2022 Drinking Water Quality Report

Loyalist Township Utilities Division

Contents

Availability of the Annual Summary Report

In light of Section 11 (7) and 11 (10) of Ontario Regulation 170/03, the notice of availability is generally done online through the Township's website and on the customers' bimonthly water bill.

The annual report is available to the public by visiting the Township's website: www.loyalist.ca/waterquality

Copies of the report can also be obtained, at no charge, from Loyalist Township office located at 263 Main Street, Odessa, ON, (613) 386-7351.

Any member of the public can also request to inspect, under Section 12 of Ontario Regulation 170/03, any sample results and reports prepared under Section 11 and Schedule 22 of Ontario Regulation 170/03, free of charge, during Loyalist Township regular office hours.

Loyalist Township strives to provide information in a format accessible to all people. Please contact the Accessibility Coordinator at 613-386-7351 ext. 110 between 8:30 am – 4:30 pm or complete a request form, available at the Municipal Office, Odessa or online at www.loyalist.ca to request an alternative format.

1. Introduction

This annual summary report is prepared and submitted to our water customers who have their drinking water supplied by the Fairfield Drinking Water System or the Bath Drinking Water System; and to the Council of Loyalist Township, in accordance with Section 11 and Schedule 22 of Ontario Regulation 170/03, as amended.

The report covers the period of January 1 to December 31, 2022.

The quality of Loyalist Township's drinking water is continuously monitored and tested by advanced online instrumentation, supervisory control and data acquisition (SCADA) system, and is supervised, managed, operated and maintained by certified Township staff who have successfully completed rigorous training and testing to become certified Drinking Water treatment and Distribution System Operators.

2. Executive Summary

The water delivered to the customers of the Bath and Fairfield drinking water systems (DWS) continues to meet all water quality standards.

In 2022, 1,101,661 m^3 of potable water were delivered to the Fairfield water distribution system and 631,698 m^3 to the Bath water distribution system. The maximum daily treated water volume was recorded at 49.7% of the Fairfield Water Treatment Plant's rated capacity and 35.7% for the Bath Water Treatment Plant.

All sampling required by the applicable acts, regulations, permits and licenses has been conducted in accordance with the legislation.

All reports required by applicable acts, regulations, permits and licenses have been prepared and submitted in accordance with the legislation.

The Ministry of Environment, Conversation and Parks (MECP) inspected both plants in 2022. The inspection rating for both drinking water systems was 100%. Although the entries in the logbook meet legislative requirements the MECP recommended reviewing best management practises regarding the integrity and security of logs and other record-keeping mechanisms with operators and exploring options for written and electronic record-keeping mechanism for the Bath Water Treatment Plant.

The filter effluent turbidity for both drinking water systems did not exceed the limits of the Ontario Drinking Water Quality Standard (ODWQS). All regulated physical, microbiological, inorganic, and organic chemical parameters tested in 2022 were well below the limits and/or maximum allowable concentration (MAC).

Two observations in accordance with Ontario Regulation 170/03, Schedule 16.4 (Duty to report other observations) were reported to the Ministry and the Health Unit in 2022:

A fire hydrant without installed backflow prevention device was used by a contractor in the Fairfield Drinking Water System in May 2022. Action was taken immediately, and properly disinfected water was directed to customers at all times.

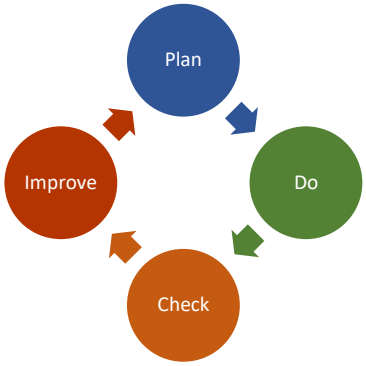
The other incident was related to the malfunction of the chlorination system at the Bath water treatment plant in January 2022. Continuous measurements and calculations could demonstrate that safe and properly disinfected water was directed to costumers at all times.

Please refer to section 11 for details.

To the best of our knowledge, both drinking water systems are in compliance with all regulatory requirements of the Drinking Water Works Permit, Municipal Drinking Water License, Permit to Take Water, Safe Drinking Water Act and its regulations.

3. Quality Management System Policy

Municipal drinking water systems in Ontario must operate under a licensing program. One of the requirements of the Municipal Drinking Water License is to have a quality management system (QMS) in place that meets the minimum requirements of the Ontario Drinking Water Quality Management Standard.



Management systems are preventive and proactive in nature and focus on consistency and continuous improvement. A QMS follows a cycle that includes **planning** what you are going to do, **do** what you planned, **check** what you did, and **improve** where possible.

Loyalist Township QMS Policy: Loyalist Township is committed to comply with all applicable legislative and regulatory requirements, as it relates to drinking water quality, to supply our consumers with safe drinking water and is committed to the maintenance and continual improvement of the QMS.

4. Description of the Fairfield DWS

Drinking water system number	220009229
Drinking water system name	Fairfield Drinking Water System
Owner & operator	Corporation of Loyalist Township
Operating authority accreditation	CERT-0146100
Drinking water system category	Large municipal residential
Drinking water works permit	158-201
Municipal drinking water license	158-101
Design capacity	8,000 m^3 per day
Type of filtration	Ultrafiltration
Commission year	2000
Original design period	2000-2046
Permit to Take Water	6024-9LUKNX
Rate of taking	9,000 m^3 per day
Raw water source	Lake Ontario
Population served	10,980

The Fairfield Water Treatment Plant currently serves the communities of Amherstview and Odessa; the Harewood and Brooklands subdivisions; Loyalist East Business Park; and Taylor-Kidd Industrial Park.

The treatment facility consists of a membrane ultrafiltration system followed by chlorination for disinfection. A target (average) free chlorine residual of 1.1 to 1.2 mg/l at the effluent of the chlorine contact chamber is desired to maintain a free chlorine residual of 0.9 mg/l at the effluent of the treatment plant. Granular activated carbon adsorbers are used at certain times of the year to assist in the control of taste and odor as well as a raw water intake chlorination system for Zebra Mussel control.

With the introduction of ultrafiltration technology, the Fairfield Water Treatment Plant is surpassing the Ministry of the Environment and Climate Change's minimum treatment guidelines for waterworks using a surface water source.

The distribution system uses elevated water storage located in Amherstview (1,100 m^3 capacity) and Odessa (900 m^3 capacity). The booster pumping station is on County Road # 6, north of Taylor Kidd Blvd, with a water reservoir (4,225 m^3 capacity) and chlorination booster capability to ensure the maintenance of acceptable chlorine residual in the system. The Odessa water tower, located at the east end of Main Street, Odessa, is also equipped with chlorination booster capability. Chlorine residual in the

water leaving each of the reservoirs is monitored continuously with free chlorine residual analyzers.

Chemicals used within the Fairfield Drinking Water System (DWS) for treatment/disinfection are chlorine gas (disinfection), sodium hypochlorite (disinfection) and sodium bisulphite (treatment of plant residue back to the raw water source). The chlorine gas and sodium hypochlorite used within the Fairfield DWS meet all applicable standards set in the Municipal Drinking Water License, in line with the American Water Works Association (AWWA) and the American National Standards Institute (ANSI) safety criteria standards NSF/60. The plant is operated with automated pre-chlorination for Zebra Mussel control and disinfection.

Emergency power supply equipment is installed at the treatment plant and booster station to ensure safe drinking water is supplied to our customers even during power outages.

