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## M E M O R A N D U M

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DATE April 19, 2022

TO Andy Peters, City of Molalla

FROM Tyler J. Molatore, PE

PROJECT NAME Wastewater Treatment Plant Upgrades – WWTP Performance Evaluation  
City of Molalla

PROJECT NO. 198.28

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This Technical Memorandum evaluates the recent performance of the City of Molalla's (City) Wastewater Treatment Plant (WWTP) relative to achieving compliance with the National Pollutant Discharge Elimination System (NPDES) permit as modified by the Mutual Agreement and Order (MAO), and evaluates the ability to connect an additional 214 new Equivalent Dwelling Units (EDUs) to the system and maintain compliance.

### 1. Background

In 2018, in response to NPDES permit violations, the City entered into a MAO with the Oregon DEQ, as well as developed a Wastewater Facility and Collection System Master Plan (WWFCSMP) authored by The Dyer Partnership. The WWFCSMP evaluated the condition of the existing WWTP, and recommended improvements.

Upgrades to the WWTP are scheduled to be commissioned in approximately three years and will include a new influent flow equalization basin, transfer pump station improvements, new grit removal system, new Sequencing Batch Reactor (SBR), new effluent filtration system, new Ultraviolet (UV) disinfection system, effluent storage pond improvements, new aerobic digester, new biosolids dewatering system, and associated support systems.

#### 1.1 Wastewater Facility and Collection System Master Plan

The WWFCSMP evaluated the condition of the City's existing infrastructure, and recommended collection system and WWTP improvements to ultimately re-establish discharge permit compliance. Changes to the discharge permit were also recommended due to errors with the City's existing NPDES permit.

Since the development of the WWFCSMP, the City has made significant progress in improving the condition and performance of the existing collection system and WWTP. In 2019, the City replaced approximately 1,209 lineal feet of sewer main along Fenton Avenue, repaired four main line leaks, repaired four sanitary sewer laterals, and grouted several existing manholes. In 2020, the City replaced approximately 1,090 lineal feet of sewer main along Patrol Street.

The objective of the collection system improvement projects is to reduce Infiltration and Inflow (I/I), and correspondingly improve the performance of the collection system and WWTP. Decreasing infiltration and inflow improves the biological and hydraulic performance of the existing WWTP, and recovers capacity previously occupied by I/I.

At the WWTP, since 2018, the City has removed 1,100 dry tons of biosolids that had accumulated in the aerated lagoon and facultative lagoons. Removing the biosolids from the aerated lagoon and facultative lagoons helped regain volumetric capacity and improve the biological and hydraulic capabilities of the WWTP. The City has also made improvements to the Dissolved Air Flotation (DAF) and gravity sand filter systems, which has improved the hydraulic capacity of the units.

### 1.2 Recycled Water Use Plan

In 2018, the City amended their Recycled Water Use Plan (The Dyer Partnership, 2018) to target Class C recycled water. The previous plan, Consolidated Recycled Water Use Plan (Brown and Caldwell, 2015), was based on Class A recycled water. Based on the type of beneficial use (pasture irrigation), the minimum classification of recycled water is Class D. Transitioning to the production of Class C recycled water reduces the level of treatment required. This allowed the City to regain discharge permit compliance while irrigating recycled water.

### 1.3 2007 Design Data

Upgrades to the existing WWTP last occurred in 2007. The performance capabilities of the existing WWTP are, in part, documented in the 2007 WWTP Improvement drawings. The design flows, as specified in the 2007 WWTP Improvements drawings, associated with the existing WWTP are summarized in Table 1.3.1.

**TABLE 1.3.1  
2007 DESIGN DOCUMENT FLOWS**

<b>Parameter</b>	<b>2005 (MGD)</b>	<b>2015 (MGD)</b>	<b>2025 (MGD)</b>
ADWF	0.8	1.1	1.4
MMDWF	1.28	1.7	2.3
AWWF	1.3	2.3	3.0
MMWWF	2.04	3.1	4.1
PDF	7.06	8.5	10.3

1. Derived from Tetra Tech/KCM 2007 Wastewater Treatment Plant Improvements Drawings.

The anticipated effluent quality reported in the 2007 WWTP Improvements record drawings was < 5/5 mg/L BOD<sub>5</sub>/TSS. This effluent expectation was due to the stringent mass load requirement, and class A recycled water requirement. The interim MAO limits and Class C recycled water requirement result in much less stringent effluent objectives.

