



# **2023 Annual/Summary Report for the Cobalt Drinking Water System**

**PREPARED BY**

Ontario Clean Water Agency  
on behalf of the Town of Cobalt

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Rev: 0

# Revision History

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## Background

Municipalities throughout Ontario are required to comply with Ontario Regulation 170/03 made under the Safe Drinking Water Act (SDWA) since June 2003. The Act was passed 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.

O. Reg. 170/03 requires the owner to produce an Annual Report, under Section 11. This report must include the following:

1. Description of system and 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 28 of each year.

The regulation also requires a Summary Report which must be presented and accepted by Council by March 31 of each year for the preceding calendar year reporting period.

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 regulatory requirement 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 two reports have been prepared by the Ontario Clean Water Agency (OCWA) on behalf of the Owner and presented to council as the 2023 Annual/Summary Report.

## Section 11 – Annual Report

### 1. Introduction

<b>Drinking-Water System Name</b>	<b>Cobalt Drinking Water System</b>
<b>Drinking-Water System Number</b>	220000362
<b>Drinking-Water System Owner</b>	The Corporation of the Town of Cobalt
<b>Drinking-Water System Category</b>	Large Municipal, Residential System
<b>Municipal Drinking Water Licence No.</b>	206-101-6 (issued September 14, 2022)
<b>Drinking Water Work Permit No.</b>	206-201-4 (issued April 28, 2021)
<b>Permit to Take Water No.</b>	6462-BB9RFA (issued May 2, 2019)
<b>Reporting Period</b>	January 1, 2023 to December 31, 2023

**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: <https://cobalt.ca/residents/municipal-services/#1652963793627-091f9918-948f>

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

Town of Cobalt Municipal Office  
 18 Silver Street, Cobalt  
 ON P0J 1C0

Township of Coleman Municipal Office  
 937907 Marsh Bay Road, Coleman  
 ON P0J 1C0

#### ***Drinking Water Systems that receive drinking water from the Cobalt Drinking Water System***

The Cobalt Drinking Water System provides drinking water to the Town of Cobalt and the Coleman distribution system.

Drinking Water System Name	Drinking Water System Number
Cobalt Drinking Water System	220000362
Coleman Distribution System	260074321

***The Annual Report was provided to all connected Drinking Water System Owners***

The Ontario Clean Water Agency prepared the 2023 Annual/Summary Report for the Cobalt Drinking Water System and provided a copy to the system owner; the Town of Cobalt and the Township of Coleman.

***System Users are notified that the Annual Report is available for viewing through:***

- Notice at the Municipal Office

## **2. Description of the Cobalt Drinking Water System**

The Cobalt Drinking Water System is owned by the Corporation of the Town of Cobalt and consists of a Class 2 water treatment subsystem and a Class 1 water distribution subsystem that services the Town of Cobalt and Coleman Township. The System serves a population of approximately 1350 residents including the connected population in the Coleman Township Distribution System. . The Ontario Clean Water Agency is the accredited operating authority and is designated as the Overall Responsible Operator for both the water treatment and water distribution facilities.

### ***Raw Water Supply***

The raw water is taken from a protected water body, Sasaginaga Lake and directed to the water treatment plant located about 500 meters West of Pyrite Street in Cobalt. The intake structure is located 191 meters into the lake, at a depth of 7.5 meters and is equipped with a 244 mm diameter drum base with a 560 mm diameter manually adjustable conical cover. The raw water intake pipe consists of a 215 m long, 450 mm diameter polyethylene intake pipe with a design capacity of 8726 m<sup>3</sup>/day.

A flow meter is located in the water treatment plant to monitor raw water flows. The raw water is also continuously monitored for pH, turbidity and temperature.

### ***Water Treatment***

The Cobalt water treatment plant is a direct filtration facility with two treatment trains operating in parallel, and each consisting of a pre-contact tank, where coagulation is undertaken, and two dual media pressure filters.

The low lift pumping station consists of two submersible highlift suction pumps (one duty and one standby), a wet well, a flow meter and two pre-contact vessels, each having a volume of 3.6 cubic meters. The pumps feed four pressurized dual media sand/anthracite filters equipped with on-line turbidity analyzer used to monitor the turbidity off each filter.

Water is then directed to two (2) parallel UV irradiation systems which are used to achieve most of the required primary disinfection. Each unit is rated at 3974 m<sup>3</sup>/day at a 85% UVT with a design

does of 40 mJ/cm<sup>2</sup> and is equipped with actuated control valves that allow switchover between units.

Chlorine gas is injected into the water following the UV system treatment using two booster pumps and two manually controlled v-chlorination feed units capable of providing 45 kilograms/day of chlorine. The chlorine is added to meet the remaining primary disinfection requirements and maintain the required secondary disinfection within the distribution systems.

### ***Water Storage***

The water then goes into an 8.527 m diameter and 10.869 m high glassed fused to steel standpipe, having a total volume of 621 m<sup>3</sup>. Two submersible high lift pumps (one duty and one standby) pump water from the standpipe to the Cobalt and Coleman Distribution Systems and to the Cobalt Water Tower.

Before entering the distribution system, the treated water is monitored for pH, free chlorine residual and turbidity using continuous on-line analyzers. The plant is protected with alarms and a stand-by generator in the event of power loss.

### ***Control System***

The Cobalt Water Treatment System is controlled by a dedicated Programmable Logic Controller (PLC) and monitored through a Control System Supervisory Control and Data Acquisition (SCADA) system. All analyzing, monitoring and control module equipment information is routed through the SCADA system for operator monitoring and control. Control of equipment can be accomplished locally using the SCADA computer or remotely using operator computers and cell phones. Alarm capability and set point adjustment along with trend monitoring are also available through SCADA system controls.

### ***Emergency Power***

A 180 kW diesel generator with a 1500 Liter fuel tank is available outside of the water treatment plant and is capable of supplying power to the facility during power failures.

### ***Distribution System***

The Cobalt drinking water system is classified as a Large Municipal Residential Drinking Water System and serves an approximate population of 1350 residents, including the connected population in the Coleman Distribution System. The Cobalt Distribution System is comprised of PVC water mains, 139 valves and approximately 615 service connections. There are 89 fire hydrants connected to the system to aid in fire protection.