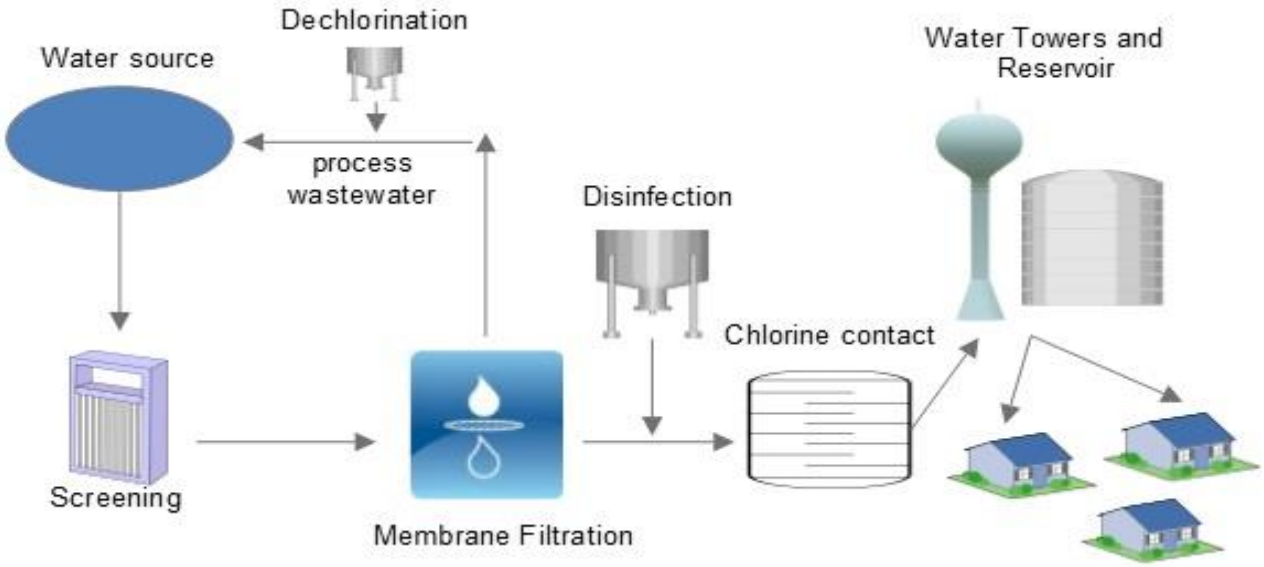


Figure 1 Fairfield Drinking Water System

5. Description of the Bath DWS

Drinking water system number	220002217
Drinking water system name	Bath Drinking Water System
Owner & operator	Corporation of Loyalist Township
Operating authority accreditation	CERT-0146100
Drinking water system category	Large municipal residential
Drinking water works permit	158-202
Municipal drinking water license	158-102
Design capacity	6,000 m^3 per day
Type of filtration	Ultrafiltration
Commission year	1997
Original design period	1997-2040
Permit to Take Water	4521-9LTHDP
Rate of taking	7,515 m^3 per day
Raw water source	Lake Ontario
Population served	3,334

The Bath Drinking Water System currently serves the community of Bath; and the Bath and Millhaven Correctional Services Canada (CSC) Institutions.

The Bath Water Treatment Plant consists of a membrane gravity filtration system (MGF) to be able to handle sudden and sustained increases in raw water turbidity, followed by chlorination as disinfection. A target (average) free chlorine residual of 1.1 to 1.2 mg/l at the effluent of the chlorine contact chamber is desired to maintain a free chlorine residual of 1.0 mg/l at the effluent of the treatment plant.

The plant is operated with automated pre-chlorination for zebra mussel control and disinfection. Emergency power supply equipment is installed at the treatment plant to ensure safe drinking water is supplied to our customers even during power outages. Turbidity of the filtered water and free chlorine residual in the water leaving the treatment facility are monitored continuously.

The distribution system has an elevated storage reservoir of 1,891 m^3 capacity located adjacent to the west side of the Millhaven Correctional property, in the east end of the village. Chlorine residual in the water leaving the reservoir is monitored continuously with a free chlorine residual analyzer.

The facility far exceeds the Ministry of the Environment's minimum treatment guidelines for waterworks using a surface water source.

Chemicals used for water treatment/disinfection within the Bath Drinking Water System (DWS) are chlorine gas (disinfection), PAX XL54 (coagulation), sodium hypochlorite (to clean the membranes) and calcium thiosulfate (to treat the plant residue back to the raw water source). They meet all applicable standards set in the Municipal Drinking Water License in line with the American Water Works Association (AWWA) and the American National Standards Institute (ANSI) safety criteria standards NSF/60.

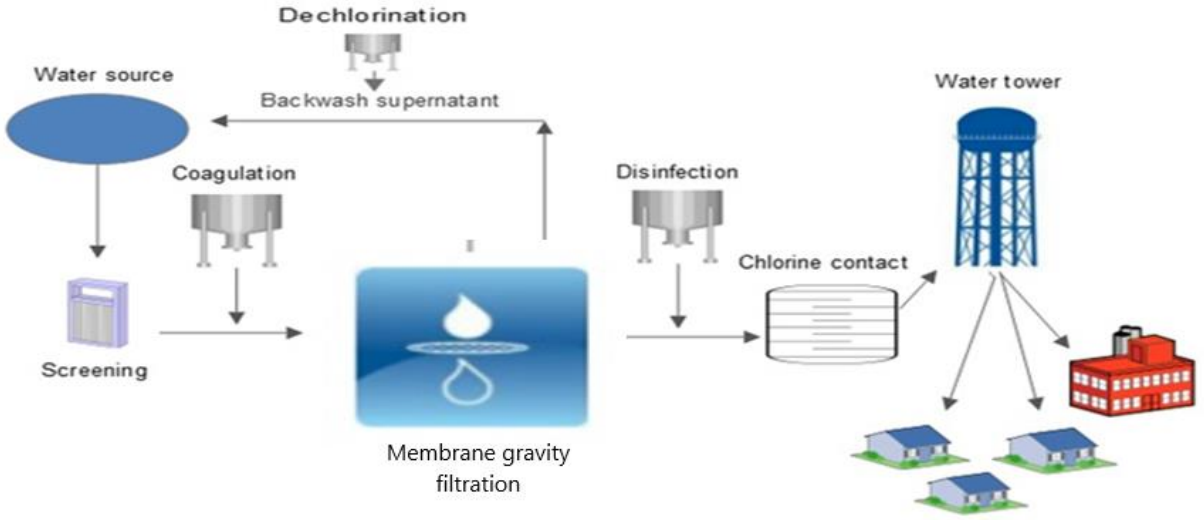


Figure 2 Bath Drinking Water System

1 cubic meter (m^3)
= 1,000 litres

6. Flow Summary

The Ministry of the Environment, Conservation and Parks (MECP) issues permits to take water (PTTW), allowing municipal drinking water systems to draw from a water source for water treatment and distribution purposes.

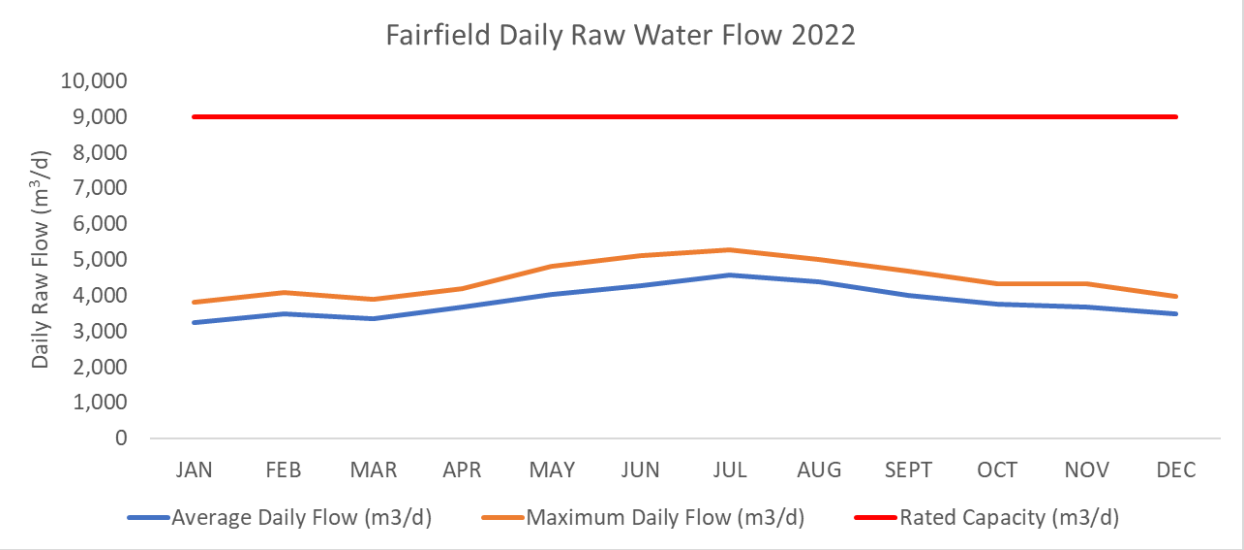
6.1. Fairfield DWS

The MECP issued Loyalist Township its most recent PTTW on July 15, 2014. The permit is valid for 10 years and allows the Township to draw a maximum of 9,000 m^3 per day from Lake Ontario for the Fairfield Water Treatment Plant. The total raw water taken

Total raw water taken in 2022:
1,397,343 m^3

Maximum daily raw water volume taken:
5,279 m^3 (59% of limit)

was 1,397,343 m^3 in 2022. The maximum daily raw water volume was measured to be 5,279 m^3/d and 59% of the limit.



