# *Memorandum*

September 12, 2024

TO: Historical Memo

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

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

*STP met its conventional permit limits for secondary effluent. The plant continued to partially nitrify/denitrify in August. 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, lower septage loading compared to August of 2023, and much lower than the average septage loading of August 2020, 2021 and 2022. Stormwater was valved to the influent the entire month.*

## Climate

August rainfall was significantly higher and average temperatures were lower compared to historical averages. 1.66-inches of rainfall fell at SeaTac Airport which was much higher than the historical average of 0.97-inches. The majority of the rainfall (0.78-inches) occurred over August 23 and 24. The observed daily high and low air temperatures were 87°F and 50°F. The monthly average daily maximum and minimum air temperatures were 75.9°F and 57.2°F, which are 1.7°F higher and identical to the maximum and minimum long-term averages, respectively. The average wastewater effluent temperature remained relatively constant throughout the month, starting at 73.3°F and ending at 73.0°F.

## Effluent Quality

All secondary effluent permit limits were met. Effluent flow averaged 58.7-million gallons per day (mgd), which is slightly higher than the historical August flow range. Final effluent quality for the month averaged 3-mg/L carbonaceous BOD ($CBOD_5$), 5-mg/L TSS and 8-mg/L total $BOD_5$. Respective removals were 99%, 98% and 98%. Maximum weekly average values were 4-mg/L, 6-mg/L and 9-mg/L, respectively.

## Offsite Flows and Loads

1.73-MG of septage was received at STP in August (288,923-lbs at 2% TS), which was similar to July 2024 and approximately 17% lower than in August 2023. However it was only 62% of the average septage pounds received for the month of August in 2020, 2021 and 2022. Septage accounted for an estimated 6.2% of STP's influent solids load for the month. Southern Transfer (aka Allentown) flow averaged 4.0-mgd, with a peak-daily flow estimate

of 6.7-mgd on August 23. Brightwater did not divert any flow to STP via the North Creek Pump Station all month; 0.2-mgd of Brightwater area flow was diverted to South Plant via the York Diversion Gate at Hollywood Pump Station.

## Sampling and Analyses

All permit-required samples (influent and effluent) were collected and analyzed. In addition, an intensive sampling event was conducted for approximately two weeks in August. The final ETS effluent sample line/sampler was usually chlorinated every fourth day. Influent flow, including recycled flows, ranged from 74.5-mgd to 95.2-mgd with an average of 87.1-mgd. Daily effluent flows ranged from 55.0-mgd to 68.6-mgd with an average flow of 58.7-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 secondary effluent continued through August - more detail is provided in the secondary treatment section. The influent loads averaged 69-tons/day $CBOD_5$, 86-tons/day $BOD_5$, and 78-tons/day TSS. The average monthly effluent chlorine ($Cl_2$) at the ETS outfall was <50-ug/L with minimum and maximum daily average values of <50-ug/l. 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. Four of the eight south primary tanks were back in service beginning August 3. TSS removal rates improved with additional primaries back in service. The primary effluent TSS averaged 85-mg/L, resulting in an average TSS removal rate in the primary clarifiers of 61%. Primary effluent CBOD averaged 96-mg/L resulting in an average CBOD removal rate across the primaries of 51%. The HLR ranged from 1,786 – 3,223-gpd per $ft^2$, with an average of 1,946-gpd per $ft^2$.

## Secondary Treatment:

Aeration was operated with 4 aeration tanks (AT) in service all month. South Plant operated the secondary process to partially nitrify and denitrify. Settled sewage feed gates were in plug flow mode all month (i.e., AT feed gates open only in Pass-1). Recycle streams averaged 21.7-mgd this month, including an estimated 19.7-mgd of unchlorinated secondary effluent on 30 days in August plus additional flow associated with maintenance activities the first 20 days of the month.

Average MLSS concentration ranged from 2,268 – 2,801-mg/L, with a monthly average concentration of 2,618-mg/L. The solids SRT ranged from 3.0 – 5.7-days, with an average of 4.7-days. The average mixed liquor settling (SVI) was lower than in July, with values ranging from 71 – 138-mL/g and a monthly average of 87-mL/g. SVI's were consistently low throughout the month and started to trend upward starting on August 28. The RAS flowrate was held constant at 3.0-mgd per clarifier in service, or around 98% of plant effluent flow.

AT air use ranged from 91.0 – 103.2-million-$ft^3$/day with an average of 98.1-million-$ft^3$/day for the month. WAS rates were held constant at 3-mgd per clarifier in service; RAS flows varied due to secondary clarifiers going in and out of service for maintenance activities. Dissolved oxygen (DO) setpoints for passes 1&2 and 3&4 varied between 1.35 – 1.90 mg/L 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.

14-21 of 24 secondary clarifiers were in service all month; POD 3 remained out of service through August 20 to repair a leak in its effluent collection pipe just downstream of the flow meter; 2 of its clarifiers were put back in service on August 21 and the remaining 2 on August 22. Clarifier 8 was out of service all month due to a leaking collector seal; clarifier 2 was out of service all month to repair a shear pin in its collector mechanism. POD5 clarifiers were taken out of service on August 1 due to a severe leak in the RAS piping; 3 of its clarifiers were placed back in service after the leak was isolated.

