

NORTH BATTLEFORD

DRINKING WATER QUALITY

2014 ANNUAL REPORT



**North
Battleford**

Executive Summary

This report provides an analysis of the Drinking Water Quality of the water produced in the City of North Battleford and the results of the Monitoring of the Distribution System.

The highlights of 2014 are as follows:

- 379 samples were submitted for bacteriological testing in 2014 as part of the routine monitoring of the distribution system. None tested positive for Coliforms.
- Three of the samples from two separate locations were below minimum guidelines for chlorine residuals. Corrective actions were taken.
- The annual average for samples submitted for Trihalomethanes were below the Maximum Acceptable Concentration.
- The average monthly turbidity for Water Treatment Plant #1 ranged from 0.030 NTU to 0.129 NTU, thus meeting the guideline of less than 1 for 95% of readings.
- Average monthly turbidity for Water Treatment Plant #2 filters ranged from 0.025 – 0.055 NTU, 0.029 – 0.052 NTU, 0.032 – 0.055 NTU, and 0.023 – 0.040 NTU. These are below the guideline of less than 0.3 NTU for 95% of readings.
- Monthly free chlorine readings were above the minimum guideline of 0.2 mg/L entering the distribution system. The monthly average readings ranged from 1.03 mg/L to 1.67 mg/L at Water Treatment Plant #1 and 0.701 mg/L to 1.175 mg/L at Water Treatment Plant #2.
- Iron levels from Water Treatment Plant #1 were below the aesthetic guidelines of 0.3 mg/L.
- Monthly manganese levels from Water Treatment Plant #1 were below the aesthetic guidelines.
- Water Treatment Plant #1 produced over 1.22 million m³.
- Water Treatment Plant #2 produced over 0.61 million m³.
- Together, the Water Treatment Plants produced over 1.8 million m³.
- Installation of a new well began in late 2014.

In conclusion, the North Battleford water treatment plants provided potable water that met the Water Security Agency guidelines.

CITY OF NORTH BATTLEFORD

DRINKING WATER QUALITY

2014 ANNUAL REPORT

CITY OF NORTH BATTLEFORD

DEPARTMENT OF OPERATIONS AND MAINTENANCE

2014

Safe Drinking Water Policy

POLICY STATEMENT

The City of North Battleford Council and Administration are committed to provide the community with good quality and safe drinking water through the City distribution system.

KEY INDICATORS

Good and safe drinking water quality will be demonstrated by:

- Water that is free of pathogenic organisms and of any harmful concentrations of chemicals or other substances as may be identified in provincial drinking water requirements, guidelines, objectives, or recommendations.
- Water that is adequately disinfected.
- Water that is aesthetically acceptable.

PRIORITY MEASURES

The following essential measures are undertaken to ensure the provision of good and safe drinking water:

- Protection of Water Sources and Watersheds within the City's Jurisdiction and Influence.
- Quality Control, Quality Assurance and Continuous Improvement Programs.
- Water Treatment, Transmission and Distribution System Maintenance and Renewal.
- Staff Training, Certification and Ongoing Learning.
- Regular and timely reporting to City Council.
- Water Quality Monitoring with Public Accountability for Verifying Quality Results.

Contents

Introduction	1
Background	1
Water Treatment Plants	1
Distribution System	2
Tested Parameters.....	2
Results Section	6
WTP #1 Summary	6
FEH WTP (WTP #2) Summary.....	6
Routine Sampling.....	7
General Chemical.....	7
Health and Toxicity with Cyanide and Mercury	7
THMs	7
Halo Acetic Acids	7
Cryptosporidium and Giardia	7
Pesticides.....	8
Organics.....	8
Water Production.....	8
Conclusion	9
Acknowledgements	9

APPENDIXES

- Appendix A: Map of Sample Zones
- Appendix B: Results Tables
- Appendix C: Water Production Volumes
- Appendix D: Glossary

Introduction

The City of North Battleford Annual Drinking Water report is designed to provide information to the public, government organizations, and internal management. Data that is represented in this report is collected from the water treatment plants and distribution system within the City of North Battleford.

Background

The City of North Battleford water supply system is comprised of two water treatment facilities, three reservoirs, one booster station, approximately 117 kilometres of water main, 580 fire hydrants and many thousands of valves.

Approximately 4,600 residential, commercial, industrial and institutional customers utilize the North Battleford distribution system.

Between January 1, 2014 and December 31, 2014 the City of North Battleford water plants produced over 1.8 million m³ of water. Table 1C, along with a graph (Figure 3C) showing water production per month, can be viewed in the results section of the report.

Water Treatment Plants

The City of North Battleford waterworks consists of two water treatment plants; Water Treatment Plant #1 (WTP#1) and F.E. Holliday Water Treatment Plant (FEH WTP). The WTPs utilize two sources of water to meet the demand of residents.

Water Treatment Plant #1 (Figure 2) is currently designated as a Level 2 Water Treatment Facility. However, WTP #1 is undergoing an evaluation by the WSA and may be upgraded to a level 3 or potentially level 4 due to the addition and upgrades completed in 2012. The plant draws water from a well field located in the river valley southwest of the city. The water treatment process in WTP#1 consists of two trains; 'Train A' which utilizes four pressure filters and 'Train B' which utilizes two open filters. All of the filters use green sand media to aid in the removal of the manganese and iron. Chlorine gas is the main disinfection method used at this plant. A liquid form of chlorine is used in pre-treatment. The 'Train B' expansion officially came online in September 2012. With this expansion, the treatment capacity of WTP#1 increased from 180 m³/h to approximately 320 m³/h. The production capability of this plant is limited by the well field.

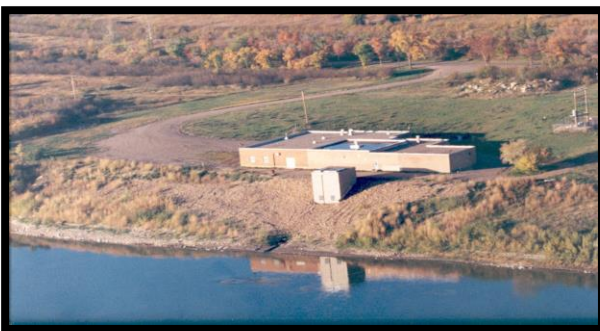


Figure 1 F.E. Holliday WTP



Figure 2 WTP #1

FEH WTP (Figure 1) is designated as a Level 3 Water Treatment Facility. The plant takes raw water directly from the North Saskatchewan River. Water is drawn from the river, sand is removed, and then the water is treated for inorganic and organic constituents and filtered. Chlorine gas is used as the primary disinfectant with ultraviolet energy (UV) providing additional disinfection. The production capability of this plant is affected by the turbidity of the North Saskatchewan River.