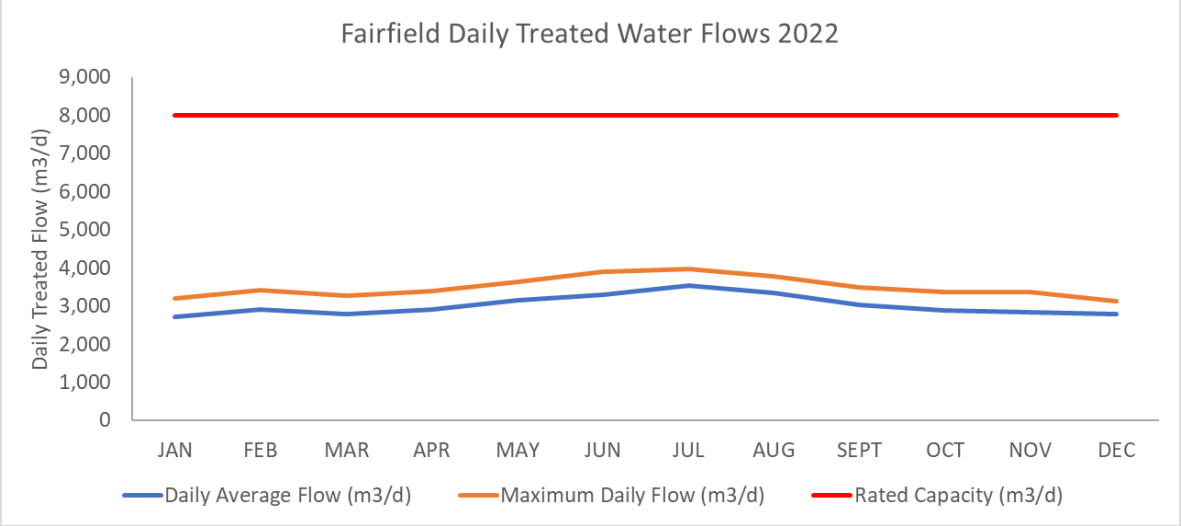
Based on the current Municipal Drinking Water License, the water treatment plant's rated capacity (8,000 m^3 per day) is assessed as being the volume of water that flows from the treatment system to the distribution system or water demand.

The total treated water sent to the distribution system in 2022 was 1,101,661 m^3. Drought, development activities, and annual maintenance in the distribution system (flushing, tower turnovers) are attributing to a higher demand in the summer of the year.

Total treated water sent to the distribution system in 2022: 1,101,661 m^3

Maximum daily treated water volume: 3,017 m^3 (49.7% of rated capacity)

The water demand reached its maximum in July and was calculated to 49.7% of the plant's rated capacity. This is a reduction of the maximum demand by 10.3% compared to the year 2021. Repairs and replacements of distribution system watermains significantly reduced the water demand in the system.



The uncommitted reserve capacity calculation performed in 2022, combined with the population growth projections for Amherstview and Odessa, places the expansion of the Fairfield Water Treatment Plant in the year 2046. The potable water demand is anticipated to reach 80% of the plant's rated capacity around 2033. When this threshold is hit, activities to expand the plant should be undertaken. Investing in water conservation initiatives or leak reduction programs would increase the available capacity of the Fairfield waterplant and would defer the need for a large-scale plant expansion by a few years.

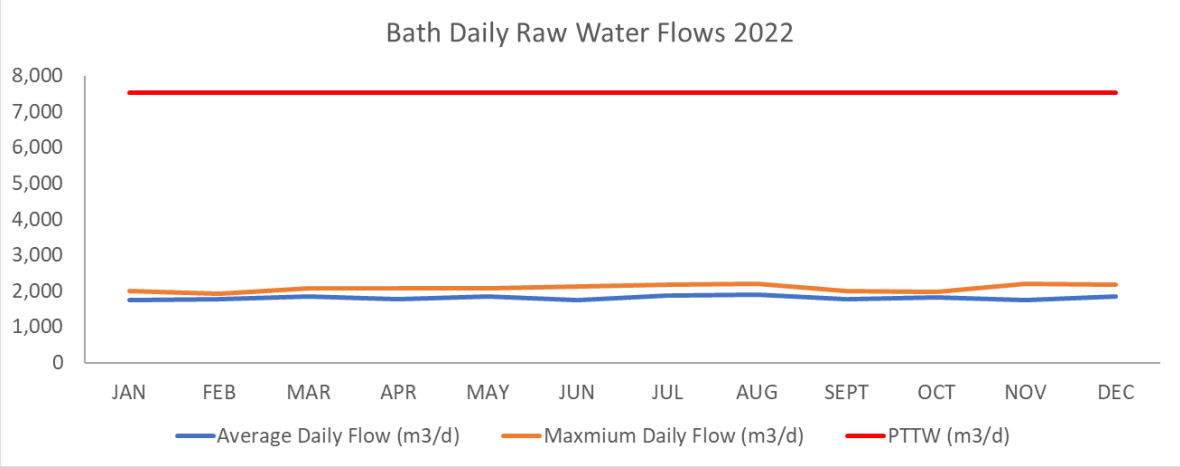
This expansion date is subject to change forward or backwards based on size of development being approved, changes in limits of the service area, actual growth rate and water demand.

6.2. Bath DWS

The most recent PTTW for this system was issued on July 18, 2014. The permit is valid for 10 years and allows the Township to draw a maximum of 7,515 m^3 of water per day from Lake Ontario for the Bath Water Treatment Plant.

Total raw water taken in 2022:
658,368 m^3
Maximum daily raw water volume taken:
2,207 m^3 (29.4% of limit)

The total raw water taken was 658,368 m^3 in 2022. The maximum daily raw water volume was measured to be 2,207 m^3/d and 29.4% of the limit.

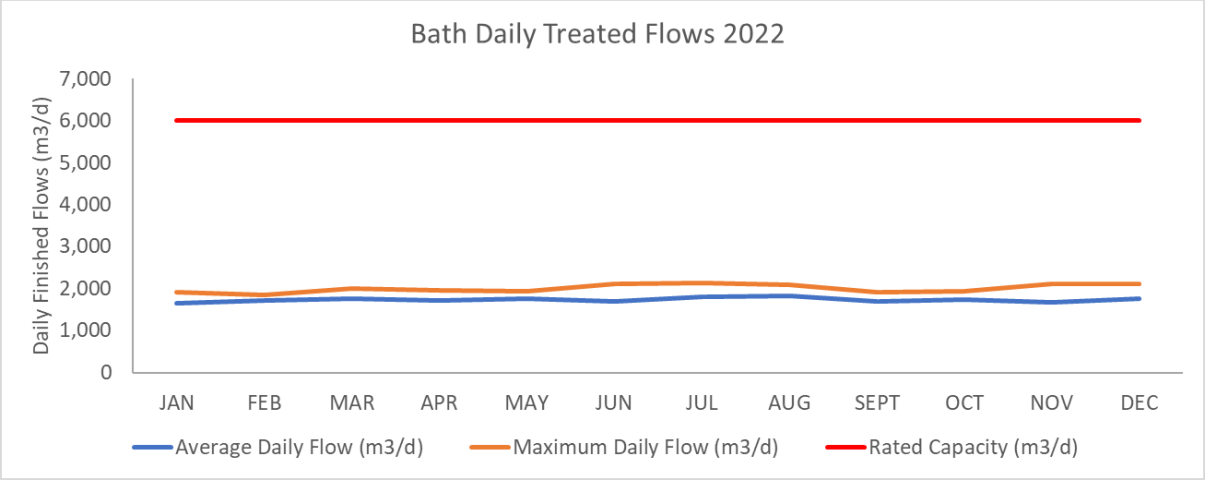


Based on the current Municipal Drinking Water License, the water treatment plant's rated capacity (6,000 m^3 per day) is assessed as being the volume of water that flows from the treatment system to the distribution system or water demand. The total treated water sent to the distribution system in 2022 was measured to be 631,698 m^3. The maximum daily treated water volume was measured to be 2,141 m^3 in 2022.

