Belgrave Well Supply
2024 Operation and Maintenance
Annual Report

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Table of Contents

1.0 INTRODUCTION AND BACKGROUND 4
2.0 DESCRIPTION OF WATER SYSTEM 4
3.0 SUMMARY OF WATER QUALITY MONITORING 6
3.1 Water Treatment Operation and Monitoring as Per Schedule 7, O. Reg 170/03..... 6
3.1.1 Point of Entry Chlorine Residual 6
3.1.2 Distribution Chlorine Residual 6
3.1.3 Turbidity 7
3.2 Microbiological Sampling as per Schedule 10, O. Reg.170/03 8
3.2.1 Raw Water Samples 8,9
3.2.2 Treated Water (Point of Entry)Samples 10
3.2.3 Distribution Samples 11
3.3 Chemical Sampling & Testing as per Schedule 13, O. Reg.170/03 12
3.3.1 Inorganics 12
3.3.2 Lead 12
3.3.3 Organics 13/14
3.3.4 Trihalomethanes and Haloacetic Acids..... 14
3.3.5 Nitrate & Nitrite 14
3.3.6 Sodium 15
3.3.7 Fluoride 15
4.0 WATER AND CHEMICAL USAGE 15
4.1 Chemical Usage.....15
4.2 Annual Flows 16
5.0 IMPROVEMENTS TO SYSTEM AND ROUTINE AND PREVENTATIVE MAINTENANCE 17
5.0 MINISTRY OF THE ENVIRONMENT INSPECTIONS AND REGULATORY ISSUES 17
7.0 MECP Regulatory Changes.....18

List of Tables

Table 1 – Treated and Distribution Chlorine Residuals for Belgrave Drinking Water System

Table 2 – Raw Water Turbidities for Belgrave Drinking Water System

Table 3a – Microbiological Results for Raw Water at Belgrave Drinking Water System Jane Well

Table 3b – Microbiological Results for Raw Water at Belgrave Drinking Water System McCrea Well

Table 4 – Microbiological Results for Point of Entry at Belgrave Drinking Water System

Table 5 – Microbiological Results for Belgrave Distribution System

Table 6 – Schedule 23 Results for Belgrave Drinking Water System

Table 7 –Lead Sampling Program Results for Belgrave Drinking Water System

Table 8 – Schedule 24 Results for Belgrave Drinking Water System

Table 9 – Nitrate, Nitrite, THM and HAA Results at Belgrave Drinking Water System

Table 10 – Chemical Usage at the Belgrave Drinking Water System

Table 11 – Treated Water Flows for Belgrave Drinking Water System

1.0 INTRODUCTION AND BACKGROUND

The purpose of the 2024 Annual Report is to document the operation and maintenance data for the Belgrave Well Supply for review by The Ministry of Environment, Conservation and Parks in accordance with O. Reg. 170/03. This report covers January 1, 2024 to December 31, 2024. A copy of this report will be submitted to the owner to be uploaded to the municipality's website and can be provided to interested parties upon request.

2.0 DESCRIPTION OF WATER SYSTEM

The Belgrave Well Supply (DWS **#220008257**), is characterized as a groundwater system and is classified as a large municipal residential system. The system consists of two wells, with a maximum capacity of 501 m^3/day. The treatment building houses the controls for the system, chlorination and iron removal treatment, in-ground storage reservoirs and pressure system including pumps for the distribution system.

One production well is located at 32 Hamilton Street (near the intersection of Jane St and referred to as the Jane Street Well), and the other at 23 McCrea Street, with both wells connected to the treatment plant at 28 McCrea Street via dedicated raw water mains. The distribution system serves the community of Belgrave with a connection to the Humphrey Subdivision (North Huron).

The system serves a population of approximately 300 residents, with approximately 113 customer services in use (and 223 service connections total).

The system consists of a Class 2 Treatment and Class 1 Distribution and Supply, which is owned by the Municipality of Morris-Turnberry and operated by Veolia Water Canada, the Operating Authority.

The Jane Street well is 42.4 meters deep, equipped with a submersible pump with a rated capacity of 1.6 Litres/second, with instrumentation and control equipment, and discharges to a combined header.

The New McCrea Street Well (drilled 2021) is 23.9 meters deep equipped with a similar submersible pump with a rated capacity of 4.2 Litres/second, with instrumentation and control equipment and discharges to a combined header.