The water tower, located on Ferland Avenue in the Town of Cobalt is a composite concrete/steel tank that was built in 1988. The off-site elevated water storage tank is 15m in diameter and 43.4m high and has a storage volume of 1400 cubic meters. It provides storage and maintains



pressure in the distribution system during peak hours of demand. Re-chlorination equipment is on hand at the water tower to provide secondary disinfection if required.

### 3. List of Water Treatment Chemicals Used

- Poly Aluminum Chloride – high performance coagulant used for flocculation
- Sodium Hydroxide – pH and alkalinity adjustment of the finished water
- Chlorine Gas – disinfection
- Sodium Hypochloride – disinfection; re-chlorination at the Cobalt Water Tower

All treatment chemicals meet AWWA and NSF/ANSI standards.

### 4. Significant Expense Incurred in 2023

OCWA is committed to maintaining the assets of the drinking water system and sustains a program of scheduled inspection and maintenance activities using a computerized Work Management System (WMS).

Significant expenses incurred in the drinking water system include the following:

- PLC/SCADA upgrade,
- Installed hot water flush and replaced chemical feed lines,
- Installed pipe labelling,
- Replaced treated water pH probe,
- Installed instrument specific flow meters on turbidity analyzers,
- Replaced faulty pressure transmitter on the standpipe,
- Water treatment chemicals,
- Quality and Environmental Management System (QEMS) external surveillance audit conducted by SAI Global.

### 5. Details of Notices Reported & Submitted to the Spills Action Center

Based on information kept on record by OCWA, four (4) adverse water quality incidents (AWQIs) and one (1) spill event were reported to the Ministry’s Spills Action Centre in 2023.

#### Incident #1: Category 2 Watermain Repair / Loss of Pressure / BWA

<b>AWQI No.</b>	161639
<b>Date</b>	March 30, 2023

<b>Details</b>	<p>Water was turned off to a section of the Cobalt distribution system (approx. 20 residences and 10 business) so that a valve could be repaired. The water was off from 1940 hrs to 2045 hrs.</p> <p>The local Health Unit (HU) and the Ministry’s Spills Action Center (SAC) were notified. The HU issued a boil water advisory (BWA) to the affected businesses and residences. The affected users were notified via door to door notices.</p>
<b>Corrective Actions</b>	<p>The valve was repaired, the water was turned back on and the affected area was flushed. Two sets of three bacteriological samples were collected 24 hours apart on March 30<sup>th</sup> and 31<sup>st</sup>.</p> <p>All results were acceptable having no total coliforms and <i>E.coli</i>. The HU lifted the BWA on Sunday April 2, 2023.</p>

**Incident #2: Category 2 Watermain Repair / Loss of Pressure / BWA**

<b>AWQI No.</b>	162237
<b>Date</b>	June 19, 2023
<b>Details</b>	<p>Watermain break at 9 Prospect Avenue in Cobalt resulted in a loss of pressure to 2 apartment buildings (approx. 20 residents), 1 restaurant and 2 commercial buildings. During planned maintenance of a service line, the public works employees discovered a leak at the saddle between the bend and main which is connected to the service. Isolation of the main was required to replace the saddle.</p> <p>The local HU and the Ministry’s SAC were notified. The HU issued a BWA to the affected businesses and residences.</p>
<b>Corrective Actions</b>	<p>After the repair was complete, the pressure was restored and the area was flushed until an acceptable free chlorine residual was achieved (1.68 mg/L). Two sets of 3 bacteriological samples were collected 24 hours apart (upstream, downstream and at the site of the break) on June 19<sup>th</sup> and June 20<sup>th</sup>.</p> <p>Sample results indicated no total coliforms or <i>E.coli</i>. The BWA was lifted on June 23<sup>rd</sup> at approximately 11:10 AM</p>

**Incident #3: Category 2 Watermain Repair / Loss of Pressure / BWA**

<b>AWQI No.</b>	163143
<b>Date</b>	August 23, 2023

<b>Details</b>	<p>Watermain break/repair resulting in a loss of pressure to 2 homes on Miller Avenue and 1 home on Cobalt Street. The local Health Unit issued a precautionary BWA for the affected homes.</p> <p>The local HU and the Ministry's SAC were notified. The HU issued a BWA to the affected residences.</p>
<b>Corrective Actions</b>	<p>After the repair was complete, the pressure was restored and the area was flushed until an acceptable chlorine residual was achieved (1.69 mg/L). Two sets of 3 bacteriological samples were collected 24 hours apart (upstream, downstream and at the site of the break) on August 23<sup>rd</sup> and 24<sup>th</sup>.</p> <p>Sample results indicated no total coliforms or <i>E.coli</i>. The BWA was lifted on August 28, 2023 at 8:45 AM.</p>

**Incident #4: Category 2 Watermain Repair / Loss of Pressure / BWA**

<b>AWQI No.</b>	163766
<b>Date</b>	October 12, 2023
<b>Details</b>	<p>A service line break/repair required isolation of the main which resulted in a loss of pressure to 14 homes on Lang Street.</p> <p>The local HU and the Ministry's SAC were notified. The HU issued a BWA for the affected residences.</p>
<b>Corrective Actions</b>	<p>After the repair was complete, the pressure was restored and the area was flushed until an acceptable chlorine residual was achieved (FCR = 1.20 mg/L). Two sets of 3 bacteriological samples were collected 24 hours a apart (upstream, downstream and at the site of the break) on October 12<sup>th</sup> and 13<sup>th</sup>.</p> <p>Sample results indicated no total coliforms or <i>E.coli</i>. The BWA was lifted on October 16, 2023 at 9:00 AM.</p>

**Incident #5: Spill from the Standpipe**

<b>SAC Event No.</b>	1-3UAFZF
<b>Date</b>	September 15, 2023
<b>Details</b>	<p>A faulty pressure transmitter (PT) caused the standpipe to overflow and spill. Approximately 260 m<sup>3</sup> of chlorinated drinking water spilled onto the ground with an unknown volume entering Sasaginaga Lake.</p>

