2023 Annual Report on Drinking Water Quality

Britannia Water Purification Plant

The following report summarizes drinking water quality results, adverse water quality notifications, and other operating information related to the **Britannia Water Purification Plant** (waterworks #220003154) for the period January 1 to December 31, 2023. It was prepared in accordance with Section 11 of O.Reg.170/03 under the Safe Drinking Water Act (SDWA, 2002).

The Annual Report for each municipal water system operated by the City of Ottawa is posted on the web site: www.ottawa.ca. Copies of each Annual Report and Summary Report prepared in accordance with Schedule 22 of O.Reg.170/03, are available to the public at 951 Clyde Avenue (telephone 3-1-1), the Britannia Water Purification Plant (2731 Cassels Street), and the Lemieux Island Water Purification Plant (1 Onigam Street).

A copy of this report is also provided to the Township of Russell (waterworks #260092014) which receives drinking water from the City of Ottawa water supply.

Description of Drinking Water System

The City of Ottawa operates two treatment plants to supply drinking water – Lemieux Island Water Purification Plant (capacity: 400 ML/d; constructed 1931) and Britannia Water Purification Plant (capacity: 360 ML/d; constructed 1961). The source water for both plants is the Ottawa River. Both plants use identical water treatment processes and have undergone significant expansion and modernization over the years.

Raw water enters the treatment plants through large intake pipes that extend into the main flow of the river. The treatment process makes use of the “multiple barrier” principle. A series of treatment steps successively remove undesirable substances such as colour, suspended particles, algae, bacteria, and viruses from the water. The purification process in Ottawa consists of the following steps:

- coagulation
- flocculation
- sedimentation
- filtration

- primary disinfection
- pH adjustment
- secondary disinfection
- fluoridation

During the final treatment step, fluoride is added for prevention of dental cavities, and chloramine (mixture of chlorine and ammonia) is added to preserve water quality as it travels through the vast water distribution system. Finally, the pH level is adjusted to 9.2 – 9.4 in order to minimize corrosion effects in the water distribution system.

After the treatment process, water is pumped through the distribution network of watermains (over 3000 km of watermain piping) to reach water customers over an area roughly 25 km by 50 km. Treated water from both the Lemieux and Britannia water plants is blended as it travels through a common distribution system. Pressure and storage requirements are met through the operation of 25 pumping stations and reservoirs located throughout the system. The total volume of water stored in reservoirs is 275 million litres, which is roughly equivalent to the daily amount of water consumed in Ottawa. All treatment, pumping, and storage systems are controlled by a dedicated computer control system and monitored by certified Water Treatment Operators 24 hours per day.

The water treatment chemicals used over this reporting period are listed below:

- Aluminum sulphate (liquid – 48.8%)
- Sulphuric acid (liquid – 93%)
- Sodium silicate (liquid – 29%)
- Sodium hypochlorite (liquid – 12%)
- Hydrofluorosilicic acid (liquid – 24%)
- Sodium bisulphite (liquid – 39%)
- Sodium hydroxide (liquid – 50%)
- Aqueous ammonia (liquid – 25%)

Monetary expenses incurred during the reporting period

In order to maintain the safe and efficient operation of the waterworks, maintenance and capital projects are undertaken from time to time. All major repairs or upgrade projects that took place during the reporting period are described below.

Chemical System Upgrades: ($610,000): A project to modify 4 chemical feed systems at the Britannia and Lemieux Island Water Treatment Plants to improve reliability and redundancy, update control systems and instrumentation, upgrade piping and replace pumps. The chemical systems which are to be modified at Britannia are sodium silicate and sulphuric acid. By 2023, the sodium silicate was mostly completed, largely by plant maintenance teams. In 2024, the focus will be on the sulphuric acid systems and commissioning both the sodium silicate and acid systems. Ammonium hydroxide at Britannia water purification plant originally included in this project will be incorporated into another capital project.

High Lift/Low Lift Pump Drive Replacements ($2.5 million): This project was started in late 2020 to replace the drives on high lift pumps 5 and 7 and low lift pumps 5 and 6 at Britannia WPP. The functional design was completed in 2023 and detailed design and construction in 2024.

