

Introduction:

In the early 90's, a number of municipalities in south central Manitoba joined to form the Pembina Valley Water Cooperative Inc. (PVWC). The purpose was to develop a regional approach to supplying potable water in an area which lacked wide distribution of good, plentiful water resources, but which also exhibited the highest rate of economic growth of any region in Manitoba. Municipalities that are members of the cooperative as of December, 2019 include:

Town of Altona	City of Winkler
R.M. of Dufferin	Town of Carman
R.M. of Grey	Municipality of Emerson - Franklin
R.M. of Montcalm	R.M. of Morris
Town of Morris	Municipality of Rhineland
R.M. of Roland	City of Morden
R.M. of Stanley	R.M. of Thompson

The mandate of the PVWC is to provide treated/potable water that meets all of the Canadian Drinking Water standards to its municipal members. It is governed by a board of 14 members, one representative from each municipal member.

The PVWC is a wholesaler of water which is distributed through its pipelines to its municipal customers. The municipalities then sell this water to the end user, their customers, which is then delivered through their own distribution system. The service area covers 9,000 square kilometers with a population base of approximately 59,000. The existing water supply system is shown in Figure 1.

Existing Water Supply

The Stephenfield Regional water treatment plant withdraws water from the Stephenfield Lake and has the capacity to produce up to 2.9 MLD of treated water. This plant provides water to St. Claude, Haywood, the R.M.s of Dufferin, Grey, Thompson and a partial supply to the R.M.s of Roland, Morris and the Town of Carman.

The Morris Regional water treatment plant at Morris also withdraws water from the Red River and pumps it into a large holding pond of 1,000 acre feet. It currently has the capacity to produce up to 7.6 MLD of treated water. From there, treated water is provided to the Town of Morris, the R.M.s of Morris, Montcalm, Roland, Thompson, and Dufferin and a partial supply to the City of Winkler and the R.M. of Stanley.

The Red River Regional water treatment plant (RRRWTP) in Letellier withdraws water from the Red River, pumps it into an oxbow with an approximate storage of two (2) months and has the ability to produce up to 7.4 Million litres/day (MLD) of treated water. From there, treated water is provided to the Town of Altona, and to the Cities of Winkler and Morden. Treated water is also provided from this plant to the Municipalities of Emerson-Franklin, Rhineland, Montcalm, Stanley, and to the Roseau River First Nation.

