



**Public Water System
Annual Report
-2007-**

*Public Water System: **Virden Water Treatment Plant**
Water Treatment Classification III
Distribution Classification II*

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Certification: Level III WT, Level II WD*

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Certification: Level III WT, Level II WD*

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1. Water Treatment Process Description:

1.1 Raw water supply

- *The Town of Virden water treatment plant receives its water from two wells located in the Assiniboine Valley approximately 4.5 miles from the town. The wells are both 60 feet deep with a 60HP, submersible turbine pump in each well*

1.2 Water treatment process

- *The raw water is pumped into the water plant at a rate of 25 to 26 litres/second, with a total plant capacity of 45 litres/second. The water upon reaching the plant is treated with ozone to oxidize the iron and manganese, and arsenic. After the ozonation a chemical (sodium metabisulfite) is added to bind the oxygen in the water to stop the biological growth of iron bacteria. The water then goes through a set of dual media gravity filters containing greensand/granular activated carbon for the partial removal of the oxidized iron, manganese and arsenic. Due to the arsenic left in the treated water approximately 40% of the filtered water is pumped to a nanofiltration unit to reduce the arsenic to below the drinking water standards. An antiscalant (Flocon 260) is added to the nano feedwater to prevent the fouling of the membranes this extends the life of the filters and increases their performance. The filtered water leaving the nano unit is extremely corrosive because of all of the minerals which have been removed from the water and the permeate (filtered water) has to be treated with soda ash to increase the pH back to a range of 7.3 to 7.5*
- *Three chemicals are injected into the blended water prior to it entering the reservoir*
 1. *gaseous chlorine for primary disinfection*
 2. *C-5 (polyphosphate) a sequestering agent for iron and manganese, and a coating for the interior walls of the distribution piping to prevent corrosion*
 3. *hydrofluorosilicic acid (fluoride) for dental caries*
- *The on site reservoir holds approximately 450,000 imperial gallons of water, and an elevated tower which holds approximately 85,000 imperial gallons, gives the town a fire fighting back up supply and a 1.5 to 2 day reserve for domestic use.*
- *Sodium hypochlorite (liquid chlorine) is added to the treated water prior to being pumped into the distribution system. The distribution*



system consists of a mixture of PVC and cast iron piping totaling approximately 36.6kms.

- The water leaving the plant is controlled in two different ways
 1. Water tower level: which is a percentage signal received over the phone line via a modem at the tower to another modem at the water treatment plant. This signal turns the distribution pumps on and off and determines the number of pumps required directly related to the tower level.
 2. Flow control: this controls the pumps by a pressure signal which is produced at the plant dependant on demand in the distribution piping. This signal also controls the number of pumps required to be running and is used as a back-up to the water tower, in cases where the tower is required to be taken off line for service or repair.

2. Water testing

The Town of Virden currently performs various tests to ensure the safety of the water leaving the plant to the consumer's tap. Under Provincial Legislation the following testing is preformed.

2.1 Bacteriological sampling: the raw water supply and the treated water are tested bi-weekly for total coliform and Escherichia coli (E-coli) by ALS LABS a government approved lab. These tests are necessary to ensure the system is free of any pathogens (disease causing bacteria) which ensures a safe drinking water source for the consumer. Average results are listed at the end of this report in table #1

2.2 Disinfection residuals: a test is done at designated locations in the distribution system to ensure a free chlorine residual of 0.1 mg/L at the farthest point in the distribution system. If the 0.1 mg/L is not met the system is flushed by opening fire hydrants until the chlorine levels reach the desired level. Average results are listed at the end of this report in table #2

2.3 Arsenic tests: arsenic tests are done every 3 months on the raw water, RO permeate, and the distribution. Our current treatment process is unable to meet the drinking water standards, which have been set at 0.01 mg/L (ppm-parts per million) Results are listed at the end of this report in table #3



3. In house testing:

3.1 Chlorine tests

- *Total chlorine: a measure of all chlorine compounds in the water*
- *Free chlorine: a measure of the actual Cl₂ remaining in the water for disinfection after all chemical reactions with chlorine are complete*

3.2 TCU (true colour units): a measure of the colour of the water after being passed through a 5 micron filter. By passing the water through the filter it eliminates measuring any suspended materials such as iron and manganese in the sample and gives a more accurate reading of the actual discoloration of the water.

3.3 Iron (Fe): a measurement of both the Ferric & Ferrous iron in the water, although iron is not a health related parameter it can cause severe staining in laundry and fixtures, usually leaving brownish discoloration. Can also cause taste & odour complaints.

3.4 Manganese (Mn): is not a health related parameter but like iron can cause staining of fixtures and laundry, usually leaving blackish discoloration.

3.5 Turbidity: a measure of the clarity of the water. Too high a turbidity will interfere with disinfection by using up available chlorine in the water or protecting the bacteria in the water from coming in contact with the disinfection process.