Britannia Highlift Flowmeter Replacement ($1.2 million): This project was initiated in 2018 and was delayed in 2020 due to COVID-19. Construction started in 2021 and significant progress was made in 2023. The scope was to install and commission 4 new magnetic flowmeters and remove from service 2 plant original venturi style flowmeters (~ 1960). The 4 new flowmeters have been installed and were put into service in 2023.

Britannia & Lemieux WPP G2 Generator Replacements ($10.4 million): This project replaces the 600V generators at Britannia & Lemieux. Design was carried out through 2019 to 2021. Preselection of the new generator supplied was completed in 2021 with construction now planned for 2024. Tendering and construction was delayed due unanticipated issues with project tendering and equipment selection. Construction is now planned to commence in 2024.

Roof Repair/Renewal Project ($1.8 million): Contractor issues in 2021 resulted in roofing contract being cancelled, roofing work commenced in 2023. Additional roofs will continue to be renewed in 2023. Britannia roofs (filters and second floor admin) were completed in 2023.

Phosphoric Acid Addition for Corrosion Control ($13.0 million): Functional design for the addition of phosphoric acid systems, at both Lemieux and Britannia were completed in 2021. Detailed design progressed in 2023 and will continue into 2024 and is to provide for new chemical and feed storage systems, at both Plants, in order to reduce dissolved lead concentrations, in drinking water from homes with lead water services. It is planned to

utilize existing building space at Lemieux while a new building will be necessary at Britannia. New ammonium hydroxide storage and feed systems, previously planned to be part of ongoing Chemical System Upgrades, will now be included, as part of this project, to address identified building safety and storage tank redundancy requirements.

Britannia & Lemieux Surge Protection Devices Upgrade($1,000,000): Project to update surge protection devices at Lemieux and Britannia water purification plants. Project initiated in 2021 and will continue into 2024.

SCADA HMI Upgrade Project ($3,500,000): This project is to upgrade the SCADA HMI across all plants and remote stations. This project was initiated in 2021 with a contract issued in 2023 and completion targeted in 2024.

Carlington Heights Pumping Station Upgrade ($13.5 million): A new pumpstation is being designed and built to replace the existing Carlington Heights Pumping Station. The detailed design phase of the project occurred in 2021 and continued in 2023. Construction to begin later in 2024.

Britannia WPP Asphalt Surface Repairs ($500,000): Asphalt and concrete curbs were replaced, in various locations, around the Britannia WPP site in 2023.

Water Quality test results

The Ontario Drinking Water System Regulation O.Reg.170/03 defines water quality sampling and testing requirements in several categories: microbiological, operational, inorganic, and organic test parameters. The sections below describe the 2023 test results for samples required by O.Reg.170/03. In addition to the required tests, the City of Ottawa analyzes its drinking water for hundreds of other trace substances and test parameters in order to ensure the safety of the water supply. A complete table of water quality test results is posted on the City website www.ottawa.ca for each water system.

Microbiological

Total Coliform and E.coli bacteria tests are performed on the raw, treated and distributed drinking water. These types of bacteria are considered to be “indicator” organisms since they themselves don’t cause disease, but their presence indicates the potential for other pathogenic organisms to be present.

Raw: “Raw” water refers to the untreated water that is drawn into the plant directly from the Ottawa River. Raw water is tested to give an indication of bacteria concentrations entering the treatment process and to see how it changes seasonally. During 2023, the concentration of Total Coliform bacteria in the raw water ranged from 9 – 2420 (cfu/100mL) and the E. coli bacteria concentrations ranged from 0 – 249 (cfu/100mL). These levels were comparable to previous years and are easily handled by the treatment process.

Treated: Treated water is tested 4 times per day as it leaves the plant and enters the distribution system. During 2023, there were no (0) samples out of the 1443 bacteriological samples taken that indicated the presence of Total Coliform or E. coli bacteria.

