East St. Paul Water System
2019 Annual Report

May 5, 2020

Prepared for:

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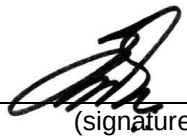
Prepared by 
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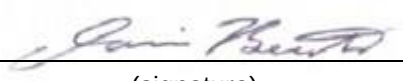
Saibal Basu, Ph.D., P.Eng.

Reviewed by 
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Jamie Brewster, M.Sc.

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1.0 WATER SYSTEM

1.1 DESCRIPTION OF WATER SYSTEM

The Rural Municipality of East St. Paul (RM) Water System consists of groundwater pumping, UV disinfection, chlorination, treated water storage, distribution pumping and distribution piping. Refer to **Figure 1.0** for a process flow diagram of the existing water system.

1.1.1 Groundwater Source

Groundwater is conveyed to the water treatment plant (WTP) using a series wells. The RM has historically operated a total of six (6) production wells. Production wells PW1, PW4, PW5, PW6 and PW8 are located east of the Floodway, off Oasis Road in the RM of Springfield. Four (4) of these production wells (PW1, PW4, PW5 and PW6) draw groundwater from a sand and gravel aquifer at a depth of approximately 24 meters below the existing grade and can provide a combined 18 L/s to the WTP. Water Rights License No. 2007-074 authorizes the withdrawal of 358,000 m^3/yr. at a maximum rate of 11.4 L/s from these four wells.

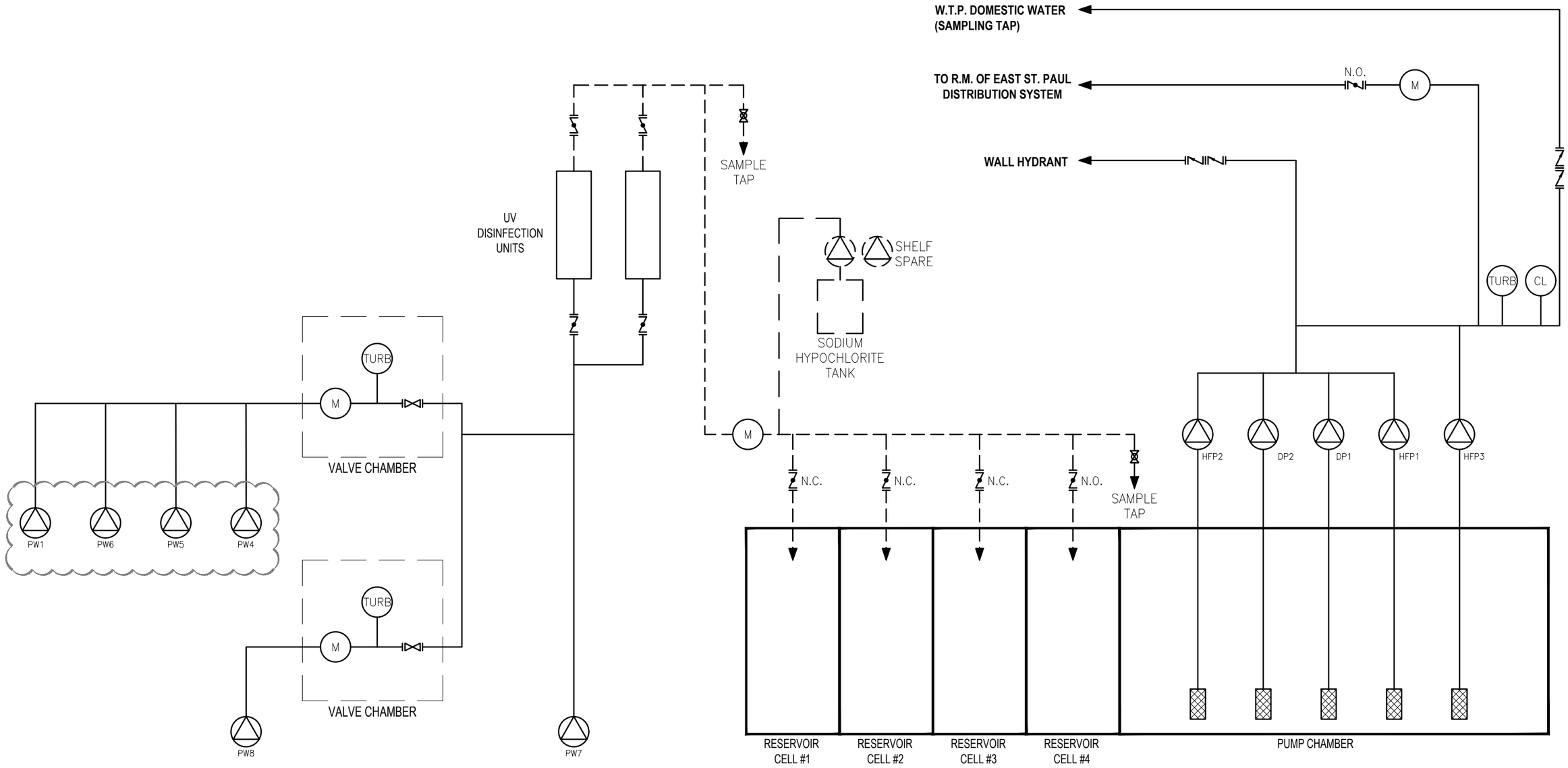
Production well PW8 withdraws groundwater from a bedrock carbonate aquifer at a depth of approximately 43 meters below grade and can provide 20 L/s to the WTP. Water Rights License No. 2005-060 authorizes the withdrawal of 195,000 m^3/yr. at a maximum rate of 20 L/s from this well. Two (2) metering chambers measure the quantity of groundwater withdrawn from each aquifer. There is also a turbidity meter in each metering chamber to monitor the raw water turbidity of the groundwater source.

