

Memorandum

June 13, 2024

TO: Historical Memo

FROM: Andy Strehler, Process Engineer; Rachael Dyda, Process Supervisor; Curtis Steinke, Process Engineer

SUBJECT: South Treatment Plant (STP) DMR Memo
May 2024 Operating Record

STP met its conventional permit limits for secondary effluent. The plant continued to partially nitrify/denitrify in May. Chlorinated secondary effluent was recycled internally with the goal of removing additional nitrate to improve TIN removal. The recycle flow also has the benefit of returning alkalinity to the process and raising the final effluent pH. Additional observations include good effluent quality, higher septage loading than May of 2023 but lower than in May of the previous 4 years, stormwater was valved to the influent the entire month.

Climate

May rainfall was lower than normal and average temperatures were slightly lower compared to historical averages. 1.54-inches of rainfall fell at SeaTac Airport which was slightly lower than the historical average of 1.88-inches. The observed daily high and low air temperatures were 80°F and 40°F. The monthly average daily maximum and minimum air temperatures were 64.0°F and 47.2°F, which are 2.3°F and 1.5°F lower than the maximum and minimum long-term averages, respectively. The average wastewater effluent temperature increased from 63.3°F to 66.2°F throughout the month, with the highest temperature recorded of 66.3°F.

Effluent Quality

All secondary effluent permit limits were met. Effluent flow averaged 65.2-million gallons per day (mgd), which falls within the historical May flow range. Final effluent quality for the month averaged 4-mg/L carbonaceous BOD (CBOD₅), 5-mg/L TSS and 10-mg/L total BOD₅. Respective removals were 98%, 98% and 97%. Maximum weekly average values were 5-mg/L, 6-mg/L and 12-mg/L, respectively.

Offsite Flows and Loads

2.17-MG of septage was received at STP in May (362,080 lbs at approximately 2% TS), which was approximately 17% higher than in May 2023 and accounted for an estimated 7% of STP's influent solids load for the month. Southern Transfer (aka Allentown) flow averaged 4.7-mgd, with a peak-daily flow estimate of 78.5-mgd on May 21. Brightwater did not divert any

flow to STP via the North Creek Pump Station or the York Diversion Gate at Hollywood Pump Station all month.

Sampling and Analyses

All permit-required samples (influent and effluent) were collected and analyzed. The final ETS effluent sample line/sampler was usually chlorinated every fourth day. Influent flow, including recycled flows, ranged from 68.2-mgd to 93.1-mgd with an average of 85.0-mgd. Daily effluent flows ranged from 60.8-mgd to 71.4-mgd with an average flow of 65.2-mgd. Typically, around 6-8-mgd of the total influent flow is from various internal processes and is returned to the influent via the plant sanitary drain system, causing the influent flow to be higher than effluent flow. Recycle of chlorinated secondary effluent continued through most of May, more detail is provided in the secondary treatment section. The influent loads averaged 67-tons/day CBOD₅, 101-tons/day BOD₅, and 84-tons/day TSS. The average monthly effluent chlorine (Cl₂) at the ETS outfall was <51-ug/L with minimum and maximum daily average values of <50 and 70-ug/l, respectively. This is well below the permitted max-day limit of 750-ug/L and the monthly average limit of 500-ug/L.

STP Facility Area Status

Primary Treatment: There were 4 north primary tanks in service all month. There were 8 south primary tanks in service between May 01 – 17; between May 18 – 31 the southeast pre-aeration and distribution tanks and 4 primary sedimentation tanks were taken out of service in preparation for planned work to the division channel. The primary effluent TSS averaged 82-mg/L, resulting in an average TSS removal rate in the primary clarifiers of 66%. Primary effluent CBOD averaged 101-mg/L resulting in an average CBOD removal rate across the primaries of 47%. The hydraulic loading rate (HLR) ranged from 1,191 – 1,901-gpd per ft², with an average of 1,410-gpd per ft².