Averages for test results can be found at the end of this report in table #4



4. Current status of the WTP and future plans:

Currently our plant is not producing the water quality we would prefer to provide to the consumer, due to a combination of problems within the facility itself. The primary treatment which is ozone is unable to provide the necessary oxidation and colour removal that it was intended for and is creating an unforeseen problem by original designers in providing an oxygen enriched environment for bacterial growth within the plant. This scenario had to be corrected by the addition of an anti-oxidant chemical addition prior to the water entering the gravity filters. The bacterial growth although not eliminated has been reduced to a manageable degree. This bacterial growth has also caused fouling problems in the nano filtration system which diminishes its capacity for treatment. The plant is still able to produce a safe drinking water to the consumer, but is not meeting the current drinking water parameters for TCU, AS, and FE. Due to these ongoing problems at the plant, a pilot study was undertaken starting in October of 2007. This pilot is intended to prove or disprove the feasibility of using strictly RO for the treatment of the raw water, and should be completed in early 2008. The pilot project has been contracted to DWG Process out of Edmonton, Alberta, and the on site operation and testing will be done by Town of Virden staff. The results are being monitored by Genivar Engineering and a final report and recommendation will be forthcoming after completion of the piloting.

Future plans for the plant include the ongoing piloting of the RO system, and the study indicating which direction the town will be taking to correct the ongoing treatment shortcomings. The current piloting will be in neighborhood of \$15,000 after completion, but will provide us with clear direction for future upgrades to the plant.



5. Provincial test result averages:

5.1-Bacteriological tests

<i>Month</i>	<i>Standard 0-Tot Coli 0-E.Coli</i>	<i>System average</i>	<i>Meet standard</i>	<i>Corrective action</i>
<i>Jan</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Feb</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Mar</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Apr</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>May</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Jun</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Jul</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Aug</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Sep</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Oct</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Nov</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	
<i>Dec</i>	<i>0</i>	<i>0</i>	<i>Yes</i>	

5.2-Distribution disinfection residuals (free chlorine)

<i>Month</i>	<i>Standard mg/L</i>	<i>System average</i>	<i>Meet standard</i>	<i>Corrective action</i>
<i>Jan</i>	<i>0.1</i>	<i>0.1</i>	<i>Yes</i>	
<i>Feb</i>	<i>0.1</i>	<i>0.1</i>	<i>Yes</i>	
<i>Mar</i>	<i>0.1</i>	<i>0.1</i>	<i>Yes</i>	
<i>Apr</i>	<i>0.1</i>	<i>0.1</i>	<i>Yes</i>	
<i>May</i>	<i>0.1</i>	<i>0.1</i>	<i>Yes</i>	
<i>Jun</i>	<i>0.1</i>	<i>0.2</i>	<i>Yes</i>	
<i>Jul</i>	<i>0.1</i>	<i>0.1</i>	<i>Yes</i>	
<i>Aug</i>	<i>0.1</i>	<i>0.05</i>	<i>No</i>	<i>Flush hydrant in area to raise level & retest</i>
<i>Sep</i>	<i>0.1</i>	<i>0.05</i>	<i>No</i>	<i>Flush hydrant in area to raise level & retest</i>
<i>Oct</i>	<i>0.1</i>	<i>0.1</i>	<i>Yes</i>	
<i>Nov</i>	<i>0.1</i>	<i>0.2</i>	<i>Yes</i>	
<i>Dec</i>	<i>0.1</i>	<i>0.2</i>	<i>Yes</i>	



5.3-Arsenic tests

Month	Standard	Distribution average	Meet standard	Corrective action
Jan	0.01	0.032	no	Due to lowered standards our plant is currently unable to meet the new levels
Feb	0.01	0.033	no	
Mar	0.01	0.032	no	
Apr	0.01	0.037	no	
May	0.01	0.039	no	Engineers start feasibility study of the WTP
Jun	0.01	0.044	no	
Jul	0.01	0.034	no	
Aug	0.01	0.034	no	Contact DWG to start with RO pilot study
Sep	0.01	0.035	no	
Oct	0.01	0.038	no	RO pilot started
Nov	0.01	0.037	no	Pilot testing
Dec	0.01	0.037	no	Pilot testing

6.In House Testing

6.1 WTP disinfection residuals (free chlorine)

Month	Standard mg/L	System average	Meet standard	Corrective action
Jan	0.5	1.4	Yes	
Feb	0.5	1.3	Yes	
Mar	0.5	1.1	Yes	
Apr	0.5	0.6	Yes	
May	0.5	0.9	Yes	
Jun	0.5	1.3	Yes	
Jul	0.5	1.1	Yes	
Aug	0.5	1.1	Yes	
Sep	0.5	1.2	Yes	
Oct	0.5	0.8	Yes	
Nov	0.5	0.4	No	Installation of liquid chlorine feed pump
Dec	0.5	1.2	Yes	Installation of feed system complete



