TORONTO Water

HIGHLAND CREEK WASTEWATER TREATMENT PLANT

2017 Annual Report

March 31, 2018

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 operates under Environmental Compliance Approval (ECA) Sewage No. 8261-99EP4S, issued on October 28, 2015.

The average daily flow rate in 2017 was 170.9 ML/day. Influent concentrations of Biochemical Oxygen Demand (BOD_5), Total Phosphorus (TP) and Total Suspended Solids (TSS) averaged 221.4 mg/L, 5.2 mg/L and 246.7 mg/L, respectively.

Highland Creek Treatment Plant achieved the following effluent quality and loading rates in 2017 in comparison to ECA limits:

	ECA[1]	2017 Final Effluent
Total Suspended Solids (TSS)	25 mg/L	14.1 mg/L
Carbonaceous Biological Oxygen Demand ($CBOD_5$)	25 mg/L	7.2 mg/L
Total Phosphorus (TP)	1 mg/L	0.7 mg/L
Escherichia Coli (E. Coli)[2]	200 CFU/100mL	16 CFU/100mL
pH	6.0-9.5	6.7
Total Chlorine Residual (TRC) (Dechlorination)	0.02 mg/L	0.004 mg/L
TSS Loading Rate	5,475 kg/day	2,406 kg/day
$CBOD_5$ Loading Rate	5,475 kg/day	1,233 kg/day
TP Loading Rate	219 kg/day	125 kg/day

[1] Referenced from ECA No. 8261-99EP4S, issued on October 28, 2015.

[2] Arithmetic mean of monthly geometric mean data.

During 2017, the sludge feed flow to the dewatering centrifuges averaged 1,849 m^3/day which resulted in 43.3 dry tonnes of dewatered solids being generated per day.

Ferrous chloride consumption for phosphorus removal was 9.54 tonnes as iron (Fe) per 1000ML wastewater treated. Polymer consumption in 2017 for waste activated sludge (WAS) thickening and sludge dewatering totalled 7.93 tonnes per 1000 ML treated. Total sodium hypochlorite (12%) consumption for disinfection totalled 52.14 m^3 per 1000 ML. Sodium Bisulphite (SBS) (38%) consumption for effluent dechlorination totalled 15.79 m^3 per 1000 ML.

There was one bypass occurrence in 2017 where there was no reduction in total effluent quality over the duration of the event. The total bypass flow was estimated to be 0.468 ML.

The plant continued with various capital projects. Notable projects included: Biosolids Treatment Upgrades, and the Headworks and Odour Control Upgrades. A variety of preventative, predictive and reactive maintenance was completed, including the calibration of effluent monitoring equipment.

Total annual consumption of potable water, hydro, and natural gas was 2,642 m^3, 30.6M kWh, and 6.6M m^3, respectively. Plant operating costs for 2017 totalled $20.1M. In 2017, the Highland Creek Treatment Plant had an establishment of 68.5 employees. As of December 31, 2017 there were two health and safety incidents and two days lost due to work related injuries.

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GLOSSARY OF ABBREVIATIONS

AAC	Annual Average Concentration
BOD_5	Five-Day Biochemical Oxygen Demand
$CBOD_5$	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
HCTP	Highland Creek Treatment Plant
HP	Horsepower
HRT	Hydraulic Retention Time
kg	kilogram
kWh	Kilowatt-hour
M	Million
MAC	Monthly Average Concentration
MGMD	Monthly Geometric Mean Concentration
MOECC	Ministry of Environment and Climate Change
MWh	Megawatt-hour
m3	Cubic metre
m3 /day	Cubic metre per day
mA	Milliamps
mg/L	Milligrams per litre
mL	Millilitre
ML	Megalitre
No.	Number
Q	Flow Rate
RAS	Return Activated Sludge
SBS	Sodium Bisulphite
SBS (P)	Sodium Bisulphite Presence
SS	Suspended Solids
TCR	Total Chlorine Residual
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

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

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

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

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, electrical power distribution, natural gas, and instrument air.

The Ministry of the Environment and Climate Change (MOECC) has classified the Highland Creek Treatment Plant as a Class IV wastewater treatment facility under Regulation 129/04. The facility operates under ECA Sewage No. 8261-99EP4S, issued on October 28, 2015.

This report is a summary of plant operations and performance in 2017. Highlights of the report include a discussion of effluent quality and summaries of process operations, 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. A Plant process flow diagram is included 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 grit and screenings removal. Aerated grit channels, cyclones and classifiers are used to remove and dewater grit; climber-type bar screens remove rags and large pieces of debris. Ferrous chloride is applied at the head of the aerated grit channels 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 effluent mixed with return activated sludge (RAS), which is sludge 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 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

[1] *https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/*
[2] *With exception of the first 2 sections of Aeration Tank 8.*

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 through an outfall pipe extending approximately 1000 m into the lake from the shore

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 five centrifuges. 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 and ash handling.

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, 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.

Following digestion, the 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.

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.

3. 2017 PROCESS SUMMARY

3.1. Process Parameters

In 2017, the Highland Creek 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)	Chlorine Residual (mg/L)	E Coli (count/100mL)
January	7.2	13.5	0.64	0.006	15
February	7.4	11.3	0.60	0.006	10
March	6.0	10.5	0.63	0.009	18
April	7.0	14.0	0.66	0.013	34
May	9.5	19.0	0.76	0.006	43
June	7.3	17.1	0.79	0.002	11
July	5.8	12.8	0.67	0.004	8
August	5.2	10.4	0.71	0.002	12
September	6.1	12.7	0.87	0.000	8
October	6.7	14.8	0.84	0.003	12
November	8.5	16.1	0.82	0.002	16
December	9.9	16.6	0.81	0.002	4
Annual Average	7.2	14.1	0.7	0.004	16
Loading (kg/d)	1233	2406	125	N/A	N/A
Removal Efficiency[1] (%)	96%	94%	86%	N/A	N/A
ECA Requirements[2, 3]					
Effluent Objective[2, 4]	AAC: 15 mg/L	AAC: 15 mg/L	MAC: 0.9 mg/L	MAC: 0 mg/L	MGMD: 150 CFU/100 mL
Effluent Limit[2, 4]	AAC: 25 mg/L	AAC: 25 mg/L	MAC: 1 mg/L	MAC: 0.02 mg/L	MGMD: 200 CFU/100 mL
Average Waste Loading Limit[2]	5475 kg/d	5475 kg/d	219 kg/d	N/A	N/A

[1] cBOD = 0.8 * BOD assumed for removal efficiency calculatons
[2] Referenced from ECA No. 8261-99EP4S, issued on October 28, 2015.
[3] The ECA effluent objective and limit for pH is 6.5 to 8.5 and 6.0 to 9.5 respectively, inclusive, at all times. Effluent pH in 2017 was within the required objective and limit.
[4] AAC refers to Annual Average Concentration, MAC refers to Monthly Average Concentration, and MGMD revers to Montly Geometric Mean Density

Influent and Final effluent concentrations of ten 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 process parameters over the past three years are shown in Table 2.

