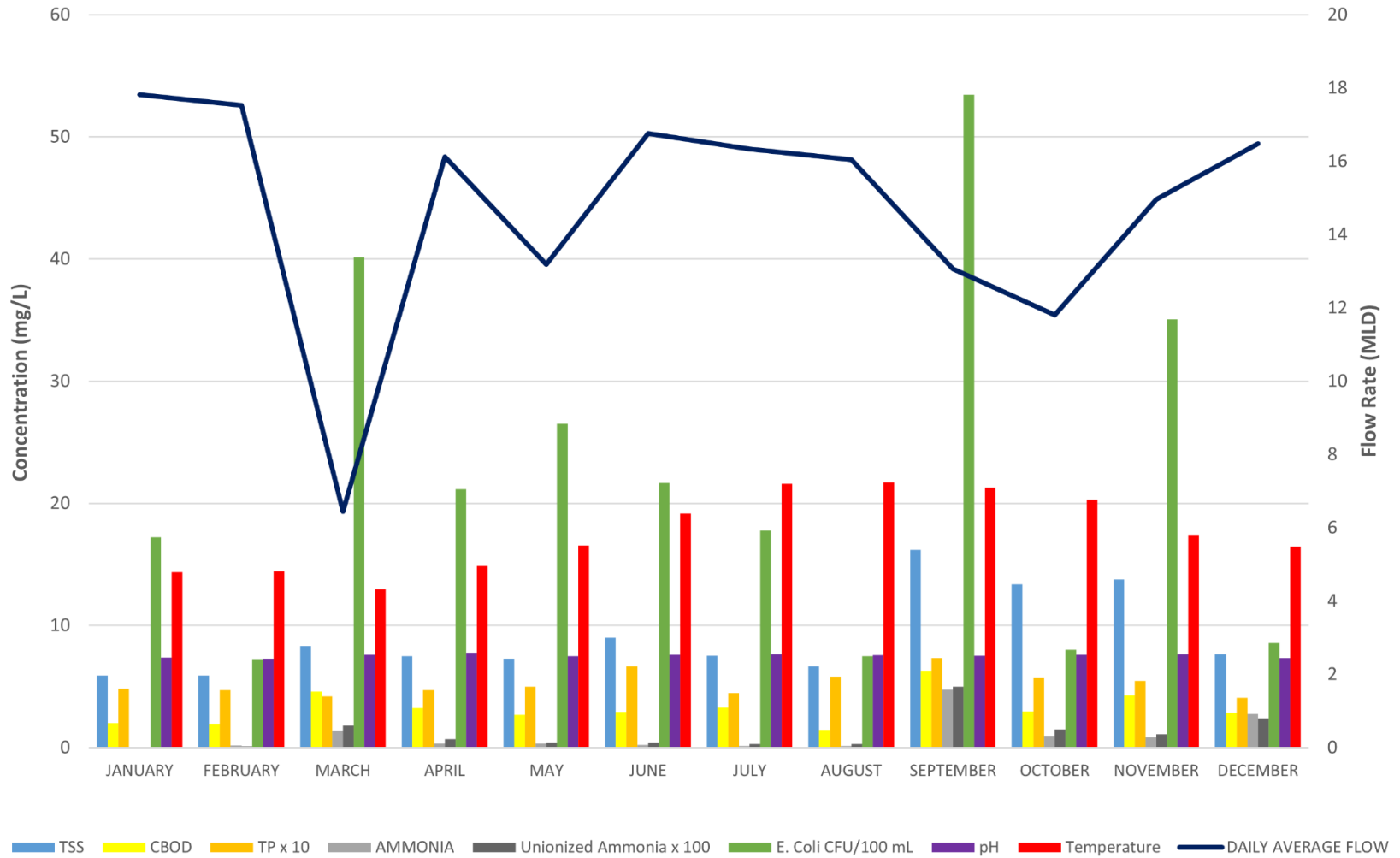
APPENDIX B – Influent and Effluent 2023 Performance Chart

