

# MEMORANDUM

July 14, 2020

TO: Historical Memo

FM: Peter Carter / Steven Yee

RE: Carnation Wastewater Treatment Plant  
June 2020 Process Summary

The Carnation Treatment Plant (CTP) discharged to the Chinook Bend wetland for the entire month of June. All reclaimed water quality requirements were met. Effluent Biochemical Oxygen Demand (BOD<sub>5</sub>) and Total Suspended Solids (TSS) averaged <1.0 mg/L and <2.0 mg/L, respectively, and BOD<sub>5</sub> and TSS removals were >99.5% and >98.7% respectively. All permit-required samples were collected and analyzed.

Effluent flow averaged 0.104-MGD. Influent flow averaged 0.110-MGD; influent flow is usually slightly higher than effluent flow due to internal recycle flows. The permeate temperature increased across the month from about 20.8°C to 24.0°C.

The plant operated with one of the two aeration basins in service (Basin 2). The MLSS averaged 8640-mg/L. An estimated 8200 dry lbs. of waste sludge and scum were hauled to the South Plant for further treatment. Flow was cycled through all five of the membrane trains for the entire month of June. Both UV trains were in service the entire month. There was a communication issue between the PLCs dedicated to the UV control and the plant SCADA system in June; the reported UV dose numbers were estimated. The communication problems are being worked on.

Total-N removal averaged 89%. Effluent ammonia (NH<sub>3</sub>) averaged <0.1-mg/L as N. Effluent nitrite plus nitrate (NO<sub>2</sub>+NO<sub>3</sub>) averaged 5.3-mg/L as N. Total phosphorus (P) averaged 4.0-mg/L for a total P removal of 38%. N and P analyses were performed every week.

Alkalinity was added to the secondary process to maintain the instantaneous effluent pH above pH 6.8. Caustic Soda (25% solution) was the alkalinity source; a total of 279 gallons was used. Effluent alkalinity averaged 102-mg/L (with a range of 95-108) as CaCO<sub>3</sub>; influent alkalinity was in the range of 226-256 mg/l as CaCO<sub>3</sub>. 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.

Tables 1 and 2 present membrane maintenance cleaning information and membrane performance data, respectively. Average TMPs were in the 1.2 to 1.5 psi range. The control system limits flow through the membranes to keep the TMP <8.0-psi; this protects the membranes' integrity. An estimated 65-gallons of sodium hypochlorite were used for maintenance cleans in June.

Table 1: Membrane Maintenance Cleans Performed June 2020

Week Beginning	Train 1	Train 2	Train 3	Train 4	Train 5
6/1	MC <sup>1</sup>	MC	MC	MC	MC
6/7	MC	MC			MC
6/14	MC	MC	MC	MC	MC
6/21	MC	MC	MC	MC	MC
6/28	MC				

<sup>1</sup> MC refers to a maintenance clean

<sup>2</sup> RChypo refers to a sodium hypochlorite recovery clean

<sup>3</sup> RCcitric refers to a citric acid recovery clean

Table 2: Membrane Performance June 2020

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
<b>Permeate Turbidity (NTU)<sup>1</sup></b>					
Average for Month	0.08	0.13	0.10	0.09	0.12
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
<b>Permeate Flow (GPD)<sup>2</sup></b>					
Average Daily for Month	25,514	20,116	24,065	24,504	22,823
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	39,751	40,979	40,915	41,563	40,336
<i>PDF (Peak Day) Design</i>	165,000	165,000	165,000	165,000	165,000
<b>Permeate Flow Rate (GPM)<sup>3</sup></b>					
Average for Month	22	15	20	20	20
Peak Hour for Month	110	88	102	105	93
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
<b>Instantaneous Flux (GFD<sup>4</sup>)<sup>5</sup></b>					
Average for Month	6.9	6.8	6.9	7.0	7.0
<b>Trans-Membrane Pressure (PSI)<sup>6</sup></b>					
Average for Month	1.2	1.3	1.4	1.2	1.3
Maximum for Month	2.4	2.5	5.0	2.4	2.4
<i>(Average/Maximum) Design</i>	2.0/10	2.0/10	2.0/10	2.0/10	2.0/10
<b>Permeate Temperature (°C)<sup>7</sup></b>					
Minimum for Month	20.6	20.6	20.6	20.6	20.6
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
<b>Permeability at 20°C (GFD/PSI)<sup>8</sup></b>					
Average for Month	5.7	5.0	4.8	5.4	5.2
<i>(Recovery Clean Trigger) Design</i>	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0

<sup>1</sup> Permeate turbidity – indication of membrane integrity.

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> “GFD” is shorthand for “GPD/Ft<sup>2</sup>”. 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.

<sup>5</sup> 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.

<sup>6</sup> Trans-membrane pressure – provides information related to fouling and biological process operation (MLSS and filterability). The average and maximum TMP are included for reference.

<sup>7</sup> Permeate temperature – listed since the hydraulic capacity can be reduced when operating below the minimum design temperature (de-rating of membrane capacity).

<sup>8</sup> Permeability (temperature corrected to 20°C) – parameter assesses fouled condition of membrane. The trigger value listed is from the GE O&M manual.