Ontario Clean Water Agency
Agence Ontarienne Des Eaux

Kirkland Lake Drinking Water System

2016 Annual/Summary Report

Prepared by the Ontario Clean Water Agency
on behalf of the Town of Kirkland Lake

Table of Contents

List of Appendices

INTRODUCTION

Municipalities throughout Ontario have been required to comply with Ontario Regulation 170/03 made under the Safe Drinking Water Act (SDWA) since June 2003. The Act was enacted following recommendations made by Commissioner O'Conner after the Walkerton Inquiry. The Act's purpose is to protect human health through the control and regulation of drinking water systems. O. Reg. 170/03 regulates drinking water testing, use of licensed laboratories, treatment requirements and reporting requirements.

Section 11 of Regulation 170/03 requires the owner to produce an Annual Report. This report must include the following:

1. Description of system & chemical(s) used
2. Summary of any adverse water quality reports and corrective actions
3. Summary of all required testing
4. Description of any major expenses incurred to install, repair or replace equipment

This annual report must be completed by February 28th of each year.

Section 22 of the regulation also requires a Summary Report which must be presented & accepted by Council by March 31st of each year for the preceding calendar year.

The report must list the requirements of the Act, its regulations, the system's Drinking Water Works Permit (DWWP), Municipal Drinking Water Licence (MDWL), Certificate of Approval (if applicable), and any Provincial Officer Order the system failed to meet during the reporting period. The report must also specify the duration of the failure, and for each failure referred to, describe the measures that were taken to correct the failure.

The Safe Drinking Water Act (2002) and the drinking water regulations can be viewed at the following website: http://www.e-laws.gov.on.ca.

To enable the Owner to assess the rated capacity of their system to meet existing and future planned water uses, the following information is also required in the report.

1. A summary of the quantities and flow rates of water supplied during the reporting period, including the monthly average and the maximum daily flows,
2. A comparison of the summary to the rated capacity and flow rates approved in the systems approval, drinking water works permit or municipal drinking water licence or a written agreement if the system is receiving all its water from another system under an agreement.

The reports have been prepared by the Ontario Clean Water Agency (OCWA) on behalf of the Owner and presented to council as the 2016 Annual/Summary Report.

Kirkland Lake Drinking Water System

Section 11

2016 Annual Report

Section 11 - ANNUAL REPORT

1.0 Introduction

Drinking-Water System Name:	**KIRKLAND LAKE DRINKING WATER SYSTEM**
Drinking-Water System No.:	220000308
Drinking-Water System Owner:	The Corporation of Town of Kirkland Lake
Drinking-Water System Category:	Large Municipal, Residential System
Period being reported:	January 1, 2016 to December 31, 2016

Does your Drinking Water System serve more than 10,000 people? No

Is your annual report available to the public at no charge on a web site on the Internet? Yes at www.kirklandlake.ca

Location where Report required under O. Reg. 170/03 Schedule 22 will be available for inspection.

Town of Kirkland Lake, Department of Physical Services
1 Dunfield Road,
Kirkland Lake ON P2N 3P4

Town of Kirkland Lake Municipal Office
3 Kirkland Street,
Kirkland Lake ON P2N 3P4

Drinking Water Systems that receive drinking water from the Kirkland Lake Drinking Water System

The Kirkland Lake Drinking Water System provides all drinking water to the communities of Kirkland Lake, Chaput Hughes and Swastika.

The Annual Report was not provided to any other Drinking Water System Owners.

The Ontario Clean Water Agency prepared the 2016 Annual/Summary Report on behalf of the Town of Kirkland Lake and provided a copy to the system owner. The Kirkland Lake Drinking Water System is a stand-alone system that does not receive water from or send water to another system.

Notification to system users that the Annual Report is available for viewing is accomplished through:

- The local newspaper
- The Town of Kirkland Lake Municipal Office
- The Town of Kirlkand Lake website

2.0 Description of the Drinking Water System (DWS# 220000308)

The Kirkland Lake Drinking Water System is owned by the Corporation of the Town of Kirkland Lake and consists of a Class 3 conventional design water treatment plant (approved capacity of 22,500 m^3/day) and a Class 2 water distribution system. The Ontario Clean Water Agency (OCWA) is designated as the Overall Responsible Operator for both the water treatment and water distribution facilities. Certified municipal operators assist OCWA by performing routine maintenance, check and repairs of the distribution system.

The Kirkland Lake Drinking Water System provides a potable water supply to the Town of Kirkland Lake which includes the communities of Chaput Hughes and Swastika. It is a standalone system that is not connected to any other drinking water system.

Raw Water Supply

The Kirkland Lake water plant draws raw water from Gull Lake through a 146 m long, 710 mm diameter intake pipe. The pipe terminates in an intake chamber located approximately 10 m from the lake shoreline. A 750 mm diameter, 17 m long pipe connects the intake chamber and the water plant.

A traveling water screen is installed immediately inside the plant. The screen removes large floating debris from the water prior to treatment. The provision for a manual screen immediately downstream from the traveling screen offers back up screening in the event the traveling screen is out of service. Following the screening, raw water can be disinfected (pre-chlorination) prior to entering the wet well of the Low Lift Pumping Station.

Water Treatment

1. Coagulation / Flocculation / Sedimentation

The Low Lift Pumping Station (LLPS), equipped with five pumps, transfers water from the wet well (where water level corresponds to the water level in the lake) to the treatment processes. The water flows by gravity through the treatment processes.

The first step of water treatment is coagulation -- a process of destabilization and initial aggregation of colloidal and finely divided suspended matter by the addition of a floc-forming chemical.

Raw water enters the treatment stage through an inlet chamber. Just prior to entering the chamber, chemical coagulant, aluminum sulfate (alum), is injected into raw water and is rapidly agitated with a flash mixer.

The mixture then overflows into three (3) contact compartments – one per pre-treatment unit. In the compartments, the mixing weirs gently turn the mixture in order to promote coagulation.
Just prior to leaving the mixing chambers, a flocculant, activated silica -- an inorganic polymer, is added.

Flocculation in water treatment is agglomeration of colloidal and finely divided suspended matter after coagulation by gentle agitation by either mechanical or hydraulic means, sometimes with an aid of chemical flocculant.

The mixture enters the bottom distribution piping of each Degremont Ultra-Pulsator clarifier via vacuum chambers. The vacuum in the chambers is created by the vacuum pumps, one per chamber. The purpose of the vacuum chambers is to create gentle movement of the sludge blanket in the clarifier for both flocculation and sludge removal.

Sedimentation is the process of subsidence and deposition of suspended matter, carried by water or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid to below the point at which it can transport the suspended material or floc.

The flow is distributed equally over the full area of the clarifiers through the distribution pipes in the bottom of the unit. The flow percolates through the sludge blanket. Upon exiting the sludge blanket, the water flows through a plate settler and then the tube settler. Clarified water is gathered by the collection pipes at the top of the units and transferred to channels that lead to the filters.

2. Filtration

Filtration is the process of passing a liquid through a filtering medium (for KLWTP this consists of granular material, sand and anthracite) for the removal of suspended or colloidal matter.

