

Annual Report

For the 2017 Operating Year

Dungannon Drinking Water System 2017 Operation and Maintenance Annual Report

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1.0 INTRODUCTION AND BACKGROUND

The purpose of the 2017 Annual Report is to document the operation and maintenance data for the Dungannon Drinking Water System for review by the Ministry of the Environment in accordance with O. Reg. 170/03. This report covers January 1, 2017 to December 31, 2017. A copy of this report will be submitted to the owner to be uploaded to the township's website and can be supplied to interested parties upon request.

2.0 DESCRIPTION OF WATER SYSTEM

The Dungannon Drinking Water System (DWS #260007842), consists of two drilled wells, Well # 1-02 was constructed September 2002, and Well # 2-02 was constructed December 2002 in accordance with construction standards as identified in the Ontario Regulation 903/03 made under the Ontario Water Resources Act. Well #1 is a 152 mm diameter 78 m deep drilled groundwater well (Water well record number 3007259) located just south of the pump house. Well # 2 is a 203 mm diameter 87 m deep drilled groundwater well (Water well record number 3007430) located south of Well # 1.

Water quality monitoring results have made it apparent that naturally occurring arsenic concentrations in Well # 1 have increased, exceeding the Ontario Drinking Water Quality Standards. (O Reg 190/03)

Well # 1 has been taken out of service to the drinking water system since April 2012.

Well # 2 water quality monitoring results confirm this well meets the Ontario Drinking Water Quality Standards. (O Reg 169/03). Only Well # 2 provides water supply to the system.

The Dungannon Well Supply is designated as a Large Municipal Residential drinking-water system that obtains water from a raw water source that is groundwater. The treatment and distribution system was commissioned in 2003 and provides potable water to an estimated population of 250 residents in the village of Dungannon.

The treatment process consists of a sodium hypochlorite disinfection system and an iron sequestering system (using sodium silicate).

The rated capacity of the treatment system is 456 L/min 9 or (657 m3/day) as identified in the facility drinking water licence.

The water treatment equipment is designed to be capable of achieving, at all times, primary disinfection in accordance with the Ministry's Procedure for Disinfection of Drinking Water in Ontario, including at least 99 per cent removal or inactivation of viruses by the time the water enters the distribution system. Secondary disinfection is provided by residual chlorine from the primary disinfection process.

The distribution system does not include any storage facilities and has no fire hydrants. There are 7 blow off valves in the distribution system to accommodate flushing.

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 colourimeters. **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 checked daily using a HACH pocket colourimeter. In 2017, 365 distribution chlorine residuals were recorded.

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

Date	Average Treated Chlorine Residual (mg/L)	Average Distribution Chlorine Residual (mg/L)
Jan	1.35	1.20
Feb	1.54	1.36
Mar	1.52	1.38
Apr	1.33	1.12
May	1.27	0.98
Jun	1.30	0.94
Jul	1.29	1.04
Aug	1.36	1.04
Sep	1.42	1.04
Oct	1.34	1.07
Nov	1.41	1.17
Dec	1.47	1.33
Average	1.54	1.14
Min	0.38	0.67
Max	3.76	1.65
# Samples	8760	365

3.1.3 Turbidity

Turbidity is measured using a pocket turbidimeter. **Table 2.** provides a summary of raw and treated turbidity results. The maximum turbidity measured in the treated water was 0.41 NTU.

Table 2. – Raw and Treated Water Turbidities for Dungannon Drinking Water System

Date	Average Raw Turbidity (NTU)	Average Treated Turbidity (NTU)
Jan	8.19	0.1
Feb	8.97	0.13
Mar	9.13	0.12
Apr	0.19	0.16
May	0.13	0.10
Jun	0.17	0.16
Jul	0.22	0.22
Aug	0.18	0.12
Sep	0.21	0.11
Oct	0.21	0.15
Nov	0.22	0.15
Dec	0.21	0.12
Average	3.43	0.14
Min	0.07	0.05
Max	24	0.41
# Samples	63	239

3.2 Microbiological Sampling

3.2.1 Raw Water Samples

Raw water samples are taken every week. In 2017, a total of 105 samples were collected and analyzed for E. coli and Total Coliforms. Each E. coli result obtained was 0 cfu/100 ml in the raw water. There were two Total Coliform results >0 in 2017. A result of 1 cfu/100 mL was received on a Well #1 raw sample on January 3, 2017 and a result of 1 cfu/100 mL was received on Well #2 on April 11, 2017. **Table 3.** provides a summary of bacteriological results performed on the raw water.

Table 3. – Microbiological Results for Raw Water at Dungannon Drinking Water System

Date	E. coli			Total Coliform		
	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples ≥1
Jan	10	10	0	10	9	1
Feb	8	8	0	8	8	0
Mar	8	8	0	8	8	0
Apr	3	3	0	3	2	1
May	5	5	0	5	5	0
Jun	4	4	0	4	4	0
Jul	4	4	0	4	4	0
Aug	5	5	0	5	5	0
Sep	4	4	0	4	4	0
Oct	4	4	0	4	4	0
Nov	4	4	0	4	4	0
Dec	4	4	0	4	4	0
Total	63	63	0	63	61	2

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 52 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 - 4 cfu/100 ml. **Table 4.** provides a summary of all bacteriological results performed on treated water.