Flow from each well is combined in a common filter influent header at the treatment plant where the flow is then split equally through three green sand filters, treated with sodium hypochlorite and then to an in-ground reservoir and a high lift pumping station.

The Jane Street well was drilled in October 1983 and The McCrea Street Well drilled in June 1976. Modifications and updates were made to the Jane Street and McCrea Street well systems in 2007 to form the new Belgrave Water Treatment System with a new treatment building.

Raw water is pumped from each well. Potassium permanganate is injected as part of the iron removal system. The filtered water is treated with 6% sodium hypochlorite and then flows to an in-ground two cell storage and chlorine contact reservoir located below the treatment building. The treatment building has three (3) high lift submersible pumps and six (6) hydro pneumatic pressure tanks that supply and maintain the water pressure to the distribution system. The system is monitored and controlled by an onsite Programmable Logic Controller (PLC).

Back-up power is supplied by one 60 KW diesel standby generator with an automatic transfer switch located in the pump house.

There is no elevated storage tank. The system pressure is maintained using pressure tanks and the high lift pumps.

The system has no hydrants and capacity for fire protection is not provided. Blow-offs are used for flushing purposes

The current water source is from two secure deep bedrock wells. Land use in the vicinity of the wells is a mixture of residential and institutional. There is no Municipal sanitary sewer system so the area is served by individual septic systems.

Disinfection is achieved on the Belgrave well supply through the use of 6 % sodium hypochlorite. This chemical is injected prior to the water entering the chlorine contact reservoir at a sufficient dosage to achieve both primary and secondary disinfection objectives.

The primary disinfection system consists of a 200 L solution tank, with one duty and one standby chemical metering pump with automatic switch-over capability. An on-line free chlorine residual analyzer ensures continuous disinfection with high and low level parameter set points and alarms.

Primary disinfection is provided via Chlorine Contact Time within the reservoir. The Chlorine Contact provided is based on the provision of a minimum regulatory CT of 4.0, to provide 99% (2-log) inactivation of viruses. The design Chlorine Contact Time is based on 2-log inactivation of viruses at a minimum free chlorine residual of 0.2 mg/L (after contact time), raw water pH of 6-9 and a minimum water temperature of 5ºC.

The chlorine dosage range varies with the chlorine demand of the raw water. The free chlorine residual is monitored at the point of entry to the distribution system, by an on-line chlorine analyzer, with a target residual of > 0.1.00 mg/l and < 2.00 mg/l.

The raw water from the wells at Belgrave has iron levels higher than what is considered aesthetically acceptable. Through the First Engineers report it was determined that the iron oxidized in the treated water and resulted in higher than acceptable turbidity levels within the distribution system. The treatment building provides iron removal through greensand plus filters. Potassium permanganate used to be injected into the water to oxidize the iron and to regenerate the greensand filters. This chemical was previously injected into the raw water upstream of the filters, it was removed October 31, 2024 when it was realized that it was not needed with the Green sand plus filters.

The treated water is monitored and controlled by an on-site PLC. A PC at the site records the data generated by the PLC at the wells and treatment building.

Distribution piping typically ranges in size from 50 mm to 150 mm in diameter, and consists of PVC Polyethylene and High Density Polyethylene Piping.

Typical system pressure ranges from 40 P.S.I to 60 P.S.I

3.0 SUMMARY OF WATER QUALITY MONITORING

3.1 Water Treatment Operation and Monitoring as Per Schedule 7, O. Reg 170/03

3.1.1 Point of Entry Chlorine Residual

Chlorine residuals are continuously measured using a HACH CL17 online chlorine analyzer and verified for accuracy using hand-held HACH pocket colorimeters.
Table 1 shows the monthly average of free chlorine residual values on the treated water at the point of entry and the distribution.

3.1.2 Distribution Chlorine Residual

Chlorine residuals in the distribution system are continuously monitored at the Humphrey sample station using a HACH Cl17 online chlorine analyzer and recorded on the SCADA system. They are also verified using a HACH pocket colorimeter.