A sixth production well (PW7) is located adjacent the WTP off Wenzel Street in the RM of East St. Paul. PW7 withdraws groundwater from the bedrock aquifer and can provide up to 19 L/s to the WTP. Water Rights License 2009-030 was issued July 16, 2009 and authorizes the withdrawal of 612,000 m^3/yr. at a maximum rate of 19 L/s from this well.

Production wells PW1, PW4, PW5 and PW6 have since been decommissioned in November 2019. Production wells PW7 and PW8 currently serves as the only source of drinking water for the RM. The RM is in the process of developing a new production well (PW10) at the Oasis Road well field.

1.1.2 UV Disinfection

The raw water is disinfected by ultraviolet (UV) light. The intent of the UV disinfection process is to provide three log reduction credits for *Giardia* and *Cryptosporidium*. There are two completely redundant UV disinfection units that operate in duty / standby mode. The UV dose is automatically adjusted based on raw water flow.



NOTE:
PRODUCTION WELLS PW1, PW4, PW5
AND PW6 WAS DECOMMISSIONED IN 2019

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Legend

RAW WATER	PUMP	R	RELIEF VALVE	M	METER
POTABLE WATER	PW	WELL PUMP		BUTTERFLY VALVE	TURB	TURBIDIMETER
CHEMICAL FEED	JP	JOCKEY PUMP		GATE VALVE	CL	CHLORINE ANALYZER
TREATED WATER	HFP	HIGH FLOW PUMP	N.C.	NORMALLY CLOSED		BACKFLOW PREVENTER
	DP	DOMESTIC PUMP	N.O.	NORMALLY OPEN		

Client/Project
R.M. OF EAST ST. PAUL
WATER SYSTEM

Figure No.
1.0

Title
PROCESS FLOW DIAGRAM

1.1.3 Chlorination

The groundwater entering the plant is chlorinated prior to being discharged to a reservoir for storage. Liquid chlorine (sodium hypochlorite – 12%) is dosed to the groundwater using a chemical feed pump based on flow. The chlorine dose is manually adjusted based on the chlorine residual entering the distribution system.

1.1.4 Treated Water Storage

Treated water is stored in a four (4) cell reservoir. The reservoir buffers the peak instantaneous demands in the distribution system and also provides storage for fire protection. The total active storage volume is 2,895 m^3.

1.1.5 Distribution Pumping

The distribution pumping system is made up of five (5) vertical turbine pumps. Two (2) domestic pumps (DP1 & DP2) each rated at 27 L/s, one high flow pump (HFP1) rated at 53 L/s and two high flow pump (HFP2 & HFP3) each rated at 65 L/s. The total and firm pumping capacity is 237 L/s and 172 L/s, respectively. All distribution pumps are operated by variable frequency drives that vary to maintain a distribution system pressure of 65 psi in the header in the WTP.