Distribution: Routine bacteriological samples are taken at approximately 55 locations to verify water quality throughout the water supply network. Bacteriological samples are also taken to monitor water quality during watermain construction and repair activities. During 2023, 4 out of 2995 distribution samples indicated the presence of Total Coliform bacteria. This rate of occurrence (0.1%) is typical for a large water system and does not indicate unsafe water quality. Total Coliform bacteria can colonize on pipe surfaces and sample tap fixtures resulting in a positive test result, even if the “bulk” water is free from bacteria.

The treated and distribution water microbiological results for Total Coliform and E.coli bacteria are summarized in the table below.

Table 1a Summary of the Total Coliform and E. coli test results for Britannia WPP treated and distributed water samples taken during 2023

Parameter	Number of treated water samples taken	Number of positive test results	Number of distribution samples taken	Number of positive test results
Total coliform bacteria (cfu/100mL)	1443	0	2995	4

Parameter	Number of treated water samples taken	Number of positive test results	Number of distribution samples taken	Number of positive test results
E.coli bacteria (cfu/100mL)	1443	0	2995	0

cfu=colony forming units

HPC (heterotrophic plate count) bacteria represent a broad spectrum of environmental aerobic bacteria that indicate biological growth. They are not harmful to humans and are therefore not considered to represent adverse drinking water quality. However, they are useful as operational indicators for the presence of biological (ie. biofilm) growth on the inside surface of a pipe or watermain. An operational limit of 500 cfu/mL has been established as a target for drinking water systems in Ontario. During 2023, 206 samples of treated water and 2723 samples of distributed water were tested for HPC bacteria. Of these, there were 19 sample from the distribution system and 2 samples of treated water that exceeded the operational target of 500 cfu/mL. This level of HPC bacteria occurrence (0.7 %) is considered to be quite low for a large water distribution system and the test results were similar to previous years.

The treated and distribution water microbiological results for HPC bacteria are summarized in the table below.

Table 1b Summary of the heterotrophic plate count (HPC) bacteria test results for Britannia WPP treated and distributed water samples taken during 2023

Parameter	Number of treated water samples taken	Range of test results	Number of distribution samples taken	Range of test results
HPC bacteria (cfu/mL)	206	0 - 3000	2723	0 – 3000

cfu=colony forming units

Operational: Operational tests are conducted by treatment plant operators to evaluate process conditions and to make adjustments to the process. Continuous on-line analyzers measure and record many of the operational tests through a computer control (SCADA) system 24 hours per day. The Britannia WPP has approximately 40 such analyzers in operation. In addition, Process Operators conduct routine laboratory tests during each 12-hour shift to verify water quality at each stage of the treatment process. The routine test results for turbidity, chlorine, and fluoride are summarized in the table below. During 2023, all operational tests of treated water complied with Ontario Drinking Water Standards.

Table 2 Summary of operational testing performed for Britannia treated water during 2023

Parameter	Average value	Range of values (min - max)	Number of samples
Turbidity	0.04 NTU	0.02 – 0.08 NTU	720
Total Chlorine	1.82 mg/L	1.70 – 2.59 mg/L	1443
Fluoride	0.67 mg/L	0.58 – 0.80 mg/L	719

Inorganics: Inorganic substances include heavy metals and dissolved minerals that may be present in treated drinking water and are tested monthly in treated water. The table below summarizes the 2023 test results, expressed as annual average concentrations in mg/L. All inorganic test results during 2023 were safely within the Maximum Acceptable Concentration (MAC) as per Ontario Drinking Water Standards. The MAC concentrations for drinking water are listed in the right column for reference.

Table 3 Summary of the inorganic parameters tested in Britannia WPP treated water during 2023.

Parameter	Unit of Measure	Result	Ontario Drinking Water Standard (MAC)
Antimony	mg/L	0	0.006
Arsenic	mg/L	0.0002	0.010
Barium	mg/L	0.0141	1
Boron	mg/L	0.0046	5
Cadmium	mg/L	0	0.005
Chromium	mg/L	0	0.05
Lead	mg/L	0	0.01
Mercury	mg/L	0	0.001
Selenium	mg/L	0	0.05
Uranium	mg/L	0	0.02
Sodium	mg/L	18.6	20*
Fluoride	mg/L	0.67	1.5
Nitrate	mg/L	0.19	10

Parameter	Unit of Measure	Result	Ontario Drinking Water Standard (MAC)
Nitrite	mg/L	0	1

A value of 0 in the table indicates that the substance was not detected.