APPENDIX B – Influent and Effluent 2023 Performance Chart



APPENDIX B – Influent and Effluent 2023 Performance Chart

Effluent Parameters



APPENDIX C – Historical Performance Data

APPENDIX C – Historical Performance Data

| | Units | 2023 | 2022 | 2021 | 2020 | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 |
|-------------------------------------------------------------|-------------------------------------------|-------|-------|-------|-------|-------|-------|---------|---------|---------|---------|-------|-------|
| Influent Parameters | | | | | | | | | | | | | |
| Flow | ML/day | 14.7 | 16.0 | 17.5 | 17.4 | 21.5 | 18.8 | 15.7 | 17.6 | 20.0 | 23.2 | 24.4 | 26.3 |
| Total Annual Flow | ML | 5358 | 5838 | 6380 | 6359 | 7,851 | 6,872 | 5,731 | 6,422 | 7,281 | 8,481 | 8,703 | 9,586 |
| Total Suspended Solids (TSS) | mg/L | 334.1 | 226.0 | 240.7 | 356.6 | 258.9 | 321.2 | 276.0 | 286.0 | 268.0 | 229.2 | 212.4 | 213.4 |
| Biochemical Oxygen Demand (BOD ₅) | mg/L | 232.9 | 182.7 | 196.3 | 260.7 | 182.5 | 204.4 | 192.0 | 197.0 | 206.0 | 169.1 | 148.6 | 144.7 |
| Total Phosphorus (TP) | mg/L | 5.3 | 4.7 | 4.8 | 5.7 | 4.8 | 5.4 | 5.2 | 5.5 | 5.5 | 4.4 | 4.0 | 4.2 |
| Total Kjeldahl Nitrogen (TKN) | mg/L | 40.1 | 36.7 | 38.1 | 42.9 | 39.1 | 40.1 | 40.5 | 41.1 | 38.8 | 34.5 | 35.1 | 38.1 |
| Preliminary Treatment | | | | | | | | | | | | | |
| Grit and Screenings | kg/day | 165.9 | 169.0 | 290.6 | 231.7 | 296.4 | 290.8 | 295 | 306.6 | 396.4 | 302.9 | 259.4 | 228.6 |
| Primary Treatment | | | | | | | | | | | | | |
| TSS | mg/L | 96.7 | 125.9 | 117.2 | 107.9 | 101.7 | 102.5 | 86.0 | 100.0 | 116.0 | 106.4 | 106.2 | 172.5 |
| Carbonaceous Biochemical Oxygen Demand (cBOD ₅) | mg/L | 87.3 | 93.7 | 91.4 | 92.1 | 70.9 | 85.0 | 69.0 | 89.0 | 89.0 | 73.5 | 82.1 | 90.3 |
| Secondary Treatment | | | | | | | | | | | | | |
| Aeration Loading | kg CBOD ₅ /m ³ .day | 0.13 | 0.15 | 0.16 | 0.16 | 0.15 | 0.16 | 0.11 | 0.15 | 0.17 | 0.17 | 0.19 | 0.16 |
| Mixed Liquor Suspended Solids | mg/L | 2561 | 2442 | 2258 | 2353 | 2,228 | 2,397 | 2,351 | 2,439 | 2,317 | 2,434 | 2,512 | 2,274 |
| Final Effluent | | | | | | | | | | | | | |
| Final Effluent Daily Average Flow | ML/day | 14.7 | 16.0 | 17.5 | 17.4 | 21.5 | 18.8 | 15.7 | 17.5 | 19.9 | 23.2 | 24.3 | 26.2 |
| TSS | mg/L | 9.1 | 6.7 | 7.5 | 7.0 | 5.8 | 6.6 | 3.0 | 3.0 | 3.6 | 4.2 | 4.9 | 6.3 |
| TSS Loading Rate | kg/day | 133.5 | 108.0 | 131.6 | 121.4 | 124.4 | 123.2 | 52.7 | 52.3 | 71.2 | 99.3 | 120.1 | 169.1 |
| cBOD ₅ | mg/L | 3.2 | 3.1 | 3.2 | 2.8 | 3.6 | 3.1 | 2.0 | 2.0 | 2.2 | 2.4 | 2.9 | 2.6 |
| cBOD ₅ Loading Rate | kg/day | 47.1 | 49.7 | 56.5 | 48.2 | 78.2 | 57.6 | 26.5 | 31.1 | 42.9 | 55.9 | 73.8 | 68.1 |
| TP | mg/L | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.5 | 0.7 | 0.7 | 0.4 | 0.4 | 0.5 |
| TP Loading Rate | kg/day | 7.7 | 7.9 | 10.1 | 10.6 | 11.9 | 11.0 | 8.5 | 12.1 | 13.4 | 9.9 | 9.0 | 12.2 |
| Escherichia Coli (E. Coli) | CFU/100 mL | 22 | 13 | 13 | 16 | 13 | 11 | 5 | 11 | 9 | 14 | 6 | 9 |
| pH | - | 7.5 | 7.2 | 7.0 | 7.2 | 7.1 | 7.1 | 7.3 | 7.1 | 7.4 | 7.6 | 7.4 | 7.3 |
| Total Chlorine Residual | SBS (P)/mg/L | 0.012 | 0.014 | 0.014 | 0.009 | 0.011 | * | SBS (P) | SBS (P) | SBS (P) | SBS (P) | N/A | N/A |

