DISTRICT OF CHETWYND COMMUNITY WATER SYSTEM

2018

ANNUAL REPORT

Prepared January 2019

Contents

1. Water System Description

1.1 Total Population Served

3100

1.2 Number of Connections – Residential and Business

1135

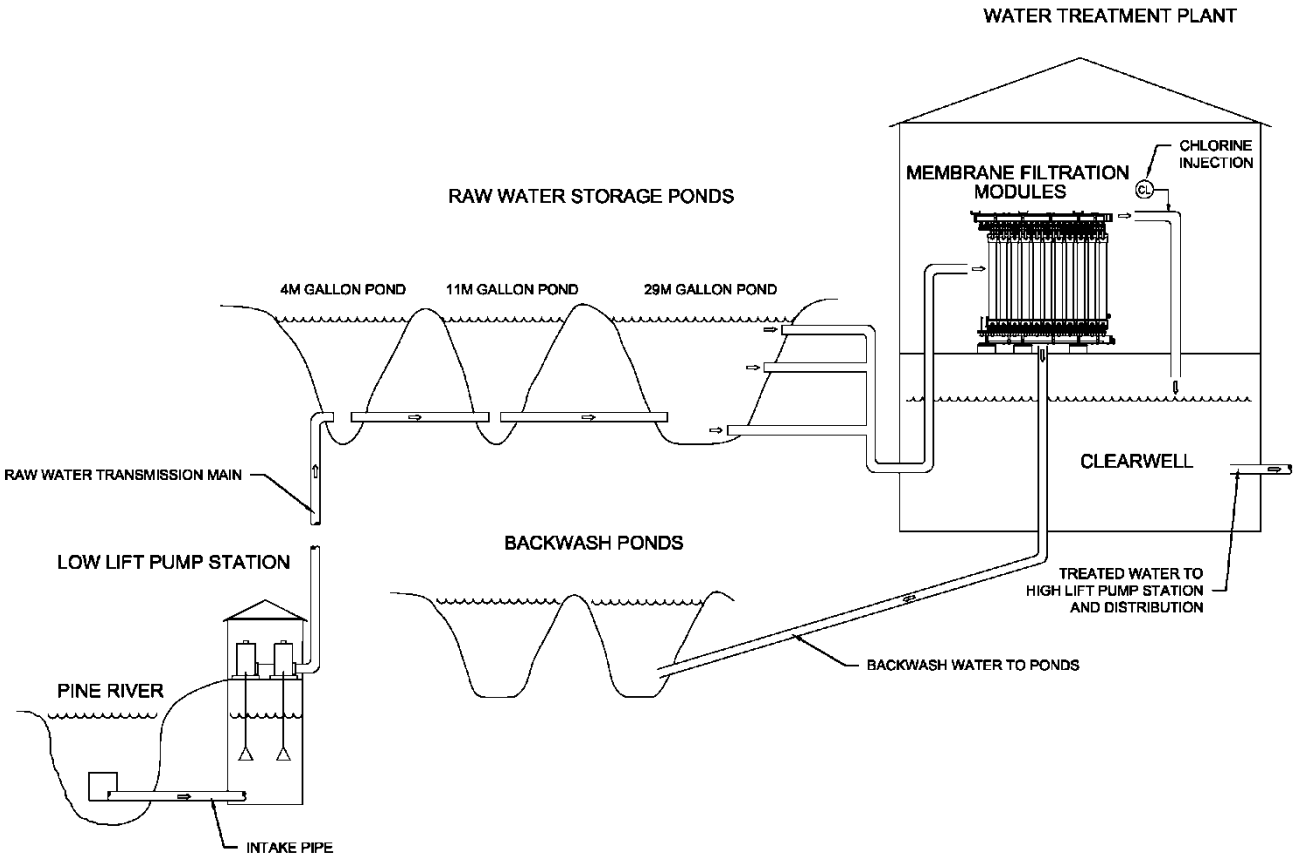


Figure 1: Overview of water treatment process

1.3 Source Water

In 2018, the primary raw water source for the District of Chetwynd from January until May was groundwater from the District's Well #3. During this period of time, the District's Water Treatment Plant underwent a substantial upgrade, thus requiring temporary modification to the source and treatment process, as described in the following sections.

Once construction at the Water Treatment Plant was complete and the new equipment was commissioned (end of May, 2018), the District returned to normal operation in which approximately 95% of its raw water was drawn from the Pine River.

- Surface water from the Pine River is gravity fed to the low lift pumping station;

- The water is then pumped from the low lift pump station to the raw water storage/settling ponds.
    - The raw water reservoirs comprised of 3 cells provide a total storage of 44 million gallons which accounts for approximately 60 days of water supply for Chetwynd
- Groundwater from Well #3, capacity 22L/s, is used as a secondary source during times of high turbidity levels in the Pine River such as spring run-off. At the well site the water is first pre-chlorinated to eliminate the iron and manganese before being pumped to the water plant for treatment and then blended with the primary treated water source.

1.4 Water Treatment Type

Chetwynd's Water Treatment Plant is automated utilizing a Supervisory Control and Data Acquisition (SCADA) system.

Treatment includes the following steps:

- Raw water is pumped into the membrane filtration system from the balancing tank. During times of high organic loading, clearpac may be added for coagulation, and to help with taste and odor.

Image 1: Balancing tanks

- Pre-treatment occurs through the self-cleaning strainer.

Image 2: Self-cleaning strainer

- Microfiltration devices remove turbidity, bacteria, cysts, and particles from ground and surface water. Membranes trap impurities by means of a fixed porous barrier.

Images 3 and 4: Microfiltration modules

- Air is injected into the filter from the air tank and, expands the pore size to shake the debris loose out of the filters.

Image 5: Air compressor and tank

- The CHN Skid dispenses chemical and warm water for circulation through the membrane modules for the various washing processes of the filter.

