TORONTO Water

HUMBER TREATMENT PLANT

2022 Annual Report

March 31, 2023

EXECUTIVE SUMMARY

The Humber Treatment Plant (HTP) is one of four wastewater treatment facilities operated by the City of Toronto. This facility, located at 130 The Queensway, has a rated capacity of 473,000 m^3/day or 473 ML/day, and serves an equivalent population of approximately 662,000. Humber Treatment Plant discharges into Lake Ontario and operates under Amended Environmental Compliance Approval No. 9032-ABZNYQ, issued on July 21, 2016.

The average daily flow rate in 2022 was 255.6 ML/day. Influent concentrations of Biochemical Oxygen Demand (BOD), Total Phosphorus (TP) and Total Suspended Solids (TSS) averaged 279.4 mg/L, 5.3 mg/L and 386.3 mg/L, respectively.

Humber Treatment Plant achieved the following effluent quality and loading rates in 2022 in comparison to ECA limits:

Parameter	ECA[1]	2022 Final Effluent
Total Suspended Solids (TSS)	25.0 mg/L	10.6
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	25.0 mg/L	6.3
Total Phosphorus (TP)	1.0 mg/L	0.6
Escherichia Coli (E. Coli)[2]	200 CFU/100mL	129
pH	6.0-9.5	6.5
Total Residual Chlorine (TRC) (Dechlorination)	0.02 mg/L	0.02
TP Loading Rate	473.0 kg/day	166

[1] Referenced from Condition 6 and 7 of ECA No. 9032-ABZNYQ, issued on July 21, 2016.

[2] Arithmetic mean of monthly geometric mean data.

The Humber Treatment Plant reported E. coli limit exceedances in July and December as well as TRC exceedances in May and June. These were determined to be a result of observed inconsistencies in sample collection/storage conditions, and analytical procedures, respectively. Corrective measures have since been implemented to mitigate possible non-compliance in the future.

Sludge generated at the Humber Treatment Plant is transferred to the Ashbridges Bay Treatment Plant via the Mid-Toronto Interceptor (MTI) for further treatment and disposal. During 2022, an average of 5, 609 m^3/day of waste activated sludge was removed from the system. Of this, 5, 364 m^3/day was thickened and stabilized prior to transfer and 245 m^3/day was transferred directly. An average of 71.9 dry tonnes of biosolids and waste activated sludge was transferred per day.

Ferrous chloride consumption for phosphorus removal totalled 356.6 tonnes as iron (Fe). There was no polymer consumption for waste activated sludge (WAS) thickening. Total sodium hypochlorite (12% w/v) consumption for disinfection totalled 3139.6 m^3. Sodium Bisulphite (SBS) (38% w/w) consumption for effluent dechlorination totalled 760.9 tonnes.

There were five bypass occurrences in 2022 where each occurrence received preliminary, primary treatment, nutrient removal, as well as disinfection and dechlorination before being blended with fully treated plant effluent and exiting the plant through the plant outfall, upstream of the final effluent sampling point.

The plant continued with various capital projects. Notable projects included: PLC Migration, Secondary Treatment Upgrades, Operations Centre Upgrades, Digesters 2 and 3 Upgrades and Repair, HVAC Upgrades, Primary Pumping and Scum Systems Upgrades, Security Upgrades and Plant Rehabilitation and Services Upgrades. A variety of scheduled, preventative, predictive and reactive maintenance activities was performed, including annual calibration of effluent monitoring equipment.

Total annual consumption of potable water, hydro, and natural gas was 155, 877 m^3, 47 M kWh, and 2.4 M scm, respectively. Direct operating cost for 2022 totalled $17.0 M. In 2022, the Humber Treatment Plant had a staffing compliment of 60 employees. As of December 31st, 2022, there was 17 health and safety incidents and 29 lost time days due to work related injuries in 2022.

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GLOSSARY OF ABREVIATIONS

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
DAF	Dissolved Air Flotation
E. Coli	Escherichia Coli
ECA	Environmental Compliance Approval
Fe	Iron
HTP	Humber Treatment Plant
HRT	Hydraulic Retention Time
kg	kilogram
kWh	Kilowatt-hour
MAC	Monthly Average Concentration
MGMD	Monthly Geometric Mean Concentration
m3	Cubic metre
m3 /day	Cubic metre per day
mg/L	Milligrams per litre
mL	Millilitre
ML	Megalitre (million litres)
MECP	Ministry of the Environment, Conservation and Parks
O/S	Out of Service
Q	Flow Rate
RAS	Return Activated Sludge
SBS	Sodium Bisulphite
scm	Standard Cubic Meters
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 a 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).

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

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

$$Aeration\ Loading = \left(\frac{kg\ cBOD}{m^3\ aeration\ capacity}\right) = \frac{(Q_{Primary\ Effluent} + Q_{RAS}) \times [cBOD_{5_{primary\ effluent}}]}{V_{aeration\ Tanks}}$$

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

1 INTRODUCTION

The Humber 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 130 The Queensway, on the border of the old City of Toronto and former City of Etobicoke near the mouth of the Humber River. This area contains an estimated connected population of 662,000[1]. The Humber Treatment Plant has a rated capacity of 473,000 m^3 per day or 473 ML/day.

Major treatment processes and equipment include screening and grit removal, primary treatment, secondary treatment, phosphorus removal with ferrous chloride, final effluent disinfection using sodium hypochlorite, and final effluent dechlorination using sodium bisulphite. Solids handling processes include stabilization by anaerobic digestion. The solids stabilized in these processes are primary (or raw) sludge as well as waste activated sludge thickened using high speed centrifuges. Treated effluent is discharged to Lake Ontario. Sludge (stabilized and non-thickened waste activated sludge) is transferred to the Ashbridges Bay Treatment Plant for disposal via the Mid-Toronto Interceptor (MTI). Numerous auxiliary systems are required for the proper operation of plant processes and include potable water, process water, HVAC, SCADA, electrical power distribution, natural gas, and instrument air. Odour control is achieved by treating air through biofilters and granular activated carbon (GAC) filters located throughout the plant.

The Ministry of the Environment, Conservation and Parks (MECP) has classified the Humber Treatment Plant as a Class IV wastewater treatment facility under Regulation 129/04. The facility operates under Amended Environmental Compliance Approval No. 9032-ABZNYQ (July 21, 2016).

This report is a summary of plant operations and performance in 2022. Highlights of the report include a discussion of effluent quality and summaries of plant operations and maintenance, chemical and utility consumption, capital projects, operational costs and human resources.

[1] Population estimated by sewershed delineation using 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 regarding the plant process can be found on the City of Toronto website[2].

2.1 Influent

Wastewater from the Queensway Sanitary Trunk Sewer and Humber Sanitary Trunk Sewer flows to the plant to a common influent channel. A portion of the Humber Treatment Plant sewershed consists of combined sanitary and storm sewers, causing plant influent to be sensitive to wet weather events.

2.2 Preliminary Treatment

Raw wastewater enters the Headworks for grit and screenings removal. Bar screens with 12 mm openings remove rags and debris. Ferrous chloride is applied to the distribution conduits to the Grit system for the first stage of phosphorous removal. Grit is removed in grit vortex chambers and aerated grit channels. 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 and lighter solids float to the top. There are 11 Primary Clarification Tanks. Sludge collectors in the tanks sweep the settled sludge, called primary or raw sludge, into sludge hoppers. Floating solids called scum are collected from the top of the water and swept into scum hoppers. The primary sludge and scum is then pumped out for further treatment and the wastewater, called primary effluent, continues onto secondary treatment.

2.4 Secondary Treatment

The primary effluent receives secondary treatment through a conventional, suspended biomass activated sludge process in the Aeration Tanks. The mixed liquor consists of primary effluent mixed with return activated sludge (RAS), which 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 wastewater. Air is supplied to the Aeration Tanks through nine electrically driven blowers. There are a total of

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

eight Aeration Tanks each equipped with fine bubble dome diffusers. Ferrous chloride is applied at the end of the aeration tanks prior to the Final Clarification Tanks for the second and final stage of phosphorous removal.

The mixed liquor from the Aeration Tanks flows to 21 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) and thickened using centrifuges.

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 (dechlorinate) from the wastewater; helping to protect the aquatic environment. The final effluent is discharged to Lake Ontario. The plant uses direct measurement of Total Residual Chlorine (TRC), in the final effluent for monitoring and compliance.

2.6 Solids Handling

Primary sludge and scum, from the Primary Clarification Tanks, is first fed into primary anaerobic digesters. Secondary sludge (WAS), from the Secondary Clarification Tanks, is thickened through centrifugation before it is also fed into primary digesters, where it undergoes the same process as primary sludge. Centrifugation reduces the volume of sludge by separating solids from liquid. The Thickening process consists of seven centrifuges. Unthickened WAS may also be pumped directly to the Ashbridges Bay Treatment Plant via the MTI.

Anaerobic digestion is the biological degradation (stabilization) of organic materials (sludge and scum) in the absence of oxygen – it reduces volume of solids, destroys pathogens and mitigates sludge odour. The process produces digester gas, made up predominantly of methane. This gas is used as a supplementary fuel for plant needs, including process and space heating and the generation of electricity via two cogeneration engines, thereby reducing the plant's operating costs and carbon footprint. The digesters are operated in the mesophilic temperature range (34 – 38^{o}C). The target operating temperature for the digesters is 36^{o}C.

The resulting anaerobically digested sludge (biosolids) is subsequently transferred to the secondary digesters for storage, until it is ultimately transferred to the Ashbridges Bay Treatment Plant via the MTI for further treatment.