Table 2: Process Summary

Parameter	Units	2017	2016	2015
Influent Parameters				
Flow	ML/day	170.9	161.8	164.9
Total Annual Flow	ML	62,388	59,200	60,208
Total Suspended Solids (TSS)	mg/L	246.7	244.8	212.1
Biochemical Oxygen Demand (BOD_5)	mg/L	221.4	242.2	234
Total Phosphorus (TP)	mg/L	5.2	5.5	5
Preliminary Treatment				
Grit and Screenings	Tonnes/day	2.0	2.4	1.9
Primary Treatment				
TSS	mg/l	134.7	151.3	171.3
BOD_5	mg/L	183.9	178.4	169.8
Secondary Treatment				
Aeration Loading	kg $CBOD_5/m^3 \cdot day$	0.59	0.54	0.53
Mixed Liquor Suspended Solids	mg/L	2,723	2,736	3,243
Solids Handling				
Primary Sludge Treated	m^3/day	910	1,090	1,525
Primary Sludge TS	%	2.6	2.4	2.8
Primary Sludge TVS	%	82	82	82
WAS to Thickening	m^3/day	3,716.4	3,519.2	3,110.0
WAS SS	mg/L	6,732	6,126.0	7,358.0
TWAS TS	%	4.1	3.8	5.3
TWAS TVS	%	77	-	-
TWAS Treated	m^3/day	560	474	323
Dewatering Centrifuge Feed Flow	m^3/day	1,848.9	1,924.0	2,143.0
Dewatering Centrifuge Feed TS	%	2	2	3
Dewatered Solids TS	%	26.2	26.6	22.7
Centrate Quality	mg/L	1,516	1,014	3,240
Solids Capture Rate	%	94	96	89
Dewatered Solids Disposed	Dry Tonnes/day	43.3	43.1[1]	57.4
Dewatered Solids Hauled[2]	Dry Tonnes/day	12.2	12.4	-
Dewatered Solids Incinerated	Dry Tonnes/day	31.1	30.7	57.4
Ash Removed	Tonnes	1,815.0	3,775.0	6,141.0

[1]Quantity incorrectly reported in 2016 has been corrected as shown.

[2]All Dewatered Solids hauled for processing to the Lystek facility in Dundalk ON

In 2017, to facilitate cleaning and rehabilitation of the digesters, anaerobic digestion of primary sludge and TWAS was not performed. The digesters have been offline since September 2015 and are

expected to be back in service in 2019. In 2017, the Highland Creek Treatment Plant encountered no abnormal operating problems, and continued to produce a high quality effluent which surpassed requirements of the effluent objectives as described in condition 6 of the plant's ECA. This was achieved through continuous improvement in operations and maintenance of treatment processes, and infrastructure delivery. The plant also met Federal Government effluent monitoring requirements for un-ionized ammonia and acute toxicity.

3.2. Biosolids Management

In 2017, the daily average inflow to the Highland Creek Treatment Plant was 170.9 ML/day. The flow projections for 2018 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 2017.

During 2017, the sludge feed flow to the dewatering centrifuges averaged 1,849 m^3/day which resulted in 43.3 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 year based on 1000ML of water treated in the facility for the past three years.

Table 3: Chemical Usage Summary

Process	Chemical	2017 Usage (/1000ML treated)	2017 Unit Cost	2016 Usage (/1000ML treated)	2016 Unit Cost	2015 Usage (/1000ML treated)	2015 Unit Cost
Phosphorus Removal	Ferrous Chloride as Fe	9.54 tonnes	$800/ tonne Fe	11.30 tonnes	$800/ tonne Fe	14.48 tonnes	$815/ tonne Fe
Disinfection	Sodium Hypochlorite	52.14 m^3	$157/$m^3$	37.47 m^3	$129/ m^3	21.45 m^3	$128/ m^3
Dechlorination	Sodium Bisulphite	15.79 m^3	$282/ m^3	7.31 m^3	$303/ m^3	2.78 m^3	$299/ m^3
Biosolids Dewatering and WAS Thickening	Polymer	7.93 tonnes	$2390/ tonne	6.83 tonnes	$2390/ tonne	3.69 tonnes	$4237/ tonne

There was a 47% increase in consumption of Sodium Hypochlorite from 2016. This is due to an increase of usage for RAS chlorination to control filamentous bulking. In addition the plant increased its chlorine dose to maintain consistent *E.coli* levels during months when the effluent suspended solids concentration was approaching the objective level. The corresponding increase in the Sodium Bisulphite dosage was required to adequately provide dechlorination to maintain the effluent total chlorine residual limit. Usage of all other chemicals has been similar year over year.

3.4. Bypasses, Overflows and Spills

3.4.1. Bypasses

There was one bypass event in 2017. Leakage at one of the bypass gates in the South East plant allowed approximately 1% of the average daily flow to bypass secondary treatment. The total volume of the bypass flow was estimated to be 0.468 ML and did combine with the rest of the plant's fully treated effluent which was disinfected and dechlorinated before being discharge to the lake. . The bypass produced no reduction in total effluent quality over the duration of the event.

3.4.2. Overflows

There were no overflow events at the Highland Creek Treatment Plant in 2017. 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 two spills reported to the MOECC in 2017. The first spill event was on January 5th when approximately 25 litres of RAS overflowed and required remediation. The second spill was on February 21st when approximately 50-75 litres of treated effluent water leaked onto the paved road and catch basin and was pumped back into the treatment process. In both instances, the spills were contained, remediated, and reported to the Spill Action Centre of the MOECC.

3.5. Complaints

The Highland Creek Treatment Plant received two complaints related to odour. The complaints were logged on March 18th and June 28th. For additional information, please refer to Section 7.6 – MOECC/MOL Correspondence.

3.6 Effluent Quality Assurance or 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 plant technicians 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.

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 4: Capital Projects4.

Table 4: Capital Projects

Project Name	Project Description	Project Stage (Dec 31, 2017)
Biosolids Treatment Unit	New dewatering centrifuges and refurbishment of multiple hearth furnaces	Construction
Headworks and Odour Control	New Headworks building with screening and grit removal. New odour control for liquids treatment process	Construction
Process Control Building	Extension to administration building with office and meeting space and upgrades to existing	Construction
RAS Pumping, Aeration and Phosphorus Removal	New chemical dosing facility for phosphorous removal and aeration upgrades to South East plant	Design
Electrical Condition Assessment Project #6	Electrical upgrades including new MCC and RPUs to the North/South West plant	Construction
PLC Platform Migration	Site wide upgrades to various Programmable Logic Controllers	Construction
Firm Capacity, Liquid Train Upgrades and Process Roadmap	Undertake various process upgrades to maintain firm capacity and process roadmap to assess future requirements and technologies.	Design
Tunnel Concrete Inspection & Repairs	Site wide concrete repairs and ongoing inspection services	Construction
Digester Cleaning and Rehabilitation	Rehabilitation of four digesters, including new waste gas burners	Construction
Disinfection and Electrical Upgrades	Upgrades to disinfection and dechlorination chemical dosing systems and various electrical upgrades.	Design
Fluidized Bed Incinerator	New fluidized bed incineration facility	Design
Communication System Upgrade	Upgrades to site wide communication system	Study

5. MAINTENANCE

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

The calibration and maintenance records of flow meters, automatic samplers and on-line analysers for regulated parameters was completed in 2017, and found to be within acceptable limits. A summary of effluent monitoring equipment calibration and maintenance performed in 2017 is included in Table 5.