APPENDIX C – Historical Performance Data

| | Units | 2023 | 2022 | 2021 | 2020 | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 |
|--------------------------------------------------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Total Kjeldahl Nitrogen (TKN) | mg/L | 1.9 | 4.4 | 3.3 | 2.8 | 5.6 | 6.7 | 2.1 | 1.7 | 4.0 | 11.4 | 5.1 | 7.7 |
| Total Ammonia Nitrogen | mg/L | 1.0 | 3.4 | 2.8 | 2.2 | 5.3 | 6.0 | 1.5 | 0.9 | 3.2 | 10.0 | 3.7 | 6.8 |
| Unionized Ammonia | mg/L | 0.012 | 0.019 | 0.011 | 0.012 | 0.028 | 0.038 | 0.010 | 0.007 | 0.038 | 0.105 | 0.040 | 0.020 |
| Nitrate +Nitrite | mg/L | 19.4 | 14.6 | 15.3 | 15.8 | 11.7 | 10.5 | 15.7 | 13.9 | 11.7 | 6.0 | 11.0 | 7.7 |
| Temperature | degrees Celsius | 18 | 18 | 19 | 18 | 17 | 18 | 17 | 18 | - | - | - | - |
| Solids Handling | | | | | | | | | | | | | |
| Sludge to Ashbridges Bay Treatment Plant (ABTP) – Flow | ML/day | 0.56 | 0.46 | 0.55 | 0.45 | 0.49 | 0.46 | 0.40 | 0.48 | 0.32 | 0.30 | 0.30 | 0.31 |
| Sludge to ABTP – Total Solids (TS) | % | 0.55 | 0.94 | 0.89 | 0.91 | 1.00 | 0.92 | 0.97 | 0.96 | 1.60 | 1.40 | 1.40 | 1.60 |

*From January to April 2018 SBS presence was confirmed; from May to December 2018 post De-Chlorination TRC was measured

APPENDIX D – Influent and Effluent Metal Concentrations

APPENDIX D – Influent and Effluent Metal Concentrations

Influent (Daily Composite tested once/month for metals)

| Parameter Units | Arsenic mg/L | Cadmium mg/L | Chromium mg/L | Cobalt mg/L | Copper mg/L | Iron mg/L | Lead mg/L | Manganese mg/L | Mercury mg/L | Nickel mg/L | Zinc mg/L |
|-----------------------|-----------------|-----------------|------------------|----------------|----------------|--------------|----------------|-------------------|-----------------|----------------|--------------|
| January | *0.005 | *0.002 | 0.00467 | *0.002 | 0.095 | 0.949 | 0.00511 | 0.043 | *0.00005 | *0.0025 | 0.114 |
| February | *0.005 | *0.002 | *0.002 | *0.002 | 0.0895 | 0.861 | 0.00544 | 0.0418 | *0.00005 | *0.0025 | 0.11 |
| March | *0.005 | *0.002 | *0.002 | *0.002 | 0.0972 | 0.977 | *0.005 | 0.0425 | *0.00005 | *0.0025 | 0.109 |
| April | *0.005 | *0.002 | *0.002 | *0.002 | 0.113 | 1.02 | 0.00545 | 0.0485 | *0.00005 | *0.0025 | 0.138 |
| May | *0.005 | *0.002 | *0.002 | *0.002 | 0.102 | 0.856 | *0.005 | 0.0483 | *0.00005 | *0.0025 | 0.132 |
| June | *0.005 | *0.002 | *0.002 | *0.002 | 0.0816 | 0.712 | *0.005 | 0.0413 | *0.00005 | *0.0025 | 0.113 |
| July | *0.005 | *0.002 | *0.002 | *0.002 | 0.0816 | 0.712 | *0.005 | 0.0413 | *0.00005 | *0.0025 | 0.113 |
| August | *0.005 | *0.002 | 0.00463 | *0.002 | 0.112 | 1.39 | 0.006 | 0.0508 | 0.000061 | *0.0025 | 0.149 |
| September | *0.005 | *0.002 | *0.002 | *0.002 | 0.146 | 1.06 | 0.00521 | 0.0453 | 0.000518 | *0.0025 | 0.189 |
| October | *0.005 | *0.002 | *0.002 | *0.002 | 0.124 | 1.2 | *0.005 | 0.0464 | 0.000163 | *0.0025 | 0.167 |
| November | *0.005 | *0.002 | *0.002 | *0.002 | 0.108 | 0.87 | *0.005 | 0.041 | *0.00005 | *0.0025 | 0.137 |
| December | *0.005 | *0.002 | *0.002 | *0.002 | 0.0832 | 0.771 | *0.005 | 0.0398 | 0.00017 | *0.0025 | 0.104 |
| Annual Average | 0.005 | 0.002 | 0.00244 | 0.002 | 0.103 | 0.948 | 0.00518 | 0.0442 | 0.000109 | 0.0025 | 0.131 |

