

# Memorandum

October 12, 2023

TO: Historical Memo

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

SUBJECT: South Treatment Plant DMR Memo (STP)  
September 2023 Operating Record

*The STP met its conventional permit limits for secondary effluent. Operation in September 2023 was characterized by above average rainfall and slightly cooler than normal temperatures. Chlorinated 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, therefore buffering the final effluent pH. Additional observations include good effluent quality, continued nitrification and denitrification (Nit/Denit), normal septage loads, stormwater valved to the influent the entire month and an average of 0.1-mgd from the Brightwater service area. Reclaimed water was used for internal purposes every day in September and Class A Reclaimed Water was distributed offsite on 30 days.*

## **Climate**

September was slightly cooler and experienced more rainfall when compared to historical averages. Rainfall (3.44-inches at SeaTac Airport) was greater than the historical average (1.61-inches at SeaTac Airport). The observed daily average high and low air temperatures were 87°F and 46°F. The average monthly maximum and minimum air temperatures were 71°F and 53°F which are 1.0°F and 0.2°F lower than the maximum and minimum long-term averages, respectively. The average wastewater effluent temperature in September started at 73.3°F at the beginning of the month, peaked at 73.5°F on Sep 2, decreased throughout the month, ending at 70.0°F.

## **Effluent Quality**

Effluent flow averaged 65.4-mgd. This is higher than what would normally be observed but influenced by higher than average rainfall and the stormwater system valved to the influent. All flows received secondary treatment, i.e., no flows were diverted around the secondary process. Final effluent quality averaged 4-mg/L carbonaceous BOD (CBOD<sub>5</sub>), 6-mg/L TSS and 9-mg/L total BOD<sub>5</sub>. Respective removals were 98%, 98% and 97%. Maximum weekly average values were 5-mg/L, 8-mg/L and 11-mg/L, respectively. All conventional permit limits for secondary effluent were met.

## **Offsite Flows and Loads**

1.57-MG of septage was received at South Plant in September, which accounted for an estimated 5% of STP's influent solids load. Southern Transfer (aka Allentown) flow averaged 4.5-mgd, with a peak-daily flow of 13.1-mgd on September 25. York P.S. flow (i.e., Brightwater based flow) averaged 0.1-mgd, accounting for less than 1% of the monthly flow and less than 1% of the influent TSS load at STP. At the end of September the Port of Seattle sent stormwater flow to STP due to a broken valve and compliance with their dry weather season discharge limit (max. month average BOD of 25-mg/l).

### **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 71.1-mgd to 98.2-million gallons per day (mgd) with an average of 80.9-mgd. Daily effluent flows ranged from 54.3-mgd to 81.9-mgd with an average flow of 65.4-mgd. Due to heavy rains at the end of the month and routing stormwater to influent, both influent and effluent flows are considerably higher than in the preceding dry months as well as in September 2022. Typically, around 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. This month an average of 8.2-mgd of chlorinated secondary effluent was also recycled to the influent and is accounted for in the reported influent flows. The measured influent loads averaged 82-tons/day BOD<sub>5</sub>, 65-tons/day CBOD<sub>5</sub>, and 81-tons/day TSS. The average monthly effluent chlorine (Cl<sub>2</sub>) at the ETS outfall was <51-ug/L with minimum and maximum daily average values of <50 and 60-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. The south primary tanks were out of service Sep. 19-21 to accommodate inspection of the South division channel for the division channel rehabilitation project. South primary tanks in service varied as follows: Sept. 1-18, 7 tanks; Sept. 19-21, 0 tanks; Sept. 22-25, 7 tanks; and Sept. 26-30, 8 tanks. The primary effluent TSS averaged 67-mg/L, resulting in an average TSS removal rate in the primary clarifiers of 72%. Primary effluent CBOD averaged 93-mg/L resulting in an average CBOD removal rate across the primaries of 52%. The hydraulic loading rate (HLR) ranged from 1,119 – 1,535-gpd per ft<sup>2</sup>, except for the three days with the south primaries out of service, when it ranged between 3,253-3,468 gpd per ft<sup>2</sup>.

**Secondary Treatment:** All four ATs were in service all month. 19-20 of 24 secondary clarifiers were in service all month. POD<sub>5</sub> (4 tanks) remained out of service in September to repair its effluent control valve. South Plant operated the secondary process to partially nitrify and denitrify. Settled sewage feed gates were in plug flow mode (i.e., AT feed gates open only in Pass-1) for the entire month.

The average MLSS concentration was in the 1,993 – 2,459-mg/L range with a solids retention time (SRT) range of 3.4 – 5.3-days, with an average monthly SRT of 4.4-days. The average mixed liquor settling (SVI) was relatively consistent throughout the month, ranging from 83 – 101-mL/g, with an average of 92-mL/g. The RAS flowrate was held constant at 3.5-mgd per tank in service.

Aeration tank air use ranged from 80.8 – 102.9-million-ft<sup>3</sup>/day with an average of 91.3-million-ft<sup>3</sup>/day for the month. DO setpoints and waste rates varied throughout the month to keep the effluent pH within a desired range and to control the amount of nitrification occurring. DO control setpoints for passes 1&2 and 3&4 control ranged from 1.2 – 2.2-mg/L. DO probe #5, located ½ way down pass 2, was used for control of airflow to passes 1&2 and DO probe #12, located at the end of pass 4, was used for control of airflow to passes 3&4 all month. Aeration tank #3 is using DO probe #10 for control due to issues with DO probe #12 values being erratic.

