Water Treatment Plant Year-end Report for 2023

For Information Only

Water demand

The total influent volume of water drawn from the Assiniboine River for treatment was approximately 1.2% higher in 2023 than in 2022, and 21% higher than in 2020. 2023 had an influent volume of 9,750,681 m3 compared to 9,635,407 m3 in 2022.

The total treated volume of water pumped to the distribution system from the water treatment plant was approximately 8,882,598 m3 in 2023, compared to 8,593,430 m3 in 2022.

The volume of water used internally for the treatment process in 2023 was 203,846 m3. This water is used in the process production for mixing chemicals, dilution of chemicals for pumping purposes, and flushing pipes after sludge removal from process systems.

Raw Water Quality

The raw water quality for 2023 had higher turbidity spikes than the previous year. From early April to nearly the end of May the water treatment plant (WTP) experienced several turbidity spikes up to 1100 NTU and over. The turbidity spikes were caused by the spring thaw, ice jams and a malfunction of the Assiniboine River diversion, which made controlling the flow of water very difficult for MIT staff. The Actiflo clarifier was able to reduce the high levels of turbidity to minimize the impact on the downstream treatment process. The plant effluent turbidity rose slightly in the spring as usual. This is due to organics, and water chemistry changes as the near-freezing water warms up.

The average raw water hardness for the winter months; January, February, March, October, November, and December 2023, was 415 ppm. The raw water hardness average for the other six months was 363 ppm. The treated water average hardness was 199 ppm and 192 ppm for the respective periods. The 2023 yearly average hardness for Raw Water was 389 ppm and Treated Water was 195 ppm.

The 2023 spring runoff caused above-average operator overtime and shift changes. Having two of the four diversion gates stuck in the open position diverted more sand and debris than usual toward our river intake. The river water caused continual plugging of our raw intake pumps. The greater-than-normal amount of debris also caused challenging conditions in our Actiflo pre-treatment clarifier. Our staff were required to work many nights during the spring runoff to service equipment to ensure water production continued. Plant operation during fall freeze-up proved easier and was similar to an average year.

Distribution System Water Quality

Distribution testing for 2023 was done weekly for Total Coliforms and Escherichia Coli. All Drinking Water Regulation treatment parameters were met.

General Chemistry sampling was conducted on a semi-annual basis from our WTP Raw and finished water, and two other locations in the City. The samples were sent for the assessment of multiple water parameters, including routine, nutrients, metals and non-metals. The samples were sent to an independent lab and all results were forwarded, by the lab, to the Manitoba Conservation and Climate, Office of Drinking Water Officer for our area. The guidelines were met for all of these samples.

On March 8, 2019, Health Canada set new regulatory guidelines for lead in potable water. The new Canadian Drinking Water Quality Guideline maximum acceptable concentration (MAC) for total lead was lowered from 0.010 mg/L, set in 1992, to 0.005 mg/L. This is based on a sample of water taken at the consumer's tap.

Starting in 2022 the provincial Office of Drinking Water, partnered with Manitoba Health has mandated the City to do lead testing in forty residences per year. In 2023, 41 sets of samples were obtained from participants' homes and tested for total lead. One sample was taken straight out of the tap without flushing and a second sample was taken after flushing the tap for 5 minutes. Many of the homes tested in 2023 had confirmed lead service lines.

More information may be obtained from the City's web page and in the 2023 Public Water System annual report, including how the City mitigates corrosion to reduce lead exposure.

Water Quality Monitoring and Analyses

Each year, an annual water system report is to be completed by the City and submitted to Manitoba Conservation & Climate, Office of Drinking Water by March 31st. The Office of Drinking Water and the City of Portage la Prairie will continue implementing testing improvements at the Water Treatment Plant to enhance the water quality and will continue to work jointly with the local Drinking Water Officer.

The attached graphs for Hardness show that Raw Water followed a typical annual pattern for the most part, being softer after spring runoff and harder near year-end. In November and December however, there were naturally large jumps in the raw hardness that were harder to deal with. Overall, in 2023 the plant operators did a good job dealing with the hardness, the average finished total hardness was 195 ppm.

As shown in the turbidity graph below and as previously mentioned, the WTP experienced higher-than-usual turbidity spikes in 2023. The high spikes in the raw water turbidities did not make a severe impact on the effluent turbidities however, as we see just small rises on the graph and no results were over the standard of 0.3 NTU for more than 12 hours.

Sodium hydroxide is added to help increase the pH of the finished water. However, the final pH is difficult to control due to the consistent fluctuations in the raw water pH. The raw water pH tends to follow seasonal trends for highs and lows, but often as in 2023, there are

substantial variances within each season or sometimes even day to day. Sodium Hydroxide is added to help prevent metal corrosion and the leaching of metals into the water from too low of a pH. Despite this, for most of the year, the effluent pH was over 7.5, and it was always over 7.0.