PVWC Distribution

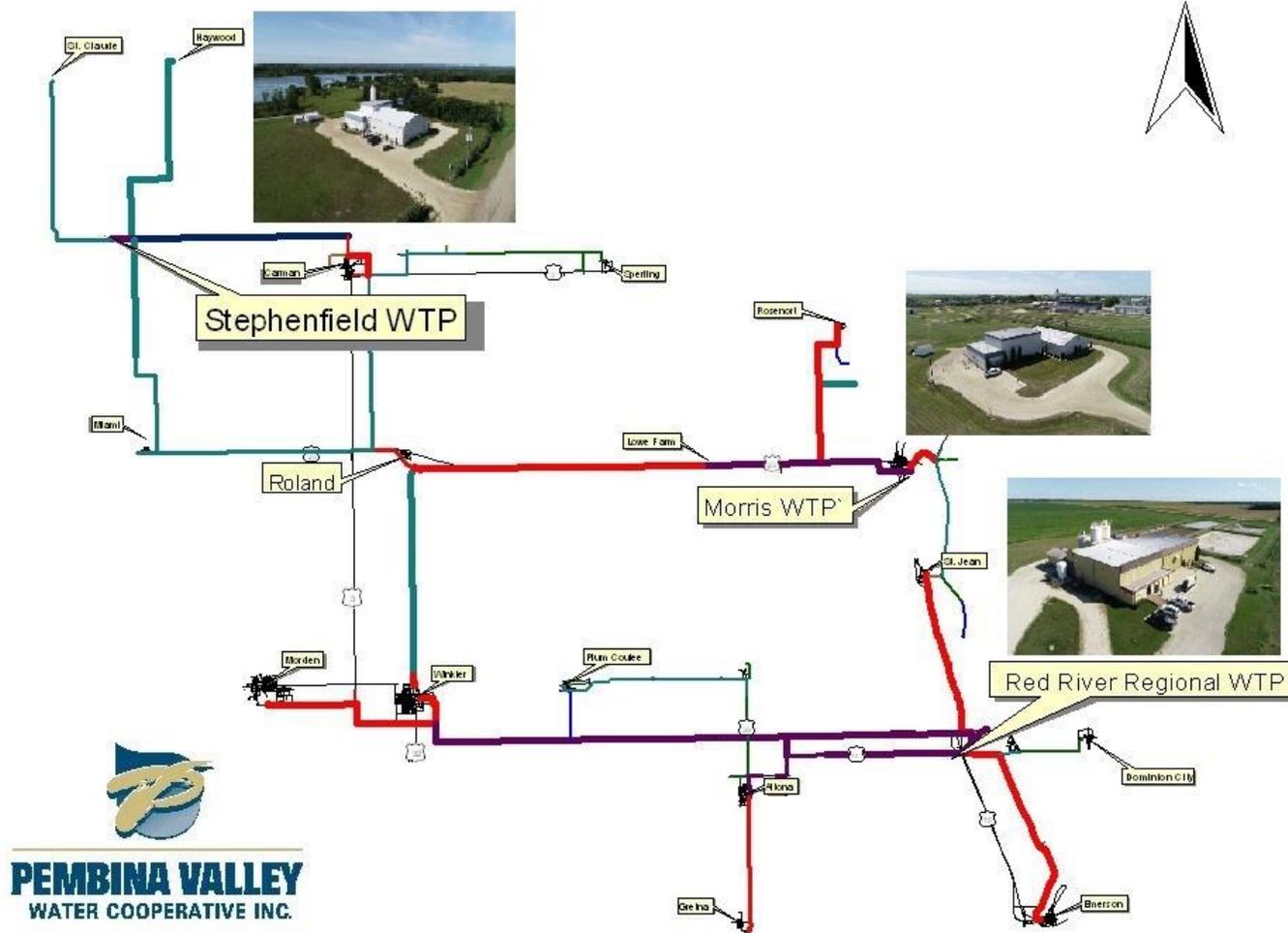


Figure 1: Model of PVWC distribution system, including the three water treatment plants.

All of the regions' existing supplies are utilized to their sustainable yield with the exception of the water treatment plant in Morris. The pond at Morris allows for growth and some drought resistance in the future. Additional options are being investigated. The City of Morden receives approximately 5% of their water supply from the PVWC with the remainder coming from Lake Minnewasta. The City of Winkler receives approximately

35% of their supply from the PVWC and the remainder is withdrawn from the Winkler Aquifer. The Town of Carman receives 25% of their water supply from the PVWC and the rest of their supply comes from the Boyne River.

The PVWC is a user-pay water supply system. The price includes the cost of production, operation and maintenance, principal and interest. There is no decreasing scale or other discounting in the pricing system. The price charged to deliver the water to the municipal system in 2019 was \$8.98 per thousand gallons.

Stephenfield Regional Water Treatment Plant

- Stephenfield Lake used as water source
- Rated for 2.9 MLD (40 l/s for 20 hours)
- Storage capacity 2,350,000 litres or 518,000 gallons
- Senior Plant Operater- Paul Termeer
- Drinking Water Officer- Kale Black



The following is a description of the treatment process for the Stephenfield Regional Water Treatment Plant. The plant is a membrane technology plant with micro filtration followed by nano filtration. Figure 4.3 is a schematic of the new process.