Image 6: CHN Skid

- A sodium hypochlorite generation system then provides disinfection of the water.

Images 7 and 8: Sodium hypochlorite generation system and pump skid

- The treated water is then conveyed to the wet well located beneath the treatment plant.

Images 9 and 10: Water Treatment Plant wet well access hatch

- Water is gravity fed from the treatment plant wet well to the high lift pump station where it is pumped to the distribution system.

Image 11: Vertical turbine pumps in High Lift Pump Station

- A back-up generator provides power to operate the water treatment plant and high lift pump station during power outages.

Image 12: Backup generator

2. Water Quality Data

2.1 Summary

Water quality sampling and testing conducted in 2018 included the following:

- Seven sites throughout Chetwynd's Water Distribution System were tested bi-weekly for free chlorine residual and bacteriological samples.
- The Water Treatment Plant tested daily for free chlorine residual, temperature, pH, turbidity and bacteriological samples were collected bi-weekly.

- The total number of free chlorine residual samples collected was 386
- The total number of bacteriological samples collected was 147:
  - 147 biweekly testing

- There were no positive test results for Bacteria or E. coli in any of the Chetwynd Distribution System during 2018.

2.2 Sampling Locations and Results

Data source: **http://www.healthspace.ca/nha**

http://www.watertrax.com/

2.2.1 Results from Bacteriological Analyses at All Sampling Locations

All sampling locations showed the following results for bacteriological samples:

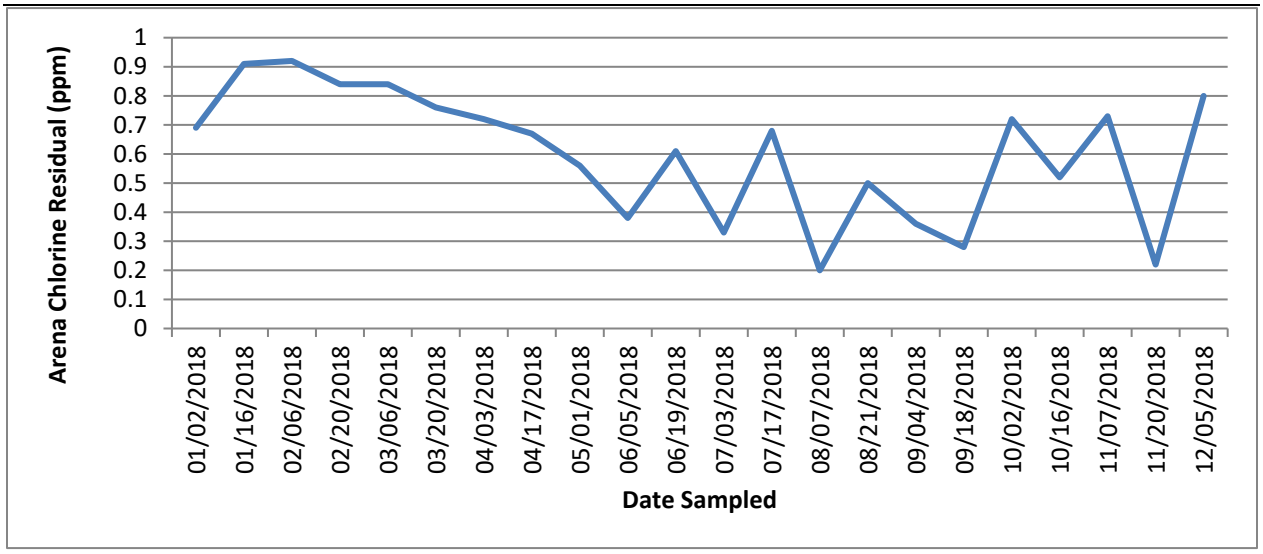
Date	Total Coliform	Fecal Coliform	E. Coli	Date	Total Coliform	Fecal Coliform	E. Coli
02-Jan-18	L1*		L1	03-Jul-18	L1		L1
16-Jan-18	L1		L1	17-Jul-18	L1		L1
06-Feb-18	L1		L1	07-Aug-18	L1		L1
20-Feb-18	L1		L1	21-Aug-18	L1		L1
06-Mar-18	L1		L1	04-Sep-18	L1		L1
20-Mar-18	L1		L1	18-Sep-18	L1		L1
03-Apr-18	L1		L1	02-Oct-18	L1		L1
17-Apr-18	L1		L1	16-Oct-18	L1		L1
01-May-18	L1		L1	07-Nov-18	L1		L1
05-Jun-18	L1		L1	20-Nov-18	L1		L1
19-Jun-18	L1		L1	05-Dec-18	L1		L1

