1. Purpose

To document the following for the Virginiatown-Kearns Drinking Water System:

- The name of the Owner and Operating Authority; and
- Provide a description of the system, including all applicable water sources, treatment system processes and distribution system components.

2. Definitions

Distribution System - means the part of a drinking water system that is used in the distribution, storage or supply of water and that is not part of a treatment system.

Primary Disinfection - means a process or series of processes intended to remove or inactivate human pathogens such as viruses, bacteria and protozoa in water.

Secondary Disinfection - means a process or series of processes intended to provide and maintain a disinfectant residual in a drinking water system's distribution system, and in plumbing connected to the distribution system, for the purposes of:

(a) protecting water from microbiological re-contamination;
(b) reducing bacterial regrowth;
(c) controlling biofilm formation;
(d) serving as an indicator of distribution system integrity; and

includes the use of disinfectant residuals from primary disinfection to provide and maintain a disinfectant residual in a drinking water system's distribution system for the purposes described in clauses (a) to (d).

Treatment System - means any part of a drinking water system that is used in relation to the treatment of water and includes,

(a) any thing that conveys or stores water and is part of a treatment process, including any treatment equipment installed in plumbing,
(b) any thing related to the management of residue from the treatment process or the management of the discharge of a substance into the natural environment from the system, and
(c) a well or intake that serves as the source or entry point of raw water supply for the system;

3. Procedure

3.1 Drinking Water System Overview

Owner / Operating Authority

The Virginiatown-Kearns Drinking Water System is a communal ground water well supply that services the communities of Virginiatown, North Virginiatown and Kearns. It is owned by the Corporation of the Township of McGarry and operated by the Ontario Clean Water Agency (OCWA). The system consists of a Class 2 water distribution and

supply subsystem. The Ontario Clean Water Agency (OCWA) is the accredited operating authority and is designated as the Overall Responsible Operator for both the water supply and water distribution facilities. Certified municipal operators assist OCWA with by performing regular checks of system.

3.2 Source Water

Raw Water Supply

The main building for the water treatment plant/pumphouse is located approximately 6 km northeast of the Virginiatown Community Centre and approximately 500 metres east of Cheminis Road. Groundwater is supplied to the plant from production Well No. 1 (Cheminis Well) which is situated within the plant and Well No. 2 (T3/91); a standby well which is located 10 metres east of the plant.

Well No. 1 (Cheminis Well) was drilled in October 1994 to a depth of 26.2 metres. The well is "double-case" constructed which consists of a 300 mm diameter steel casing and is equipped with a vertical turbine pump assembly and fixed-rate control system to pump at a maximum rate of 1,420 L/minute. A magnetic flow meter is mounted on the 150 mm diameter discharge line from the well into the treatment process.

Well No. 2 (T3/91) was originally drilled in February 1991 and maintained as a test well. It was modified in December 2014 to service as a standby well. It is located approximately 10 m east of the well house and Well No. 1. It is drilled to a depth of 28.65 metres and equipped with a submersible deep well pump rated at 1,105 L/minute. It includes a newly installed pitless adaptor and 100 mm diameter discharge pipe that connects to the Well No. 1 discharge header at a point just before the flow meter located inside the plant.

The standby well is intended for use when production Well No.1 has been taken out of service for repair and maintenance, or in an emergency situation. The well can also be used periodically as required to ensure water quality; it is currently configured to operate once in every 60 tower filling cycles.

General Characteristics

The raw water source for the drinking water system is the groundwater supplied by production Well No. 1. The chemical results of the groundwater are consistently below the Ontario Drinking Water Quality Standards which indicates a highly suitable source for drinking water. The turbidity is low and shows very little variation. Bacteriological analysis of the raw water also indicates a source of good quality.

Well No. 1 (Cheminis): Raw Water Characteristics (based on average data from 2014 to 2019)

Characteristic	Average					
	2014	2015	2016	2017	2018	2019
E. coli (CFU/100 mL)	0	0.09	0	0	0	0
Total Coliforms (CFU/100 mL)	0	0.09	0	0	0.02	0
Turbidity (NTU)	0.22	0.45	0.40	0.28	0.48	0.15
Temperature (^{o}C)	-	8.16	7.23	10.0	6.37	7.19
pH	-	6.50	7.06	6.93	7.00	7.13

A former test well (Well No. 2-T3/91) was installed in December 2014 to act as a standby water source. The well is configured to operate once in every 60 tower filling cycles to ensure proper operations and good quality water. Sampling indicates that the water source is of good quality having low levels of total coliforms and *E.coli* and fairly low levels of turbidity.

