

MEMORANDUM

September 7, 2017

TO: Historical Memo

FM: Peter Carter / Steven Yee

RE: Carnation Wastewater Treatment Plant
August 2017 Process Summary

The Carnation Treatment Plant (CTP) performed well and met all its permit conditions in August. Class-A Reclaimed Water was applied to the wetland site the entire month. 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 in August.

Effluent flow averaged 0.091-MGD for the month. Influent flow to the CTP averaged slightly higher (0.097-MGD) due to internal recycle flows. The max-day effluent flow was 0.110-MGD on August 27. The effluent temperature increased from 76.9°F to 79.1°F across the month.

The plant operated with one of two aeration basins in service (Basin 2). The MLSS averaged 8350-mg/L. An estimated 6800 dry lbs. of waste sludge and scum were hauled to the South Plant for further treatment.

Total-N removal averaged 80%. Effluent ammonia (NH₃) averaged <0.1-mg/L as N. Effluent nitrite plus nitrate (NO₂+NO₃) averaged 12.3-mg/L as N. Total phosphorus (P) removal averaged 27% and effluent P averaged 5.6-mg/L. N and P analyses were performed weekly.

Alkalinity (as 25% sodium hydroxide) was added continuously to Basin 2 to maintain the effluent pH above pH 6.7 at all times; the target pH was pH 7.0. 997-gallons of 25% caustic soda was added in August. Effluent alkalinity averaged 167-mg/L as CaCO₃; influent alkalinity was in the range of 223-287 mg/l as CaCO₃. (Alkalinity addition is required to replace the alkalinity lost during nitrification; the effluent pH would likely be below the permitted minimum pH 6.0 if alkalinity addition stopped.)

Flow was cycled through all five membrane trains and both UV trains in August. Tables 1 and 2 present membrane maintenance cleaning information and membrane performance data, respectively. An estimated 97-gallons of 12.5% sodium hypochlorite were used for maintenance cleans. An inadvertent change in the automated schedule for the weekly maintenance cleans resulted in daily cleanings for the first half of the month for membrane train 1 and during the last week of the month for membrane train 5, while membrane train 3 only received one maintenance clean in August. In spite of this, the trans-membrane pressures (TMPs) remained reasonable through the month. The normal weekly cleaning schedule for all membrane trains was restored by the end of the month. Average TMPs were in the 1.3-1.5 psi range. The maximum TMPs was 3.2 psi; the maximum TMP allowed by the manufacturer is 8.0-psi (to protect the membranes' integrity).

Table 1: Membrane Maintenance Cleans Performed

Week Beginning:	Train 1	Train 2	Train 3	Train 4	Train 5
8/1		MC ¹	MC	MC	MC
8/5	MC	MC		MC	
8/12	MC	MC		MC	MC
8/19	MC	MC		MC	MC
8/26	MC	MC		MC	MC

¹ MC refers to a Maintenance Clean

Table 2: Membrane Performance August 2017

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
Permeate Turbidity (NTU)¹					
Average for Month	0.07	0.10	0.07	0.07	0.09
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Permeate Flow (GPD)²					
Average Daily for Month	19,516	22,153	21,573	18,660	20,714
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	32,947	34,271	36,351	31,697	32,538
<i>PDF (Peak Day) Design</i>	165,000	165,000	165,000	165,000	165,000
Permeate Flow Rate (GPM)³					
Average for Month	19	16	16	14	15
Peak Hour for Month	94	83	83	87	105
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
Instantaneous Flux (GFD⁴)⁵					
Average for Month	6.9	6.6	6.8	7.1	7.1
Trans-Membrane Pressure (PSI)⁶					
Average for Month	1.3	1.4	1.5	1.4	1.4
Maximum for Month	2.5	2.1	2.3	2.5	3.2
<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	24.8	24.8	24.8	24.8	24.8
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
Permeability at 20°C (GFD/PSI)⁸					
Average for Month	4.6	4.2	4.0	4.5	4.3
<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.