***Public Water System***
***Annual Report***

## *Water Treatment Process Description:*

### *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*

### *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.*

***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.*

***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*

***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*

***Trihalomethane sampling (THM)**: THMs are formed when chlorine is combined with organics in the water. THMs are considered to be carcinogens (cancer causing compounds) and therefore are regulated by the province. Results are listed at the end of this report in table #3*

***Turbidity tests**: measured in NTU (nephelometric turbidity units). This test is done on the raw water, to determine whether or not there are any changes in the water supply, and is a measure of the cloudiness or clarity of the water. Average results are listed at the end of this report in table #4*

***Onsite testing**:*

*Chlorine tests*

- *Total chlorine: a measure of all chlorine compounds in the water*

- *Free chlorine: a measure of the actual $Cl_2$ remaining in the water for disinfection after all chemical reactions with chlorine are complete*

*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.*

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

*Manganese (Mn): is not a health related parameter but like iron can cause staining of fixtures and laundry.*

*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 #5*

***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 THMs, TCU, Fe, and TOC. Due to these ongoing problems at the plant, a pilot study was undertaken starting in October of 2007 and completed in February of 2008, to determine what improvements or changes could be done to the treatment process in order to meet or even exceed the current and or future standards for drinking water. The study was conducted by DWG Process (Edmonton, Alberta), and the Town of Virden, under the direction of GENIVAR Engineering. The results were conclusive, indicating that our current process would not be able to be made to work, and that a new process was required for our treatment plant. This prompted the piloting of a new reverse osmosis (RO) system, running our raw water directly through the RO without any prior pretreatment. The results of the piloting were studied by DWG and Genivar Engineering and a recommendation to change our process to RO was given by Genivar and approved by town council.*

*The equipment contract for the new RO process has been awarded to GE Osmonics, from Minnetonka, Minnesota.*

*The projected cost for the upgrade to the existing water treatment process is estimated to be approximately 1.8 million dollars, and a projected time frame for installation is February of 2010. The demolition/removal of the existing treatment process was started in December of 2009, and interim treatment of pre filter chlorination and post filter chlorination initiated, on December23, 2009.*

***5. Provincial test result averages:***

***5.1-Bacteriological tests***

| *Month* | *Standard* *0-Tot Coli* *O-E.Coli* | *System average* | *Meet standard* | *Corrective action* |
|---|---|---|---|---|
| *Jan* | *0* | *0* | *Yes* | |
| *Feb* | *0* | *0* | *Yes* | |
| *Mar* | *0* | *0* | *Yes* | |
| *Apr* | *0* | *0* | *Yes* | |
| *May* | *0* | *0* | *Yes* | |
| *Jun* | *0* | *0* | *Yes* | |
| *Jul* | *0* | *0* | *Yes* | |
| *Aug* | *0* | *0* | *Yes* | |
| *Sep* | *0* | *0* | *Yes* | |
| *Oct* | *0* | *0* | *Yes* | |
| *Nov* | *0* | *0* | *Yes* | |
| *Dec* | *0* | *0* | *Yes* | |

***5.2-Distribution disinfection residuals*** *(free chlorine)*

| *Month* | *Standard mg/L* | *System low* | *Meet standard* | *Corrective action* |
|---|---|---|---|---|
| *Jan* | *0.1* | *0.13* | *Yes* | |
| *Feb* | *0.1* | *0.13* | *Yes* | |
| *Mar* | *0.1* | *0.12* | *Yes* | |
| *Apr* | *0.1* | *0.11* | *Yes* | |
| *May* | *0.1* | *0.10* | *Yes* | |
| *Jun* | *0.1* | *0.10* | *Yes* | |
| *Jul* | *0.1* | *0.05* | *No* | *Flush hydrant in area, result = 0.07mg/L* |
| *Aug* | *0.1* | *0.07* | *No* | *Flush hydrant in area, result = 0..19mg/L* |
| *Sep* | *0.1* | *0.10* | *Yes* | |
| *Oct* | *0.1* | *0.04* | *No* | *Flush hydrant in area, result = 0.12mg/L* |
| *Nov* | *0.1* | *0.10* | *Yes* | |
| *Dec* | *0.1* | *0.10* | *yes* | |

***5.3-Arsenic tests***

| *Month* | *Standard* | *Distribution average* | *Meet standard* | *Corrective action* |
|---|---|---|---|---|
| *Jan* | *0.01* | *0.040* | *No* | *Plant upgrade in 2010* |
| *Feb* | *0.01* | *0.047* | *No* | " |
| *Mar* | *0.01* | *0.046* | *No* | " |
| *Apr* | *0.01* | *0.044* | *No* | " |
| *May* | *0.01* | *0.040* | *No* | " |
| *Jun* | *0.01* | *0.046* | *No* | " |
| *Jul* | *0.01* | *0.041* | *No* | " |
| *Aug* | *0.01* | *0.043* | *No* | " |
| *Sep* | *0.01* | *0.043* | *No* | " |
| *Oct* | *0.01* | *0.040* | *No* | " |
| *Nov* | *0.01* | *0.044* | *No* | " |
| *Dec* | *0.01* | *0.040* | *No* | " |