<b>Corrective Actions</b>	<p>OCWA's Instrumentation Technician re-programmed and re-calibrated the PT until it was replaced. Will be replaced before the end of the day.</p> <p>Verbal notifications were made to the local HU, local MECP and SAC. Written Report sent to MECP SAC, local MECP and Environment Canada.</p>
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## 6. Microbiological Testing

Table 1: Summary of Microbiological Results

Sample Type	# of Samples	Range of <i>E.coli</i> Results (min to max)	Range of Total Coliform Results (min to max)	# of HPC Samples	Range of HPC Results (min to max)
Raw	52	0 to 16/NDOGN/T	< 2 to 360/NDOGN/T	N/A	N/A
Treated	52	0 to 0	0 to 0	52	< 10 to 70
Distribution	156	0 to 0	0 to 0	52	< 10 to 290

Maximum Acceptable Concentration (MAC) for treated and distribution samples: *E. coli* = 0 CFUs/100 mL and MAC for Total Coliforms = 0 CFUs/100 mL

NDOGN = No Data, Overgrown with Non-Target bacteria

NDOGT = No Data, Overgrown with Target bacteria

"<" denotes less than the laboratory's method detection limit

**Note:** One microbiological sample is collected and tested each week from the raw and treated water supply. A total of three microbiological samples are collected and tested each week from the distribution system. At least 25% of the distribution samples must be tested for HPC bacteria.

Refer to *Appendix A* for a monthly summary of the above microbiological data.

## 7. Operational Testing

Table 2: Continuous Monitoring in the Treatment Process

Parameter	# of Samples	Range of Results (min to max)	Unit of Measure	Standard
Turbidity (Filter 1)	8760	0.00 to 0.99	NTU	≤ 1.0 <sup>Note 2</sup>
Turbidity (Filter 2)	8760	0.00 to 0.99	NTU	
Turbidity (Filter 3)	8760	0.00 to 0.99	NTU	
Turbidity (Filter 4)	8760	0.00 to 0.98	NTU	

Parameter	# of Samples	Range of Results (min to max)	Unit of Measure	Standard
Free Chlorine Residual	8760	1.01 to 2.42	mg/L	CT <sup>Note 3</sup>

**Notes:**

1. For continuous monitors 8760 is used as the number of samples.
2. Effective backwash procedures, including filter to waste and automatic filter shut down features are in place to ensure that the effluent turbidity requirements as described in the Filter Performance Criteria are met all times. Turbidity exceedances occur when two (2) readings are above 1 NTU for 15 minutes or more in a 24 hour period. Filters will backwash if turbidity reaches 0.3 NTU, filters will shut down and alarm at 0.7 NTU, filters also shut down and alarm at 1.0 NTU. The system performed as programmed and no high turbidity water was directed to the next phase of the process.
3. 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 for the Cobalt water plant if the free chlorine residual level drops below 0.30 mg/L to ensure primary disinfection is achieved.

*Table 3: Summary of Chlorine Residuals in the Distribution System*

Parameter	# of Samples	Range of Results (min to max)	Unit of Measure	Standard
Free Chlorine Residual	370	0.70 to 2.19	mg/L	≥ 0.05

**Note:** A total of seven operational checks for chlorine residual in the distribution system are collected each week. Four (4) samples are 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 operational data.

## 8. Chemical Testing

*Table 4: Summary of Nitrate & Nitrite Data from the Water Treatment Plant*

Date of Sample	Nitrate Result	Nitrite Result	Unit of Measure	Exceedance
January 9	< 0.1	< 0.01	mg/L	No
April 11	0.1	< 0.01	mg/L	No
July 10	< 0.1	< 0.01	mg/L	No
October 16	< 0.1	< 0.01	mg/L	No

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

*Table 5: Summary of Total Trihalomethane Results from the Distribution System*

Date of Sample	THM Result	Unit of Measure	Running Average	Exceedance
January 9	38.0	ug/L	Q1 = 33.3	No
April 11	33.2	ug/L	Q2 = 33.8	No
July 10	44.0	ug/L	Q3 = 36.4	No
October 16	71.9	ug/L	Q4 = 46.8	No

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

*Table 6: Summary of Total Haloacetic Acid Results from the Distribution System*

Date of Sample	Result Value	Unit of Measure	Running Average	Exceedance
January 9	36	ug/L	Q1 = 41.0	No
April 11	43	ug/L	Q2 = 47.0	No
July 10	57	ug/L	Q3 = 46.0	No
October 16	83	ug/L	Q4 = 55.8	No

Maximum Allowable Concentration (MAC) for Total Haloacetic Acid = 80 ug/L (Four Quarter Running Average)

*Table 7: Summary of Lead Results under Schedule 15.1 (from the distribution system)*

Date of Sample	# of Samples	Field pH (min to max)	Field Temperature (°C) (min to max)	Alkalinity (mg/L) (min to max)	Lead (ug/L) (min to max)
March 7	2	6.80 to 7.39	3.8 to 4.6	56 to 56	N/A
September 13	2	7.36 to 7.48	11.4 to 11.9	50 to 51	N/A

Maximum Allowable Concentration (MAC) for Lead -10 ug/L

The system is required to test for total alkalinity and pH in two distribution samples collected during the period of December 15 to April 15 (winter period) and two distribution sample during the period of 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.

Lead testing was not required this reporting period, but was done in 2022. The results were <0.1 and 0.2 ug/L sampled on March 15<sup>th</sup> and 0.3 and 18.1 ug/L sampled on September 13<sup>th</sup>. One sample collected on September 13<sup>th</sup> exceeded the maximum allowable concentration of 10 ug/L. The suspected cause was that the sample was collected during distribution flushing. Resample results were <0.1 ug/L. Next lead sampling is scheduled for 2025.