### 1.4 NPDES Permit

The City operates its wastewater system under NPDES Permit No. 101514. There are two permitted outfalls. Outfall 001 is located on the Molalla River at approximately River Mile 20. Discharge is only permitted to the Molalla River Outfall 001 from November 1 to April 30. Outfall 002 is the recycled water outfall for DEQ approved land application sites. Effluent is land applied in accordance with permit requirements from May 1 through October 31.

**TABLE 1.4.1  
NPDES PERMIT (101514) BOD<sub>5</sub> AND TSS LIMITS  
OUTFALL 001 (NOV 1 – APR 30)**

Parameter	Average Effluent Concentrations		Monthly Average	Weekly Average	Daily Maximum
	Monthly	Weekly	lbs/day	lbs/day	lbs
BOD <sub>5</sub>	10 mg/L	15 mg/L	160	240	320
TSS	10 mg/L	15 mg/L	160	240	320

**TABLE 1.4.2  
NPDES PERMIT (101514) ADDITIONAL PARAMETERS  
OUTFALL 001 (NOV 1 – APR 30)**

Parameter	Limits
BOD <sub>5</sub> and TSS Removal Efficiency	May not be less than 85% monthly average for BOD <sub>5</sub> and TSS.
E. coli Bacteria	Monthly geometric mean may not exceed 126 organisms per 100 ml. No single sample may exceed 406 organisms per 100 ml.
pH	Must be within the range of 6.0 to 9.0 S.U.
Total Residual Chlorine	Monthly average concentration may not exceed 0.07 mg/L. Daily maximum concentration may not exceed 0.18 mg/L.
Ammonia (NH <sub>3</sub> -N)	Monthly average concentration may not exceed 16.7 mg/L. Daily maximum concentration may not exceed 25.9 mg/L.
Dilution	Discharge may not commence until gauged stream flow exceeds 350 cfs and will cease when the average stream flow for the previous seven day period is less than 350 cfs.
Temperature	Effluent discharge will cease when the 7-day moving average effluent temperature exceeds 18°C.
Notes	No single E. coli sample may exceed 406 organisms per 100 mL; however, no violation has occurred if the permittee takes at least 5 consecutive re-samples at 4 hour intervals beginning within 28 hours after the original sample was taken and the log mean of the 5 re-samples is less than or equal to 126 E. coli organisms per 100 mL.

Table 1.4.3 lists the recycled water quality requirements for Class C recycled water.

**TABLE 1.4.3  
QUALITY OF RECYCLED WATER**

Parameter	Class C
Oxidized	Yes
Disinfected	Yes
Total Coliform (organisms/100 mL)	
7-day median	23
Maximum in any sample	-
Maximum in 2-consecutive samples	240
Monitoring frequency	1/week

### 1.5 Mutual Agreement and Order

In 2018, the City entered into an MAO with the DEQ. The MAO was amended in 2021 to include interim discharge permit limits for effluent Biochemical Oxygen Demand (BOD<sub>5</sub>). Table 1.5.1 lists the interim BOD<sub>5</sub> and TSS discharge permit limits as set forth in the MAO.