Well No. 2 (Standby) Raw Water Characteristics (based on average data from 2014 to 2019)

Characteristic	Average					
	2014	2015	2016	2017	2018	2019
E. coli (CFU/100 mL)	-	0	0	0	>1.8	0
Total Coliforms (CFU/100 mL)	-	0	0.17	0.02	>1.8	0.02
Turbidity (NTU)	-	1.13	1.40	1.04	1.61	0.52
Temperature (^{o}C)	-	9.08	7.16	9.83	6.55	7.17
pH	-	6.69	7.02	6.88	7.05	7.07

> = greater than the laboratory's method detection limit

Common Fluctuations

Well No. 1 - Data available for the past several years indicates that the water source is stable and consistent in terms of both quality and quantity.

Well No. 2 (standby) – Data available for the past several years indicates that the water source is stable and consistent in terms of both quality and quantity.

Threats

A potential threat to the raw water source is the proximity of the well house to a railway. The Ontario Northland Railway is approximately 100 m southwest of the well house. A fuel or chemical spill from a train derailment could result in a contaminated aquifer.

Operational Challenges

According to the system's Permit to Take Water, Well No. 2, the standby well can only operate 10 hours a day and 141 days per year. If the main production well is out of service for a long period of time, the standby well may need to run for more than 10 hours per day to satisfy consumer demand and more than 141 days per year. The Ministry of the Environment and Climate Change can be notified to extend the use of the well through a temporary permit.

3.3 Treatment System Description

Water Treatment

The wells feed the water treatment system that has a maximum rated capacity of 2045 cubic meters per day (m^3/d).

The groundwater is then chlorinated using a sodium hypochlorite disinfection system, complete with a chemical feed panel consisting of duplicate chemical metering pumps (duty and standby), and a single 400 L storage tank with secondary spill containment and an outside fill line. Also integrated into the treatment process are off-site chlorine contact facilities. The first is a 6 km long by 200 mm diameter ductile iron forcemain (pipe) with no service connections that extends from the treatment plant to the elevated reservoir/tower.

Water Storage

The tower is located approximately 150 m to the west of the Virginiatown Community Centre at the intersection of Twenty-Seventh Avenue and Twenty-Seventh Street within the community of North Virginiatown. The tower has 1,300 cubic metres of usable volume for water storage. A free chlorine residual analyzer and a pressure transmitter both using a circular chart recorder are on-site and utilize the alarm communication device. An 8" Promag 50W magnetic flow meter was installed on the tower discharge line in June 2015 to continuously monitor the flow rate and daily volume of treated water that is being directed to the distribution system. Piping for filling, discharging, draining, sampling and bypassing purposes are also housed within the elevated water storage.

Emergency Power

A 56 kW diesel engine generator set and its associated fuel storage and secondary spill containment is available at the pump house for standby power.

A 15 KW diesel generator is also available outside the water tower to provide emergency power in case of a power failure.

3.4 Treatment System Process Flow Diagram

Refer to Figure 1 on page 6.

3.5 Description of the Distribution System Components

The distribution system serves an estimated population of approximately 590 people spread throughout the residential areas of Virginiatown, North Virginiatown and Kearns. The distribution system itself consists primarily of ten (10), eight (8), and six (6) inch ductile iron constructed water mains. The service life of the distribution system ranges from 60 years (for the North Virginiatown sector) to 80 years (for the Virginiatown sector). More recent watermain installations and repair sections are comprised of polyvinyl chlorite (PVC) piping. There are 48 fire hydrants connected to the distribution system to aid in fire protection. Based on the number of service connections (315 residential and 15 commercial), the system is classified as a Large Municipal Residential Drinking Water System.

3.6 Distribution System Components Maps

Refer to Figure 2 on page 7.

4. Related Documents

None

5. Revision History

Date	Revision #	Reason for Revision
Jun. 07, 2018	0	Procedure issued – Information within OP-06 (s. 3) was originally set out in main body of the Virginiatown-Kearns Drinking Water System Operational Plan (revision 7, dated September 21, 2017). New Purpose, Definitions, Procedure, Related Documents and separate Revision History sections. Updates based on revisions to DWQMS (e.g. removal of critical upstream or downstream processes, separation of systems that provide primary and/or secondary disinfection and systems that do not, for systems that are connected to another system with different owners, must now include which system is relied upon to ensure the provision of safe drinking water). Moved order of system description to follow the process (e.g., source water first, then treatment, then distribution). Updated the Raw Water Characteristics for Well 2 and updated the table with more current data. Updated Operational Challenges and changed the number of hydrants in the distribution system from 41 to 46.
Oct. 06, 2019	2	Updated how often the standby well (Well No.2) operates in Step 3.2, included the sodium hypochlorite outside fill line in Step 3.3, updated

Date	Revision #	Reason for Revision
		distribution information in Step 3.5 (new watermain composition and number of fire hydrants; 46 to 48) and include an updated distribution map.
Sep. 24, 2020	3	Included more information to the well descriptions in step 3.2, corrected the flow rate of Well No. 1 and updated the operational frequency from 30 tower cycles to 60 for Well No.2. Added the number of residential and commercial service connections is step 3.5. Updated the raw water characteristics in the tables to include average data from 2014 to 2019.