There are four (4) dual media filters at the plant. Each filter is approximately 6.4 m x 4.3 m x 3m deep and rated to operate at a maximum rise rate of 9.0 m/hr or a max. flow rate of 65.0 L/sec. The filter media consists of 450 mm of anthracite underlain by a 300 mm layer of silica sand. A concrete underdrain slab outfitted with strainer nozzles supports the filter media. During normal operation, the water flows into the filter from the filter channel via an inlet sluice gate and travels through the media in a downward pattern. The filtered water is collected in the underdrain area and transported by pipes to the clearwell, located under the ground slab of the plant. The flow through each filter is measured by individual flow meters and is controlled by dedicated filter control valves. A headloss indicator monitors the filter media condition. The filtrate quality is continuously monitored by individual turbidimeters, and a particle analyzer.

3. Disinfection (Chlorination)

Filtered water is disinfected following filtration. Chlorine solution is diffused into the water stream in the clearwell of the treatment building. The diffuser and a series of baffles promote complete mixing of chlorine with water. The chlorine solution is prepared on-site by mixing chlorine gas with water. A chlorinator controls the chlorine gas feed rate. There are three (3) chlorinators installed at the plant - one serves as a duty pre-chlorinator while the second is a duty post-chlorinator. The third chlorinator serves as a stand-by for either one of the duty chlorinators. Chlorine gas is mixed with water in the ejectors and is sent to diffusers as a chlorine solution.

SCADA monitors the chlorinators which will generate alarms upon high and low vacuum levels or abnormal chlorine levels. Each chlorinator is rated to supply 67.0 kg per day of chlorine gas which, based on the plant rated capacity, equals to the maximum chlorine feed rate of up to 3.0 mg/L (3.0 ppm or parts per million) at each location. The gas is withdrawn at any given time from only one of the two one tonne cylinders that are located on the monitored weigh scale. The chlorine feed system will switch automatically to another cylinder when pressure in the duty cylinder drops below the pre-set value. If both cylinders approach low levels, SCADA will alarm the operator.

4. pH Adjustment

The pH adjustment process uses 50% sodium hydroxide (NaOH) to restore treated water to a neutral pH. Two metering pumps (1 duty and 1 standby) feed the NaOH to the clearwell of the treatment building at the point of exit to the pumping building. Four high lift pumps are used to direct treated water into the distribution system.

5. Process Waste Residuals Management

Filter backwash water and withdrawn sludge from the sedimentation tanks are directed to two wastewater tanks. The capacity of each tank is approximately 900 m^3. Wastewater is discharged to the sanitary sewer system.

Emergency Power

The plant has a standby power generator rated at 300 kW and equipped with an automatic transfer switch, underground and in-plant fuel storage tanks.

Distribution System and Elevated Storage Tank

The Kirkland Lake Drinking Water System is classified as a Large Municipal Residential Drinking Water System and provides water to approximately 9000 residents. Distribution piping typically ranges in size from 150 mm to 250 mm, and may consist of cast iron, ductile iron, or PVC, depending on the location and date of installation. Typical system pressure ranges from 55 P.S.I. to 70 P.S.I. The standpipe provides for storage for approximately 7,115 m^3 of water, helps stabilize water pressure in the distribution system and provides extra water in the case of an emergency. To ensure optimum chlorine residual in the distribution system there are two chlorine booster stations, one at the Chaput Hughes Standpipe and the other at the Swastika Valve Chamber.

3.0 List of Water Treatment Chemicals Used Over the Reporting Period

The following chemicals were used in the treatment process at the Kirkland Lake Water Treatment Plant.

- Aluminum Sulphate (Alum) - Coagulation/Flocculation
- Sodium Carbonate (Soda Ash) - pH Adjustment/oxidation of iron and manganese (trial)

- Sulfuric Acid – mixed with sodium silicate to make activated silica which is used as a flocculant
- Sodium Silicate – mixed with sulphuric acid to make activated silica which is used as a flocculant
- Sodium Hydroxide – pH adjustment
- Chlorine gas – primary disinfection
- Sodium Hypochlorite – booster chlorination at the Chaput Hughes standpipe and Swastika booster station.

4.0 Significant Expenses Incurred in the Drinking Water System

OCWA is committed to maintaining the assets of the drinking water system and maintains a program of scheduled inspection and maintenance activities using a computerized Work Management System (WMS). OCWA implemented a new Workplace Management System (Maximo) in 2016 which better maintains and optimizes facility assets.

Significant expenses incurred in the drinking water system include:

- Replaced two 125 hp high lift pumps with 75 hp pumps with soft check valves and one having a variable frequency drive (VFD) motor. The remaining two high lift pumps are scheduled for replacement in 2017.

- Installed three new peristaltic Watson Marlow activated silica pumps to replace old diaphragm type pumps. Supplier could no longer provide replacement parts.

- Installed four new automatic chemical valve actuators to replace original equipment that no longer supported replacement parts.

- Installed new Variable Frequency Drive (VFD) for the backwash water return pump. The old VFD failed
- Decommissioned the fluoridation system
- Installed new caustic soda line and connected to the system
- Installed sodium silicate level indicator on the both tanks
- Installed two new seals on GA valves of the high lift pumps
- SCADA work done to reduce unnecessary alarms
- Installed new motor on activated silicate pump #2
- Built a new solids separator for the activated silica pump system
- Installed a new pressure line to the level transmitter at the water tower
- Repaired the vacuum actuator on the clarifiers.
- Upgrades to the distribution system are on-going with phase 2 of the Wood, King and Comfort streets watermain replacements complete. Phase 3 is dependent on funding.

5.0 Drinking Water System Highlights

- The MOECC performed an annual inspection on December 14, 2016. The inspection included a physical assessment of the water treatment plant, water control buildings, distribution system and a document review for the period of December 1, 2015 to December 13, 2016. The system received a risk rating of 100% having no non-compliance issues identified in the report. However, a recommendation to reduce the amount of water used by residents should be considered.

- SAI Global conducted an on-site verification audit of the Kirkland Lake Drinking Water System's Quality and Environmental Management System (QEMS). The system and processes associated with the QEMS were evaluated on May 19, 2016 to ensure implementation of the Operational Plan and procedures and conformance to the Drinking Water Quality Management Standard. Two (2) minor non-conformances and two (2) opportunities for improvement were identified during the audit and have been resolved. Full Scope accreditation was achieved on August 19, 2016.

- The system produced good quality water; however several discoloured water complaints were documented in the first part of the year. Soda ash was added to the raw water from April to July of 2016 to enhance the chemical process and aid in the oxidation of iron and manganese to prevent it from getting into the distribution system and causing complaints. The trial went very well and OCWA received approval from the MOECC Approvals branch to make soda ash permanent in the 2017.

- OCWA is also working to remove the Activated Silica (AS) system and replace it with a polymer system to reduce operational issues and call-ins. Jar testing was performed using

Flowpam 4242PWG which showed encouraging results. The MOECC granted OCWA approval for an in-plant trial. If the trial is successful, polymer will permanently replace AS in 2017.

- The KL Standpipe was cleaned and inspected. No damage was found to the interior walls, standpipe inlet, standpipe outlet and drain. All damage to the interior liner occurred during the winter months of previous years. The exterior of the Standpipe also found to be in good condition. Items inspected included the rupture disk, clearance lights and vents found on roof of standpipe. Both clearance lights were changed using traffic signal lights provided by the Town of Kirkland Lake. Access to the Standpipe roof all found to be in good condition including ladder and safety cable.