**TABLE 1.5.1  
INTERIM PERMIT LIMITS**

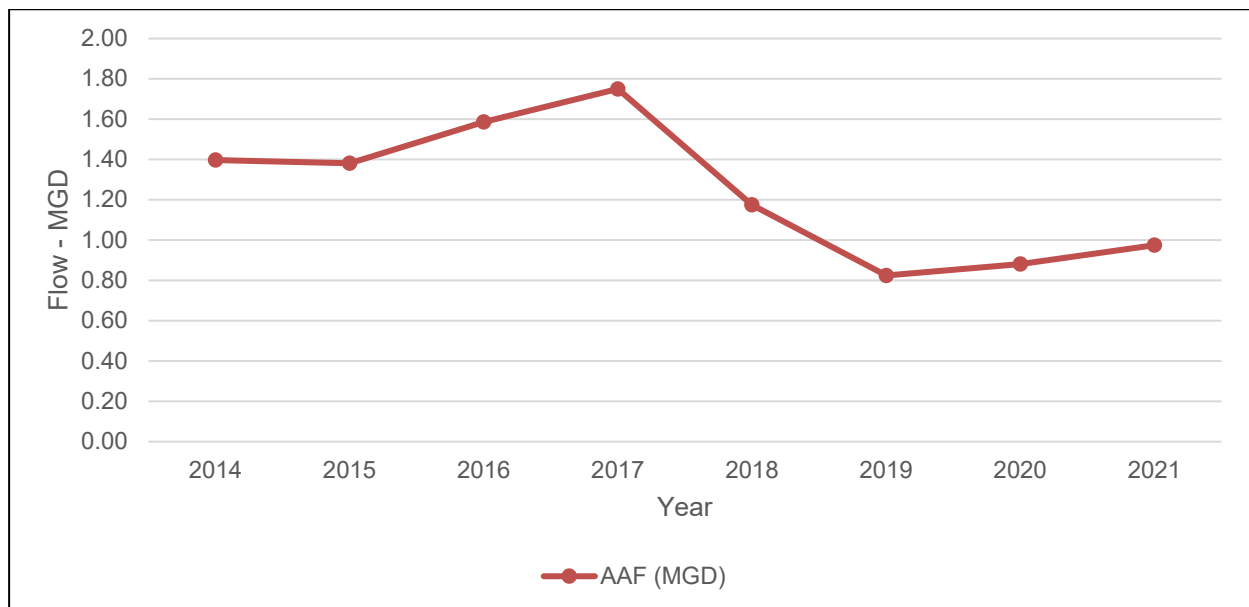
	Units	Average Monthly	Average Weekly	Daily Maximum
TSS (November 1 – April 30)	mg/L	15	20	-
	lbs/day	240	300	480
	% removal	85	-	-
BOD <sub>5</sub> (November 1 – April 30)	mg/L	25	37	-
	lbs/day	400	600	800
	% removal	85	-	-

The MAO also notes that out of season discharges not authorized by the NPDES permit that occur in the months of May, June, and October will be addressed per DEQ’s Enforcement Guidance Internal Management Directive in effect at the time of the violation.

### 2. Influent Flows and Loads

Influent flows were analyzed to understand the impacts of recent collection system improvement projects, but also to compare flows to the design data specified in the 2007 WWTP Improvement drawings. The average annual influent flows from 2014 through 2021 are summarized in Figure 2.0.1.

**FIGURE 2.0.1  
AVERAGE ANNUAL FLOWS 2014-2021**



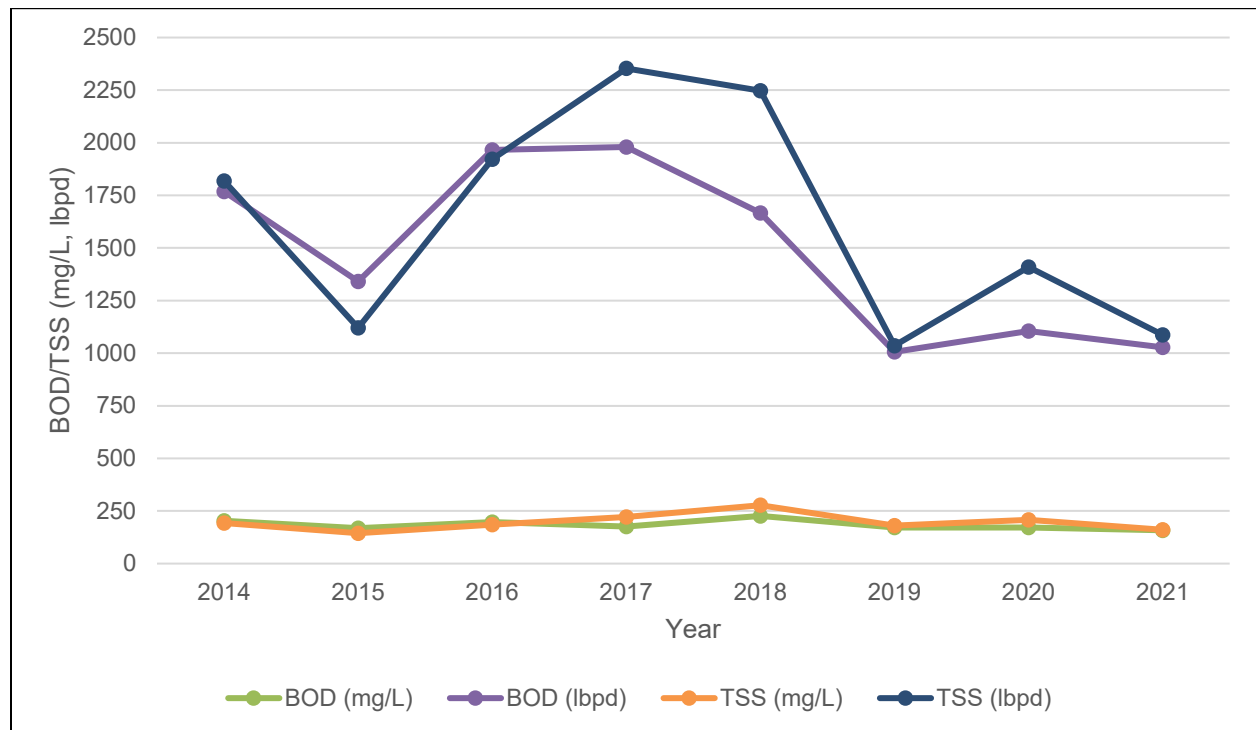
Recent flows have been lower than in the past. The percent decrease in flows from the time period 2014 through 2017 compared to 2018 through 2021 is summarized in Table 2.0.1. Influent flows are lower due to recent collection system improvement projects and reduced I/I. Below average rainfall during the 2018 through 2021 time period likely also contributed to lower flows.

