WATERWORKS SYSTEM ASSESSMENT

TOWN OF STRASBOURG

Spring Creek Consulting

April 2020

Water Security Agency

WATERWORKS SYSTEM ASSESSMENT ROUND 4

The Waterworks System Assessment for:

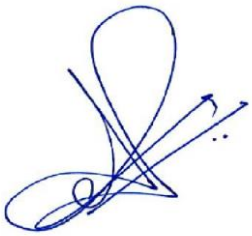
Town of Strasbourg, prepared by
(Community Name)

Spring Creek Consulting, is deemed complete, and thereby meets the
(Consultant)

requirements of the Saskatchewan Water Security Agency Standard.

Aleena James — April 27, 2020
(Name – *please print*) (Date)

Environmental Project Officer
(Position)



_____
(Signature)

Signature Sheet

This document, entitled "Waterworks System Assessment - Town of Strasbourg" was prepared by Spring Creek Consulting for the exclusive use of the Town of Strasbourg. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Spring Creek Consulting, or as required to meet a regulatory obligation.

The material in it reflects Spring Creek Consulting's best judgement, in the light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, is the responsibility of such third parties. Spring Creek Consulting accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on reliance of this report.

"I, the undersigned, declare that the information contained within this submission is, to the best of my knowledge, complete and accurate, and has been prepared in accordance with the standard for this submission as published by the Saskatchewan Water Security Agency."

Prepared by: Ben F Boots, P.Eng., FEC, Principal and Owner of Spring Creek Consulting

Ben Boots, P.Eng. FEC
Spring Creek Consulting
1344 – 7th Ave NW
Moose Jaw SK
S6H 4C9
ph. 306-631-6159

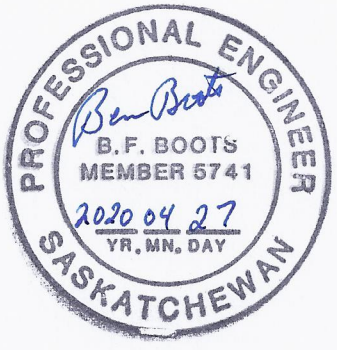


Table of Contents

List of Tables

List of Figures

List of Appendices

ABBREVIATIONS

AAF	Annual Average Day Flow
ADF	Average Day Flow
EPO	Saskatchewan Water Security Agency Environment Project Officer
GUDI	Groundwater Under Direct Influence of surface water
GPD	Gallons per Day
hp	Horsepower
IG	Imperial Gallon
IGPM	Imperial Gallons Per Minute
LPCD	Litres per Capita per Day
L/s	Litres per second
L/m	Litres per minute
kg	Kilogram
km	Kilometre
m	Metre
M3	Cubic Metre
MDF	Maximum Day Flow
mg/l	Milligram per Litre
Town	Saskatchewan Town of Towns, Culture and Sport
NTU	Nephelometric Turbidity Unit
PDD	Peak Day Demand
PLC	Programmable Logic Controller
ppm	Parts per million
PVC	Polyvinylchloride
rpm	Revolutions per minute
SCADA	Supervisory Control And Data Acquisition
SCC	Spring Creek Consulting
SDWQSO	Saskatchewan Drinking Water Quality Standards and Objectives
SWSA	Saskatchewan Water Security Agency
VFD	Variable Frequency Drive
WSA	Waterworks System Assessment
WTP	Water Treatment Plant

Executive Summary

Spring Creek Consulting was selected to conduct the 2020 Waterworks System Assessment for the Town of Strasbourg. The Water Security Agency has developed a set of Standards (EPB 233) that outline their expectations for these assessments. As required by the Standards, Ben Boots, P.Eng. FEC conducted a site visit on March 4, 2020 to inspect the waterworks and collect the information required for this report.

The Town of Strasbourg has recently increased reservoir volumes, added standby electrical generation, and refurbished all four pressure filters.

The Town of Strasbourg waterworks will require future capital investments to increase the robustness of the well water supply, and replace the cast iron piping in the distribution system.

This assessment found that the Town of Strasbourg's waterworks, in its current state, is capable of producing treated water that meets all regulated drinking water quality guidelines.

Spring Creek Consulting expresses its appreciation to Jennifer Josephson, Administrator, Tyler Hilderman (Public Works Foreman), and Keith Hilderman (Assistant Public Works Foreman), for their assistance in the preparation of this report.

Spring Creek Consulting has made several recommendations through the body of this Report. They are summarized below in the following table.

Town of Strasbourg Waterworks System Assessment - Recommendations

Issue	Report Section No.	Recommendation	Priority	Cost Estimate
Old Wells	2.1	It is recommended the Town permanently abandon these wells in accordance with Water Security Agency guidelines.	**Medium**	$20,000
Raw Water Quality	2.2	The recommendation is made that the raw water quality of both wells, but especially the Kerr Well, be analyzed in 2020, and every two to four years thereafter.	**Medium**	$500 every two years.
Raw Water Licences and Allocations	2.5	It is recommended the Town obtain a higher authorized rate of diversion for all operable wells.	**Medium (Regulatory)**	$2,000
Reservoir Assessment	3.0	It is recommended that a reservoir inspection from the hatch be done on an annual basis to check for any potential future accumulations.	**Low**	Policy or Procedure
Chemical Addition	3.2	The KMnO4 batch solution should be stored on 'drip-trays.	**Medium**	$1,000
Filtration	3.3	It is recommended that operations staff review the previous operational guidance in relation to potentially reducing the backwash flowrate and maximise treated water production.	**Medium**	Policy or Procedure
Disinfection Optimization	4.2	It is recommended that the free chlorine residual entering the distribution system should be maintained above 0.50 mg/l.	**Medium**	Policy or Procedure
Distribution Pumping	6.1	It is recommended that when replacing the distribution pumps that a different style of pump be evaluated, such as a vertical turbine, or a vertical in-line pump, which could increase the available reservoir size.	**Low**	$20,000 (New Pump)
Fire Protection	6.3	It is recommended that fire hydrant flow testing be conducted to determine the actual flowrates available at each fire hydrant.	**Low**	$10,000
Fire Protection	6.3	It is recommended that the hydrants are used to either only fill the tank on a fire truck, or supply water to the truck pump	**High**	Policy or Procedure

		with a soft hose to prevent damage to the distribution piping.		
Fire Protection	6.3	Spring Creek Consulting recommends that hydrants be operated very slowly to minimize the pressure surges that occur due to "water hammer."	**High**	Policy or Procedure
Raw Water Supply	7.1	It is recommended that when significant maintenance to the In Town well, or well pump, is next planned, that a more rigorous method of weather protection be considered.	**Medium**	$10,000
Raw Water Supply	7.1	Spring Creek Consulting recommends that the Town investigate options and plan to develop a larger back-up well that could meet present and future peak demands.	**Medium**	$60,000
Raw Water Supply	7.1	It is recommended the Town monitor the condition and supply capabilities of the Kerr Well. If a degradation in the supply becomes apparent, planning for replacement well(s) should commence more expediently.	**Medium**	Policy or Procedure
Water Quality Monitoring	7.3	It is recommended that the actual applied chemical dosages be calculated regularly to confirm chemical feed operations and note potential fluctuations in the raw water chemical demand.	**Medium (Regulatory)**	Policy or Procedure
Cast Iron piping in the Distribution System	7.5	It is recommended that the Town continue to monitor the condition of the cast iron piping in the distribution system and plan for future replacement or refurbishment.	**Medium to High**	Planning Study $25,000. Construction $5 Million over the next 10 to 20 years.
Remaining Service Life	9.0	Spring Creek Consulting does not recommend replacing the natural gas driven pump with a similar unit, but rather that an additional electric pump be acquired if needed.	**Low**	$20,000
Waterworks Cost Analysis	11.0	Spring Creek Consulting does not recommend any change to the bylaw or water rates set by the Town. The Town has been very successful in funding its water and sewer works and will be capable of financing the projects required in the next 10 years and beyond.		Policy or Procedure

1.0 Introduction

1.1 Location

The Town of Strasbourg is located approximately 83 km north of Regina. The Town has a population of 800 from the 2016 census, compared to 752 from the 2011 census, and 732 as indicated in the 2006 census.

Table 1: Strasbourg Population Growth

Census Year	Population	Increase in Population from Previous Census	Percent increase in Population from Previous Census	Annualized Growth Rate (%) from Previous Census
2016	800	48	6.4 %	1.25%
2011	752	20	2.7%	0.55%
2006	732			

The Town, in accordance with Section 35 of "The Water Regulations," 2002, requires that a Waterworks System Assessment be conducted that meets the standards specified by the provincial Water Security Agency. Spring Creek Consulting was selected to conduct the 2020 Waterworks System Assessment (Round 4) for the Town of Strasbourg. The Water Security Agency has developed a set of standards that outline their expectations for these assessments. As required by the standards, Ben Boots, P.Eng. FEC, conducted a site visit on March 4, 2020 to inspect the waterworks and collect the information required for this report. Subsequent to the site visit, additional information was obtained through email and phone conversation with the Town Administrator and Public Works staff.

1.2 Water System Overview

The main components of the water system consist of four groundwater wells, which are classified as "True Groundwater," the Water Treatment Plant (WTP), three underground concrete reservoirs and associated water distribution pipe networks. Only two of the four wells, the "Kerr Well" and the "In-Town Well" are currently connected to the waterworks. The "Kerr Well" is used almost exclusively because of the higher production capacity and lower iron concentration. The current treatment process consists of chemical oxidation followed by pressure filtration for iron and manganese removal. The chemicals utilized at the plant are potassium permanganate for iron and manganese removal and chlorine gas for primary disinfection.

1.3 Historic Problems

The following issues were noted in the 2015 Town of Strasbourg waterworks system assessment report:

- Increase the reservoir capacity as the storage volume at that time, 2015, provided by two reservoirs, was less than the recommended "twice average day demand" volume for waterworks providing fire protection. The Town commissioned a third reservoir in 2019.
- Acquire standby electrical generation to replace or supplement the natural-gas fired engine driven pump. The Town commissioned a new backup generator in December, 2017.

These items will be discussed further in the report.

2.0 Raw Water Supply System

2.1 Raw Water System Components

Figure 1 Strasbourg Kerr Well No. 3

The Town of Strasbourg waterworks owns four wells, though only two are presently used to supply the WTP. All wells are classified as "True Groundwater." The wells supplying the water treatment plant are the "Kerr Well" No. 3, drilled in 1977 and the "In-Town Well" No. 4, drilled in 1981.

The well pumps are started and stopped based on reservoir levels at the WTP. The control system communicates to the well pump electrical panels in the WTP. The well pumps are hard-wired from the panel through an underground power supply cable.

The piping from the wells utilized to supply to the water treatment plant (WTP) is buried below the frost line.

The power and pipe connections have been removed from the "CPR Well" No. 1. The power supply to the "Bender Well" No. 5 has also been disconnected. The Town has no intention of using the CPR or Bender wells in the foreseeable future. Because the CPR and Bender wells are physically inoperable, and their future use is not considered, they will not be discussed further in this report. It is recommended the Town permanently abandon these wells in accordance with Water Security Agency guidelines.