The untreated and treated water is monitored and tested daily at each WTP when they are operating to ensure that the finished product meets the standards set by the WSA. A summary of plant operations for each Water Treatment Plant can be found in the results section.

Distribution System

In 2013, the City of North Battleford had over 117 km of water mains. These mains are a combination of asbestos concrete, cast iron, polyvinyl chloride (PVC) pipe, high density polyethylene (HDPE) pipe, copper, and steel. In 2014, there were 14 water main leaks detected and repaired. Work was done on 95 hydrants. This work included repairing leaks, replacing damaged parts of the hydrants or the entire hydrant, or thawing the hydrant.

Water in the distribution system is regularly tested at 7 monitoring locations per week throughout the City. A map showing the division of the city into 12 sampling zones can be found in **Appendix A**. Each monitoring location is sampled weekly or biweekly. The Permit to Operate a Waterworks only requires 3 samples be taken per week. In 2014, 389 routine monitoring samples were submitted. 'Other' samples collected from new services, complaints about taste or odour, or following water main repairs are not considered 'routine' samples but do undergo the same tests. Each sample submitted for coliform testing is also tested for free chlorine, total chlorine, and turbidity. A summary of 'routine' and 'other' sampling can be found in the results section.

Tested Parameters

The City of North Battleford performs testing as required by the Permit to Operate a Waterworks and as directed by the Water Security Agency (WSA). Additional testing may be done at the discretion of the City in advance of proposed changes to Drinking Water Quality Guidelines to determine the effect of potential changes on the treatment processes. Tested parameters may or may not be subject to a guideline limit. These limits can be health based, Maximum Acceptable Concentration (MAC) or interim Maximum Acceptable Concentration (iMAC), or based on odour, taste, or staining, Aesthetic Objective (AO). These limits may be expressed as milligrams per litre (mg/L), micrograms per litre ($\mu\text{g/L}$), or counts per millilitre or litre (0 cts/100mL or 0 cts/100L).

Coliform Bacteria, Total

Total coliform bacteria are used as an operational tool to determine how well the drinking water treatment system is operating. Total coliform include a variety of natural occurring bacteria in water, soil, and vegetation as well as human and animal faeces. The majority of these bacteria are harmless. The presence of total coliform bacteria indicates that the system is vulnerable to contamination and that additional actions need to be taken. Any exceedances should be investigated. Testing is used to ensure water quality meets

permitted levels. The guideline for the presence/absence of Total Coliforms is a health objective, and as such is expressed as a MAC. The WSA limit for total coliform bacteria is 0 cts/100mL of sample.

Escherichia coli, (E. coli)

E. coli is used to determine the microbiological safety of drinking water. If it is detected, other pathogens may also be present. The presence of E. coli in water strongly indicates recent fecal pollution from animal and/or human sources and the potential presence of microorganisms capable of causing gastrointestinal illnesses. E. coli is not reported when total coliform is not detected. The limit set by the WSA for drinking water is 0 cts/100 mL, which is also a MAC.

Chlorine

Chlorine is an oxidizing agent that is commonly used as a disinfectant. When chlorine is added to water it reacts to form two disinfectants known as "free residual chlorine" and "combined residual chlorine". A minimum of 0.10 mg/L of free residual chlorine or 0.50 mg/L of total residual (free plus combined) must be maintained continuously throughout the distribution system.

The WSA has placed a limit of not less than 0.2 mg/L of free residual chlorine in the water entering the water distribution system. As per the permit to operate, the City must test free residual in the water entering the distribution system continuously or at least once per hour. The WTPs use on-line analytical instruments to monitor the free chlorine. In addition, free and total chlorine are tested at least once daily at WTP #1 and hourly at WTP #2 while the plant is in operation. These tests are used to confirm that the on-line instruments are operating properly.

Turbidity

Turbidity is used to assess the clarity of water. It is a measure of suspended inorganic and organic particles in the water. Turbidity can be caused by sediment, particles of dirt, clay, silt, air bubbles, vegetation, plankton, and other microscopic organisms suspended in the water. Turbid water may protect microorganisms from disinfection or prevent the removal of naturally occurring particles that the treatment process wants to control or eliminate.

While there is no limit for Turbidity in the distribution system, it is recommended that the turbidity be less than 5.0 Nephelometric Turbidity Units (NTU). The limit leaving WTP #1 is to be less than 1.0 NTU 95% of readings and the limit leaving the filters at FEH WTP is to be less than 0.3 NTU 95% of readings and never more than 1 NTU off of each filter.

Iron

Iron is an inorganic element and one of the most abundant metals in the earth's crust. Small quantities of iron are naturally found in many groundwater sources. An AO of less than 0.3 mg/L is used to minimize iron staining of laundry and plumbing fixtures, and to reduce undesirable tastes in beverages.

Manganese

Manganese is a naturally occurring inorganic element from the erosion and weathering of rocks and minerals. Water naturally contains small amounts of manganese; the guideline limit is based on taste and staining of laundry and plumbing fixtures. The AO for manganese in drinking water is less than 0.05 mg/L.

Additional Testing

Additional water quality parameters are tested as set out in the Permit to Operate a Waterworks, as directed by the WSA or at the discretion of the City of North Battleford.

General Chemical

A general water quality analysis is done semi-annually on the treated water from WTP #1 and quarterly from FEH WTP. Some of the parameters tested have guideline limits while others do not. The presence of some parameters may interfere with the removal of health-related parameters (such as bacteria), they may affect the treatment system's effectiveness, and they may be indicators of overall water quality. The City of North Battleford does not fluoridate the water, any fluoride present is naturally occurring in the source water. Starting in 2013, general chemical analysis was completed on the source waters for the WTPs to track changes in water quality that could affect the treatment processes.

Health and Toxicity

Trace elements in North Battleford's water are monitored annually. These elements can be naturally occurring or the result of leaching, runoff, or spills. Some parameters are subject to a MAC while others are subject to an AO. The results of Health and Toxicity testing can be found in the results section.

Trihalomethanes

Trihalomethanes (THMs) are organic compounds formed in drinking water as a by-product of chlorine disinfection. THMs may be linked to cancer or other health problems. The MAC of total THMs is 100 µg/L (0.1 mg/L) based on an annual average of quarterly tests. The results for the City of North Battleford can be viewed in the results section.