**Table 8: Most Recent Schedule 23 Inorganic Results from the Water Treatment Plant**

Parameter	Result Value	Unit of Measure	MAC	MAC Exceedance	½ MAC Exceedance
Antimony	< 0.5	ug/L	6	No	No
Arsenic	< 1.0	ug/L	10	No	No
Barium	5	ug/L	1000	No	No
Boron	< 2	ug/L	5000	No	No
Cadmium	< 0.1	ug/L	5	No	No
Chromium	< 1	ug/L	50	No	No
Mercury	< 0.1	ug/L	1	No	No
Selenium	< 0.2	ug/L	50	No	No
Uranium	< 1	ug/L	20	No	No

**Note:** Sample required every 12 months (sample date = October 16, 2023)

**Table 9: Most Recent Schedule 24 Organic Results from the Water Treatment Plant**

Parameter	Result Value	Unit of Measure	Standard	MAC Exceedance	½ MAC Exceedance
Alachlor	< 0.34	ug/L	5	No	No
Atrazine + N-dealkylated metabolites	< 0.5	ug/L	5	No	No
Azinphos-methyl	< 0.255	ug/L	20	No	No
Benzene	< 0.1	ug/L	1	No	No
Benzo(a)pyrene	< 0.01	ug/L	0.01	No	No
Bromoxynil	< 0.0988	ug/L	5	No	No
Carbaryl	< 2	ug/L	90	No	No
Carbofuran	< 4	ug/L	90	No	No
Carbon Tetrachloride	< 0.2	ug/L	2	No	No
Chlorpyrifos	< 0.225	ug/L	90	No	No
Diazinon	< 0.225	ug/L	20	No	No
Dicamba	< 0.0864	ug/L	120	No	No

Parameter	Result Value	Unit of Measure	Standard	MAC Exceedance	½ MAC Exceedance
1,2-Dichlorobenzene	< 0.2	ug/L	200	No	No
1,4-Dichlorobenzene	< 0.3	ug/L	5	No	No
1,2-Dichloroethane	< 0.2	ug/L	5	No	No
1,1-Dichloroethylene (vinylidene chloride)	< 0.3	ug/L	14	No	No
Dichloromethane	< 1	ug/L	50	No	No
2-4 Dichlorophenol	< 0.2	ug/L	900	No	No
2,4-Dichlorophenoxy acetic acid (2,4-D)	< 0.37	ug/L	100	No	No
Diclofop-methyl	< 0.133	ug/L	9	No	No
Dimethoate	< 0.255	ug/L	20	No	No
Diquat	< 0.2	ug/L	70	No	No
Diuron	< 10	ug/L	150	No	No
Glyphosate	< 20	ug/L	280	No	No
Malathion	< 0.255	ug/L	190	No	No
Metolachlor	< 0.17	ug/L	50	No	No
Metribuzin	< 0.17	ug/L	80	No	No
Monochlorobenzene	< 0.5	ug/L	80	No	No
Paraquat	< 0.2	ug/L	10	No	No
Polychlorinated Biphenyls (PCBs)	< 0.07	ug/L	3	No	No
Pentachlorophenol	< 0.3	ug/L	60	No	No
Phorate	< 0.17	ug/L	2	No	No
Picloram	< 0.0864	ug/L	190	No	No
Prometryne	< 0.0849	ug/L	1	No	No
Simazine	< 0.255	ug/L	10	No	No
Terbufos	< 0.17	ug/L	1	No	No
Tetrachloroethylene	< 0.3	ug/L	10	No	No



Parameter	Result Value	Unit of Measure	Standard	MAC Exceedance	½ MAC Exceedance
2,3,4,6-Tetrachlorophenol	< 0.3	ug/L	100	No	No
Triallate	< 0.17	ug/L	230	No	No
Trichloroethylene	< 0.2	ug/L	5	No	No
2,4,6-Trichlorophenol	< 0.2	ug/L	5	No	No
2-methyl-4-chlorophenoxyacetic acid (MCPA)	< 6.17	ug/L	100	No	No
Trifluralin	< 0.17	ug/L	45	No	No
Vinyl Chloride	< 0.1	ug/L	1	No	No

**Note:** Sample required every 12 months (sample date = October 16, 2023)

*Inorganic or Organic Parameter(s) that Exceeded Half the Standard Prescribed in Schedule 2 of Ontario Drinking Water Quality Standards*

No inorganic or organic parameter(s) listed in Schedule 23 and 24 of Ontario Regulation 170/03 (parameters listed in Table 8 and Table 9 of this report) exceeded half the standard found in Schedule 2 of the Ontario Drinking Water Standard (O. Reg.169/03) during the reporting period.

*Table 10: Most Recent Sodium Data (from the Water Treatment Plant)*

Date of Sample	# of Samples	Result Value	Unit of Measure	MAC	Exceedance
April 6, 2020	1	5.75	mg/L	20	No

**Note:** Sample required every 60 months. Next sampling scheduled for April 2025.

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.

*Table 11: Most Recent Fluoride Data Sampled at the Water Treatment Plant*

Date of Sample	# of Samples	Result Value	Unit of Measure	MAC	Exceedance
October 25, 2022	1	< 0.05	mg/L	1.5	No

**Note:** Sample required every 60 months. Next sampling scheduled for October 2027.

## 9. Additional Testing Performed in Accordance with a Legal Instrument

### 1. Ultraviolet (UV) Monitoring

Condition 1.6 of Schedule C to Municipal Drinking Water License (MDWL) No. 206-101 issued on April 28, 2021 requires the UV disinfection system to maintain a continuous pass-through UV dose of at least 40 mJ/cm<sup>2</sup>.

Table 12: Summary of UV Dosage

UV System	Range of Results (min to max)	Unit of Measure	Standard
UV Unit No. 1	0 to 200	mJ/cm <sup>2</sup>	40
UV Unit No. 2	0 to 200	mJ/cm <sup>2</sup>	40

**Note:** Zero results occur when the plant is not producing water and the units are off. The duty UV unit will alarm and automatically switch over to the standby unit if the dose falls to 40 mJ/cm<sup>2</sup>. If both units fail, the system will alarm and automatically shut down. Flow through the UV is not to exceed 46 L/s.

### 2. Chlorine Residual Monitoring when Standpipe is Off-line

Condition 2.2 of Schedule D to MDWL No. 206-101 requires that; when the standpipe is off line, the free chlorine residual shall be continuously monitored at the plant discharge, and a grab sample shall be taken and tested for free chlorine residual weekly from the Cobalt and Coleman watermain at a point near the first or second consumer.