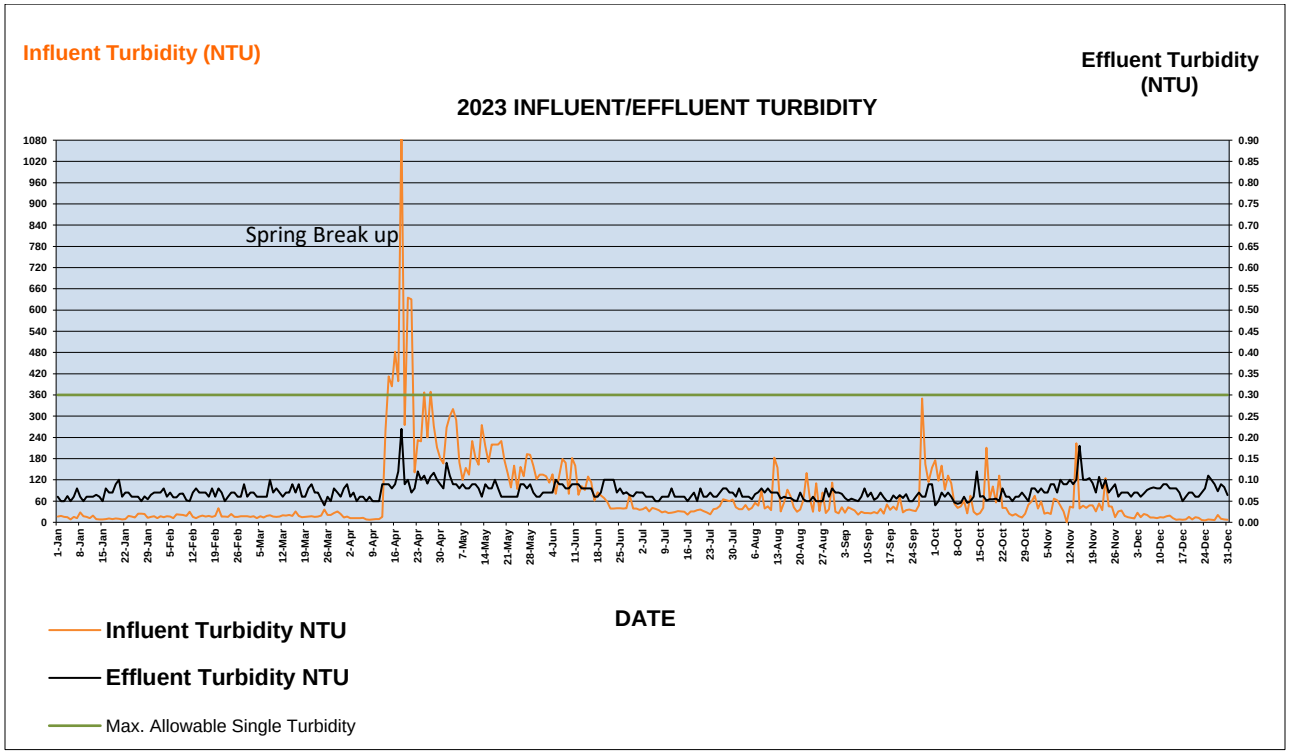
The Fluoride graph shows some variation in Fluoride levels in 2023. Fluctuation is common in feeding fluoride due to the very low level injected and the fact that the method used for in-house testing of Fluoride is finicky. The fluoride test results are from the morning sample and represent the reading in the effluent water at that time, and not as a daily average. A concentration of 0.70 mg/l has been deemed optimum by Health Canada.