Pesticides

The City of North Battleford tests for pesticides in the treated water once every twenty-four months. Pesticides can enter source water (usually surface water) as a result of leaching and/or runoff from agricultural or other uses. Limits on pesticide concentrations are health based and subject to a MAC. The next test will be done in 2015.

Organics

The City of North Battleford tests for Organics in the treated water once every twenty-four months. Organics, usually petroleum products, can enter source water (usually surface water) through a variety of means. Limits on organics are mainly health based and subject to a MAC. A few are subject to an AO. The next test will be done in 2015.

Cryptosporidium and Giardia

Cryptosporidium (pronounced as cryp-toe-spore-id-ium) and Giardia (pronounced gee-are-dee-ah) are pathogens commonly found in surface water. They are associated with gastrointestinal upset. They can cause nausea, vomiting and diarrhoea. Cryptosporidium oocysts and Giardia cysts are found in human and animal wastes, which sometimes wash into rivers and lakes.

The minimum treatment process goal is a 3 log (99.9%) reduction or inactivation of Cryptosporidium oocysts and Giardia cysts. The combination of physical removal (filtration) and the use of an ultraviolet treatment system, allows WTP #2 to reach this goal. As part of the current operating permit, City of North Battleford is only required to test for these during periods of upset or under the direction of the WSA.

Microcystin

Microcystins are toxins produced by blue-green algae. Blue-green algae are commonly found in surface water when conditions are favourable for growth and the formation of algal blooms. The toxins are released when the algae die and may continue to be present in the water for weeks to months.

Most microcystins are liver toxins, but they are also a skin, eye and throat irritant. Blue-green algal blooms can occur with adequate levels of phosphorous and nitrogen, a temperature range of 5 to 30 degrees Celsius and a 6 to 9 pH range. Most blooms will occur in late summer and early fall.

Health Canada has set a guideline MAC of 1.5 µg/L that will be adopted once a practical analytical method is available to all jurisdictions. The City was not required to submit a sample for microcystin analysis in 2014.

Results Section

WTP #1 Summary

The treated water leaving WTP #1 was tested for five parameters (turbidity, free chlorine, total chlorine, iron, and manganese) daily and met the guidelines set out by the WSA.

The monthly average for turbidity from the on-line analyzer ranged from 0.030 (February Train B) to 0.129 NTU (October Train A). The highest reading recorded was 0.176 NTU (May, Train A) while the lowest reading was 0.019 NTU (February Train B). The high readings are below the recommendation of 5.0 NTU set out by the WSA.

The average monthly free chlorine reading from the on-line analyzer ranged from 1.03 mg/L (June Train B) to 1.67 mg/L (October Train A). The highest free chlorine reading recorded was 1.78 mg/L (November Train A) while the lowest free chlorine reading was 0.33 mg/L (May Train A). A summary of the results for WTP #1 can be found in **Table 1B, Appendix B**.

Average iron readings ranged from 0.015 mg/L (February Train B, November and December Train A) to 0.049 mg/L (August Train B). The highest reading recorded was 0.40 mg/L (May Train B) while the lowest reading was below detection limits (several readings). May 20, 2014 resulted in an iron reading of 0.40 mg/L which is above the AO of 0.3 mg/L. Although this reading is above the AO of 0.3 mg/L, the average iron reading was below the AO.

Average manganese readings ranged from 0.009 (February, Train A and Train B) to 0.033 mg/L (December Train B). The lowest reading for manganese recorded was below Detection Limits (several readings) and the highest was 0.098 mg/L (June Train B). While there were 11 days where the reading recorded was above the AO, the average readings for manganese were below the AO of 0.05 mg/L.

FEH WTP (WTP #2) Summary

The treated water leaving WTP #2 was tested daily for turbidity and free chlorine and met the guidelines set out by the WSA. Turbidity was tested leaving the filters and clearwell, while the free chlorine was tested leaving the clearwell.

The average turbidity leaving the four filters ranged from 0.025 – 0.055 NTU for filter #1, 0.029 – 0.052 NTU for filter #2, 0.032 – 0.055 NTU for filter #3, and 0.023 – 0.040 NTU for filter #4. The highest turbidity reading recorded from the filters was 0.52 NTU (September, filter #1) while the lowest reading was 0.019 NTU (March, filter #4).

Average free chlorine readings recorded entering the distribution system ranged from 0.701 mg/L to 1.175 mg/L. The highest chlorine reading recorded was 5.0 mg/L (September) while the lowest was 0.035 mg/L (August). The results can be found in **Table 2B, Appendix B**.

Routine Sampling

In 2014, 379 samples were submitted as part of the routine monitoring required by the WSA. None of these samples came back positive for Total Coliforms or E. coli. Three samples submitted had Free and Total Chlorine residuals below guidelines. Two occurred at a location known for having chlorine readings at or slightly above the minimum guidelines. This occurred in September as a result of a drop in pressure during the flushing program. The drop in pressure prevented staff from being able to properly flush the line to raise the chlorine readings. A bleed line has since been installed in this location. The third occurred during the training period for the newly hired Environmental Technologist. The training method was reviewed and corrections made to the instructions giving to the technologist. An additional 202 'other' samples were submitted for testing as a result of new services, complaints, water main breaks, or samples taken at the water treatment plants. Four public drinking water advisory (PDWA) samples tested positive for Total Coliform and two samples tested positive for E.coli. Follow up samples for those locations were submitted and laboratory results came back negative. **Table 3B, Appendix B** shows the results for the routine monitoring of the distribution system as well as the results of 'other' sampling.

General Chemical

Two samples of the treated water from WTP#1 and four from FEH WTP (WTP #2) were submitted for General Chemical Analysis in 2014. The parameters tested met all aesthetic and health objectives. The results are shown in **Tables 4B and 5B, Appendix B**.

Health and Toxicity with Cyanide and Mercury

One sample of the treated water from each WTP was submitted for Health and Toxicity with Cyanide and Mercury in 2014. The parameters tested were either below the guidelines or below detection limits. The results are shown in **Table 6B, Appendix B**.

THMs

Two samples from the distribution system were submitted for THMs each quarter in 2014. The average for the 8 samples was 41.3 µg/L, which is below the MAC of 100 µg/L. The results are shown in **Table 7B, Appendix B**.

Halo Acetic Acids

Two samples from the distribution system along with a sample from each WTP were submitted for HAAs each quarter in 2014. The average for the 8 samples was 36.8 µg/L, which is below the MAC of 80 µg/L. The results are shown in **Table 8B, Appendix B**.