*note: “L1” indicates less than 1 (<1); acceptable

2.2.2 Free Chlorine Residual Testing

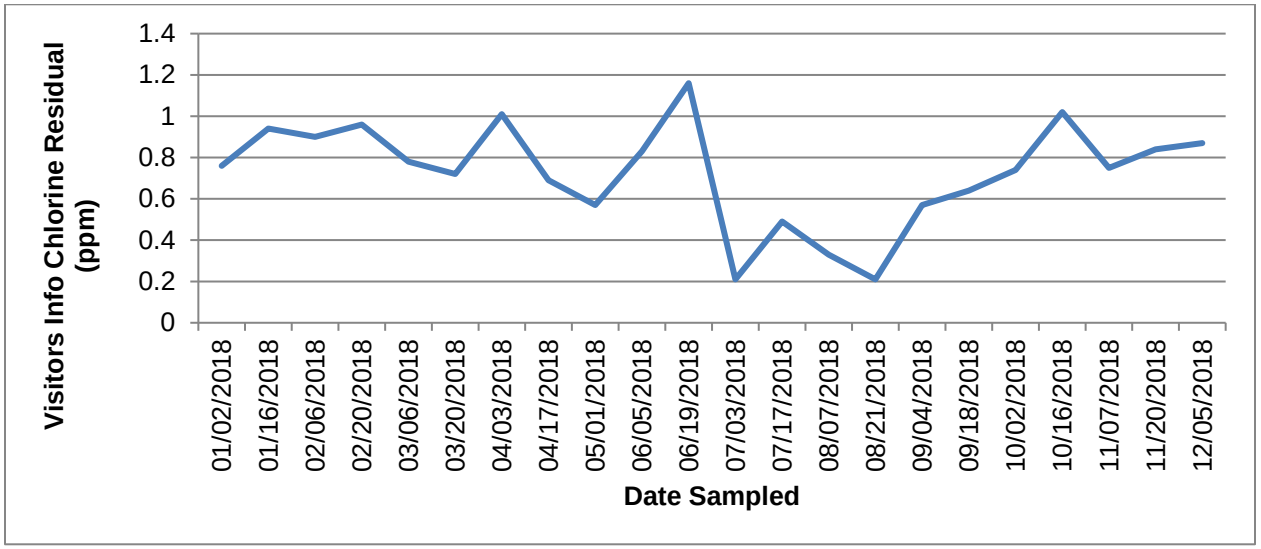
Chetwynd Arena

4552 North Access Road



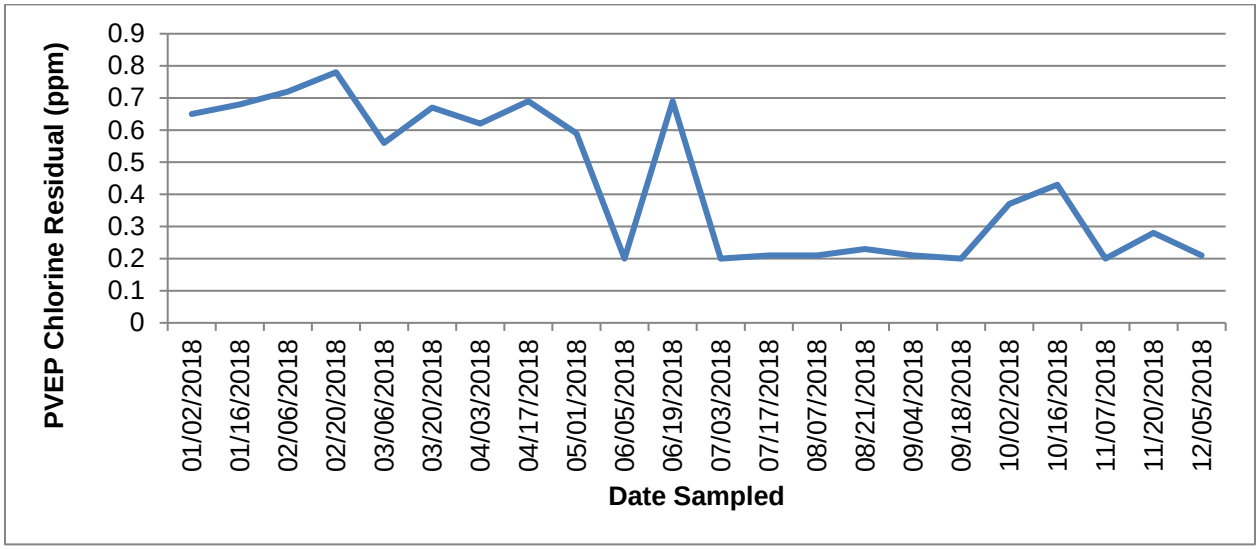
Visitor's Information Office

5400 North Access Road



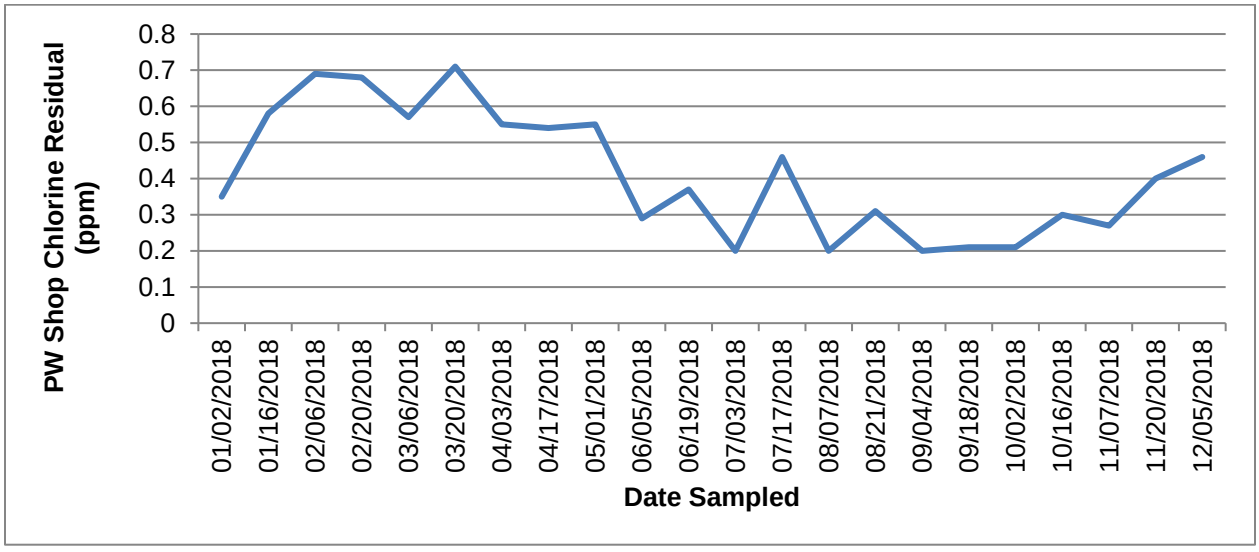
Pine Valley Senior's Hall

5312 47th Ave NW



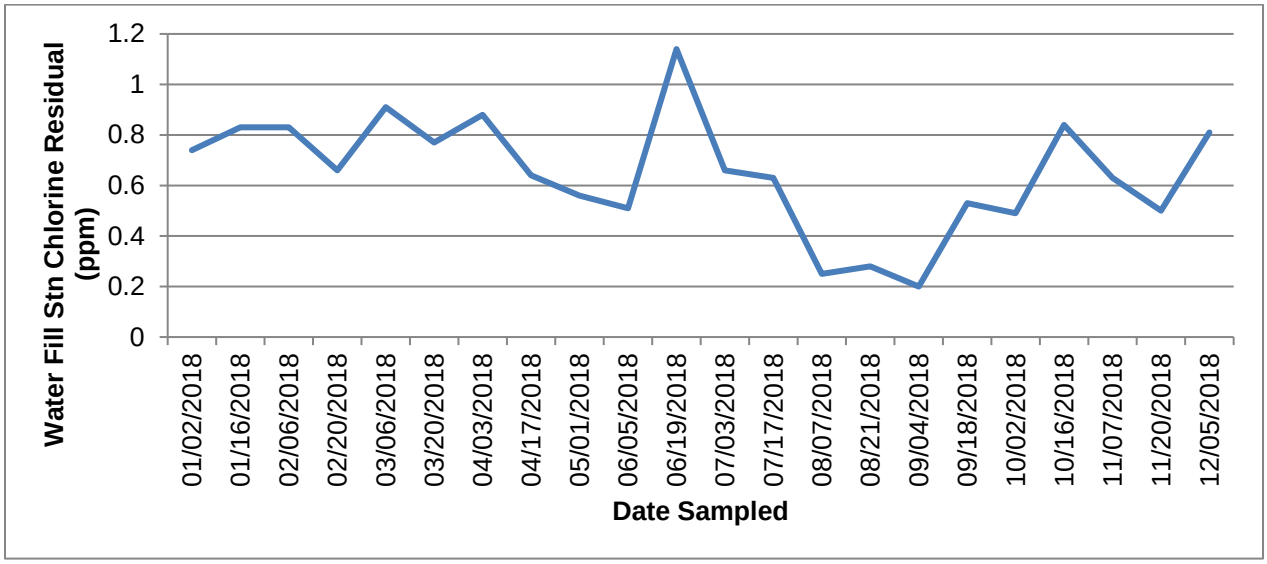
Public Works Shop/Industrial Site

4508 Nicholson St NE