**TABLE 2.0.1  
2014-2017 FLOWS COMPARED TO 2018-2021**

Parameter	2014-2017 Flow (MGD)	2018-2021 Flow (MGD)	Percent Decrease from 2014-2017 to 2018-2021 (%)
ADWF	1	0.62	-38%
AWWF	2.02	1.32	-35%
MMDWF	1.56	0.81	-48%
MMWWF	2.73	1.89	-31%
PDAF	5.89	5.56	-6%

Average annual influent BOD<sub>5</sub> and TSS loads were analyzed from 2014 through 2021 DMR data. Figure 2.0.2 shows the average annual influent BOD<sub>5</sub> and TSS loads.

**FIGURE 2.0.2  
AVERAGE ANNUAL INFLUENT BOD/TSS 2014-2021**



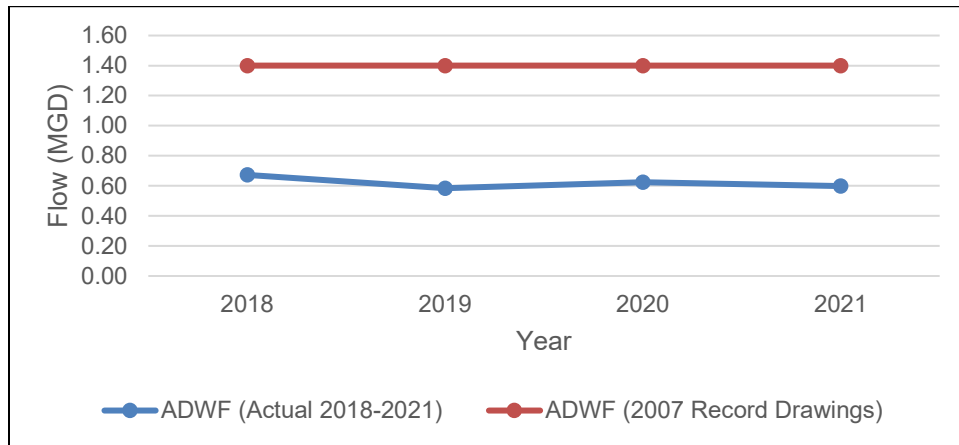
Influent flows from 2018 through 2021 were analyzed in more detail, as these flows more accurately represent flows after the City’s recently implemented collection and treatment system improvement projects. Table 2.0.2, below, summarizes the average annual flow (AAF), average dry weather flow (ADWF), average wet weather flow (AWWF), maximum month dry weather flow (MMDWF), maximum month wet weather flow (MMWWF), and the peak daily average flow (PDAF).