3 PROCESS SUMMARY

3.1 Process Parameters

In 2022, the Humber 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. Regulated parameters are highlighted. 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 (mg/L)	E-Coli (count/ 100mL)	pH	
						Min	Max
January	6.9	10.7	0.9	0.01	80	6.4	7.1
February	8.4	14.0	0.5	0.02	134	6.3	7.1
March	8.5	12.5	0.4	0.01	108	6.1	7.1
April	6.4	10.2	0.6	0.01	28	6.1	7.1
May	6.3	10.9	0.8	0.05	37	6.1	7.2
June	6.4	11.0	0.8	0.05	50	6.1	7.6
July	7.0	11.0	0.9	0.00	378	6.1	7.0
August	5.6	11.9	0.8	0.01	40	6.1	7.5
September	4.1	9.2	0.5	0.01	26	6.1	6.6
October	4.8	7.2	0.7	0.02	147	6.1	7.1
November	5.6	9.8	0.6	0.02	104	6.1	7.0
December	5.0	9.0	0.4	0.01	406	6.1	7.0
Annual Average	6.3	10.6	0.6	0.02	129	6.5	
Loading (kg/d) [1]	1597	2713	165.7	N/A	N/A	N/A	
Removal Efficiency[2] *(%)*	97%	97%	88%	N/A	N/A	N/A	
ECA Requirements [3, 4]							
Effluent Objective	AAC: 15.0 mg/L	AAC: 15.0 mg/L	MAC: 0.9 mg/L	MAC: 0 mg/L	MGMD: 150 CFU/100	6.5 - 8.5	
Effluent Limit	AAC: 25.0 mg/L	AAC: 25.0mg/L	MAC: 1.0 mg/L	MAC: 0.02 mg/L	MGMD: 200 CFU/100	6.0 - 9.5	
Average Waste Loading Limit[1]	N/A	N/A	AAL: 473.0 kg/d	N/A	N/A	N/A	

[1] Loading is calculated based on the flow rates as provided in Table 2.

[2] CBOD = 0.8 * BOD assumed for removal efficiency calculations

[3] Referenced from Amended Environmental Compliance Approval No. 9032-ABZNYQ, issued on July 21, 2016.

[4] AAC 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 11 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 averages of process parameters over the past three years are shown in Table 2.

Table 2: Process Summary

Parameter	Units	2022	2021	2020
Influent Parameters				
Flow	ML/day	255.6	249.9	371.5
Total Annual Flow	ML	93,312	91,204	135,952
Total Suspended Solids (TSS)	mg/L	386.3	366.3	308.8
Biological Oxygen Demand (BOD)	mg/L	279.4	287.2	254.8
Total Phosphorus (TP)	mg/L	5.3	5.2	5.0
Preliminary Treatment				
Grit and Screenings	Tonnes/day	2.8	2.9	2.8
Primary Treatment				
TSS	mg/l	105.7	103.6	84.7
cBOD5	mg/L	151.3	162.8	157.2
Secondary Treatment				
Aeration Loading	kg $CBOD^5/m^3$·day	0.42	0.44	0.63
Mixed Liquor Suspended Solids	mg/L	3,734	3,405	3,395
Solids Handling				
Primary Sludge Treated	m^3/day	2,241	2,169	2,577
Primary Sludge TS	%	2.2	2.0	1.4
Primary Sludge TVS	%	73.6	73.5	66.7
WAS to Thickening	m^3/day	5,609	5,011	3,218
WAS transferred to Ashbridges Bay	DT/day	2	4	8
Biosolids Transferred to Ashbridges Bay	DT/day	70	53	60
Biosolids TS	%	2.27	1.75	1.93
WAS SS	mg/L	7,839	8,357	7,824
TWAS TS	%	4.4	3.4	3.4
TWAS TVS	%	79.2	77.6	77.3
TWAS Treated	m^3/day	680	674	545
Volume to Digestion	m^3/day	2921	2,843	3,122
Digester Hydraulic Retention Time	days	13.0	13.3	10.2
Organic Loading to Digesters	TVS/m^3/day	1.9	1.6	1.0
Digester Gas Volume	m^3/day	23,426	27,750	22,793

[1] Flow monitoring is provided by influent flow meters. There are no effluent flow meters due to infrastructure limitations. There is no appreciable difference between influent and effluent flow rates at the Humber Treatment Plant.

Influent flow to the Humber Treatment Plant increased by 2.3% in 2022. The influent quality remained relatively unchanged - TSS increased by 5.5%, while BOD, TP, and TKN decreased by 2.7%, 0.5%, and 5.2% respectively.

Final effluent annual average concentration for cBOD, TSS, and TP were 6.3 mg/L, 10.6 mg/L, and 0.6 mg/L, respectively, and met the compliance limits specified in Condition 7 of the ECA throughout 2022. The final effluent annual average for e. Coli monthly geometric mean density in 2022 was 128 CFU/100 mL. Final effluent pH remained between the range of 6.0 – 9.5 throughout the course of 2022.

The Humber Treatment Plant reported E. coli limit exceedances in July and December as well as TRC exceedances in May and June. These were determined to be a result of observed inconsistencies in sample collection/storage conditions, and analytical procedures, respectively. Efforts to limit future non-compliance have included implementing operational best practices associated with bacteriological samples as well as reviewing TRC analytical procedures with operations staff. In addition, the facility maintains a detailed sampling and analysis plan which has been updated to reflect the operational practices needed to ensure future sampling is representative of the effluent quality at the plant.

The Humber Treatment Plant encountered no chronic operating problems and continued to produce quality effluent through the continued improvement of operations and maintenance of treatment processes.

3.2 Biosolids Management

The flow projections for 2023 do not exceed the plant rated capacity of 473 ML/day and are expected to generate a sludge volume that will be +/- 5% of the volume generated in 2022.

All sludge generated at the Humber Treatment Plant is transferred to the Ashbridges Bay Treatment Plant for further treatment. The sludge generated (WAS and biosolids) during 2022 averaged 3,328 m^3/day (71.9 dry tonnes per day). A summary of the digested sludge parameter analysis is included in Appendix E.

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 years. Costs listed are plus applicable taxes.

Table 3: Chemical Usage and Chemical Cost Summary

Process	Chemical		2022	2021	2020
Phosphorus Removal	Ferrous Chloride as Fe	Dosage as Fe (mg/L)	3.8	3.9	3.3
		Consumption (tonnes as Fe)	356.6	353.4	454.5
		Cost ($)	388,728	385,218	368,140
Disinfection	Sodium Hypochlorite (12% w/v)	Dosage as Cl (mg/L)	4.49	4.49	3.90
		Consumption (m3)	3139.6	3070.3	3971.6
		Cost ($)	636,091	501,076	648,167
Dechlorination	Sodium Bisulphite (38 w/w)	Dosage (mg/L)	3.10	3.26	2.56
		Consumption (tonnes)	760.9	782.6	917.57
		Cost ($)	193,876	169,035	192,597

3.4 Bypasses, Overflows, Spills, and Abnormal Discharge Events

3.4.1 Bypasses

There were 5 secondary bypass events in 2022. The total volume of bypass flow was 53.3 ML, or 0.06 % of the annual flow. 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. All bypass flow received preliminary, primary treatment, nutrient removal, as well as disinfection and dechlorination and exited the plant through the plant outfall upstream of the final effluent sampling point. Each instance was reported to the MECP Spills Action Center and recorded into the plant's monthly report. Secondary bypasses occur due to high wet weather flows that exceed the plant's secondary treatment capacity. Total precipitation in the Toronto area[3] was 728.9 mm in 2022, a 3% decrease from 2021.

Table 4: Bypass Summary

Date	Start of Event	End of Event	Active Duration[1] (hr)	Duration (hr)	Volume (m^3)
February 17, 2022	05:20	20:31	14.9	14.9	191, 452
February 22, 2022	17:58	22:00	4.0	4.0	12, 433

[3] *Adapted from http://climate.weather.gc.ca/historical_data/search_historic_data_e.html, Toronto City Station*

Date	Start of Event	End of Event	Active Duration[1] (hr)	Duration (hr)	Volume (m^3)
March 23-24, 2022	23:25	02:40	4.3	4.3	35, 586
July 24 -25, 2022	23:33	0:12	1.7	1.7	4, 127
December 31, 2022	11:16	12:20	1.1	1.1	1, 153

[1] In wet weather the plant may bypass intermittently. The active duration is the period for which the bypass was actively occurring, whereas the duration is the total duration for the event.

3.4.2 Overflows

There were no overflow events at the Humber Treatment Plant in 2022. An overflow is defined as a discharge to the environment from the plant at a location other than the plant outfall or into the plant outfall downstream of the final effluent sampling station.

3.4.3 Spills

There were no spills reported to the MECP in 2022. A spill is defined within the meaning of Part X of the Environmental Protection Act.

3.4.4 Abnormal Discharge Events

There were no abnormal discharge events at the Humber Treatment Plant in 2022.

3.5 Complaints

The Humber Treatment Plant investigated 3 complaints related to odour and 0 complaints related to noise. The odour complaints were received on July 13, August 23, and September 7. During investigation, no unusual odours were found, so no corrective action was warranted.

All complaints were recorded, investigated by Toronto Water Staff, reported to the MECP, and followed up on with the complainant.

A table of correspondence related to complaints can be found in Section 7.6.

3.6 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 biosolids. 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.

3.7 Odour Reduction Plan

As per Section 8 (4) of the Humber Treatment Plant Amended ECA – Air No. 0858-AEXNV7 issued July 12, 2017, a review of the Odour Reduction Plan summarizing the work progress in 2022, including activities to reduce emissions of odour and total reduced sulphur, the estimated emissions reduction for each activity, and the schedule for completion of each activity can be found in Appendix F.

4 CAPITAL PROJECTS

Under Toronto Water's capital program, the Humber Treatment Plant commenced or continued with the capital works projects and studies listed in Table 6 in 2022.

