TORONTO Water

HIGHLAND CREEK TREATMENT PLANT

2019 Annual Report

March 31, 2020

EXECUTIVE SUMMARY

The Highland Creek Treatment Plant (HCTP) is one of four wastewater treatment facilities operated by the City of Toronto. This facility, located at 51 Beechgrove Drive has a rated capacity of 219,000 m^3/day, or 219 ML/day, and serves an equivalent population of approximately 533,000. The Highland Creek Treatment Plant discharges into Lake Ontario and operated under Amended Environmental Compliance Approval (ECA) Sewage No. 3448-B2UK8W from January 1 to May 14, 2019, at which point it was replaced by Amended ECA No. 7622-B96S2G, issued on May 14, 2019.

The average daily flow rate in 2019 was 175.2 ML/day. Influent concentrations of Biochemical Oxygen Demand (BOD_5), Total Phosphorus (TP) and Total Suspended Solids (TSS) averaged 232.5 mg/L, 5.2 mg/L and 305.3 mg/L, respectively.

Highland Creek Treatment Plant achieved the following effluent quality and loading rates in 2019 in comparison to ECA limits:

Parameter	ECA[1]	2019 Final Effluent
Total Suspended Solids (TSS)	25 mg/L	14.7 mg/L
Carbonaceous Biological Oxygen Demand (CBOD5)	25 mg/L	6.9 mg/L
Total Phosphorus (TP)	1 mg/L	0.8 mg/L
Escherichia Coli (E. Coli)[2]	200 CFU/100mL	12 CFU/100mL
pH	6.0-9.5	6.6
Total Chlorine Residual (TRC) (Dechlorination)	0.020 mg/L	0.003 mg/L
TSS Loading Rate	5,475 kg/day	2,578 kg/day
CBOD5 Loading Rate	5,475 kg/day	1,212 kg/day
TP Loading Rate	219 kg/day	132 kg/day

[1] Referenced from Amended ECA No. 7622-B96S2G, issued on May 14, 2019.

[2] Arithmetic mean of monthly geometric mean data.

During 2019, the sludge feed flow to the dewatering centrifuges averaged 2,478 m^3/day which resulted in 42 dry tonnes of dewatered solids being generated per day.

Ferrous chloride consumption for phosphorus removal totalled 629.5 tonnes as Fe. Polymer consumption in 2019 for waste activated sludge (WAS) thickening and sludge dewatering totalled 30.2 and 392.4 tonnes, respectively. Total sodium hypochlorite (12% w/v) consumption for disinfection totalled 2,597.2 m^3. Sodium Bisulphite (SBS) (38% w/w) consumption for effluent dechlorination totalled 633.6 tonnes.

There were no bypass occurrences at Highland Creek Treatment Plant in 2019. The plant continued with various capital projects. Notable projects included: Digester Cleaning and Rehabilitation and the Headworks and Odour Control Upgrades. A variety of scheduled, preventative, predictive and reactive maintenance was completed, including the calibration of influent and effluent monitoring equipment.

Total annual consumption of potable water, hydro, and natural gas was 332,519 m^3, 36.6M kWh, and 9.1M scm, respectively. Plant direct operating costs for 2019 totalled $20M. In 2019, the Highland Creek Treatment Plant had a staffing complement of 67 employees. As of December 31, 2019, there were seven health and safety incidents and a total of 37.75 lost time days in 2019 due to work related injuries.

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GLOSSARY OF ABREVIATIONS AND DEFINITIONS

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
HP	Horsepower
HRT	Hydraulic Retention Time
kg	kilogram
kWh	Kilowatt-hour
MAC	Monthly Average Concentration
MGMD	Monthly Geometric Mean Density
MWh	Megawatt-hour
m^3	Cubic metre
m^3/day	Cubic metre per day
mA	Milliamps
mg/L	Milligrams per litre
mL	Millilitre
mm	Millimetre
ML	Million Litres
MECP	Ministry of the Environment, Conservation and Parks
Q	Flow Rate
RAS	Return Activated Sludge
RMDL	Regulatory Method Detection Limit
SBS	Sodium Bisulphite
SBS (P)	Sodium Bisulphite Presence
scm	Standard Cubic Metre
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

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 Highland Creek Treatment Plant (HCTP) 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 51 Beechgrove Drive, south of Lawrence Avenue East and services an area bounded by Steeles Avenue on the north, Victoria Park Avenue on the west, the Rouge River on the east and Lake Ontario on the south. This area contains an estimated connected population of 533,000. The Highland Creek Treatment Plant has a rated capacity of 219,000 m^3/day, or 219 ML/day.

Major treatment processes include preliminary treatment, primary treatment, secondary treatment, phosphorus removal with ferrous chloride, final effluent disinfection using sodium hypochlorite, and final effluent dechlorination using sodium bisulphite. Treated effluent is discharged to Lake Ontario. Solids handling processes include Waste Activated Sludge Thickening, sludge stabilization by anaerobic digestion followed by dewatering using high speed centrifuges. Two multiple hearth incinerators are used for the disposal of the dewatered biosolids. Numerous auxiliary systems are required for the proper operation of plant processes and include potable water, process water, HVAC, SCADA, odour control, electrical power distribution, natural gas, digester gas and instrument air.

The Ministry of the Environment, Conservation and Parks (MECP) has classified the Highland Creek Treatment Plant as a Class IV wastewater treatment facility under Regulation 129/04. The facility operated under Environmental Compliance Approval (ECA) Sewage No. 8261-99EP4S from January 1 to May 14, 2019, at which point it was superseded with ECA No. 7622-B96S2G, issued on May 14, 2019, for the duration of the year. For reporting purposes, conditions listed in this annual report reference ECA Sewage No. 7622-B96S2G since it was in effect for the majority of the operating year.

This report is a summary of plant operations and performance in 2019. 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.

2 PLANT PROCESS OVERVIEW

A description of the plant process is included below and a schematic flow diagram is available in Appendix A. Additional information on the plant's process can be found on the City of Toronto website[1].

2.1 Influent

Wastewater from the Morningside Sanitary Trunk Sewer and Highland Creek Sanitary Trunk Sewer flows to the plant via a common sewer.

2.2 Preliminary Treatment

Raw wastewater enters the Headworks for screenings and grit removal. Perforated plate screens (6 mm) and washer-compactors are used to capture, wash and remove rags, sticks and large pieces of debris. Vortex grit chambers, grit pumps and hydrocyclones are used to remove, wash and dewater sand, gravel and other heavy inorganics. Ferrous chloride is applied to the raw wastewater upstream of the screens for phosphorous removal. 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 12 Primary Clarification Tanks. Sludge collectors in the tanks sweep the settled sludge, called primary or raw sludge, into sludge 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

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

effluent mixed with return activated sludge (RAS), which is sludge removed from the Final Clarification Tanks. RAS 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 electrically driven blowers. There are a total of 16 Aeration Tanks each equipped with ceramic fine bubble dome diffusers[2].

The mixed liquor from the Aeration Tanks flows to 16 large quiescent 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 sludge 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 (i.e. dechlorinate) from the wastewater, helping to protect the aquatic environment. The final effluent is discharged to Lake Ontario through an outfall pipe extending approximately 1,000 m into the lake. The plant uses direct measurement of Total Residual Chlorine (TRC), in the final dechlorinated effluent for monitoring and compliance.

2.6 Solids Handling

All primary sludge, thickened WAS (TWAS), and scum from the Primary and Secondary Clarification Tanks, collectively called sludge, is treated, handled and disposed of in a similar manner, consisting of anaerobic digestion, intermediate blending and storage, dewatering and then incineration.

Primary sludge, from the Primary Clarification Tanks, is first fed into primary anaerobic digesters. Secondary sludge (WAS), from the Secondary Clarification Tanks, is first thickened through centrifugation and then it is also fed into primary digesters. Centrifugation reduces

[2] *With exception of the first two sections of Aeration Tank 8.*

the volume of sludge by separating solids from liquid. The Thickening process consists of five centrifuges.

Anaerobic digestion is the biological degradation (stabilization) of organic materials (sludge) in the absence of oxygen – it reduces the 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, 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 digestion process consists of a digester control building and four primary digesters.