Total treated water sent to the distribution system in 2022:
631,698 m^3

Maximum daily treated water volume:
2,141 m^3 (35.7% of rated capacity)

The water demand reached 35.7% of the plant's rated capacity (6,000 m^3 per day) in 2022.



It should be noted that all of the existing capacity of the Bath Water System has been allocated through front-end funding agreements to developers and Correctional Services Canada (CSC), leaving no room for further allocation.

Based on population growth projections for the Village of Bath, an expansion of the Bath Water Treatment Plant is not expected to be necessary prior to 2050. It should be noted that this projection could be accelerated or delayed based on several factors, such as the rate of construction of new developments or changes to trends in water demand.

6.3. Water Losses

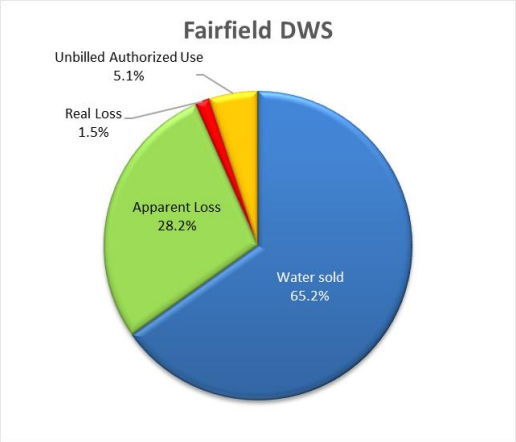
Water Loss or "unaccounted-for water" is the difference between the quantity of water supplied to the distribution system and the metered quantity of water used by the customers. The MECP Design Guideline for Drinking Water Systems refers to "unaccounted-for water" when considering rated capacity. Their policy requires system owners to consider unaccounted-for water to the level of 15% of the average daily demand.

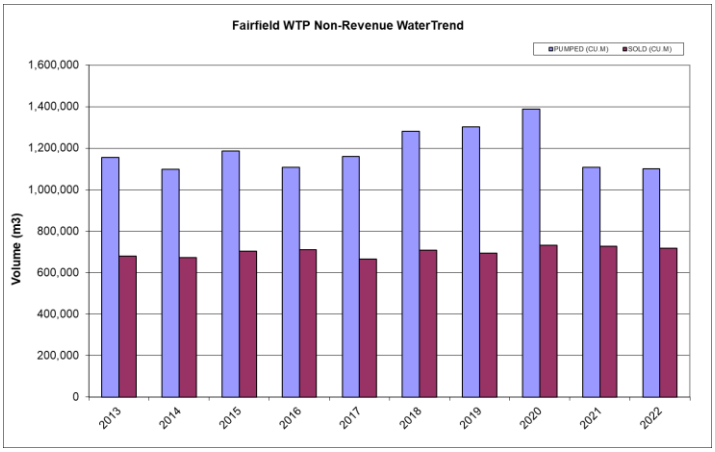
In 2022, 34.8% of water sent to the Fairfield water distribution system and 22.9% for the Bath water distribution system is water for which no revenue was generated. Not all is considered unaccounted-for:

Non-revenue water (NRW) is generally categorized as **unbilled authorized consumption** (water use inside the treatment facilities, distribution system flushing, water used for construction activities, fire training/fire fighting purposes and water used for recreation purposes), **real water losses** (watermain breaks and leaks) and

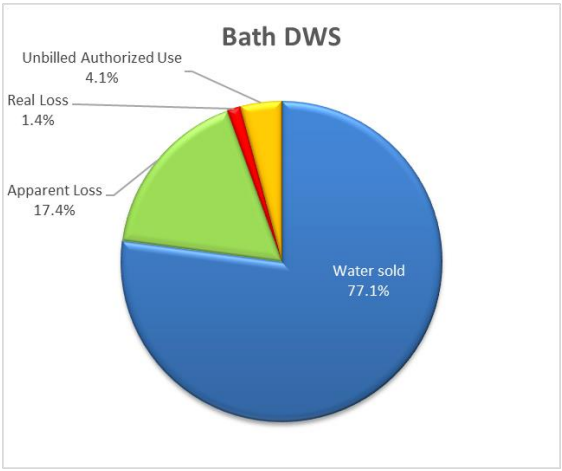
apparent water losses (unauthorized consumption/theft, unknown water usage, and metering/data inaccuracies).

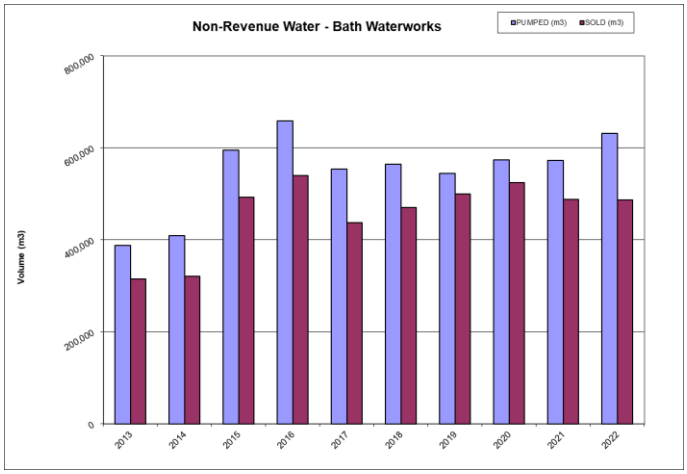
In 2022, 28.2% of water produced in Fairfield is apparent water loss, 5.1% are considered to be unbilled authorized use, and 1.5% is real water loss. Aging infrastructure was replaced in 2021, major leaks were repaired by Utilities staff in 2021 and 2022.





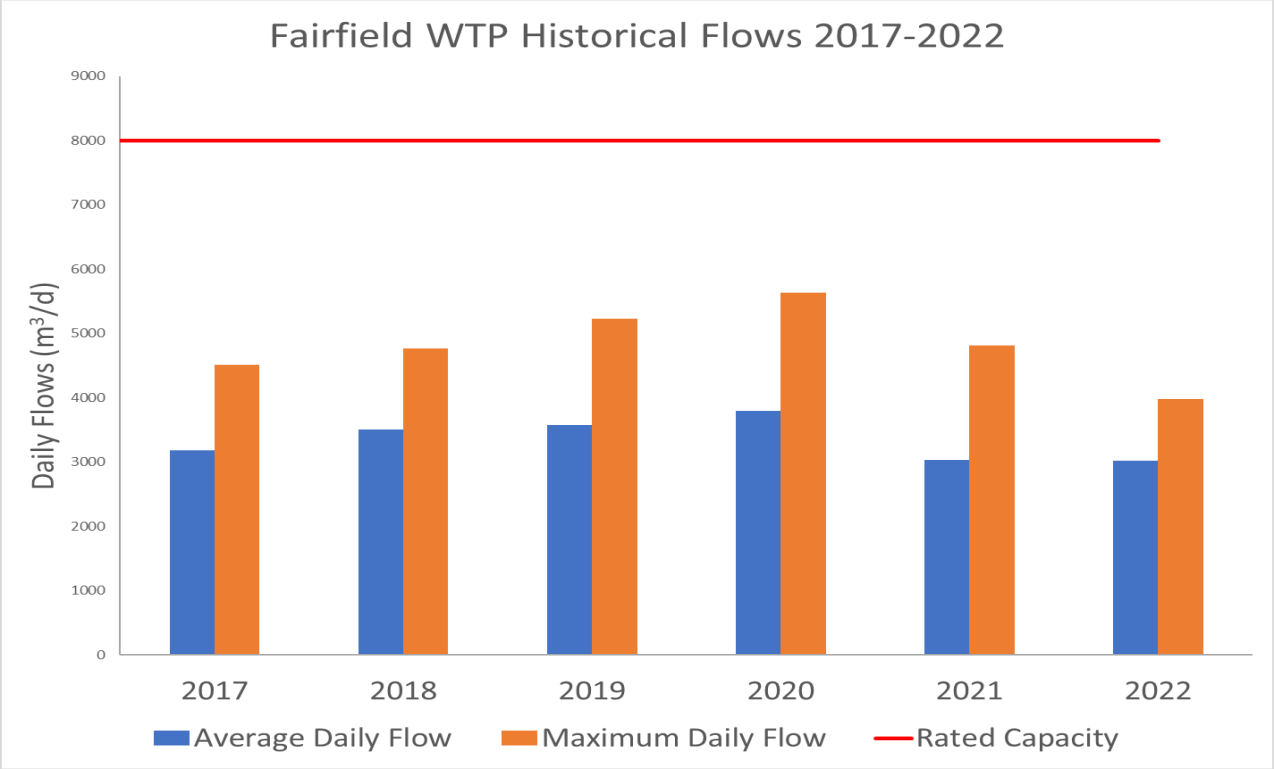
17.4% of water produced in Bath is considered apparent water loss, in 2022. Unbilled authorized use was calculated to be 4.1% and the real water loss due to breaks and leaks to 1.4%. The apparent water loss in the Bath distribution system in the last five years averaged 12.1% of the average daily water demand. Trending indicates the apparent water loss is on the rise in Bath.