Major components of the raw water supply system are summarized in the following table:

Table 2: Raw Water System Summary (For Wells Supplying the WTP)

Description	Well No. 3	Well No. 4
Common Name	Kerr Well	In-Town Well
SWSA License Number	1082	341
Annual Allocation Acre-Feet (Imperial Gallons) (dam3) (Cubic Metres)	 40 Acre-Feet 10,850,000 Imp. Gallons 49.32 dam3 49,320 M3	 40 Acre-Feet 10,850,000 Imp. Gallons 49.32 dam3 49,320 M3
Authorized Rate of Diversion IGPM L/s	 150 IGPM 11.37 L/s	 100 IGPM 7.58 L/s
Year Completed	1990	1980
Date Last Well Rehabilitation	2005	June, 2019
Drilled Depth (Metres)	48.8 m	48.8
Casing (Length and Material)	42.8 m 200 mm PVC	34.1 m 200 mm Black Iron
Screen (Length and Material)	6 m stainless steel	6.1 m Stainless Steel
Well Pump Manufacturer	Goulds	Goulds
Year Installed	2013	2014
Motor HP	10	7.5
Pump Rated Capacity IGPM L/s	 180 IGPM 13.64 L/s	 100 IGPM 7.58 L/s
Supply Pipeline Material	Asbestos Cement	PVC
Supply Pipeline Length (Metres)	~100 metres	~20 metres
Supply Pipeline Diameter (mm)	150 mm	100 mm

2.2 Raw Water Quality

The most recent water quality information that is available is noted in the following table.

Table 3: Selected Raw Water Quality Parameters

Parameter	Units	Kerr Well (2010)	Kerr Well (2016)	In-Town Well (2005)	In-Town Well (2016)	SDWQSO
Bicarbonate	mg/l	426	422		448	No Guideline
Carbonate	mg/l	< 1	0		0	No Guideline
Chloride	mg/l	17	17.3		10.3	< 250
Hydroxide	mg/l	< 1	0		0	No Guideline
pH	pH Units	7.63	7.9	7.73	7.7	6.5 – 9.0
Conductivity	uS/cm	1170	1144		1040	< 2300
Total Alkalinity	mg/l	349	346	327	367	< 500
Total Hardness	mg/l	463	476	421	466	< 800
Nitrate	mg/l	< 0.04	< 0.2	< 0.2	< 0.2	< 45
Fluoride	mg/l	0.33	0.28		0.25	< 1.5
Total Dissolved Solids	mg/l	794	967	814	893	< 1500
Calcium	mg/l	108	110		114	No Guideline
Magnesium	mg/l	47	49		44	< 200
Potassium	mg/l	5.7	5		5	No Guideline
Sodium	mg/l	89	85	54	59	< 300
Sulfate	mg/l	280	278.1	201	202.5	< 500
Aluminum	mg/l	0.0027	<0.007		<0.007	No Guideline
Arsenic	ug/l	24	21.6	19	17.5	< 10
Barium	ug/l	31	28.2		81.5	< 1000
Boron	mg/l	0.25	0.3		0.3	< 5.0
Cadmium	ug/l	< 0.01	< 0.15		< 0.15	< 5
Chromium	ug/l	< 0.5	< 0.19		< 0.19	< 50
Copper	ug/l	< 0.2	< 8.29		< 8.29	< 1000
Iron	mg/l	0.92	1.3	1.4	0.8	< 0.3
Lead	ug/l	< 0.1	< 0.07		0.1	< 10
Manganese	mg/l	0.56	0.49	0.39	0.27	< 0.05
Selenium	ug/l	0.4	< 1.13		< 1.13	< 10
Uranium	ug/l	5.0	5.1	2.5	2.7	< 20
Zinc	ug/l	< 0.5	< 4.00		< 4.00	< 5000
Ammonia	mg/l		0.61		0.63	No Guideline

The raw water arsenic levels exceed the MAC, and iron and manganese concentrations exceed aesthetic objectives. Proper treatment is in place to address these issues as confirmed by the treated water quality reports noted in the appendix. Arsenic concentrations vary between 17.5 and 24 ug/l. Iron concentrations vary between 0.92 to 1.4 mg/l, and the manganese concentrations are reported to be between 0.39 to 0.56 mg/l. In 2019 Health Canada promulgated a new manganese guideline, as follows: "The maximum acceptable concentration (MAC) for total manganese in drinking water is 0.12 mg/L (120 µg/L). The aesthetic objective (AO) for total manganese in drinking water is 0.02 mg/L (20 µg/L)." The Water Security Agency advises that the Agency is considering adoption of this guideline. It is observed that most water quality parameters are stable between the two sample dates, except for the increase in Total Dissolved Solids in the Kerr Well. The recommendation is made that the raw water quality of both wells, but especially the Kerr Well, be analyzed in 2020, and every two to four years thereafter.

2.3 Raw Water Source Concerns

The Kerr and In-Town wells are positioned such that the risk of potential damage from vehicular traffic is very low. All well heads are above grade.

2.4 Raw Water System Supply Capacity

The monthly volumes for the Town of Strasbourg waterworks for 2015 to 2019 including the "Average" and "Peak" day volumes are shown in the following table.

A similar table and discussion, in metric units, is in the Appendix.

Table 4: Monthly Volumes 2015 to 2019 (Imperial Gallons)

Month	2015	2016	2017	2018	2019
January	1,637,700	1,583,200	1,601,700	1,829,400	2,431,000
February	1,884,600	1,541,400	1,591,400	1,665,900	2,169,400
March	2,054,000	1,695,900	1,735,400	1,969,000	2,304,000
April	1,678,000	1,736,600	1,763,900	1,879,400	2,116,100
May	2,236,100	2,022,900	2,105,500	2,800,100	2,942,200
June	2,189,100	2,027,300	2,506,500	2,759,500	2,724,600
July	2,183,500	1,834,900	3,504,800	3,151,700	2,129,800
August	1,707,800	1,779,900	2,730,400	2,759,000	2,232,200
September	1,532,300	1,780,000	2,165,000	2,087,800	1,802,600
October	1,699,700	1,834,400	1,936,400	2,269,600	2,028,900
November	1,479,700	1,509,200	1,626,500	1,904,300	1,998,500
December	1,515,900	1,611,500	1,749,800	2,397,400	1,931,700
Total	21,798,400	20,957,200	25,017,300	27,473,100	26,811,000
Peak Day Volume	238,900	106,500	145,900	174,300	195,000
Peak Day	27-Feb	01-Oct	18-Jul	17-Jul	03-Jan
Average Day Volume	59722	57417	68541	75269	73455

Note: Highlighted Values represent the largest observed values.

The maximum monthly volume recorded in the WSA report time interval was in July of 2017 at 3,504,800 IG. The peak day recorded volume is 238,900 IG from February 27, 2015, which is an anomaly, due to an extended water main leak. The second highest peak day volume is 195,000 IG from January 3, 2019 which was when the new reservoir was filled. The highest summertime peak is 174,300 IG from July 17, 2018. For the estimation of peak demand, Spring Creek Consulting will use the summertime peak of 174,300 IG.

As previously mentioned in Section 1.1, the Town has a population of 800 from the 2016 census. The peak daily consumption per person using a population of 800 is 174,300 IG divided by 800 persons, which is 218 IG per person per day. The highest average daily consumption per person using a population of 800 is 75269 IG divided by 800 persons, which is 94 IG per person per day. These values will be used in Section 10 of the report dealing with the system capacity.

The practice at the Town of Strasbourg waterworks is to backwash the filters at a maximum of 300,000 IG. This corresponds to three times per week in the summer and two times per week in the winter. It takes approximately two hours to backwash all four filters, and the piping does not allow production through one filter while another is being backwashed. The two well pumps used to supply the WTP are rated at 180 IGPM, (13.64 L/s) (Kerr) and 100 IGPM, (7.58 L/s) (In-Town) respectively. Accordingly, assuming operations for 22 hours per day, to allow for the filter backwashing time, the maximum raw water volume produced by the WTP from the Kerr Well in a single day is calculated to be 237,600 IG per day, again confirming adequate raw water system supply capacity. The maximum raw water volume produced by the WTP from the In-Town Well in a single day would be 132,000 IG per day, which would meet the average day demand, but not peak summer-time demand. It is important to confirm filter capacity, which will be done later in the report.

There is no raw water storage reservoir associated with this waterworks; given that the Town can obtain water from two different wells a raw water storage reservoir is not recommended.

2.5 Raw Water Supply License and Allocation

The raw water licenses and allocations are noted in Table 1: Raw Water System Summary. It is noted that the Kerr well is operated at a rate of 180 IGPM that is higher than the authorized maximum rate of diversion of 150 IGPM. It is recommended that the Town apply for an increase in the authorized rate of diversion. The Town's records of the water levels in the monitoring well(s) will be helpful in that application process.

3.0 Water Treatment Plant and Reservoir Assessment

The Water Treatment Plant building and original clearwell were constructed in 1961. Reservoirs were added in 1979 and 2019.

The 100 KW diesel powered standby generator is from December, 2017.

The entrance door is steel. The roof and exterior building walls are clad with metal, providing good protection from an external fire.

The building is heated by a gas unit heater. The WTP building interior is well maintained and orderly, though additional floor space for storage is minimal. The WTP is locked when not occupied. Access hatches to the external reservoirs are locked with a padlock. Site security is not an issue.

The standby electrical generation powers the water treatment plant including the Kerr and In-Town well pumps and the distribution pumps. A system depressurization does not occur if there is a power utility interruption because the electrical generation system includes an automatic transfer switch.

The Strasbourg waterworks originally had one clearwell constructed in 1961. Two reservoirs have been added, one in 1979 and a newly-commissioned reservoir in 2019. All reservoirs are underground reinforced concrete structures. All vents are screened to prevent insects entering. The clearwell is located beneath the WTP; the reservoirs are located adjacent to the WTP. The piping connecting the reservoirs to the WTP optimizes chlorine contact time. Filtered water is normally directed to the furthest (2019) reservoir. The clearwell is approximately 8.1 m x 8.2 m x 5.0 m, and the added reservoirs are both 7.4 m x 12.4 m x 4.416 m. The three distribution pumps are identical submersible units. Two of them pump water from the original clearwell, and the third can draw from the clearwell or the 1979 or 2019 reservoir. According to the pump supplier these pumps require a minimum depth of 1.14 meters to operate which results in an effective usable depth of 3.86 m.

Information summarizing the three concrete reservoirs is contained in the following table.

Table 5A: Strasbourg Treated Water Storage Reservoirs (Imperial Gallons)

Year Constructed	Total Volume IG	Usable Volume Based on Existing Distribution pumps.	Year Last Cleaned
1961	73,060	56,400	2012
1979	89,150	77,900	2018 (And interior recoated with Xypex)
2019	89,150	77,900	With construction in 2019
Total Volume	251,360 IG	212,200 IG	

Table 5B: Strasbourg Treated Water Storage Reservoirs (Cubic Metres)

Year Constructed	Total Volume	Usable Volume Based on Existing Distribution pumps.	Year Last Cleaned
1961	332.1	256.4	2012
1979	405.2	354.2	2018 (And interior recoated with Xypex)
2019	405.2	354.2	With construction in 2019
Total Volume	1,142.5 M3	964.8 M3	

The total usable reservoir volume is 964.8 M3 or 212,000 IG. The reservoir size is approximately 2.8 times the average day demand of 75,269 IG. For systems requiring fire protection, the recommended

minimum storage capacity should equal twice the average day demand. This total volume of the Strasbourg reservoirs is satisfactory for a system providing fire protection. Fire protection is discussed in more detail further in the report.

Draining the reservoir to conduct an internal inspection is beyond the scope of a waterworks system assessment. During the site visit, the condition of the clearwell was viewed from the hatch opening, and a disinfected plumb bob on a string was dropped to the floor. The reservoir has not been cleaned since 2012. A miniscule amount of foreign material was observed on the concrete floor. The small amount does not warrant draining and cleaning the reservoir at this time. It is recommended that an inspection from the hatch be done on an annual basis to check for any potential future accumulations. Additionally, if the turbidity of the water leaving the reservoirs increases, the reservoir conditions should be checked.

Figure 2 Exterior View of the 2019 Strasbourg Reservoir. (Reservoir No. 3)

3.1 Water Treatment Process Overview and Process Flow Diagram

The Water Treatment Plant facilities include manganese greensand filtration using potassium permanganate. Chlorine gas is utilized for disinfection purposes.

