

MEMORANDUM

March 7, 2019

TO: Historical Memo

FM: Peter Carter / Steven Yee

RE: Carnation Wastewater Treatment Plant
February 2019 Process Summary

The Carnation Treatment Plant (CTP) discharged to the Chinook Bend wetlands for the entire month of February. 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 (0.112-MGD) due to internal recycle flows. The max-day effluent flow was 0.133-MGD on February 20. Local rainfall (Fall City gage) totaled 3.73-inches for the month. The permeate temperature dropped from 61°F to 56°F across the month.

Access to the plant was difficult during the heavy snowfall in February, but the only problem the plant suffered due to the snow was damage to the gutters on the west side of the Operations building.

The plant operated with one of two aeration basins in service (Basin 1). The MLSS averaged 8750-mg/L. An estimated 3400 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 February. Membrane Train 5 continued to operate with a manually-operated feed valve while we await parts.

Total-N removal averaged 74%. Effluent ammonia (NH₃) averaged 0.2-mg/L as N. Effluent nitrite plus nitrate (NO₂+NO₃) averaged 15.3-mg/L as N. Effluent Total phosphorus (P) averaged 3.3-mg/L for a total P removal of 49%. N and P analyses are performed on a weekly basis.

Alkalinity was added continuously to the secondary process to always maintain the effluent pH above pH 7.0. Caustic Soda was the alkalinity source this month; a total of 691 gallons was used. Effluent alkalinity averaged 149-mg/L (with a range of 139-169) as CaCO₃; influent alkalinity was in the range of 196-288 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 1.6 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 77-gallons of 12.5% sodium hypochlorite were used for maintenance cleans in February.

Table 1: Membrane Maintenance Cleans Performed

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

¹ MC refers to a Maintenance Clean

Table 2: Membrane Performance February 2019

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
Permeate Turbidity (NTU)¹					
Average for Month	0.06	0.07	0.04	0.07	0.13
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Permeate Flow (GPD)²					
Average Daily for Month	23,500	25,997	19,341	23,379	22,120
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	39,321	43,232	34,791	39,445	38,662
<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	20	15	17	17
Peak Hour for Month	105	94	87	101	103
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
Instantaneous Flux (GFD⁴)⁵					
Average for Month	7.0	7.0	7.3	7.0	7.5
Trans-Membrane Pressure (PSI)⁶					
Average for Month	1.8	1.6	1.7	1.7	1.7
Maximum for Month	4.3	4.6	2.8	4.4	3.7
<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	10.4	10.4	10.4	10.4	10.4
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
Permeability at 20°C (GFD/PSI)⁸					
Average for Month	5.0	4.9	4.9	4.9	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.