Table 13: Summary of Chlorine Residual Monitoring at the First Consumer

Cobalt WTP	Coleman Distribution	Correlation Difference	Cobalt Distribution	Correlation Difference	Unit of Measure
------------	----------------------	------------------------	---------------------	------------------------	-----------------

The standpipe was on-line for the duration of 2023 and this sampling was not required.

### 3. Harmful Algal Bloom Monitoring

Condition 6.0 (6.1) of Schedule C to MDWL No. 206-101 requires a Harmful Algal Bloom (HAB) monitoring, reporting and sampling plan. The plan must be implemented during the harmful algae bloom season, during but not limited to the warm seasonal period between June 1<sup>st</sup> and October 31<sup>st</sup> of each year, or as otherwise directed by the Medical Officer of Health. A Plan has been developed and is in effect for the Cobalt Drinking Water System during the HAB season. The Plan includes visual inspection of the HAB monitoring area at least once per week. Sampling and testing for microcystins on the raw and treated water is only required if a HAB is suspected or occurring in the HAB monitoring area. Reporting to the local Health

Unit and the Ministry’s Spills Actions Center if a suspected bloom is observed or if microcystins are detected in either the raw or treated water samples.

*Table 14: Summary of Microcystin Results*

<b>Sample Type</b>	<b># of Samples</b>	<b>Range of Microcystin Results</b> <i>(min to max)</i>	<b>Unit of Measure</b>	<b>Exceedance</b>
--------------------	---------------------	--	------------------------	-------------------

No incidents of suspected and/or confirmed harmful blue green algal blooms were observed in the HAB monitoring area during the 2023 season.

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Maximum Allowable Concentration (MAC) for Microcystin-LR = 1.5 ug/L

## Schedule 22 – Summary Reports for Municipalities

### 10. Requirements the System Failed to Meet

The following table lists the requirements of the Safe Drinking Water Act (2002), the drinking water regulations, the system’s approval, drinking water works permit, municipal drinking water works licence, and any other orders applicable to the system that were not met at any time during the reporting period. The duration of the failure and details of the actions that were taken to correct the failure must be described.

According to information kept on record by OCWA, the Cobalt Drinking Water System failed to meet the following requirements that were identified in the last MECP Inspection Report dated July 25, 2023.

*Table 15: Requirements the System Failed to Meet*

Legislation	Requirement(s) not Met	Duration	Corrective Action(s)
O. Regulation 128/04	<p>Logbooks were not properly maintained and/or did not contain the required information.</p> <p>On November 3, 2022, the operator performing the '72-hour' review of continuous monitoring data identified a gap in the Wonderware data from November 2, 2022, from approximately 07:25 to 15:00 hours. That operator sent a text message to a second operator, requesting that they check this missing data on datalogger at the water treatment plant.</p> <p>There are no records to indicate the second operator reviewed the 5.5 hours of missing continuous monitoring data on the datalogger at the water treatment plant.</p>	November 2, 2022 from 07:25 to 15:00 hours	See corrective action below

Legislation	Requirement(s) not Met	Duration	Corrective Action(s)
O. Regulation 128/04	<p>Operators were not examining continuous monitoring test results or they were not examining the results within 72 hours of the test.</p> <p>A four (4) hour data gap was observed on the November 2, 2022 Wonderware trend during the daily data review on November 3<sup>rd</sup>. The operator reviewing the data sent a text message to the operator on-site at the water plant to review the plant SCADA trend. The on-site operator documented that the data on the hardcopy of the daily SCADA report showing min, max and mean values was reviewed but there was no indication that the trend was reviewed in either the log book or on the data review sheet.</p>	November 2, 2022 from 07:25 to 15:00 hours	<p>In response to the 2 non-compliances, the Data Review SOP was reviewed and updated to better describe how observed gaps are to be recorded, to ensure on-site continuous monitoring equipment is reviewed within 72 hours and the review is documented.</p> <p>Training was completed with operators on August 23, 2023.</p>

Also to be noted in this section, four (4) adverse water quality incidents and one (1) spill event were reported to the Ministry’s Spills Action Center during the reporting period. Refer to *Section 5 - Details of Notices Reported & Submitted to the Spills Action Center* on page 5 of this report for details.

## 11. Summary of Quantities and Flow Rates

### 11.1 Flow Monitoring

The Municipal Drinking Water Licence (MDWL) No. 206-101 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 water conveyed from the treatment system to the distribution system,
- the flow rate and daily volume of water conveyed into the treatment system.

The systems’ Permit to Take Water (PTTW) No. 6462-BB9RFA requires that on each day water is taken from the source, the date, the volume of water taken on that date and the rate at which it was taken be recorded.

The Cobalt drinking water system has one flow meter to monitor the raw water entering the treatment plant and one to monitor the treated water entering the distribution system. These flow metering devices are calibrated in accordance to manufacturers' specifications on an annual basis and are operating as required.

## **11.2 Rated Capacity & Flow Rates**

The system's Permit to take Water (PTTW) allows the plant to withdraw a maximum volume of 3974 cubic meters from Sasaginaga Lake each day. A review of the raw water flow data indicates that the system did not exceed this allowable limit having a maximum volume of 2036 m<sup>3</sup>.

The Permit also allows a maximum flow rate of 2760 L/minute which was not exceeded during the reporting period having a maximum flow rate of 2554 L/min.

Condition 1.0 (1.1) to Schedule C of MDWL No. 206-101 states that the maximum daily volume of treated water that flows from the treatment subsystem to the distribution system not exceed a maximum flow of 3974 m<sup>3</sup> on any calendar day. The Cobalt DWS complied with this limit having a recorded maximum volume of 1648 m<sup>3</sup>/day, which is 41.5 % of the rated capacity.

The following tables (Table 16 and Table 17) indicate the quantities and flow rates of water taken and produced during the reporting period, including monthly average flows, maximum daily flows and total monthly volumes. A comparison of the water data is made to the rated capacity and flow rates specified in the system's Permit to Take Water and the Municipal Drinking Water License.