Table 5: Capital Projects

Project Name	Project Description	Project Stage (Dec 31, 2022)
Secondary Process Upgrades	Refurbishment of south aeration system including expanded return activated sludge pumping station, new plant water pumping station, new phosphorus removal system.	Construction
PLC Platform Upgrade	Replacement of outdated control hardware for reliability.	Construction
Primary Scum and Sludge Upgrades	Upgrade of north primary treatment sludge and scum systems.	Construction
TW Operations Centre	Expansion of the operations centre to meet current and future needs.	Construction
Waste Gas Burner Upgrades	Replacement of existing waste gas burners to meet regulations and improve proves efficiency.	Construction
Digester 2&3 Upgrade and Repairs	Upgrades and repairs to Digesters 2 and 3.	Design
Rehabilitation and Services Upgrades	A comprehensive project to rehabilitate and upgrade plant wide process and maintenance support services at the HTP. This will include, the plant hot water system, HVAC, digesters, sludge thickening, south primary treatment, headhouse, north grit, new maintenance shop, secondary treatment and other miscellaneous required upgrades.	Design
Security Upgrades	Various plant wide upgrades to security including replacement of the exterior fence and CCTVs, upgrades to building access control system and security network.	Design
Preliminary Treatment Improvements	Upgrades to odour control grit removal systems.	Design
Head House Conveyors Modifications	Operational improvements to Head House conveyors.	Design
Flood Wall Upgrades	Upgrades to existing flood wall to ensure adequate defence against potential flooding.	Design
Blowers Upgrades	Upgrades to air blower system to increase process and cost efficiency.	Design
Wet Weather Flow Upgrades	Study to identify ways to handle increased flows and higher lake levels, as well as decrease the quantity and increase the quality of bypass flows.	Design
TW Elevator Modernization	Modernization of TW wide elevators to comply with safety, usability, and maintenance recommendations	Design
HVAC Upgrades	Refurbishment of HVAC system and potable water system.	Complete

5 MAINTENANCE

Staff from the Humber Treatment Plant performed a variety of scheduled, preventative, predictive and reactive maintenance activities 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 2022, and found to be within acceptable limits. A summary of effluent monitoring equipment calibration and maintenance performed in 2022 is included in Table 7.

Table 6: Summary of Regulated Monitoring Equipment Calibration and Maintenance

Calibration and/or Maintenance Record	Completion Date
Influent Flow Meter THR-PLT-FIT-2001A - Verification	September 14, 2022
Influent Flow Meter THR-PLT-FIT-2003A – Verification	September 14, 2022
Influent Flow Meter THR-PLT-FIT-1012 – Verification	August 22, 2022
Effluent pH analyzer THR-EPS-AIT-0055 - Calibration	Weekly
Effluent temperature analyzer THR-EPS-TIT-0053 - Verification	Weekly
HACH DR3900 Spectrophotometer THR-ELS-INQ-3900 – Calibration	March 9, 2022
Effluent Autosampler THR-FT-SP-0001 - Calibration	Monthly
Influent Auto sampler THR-PLT-SP-0001 – Calibration	Monthly
Aeration Flow Meter- THR-AER-FIT-0105 - Verification	June 22, 2022
Aeration Flow Meter- THR-AER-FIT-0205 - Verification	June 22, 2022
Aeration Flow Meter- THR-AER-FIT-0305 - Verification	June 22, 2022
Aeration Flow Meter- THR-AER-FIT-0402 - Verification	June 22, 2022
Aeration Flow Meter- THR-AER-FIT-0505 - Verification	June 22, 2022
Aeration Flow Meter- THR-AER-FIT-0602 - Verification	June 22, 2022
Aeration Flow Meter- THR-AER-FIT-0702 - Verification	June 22, 2022
Aeration Flow Meter- THR-AER-FIT-0802 - Verification	June 22, 2022

In 2022, there were a total of 13, 021 work orders completed; refer to Appendix G for a summary of maintenance activities as per Conditions 10(6)(c) of the ECA. None of the maintenance activities undertaken at the plant fell under Limited Operational Flexibility; as a result, no Notices of Modifications were submitted to the Water Supervisor as per Condition 10(6)(j) of the ECA. Regular safety inspections and preventative maintenance was performed on the life safety systems at the plant in 2022.

6 UTILITIES

A summary of monthly utility consumption for the previous three years at Humber Treatment Plant is provided in Figure 1. Table 8 below summarizes the total cost and average unit cost for water, hydro, and natural gas. Total annual consumption of potable water, hydro, and natural gas was 155, 877 m^3, 47.0 M kWh, and 2.4 M m^3, respectively.

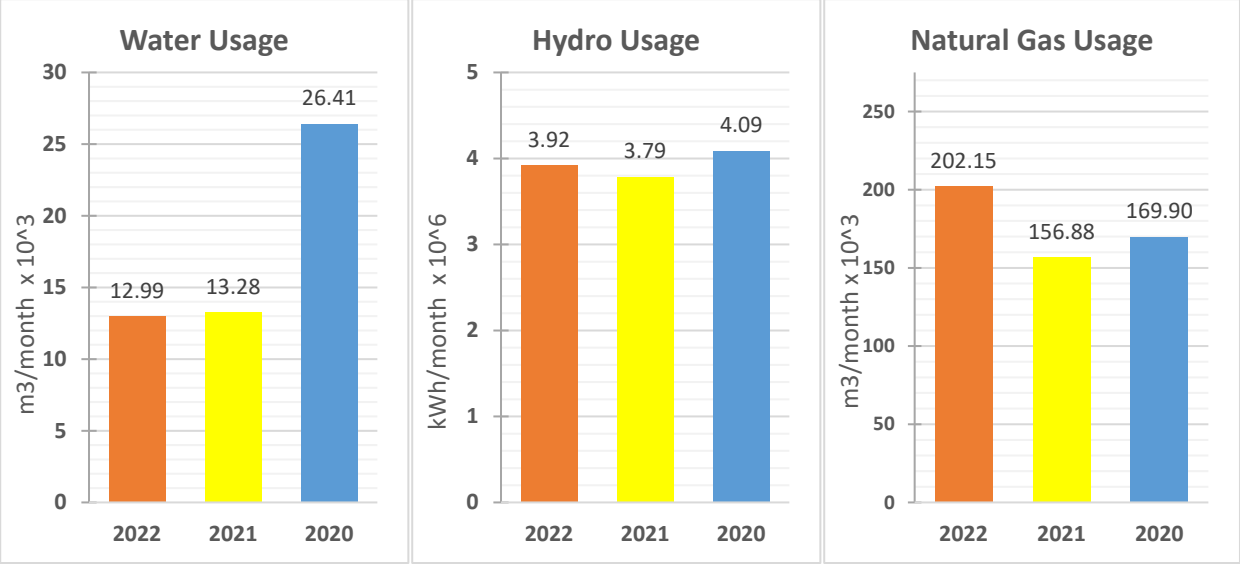


Figure 1: Annual Utility Consumption (Water, Hydro, Gas)

Table 7: Average Unit and Total Utility Cost

Utility	2022	2021	2020
Water Unit Cost ($/$m^3$)	$4.30	$4.35	$4.29
Water Total Cost ($/year)	$0.67M	$0.69M	1.36M
Hydro Unit Cost ($/kWh)	$0.10	$0.09	$0.10
Hydro Total Cost ($/year)	$4.77M	$4.22M	$4.73M
Natural Gas Unit Cost ($/$m^3$)	$0.33	$0.26	$0.24
Natural Gas Total Cost ($/year)	$0.81M	$0.48M	$0.49M

7 ADMINISTRATION

7.1 Operations and Maintenance Costs

The 2022 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 annual operations and maintenance costs for the past three years is illustrated in Figure 2. Overall, operational costs increased by 3.2% from 2021.

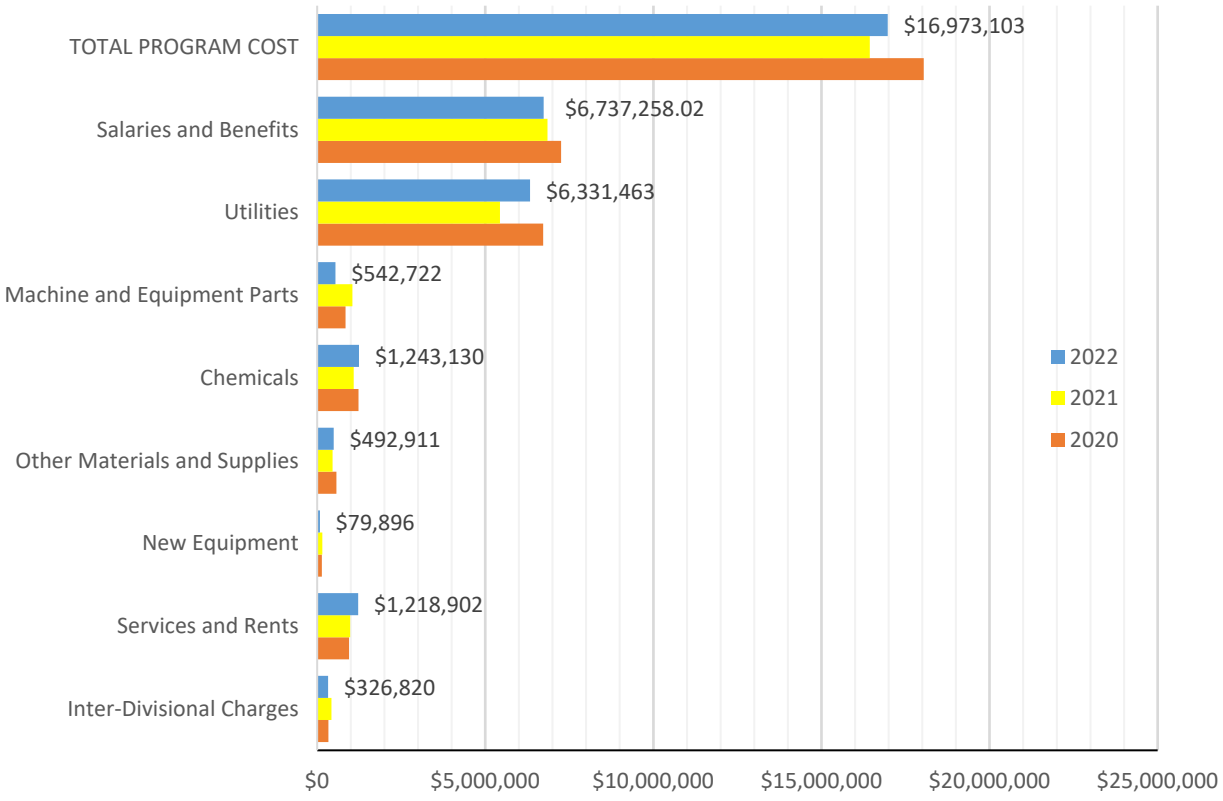


Figure 2: Operations and Maintenance Cost Breakdown

7.2 Human Resources

Plant Staffing at the Humber Treatment Plant in 2022 is shown in Table 9.