Secondary Treatment:

Aeration was operated with 3 ATs in service most of the month; AT-1 was out of service between May 02 – 28 to accommodate repairs to its aeration piping and diffusers. South Plant operated the secondary process to partially nitrify and denitrify. With only 3 aeration tanks in service there was less nitrification and total nitrogen removal was lower than in April. The plant was operated in plug flow mode on May 01 and between May 25 – 31. Between May 02 – 24, while AT-1 was out of service, the settled sewage feed gates were in partial step feed mode, with gate configuration set at 8 gates open in pass-1 and 1 gate open in pass-2. Recycle of chlorinated secondary effluent to influent occurred most of the month to provide additional denitrification, but was significantly reduced between May 25 – 29 because nitrification rates decreased. Effluent recycle rates throughout the month were estimated as follows: May 01 – 24: 13.7-mgd; May 25 – 29: 0 – 5.3-mgd; May 30 – 31: 15.7-mgd.

Average MLSS concentration ranged from 2,801 – 3,614-mg/L, with a monthly average concentration of 3,396-mg/L. The solids SRT ranged from 4.5 – 6.9-days, with an average of

5.4-days. The average mixed liquor settling (SVI) was slightly higher than in April, with values ranging from 86 – 128-mL/g and a monthly average of 99-mL/g. The RAS flowrate was held constant at 3.0-mgd per clarifier in service, or around 103% of plant effluent flow.

Aeration tank air use ranged from 83.2 – 99.8-million-ft³/day with an average of 91.1-million-ft³/day for the month, which was higher than in April due to nitrifying the full month and adjustments made while having one AT out of service. WAS flows and loads along with dissolved oxygen (DO) setpoints for passes 1&2 and 3&4 varied throughout the month to maintain partial nitrification. DO probe #5, located ½ way down pass 2, was used for control of airflow to passes 1&2 and DO probe #12 was used to control airflow to passes 3&4 all month.

22-23 of 24 secondary clarifiers were in service all month; clarifier 8 was out of service all month due to a leaking collector seal; clarifier-2 was out of service from May 11 through the end of the month to repair a shear pin in its collector mechanism. The POD5 effluent control valve continues to be operated manually. POD 3 effluent flow control valve failed in a fixed position at the end of April and it discharged at a fixed flow of approximately 15.5-mgd between May 01 – 22, and at 11.5-mgd between May 23 - 31.

Nutrient Removal and Puget Sound Nutrient (Nitrogen) General Permit (PSNGP)

STP operated the secondary process for total inorganic nitrogen (TIN) removal during all of May in order to meet the WTD bubbled PSNGP annual total inorganic nitrogen action level for 2024. TIN removal averaged 50.4% in May. Effluent ammonia (NH₃) and nitrite plus nitrate (NO₂+NO₃) averaged 12.4-mg/L as N and 9.5-mg/L as N, respectively, resulting in an average effluent TIN of 22.0-mg/L as N. On a mass (as N) basis, the daily average effluent NH₃, NO₂+NO₃, and TIN loads were 6,777-lbs/day, 5,165-lbs/day and 11,942-lbs/day, respectively. South Plant recycled approximately 363-MG of chlorinated effluent to the influent in May to increase denitrification; resulting in an estimated 25,700-lbs additional TIN removal. The monthly total effluent TIN load for STP in May was 370,198-lbs, which was 51,496-lbs below STP's individual monthly limit, if STP had a monthly limit (calculated using STP's individual action level of 7.34 million-lbs/year divided by 366 days and multiplied by # of days per month if WTD had not bubbled and STP had a monthly limit). All permit-required samples (influent and effluent) were collected and analyzed.

Phosphorus (P) removal in April averaged 55% and effluent Total-P averaged 3.46-mg/L or 1,926-lbs/day.

Disinfection

40,424 gallons of 12.5% sodium hypochlorite (NaOCl) were used to disinfect STP's final effluent in May. This resulted in an average dose of 2.3-mg/L as chlorine (Cl₂) based on secondary effluent (POD) flow. Hypochlorite use in May averaged 1,300-gpd, which was the same as use in April. Dechlorination via sodium bisulfite was not required.