Table 1 – Treated and Distribution Chlorine Residuals for Belgrave Drinking Water System

Date	Avg. Treated Chlorine Residuals (mg/L)	Avg. Distribution Chlorine Residuals (mg/L)
January	1.66	1.57
February	1.64	1.63
March	1.72	1.48
April	2.04	1.72
May	1.80	1.49
June	1.81	1.48
July	1.70	1.42
August	1.58	1.38
September	1.48	1.32
October	1.45	1.29
November	1.63	1.42
December	1.68	1.48
Average	1.68	1.47
Minimum	0.82	0.65
Maximum	3.27	4.65

3.1.3 Turbidity

The maximum raw turbidity (NTU) measured at the Jane Well was 0.39 NTU and at the McCrae well the maximum raw turbidity(NTU) was 0.39 NTU.

Table 2 provides a summary of raw turbidity results.

Table 2. – Raw Water Turbidities (NTU) for Belgrave Well Supply

Date	Avg Jane Well Raw NTU	Avg McCrae Well Raw NTU
January	0.17	0.19
February	0.39	0.38
March	0.35	0.39
April	0.19	0.14
May	0.17	0.11
June	0.22	0.19
July	0.19	0.17
August	0.19	0.17
September	0.35	0.35
October	0.26	0.23
November	0.15	0.21
December	0.13	0.19
Minimum	0.13	0.11
Maximum	0.39	0.39
# samples	12	12

3.2 Microbiological Sampling as Per Schedule 10, O. Reg 170/03

3.2.1 Raw Water Samples

Raw water samples are taken every week. A total of 53 samples from Jane Well and 53 samples from McCrea Well were collected and analyzed for E. Coli and Total Coliforms. Each E. Coli and Total Coliform result obtained was 0 cfu/100 ml.

Table 3a and **Table 3b** provide a summary of bacteriological results performed on the raw water.

Table 3a – Microbiological Results for Raw Water at the ***Jane Well***

Date	E. Coli			Total Coliform		
	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples ≥1
Jan	5	5	0	5	5	0
Feb	4	4	0	4	4	0
Mar	4	4	0	4	4	0
Apr	5	5	0	5	5	0
May	4	4	0	4	4	0
Jun	4	4	0	4	4	0
Jul	5	5	0	5	5	0
Aug	4	4	0	4	4	0
Sep	5	5	0	5	5	0
Oct	4	4	0	4	4	0
Nov	4	4	0	4	4	0
Dec	5	5	0	5	5	0
Total	53	53	**0**	53	53	**0**

Table 3b. Microbiological Results for Raw Water at the ***McCrea Well***

Date	E. Coli			Total Coliform		
	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples ≥1
Jan	5	5	0	5	5	0
Feb	4	4	0	4	4	0
Mar	4	4	0	4	4	0
Apr	5	5	0	5	5	0
May	4	4	0	4	4	0
Jun	4	4	0	4	4	0
Jul	5	5	0	5	5	0
Aug	4	4	0	4	4	0
Sep	5	5	0	5	5	0
Oct	4	4	0	4	4	0
Nov	4	4	0	4	4	0
Dec	5	5	0	5	5	0
Total	53	53	**0**	53	53	0

3.2.2 Treated Water (Point of Entry) Samples

One treated water sample from the point of entry is taken every week and analyzed for E.Coli, Total Coliforms and for Heterotrophic Plate Count (HPC). A total of 53 treated water samples were collected and analyzed for the above parameters. All E. Coli and Total Coliform samples were found to be safe. The range of HPC results were 0 - <10 cfu/100 ml.

Table 4 provides a summary of all bacteriological results performed on the treated water.

Table 4. – Microbiological Results for Point of Entry

	E. Coli			Total Coliform			HPC		
Date	**# Samples**	**# Samples 0**	**# Samples ≥1**	**# Samples**	**# Samples 0**	**# Samples ≥1**	**# Samples**	**# Safe**	**Deteriorating**
Jan	5	5	0	5	5	0	5	5	0
Feb	4	4	0	4	4	0	4	4	0
Mar	4	4	0	4	4	0	4	4	0
Apr	5	5	0	5	5	0	5	5	0
May	4	4	0	4	4	0	4	4	0
Jun	4	4	0	4	4	0	4	4	0
Jul	5	5	0	5	5	0	5	5	0
Aug	4	4	0	4	4	0	4	4	0
Sep	5	5	0	5	5	0	5	5	0
Oct	4	4	0	4	4	0	4	4	0
Nov	4	4	0	4	4	0	4	4	0
Dec	5	5	0	5	5	0	5	5	0
Total	53	53	**0**	53	53	**0**	53	53	**0**

3.2.3 Distribution Samples

Distribution samples are collected every week and tested for E.Coli, Total Coliforms and for Heterotrophic Plate Count (HPC). A total of 106 distribution samples were collected and analyzed for the above parameters. All E. Coli and Total Coliform results from the distribution water were 0 cfu/100 ml. The range of HPC results were 10 - <10 cfu/100 ml.