- All clarifiers were drained and cleaned

- OCWA's Capital Project's Department examined the plant's efficiencies. Recommendations were provided the Owner.

6.0 Details on Notices of Adverse Test Results and Other Problems Reported to & Submitted to the Spills Action Center

Based on information kept on record by OCWA, four (4) the adverse water quality incidents were reported to the MOE's Spills Action Centre.

1. **AWQI 128070 – Watermain Break/Loss of Pressure/Boil Water Advisory**
   January 18 @ 0530 hrs: A hydrant on Government Road between Kirkland Lake and Swastika failed. Town crew had to shut the water off to the community of Swastika to isolate the hydrant to perform repairs. The Town issued a precautionary boil water advisory (BWA) for the affected area (approximately 200 people). MOE SAC and the local Health Unit were notified. The repair was completed around noon, but the hydrant failed again at about 6:30 PM. Repairs were completed that evening and pressure was fully restored at 1:00 AM on January 19th. A new 7 ft. hydrant, 6 inch gate valve and 6 inch spool pieces were installed. Materials were disinfected and as per AWWA Standard C651-14 and bacti sampling conducted. Sample results indicated no total coliforms or *E.coli*. and the BWA was lifted at approximately 1400 hours on January 21st.

2. **AWQI 129619 – Watermain Break/Loss of Pressure/Boil Water Advisory**
   May 3 @ 1500 hrs: Watermain break (category 2) occurred at the end of First Street and Tower Street causing a loss of pressure to Northern College. MOE SAC and the local Health Unit were notified. The Health Unit issued a BWA at approximately 1620 hours on May 31st for Northern College only. The main was repaired and disinfected following MOECC's Watermain Disinfection procedure. The affected section was flushed and sampled. Two sets of bacti samples were collected and no total coliforms or *E.coli were* detected. The BWA was lifted at 1400 hours on June 3rd.

3. AWQI #131122 – Total Coliforms (3 CFU/100mL)

September 6 @ 1048 hrs**:** 3 Total Coliforms were detected in a drinking water sample collected at the Kirkland Lake water treatment plant point of entry into the distribution system (free chlorine residual = 1.32 mg/L). Re-samples were collected as required by O. Regulation 170/03; on September 7th. All results indicated zero total coliforms and zero *E. coli*. Issue resolved on September 9th.

4. AWQI 131694 – Watermain Break/Loss of Pressure/Boil Water Advisory

October 29 @ 0800 hrs: Watermain break occurred on Pollock Avenue. Pressure was maintained throughout the repair and an air gap was created. There was no risk of contamination (category 1 break). However, about 21 homes were without pressure on sections of Carter Ave and Black Property. The health inspector issued a precautionary boil water advisory (BWA) at about 1430 hours. The main was repaired and disinfected following MOECC's Watermain Disinfection procedure. Pressure was restored at 1:45 pm. The health unit requested that 2 sets of 3 bacti samples be collected. The Town collected 4 samples on Saturday from 2:00 to 3:13 PM and other four on Sunday 24 hours apart. All results indicated zero total coliforms and zero and the BWA was lifted at 1315 hours on October 31st.

7.0 Microbiological Testing Performed During the Reporting Period

Summary of Microbiological Data

Sample Type	No. of Samples	Range of Total Coliform Results *(min to max)*	Range of *E.coli* Results *(min to max)*	# of HPC Samples	Range of HPC Results *(min to max)*
Raw (Gull Lake)	52	0 to 262	0 to 6	0	N/A
Treated (POE)	52	0 to 3*	0 to 0	52	<10 to 410
Distribution (Location 1)	52	0 to 0	0 to 0	24	<10 to 660
Distribution (Location 2)	52	0 to 0	0 to 0	21	<10 to 100
Distribution (Location 3)	52	0 to 0	0 to 0	20	<10 to <10
Distribution (Location 4)	52	0 to 0	0 to 0	19	<10 to 10
Distribution (Location 5)	52	0 to 0	0 to 0	20	<10 to 10

Maximum Allowable Concentration (MAC) for *E. coli* = 0 Counts/100 mL
MAC for Total Coliforms = 0 Counts/100 mL

Notes:

1. One microbiological sample is collected and tested each week from the raw and treated water supply. A total of five microbiological samples are collected and tested each week from the Kirkland Lake distribution system which includes one sample from the community of Swastika.
2. September 6th - 3 Total Coliforms were detected in a drinking water sample collected at the Kirkland Lake water treatment plant point of entry into the distribution system (AWQI No. 131122).

Refer to *Appendix A* for a monthly summary of microbiological test results.

8.0 Operational Testing Performed During the Reporting Period

Continuous Monitoring in the Treatment Process

Parameter	No. of Samples	Range of Results *(min to max)*	Unit of Measure	Standard
Turbidity (Filter 1)	8760	0.02 to 1.1	NTU	1.0 (for more than 15 minutes)
Turbidity (Filter 2)	8760	0.03 to 1.2	NTU	
Turbidity (Filter 3)	8760	0.02 to 0.92	NTU	
Turbidity (Filter 4)	8760	0.00 to 0.80	NTU	
Free Chlorine	8760	0.70 to 3.52	mg/L	CT*

Notes: For continuous monitors, 8760 is used as the number of samples.

If the filter effluent turbidity reaches 0.8 NTU, the filter will automatically shut down after 15 seconds. Turbidities above 1.0 NTU were detected on filters 1 and 2 for less than 5 minutes during the first polymer trial.

CT is the concentration of chlorine in the water times the time of contact that the chlorine has with the water. It is used to demonstrate the level of disinfection treatment in the water. CT calculations are performed by the plant's SCADA system and are monitored daily to ensure primary disinfection is achieved.

Summary of Chlorine Residual Data in the Distribution System

Parameter	No. of Samples	Range of Results *(min to max)*	Unit of Measure	Standard
Free Chlorine (Location 1)	103	0.14 to 1.62	mg/L	0.05
Free Chlorine (Location 2)	103	0.21 to 1.62		
Free Chlorine (Location 3)	103	0.17 to 1.50		
Free Chlorine (Location 4)	52	0.36 to 1.33		
Free Chlorine (Location 5)	52	0.46 to 1.67		

Note: A total of eight operational checks for chlorine residual in the distribution system were collected each week. Five (5) samples were tested one day and three (3) on a second day. The sample sets are collected at least 48-hours apart and samples collected on the same day are from different locations.

Refer to *Appendix B* for a monthly summary of the above chemical test results.