*NOTE: Sodium health advisory level of 20 mg/L for people on sodium-restricted diets only.

Organics: Trace organic substances include: volatile organic compounds, pesticides, herbicides, industrial solvents, and disinfection by-products. Trace organic substances are tested quarterly, and the table below shows the 2023 test results, expressed as average concentrations in treated water. None of the trace organic substances were detected with the exception of Trihalomethanes (THM) and Haloacetic Acids (HAA). THMs and HAAs are organic compounds that form during the treatment process when chlorine reacts with natural organic matter dissolved in the water. All trace organic test results during 2023 were safely within the Maximum Acceptable Concentration (MAC) as per Ontario Drinking Water Standards. The MAC concentrations for drinking water are listed in the right column for reference.

Table 4 Summary of 2023 trace organic test results for Britannia WPP treated water

Parameter	Units	Result	Ontario Drinking Water Standard (MAC)
Alachlor	mg/L	0	0.005
Atrazine + N-dealkylated metabolites	mg/L	0	0.005
Azinphos-methyl	mg/L	0	0.02

Parameter	Units	Result	Ontario Drinking Water Standard (MAC)
Benzene	mg/L	0	0.001
Benzo(a)pyrene	mg/L	0	0.00001
Bromoxynil	mg/L	0	0.005
Carbaryl	mg/L	0	0.09
Carbofuran	mg/L	0	0.09
Carbon Tetrachloride	mg/L	0	0.002
Chlorpyrifos	mg/L	0	0.09
Diazinon	mg/L	0	0.02
Dicamba	mg/L	0	0.12
1,2-Dichlorobenzene	mg/L	0	0.2
1,4-Dichlorobenzene	mg/L	0	0.005
1,2-Dichloroethane	mg/L	0	0.005
1,1-Dichloroethylene	mg/L	0	0.014

Parameter	Units	Result	Ontario Drinking Water Standard (MAC)
Dichloromethane	mg/L	0	0.05
2,4-Dichlorophenol	mg/L	0	0.9
2,4-Dichlorophenoxy acetic acid (2,4D)	mg/L	0	0.1
Diclofop-methyl	mg/L	0	0.009
Dimethoate	mg/L	0	0.02
Diquat	mg/L	0	0.07
Diuron	mg/L	0	0.15
Glyphosate	mg/L	0	0.28
Haloacetic Acids*	mg/L	0.032	0.080
Malathion	mg/L	0	0.19
2-Methyl-4-chlorophenoxyacetic Acid (MCPA)	mg/L	0	0.10
Metolachlor	mg/L	0	0.05
Metribuzin	mg/L	0	0.08

Parameter	Units	Result	Ontario Drinking Water Standard (MAC)
Monochlorobenzene	mg/L	0	0.08
Paraquat	mg/L	0	0.007
Pentachlorophenol	mg/L	0	0.06
Phorate	mg/L	0	0.002
Picloram	mg/L	0	0.19
Polychlorinated Biphenyls (PCB)	mg/L	0	0.003
Prometryne	mg/L	0	0.001
Simazine	mg/L	0	0.01
Terbufos	mg/L	0	0.001
Tetrachloroethylene	mg/L	0	0.01
2,3,4,6-Tetrachlorophenol	mg/L	0	0.1
Triallate	mg/L	0	0.23
Trichloroethylene	mg/L	0	0.005

Parameter	Units	Result	Ontario Drinking Water Standard (MAC)
2,4,6-Trichlorophenol	mg/L	0	0.005
Trifluralin	mg/L	0	0.045
Trihalomethanes*	mg/L	0.036	0.1
Vinyl Chloride	mg/L	0	0.001

0 denotes the chemical was below the analytical detection limit

NOTE*: The reported Trihalomethane (THM) and Haloacetic acid (HAA) results represent the average concentration measured in the distribution system.