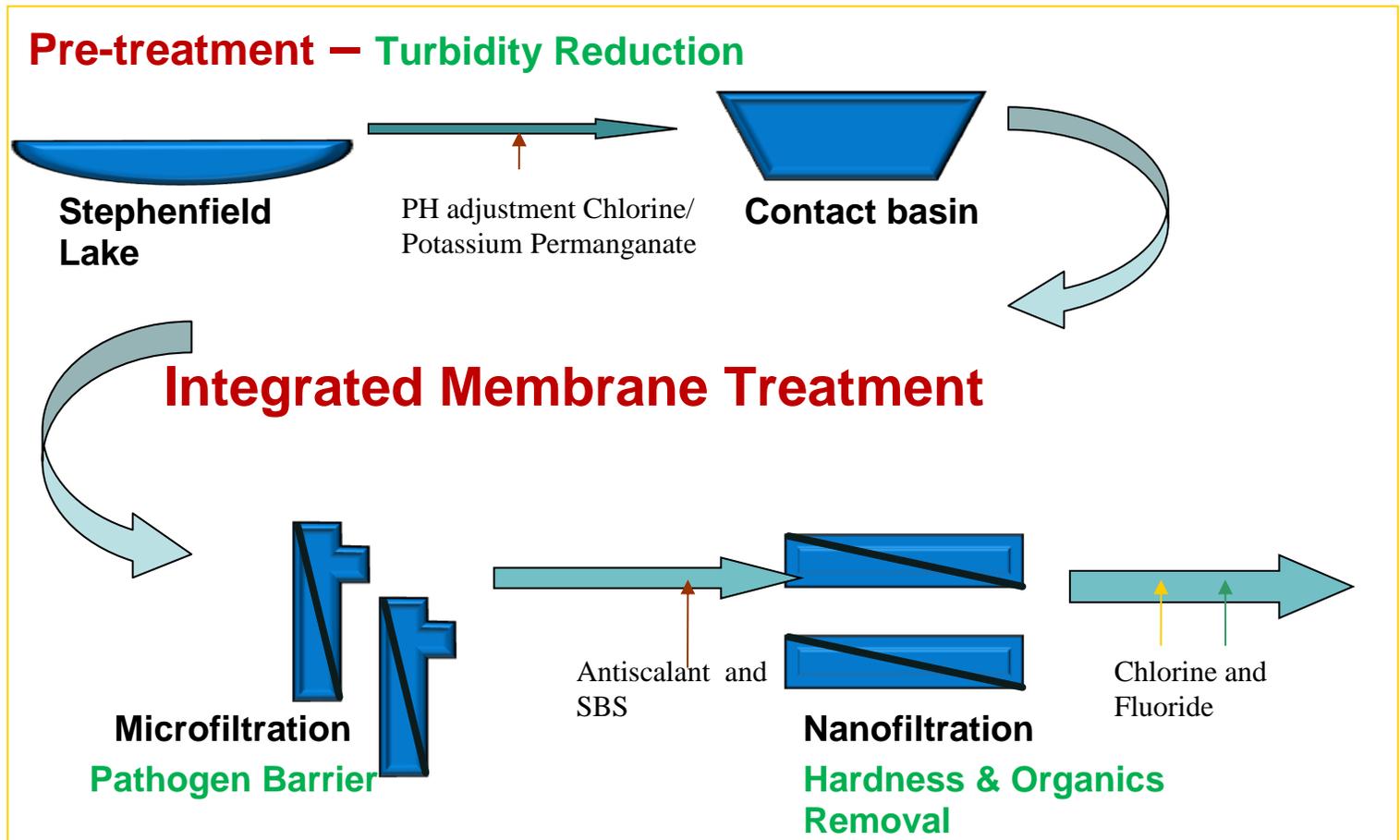


Figure 4.3

The current process consists of a screened raw water intake located in Stephenfield Lake that feeds water directly to the pumps in the water treatment plant. The pumps supply water to the contact basin (clarifier) which provides contact time with oxidants. The subsequent microfiltration removes the pathogens and reduces the turbidity to a point where it is potable. The nano membrane step then removes most of the hardness and organics. The filtered water is then dosed with chlorine for disinfection and fluoride for dental maintenance. The fluoridation program is monitored by Manitoba Health.

Disinfection Monitoring and Reporting

The treated water leaving the water plant is tested continuously for a level of chlorine high enough for proper disinfection in the distribution system.

Free chlorine at the end of a distribution system is dependent on the initial chlorine injected at the source, the rate of flow in the distribution system and the time spent in the distribution system. These parameters are closely monitored by the operators along with bacterial test results. Changes in any of these factors can result in lower chlorine residuals. **Compliance requirements were met.**

Bacteriological Monitoring and Reporting

The raw and treated water is tested on a bi-weekly basis for the presence of total coliform and E. coli bacteria. If this bacteria is present in the water it is an indication that disease causing organisms may also be present.

A copy of the water test results is kept at the water treatment plant and at the main office in Altona. **Compliance requirements were met.**

Turbidity Monitoring and Reporting

Turbidity is a measurement of the clarity of water. Turbidity is used to tell if the treatment process and filtration is working to remove particles and other contaminants from the water. A high turbidity can cause the water to look cloudy and affect the disinfection process. Turbidity is continuously tested after the microfilters and before disinfection. Turbidity, which is measured and reported in nephelometric turbidity units (NTU), is an optical measurement of water's ability to scatter and absorb light rather than transmit it in straight lines. **Compliance requirements were met.**

Disinfection By-products Monitoring and Reporting

Trihalomethane (THMs) and Haloacetic Acids (HAAs) are formed when chlorine reacts with naturally occurring organic matter in the water. Studies have shown a link between

high levels of THMs and cancer. The province has set a standard for THMs of 100 µg/L and HAA of 80 µg/L. The THM standard is based on an average of four samples per year. Our water is tested at four locations in the distribution system. **Compliance requirements were met.**

Location	Test	Requirement	Performance
Trihalomethane and HAA sampling requirements		2 sample locations 4 times a year	100%
St. Claude	THM	≤100 µg/L as annual average of quarterly samples	18.9µg/L
Dufferin Re-chlorination	THM		19.0 µg/L
Dufferin Booster	HAA	< 80 µg/L as an annual average of quarterly samples	8.5 µg/L
Graysville	HAA		8.0 µg/L

Operational Reporting

A snow storm in October along with a generator failure caused depressurization in the distribution system, resulting in a boil water advisory.

Major Expenses for the Stephenfield Regional Water Treatment Plant in 2019

PVWC is upgrading the MF/NF membranes from 2.9 to 5.2 MLD, producing 60 l/s to provide 100% of Carman requirement. This will support their plan to build a larger reservoir (3600 m³) and decommission the Carman Water Treatment Plant. Process improvement for bio-growth and poor raw water quality continue to be an area of focus.

Future Projects for the Stephenfield Regional Water Treatment Plant

PVWC is investigating the addition of a raw water pond. This would improve the water quality and allocation of water rights.

The La Salle Red Boyne Conservation District and PVWC are working together to utilize the aeration system during the winter in order to improve water quality for drinking and the ecosystem.

Health Canada has made recent changes to the Canadian Drinking Water Guidelines, including manganese and lead. This may require additional equipment or plant process changes.