Values in red with an asterisk prefix are half the MDL

APPENDIX D – Influent and Effluent Metal Concentrations

Final Effluent (Daily Composite tested once/month for metals)

| Parameter Units | Arsenic mg/L | Cadmium mg/L | Chromium mg/L | Cobalt mg/L | Copper mg/L | Iron mg/L | Lead mg/L | Manganese mg/L | Mercury mg/L | Nickel mg/L | Zinc mg/L |
|-----------------------|-----------------|-----------------|------------------|----------------|----------------|--------------|---------------|-------------------|-----------------|----------------|---------------|
| January | *0.005 | *0.002 | *0.002 | *0.002 | 0.0169 | 0.639 | *0.0025 | 0.0357 | *0.00005 | *0.0025 | 0.0366 |
| February | *0.005 | *0.002 | *0.002 | *0.002 | 0.015 | 0.452 | *0.0025 | 0.0524 | *0.00005 | *0.0025 | 0.0359 |
| March | *0.005 | *0.002 | *0.002 | *0.002 | 0.0203 | 0.856 | *0.0025 | 0.0672 | *0.00005 | *0.0025 | 0.0395 |
| April | *0.005 | *0.002 | *0.002 | *0.002 | 0.0172 | 0.651 | *0.0025 | 0.0552 | *0.00005 | *0.0025 | 0.0441 |
| May | *0.005 | *0.002 | *0.002 | *0.002 | 0.0138 | 0.554 | *0.0025 | 0.0642 | *0.00005 | *0.0025 | 0.0325 |
| June | *0.005 | *0.002 | *0.002 | *0.002 | 0.0146 | 0.535 | *0.0025 | 0.0376 | *0.00005 | *0.0025 | 0.0302 |
| July | *0.005 | *0.002 | *0.002 | *0.002 | 0.0146 | 0.535 | *0.0025 | 0.0376 | *0.00005 | *0.0025 | 0.0302 |
| August | *0.005 | *0.002 | *0.002 | *0.002 | 0.021 | 0.449 | *0.0025 | 0.0166 | *0.00005 | *0.0025 | 0.0327 |
| September | *0.005 | *0.002 | *0.002 | *0.002 | 0.0279 | 0.986 | *0.0025 | 0.0396 | *0.00005 | *0.0025 | 0.0387 |
| October | *0.005 | *0.002 | *0.002 | *0.002 | 0.0463 | 1.66 | *0.0025 | 0.151 | *0.00005 | 0.00676 | 0.0575 |
| November | *0.005 | *0.002 | *0.002 | *0.002 | 0.0267 | 1.2 | *0.0025 | 0.0333 | *0.00005 | *0.0025 | 0.0334 |
| December | *0.005 | *0.002 | *0.002 | *0.002 | 0.0212 | 0.562 | *0.0025 | 0.0689 | *0.00005 | *0.0025 | 0.0331 |
| Annual Average | 0.005 | 0.002 | 0.002 | 0.002 | 0.0213 | 0.757 | 0.0025 | 0.0549 | 0.00005 | 0.00286 | 0.0370 |

Values in red with an asterisk prefix are half the MDL

APPENDIX E – Staff Training Courses

Training attended by North Toronto Treatment Plant operations and skilled trades staff in 2023 includes the list of courses below.