Adverse Water Quality Incidents (AWQI) Requiring Notification

The drinking water regulations identify several “Indicators of Adverse Water Quality” for which the waterworks must immediately notify health officials and the Ministry of Environment, Conservation and Parks (MECP). These refer to any sample of treated or distributed drinking water that does not meet a provincial water quality standard or a situation where disinfection of the water may be compromised. For each Adverse Water Quality Incident (AWQI), City of Ottawa staff immediately notify the Ottawa Public Health Department and the Ministry of Environment, Conservation and Parks (MECP) as required by regulations. Corrective actions, re-sampling, and reporting are required in each case.

During 2023, there were no AWQI events for Britannia treated water and 17 AWQI events reported for the water distribution system. The events are summarized in the table below including the adverse result, corrective actions taken, and date of resolution.

Table 5 Adverse Water Quality Incidents for the distribution system

Incident Date	Test Parameter and Location	Result	Unit of Measure	Corrective Action	Date of Resolution
20-Mar-23 AWQI# 161537	**Chloramine <0.25 mg/L** Closed watermain valve on Bronson Ave resulted in low chloramine concentration	0.07	mg/L	Flushed until chloramine concentration restored	20-Mar-23
19-Apr-23 AWQI# 161780	**Total Coliform bacteria >0** Sample taken from routine distribution sample at Orleans Fire Hall	Positive	cfu/100 mL	Flushed and resample	20-Apr-23
25-May-23 AWQI# 162007	**Chloramine <0.25 mg/L** Sample taken at a dead end on Walden Dr resulted in low chloramine concentration	0.16	mg/L	Flushed until chloramine concentration restored	25-May-23
16-Jun-23 AWQI# 162222	**Improperly disinfected water directed to users** Contractor opened a valve on temporary service on Bronson Ave	N/A	N/A	Flushed and took bacteria sample	19-Jun-23
12-Jul-23 AWQI# 162521	**Chloramine <0.25 mg/L** Sample taken at a dead end on Boyd Ave resulted in low chloramine concentration	0.17	mg/L	Flushed until chloramine concentration restored and took bacteria sample	14-Jul-23

Incident Date	Test Parameter and Location	Result	Unit of Measure	Corrective Action	Date of Resolution
20-Jul-23 AWQI# 162685	**Total Coliform bacteria >0** Sample taken from routine distribution sample at Blackburn Arena	Positive	cfu/100 mL	Flushed and resample	21-Jul-23
22-Aug-23 AWQI# 163156	**Total Coliform bacteria >0** Sample taken following watermain break on Preston Ave	Positive	cfu/100 mL	Flush and resample	25-Aug-23
24-Aug-23 AWQI# 163160	**Chloramine <0.25 mg/L** Sample taken at a dead end on March Rd resulted in low chloramine concentration	0.00	mg/L	Flushed until chloramine concentration restored and took bacteria sample	26-Aug-23
25-Aug-23 AWQI# 163176	**Total Coliform bacteria >0** Sample taken from a temporary service line on Bronson Ave	Positive	cfu/100 mL	Flush and resample	26-Aug-23
5-Sep-23 AWQI# 163301	**Chloramine <0.25 mg/L** Auto flusher valve not working at a dead end resulted in low chloramine concentration at Bowesville Rd	0.08	mg/L	Repaired valve, flushed until chloramine concentration restored and took bacteria sample	7-Sep-23

Incident Date	Test Parameter and Location	Result	Unit of Measure	Corrective Action	Date of Resolution
6-Sep-23 AWQI# 163313	**Chloramine <0.25 mg/L** Sample taken in an area with low flow on Young St resulted in low chloramine concentration	0.17	mg/L	Flushed until chloramine concentration restored and took bacteria sample	7-Sep-23
12-Oct-23 AWQI# 163773	**Chloramine <0.25 mg/L** Anti Anti-Stagnation valve was not working which caused a dead end resulting in a low chloramine concentration at the Manotick boundary valve	0.03	mg/L	Repaired Valve, flushed until chloramine concentration restored and took bacteria sample	16-Oct-23
12-Oct-23 AWQI# 163775	**Chloramine <0.25 mg/L** New development at Cope Dr with low occupancy resulted in low chloramine concentrations within watermains	0.06	mg/L	Flushed until chloramine concentration restored and took bacteria sample	16-Oct-23
16-Oct-23 AWQI# 163814	**Chloramine <0.25 mg/L** New Development at Elsie MacGill Walk with low occupancy resulted in low chloramine concentrations within watermains	0.11	mg/L	Flushed until chloramine concentration restored and took bacteria sample	18-Oct-23