Cryptosporidium and Giardia

No sampling was conducted for cryptosporidium and Giardia in 2014. Sampling is done under upset conditions or under the direction of the WSA.

Pesticides

No sampling was conducted for pesticides in 2014. This sampling is scheduled for 2015.

Organics

No sampling was conducted for organics in 2014. This sampling is scheduled for 2015.

Water Production

In 2014, over 1.84 million m³ of potable water was produced by the two Water Treatment Plants. WTP #1 produced 1.22 million m³, while just over 0.61 million m³ of potable water was produced by FEH WTP. The increased production capability of WTP#1 allows FEH WTP to be run as a ‘top off’ plant.

Combined, the monthly amount of water produced by the WTPs ranged from a low of 123,502.6 m³ in November to a high of 202,339.4 m³ in July (Figure 3). The average daily production was 5,054.2 m³. The peak amount produced by both WTPs was 9,473.8 m³ on July 17th. The lowest amount produced by both WTPs was 2389.8 m³ on May 27th. The production amounts for both WTPs along with the combined monthly total can be seen in **Table 1C, Appendix C**.

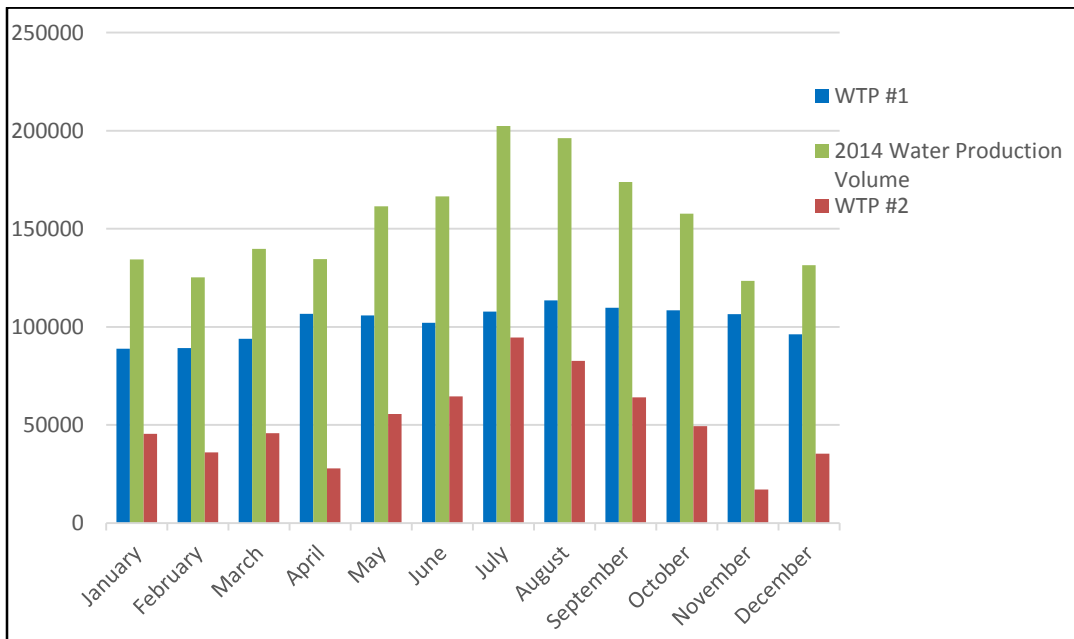


Figure 3 Monthly Production Volumes

Conclusion

In conclusion, the North Battleford water treatment plants were able to provide potable water that met the WSA guidelines as set out in the Permit to Operate. For the distribution system in the City of North Battleford, chlorine levels generally exceeded the minimum level outlined by the WSA. In the three cases where chlorine levels were below the WSA guidelines, corrective actions were taken to limit future occurrences.

Acknowledgements

The Operations and Maintenance Department of the City of North Battleford prepared this report. The dedication and commitment of civic staff in providing safe water during 2014 is acknowledged.

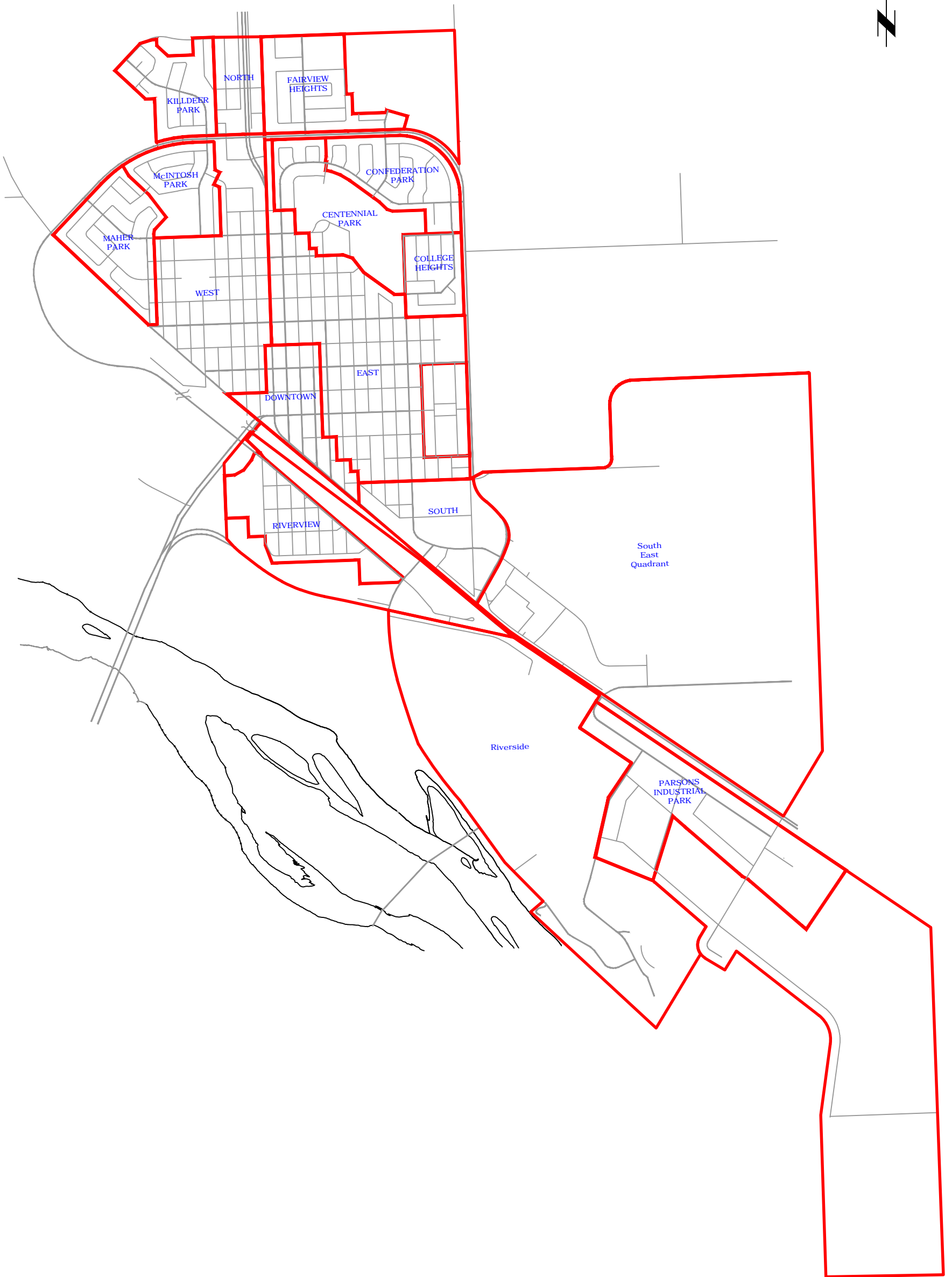
Also acknowledged is the ongoing assistance of the WSA.