Figure 1: Virginiatown-Kearns Water Treatment Plant - Process Flow & Instrumentation Diagram

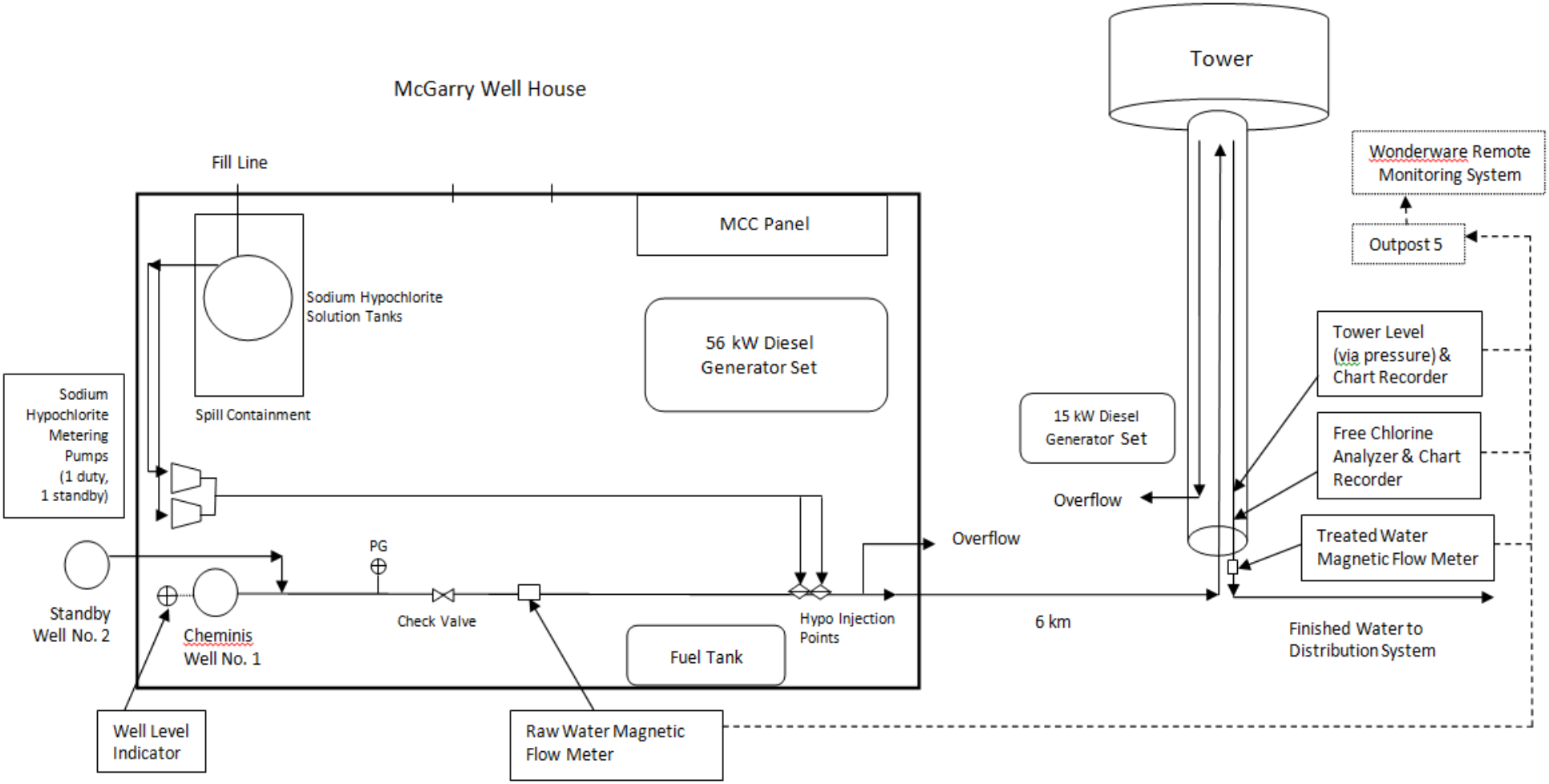

Figure 2: Virginiatown-Kearns Drinking Water System – Distribution Map