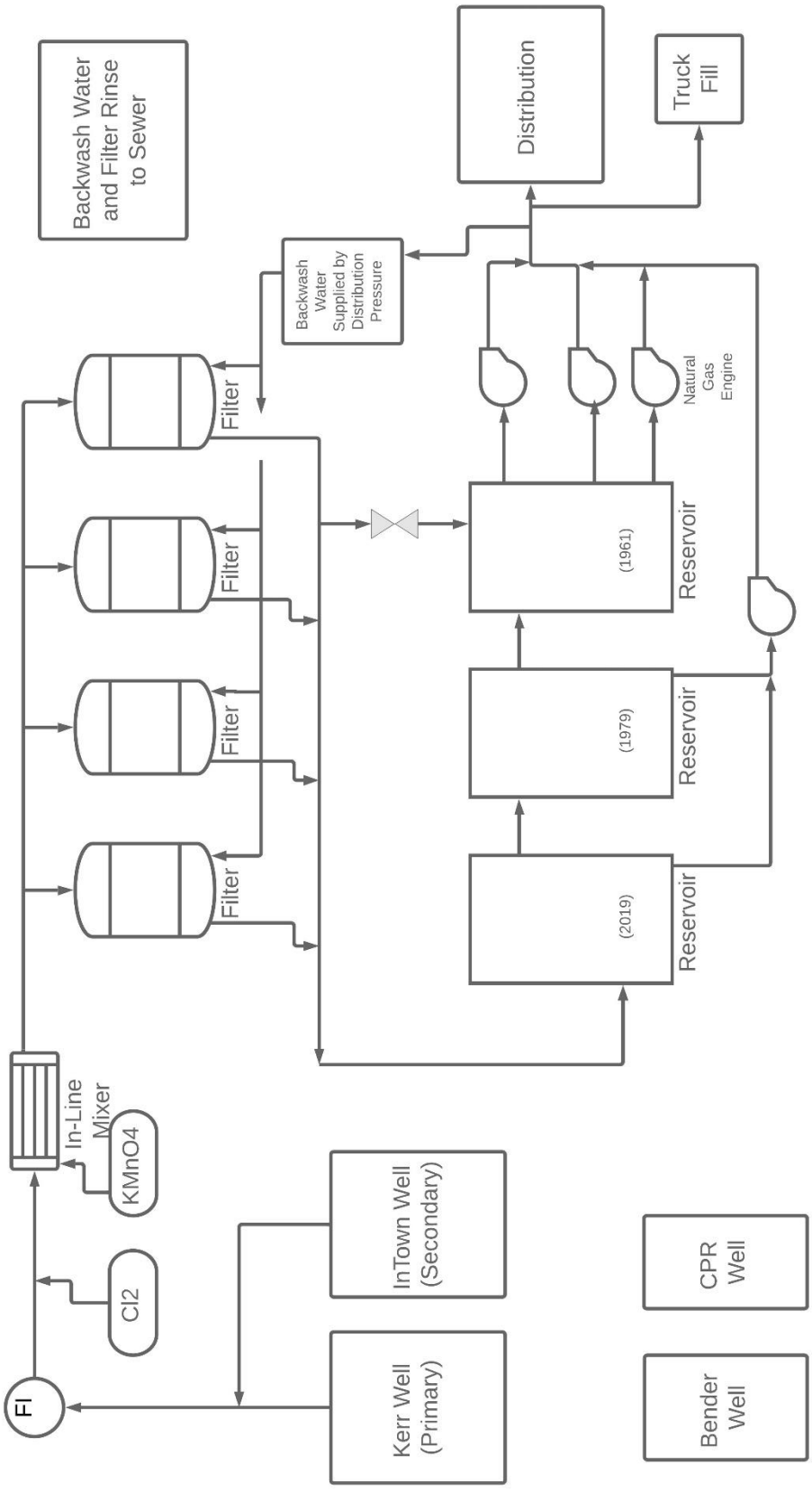
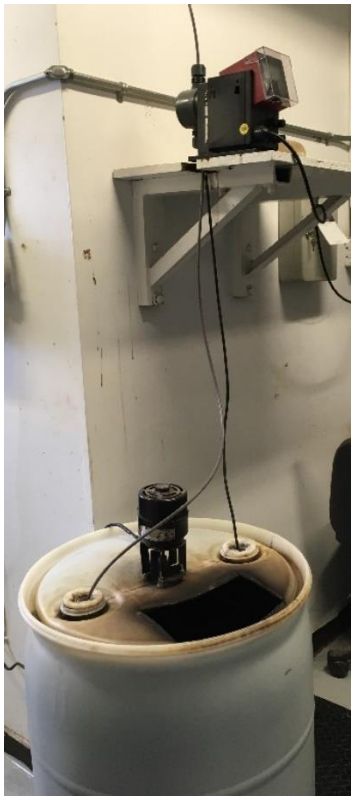


Figure 3 Process Flow Schematic

3.2 Chemical Addition – Chemical Addition System Components



Two chemicals are added in the Strasbourg WTP. Primary disinfection is achieved with chlorine gas. The chlorine gas is injected under vacuum into a water solution. The chlorine solution and potassium permanganate (KMnO4) are injected into the raw water stream ahead of filtration. The solutions are mixed with the raw water with a "Statiflo" brand 100 mm (4 inch) motionless mixer. The mixer is new from October, 2017.

The chemical feed pumps are appropriate for the dosages being injected. The potassium permanganate batch solution is not stored on 'drip trays.' The recommendation is made that the KMnO4 batch solution be stored on 'drip-trays.' Spring Creek Consulting calculated dosages from the recorded data; no chemical dosages exceed NSF 60 Maximum Usage Limits. The Town has a spare chemical feed pump.

Figure 4 Potassium Permanganate Injection System

Table 6: Chemical Addition Systems

Chemical / Injection Location	Supplied or Stored Batch Solution Concentration	Dosage Ranges	Pump
Chlorine Gas / Raw Water Header	Pure Chlorine Gas	6.5 to 7.5 mg/l	Vacuum Regulator
Potassium Permanganate / Raw Water Header	400 grams KMnO4 per 20 litres. (2% Solution)	1.1 to 1.5 mg/l	Grundfos DDA New in 2018

3.3 Filtration

The highest-capacity well, the Kerr Well, is operated typically at 180 IGPM, or 1,080 M3 per day. Through all four filters, this equates to a filtration rate of 6.2 m / hour, compared to the guideline in EPB 501 "Waterworks Design Standard" which states that manganese greensand filtration rates should be between 5 m/h (2.0 IGPM/sq. ft.) and 12.5 m/h (5.1 IGPM/sq. ft.). Production from the In-Town Well is at a lower rate. It would appear that the four filters are adequately designed for the present maximum flows, with remaining capacity. As noted later in the report, filter effluent turbidity readings meet required standards.

Table 7: Treatment Process Equipment

Equipment	Number of Units	Description
Pressure Filter	4	Tank diameter: 1,524 mm (60 inch) Filtration Area: 1.824 M2 each,7.30 M2 total. Manganese Greensand
Vessel Age	4	Filter No. 1 – 1961 Filter No. 2 – 1961 Filter No. 3 – 1985 Filter No. 4 – 1985 All filters upgraded with new internal epoxy coatings and new Stainless Steel Hubs and Laterals when media was replaced.
Media Replaced	4	Filter No. 1 – January, 2018 Filter No. 2 – June, 2016 Filter No. 3 – November, 2015 Filter No. 4 – November, 2015
Air Scour Blower	1	Dresser – Roots Universal Model 24 URAI Blower Age : New in 2000
Backwash	1	Uses Distribution Pressure

Filter backwashes are every 200,000 gallons, (909 M3) and performed manually. Given the iron and manganese concentrations in the raw water, and the filtration rate, the filter backwash frequency is appropriate. The filter backwash is initiated with air scour for approximately five minutes. Filter backwash water is supplied from distribution pump pressure. The recommended backwash rate for manganese greensand to achieve appropriate media bed expansion is approximately 35 m/h. This equates to a backwash flow rate of 17.7 L/s (234 Igpm) for 1,524 mm filters. The operational guidance

manual states a maximum backwash rate of 300 US gpm. Previous guidance was in the range of 200 to 250 IGPM or 240 to 300 USgpm. The operations staff presently backwash the filters at 290 USgpm. It is recommended that operations staff review the previous operational guidance in relation to potentially reducing the backwash flowrate and maximise treated water production. The backwash flow rate is indicated by a flow meter. After backwashing, the filter effluent is directed to waste, to stabilize the media and ensure excellent filtered water turbidity to the clearwell.

3.4 Chlorination

The chlorination disinfection, and distribution chlorine residual, are provided with injection of a chlorine gas solution into the raw water / filter influent stream ahead of the Statiflo mixer. Ideally, according to EPB 265, the injection of chlorine gas into solution should take place in the chlorine room. The applied dosage is between 6.5 to 7.5 mg/l as chlorine. The waterworks receives chlorine gas in 68 kg cylinders. The chlorination facilities have an automatic changeover system; when a cylinder runs empty the flow of chlorine starts immediately from the second connected cylinder. A cylinder lasts three to five weeks, depending on the volumes of water to be treated.

3.5 Water Treatment Residuals Management

Backwash water, and filter-to-waste water, is directed to the sanitary sewer, and then to the Town's sewage lagoons.

4.0 Disinfection Process Effectiveness

4.1 CT Calculations / Disinfection Effectiveness

Quoting from SWSA standards WSA 510 and EPB 501: The effectiveness of disinfection is demonstrated through the concept of contact time (CT), which is defined as a product of a disinfectant residual concentration(C), in mg/L and the effective disinfectant contact time (T), in minutes. The CT value is developed to relate the levels of inactivation under different operational conditions. A water treatment plant designed for the treatment of "True Groundwater" should provide 4-log (99.99%) removal and/or inactivation of viruses.

The CT calculation should be performed using assumed values representing a reasonably challenged WTP system. This means the reservoir depth used in the calculation is 50% full, rather than completely empty or completely full. A "Baffle Factor" representing flow paths between the water entering and exiting the reservoirs is used to address possible short-circuiting.

The current Permit to Operate for the Town of Strasbourg WTP requires a minimum free chlorine residual of 0.1 mg/l for treated water entering the distribution system. For this initial analysis for the Town of Strasbourg WTP, the following assumptions were made to examine if adequate CT can be provided with a free chlorine residual of 0.1 mg/l representing the regulated Permit requirement:

- The total reservoir volume, including the original clearwell and the two added reservoirs is 251,360 IG or 1,142,500 litres. When 50% full, the reservoirs would hold 125,680 IG or 571,250 litres. There are three separate vessels so the baffle factor is assumed to be 0.3.

- The Town of Strasbourg, like many waterworks, only records the volumes used once per day. It is well-known that flow rates to the distribution system vary throughout the day. For example, the amount used at 03:00 in the morning will be much less than at 7:30. The concept of a "peak demand factor" is used to try to estimate the maximum flow rate to distribution from the observed total daily volume. A "peak demand factor" of 2.5 is reasonable, if using the peak daily volume. The maximum one-day recorded flow in this review period was 238,900 IG or 1,086 M3/day. Using the "peak demand factor" of 2.5, this equates to 415 IGPM.
- A free chlorine residual of 0.10 mg/L in the treated water reservoir.
- A minimum temperature of 5°C was used for this "True Groundwater" source.
- From EPB 501, the CT required for 4 log virus removal is 8 mg/l-min at a water temperature of 5°C.