Table 8: Plant Staffing

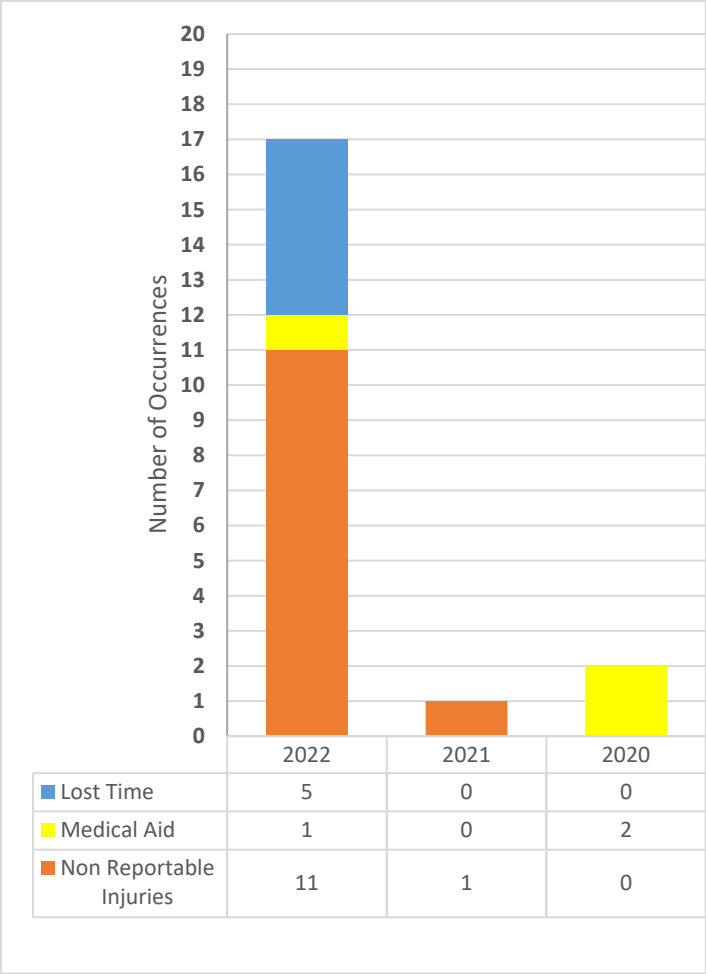
Position	Number of FTE[1]
Plant Manager	1
Senior Engineer	2
Engineer	1
Area Supervisors	4
Electrical & Instrumentation Specialist	1
Plant Technicians	15
Industrial Millwrights	22
Electrical Instrumentation Control Technicians	7
Wastewater Treatment Plant Workers	4
Support Assistant/Materials Management	3
Engineering Technologist	0
Total FTE Positions	**60**

[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 Humber 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 Humber Treatment Plant are included in Figure 3.

As of December 31, 2022, there was 17 health and safety incidents, and 29 lost time days due to work related injuries.



	2022	2021	2020
Lost Time	5	0	0
Medical Aid	1	0	2
Non Reportable Injuries	11	1	0

Figure 3: Humber 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 Humber Treatment Plant operations and skilled trades staff in 2022 includes the list of courses shown in Appendix H. 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 to prepare staff for any certification examination that they need to write. Table 10 summarizes the status of operator certification at the Humber Treatment Plant in 2022.

Table 9: Wastewater Treatment Certificates

Class Level	Number of Licenses
Class IV	15
Class III	4
Class II	4
Class I	31
O.I.T.	3
Total	**57**

7.6 MECP Correspondence

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

Table 11 summarizes the correspondence submitted to the MECP for the Humber Treatment Plant. Correspondence related to spills and bypasses can be referenced in Section 3.4.

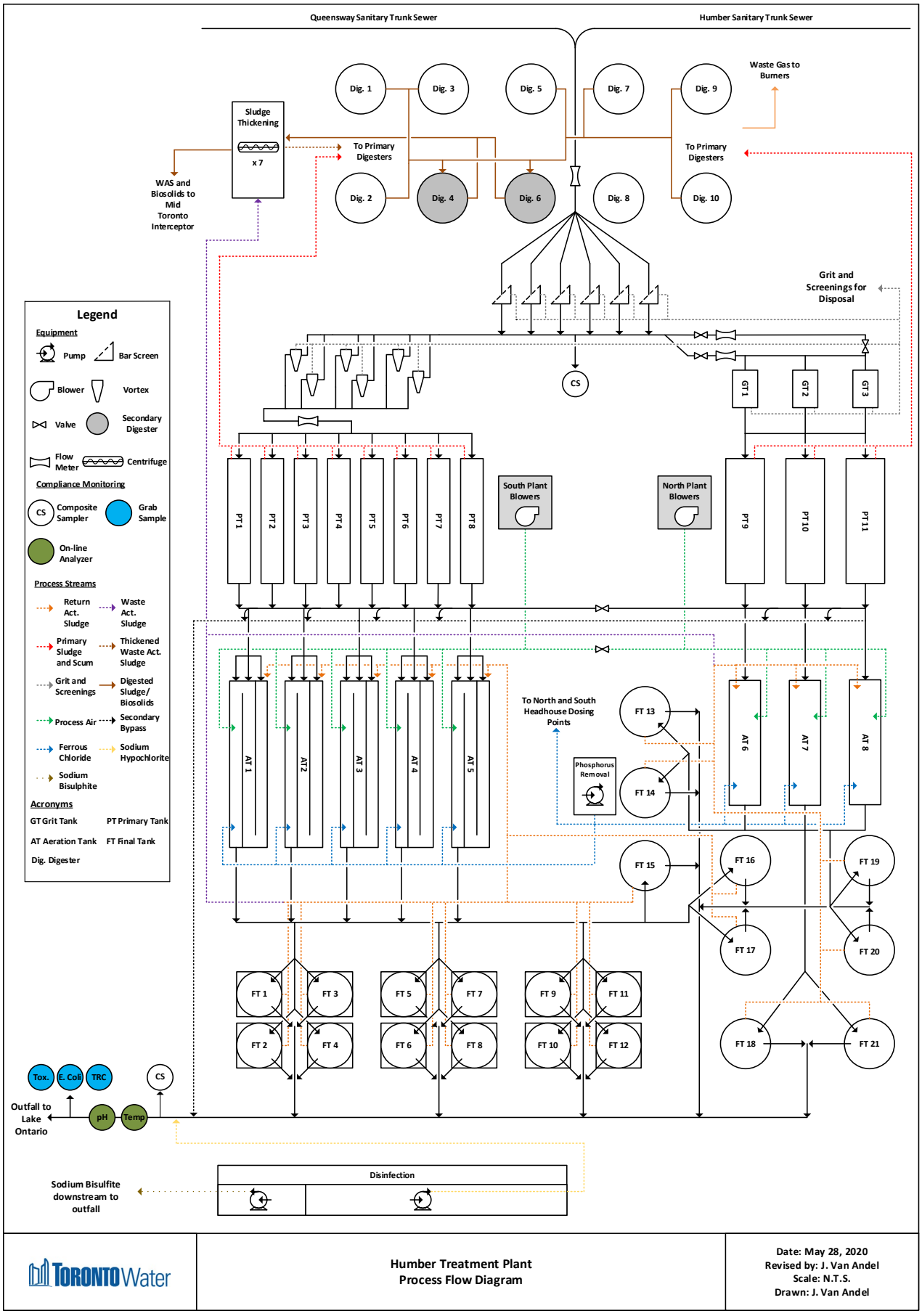
Table 10: Correspondence submitted to the MECP

Event Date	Type	Description	Resolution	Resolution Date
Complaints				
July 13, 2022	Odour	Complaint from resident that sewage smell in their home	Plant investigation determined the smell did not originate on-site. Follow up with resident and smell had subsided.	July 13, 2022
August 23, 2022	Odour	Complaint from condo corporation residents of sewage smell for the last few weeks	Plant investigation determined that all odour control equipment functioning and that no evident process upset occurring on site.	August 23, 2022
September 7, 2022	Odour	Resident complaint of strong odour originating from plant for last 3-4 days	Inspected plant and surrounding area the following dat, no unusual odours observed. Followed up with resident.	September 8, 2022
Consent Letters				
N/A				

Event Date	Type	Description	Resolution	Resolution Date
Notice of Modification to Sewage Works				
N/A				
Notice of Start-up				
April 19, 2022	N/A	Start-up of Aeration Tank 4, Tuesday May 2, 2022	N/A	April 19, 2022
Additional Correspondence				
July 15, 2022	Exceedance of Monthly Compliance Limit	May and June monthly average TRC exceeded the compliance limit.	Reported TRC results were investigated and compared to process conditions on days withy elevated results. Determined to be a result of analytical errors.	July 15, 2022
September 12, 2022	Exceedance of Monthly Compliance Limit	July e. Coli geometric mean exceeded the compliance limit	Sample storage was determined to be at a temperature that degraded sample quality and resulted in poor results that month.	September 12, 2022
February 9, 2023	Exceedance of Monthly Compliance Limit	December e. Coli geometric mean exceeded the compliance limit	Operating conditions during sample collection were not representative of normal operating state.	February 9, 2023
MECP Inspection				
No inspection conducted				