***6.In House Testing***

***6.1 WTP disinfection residuals*** *(free chlorine)*

| *Month* | *Standard mg/L* | *System average* | *Meet standard* | *Corrective action* |
|---|---|---|---|---|
| *Jan* | *0.5* | *0.61* | *Yes* | |
| *Feb* | *0.5* | *0.75* | *Yes* | |
| *Mar* | *0.5* | *0.52* | *Yes* | |
| *Apr* | *0.5* | *0.75* | *Yes* | |
| *May* | *0.5* | *0.55* | *Yes* | |
| *Jun* | *0.5* | *0.52* | *Yes* | |
| *Jul* | *0.5* | *0.52* | *Yes* | |
| *Aug* | *0.5* | *0.67* | *Yes* | |
| *Sep* | *0.5* | *0.25* | *No* | *Sep 13, divert RO permeate flow to reservoir Sep 14 residual =0.5mg/L* |
| *Oct* | *0.5* | *0.30* | *No* | *Oct 30, increase chlorine feed, Oct 31residual = 0.54mg/L* |
| *Nov* | *0.5* | *1.03* | *Yes* | |
| *Dec* | *0.5* | *1.67* | *Yes* | |

### *6.2 Fe (iron) averages*

| *Month* | *Objective mg/l* | *System average* | *Meet objective* | *Corrective action* |
|---|---|---|---|---|
| ***Jan*** | ***0.3*** | ***0.42*** | ***No*** | *Upgrade to plant for 2010* |
| ***Feb*** | ***0.3*** | ***0.47*** | ***No*** | " |
| ***Mar*** | ***0.3*** | ***0.43*** | ***No*** | " |
| ***Apr*** | ***0.3*** | ***0.49*** | ***No*** | " |
| ***May*** | ***0.3*** | ***0.46*** | ***No*** | " |
| ***Jun*** | ***0.3*** | ***0.45*** | ***No*** | " |
| ***Jul*** | ***0.3*** | ***0.40*** | ***No*** | " |
| ***Aug*** | ***0.3*** | ***0.39*** | ***No*** | " |
| ***Sep*** | ***0.3*** | ***0.37*** | ***No*** | " |
| ***Oct*** | ***0.3*** | ***0.38*** | ***No*** | " |
| ***Nov*** | ***0.3*** | ***0.37*** | ***No*** | " |
| ***Dec*** | ***0.3*** | ***0.24*** | ***yes*** | " |

### *6.3 Mn (manganese) averages –raw water*

| *Month* | *Objective mg/l* | *System average* | *Meet objective* | *Corrective action* |
|---|---|---|---|---|
| ***Jan*** | ***0.05*** | ***0.036*** | ***Yes*** | |
| ***Feb*** | ***0.05*** | ***0.037*** | ***Yes*** | |
| ***Mar*** | ***0.05*** | ***0.045*** | ***Yes*** | |
| ***Apr*** | ***0.05*** | ***0.045*** | ***Yes*** | |
| ***May*** | ***0.05*** | ***0.042*** | ***Yes*** | |
| ***Jun*** | ***0.05*** | ***0.040*** | ***Yes*** | |
| ***Jul*** | ***0.05*** | ***0.040*** | ***Yes*** | |
| ***Aug*** | ***0.05*** | ***0.040*** | ***Yes*** | |
| ***Sep*** | ***0.05*** | ***0.060*** | ***No*** | *Regenerate filters* |
| ***Oct*** | ***0.05*** | ***0.030*** | ***Yes*** | |
| ***Nov*** | ***0.05*** | ***0.045*** | ***Yes*** | |
| ***Dec*** | ***0.05*** | ***0.037*** | ***Yes*** | |

### *6.4 Turbidity averages Distribution*

| *Month* | *Objective NTU* | *System average* | *Meet objective* | *Corrective action* |
|---|---|---|---|---|
| ***Jan*** | ***0.3*** | ***0.42*** | ***No*** | *Upgrade to plant for 2010* |
| ***Feb*** | ***0.3*** | ***0.42*** | ***No*** | " |
| ***Mar*** | ***0.3*** | ***0.40*** | ***No*** | " |
| ***Apr*** | ***0.3*** | ***0.38*** | ***No*** | " |
| ***May*** | ***0.3*** | ***0.43*** | ***No*** | " |
| ***Jun*** | ***0.3*** | ***0.38*** | ***No*** | " |
| ***Jul*** | ***0.3*** | ***0.38*** | ***No*** | " |
| ***Aug*** | ***0.3*** | ***0.40*** | ***No*** | " |
| ***Sep*** | ***0.3*** | ***0.50*** | ***No*** | " |
| ***Oct*** | ***0.3*** | ***0.36*** | ***No*** | " |
| ***Nov*** | ***0.3*** | ***0.41*** | ***No*** | " |
| ***Dec*** | ***0.3*** | ***0.33*** | ***No*** | " |

### *6.5 TCU (true colour units) averages*

| *Month* | *Objective TCU* | *System average* | *Meet objective* | *Corrective action* |
|---|---|---|---|---|
| ***Jan*** | ***8*** | ***12*** | ***No*** | *Upgrade to plant for 2010* |
| ***Feb*** | ***8*** | ***13*** | ***No*** | " |
| ***Mar*** | ***8*** | ***12*** | ***No*** | " |
| ***Apr*** | ***8*** | ***12*** | ***No*** | " |
| ***May*** | ***8*** | ***9*** | ***No*** | " |
| ***Jun*** | ***8*** | ***13*** | ***No*** | " |
| ***Jul*** | ***8*** | ***11*** | ***No*** | " |
| ***Aug*** | ***8*** | ***8*** | ***Yes*** | " |
| ***Sep*** | ***8*** | ***11*** | ***No*** | " |
| ***Oct*** | ***8*** | ***8*** | ***Yes*** | " |
| ***Nov*** | ***8*** | ***9*** | ***No*** | " |
| ***Dec*** | ***8*** | ***6*** | ***yes*** | " |

***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 by the end of March 2010 for the period of this report.*

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*Dated: January 21, 2010*