Digested biosolids are conditioned with a polymer and dewatered by centrifugation. Centrifugation reduces the volume of sludge by separating solids from liquid. The Dewatering process consists of five centrifuges. It is not essential that sludge be digested at Highland Creek Treatment Plant – undigested sludge may be fed directly to the dewatering process and then incinerated.

Digester operations had been suspended since 2015 for rehabilitation/cleaning efforts. Those efforts have since concluded, and commissioning of the digesters began in October 2019.

2.7 Solids Management

The dewatered biosolids are incinerated in one of the two multiple-hearth incinerators. This thermal reduction process produces an ash that is mixed with effluent water from the scrubbers and pumped to one of two ash lagoons. When a lagoon is full, ash is removed and hauled to a landfill site for final disposal.

In extreme situations when the incinerators are out of service for an extended period of time due to unforeseen equipment failure, dewatered biosolids may be hauled off-site for third-party processing and disposal.

3 PROCESS SUMMARY

3.1 Process Parameters

In 2019, the Highland Creek Treatment Plant continued to produce a high quality effluent. A summary of key final effluent parameters and their corresponding 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	cBOD5 (mg/L)	TSS (mg/L)	TP (mg/L)	TRC[1] (mg/L)	E-Coli (count/ 100mL)	pH	
						Min	Max
January	7.3	16.3	0.7	0.009	17	6.6	6.7
February	7.9	15.8	0.7	0.001	12	6.5	6.8
March	6.3	13.0	0.7	0.000	12	6.5	6.7
April	5.2	9.4	0.5	0.000	19	6.4	7.9
May	5.9	12.7	0.7	0.001	9	6.6	6.8
June	6.6	13.2	0.8	0.000	13	6.5	6.7
July	5.9	17.2	0.9	0.002	4	6.5	6.7
August	5.8	13.0	0.8	0.004	6	6.5	6.7
September	7.5	15.4	0.8	0.006	16	6.5	6.6
October	6.1	14.5	0.8	0.007	9	6.3	6.7
November	8.9	20.7	0.9	0.005	6	6.3	6.8
December	9.7	15.4	0.8	0.001	13	6.4	6.8
Annual Average	6.9	14.7	0.8	0.003	12	6.6	
Loading (kg/d)[2]	1,212	2,578	132	N/A	N/A	N/A	
Removal Efficiency[3] (%)	96%	95%	85%	N/A	N/A	N/A	
ECA Requirements[4,5]							
Effluent Objective	AAC: 15.0 mg/L	AAC: 15.0 mg/L	MAC: 0.9 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	
Effluent Loading Limit	AAL: 5,475 kg/d	AAL: 5,475 kg/d	AAL: 219 kg/d	N/A	N/A	N/A	

[1] In addition to TRC analysis, continuous sulfite monitoring is measured as a surrogate for adequate dechlorination of the final effluent
[2] Loading is calculated based on the flow rates as provided in Table 2.
[3] cBOD = 0.8 * BOD assumed for removal efficiency calculatons
[4] Referenced from Amended ECA No. 7622-B96S2G, issued on May 14, 2019.
[5] AAC refers to Annual Average Concentration, MAC refers to Monthly Average Concentration, MGMD refers to Montly 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 Sewers Bylaw 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	2019	2018	2017
Influent Parameters				
Flow [1]	ML/day	175.2	171.7	170.9
Total Annual Flow [1]	ML	63,964	62,671	62,388
Total Suspended Solids (TSS)	mg/L	305.3	288.7	246.7
Biological Oxygen Demand (BOD)	mg/L	232.5	255.9	221.4
Total Phosphorus (TP)	mg/L	5.2	5.7	5.2
Preliminary Treatment				
Grit and Screenings	tonnes/day	4.8	1.8	2.0
Primary Treatment				
TSS	mg/l	124.6	121.5	134.7
cBOD5	mg/L	173.6	169.3	183.9
Secondary Treatment				
Aeration Loading	kg CBOD5/m^3.day	0.57	0.55	0.59
Mixed Liquor Suspended Solids	mg/L	2,705	2,619	2,723
Solids Handling				
Primary Sludge Treated	m^3/day	463	770	910
Primary Sludge TS[2]	%	1.7	2.8	2.6
Primary Sludge TVS[2]	%	n/a	94	82
WAS to Thickening	m^3/day	4,158.6	4,315.0	3,716.4
WAS SS	mg/L	5,886	5,768	6,732
TWAS TS	%	3.1	3.2	4.1
TWAS TVS	%	77	76	77
TWAS Treated	m^3/day	687	665	560
Dewatering Centrifuge Feed Flow	m^3/day	2,478.3	2,494.4	1,848.9
Dewatering Centrifuge Feed TS	%	2	2	2
Dewatered Biosolids TS	%	25.7	28.0	26.2
Centrate Quality	mg/L	853	996	1,516
Solids Capture Rate	%	95	95	94
Dewatered Biosolids Disposed	Dry tonnes/day	42	49	43

Parameter	Units	2019	2018	2017
Dewatered Biosolids Hauled [3]	Dry tonnes/day	0	4	12
Dewatered Biosolids Incinerated	Dry tonnes/day	42	45	31
Ash Removed	tonnes	5,501.5	2,968.6	1,815.0

[1] Flow monitoring is provided by influent flow meters. There are no effluent flow meters due to infrastructure limitations.
[2] Grab samples of raw sludge were replaced with TS% readings from online density analyser in 2019. TVS lab testing was halted, typical range of TVS is 80-90%
[3] Dewatered Solids hauled for processing to the Lystek facility in Dundalk, Ontario, when required as a contingency measure.

In 2019, the total annual influent flow increased by 2.0% as compared to 2018, bringing the plant to 80% of rated capacity. While over the past five years, sewage flow to Highland Creek Treatment Plant has remained relatively constant, the plant is currently in design of a capital project aimed at improving firm capacity and increasing treatment efficiency by installing additional liquid treatment works and rehabilitating the existing process trains.

The sewershed is comprised of mainly separated sewers so the plant does not typically see severe flow variations during typical rain storms; however during intense storms or extended extreme wet weather events, high peak flows may be experienced due to infiltration.

Grit and screenings capture increased 170% in 2019. This was due to the commissioning of the plant's new headworks facility.

There were no effluent limit exceedances/operational issues for 2019 and the plant continued to produce a high quality effluent which surpassed the requirements described in Schedule C of the plant's ECA. This was achieved through continuous improvement in operations and maintenance of treatment processes, and capital project delivery. Annual average effluent concentrations for cBOD and TSS were 6.9 and 14.7 mg/L respectively for 2019. Total Phosphorous in 2019 was 0.8 mg/L and saw no exceedance of effluent objectives for any month. The plant also met Federal Government WSER requirements at all times for un-ionized ammonia and acute toxicity.

The TRC objective under Schedule B of the ECA is prescribed as non-detect. The Highland Creek Treatment Plant utilizes continuous effluent sulphite monitoring as a surrogate to demonstrate adequate dechlorination. Furthermore, in reference to the MECP regulatory method detection limit (RMDL) of 0.01 mg/L for TRC analysis using the amperometric method, the Highland Creek Treatment Plant has adopted an alternate approved method (i.e. colourimetric). This method does not have a MECP RMDL but has a lower measurement range, as specified by the manufacturer, of 0.002 mg/L. This allows for more significant figures to be reported. Considering the RMDL of 0.01 mg/L, the Highland Creek Treatment Plant met the objective for TRC for all of 2019.

There was no deviation from the monitoring schedule as per Condition 11(4)(c). TRC monitoring will be increased to daily and E. Coli sampling to 3 times/week in 2020 to meet the monitoring frequency specified by Condition 9(1)(b).

3.2 Biosolids Management

In 2019, the daily average inflow to the Highland Creek Treatment Plant was 175.2 ML/day. The flow projections for 2019 do not exceed the plant rated capacity of 219 ML/day and are expected to generate a sludge volume that will be +/- 5% of the given volume for 2019.

During 2019, the sludge feed flow to the dewatering centrifuges averaged 2,478 m^3/day which resulted in 42 dry tonnes of dewatered solids being generated per day.

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 exclude applicable taxes. Due to optimization of the dechlorinating process pump set points, the dosage of Sodium Bisulfite was reduced.

