

Memorandum

January 19, 2018

TO: Historical Memo

FROM: Carol Nelson
Peter Carter

SUBJECT: Brightwater Treatment Plant
December 2017 Operating Record

All discharge permit requirements were met in December at the Brightwater Treatment Plant (BWTP). All wastewater received MBR secondary treatment. Effluent BOD and TSS averaged <1.1-mg/L and <2.0-mg/L, respectively, and removals were both >99%. All results for Fecal Coliform were 0-cfu/100-mL. Effluent pH was maintained between 6.8 and 7.2. Continuous dosing of caustic soda (25% NaOH) was required to assure permit compliance for pH.

Effluent flow to Puget Sound averaged 16.6-MGD. Influent flow to the BWTP averaged 17.0-MGD since 0.4-MGD of effluent was recirculated to the influent pump station (IPS) for plant process, for flushing North Creek pump station, and to keep the influent flow at or above 12-MGD. Recirculation was stopped after the second week of the month, with the exception of Dec 27-28 when the North Creek pump station was flushed. An average of 3.2-MGD of raw sewage was redirected to South Plant. 0.78-MG was directed to West Point on Dec 28.

December was rainy, typical of winter weather. Rainfall totaled 5.2-inches this month (local rain gauges). Rainfall at SeaTac Airport totaled 5.4-inches, which is 0.1-inches above normal. Most of the 5.2-inches fell on Dec. 2, Dec. 18-20 and Dec. 28-29.

The maximum daily flow was 21.6-MGD on Dec. 19. Maximum flows in December do not correlate with the maximum rainy days because of the flow diversion to South Plant. If no flow had been diverted to South Plant and/or West Point, the monthly average effluent flow would have been 19.8-MGD and the maximum day flow would have been 28.0-MGD on Dec. 19 (which does correlate with rainfall as 1.82-inches fell on Dec. 18-19).

All permit-required samples were collected and reported. The results for the influent samples collected on Dec. 30 and 31 were rejected as non-representative; the sample system was most likely plugged. Without these samples, the influent TSS averaged 230-mg/L for the month.

Influent Pumping: Influent storage and plant effluent recirculation were used to keep the influent raw sewage pumps (RSPs) running continuously; the minimum flow for the RSPs is 12-MGD. Effluent was recirculated on most days during the first two weeks because of the relatively dry weather; little recirculation occurred in the latter half of the month. In addition to recirculating flow, the North Creek Connector gate was opened during low flow periods of the day to increase influent flow to Brightwater (i.e., by decreasing the diverted flow to South Plant).

Influent flow was frequently diverted to South Plant (via the North Creek Connector gate) to prevent exceeding the Membrane capacity. Membrane capacity in December was affected by both filterability and one of eight membrane train being out of service for repairs. Influent flow diverted to South Plant averaged 3.2-MGD, with the highest flow diversions occurring during the wet weather that occurred on Dec. 19 and 28. An additional 0.78-MG was directed to West

Point on Dec. 28 while the North Creek Pump Station was flushed. BWTP Staff maintained communication with South Plant and West Point operations to ensure that the collections systems had capacity to accept the diverted flow.

Primary Treatment: Three of five primary clarifiers (1, 2, and 3) were in service all month. Primary Effluent Screens were cleaned once this month.

Secondary Treatment: All three aeration basins (ABs) were in service. The MLSS and mean cell residence time (MCRT) averaged about 7660-mg/L and 38-days, respectively. In past years, higher MLSS concentrations were required in winter to achieve good filterability and full nitrification. The MLSS concentration was maintained between 6600 and 8400 mg/L this month. ML soluble COD averaged 230-mg/L this month, considerably higher than the desired concentration of 50-mg/L. DO concentrations in the second aerated zone of each AB were maintained at, or above, the desired setpoint of 1.4-mg/L. Surface wasting remained the predominant mode of wasting solids. Some secondary foam was observed Dec 11- 13, possibly a result of seasonal changes and sequential recovery cleans of membrane basins. The aeration system was cycled on and off several times per day to mitigate the high foaming.

Full nitrification was achieved all month, while denitrification was incomplete. Effluent ammonia-nitrogen ($\text{NH}_3\text{-N}$) averaged <0.10-mg/L while nitrite/nitrate ($\text{NO}_2\text{+NO}_3$) averaged 37-mg/L as N. Total-N removal only averaged 7%. The low removal rate could have been partially a result of lower than normal influent concentrations - influent TKN averaged only 40-mg/L, higher DO near the anoxic zone, and lower wastewater temperatures.

Continuous dosing of caustic soda to the secondary process was required to ensure minimum effluent pH permit conditions were met, and to achieve complete nitrification. The dose averaged 5180-gpd of 25% NaOH solution, or 305 gallons/MG of influent. Influent alkalinity averaged 179-mg/L as CaCO_3 . Influent alkalinity decreases during wet weather and thus, the required caustic dose increases relative to the dose in the summer and early fall.