Figure 1 is a comparison of the maximum rated capacity specified in the system's MDWL to the average and maximum treated water flows entering the distribution system.

Table 18 lists historical maximum raw and treated flows from 2018 to 2023.

Table 19 provides a comparison of Cobalt and Coleman flows.

*Table 16: 2023 – Monthly Summary of Water Takings from the Source (Sasaginaga Lake)*

Regulated by Permit to Take Water (PTTW) #6462-BB9RFA, issued May 1, 2019

<b>Sasaginaga Lake</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Annual</b>
Total Volume (m <sup>3</sup> )	45623	41077	45681	47404	50133	42695	30321	28984	31187	30828	30983	33286	458202
Average Volume (m <sup>3</sup> /d)	1472	1467	1474	1580	1617	1423	978	935	1040	994	1033	1074	1257
Maximum Volume (m <sup>3</sup> /d)	1788	1696	1610	1955	1974	2036	1354	1112	1589	1514	1416	1294	2036
PTTW - Maximum Allowable Volume (m <sup>3</sup> /day)	3974	3974	3974	3974	3974	3974	3974	3974	3974	3974	3974	3974	3974
Maximum Flow Rate (L/min)	1981	1963	1953	1981	1956	2370	1974	1880	2554	1894	1634	1601	2554
PTTW - Maximum Allowable Flow Rate (L/min)	2760	2760	2760	2760	2760	2760	2760	2760	2760	2760	2760	2760	2760

*Table 17: 2023 – Monthly Summary of Treated Water Supplied to the Distribution System*

Regulated by Municipal Drinking Water Licence (MDWL) #206-101-6, issued September 14, 2022

<b>Treatment Plant</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Annual</b>
Total Volume (m <sup>3</sup> )	39181	36559	40357	40620	41904	36006	26542	25920	28740	27292	25820	29023	397964
Average Volume (m <sup>3</sup> /d)	1264	1306	1302	1354	1352	1200	856	836	958	880	861	936	1092
Maximum Volume (m <sup>3</sup> /d)	1464	1557	1518	1549	1556	1648	1080	994	1560	1599	1177	1133	1648
MDWL - Rated Capacity (m <sup>3</sup> /day)	3974	3974	3974	3974	3974	3974	3974	3974	3974	3974	3974	3974	3974
% Rated Capacity	37	39	38	39	39	41	27	25	39	40	30	29	41

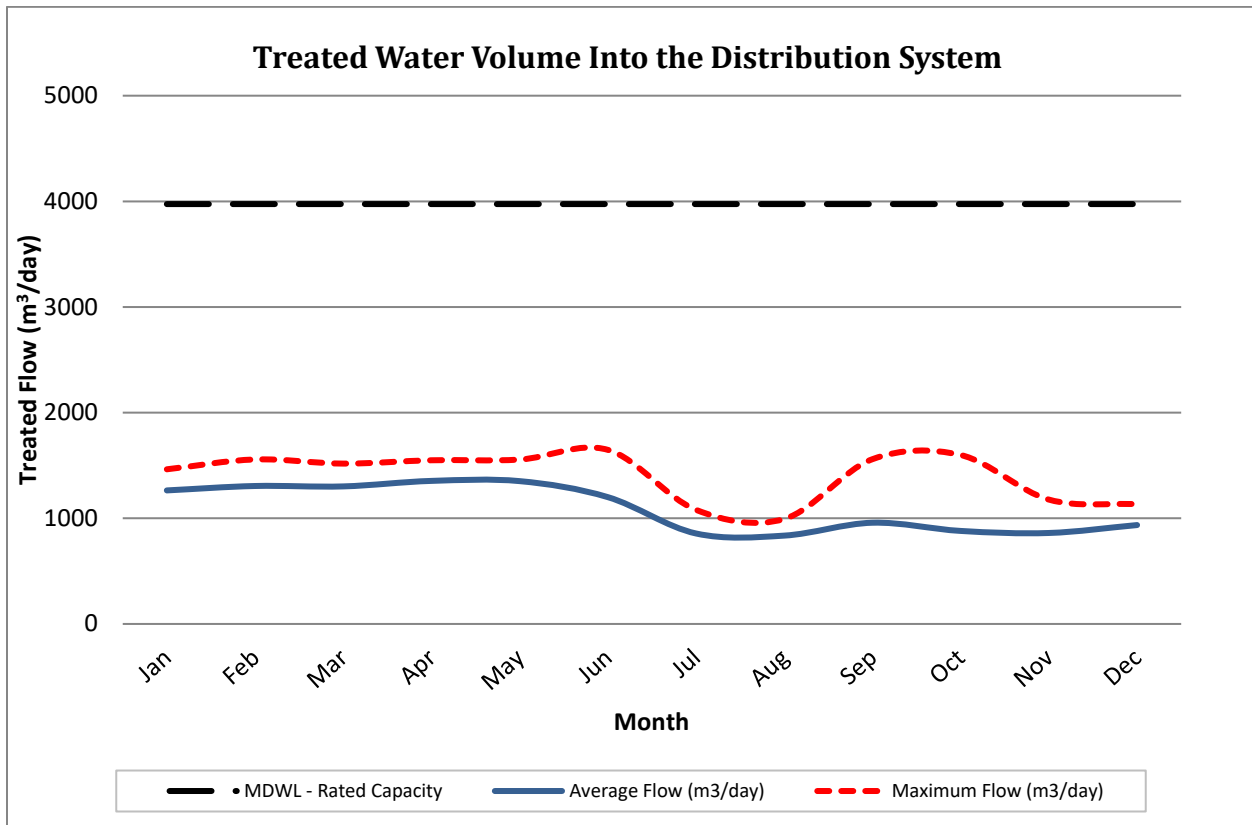


Figure 1: Comparison of Treated Flows to the Maximum Rated Capacity

Table 18: 2023 – Historical Maximum Flows (2018 to 2023)