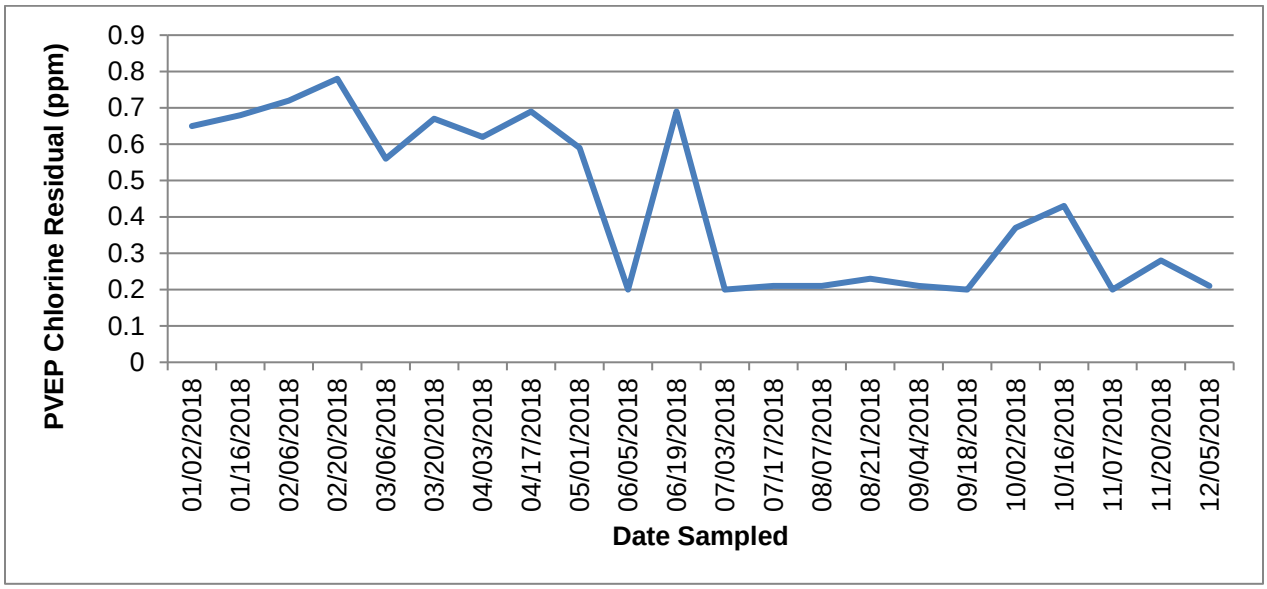
Water Fill Station

5375 Nicholson Rd SE

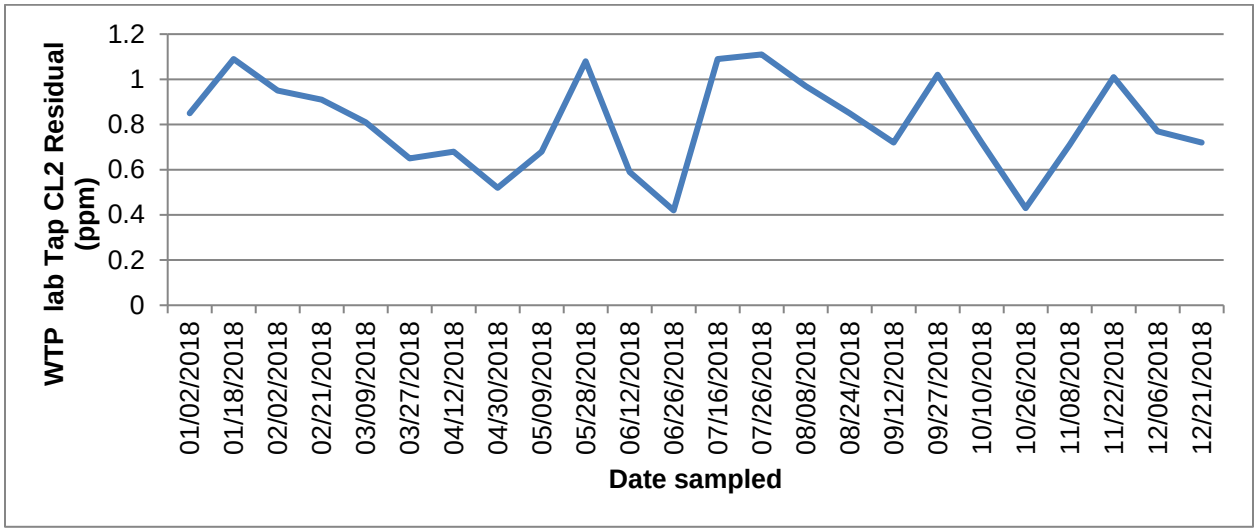


Pine Valley Exhibition Park

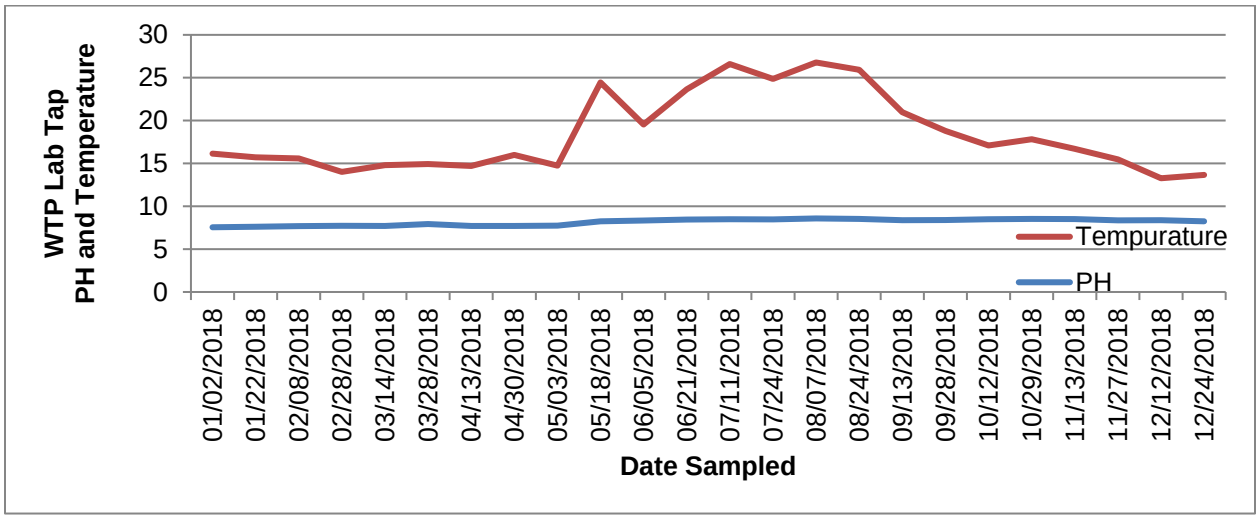
3900 Pine Valley Way NE



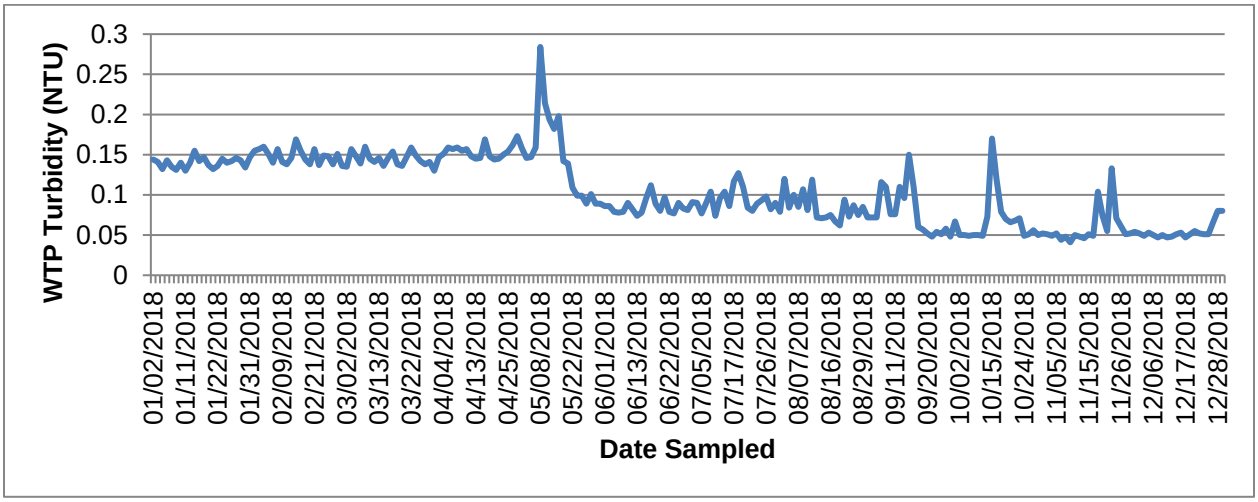
Water Treatment Plant - Lab Tap



pH and Temperature Results - Water Treatment Plant – Lab Tap



Turbidity Results - Water Treatment Plant – Lab Tap



3. Water Chemistry Data

The Water Chemistry Data is provided in “Appendix A”. During the times of high turbidity in the Pine River (generally less than 5% of the year) the water from Well No.3 is blended 50/50 with the raw water feed to the Water Treatment Plant. It is shown that all of the water chemistry Analyte(s) for the treated drinking water, as shown as “Skid A” and “WTP lab tap” sample source, are within the Guideline for Canadian Drinking Water Quality, although Well #3 showed a slightly higher than normal barium content.

