MEMORANDUM

September 8, 2020

Note: there is a typographical date error for this memorandum; however, it is the correct report for the September monitoring period submitted on October 14, 2020.

TO: Historical Memo

FM: Peter Carter / Matt Macdonald

RE: Carnation Wastewater Treatment Plant
September 2020 Process Summary

The Carnation Treatment Plant (CTP) discharged to the Chinook Bend wetland for the entire month of September. All reclaimed water quality requirements were met. Effluent Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) averaged <1.1 mg/L and <2.0 mg/L, respectively, and BOD_5 and TSS removals were >99.7% and >99.2% respectively. All permit-required samples were collected and analyzed.

Effluent flow averaged 0.102-MGD. Influent flow averaged 0.107-MGD; influent flow is usually slightly higher than effluent flow due to internal recycle flows. Influent flow was withheld in the collection system for several hours on September 29 to replace the plant influent flow meter. Networking problems subsequently resulted in a loss of SCADA communication with the flow meter and no recorded influent flow totals for September 29 and 30. These two data points were estimated using the effluent flow, mixed liquor wasted, and the historical internal plant recycle rate. The influent samples on September 29 and 30 were time-composited , rather than flow-composited, due to the influent flowmeter issue. The permeate temperature decreased across the month from about 25.4°C to 23.4°C.

The plant operated with aeration basin #2 in service and aeration basin #1 out of service. The MLSS averaged 8552-mg/L. An estimated 6146 dry lbs. of waste sludge and scum were hauled to the South Plant for further treatment.

Flow was cycled through all five membrane trains until September 22 when membrane train #1 was taken out of service to fix a malfunctioning cyclic valve. Subsequently, flow was cycled through the remaining four in-service trains for the remainder of the month. Both UV trains were in service the entire month.

Total-N removal averaged 88%. Effluent ammonia (NH_3) averaged <0.1-mg/L as N. Effluent nitrite plus nitrate (NO_2+NO_3) averaged 7.3-mg/L as N. Total phosphorus (P) averaged 3.8-mg/L for a total P removal of 54%. N and P analyses were performed every Tuesday in September.

Alkalinity was added to the secondary process to maintain the instantaneous effluent pH above pH 6.9. Caustic Soda (25% solution) was the alkalinity source; a total of 230[1] gallons was used. Effluent alkalinity averaged 101-mg/L (with a range of 88-114) as $CaCO_3$; influent alkalinity was in the range of 229-256 mg/l as $CaCO_3$. Alkalinity addition replaces the alkalinity lost during nitrification; the effluent pH would likely fall below the permitted minimum pH 6.0 if alkalinity addition stopped.

[1] Caustic soda usage is typically estimated based on the level drop in the bulk chemical tank. Due to a communication error and loss of tank level data, the pumped flow totalizer was used to estimate chemical usage.

Tables 1 and 2 present membrane maintenance cleaning information and membrane performance data, respectively. Average TMPs were in the 1.4 to 1.8 psi range. The control system limits flow through the membranes to keep the TMP <8.0-psi; this protects the membranes' integrity. An estimated 72[1]-gallons of sodium hypochlorite were used for maintenance cleans in September.

Table 1: Membrane Maintenance Cleans Performed September 2020

Week Beginning	Train 1	Train 2	Train 3	Train 4	Train 5
9/1		MC[2]	MC	MC	MC
9/6	MC	MC	MC	MC	MC
9/13	MC	MC	MC	MC	MC
9/20	MC	MC	MC	MC	MC
9/27		MC	MC		

[1] Sodium hypochlorite usage is typically estimated based on the level drop in the bulk chemical tank. Due to a communication error and loss of tank level data, the usage was estimated using an average volume of sodium hypochlorite per maintenance clean.

[2] MC refers to a maintenance clean

Table 2: Membrane Performance September 2020

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
Permeate Turbidity (NTU)[1]					
Average for Month	0.20	0.11	0.08	0.09	0.12
Design	*< 0.2*	*< 0.2*	*< 0.2*	*< 0.2*	*< 0.2*
Permeate Flow (GPD)[2]					
Average Daily for Month	17,141	25,444	23,598	25,536	23,228
AADF (Annual Average Flow) Design	*97,500*	*97,500*	*97,500*	*97,500*	*97,500*
Maximum Daily for Month	35,220	49,812	37,058	47,145	45,760
PDF (Peak Day) Design	*165,000*	*165,000*	*165,000*	*165,000*	*165,000*
Permeate Flow Rate (GPM)[3]					
Average for Month	13	21	22	22	21
Peak Hour for Month	87	139	95	112	114
PHF (Peak Hour) Design	*180*	*180*	*180*	*180*	*180*
Instantaneous Flux (GFD[4])[5]					
Average for Month	7.2	7.2	6.7	7.3	7.3
Trans-Membrane Pressure (PSI)[6]					
Average for Month	1.4	1.5	1.4	1.5	1.8
Maximum for Month	2.0	8.1*	8.5*	8.1*	9.3*
(Average/Maximum) Design	*2.0/10*	*2.0/10*	*2.0/10*	*2.0/10*	*2.0/10*
Permeate Temperature (ºC)[7]					
Minimum for Month	23.2	23.2	23.2	23.2	23.2
Design	*>12*	*> 12*	*> 12*	*> 12*	*> 12*
Permeability at 20ºC (GFD/PSI)[8]					
Average for Month	4.6	4.5	4.1	4.5	4.1
(Recovery Clean Trigger) Design	*< 3.0*	*< 3.0*	*< 3.0*	*< 3.0*	*< 3.0*

*Max TMP from peak flow testing on September 8. Not indicative of typical maximum operating TPM.

[1] Permeate turbidity – indication of membrane integrity.
[2] Permeate flow – compares operating to design capacity. The design capacity (AADF and PDF) are both based on entire treatment plant flow with four membrane trains available.
[3] Permeate flow rate – check of acute operating conditions to confirm peak hour design condition is not being approached. The design capacity (PHF) is based on entire treatment plant flow with five membrane trains available. The average rate is only for when the membrane is operating.
[4] "GFD" is shorthand for "GPD/Ft^2". GFD is a flux measurement based on the flow (gallons/day) of permeate that passes through a square foot of membrane surface. Each train has one membrane cassette with 12,920 square feet of surface area.
[5]Instantaneous flux – check of membrane operating flux. Instantaneous differs from net flux in that it does not account for backpulse and/or relax periods (It is therefore always slightly higher). The design condition is based on net flux and therefore not included. The permeate flow design conditions provide the same information since only a single cassette is operating in each membrane train.
[6] Trans-membrane pressure – provides information related to fouling and biological process operation (MLSS and filterability). The average and maximum TMP are included for reference.
[7] Permeate temperature – listed since the hydraulic capacity can be reduced when operating below the minimum design temperature (de-rating of membrane capacity).
[8] Permeability (temperature corrected to 20ºC) – parameter assesses fouled condition of membrane. The trigger value listed is from the GE O&M manual.