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*City of North Battleford
Drinking Water Quality
2014 Report
Appendix A: Map of Sampling Zones*



 North Battleford	DATE REVISED	BY	DESIGNED BY:	DATE:	SCALE:	PAGE:
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*City of North Battleford
Drinking Water Quality
2014 Report
Appendix B: Results Tables*

Table 1B								
Month		CHLORINE			TURBIDITY		IRON	MANGANESE
		Free (Lab)	Free (Wall)	Total				
		mg/L	mg/L	mg/L	NTU (Lab)	NTU (Wall)	mg/L	mg/L
January	Train A							
	Average	1.06	1.11	1.36	0.11	0.049	0.035	0.014
	Max	1.50	1.55	1.89	0.24	0.105	0.100	0.034
	Min	0.75	0.85	0.99	0.06	0.032	0.000	0.000
	Train B							
	Average	1.12	1.14	1.37	0.10	0.035	0.032	0.014
	Max	1.57	1.60	1.83	0.16	0.039	0.080	0.029
February	Train A							
	Average	1.17	1.17	1.45	0.11	0.074	0.023	0.009
	Max	1.62	1.60	1.86	0.19	0.890	0.080	0.019
	Min	0.65	0.68	0.93	0.06	0.031	0.000	0.001
	Train B							
	Average	1.15	1.15	1.45	0.10	0.030	0.015	0.009
	Max	1.56	1.55	1.69	0.15	0.039	0.090	0.021
March	Train A							
	Average	1.02	1.10	1.31	0.12	0.052	0.023	0.018
	Max	1.55	1.50	1.74	0.19	0.079	0.070	0.060
	Min	0.83	0.83	1.05	0.06	0.035	0.000	0.000
	Train B							
	Average	1.01	1.10	1.28	0.11	0.033	0.021	0.015
	Max	1.42	1.45	1.78	0.16	0.080	0.060	0.030
April	Train A							
	Average	1.06	1.09	1.32	0.13	0.072	0.040	0.015
	Max	1.22	1.24	1.55	0.20	0.085	0.080	0.028
	Min	0.88	0.90	1.09	0.09	0.037	0.010	0.001
	Train B							
	Average	1.12	1.13	1.38	0.12	0.035	0.031	0.013
	Max	1.37	1.26	1.75	0.23	0.042	0.060	0.041
May	Train A							
	Average	1.07	1.14	1.29	0.11	0.074	0.039	0.014
	Max	1.45	1.55	1.66	0.18	0.176	0.110	0.025
	Min	0.21	0.33	1.02	0.08	0.046	0.000	0.005
	Train B							
	Average	1.22	1.25	1.44	0.11	0.050	0.044	0.012
	Max	1.53	1.73	1.82	0.16	0.101	0.400	0.025
June	Train A							
	Average	1.02	1.08	1.26	0.16	0.070	0.017	0.021
	Max	1.28	1.30	1.49	0.21	0.174	0.030	0.052
	Min	0.72	0.78	0.99	0.08	0.045	0.000	0.004
	Train B							
	Average	1.08	1.03	1.33	0.15	0.050	0.017	0.028
	Max	1.46	1.32	1.70	0.26	0.077	0.050	0.098
Min	0.80	0.75	1.02	0.07	0.037	0.000	0.008	

Table 1B								
Month		CHLORINE			TURBIDITY		IRON	MANGANESE
		Free (Lab)	Free (Wall)	Total				
		mg/L	mg/L	mg/L	NTU (Lab)	NTU (Wall)	mg/L	mg/L
July	Train A							
	Average	1.17	1.23	1.45	0.17	0.064	0.026	0.019
	Max	1.66	1.59	1.89	0.90	0.081	0.080	0.058
	Min	0.81	0.94	1.13	0.09	0.046	0.000	0.000
	Train B							
	Average	1.25	1.24	1.61	0.13	0.044	0.028	0.028
	Max	1.63	1.58	2.04	0.25	0.091	0.110	0.094
Min	0.77	0.89	1.08	0.07	0.034	0.000	0.003	
August	Train A							
	Average	1.24	1.23	1.58	0.14	0.065	0.031	0.028
	Max	1.60	1.57	1.97	0.27	0.087	0.070	0.049
	Min	0.89	0.89	1.22	0.06	0.038	0.000	0.002
	Train B							
	Average	1.21	1.17	1.53	0.13	0.052	0.049	0.030
	Max	1.60	1.68	2.04	0.25	0.143	0.820	0.093
Min	0.84	0.85	1.07	0.04	0.037	0.000	0.011	
September	Train A							
	Average	1.23	1.26	1.48	0.15	0.081	0.028	0.028
	Max	1.48	1.61	1.84	0.24	0.125	0.070	0.055
	Min	0.95	1.00	1.00	0.10	0.041	0.000	0.007
	Train B							
	Average	1.33	1.31	1.67	0.12	0.047	0.025	0.026
	Max	1.92	1.73	2.48	0.18	0.111	0.060	0.069
Min	0.84	1.04	1.34	0.02	0.038	0.000	0.003	
October	Train A							
	Average	1.35	1.67	1.61	0.13	0.129	0.027	0.024
	Max	1.63	10.80	1.92	0.18	0.900	0.098	0.038
	Min	1.00	0.99	1.21	0.08	0.046	0.000	0.013
	Train B							
	Average	1.24	1.21	1.49	0.11	0.049	0.018	0.023
	Max	1.66	1.61	1.89	0.18	0.082	0.090	0.048
Min	0.50	0.58	0.68	0.07	0.038	0.000	0.011	
November	Train A							
	Average	1.33	1.34	1.61	0.11	0.055	0.015	0.027
	Max	1.60	1.64	1.84	0.19	0.073	0.030	0.047
	Min	1.06	1.05	1.36	0.08	0.047	0.000	0.008
	Train B							
	Average	1.40	1.41	1.69	0.11	0.064	0.023	0.030
	Max	1.65	1.78	1.96	0.21	0.133	0.080	0.048
Min	1.06	1.09	1.11	0.06	0.040	0.000	0.014	
December	Train A							
	Average	1.26	1.29	1.51	0.15	0.064	0.015	0.028
	Max	1.84	1.75	2.18	0.30	0.104	0.060	0.045
	Min	0.91	0.91	1.13	0.07	0.040	0.000	0.012
	Train B							
	Average	1.23	1.29	1.53	0.14	0.084	0.021	0.033
	Max	1.66	1.70	2.02	0.26	0.149	0.080	0.048
Min	0.75	0.83	1.09	0.06	0.044	0.000	0.016	