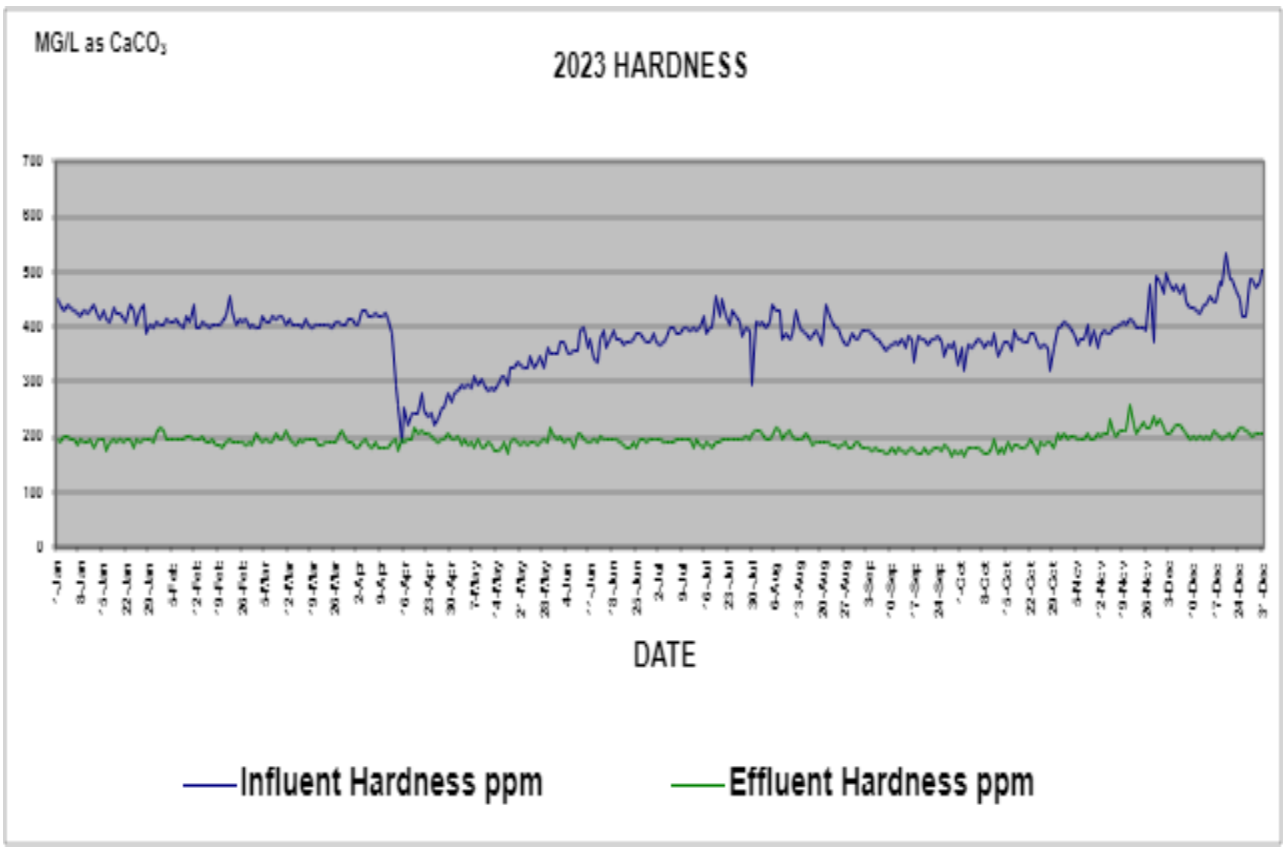
As a whole, the chlorine feed was more consistent in 2023 than in 2022 and there was less day-to-day variation in residuals. The plant is also working towards more redundancy in the chlorine feed systems. Weekly sampling of the distribution areas for chlorine residual was conducted while samples were collected for bacteria analysis. The samples are sent to an independent lab for analysis and reporting to the Drinking Water Officer and Water Plant Management. Only one sample out of our scheduled weekly samples came back as positive out of over 350 taken each year. A secondary sample in that location was negative.

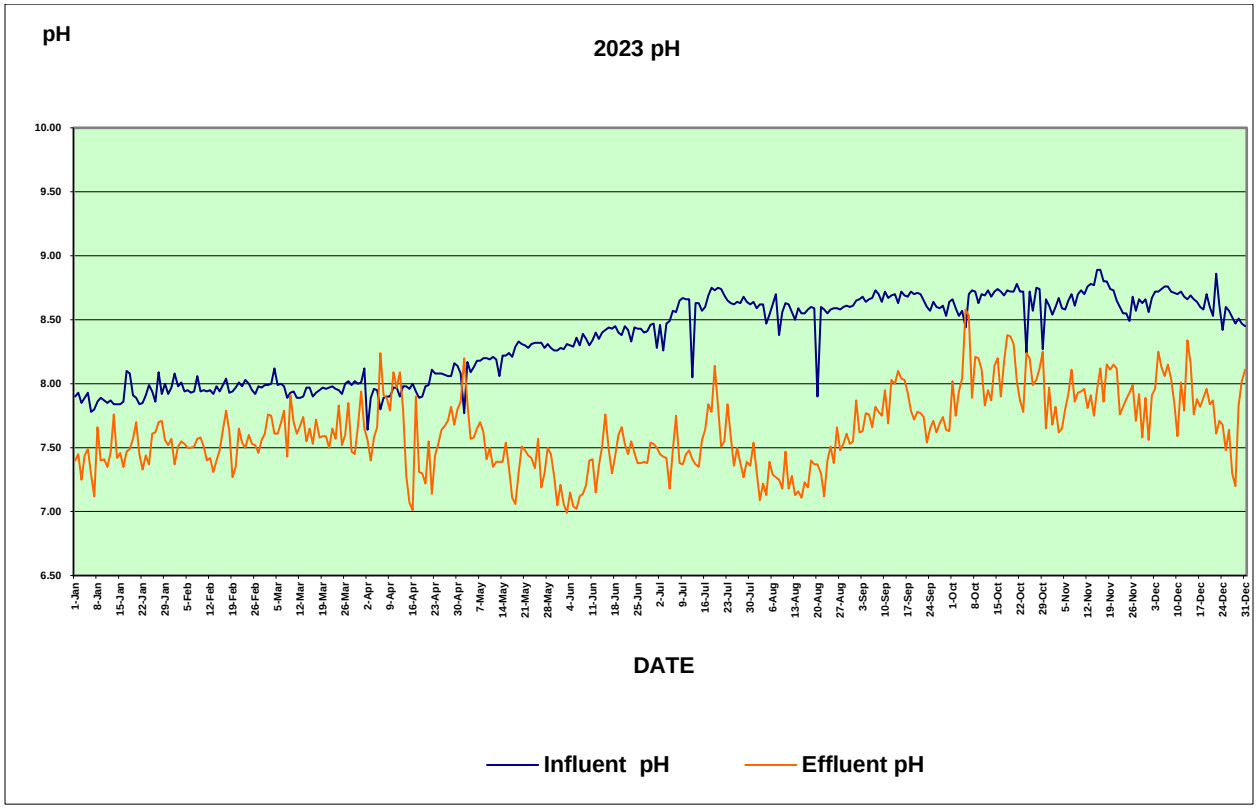
In 2023, the Tri-halomethane (THM) regulation requirements were met in the city limits. In the regional water systems where the water age increases, THM results are higher. THMs and other disinfection byproducts develop when chlorine reacts with organics in the water, organics can also cause taste and odour issues. Taste and odours are removed in part by the granular activated carbon filters. While these filters still seem to be reducing taste and odour, they are showing higher levels of embedded total organic carbon (TOC) that could react with chlorine to form THMs. The effective removal of THM-forming compounds is limited. The expected life rating of the GAC media life is well below the originally anticipated three years, but the replacement of the GAC media annually, or more frequently, would be cost-prohibitive. Monitoring of the raw and treated water will continue to detect problems within the raw water that would cause this.