Summary of Nitrate & Nitrite Data (sampled at the water treatment plant)

Date of Sample	Nitrate Result Value	Nitrite Result Value	Unit of Measure	Exceedance
January 11	< 0.1	< 0.03	mg/L	No
April 11	< 0.1	< 0.05	mg/L	No
July 11	< 0.1	< 0.03	mg/L	No
October 3	0.20	< 0.03	mg/L	No

Maximum Allowable Concentration (MAC) for Nitrate = 10 mg/L
MAC for Nitrite = 1 mg/L

Summary of Total Trihalomethane Data *(sampled in the distribution system)*

Date of Sample	Result Value	Unit of Measure	Running Average	Exceedance
January 11	69.1	ug/L	86.8	No
April 11	61.3			
July 11	136			
October 3	80.8			

Maximum Allowable Concentration (MAC) for Total Trihalomethanes = 100 ug/L (Four Quarter Running Average)

Summary of Most Recent Lead Data

(applicable to the following drinking water systems; large municipal residential systems, small, municipal residential systems, and non-municipal year-round residential systems)

The Kirkland Lake Drinking Water System was eligible to follow the "Exemption from Plumbing Sampling" as described in section 15.1-5(9) and 15.1-5(10) of Schedule 15.1 of Ontario Regulation 170/03. The exemption applies to a drinking water system if, in two consecutive periods at reduced sampling, not more than 10% of all samples from plumbing exceed the maximum allowable concentration (MAC) of 10 ug/L for lead. As such, the system was required to test for total alkalinity and pH in three distribution sample collected during the periods of December 15 to April 15 (winter period) and June 15 to October 15 (summer period). This testing is required in every 12-month period with lead testing in every third 12-month period.
Two rounds of alkalinity and pH testing were carried out on April 11th and October 4th of 2016. Results are summarized in the table below.

Summary of pH & Alkalinity Data *(sampled in the distribution system)*

Date of Sample	No. of Samples	Field pH *(min to max)*	Field Temperature (^{o}C) *(min to max)*	Alkalinity (mg/L) *(min to max)*
April 11	3	6.32 to 6.75	6.0 to 11.6	41.6 to 42.1
October 4	3	6.68 to 6.81	15.2 to 16.0	65.7 to 117

Most Recent Schedule 23 Inorganic Data Tested at the Water Treatment Plant

Parameter	Result Value	Unit of Measure	Standard	Exceedance
Antimony	< 0.5	ug/L	6	No
Arsenic	< 1.0	ug/L	25	No
Barium	39.1	ug/L	1000	No
Boron	5.0	ug/L	5000	No
Cadmium	< 0.1	ug/L	5	No
Chromium	< 1.0	ug/L	50	No
Mercury	< 0.1	ug/L	1	No
Selenium	< 1.0	ug/L	10	No
Uranium	< 1.0	ug/L	20	No

Note: Sample required every 12 months (sample date = *October 3, 2016)*

Most Recent Schedule 24 Organic Data Tested at the Water Treatment Plant

Parameter	Result Value	Unit of Measure	Standard	Exceedance
Alachlor	< 0.5	ug/L	5	No
Atrazine + N-dealkylated metobolites	< 0.9	ug/L	5	No
Azinphos-methyl	< 0.4	ug/L	20	No
Benzene	< 0.2	ug/L	5	No
Benzo(a)pyrene	< 0.005	ug/L	0.01	No
Bromoxynil	< 0.09	ug/L	5	No
Carbaryl	< 1.0	ug/L	90	No
Carbofuran	< 1.0	ug/L	90	No
Carbon Tetrachloride	< 0.2	ug/L	5	No
Chlorpyrifos	< 0.4	ug/L	90	No
Diazinon	< 0.4	ug/L	20	No
Dicamba	< 0.08	ug/L	120	No
1,2-Dichlorobenzene	< 0.2	ug/L	200	No
1,4-Dichlorobenzene	< 0.3	ug/L	5	No
1,2-Dichloroethane	< 0.2	ug/L	5	No
1,1-Dichloroethylene (vinylidene chloride)	< 0.3	ug/L	14	No
Dichloromethane	< 1.0	ug/L	50	No
2-4 Dichlorophenol	< 0.2	ug/L	900	No
2,4-Dichlorophenoxy acetic acid (2,4-D)	< 0.08	ug/L	100	No
Diclofop-methyl	< 0.08	ug/L	9	No
Dimethoate	< 0.4	ug/L	20	No
Diquat	< 7.0	ug/L	70	No
Diuron	< 6.0	ug/L	150	No
Glyphosate	< 20.0	ug/L	280	No
2-Methyl-4-chlororphenoxyacetic acid (MCPA)	< 0.4	ug/L	N/A	N/A
Malathion	< 0.2	ug/L	190	No
Metolachlor	< 0.2	ug/L	50	No
Metribuzin	< 0.5	ug/L	80	No
Monochlorobenzene	< 1.0	ug/L	80	No
Paraquat	< 0.06	ug/L	10	No
Pentachlorophenol	< 0.6	ug/L	60	No
Phorate	< 0.2	ug/L	2	No
Picloram	< 0.08	ug/L	190	No
Polychlorinated Biphenyls (PCB)	< 0.1	ug/L	3	No
Prometryne	< 0.4	ug/L	1	No
Simazine	< 0.1	ug/L	10	No
Terbufos	< 0.3	ug/L	1	No
Tetrachloroethylene	< 0.6	ug/L	30	No
2,3,4,6-Tetrachlorophenol	< 0.2	ug/L	100	No

Most Recent Schedule 24 Organic Data Tested at the Water Treatment Plant

Parameter	Result Value	Unit of Measure	Standard	Exceedance
Triallate	< 0.2	ug/L	230	No
Trichloroethylene	< 0.5	ug/L	5	No
2,4,6-Trichlorophenol	< 0.2	ug/L	5	No
Trifluralin	< 0.2	ug/L	45	No
Vinyl Chloride	< 0.5	ug/L	2	No

Note: Sample required every 12 months (sample date = *October 3, 2016)*

Inorganic or Organic Test Results that Exceeded Half the Standard Prescribed in Schedule 2 of the Ontario Drinking Water Quality Standards.

No inorganic or organic parameter(s) listed in Schedule 23 and 24 of Ontario Regulation 170/03 exceeded half the standard found in Schedule 2 of the Ontario Drinking Water Standard (O. Reg. 169/03) during the reporting period.

Most Recent Sodium Data Sampled at the Water Treatment Plant

Date of Sample	No. of Samples	Result Value	Unit of Measure	Standard	Exceedance
October 5, 2015	1	25.9	mg/L	20	Yes

Note: Sample required every 60 months. Next sampling scheduled for October 2020

The aesthetic objective for sodium in drinking water is 200 mg/L at which it can be detected by a salty taste. It is required that the local Medical Officer of Health be notified when the concentration exceeds 20 mg/L so that persons on sodium restricted diets can be notified by their physicians. Sodium exceedances are only reported every five years. The last reported exceedance occurred in February 2012. (AWQI# 105146).

Most Recent Fluoride Data Sampled at the Water Treatment Plant

Date of Sample	No. of Samples	Result Value	Unit of Measure	Standard	Exceedance
October 5, 2015	1	< 0.1	mg/L	1.5	No

Note: Sample required every 60 months. Next sampling scheduled for October 2020

Summary of Additional Testing Performed in Accordance with a Legal Instrument.

No additional sampling and testing was required for the Kirkland Lake Drinking Water System during the 2016 reporting period.