Stephenfield Regional WTP Water Analysis

SWTP Chemistry New Plant		Aesthetic	MAC	Raw	Treated	Distribution
Analytes	Units	Objective	limits	August	August	August
Colour, True	CU	15		22.8	<5.0	-
Conductivity	umhos/cm			623	240	-
Hardness (as CaCO ₃)	mg/L			300	87.1	-
Langelier Index (4 C)				1.1	-0.32	-
Langelier Index (60 C)				1.9	0.45	-
pH	pH units	7.0-10.5		8.69	8.02	-
Total Dissolved Solids	mg/L	500		419	137	-
Transmittance, UV (254 nm)	% T			50.4	99.8	-
Turbidity	NTU			10.9	0.1	-
Alkalinity, Total (as CaCO ₃)	mg/L			218	100	-
Ammonia, Total (as N)	mg/L			0.182	<0.010	-
Bicarbonate (HCO ₃)	mg/L			236	122	-
Bromide (Br)	mg/L			0.056	<0.010	-
Carbonate (CO ₃)	mg/L			14.5	<0.60	-
Chloride	mg/L	250		14.9	14.5	-
Fluoride	mg/L		1.5	0.254	0.613	-
Hydroxide (OH)	mg/L			<0.34	<0.34	-
Nitrate-N	mg/L		10	0.0711	0.0757	-
Nitrite-N	mg/L		1	0.014	<0.0010	-
Sulfate	mg/L	500		111	1.13	-
Dissolved Organic Carbon	mg/L			11.6	<0.50	-
Total Organic Carbon	mg/L			12.9	<0.50	-
Aluminum (Al)-Total	mg/L	0.1		0.0416	<0.0030	<0.0030
Arsenic (As)-Total	mg/L		0.01	0.00943	0.00027	0.00032
Barium (Ba)-Total	mg/L		1	0.0631	0.0173	0.0174
Boron (B)-Total	mg/L		5	0.098	0.094	0.093
Cadmium (Cd)-Total	mg/L		0.005	0.0000149	<0.0000050	<0.0000050
Calcium (Ca)-Total	mg/L			62.8	18.5	19.4
Copper (Cu)-Total	mg/L	1	2	0.00114	0.0165	0.0058
Iron (Fe)-Total	mg/L	0.3		0.107	<0.010	<0.010
Lead (Pb)-Total	mg/L			0.000136	<0.000050	0.000579
Lithium (Li)-Total	mg/L			0.0349	0.0192	0.0198
Magnesium (Mg)-Total	mg/L			34.7	9.91	10.4
Manganese (Mn)-Total	mg/L	0.05		0.17	0.00752	0.00161
Phosphorus (P)-Total	mg/L			0.348	<0.030	<0.030
Potassium (K)-Total	mg/L			7.84	4.2	4.2
Silicon (Si)-Total	mg/L			6.37	4.56	4.74
Sodium (Na)-Total	mg/L	200		21.6	14.6	14.7
Strontium (Sr)-Total	mg/L			0.295	0.084	0.0892
Sulfur	mg/L			36.7	<0.50	<0.50
Uranium (U)-Total	mg/L		0.02	0.00705	0.000077	0.000078
Zinc (Zn)-Total	mg/L	5		<0.0030	0.0048	<0.0030

Morris Regional Water Treatment Plant

- Red River used as water source
- Raw water storage of 1,000 acre feet
- Rated for 7.6 MLD (88 l/s)
- Storage capacity 2,800,000 litres or 616,000 gallons
- Senior Plant Operator- Byron Klassen
- Drinking Water Officer- Kale Black



The following is a description of the major treatment process for the Morris Regional Water Treatment Plant which was commissioned on March 17, 2010. The plant consists of a microfiltration followed by a nanofiltration membrane. Figure 4.2 is a schematic of the process.