**TABLE 2.0.2  
2018-2021 FLOWS (ACTUAL)**

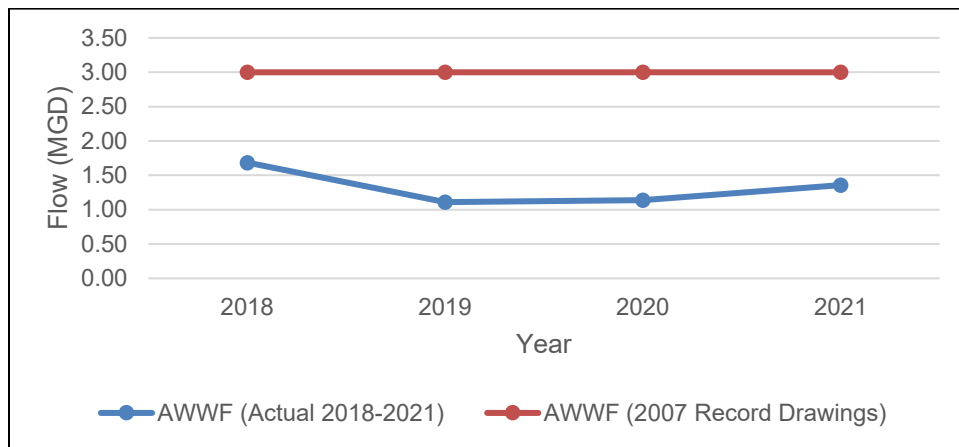
Year	AAF (MGD)	ADWF (MGD)	AWWF (MGD)	MMDWF (MGD)	MMWWF (MGD)	PDAF (MGD)
2018	1.18	0.67	1.69	0.92	2.45	4.26
2019	0.85	0.58	1.11	0.68	1.66	8.24
2020	0.88	0.62	1.14	0.78	1.49	4.87
2021	0.98	0.60	1.36	0.84	1.96	4.88
Average	0.97	0.62	1.32	0.81	1.89	5.56

Actual flow data from 2018 through 2021 was compared against the design data from the 2007 WWTP Improvements record drawings. This comparison illustrates, in part, the available capacity of the WWTP relative to the 2007 WWTP Improvement drawing design data. Figure 2.0.3 through 2.0.7 compare the 2018 through 2021 actual flows to the 2007 WWTP Improvements record drawing flows.