Table 5: Summary of Regulated Parameters Monitoring Equipment Calibration and Maintenance

Calibration and/or Maintenance Record	Completion Date
Primary Influent Flow Meter Phase 1 Calibration	Jan 4, Sept 9, 2017
Primary Influent Flow Meter Phase 4 Calibration	Feb 12, Dec 18, 2017
Primary Influent Flow Meter Old 1-4 Calibration	Apr 29, Dec 16, 2017
Primary Influent Flow Meter Old 5-8 Calibration	Apr 29, Dec 16, 2017
Final Effluent pH and Temperature Meter Calibration	Oct 20, 2017
HACH DR3900 Spectrophotometer Calibration	June 17, 2017
Influent Auto Sampler Calibration and Preventative Maintenance every 3 months	Mar 20, Jun 15, Sept 15, Dec 20, 2017
Final Effluent Auto Sampler Calibration and Preventative Maintenance every 3 months	Jan 26, Mar 22, Jun 15, Dec 28, 2017

Under condition 10(6) (j) of the ECA, related to Limited Operability Flexibility, one Notice of Modification to Sewage Works for the installation of a emulsion polymer chemical system was submitted on May 30, 2017 to the Water Supervisor of the MOECC. A copy of the notice can be found in Appendix E.

The following is a summary, by Work Area, of significant maintenance activities completed in 2017; these are maintenance activities as per Conditions 10(6) (c) of the ECA.

5.1. Solids Handling (Work Area 1)

Work Area 1 encompasses the solids treatment portion of the plant including sludge digestion, dewatering, and incineration. The following major maintenance was completed in 2017 in this Work Area:

- Overhauled 2 Ash slurry pumps for Incinerator #1 and one pump for Incinerator #2
- Repaired 2 Ash slurry hoppers and level controllers and isolation valves
- Overhauled Incinerator #1 and Incinerator #2 quencher/scrubber
- Replaced 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
- Repaired centrifuge feed lines
- Tuned burners on Incinerator #1 and Incinerator #2
- Continuous SCADA upgrades for incinerators, sludge feed, and polymer mixing system
- Rebuilt one polymer feed pump and polymer neat pump

5.2. Liquids Handling (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. The following major maintenance was completed in 2017 for Work Area 2:

- Structural repairs to Primary Tanks 5, 6, 7, 8, 9, 10, 11 and 12
- Structural repairs to Final Tank 5, 6, 7, 10, 13, 14 and 16
- Various primary and final tank sludge and scum collector repairs
- Structural and diffuser repairs to Grit Channels 1, 2, 3 and 4
- Repairs to Bar Screens 1, 2, 3 and 5
- Repairs to all Turblex blowers
- Rebuild of Ferrous Chloride pumps and Sodium Hypochlorite pumps
- Raw sludge, Return Activated Sludge and scum pump repairs
    - Thickening Centrifuges 1 and 6 overhauled
    - Rebuild of TWAS transfer pumps and polymer dosing pumps

5.3. 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 and building HVAC systems. The following maintenance was completed in 2017 for Work Area 3:

- 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 & 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
- 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
- Install new scum collector on #10 Primary Clarifier
- Coordinate maintenance and repairs on licensed vehicles

5.4. 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 plant fire protection. The following maintenance was completed in 2017 for Work Area 4:

- Serviced 5 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 2 hot water pumps in the plant
- Rebuilt or serviced 6 hot water pumps
- Overhauled primary tanks #5, #6, #7, and #8
- Overhauled final tanks #5, #6, #7, #10, #13, #14, and #16
- Serviced and maintained 2 biofilters
- Rebuilt 2 RAS pumps in South East plant (complete with new impellers)
- Serviced heating system piping, coils and glycol system
- Various plant upgrade projects
- Installed new scum collector on #10 Primary Clarifier

6. UTILITIES

A summary of monthly utility consumption for the previous three years at Highland Creek Treatment Plant is provided in Figure 1. Table 6 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 2,642 m^3, 30.6M kWh, and 6.6M m^3, respectively.

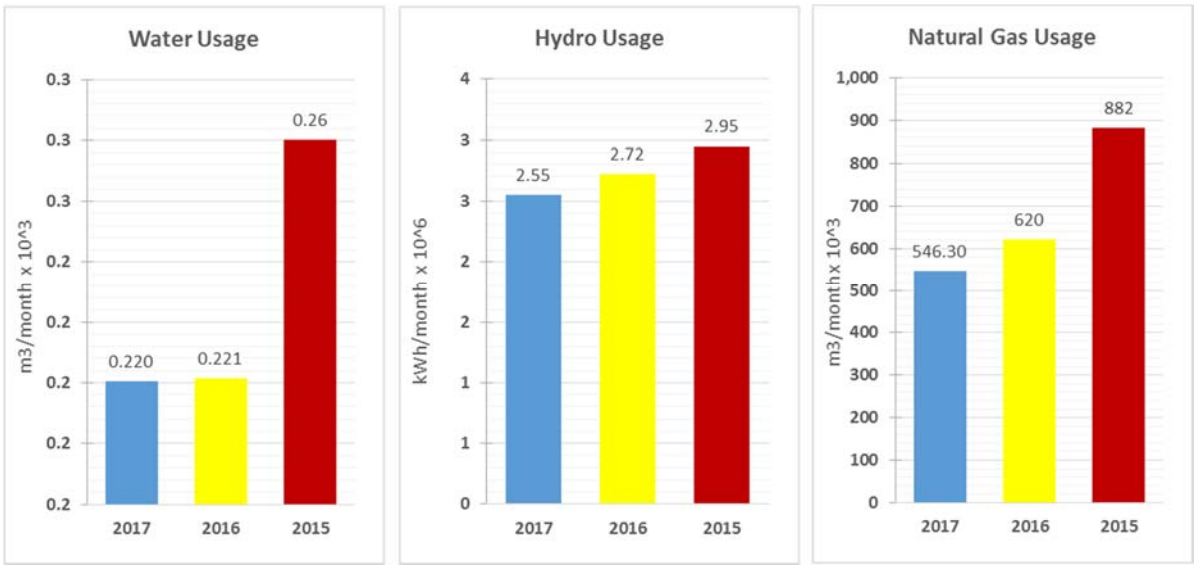


Figure 1: Monthly Utility Consumption (Water, Hydro, Natural Gas)

Table 6: Average Unit and Total Utility Cost

Utility	2017	2016	2015
Water Unit Cost ($/m^3)	3.81	3.63	2.48
Water Total Cost ($/year)	10,074	6,991	7,734
Hydro Unit Cost ($/kWh)	0.12	0.14	0.13
Hydro Total Cost ($/year)	3.69M	4.66M	4.45M
Natural Gas Unit Cost ($/m^3)	0.22	0.21	0.21
Natural Gas Total Cost ($/year)	1.42M	1.53M	2.27M

7. ADMINISTRATION

7.1. Operations and Maintenance Costs

The 2017 plant operational costs are broken down into five (5) 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 2016 and 2017 annual operations and maintenance costs is illustrated in Figure 2. Overall, operational costs increased by 2.7% from 2016.