Kirkland Lake Drinking Water System

Schedule 22

2016 SUMMARY REPORT

FOR MUNICIPALITIES

Schedule 22 - SUMMARY REPORTS FOR MUNICIPALITIES

1.0 Introduction

Drinking-Water System Name:	**KIRKLAND LAKE DRINKING WATER SYSTEM**
Municipal Drinking Water Licence (MDWL) No.:	214-101-2 (issued April 13, 2016)
Drinking Water Work Permit (DWWP) No.:	214-201-2 (issued April 13, 2016)
Permit to Take Water (PTTW) No.:	3312-79FN3K (issued November 30, 2007)
Period being reported:	January 1, 2016 to December 31, 2016

2.0 Requirements the System Failed to Meet

According to information kept on record by OCWA, the Kirkland Lake Drinking Water System has complied with all the requirements set out in the system's MDWL, its DWWP, the Act and its Regulations.

However, it should be noted that, four (4) adverse water quality incidents were reported to the MOE's Spills Action Center. Refer to Section 6.0 – *Details on Notices of Adverse Test Results and Other Problems Reported to & Submitted to the Spills Actions Center* starting on page 9 of this report for details.

3.0 Summary of Quantities and Flow Rates

Flow Monitoring

MDWL No. 209-101 requires the owner to install a sufficient number of flow measuring devices to permit the continuous measurement and recording of:

- the flow rate and daily volume of treated water that flows from the treatment subsystem the distribution system (treated water flow from the high lift pump facilities), and

- the flow rate and daily volume of water that flows into the treatment subsystem (raw water flow from the low lift pump facilities).

The flow monitoring equipment identified in the MDWL is present and operating as required. These flow meters are calibrated on an annual basis as specified in the manufacturers' instructions.

Water Usage

The following water usage tables summarize the quantities and flow rates of water taken and produced during the 2016 reporting period, including total monthly volumes, average monthly volumes, maximum monthly volumes, and maximum flow rates.

Raw Water

2016 - Monthly Summary of Water Takings from the Source (Gull Lake)
Regulated by by Permit to Take Water (PTTW) #3312-79FN3K issued November 30, 2007

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year to Date
Total Volume (m^3)	278797	269648	293637	275275	303876	320835	301838	344769	292476	294540	282041	331023	3588755
Average Volume (m^3/d)	8993	9298	9472	9176	9802	10695	9737	11122	9749	9501	9401	10678	9802
Maximum Volume (m^3/d)	14083	10758	11425	10640	12307	13664	11350	13661	12752	12065	11439	3098	14083
PTTW - Maximum Allowable Volume (m^3/day)	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500
Maximum Flow Rate (L/min)	13242	9576	13728	9414	9348	14028	14022	15108	14100	14100	14040	15210	15210
PTTW - Maximum Allowable Flow Rate (L/min)	15625	15625	15625	15625	15625	15625	15625	15625	15625	15625	15625	15625	15625

The system's Permit to Take Water #3312-79FN3K, allows the Municipality to withdraw a maximum volume of 22,500 cubic meters from Gull Lake each day. A review of the raw water flow data indicates that the system never exceeded this allowable limit having a maximum volume of 14,083 m^3 on January 18th. The Permit also allows a maximum flow rate of 15,625 L/minute. At no point during the reporting period did the system exceed this rate having a maximum recorded flow of 15,210 L/minute on December 6th.

Treated Water

2016 - Monthly Summary of Treated Water Supplied to the Distribution System
Regulated Municipal Drinking Water Licence (MDWL) #209-101 - Issue 2, dated April 13, 2016

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year to Date
Total Volume (m^3)	273749	253044	279145	260892	284636	298327	279873	315563	270691	275621	263711	307279	3362531
Average Volume (m^3/d)	8831	8726	9005	8696	9182	9944	9028	10179	9023	8891	8790	9912	9184
Maximum Volume (m^3/d)	13580	9804	10391	9743	11658	12599	10593	12376	11146	11202	9813	12402	13580
MDWL/C of A - Rated Capacity (m^3/day)	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500

Schedule C, Section 1.1 of MDWL No. 214-101 states that the maximum daily volume of treated water that flows from the treatment subsystem to the distribution system shall not exceed a maximum flow rate of 22,500 m^3 on any calendar day. The Kirkland Lake DWS complied with this limit having a recorded maximum volume of 13,583 m^3/day on January 18th which is 60.3% of the rated capacity.

Figure 1 compares the average and maximum flow rates into the distribution system to the rated capacity of the system identified in the MDWL. This information enables the Owner to assess the system's existing and future planned water usage needs.

Figure 2 provides water usage information for the community of Swastika.

Comparison of the Flow Summary to the Rated Capacity & Flow Rates Allowed in the Systems Licence & Permit

Rated Capacity of the Plant (MDWL)	22,500 m^3/day	
Average Daily Flow for 2016	9,184 m^3/day	40.8 % of the rated capacity
Maximum Daily Flow for 2016	13,580 m^3/day	60.3 % of the rated capacity
Total Treated Water Produced in 2016	3,362,531 m^3	

The Kirkland Lake water treatment plant is rated to produce 22,500 cubic meters of water per day as specified in the system's Municipal Drinking Water Licence. The average daily flow was 9,184 m^3 per day, which is 40.8% of the rated capacity. This information clearly shows that the plant is well within its rated capacity and is able to meet current demands of consumers.

Figure 1: 2016 - Daily Volume of Treated Water into the Distribution System

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Flow (m^3/day)	8993	9298	9472	9176	9835	10695	9737	11122	9780	9501	9401	10678
Maximum Flow (m^3/day)	14083	10758	11425	10640	12307	13664	11350	13661	12752	12065	11439	13098
MDWL - Rated Capacity	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500	22500
% Rated Capacity	63	48	51	47	55	61	50	61	57	54	51	58