Table 5 provides a summary of all bacteriological samples taken in the distribution system.

Table 5 – Microbiological Results for the Distribution

	E. Coli			Total Coliform			HPC		
Date	**# Samples**	**# Samples 0**	**# Samples ≥1**	**# Samples**	**# Samples 0**	**# Samples ≥1**	**# Samples**	**# safe**	**Deteriorating**
Jan	10	10	0	10	10	0	5	5	0
Feb	8	8	0	8	8	0	4	4	0
Mar	8	8	0	8	8	0	4	4	0
Apr	10	10	0	10	10	0	5	5	0
May	8	8	0	8	8	0	4	4	0
Jun	8	8	0	8	8	0	4	4	0
Jul	10	10	0	10	10	0	5	5	0
Aug	8	8	0	8	8	0	4	4	0
Sep	10	10	0	10	10	0	5	5	0
Oct	8	8	0	8	8	0	4	4	0
Nov	8	8	0	8	8	0	4	4	0
Dec	10	10	0	10	10	0	5	5	0
Total	106	106	**0**	106	106	0	53	53	0

3.3 Chemical Sampling & Testing as Per Schedule 13, O. Reg 170/03

3.3.1 Inorganics

One treated water sample is taken every 36 months and tested for inorganics. The most recent samples for the Belgrave Drinking Water System were collected on January 31, 2023 and submitted to the laboratory for analysis of inorganics as listed in Schedule 23. All parameters were found to be within compliance. Inorganics will be sampled and analyzed again ***January, 2026***.
Results from 2020 and 2023 can be found in **Table 6.**

Table 6. – Schedule 23 Results for Belgrave Well Supply

Parameter	Result (µg/L) 2020	Results (µg/L) 2023	Maximum Allowable Concentration µg/L
Antimony	<0.09	<0.6	6
Arsenic	0.6	0.7	10
Barium	153	169	1000
Boron	<2	22	5000
Cadmium	0.003	0.003	5
Chromium	<0.08	0.29	50
Mercury	0.01	<0.01	1
Selenium	<0.04	0.08	10
Uranium	0.854	0.711	20

3.3.2 Lead

Schedule 15.1 of Ontario Regulation 170/03 requires that samples be taken during two seasons: once between December 15 and April 15 and once between June 15 and October 15. The Maximum Allowable Concentration for Lead is 10µg/L. Lead, pH and Alkalinity samples were taken on January 9th and again on July 8th, 2024. All samples were found to be Compliant.

2024 results can be found in **Table 7**.

Table 7. – Lead Sampling Program Results for Belgrave Drinking Water System

DATE	pH	Alkalinity (mg/L)	Lead(µg/L)
Dec-Apr	8.02	235	0.06
Jun-Oct	8.26	262	0.01

3.3.3 Organics

One treated water sample is taken every 36 months and tested for schedule 24 organic parameters. The most recent samples were collected on January 31, 2023. All parameters were found to be within compliance. Organics will be sampled and analyzed again in ***January 2026***

2023 sample results can be found in **Table 8.**

Table 8. – Schedule 24 Results for Belgrave Drinking Water System

Parameter	Result (µg/L)	Maximum Allowable Concentration (µg/L)
Benzene	<0.32	1
Carbon Tetrachloride	<0.17	2
1,2-Dichlorobenzene	<0.41	200
1,4-Dichlorobenzene	<0.36	5
1,1-Dichloroethylene	<0.33	14
1,2-Dichloroethane	<0.35	5
Dichloromethane	<0.35	50
Monochlorobenzene	<0.3	80
Tetrachloroethylene	<0.35	10
Trichloroethylene	<0.44	5
Vinyl Chloride	<0.17	1
Polychlorinated Biphenyls	<0.04	3
Benzo(a)pyrene	<0.004	0.01
2,4-dichlorophenol	<0.15	900
2,4,6-trichlorophenol	<0.25	5
2,3,4,6-tetrachlorophenol	<0.20	100
Pentachlorophenol	<0.15	60
Alachlor	<0.02	5
Atrazine+N-dealkylated metabolites	<0.01	5
Atrazine	<0.01	-
Desethyl atrazine	<0.01	-
Azinphos-methyl	<0.05	20
Carbaryl	<0.05	90
Carbofuran	<0.01	90
Chlorpyrifos	<0.02	90
Diazinon	<0.02	20
Dimethoate	<0.06	20
Diuron	<0.03	150
Malathion	<0.02	190
Metolachlor	<0.01	50
Metribuzin	<0.02	80
Phorate	<0.01	2
Prometryne	<0.03	1
Simazine	<0.01	10
Terbufos	<0.01	1