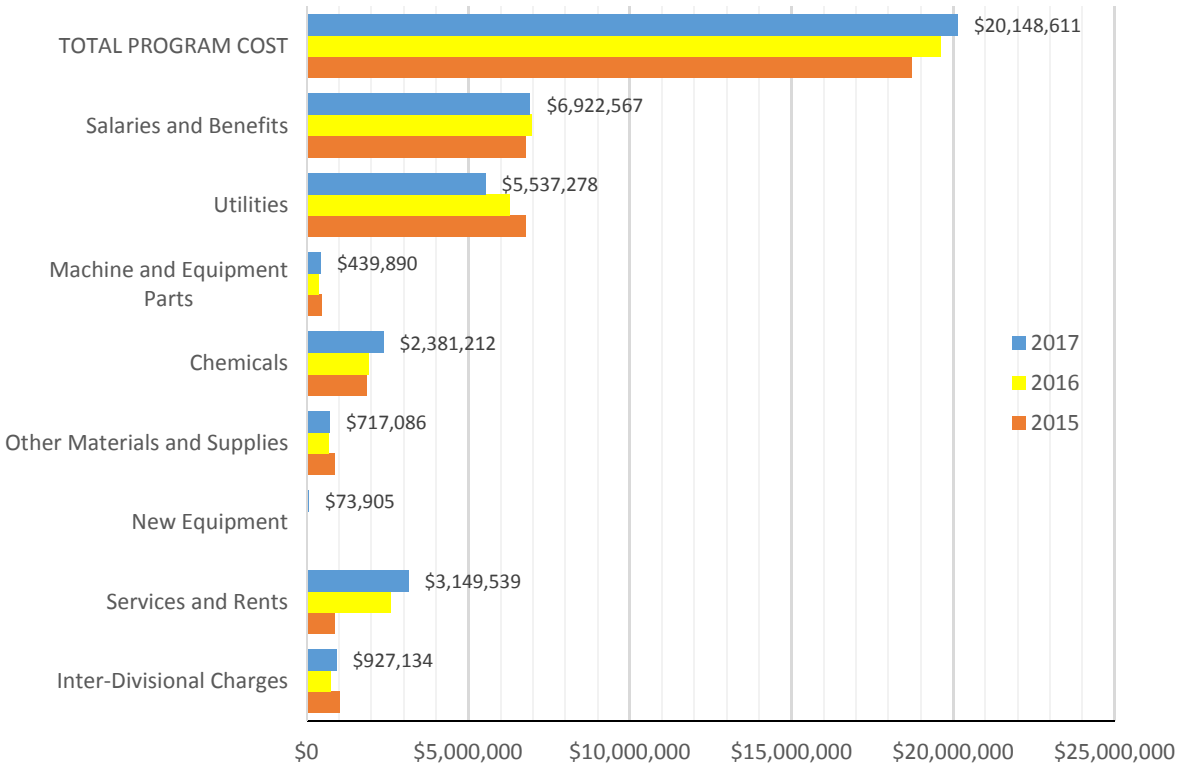


Figure 2: Operations and Maintenance Cost Breakdown

7.2. Human Resources

Plant Staffing at the Highland Creek Treatment Plant in 2017 is shown in Table 7.

Table 7: Plant Staffing

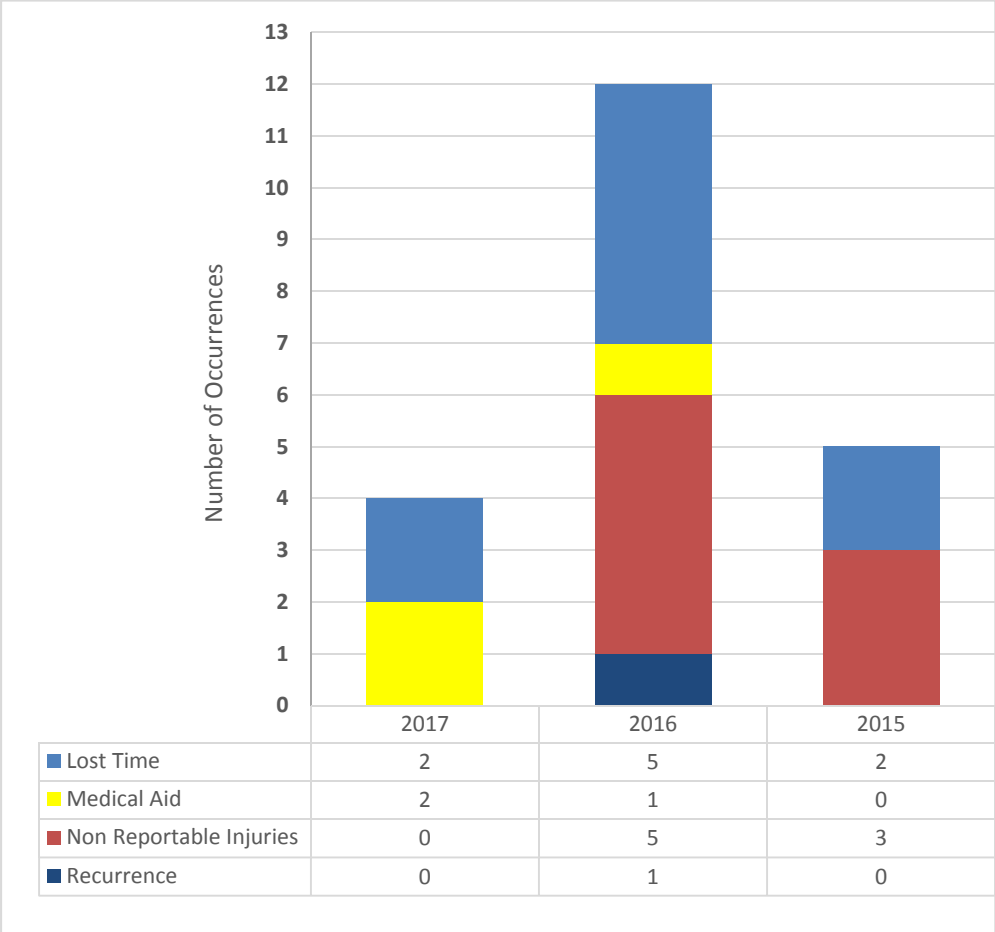
Position	Number of FTE[1] Staff
Plant Manager	1
Senior Engineer	1
Engineer	1
Area Supervisors	4
Electrical & Instrumentation Specialist	1
Electricians	1
Plant Technicians	26
Industrial Millwrights	16
Electrical Instrumentation Control Technicians	7
Wastewater Treatment Plant Workers	6
Support/Materials Management Assistants	2
Engineering Technologist	1
Seasonal Temporary	1.5
Total FTE Positions	**68.5**

[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 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 in 2017 are included in Figure 3.

As of December 31, 2017, there was a total of 2 lost time days due to work related injuries.



	2017	2016	2015
Lost Time	2	5	2
Medical Aid	2	1	0
Non Reportable Injuries	0	5	3
Recurrence	0	1	0

Figure 3: Highland Creek Health & Safety Injury Summary

7.4. Staff Training and Development

The Strategic Planning and Workforce Development unit of Toronto Water facilitates a comprehensive training programs that expands the abilities of the staff, resulting in better service to the public.

