

Annual Report

For the 2019 Operating Year

Belgrave Well Supply 2019 Operation and Maintenance Annual Report

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PREPARED BY

Veolia Water
100 Cove Rd.
Goderich, ON
N7A 3Z2

TO

Municipality of Morris Turnberry,
RR#4, 41342 Morris Road,
Brussels, ON
N0G 1H0

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1.0 INTRODUCTION AND BACKGROUND

The purpose of the 2019 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, 2019 to December 31, 2019. A copy of this report will be submitted to the owner to be uploaded to the municipality's website and can be supplied to interested parties upon request.

2.0 DESCRIPTION OF WATER SYSTEM

The Belgrave Well Supply (DWS #220008257), is characterized as a ground water system and is classified as a large municipal residential system. The system consists of two wells, with a maximum capacity of 501 m³/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 l/s, with instrumentation and control equipment, and discharges to a combined header.

The McCrea Street Well is 38.1 meters deep equipped with a 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 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.

The current water source is from two secure deep bed rock 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 two 200 L solution tanks, 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 5°C.

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 filters. Potassium permanganate is injected into the water to oxidize the iron and to regenerate the greensand filters. This chemical is injected into to the raw water upstream of the 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, 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 Equipment Operation and Monitoring

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.

3.1.2 Distribution Chlorine Residual

Chlorine residuals in the distribution system are continuously monitored at the Humphrey sample station using a HACH CI17 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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Min	Max	# Samples
Average Treated Chlorine Residual (mg/L)	1.52	1.42	1.37	1.72	1.59	1.35	1.40	1.56	1.44	1.47	1.45	1.46	1.48	0.67	2.23	8760
Average Distribution Chlorine Residual (mg/L)	1.42	1.31	1.25	1.54	1.47	1.21	1.22	1.26	1.14	1.19	1.19	1.23	1.29	0.80	1.96	8760

3.1.3 Turbidity

Turbidity is measured daily using a pocket turbidimeter. **Table 2** provides a summary of raw turbidity results. The maximum raw turbidity measured was **0.33** NTU.

Table 2. – Raw Water Turbidities for Belgrave Well Supply

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Min	Max	# Samples
Average Jane Well Turbidity (NTU)	0.27	0.30	0.22	0.21	0.16	0.25	0.20	0.14	0.21	0.16	0.16	0.11	0.21	0.11	0.32	13
Average McCrae Well Turbidity (NTU)	0.27	0.25	0.22	0.18	0.17	0.81	0.13	0.23	0.21	0.16	0.12	0.13	0.24	0.12	0.81	13

3.2 Microbiological Sampling

3.2.1 Raw Water Samples

Raw water samples are taken every week. In 2019, 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 Total Coliform and E. coli 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 Belgrave Well Supply 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	3	3	0	3	3	0
Sep	5	5	0	5	5	0
Oct	5	5	0	5	5	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 Belgrave Well Supply 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	3	3	0	3	3	0
Sep	5	5	0	5	5	0
Oct	5	5	0	5	5	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 samples were found to be safe. Each E. coli and total coliform result from the treated water was 0 cfu/100 ml. The range of HPC results were 0 – 2 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 at Belgrave Well Supply ^a

Date	E. coli			Total Coliform			HPC		
	# 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	3	3	0	3	3	0	3	3	0
Sep	5	5	0	5	5	0	5	5	0
Oct	5	5	0	5	5	0	5	5	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 System

Distribution samples are collected every week and tested for E.Coli, Total Coliforms and for Heterotrophic Plate Count (HPC). In 2019, a total of 106 distribution samples were collected and analyzed for the above parameters. All E. coli results from the treated water were 0 cfu/100 ml. There was one instance of 1cfu/100ml of Total Coliform (see AWQI# 145474). The range of HPC results were 0 -7 cfu/100 ml. **Table 5** provides a summary of all bacteriological samples taken in the distribution system.