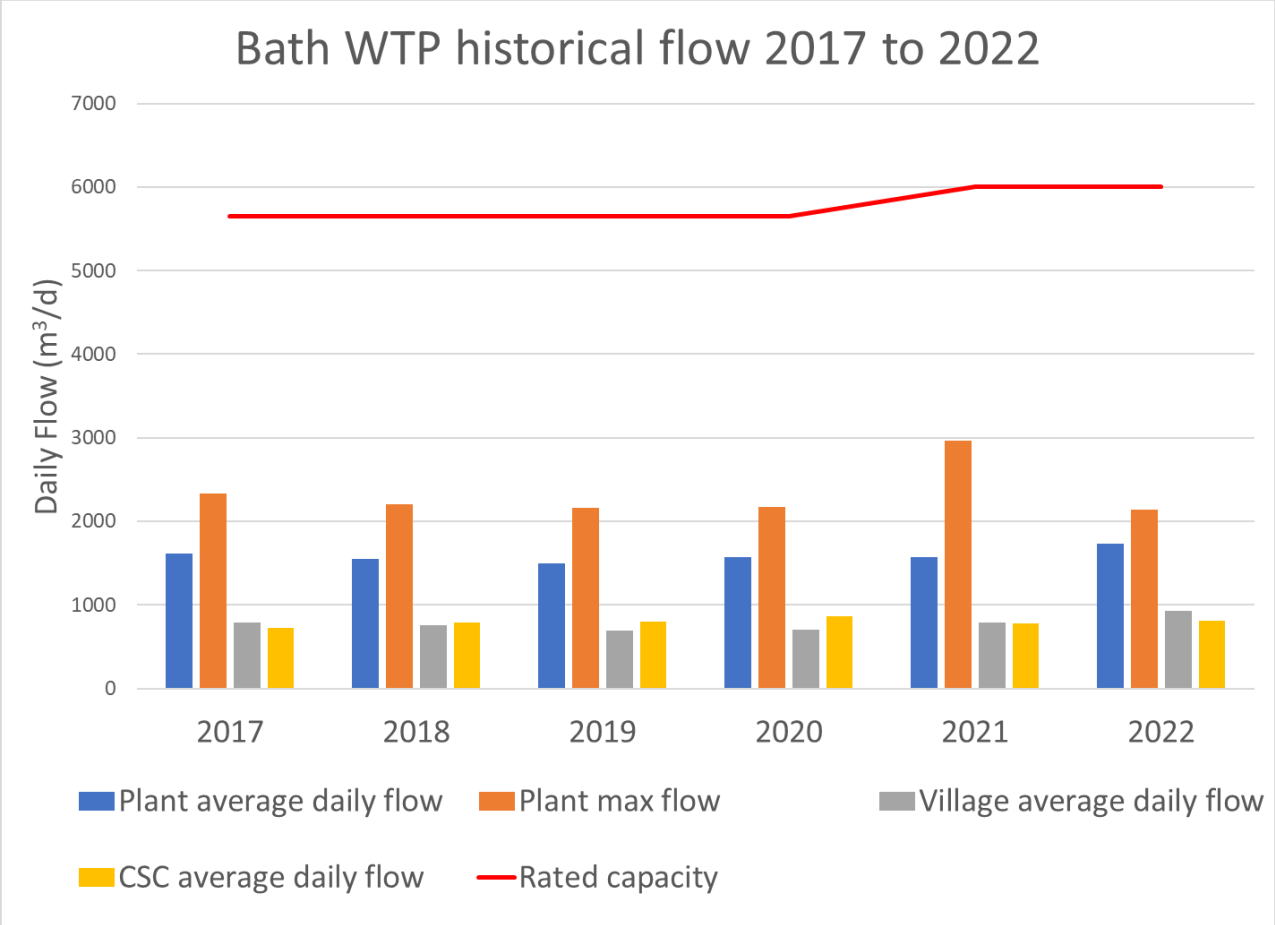
6.4. Historical Trends

Historical trending indicates that total water consumption (annual average daily flow) is starting to trend down for the Fairfield DWS although development and population continues to grow. The increase in flow demand expected with a population growth is balanced with household water usage efficiencies and a reduction in water losses achieved by replacing older watermains.



As expected, the fluctuation of the maximum daily flow is very much a function of precipitation and major events in the distribution system. Watermain breaks, leaks, major construction activities and unmetered temporary water services lead to additional flow increases between 2018 to mid of 2021. In the past years major leaks were repaired by Utilities operators and aging distribution watermains were replaced. Both resulted in a significant reduction of the daily water flows.

For Bath, trending indicates that water consumption (annual average flows) has not changed significantly over the years, and it is very much influenced by water demand from CSC. The maximum daily flow, significantly higher in 2021, can be attributed to the testing and commissioning of the new membrane gravity filtration system.



7. Waterworks Upgrade and Major Maintenance

In 2022 the following major upgrades and maintenance activities took place:

Fairfield DWS:

- Routine vibration analysis on larger pumps and blowers
- Upgraded generator fuel system to meet standards
- Rebuilt chlorine gas equipment & installed a lock out on High Lift Chlorinator
- Replaced valves, actuators, ejector within membrane system
- Replaced reject pump, raw sample pump, sump pumps 3 and 4
- Replaced capacitor, check valve and soft start on HLP 1
- Connected chlorine room warning light to alarm
- Replaced bearings in permeate pump
- Replaced free chlorine analyzer at Amherstview Tower
- Replaced chemical lines at Odessa Tower
- Replaced a fire hydrant and two valves in Odessa
- Development Babcock Mills
- Development Lakeside Ponds

Bath DWS:

- Routine vibration analysis on larger pumps
- Replacement of Contact Chamber Ejector
- Installed a lock out on High Lift Chlorinator
- Installed a backwash sampling line
- Added piping for flushing chemical line
- Maintenance on HLPs 2 and 3, LLP 2, backwash pump, raw sample pump
- Repaired village pressure sensor
- Repaired membranes
- Drained, cleaned and inspected raw well & capped overflow pipe to clearwell
- Rebuild all chlorine gas equipment
- Replaced SCADA ethernet switch and changes to SCADA programming
- Replaced and rebuild valves within the treatment plant
- Development Aura by the Lake
- Development Loyalist Estates Phase 10
- Partial twinning of the High Pressure watermain at the East End of Bath to provide redundancy

8. Regulatory Sampling Requirements

Regulatory samples are analyzed by laboratories that are accredited to conduct these specific analyses. Caduceon Environmental (Kingston) is our contracted accredited laboratory. As regulated, operational checks, testing and sampling are also conducted by certified operators and/or continuous analyzers.

8.1. Sampling Locations

Samples are collected at the following locations on a set schedule, as required by the regulation and more frequently if required operationally:

- Raw water
- Each filter effluent
- Treated water (point where water enters the distribution system)
- Process water discharge to water source
- Distribution system (point with maximum residency time)
- Distribution system (routine microbiological and lead sampling locations)
- Distribution system (water towers and water reservoir)

8.2. Equipment Calibration

All testing instruments are calibrated regularly as per manufacturer's specifications. Although not required to do so, the Township retains a third-party instrumentation service provider to conduct annual servicing on the majority of our laboratory equipment, as a quality control measure.

8.3. Turbidity and Free Chlorine Residual Sampling

Sampling for turbidity and free chlorine residual is required by **Schedule 7** of O.Reg. 170/03. Continuous free chlorine residual and turbidity analyzers are installed throughout the treatment plant and continuous free chlorine analyzers are installed in the water distribution system at the Amherstview, Bath, and Odessa water towers, as well as at the Odessa water booster station, all in accordance with the requirements of the Drinking Water Works Permit.

Readings from these analyzers are trended by the supervisory control and data acquisition (SCADA) system at each water treatment plant and reports of minimum, maximum and average values during a 24-hour period are printed and reviewed by a certified operator on a daily basis.