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

Total Inorganic Nitrogen (TIN) removal averaged 46% in September. Effluent ammonia (NH<sub>3</sub>) and nitrite plus nitrate (NO<sub>2</sub>+NO<sub>3</sub>) averaged 12.1-mg/L as N and 11.3-mg/L as N, respectively, resulting in an average effluent TIN of 23.3-mg/L as N. On a mass (as N) basis, the daily average effluent NH<sub>3</sub>, NO<sub>2</sub>+NO<sub>3</sub>, and TIN loads were 6,577-lbs/day, 6,048-lbs/day and 12,625-lbs/day, respectively. The monthly total effluent TIN load for STP in September was 378,755-lbs, which was 224,533-lbs under STP's individual monthly limit, if South Plant had a monthly limit (calculated using South Plant's individual action level of 7.34 million lbs/year divided by 365 days and multiplied by # of days per month if WTD had not bubbled and South Plant had a monthly limit).

Recycle of NO<sub>3</sub> containing streams to secondary occurred two ways: RAS and secondary effluent recycle. The RAS flowrate was held constant at 3.5-mgd per tank in service. An average of 8.2-mgd of chlorinated secondary effluent was recycled to the headworks in order to achieve additional denitrification. The RAS plus recycle flow averaged 78.3-mgd, or 120% of effluent flow.

Phosphorus (P) removal in September averaged 43% and effluent Total-P averaged 4.19-mg/L or 2,354-lbs/day.

### **Disinfection**

41,722 gallons of 12.5% sodium hypochlorite (NaOCl) were used to disinfect STP's final effluent in September. This resulted in an average dose of 2.1-mg/L as chlorine (Cl<sub>2</sub>) based on secondary effluent (POD) flow. Average hypochlorite use was 1,391-gpd range, which is approximately 100 gpd lower than August 2023 and comparable to July 2023 and summer of 2022. The dosing of the chlorine contact channels (CCCs) remained off in September due to a leak in the dosage piping, repair efforts are ongoing. Dechlorination via sodium

bisulfite was not required. Neither RAS chlorination nor influent pre-chlorination were utilized in September.

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 87.9-dry-tons/day (0.361-mgd at 5.84% TS) of co-thickened raw and waste activated sludge (THS) was produced by the DAFTs. DAFT 4 remained out of service all of September (taken out of service on 11/26/22) due to failure of its track system. 5 of 6 DAFTs were in service the entire month of September. 14,850-lbs of polymer (Polydyne WE-1531) were added to DAFT feed sludge in September. In September, the solids loading rate (SLR) averaged 18.6-lbs./d/ft<sup>2</sup> for the smaller DAFTs and 19.5-lbs./d/ft<sup>2</sup> for the larger DAFTs. SLR ranged from 16.5-lb/ft<sup>2</sup>/day to 22.8-lb/ft<sup>2</sup> /day throughout the month. All DAFTs had 1 pressurization system in service for the entire month.

### **Anaerobic Digestion**

Time and temperature requirements for Class B biosolids were met via 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 30.8-days with Digester 5 providing an additional 4.4-days. Volatile solids (VS) reduction among through the digestion process averaged 58.6%.

The VS loading rate averaged 0.11-lbs./day/ft<sup>3</sup> for the four primary digesters. The VS/TS percent entering and leaving the digestion process averaged 88.2% and 75.6%, respectively. The alkalinity concentrations were in the 5,700 – 6,500-mg/L as calcium carbonate (CaCO<sub>3</sub>) for Digesters 1-4. Digester temperatures were in the 95 – 101°F range.

### **Energy**

The gas system operated and sold biomethane every day in September. 228,630-therms of scrubbed gas (biomethane) was distributed into PSE's pipeline. 13,241-therms, or approximately 5.4% of the biogas produced, was flared. Cogen Turbine 2 was operated for a short time to exercise the equipment. Cogen Turbine 1 remains unavailable.

The boiler was off from August 26 through Sept. 8 to perform PM work on the boiler and modifications to the HRR/HRS piping for the heat system upgrade project. This included replacing the digester HRS valves with modulating valves to allow for operating the HRS temperature control under a most open valve (MOV) strategy. In cascade control the HRS temperature will increase or decrease to maintain the MOV around 70% open. Digester temperature control went from manual adjustment of HRS temperature and open and closed temperature setpoints, to a fixed temperature setpoint. Following the shutdown

work, the set digester temperature setpoint was fixed at 99°F, and the HRS temperature varied between 120 - 140°F in cascade control.

### **Dewatering/Biosolids**

1,091-dry-tons biosolids (5,256-wet-tons at 20.8% TS) were hauled in September. Approximately 71% of the biosolids (based on wet tons) were distributed to Western Washington (WA) forest sites and 29% to Eastern WA agricultural sites. An estimated 47,950 lbs.-active polymer were applied for dewatering biosolids equal to an average dose of 43.9 lb.-active/dry ton hauled. The polymer was Polydyne WE1514, a 43% active cationic emulsion solution.

Dewatering operated every day in September. Polymer trials were held at STP on 4 days in September. Dewatering operation was essentially 24-hour shifts on weekdays and half-day shifts on weekends, with two centrifuges typically in operation. Typical centrifuge feed rate ranged between 150 – 240-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 September.