Table 5 – Microbiological Results for Belgrave Distribution System

Date	E. coli			Total Coliform			HPC		
	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples ≥1	# Samples	Safe	Deteriorating
Jan	11	11	0	11	11	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	9	9	0	9	8	1	4	4	0
Jun	8	8	0	8	8	0	4	4	0
Jul	10	10	0	10	10	0	5	5	0
Aug	6	6	0	10	10	0	3	3	0
Sep	10	10	0	8	8	0	5	5	0
Oct	10	10	0	10	10	0	5	5	0
Nov	8	8	0	8	8	0	4	4	0
Dec	8	8	0	8	8	0	4	4	0
Total	106	106	0	105	104	1	52	52	0

3.3 Chemical Sampling & Testing

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 March 1, 2017 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 on or before March 1, 2020. Results from March 1, 2017 can be found in **Table 6**.

Table 6. – Schedule 23 Results for Belgrave Well Supply ^a

Parameter	Result (µg/L)	Maximum Allowable Concentration (µg/L)
Antimony	<0.02	6
Arsenic	.8	10
Barium	146	1000
Boron	21	5000
Cadmium	<0.003	5
Chromium	0.48	50
Mercury	<0.01	1
Selenium	<.04	10
Uranium	0.802	20

NOTE: New regulation standards changed in 2018 for Arsenic. The previous standard of 25µg/L changed January 2018, to the new standard of 10µg/L. The last sample taken in 2016 was within compliance at that time, the result was 0.8µg/L. The next sample is required before March 2020. Consideration and discussion of this parameter should be investigated as soon as possible.

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 0.01 mg/L. In the two previous lead sampling seasons, pH and Alkalinity samples were taken on February 5, 2019 and again on July 18, 2019. The next lead samples are required in 2020. 2019 results can be found in **Table 7**.

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

	pH	Alkalinity (mg/L)	Lead
Dec-Apr	7.68	237	n/a
Jun-Oct	8.17	236	n/a

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 March 1, 2017. All parameters were found to be within compliance. Organics will be sampled and analyzed again on or before March 1, 2020. 2017 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	<0.16	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	30
Trichloroethylene	<0.43	50
Vinyl Chloride	<0.17	1
Diquat	<1	70
Paraquat	<1	10
Glyphosate	<1	280
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	-
De-ethylated 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	<0.03	20
Diuron	<0.03	150
Melathion	<0.02	190
Methoxychlor	<0.01	900
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
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	.00012
Picloram	<1	190

3.3.4 Trihalomethanes

One distribution sample is taken every three months from a point in the distribution system and tested for Trihalomethanes (THMs) and Haloacetic Acids (HAAs). In 2019, samples were collected during the months of February, May, August and November. The Ontario Drinking Water Quality Standard (ODWQS) have set a Maximum Allowable Concentration (MAC) of 100 µg/L for THMs and it is expressed as a running annual average. There was previously no MAC for HAAs, in 2020 the new HAA MAC will be 80 µg/L. In 2019, the average THM was found to be 12.25 µg/L, which is 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. In 2019, samples were collected during the months of February, May, August and November. The Ontario Drinking Water Quality Standard (ODWQS) have set a 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

Date	Nitrate		Nitrite		THMs		HAAs	
	# Samples	Result (mg/L)	# Samples	Result (mg/L)	# Samples	Results (µg/L)	# Samples	Result (µg/L)
Feb	1	0.010	1	<0.003	1	12	1	<5.3
May	1	0.010	1	<0.003	1	15	1	<5.3
Aug	1	<0.006	1	<0.003	1	10	1	<5.3
Nov	1	0.013	1	<0.003	1	12	1	<5.3
Total	4		4		4		4	
Average		0.009		<0.003		12.25		<5.3
Maximum		0.013		<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 March 5, 2018 and were found to be 16.6 mg/L, which is in compliance. The next water sample for Sodium will be collected and analyzed on or before March 5, 2023

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 5, 2015, a sample was collected for this analysis. The sample was found to have a concentration of 1.48 mg/L, which is in compliance. The next water sample for Fluoride will be collected and analyzed on or before May 5, 2020.

4.0 WATER AND CHEMICAL USAGE

4.1 Chemical Usage

Refer to **Table 10**. From January 1, 2019 to December 31, 2019, 78.72 kg of sodium hypochlorite was used to ensure proper disinfection.