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

STP operated the secondary process for total inorganic nitrogen (TIN) removal during all of August in order to meet the WTD bubbled PSNGP annual total inorganic nitrogen action level for 2024. TIN removal averaged 52.5% in August. Effluent ammonia ($NH_3$) and nitrite plus nitrate ($NO_2$+$NO_3$) averaged 10.7-mg/L as N and 12.1-mg/L as N, respectively, resulting in an average effluent TIN of 23.1-mg/L as N. On a mass (as N) basis, the daily average effluent $NH_3$, $NO_2$+$NO_3$, and TIN loads were 5,203-lbs/day, 5,914-lbs/day and 11,299-lbs/day, respectively. South Plant recycled approximately 672-MG of unchlorinated effluent to the influent in August to increase denitrification; which resulted in an estimated 61,096-lbs of additional TIN removal. The monthly total effluent TIN load for STP in August was 350,268-lbs, which was 271,426-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 August averaged 53% and effluent Total-P averaged 4.81-mg/L or 2,369-lbs/day.

## Disinfection

39,049 gallons of 12.5% sodium hypochlorite (NaOCl) were used to disinfect STP's final effluent in August. This resulted in an average dose of 2.2-mg/L as chlorine ($Cl_2$) based on secondary effluent (POD) flow. Hypochlorite use in August averaged 1,260-gpd, which was 8% lower than in July. Dechlorination via sodium bisulfite was not required.

Both the north and south CCCs were in service. The recycle of unchlorinated secondary effluent to the influent continued in August. Effluent flow was disinfected using the east

CCC disinfection pumps; PODs 1-4 flow was directed east to meet the POD 5&6 effluent flow, from there the combined disinfected effluent flowed west along the south CCC and on to the ETS forebay.

## DAFT

An average of 86.4-dry-tons/day (0.354-mgd at 5.77% TS) of co-thickened raw and waste activated sludge (THS) was produced by the DAFTs. The THS TS values were typical all month. DAFT production was interrupted on August 1 following a power outage. After the power was restored a suspected pressure transient caused a leak in the THS piping. There were 5 DAFTs in service (DAFTs 2 – 6) until August 8 when DAFT 6 suffered catastrophic failure of the collector mechanism and was taken out of service for repairs. Following the failure of DAFT 6, second pressurization systems were started on DAFTs 2, 3 and 5. The second pressurization system on DAFT 4 was started on August 21. 16,500-lbs of polymer (Polydyne WE-1531) were added to DAFT feed sludge in August. With fewer DAFTs in service, the average solids loading rate (SLR) increased, averaging 27.0-lbs./d/ft$^2$ for the smaller DAFTs and 27.3-lbs./d/ft$^2$ for DAFT 5. SLR ranged from 16.0-lb/ft$^2$/day to 38.9-lb/ft$^2$/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 30.5-days with Digester 5 providing an additional 3.4-days. Volatile solids (VS) reduction through the digestion process averaged 62.7%.

The VS loading rate averaged 0.11-lbs./day/ft$^3$ for the four primary digesters. The VS/TS percent entering and leaving the digestion process averaged 88.9 and 75.2%, respectively. The alkalinity concentrations ranged from 4,294 – 6,926-mg/L as calcium carbonate ($CaCO_3$) for Digesters 1-4. Digester temperatures ranged from 96 – 98°F.

## Energy

PSE continued emergency repairs to their main pipeline in August. The system was repaired on August 15 (approximately a 21 day outage) and South Plant subsequently resumed biomethane sales after PSE's pipeline was restored back to the normal operating pressure. An estimated 240,749-therms of biomethane gas were produced and 120,510-therms of scrubbed gas (biomethane) were distributed into PSE's pipeline. 113,131-therms of biomethane gas were flared-more than double than in July due to the pipeline repairs.

Cogen turbines #1 and #2 were operated on August 17 & 30 for PM and both Cogen 1 and 2 were run during the lightening, thunder and rain storm starting around 5pm on August 18 until approximately 1am on August 19.

The boilers in the Cogen facility supplied the plant heat loop during all of August. The solids area gas-fired boiler was off all month and the main control electric boiler provided heat, as needed, to the isolated Administration and Main control building areas. 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 August. 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

1,184-dry-tons biosolids (5,639-wet-tons at 21% TS) were hauled in August. Approximately 70% of the biosolids (based on wet tons) were distributed to Western Washington (WA) forest sites and 30% to Eastern WA agricultural sites. An estimated 56,973-lbs. of active polymer were applied for dewatering biosolids equal to an average dose of 49.5-lb-active/dry ton hauled. The polymer was Polydyne WE1514, a 43% active cationic emulsion solution.

Dewatering operated on 31 days in August. Dewatering operation was 24-hour shifts on weekdays and half-day shifts on weekends. Two centrifuges were typically in service during dewatering operations. Centrifuges 1 & 2 operated all month for normal dewatering operations; centrifuge 3 was utilized for for normal dewatering operations between Aug. 11 – 23, and for polymer trials between Aug 26 - 28. Typical centrifuge feed rate ranged between 150 – 200-gpm per each centrifuge in service, but feed rates were as high as 230-gpm on three days to adjust inventory in the digesters. Some gas-scrubbing water was sent to the centrate sump to provide struvite control. Centrate was valved to the DAFTs in August.