Turbidity is defined as the cloudiness of the water caused by suspended matter and is an important measure of filter performance. Its measurement is expressed in Nephelometric Turbidity Units (NTU). Water becomes “cloudier” as the NTU increase.

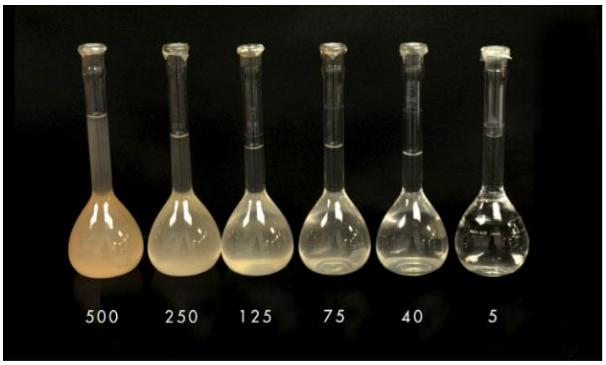


Figure 3 Turbidity ranges illustrated in water

Turbidity in the water interferes greatly with the disinfection process, as the particles causing high turbidity can shield or entrap disease-causing organisms, making it difficult for the disinfectant to reach and destroy them.

The filter performance criteria for membrane filtration (Fairfield and Bath) is ≤ 0.1 NTU in 99% of all turbidity readings taken over the course of one month.

Filter effluent turbidity met the ODWQS criteria at all times at both plants in 2022

Turbidity higher than 1 NTU at the filter effluent for a duration of 15 minutes is an indicator of “adverse water quality”.

Filter Turbidity Results 2022					
	Samples	Limit	Unit	Average	min/max
Fairfield					
Train 1	continuous	1*	NTU	0.01	0.01 / 0.14
Train 2	continuous			0.02	0.01 / 0.60
Train 1	continuous	99**	%	100	100
Train 2	continuous			100	100
Bath					
MGF 1***	continuous	1*	NTU	0.02	0.01 / 1.00
MGF 2***	continuous			0.02	0.01 / 0.98
MGF 1***	continuous	99**	%	100	100
MGF 2***	continuous			100	100

* max for longer than 15 minutes
** Percentile
***MGF: membrane gravity filtration system

In Bath, starting up the membrane gravity system is causing short turbidity spikes likely due to air in the system. None of the spikes were over 1 NTU.

The limits and percentiles were met at all times at both drinking water plants.

Free chlorine residual is the concentration of residual chlorine that is the most effective at killing or inactivating disease-causing organisms in water. Its measurement is expressed in milligram per liter (mg/l).

Free chlorine residuals were above the legislative minimum criteria.

Proper disinfected water was directed to customers at all times!

The free chlorine residual required in treated water to confirm proper disinfection at Fairfield was above 0.9 mg/L over the course of the calendar year 2022. The minimum concentration in the distribution system to protect from bacterial re-growth is 0.2 mg/L. In the Fairfield distribution system the minimum concentration measured was 0.29 mg/L. In 2022, proper disinfection was achieved at Fairfield at all times.

2022 Free Chlorine Residual Results					
	Samples	Limit	Unit	Average	min
Fairfield					
FCR (treated)	continuous daily grab	0.9*	mg/l	1.56	0.94
FCR (distribution)	continuous daily grab	0.05		1.24	0.29
Bath					
FCR (treated)	continuous daily grab	1.0*	mg/l	1.62	0.74
FCR (distribution)	continuous daily grab	0.05		1.29	0.09

*limit depending on flows, temperature, and pH – conservative worst-case scenario

For the Bath water treatment plant, the minimum free chlorine residual required in worst case, extremely conservative scenarios, would be 1.0 mg/L in treated water. The free chlorine residual required to confirm proper disinfection at Bath was in January, April, May, June and August below the set value of 1.0 mg/L The minimum was recorded as 0.74 mg/l during the time of the malfunction of the chlorination system in January 2022. It could be demonstrated that the legislative disinfection criteria was met based on parameters, and water distributed to customers was safe at all times.

The events in April, May, June and August can be attributed to the turnover of Lake Ontario and increased dissolved organic matter in raw water, maintenance activities and a malfunction of the chlorination system. Emergency Contact Time (CT) calculations were performed by the operator in charge for each incident, and the calculations confirmed that water directed to users was safe at all time and confirmed proper disinfection has been achieved at Bath at all times in 2022.

The minimum free chlorine concentration in the distribution system to protect from bacterial re-growth is 0.2 mg/l. The legislative minimum residual to ensure proper disinfected water is directed to customers is 0.05 mg/L. In the Bath distribution system the minimum concentration measured was 0.09 mg/L in April 2022. This was attributed to increasing temperatures, and higher chlorine demand due to Lake turnover and organics in the raw water. Operators took action, increased chlorine residuals at the water plant, and flushed the system to restore disinfection above the provincial guideline of 0.2 mg/L.

8.4. Microbiological Sampling

Microbiological sampling of raw, treated and distribution water is required by **Schedule 10** of O.Reg. 170/03.

Organisms such as bacteria may come from storm water, sewage plants, livestock operations, septic systems and wildlife. Most present little or no health concerns for humans. The indicator tests include total coliforms, Escherichia coliforms (E. coli), and heterotrophic plate count (HPC).

The presence of any total coliforms or E. coli in water leaving a treatment plant (following the disinfection process) signifies inadequate treatment and an increased risk to public health.

2022 Microbiological Results					
	Number of Samples	E. coli	T. coliforms	Number of Samples	HPC
		CFU/100 mL min – max			counts/mL min - max
Fairfield DWS					
Raw	52	0 – 14	0 – 3,100	n/a	n/a
Treated	70	0	0	62	<10 - 80
Distribution	466	0	0	156	<10-80
Bath DWS					
Raw	52	0 - 32	0 – >200	n/a	n/a
Treated	55	0	0	53	<10 - 20
Distribution	226	0	0	52	<10 - 60

In 2022 the total coliform count and E. coli in the treated water at both water treatment plants and in the distribution systems were always below the limit of 0 CFU/100 mL.

Heterotrophic plate count (HPC) results give an indication of overall water quality in drinking water systems. While a gradual change in results can indicate a change in overall water quality or a problem such as bacterial regrowth in the distribution system, a sudden high result is more an indication of sampling point contamination, issue with sample preparation for analysis or with the analysis itself.

HPC results of 20 count/ml or less in the treated and distribution water can be expected. Occasional higher results are possible but as a guideline, each result should be less than 500 count/ml. All sample results were well below the guideline.

8.5. Quarterly Chemical Sampling

Quarterly sampling and testing for nitrates and nitrites in a treated water sample, haloacetic acids and trihalomethanes in distribution samples is required by **Schedule 13,** O.Reg. 170/03.

All samples collected as per Schedule 13 of O.Reg. 170/03
met the standards prescribed in the ODWQS

Nitrate is present in the water as a result of decay of plant or animal material, the use of agriculture fertilizer, sewage and treated wastewater contamination or geological formations containing soluble nitrogen compounds. There is a risk for infants to suffer from blood related problems if the nitrate concentration is higher than 50 mg/L in drinking water. Nitrite may occur in groundwater, but with chlorination it's rapidly oxidized to nitrate.

All nitrate and nitrite concentrations were well below the established limits in 2022.

Trihalomethanes (THMs) and haloacetic acids (HAAs) are by-products of disinfection (DBP) and are formed when chlorine reacts with organic matter naturally present in water. The level of THMs and HAAs in treated water depends on numerous factors including total organic carbon, temperature, pH, chlorination dose and residency time in the distribution system.

2022 Nitrate, Nitrite, THM, HAA - Schedule 13				
	Samples	ODWQS	Unit	Average Concentration
Fairfield DWS (distribution)				
Nitrate (N)	4	10	mg/L	0.3
Nitrite (N)	4	1	mg/L	<0.1
THM – 5 Main Street	4	100	µg/L	54
HAA – 5 Main Street	4	80	µg/L	41
Bath DWS (distribution)				
Nitrate (N)	4	10	mg/L	0.3
Nitrite (N)	4	1	mg/L	<0.1
THM - Main St – Hydrant 534	4	100	µg/L	62
HAA - Bath STP	4	80	µg/L	40.5

For THMs, the maximum acceptable concentration (MAC) is 100 µg/l. For HAAs, the standard has been established at 80 µg/l, based on a four-quarter moving average.