Table 8: CT Credits from Chlorine Disinfection

Parameter	Value	Units	Comments / Reference
Regulated Minimum Free Chlorine Residual	0.1	mg/l	Permit to Operate Requirement
pH	7.8		
Temperature (Assumed)	5	Degrees Celsius	
50% Full Reservoir Volume	125,680	IG	Based on drawings
Baffle Factor	0.30		WSA 510
Calculated T10 Reservoir Volume	37,700	IG	
Peak Flow to Distribution	415	IGPM	February 27, 2015 Daily flow of 238,900 IG with peaking factor of 2.5
T 10 Contact Time	90.9	Minutes	
CT (Available from Cl2 Disinfection with a 0.10 mg/l free chlorine residual)	9.09	mg/l - min	CT Required is 8

The above analysis concludes that the chlorine residual noted in the current Permit to Operate of 0.10 mg/l will achieve the required virus inactivation from chlorine disinfection.

4.2 Disinfection Process Optimization

Operating staff should ensure that for the Town of Strasbourg waterworks, the free chlorine residual in the reservoir is maintained above 0.1 mg/l to ensure virus inactivation as noted in the present Permit to Operate. The 2015 waterworks system assessment confirmed that if operating with only the original clearwell and the 1979 reservoir, a free chlorine residual of 0.1 mg/l provided sufficient CT for viral inactivation. If operating with only the Clearwell, the required free chlorine residual is 0.23 mg/l. For robustness of operations, and to ensure chlorine residuals in the distribution system are maintained, Spring Creek Consulting recommends that the free chlorine residual entering the distribution system be

maintained above 0.50 mg/l. A review of the WTP records indicates the free chlorine residual is usually maintained above 0.50 mg/l.

5.0 Water Treatment Performance

5.1 Treated Water Quality

The current Permit to Operate a Waterworks requires the Town of Strasbourg to daily analyze the free chlorine residual and the turbidity of the water entering the distribution system. The Permit also requires free chlorine residual and turbidity sampling at the same locations and frequency as for bacteriological sampling. A summary of these results is in the following table.

5.2 Distributed Water Quality

The current Permit to Operate a Waterworks requires the Town of Strasbourg to submit bacteriological samples once per week. The sample must contain zero "Total Coliform" or "Escherichia coli" organisms per 100 mL. The background bacteria levels in the sample shall be less than 200 organisms per 100 mL. Positive bacteriological samples, in some cases, do not necessarily mean that there is a serious problem with the drinking water; it can be an isolated event caused by a sampling problem or another issue. In those instances where a positive sample is detected a repeat sample is taken. If the repeat sample also indicates the presence of bacteria, additional measures will be required by the waterworks and the Water Security Agency.

For the period January, 2009 to March, 2020 no positive coliform bacteriological samples were observed in samples from the Town.

The Town is required to sample for various parameters within the "General Chemical" category and for those parameters listed in the "Chemical Health" category once every two years. The required sampling was conducted in 2016, 2018 and 2020. Sample results indicated that the provincial drinking water quality standards were not exceeded for those parameters listed in the "Chemical Health" or "General Chemical" categories.

The Drinking Water and Quality Reports give an annual summary of the treated water quality. The following table is a summary of the previous five years.

Table 9: Drinking Water Quality and Compliance Reports Summary

Year	Distribution System Free Chlorine Residual Range (mg/l)	Water Entering Distribution System Free Chlorine Residual Range (mg/l)	Turbidity Range (NTU)
2015	0.10 – 0.49	0.03 – 1.87	0.10 – 0.37
2016	0.11 – 0.53	0.12 – 0.67	0.07 – 0.74
2017	0.14 – 0.49	0.30 – 0.81	0.06 – 0.43
2018	0.13 – 0.84	0.25 – 0.88	0.06 – 0.90
2019	0.23 – 0.76	0.47 – 0.93	0.06 – 0.40

6.0 Distribution System

6.1 Distribution Pumps

Figure 6 Submersible Distribution Pump Discharge Piping

Treated water is supplied to the distribution system at 50 psi (350 kPa). There are three 10 HP electrical submersible and one engine driven (natural gas) distribution pumps. The electrical distribution pumps were upgraded in 2010 / 2011 with the addition of Goulds AquaVAR VFD's. One distribution pump was replaced in 2019.

The two distribution pumps that draw from the Clearwell operate on a "lead / lag" configuration that switches automatically every 24 hours. For most conditions, only one of these pumps operates. The second pump starts if the pressure drops below 48 psi. The third pump will start if the pressure drops below 46 psi. The third distribution pump is also used to supply filter backwash water. A summary of the distribution pumps is contained in the following table.

Table 10: Strasbourg Distribution Pumping Equipment

Pump No.	Pump Manufacturer	Type	Motor (HP)	Motor Manufacturer	Capacity (IGPM)	Capacity (litres / sec)	Age	Draws From
1	Franklin 225ST10D6X	Submersible	10	Franklin	224	17.0	2011	CW
2	Franklin 225ST10D6X	Submersible	10	Franklin	224	17.0	2019	CW
3	Franklin 225ST10D6X	Submersible	10	Franklin	224	17.0	2011	CW, Res #2, Res #3
Standby	Layne	Vertical Turbine	30		415	31.5	1961	CW

The style of distribution pump, a submersible pump contained within a sleeve, requires a minimum depth of 1.14 meters to operate, which results in a reduction in the available reservoir size. It is

recognized, though, that this style of pump is very reliable. Spring Creek Consulting recommends that when replacing the distribution pumps that a different style of pump be evaluated, such as a vertical turbine, or a vertical in-line pump, which could increase the available reservoir size.

6.2 Distribution Piping Materials

The original distribution system components were first constructed of cast iron mains in the 1960's with the original WTP. The distribution system was expanded with asbestos cement in the mid 1970's and PVC lines in the early 1980's. The Town reports that in the distribution system, there is approximately 5,600 metres of cast iron main, and approximately 1,500 meters of PVC and asbestos cement mains.

The performance and future life of the cast iron mains is starting to become a concern for the Town. The remaining service life will be discussed in sections 7.5 and 9. The costs for water main repairs are increasing, as will be discussed later in section 11. Between 2000 and 2005 five blocks (800 metres) of cast iron mains were replaced with PVC. One block (266 metres) was replaced between 2005 and 2010. There are no reports of mains being replaced between 2010 and 2015. In 2019 one block, the cast iron piping in the 200 block of Blackstock Street, was replaced.

In 2019, 13 distribution system valves were replaced. Public works staff flush the fire hydrants twice per year. Distribution valves are exercised at least annually, and a record is maintained of the exercise. Unidirectional flushing was attempted in 2019 and consideration is being given to contract this service in future years to improve the efficiency of cleaning the water mains.

6.3 Fire Protection

Figure 7 Fire Hydrant

The Town of Strasbourg reservoirs, distribution pumps and piping system, meet all provincial requirement to provide fire protection. The newly-expanded reservoirs hold approximately 2.8 times the average day demand of 75,269 IG compared to the recommended minimum storage capacity of twice the average day demand. The fire hydrants are located on 6-inch (150 mm) mains. The three distribution pumps alone are rated to supply the system with appropriate flow rates. The natural gas-powered pump provides an extra measure of redundant capacity. The entire WTP including the well pumps and the distribution pumps can be powered from the standby generator ensuring a continuous supply.

It is recommended that fire hydrant flow testing be conducted to determine the actual flowrates available at each fire hydrant. Depending on the capacity of the fire truck pump(s), if the fire truck pump suction imposes a negative pressure at the hydrant it is possible to cause damage to the distribution piping. It is recommended that the hydrants are used to either only fill the tank on a fire truck, or supply water to the truck pump with a soft hose.

The Town has 32 hydrants. Six fire hydrants were replaced prior to 2005, one was replaced in each of the following years: 2008, 2014, 2016, 2017, 2018, and 2019 and two were replaced in 2015.

The cast iron mains will become increasingly susceptible to pressure transients, or pressure surges. Spring Creek Consulting recommends that hydrants be operated very slowly to minimize the pressure surges that occur due to “water hammer.”

6.4 Backflow Prevention

The Strasbourg waterworks utilizes backflow devices on the truck fill station.

It is noted that, according to the latest EPO inspection, the Town waterworks are in compliance with respect to backflow prevention.

Figure 8 Backflow Prevention Device at Truck Fill Station

7.0 Waterworks Condition

7.1 Raw Water Supply

The well heads are in generally fair to good condition and safely protected from vehicle traffic. All well heads are above grade. The top of the In-Town well is covered with a plastic pail to provide some weather protection to the electrical connections. It is recommended that when significant maintenance to the well or well pump is next planned that a more rigorous method of weather protection be considered. Some examples could be converting the well head style to the same as the Kerr well, or covering the In-Town well with a lockable small metal building.

The Town utilizes the Kerr well almost exclusively. The rated capacity of the In-Town well and pump is lower than the peak day demand. As was recommended in the 2010 and 2015 waterworks system assessment reports, Spring Creek Consulting recommends that the Town investigate options, and plan to develop a larger back-up well, that could meet present and future peak demands.

It is recommended the Town monitor the condition and supply capabilities of the Kerr Well. If a degradation in the supply becomes apparent, planning for replacement well(s) should commence more expediently.

7.2 Water Treatment Process Equipment

The WTP process equipment is in generally good to excellent condition. The manganese green sand filters have all been extensively refurbished in the last five years. The mixer was replaced in 2017. The KMnO4 chemical feed pump was replaced in 2018. The blower that provides the air for "air-scour" is approaching 20 years of age, but this unit is operated only during filter backwashes. With continued good maintenance, the service life of the blower could be extended another 10 years.

The reservoir vent lines are screened to prevent insects entering.

7.3 Waterworks Electrical and Control Equipment

Figure 9 Ultrasonic Level Indicator

The electrical and controls equipment is in fair to good condition. The chemical feed pump is powered through an extension cord rather than being hard-wired directly from the electrical panel.

Well pumps are manually selected at the electrical panel at the WTP and then automatically controlled by an ultrasonic level controller located in the treated water reservoir. The device provides an indication of the water level in the clearwell.

The waterworks is extremely well-protected with the alarm systems. There are high and low reservoir level alarms as well as distribution high and low pressure alarms. There are building intrusion alarms, and low / high building temperature alarms. There are heat / smoke fire alarms. Monitors will detect water on the WTP floor indicative of a leak in the building. There are chlorine gas monitors and alarms in the chlorine building and the WTP. All alarms are forwarded to an automatic 'call-out' system.

Figure 10 Standby Generator

There is standby-power generation, with an automatic transfer switch, so a power interruption does not result in a system depressurization. Once per week, the generator and transfer switch are tested by operations staff running the entire WTP on the generator's power supply for about 30 minutes.

The KMnO4 chemical feed pump is set to run at a single speed to correlate to the well pump flowrates. When a well pump runs, the chemical feed pump runs. Changes in dosages are made by manually adjusting the chemical feed pump.

Figure 11 Automatic Transfer Switch

7.4 Waterworks Buildings

The WTP building exterior is built of fire-resistant materials. The buildings are well-maintained. The building is heated with thermostatically controlled natural gas heaters. The building air ventilation system is in fair to good condition.

A fire extinguisher, first aid supplies, and eye wash station are available in the WTP.

The grounds around the buildings are well maintained.

7.5 Distribution System

The submersible distribution pumps should be in good condition given their ages.

The distribution system is constructed of cast iron, asbestos cement and PVC. The cast iron mains are likely in poor to fair condition given the following three observations:

- One of the two highest volume days in the assessment period of 2015 to 2019 occurred during the winter due to a main break.
- Expenses to repair main breaks in the period 2015 to 2019 are 61% higher than the period 2010 to 2014.

The asbestos cement and PVC mains should be in fair to good condition considering their age and materials of construction. It is recommended that the Town of Strasbourg continue to monitor the condition of the cast iron piping in the distribution system and plan for future replacement or refurbishment.

8.0 Operations and Maintenance

The Town of Strasbourg Permit to Operate states the waterworks are rated Class 1 for the treatment process and Class 1 for the distribution system. The Town employs three staff certified at Class 1 for treatment and distribution, confirmed by Operator Certification Board records.