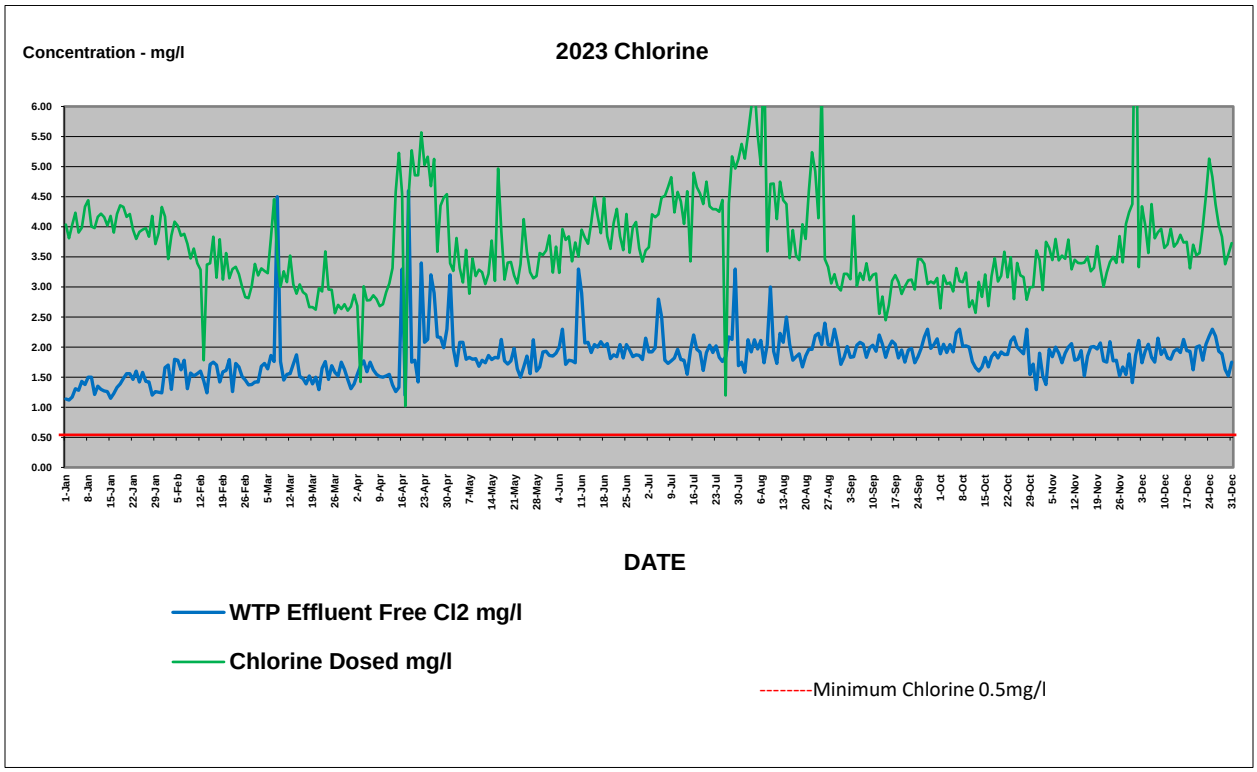
City of Portage la Prairie Water Treatment Plant - 2023 Annual Data Summary