At all sampling points in the distribution system in Fairfield, the running annual average for THM and HAA was well below the established value of 100 µg/l and 80 µg/l respectively. Although, the running annual average for THM and HAA is below the MAC in the Bath distribution system, concentrations appear to be increasing over the past two years. The running annual averages were calculated to be above half of the MAC in 2022. Operators are optimizing the chlorination based on demand, and flushing every section of the system on a regular basis to ensure that concentrations stay below the MAC.

8.6. Annual Inorganic and Organic Sampling

Yearly sampling of specific inorganic and organic parameters in a treated water sample is required by **Schedules 23 and 24** of O.Reg. 170/03.

If the result for a parameter listed in these schedules exceeds half of the standard prescribed by the ODWQS, then the frequency of testing for that parameter must be increased to quarterly.

All samples collected as per Schedule 23 and Schedule 24 of O.Reg. 170/03 **were well below half of the standard** prescribed in the ODWQS

The results for the inorganic and organic parameters are summarized in the tables below.

All inorganic and organic parameters were well below the limit and all parameters were far below of the half of the standard prescribed by the ODWQS.

2022 Annual Inorganic Results – Schedule 23			
	ODWQS	Fairfield DWS	Bath DWS
Parameter	**µg/L**		
Antimony	6	0.1	0.2
Arsenic	10	0.8	0.8
Barium	1000	24	33
Boron	5000	14	22
Cadmium	5	<0.015	<0.015
Chromium	5	<2	<2
Mercury	1	<0.02	<0.02
Selenium	50	<1	<1
Uranium	20	0.26	0.28

2022 Annual Organic Results - Schedule 24			
	ODWQS	Fairfield DWS	Bath DWS
Parameter	**µg/L**		
Alachlor	5	<0.3	<0.3
Atrazine & Metabolites	5	<0.5	<0.5
Azinphos-methyl	20	<1	<1
Benzene	1	<0.5	<0.5
Benzo(a)pyrene	0.01	<0.006	<0.006
Bromoxynil	5	<0.5	<0.5
Carbaryl	90	<3	<3
Carbofuran	90	<1	<1
Carbon Tetrachloride	2	<0.2	<0.2
Chlorpyrifos	9	<0.5	<0.5
Diazinon	2	<1	<1
Dicamba	120	<1	<1
1,2-Dichlorobenzene	200	<0.5	<0.5
1,4-Dichlorobenzene	5	<0.5	<0.5
1,2-Dichloroethane	5	<0.5	<0.5
1,1-Dichloroethylene	14	<0.5	<0.5
Dichloromethane	50	<5	<5
2,4-Dichlorophenol	900	<0.2	<0.2
2,4-Dichlorophenoxy-aceticacid (2,4-D)	100	<1	<1
Diclofop-methyl	9	<0.9	<0.9
Dimethoate	20	<1	<1
Diquat	70	<5	<5
Diuron	150	<5	<5
Glyphosate	280	<25	<25
Malathion	190	<5	<5
MCPA	100	<10	<10
Metolachlor	50	<3	<3
Metribuzin	80	<3	<3
Monochlorobenzene	80	<0.5	<0.5
Paraquat	10	<1	<1
Pentachlorophenol	60	<0.2	<0.2
Phorate	2	<0.3	<0.3
Picloram	190	<5	<5
PCBs	3	<0.05	<0.05
Prometryne	1	<0.1	<0.1
Simazine	10	<0.5	<0.5
Terbufos	1	<0.5	<0.5
Tetrachloroethylene	10	<0.5	<0.5
2,3,4,6-Tetrachlorophenol	100	<0.2	<0.2
Triallate	230	<10	<10
2,4,6-Trichlorophenol	5	<0.2	<0.2
Trichloroethylene	5	<0.5	<0.5
Triflualin	45	<0.5	<0.5
Vinylchlorid	1	<0.2	<0.2

8.7. Fluoride and Sodium Sampling

Once every 5 years, sodium and fluoride must be tested in one treated water sample. The last sampling was done in January 2018. The results are summarized in the table below and treated water in both systems is meeting the requirements of the ODWQS.

The next samples for fluoride and sodium will be taken in 2023.

2018 Fluoride & Sodium Results			
	ODWQS	Fairfield DWS	Bath DWS
Parameter	**mg/L**		
Fluoride	1.5	0.2	<0.1
Sodium	-	14.5	13.3

8.8. Distribution System Lead Sampling

Semi-annual sampling in the distribution system for pH and alkalinity is a requirement of Schedule 15.1, O.Reg. 170/03.

The Fairfield and Bath Drinking Water Systems have qualified for reduced sampling of lead in residential plumbing and the distribution system. This is because samples collected from previous years indicated that lead concentrations did not pose a risk to public health, based on the ODWQS.

All results of lead samples collected were well below the limits prescribed in the ODWQS

The requirement for reduced sampling is based on the population served. To determine the amount of sampling locations for the Fairfield and Bath Drinking Water System in 2022, published population figures for the year 2021 were taken. Samples were collected at four different locations in the Fairfield distribution system and at two locations for the Bath distribution system respectively.

Lead must be analyzed every third year between May and October and November and April. It was measured the last time in 2020.

In 2022 the samples were analyzed for pH and alkalinity. In the following table the parameters and the average of the sampling results are listed.

2022 Lead Sampling - Schedule 15.1					
	ODWQS AO/OG	Unit	Dates	Fairfield DWS	Bath DWS
Sample number per date				4	2
Lead	10	µg/L	13.1.20	0.13	0.05
			29.9.20	0.22	0.08
pH	6.5-8.5	-	11.4.22	7.54	7.54
			11.10.22	7.58	7.54
Alkalinity	30-500	mg/L	11.4.22	147	151
			11.10.22	95	97

All lead samples taken in 2020 met the criteria of the ODWQS.

The pH and alkalinity of the sample taken in 2022 were within the range of the objectives and guidelines.

9. General Water Quality Parameters

Tests for hardness, dissolved organic carbon (DOC), conductivity, total Kjeldahl nitrogen (TKN), ammonia/ammonium, colour, and temperature on raw and finished water are also conducted on a daily or quarterly basis at Bath and Fairfield. The types and frequency of sampling are informed by recommendations from the Engineer's Report, operational experience, and specific treatment needs. Because a small amount of derivative of aluminum is used as coagulant for the Bath membrane filtration, the residual of aluminium in the finished water is measured in an effort to keep the concentration below a level that could cause adverse effect in the distribution system, such as coating of pipes and flocculation. According to the "Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines – June 2006" and Health Canada's guideline, the treatment process should be optimized to reduce the residual to below 0.1 mg/L. The aluminum residual was well below this limit.

Test results are summarized in the table below for 2022.

The document "Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines, June 2006" provides operational guidelines and aesthetic objectives for certain parameters in drinking water. These are provided below for comparison purposes.

2022 General Water Quality Parameter (Annual Average)							
				Fairfield DWS		**Bath DWS**	
Parameter	Units	**AO**	**OG**	Raw Water	**Treated Water**	Raw Water	**Treated Water**
Hardness	mg/L CaCO3	**-**	**80-100**	126	**126**	131	**129**
Alkalinity	mg/L		**30-500**	-	**97**	103	**98**
DOC	mg/L	**5**	**-**	3.0	**2.3**	2.7	**2.8**
Conductivity	umho/cm	**-**	**-**	-	**-**	299	**299**
TKN	mg/L	**-**	**-**	0.3	**0.1**	0.2	**0.2**
Ammonia/ Ammonium	mg/L	**-**	**-**	0.011	**0.01**	0.02	**0.01**
Colour	TCU	**5**	**-**	1.0	**0**	16	**0**
Aluminum	mg/L	**-**	**0.1**	-	**-**	-	**0.02**
Temperature	°C	**<15**	**-**	12.0	**12.6**	12.5	**11.9**

All listed parameters are, except for hardness, below the operational guidelines and aesthetic objectives. Water hardness is defined by the amount of dissolved calcium and magnesium in water. Hard water (121 – 180 mg $CaCO_3$/L) is high in dissolved minerals and has a tendency to form scale deposits. This does not mean that it poses a health risk. It only means that more soap or detergent is needed to clean things. Hard water has benefits as well: humans need minerals to stay healthy and drinking water could contribute to calcium and magnesium in the diet. In Ontario the hardness from surface sources ranges from 3.7 to 296 mg/L.