8.1 Operations Procedures and Records

The operations program for the treated water storage and distribution system includes:

- Daily analysis of the turbidity levels, total chlorine and free chlorine residuals on the water leaving the WTP,
- Daily iron and weekly manganese concentrations in the treated water,
- Backwashing the filters when target volumes are reached,
- Creating KMnO4 batch solutions, and changing chlorine cylinders as required,
- Bacteriological water samples collected once per week at various locations throughout the distribution system which are submitted for analysis at the provincial laboratory. Turbidity levels, total chlorine and free chlorine residuals are measured in the distribution system when these samples are taken,
- Daily recording the produced water volumes.
- The water level in the aquifer monitoring well(s).

The operations staff record the levels in the chlorine storage. Operations staff record the make-up volumes of the KMnO4 batch tank when a new batch is produced. It is recommended that the actual applied chemical dosages be calculated regularly to confirm chemical feed operations and note potential fluctuations in the raw water chemical demand. Operations records are kept at the WTP and Town office; digital records are maintained at the Town office.

8.2 Maintenance Procedures, Records and Equipment Manuals

Maintenance equipment and procedure manuals are located in the WTP and Town office. Maintenance records are stored at the WTP and Town office and are up-to-date.

Routine maintenance consists of checking equipment operation, treatment chemicals management, and janitorial. Major servicing of equipment, such as reservoir cleaning or well pump removal and reinstallation is performed by Town and contracted staff. Excavation for distribution pipe repairs is contracted out; the Town maintains an extensive inventory of repair materials.

8.3 Analytical Equipment

Figure 12 Strasbourg Analytical Equipment

Operators perform water tests for iron and manganese concentrations, turbidity levels, total chlorine and free chlorine residuals on the treated water.

Water quality testing equipment located in the plant includes:

- Hach 2100Q portable turbidimeter, (New in 2012)
- Hach DR 900 portable colorimeter. (New in 2020)

All of the testing equipment is appropriate for the chemical analysis required by the Permit to Operate. The units are calibrated as per manufacturer's recommendations; the current certification records were reviewed on the day of the site visit. The Town has spare water quality testing equipment.

9.0 Remaining Service Life – Major Waterworks Components

The "remaining service life" of the major components of the Town of Strasbourg waterworks are listed in the following table:

Table 11: Remaining Service Life and Estimated Capital Cost Replacement – Major Waterworks Components

Component	Year Constructed or Refurbished	Age (Years)	Typical Service Life (Years)	Assessed Condition (Years)	Remaining Service Life (Years)	Replacement Capital Cost Class "D" Estimate
Kerr Well No. 3	1990	30	30	Fair to Good	Note 1	$60,000
Kerr Well Pump	2013	7	20	Fair to Good	13	$20,000
In-Town Well No. 4	1980 Rehabilitated 2019	40	30	Fair to Good	Note 1	$60,000
In-Town Well Pump	2014	6	20	Fair to Good	14	$20,000
Supply Pipelines	1980 to 2019	1 to 40	75	Fair to Good	35 to 75	$650 per metre

WTP Building	1961	59	75	Fair to Good	16	$250,000
WTP Process Equipment	Refurbished 2015 to 2018	2 to 5	25	Good to Excellent	20 to 23	$150,000
Clearwell	1961	59	75	Fair to Good	16+ Note 2	$1,250,000
Reservoir No. 2	1979 Xypex coat 2018	2 to 41	75	Good	35+	$750,000
Reservoir No. 3	2019	1	75	Excellent	74+	$750,000
WTP Electrical and Controls	2000 to 2010	10 to 20	30	Fair to Good	10 to 20	$50,000
Electrical Distribution Pumps	2011 to 2019	1 to 9	25	Good to Excellent	16 to 24	$20,000 each
Natural Gas Distribution Pump	1961	59	35	Fair	Note 3	N/A
Cast Iron Distribution Mains (5,600 metres)	1961		50 to 75	Fair to Poor	Note 1	$900 per metre (~$5 million total)
PVC and AC Distribution Mains (1,500 metres)	1975 to 1983		60 to 75	Fair to Good		$900 per metre

Note 1: The wells and cast iron mains may be approaching the end of their useful service life.
Note 2: The Reservoirs No. 2 and 3 provide options to perform major concrete repairs to the original clearwell if that is ever required.
Note 3: Spring Creek Consulting does not recommend replacing the natural gas driven pump with a similar unit, but rather that an additional electric pump be acquired if needed.

10.0 System Capacity

10.1 Raw Water Supply Capacity

Raw water supply capacity was discussed in section 2.4. The rated capacities of the well pumps supplying the WTP are shown in the following table. The Kerr Well Pump capacity exceeds the peak demand.

10.2 Water Treatment Process Equipment Capacity

The capacity of the WTP process equipment was discussed in section 3.1. The typical design capacity of manganese greensand filters is 5 to 12 m/hr and the Town of Strasbourg filter are presently operated at 6.2 m / hour. Given the iron and manganese concentrations in the raw water, the filtration capacity is sufficient for present peak demands.

10.3 Distribution System Equipment Capacity

The capacity of the distribution pumps was discussed in section 6.1. The rated capacity of the distribution pumps is 224 IGPM or 17 L/s each; in the CT analysis of section 4, the maximum flow to distribution was calculated to be 415 IGPM. Two pumps would be required to meet this peak system demand, and the Town has three.

The Raw Water Supply, WTP Process Equipment and Distribution System capacity is summarized in the following table.

Table 12: Major Waterworks Components Capacity versus Present Peak Day Demand

Component	(IGPM)	IG or IG per day	(L/s)	(M3) or (M3 per day)
Observed Peak Day Demand (February 27, 2015)		238,900		1,086
Observed Summer Peak Day Demand		174,300		792
Calculated Peak Flow to Distribution	415		31.4	
Kerr Well Pump Capacity	180	237,600 *	13.6	1080.1 *
In-Town Well Pump Capacity	100	132,200 *	7.6	600.1 *
Manganese Greensand Filter Capacity at 5 m / hour	134	176578 *	10.1	802.6 *
Manganese Greensand Filter Capacity at 7 m / hour	187	247209 *	14.2	1123.7 *
Distribution Pumps Capacity (each)	224			
Average Day Demand		75,269 IG		342
Total Available Reservoir Size		212,000 IG		964.8 M3

Figures with a highlighted asterisk (*) are based on a 22 hour day to permit filter backwashing.

Filtration rates above 7 m / hour would not be recommended given the iron and manganese concentrations.

Referring to the above table it is noted that:

- The capacity of the Kerr well and pumps is sufficient for the current peak day demand.
- The capacity of the In-Town well and pump can meet average day demands, but not observed peak day demands.
- The four manganese greensand filters have sufficient capacity to meet peak day demands.
- The distribution pumping capacity is sufficient to meet peak day demands.

- The reservoir storage capacity is larger than the recommended minimum volume of twice the average day demand for full fire protection.

The capacity of the major components to meet projected future demands is discussed in Section 12 Sustainability.

11.0 Waterworks Costs Analysis

The Water Security Agency has published Standards for the manner in which a Waterworks Cost Analysis should be conducted in the Waterworks System Assessments (Round 4) 2020. The Water Security Agency Standards for the manner in which a Waterworks Cost Analysis should be conducted in the Waterworks System Assessments (Round 4) 2020 ask for an estimate of the capital replacement costs of any major system components that are expected to require replacement within the next 10 years. The Town has upgraded its reservoirs, water treatment plant and distribution pumping within the past 10 years. Referring back to table in section 9, it is noted that the well water supply and distribution cast iron mains are the components that would require improvements in the next 10 years.

Like many municipalities, Strasbourg combines water and sewer expenditures into a utility. The Town provided the following information with respect to revenues and expenses for the utility:

Table 13: Town of Strasbourg Expenses and Revenues

	2019	2018	2017	2016	2015
REVENUES					
Water - Well Charges	$ 12,950	$ 12,989	$ 14,810	$ 9,641	$ 9,400
Water	$ 177,523	$ 187,251	$ 180,330	$ 171,109	$ 167,960
Water - Connection Fees	$ 775	$950	$ 1,875	$ 925	$ 600
Water - Other Revenue	$ 1,140	$ -	$ 46	$ 1,515	$ -
Sewer	$ 69,602	$ 69,225	$ 69,090	$ 69,017	$ 64,020
Sewer - Cleaning/Rentals/Supplies	$ 750	$ -	$ -	$ 1,066	$ 2,775
Sewer - Infrastructure Fees	$80,490	$80,055	$79,868	$79,811	$80,205
Sewer - Lagoon Dumping Fees	$3,540	$40	$ -	$-	$ 1,440
Total Revenue	$ 346,770	$ 350,510	$ 346,018	$333,083	$ 326,400
EXPENDITURES					
Water - Salaries	$151,745	$67,136	$67,302	$53,276	$51,645
Water - Benefits	$21,514	$9,040	$9,197	$ 9,597	$ 8,997
Water - Engineering Fees	$1,750	$2,581	$ -	$-	$ 7,050
Water - Travel, Meals & Training	$1,300	$3,245	$3,786	$-	$ 1,385
Water - Insurance	$4,527	$3,470	$2,423	$638	$ 636
Water - Repairs - Water Line Breaks	$72,585	$68,065	$82,519	$26,052	$ 126,827
Water - Repairs - Catch Basin	$1,378	$25,122	$ -	$ 3,890	$ -
Water - Repairs - WTP	$13,714	$23,025	$27,822	$22,700	$27,041
Water - Water Tests	$2,681	$4,323	$1,620	$ 3,631	$ 2,422

Water - Heat/Power/Water/Phone/Alarm	$16,692	$15,533	$12,416	$11,320	$11,733
Lagoon - Power	$1,067	$1,644			
Water - Well Easement	$ 50	$50	$ 50	$ 50	$ 50
Water - Materials & Supplies	$6,358	$7,428	$3,185	$ 2,364	$ -
Water - Chemicals	$9,711	$9,257	$9,748	$11,605	$12,069
Lagoon - Supplies/Maintenance	$7,383	$24,422			
Water - Amortization	$ 72,921	$ 22,018	$ 17,684	$17,684	$17,784
Total Expenditures	$385,376	$ 286,357	$ 237,751	$162,809	$ 267,637
Profit/Loss (Revenue-Expenditures)	-$38,606	$64,153	$ 108,267	$170,274	$58,763

In most years of the review period, the water and sewer utility has operated at a reported surplus. In 2019, the Town moved to allocate a more appropriate value of their staff costs to the utility.

All water sales to residences and businesses is metered. The Town has enacted Bylaw 369 / 16 that sets water and sewer rates; a copy of the Bylaw is in the appendices. Water rates for residences effective January 1, 2020 are: $99.00 for the first 10,000 gallons every three months, plus $5.00 for each 1,000 gallons for usage above 10,000 gallons. Sewer rates are $39.00 per residence every three months. The Town levies an infrastructure rate of $45.00 per residence every three months. Other rates are set for particular utility customers. These rates allow the Town to build reserves for the required future capital expenditures.

Spring Creek Consulting does not recommend any change to the bylaw or water rates set by the Town. The Town has been very successful in funding its water and sewer works and will be capable of financing the projects required in the next 10 years and beyond. Town council and administration are fully aware of the future water and sewer capital needs.

12.0 Waterworks Sustainability

The Town of Strasbourg population has been growing. The annualized growth rate between the 2011 and 2016 census was 1.25%, and 0.55% between the 2006 and 2011 census. The recent strong growth rate may impact demands on the water and sewer utility, though it is recognized that there has not been an expansion of the distribution system infrastructure in the past five years to service the increasing population. The following analysis was completed to determine potential impacts of a 1% annualized growth in system demands, assuming a per capita consumption of 94 IG per person per day. A 1% growth rate would increase the population of Strasbourg to 920 persons by the year 2030.