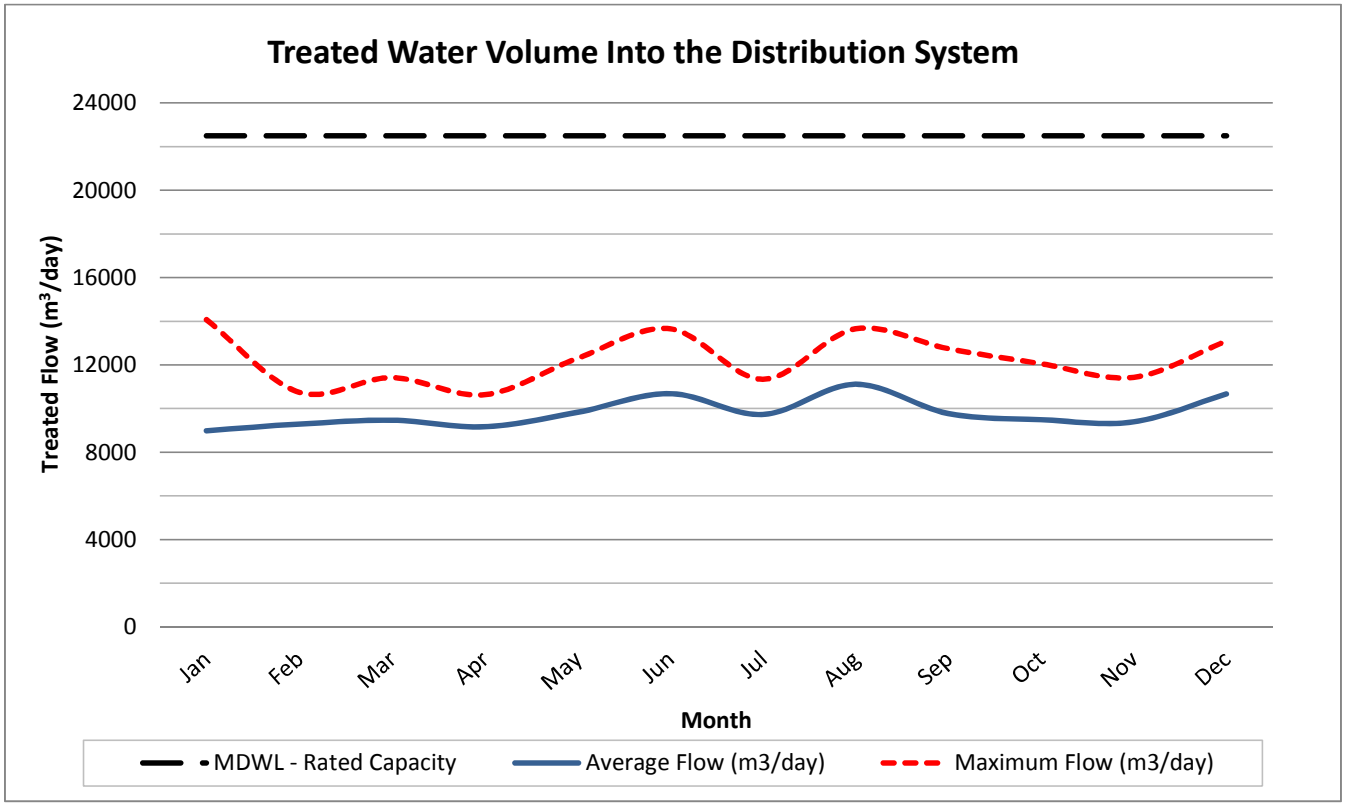
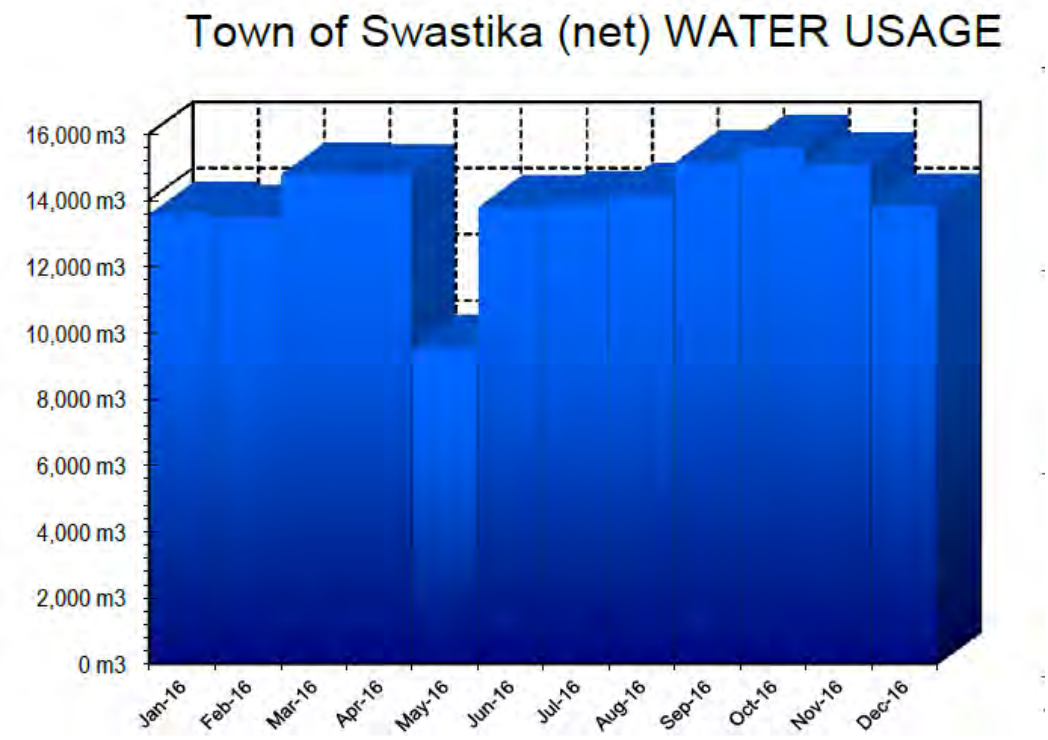


Figure 2 – Swastika Water Usage

			Swastika mag. meter (into Town)		
Mth	**WTP discharge**	**Swastika's USAGE (%)**	**metered volume**	**HIGHEST DAY**	**AVERAGE DAY**
Jan-16	273,749 m3	*4.96%*	**13,584 m3**	574.3 m3	438 m3
Feb-16	253,044 m3	*5.33%*	**13,497 m3**	507.9 m3	465 m3
Mar-16	279,145 m3	*5.29%*	**14,778 m3**	515.1 m3	477 m3
Apr-16	260,892 m3	*5.64%*	**14,725 m3**	502.9 m3	491 m3
May-16	284,636 m3	*3.36%*	**9,569 m3**	496.3 m3	309 m3
Jun-16	298,327 m3	*4.62%*	**13,782 m3**	681.0 m3	459 m3
Jul-16	279,873 m3	*4.97%*	**13,903 m3**	536.9 m3	448 m3
Aug-16	315,563 m3	*4.49%*	**14,164 m3**	511.7 m3	457 m3
Sep-16	270,691 m3	*5.59%*	**15,136 m3**	544.9 m3	505 m3
Oct-16	275,621 m3	*5.66%*	**15,597 m3**	655.4 m3	503 m3
Nov-16	263,711 m3	*5.72%*	**15,083 m3**	534.1 m3	503 m3
Dec-16	307,279 m3	*4.50%*	**13,834 m3**	537.9 m3	446 m3
Annual Total	3,362,530 m3	*4.99%*	**167,653 m3**		
Maximum month	315,563 m3 *August-16*	*5.72% Nov-16*	15,597 m3 *October-16*	681.0 m3 *8-Jun-16*	
Minimum month	253,044 m3 *February-16*		9,569 m3 *May-16*		
Average month	280,211 m3		13,971 m3		
Average day for the year					458 m3



CONCLUSION

In 2016, the Kirkland Lake drinking water system (DWS) provided safe and reliable drinking water to the communities of Kirkland Lake, Chaput Hughes and Swastika. The system complied with the regulatory requirements of the Safe Drinking Water Act and its Regulations and met the terms and conditions outlined in its site specific drinking water works permit and municipal drinking water licence having no incidents of non-compliance during the reporting period. The system was able to operate within the water taking limits of the permit and in accordance with the rated capacity of the licence while meeting the community's demand for water use.