Year	Maximum Raw Flow (m³/d)	Max. Day % of PTTW Allowable (3974 m³/d)	Maximum Treated Flow (m³/d)	Max. Day % of MDWL Capacity (3974 m³/d)
2023	2036	51%	1648	41%
2022	2296	58%	1970	50%
2021	1938	49%	1708	43%
2020	1681	42%	1422	36%
2019	1514	38%	1252	32%
2018	1817	46%	1193	30%



Table 19: 2023 – Monthly Consumption (Cobalt vs Coleman)

Month	Total (m <sup>3</sup> )	Usage (m <sup>3</sup> )		% Used By	
		Cobalt	Coleman	Cobalt	Coleman
January	39,181	37,086	2,095	94.7	5.3
February	36,559	34,867	1,692	95.4	4.6
March	40,357	38,496	1,861	95.4	4.6
April	40,620	38,733	1,887	95.4	4.6
May	41,904	40,170	1,734	95.9	4.1
June	36,006	34,059	1,947	94.6	5.4
July	26,542	34,673	1,870	94.9	5.1
August	25,920	24,,501	1,419	94.5	5.5
September	28,740	27370	1,370	95.2	4.8
October	27,292	26,538	754	97.2	2.8
November	25,820	24,564	1,256	95.1	4.9
December	29,023	27,273	1,750	94.0	6.0
<b>TOTALS</b>	<b>397,964</b>	<b>378,329</b>	<b>19,635</b>	<b>95.1</b>	<b>4.9</b>

### 11.3 System Performance

The following information is provided to enable the Owner to assess the capability of the system to meet existing and future water usage needs:

Rated Capacity of the Plant (MDWL)	3,974 m <sup>3</sup> /day	
Average Daily Flow for 2023	1092 m <sup>3</sup> /day	27 % of the rated capacity
Maximum Daily Flow for 2023	1648 m <sup>3</sup> /day	41 % of the rated capacity
Total Treated Water Produced in 2023	397,964 m <sup>3</sup>	

## Conclusion

The water quality data collected in 2023 demonstrates that the Cobalt drinking water system provided high quality drinking water to its users.

The system was able to operate in accordance with the terms and conditions of the Permit to Take Water and in accordance with the rated capacity of the licence while meeting the community's demand for water use.

All Adverse Water Quality Incidents were reported to the Ministry's Spills Action Center and the corrective actions were completed as required and resolved as soon as possible.

Any non-compliances that were identified during the reporting period were addressed as soon as possible.

# **APPENDIX A**

## **Monthly Summary of Microbiological Test Results**

**COBALT DRINKING WATER SYSTEM  
2023 Summary of Microbiological Test Results**

Raw Water	01/2023	02/2023	03/2023	04/2023	05/2023	06/2023	07/2023	08/2023	09/2023	10/2023	11/2023	12/2023	Total	Avg	Max	Min
<b>Sasaginaga Lake / Total Coliform: TC - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	4	5	4	4	52			
Max Lab	80	60	115	130	< 150	85	< 190	25/NDOGN	5/NDOGN/T	80/NDOGN/T	360/NDOGT	120			360/NDOGN/T	
Mean Lab	48.6	35.5	61	68.75	< 39	48	< 65.4	22.5	5	80	178.333	95.5	<	64.949		
Min Lab	16	11	30	30	< 5	2	< 2	20	5	80	30	78				< 2
<b>Sasaginaga Lake / E. Coli: EC - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	5	4	4	4	52			
Max Lab	< 5	< 5	< 2	< 5	< 5	< 5	< 5	< 16/NDOGN	5/NDOGN/T	15/NDOGT	< 10/NDOGT	< 2			16/NDOGN/T	
Mean Lab	< 2.6	< 2.5	< 2	< 2.75	< 3.2	< 2.75	< 3.8	< 10.5	5	15	< 4.667	< 2	<	3.692		
Min Lab	< 2	< 0	< 2	< 2	< 2	< 2	< 2	< 5	5	15	< 2	< 2				< 0
<b>Treated Water</b>																
<b>Treated Water POE / Total Coliform: TC - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	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
<b>Treated Water POE / E. Coli: EC - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	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
<b>Treated Water POE / HPC - cfu/mL</b>																
Count Lab	5	4	4	4	5	4	5	4	4	5	4	4	52			
Max Lab	< 60	< 10	< 10	< 30	< 20	< 10	< 70	< 10	< 20	< 20	< 40	< 40			70	
Mean Lab	< 20	< 10	< 10	< 15	< 12	< 10	< 22	< 10	< 12.5	< 16	< 20	< 17.5	<	14.808		
Min Lab	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10				< 10
<b>Distribution Water</b>																
<b>1st Bacti/Residual / Total Coliform: TC - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	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
<b>1st Bacti/Residual / E. Coli - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	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
<b>2nd Bacti/Residual / Total Coliform: TC - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	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
<b>2nd Bacti/Residual / E. Coli - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	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
<b>3rd Bacti/Residual / Total Coliform: TC - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	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
<b>3rd Bacti/Residual / E. Coli - cfu/100mL</b>																
Count Lab	5	4	4	4	5	4	5	4	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
<b>3rd Bacti/Residual / HPC - cfu/mL</b>																
Count Lab	5	4	4	4	5	4	5	4	4	5	4	4	52			
Max Lab	< 10	< 10	< 10	< 10	< 20	< 30	< 30	< 20	< 40	< 60	< 30	< 290			290	
Mean Lab	< 10	< 10	< 10	< 10	< 12	< 15	< 14	< 12.5	< 17.5	< 26	< 17.5	< 82.5	<	19.423		
Min Lab	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10				< 10

**NOTES:**  
February 6 & 13 - raw water samples had results of NDOGN = no data, overgrown with non-target,  
March 6 - raw water sample had result of NDOGN  
August 14 & 28 - raw water samples had results of NDOGN  
September 5 & 11- raw water samples had results of NDOGT = no data, overgrown with target,  
September 25 - raw water sample had result of NDOGN  
October 3 - raw water sample had a result of NDOGN,  
October 16, 23 & 30 - raw water samples had results of NDOGT  
November 6 - raw water sample had a result of NDOGT