Table 3: Chemical Usage Summary

Process	Chemical		2019	2018	2017
Phosphorus Removal	Ferrous Chloride as Fe	Dosage as Fe (mg/L)	9.9	10.3	9.5
		Consumption (tonnes as Fe)	629.5	647.8	589.6
		Cost ($)	$ 522,374	$ 518,240	$ 471,680
Disinfection	Sodium Hypochlorite (12% w/v)	Dosage as Cl (mg/L)	4.9	5.9	6.5
		Consumption (m3)	2,597.2	3,053	3,253
		Cost ($)	$ 451,213	$ 529,552	$ 564,179
Dechlorination	Sodium Bisulfite (38% w/w)	Dosage (mg/L)	3.7	6.9	7.9
		Consumption (tonnes)	633.6	1,138.6	1,309.9
		Cost ($)	$ 136,696	$ 241,256	$ 298,093
Thickening	Polymer	Consumption (tonne)	30.2	27.5	35.2
		Cost ($)	$ 72,091	$ 65,725	$ 84,128
Dewatering	Polymer	Consumption (tonne)	392.4	357.3	457.7
		Cost ($)	$ 937,937	$ 853,947	$ 1, 093,903

3.4 Bypasses, Overflows, Spills, and Abnormal Discharge Events

3.4.1 Bypasses

The Highland Creek Treatment Plant historically does not need to bypass during wet weather events, and did not bypass in 2019. 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. Bypass flow bypasses secondary treatment (i.e. the Aeration Tanks) but receives preliminary, primary treatment, nutrient removal, as well as disinfection and dechlorination before the final effluent sampling point. Secondary bypasses result from high wet weather flows that exceed the plant's secondary treatment capacity. Total precipitation in the Toronto area[3] was 908 mm in 2019, a 1% decrease from 2018.

3.4.2 Overflows

There were no overflow events at the Highland Creek Treatment Plant in 2019. 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.

3.4.3 Spills

There were no liquid spills reported to the MECP in 2019. There were 8 spills to air reported to the MECP in 2019; they are summarized in Table 4 below.

Table 4: Spills Summary[1]

Date	Duration (mins)	Nature of event	Description
Feb.03.	3	Stub Stack Emergency Pressure Relief	Main Power feeder interruption
Feb.06	1	Stub Stack Emergency Pressure Relief	Main Power feeder interruption
Apr.08	2	Stub Stack Emergency Pressure Relief	Main Power feeder interruption
May.03	1	Stub Stack Emergency Pressure Relief	Main Power feeder interruption

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

Date	Duration (mins)	Nature of event	Description
Aug.12	2	Stub Stack Emergency Pressure Relief	Vibration Alarm power trip ID Fan
Aug.13	2	Stub Stack Emergency Pressure Relief	Vibration Alarm power trip ID Fan
Oct. 04	0.5	Stub Stack Emergency Pressure Relief	Main Power feeder interruption
Oct. 08	0.5	Stub Stack Emergency Pressure Relief	Main Power feeder interruption

[1] Under Certificate of Approval No. 3-1044-75-877, use of the stub stacks is limited to emergency situations including power failure, mechnical or electrical failure with the incineration system, and shut down of the incinerator for unanticipated reasons. A notification to the District Officer was issued for every stub stack emergency pressure relief event.

3.4.4 Abnormal Discharge Events

There was one abnormal discharge event at the Highland Creek Treatment plant in 2019 resulting from an interruption to disinfection. A table of correspondence with the MECP, including abnormal discharge events can be found in Section 7.6.

3.5 MECP Procedure F-5-1

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. The plant utilizes the activated sludge treatment process to meet secondary or equivalent treatment and consistently achieves effluent quality at or beyond the compliance limits outlined in the ECA. A description of Effluent Quality Assurance and Control Measures is located in section 3.7.

3.6 Complaints

The Highland Creek Treatment Plant received no complaints related to odour or noise in 2019.

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 operations and performance are monitored by licensed operators as well as by the facility management team. Standard Operating 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. A hybrid Quality and Environmental Management System is also in development and will be reported on in future Annual Reports.

4 CAPITAL PROJECTS

Under Toronto Water's capital program, the Highland Creek Treatment Plant commenced or continued with the capital works projects and studies listed in Table 5 in 2019

Table 5: Capital Projects

Project Name	Project Description	Project Stage (Dec 31, 2019)	Estimated Completion (yyyy)
Beechgrove Influent Sewer	New Beechgrove Sewer influent chamber and twin influent channels to Headworks Building	Tender	2021
Liquid Train Upgrades – Contract 1 and RAS Pumping, Aeration and Phosphorus Removal	Various liquid train upgrades of existing process and new chemical dosing facility for phosphorous removal and aeration upgrades to South East plant.	Construction	2025
Firm Capacity, Liquid Train Upgrades and Process Roadmap	Contract 2-Undertake various process upgrades to maintain firm capacity and process roadmap to assess future requirements and technologies.	Design	2029
Disinfection and Electrical Upgrades	Upgrades to disinfection and dechlorination chemical dosing systems and various electrical upgrades.	Design	2024
Fluidized Bed Incinerator	New fluidized bed incineration facility.	Design	2026
Headworks and Odour Control	New Headworks building with screening and grit removal. New odour control for liquids treatment process.	Complete	2019
Process Control Building	Extension to administration building with office and meeting space and upgrades to existing.	Complete	2019
Electrical Condition Assessment Project #6	Electrical upgrades including new MCC and RPUs to the North/South West plant.	Complete	2019
PLC Platform Migration	Site wide upgrades to various Programmable Logic Controllers.	Complete	2019
Digester Cleaning and Rehabilitation	Rehabilitation of four digesters, including new waste gas burners.	Complete	2019

5 MAINTENANCE

Staff from the Highland Creek Treatment Plant performed a variety of scheduled, preventative, predictive and reactive maintenance activities on a diverse spectrum of equipment. Equipment availability and reliability ensures regulatory compliance is achieved.

The annual calibration and maintenance records of flow meters and on-line analysers for regulated parameters was completed in 2019, and found to be within acceptable limits. A summary of effluent monitoring equipment calibration and maintenance performed in 2019 is included in Table 6.

Table 6: Summary of Regulated Monitoring Equipment Calibration and Maintenance

Calibration and/or Maintenance Record	Completion Date
Primary Influent Flow Meter Phase 1 Calibration	May 7, Oct. 2
Primary Influent Flow Meter Phase 4 Calibration	March 28, Oct. 2
Primary Influent Flow Meter Old 1-4 Calibration	April 29, Oct. 3, Nov. 23
Primary Influent Flow Meter Old 5-8 Calibration	April 29, Oct. 3, Nov. 23
Final Effluent pH and Temperature Meter Calibration	Weekly
HACH DR3900 Spectrophotometer Calibration	June 24
Influent Auto Sampler Calibration and Preventative Maintenance	Feb. 7, April 15, May 29, July 2, Aug. 21, Nov. 21
Final Effluent Auto Sampler Calibration and Preventative Maintenance	Feb. 7, April 15, May 8, July 11, Oct. 11, Dec. 9
ATI Model A15/66 Residual Sulfite Monitor	Aug. 21, Nov. 22

In 2019, there was a total of 8200 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; as a result, no Notices of Modifications were submitted to the Water Supervisor as per Condition 11(4)(l) of the ECA. Regular safety inspections and preventative maintenance were performed on life safety systems at the plant in 2019.

6 UTILITIES

A summary of monthly utility consumption for the previous three years at Highland Creek Treatment Plant is provided in Figure 1. Table 7 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 332 519 m^3, 36.6M kWh, and 9.1M scm, respectively.