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

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	4	4	0	4	4	0	4	4	0
May	5	5	0	5	5	0	5	5	0
Jun	4	4	0	4	4	0	4	4	0
Jul	4	4	0	4	4	0	4	4	0
Aug	5	5	0	5	5	0	5	5	0
Sep	4	4	0	4	4	0	4	4	0
Oct	5	5	0	5	5	0	5	5	0
Nov	4	4	0	4	4	0	4	4	0
Dec	4	4	0	4	4	0	4	4	0
Total	52	52	0	52	52	0	52	52	0

3.2.3 Distribution System

Distribution samples are collected every week and tested for E.Coli, Total Coliform and for Heterotrophic Plate Count (HPC). In 2017, a total of 105 distribution samples were collected and analyzed for the above parameters. Most E. coli and total coliform result from the treated water were 0 cfu/100 ml. There was one instance where a 20 cfu/100 mL total coliform result was received on a distribution sample. See Section 6.0 for more information. The range of HPC results were 0 - 8 cfu/100 ml. **Table 5.** provides a summary of all bacteriological samples taken in the distribution system.

Table 5. – Microbiological Results for Dungannon Distribution System

Date	E. coli			Total Coliform			HPC		
	# 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	8	8	0	8	8	0	4	4	0
May	10	10	0	10	10	0	5	5	0
Jun	8	8	0	8	8	0	4	4	0
Jul	11	11	0	10	9	1	4	4	0
Aug	10	10	0	10	10	0	5	5	0
Sep	8	8	0	8	8	0	4	4	0
Oct	8	8	0	8	8	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	105	105	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 Dungannon Drinking Water System were collected on December 23, 2016 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 December 23, 2019. Results from 2016 can be found in **Table 6a**. Results for arsenic testing can be found in **Table 6b**.

Table 6a. – Schedule 23 Results for Dungannon Drinking Water System

Parameter	Result (µg/L)	Maximum Allowable Concentration (µg/L)
Antimony	<0.02	6
Barium	148	1000
Boron	62	5000
Cadmium	0.004	5
Chromium	0.50	50
Mercury	<0.01	1
Selenium	<0.04	10
Uranium	0.939	20

Table 6b. – Arsenic Results for Dungannon Drinking Water System

Date	Well #1 (µg/L)	Well #2 (µg/L)	Treated Water (µg/L)
28/02/2017	99.9	14.8	
11/04/2017		16.9	
18/04/2017		15.6	
26/04/2017		17.4	19.9
02/05/2017		16.8	
09/05/2017		18.1	
10/05/2017		17.9	

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16/05/2017	18.2	
16/05/2017	18.2	
23/05/2017	20.3	
31/05/2017	24.5	
14/06/2017	21.3	
20/06/2017	19.3	
23/06/2017	9.2	
27/06/2017	11.8	
04/07/2017	11.3	
11/07/2017	11.3	
19/07/2017	10.4	
26/07/2017	10.8	
02/08/2017	9.6	
08/08/2017	11.5	
15/08/2017	9.3	
22/08/2017	10.8	
29/08/2017	10.8	
06/09/2017	11.2	11.7
12/09/2017	11.5	
19/09/2017	11.4	
26/09/2017	11.6	
04/10/2017	10.8	
10/10/2017	11.8	
17/10/2017	11.5	
24/10/2017	11.2	
07/11/2017	10.2	

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21/11/2017	10.3
05/12/2017	10.0
19/12/2017	11.2

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 March 28, 2017 and one lead, pH and alkalinity sample on August 28, 2017. 2017 results can be found in **Table 7**.

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

	Lead (mg/L)	pH	Alkalinity (mg/L)
Dec-Apr		7.69	217
Jun-Oct	0.00015	7.56	211

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 December 23, 2016. All parameters were found to be within compliance. Organics will be sampled and analyzed again on or before December, 2019. 2016 sample results can be found in **Table 8**.

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

Parameter	Result (µg/L)	Maximum Allowable Concentration (µg/L)
Benzene	<0.32	5
Carbon Tetrachloride	<0.16	5
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	2
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
Malathion	<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

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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	0.00012
Picloram	<1	190

3.3.4 Trihalomethanes and Haloacetic Acids

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 2017, 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. Currently there is no MAC for HAAs. In 2017, the average THM was found to be 13.55 µg/L, which is within compliance. Refer to **Table 9**, for the summary of trihalomethane and haloacetic acid results.