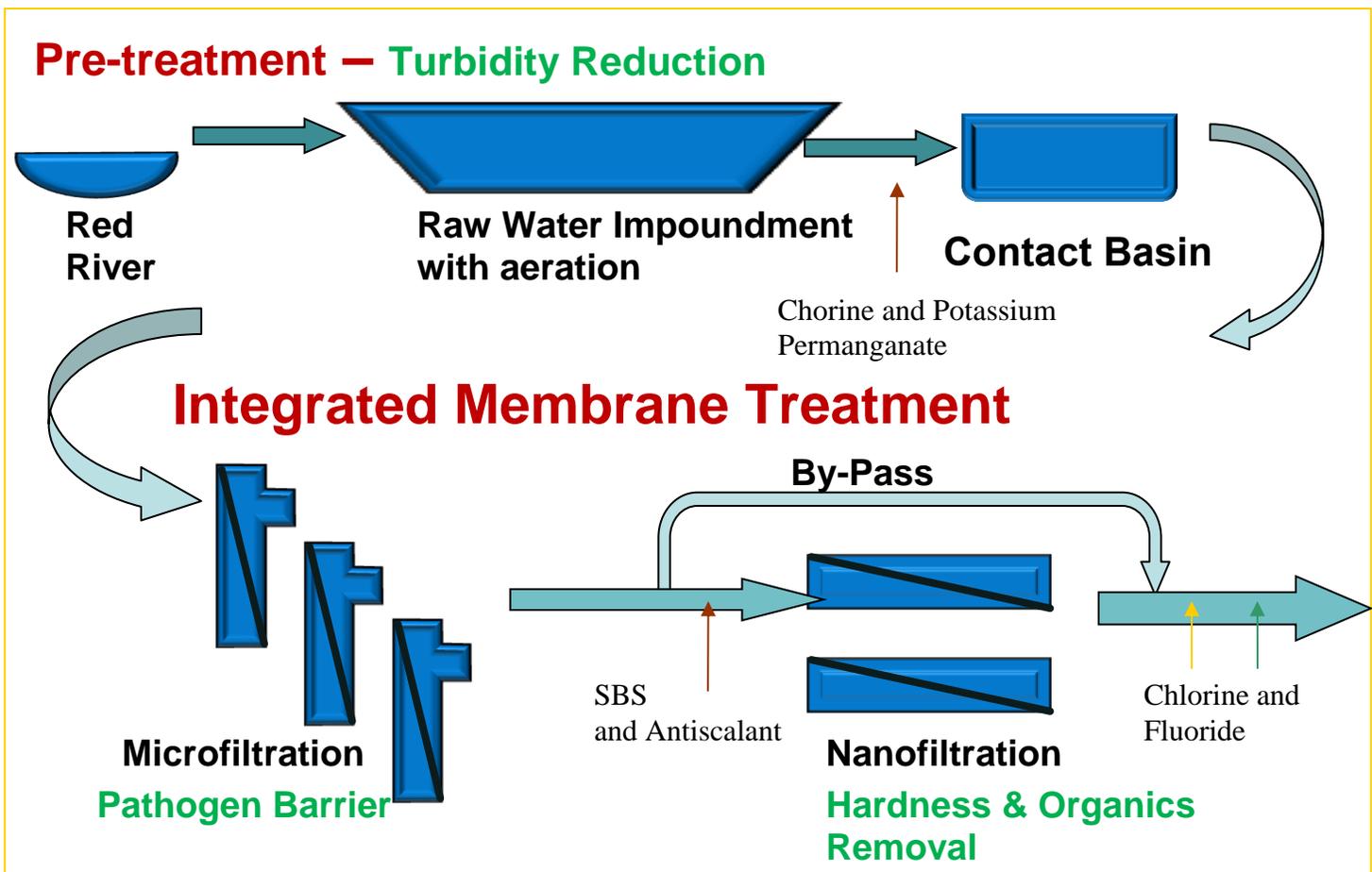


Figure 4.2

The process consists of a screened raw water intake located in the Red River that pumps into a raw water impound for off stream storage and settling. The microfiltration removes the pathogens and reduces the turbidity to a point where it is potable. A partial percentage of the water is bypassed and put into the distribution system. The subsequent nano membrane step removes the hardness and the organics so that when the water is blended it meets all of the Manitoba Drinking Water guidelines. The blended water is then dosed with

chlorine for disinfection and fluoride for dental maintenance. The fluoridation program is monitored by Manitoba Health.

Disinfection Monitoring and Reporting

The treated water leaving the water plant is tested continuously for a level of chlorine that is high enough for proper disinfection in the distribution system. **Compliance requirements were met.**

Bacteriological Monitoring and Reporting

The raw and treated water is tested on a weekly basis for the presence of total coliform and E. coli bacteria. If these bacteria are present in the water it is an indication that disease causing organisms may also be present.

A copy of the water test results are kept at the water treatment plant and at the main office in Altona. **Compliance requirements were met.**

Turbidity Monitoring and Reporting

Turbidity is a measurement of the clarity of water. Turbidity is used to tell us if the treatment process and filtration is working to remove particles and other contaminants from the water. A high turbidity can cause the water to look cloudy and affect the disinfection process. Turbidity is continuously tested after the microfiltration process and before disinfection.

Turbidity, which is measured and reported in nephelometric turbidity units (NTU), is an optical measurement of water's ability to scatter and absorb light rather than transmit it in straight lines. In March a turbidity spike happen after a cleaning of the MF unit. The likely cause is air or some chlorine residual. Additional measures were taken to reduce the spikes. On September 16th the NTU rose above 0.3 for several hours causing the Morris distribution system to be placed on a boil water advisory.

	Requirement
Continuous sampling of the effluent from each of the microfiltration skids.	≤ 0.1 NTU in at least 99% of the samples taken per month
	Not to exceed 0.3 NTU for any continuous time
Frequency of testing	Continuous
Report submissions	Monthly