Table 2B										
	Raw Water		Filter Effluent - Turbidities (NTU)				Clearwell Turbidities (NTU)		Clearwell Free Cl ₂ (mg/L)	
	SUPPLY RATE (m ³ /hr)	TURBIDITY (NTU)	No. 1 1720 D	No. 2 1720 D	No. 3 1720 D	No. 4 1720 D	1 / 2 1720 D	3 / 4 1720 D	1 / 2 Cl 17	3 / 4 Cl 17
January										
Max	288.00	5.08	0.045	0.047	0.041	0.033	0.112	0.076	1.330	1.260
Min	288.00	2.53	0.027	0.026	0.028	0.019	0.004	0.020	0.570	0.770
Average	288.00	3.74	0.030	0.029	0.032	0.023	0.042	0.033	1.037	1.075
February										
Max	288.00	3.84	0.045	0.045	0.042	0.033	0.055	0.051	1.44	1.37
Min	288.00	2.82	0.029	0.028	0.031	0.020	0.040	0.033	0.72	0.65
Average	288.00	3.26	0.033	0.031	0.034	0.024	0.044	0.037	1.12	1.13
March										
Max	288.00	5.70	0.052	0.051	0.051	0.054	0.060	0.062	1.430	1.330
Min	288.00	3.10	0.029	0.028	0.029	0.019	0.039	0.030	0.690	0.520
Average	288.00	4.03	0.034	0.032	0.033	0.024	0.044	0.037	0.956	1.047
April										
Max	288.00	733.00	0.068	0.068	0.069	0.061	0.134	0.147	1.640	1.560
Min	288.00	2.69	0.031	0.031	0.031	0.020	0.040	0.033	0.760	0.560
Average	288.00	125.42	0.041	0.040	0.041	0.030	0.056	0.052	1.161	1.067
May										
Max	360.00	490.00	0.049	0.058	0.061	0.047	0.076	0.099	1.600	1.400
Min	288.00	27.00	0.026	0.027	0.040	0.026	0.039	0.029	0.700	0.410
Average	324.00	94.20	0.034	0.042	0.047	0.033	0.050	0.048	1.137	1.076
June										
Max	360.00	290.00	0.044	0.053	0.053	0.040	0.076	0.084	4.750	1.290
Min	360.00	30.50	0.025	0.038	0.039	0.025	0.033	0.026	0.430	0.250
Average	360.00	84.35	0.033	0.042	0.044	0.030	0.045	0.037	1.121	0.980
July										
Max	360.00	54.70	0.055	0.069	0.082	0.066	0.093	0.271	1.497	1.430
Min	360.00	15.30	0.032	0.031	0.045	0.032	0.039	0.035	0.054	0.500
Average	360.00	27.35	0.039	0.050	0.055	0.040	0.052	0.049	1.152	1.129
August										
Max	360.00	22.10	0.074	0.094	0.065	0.053	0.086	0.071	1.480	1.400
Min	360.00	0.63	0.033	0.045	0.041	0.028	0.039	0.031	0.040	0.035
Average	360.00	13.54	0.050	0.052	0.047	0.034	0.047	0.042	1.175	1.095
September										
Max	360.00	9.92	0.520	0.068	0.048	0.039	0.213	0.060	5.000	3.500
Min	288.00	3.36	0.048	0.048	0.038	0.023	0.035	0.024	0.110	0.560
Average	328.80	5.75	0.055	0.052	0.041	0.028	0.047	0.034	1.081	1.062
October										
Max	288.00	8.06	0.053	0.054	0.053	0.029	0.076	0.039	1.475	1.160
Min	288.00	3.31	0.020	0.027	0.036	0.022	0.044	0.025	0.850	0.630
Average	288.00	4.26	0.038	0.040	0.044	0.025	0.049	0.029	1.109	0.958
November										
Max	1645.00	6.43	0.033	0.040	0.054	0.034	0.141	0.044	1.740	1.060
Min	288.00	1.92	0.021	0.027	0.034	0.022	0.046	0.028	0.610	0.430
Average	457.31	3.64	0.025	0.033	0.042	0.028	0.056	0.034	0.990	0.701
December										
Max	288.00	4.16	0.124	0.038	0.040	0.031	0.074	0.051	1.83	1.44
Min	288.00	2.09	0.020	0.026	0.004	0.022	0.040	0.024	0.64	0.36
Average	288.00	2.99	0.025	0.030	0.034	0.025	0.045	0.029	1.09	0.89

Table 3B						
LOCATION	SAMPLES	BACTERIOLOGICAL			CHLORINE	TURBIDITY
		# of positive samples			# of samples below guidelines	
	# of Samples	>200 Background Colonies	Total Coliform	E. Coli	Total < 0.5 Free < 0.1	Average
North	26	0	0	0	0	0.28
Fairview Heights	27	0	0	0	0	0.29
Kildeer Park	49	0	0	0	0	0.23
Maher/McIntosh Park	22	0	0	0	0	0.25
West	23	0	0	0	0	0.16
Downtown	26	0	0	0	1	0.35
East	25	0	0	0	0	0.27
South	24	0	0	0	0	0.24
Southeast	26	0	0	0	2	0.29
River View	52	0	0	0	0	0.30
Riverside	31	0	0	0	0	0.31
Parsons Industrial Park	48	0	0	0	0	0.18
Other ¹	202	0	4	2	2	0.72
Total Samples	581	0	4	2		
# of Routine Samples	379	0	0	0		
# of Routine Samples Required	156					

¹ These samples are not part of the routine sampling

² In cases where a sample comes back positive for Total Coliforms or E. Coli, samples are submitted 24 hours apart until 2 consecutive samples come back negative

*In cases where the Free and Total Chlorine falls below the guidelines set out by the Water Security Agency, the lines are flushed and chlorine retested.