# **APPENDIX B**

## **Monthly Summary of Operational Results**

**COBALT DRINKING WATER SYSTEM  
2023 Summary of Operational Test Results**

<b>Filtered Water</b>	01/2023	02/2023	03/2023	04/2023	05/2023	06/2023	07/2023	08/2023	09/2023	10/2023	11/2023	12/2023	Total	Avg	Max	Min
<b>Filter #1 / Turbidity - NTU</b>																
Max OL	0.303	0.291	0.300	0.243	0.299	0.750	0.541	0.460	0.800	0.730	0.990	0.910			0.990	
Mean OL	0.164	0.130	0.114	2.809	0.139	0.163	0.122	0.084	0.074	0.072	0.087	0.078		0.399		
Min OL	0.087	0.079	0.057	0.068	0.057	0.077	0.050	0.010	0.010	0.000	0.005	0.040				0.000
<b>Filter #2 / Turbidity - NTU</b>																
Max OL	0.268	0.270	0.250	0.289	0.274	0.298	0.670	0.700	0.270	0.910	0.950	0.990			0.990	
Mean OL	0.133	0.093	0.091	0.105	0.101	0.112	0.114	0.091	0.073	0.069	0.087	0.086		0.081		
Min OL	0.076	0.065	0.066	0.071	0.020	0.068	0.070	0.000	0.000	0.000	0.000	0.050				0.000
<b>Filter #3 / Turbidity - NTU</b>																
Max OL	0.300	0.300	0.296	0.271	0.300	0.738	0.883	0.610	0.560	0.824	0.990	0.990			0.990	
Mean OL	0.202	0.175	0.097	0.099	0.120	0.142	0.108	0.334	0.066	0.064	0.081	0.073		0.130		
Min OL	0.092	0.092	0.061	0.060	0.055	0.075	0.050	0.050	0.030	0.040	0.048	0.044				0.030
<b>Filter #4 / Turbidity - NTU</b>																
Max OL	0.260	0.184	0.200	0.235	0.298	0.449	0.660	0.610	0.560	0.800	0.980	0.646			0.980	
Mean OL	0.151	0.114	0.102	0.096	0.109	0.131	0.116	0.083	0.068	0.070	0.083	0.075		0.100		
Min OL	0.088	0.080	0.055	0.067	0.039	0.071	0.051	0.060	0.040	0.040	0.055	0.054				0.039
<b>Treated Water</b>	01/2023	02/2023	03/2023	04/2023	05/2023	06/2023	07/2023	08/2023	09/2023	10/2023	11/2023	12/2023	Total	Avg	Max	Min
<b>Treated Water POE / Cl Residual OL (Min 1 mg/L) - mg/L</b>																
Max OL	2.219	2.288	1.855	2.171	2.247	2.357	1.92	2.01	2.08	2.4	2.144	2.418			2.418	
Mean OL	1.838	2.022	1.725	1.806	1.911	1.796	1.593	6.878	2.037	1.789	1.709	1.879		2.249		
Min OL	1.642	1.594	1.491	1.285	1.581	1.176	1.25	1.44	1.09	1.01	1.052	1.53				1.01
<b>Distribution Water</b>	01/2023	02/2023	03/2023	04/2023	05/2023	06/2023	07/2023	08/2023	09/2023	10/2023	11/2023	12/2023	Total	Avg	Max	Min
<b>1st Bacti/Residual / Cl Residual: Free - mg/L</b>																
Count IH	9	8	9	8	9	11	9	9	8	9	9	8	106			
Total IH	12.64	11.63	12.25	10.67	12.2	14.96	10.59	10.83	10.99	12.63	13.24	12.67	145.3			
Max IH	1.7	1.88	1.6	1.76	1.53	1.91	1.57	1.71	1.64	1.67	1.88	2.05			2.05	
Mean IH	1.404	1.454	1.361	1.334	1.356	1.36	1.177	1.203	1.374	1.403	1.471	1.584		1.371		
Min IH	1.12	0.80	1.13	0.98	1.15	0.96	0.82	0.96	0.91	1.09	1.23	0.97				0.80
<b>2nd Bacti/Residual / Cl Residual: Free - mg/L</b>																
Count IH	9	8	9	8	9	11	9	9	8	9	9	8	106			
Total IH	11.89	11.22	12.17	11.58	12.84	14.49	8.02	9.77	10.85	9.57	10.84	11.42	134.66			
Max IH	1.67	1.88	1.59	1.92	1.66	1.69	1.07	1.28	1.74	1.59	1.59	1.87			1.92	
Mean IH	1.321	1.402	1.352	1.448	1.427	1.317	0.891	1.086	1.356	1.063	1.204	1.428		1.27		
Min IH	1.11	1.09	1.08	1.03	1.19	0.90	0.77	0.89	0.98	0.70	1.05	1.08				0.70
<b>3rd Bacti/Residual / Cl Residual: Free - mg/L</b>																
Count IH	9	8	9	8	9	11	9	9	8	9	9	8	106			
Total IH	12.64	12.36	13.61	10.7	14.2	17.22	9.38	10.86	11.91	11.11	12.75	13.15	149.89			
Max IH	1.65	1.82	1.62	1.61	1.8	2.07	1.48	1.62	1.75	1.68	1.8	2.19			2.19	
Mean IH	1.404	1.545	1.512	1.338	1.578	1.565	1.042	1.207	1.489	1.234	1.417	1.644		1.414		
Min IH	1.18	1.17	1.13	0.97	1.27	1.19	0.75	0.70	1.07	0.95	1.08	1.16				0.70
<b>4th Residual / Cl Residual: Free - mg/L</b>																
Count IH	5	4	4	4	5	4	5	4	4	5	4	4	52			
Total IH	6.98	5.7	5.87	6.2	8.04	6.6	6.23	4.72	5.74	7.17	6.47	7.23	76.95			
Max IH	1.66	1.8	1.63	1.84	1.81	2.02	1.41	1.32	1.8	1.78	1.65	1.96			2.02	
Mean IH	1.396	1.425	1.467	1.55	1.608	1.65	1.246	1.18	1.435	1.434	1.618	1.807		1.48		
Min IH	0.92	1.15	1.26	1.35	1.35	1.36	0.98	1	1.08	1.07	1.57	1.69				0.92