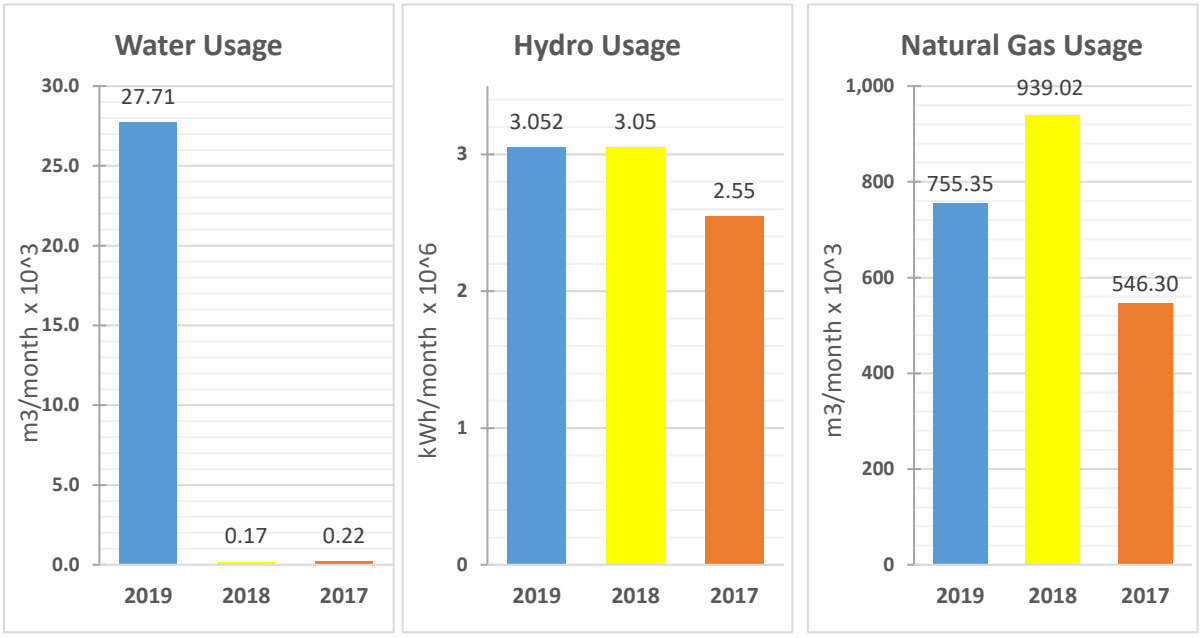


Figure 1: Annual Utility Consumption (Water, Hydro, Gas)

Table 7: Average Unit and Total Utility Cost

Utility	2019	2018	2017
Water Unit Cost ($/$m^3$)	4.07	4.92	3.81
Water Total Cost ($/year)	1,352,086	13,046	10,074
Hydro Unit Cost ($/kWh)	0.10	0.09	0.12
Hydro Total Cost ($/year)	3.50M	3.26M	3.69M
Natural Gas Unit Cost ($/$m^3$)	0.18	0.16	0.22
Natural Gas Total Cost ($/year)	1.60M	1.79M	1.42M

In 2019, the Highland Creek Treatment Plant had its automated water meters commissioned. Water consumption was previously not accurately metered.

7 ADMINISTRATION

7.1 Operations and Maintenance Costs

The 2019 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 and 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 7.2% from 2018.

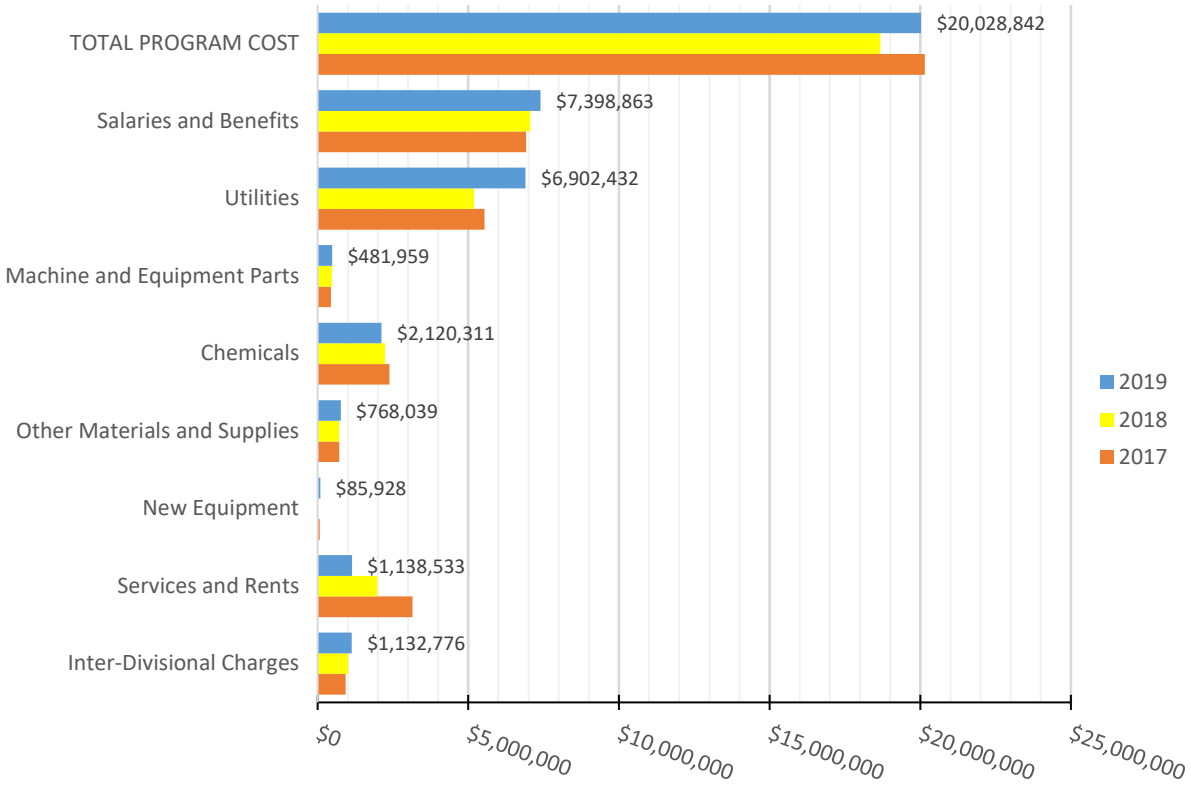


Figure 2: Operations and Maintenance Cost Breakdown

7.2 Human Resources

Plant Staffing at the Highland Creek Treatment Plant in 2019 is shown in Table 8.

Table 8: Plant Staffing

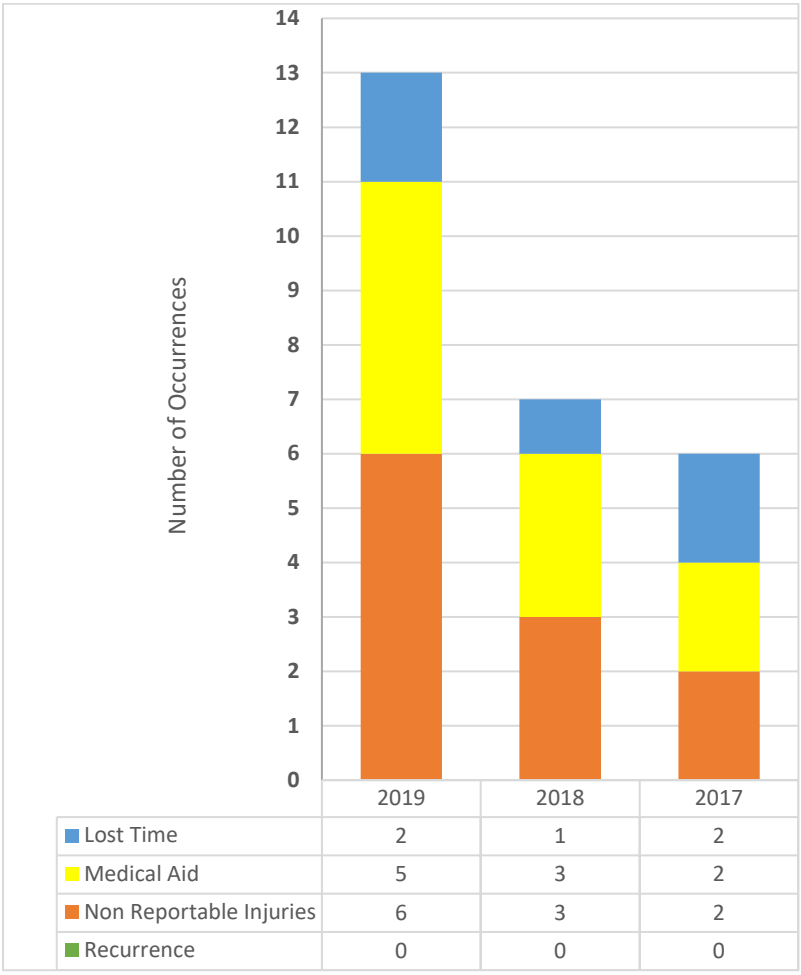
Position	Number of FTE[1]
Plant Manager	1
Senior Engineer	1
Engineer	1
Area Supervisors	4
Electrical & Instrumentation Specialist	1
Electricians	1
Plant Technicians	26
Industrial Millwrights	16
Electrical Instrumentation Control Technicians	7
Wastewater Treatment Plant Workers	6
Support/Materials Management Assistants	2
Engineering Technologist	1
Total FTE Positions	67

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

7.3 Occupational Health and Safety

Continuous efforts are made to ensure a safe working environment at the Highland Creek 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 Highland Creek Treatment Plant are included in Figure 3.