Table 10. – Chemical Usage at Belgrave Drinking Water System

Date	Sodium Hypochlorite		Potassium Permanganate
	Usage (kg)	Average Dosage (mg/L)	Total Usage (L)
Jan	6.01	2.95	123.00
Feb	4.52	2.68	107.75
Mar	4.85	2.47	107.75
Apr	6.08	3.19	113.00
May	7.03	2.92	147.00
Jun	6.21	2.55	164.75
Jul	10.28	3.20	199.50
Aug	9.04	2.89	202.75
Sep	7.74	3.59	147.45
Oct	5.90	2.85	135.50
Nov	5.46	2.68	131.25
Dec	5.60	2.73	129.75
Total	78.72		1709.45
Average		2.89	

4.2 Annual Flows

A summary of the water supplied to the distribution system in 2019 is provided in **Table 11**. This Table provides a breakdown of the monthly flow provided to the distribution system.

Flow meters were calibrated on June 28, 2019 by Corix/Iconix and were found to be acceptable.

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

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Max	Total
Average Daily Flow (m³)	56	53	52	22	36	68	86	83	61	60	58	57	58		
Maximum Daily Flow (m³)	78	75	79	63	200	95	129	173	90	83	144	146		200	
Total Monthly Flow (m³)	1723	1490	1605	663	1131	2047	2662	2584	1839	1863	1748	1773			21,129

5.0 MINISTRY OF ENVIRONMENT INSPECTIONS AND REGULATORY ISSUES

The Ministry of the Environment, Conservation and Parks conducted an inspection on the Belgrave Drinking Water System on December 5, 2019, the results were 100%.

- Spring flushing occurred in June.
- Replacement of Stenner SVA sodium hypochlorite pumps and accessories with Grundfos DDA accessories
- Fall flushing occurred in October.

There was 1 adverse water events in 2019:

AWQI #145474 – On May 23rd There was a 1Total Coliform result from the Hamilton Street Sample Station samples. New samples were taken upstream, downstream and at the sample station, all results came back clear of Total Coliform and E. Coli.

7.0 MECP Regulatory Changes

It should be noted that there will be some upcoming changes to Ontario Regulation 170/03 and Ontario Regulation 169/03 that strengthen standards and clarify testing requirements as follows:

- Strengthen standards for Arsenic, Carbon Tetrachloride, Benzene, and Vinyl Chloride;
- Adopt new standards for Chlorate, Chlorite, 1-Methyl-4-Chlorophenoxyacetic acid (MCPA) and Haloacetic Acids (HAAs); (NOTE: Chlorate and Chlorite testing is only required for Municipal Drinking Water Systems using Chlorine Dioxide treatment equipment.)
- Clarify/optimize testing, sampling and reporting requirements for Trihalomethanes (THMs) and HAAs; and
- Remove 13 pesticides from testing requirements.

The aforementioned amendments will be phased in over the next four years to allow system owners and/or operators the opportunity to collect baseline information and complete required system upgrades. Currently, the new sampling, testing, reporting and re-sampling requirements, and the removal of 13 pesticides came into effect January 1, 2016. Refer to **Table 12** for the new Regulatory Requirements. Subsequent phase-in dates are:

- January 1, 2017: Testing requirements for HAAs and updates to standards for Carbon Tetrachloride, Benzene, Vinyl Chloride, Chlorate, Chlorite, and MCPA come into effect / require reporting
- January 1, 2018: Updates to standards for Arsenic come into effect / require reporting
- January 1, 2020: New standards for HAAs and HAAs testing optimization rule for smaller systems will come into effect / require reporting.

Table 12 – Regulatory Requirements

Parameter	Past Requirements		Amended Requirements	
	MAC	½ MAC	MAC	½ MAC
Arsenic	25 µg/L	12.5 µg/L	10 µg/L	5 µg/L
Benzene	5 µg/L	2.5 µg/L	1 µg/L	0.5 µg/L
Carbon Tetrachloride	5 µg/L	2.5 µg/L	2 µg/L	1 µg/L
Vinyl Chloride	2 µg/L	1 µg/L	1 µg/L	0.5 µg/L