Morris Regional Water Treatment Plant Water Analysis

MWTP Chemistry		Aesthetic	MACs	Raw	Treated	Distribution
Analytes	Units	Objective	Limit	August	August	August
						-
Colour, True	CU	15		23.6	5.5	-
Conductivity	umhos/cm			955	282	-
Hardness (as CaCO3)	mg/L			371	80	-
Langelier Index (4 C)				1.3	-0.74	-
Langelier Index (60 C)				2	0.029	-
pH	pH units	7.0-10.5		8.84	7.98	-
Total Dissolved Solids	mg/L	500		659	171	-
Transmittance, UV (254 nm)	% T			56.9	92.5	-
Turbidity	NTU			2.18	<0.10	-
Alkalinity, Total (as CaCO3)	mg/L			223	56.3	-
Ammonia, Total (as N)	mg/L			0.096	<0.010	-
Bicarbonate (HCO3)	mg/L			228	68.7	-
Bromide (Br)	mg/L			0.084	<0.010	-
Carbonate (CO3)	mg/L			21.6	<0.60	-
Chloride	mg/L	250		44.7	16.3	-
Fluoride	mg/L		1.5	0.191	0.601	-
Hydroxide (OH)	mg/L			<0.34	<0.34	-
Nitrate-N	mg/L		10	0.091	0.0503	-
Nitrite-N	mg/L		1	0.0266	<0.0010	-
Sulfate	mg/L	500		244	54.9	-
Dissolved Organic Carbon	mg/L			11.5	2.31	-
Total Organic Carbon	mg/L			11.4	2.19	-
Aluminum (Al)-Total	mg/L	0.1		0.072	0.0037	0.0044
Arsenic (As)-Total	mg/L		0.01	0.0094	0.00201	0.00188
Barium (Ba)-Total	mg/L		1	0.056	0.0108	0.0101
Boron (B)-Total	mg/L		5	0.101	0.092	0.091
Cadmium (Cd)-Total	mg/L		0.005	0.000015	<0.0000050	<0.0000050
Calcium (Ca)-Total	mg/L			68.1	14.2	14.3
Copper (Cu)-Total	mg/L	1	2	0.0065	0.00651	0.00454
Iron (Fe)-Total	mg/L	0.3		0.076	<0.010	<0.010
Lead (Pb)-Total	mg/L			0.000416	<0.000050	0.00103
Lithium (Li)-Total	mg/L			0.0563	0.0189	0.0186
Magnesium (Mg)-Total	mg/L			48.9	10.8	10.8
Manganese (Mn)-Total	mg/L	0.05		0.263	0.00872	0.00223
Phosphorus (P)-Total	mg/L			0.218	0.373	0.706
Potassium (K)-Total	mg/L			9.48	3.13	3.06
Silicon (Si)-Total	mg/L			7.41	2.37	2.18
Sodium (Na)-Total	mg/L	200		61.6	21	21
Strontium (Sr)-Total	mg/L			0.303	0.0687	0.0687
Sulfur (S)-Total	mg/L			83.3	17.9	18
Uranium (U)-Total	mg/L		0.02	0.00447	0.000975	0.00106
Zinc (Zn)-Total	mg/L	5		0.007	0.0032	<0.0030

Disinfection By-products Monitoring and Reporting

Trihalomethane (THMs) and Haloacetic Acids (HAAs) are formed when chlorine reacts with naturally occurring organic matter in the water. Studies have shown a link between high levels of THMs and cancer. The province has set a standard for THMs of 100 µg/L and HAA of 80 µg/L. The THM standard is based on an average of four samples per year. Our water is tested at three locations in the distribution system. **Compliance requirements were met.**

Trihalomethane and Haloacetic Acids quarterly sampling

Location	Test	Requirement	Performance
Trihalomethane and HAA sampling requirements		4 sample locations 4 times a year	100%
Miami	THM	≤100 µg/L as an annual average of quarterly samples	68.5 µg/L
Rosenort	THM		62.2 µg/L
Kane Booster	HAA	< 80 µg/L as an annual average of quarterly samples	41.6 µg/L
Rosenort Booster	HAA		46.6 µg/L

Operational Reporting

In October a major snow storm effecting power to the Roland reservoir and other booster stations caused low distribution pressure for a period of time resulting in a boil water advisory(BWA). Bacteria samples were taken and the BWA was removed.

Major Expenses for the Morris Regional Water Treatment Plant in 2019

The third Nanofiltration membrane and additional pumps were installed and commissioned increasing the plant capacity to 7.6 MLD. The Morris to St Jean Pipeline was installed and will be commissioned in early 2020. The distribution system was expanded on the east side of the Red River feeding into the Municipality of Emerson-Franklin into Dominion City. A generator was installed at the Roland reservoir. These projects costed approximately \$5 million.

Future Expenses for the Morris Regional Water Treatment Plant

A fourth MF unit is being considered to increase the water treatment capacity from 7.6 to 8.6 MLD. Other treatment options are being explored. Other improvements include an upgrade to the aeration system in the pond and in the process of implementing a plan to reduce the effects of zebra mussels.

Red River Regional Water Treatment Plant - Letellier

- Red River used as water source
- Raw water storage of approx 250 acre-feet
- Rated for 7.4 Million liters/day(Mld) (85 l/s)
- Storage capacity 2,450,000 litres or 540,000 gallons
- Senior Plant Operater- Trevor Hodgins
- Drinking Water Officer- Kale Black



The following (Figure 2) is a description of the major treatment process for the Red River Regional Water Treatment Plant: This lime softening plant, which is typical of those commonly found throughout the Manitoba prairies, is used to treat the water from the Red River.