Table 4B				
WTP #1 - Treated				
Month		30-Jan	13-Aug	AO
Parameter	Units	Results	Results	
Bicarbonate	mg/L	307	309	
Calcium	mg/L	88	88	
Carbonate	mg/L	<1	<1	
Chloride	mg/L	22	20	250
Hydroxide	mg/L	<1	<1	
Magnesium	mg/L	29	28	200
pH	pH Units	7.75	7.83	6.5-9.0
Potassium	mg/L	2.7	2.1	
Sodium	mg/L	42	41	300
E.C.	uS/cm	791	806	
Sulphate	mg/L	160	160	500
Sum of Ions	me/L	651	648	
Total Alkalinity	mg/L	252	253	500
Total Hardness	mg/L	339	334	800
Nitrate	mg/L	<0.04	0.09	
Fluoride	mg/L	0.38	0.12	1.5
TDS	mg/L	507	515	1500

Table 5B						
WTP #2 - Treated						
Month		30-Jan	28-May	13-Aug	13-Nov	AO
Analyte	Units	Results	Results	Results	Results	
Bicarbonate	mg/L	183	151	165	161	
Calcium	mg/L	54	46	44	43	
Carbonate	mg/L	<1	<1	<1	<1	
Chloride	mg/L	21	34	22	13	250
Hydroxide	mg/L	<1	<1	<1	<1	
Magnesium	mg/L	15	20	17	14	200
pH	pH Units	7.79	7.68	7.83	7.76	6.5-9.0
Potassium	mg/L	1.7	3	2	0.9	
Sodium	mg/L	15	20	14	8.5	300
E.C.	uS/cm	437	492	434	385	
Sulfate	mg/L	54	76	61	49	500
Sum of Ions	me/L	346	351	325	290	
Total Alkalinity	mg/L	150	124	135	132	500
Total Hardness	mg/L	196	197	180	165	800
Nitrate	mg/L	2	0.84	0.04	0.84	45*
Fluoride	mg/L	0.36	0.08	0.11	0.1	1.5
TDS	mg/L	242	298	251	216	1500

*This is a MAC based on Nitrate as NO₃

Table 6B						
Parameter	Units	WTP #1	WTP #2	MAC	iMAC	AO
Aluminum	mg/L	0.0006	0.13	n/a		
Arsenic	ug/L	0.2	0.1		25	
Barium	mg/L	0.11	0.068	1		
Boron	mg/L	0.03	0.02		5	
Cadmium	mg/L	0.00001	0.00001	0.005		
Chromium	mg/L	<0.0005	<0.0005	n/a		
Copper	mg/L	0.37	0.0013	1		
Iron	mg/L	0.0036	0.0043			0.3
Lead	mg/L	0.0003	<0.0001	0.01		
Manganese	mg/L	0.0045	0.015			0.05
Selenium	mg/L	<0.0001	0.0003	0.01		
Uranium	ug/L	0.2	0.4	0.00002		
Zinc	mg/L	0.064	0.0016			5
Cyanide	ug/L	<1	<1	0.0002		
Mercury	ug/L	<0.01	<0.01	0.000001		

Table 7B							
Trihalomethanes							
		iMAC	Total THMs	BROMOFORM	DIBROMO CHLOROMETHANE	DICHLORO BROMOMETHANE	CHLOROFORM
LOCATION	DATE	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Riverview	30-Jan-14		43.0	2	1.3	6.7	35
	28-May-14		28.8	2	<1	4.8	24
	6-Aug-14		40.3	2	1	6.3	33
	3-Nov-14		43.4	2	1.5	6.9	35
Downtown	30-Jan-14		43.1	2	1.3	6.8	35
	28-May-14		26.6	2	<1	4.6	22
	6-Aug-14		39.8	2	1	6.8	32
	3-Nov-14		65.1	2	2.1	11	52
	AVERAGE	<100	41.3	2	1.3	6.7	34
	Max		65.1	2	2.1	11.0	52
	Min		26.6	2	1.0	4.6	22