Training attended by Highland Creek Treatment Plant operations and skilled trades staff in 2017 includes the list of courses shown below. Some of these courses were eligible 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 as installed as part of the capital program was provided as required.

a) Technical and Health and Safety Training:

- 2015 Ontario Electrical Safety Code (26th Edition) New And Amended Requirements General Level 1
- 2015 Ontario Electrical Safety Code (26th Edition) New And Amended Requirements General Level 2
- Air Purifying Respirators (2017)
- Arc Flash for Non-Qualified Persons
- Centrifugal and Positive Displacement Pump Operation
- Confined Space Awareness ½ Day (2016-2018)
- Industrial Maintenance Technician (ITM)M Certification
- Machinery Installation Using Laser Based Measurements
- Wastewater Plant Technician Process Training
- Wastewater Treatment Certification Program Level 3 & 4

b) Other Training:

- Human Rights in the Workplace
- Leadership skills for Non-Managers
- Preparing To Move Into Supervision
- The Business of Environmental Compliance
- WMS AVANTIS Workshop
- Tailgate – Distracted Driving
- Tailgate – TW Emergency Plan
- Tailgate – Hazard Identification and Reporting
- Tailgate – WHMIS 2015: New chemical Safety Information System

7.5. Utility Operator Certification

Toronto Water has incorporated the requirement of a Class I operating licence for all skilled trade job profiles at Wastewater Treatment facilities. As part of this initiative, general operational/process training was delivered in order to prepare staff for the certification examination. Table 8 summarizes the status of operator certification at the Highland Creek Treatment Plant in 2017.

Table 8: Wastewater Treatment Certificates

Class Level	Licensed
Class IV	21
Class III	0
Class II	6
Class I	10
O.I.T.	17
Total	**54**

7.6. MOECC/MOL Correspondence

There were no orders issued by the Ministry of the Environment and Climate Change (MOECC) or the Ministry of Labour (MOL).

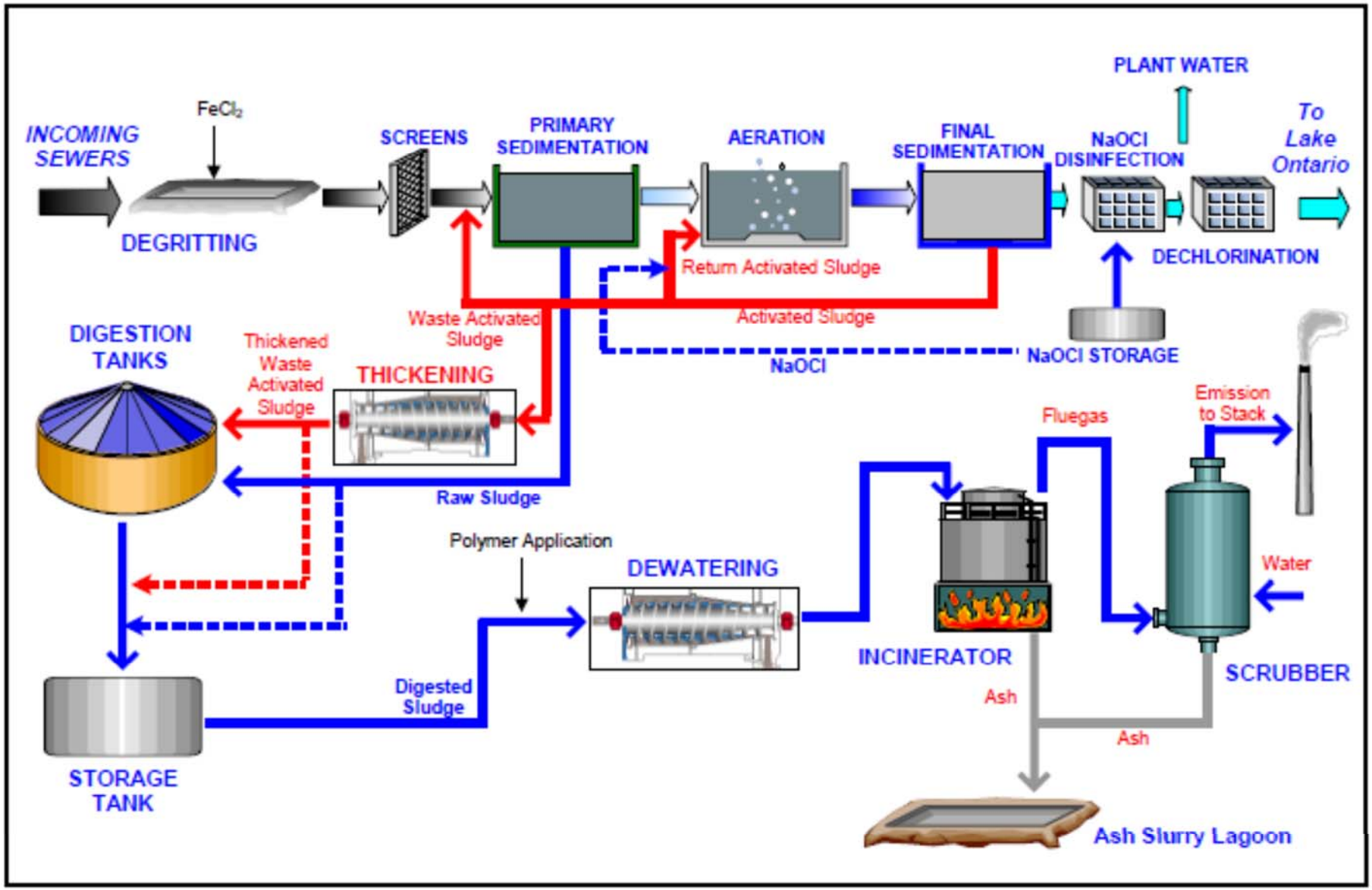
A report was submitted to the MOECC for two odour complaints; no noise complaints were received at the plant in 2017. Table 9 summarizes the additional correspondence submitted to the MOECC for the Highland Creek Treatment Plant.

Table 9: Correspondence submitted to the MOECC

Date	Type	Description
March 18th	Communication regarding an odour compliant	The plant was checked and all odour control equipment was found to be operating normally. No further remedial action took place.
June 28th	Communication regarding an odour compliant	The plant was checked and all odour control equipment was found to be operating normally. No further remedial action took place.
Consent Letters		
N/A	N/A	N/A
Notice of Start up		
N/A	N/A	N/A
MOE Inspection		
No Inspection		