3.1 System Improvements

The following major upgrades to the Water Treatment Plant were completed between January and May of 2018:

A new micro-filtration water treatment plant came online mid-May. The Pall Aria Water Treatment System uses hollow fiber micro-filtration devices to remove turbidity, bacteria, cysts, and particles from ground and surface water. Membranes trap impurities by means of a fixed porous barrier. The Pall system includes 2 units with 42 membrane modules on a 60 module space skid in order to add extra modules if there is more demand for water to accommodate future growth for Chetwynd.

The processes involved in the Pall system are automated for ease of operator control and consistent performance. These processes include normal production of filtrate (finished water) and regeneration (backwashes, which are done every 45 minutes of run time). Backwashes consist of an air scrub and reverse filtration for cleaning of the modules. Then there is a process called enhanced backwashes which include chlorine addition and a circulation time of 30 minutes. These enhanced backwashes are done based on volume of filtrate produced (3000m3). The most intense cleaning process is called CIP (clean-in-place), which involves a superior cleaning using chlorine, citric acid, and caustic soda. A CIP cleaning is done once every 60 days, or depending on feed water quality and membrane performance.

The system performs 5 minute integrity tests every 24 run time hours. This test checks for broken fibers in the modules. This test uses compressed air and introduces it to the feed side of the modules, and the modules are isolated from the rest of the piping system. If the modules maintain pressure during the test period, then the membrane fibers are confirmed to be intact. The Pall system also has a raw water feed strainer at the beginning of the process which performs automatic backwashes to avoid clogging.

The Pall system records, displays, and stores operating data for process control, troubleshooting, and diagnostics. It monitors pressures, flows, temperatures, turbidity, and process volume measurements. Also, it monitors membrane performance before and after cleaning, membrane and system integrity, run activity, operator input, and any alarms with the system.

This system is designed to produce 6000 m3/day of finished water with a maximum flow rate of 112 l/s (1,777 gal/min) with both skids running. Each skid is designed with a max flow rate of 61.3 l/s (972 gal/min). The former water plant had a maximum flow rate of 70 l/s (923 gal/min) with both plants running (35 l/s per plant). Also wastewater from the old water plant from backwashing and upflushes was approximately 150,000 m3 per year; the new plant is estimated to be 25,000 m3 per year. The turbidity for the old plant averaged .3 NTU; the new water plant results in a turbidity of .05 NTU on average. Also, prior to the upgrades, operators were unable to increase the water flow to meet demands, which they are now able to do with the Pall system. With the upgrades, operators can also now add poly aluminum chloride to the balancing tanks only when needed, during times of algae blooms in the summer months. The new treatment process also provides better organics removal from the raw water in comparison to the former treatment process, resulting in higher quality treated water.

The main sewer line from 47th Street NE to 50 Ave NE was replaced and the service lines were inspected and replaced back to property line if needed. This project was in essential, as there was significant deterioration in the line and is part of our ongoing infrastructure replacement plan.

4. Compliance with Operating Permit

The District of Chetwynd continues to meet the conditions of our operation permit, as well as additional testing and monitoring.

5. Additional Information

For additional information or any general inquiries regarding our water system, please contact our Engineering and Public Works department at 250-401-4100.

Appendix A: Water Chemistry Data

ALS			WATER TREATMENT LAB TAP	SKID A	WELL #3
1/15/2019			L2190576-1	L2190576-2	L2190576-6
L2190576			10/30/2018 9:30:00 AM	10/30/2018 10:00:00 AM	10/30/2018 11:15:00 AM
Analyte	**Units**	**GCDWQ - MAC**	Water	Water	Water
UV Absorbance (254 nm)	Abs/cm	-	-	-	-
Colour, True	CU	-	<5.0	-	-
Conductivity	uS/cm	-	313	-	-
Hardness (as CaCO3)	mg/L	-	154	-	-
pH	pH	-	8.4	-	-
Total Suspended Solids	mg/L	-	<3.0	-	-
Total Dissolved Solids	mg/L	-	198	-	-
Transmittance, UV (254 nm)	%T/cm	-	-	-	-
Turbidity	NTU	-	<0.10	-	-
Alkalinity, Total (as CaCO3)	mg/L	-	136	-	-
Ammonia, Total (as N)	mg/L	-	<0.0050	-	-
Bromide (Br)	mg/L	-	<0.050	-	-
Chloride (Cl)	mg/L	-	5.76	-	-
Fluoride (F)	mg/L	1.5	0.088	-	-
Nitrate (as N)	mg/L	10	<0.0050	-	-
Nitrite (as N)	mg/L	1	<0.0010	-	-
Total Kjeldahl Nitrogen	mg/L	-	0.118	-	-
Total Nitrogen	mg/L	-	0.118	-	-
Total Organic Nitrogen	mg/L	-	0.118	-	-
Orthophosphate-Dissolved (as P)	mg/L	-	<0.0010	-	-
Phosphorus (P)-Total	mg/L	-	<0.0020	-	-
Sulfate (SO4)	mg/L	-	23.5	-	-
Dissolved Organic Carbon	mg/L	-	2.24	2.26	-
Total Inorganic Carbon	mg/L	-	35	-	-
Total Organic Carbon	mg/L	-	2.36	2.46	-