As of December 31, 2019, there were seven health and safety incidents and a total of 37.75 lost time days in 2019 due to work related injuries.



	2019	2018	2017
Lost Time	2	1	2
Medical Aid	5	3	2
Non Reportable Injuries	6	3	2
Recurrence	0	0	0

Figure 3: Highland Creek Treatment Plant Health and Safety Injury Summary[4]

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 Highland Creek Treatment Plant operations and skilled trades staff in 2019 includes the list of courses shown in Appendix G. Some of these courses were eligible

[4] *The previously reported values for 2018 and 2017 have been changed to reflect the status of those WSIB claims as of December 31st, 2019.*

for Continuing Education Units (CEU's) from the Ontario Environmental Training Consortium (OETC). 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 license. 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 9 summarizes the status of operator certification at the Highland Creek Treatment Plant in 2019.

Table 9: Wastewater Treatment Certificates

Class Level	Number of Licenses
Class IV	**19**
Class III	2
Class II	6
Class I	13
O.I.T.	11
Total	51

7.6 MECP/MOL Correspondence

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

Reports were submitted to the MECP for the one odour and two noise complaints received at the plant in 2019.

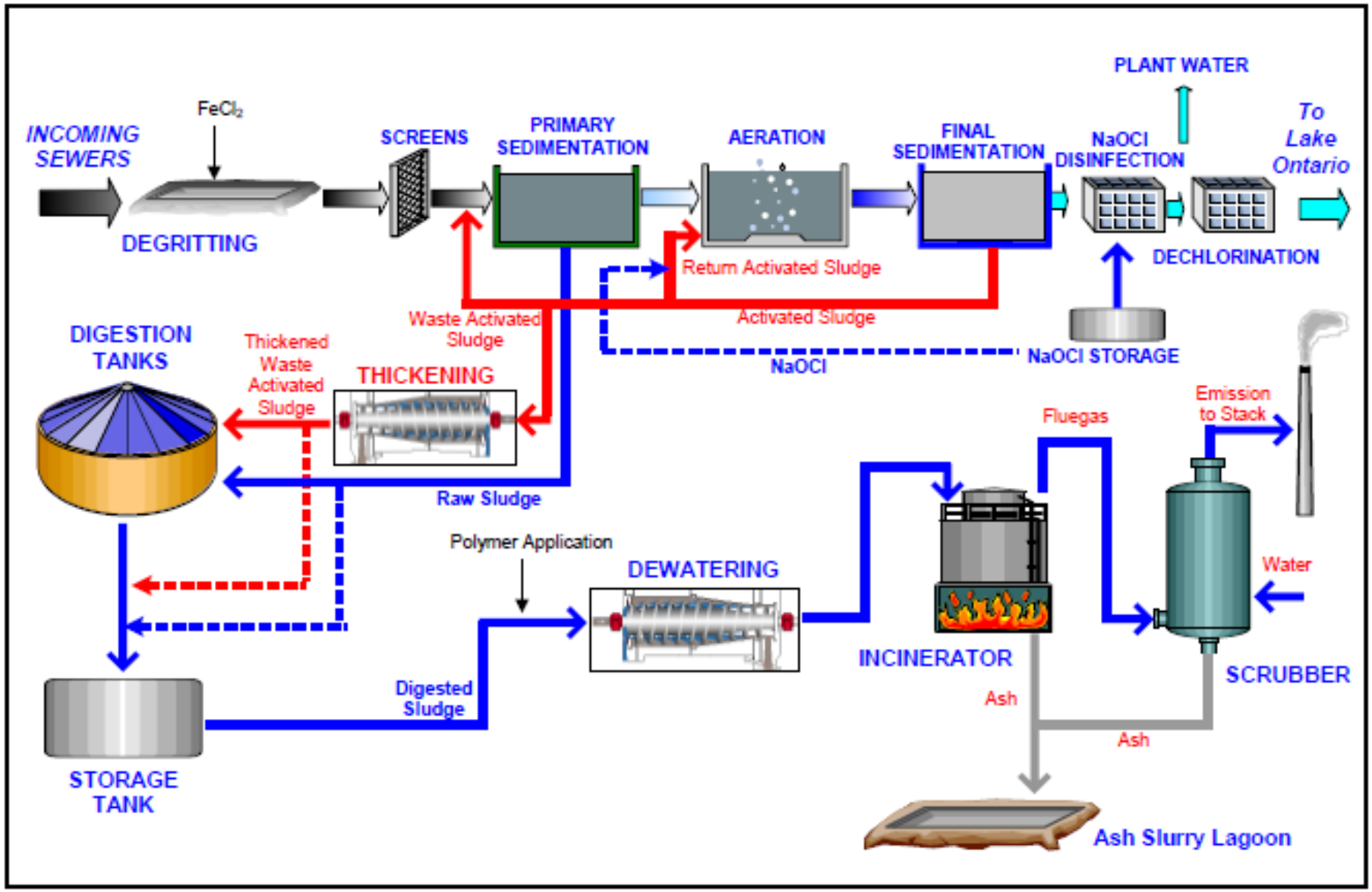
Table 10 summarizes the correspondence submitted to the MECP and MOL for the Highland Creek Treatment Plant. Correspondence related to spills can be referenced in Section 3.4.3.

Table 10: Correspondence submitted to the MECP and MOL

Event Date	Type	Description	Resolution	Resolution Date
December 9, 2019	Abnormal Discharge Event	Interruption to Disinfection	Notified SAC. Replacement of automatic transfer switch (ATS) on emergency generator.	Follow up letter on December 20 to MECP
Consent Letters				
N/A				
Notice of Start-up Notice of Start-up				
N/A				
MECP Inspection				
No inspection conducted				