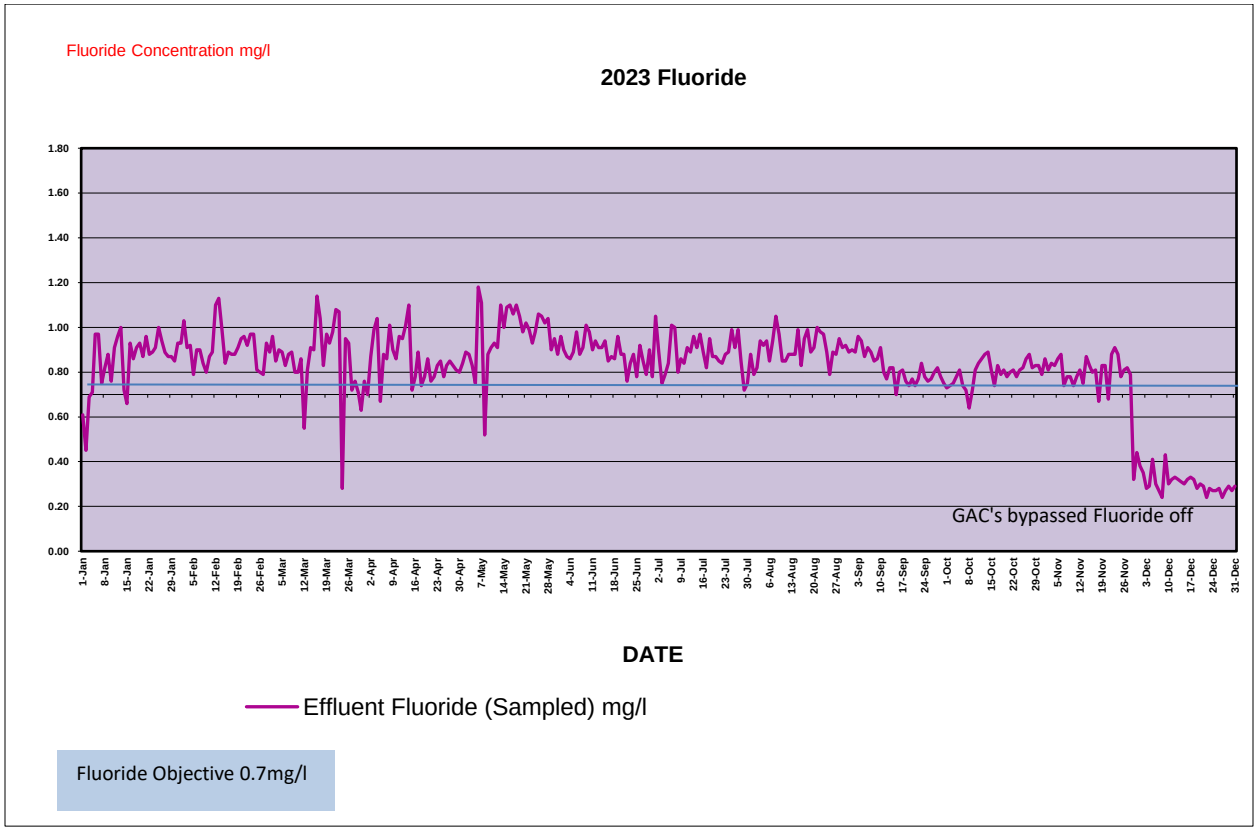
	Influent Hardness ppm	Effluent Hardness ppm	Influent Turbidity NTU	Effluent Turbidity NTU	Influent pH	Effluent pH	WTP Effluent Free Cl_2 (sampled)mg/l	W.T.P. Effluent Fluoride (Sampled) mg/l	WTP Reservoir Influent Flow m3	Reservoir Effluent less process water m3
TOTAL ANNUAL									9,086,444	8,714,501
AVERAGE	**389**	**195**	**70.51**	**0.07**	**8.35**	**7.63**	**1.84**	**0.82**	**24,894**	**23,875**
PEAK DAY	536	258	1125.00	0.22	8.89	8.58	4.60	1.18	36,250	30,949
90th PERCENTILE	440	210	177.40	0.09	8.72	8.04	2.15	0.99		
MEDIAN	398	196	31.80	0.07	8.43	7.59	1.82	0.86		
WINTER AVG	415	199								
SUMMER AVG	363	192								