Incident Date	Test Parameter and Location	Result	Unit of Measure	Corrective Action	Date of Resolution
24-Oct-23 AWQI# 163868	**Chloramine <0.25 mg/L** Closed watermain valve on Northside Rd resulted in low chloramine concentration	0.08	mg/L	Flushed until chloramine concentration restored and took bacteria sample	30-Oct-23
24-Oct-23 AWQI# 163872	**Chloramine <0.25 mg/L** New Development at Peony Lane with low occupancy resulted in low chloramine concentrations within watermains	0.04	mg/L	Flushed until chloramine concentration restored and took bacteria sample	30-Oct-23
28-Nov-23 AWQI# 164131	**Chloramine <0.25 mg/L** Closed watermain valve on Kanata Ave resulted in low chloramine concentration	0.15	mg/L	Flushed until chloramine concentration restored	28-Nov-23

cfu=colony forming units

Community Lead Testing Program

The treated water produced by the Britannia Water Purification Plant is lead-free. However, trace amounts of lead can potentially be dissolved into water when it travels through lead service pipes or household plumbing components such as lead solder and brass fittings. The current Ontario standard for lead in drinking water is 10 ppb (parts per billion), expressed as a Maximum Acceptable Concentration (MAC) measured at the customer's tap. During 2019, Health Canada lowered the acceptable concentration to 5 ppb for lead in drinking water, due to increasing concerns for adverse health effects in children. To date, the Ontario standard for lead has not yet been revised to align with the new Health Canada guideline.

In 2007, a new provincial regulation (amendment to O.Reg.170/03) was initiated in response to concerns about potential lead levels in Ontario water supplies. The Community Lead Testing Program requires each water system to test tap water specifically in homes with lead service pipes to represent worst case lead concentrations. The testing is conducted during winter and summer periods to represent any seasonal changes in water quality. Approximately 50 Ottawa homes are tested during each winter and summer sampling period. In order to meet compliance standards, 90% of the tap water samples must have a lead concentration below 10 ppb (parts per billion) following a 30-minute period of stagnation in the plumbing system. Ottawa's test results have consistently passed the Provincial lead testing criteria of 10 ppb for drinking water.

Combining results for all twenty-seven rounds of testing between 2007 – 2020, 2023 (COVID relief in 2020-2022) the average lead concentrations measured in Ottawa homes with lead supply pipes were 2.5 (ppb) in Litre-1 and 2.6 (ppb) in Litre-2. The 90th percentile concentrations are 4.3 (ppb) in Litre-1 and 5.2 (ppb) in Litre-2. These results comply with the current 10 ppb Ontario standard for lead in drinking water. In general, excellent results have been observed in Ottawa due to the optimized corrosion control strategy of pH adjustment being applied at both water purification plants.

Table 6 Summary of the lead testing results for winter and summer sampling sessions during 2023

Location Type	**Average lead concentration (ppb) in tap water**	**Range of lead concentrations measured (ppb)**	**Number of samples with lead concentration above 10 ppb**	**Total number of samples taken**
Customer taps (plumbing)	2.6	<0.1 – 14.4	2	224
Watermains (distribution)	0.45	<0.1 – 1.6	0	20

Summary

The results demonstrate that the quality of drinking water treated and distributed from the Britannia Water Purification Plant remained high during 2023 and met all Ontario Drinking Water Standards.

If you have any questions or concerns regarding the quality of your drinking water please contact the City of Ottawa at 3-1-1 or email at info-water@ottawa.ca.

For more information on the City of Ottawa drinking water please visit us at www.ottawa.ca.