APPENDIX A –
Plant Schematic

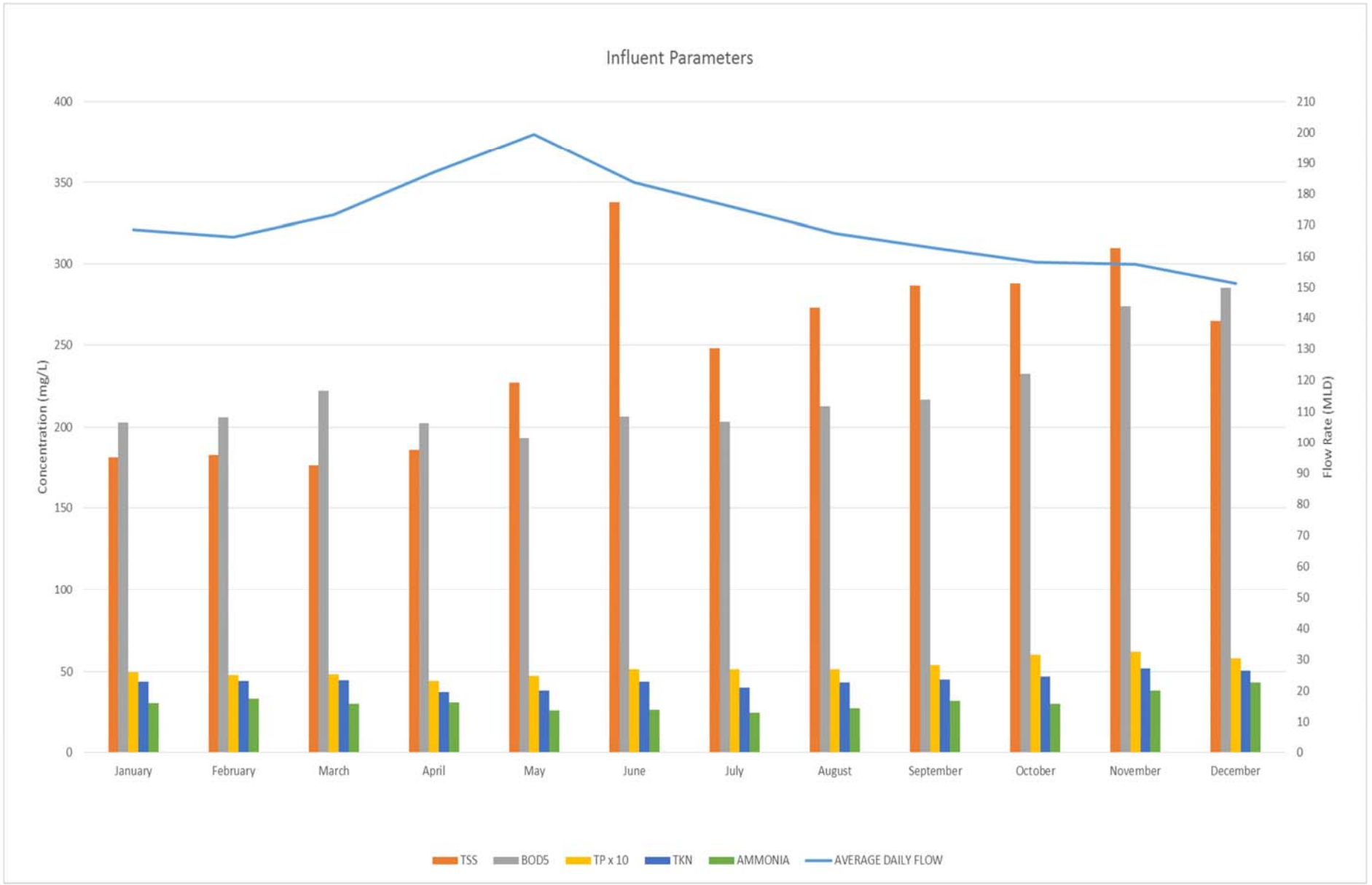
APPENDIX B: INFLUENT AND EFFLUENT 2017 PERFORMANCE CHARTS



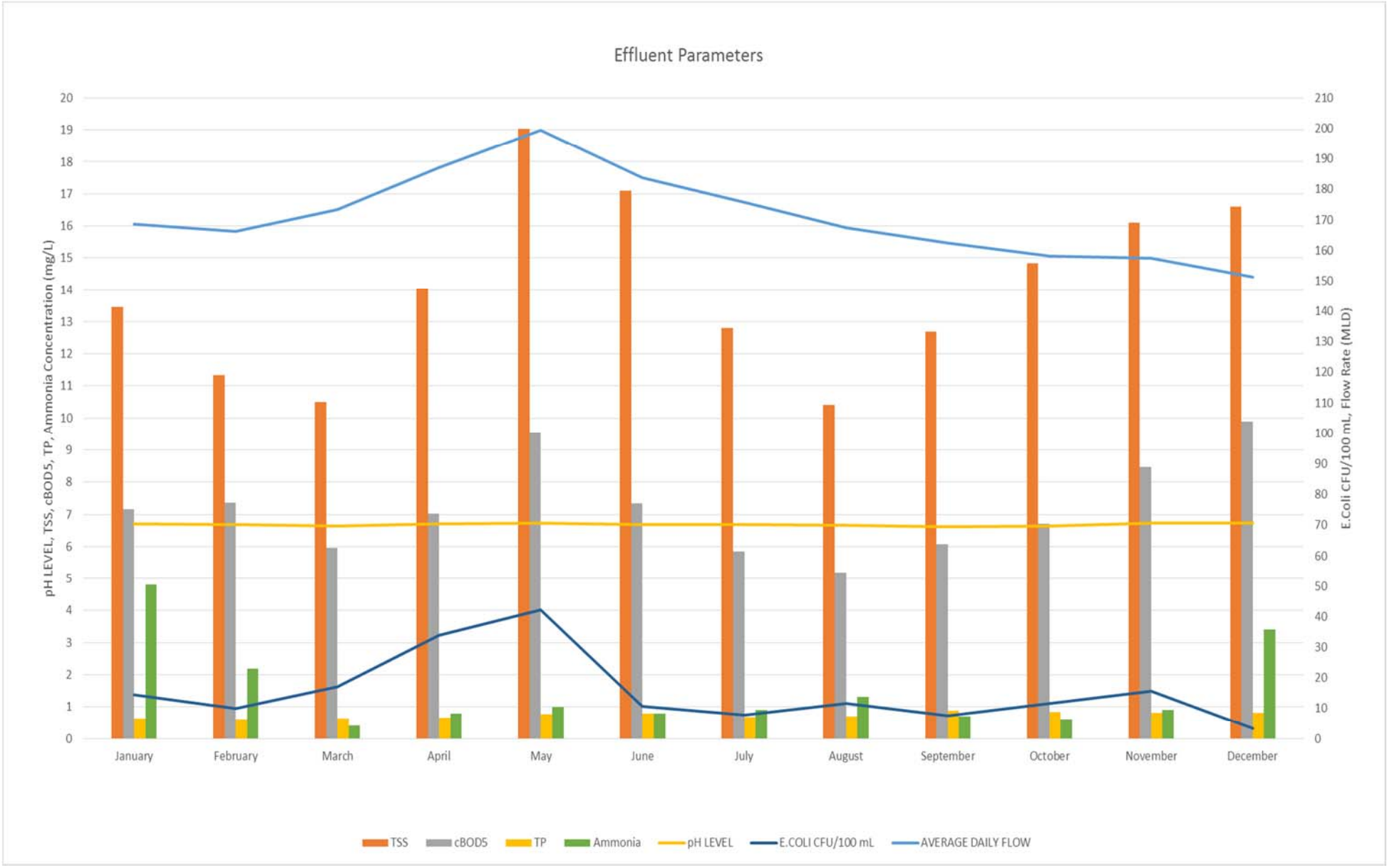
Process Flow Diagram for Highland Creek Wastewater Treatment Plant