APPENDIX A – Plant Schematic

APPENDIX A – Plant Schematic



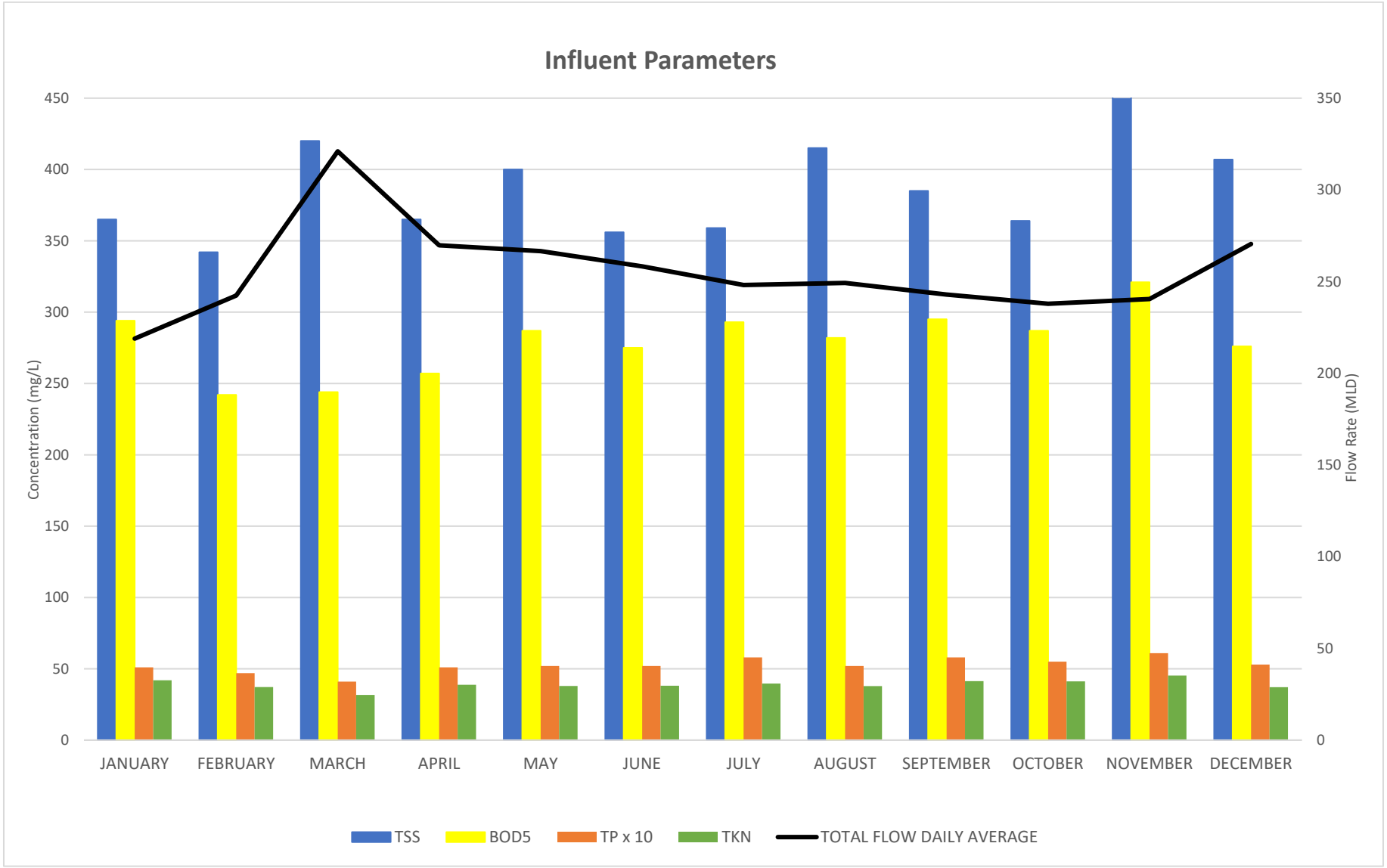
TORONTO Water

Humber Treatment Plant
Process Flow Diagram

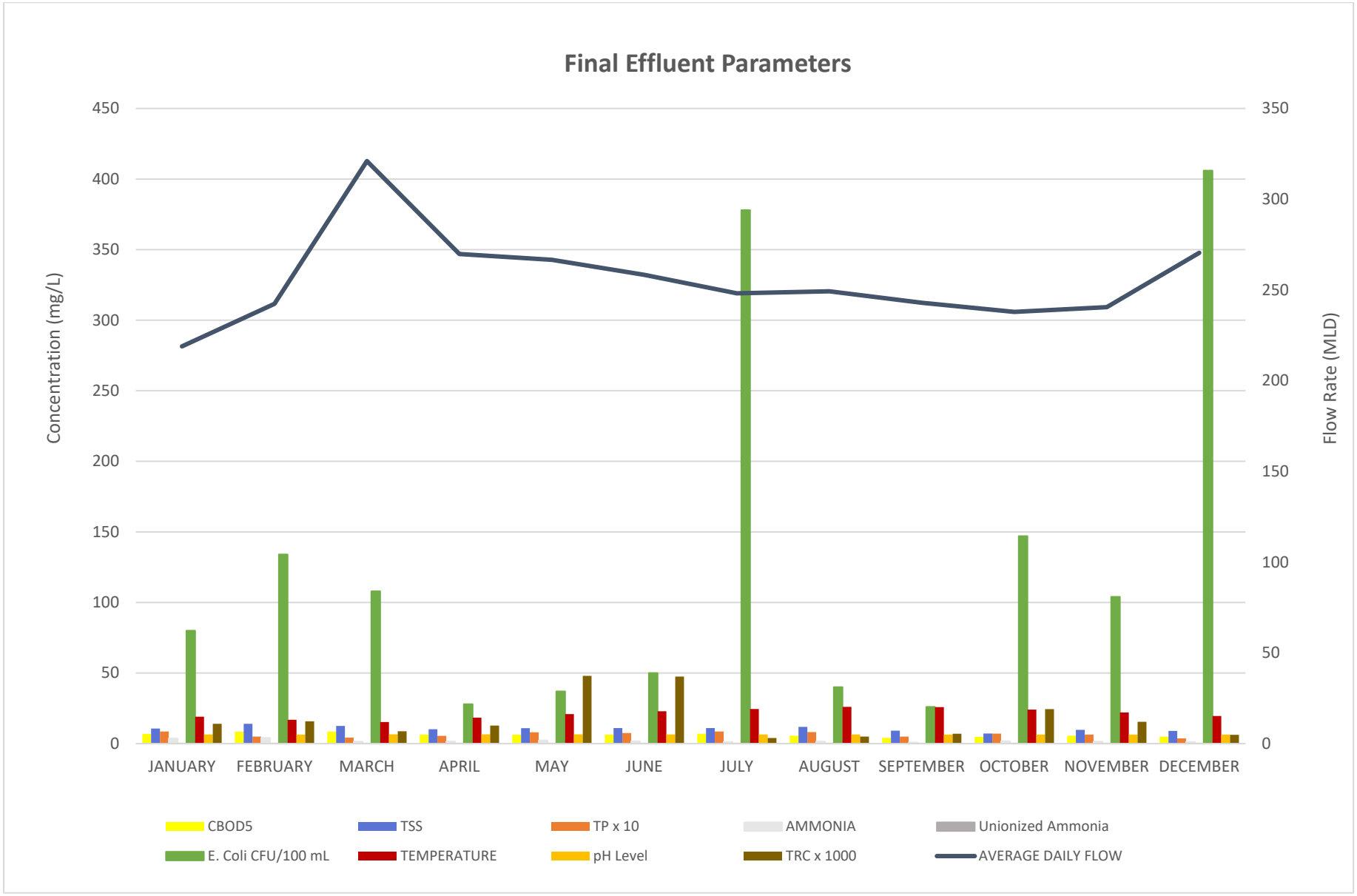
Date: May 28, 2020
Revised by: J. Van Andel
Scale: N.T.S.
Drawn: J. Van Andel

APPENDIX B – Influent and Effluent 2022 Performance Charts

APPENDIX B – Influent and Effluent 2020 Performance Charts



APPENDIX B – Influent and Effluent 2020 Performance Charts



APPENDIX C – Historical Performance Data

APPENDIX C – Historical Performance Data

	Units	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Influent Parameters												
Flow	ML/day	255.65	249.88	371.45	313.88	286.07	331.70	257.30	269.00	280.50	312.00	287.50
Total Annual Flow	ML	93,312	91,204	135,952	114,566	104,417	121,062	94,168	98,174	102,364	113,709	105,444
Total Suspended Solids (TSS)	mg/L	386.33	366.25	308.75	293.26	280.75	301.20	331.00	369.00	356.00	318.00	405.00
Biochemical Oxygen Demand (BOD_5)	mg/L	279.42	287.17	254.79	247.57	247.83	255.20	299.00	318.00	295.00	238.00	261.00
Total Phosphorus (TP)	mg/L	5.26	5.23	4.97	5.30	5.24	5.30	5.80	5.80	5.00	4.40	4.90
Total Kjeldahl Nitrogen (TKN)	mg/L	39.03	41.17	38.14	40.64	40.02	39.80	45.20	42.70	38.40	39.31	43.42
Preliminary Treatment												
Grit and Screenings	tonnes/day	2.85	2.86	2.78	3.66	4.10	2.10	1.60	2.20	2.10	3.40	1.80
Primary Treatment												
TSS	mg/L	105.68	103.58	84.72	89.80	95.70	102.00	94.00	97.00	101.00	151.00	148.00
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	mg/L	151.30	162.75	157.25	152.12	140.90	118.30	158.00	156.00	138.00	142.00	160.00
Secondary Treatment												
Aeration Loading	kg $CBOD_5$/ m^3.day	0.42	0.44	0.63	0.52	0.44	0.41	0.38	0.39	0.37	0.40	0.47
Mixed Liquor Suspended Solids	mg/L	3,734.17	3,405.31	3,395.01	3,109.27	2,839.32	2,842.00	2,953.00	2,838.00	2,998.00	2,885.00	2,151.00
Final Effluent												
Final Effluent Daily Average Flow	ML/day	218.90	248.78	366.49	312.49	284.83	320.59	257.00	268.40	275.50	305.83	288.49
TSS	mg/L	10.62	10.98	10.43	9.70	11.00	13.00	13.00	11.00	12.00	13.00	15.70
TSS Loading Rate	kg/day	2,712.69	2,742.40	3,869.27	3,042.16	3,157.47	4,322.00	3,341.00	2,952.40	3,306.00	4,050.00	4,523.00
cBOD5	mg/L	6.25	6.35	5.72	5.36	5.90	6.60	5.70	5.40	4.80	6.00	6.00
cBOD5 Loading Rate	kg/day	1,596.95	1,586.72	2,121.76	1,681.26	1,677.78	2,202.00	1,464.90	1,449.36	1,322.40	1,869.00	1,728.00
TP	mg/L	0.65	0.67	0.58	0.44	0.60	0.80	0.70	0.77	0.67	0.65	0.64
TP Loading Rate	kg/day	165.66	168.04	216.51	139.52	178.00	250.00	180.00	210.00	210.00	202.00	184.00
Escherichia Coli (E. Coli)	CFU/100 mL	128.17	94.25	54.98	82.91	67.80	72.00	29.00	52.00	30.00	31.00	26.00
pH	-	6.47	6.51	6.66	6.85	7.00	8.00	7.20	7.40	7.00	7.00	7.00

