

Memorandum

May 13, 2022

TO: Historical Memo

FROM: Carol Nelson, Process Analyst
Samayyah Williams, Process Engineer

SUBJECT: Brightwater Treatment Plant
April 2022 Operating Record

All discharge permit requirements were met in April at the Brightwater Treatment Plant (BWTP). All wastewater received MBR secondary treatment. Effluent BOD and TSS averaged 1.4-mg/L and <2.0-mg/L, respectively, and removals were both $\geq 99\%$. All Fecal Coliform results were less than 1-cfu/100-mL. Effluent pH was maintained between 6.7 and 7.3. Continuous dosing of 59% Magnesium Hydroxide ($Mg(OH)_2$) was required to assure permit compliance for pH. 35 gallons of 25% Sodium Hydroxide (NaOH) was used to supplement the dose of $Mg(OH)_2$ this month.

Effluent flow to Puget Sound averaged 19.3-MGD. Approximately 0.1-MGD of effluent was used to flush and fill the Reclaimed Water line in preparation for reclaimed water distribution which normally starts in late May or early June. No reclaimed water was distributed offsite in April. More than 0.05-MGD of this flow was recirculated to the plant influent via IPS. Influent flow averaged 19.5-MGD. The max-day influent and effluent flows, 22.3 and 22.4-MGD, respectively, occurred on Apr. 4. The max-day flow was the result of 0.66-inches of rain that fell on April 3 and 4. Influent flow was directed to South Plant eleven times this month during wet well pump downs at the Influent Pump Station (IPS) and once for maintenance at Hollywood Pump Station. The monthly total volume directed to South Plant was 4.9 MG. No bypass or overflows resulted from the redirected influent. Membrane capacity was adequate for the influent flow in April with measured capacity ranging between 39-MGD and 45-MGD.

April rainfall totaled 3.1-inches based on local rain gauges. The two wettest periods occurred Apr. 3-4 (0.66-inches) and Apr. 8-10 (0.86-inches). Precipitation recorded for SeaTac Airport was 2.7-inches, which is 0.5-inches below normal. Local area air temperatures were 4.2°F below normal this month. Membrane effluent temperatures averaged 60.9 °F, rising from 60.3°F at the beginning to 62°F by the end.

All permit-required samples were collected and analyzed. No blending events occurred this month.

Influent Pumping: Influent flow was pumped using the two small raw sewage pump sets (RSP). Two RSPs were required when flows exceeded 20-MGD; this occurred every day for up to 15 hours on one day. The IPS wet well was “pumped down” on 19 days in April to remove accumulated grease and rags. Influent flow was diverted to South Plant during 12 of the pump downs. Influent flow was diverted for less than two hours during pump downs. All four influent screens were available this month; this helped reduce blinding of the screens during wet well pump downs and higher flow events.

Primary Treatment: Three of five primary clarifiers (PC), (PC-1, PC-2, and PC-4), were in service this month. Solids return flows were directed primarily to PC-1 this month. Regular cleaning of the primary effluent screens continued. PC-5 remains out of service because of an apparent leak near the top of the tank wall. This leak results in puddles of water collecting in a below-grade equipment room adjacent to PC-5.

Secondary Treatment: All three aeration basins (AB's) were in service this month. The MLSS averaged 8,470-mg/L and ranged from 7,060 to 9,833 mg/L. The solids retention time (SRT) averaged 27-days. Secondary foam was minimal this month. The SRT and MLSS were maintained primarily by surface wasting over the scum gates; mixed liquor wasting was a much smaller portion of the total wasting. Aeration air flow averaged 12,880-scfm, which is 1,150-scfm less than March's average flow. Aeration blowers were in DO-control mode this month. On average, DO concentrations were at or above the desired levels. Tuning and testing of the new zone aeration control strategy, part of the Aeration Optimization project, began the last week of the month.

Total-N removal averaged 30%. Full nitrification was achieved this month while denitrification was minimal. Effluent $\text{NH}_3\text{-N}$ averaged <0.1-mg/L, effluent nitrite/nitrate (NO_2+NO_3) averaged 37-mg/L as N and influent TKN averaged 55-mg/L. The average influent TKN concentration was higher than March's average, most likely due to lower rainfall and dilution of the influent. Influent TKN averaged 8,879-ppd, effluent NO_2+NO_3 averaged 6,014-ppd as N, and effluent total inorganic nitrogen (TIN) averaged 6,023-ppd as N. April's effluent TIN lbs/day average was lower than March's due to lower influent and effluent flows and slightly better removals. April's total influent and effluent nitrogen loadings (lb/month) were lower than March's due primarily due to the lower influent and effluent flow and April's 30 days vs. March's 31.

