

MEMORANDUM

December 12, 2019

TO: Historical Memo

FM: Peter Carter / Steven Yee

RE: Carnation Wastewater Treatment Plant
November 2019 Process Summary

The Carnation Treatment Plant (CTP) discharged to the Chinook Bend wetlands for the entire month of November. All reclaimed water quality requirements were met. Effluent Biochemical Oxygen Demand (BOD₅) and Total Suspended Solids (TSS) averaged <1.0 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 0.108-MGD. Influent flow to the CTP also averaged 0.116-MGD. Influent flow is usually slightly higher than effluent flow due to internal recycle flows. The max-day effluent flow was 0.128-MGD on November 24. The permeate temperature dropped from 19.8°C to 16.3°C across the month.

The plant operated with one of two aeration basins in service (Basin 1). The MLSS averaged 9450-mg/L. An estimated 3700 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 November.

Total-N removal averaged 88%. Effluent ammonia (NH₃) averaged <0.2-mg/L as N. Effluent nitrite plus nitrate (NO₂+NO₃) averaged 6.7-mg/L as N. Total phosphorus (P) averaged 4.4-mg/L for a total P removal of 30%. N and P analyses were performed on three of the four weeks in November.

Alkalinity was added to the secondary process to always maintain the effluent pH above pH 6.7. Caustic Soda (25% solution) was the alkalinity source this month; a total of 582 gallons was used. Effluent alkalinity averaged 136-mg/L (with a range of 115-150) as CaCO₃; influent alkalinity was in the range of 197-236 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.

Tables 1 and 2 present membrane maintenance cleaning information and membrane performance data, respectively. Average TMPs were in the 1.5 to 1.7 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 12% sodium hypochlorite were used for maintenance and recovery cleans in November.

Table 1: Membrane Maintenance Cleans Performed November 2019

Week Beginning	Train 1	Train 2	Train 3	Train 4	Train 5
11/1					MC ¹
11/3	MC			MC	MC
11/10	MC	MC	MC	MC	MC
11/17	MC	MC	MC	MC	MC
11/24	MC	MC		MC	MC

¹ MC refers to a maintenance clean

Table 2: Membrane Performance November 2019

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
Permeate Turbidity (NTU)¹					
Average for Month	0.09	0.12	0.10	0.08	0.10
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Permeate Flow (GPD)²					
Average Daily for Month	28,100	24,406	17,906	24,012	23,534
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	42,059	36,524	44,817	34,293	41,980
<i>PDF (Peak Day) Design</i>	165,000	165,000	165,000	165,000	165,000
Permeate Flow Rate (GPM)³					
Average for Month	21	18	13	19	19
Peak Hour for Month	99	104	93	108	97
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
Instantaneous Flux (GFD⁴)⁵					
Average for Month	8.0	8.0	7.2	7.8	7.8
Trans-Membrane Pressure (PSI)⁶					
Average for Month	1.7	1.6	1.6	1.5	1.6
Maximum for Month	7.0	5.8	3.0	2.9	3.1
<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	16.4	16.4	16.4	16.4	16.4
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
Permeability at 20°C (GFD/PSI)⁸					
Average for Month	5.0	5.2	4.8	5.3	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.