APPENDIX C – Historical Performance Data

	Units	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Total Residual Chlorine	mg/L	0.02	0.01	0.01	0.01	0.01	SBS (P)	SBS (P)	SBS (P)	SBS (P)	-	-
Total Kjeldahl Nitrogen (TKN)	mg/L	3.37	4.28	2.63	2.65	3.30	3.20	2.66	2.24	2.10	1.95	3.18
Total Ammonia Nitrogen	mg/L	1.89	3.28	1.07	1.18	1.70	1.60	1.22	1.40	0.85	0.66	0.99
Temperature	degrees Celsius	21.31	22.07	21.39	20.12	20.00	15.80	17.60	18.90	18.70	20.00	21.00
Solids Handling												
Primary Sludge Treated	m^3/day	2,240.55	2,169.36	2,577.29	2,564.37	2,627.10	2,813.00	2,689.00	2,723.00	3,495.00	2,639.00	2,532.00
Primary Sludge Total Solids (TS)	%	2.16	2.00	1.41	1.49	2.10	1.90	-	-	-	-	-
Primary Sludge Total Volatile Solids (TVS)	%	73.65	73.45	66.69	69.16	76.70	73.60	-	-	-	-	-
Waste Activated Sludge (WAS) to Thickening	m^3/day	5,608.50	5,010.98	3,218.32	5,107.50	3,697.00	3,776.00	3,573.00	3,135.00	3,782.00	2,984.00	3,779.00
WAS SS	mg/L	7,838.56	8,356.65	7,823.97	9,301.79	9,499.00	8,806.00	8,630.00	9,448.00	8,863.00	10,391.00	9,012.00
Thickened WAS (TWAS) TS	%	4.44	3.39	3.38	3.47	3.70	4.60	4.00	4.20	4.40	5.30	4.70
TWAS VS	%	79.19	77.60	77.28	76.56	74.90	77.60	75.00	78.60	78.00	79.00	78.70
TWAS Treated	m^3/day	679.99	674.11	545.02	548.63	m3/day	714.00	598.00	350.00	512.00	464.00	726.00
Digested Solids to ABTP	DT/day	78.67	53.05	60.10	64.57	72.88	80.00	59.00	57.00	64.00	57.00	54.00
WAS to ABTP	DT/day	1.92	4.28	7.61	2.69	4.90	4.90	5.00	17.00	11.70	5.80	1.70
Digester Gas Generated	10^3 m^3/day	23.43	27.75	22.79	23.85	26.70	26.20	28.10	25.40	24.60	20.30	21.30

APPENDIX D – Influent and Effluent Metal Concentrations

APPENDIX D – Influent and Effluent Metal Concentrations

Influent (Daily Composite tested once/month for metals)

Parameter	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	0.005	0.002	0.00675	0.002	0.105	1.8	0.0025	0.0827	0.00005	0.00925	0.13
February	0.005	0.002	0.00689	0.002	0.089	1.23	0.0025	0.0646	0.00005	0.00989	0.116
March	0.005	0.002	0.00838	0.002	0.0856	1.14	0.0025	0.0667	0.00005	0.00795	0.112
April	0.005	0.002	0.0117	0.002	0.102	1.25	0.00535	0.0706	0.000209	0.00948	0.141
May	0.005	0.002	0.0091	0.002	0.0961	1.38	0.00693	0.0718	0.000244	0.01	0.139
June	0.005	0.002	0.00919	0.002	0.112	2.66	0.00702	0.0888	0.00005	0.00864	0.158
July	0.005	0.002	0.009	0.002	0.111	1.96	0.00528	0.0719	0.00005	0.00945	0.159
August	0.005	0.002	0.012	0.002	0.112	8.49	0.00598	0.113	0.00005	0.0151	0.173
September	0.005	0.002	0.00751	0.002	0.128	2.24	0.0025	0.0708	0.00005	0.0101	0.167
October	0.005	0.002	0.00811	0.002	0.104	3.97	0.0025	0.0824	0.000139	0.00962	0.145
November	0.005	0.002	0.0105	0.002	0.113	5.02	0.0074	0.102	0.00005	0.0122	0.169
December	0.005	0.002	0.00805	0.002	0.0916	2.36	0.00561	0.0859	0.00005	0.0103	0.127
Annual Average	**0.005**	**0.002**	**0.009**	**0.002**	**0.104**	**2.792**	**0.0047**	**0.081**	**0.00009**	**0.0102**	**0.145**

Data in red is half the MDL

APPENDIX D – Influent and Effluent Metal Concentrations

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

Parameter	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	0.005	0.002	0.002	0.002	0.014	0.382	0.0025	0.0512	0.00005	0.0061	0.0413
February	0.005	0.002	0.002	0.002	0.0145	0.495	0.0025	0.0492	0.00005	0.0066	0.0364
March	0.005	0.002	0.002	0.002	0.0126	0.435	0.0025	0.0451	0.00005	0.00529	0.0386
April	0.005	0.002	0.002	0.002	0.0128	0.338	0.0025	0.045	0.00005	0.00503	0.0376
May	0.005	0.002	0.002	0.002	0.0115	0.265	0.0025	0.0436	0.00005	0.00599	0.0409
June	0.005	0.002	0.002	0.002	0.0108	0.298	0.0025	0.0479	0.00005	0.0025	0.0352
July	0.005	0.002	0.002	0.002	0.0123	0.545	0.0025	0.0401	0.00005	0.00533	0.0338
August	0.005	0.002	0.002	0.002	0.0117	0.509	0.0025	0.0374	0.00005	0.00608	0.0353
September	0.005	0.002	0.002	0.002	0.0118	0.355	0.0025	0.0332	0.00005	0.00523	0.0323
October	0.005	0.002	0.002	0.002	0.0123	0.347	0.0025	0.0271	0.00005	0.00513	0.0361
November	0.005	0.002	0.002	0.002	0.0121	0.366	0.0025	0.0268	0.00005	0.00603	0.0331
December	0.005	0.002	0.002	0.002	0.0104	0.38	0.0025	0.024	0.00005	0.00586	0.0322
Annual Average	**0.005**	**0.002**	**0.002**	**0.002**	**0.0122**	**0.3929**	**0.0025**	**0.03922**	**0.00005**	**0.0054**	**0.0361**

Data in red is half the MDL

APPENDIX E – Digested Sludge Analysis

APPENDIX E – Digested Sludge Analysis

	Arsenic	Cadmium	Cobolt	Chromium	Copper	Mercury	Molybdenum	Nickel	Lead	Selenium	Zinc
Limit[1]	*170*	*34*	*340*	*2800*	*1700*	*11*	*94*	*420*	*1100*	*34*	*4200*
January	1.5	0.3	3.4	45.9	408.8	0.1	4.5	21.5	21.9	1.0	399.2
February											
March	2.3	0.6	4.4	54.0	544.1	0.5	7.3	27.6	25.7	2.3	593.9
April											
May											
June											
July	1.9	0.1	4.7	42.7	501.7	0.2	6.8	24.0	30.0	1.5	447.5
August											
September	0.7	0.1	3.7	25.7	237.3	0.1	2.5	15.4	31.0	0.4	200.5
October											
November											
December											
Annual Average	**1.610**	**0.28**	**4.04**	**42.073**	**422.983**	**0.209**	**5.270**	**22.120**	**27.168**	**1.30**	**410.26**

[1]As per MOECC regulations for sludge utilization on agricultural lands. All sludge from HTP received further treatment at Ashbridges Bay Treatment Plant

All values are expressed in terms of mg metal / kg digested sludge dry weight

APPENDIX F – Odour Reduction Plan

Humber Treatment Plant
Odour Reduction Report

Prepared by:

Timothy Shen, P.Eng
Senior Engineer, Toronto Water

March 31, 2023

Table of Contents

Purpose

This report is intended to detail the progress of the implementation of the Odour Reduction Plan, as required under Environmental Compliance Approval No. 0858-AEXNV7 (the ECA), issued July 12, 2017 and as amended as per Notice No. 1 issued December 14, 2018. A copy of the Odour Reduction Plan can be found in Appendix A.

Scope

The scope of this report is to detail the progress of the installation of the *Proposed Equipment*, in the ECA which will impact odours at the plant.

The ECA also lists equipment which is not expected to have an impact on odour at the plant. This includes modifications to the aeration tanks, the disinfection facility, and the decommissioning of existing odour control equipment. As they are not anticipated to have any impact on odour, they are beyond the scope of this report.

Background

In 2010, the City of Toronto (the City) hired Stantec Consulting Inc. (Stantec) to provide engineering design, construction administration and post construction services of odour control facilities to drastically reduce nuisance odours at the facility's property line and beyond. This included several upgrades to process equipment and odour handling facilities at the plant.

Odour Control Equipment

A central component of the Odour Control Project is the construction of a centralized Biofilter to control emissions from the Headhouse and South Grit Building, the North Grit Building, and the north primary tanks influent and effluent channels. The biofilter includes:

- Four cells, 15.5 m by 32.2 m, with an organic media depth of 1.22 m
- An irrigation system
- Two separate 2.2 m stacks extending 4.2 m above grade, with a maximum flow rate of 19.8 m^3/s

In addition to the centralized biofilter, a second biofilter has been constructed at the south end of the south primary tanks. This biofilter treats air from the influent and effluent channels of the south primary tanks and consists of:

- 3 cells, 8 m by 5.5 m, with an organic media depth of 1.22 m
- An irrigation system
- An open area discharge, with a maximum volumetric discharge of 2.36 m^3/s

The third odour reducing component of the project includes a granular activated carbon (GAC) scrubber unit, which treats air from the Headhouse screen room. The GAC unit has:

- 45 m^3 of GAC
- A maximum discharge rate of 16 m^3/s, through a 1.21 m stack, located 4 m above grade

Process Upgrades

The Headhouse and South Grit Building has undergone extensive renovations to ensure process reliability, as well as ensure that odours are contained and treated. The work in this area includes:

- Replacement of 2 bar screens to increase reliability
- Enclosure of all replaced and existing bar screens with odour control piping installed
- Replacement of the conveyor system to increase reliability and enable them to be enclosed at all times
- Modifications to the vortex system replace the classifiers and air lift system with a grit pumping system and merge the grit slurry handling with the north grit facility
- Decommission 4 general building exhaust systems
- Installation of a new truck loading bay for screenings
- Installation of a standby diesel generator to ensure continuous operation of critical equipment
- Construction of a new electrical building

North Grit Building

- Upgrades to the grit tanks to use a screw conveyor for grit removal
- Installation of new grit handling pumps, hydrocyclones and classifiers
- Installation of a new grit handling facility and loading bay
- Construction of a new electrical building

Additionally, the project scope included decommissioning the existing HVAC and odour control equipment and allowing the aeration tanks to vent to atmosphere.