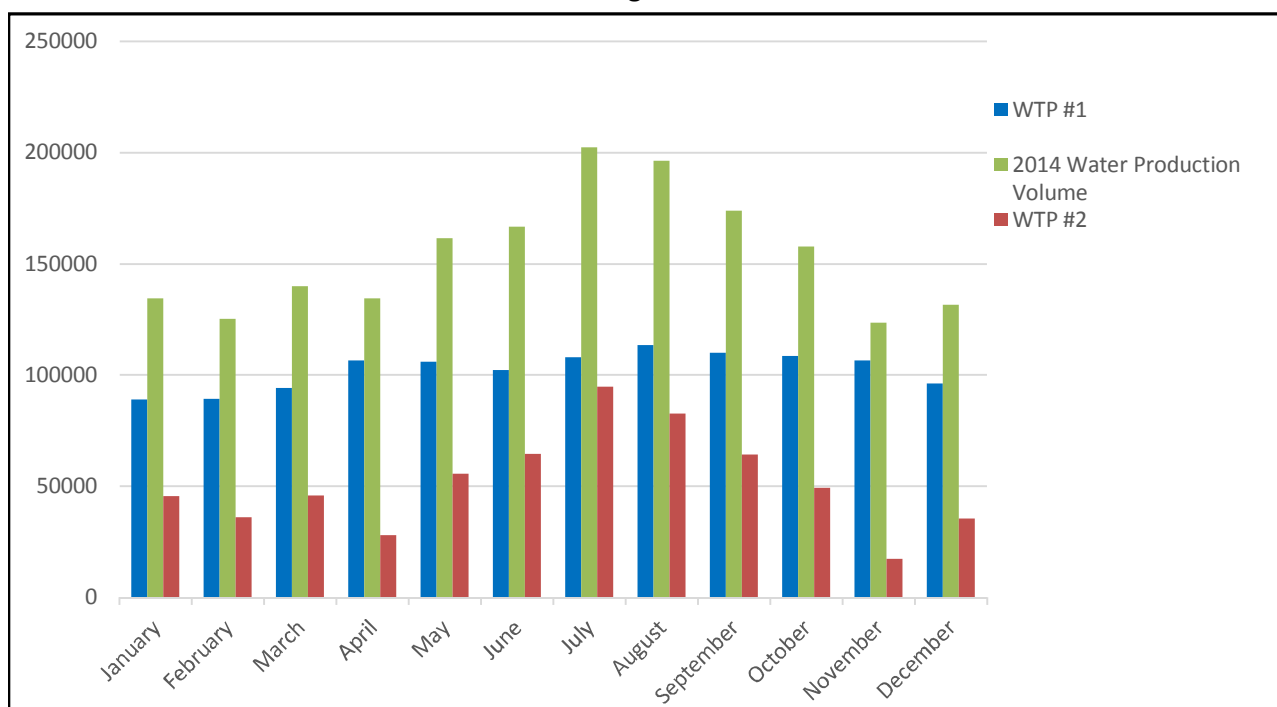
Table 8B									
Halo Acetic Acids									
		iMAC	Total HAAs	MONOCHLORACETIC ACID	MONOBROMOACETIC ACID	DICHLOROACETIC ACID	TRICHLORACETIC ACID	DIBROMOACETIC ACID	BROMOCHLOROACETIC ACID
LOCATION	DATE	ug/L		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Riverview	30-Jan-14		35.3	5	<1	14	14	<0.5	2.3
	28-May-14		31.5	5	1	11	10	1.5	3.0
	6-Jun-14		41.6	5	<1	18	13	1.4	4.2
	3-Nov-14		41.1	5	<1	19	15	<0.5	2.1
Downtown	30-Jan-14		34.1	5	<1	13	14	<0.5	2.1
	28-May-14		32.5	5	1	11	11	1.5	3.0
	6-Aug-14		39.0	5	<1	15	14	1.4	3.6
	3-Nov-14		39.4	5	<1	18	15	<0.5	1.4
	AVERAGE	<80	36.8	5	1.0	14.9	13	1.5	2.7
	Max		41.6	5	1.0	19.0	15	1.5	4.2
	Min		31.5	5	1.0	11.0	10	1.4	1.4

City of North Battleford
Drinking Water Quality
2014 Report
Appendix C: Water Production Volumes

Table 1C						
	WTP #1		WTP #2		Combined	
Month	Total	Average	Total	Average	Total Monthly Production	Average Daily Production
January	88863.5	2866.565	45466.6	1466.66452	134330.1	4333.229032
February	89179.5	3184.982	36052	1287.57143	125231.5	4472.553571
March	93945.5	3030.5	45780.7	1476.79677	139726.2	4507.296774
April	106577.5	3552.583	27912.6	930.42	134490.1	4483.003333
May	105844.7	3414.345	55586.4	1793.10968	161431.1	5207.454839
June	102019.7	3400.657	64552.1	2151.73667	166571.8	5552.393333
July	107789.2	3477.071	94550.2	3050.00645	202339.4	6527.077419
August	113504.2	3661.426	82643.7	2665.92581	196147.9	6327.351613
September	109773.7	3659.123	64126.2	2137.54	173899.9	5796.663333
October	108419.1	3497.39	49291.6	1590.05161	157710.7	5087.441935
November	106406.3	3546.877	17096.3	569.876667	123502.6	4116.753333
December	96131.6	3101.019	35294.5	1138.53226	131426.1	4239.551613
Yearly Total	1228455	3366.045	618352.9	1688.18599	1846807.4	5054.230844

Note: All readings are in m³

Figure 3C



*City of North Battleford
Drinking Water Quality
2014 Report
Appendix D: Glossary*

Glossary

AO – Aesthetic Objective and is based on taste, odour, or staining

BOD – Biochemical Oxygen Demand is the amount of dissolved oxygen needed by aerobic organisms in water to break down organic material present.

BTEX – Benzene, Toluene, Ethylbenzene, and Xylene are volatile organic compounds typically found in petroleum products such as gasoline and diesel.

EC – is a measure of water's ability to conduct electricity, The higher the concentration of dissolved ions, the higher the conductivity. It is most often measured in $\mu\text{S}/\text{cm}$ – microSiemens per centimetre.

E. coli – is the only member of the total coliform group of bacteria that is found only in the intestines of mammals. The presence of E. coli in water indicates recent fecal contamination and may indicate the possible presence of disease-causing pathogens

FEH WTP – F.E. Holliday Water Treatment Plant

iMAC – Interim Maximum Acceptable Limit and is health based

MAC - Maximum Acceptable Limit and is health based

Microcystins – are toxins produced by blue-green algae (cyanobacteria).

mg/L – milligrams per litre

NTU – Nephelometric Turbidity Unit is based on the amount of light that is scattered by particles

OG – Operational Guidelines and is based on operational considerations (for example the water treatment process used)

Pathogen – is a disease causing microorganism such as a virus or bacterium.

pH – is a measure of how acidic or basic a solution is. It ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic while a pH greater than 7 is basic.

S.E. – Saskatchewan Ministry of the Environment is the department that oversees solid waste disposal

THMs – Trihalomethanes are disinfection by-products that form when chlorine is added to water that contains natural organic matter.

TKN – Total Kjeldahl nitrogen is the sum of organic nitrogen, ammonia, and ammonium.

Total Coliforms – are a group of bacteria commonly found in the environment. They are not likely to cause illness, but their presence indicates the water supply may be vulnerable to contamination by more harmful microorganisms.

Total P – Total Phosphorus is a measure of all the forms of phosphorus in a sample

TSS – Total Suspended Solids includes all particles suspended in water which will not pass through a filter.

Turbidity – is a measure of relative clarity of a liquid. Guidelines for turbidity are a safeguard against pathogens in drinking water.

VSS – Volatile Suspended Solids is the portion of Total Suspended Solids that can be ignited and is made up of organic material.

WSA – The Water Security Agency was created on October 1, 2012. The former Saskatchewan Watershed Authority is now part of this new provincial water organization. This agency regulates and monitors waterworks and wastewaterworks.

WTP – Water Treatment Plant

WTP #1- Water Treatment Plant #1, this is the groundwater plant

WTP #2 – Water Treatment Plant #2, also officially known as F.E.Holliday Water Treatment Plant, this is the surface water plant

µg/L – micrograms per litre; this is 1000 times smaller than a milligram (0.001mg/L)