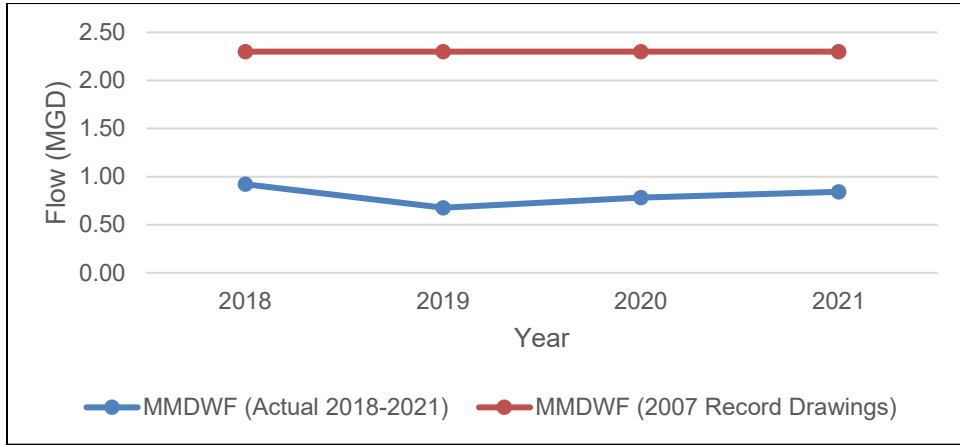
**FIGURE 2.0.3  
ADWF COMPARISON**



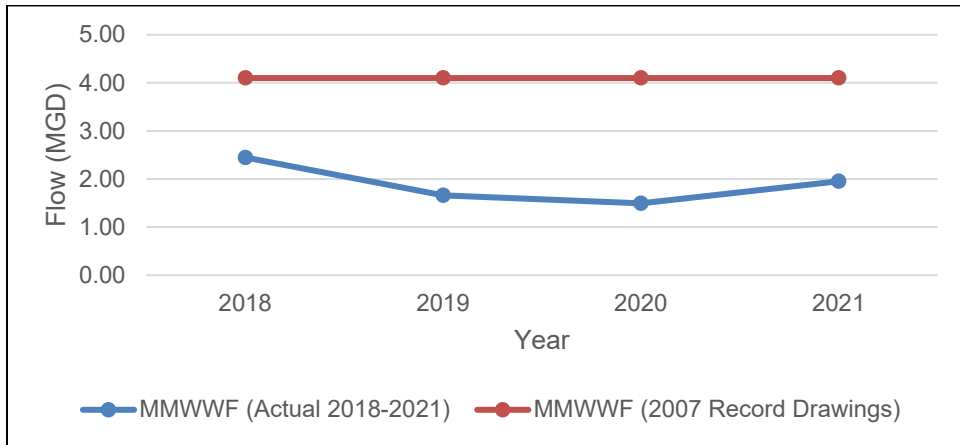
**FIGURE 2.0.4  
AWWF COMPARISON**



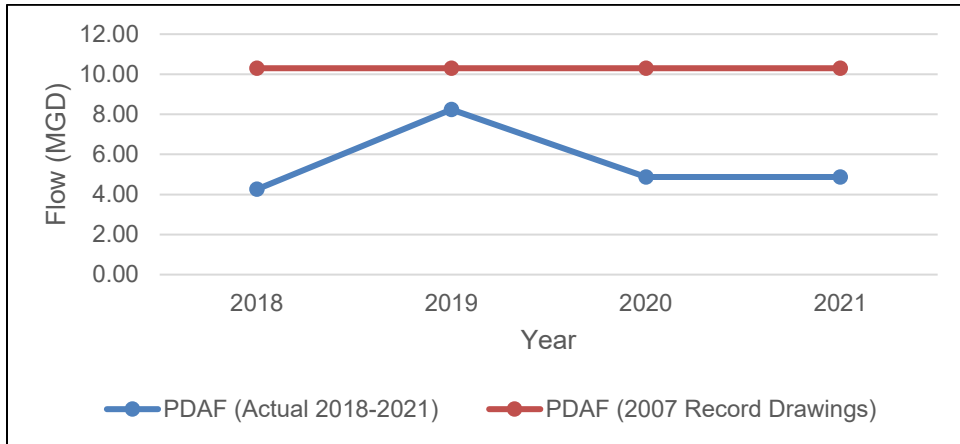
**FIGURE 2.0.5  
MMDWF COMPARISON**



**FIGURE 2.0.6  
MMWWF COMPARISON**



**FIGURE 2.0.7  
PDAF COMPARISON**



Per capita flows, from 2018 through 2021, were calculated to assist with the projection of flows associated with future developments. Actual per capita flow data is based on Portland State University’s Population Research Center certified population estimate for 2021 of 10,207 people. Table 2.0.2 lists the average per capita flows for the years 2018 through 2021.

**TABLE 2.0.3  
AVERAGE PER CAPITA FLOWS (2018-2021)**

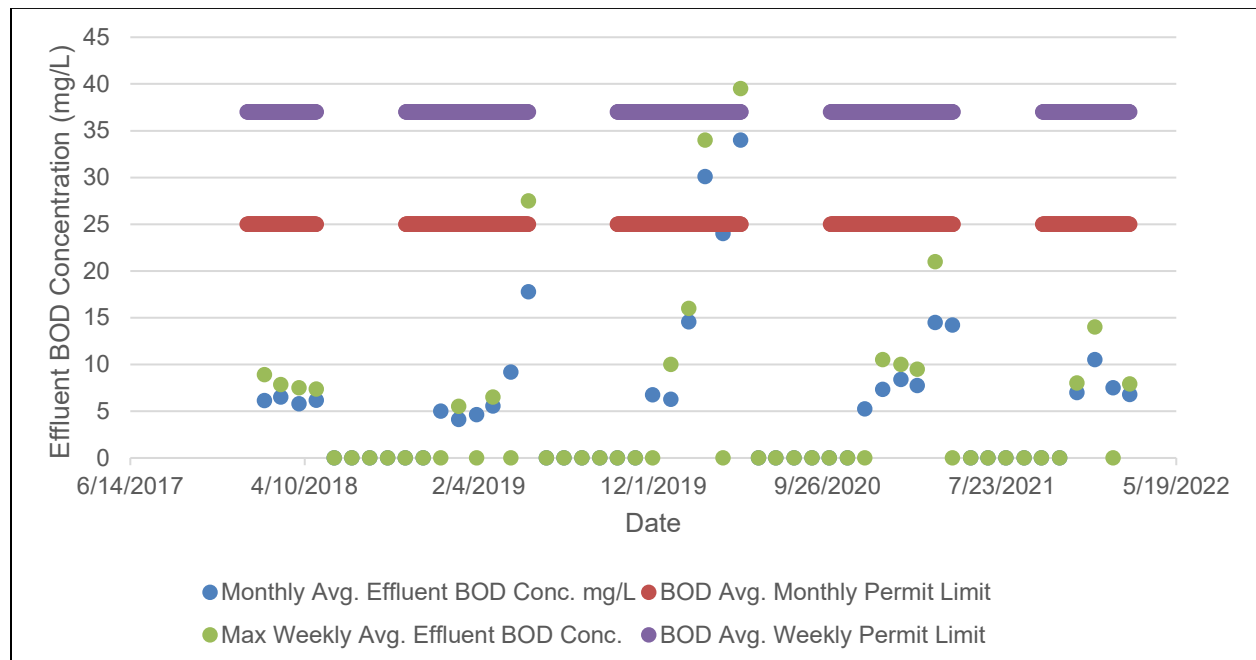
Parameter	Flow (GPCD)
ADWF	61
AWWF	130
MMDWF	79
MMWWF	185
PDAF	545

