

MEMORANDUM

September 12, 2019

TO: Historical Memo

FM: Peter Carter / Steven Yee

RE: Carnation Wastewater Treatment Plant
August 2019 Process Summary

The Carnation Treatment Plant (CTP) discharged to the Chinook Bend wetlands for the entire month of August. All reclaimed water quality requirements were met. Effluent Biochemical Oxygen Demand (BOD₅) and Total Suspended Solids (TSS) averaged <1.1 mg/L and <2.0 mg/L, respectively. BOD₅ and TSS removals were both >99%. All permit-required samples were collected and analyzed. Effluent flow averaged 0.103-MGD. Influent flow to the CTP averaged slightly higher (0.108-MGD) due to internal recycle flows. The max-day effluent flow was 0.132-MGD on August 16. This flow was especially high because of discharging influent from the previous day that had been stored in the solids handling basin. The permeate temperature ranged from 76°F to 79°F across the month.

On August 15 in the evening a large quantity of rocks came into the plant and plugged the influent line leaving the roto-screen. This caused the influent to overflow into the solids handling basin (as designed) as well as into the lower floor of the headworks building and down the drain (contained, but not as designed). Operations discovered the clog, switched to the other roto-screen and cleared the influent line on the morning of September 16. All of the overflow was either captured in the solids handling basin or recirculated back to the plant. On September 16, 17 and 18 the solids handling basin was pumped down through the roto screens and into the plant. The influent flow numbers for those days have been adjusted to reflect the net flow into the plant.

The plant operated with one of two aeration basins in service (Basin 1). The MLSS averaged 8500-mg/L. An estimated 4700 dry lbs. of waste sludge and scum were hauled to the South Plant for further treatment. Flow was cycled through all five membrane trains and both UV trains in August.

Total-N removal averaged 86%. Effluent ammonia (NH₃) averaged <0.1-mg/L as N. Effluent nitrite plus nitrate (NO₂+NO₃) averaged 5.8-mg/L as N. Total phosphorus (P) averaged 4.7-mg/L for a total P removal of 38%. N and P analyses are performed on a weekly basis.

Alkalinity was added to the secondary process to always maintain the effluent pH above pH 6.8. Caustic Soda (25% solution) was the alkalinity source this month; a total of 583 gallons was used. Effluent alkalinity averaged 138-mg/L (with a range of 127-150) as CaCO₃; influent alkalinity was in the range of 211-236 mg/l as CaCO₃. 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.

All trains were bubble tested in August. (Low pressure air is applied to the inside of the membrane fibers. Bubbles indicate leaks.) Bubble testing allows us to find membrane leaks that are too small to cause turbidity excursions. Repairs were performed on membrane cassettes 1, 2, 3 and 5.

Tables 1 and 2 present membrane maintenance cleaning information and membrane performance data, respectively. Average TMPs were in the 1.2 to 1.4 psi range. The control system limits flow through the membranes to keep the TMP <8.0-psi; this protects the membranes' integrity. An estimated 64-gallons of 12.5% sodium hypochlorite were used for maintenance cleans in August.

Table 1: Membrane Maintenance Cleans Performed August 2019

Week Beginning	Train 1	Train 2	Train 3	Train 4	Train 5
8/1				MC ¹	MC
8/4	MC		MC	MC	MC
8/11	MC		MC	MC	MC
8/18	MC		MC	MC	MC
8/25	MC	MC	MC	MC	MC

¹ MC refers to a maintenance clean

Table 2: Membrane Performance August 2019

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
Permeate Turbidity (NTU)¹					
Average for Month	0.07	0.08	0.07	0.07	0.11
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Permeate Flow (GPD)²					
Average Daily for Month	24,149	24,794	19,897	22,701	20,896
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	40,567	37,805	40,434	33,749	41,082
<i>PDF (Peak Day) Design</i>	165,000	165,000	165,000	165,000	165,000
Permeate Flow Rate (GPM)³					
Average for Month	18	18	16	17	16
Peak Hour for Month	115	116	117	117	109
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
Instantaneous Flux (GFD⁴)⁵					
Average for Month	7.3	7.4	7.3	7.6	7.5
Trans-Membrane Pressure (PSI)⁶					
Average for Month	1.2	1.4	1.4	1.3	1.3
Maximum for Month	4.3	8.4	3.8	2.5	2.4
<i>(Average/Maximum) Design</i>	2.0/10	2.0/10	2.0/10	2.0/10	2.0/10
Permeate Temperature (°C)⁷					
Minimum for Month	24.3	24.3	24.3	24.3	24.3
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
Permeability at 20°C (GFD/PSI)⁸					
Average for Month	5.3	4.8	4.7	5.4	5.0
<i>(Recovery Clean Trigger) Design</i>	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0

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/Ft²”. 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 20°C) – parameter assesses fouled condition of membrane. The trigger value listed is from the GE O&M manual.