APPENDIX A – Plant Schematic

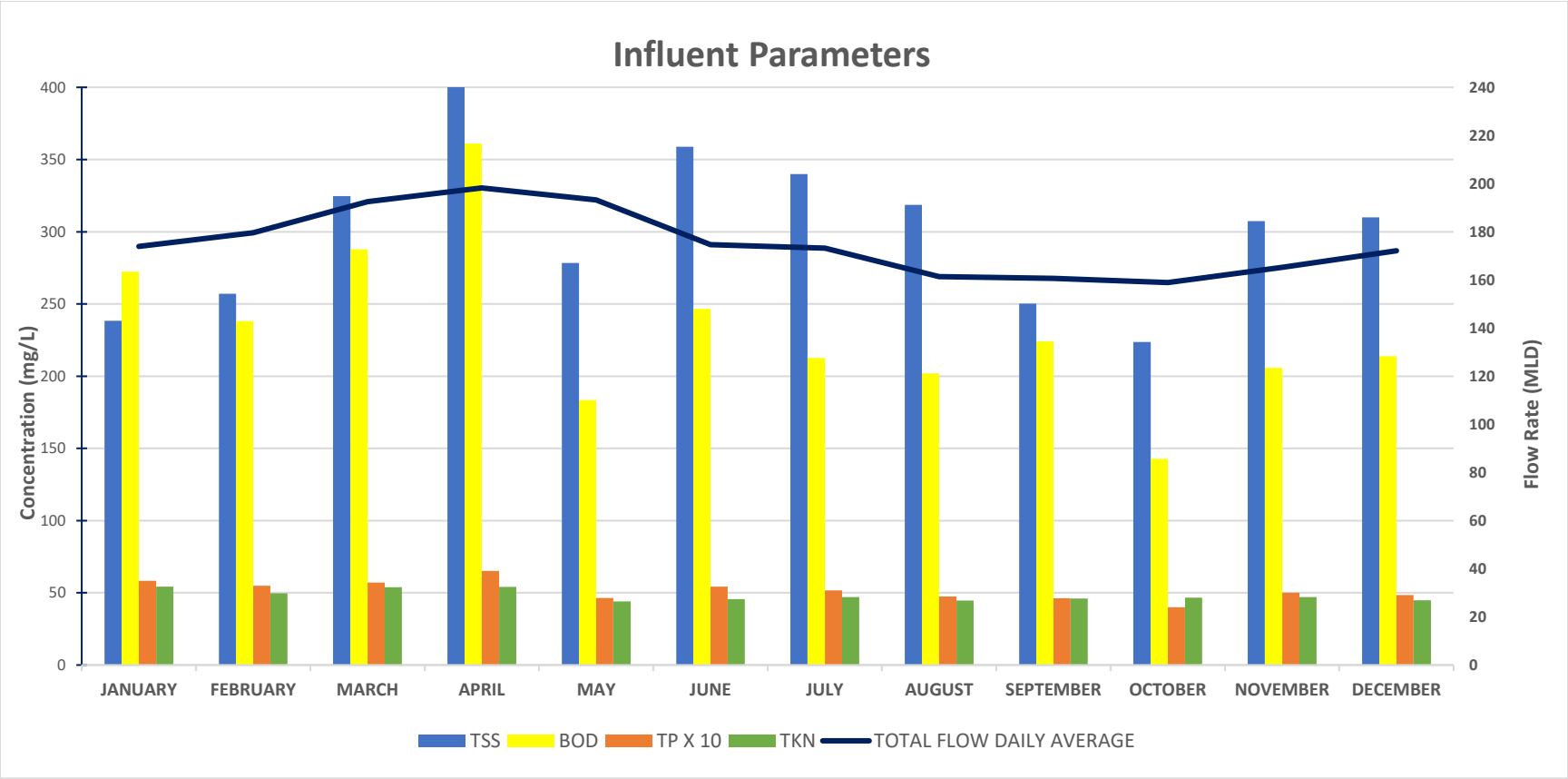
APPENDIX A – Plant Schematic



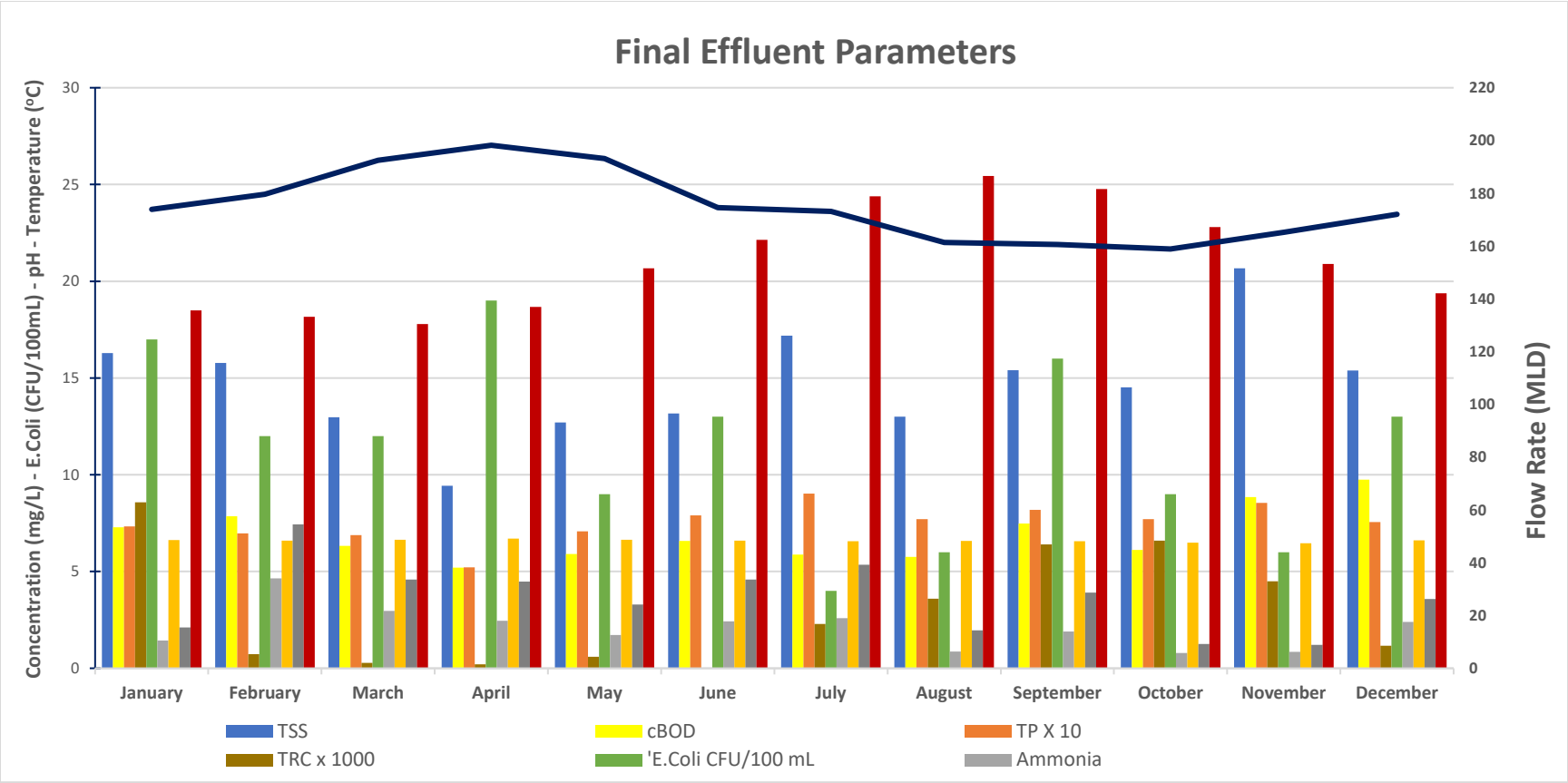
Process Flow Diagram for Highland Creek Wastewater Treatment Plant

APPENDIX B – Influent and Effluent 2019 Performance Charts

APPENDIX B – Influent and Effluent 2019 Performance Charts



APPENDIX B – Influent and Effluent 2019 Performance Charts



APPENDIX C – Historical Performance Data

APPENDIX C – Historical Performance Data

	Units	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Influent Parameters												
Flow	ML/day	175.2	171.7	170.9	161.8	164.9	170.6	169.3	171.1	171.9	166.4	184.7
Total Annual Flow	ML	63964	62670	62388	59200	60208	62242	61804	62453	62753	60720	67398
Total Suspended Solids (TSS)	mg/L	305.3	288.7	246.7	244.8	212.1	247.6	232.3	268.1	238	312.8	295.3
Biochemical Oxygen Demand (BOD_5)	mg/L	232.5	255.9	221.4	242.2	234	232.1	205.9	206.7	185.3	246.1	205.6
Total Phosphorus (TP)	mg/L	5.2	5.7	5.2	5.2	5	4.9	4.4	4.8	4.7	5.6	5.4
Total Kjeldahl Nitrogen (TKN)	mg/L	48.1	48.3	44.0	46.1	39.6	44.3	48.7	52.3	45.0	51.6	45.4
Preliminary Treatment												
Grit and Screenings	tonnes/day	4.8	1.8	2	2.4	1.9	2.3	-	-	-	-	2.8
Primary Treatment												
TSS	mg/L	124.6	121.5	134.7	151	171	339	232.1	332.6	244.4	209.3	175.7
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	mg/L	173.6	169.3	183.9	178	170	180	129.8	155	143.5	124	87.4
Secondary Treatment												
Aeration Loading	kg $CBOD_5$/ m^3.day	0.57	0.5	0.59	0.54	0.53	0.58	0.65	0.66	0.46	0.3	0.3
Mixed Liquor Suspended Solids	mg/L	2705	2620	2723	2736	3243	3296	2380	1577	2747	2431	2372
Final Effluent												
TSS	mg/L	14.7	15.9	14.1	14.6	17.4	20.2	22.8	21	14.6	12.4	15.8
TSS Loading Rate	kg/day	2578	2736	2406	2368	2877	3440	3868	3598	2492	2056	2901
cBOD5	mg/L	6.9	7.3	7.2	6.7	6.2	5.9	8.8	9.1	6.4	5.2	6.3
cBOD5 Loading Rate	kg/day	1212	1245.1	1233	1077	1025	1008	1506	1553	1091	864	1168
TP	mg/L	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.5	0.5	0.6
TP Loading Rate	kg/day	132	120.9	219	117	115	100	104	116	83.5	85	105
Escherichia Coli (E. Coli)	CFU/100 mL	11.3	21.0	16.0	53.2	40.2	10.4	34.9	15.5	6.4	3.9	16.7
pH	-	6.6	6.7	6.7	6.5	6.5	6.5	6.2	6.4	6.9	6.6	6.6