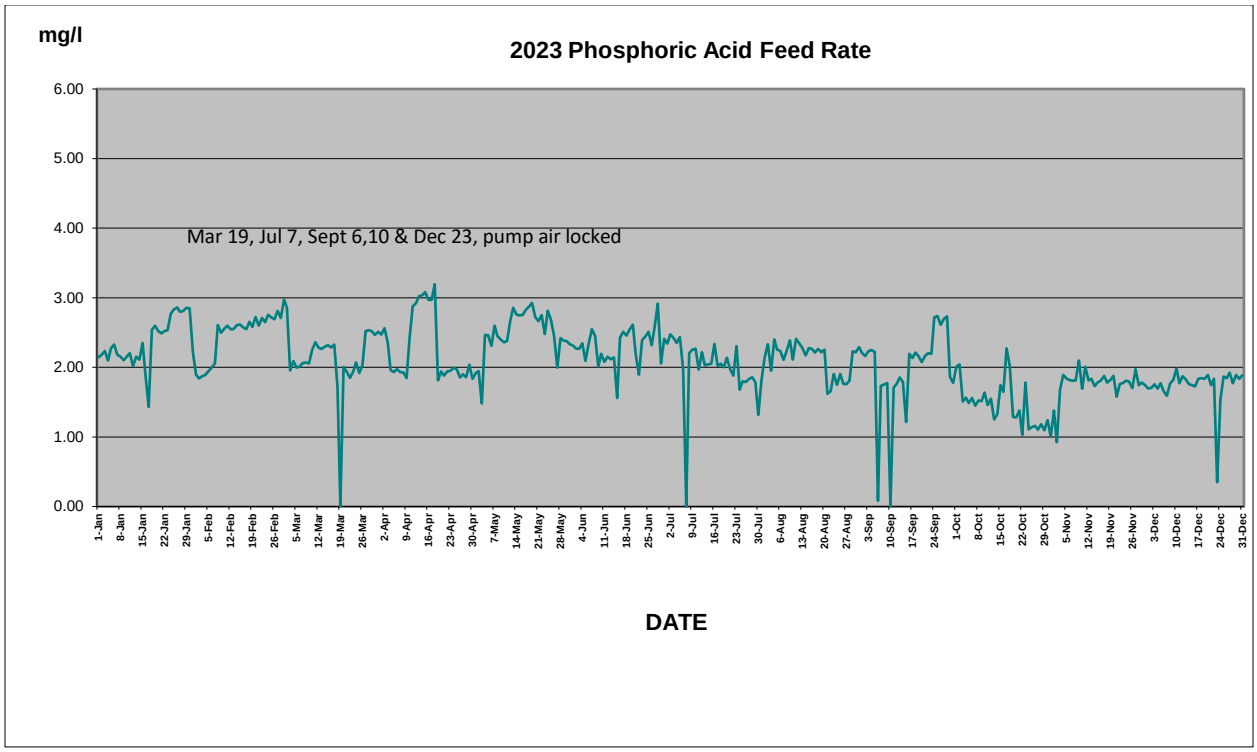

Influent Turbidity (NTU)
Effluent Turbidity (NTU)
2023 INFLUENT/EFFLUENT TURBIDITY
Spring Break up
DATE
Influent Turbidity NTU
Effluent Turbidity NTU
Max. Allowable Single Turbidity