Aluminum (Al)-Total	mg/L	-	0.0126	-	<0.0030
Antimony (Sb)-Total	mg/L	0.006	<0.00020	-	<0.00010
Arsenic (As)-Total	mg/L	0.01	0.0003	-	0.00599
Barium (Ba)-Total	mg/L	1	0.124	-	0.944
Beryllium (Be)-Total	mg/L	-	<0.0010	-	<0.00010
Bismuth (Bi)-Total	mg/L	-	<0.0010	-	<0.000050
Boron (B)-Total	mg/L	5	<0.050	-	0.066
Cadmium (Cd)-Total	mg/L	0.005	<0.00020	-	0.0000079
Calcium (Ca)-Total	mg/L	-	44.9	-	41.1
Cesium (Cs)-Total	mg/L	-	-	-	0.000015
Chromium (Cr)-Total	mg/L	0.05	<0.0010	-	<0.00010
Cobalt (Co)-Total	mg/L	-	<0.0010	-	<0.00010
Copper (Cu)-Total	mg/L	2	0.003	-	0.0009
Iron (Fe)-Total	mg/L	-	<0.030	-	1.12
Lead (Pb)-Total	mg/L	0.01	<0.0010	-	<0.000050
Lithium (Li)-Total	mg/L	-	0.012	-	0.0187
Magnesium (Mg)-Total	mg/L	-	11.4	-	26.7
Manganese (Mn)-Total	mg/L	-	<0.0010	-	0.0257
Mercury (Hg)-Total	mg/L	0.001	<0.000050	-	<0.000050
Molybdenum (Mo)-Total	mg/L	-	0.0012	-	0.0214
Nickel (Ni)-Total	mg/L	-	<0.0010	-	0.00068
Phosphorus (P)-Total	mg/L	-	<0.30	-	<0.050
Potassium (K)-Total	mg/L	-	0.664	-	2.06
Rubidium (Rb)-Total	mg/L	-	-	-	0.00101
Selenium (Se)-Total	mg/L	0.05	<0.0010	-	<0.000050
Silicon (Si)-Total	mg/L	-	1.47	-	5.44
Silver (Ag)-Total	mg/L	-	<0.00010	-	<0.000010
Sodium (Na)-Total	mg/L	-	6.32	-	29.4
Strontium (Sr)-Total	mg/L	-	0.272	-	0.605
Sulfur (S)-Total	mg/L	-	-	-	2.53
Tellurium (Te)-Total	mg/L	-	-	-	<0.00020
Thallium (Tl)-Total	mg/L	-	<0.0010	-	<0.000010
Thorium (Th)-Total	mg/L	-	-	-	<0.00010
Tin (Sn)-Total	mg/L	-	<0.0010	-	<0.00010
Titanium (Ti)-Total	mg/L	-	-	-	<0.00030
Tungsten (W)-Total	mg/L	-	-	-	<0.00010

Uranium (U)-Total	mg/L	0.02	0.000515	-	0.000949
Vanadium (V)-Total	mg/L	-	<0.0050	-	<0.00050
Zinc (Zn)-Total	mg/L	-	<0.0050	-	<0.0030
Zirconium (Zr)-Total	mg/L	-	-	-	<0.000060
Dissolved Mercury Filtration Location		-	LAB	-	LAB
Dissolved Metals Filtration Location		-	LAB	-	LAB
Aluminum (Al)-Dissolved	mg/L	-	0.0118	-	<0.0010
Antimony (Sb)-Dissolved	mg/L	0.006	<0.00020	-	<0.00010
Arsenic (As)-Dissolved	mg/L	0.01	0.00027	-	0.004
Barium (Ba)-Dissolved	mg/L	1	0.123	-	1.01
Beryllium (Be)-Dissolved	mg/L	-	<0.0010	-	<0.00010
Bismuth (Bi)-Dissolved	mg/L	-	<0.0010	-	<0.000050
Boron (B)-Dissolved	mg/L	5	<0.050	-	0.061
Cadmium (Cd)-Dissolved	mg/L	0.005	<0.00020	-	0.0000068
Calcium (Ca)-Dissolved	mg/L	-	43	-	39.9
Cesium (Cs)-Dissolved	mg/L	-	-	-	0.000017
Chromium (Cr)-Dissolved	mg/L	0.05	<0.0010	-	<0.00010
Cobalt (Co)-Dissolved	mg/L	-	<0.0010	-	<0.00010
Copper (Cu)-Dissolved	mg/L	2	0.0026	-	<0.00020
Iron (Fe)-Dissolved	mg/L	-	<0.030	-	<0.010
Lead (Pb)-Dissolved	mg/L	0.01	<0.0010	-	<0.000050
Lithium (Li)-Dissolved	mg/L	-	0.011	-	0.0178
Magnesium (Mg)-Dissolved	mg/L	-	11.2	-	25.5
Manganese (Mn)-Dissolved	mg/L	-	<0.0010	-	0.0223
Mercury (Hg)-Dissolved	mg/L	0.001	<0.000050	-	<0.000050
Molybdenum (Mo)-Dissolved	mg/L	-	0.0012	-	0.0218
Nickel (Ni)-Dissolved	mg/L	-	<0.0010	-	<0.00050
Phosphorus (P)-Dissolved	mg/L	-	<0.30	-	<0.050
Potassium (K)-Dissolved	mg/L	-	0.664	-	1.98
Rubidium (Rb)-Dissolved	mg/L	-	-	-	0.00088
Selenium (Se)-Dissolved	mg/L	0.05	<0.0010	-	<0.000050
Silicon (Si)-Dissolved	mg/L	-	1.45	-	5.3
Silver (Ag)-Dissolved	mg/L	-	<0.00010	-	<0.000010
Sodium (Na)-Dissolved	mg/L	-	6.01	-	27.4