Technical and Health and Safety Training:

- Air Quality and Your Health
- Confined Space Entry and Rescue
- Distracted Driving
- Equipment Safety - Inspect It Before You Use It
- Ergonomics - Safe Lifting
- Ergonomics Injuries - Simple Precautions
- Fundamentals of Ladder Safety Awareness
- G Permit Vehicle Operator Orientation
- Health and Safety Competency for Supervisors
- Heat Stress
- Hybrid Work – Fire Safety Review
- Joint Health and Safety Committee (JHSC) Certification Training
- Mobile Elevating Work Platforms - Scissor Lift & Zoom Boom
- Nutrient Removal System
- Operational Imperatives
- Preventing Back Injuries
- Preventing Struck-By / Contact Injuries
- Psychosocial Program, Risk Assessments & Mental Health in our Workplace
- Right to Refuse Unsafe Work
- SCADA Cybersecurity Training
- Situational Awareness
- Toronto Water Emergency Plan Awareness
- Worker Health and Safety Awareness in 4 Steps

Other Training:

- Accessibility 101
- City Benefit and Pension Seminars
- Civility in the Workplace
- Cyber Awareness Refresher Training

- Cyber Security - Choose Your Own Adventure: Curse of the Mummy's Data
- Cyber Security - Choose Your Own Adventure: Deep Space Danger
- Cyber Security - Choose Your Own Adventure: League of Cyberheroes
- Cyber Security - Choose Your Own Adventure: Plunge Into Peril
- Cyber Security - Choose Your Own Adventure: Yeti Escape
- Cyber Security - Choose Your Own Adventure: Zombie Invasion
- Executive Cyber Security Awareness Program Curriculum
- Grievances, Arbitration, And Discipline
- Human Rights 101
- Introduction to Indigenous Learning
- Just the Facts: Data Destruction
- Just the Facts: Insider Threats
- Just the Facts: Travel Security
- Let's Talk About Allyship
- Let's Talk About Bias
- Let's Talk About Colonialism
- Let's Talk About Equity
- Let's Talk About Privilege
- Let's Talk About Systemic Injustice
- Performance Management in a Unionized Environment
- The Toronto Public Service By-law eLearning

APPENDIX F – Maintenance Activities

The following maintenance activities on major structures and equipment at North Toronto Treatment Plant were completed in 2023:

Monthly Activities

- Test Standby WAS and RAS pumps
- Lubricate WAS and RAS pump coupling, bearing and motor bearing
- Lubricate bridge rotating collector
- Inspect RAS and WAS pump gland packing water seal
- Inspect boilers
- Inspect UPS battery charger and battery
- Clean primary wet well level transmitter
- Clean drop shaft influent screens
- Regular maintenance of aeration blower actuator valve

Quarterly Activities

- Calibrate the CI/ORP analyzer sample probe
- Inspect roof air handler unit fan and motor bearings, damper links, filters, drive belts, shelves and structure
- Inspect burner furnace oil filter
- Exercise the furnace oil manual valves
- Exercise the hot water primary loop manual valves
- Test the sump pump float switch
- Verification and testing of autosamplers
- Test the sump pit submersible pump
- Verify the operation of Low Water Level cut out trip circuit
- Lubricate the drainage pump shaft and motor bearings
- Inspect and exercise the manual sodium hypochlorite valve
- Inspect and exercise the manual sodium bisulphite valves
- Inspect final clarifiers motor bearing
- Inspect Furnace oil feed pump and motor bearings
- Inspect sludge pump and sludge pump motor bearings

Biannual Activities

- Test sodium bisulphite/hypochlorite tank spill containment limit switch test
- Lubricate bar screen channel inlet and discharge sluice gate stem
- Inspect, clean, and lubricate belt driven roof exhaust fan bearings

- Lubricate circular collector torque switch articulated arm
- Inspect and calibrate aeration dissolved oxygen analyzer transmitter
- Inspect and calibrate aeration flow transmitter
- Inspect and pressure match aeration pressure transmitter
- Clean chemical dosing pump diaphragm and valves
- Clean and test wet well low/high level float

Annual Activities

- Exercise and check final clarifiers distribution channel gate valves
- Exercise secondary gate valves
- Exercise drainage pump system isolation valve
- Replace hypochlorite and sulphite analyzer probe
- Load and performance test on boiler after annual maintenance outage and during start-up
- Wet well level transmitter functional test
- Functional test of the HVAC unit high supply air temperature shutdown and alarm circuit
- Circular collector shutdown torque switch functional test
- Lubricate hot water boiler primary loop gate valves
- Lubricate primary tank inlet/scum outlet sluice gate valve stem
- Lubricate sluice gate and check oil of actuator
- Test and inspect backflow preventer
- Inspect bridge rotating collector
- Inspect, change grease, and lubricate bearings on primary heating system recirculating pump drive coupling
- Inspect motor/pump shaft sheave
- Inspect and clean heater Fan Motor, sheaves and belts
- Inspect WAS and RAS pump/motor drive belts
- Inspect final clarifiers motor sheave/drive belts
- Inspect boiler recirculation pumps mechanical seals
- Clean air handling unit heating coil
- Maintain aeration tank actuated air valve