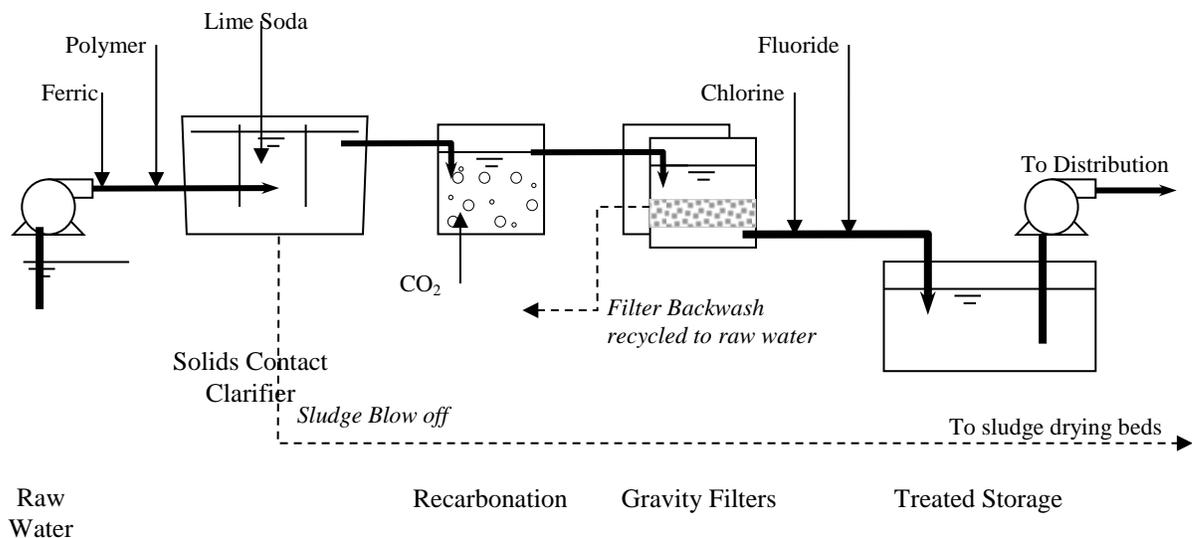


Figure 2: Schematic of the existing process.

The current process consists of a screened raw water intake located off the Red River that pumps to an off stream storage reservoir beside the plant which is then pumped directly to the solids contact clarifier. The cold lime softening clarifier then reduces hardness and turbidity. The subsequent re-carbonation step stabilizes the clarifier effluent and the gravity filters polish the water for final turbidity and pathogen reduction.

The filtered water is then dosed with chlorine for disinfection and fluoride for dental maintenance. The fluoridation program is monitored by Manitoba Health. On December 16th an incident occurred where fluoride exceeded the 1.5 mg/l limit.

Disinfection Monitoring and Reporting

The treated water leaving the water plant is tested continuously for a level of chlorine that is high enough for proper disinfection in the distribution system and leaving a minimum chlorine residual of greater than 0.1 mg/l.

These values are closely monitored by the operators along with bacterial test results. Changes in any of these values can result in lower chlorine residuals. Due to a plant upset in December one instance of failing to maintain 0.1 mg/l of free chlorine at the end of the distribution system.

Bacteriological Monitoring and Reporting

The raw and treated water is tested on a weekly basis at six locations, for the presence of total coliform and E. coli bacteria. If these bacteria are present in the water, it is an indication that disease causing organisms may also be present. **Compliance requirements were met.**

Turbidity Monitoring and Reporting

Turbidity is a measurement of the clarity of water. Turbidity is used to tell us if the treatment process and filtration is working to remove particles and other contaminants from the water. A high turbidity can cause the water to look cloudy and affect the disinfection process. Turbidity is continuously tested after the filtering process and before disinfection.

Turbidity, which is measured and reported in nephelometric turbidity units (NTU), is an optical measurement of water's ability to scatter and absorb light rather than transmit it in straight lines.

	Requirement
Chemically assisted, rapid gravity filtration process for water treatment	≤ 0.3 NTU in at least 95% of the samples taken per month
	Not to exceed 0.3 NTU for more than 12 continuous hours
	Not to exceed 1.0 NTU at any time

There was 1 month where the turbidity on one filter failed to maintain less than 0.3 NTU for 95% of the time. The incident was due to the filter having new media in it and needed some break in time (ripening).

Disinfection By-products Monitoring and Reporting

Trihalomethanes (THMs) and Haloacetic Acids (HAAs) are formed when chlorine reacts with naturally occurring organic matter in the water. Studies have shown a link between high levels of THMs and cancer. The province has set a standard for THMs of 100 µg/L and HAA of 80 µg/L. The THM standard is based on an average of four samples per year. Our water from the Letellier plant is tested at six locations in the distribution system.

Locations	Type	Requirement	Test Results
Emerson	THM	≤ 100 µg/L as an annual average of quarterly samples	128 µg/L
St. Jean Baptiste	THM		128 µg/L
Gretna	THM		142 µg/L
Morden	THM		135µg/L
Altona Booster	HAA	< 80 µg/L as an annual average of quarterly samples	81.4 µg/L
Stanley Booster	HAA		90.6 µg/L

One factor in the increase in THM’s is the regulatory requirements to maintain greater than 0.1 mg/l of chlorine residual in the water distribution system. This has made it necessary to increase the chlorine concentration leaving the water treatment plant which has the direct result of increasing the THM’s. The future reservoir will help reduce the disinfection by-products created by chlorine. One of the quarterly tests were not submitted which would have lowered the quarterly average.