APPENDIX A

Monthly Summary of Microbiological Test Results

KIRKLAND LAKE DRINKING WATER SYSYTEM
Monthly Microbiologocal Report

Facility Org Number: 1298
Facility Works Number: 220000308
Facility Name: KIRKLAND LAKE DRINKING WATER SYSTEM
Facility Owner: Municipality: Town of Kirkland Lake
Facility Classification: Class 3 Water Treatment
Service Population: 9000.0
Total Design Capacity: 22500.0 m3/day
From: 01/01/2016 to 31/12/2016

Raw Water	01/2016	02/2016	03/2016	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	Total	Avg	Max	Min
Gull Lake / Total Coliform: TC - cfu/100mL																
Count Lab	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max Lab	114	68	26	74	262	8	18	16	8	88	58	58			262	
Mean Lab	39.5	29.6	23.5	50	84	5	6	7.6	6	47.2	39.5	39		32		
Min Lab	4	10	20	16	14	2	0	2	4	8	26	32				0
Gull Lake / E. Coli: EC - cfu/100mL																
Count Lab	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max Lab	< 2	< 2	< 2	< 2	< 2	< 2	4	< 6	< 4	< 2	< 2	< 2			6	
Mean Lab	< 2	< 2	< 2	< 2	< 2	< 2	< 1.5	< 2.8	< 2.5	< 2	< 2	< 2		< 2		
Min Lab	< 2	< 2	< 2	< 2	< 2	< 2	< 0	< 2	< 2	< 2	< 2	< 2				0

Treated Water	01/2016	02/2016	03/2016	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	Total	Avg	Max	Min
Treated Water (POE) / Total Coliform: TC - cfu/100mL																
Count Lab	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max Lab	0	0	0	0	0	0	0	0	3	0	0	0			3	
Mean Lab	0	0	0	0	0	0	0	0	0.75	0	0	0		< 0.06		
Min Lab	0	0	0	0	0	0	0	0	0	0	0	0				0
Treated Water (POE) / E. Coli: EC - cfu/100mL																
Count Lab	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max Lab	0	0	0	0	0	0	0	0	0	0	0	0			0	
Mean Lab	0	0	0	0	0	0	0	0	0	0	0	0		0		
Min Lab	0	0	0	0	0	0	0	0	0	0	0	0				0
Treated Water (POE) / HPC - cfu/mL																
Count Lab	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max Lab	< 10	< 10	< 10	< 10	< 10	410	< 10	< 250	< 10	< 10	< 10	< 10			410	
Mean Lab	< 10	< 10	< 10	< 10	< 10	110	< 10	< 58	< 10	< 10	< 10	< 10		< 22.3		
Min Lab	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10				< 10

September 6th - 3 Total Coliforms were detected in a drinking water sample collected at the Kirkland Lake water treatment plant point of entry into the distribution system. AWQI No. 131122)

Distribution Water	01/2016	02/2016	03/2016	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	Total	Avg	Max	Min
KL-3 / Total Coliform: TC - cfu/100mL																
Count Lab	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max Lab	0	0	0	0	0	0	0	0	0	0	0	0			0	
Mean Lab	0	0	0	0	0	0	0	0	0	0	0	0		0		
Min Lab	0	0	0	0	0	0	0	0	0	0	0	0				0
KL-3 / E. Coli - cfu/100mL																
Count Lab	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max Lab	0	0	0	0	0	0	0	0	0	0	0	0			0	
Mean Lab	0	0	0	0	0	0	0	0	0	0	0	0		0		
Min Lab	0	0	0	0	0	0	0	0	0	0	0	0				0
KL-3 / HPC - cfu/mL																
Count Lab	3	4	1	1	2	1	2	3	2	2	2	1	24			
Max Lab	30	100	40	80	160	290	380	520	660	350	260	< 10			660	
Mean Lab	23	75	40	80	125	290	370	463	635	275	210	< 10		< 225		
Min Lab	10	60	40	80	90	290	360	420	610	200	160	< 10				< 10

Distribution Water		01/2016		02/2016		03/2016		04/2016		05/2016		06/2016		07/2016		08/2016		09/2016		10/2016		11/2016		12/2016		Total		Avg		Max		Min
KL-4 / Total Coliform: TC - cfu/100mL																														
Count Lab		4		5		4		4		5		4		4		5		4		5		4		4		52					
Max Lab		0		0		0		0		0		0		0		0		0		0		0		0						0	
Mean Lab		0		0		0		0		0		0		0		0		0		0		0		0				0		
Min Lab		0		0		0		0		0		0		0		0		0		0		0		0						0
KL-4 / E. Coli - cfu/100mL																														
Count Lab		4		5		4		4		5		4		4		5		4		5		4		4		52					
Max Lab		0		0		0		0		0		0		0		0		0		0		0		0						0	
Mean Lab		0		0		0		0		0		0		0		0		0		0		0		0				0		
Min Lab		0		0		0		0		0		0		0		0		0		0		0		0						0
KL-4 / HPC - cfu/mL																														
Count Lab		1		3		1		2		2		2		2		1		2		2		1		2		21					
Max Lab	<	10	<	10	<	10	<	10	<	10	<	10	<	10		10		10	<	10		100	<	10						100	
Mean Lab	<	10	<	10	<	10	<	10	<	10	<	10	<	10		10		10	<	10		100	<	10			<	14.3			
Min Lab	<	10	<	10	<	10	<	10	<	10	<	10	<	10		10		10	<	10		100	<	10					<		10
KL-5 / Total Coliform: TC - cfu/100mL																														
Count Lab		4		5		4		4		5		4		4		5		4		5		4		4		52					
Max Lab		0		0		0		0		0		0		0		0		0		0		0		0						0	
Mean Lab		0		0		0		0		0		0		0		0		0		0		0		0				0		
Min Lab		0		0		0		0		0		0		0		0		0		0		0		0						0
KL-5 / E. Coli - cfu/100mL																														
Count Lab		4		5		4		4		5		4		4		5		4		5		4		4		52					
Max Lab	<	0	<	0		0		0		0		0		0		0		0		0		0		0						0	
Mean Lab	<	0	<	0		0		0		0		0		0		0		0		0		0		0				0		
Min Lab	<	0	<	0		0		0		0		0		0		0		0		0		0		0						0
KL-5 / HPC - cfu/mL																														
Count Lab		1		1		2		2		2		2		2		2		1		2		1		2		20					
Max Lab	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10					<	10	
Mean Lab	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10			<	10			
Min Lab	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10	<	10					<		10
KL-6 / Total Coliform: TC - cfu/100mL																														
Count Lab		4		5		4		4		5		4		4		5		4		5		4		4		52					
Max Lab		0		0		0		0		0		0		0		0		0		0		0		0						0	
Mean Lab		0		0		0		0		0		0		0		0		0		0		0		0				0		
Min Lab		0		0		0		0		0		0		0		0		0		0		0		0						0
KL-6 / E. Coli - cfu/100mL																														
Count Lab		4		5		4		4		5		4		4		5		4		5		4		4		52					
Max Lab		0		0		0		0		0		0		0		0		0		0		0		0						0	
Mean Lab		0		0		0		0		0		0		0		0		0		0		0		0				0		
Min Lab		0		0		0		0		0		0		0		0		0		0		0		0						0
KL-6 / HPC - cfu/mL																														
Count Lab		1		0		2		2		2		2		1		2		1		2		2		2		19					
Max Lab	<	10		-	<	10	<	10	<	10	<	10		10	<	10	<	10	<	10	<	10	<	10						10	
Mean Lab	<	10		-	<	10	<	10	<	10	<	10		10	<	10	<	10	<	10	<	10	<	10			<	10			
Min Lab	<	10		-	<	10	<	10	<	10	<	10		10	<	10	<	10	<	10	<	10	<	10					<		10
KL-7 / Total Coliform: TC - cfu/100mL																														
Count Lab		4		5		4		4		5		4		4		5		4		5		4		4		52					
Max Lab		0		0		0		0		0		0		0		0		0		0		0		0						0	
Mean Lab		0		0		0		0		0		0		0		0		0		0		0		0				0		
Min Lab		0		0		0		0		0		0		0		0		0		0		0		0						0
KL-7 / E. Coli - cfu/100mL																														
Count Lab		4		5		4		4		5		4		4		5		4		5		4		4		52					
Max Lab		0		0		0		0		0		0		0		0		0		0		0		0						0	
Mean Lab		0		0		0		0		0		0		0		0		0		0		0		0				0		
Min Lab		0		0		0		0		0		0		0		0		0		0		0		0						0
KL-7 / HPC - cfu/mL																														
Count Lab		2		2		2		1		2		1		1		2		2		2		2		1		20					
Max Lab	<	10	<	10	<	10	<	10	<	10	<	10		10	<	10	<	10	<	10	<	10	<	10						10	
Mean Lab	<	10	<	10	<	10	<	10	<	10	<	10		10	<	10	<	10	<	10	<	10	<	10			<	10			
Min Lab	<	10	<	10	<	10	<	10	<	10	<	10		10	<	10	<	10	<	10	<	10	<	10					<		10