Triallate	<0.01	230

Table 8 Con't

Parameter	Result (µg/L)	Maximum Allowable Concentration (µg/L)
Trifluralin	<0.02	45
2,4-dichlorophenoxyacetic acid	<0.19	100
Bromoxynil	<0.33	5
Dicamba	<0.20	120
Diclofop-methyl	<0.40	9
MCPA	<0.00012	.1
Picloram	<1	190

3.3.4 Trihalomethanes and Haloacetic Acid

One distribution sample is taken every three months from a point in the distribution system and tested for Trihalomethanes (THMs) and Haloacetic Acids (HAAs). Samples were collected during the months of February, May, August and November. The Ontario Drinking Water Quality Standard (ODWQS) has set a Maximum Allowable Concentration (MAC) of 100 µg/L for THMs and it is expressed as a running annual average(RAA). The RRA for THMs was found to be 13.25 µg/L, which is within compliance. The HAA MAC is 80 µg/L the results were found to be within compliance.

Refer to **Table 9** for the summary of trihalomethane and haloacetic acids results.

3.3.5 Nitrate & Nitrite

One treated water sample is taken every three months and tested for nitrate and nitrite. Samples were collected during the months of February, May, August and November. The Ontario Drinking Water Quality Standard (ODWQS) has a set Maximum Allowable Concentration (MAC) of 1 mg/L for nitrites and 10 mg/L for nitrates. The results were found to be within compliance.

Refer to **Table 9.**

Table 9. – Nitrate, Nitrite ,THM and HAAs Results at Belgrave Drinking Water System

	Nitrate		Nitrite		THMs			HAAs
Date	# Samples	Result (mg/L)	# Samples	Result (mg/L)	# Samples	Results (µg/L)	# Samples	Result (µg/L)
Feb	1	0.012	1	<0.003	1	11	1	<5.3
May	1	0.018	1	<0.003	1	13	1	<5.3
Aug	1	0.012	1	<0.003	1	14	1	<5.3
Nov	1	<0.006	1	<0.003	1	15	1	<5.3
Total	4		4		4		4	
Avg.		0.014		<0.003		RAA 13.25		<5.3
Max		0.018		<0.003		15		<5.3

3.3.6 Sodium

One water sample is collected every 60 months and tested for Sodium. The Ontario Drinking Water Standards (ODWQS) have set a Maximum Acceptable concentration (MAC) of 200 mg/L for Sodium and requires the Medical Office of Health be notified if the concentration exceeds 20 mg/L. These samples were last collected on January 31, 2023 and were 10.2 mg/L, which is in compliance. The next water sample for Sodium will be collected and analyzed in March **,** 2028.

3.3.7 Fluoride

One water sample is collected at least once in every 60 months and tested for Fluoride. The Ontario Drinking Water Quality Standards (ODWQS) have set a MAC of 1.5 mg/L. On May 11, 2020 a sample was collected for this analysis. The sample was found to have a concentration of 1.49 mg/L, which is in compliance. The next water sample for Fluoride will be collected and analyzed on or before ***May 5, 2024***

4.0 WATER AND CHEMICAL USAGE

4.1 Chemical Usage

93.97 kg of sodium hypochlorite and 37.06 kg of Potassium Permanganate (before it was removed) was used to ensure proper disinfection.
Refer to **Table 10**