The project was tendered in late 2013, and the order to commence issued to Walsh Construction Canada (WCC) on April 14, 2014. The contract value is $58,640,220, with an original contract completion date of February 6, 2017. The completion date was extended, and the project was completed by the second quarter of 2019. WCC, Stantec, and the City have completed the works in an accordance with the tender documents and schedules.

2022 Progress

In the previous report issued for the period of 2020, work on the Odour Control Project was denoted as already completed a year prior and equipment running under the full control of the plant. These constituted all the Proposed Works within the Odour Reduction Plan. During odour source testing for the site in the same year it was noted

from odour results that the biofilter media required an end-of-life changeout from visual observation as well as based on the length of time they have been operating. Some irrigation adjustments were also noted to be required to optimize biofilter odour removal.

As a result an extension was requested to the MECP for submission of the Source Testing Report as required by the ECA to allow time to obtain new biofilter media, conduct a changeout for the central and south biofilters and make adjustments/upgrades to re-align operating parameters. The extension was requested for final re-testing by June 30, 2022 after biofilter media changeout and adjustments are expected to be completed.

Over the course of 2022 media changeout in addition to unforeseen repairs were conducted at the biofilters. Further delays occurred due to the supplier shortages and new short-circuiting and corrosion issues were noticed that needed to be addressed before operation could be reinstated. As a result another extension was requested to October 31, 2022 that was granted by the MECP. The City was able to complete the biofilter repairs and changeout in early September and the biofilter was source tested in October 2022. The source test was submitted to the MECP on October 31, 2022.

Odour Reductions Achieved in 2022

All work regarding the Odour Control Plan and source testing was completed as of October 2022. The source test showed major reductions in odours within the biofilters as a result of the media changeout and repairs and is indicative that the work was successful in rehabilitating operation. 2022 vs 2020 source testing showed between 92 and 98% biofilter odour reduction and Total Reduced Sulfur reductions up to 84%. All re-tested sources were well below ECA ESDM targets.

Complaints Received in 2022

Three odour complaints were received in 2022. All complaints were investigated and reported to the Water Supervisor as per the requirements in the ECA. All three complaints could not be attributed to any cause after the entire process was checked by operational staff in each case.

Next Steps

All work with an odour impact stated within the Odour Reduction Plan was completed prior to this point as of 2020 and final source testing was completed with positive results in late 2022. This report marks the final closure of the Odour Reduction Plan and there will be no more forthcoming reports.

Appendix A: Odour Reduction Plan

Location	Plan	Percent Odour Reduction	Current Progress	Target date
Headhouse and South Grit	Replace remaining 2 bar screens to increase reliability and enable them to be enclosed at all times	20%	Complete	
	Replace conveyor system to increase reliability and enable them to be enclosed at all times		Complete	
	Modify vortex system to no longer require the classifiers or an air lift system in this location		Complete	
	Decommission 4 general building exhaust systems		Complete	
	New centralized biofilter to treat foul process air		Complete	
	Construction of a standby diesel generator		Complete	
	New Activated Granular Carbon Unit to extract and treat foul building air	10%	Complete	
North Grit Building	Collection and treatment of emissions from the 3 aerated grit tanks through the new centralized biofilter	20%	Complete	
	Collection and treatment of emissions from the grit tank room and loading bay areas through the centralized biofilter		Complete	
	Decommission existing general building ventilation system		Complete	
	Decommission the existing exhaust system for aerated grit tanks		Complete	
North Primary Tanks	Installation of covers over the influent and effluent channels, effluent weirs, and overflow channel	20%	Complete	
	Treatment of foul air from below the covers through a new centralized biofilter		Complete	
South Primary Tanks	Installation of covers over the influent and effluent troughs	20%	Complete	
	Treatment of foul air from below the covers through a new south primary biofilter		Complete	
Aeration Tanks	New aeration piping and diffusers	N/A	Construction	N/A
	New ventilation scheme that will involve vent stacks to allow air to discharge to the atmosphere		Construction	N/A
Disinfection Facility	New Sodium Hypochlorite Tanks (1-3)	N/A	Complete	
	New Sodium Hypochlorite Tanks (4-8)		Complete	
	New welding fume hood		Complete	
	New standby diesel generator		Complete	
	Decomission chlorine gas scrubbers		Complete	
Air Scrubbers/ Ozone	Decommission air scrubbers and ozone building	N/A	Complete	N/A

Updated March 25, 2022 by Timothy Shen

APPENDIX G – Maintenance Activities

APPENDIX G – Maintenance Activities

Solids Handling (Work Area 1)

Work Area 1 includes WAS thickening centrifuges, anaerobic digesters and gas collection, compression, and burner systems. A total of 3,212 work orders were closed in this work area in 2022. The following maintenance on major structures, equipment, apparatus, mechanism, or thing forming the Works was completed by Work Area 1 in 2022:

- **Monthly activities**
  - Valve exercises
    - Centrate pump valves
    - Centrifuge feed pump and flushing water valves
    - Digester scum feed valves
    - Digester sampling valves
    - Digester sludge recirculation valves
    - MTI Line isolation valves
    - TWAS Transfer Pump valves
    - Waste gas burner pressure regulating valves
  - Scum Tanks and hoppers, chute and paddle cleaning
  - Inspections
    - Sealing oil reservoir tank
    - Standby gas compressor inspection and operational testing
    - Portable eyewashes, fire extinguishers and first aid kits
- **Quarterly activities**
  - Scum tanks and hoppers cleaning
  - Inspections
    - Waste gas burners
    - TWAS transfer pumps
    - MTI transfer pumps
    - Centrate transfer pump
    - Centrifuge feed pumps
    - Sludge recirculating pump
    - Hot water recirculating pump
    - Digester gas compressor and accumulator
  - Centrifuge motor bearing vibrational analysis
- **Bi-annual activities**
  - Centrate pump valve exercises
  - Digester flame arrestors and gas stack valve cleaning
  - Lubrication
    - Sludge transfer and recirculation pumps bearings
    - MTI transfer pump bearings
    - Digester gas booster compressor bearings
    - Actuator valve stems
    - TWAS transfer pump motor

        - MTI transfer pump motor and bearings
    - Inspections:
        - Digester dome valves
        - Digester gas stack valves and flame arrestors
        - Natural gas pilot pressure regulating valve
        - Digester valves
        - Waste gas burners
- **Annual activities**
    - Valve Exercises
        - Scum Tank, hopper and pump valves
        - Sludge flowmeter valves
        - Centrifuge isolation valves
        - Waste gas header isolation valves (including lubrication)
        - Waste gas burner valves
        - Digester routing and sample valves (including lubrication)
        - Scum valves (including inspection)
        - TWAS feed valves (including lubrication)
        - Digester discharge valves (including inspection)
        - Condensate and sediment tank valves (including inspection)
    - Cleaning
        - Condensate and sediment tanks (including inspection)
        - Digester Gas burner regulating valves (including calibration)
    - Inspections/maintenance:
        - Centrate pump valve isolation exercise and drive sheaves
        - Digester gas compressors and boosters (including lubrication)
        - Standby gas compressor
        - Centrifuge flushing valves and flexible chute connections
        - Centrifuge feed pumps isolation and flushing valve exercises.
        - Sludge recirculation and transfer pumps and valves
        - Coffin box valves (including lubrication)
        - WAS storage tank mixers
        - Backflow preventers
        - MTI transfer pumps
        - TWAS pumps

Liquid Primary Treatment (Work Area 2)

Work Area 2 encompasses preliminary treatment processes including influent bar screens, aerated grit chambers, vortex grit chambers, and primary clarifiers. A total of 2,427 work orders were closed in this work area in 2022. The following maintenance on major structures, equipment, apparatus, mechanism, or thing forming the Works was completed by Work Area 2 in 2022:

- Bi-weekly inspection and lubrication of bar screen switch and bushings

APPENDIX G – Maintenance Activities

- **Monthly activities**
  - North Plant bridge lubrication
  - Inspections
    - Grit blowers air inlet and inverter filters (including replacement)
    - Scum transfer pump
    - Vortex slewing gear (including lubrication)
    - Portable eyewashes, fire extinguishers and first aid kits
    - AED and SCBA
  - 2 month bar screen pillow block lubrication
  - 2 month plant wide SCBA training exercise
- **Quarterly activities**
  - Grit pump pinch valves inspection
  - Bar screen carriage drive chains lubrication
  - Ultrasonic testing of vortex pumps, grit pumps and scum pumps
  - Vibrational testing of sludge pumps and vortex blowers
- **Bi-annual activities**
  - Valve exercises
    - Grit channel sluice gates (including lubrication)
    - Primary sluice gates (including lubrication)
    - Vortex sluice gates (including lubrication)
  - Inspection
    - Ultrasonic testing of vortex pumps
    - Bar screen conveyers and compactors
    - Grit and screenings conveyors
    - Conveyor and scum collector gear box oil analysis
    - Grit de-watering pump
    - Classifiers and cyclones
    - Vortex pumps
    - Primary scum pump (including lubrication)
    - Sludge transfer pump seal water line
    - Ladders
  - Scum collector cleaning and lubrication
  - Preliminary treatment bypass valve stem lubrication
- **Annual activities**
  - Sludge pumps and header isolation valve exercises
  - Scum and sludge long and cross collector gearbox lubrication check
  - Inspections
    - Primary collector drives
    - Primary cross collector gear box lubrication
    - North primary bridges
    - Sludge transfer pumps (and valve exercise).
    - Backflow preventer
    - Grit tank conveyor
    - Primary sluice gate inlet and actuator (including lubrication)

APPENDIX G – Maintenance Activities

Support Services (Work Area 3)