1.1.6 Distribution System

The distribution system is comprised of approximately 37,005 meters of PVC and HDPE. There are approximately 986 service connections in the distribution system.

1.2 DISINFECTION

The raw water source is deemed surface water under the direct influence (GUDI) of surface water and therefore is required to provide:

- 3 log reduction for *Giardia* and *Cryptosporidium*
- 4 log reduction of viruses
- 20 minutes of chlorine contact time

UV and chlorine are both relied on for disinfection. UV provides 3 log reduction for *Giardia and Cryptosporidium*, while chlorine contract time provides 4 log reduction for viruses and satisfies the 20-minute contact time requirement for bacteria.

The operating license requires a minimum UV dose of 33 mJ/cm^2 for 95% of the readings in one month to provide 3 log reduction for *Giardia and Cryptosporidium*. The effectiveness of the UV system is tracked by monitoring UV intensity and calculating the UV dose based on an operator entered UV transmittance.

The daily average, minimum and maximum UV dose is tracked and reported against the required UV dose to provide 3 log reduction of *Giardia and Cryptosporidium*.

The Drinking Water Safety Act (DWSA) also requires a minimum free chlorine residual entering the distribution system of 0.5 mg/L and a minimum free chlorine residual of 0.1 mg/L in the distribution system. The RM continuously measures the chlorine level entering the distribution system using an online analyzer and reports the reading every 5 minutes. The RM also manually measures the chlorine level entering the distribution system on a daily basis and the chlorine level at various locations in the distribution system on a biweekly basis.

The compliance with respect to monitoring the UV dose and chlorine residual is summarized in **Table 1.1.**

Table 1.1 – Disinfection Testing Performance

Description	Requirement	Compliance
Free Chlorine residual entering the distribution system based on manual daily sample	≥ 0.5 mg/L	100%
Free chlorine residual entering the distribution system based on 5-minute sample results	≥ 0.5 mg/L	99.94% [1]
Frequency of testing daily at WTP	Daily	100%
Free Chlorine residual in the distribution system	≥ 0.1 mg/L	100%
Frequency of testing in the distribution system	weekly	100%
Report Submission	Monthly	100%
UV dose	≥ 33 mJ/cm^2 (95% / month)	100%

[1] Occasions where the distribution system chlorine analyzer reported lower than 0.5 mg/L were a result of analyzer sensor maintenance or a power outage.

1.3 SAMPLING, TESTING AND REPORTING

1.3.1 Bacteriological Sampling

While the RM is required to sample the raw water entering the WTP, treated water leaving the WTP and treated water in the distribution system on a biweekly basis, the RM samples weekly in an effort to be proactive. Samples are sent to ALS Laboratory Group for Total Coliform and E. Coli testing.

Total coliform and *E. Coli* were not detected in the raw water entering the WTP, treated water leaving the WTP or the distribution samples collected weekly in 2019. Sampling results for the treated water are summarized in **Table 1.2** as follows:

Table 1.2 – Bacteriological Testing Performance

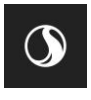
Description	Requirement	Results	Compliance
Sampling Frequency	Bi-weekly	Weekly	100%
Total Coliform	< 1 MPN / 100 mL	0	100%
E. Coli	< 1 MPN / 100 mL	0	100%

1.4 CHEMICAL AND RADIOLOGICAL PARAMETERS

The RM is required to sample and test for chemical and radiological parameters once every year. The RM completed the sampling on September 18, 2019. The results for key parameters related to the Guideline for Canadian Drinking Water Quality (GCDWQ) aesthetic objectives (AO) and the DWSA maximum acceptable concentration (MAC) are summarized in **Table 1.3**.

Table 1.3 – Raw and Treated Water Quality Data Collected in 2019 Relevant to the DWSA

Parameter	Raw	Treated	[MAC] / AO
Total Alkalinity (mg/L as $CaCO_3$)	254	243	N/A
pH	8.06	8.08	7.0 ~ 10.0
Colour (TCU)	< 5.0	< 5.0	≤ 15
Conductivity	572	558	N/A
Hardness (mg/L as $CaCO_3$)	303	288	N/A
TDS (mg/L)	350	338	≤ 500
Turbidity (NTU)	0.12	< 0.10	≤ 1
Arsenic (mg/L)	0.00016	0.00022	[0.01]
Fluoride (mg/L)	0.209	0.193	[1.5]
Lead (mg/L)	< 0.000050	0.000169	[0.01]
Nitrate-N (mg/L)	0.0548	0.0696	[10]
Uranium (mg/L)	0.00296	0.00253	[0.02]
Iron (mg/L)	< 0.010	< 0.010	0.3
Manganese (mg/L)	0.00208	0.00104	[0.12]/≤ 0.02
Lead (mg/L)	< 0.000050	0.000169	[0.005]
Sodium (mg/L)	8.15	8.68	≤ 200