Effluent turbidity of membrane trains ranged from 0.06 to 0.1 NTU. High turbidity in Train8 caused the train to shutdown numerous times, indicating that there were integrity issues with one or more of the cassettes. This train was taken out of service on Dec. 22 to test its integrity: 5 cassettes were found with broken fibers. The worst cassette was removed for repair; Train8 returned to service on Dec. 28 with 19 of 20 cassettes. The flow demand and backpulse frequency was reduced for this train to reduce the effluent turbidity.

The membranes were primarily in “backpulse” mode this month. Membrane air scour operated in 10-sec ON/10-sec OFF mode during most of the month; 10s/30s mode was used during the lower flow time periods. Approximately 1600-gallons of 12.5% sodium hypochlorite (NaOCl) were used for weekly maintenance cleans this month. Recovery cleans were performed on three trains this month, requiring an additional 2660 gallons of 12.5% NaOCl . TMPs during and before backpulse improved after the recovery cleans on these three trains. Eductors (which remove air from the permeate line) on two membranes trains needed to be replaced or repaired because of problems with priming the permeate pumps.

Membrane capacity started the month at 28-MGD, dropped to 17-MGD after the third week, and improved to 23-MGD by month's end. The maximum flux was 12-gfd (i.e., gallons per day per square foot of membrane surface) at the beginning of the month, but only 9-gfd by Dec. 30.

The table below shows the variations in TMP, membrane permeability, and MCRT over the month. The design instantaneous peak hourly flow rating for one membrane train is 4950-gpm. Peak flow tests are run on one membrane train per day with an initial flow of 4800-gpm until Dec. 20 when the initial flow was changed to 4700-gpm. TMPs of 8-psi or greater were always

reached during the flow tests, which caused the membrane trains to lower flow to keep the TMP's at or below 8-psi. The average flows during the daily peak flow tests were usually in the 2000-2300 gpm range.

Parameter	12/4	12/11	12/18	12/25
TMP before backpulse, average psi	7.5 ²	5 ²	5.5 ²	6 ²
TMP before backpulse, peak flow test, psi	8.0	8.0	8.0	8.0
Permeability temperature-corrected ¹ , gfd/psi	1.4	1.2	1.3	1.25
Flow target for peak flow test, gpm	4800	4800	4800	4700
Flow average during peak flow test, gpm	2304	2010	2007	2062
ME temperature, degrees F	63.2	63.0	63.2	60.9
MLSS, mg/l	7770	8080	7373	7400
MCRT, days	32	26	60	40

1 Temperature-corrected Permeability based on Peak Flow Test.

2TMPs were at 1 – 2 psi during the minimum flow period of the day

Odor Control: The Odor Control facilities performed well this month.

Disinfection: Approximately 8510 gallons of 12.5% NaOCl was used for final effluent disinfection and process water at IPS. This is equal to an average dose of 2.3-mg/L as Cl₂. Hypochlorite was applied through the diffuser since the “water champ” mixer was still out of service. Effluent Cl₂ residual at the outfall (aka Point Wells) met both the monthly and max-weekly permit limits. The monthly average and maximum weekly residuals were 0.09-mg/L Cl₂ and 0.10-mg/L Cl₂, respectively.

Thickening: Thickening performed well in December. All three gravity belt thickeners (GBTs) were rotated in service this month. The GBTs thickened feed sludge from an average of 1.44% total solids (TS) to 5.32% TS, with an average solids capture of 89.7% Thickened sludge production totaled 525 dry tons. The polymer dose for thickening averaged 10.3 pounds active polymer per dry tons solids processed.

Anaerobic Digestion: The digestion process met time and temperature requirements for Class B biosolids production. All three Digesters and the blended storage tank were in service. In the active digesters, the solids retention time averaged 40-days, temperature averaged 99°F, and volatile solids (VS) destruction averaged 63.2%. The total solids concentration in the active digesters averaged 2.2%, with a volatile solids (VS) fraction of 78.6 % VS/TS. The digester VS load averaged 0.09 lbs-VS/cu-ft./d. Monthly gas production is estimated to be 8.7 million ft³ (based on an estimated 273 tons of VS destroyed).

Dewatering/Biosolids: 199 (feed flow meters and % solids) dry tons of solids were processed in December. 865 wet tons (186 dry tons) of biosolids were produced and 936 wet tons (201 dry tons) were hauled. Solids recovery in the dewatering process averaged 93.4%. Polymer dosage averaged 55.8 lbs-active per dry ton processed. Dewatering operated 27 days in December using both centrifuges (No. 1 and No.3). Centrifuge feed TS averaged 2.2% and VS averaged 78.6% VS/TS. Centrifuge 1 biosolids averaged 21.5% TS at 78.6% VS/TS. Centrifuge 3 biosolids averaged 21.5% TS at 81.3% VS/TS. The dewatering strategy generally continues to be: operate mostly during day shift and only one centrifuge at a time to avoid sending a large ammonia return load to the secondary process (via the centrate).