APPENDIX C – Historical Performance Data

	Units	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
Total Residual Chlorine	mg/L	0.003	0.004	0.004	0.007	0.006	SBS (P)	SBS (P)	SBS (P)	SBS (P)	SBS (P)	-
Total Kjeldahl Nitrogen (TKN)	mg/L	3.6	3.8	3.4	2.8	3.5	4.6	5.0	10.2	9.7	10.1	15.2
Total Ammonia Nitrogen	mg/L	2.1	2.0	1.5	1.1	1.4	2.9	3.4	7.7	8.1	9.0	12.4
Temperature	degrees Celsius	21.1	21.8	21.5	22.2	-	-	-	-	-	-	-
Solids Handling												
Primary Sludge Treated	m3/day	463	770	910	1090	1525	2150	2900	2944	4100	3553	3900
Primary Sludge Total Solids (TS)	%	1.67	2.85	2.55	2.4	2.8	2.6	2.2	2.2	3.2	2.4	2.4
Primary Sludge TVS	%	n/a	93.56	81.83	81.9	81.6	77.9	73.5	78.9	60.8	66.5	72.5
WAS to Thickening	m3/day	4,159	4,315	3716	3519	3110	2254	-	-	-	-	-
Thickened WAS (TWAS) TS	%	3.11	3.23	4.12	3.83	5.3	5.7	-	-	-	-	-
TWAS Treated	m3/day	687	665.18		474	323	1236	-	-	-	-	-
WAS to Co-settling	m3/day	-	-	-	-	-	-	6600	6875	5893	6905	7250
WAS SS	mg/L	5,886	5,768	6732	6126	7358	7300	4500	3262	4148	3491	3700
Dewatering Centrifuge Feed Flow	m3/day	2,478	2,494	1849	1924	2143	2065	1966	1906	1873	1913	1818
Dewatering Centrifuge Feed TS	%	2	2.06	2.48	2.3	3	2	1.7	1.5	1.6	1.6	1.6
Dewatered Biosolids incinerated	Dry tonnes/day	42	45.38	31.1	45.1	57.4	38.5	29.2	23.1	28.1	28.9	27.5
Dewatered Biosolids TS	%	26	28.0	26.2	26.6	22.8	25	25.8	26.5	26.4	26.5	27.1
Ash Removed	tonnes	5,502	2968.59	1815	3775	6141	3300	2100	-	-	-	-

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*	*0.002*	*0.002*	0.191	1.97	*0.0025*	0.073	*0.00005*	0.0060	0.117
February	*0.005*	*0.002*	0.00443	*0.002*	0.121	1.85	*0.0025*	0.064	*0.00005*	0.0062	0.132
March	*0.005*	*0.002*	0.0219	*0.002*	0.216	33	0.0124	0.285	0.00032	0.0160	0.255
April	*0.005*	*0.002*	0.0188	*0.002*	0.213	23	0.0111	0.203	0.00020	0.0110	0.18
May	*0.005*	*0.002*	0.0116	*0.002*	0.115	11.8	*0.0025*	0.126	0.00012	0.0080	0.119
June	*0.005*	*0.002*	0.0142	*0.002*	0.127	14.7	*0.0025*	0.153	*0.00005*	0.0085	0.129
July	*0.005*	*0.002*	0.0185	*0.002*	0.152	21.6	*0.0025*	0.200	0.00011	0.0105	0.124
August	*0.005*	*0.002*	0.0225	*0.002*	0.147	30.4	*0.0025*	0.291	*0.00005*	0.0114	0.123
September	*0.005*	*0.002*	0.0236	*0.002*	0.109	33.5	*0.0025*	0.351	0.00017	0.0110	0.0752
October	*0.005*	*0.002*	0.0186	*0.002*	0.122	26.2	*0.0025*	0.280	0.00010	0.0116	0.0874
November	*0.005*	*0.002*	0.0225	*0.002*	0.193	34.3	*0.0025*	0.296	*0.00005*	0.0117	0.106
December	*0.005*	*0.002*	0.0203	*0.002*	0.12	27.9	*0.0025*	0.193	*0.00005*	0.0097	0.0965
Annual Average	*0.005*	*0.002*	0.01658	*0.002*	0.1522	21.685	0.0040	0.210	0.00011	0.0101	0.1287

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

APPENDIX D – Influent and Effluent Metal Concentrations

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*	0.0334	1.21	*0.0025*	0.0654	*0.00005*	0.0054	0.0358
February	*0.005*	*0.002*	*0.002*	*0.002*	0.0162	0.884	*0.0025*	0.0764	*0.00005*	0.0054	0.035
March	*0.005*	*0.002*	*0.002*	*0.002*	0.0133	0.671	*0.0025*	0.0795	*0.00005*	0.0058	0.0313
April	*0.005*	*0.002*	*0.002*	*0.002*	0.0128	0.717	*0.0025*	0.07	*0.00005*	*0.0025*	0.0289
May	*0.005*	*0.002*	*0.002*	*0.002*	0.0126	0.796	*0.0025*	0.0656	*0.00005*	*0.0025*	0.0328
June	*0.005*	*0.002*	*0.002*	*0.002*	0.0137	0.882	*0.0025*	0.0708	*0.00005*	*0.0025*	0.0315
July	*0.005*	*0.002*	*0.002*	*0.002*	0.0151	1.21	*0.0025*	0.0857	*0.00005*	0.0052	0.0316
August	*0.005*	*0.002*	*0.002*	*0.002*	0.0143	1.01	*0.0025*	0.0823	*0.00005*	0.0054	0.033
September	*0.005*	*0.002*	*0.002*	*0.002*	0.016	1.32	*0.0025*	0.0788	*0.00005*	0.0053	0.0307
October	*0.005*	*0.002*	*0.002*	*0.002*	0.0114	1.12	*0.0025*	0.0731	*0.00005*	0.0089	0.0273
November	*0.005*	*0.002*	*0.002*	*0.002*	0.0187	1.52	*0.0025*	0.0815	*0.00005*	*0.0025*	0.0331
December	*0.005*	*0.002*	*0.002*	*0.002*	0.015	1.2	*0.0025*	0.0768	*0.00005*	*0.0025*	0.106
Annual Average	*0.005*	*0.002*	*0.002*	*0.002*	0.016	1.045	*0.0025*	0.075492	*0.00005*	0.0045	0.0381

Values in red italics are half the MDL

APPENDIX E – Dewatered Sludge Analysis

APPENDIX E – Dewatered Sludge Analysis

	Arsenic	Cadmium	Cobolt	Chromium	Copper	Mercury	Molybdenum	Nickel	Lead	Potassium	Selenium	Zinc
Limit (1)	*170*	*34*	*340*	*2800*	*1700*	*11*	*94*	*420*	*1100*	*-*	*34*	*4200*
January	1.84	0.23	1.38	29.2	370	0.073	5.17	10.1	7.1	44.2	1.92	263
February												
March												
April	1.60	0.64	1.35	26.5	369	0.116	5.00	11.5	8.7		1.60	304
May	1.72	0.22	1.22	22.5	354	0.217	6.48	10.2	7.5		1.92	346
June	1.77	0.22	1.31	33.2	368	0.283	5.34	9.7	7.6		1.77	290
July												
August	1.47	0.24	2.32	35.3	414	0.245	6.99	13.8	10.0		2.59	366
September												
October	0.61	0.24	1.35	29.5	356	0.064	8.45	26.2	12.1		2.14	306
November												
December												
Annual Average	1.5	0.30	1.49	29.4	372	0.17	6.24	13.6	8.9	44.2	1.99	313

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

(1) As per MECP regulations for sludge utilization on agricultural lands.