Parameter	Raw	Treated	[MAC] / AO
Zinc (mg/L)	0.0044	0.0068	≤ 5.0
Chloride (mg/L)	19.6	24.1	250
Fluoride (mg/L)	0.209	0.193	[1.5]
Sulphate (mg/L)	54.6	53.5	≤ 500
Total Organic Carbon(TOC)	< 0.50	< 0.50	N/A
UVT (%)	98.2	98.2	N/A

Since 2016 the RM has been required to take quarterly samples from the distribution system (February, May, August and November) that are to be analyzed for total trihalomethanes (TTHMs) and haloacetic acids (HAAs) every second year. The RM took four (4) samples in 2019 the results of which are summarized in **Table 1.4**. Based on the data presented, both THM and HAA are well within the MAC limits.

Table 1.4 – Average Disinfection Byproduct Sampling Results (mg/L)

Parameter	March 27	May 15	August 28	November 13	Average	MAC
Total Trihalomethanes (TTHMs)	0.0132	0.0129	0.0076	0.0093	0.0108	0.1
Total Halocetic Acids (HAAs)	< 0.0054	< 0.0054	< 0.0054	< 0.0054	< 0.0054	0.08

1.4.1 Physical Parameters

There are no physical limits specified in the RM's operating license, although the new operating license requires the RM to take one sample per day of the raw water and analyze it for turbidity. Turbidity is also to be noted in the distribution system at the time of bacteriological sampling. The RM was 100% compliant with the requirement for daily raw water turbidity sampling. Based on the reported daily readings for 2019, the raw water turbidity was below the aesthetic objective of 1 NTU in all samples except for 2 days in March due to the development of new wells.

1.4.2 Microbial Parameters

The RM's operating license requires:

- 3 log reduction for *Giardia* and *Cryptosporidium*
- 4 log reduction of viruses
- 20 minutes of chlorine contact time

UV disinfection satisfies the 3 log reduction requirement for *Giardia* and *Cryptosporidium*, while chlorine contact time in the reservoir satisfies the 20 minute chlorine contact time requirement and the 4 log reduction requirement for viruses.

1.5 RECORD KEEPING

The RM retains all the testing data and stores one copy at the WTP. Copies of the chlorination and UV data are submitted to the ODW on a monthly basis. Bacteriological testing results are also copied to the Regional Drinking Water Officer.

The Office of Drinking Water (ODW) completed an audit of the water system in 2019 and the RM was notified of the results via a letter dated March 26, 2019. ODW noted that the RM did not meet the following two (2) requirements with respect to the Operating Licence:

- Failure to submit the required water samples for TTHMs
- Failure to submit the required water samples for HAAs

Due to some miscommunications, the RM did not receive the Chain of Custody forms until late 2018. ODW should note that the concerns noted in the 2019 Audit is not a compliance issue as TTHMs and HAAs testing is required every second year. The RM has been undertaking these tests on an annual basis.

1.6 DRINKING WATER SAFETY ORDERS

There were no drinking water safety orders issued to the RM in 2019 except for the two non-compliance issue noted in the Audit Report for Chemical Requirements (TTHMs and HAAs)

1.7 BOIL WATER ADVISORIES

There were no boil water advisories issued to the RM in 2019.

1.8 MAJOR EXPENSES INCURRED

PWs 1, 4, 5 and 6 was decommissioned in November 2019. PWs 7 and 8 remain as RM's drinking water source. The work was performed by Friesen Drillers. Work to develop a new well (PW 10) at the Oasis well field site has been on going.

1.9 UPCOMING EXPENSES

ESP has been working on developing PW 10. In 2019, a location was selected and a 250 mm (10 inch) casing was installed as well as pumping tests undertaken. Due to numerous complications this well has not been developed any further and is not yet connected or functional. This project is currently on hold while the RM investigates the situation further.