Alkalinity in the form of a 59% $\text{Mg}(\text{OH})_2$ solution was added to the secondary process to ensure minimum effluent pH limits were met and to achieve complete nitrification. $\text{Mg}(\text{OH})_2$ addition is a full-scale trial to determine the operational benefits and costs compared with using 25% NaOH solution. The 59% $\text{Mg}(\text{OH})_2$ solution dose averaged approximately 2,080-gpd or 107 gallons/MG of influent. The $\text{Mg}(\text{OH})_2$ pumping system had adequate capacity for the alkalinity demand in April.

Membrane effluent turbidity averaged 0.02 - 0.04 NTU. Membrane Trains were in "relax" mode and LEAP "low" mode this month because filterability was very good. All cassettes were in service. Approximately 1760-gallons of 12.5% NaOCl were used for membrane maintenance cleans, and 2460-gallons for recovery cleans on Trains 3, 7, and 8.

Membrane capacity ranged between 39-mgd and 45-mgd this month. This range was well above the range needed to process the influent flow. Permeability continued to be good this month, averaging 9.0 gfd/psi during the peak flow tests. Soluble COD (sCOD) in the mixed liquor, which has been well correlated with permeability, remained relatively low at an average of 43-mg/L. The maximum hourly flux during peak flow tests was between 15.9-gpd and 16.4-gpd per ft^2 of membrane surface.

Table 1 shows the weekly average trans-membrane pressure (TMP), membrane permeability, and SRT. Peak flow tests were run on two trains per day. Flow setpoints for the peak flow tests are normally adjusted up/down depending on the TMP before backpulse. This month the flow setpoint remained at 4500-gpm; the rated instantaneous peak hourly flow for one membrane train is 4950-gpm. TMPs did not drop below -3.0 psi during the peak flow test this month, indicating that the capacity is adequate for the peak hourly design flow. Changes in permeability with time are easily observed when the peak-flow setpoint is held constant.

Disinfection: Approximately 13,290 gallons of 12.5% Sodium Hypochlorite (NaOCl) were used in April for final effluent disinfection. The hypochlorite effluent disinfection dose averaged 3.3-mg/L as Cl_2 . Hypochlorite was applied through the diffuser. Effluent Cl_2 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 and 0.10-mg/L, respectively. An additional 150-gallons of hypochlorite was used while filling and flushing the reclaimed water pipes and valves.

Odor Control: The Odor Control (OC) facilities performed well. Repairs of metering pumps and chemical leaks are ongoing. All odor control areas had the design-specified number of trains in service; three each for Secondary and Solids and four for Headworks

Table 1. Trans-membrane pressure, membrane permeability, and SRT.

Parameter	Week ending 4/4	Week ending 4/11	Week ending 4/18	Week ending 4/25
TMP before backpulse, average psi ²	-1.3	-1.2	-1.1	-1.0
TMP before backpulse, peak flow test, psi	-2.1	-2.1	-2.0	-2.1
Permeability temperature-corrected ¹ , gfd/psi	9.0	9.0	9.4	8.8
Flow target for peak flow test, gpm	4500	4500	4500	4500
Flow hourly average during peak flow test, gpm	3680	3660	3670	3630
MBR Effluent temperature, degrees F	60.2	60.2	60.4	61.2
SRT, days	26	26	23	33
MLSS, mg/L	9495	8910	8480	8055
ML soluble COD, mg/L	48	41	41	48

1 Temperature-corrected Permeability based on Peak Flow Test.

2 TMPs during the moderate flow period of the day

Thickening: All three gravity belt thickeners (GBTs) were operated in April. The GBTs thickened approximately 15.2 MG of feed sludge from an average of 1.2% total solids (TS) to 6.1% TS, with an average solids capture of 92.9%. Sludge loading to the thickeners totaled 751 dry tons. The polymer dose for thickening averaged 6.6 pounds active polymer per dry tons solids processed.

Anaerobic Digestion: The digestion process met time and temperature requirements for Class B biosolids production and operated with all three active digesters during the month of April. In the active digesters: the solids retention time averaged 34.7 days, temperature averaged 98.1°F, and volatile solids (VS) destruction averaged 60.5%. The total solids concentration in the active digesters averaged 2.6% with a VS fraction of 82.4% VS/TS. The average digester VS load was 0.10 lbs-VS/cu-ft./d. Monthly gas production totaled 12.9 million ft³ (based on the waste gas burner and boiler flow meters).

Dewatering/Biosolids: All biosolids met the requirements for Class B. Dewatering operated 25 days in April, using both centrifuges. Centrifuge feed averaged 2.3% TS and 80.6% VS/TS for the month. Centrifuge biosolids product averaged 21.1% TS at 83.1% VS/TS for centrifuge 1 and 20.9% TS at 83.8% VS/TS for centrifuge 3. 1,215 wet tons (255 dry tons at 21.0% TS) of biosolids cake were produced and 1,210 wet tons (254 dry tons) of biosolids cake were hauled in April. Solids recovery in the dewatering process averaged 95.8%. Polymer dosage averaged 57.9 lbs-active per dry ton produced.