Major Expenses for the Red River Regional Water Treatment Plant in 2019

A regional coordinated advisory notification plan, compliance plan, and a sampling plan for the distribution system is a major initiative. This includes upgrading numerous pressure sustaining valves and meters. A pipeline from Morris to St Jean was installed and will pump additional water into the Letellier plant in 2020. Extra pipelines were installed to improve the redundancy of the distribution system.

Future Projects for the Red River Regional Water Treatment Plant

A treated water reservoir with increased capacity and the potential for upgraded treatment is being planned. PVWC has requesting government funding for these projects. A plan to reduce the Zebra mussel problem is being worked on.

Red River Regional Water Treatment Plant Water Analysis

RRRWTP Chemistry		Aesthetic MACs		Raw	Treated	Raw	Treated	Distribution
Analyte	Units	Objective limits		February	February	August	August	Morden
Colour, True	CU	15		16.2	<5.0	28.8	<5.0	-
Conductivity	umhos/cm			1260	984	973	741	-
Hardness (as CaCO3)	mg/L			537	299	449	250	-
Langelier Index (4 C)				1.2	-0.31	0.81	-0.71	-
Langelier Index (60 C)				1.9	0.45	1.6	0.049	-
pH	pH units	7.0-10.5		8.38	7.68	8.28	7.51	-
Total Dissolved Solids	mg/L	500		912	774	689	511	-
Transmittance, UV (254 nm)	% T			60	82.8	46.3	82.2	-
Turbidity	NTU			2.85	<0.10	7.41	<0.10	-
Alkalinity, Total (as CaCO3)	mg/L			398	86.8	232	44.1	-
Ammonia, Total (as N)	mg/L			0.236	0.04	0.021	0.02	-
Bicarbonate (HCO3)	mg/L			468	106	283	53.8	-
Bromide (Br)	mg/L			0.165	0.083	0.151	<0.010	-
Carbonate (CO3)	mg/L			8.4	<0.60	<0.60	<0.60	-
Chloride (Cl)	mg/L	250		82.8	89.8	32.6	37.6	-
Fluoride (F)	mg/L		1.5	0.23	0.489	0.204	0.567	-
Hydroxide (OH)	mg/L			<0.34	<0.34	<0.34	<0.34	-
Nitrate (as N)	mg/L		10	0.838	0.856	<0.010 *	0.172	-
Nitrite (as N)	mg/L		1	0.0131	<0.0020 *	<0.0020 *	<0.0010	-
Sulfate (SO4)	mg/L	500		306	306	270	266	-
Dissolved Organic Carbon	mg/L			11.3	6.96	13.1	7.16	-
Total Organic Carbon	mg/L			11.3	7.06	13.4	6.93	-
Aluminum (Al)-Total	mg/L	0.1		0.0545	<0.0030	0.0543	<0.0030	0.0051
Arsenic (As)-Total	mg/L		0.01	0.00322	0.00093	0.00867	0.00123	0.00133
Barium (Ba)-Total	mg/L		1	0.0759	0.0146	0.0702	0.0235	0.027
Boron (B)-Total	mg/L		5	0.149	0.068	0.111	0.056	0.056
Cadmium (Cd)-Total	mg/L		0.005	0.000019	0.0000104	0.0000137	<0.0000050	0.0000063
Calcium (Ca)-Total	mg/L			95.1	67.2	85.7	71.2	86.4
Copper (Cu)-Total	mg/L	1	2	0.00177	0.00652	0.00188	0.0235	0.00609
Iron (Fe)-Total	mg/L	0.3		0.109	<0.010	0.107	0.023	0.027
Lead (Pb)-Total	mg/L			0.000073	0.000077	0.000189	0.000249	0.000332
Lithium (Li)-Total	mg/L			0.0725	0.0732	0.0676	0.0674	0.0668
Magnesium (Mg)-Total	mg/L			72.7	32	57.2	17.5	12.5
Manganese (Mn)-Total	mg/L	0.05		0.0534	0.00035	0.135	0.00086	0.00314
Phosphorus (P)-Total	mg/L			0.195	<0.050	0.326	<0.050	<0.030
Potassium (K)-Total	mg/L			13.5	13.4	9.09	9.32	8.83
Silicon (Si)-Total	mg/L			9.72	4.34	10.6	2.35	2.51
Sodium (Na)-Total	mg/L	200		103	104	55.8	55.9	53.9
Strontium (Sr)-Total	mg/L			0.436	0.229	0.375	0.266	0.275
Uranium (U)-Total	mg/L		0.02	0.00543	0.000212	0.003	0.000073	0.000111
Zinc (Zn)-Total	mg/L	5		<0.0030	0.0032	<0.0030	0.0087	0.0322

Organizational Resources