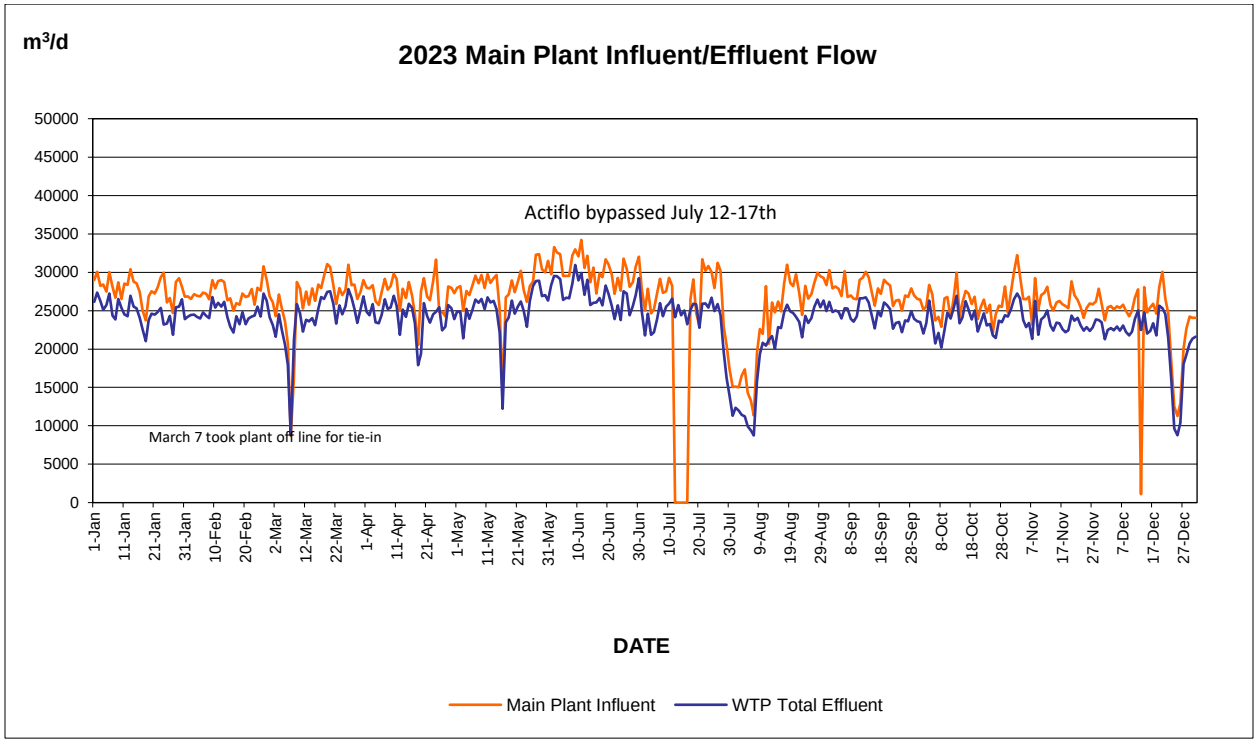

MG/L as CaCO3
2023 HARDNESS
DATE
Influent Hardness ppm
Effluent Hardness ppm

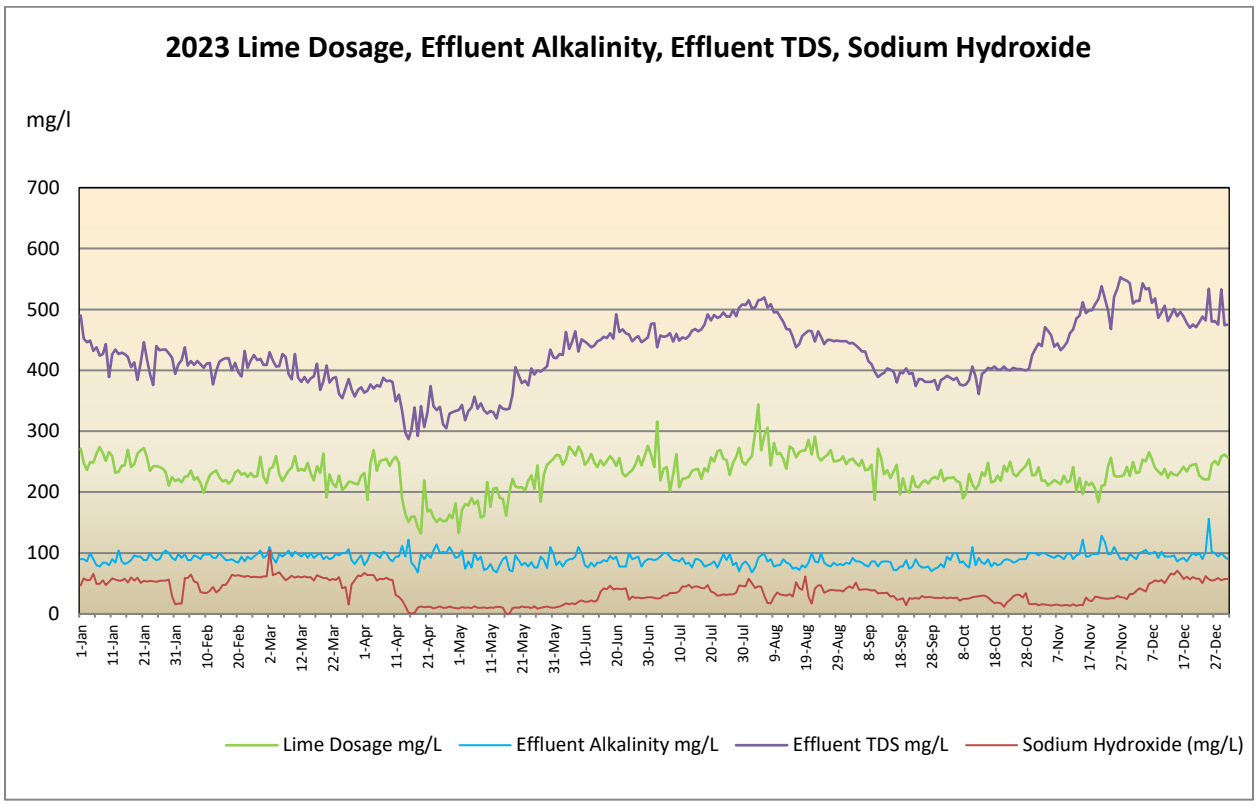

pH
2023 pH
10.00
9.50
9.00
8.50
8.00
7.50
7.00
6.50
1-Jan 8-Jan 15-Jan 22-Jan 29-Jan 5-Feb 12-Feb 19-Feb 26-Feb 5-Mar 12-Mar 19-Mar 26-Mar 2-Apr 9-Apr 16-Apr 23-Apr 30-Apr 7-May 14-May 21-May 28-May 4-Jun 11-Jun 18-Jun 25-Jun 2-Jul 9-Jul 16-Jul 23-Jul 30-Jul 6-Aug 13-Aug 20-Aug 27-Aug 3-Sep 10-Sep 17-Sep 24-Sep 1-Oct 8-Oct 15-Oct 22-Oct 29-Oct 5-Nov 12-Nov 19-Nov 26-Nov 3-Dec 10-Dec 17-Dec 24-Dec 31-Dec
DATE
Influent pH
Effluent pH