Table 10. – Chemical Usage at Belgrave Drinking Water System

Date	Sodium Hypochlorite		Potassium Permanganate	
	Usage (kg)	Average Dosage (mg/L)	Total Usage (kg)	Average Dosage (mg/L)
Jan	6.68	2.86	2.78	2.04
Feb	5.93	2.81	2.61	2.45
Mar	6.86	3.01	2.71	1.66
Apr	7.30	3.25	2.86	2.74
May	8.85	3.28	3.96	2.66
Jun	9.80	3.39	4.30	2.72
Jul	9.52	3.10	5.04	2.99
Aug	8.86	3.26	4.80	2.86
Sep	8.93	3.25	4.44	2.96
Oct	7.51	3.11	3.56	2.82
Nov	7.03	2.86	Removed	
Dec	6.70	2.63		
Total	93.97	–	37.06	–
Average	–	3.07	–	2.59

4.2 Annual Flows

A summary of the water supplied to the distribution system is provided in **Table 11.** This Table provides a breakdown of the monthly flow provided to the distribution system from the Logbook entries as the SCADA System was down from January to May.

Flow meters were calibrated on July 9, 2024.

Table 11. – Treated Water Flows for Belgrave Drinking Water System

Date	Avg.Daily Flow (m3)	Max Daily Flow (m3)	Total Daily Flow (m3)
Jan	81	121	2,432
Feb	79	118	2,220
March	81	111	2,420
April	81	103	2,363
May	97	143	2,895
June	106	154	3,067
July	109	141	3,273
Aug.	96	140	2,867
Sept.	100	131	2,896
Oct.	84	176	2,527
Nov.	85	103	2,370
Dec.	82	99	2,466
Avg	90	–	–
Max	–	176	–
Total	–	–	31,882

5.0 IMPROVEMENTS TO SYSTEM AND ROUTINE AND PREVENTATIVE MAINTENANCE

The following summarizes water system improvements and routine and preventative maintenance for the Belgrave Drinking Water System:

- Communication was set up with the Humphrey well house through Rodgers
- Core sampling on filter #3 was completed by Barry Otten
- Sludge was removed from the outside tank several times by Panabaker
- The decant chamber was cleaned out by Wessuc and CT Environment
- 2" ball valve was replaced to allow for filling trucks
- Backflow preventers were tested by Fergusons
- Analyzers were calibrated by Cleartech
- Potassium Permanganate was removed from the system
- Annual fire and safety checks were completed by Georgian Bay Fire and Safety
- Decant tank was filling from a leak and was repaired

5.0 MINISTRY OF ENVIRONMENT INSPECTIONS AND REGULATORY ISSUES

SAI Global conducted a Surveillance System Audit on August 20, 2024. There was no nonconformance, and 3 opportunities for Improvement to be considered.

It is suggested that the opportunities for improvement be considered by management to further enhance the Operating Authority's Quality Management System and performance.

The Ministry of the Environment, Conservation and Parks last inspection on the Belgrave Drinking Water System was September 10, 2024. there were no non compliance/non conformances noted and was given a rating of 100%:

There were no adverse water events in 2024.
There were no Precautionary Boil Water Notices (PBWN) in 2024.

7.0 MECP Regulatory Changes

Proposed amendments to drinking water operator and water quality analyst certification regulations have been issued to address the impacts of emergencies. These include:

- allowing the Ministry to act quickly to ensure the Province's drinking water is protected during an emergency
- extending Operator certificates and allowing certain qualified but non-certified staff to temporarily maintain system operations, and would only be enacted during an emergency
- allowing temporary relief from training and certification requirements

This proposal has been registered with the Environmental Registry of Ontario and the consultation process was closed on July 2, 2021. The outcome of this proposal is expected to be published in 2022.

Proposed updates to the Director's Directions - Minimum Requirements for Operational Plans - May 2021. The Director's Directions have updated the following:

- Content Requirements - all referenced documents will be considered part of the Operational Plan.
- Procedures for version control - version number and revision date is to be embedded in ever electronic copy, and recorded on every page of any physical copy
- Completed copy of Subject System Description Form in Schedule "C" of the Director's Directions
- Operational Plans are to be submitted to the Director electronically
- Retention of Operational Plans - Operational Plans that were the subject of an audit by an auditor for the accreditation body shall be retained for a minimum of 10 years
- Public Disclosure of Operational Plans - shall be made available for viewing by the public either electronically (website) or at the principal place of business, but not in a manner that would threaten the safety, health or quality of the drinking water, or create significant prejudice with the contractual obligations of the Operating Authority or other organization.
- Operational Plans shall be updated to meet the requirements of the Director's Directions no later than April 1, 2022.

The Municipality will provide A copy of the Operational Plan by request