APPENDIX B

Monthly Summary of Operational Data

KIRKLAND LAKE DRINKING WATER SYSYTEM
Monthly Summary of Operational Data

Facility Org Number: 1298
Facility Works Number: 220000308
Facility Name: KIRKLAND LAKE DRINKING WATER SYSTEM
Facility Owner: Municipality: Town of Kirkland Lake
Facility Classification: Class 3 Water Treatment
Service Population: 9000.0
Total Design Capacity: 22500.0 m3/day
From: 01/01/2016 to 31/12/2016

Filtered Water	01/2016	02/2016	03/2016	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	Total	Avg	Max	Min
Filter 1 / Turbidity - NTU																
Max OL	0.16	0.22	0.17	0.11	0.06	0.08	0.13	0.17	0.16	0.09	0.09	1.1			1.1	
Mean OL	0.032	0.035	0.043	0.033	0.025	0.027	0.04	0.053	0.042	0.039	0.031	0.052		0.038		
Min OL	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.02				0.02
Filter 2 / Turbidity - NTU																
Max OL	0.23	0.23	0.41	0.12	0.1	0.11	0.14	0.15	0.15	0.13	0.1	1.2			1.2	
Mean OL	0.053	0.063	0.06	0.048	0.034	0.034	0.055	0.068	0.053	0.21	0.04	0.047		0.064		
Min OL	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03				0.03
Filter 3 / Turbidity - NTU																
Max OL	0.24	0.25	0.28	0.15	0.36	0.17	0.14	0.15	0.12	0.13	0.32	0.916			0.916	
Mean OL	0.051	0.064	0.062	0.047	0.036	0.038	0.079	0.067	0.054	0.051	0.045	0.046		0.053		
Min OL	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03				0.02
Filter 4 / Turbidity - NTU																
Max OL	0.19	0.25	0.8	0.11	0.08	0.08	0.11	0.11	0.09	0.1	0.14	0.73			0.80	
Mean OL	0.055	0.062	0.054	0.043	0.035	0.034	0.049	0.06	0.05	0.063	0.042	0.05		0.05		
Min OL	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.04	0.03	0.00	0.03	0.02				0.00

Treated Water	01/2016	02/2016	03/2016	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	Total	Avg	Max	Min
Treated Water (POE) / Cl Residual: Free - mg/L																
Max OL	1.89	3.21	1.76	2.56	3.19	2.36	3.52	1.66	2.83	2.61	1.85	1.79			3.52	
Mean OL	1.238	1.169	1.072	1.319	1.422	1.401	1.315	1.196	1.256	1.393	1.444	1.305		1.294		
Min OL	0.70	0.87	0.75	0.84	0.83	0.86	0.83	0.80	0.83	0.71	1.24	0.96				0.70

Distribution Water	01/2016	02/2016	03/2016	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	Total	Avg	Max	Min
KL-3 / Cl Residual: Free - mg/L																
Count IH	8	9	8	9	9	9	8	9	9	9	8	8	103			
Max IH	1.42	1.32	1.36	1	1.07	1.27	1.1	1.17	1.17	1.27	1.66	1.59			1.66	
Mean IH	0.61	0.502	0.848	0.833	0.796	0.857	0.705	0.742	0.857	0.937	1.235	1.07		0.83		
Min IH	0.14	0.15	0.42	0.42	0.5	0.64	0.48	0.43	0.46	0.36	0.87	0.62				0.14
KL-4 / Cl Residual: Free - mg/L																
Count IH	8	9	8	9	9	9	8	9	9	9	8	8	103			
Max IH	0.95	1.62	1.38	1.1	1.39	1.17	0.75	1.04	0.86	1.12	1.34	1.44			1.62	
Mean IH	0.689	0.961	0.948	0.773	1.058	0.81	0.561	0.723	0.711	0.789	0.941	0.864		0.82		
Min IH	0.21	0.64	0.58	0.45	0.58	0.6	0.31	0.51	0.48	0.52	0.58	0.59				0.21
KL-5 / Cl Residual: Free - mg/L																
Count IH	8	9	8	9	9	9	8	9	9	9	8	8	103			
Max IH	1.15	1.43	1.21	1.5	1.33	1.02	0.98	0.81	1.31	1.14	1.26	1.36			1.5	
Mean IH	0.811	0.949	0.832	0.951	0.863	0.684	0.606	0.567	0.707	0.851	0.814	0.904		0.795		
Min IH	0.53	0.58	0.3	0.53	0.58	0.38	0.17	0.28	0.51	0.48	0.5	0.64				0.17
KL-6 / Cl Residual: Free - mg/L																
Count IH	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max IH	0.98	0.88	1.2	1.21	1.15	0.77	0.89	0.9	0.67	1.12	1.02	1.33			1.33	
Mean IH	0.763	0.68	0.855	0.928	0.956	0.715	0.583	0.772	0.518	0.956	0.67	0.95		0.783		
Min IH	0.63	0.52	0.55	0.64	0.65	0.58	0.42	0.61	0.36	0.75	0.36	0.76				0.36
KL-7 / Cl Residual: Free - mg/L																
Count IH	4	5	4	4	5	4	4	5	4	5	4	4	52			
Max IH	1.5	1.67	1.38	1.61	1.3	1.5	0.89	0.7	0.74	0.98	0.86	1.05			1.67	
Mean IH	0.95	0.882	1.15	1.335	1.034	1.355	0.665	0.652	0.635	0.852	0.688	0.948		0.923		
Min IH	0.7	0.56	0.98	0.98	0.6	1.18	0.57	0.55	0.51	0.75	0.46	0.78				0.46