APPENDIX B –
Influent and Effluent 2017
Performance Charts

APPENDIX B: INFLUENT AND EFFLUENT 2017 PERFORMANCE CHARTS



APPENDIX B: INFLUENT AND EFFLUENT 2017 PERFORMANCE CHARTS



APPENDIX C –
Historical Performance Data

APPENDIX C: HISTORICAL PERFORMANCE DATA

Influent Parameters	**Units**	**2017**	**2016**	**2015**	**2014**	**2013**	**2012**	**2011**	**2010**	**2009**	**2008**	**2007**
Flow	*ML/day*	170.9	161.8	164.9	170.6	169.3	171.1	171.9	166.4	184.7	181.2	169.5
Total Annual Flow	*ML*	62,388	59200	60208	62242	61804	62453	62753	60720	67398	66328	61868
Total Suspended Solids (TSS)	*mg/L*	246.7	244.8	212.1	247.6	232.3	268.1	238	312.8	295.3	265	252.5
Biological Oxygen Demand (BOD)	*mg/L*	221.4	242.2	234	232.1	205.9	206.7	185.3	246.1	205.6	140.1	156.3
Total Phosphorus (TP)	*mg/L*	5.2	5.2	5	4.9	4.4	4.8	4.7	5.6	5.4	5.6	4.8
Primary Treatment												
TSS	*mg/l*	134.7	151	171	339	232.1	332.6	244.4	209.3	175.7	271.6	432.5
cBOD5	*mg/L*	183.9	178	170	180	129.8	155	143.5	124	87.4	101.5	141
Secondary Treatment												
Aeration Loading	*kg CBOD5/m3.day*	0.59	0.54	0.53	0.58	0.65	0.66	0.46	0.3	0.3	0.35	0.45
Mixed Liquor Suspended Solids	*mg/L*	2,723	2736	3243	3296	2380	1577	2747	2431	2372	2432	2926
Final Effluent												
TSS	*mg/l*	14.1	14.6	17.4	20.2	22.8	21	14.6	12.4	15.8	14.7	15.6
cBOD5	*mg/L*	7.20	6.7	6.2	5.9	8.8	9.1	6.4	5.2	6.3	5.2	5.2
TP	*mg/L*	0.7	0.7	0.7	0.6	0.6	0.7	0.5	0.5	0.6	0.6	0.7
Escherichia Coli (E. Coli)	*CFU/100 mL*	16	53.2	40.2	10.4	34.9	15.5	6.4	3.9	16.7	7.6	9
pH		6.7	6.5	6.5	6.5	6.2	6.4	6.9	6.6	6.6	7.1	8
Total Chlorine Residual	*mg/L*	0.004	0.007	0.006	SBS (P)	SBS (P)	SBS (P)	SBS (P)	SBS (P)	-	-	-
TP Loading Rate	*kg/day*	219	117	115	100	104	116	83.5	85	105	110	119
Solids Handling												
Primary Sludge Treated	*m3/day*	910	1090	1525	2150	2900	2944	4100	3553	3900	5100	5460
Primary Sludge Total Solids (TS)	*%*	2.55	2.4	2.8	2.6	2.2	2.2	3.2	2.4	2.4	2.7	2.4
Primary Sludge TVS	*%*	81.83	81.9	81.6	77.9	73.5	78.9	60.8	66.5	72.5	76	66
WAS to Thickening	*m3/day*	3,716	3519	3110	2254	-	-	-	-	-	-	-
Thickened WAS (TWAS) TS	*%*	4.12	3.83	5.3	5.7	-	-	-	-	-	-	-
TWAS Treated	*m3/day*		474	323	1236	-	-	-	-	-	-	-
WAS to Co-settling	*m3/day*	-	-	-	-	6600	6875	5893	6905	7250	10960	12700
WAS SS	*mg/L*	6,732	6126	7358	7300	4500	3262	4148	3491	3700	3780	5966
Dewatering Centrifuge Feed Flow	*m3/day*	1,849	1924	2143	2065	1966	1906	1873	1913	1818	2008	2046
Dewatering Centrifuge Feed TS	*%*	2.48	2.3	3	2	1.7	1.5	1.6	1.6	1.6	1.7	1.6
Dewatered Biosolids incinerated	*Dry tonnes/day*	31.1	45.1	57.4	38.5	29.2	23.1	28.1	28.9	27.5	33.2	28.7
Dewatered Biosolids TS	*%*	26.2	26.6	22.8	25	25.8	26.5	26.4	26.5	27.1	27.3	25.6
Ash Removed	*tonnes*	1815	3775	6141	3300	2100	-	-	-	-	-	-

APPENDIX D –
Influent and Effluent Metal Concentrations

APPENDIX D: INFLUENT AND EFFLUENT METALS ANALYSIS

Influent (Daily Composite tested once/month for metals) ***(Data in red italics is half of the MDL)***

Parameter	**Arsenic**	**Cadmium**	**Chromium**	**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
January	*0.005*	*0.002*	0.00561	0.0967	0.915	*0.0025*	0.068	0.000078	0.00661	0.121
February	*0.005*	*0.002*	0.00692	0.0895	0.926	*0.0025*	0.0757	0.000201	0.00603	0.134
March	*0.005*	*0.002*	0.00593	0.117	0.67	*0.0025*	0.0714	0.000091	0.00603	0.132
April	*0.005*	*0.002*	0.00659	0.0963	0.861	*0.0025*	0.0616	0.000088	0.00523	0.103
May	*0.005*	*0.002*	0.0096	0.135	1.58	*0.0025*	0.0705	0.000121	0.00607	0.145
June	*0.005*	*0.002*	0.00585	0.11	1.3	*0.0025*	0.0712	0.00023	0.00588	0.124
July	*0.005*	*0.002*	0.00637	0.123	0.814	*0.0025*	0.0721	0.000102	0.00643	0.137
August	*0.005*	*0.002*	0.00619	0.109	0.745	*0.0025*	0.0676	0.000126	0.00574	0.139
September	*0.005*	*0.002*	0.00455	0.111	0.661	*0.0025*	0.0585	0.000554	0.00582	0.133
October	*0.005*	*0.002*	0.00766	0.144	1.14	*0.0025*	0.0698	*0.00005*	0.00773	0.162
November	*0.005*	*0.002*	0.00864	0.163	1.1	*0.0025*	0.0724	*0.00005*	0.00683	0.168
December	*0.005*	*0.002*	0.00501	0.104	1.29	*0.0025*	0.0683	*0.00005*	0.00663	0.142
Average	***0.005***	***0.002***	**0.007**	**0.117**	**1.000**	***0.0025***	**0.069**	**0.00015**	**0.006**	**0.137**