Both the north and south CCCs were in service. A gate between the north and south CCCs near POD4 directed PODs 5&6 effluents to flow down the south CCC while PODs 1-4 effluent flowed down the north CCC.

DAFT

An average of 89.3-dry-tons/day (0.370-mgd at 5.79% TS) of co-thickened raw and waste activated sludge (THS) was produced by the DAFTs and the THS TS values were typical all month. There were 4 DAFTs in service (DAFT 2, 3, 5 & 6) the first 2 days of May, and then 5 DAFTs in service (DAFT 2, 3, 4, 5 & 6) the remainder of the month. While in four DAFTs operation the DAFTs operated with two pressurization units in service. When going to 5 DAFTs in service only 1 pressurization system was needed for meeting the appropriate air to solids loading ratio for proper operation. 14,850-lbs of polymer (Polydyne WE-1531) were added to DAFT feed sludge in April. The solids loading rate (SLR) averaged 20.6-lbs./d/ft² for the smaller DAFTs and 23.0-lbs./d/ft² for the larger DAFTs. SLR ranged from 16.7-lb/ft²/day to 38.0-lb/ft²/day throughout the month.

Anaerobic Digestion

Time and temperature requirements for Class B biosolids were met via anaerobic digestion. All five digesters were in service. Digesters 1-4 were the primary digesters, operated in parallel and fed equal amounts of THS. Each discharged to Digester 5, which served as the blending tank before dewatering. Over the month, the primary digester detention time averaged 29.7-days with Digester 5 providing an additional 3.7-days. Volatile solids (VS) reduction through the digestion process averaged 65.1%.

The VS loading rate averaged 0.11-lbs./day/ft³ for the four primary digesters. The VS/TS percent entering and leaving the digestion process averaged 88.9% and 73.6%, respectively. The alkalinity concentrations ranged from 6,000 – 7,800-mg/L as calcium carbonate (CaCO₃) for Digesters 1-4. Digester temperatures ranged from 97 – 98°F.

Energy

The gas scrubbing system operated and sold biomethane every day in May. An estimated 300,652-therms biomethane gas were produced and 250,500-therms of scrubbed gas (biomethane) were distributed into PSE's pipeline. 11,261-therms of biomethane gas were flared.

Cogen-1 Turbine was available all of May and it was operated twice for routine PM on May 12 & 22; it was operated twice to buffer against power bumps during heavy storm and wind conditions on May 16 & 29. Operational testing of both cogeneration units occurred on May 14, Cogen-1 started with no issues, Cogen-2 did not start. Cogen-2 did not run all month.

The solids area gas-fired boiler ran the first half of the month to supply the plant heat loop, except between May 08 – 13 when additional tuning occurred on the new gas-fired boilers

in the Cogen facility. The boilers in the cogen facility supplied the plant heat loop between May 14 – 31. The digester temperature setpoints were set at 97.5°F the entire month.

The treatment plant was operated to partially nitrify and denitrify all of May. This required additional energy use: higher aeration rates to achieve nitrification, higher RAS pumping rates, and re-treatment of effluent recycled to the influent to enhance denitrification.

Dewatering/Biosolids

1,230-dry-tons biosolids (5,792-wet-tons at 21.2% TS) were hauled in May. Approximately 63% of the biosolids (based on wet tons) were distributed to Western Washington (WA) forest sites and 37% to Eastern WA agricultural sites. An estimated 59,600-lbs. of active polymer were applied for dewatering biosolids equal to an average dose of 47.8 lb-active/dry ton hauled. The polymer was Polydyne WE1514, a 43% active cationic emulsion solution.

Dewatering operated on 31 days in May. Dewatering operation was 24-hour shifts on weekdays and half-day shifts on weekends. Two centrifuges were typically in service during dewatering operations. Typical centrifuge feed rate ranged between 150 – 200-gpm per each centrifuge in service. Some gas-scrubbing water was sent to the centrate sump to provide struvite control. Centrate was valved to the DAFTs in May. Centrifuges 1 and 3 were operated for the first three weeks of the month; centrifuge 2 was out of service for its quarterly PM during the first part of May. Centrifuges 1 and 3 were operated the last week of the month.