Strontium (Sr)-Dissolved	mg/L	-	0.279	-	0.643
Sulfur (S)-Dissolved	mg/L	-	-	-	2
Tellurium (Te)-Dissolved	mg/L	-	-	-	<0.00020
Thallium (Tl)-Dissolved	mg/L	-	<0.0010	-	<0.000010
Thorium (Th)-Dissolved	mg/L	-	-	-	<0.00010
Tin (Sn)-Dissolved	mg/L	-	<0.0010	-	<0.00010
Titanium (Ti)-Dissolved	mg/L	-	-	-	<0.00030
Tungsten (W)-Dissolved	mg/L	-	-	-	<0.00010
Uranium (U)-Dissolved	mg/L	0.02	0.000474	-	0.000834
Vanadium (V)-Dissolved	mg/L	-	<0.0050	-	<0.00050
Zinc (Zn)-Dissolved	mg/L	-	<0.0050	-	<0.0010
Zirconium (Zr)-Dissolved	mg/L	-	-	-	<0.000060
Benzene	mg/L	0.005	-	-	-
Bromodichloromethane	mg/L	-	-	-	-
Bromoform	mg/L	-	-	-	-
Carbon Tetrachloride	mg/L	0.005	-	-	-
Chlorobenzene	mg/L	0.08	-	-	-
Dibromochloromethane	mg/L	-	-	-	-
Chloroethane	mg/L	-	-	-	-
Chloroform	mg/L	-	-	-	-
Chloromethane	mg/L	-	-	-	-
1,2-Dichlorobenzene	mg/L	0.2	-	-	-
1,3-Dichlorobenzene	mg/L	-	-	-	-
1,4-Dichlorobenzene	mg/L	0.005	-	-	-
1,1-Dichloroethane	mg/L	-	-	-	-
1,2-Dichloroethane	mg/L	0.005	-	-	-
1,1-Dichloroethylene	mg/L	0.014	-	-	-
cis-1,2-Dichloroethylene	mg/L	-	-	-	-
trans-1,2-Dichloroethylene	mg/L	-	-	-	-
Dichloromethane	mg/L	0.05	-	-	-
1,2-Dichloropropane	mg/L	-	-	-	-
cis-1,3-Dichloropropylene	mg/L	-	-	-	-
trans-1,3-Dichloropropylene	mg/L	-	-	-	-
1,3-Dichloropropene (cis & trans)	mg/L	-	-	-	-
Ethylbenzene	mg/L	0.14	-	-	-
Methyl t-butyl ether (MTBE)	mg/L	-	-	-	-

Styrene	mg/L	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/L	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/L	-	-	-	-
Tetrachloroethylene	mg/L	0.01	-	-	-
Toluene	mg/L	0.06	-	-	-
1,1,1-Trichloroethane	mg/L	-	-	-	-
1,1,2-Trichloroethane	mg/L	-	-	-	-
Trichloroethylene	mg/L	0.005	-	-	-
Trichlorofluoromethane	mg/L	-	-	-	-
Vinyl Chloride	mg/L	0.002	-	-	-
ortho-Xylene	mg/L	-	-	-	-
meta- & para-Xylene	mg/L	-	-	-	-
Xylenes	mg/L	0.09	-	-	-
4-Bromofluorobenzene (SS)	%	-	-	-	-
1,4-Difluorobenzene (SS)	%	-	-	-	-
Acenaphthene	mg/L	-	-	-	-
Acenaphthylene	mg/L	-	-	-	-
Acridine	mg/L	-	-	-	-
Anthracene	mg/L	-	-	-	-
Benz(a)anthracene	mg/L	-	-	-	-
Benzo(a)pyrene	mg/L	0.00004	-	-	-
Benzo(b&j)fluoranthene	mg/L	-	-	-	-
Benzo(b+j+k)fluoranthene	mg/L	-	-	-	-
Benzo(g,h,i)perylene	mg/L	-	-	-	-
Benzo(k)fluoranthene	mg/L	-	-	-	-
Chrysene	mg/L	-	-	-	-
Dibenz(a,h)anthracene	mg/L	-	-	-	-
Fluoranthene	mg/L	-	-	-	-
Fluorene	mg/L	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/L	-	-	-	-
1-Methylnaphthalene	mg/L	-	-	-	-
2-Methylnaphthalene	mg/L	-	-	-	-
Naphthalene	mg/L	-	-	-	-
Phenanthrene	mg/L	-	-	-	-
Pyrene	mg/L	-	-	-	-
Quinoline	mg/L	-	-	-	-

Acridine d9	%	-	-	-	-
Chrysene d12	%	-	-	-	-
Naphthalene d8	%	-	-	-	-
Phenanthrene d10	%	-	-	-	-
Bromodichloromethane	mg/L	-	0.004	-	-
Bromoform	mg/L	-	<0.0010	-	-
Dibromochloromethane	mg/L	-	<0.0010	-	-
Chloroform	mg/L	-	0.0419	-	-
Total THMs	mg/L	0.1	0.0459	-	-
Bromochloroacetic Acid	mg/L	-	0.002	-	-
Dibromoacetic Acid	mg/L	-	0.002	-	-
Dichloroacetic Acid	mg/L	-	0.0127	-	-
Total Haloacetic Acids 5	mg/L	0.08	0.0269	-	-
Monobromoacetic Acid	mg/L	-	<0.0010	-	-
Monochloroacetic Acid	mg/L	-	<0.0050	-	-
Trichloroacetic Acid	mg/L	-	0.0123	-	-
2,3-Dibromopropionic Acid (SS)	%	-	108.9	-	-
Applied Guideline:	**Federal Guidelines for Canadian Drinking Water Quality (FEB, 2017) - GCDWQ - Maximum Acceptable Concentrations (MACs)**				
Colour Key:	Within Guideline				