Table 14: Major Waterworks Components Capacity versus Projected Future Demands

Component	(IGPM)	IG or IG per day	Corresponding Value with a 1% Growth Rate for 10 years.	Population Serviceable with Existing Equipment
Observed Summer Peak Day Demand		174,300	192,536 IG	
Calculated Peak Flow to Distribution	415		458 IGPM	
Kerr Well Pump Capacity	180	237,600 *		2,527
In-Town Well Pump Capacity	100	132,200 *		1,404
Manganese Greensand Filter Capacity at 5 m / hour	134	176578 *		1,878
Manganese Greensand Filter Capacity at 7 m / hour	187	247209 *		
Distribution Pumps Capacity (each)	224			1,373
Average Day Demand		75,269 IG	83,144	
Total Available Reservoir Size		212,000 IG		1,129 Maintaining two days of storage.

Figures with a highlighted asterisk (*) are based on a 22-hour day to permit filter backwashing.

Assuming a 1% growth rate in demands, it is reassuring to note that over the next ten years:

- The Kerr Well and pump, or a different well and pump of similar capacity, is still sufficient to meet projected future demands.
- The manganese greensand filters would need to be operated at more than 5 m / hour to meet summer peak demands; but if operated at 7 m / hour could meet those demands.
- There is a small potential that all three distribution pumps would be required to meet peak and fire flows.
- The present reservoir capacity would still provide more than the twice the average day demand.

The waterworks will require capital investment in the next five to ten years to upgrade the well water supply, and address the cast iron distribution mains. The capacity of the existing components, though, is sufficient to meet potential growing population and system demands.

13.0 Recommendations

Spring Creek Consulting has made several recommendations through the body of this Report. They are summarized below in the following table:

Table 15: Town of Strasbourg Waterworks System Assessment - Recommendations

Issue	Report Section No.	Recommendation	Priority	Cost Estimate
Old Wells	2.1	It is recommended the Town permanently abandon these wells in accordance with Water Security Agency guidelines.	**Medium**	$20,000
Raw Water Quality	2.2	The recommendation is made that the raw water quality of both wells, but especially the Kerr Well, be analyzed in 2020, and every two to four years thereafter.	**Medium**	$500 every two years.
Raw Water Licences and Allocations	2.5	It is recommended the Town obtain a higher authorized rate of diversion for all operable wells.	**Medium (Regulatory)**	$2,000
Reservoir Assessment	3.0	It is recommended that a reservoir inspection from the hatch be done on an annual basis to check for any potential future accumulations.	**Low**	Policy or Procedure
Chemical Addition	3.2	The KMnO4 batch solution should be stored on 'drip-trays.	**Medium**	$1,000
Filtration	3.3	It is recommended that operations staff review the previous operational guidance in relation to potentially reducing the backwash flowrate and maximise treated water production.	**Medium**	Policy or Procedure
Disinfection Optimization	4.2	It is recommended that the free chlorine residual entering the distribution system should be maintained above 0.50 mg/l.	**Medium**	Policy or Procedure
Distribution Pumping	6.1	It is recommended that when replacing the distribution pumps that a different style of pump be evaluated, such as a vertical turbine, or a vertical in-line pump, which could increase the available reservoir size.	**Low**	$20,000 (New Pump)
Fire Protection	6.3	It is recommended that fire hydrant flow testing be conducted to determine the actual flowrates available at each fire hydrant.	**Low**	$10,000

Fire Protection	6.3	It is recommended that the hydrants are used to either only fill the tank on a fire truck, or supply water to the truck pump with a soft hose to prevent damage to the distribution piping.	**High**	Policy or Procedure
Fire Protection	6.3	Spring Creek Consulting recommends that hydrants be operated very slowly to minimize the pressure surges that occur due to "water hammer."	**High**	Policy or Procedure
Raw Water Supply	7.1	It is recommended that when significant maintenance to the In Town well, or well pump, is next planned, that a more rigorous method of weather protection be considered.	**Medium**	$10,000
Raw Water Supply	7.1	Spring Creek Consulting recommends that the Town investigate options and plan to develop a larger back-up well that could meet present and future peak demands.	**Medium**	$60,000
Raw Water Supply	7.1	It is recommended the Town monitor the condition and supply capabilities of the Kerr Well. If a degradation in the supply becomes apparent, planning for replacement well(s) should commence more expediently.	**Medium**	Policy or Procedure
Water Quality Monitoring	7.3	It is recommended that the actual applied chemical dosages be calculated regularly to confirm chemical feed operations and note potential fluctuations in the raw water chemical demand.	**Medium (Regulatory)**	Policy or Procedure
Cast Iron piping in the Distribution System	7.5	It is recommended that the Town continue to monitor the condition of the cast iron piping in the distribution system and plan for future replacement or refurbishment.	**Medium to High**	Planning Study $25,000. Construction $5 Million over the next 10 to 20 years.
Remaining Service Life	9.0	Spring Creek Consulting does not recommend replacing the natural gas driven pump with a similar unit, but rather that an additional electric pump be acquired if needed.	**Low**	$20,000
Waterworks Cost Analysis	11.0	Spring Creek Consulting does not recommend any change to the bylaw or water rates set by the Town. The Town has been very successful in funding its water and sewer works and will be		Policy or Procedure

		capable of financing the projects required in the next 10 years and beyond.		

The recommendations from previous Waterworks System Assessment reports and the current status of the recommended actions is summarized in the table below:

Table 16: Previous WSA Recommendations – Current Status

Recommendation (From 2015 WSA Report unless noted)	Current Status
Hydrogeologist study to select aquifer for replacement of In-Town Well	Repeated in this report.
Backup well, engineering, and construction for replacement of In-Town Well	Repeated in this report.
WTP reservoir expansion	Completed.
Kerr and In-Town Well Security improvements Eventual Kerr Well replacement	Repeated in this report.
Curbed or secondary containment of chemicals	Repeated in this report.
Standby generator	Completed.
Filter pressure vessels	Completed.
Controls & instrumentation condition study	Completed.
Replace water meter – metric register	Not Completed.

14.0 Conclusions

The Town of Strasbourg has recently increased the reservoir volumes, added standby electrical generation, and refurbished all four pressure filters.

This assessment found that the Town of Strasbourg's waterworks, in its current state, is capable of producing treated water that meets all regulated drinking water quality guidelines.

The Town of Strasbourg waterworks will require capital investments in the future to increase the robustness of the well water supply, and replace the cast iron piping in the distribution system.

APPENDICES

APPENDIX A Additional Site Photographs

Blower for Backwash Air Scour

WTP Electrical Panel

Chlorine Gas Injector

Backwash Wastewater Sump - note sample collection cup

Natural Gas Engine Driven Pump

Emergency Air Supply New in 2019

Chlorine Gas Detector

Truck Fill Station

APPENDIX B Treated Water Quality Data

Strasbourg Waterworks

Location	Parameter	Sample Frequency	Sample Date	Value	Minimum Allowable Limit	Maximum Allowable Limit
Strasbourg Distribution System	Distributed Water Alkalinity Total Caco3	Every Two Years (Effective: March 10, 2004)	January 18, 2018	335 MG/L	Not Applicable*	500 MG/L*
Strasbourg Distribution System	Distributed Water Aluminum Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	1 UG/L	Not Applicable*	.1 MG/L*
Strasbourg Distribution System	Distributed Water Arsenic Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	2.4 UG/L	Not Applicable*	10 UG/L*
Strasbourg Distribution System	Distributed Water Barium Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	20.2 UG/L	Not Applicable*	1 MG/L*
Strasbourg Distribution System	Distributed Water Bicarbonate (Calcd.)	Every Two Years (Effective: March 10, 2004)	January 18, 2018	409 MG/L	Not Applicable	No Limit Established
Strasbourg Distribution System	Distributed Water Boron Total	Every Two Years (Effective: March 10, 2004)	May 23, 2012	.26 MG/L	Not Applicable*	5 MG/L*
Strasbourg Distribution System	Distributed Water Cadmium Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	< .15 UG/L	Not Applicable*	.005 MG/L*
Strasbourg Distribution System	Distributed Water Calcium Dissolved	Every Two Years (Effective: March 10, 2004)	January 18, 2018	98 MG/L	Not Applicable	No Limit Established
Strasbourg Distribution System	Distributed Water Carbonate (Calcd.)	Every Two Years (Effective: March 10, 2004)	January 18, 2018	0 MG/L	Not Applicable	No Limit Established
Strasbourg Distribution System	Distributed Water Chloride Dissolved	Every Two Years (Effective: March 10, 2004)	January 18, 2018	24.7 MG/L	Not Applicable*	250 MG/L*
Strasbourg Distribution System	Distributed Water Chlorine Free - Client	Followup Sampling (Effective: March 10, 2005)	November 29, 2010	1.04 MG/L	Not Applicable	No Limit Established
Strasbourg Distribution System	Distributed Water Chlorine Free - Client	Weekly (Effective: March 11, 2005)	October 17, 2019	.4 MG/L	.1 MG/L	No Limit Established
Strasbourg Distribution System	Distributed Water Chlorine Total - Client	Followup Sampling (Effective: March 10, 2005)	November 29, 2010	1.07 MG/L	Not Applicable	No Limit Established

Strasbourg Distribution System	Distributed Water Chlorine Total - Client	Weekly (Effective: March 11, 2005)	October 17, 2019	.57 MG/L	.5 MG/L	No Limit Established
Strasbourg Distribution System	Distributed Water Chromium Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	< .19 UG/L	Not Applicable*	.05 MG/L*
Strasbourg Distribution System	Distributed Water Coliforms Total	Followup Sampling (Effective: March 10, 2005)	November 29, 2010	0 NO/100ML	Not Applicable*	0 NO/100ML*
Strasbourg Distribution System	Distributed Water Coliforms Total	Weekly (Effective: March 11, 2005)	October 17, 2019	0 NO/100ML	Not Applicable*	0 NO/100ML*
Strasbourg Distribution System	Distributed Water Copper Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	< 8.29 UG/L	Not Applicable*	1 MG/L*
Strasbourg Distribution System	Distributed Water Escherichia, Coli	As Required (Effective: March 10, 2005)	October 17, 2019	0 NO/100ML	Not Applicable*	0 ABSEN/PRES*
Strasbourg Distribution System	Distributed Water Escherichia, Coli	Followup Sampling (Effective: March 10, 2005)	November 29, 2010	0 NO/100ML	Not Applicable*	0 ABSEN/PRES*
Strasbourg Distribution System	Distributed Water Fluoride Dissolved	Every Two Years (Effective: March 10, 2004)	January 18, 2018	.3 MG/L	Not Applicable*	1.5 MG/L*
Strasbourg Distribution System	Distributed Water Hardness Total (Calcd.) Caco3	Every Two Years (Effective: March 10, 2004)	January 18, 2018	426 MG/L	Not Applicable*	800 MG/L*
Strasbourg Distribution System	Distributed Water Iron Total	Every Two Years (Effective: March 10, 2004)	May 23, 2012	.02 MG/L	Not Applicable*	.3 MG/L*
Strasbourg Distribution System	Distributed Water Lead Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	.1 UG/L	Not Applicable*	.01 MG/L*
Strasbourg Distribution System	Distributed Water Magnesium Dissolved	Every Two Years (Effective: March 10, 2004)	January 18, 2018	44 MG/L	Not Applicable*	200 MG/L*
Strasbourg Distribution System	Distributed Water Manganese Total	Every Two Years (Effective: March 10, 2004)	May 23, 2012	.01 MG/L	Not Applicable*	.05 MG/L*
Strasbourg Distribution System	Distributed Water Ph	Every Two Years (Effective: March 10, 2004)	January 18, 2018	7.3 PH UNITS	6.5 PH UNITS*	9 PH UNITS*