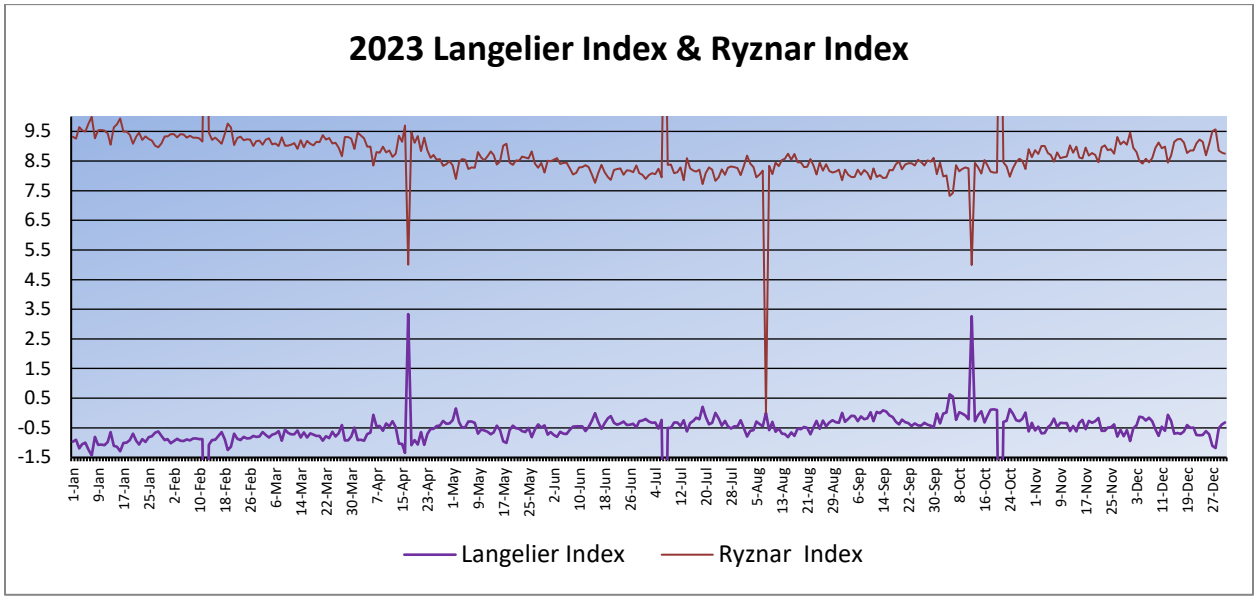

Concentration - mg/l
2023 Chlorine
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan 8-Jan 15-Jan 22-Jan 29-Jan 5-Feb 12-Feb 19-Feb 26-Feb 5-Mar 12-Mar 19-Mar 26-Mar 2-Apr 9-Apr 16-Apr 23-Apr 30-Apr 7-May 14-May 21-May 28-May 4-Jun 11-Jun 18-Jun 25-Jun 2-Jul 9-Jul 16-Jul 23-Jul 30-Jul 6-Aug 13-Aug 20-Aug 27-Aug 3-Sep 10-Sep 17-Sep 24-Sep 1-Oct 8-Oct 15-Oct 22-Oct 29-Oct 5-Nov 12-Nov 19-Nov 26-Nov 3-Dec 10-Dec 17-Dec 24-Dec 31-Dec
DATE
WTP Effluent Free Cl2 mg/l
Chlorine Dosed mg/l
Minimum Chlorine 0.5mg/l


Fluoride Concentration mg/l
2023 Fluoride
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
GAC's bypassed Fluoride off
DATE
Effluent Fluoride (Sampled) mg/l
Fluoride Objective 0.7mg/l


mg/l
2023 Phosphoric Acid Feed Rate
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Mar 19, Jul 7, Sept 6,10 & Dec 23, pump air locked
DATE


m³/d
2023 Main Plant Influent/Effluent Flow
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Actiflo bypassed July 12-17th
March 7 took plant off line for tie-in
1-Jan
11-Jan
21-Jan
31-Jan
10-Feb
20-Feb
2-Mar
12-Mar
22-Mar
1-Apr
11-Apr
21-Apr
1-May
11-May
21-May
31-May
10-Jun
20-Jun
30-Jun
10-Jul
20-Jul
30-Jul
9-Aug
19-Aug
29-Aug
8-Sep
18-Sep
28-Sep
8-Oct
18-Oct
28-Oct
7-Nov
17-Nov
27-Nov
7-Dec
17-Dec
27-Dec
DATE
Main Plant Influent
WTP Total Effluent


2023 Lime Dosage, Effluent Alkalinity, Effluent TDS, Sodium Hydroxide
mg/l
700
600
500
400
300
200
100
0
1-Jan
11-Jan
21-Jan
31-Jan
10-Feb
20-Feb
2-Mar
12-Mar
22-Mar
1-Apr
11-Apr
21-Apr
1-May
11-May
21-May
31-May
10-Jun
20-Jun
30-Jun
10-Jul
20-Jul
30-Jul
9-Aug
19-Aug
29-Aug
8-Sep
18-Sep
28-Sep
8-Oct
18-Oct
28-Oct
7-Nov
17-Nov
27-Nov
7-Dec
17-Dec
27-Dec
Lime Dosage mg/L
Effluent Alkalinity mg/L
Effluent TDS mg/L
Sodium Hydroxide (mg/L)



Major Maintenance in 2023

Phase 2 A and B plant upgrades were now complete.

Phase Three of the water plant upgrades include a water treatment plant expansion. The expansion would consist of a membrane plant to run along with the existing conventional treatment plant. The Functional Design for Phase 3 has now been updated for increased projected water demands by Stantec Engineering, and it now calls for a combined plant output of 55 MLD for the design year of 2050. Poplar Bluff Reservoir is nearing completion; however, commissioning is waiting until the onsite generator arrives and is installed. This should be in early 2024.

Below are some of the more major projects and upgrades for 2023:

Poplar Bluff Reservoir and pipeline	~$3.5 million (City share)
McKay Reservoir roof membrane replacement	$1,168,000
West pond sludge removal	$1,085,000
Ozone air compressor ventilation	$84,000
Clarifier 1 & 2 turnbuckles	$45,000
Sludge pumps (2)	$44,000
Generator circuit board	$22,300
McKay Reservoir Communication upgrade	$15,000

Summary

Ongoing continuous improvement will be used to optimize the treatment process to ensure a safe, reliable product for our customers.

The plant was kept in operation during maintenance work and plant shutdowns were done in a manner that kept the consumers supplied with water.

Operating staff will continue to abide by all Government operational requirements and work with the local Drinking Water Officer to ensure the best quality of water for all customers.