3.3.5 Nitrate & Nitrite

One treated water sample is taken every three months and tested for nitrate and nitrite. In 2017, 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 HAA Results at Dungannon Drinking Water System

Date	Nitrate		Nitrite		THMs		HAAs	
	# Samples	Result (mg/L)	# Samples	Result (mg/L)	# Samples	Result (µg/L)	# Samples	Result (µg/L)
Feb	1	<0.006	1	<0.003	1	7.2	1	<5.3
May	1	<0.006	1	<0.003	1	24	1	10.8
Aug	1	<0.006	1	<0.003	1	12	1	<5.3
Nov	1	<0.006	1	<0.003	1	11	1	<5.3
Total	4		4		4		4	
Average		<0.006		<0.003		7.25		<5.3
Maximum		<0.006		<0.003		24		10.8

3.3.6 Sodium

One treated water sample is collected every 60 months and tested for Sodium. O. Reg 170/03 has set a Maximum Acceptable concentration (MAC) of 20 mg/L for Sodium which requires the Medical Office of Health be notified if the concentration exceeds the MAC. These samples were last collected on June 21, 2016 and were found to be 18.2 mg/L, which is within compliance. The next water sample for Sodium will be collected and analyzed on or before June 21, 2021.

3.3.7 Fluoride

One treated 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 November 14, 2017 and November 21, 2017 a sample was collected for this analysis. The first sample was found to have a concentration of 1.61 mg/L, which is greater than the MAC. This is due to high levels of naturally occurring fluoride in the aquifer. For more information see: <http://www.acwtownship.ca/wordpress/wp-content/uploads/2013/09/DungannonWaterQualityInformation.pdf>. The second sample came back under the MAC at 1.45 mg/L. The next water sample for Fluoride will be collected and analyzed on or before November 14, 2022.

4.0 WATER AND CHEMICAL USAGE

4.1 Chemical Usage

Refer to **Table 10**. From January 1, 2017 to December 31, 2017, **64.52** kg of sodium hypochlorite was used to ensure proper disinfection in the distribution system with an average dosage of 4.01 mg/L. 430.58 kg of sodium silicate was used in 2017 to reduce the concentration of dissolved iron.

Table 10. – Chemical Usage at Dungannon Drinking Water System

Date	Sodium Hypochlorite		Sodium Silicate
	Usage (kg)	Average Dosage (mg/L)	Usage (kg)
Jan	5.40	3.93	34.50
Feb	5.46	3.88	34.04
Mar	5.46	3.73	35.42
Apr	4.16	3.68	21.62
May	5.40	3.79	40.02
Jun	6.31	4.05	45.08
Jul	5.92	3.95	32.20
Aug	5.07	4.15	33.58
Sep	5.33	4.29	35.88
Oct	5.59	4.32	40.94
Nov	5.40	4.33	38.18
Dec	5.01	3.96	39.10
Total	64.52		430.58
Average		4.01	

4.2 Annual Flows

A summary of the water supplied to the distribution system in 2017 is provided in **Table 11**. This Table provides a breakdown of the monthly flow provided to the distribution system.

Flow meters were calibrated on July 12, 2017 by Corix and were found to be acceptable.

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

Date	Average Daily Flow (m ³)	Maximum Daily Flow (m ³)	Total Monthly Flow (m ³)
Jan	44.26	55	1372
Feb	50.32	84	1409
Mar	47.26	73	1465
Apr	37.70	80	1131
May	45.90	77	1423
Jun	51.97	101	1559
Jul	48.35	91	1499
Aug	39.39	52	1221
Sep	41.47	64	1244
Oct	41.74	64	1294
Nov	41.53	69	1246
Dec	40.81	58	1265
Average	44		
Max		101	
Total			16,128

5.0 IMPROVEMENTS TO SYSTEM AND ROUTINE AND PREVENTATIVE MAINTENANCE

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

- Well #1 abandoned on April 3, 2017 and packer installed in Well #2
- Controller re-programmed by Rick Beer of Datasoft to remove well #1 controls on May 1, 2017
- Packer in Well #2 was deflated on June 22, 2017
- Backflow preventer tested on August 22nd, 2017
- Outdoor LED light installed on November 28, 2017
- Installed new UPS on chlorine analyzer on December 13th, 2017
- Installed new CL17 chlorine analyzer on December 20th, 2017

6.0 MINISTRY OF THE ENVIRONMENT INSPECTIONS AND REGULATORY ISSUES

The Dungannon Drinking Water System was inspected twice in 2017 by The Ministry of Environment and Climate Change inspection. Each inspection was completed by Rhonda Shannon on January 13, 2017 and October 16, 2017.

There were no non-compliances noted for either inspection. The Inspection Rating for each report was 100%.

Instances of adverse water quality:

AWQI #134654 - on July 27, 2017 a total coliform result of 20 cfu/100 mL was received on the distribution system. The area was re-sampled and the results came back clear.

AWQI #135891 – on November 21, 2017 a treated water fluoride sample was received which came back as 1.61 mg/L which is over the Maximum Acceptable Concentration (MAC). A re-sample was taken that came back under the MAC at 1.45 mg/L.

7.0 MOECC 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. As well, testing requirements for HAAs and updates to standards for Carbon Tetrachloride, Benzene, Vinyl Chloride, Chlorate, Chlorite, and MCPA came into effect January 2017. Refer to **Table 12** for the new Regulatory Requirements. Subsequent phase-in dates are:

- 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	Current Requirement		Amended Requirement	
	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