Work Area 3 includes support services around the plant, process air blowers, and the electrical system. A total of 4, 304 work orders were closed in this work area in 2022. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 2 in 2022:

- **Weekly activities**
  - Inspections
    - Emergency generator
    - Dechlorination analyzers
    - Chlorine analyzer probe check (including cleaning)
  - Monitor of air compressor motor temperature
  - Biweekly verification of boiler low level trip circuits
- **Monthly activities**
  - Inspections
    - Boiler exhaust valve actuator (visual)
    - Screen channel level alarms
    - Air dryers and receivers
    - Blower and blower air inlet filters
    - Substation
    - Plant wide emergency lighting
    - Sprinkler system alarm and fire water valves
    - Control room paging modulator alarm system
    - Portable eyewashes, fire extinguishers and first aid kits
  - Cleanings
    - Bio-filter beds (Summer months)
    - Venturi ports
    - Chlorine analyzer probe (including calibration)
  - Repositioning of cogeneration engine crankshaft
  - Test and verify emergency generator on load
  - Elevator guide door cleaning and testing
- **Quarterly activities**
  - Inspections
    - 600 V MCC room
    - Gallery cooling water pumps
    - Waste gas burners
    - Phosphorus removal system pumps
    - Glycol pumps
    - Primary loop hot water pumps and PRVs
  - Glycol pump gland filter replacement
  - Vibrational testing of hot water recirculation pump motor bearings
- **Bi-annual activities**
  - Inspections
    - Dechlorination pump VFD drives, cabinets and fans

APPENDIX G – Maintenance Activities

        - Plant wide supply and exhaust fans (including cleaning)
        - Electrical and mechanical generators
        - Chilled water pumps and skid
        - Control panels
        - WAS and sludge pumps (including motor bearing lubrication)
        - Sludge thickening scrubbers
        - Air compressor (including cleaning)
        - Gallery Air curtain
        - Glycol skids
        - Pneumatic positioner air filters
        - WAS pump and motor (including bearing lubrication)
        - Plant wide air handling unit and HVAC (including maintenance)
    - Calibrations/Verifications
        - Temperature transmitters
        - pH, DO analyzers
        - Raw sludge densitometer (including cleaning)
        - Hazardous gas detectors, alarms and portable gas meters
        - Control valves and actuators
        - Blower discharge and bypass valves
        - Blower axial trip alarms
    - Lubrication of hot water recirculation pumps
    - Digester gas compressor building ventilation fan testing
    - Testing of the blower motor bearings and auxiliary oil pump.
- **Annual activities**
    - Inspections
        - Gas compressor flow, pressure and temperature circuits
        - Heat tracing on sodium bisulphate piping and waste gas burners
        - Waste gas burner instrumentation
        - Glycol pressure relief valve and skid
        - RAS and WAS pump motor and VFD
        - Sludge recirculation pumps and instrumentation
        - Digester gas boosters and instrumentation
        - Hot water recirculation pumps
        - Centrifuge electrical and instrumentation checks
    - Calibrations/Verifications
        - Digester pump discharge and seal oil water switches
        - Digester PLC, RPU functionality testing
        - Primary collector shutdown torque switch
        - RAS, WAS, primary sludge and waste gas burner flow meters
        - Effluent sampling pump flow transmitter
        - Scum transfer pump control panel and instrumentation
        - Digester floating cover sensor
        - TWAS and WAS storage level transmitter sensors
        - Final effluent disinfection transmitters
        - Palace pier level switches

        - Sludge recirculation pumps and instrumentation
        - Bar screen rake drive motor emergency shutdown circuit
        - Digester dome and tank instrumentation
    - Maintenance/cleaning
        - Plant wide wall and roof mounted exhaust fans
        - TWAS pump motor (including calibration
        - Centrate pump motor and pressure switches
    - Electrical and instrumentation checks of centrifuges and gas compressor

Liquid Secondary Treatment (Work Area 4)

Work Area 4 encompasses secondary treatment processes including aeration, phosphorus removal and final clarification. A total of 3, 078 work orders were closed in this work area in 2022. The following maintenance on major structures, equipment, apparatus, mechanism, or thing forming the Works was completed by Work Area 2 in 2022:

- **Monthly activities**
    - Inspections
        - Effluent sampling pumps
        - Portable eyewashes, fire extinguishers and first aid kits
        - WAS and RAS pumps
        - Plant water backwash air regulator seat
        - Sodium Hypochlorite tanks (detection holes and stave joints)
        - Final clarifying tanks scum collector mechanisms
        - Air driers and receivers
        - Filtered plant water pumps, piping and isolation valves
    - Sodium hypochlorite sump drain valve exercises
- **Quarterly activities**
    - Cleaning of sodium hypochlorite dosing pump inlet strainer
    - Inspections
        - Air driers and receivers
        - Plant water sump pump
        - Plant water filter cell trash basket
        - trainer brushes and blades on dechlorination discharge line
        - Effluent discharge mixers lubricant level
    - Lubrication of filtered plant water pumps and motors
    - Vibrational testing
        - RAS, WAS and filtered plant water pumps
        - Aeration blowers and cogeneration burner fans (including oil analysis)
- Bi-annual activities
    - Scum pump lubrication, hopper flushing water solenoid verification and seal inspection
    - Inspections
        - Sodium hypochlorite control valve

        - Scum and sludge collector gearbox oil level
        - Final clarifying tanks drainage pumps
        - Chlorine analyzer sample line
        - Air compressor (including cleaning)
    - Scum tank cleaning and trough flushing
    - Testing of sodium bisulphate containment area level switch
    - Verification/calibration of chlorine gas analyzer
- Annual activities
    - Lubricate and exercise filtered plant water pump isolation valves
    - Lubrication of final clarifying tanks inlet gate valve stem and inspect actuator oil level
    - Inspections
        - Backflow preventers
    - Replacement of process air regulator diaphragm

APPENDIX H – Staff Training Courses

APPENDIX H – Staff Training Courses

Training attended by Humber Treatment Plant operations and skilled trades staff in 2022 includes the list of courses below.

Technical and Health and Safety:

- Variable Frequency Drives
- AC & Condensing Units / Air Distribution System
- Activated Sludge
- Activity and Process Cost Management
- Air Purifying Respirators
- Arc Flash for Non-Qualified Persons
- Asbestos Awareness
- Aeration Tank 5 Auto Start-up Process Training
- Backflow Prevention Awareness
- Basic Spill Response
- Basic Vibrations Analysis
- Building Reliance While Facing Adversity in Work and Life
- Waste Gas Burners
- Centrifugal and Positive Displacement Pump Operation
- Chainsaw Safety and Awareness
- Class III/IV Exam Preparation
- Classroom Review of Common Wear Items for Plant Machinery
- Conductors
- Confined Space Awareness
- Confined Space Rescue
- Confined Space Rescue Upgrade
- Conflict Resolution and Negotiation Skills
- Content Server – eDOCs
- Critical Pump Maintenance, Packing and Mechanical Seals
- Cross Connection Specialist Backflow Tester Certification
- Musculo-Skeletal Disorder Overview,
- Construction Contractor Safety management Program
- General Emergency Response Plan
- Training for Wastewater Treatment Plant Technicians
- Designated Substances
- Designated Substances awareness
- Digesters and the Sludge Digestion Process
- ECS Building Orientation
- Electrical Awareness
- Electrical Safety for District Operators and Maintenance Operators
- Electrical Safety for Maintenance Staff
- Electrical Safety in the Workplace
- Emergency First Aid Level "A" CPR
- Fall Protection Awareness

APPENDIX H – Staff Training Courses

- Fall Protection in an Industrial Work Setting
- Final Clarifiers Operations and Maintenance Training
- Fire Extinguisher Training
- Fire Hydrant and Valve – Operation, Inspection, Maintenance and Installation
- Fundamentals of Ladder Safety Awareness
- Health and Safety Aspects of Contracts for Services
- Health and Safety Competency for Front-line Supervisors
- Hot Work Permit System Awareness
- HTP Headhouse and North Grit HVAC, BAS, and Gas Detection
- Incident Reporting
- Industrial Maintenance Technician – Mechanical and Electrical
- Joint Health and Safety Committee (JHSC) Certification Training – Refresher
- Lock out, Tag out and Test Awareness
- Logbook Entries
- MMR – Self Contained Breathing Apparatus
- Mould Awareness
- On the job: Humber WWTP Co-Gen System Operation
- On the job: Humber WWTP Digestion Process Major Components
- On the job: Humber WWTP Primary Process Major Components
- On the job: Humber WWTP Screening and Odour Control Process
- On the job: Humber WWTP Sludge Thickening Major Components
- On the job: Humber WWTP Sludge Thickening Process Overview
- On the job: Humber WWTP Solids Work Area Overview
- Preliminary and Odour Control Treatment
- Project Management: An Introduction
- Rigging Safety Awareness
- Scaffold Safety
- South Scum System Equipment Training
- Standard First Aid – Level "C" CPR and AED
- Tailgate – Cold Stress
- Tailgate – Corporate Security – Surviving an Active Shooter
- Tailgate - Hazard Identification and Reporting
- Tailgate – Injury Reporting
- Tailgate – Psychosocial Program and Risk Assessments
- Tailgate – Sewage Works and Surface Water Spill Response Awareness
- Toronto Public Service New Employee Orientation
- Traffic Control and Traffic Control Person
- Traffic Control Roadway Work
- Transportation of Dangerous Goods
- Trenching and Excavation Awareness
- Valve Actuator
- Violence in the Workplace
- Water Systems Repairs: Introduction to Oxy-Acetylene Cutting and Stick Welding
- West Substation RPUs

APPENDIX H – Staff Training Courses

- WMS Avantis Workshop
- Working at Heights
- Working at Heights Refresher
- Xylem Submersible Pumps Training

Other Training:

- Coping with Shift Work
- Customer Care Centre Information
- Emotional Intelligence and Interpersonal Awareness
- Five Ways to Boost a Teams Culture
- Toronto Water Manager and Supervisor Employee Engagement Initiatives Workshop
- Management Summit: Engaging Employees and Building a Positive Workplace Culture
- Managing through a Labour Disruption
- Preparing to Move into Supervision
- Respect in our workplace
- Sharing Knowledge for Success
- Success Factors – Managers with Direct Reports
- Wellness and Resiliency