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

Parameter	**Arsenic**	**Cadmium**	**Chromium**	**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
January	*0.005*	*0.002*	*0.002*	0.0167	1.45	*0.0025*	0.0758	*0.00003*	0.00637	0.0374
February	*0.005*	*0.002*	*0.002*	0.0139	2.3	*0.0025*	0.0809	*0.00003*	0.0059	0.0361
March	*0.005*	*0.002*	*0.002*	0.0217	1.48	*0.0025*	0.0689	*0.00003*	0.00634	0.0425
April	*0.005*	*0.002*	*0.002*	0.0205	0.75	*0.0025*	0.0539	*0.00003*	<0.0025	0.0366
May	*0.005*	*0.002*	*0.002*	0.0251	1.3	*0.0025*	0.069	*0.00005*	0.00504	0.0411
June	*0.005*	*0.002*	*0.002*	0.0161	1.35	*0.0025*	0.0704	*0.00005*	0.00508	0.0347
July	*0.005*	*0.002*	*0.002*	0.0202	1.22	*0.0025*	0.0694	*0.00005*	0.0066	0.0441
August	*0.005*	*0.002*	*0.002*	0.0138	1.11	*0.0025*	0.0505	*0.00005*	0.00553	0.0337
September	*0.005*	*0.002*	*0.002*	0.015	0.799	*0.0025*	0.0683	*0.00005*	0.00563	0.038
October	*0.005*	*0.002*	*0.002*	0.0204	1.47	*0.0025*	0.0571	*0.00005*	0.00654	0.0413
November	*0.005*	*0.002*	*0.002*	0.0198	1.63	*0.0025*	0.0718	*0.00005*	0.00651	0.0448
December	*0.005*	*0.002*	*0.002*	0.0217	1.87	*0.0025*	0.083	*0.00005*	0.0066	0.044
Average	***0.005***	***0.002***	***0.002***	**0.019**	**1.394**	***0.0025***	**0.068**	***0.00004***	**0.006**	**0.040**

APPENDIX E –
Dewatered Sludge Metal Analyses

APPENDIX E: DEWATERED SLUDGE METAL ANALYSES

Dewatered Sludge Metal Analysis

Parameter	***Arsenic***	***Cadmium***	***Cobalt***	***Chromium***	***Copper***	***Mercury***	***Molybdenum***	***Nickel***	***Lead***	***Selenium***	***Zinc***
Units	***mg/kg***	***mg/kg***	***mg/kg***	***mg/kg***	***mg/kg***	***mg/kg***	***mg/kg***	***mg/kg***	***mg/kg***	***mg/kg***	***mg/kg***
June	2.48	0.13	2.51	38.0	407	0.255	6.27	12.4	10.6	2.03	343
July	2.30	0.16	2.25	37.9	408	0.383	6.72	11.3	9.0	2.28	370
October	1.84	0.18	1.60	28.5	439	0.211	6.45	11.9	9.2	1.89	306
December	1.81	0.15	1.63	40.0	411	0.299	5.33	13.4	9.0	1.59	370
Average	**2.1**	**0.15**	**2.00**	**36.1**	**416**	**0.29**	**6.19**	**12.2**	**9.5**	**1.95**	**347**

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

APPENDIX F –
LOF Notice of Modification to Sewage Works

APPENDIX F: LOF NOTICE OF MODIFICATION TO SEWAGE WORKS

Ontario
Ministry of the Environment

Notice of Modification to Sewage Works

RETAIN COPY OF COMPLETED FORM AS PART OF THE ECA AND SEND A COPY TO THE WATER SUPERVISOR (FOR MUNICIPAL) OR DISTRICT MANAGER (FOR NON-MUNICIPAL SYSTEMS)

Part 1 – Environmental Compliance Approval (ECA) with Limited Operational Flexibility

(Insert the ECA's owner, number and issuance date and notice number, which should start with "01" and consecutive numbers thereafter)

ECA Number	Issuance Date (mm/dd/yy)	Notice number (if applicable)
8261-99EP4S	10/28/15	01

ECA Owner	Municipality
Highland Creek WWTP	City of Toronto

Part 2: Description of the modifications as part of the Limited Operational Flexibility

(Attach a detailed description of the sewage works)

The addition of one (1) Alfa Laval L60M Polycube packaged skid for emulsion polymer blending equipment, complete with neat emulsion polymer pump, control valve and blender. The pump skid prepares polymer solution for distribution to the dewatering centrifuges.

The anticipated environmental effects are negligible. The process control narrative, P&IDs, contract drawings and owners operations and maintenance manuals have been updated to include the polymer feed skid.

Description shall include:
1. A detail description of the modifications and/or operations to the sewage works (e.g. sewage work component, location, size, equipment type/model, material, process name, etc.)
2. Confirmation that the anticipated environmental effects are negligible.
3. List of updated versions of, or amendments to, all relevant technical documents that are affected by the modifications as applicable, i.e. submission of documentation is not required, but the listing of updated documents is (design brief, drawings, emergency plan, etc.)

Part 3 – Declaration by Professional Engineer

I hereby declare that I have verified the scope and technical aspects of this modification and confirm that the design:
1. Has been prepared or reviewed by a Professional Engineer who is licensed to practice in the Province of Ontario;
2. Has been designed in accordance with the Limited Operational Flexibility as described in the ECA;
3. Has been designed consistent with Ministry's Design Guidelines, adhering to engineering standards, industry's best management practices, and demonstrating ongoing compliance with s.53 of the Ontario Water Resources Act, and other appropriate regulations.

I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate

Name (Print)	PEO License Number
Bruce A. Lockhart, P.Eng.	27219500
Signature	Date (mm/dd/yy) 05/18/17
Name of Employer: AECOM Consulting Engineers	

Part 4 – Declaration by Owner

I hereby declare that:
1. I am authorized by the Owner to complete this Declaration;
2. The Owner consents to the modification; and
3. The modifications to the sewage works are proposed in accordance with the Limited Operational Flexibility as described in the ECA.
4. The Owner has fulfilled all applicable requirements of the *Environmental Assessment Act*.

I hereby declare that to the best of my knowledge, information and belief the information contained in this form is complete and accurate

Name of Owner Representative (Print)	Owner representative's title (Print)
Martin Shigeishi, P.Eng.	Plant Manager – Highland Creek Treatment Plant
Owner Representative's Signature	Date (mm/dd/yy) 05/24/17

EAB Form December 2, 2013

APPENDIX F: LOF NOTICE OF MODIFICATION TO SEWAGE WORKS

Anthony Pigaidoulis

From: Martin Shigeishi
Sent: March-22-18 11:31 AM
To: Anthony Pigaidoulis
Subject: FW: LOF Notice for the emulsion polymer system
Attachments: LOF Notice_Emulsion Polymer.pdf

From: Ayaz Buzdar
Sent: May-30-17 4:05 PM
To: 'Demetra.Koros@ontario.ca' <Demetra.Koros@ontario.ca>
Cc: 'Shannon.Boland@ontario.ca' <Shannon.Boland@ontario.ca>; 'Tessa.Villeneuve@ontario.ca' <Tessa.Villeneuve@ontario.ca>; Martin Shigeishi <Martin.Shigeishi@toronto.ca>; Ying Zheng <Ying.Zheng@toronto.ca>
Subject: LOF Notice for the emulsion polymer system

Demetra,

I have attached the above LOF Notice for the emulsion polymer system in this email.
This emulsion polymer system was installed for our dewatering process.

Let me know if you have any questions.

Regards,

Ayaz Buzdar
EHS Field Representative
Toronto Water, EHS Compliance Unit

1