10. Municipal Drinking Water License Sampling Requirements

According to section C.5.2 of the license for each of the DWS backwash/wastewater, samples of the treatment plant at the point of discharge to Lake Ontario must be taken.

For the Fairfield WTP, free chlorine residual in the discharge must be sampled monthly. The residual must remain below 0.05 mg/l (as an annual average).

For the Bath WTP, suspended solids concentration must be sampled monthly and remain below 25 mg/l (as an annual average).

Residue Management 2022 (January 1st – Dec 31st)							
System	Parameter	Limit	Unit	Required sampling	Samples	Annual Average	min - max
Fairfield	FCR*	0.05***	mg/l	1/month	57	0.03	0 – 0.10
Bath	SS**	25***	mg/l	1/month	53	9	2 - 33

*FCR: Free Chlorine Residual
**SS: Suspended Solids
*** Limit as annual average

Operationally each respective parameter is tested several times each month. The residues of both plants are well below the limits.

According to section C 6.0 of the license, the owner of a drinking water system shall develop and implement a Harmful Algal Bloom monitoring, reporting and sampling plan for each plant. “Harmful Algal Bloom” is an overgrowth of aquatic algal bacteria that produce or have the potential to produce toxins in the surrounding water. Such bacteria are harmful to people and animals and include microcystins produced by cyanobacterial blooms.

At both treatment plants visual monitoring for harmful algal blooms at/near the source water intake(s) was also conducted 3 times per week from the beginning of May to the end of October 2022.

Raw and finished water for both drinking water systems was sampled monthly during the seasonal warm period (May to October 2022) for Microcystin L-R at both treatment plants.

In August and September 2022 Microcystin L-R was detected in raw water of the Fairfield Drinking Water System but reported to be well below ½ of the ODWQS. Weekly sampling was started until three consecutive raw water samples were below the quantification limit – all in accordance with the implemented Harmful Algal Bloom Plan and the drinking water license.

For the Bath treatment plant, Microcystin L-R was detected above the limit of quantification but remained below ½ of the ODWQS in raw water in August 2022. Weekly sampling occurred until three consecutive sample results came back below the limit of quantification.

2022 Microcystins (Total) Results			
		Fairfield DWS	Bath DWS
		(µg/L)	
ODWQS		**1.5**	**1.5**
Raw Water	average min/max	0.14 <0.15 – 0.37	0.11 <0.15 - 0.26
Finished Water	average min/max	<0.15 <0.15	<0.15 <0.15
Number of Samples		15	10

The treatment process of both plants performed well, and concentrations determined in treated water were below the limit of quantification. The ODWQS was met at all times.

11. Adverse Water Quality Indicator Notifications

In accordance with section 11 (Annual Reports) of Ontario Regulation 170/03, this report must summarize any reports made to the Ministry under subsection 16-4 (Duty to report other observations) of Schedule 16 of O.Reg 170/03. Additionally, this report must describe any corrective actions taken under Schedule 17 of O. Reg 170/03 during the period covered by the report. The two incidents of other observations that occurred in 2022 for Bath or Fairfield Drinking Water Systems are summarized below:

One incident occurred at the Bath Drinking Water System in January 2022 with respect to monitoring and recording requirements for free chlorine residuals for primary disinfection as per O. Reg 170/03 after a malfunction of the chlorination system. The High Lift Chlorination system upstream the chlorine analyzer was activated for about 37 minutes. Continuous measurements in the contact chamber, finished water, the distribution system and calculations demonstrated that safe and properly disinfected water was directed to customers during this time, although the measurement frequency and their documentation was slightly deviating from regulatory requirements under 170/03. As mitigation measure the High Lift Chlorination System was locked out with the ability to be manually activated when needed.

The other incident was in respect to the non-permitted usage of a fire hydrant by a contractor without operator supervision and without a properly installed backflow prevention device in the Fairfield distribution system in May 2022. The incident was reported by a resident. Distribution system pressure is alarmed in the Fairfield drinking water system, no alarm was received during this time confirming the illegal operation did not have an adverse effect on pressure in the system. Operators flushed and sampled after the incident. Sample results demonstrated that properly disinfected water was distributed to customers at all times.

12. Non-compliance Incidents

Under Schedule 22 of O.Reg. 170/03, any incidents of non-compliance with the SDWA, its regulations, the drinking water works permit (DWWP), municipal drinking water license (MDWL), or any orders applicable to the system have to be reported. Additionally, this report must specify the duration of the failure and the measures that were taken to correct the failure.

The most recent inspection by the MECP was initiated in July for Fairfield and in August 2022 for Bath respectively. The final inspection rating was 100% for both plants. MECP recommended reviewing best management practises regarding the integrity and security of logs and other record-keeping mechanisms with operators and exploring options for written and electronic methods although logs contained the information required. Staff will be exploring electronic log and record keeping systems in 2023.

Both Drinking Water Systems were operated to the best of our knowledge in compliance with the above noted legal requirements in 2022.

13. Definitions and Terms

Adverse Water Quality
Presence of specific parameters in the drinking water identified as indicator of adverse water quality (potential health effects); listed in Schedule 16 of O.Reg. 170/03

Aesthetic Objective (AO)
Aspects of drinking water quality (namely taste, odour, color, clarity, iron, manganese) that are perceivable by the senses

Inorganic parameters
Substances which are naturally occurring or a result of urban storm runoff, industrial or domestic wastewater discharge, mining or agriculture. Examples are salt, metals, carbonates, nitrate, nitrite. Some may be a result of treatment and distribution of water (for example, lead from old solder in pipes)

Maximum Acceptable Concentration (MAC)
This is a health-related standard established for contaminants having known or suspected adverse health effects when above a certain concentration. The length of time the MAC can be exceeded without injury to health will depend on the nature and concentration of the parameter.

Operational Guidelines (OG)
For parameters, which may affect the treatment, disinfection and distribution of the water, are operational guidelines set. Examples are alkalinity, hardness, and pH.

Organic parameters
Substances which contain a carbon atom are organic compounds, with few exceptions as i.e. carbonates. These includes fats, proteins, sugars, hummin acids, etc. Most of them are present naturally in our environment. Some of them are potentially hazardous for the environment and of concern for the drinking water. These mostly synthetic produced organics include pesticides and their metabolites, VOCs, THM, HAA, PCBs, etc. They originate from industrial discharges, urban and agricultural storm runoff, air deposition, from treatment of drinking water or other sources.

14. Acts and Regulations

In addition to meeting permits and license requirements issued for the Drinking Water Systems, all acts and regulations made with regards to operating, licensing of facilities, licensing of operators, and quality standards must be met. A summary of pertinent legislation is as follows:

- *Safe Drinking Water Act*, 2002
  - Drinking Water Systems, O.Reg. 170/03
  - Licensing of Municipal Drinking Water Systems, O.Reg. 188/07
  - Certification of Drinking Water Operators, O.Reg. 128/04
  - Ontario Drinking Water Quality Standards, O.Reg. 169/03
  - Drinking Water Testing Services, O.Reg. 248/03
  - Financial Plans, O.Reg. 453/07
  - Procedure for Disinfection of Drinking Water in Ontario
  - Watermain Disinfection Procedure

- *Ontario Water Resources Act*, 1990
  - Water Taking, O.Reg. 387/04
  - Charges for Industrial and Commercial Water Users, O.Reg. 450/07

- *Environmental Protection Act* and its regulations

- *Fisheries Act*, 1985 and its regulations

- Several other MECP, Environment Canada and Health Canada guidelines and protocols

15. References

Technical Support Document for Ontario Drinking Water Standards, Objectives and Guideline, Ministry of Environment, PIBS 4449e01 revised June 2006

Entry level drinking water operator course manual, Ministry of Environment, 3rd Edition (revised 02-2010)

Canadian Association for Laboratory Accreditation (www.cala.ca)

Canadian Water and Wastewater Association (www.cwwa.ca)

e-Laws (https://www.ontario.ca/laws)

Environment Canada (https://www.canada.ca/en/environment-climate-change/services/water-overview.html)

Health Canada (www.hc-sc.gc.ca)

MECP (www.ontario.ca/page/drinking-water

Ontario Municipal Water Association (www.omwa.org)

Ontario Water and Wastewater Certification Office (www.owwco.ca)

Ontario Waterworks Association (www.owwa.com)

Walkerton Clean Water Centre (www.wcwc.ca)

16. Key Contacts

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