Strasbourg Distribution System	Distributed Water Selenium Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	< 1.13 UG/L	Not Applicable*	.01 MG/L*
Strasbourg Distribution System	Distributed Water Sodium Dissolved	Every Two Years (Effective: March 10, 2004)	January 18, 2018	77 MG/L	Not Applicable*	300 MG/L*
Strasbourg Distribution System	Distributed Water Specific Conductance	Every Two Years (Effective: March 10, 2004)	January 18, 2018	1138 USIE/CM	Not Applicable	No Limit Established
Strasbourg Distribution System	Distributed Water Total Dissolved Solids (Calcd.)	Every Two Years (Effective: March 10, 2004)	January 18, 2018	936 MG/L	Not Applicable*	1500 MG/L*
Strasbourg Distribution System	Distributed Water Turbidity - Client	Followup Sampling (Effective: March 10, 2005)	November 29, 2010	.83 NTU	Not Applicable	No Limit Established
Strasbourg Distribution System	Distributed Water Turbidity - Client	Weekly (Effective: March 11, 2005)	October 17, 2019	.18 NTU	Not Applicable	No Limit Established
Strasbourg Distribution System	Distributed Water Uranium Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	4.9 UG/L	Not Applicable*	20 UG/L*
Strasbourg Distribution System	Distributed Water Zinc Total	Every Two Years (Effective: March 10, 2004)	January 18, 2018	< 4 UG/L	Not Applicable*	5 MG/L*

APPENDIX C Collected Well Information

Water Well Driller's Report

23-Mar-2020
WSaskWWDR01

Well Name: **STRASBOURG** IN-TOWN Well WWDR #: **065337**

Well Location

Land Location	**SW-25-024 -22 -W2**	Location of Well (in Quarter)		
LSD	**00**	**500**	ft from N/S Boundary	**S**
Reserve		**100**	ft from E/W Boundary	**W**
RM:				
NTS Map:	**72P00**	Major Basin:	**05**	
Elevation (ft)	**1800**	SubBasin:	**23**	
Aquifer	**Glac**			

Well Information

Driller	**MITCHELL DRILLING (1979) LTD**
Completion Date	**1980.10.01**
Hole #	**001**
Install Method	**Drilled**
Borehole Depth (ft)	**160**
Bit Dia (in)	**6.2**
Water Level	**57**
Flowing Head	**0**
Water Use	**Municipal**
Well Use	**Withdrawal**
Completion Method	**Well Screen And Gravel Pack**
E-Log	**Yes**

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Material
112	**110**	**8**	**Black Iron**
0	**0**	**0**	
0	**0**	**0**	

Well Screens

Length (ft)	Bottom (ft)	Dia (in)	Slot (in)	Material
20	**132**	**8**	**30**	**Stainless Steel**
0	**0**	**0**	**0**	
0	**0**	**0**	**0**	

Pump Test

Draw Down	**38**	ft
Duration	**10**	hrs
Pumping Rate	**100**	igpm
Temperature	**42**	deg. F
Rec. Pumping Rate	**100**	igpm

Lithology List

Depth (ft):	Material	Colour	Description
5	Gravel	Unknown	Oxidized
18	Silt	Brown	Oxidized
23	Sand	Brown	Fine-medium
29	Till	Grey	Oxidized
37	Sand	Brown	Dry
58	Silt	Brown	Oxidized
65	Silt	Brown	Sandy
66	Silt	Brown	Oxidized
77	Till	Brown	Sandy
105	Till	Grey	Unoxidized
110	Till	Grey	Unoxidized
115	Sand	Grey	Clean
131	Gravel	Grey	Fine-medium
160	Till	Grey	Unknown

Water Well Driller's Report

23-Mar-2020
WSaskWWDR01

Well Name: STRASBOURG KERR 1977 Well WWDR #: 050651

Well Location

Land Location	SE-26-024 -22 -W2	Location of Well (in Quarter)	
LSD	00	0	ft from N/S Boundary
Reserve		0	ft from E/W Boundary
RM:			
NTS Map:	72P00	Major Basin:	05
Elevation (ft)	1775	SubBasin:	23
Aquifer			

Well Information

Driller	HAYTER DRILLING LTD
Completion Date	1977.05.26
Hole #	001
Install Method	Drilled
Borehole Depth (ft)	160
Bit Dia (in)	9.9
Water Level	34
Flowing Head	0
Water Use	Municipal
Well Use	Withdrawal
Completion Method	Well Screen And Gravel Pack
E-Log	Yes

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Material
107	107	8	Steel
3	123	5	Black Iron
10	110	5	Steel

Well Screens

Length (ft)	Bottom (ft)	Dia (in)	Slot (in)	Material
10	120	6	40	Stainless Steel
10	133	6	40	Stainless Steel
0	0	0	0	

Pump Test

Draw Down	25	ft
Duration	2	hrs
Pumping Rate	150	igpm
Temperature	43	deg. F
Rec. Pumping Rate	150	igpm

Lithology List

Depth (ft):	Material	Colour	Description
2	Silt	Brown	Unknown
4	Sand	Unknown	Unknown
15	Till	Brown	Unknown
24	Silt	Brown	Unknown
26	Gravel	Unknown	Unknown
27	Till	Brown	Unknown
54	Sand	Unknown	Unknown
57	Silt	Brown	Unknown
60	Clay	Brown	Unknown
71	Silt	Brown	Unknown
105	Sand	Unknown	Fine
107	Silt	Grey	Unknown
109	Till	Grey	Unknown
114	Sand	Unknown	Coarse

117	Silt	Brown	Unknown
132	Sand	Unknown	Coarse
135	Till	Brown	Unknown
160	Till	Grey	Unknown

APPENDIX D

Section 2.4 in Metric Units

The monthly volumes for the Town of Strasbourg waterworks for 2015 to 2019 including the "Average" and "Peak" day volumes are shown in the following table.

A similar table, in Imperial Gallons, is in the body of the report.

Table 2: Monthly Volumes 2015 to 2019 (Cubic Metres)

Month	2015	2016	2017	2018	2019
January	7,445	7,197	7,281	8,316	11,051
February	8,567	7,007	7,235	7,573	9,862
March	9,337	7,710	7,889	8,951	10,474
April	7,628	7,895	8,019	8,544	9,620
May	10,165	9,196	9,572	12,729	13,375
June	9,952	9,216	11,395	12,545	12,386
July	9,926	8,341	15,933	14,328	9,682
August	7,764	8,091	12,412	12,542	10,148
September	6,966	8,092	9,842	9,491	8,195
October	7,727	8,339	8,803	10,318	9,223
November	6,727	6,861	7,394	8,657	9,085
December	6,891	7,326	7,955	10,899	8,782
Total	99,096	95,271	113,729	124,893	121,883
Peak Day Volume	1,086	484	663	792	886
Peak Day	27-Feb	01-Oct	18-Jul	17-Jul	03-Jan
Average Day Volume	271	261	312	342	334

Note: Highlighted Values represent the largest observed values.

The maximum monthly volume recorded in the WSA report time interval was in July of 2017 at 15,933 M3. The peak day recorded volume is 1,086 M3 from February 27, 2015, which is likely an anomaly. The second highest peak day volume is 886 M3 from January 3, 2019 which is also likely an anomaly. The highest summertime peak is 792 M3 from July 17, 2018. For the estimation of peak demand, Spring Creek Consulting will use the summertime peak of 792 M3.

As previously mentioned in Section 1.1, the Town has a population of 800 from the 2016 census. The peak daily consumption per person using a population of 800 is 792 M3 (or 792,000 Litres) divided by 800 persons, which is 990 Litres per person per day. The highest average daily consumption per person using a population of 800 is 342 M3 (or 342,000 Litres) divided by 800 persons, which is 422 Litres per person per day. These values will be used in Section 10 of the report dealing with the system capacity.

The practice at the Town of Strasbourg waterworks is to backwash the filters at a maximum of 945 cubic metres. This corresponds to three times per week in the summer and two times per week in the winter. It takes approximately two hours to backwash all four filters. The two well pumps used to supply the WTP are rated at 13.64 L/s (Kerr) and 7.58 L/s (In-Town) respectively. Accordingly, assuming operations

for 22 hours per day, to allow for the filter backwashing time, the maximum raw water volume produced by the WTP from the Kerr Well in a single day is calculated to be 1,080 M3 per day, again confirming adequate raw water system supply capacity. The maximum raw water volume produced by the WTP from the In-Town Well in a single day would be 600 M3 per day. It is important to confirm filter capacity, which will be done later in the report.

APPENDIX E Bylaw 369 / 16 Policy #UT-001

Town of Strasbourg

BYLAW NO. 369/16
WATER AND SEWER RATES BYLAW

A BYLAW OF THE TOWN OF STRASBOURG, IN THE PROVINCE OF SASKATCHEWAN, TO FIX THE RATES TO BE CHARGED FOR THE USE AND CONSUMPTION OF WATER, BY WAY OF RENT OR SERVICE CHARGE FOR THE USE OF SEWER, AND BY WAY OF SERVICE CHARGE FOR INFRASTRUCTURE

The Council of the Town of Strasbourg in the Province of Saskatchewan enacts as follows:

1. The charges to be paid by the water consumer whose water service has been turned on shall be those set out in Schedule "A" attached; provided, however, that the minimum shall be payable in every case whether or not any water is consumed.

2. The bulk water rates for the Water Treatment Plant at 408 Gastle Street shall be those set out in Schedule "A" attached.

3. Persons who own or occupy premises drained or that are by bylaw required to be drained in the sewer shall pay for such services a rental rate or service charge in accordance with Schedule "B" attached.

4. Persons who own or occupy premises drained into the waterworks and sanitary sewer system shall pay an infrastructure fee in accordance with Schedule "C" attached.

5. Accounts for waterworks service and/or sanitary sewer service shall cover a period of three (3) successive months, and shall be rendered on or before the fifteenth (15) of the month next following such period. Accounts shall be paid within a period of forty-five (45) days from the date on which such accounts are rendered. If an account is not paid within the said period of forty-five (45) days, the water service will be cut off. When the water service is cut off, it shall not be resumed until all arrears have been paid in full, together with a fee of $150.00 to cover the expenses of turning the water off and on again.

6. If the water supply is shut off to the premises of a consumer for infringement of the provisions of this Bylaw, same shall not be turned on until all penalties, fees, rates, charges, and arrears, if any, have been paid in full.

7. Consumers may be permitted to pay for water, sewer, and/or infrastructure charges in advance of billings or the date that such billings are due, however, that consumer shall not receive any discount off the base rate or total billing.

8. A decision of the court that one or more of the provisions of this Bylaw are invalid in whole or in part does not affect the validity, effectiveness or enforceability of the other provisions or parts thereof with respect to this Bylaw.

9. Bylaw No. 337/13, being a Bylaw to Fix the Rates to be Charged for the Use and Consumption of Water and to Fix the Rates to be Charged by Way of Rent or Service Charge for the Use of Sewer is hereby repealed.

10. The rates, charges, tolls or rents contained in this Bylaw shall come into force and take effect on the date of final approval being issued by the Local Government Committee of the Saskatchewan Municipal Board.

TOWN OF STRASBOURG INCORPORATED A.D. [SEAL] 1907 SASKATCHEWAN

Mayor

Administrator

Certified to be a true copy of Bylaw No. 369/16 adopted by the Council of the Town of Strasbourg, on the 12th day of October, 2016.