6.2 Fe (iron) averages

<i>Month</i>	<i>Objective mg/l</i>	<i>System average</i>	<i>Meet objective</i>	<i>Corrective action</i>
<i>Jan</i>	<i>0.3</i>	<i>0.1</i>	<i>Yes</i>	
<i>Feb</i>	<i>0.3</i>	<i>0.1</i>	<i>Yes</i>	
<i>Mar</i>	<i>0.3</i>	<i>0.3</i>	<i>Yes</i>	
<i>Apr</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>Chemical pump failure</i>
<i>May</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>“</i>
<i>Jun</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>“</i>
<i>Jul</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>“</i>
<i>Aug</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>“</i>
<i>Sep</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>“</i>
<i>Oct</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>New pump installed</i>
<i>Nov</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>Chemical pump failure</i>
<i>Dec</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>“</i>

6.3 Mn (manganese) averages –raw water

<i>Month</i>	<i>Objective mg/l</i>	<i>System average</i>	<i>Meet objective</i>	<i>Corrective action</i>
<i>Jan</i>	<i>0.05</i>	<i>0.029</i>	<i>Yes</i>	
<i>Feb</i>	<i>0.05</i>	<i>0.027</i>	<i>Yes</i>	
<i>Mar</i>	<i>0.05</i>	<i>0.048</i>	<i>Yes</i>	
<i>Apr</i>	<i>0.05</i>	<i>0.048</i>	<i>Yes</i>	
<i>May</i>	<i>0.05</i>	<i>0.034</i>	<i>Yes</i>	
<i>Jun</i>	<i>0.05</i>	<i>0.038</i>	<i>Yes</i>	
<i>Jul</i>	<i>0.05</i>	<i>0.028</i>	<i>Yes</i>	
<i>Aug</i>	<i>0.05</i>	<i>0.031</i>	<i>Yes</i>	
<i>Sep</i>	<i>0.05</i>	<i>0.021</i>	<i>Yes</i>	
<i>Oct</i>	<i>0.05</i>	<i>0.027</i>	<i>Yes</i>	
<i>Nov</i>	<i>0.05</i>	<i>0.022</i>	<i>Yes</i>	
<i>Dec</i>	<i>0.05</i>	<i>0.020</i>	<i>yes</i>	



6.4 Turbidity averages Distribution

<i>Month</i>	<i>Objective NTU</i>	<i>System average</i>	<i>Meet objective</i>	<i>Corrective action</i>
<i>Jan</i>	<i>0.3</i>	<i>0.3</i>	<i>Yes</i>	
<i>Feb</i>	<i>0.3</i>	<i>0.3</i>	<i>Yes</i>	
<i>Mar</i>	<i>0.3</i>	<i>0.3</i>	<i>Yes</i>	
<i>Apr</i>	<i>0.3</i>	<i>0.3</i>	<i>Yes</i>	
<i>May</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>Increase filter backwash</i>
<i>Jun</i>	<i>0.3</i>	<i>0.5</i>	<i>No</i>	<i>Check filter media</i>
<i>Jul</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>Pilot new filter media</i>
<i>Aug</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>“</i>
<i>Sep</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	
<i>Oct</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	<i>Start RO pilot</i>
<i>Nov</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	
<i>Dec</i>	<i>0.3</i>	<i>0.4</i>	<i>No</i>	

6.5 TCU (true colour units) averages

<i>Month</i>	<i>Objective TCU</i>	<i>System average</i>	<i>Meet objective</i>	<i>Corrective action</i>
<i>Jan</i>	<i>8</i>	<i>19</i>	<i>No</i>	<i>Ozone failure</i>
<i>Feb</i>	<i>8</i>	<i>18</i>	<i>No</i>	
<i>Mar</i>	<i>8</i>	<i>20</i>	<i>No</i>	
<i>Apr</i>	<i>8</i>	<i>20</i>	<i>No</i>	
<i>May</i>	<i>8</i>	<i>11</i>	<i>No</i>	
<i>Jun</i>	<i>8</i>	<i>9</i>	<i>No</i>	<i>New ozone system installed</i>
<i>Jul</i>	<i>8</i>	<i>12</i>	<i>No</i>	
<i>Aug</i>	<i>8</i>	<i>18</i>	<i>No</i>	<i>Ozone system failure</i>
<i>Sep</i>	<i>8</i>	<i>15</i>	<i>No</i>	
<i>Oct</i>	<i>8</i>	<i>14</i>	<i>No</i>	<i>Ozone generator repairs</i>
<i>Nov</i>	<i>8</i>	<i>10</i>	<i>No</i>	
<i>Dec</i>	<i>8</i>	<i>9</i>	<i>No</i>	



Conclusion:

This report was prepared by the Town of Virden to provide its rate payers with an overview of the water treatment facility current status. If you have any comments or concerns please call the town office during business hours, and we will try to answer any questions you may have. For a complete list of all test results, records are available at the office and will be posted on our website in the very near future.

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Dated: September 30, 2008*