Values in red are half of the less than values converted from mg/l

APPENDIX F – Maintenance Activities

APPENDIX G – Maintenance Activities

Solids Handling (Work Area 1)

Work Area 1 includes sludge storage and dewatering centrifuges, incineration and ash handling, and anaerobic digesters. A total of 2,376 work orders were closed in this work area in 2019. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 1 in 2019:

- Sludge dewatering centrifuges:
    - Centrifuge preventative maintenance.
    - Overhaul of centrifuges as required
- Ash slurry pumps preventative maintenance
- Repaired Ash slurry hoppers and level controllers and isolation valves
- Incinerator #1 and Incinerator #2 quencher/scrubber maintenance
- Replaced/rebuild sludge grinder
- Replaced sections of ash slurry piping and check valves
- Removed Incinerator #2 clinkers and broken refractory
- Removed refractory from Incinerator #2 broken rabble arms
- Tuned burners on Incinerator #1 and Incinerator #2
- Continuous SCADA upgrades for incinerators, sludge feed, and polymer mixing system
- Regular maintenance of polymer feed pump and polymer neat pump
- Testing and calibration of all WA-1 back-flow preventers (with documentation)

Liquids (Work Area 2)

Work Area 2 encompasses the liquid treatment portion of the plant including grit and screening removal, primary clarification, aeration and secondary clarification, TWAS, phosphorous removal, effluent disinfection and dechlorination. A total of 3,491 work orders were closed in this work area in 2019. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 2 in 2019:

- Headworks:
    - Bar screens regular preventative maintenance.
    - Screw Conveyers, replacement of wear liners.
    - Vortex gear boxes lubricated and inspected.
    - Grit pumps, grit valves, tanks and conveyer system maintained.
- Primary Tanks:
    - Primary bridge drive lubricated and alignment checked. Wear parts replaced.
    - Scum and sludge pumps lubricated and inspected.
    - Valves and piping inspected.
- Mechanical repairs to Primary tank collectors

APPENDIX G – Maintenance Activities

- Mechanical repairs to Final tank collectors
- Various primary and final tank sludge and scum collector repairs
- Repairs to process air blowers
- Rebuild of Ferrous Chloride pumps and Sodium Hypochlorite pumps
- Raw sludge, Return Activated Sludge and scum pump repairs
- Thickening Centrifuges overhauled
- Rebuild of TWAS transfer pumps and polymer dosing pumps
- Sump pump preventative maintenance.
- Testing and calibration of all WA-2 back-flow preventers (with documentation). Repair and rebuild as required.
- Repair and rebuild of backflow preventers.

Plant Services 1 (Work Area 3)

Work Area 3 encompasses various plant support services such as effluent water pumping, instrument air system, buildings and grounds maintenance, security and building HVAC systems. A total of 1,321 work orders were closed in this work area in 2019. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 3 in 2019:

- Inspection, maintenance and corrective repairs of the following safety instrumentation:
    - Gas detectors.
    - Waste gas burner instrumentation.
- Inspection, maintenance and corrective repairs of the following services:
    - Electrical and power equipment
    - HVAC systems
- Plant roadway lighting upgrades
- Forklifts, Scissor lift and Overhead Cranes annual inspections
- Maintained and repaired unlicensed vehicles (personnel vehicles for plant use only)
- Disposed of environmental wastes, fluorescent bulbs and batteries
- Repaired various potholes on all plant roadways
- Continuous improvement of tunnel and outside building lighting
- Replaced sump pumps in various locations
- Inspection and repairs, as required, for all Back Flow Preventers
- Preventative maintenance on Emergency generators (Headhouse and Solids Disposal Building)
- Repaired and replaced heating valves and piping in various location
- Repaired and replaced heating booster pumps in various locations
- Replaced corroded effluent water piping and valves in various locations
- Repaired and replaced heating coils
- Maintained monthly inspections on fire extinguishers

APPENDIX G – Maintenance Activities

- Maintained monthly inspections on elevators
- Preventive maintenance and repairs on plant HVAC systems
- Coordinate all landscaping, grounds keeping and snow removal
- Coordinate with Toronto Security all repairs, replacement and upgrades to cameras, doors, gates and locks
- Coordinate maintenance and repairs on licensed vehicles

Plant Services 2 (Work Area 4)

Work Area 4 encompasses various plant support services such as the digester gas system, boilers, process ventilation, odour control systems and fire protection systems. A total of 1,012 work orders were closed in this work area in 2019. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 4 in 2019:

- Lubricated all mechanical components.
- Serviced boilers and inspected all control systems
- Optimized operations of 4 boiler hot water feed pumps
- Monthly maintenance and servicing of all 7 ozone generators
- Monthly testing and service of all plant gas monitoring systems
- Tested and serviced all plant fire hydrants as needed
- Replaced hot water pumps in the plant
- Rebuilt or serviced 6 hot water pumps
- Overhauled primary tanks
- Overhauled final tanks
- Serviced and maintained 2 biofilters
- Serviced heating system piping, coils and glycol system
- Various plant upgrade projects
- Installed new scum collector on primary clarifier.
- Testing and calibration of all WA-4 back-flow preventers (with documentation).

APPENDIX G – Staff Training Courses

Training attended by Highland Creek Treatment Plant operations and skilled trade staff in 2019 includes the list of courses below.

Technical and Health and Safety Training:

- Accident & Damage Reporting
- Accident/Incident Reporting
- Activated Sludge
- AED, level "C" CPR Renewal Course
- Aerial Work Platform Safety
- Air Purifying Respirators
- Arc Flash for Non-Qualified Persons
- Asbestos Awareness
- Basic Vibration Analysis
- Confined Space Rescue - 2 Day
- Corporate Security: Surviving an Active Shooter(November 2019 Tailgate)
- Critical Pump Maintenance, Packing, and Mechanical Seals
- Cross Connection Specialist Backflow Tester – Certification
- Electrical Safety for District Operations and Maintenance Operators
- ELOG Employer Minimum Content
- Emergency First Aid Level "A" CPR
- Fall Protection Awareness
- Fundamentals of Ladder Safety Awareness
- HCTP Bulk Chemical Receiving And Unloading Training
- HCTP Fire Evacuation Training
- HCTP Shelter In Place Evacuation Training
- Hot Work Permit System Awareness
- Industrial Maintenance Technician (IMT)M Certification
- In-Service Heath and Safet Orientation
- Joint Health and Safety Committees - (JHSC) Certification Training Part I - Basic
- Joint Health and Safety Committees - (JHSC) Certification Training Part II - Workplace Specific Hazard Training
- Lock Out Tag Out Training
- Lock Out, Tag Out and Test Awareness
- Logbook Entry
- Mathematics For Operators: Module 1

- Mathematics For Operators: Module 2
- MMR – Self-Contained Breathing Apparatus
- Quarterly Inspections
- Quatro Safety Incident Reporting
- Rigging Safety Awareness
- Scaffolding Awareness Course
- SCBA Refresher
- Sewage Works & Surface Water Spill Response Awareness (May 2019 Tailgate)
- Spill Contingency Plan
- Standard First Aid - Level "C" CPR and AED - 2 Day
- Transportation of Dangerous Goods
- Trenching And Excavation Awareness
- Water Valve Training, Selection, Operation, Maintenance
- WMS Avantis Workshop
- WWT-MOECC Exam Prep For Wastewater Treatment Level 3 And 4

Other Training:

- Access to Information and Protection of Privacy
- Accessible Customer Service Standard
- AODA - IASR Information and communications Standard training
- Attendance Management
- Coping with Shift Work
- OneNote 2013 Fundamentals
- Outlook 2013 – Increase your Productivity with Outlook
- Performance Management in a Unionized Environment
- Preparing to Move into Supervision
- Respect in our Workplace
- Violence in the Workplace