Administrator

TOWN OF STRASBOURG INCORPORATED A.D. [SEAL] 1907 SASKATCHEWAN

SCHEDULE "A" to Bylaw 369/16
Water Rates

1. **Effective January 1, 2017**

Water rates per three (3) month period:	
0 to 10,000 gallons	$90.00
10,001 gallons or more	$5.00 per 1,000 gallons

2. **Effective January 1, 2018**

Water rates per three (3) month period:	
0 to 10,000 gallons	$93.00
10,001 gallons or more	$5.00 per 1,000 gallons

3. **Effective January 1, 2019**

Water rates per three (3) month period:	
0 to 10,000 gallons	$96.00
10,001 gallons or more	$5.00 per 1,000 gallons

4. **Effective January 1, 2020**

Water rates per three (3) month period:	
0 to 10,000 gallons	$99.00
10,001 gallons or more	$5.00 per 1,000 gallons

5. **Bulk Water Rates at 408 Gastle Street**
   $4.00 per 100 gallons

SCHEDULE "B" to Bylaw 369/16
Sewer Rates

1. **Effective January 1, 2017**

Sewer rates per three (3) month period:

Apartments, multiple housing	$39.00 per unit
Hotel	$78.00
Last Mountain Pioneer Home	$156.00
Laundromat	$78.00
Residences	$39.00
School	$156.00
All others	$39.00

SCHEDULE "C" to Bylaw 369/16
Infrastructure Rates

1. **Effective January 1, 2017**

Infrastructure rates per three (3) month period:

Apartments, multiple housing	$45.00 per unit
Hotel	$90.00
Last Mountain Pioneer Home	$180.00
Laundromat	$90.00
Residences	$45.00
School	$180.00
All others	$45.00

Town of Strasbourg

Policy #UT-001

Policy Title: 2018 WATERWORKS RATE & CAPITAL INVESTMENT STRATEGY POLICY

Policy Objective	This policy is an annual requirement of *The Municipalities Regulations* whereby the municipality needs to submit to the Minister of Government Relations and to the ratepayers, a policy regarding the water, sewer, and infrastructure rates, a utility capital investment strategy, and financial information by September 1 of year.
Authority	Resolution #163/2018 Amended #182/2019
Supporting Bylaw	Bylaw #369/16
Related Policy	n/a

Legislative Authority:

The Municipalities Act Regulations

Information to be provided to the consumers and to the minister

55(1) On or before September 1 of each year, every council must provide the following information to its consumers respecting the municipality's municipal waterworks:

(a) A statement of the municipality's revenues, expenditures, and debt payments for the previous calendar year;

(b) A comparison of the municipality's revenues to the municipality's expenditures and debt payments, expressed as a ratio in accordance with the following formula:

$$\frac{R}{(E + D)}$$

where:

R is the municipality's revenues;
E is the municipality's expenditures; and
D is the municipality's debt payments;

(c) Any explanation of the ratio mentioned in clause (b) that the municipality considers necessary.

Waterworks Rates & Fees – As per Bylaw #369/16

- Adopted by resolution on October 12, 2016.
- Approved by the Local Government Committee of the Saskatchewan Municipal Board on October 21, 2016.
- Under the waterworks rate policy resolution, the following schedule from Bylaw #369/16 set the water rates as follows:

SCHEDULE "A" to Bylaw #369/16
Water Rates

1. **Effective January 1, 2017**

Water rates per three (3) month period:

0 to 10,000 gallons	$90.00
10,001 gallons or more	$5.00 per 1,000 gallons

2. **Effective January 1, 2018**

Water rates per three (3) month period:

0 to 10,000 gallons	$93.00
10,001 gallons or more	$5.00 per 1,000 gallons

3. **Effective January 1, 2019**

Water rates per three (3) month period:

0 to 10,000 gallons	$96.00
10,001 gallons or more	$5.00 per 1,000 gallons

4. **Effective January 1, 2020**

Water rates per three (3) month period:

0 to 10,000 gallons	$99.00
10,001 gallons or more	$5.00 per 1,000 gallons

5. **Bulk Water Rates at 408 Gastle Street**

$4.00 per 100 gallons

SCHEDULE "B" to Bylaw #369/16
Sewer Rates

1. **Effective January 1, 2017**

Sewer rates per three (3) month period:

Apartments, multiple housing	$39.00 per unit
Hotel	$78.00
Last Mountain Pioneer Home	$156.00
Laundromat	$78.00
Residences	$39.00
School	$156.00
All others	$39.00

SCHEDULE "C" to Bylaw #369/16
Infrastructure Rates

1. Effective January 1, 2017

Infrastructure rates per three (3) month period:	
Apartments, multiple housing	$45.00 per unit
Hotel	$90.00
Last Mountain Pioneer Home	$180.00
Laundromat	$90.00
Residences	$45.00
School	$180.00
All others	$45.00

Since the original waterworks policy was implemented on October 12, 2011, the current Council was to review the policy to ensure that waterworks revenues covered waterworks expenditures on an annual basis. This current waterworks policy is to reflect that Council is working to maintain a self-sustaining waterworks operation, whereby the users pay for the costs of the service. Council wants the waterworks operation to not compete with other key municipal financial demands under the municipal general revenue fund. By ensuring that waterworks rates are successfully covering all expenditures, the Town can maintain safe, quality drinking water for the residents without the need to sacrifice other funding areas of the municipality. The rates will also influence consumer demand, which will aid with water conservation within the municipality.

With the quarterly increases, the water rate has increased 4.00% per year since original the implementation of the policy in October of 2011. The proposed minimum quarterly rate will continue to increase 4.00% per year for the next four years to accommodate rising costs of water treatment plant maintenance and to ensure that enough capital funds are available for the planned projects. This waterworks increase comes at the recommendation from the *2015 Waterworks System* Assessment completed by Stantec Consulting Ltd.

In July of 2013, Council implemented an infrastructure rate that has remained unchanged for the last six (6) years. This infrastructure rate was started to put away reserve funds for future infrastructure expenditures. Going forward over the next four years, the infrastructure fee will remain unchanged and will continue to be levied for the purpose of capital reserves.

At January 1, 2019, the minimum water rate increased to $96.00 per 10,000 gallons, which is the base rate for three (3) months. If over 10,001 gallons, $5.00 per 1,000 gallons is applied. The overage charge was set January 14, 2004 and will remain unchanged for the near future. The chart below lists the planned increases in the upcoming years:

Date	**Minimum Quarterly Rate**	**Overage Charge**
January 1, 2020	$99.00	$5.00 per 10,000 gallons
January 1, 2021	$102.00	$5.00 per 10,000 gallons
January 1, 2022	$105.00	$5.00 per 10,000 gallons
January 1, 2023	$108.00	$5.00 per 10,000 gallons
January 1, 2024	$111.00	$5.00 per 10,000 gallons

Currently, the minimum water rate generates enough waterworks revenues to cover the waterworks operating costs, with 0% of the operating costs being covered by monies from the

general funds. Waterworks operating costs, or expenditures, includes waterworks' staff salaries, benefits, and training, power, telephone, fuel, heat, alarm system, internet, insurance, chemicals, repairs, maintenance, supplies, etc.

The chart below lists the revenue and expenditures from the past five (5) years for our utility service, as outlined in Schedule 4 of our audited financial statements:

Year	Revenue	Expenditure	Difference
2014	$345,145	$206,927	+$138,218
2015	$347,757	$267,636	+$80,121
2016	$398,206	$163,099	+$235,107
2017	$2,978,350	$247,940	+$2,730,410
2018	$396,457	$325,741	+70,716

The surplus gained from the revenues over the expenditures is put into infrastructure reserves set out for water treatment plant upgrades and general infrastructure upgrades.

Waterworks Capital Investment Strategy

The objective of the waterworks capital investment strategy is to address anticipated waterworks infrastructure maintenance. Immediate drinking water infrastructure problems and future infrastructure replacement objectives are needed to be done in a timely fashion so as to ensure the municipal waterworks provides safe drinking water to residents and businesses. The capital investment strategy uses the recommendations outlined in the *2015 Waterworks System Assessment*, which is required by Water Security Agency, as well as the Town's newly created *Asset Management Plan* for infrastructure planning.

As noted above, in July of 2013, Council implemented an infrastructure levy that was a uniform amount applied to all residences and businesses for the express purpose of building up funds in capital reserves. As well, Council has been continually increasing the water rates to help add more funds annually into the reserves, but keeping in mind the rising costs of the water treatment plant operations.

Capital plans have been established to address the waterworks infrastructure deficiencies and replacements as identified and prioritized in the *2015 Waterworks System Assessment* to ensure safe drinking water for the community. The current and future waterworks capital plans and planned sources of funding are as follows:

Project	Planned Year of Completion	2019 Cost	Future Cost*	Source of Funding
WTP Reservoir Expansion	2019	$700,000		Reserves & Loans
In-Town Well Repair	2019	$15,000		General Expenditure
Remote Water Meter Reading System	2019-2021	$65,000	$130,000 (Year 2 and 3)	General Expenditure
Town-Wide Valve Replacements	2019	$60,000		General Expenditure

200 Block Blackstock Street Water Main Replacement	2019	$75,000		General Expenditure
Hydrogeologist Study	2020		$18,727	General Expenditure
Water Meter Replacement in WTP	2020		$1,872	General Expenditure
Secondary Containment of Chemicals	2020		$1,224	General Expenditure
Filter Pressure Valves	2021		$312,120	Reserves & Grants
Kerr Well Replacement	2024		$218,484	Reserves & Grants

**Assuming 2% rate of inflation per year*

While many of the items listed are requiring reserves and grants for funding, the implementation of these projects will depend solely on the amount of reserve money from year to year. As well, if the Town is successful at receiving grant money from provincial and federal sources, this would drastically change the timeline as to when these projects could be completed.

Annual Financial Overview

Total 2018 waterworks revenues (as reported in the Financial Statement) - **$396,457**

Total 2018 waterworks expenditures (as reported in the Financial Statement, which includes interest paid on waterworks infrastructure loans) - **$325,741**

Total debt payments on waterworks infrastructure loans - **$0**

Comparison of waterworks revenues to expenditures plus debt payments, expressed as ratio

$$\frac{\$396,457}{\$325,741 + \$0} = 1.22$$

Amount of 2018 waterworks revenues transferred out of the utility, specifying where the revenues were transferred - **$90,000 transferred into the Water and Sewer Infrastructure Reserve; $50,000 transferred into Water Treatment Plant Upgrade Reserve**

Amount of 2018 supplementary funding required to cover expenditures, specifying the source of the supplementary funding from the general revenue fund - **$0**

Reserves

Reserves available for waterworks capital infrastructure - **$796,356**

Attachments

- *2015 Waterworks System Assessment* under Section 35 of *The Water Regulations, 2002.*

Round 4 Waterworks System Assessment Summary

Waterworks: Town of Strasbourg | Owner(s): Town of Strasbourg

Env. Project Officer: Aleena James | Summary Completion Date: Apr-20

Population: Full Time: 800 | Seasonal:

Source: Groundwater: [X] | Surface Water: [ ] | GUDI (groundwater under direct influence): [ ]
Treated Groundwater: [ ] | Treated Surface Water: [ ] | Treated GUDI: [ ]

Sourcewater Protection Concerns: None

Source/Raw Water Quality Issues that May Affect Treatment/Treated Water Quality:

Parameter:	Level:	Parameter:	Level:
Iron	1.4 mg/l		
Manganese	0.56 mg/l		
Arsenic	24 ug/l		

Raw water capacity/allocation: Two wells - 40 Acre-feet per year each

Treated/Distributed Water Quality Issues (any that exceed Standards and Objectives after treatment):

Parameter:	Level:	Parameter:	Level:
None			

List of Chemicals Used: Chlorine Gas and KMnO4

Description of Treatment Processes in Place:

Cl2 Disinfection, KMnO4 for Iron and Manganese removal, Pressure Manganese Greensand Filtration

Treatment Processes with existing issues (including capacity issues):

None

Other issues identified within the waterworks:

None

Major Recommendations:

Hydrogeologic Study to replace aging wells, Planning for cast iron pipe replacement / refurbishment.

Any Recommendations that may pose an Immediate Health Concern:

None

Total Cost of Recommended Upgrades: $89,000 ~$5 Million Cast Iron Pipe Repl.

Other Comments:

*Please submit electronic copy to WSA. If more space is required, a longer summary sheet may be requested.