### 3. WWTP Performance

#### 3.1 Effluent BOD<sub>5</sub> and TSS Performance

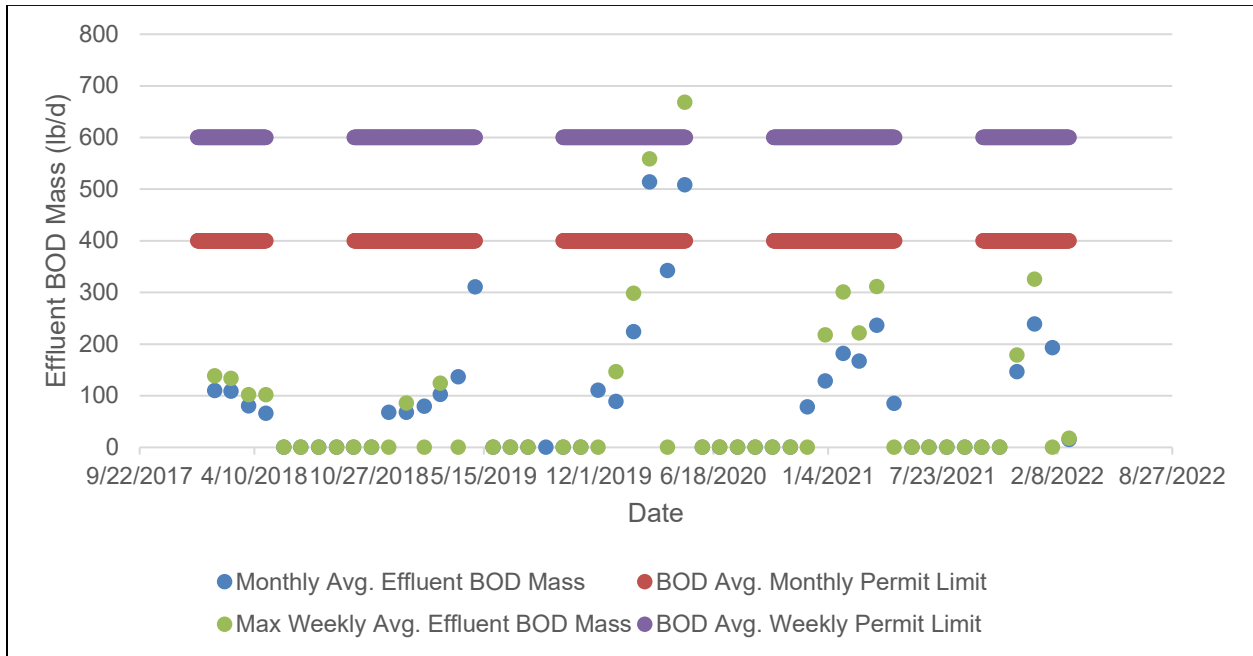
Discharge Monitoring Report data from 2018 through 2021 was analyzed to assess the WWTP’s recent ability to achieve the interim discharge permit limits in accordance with the NPDES permit as amended by the MAO. Figures 3.1.1 through 3.1.6 illustrate the WWTP’s performance relative to the interim BOD<sub>5</sub> and TSS permit limits as set forth in the MAO.

**FIGURE 3.1.1  
EFFLUENT BOD<sub>5</sub> PERFORMANCE - CONCENTRATION**

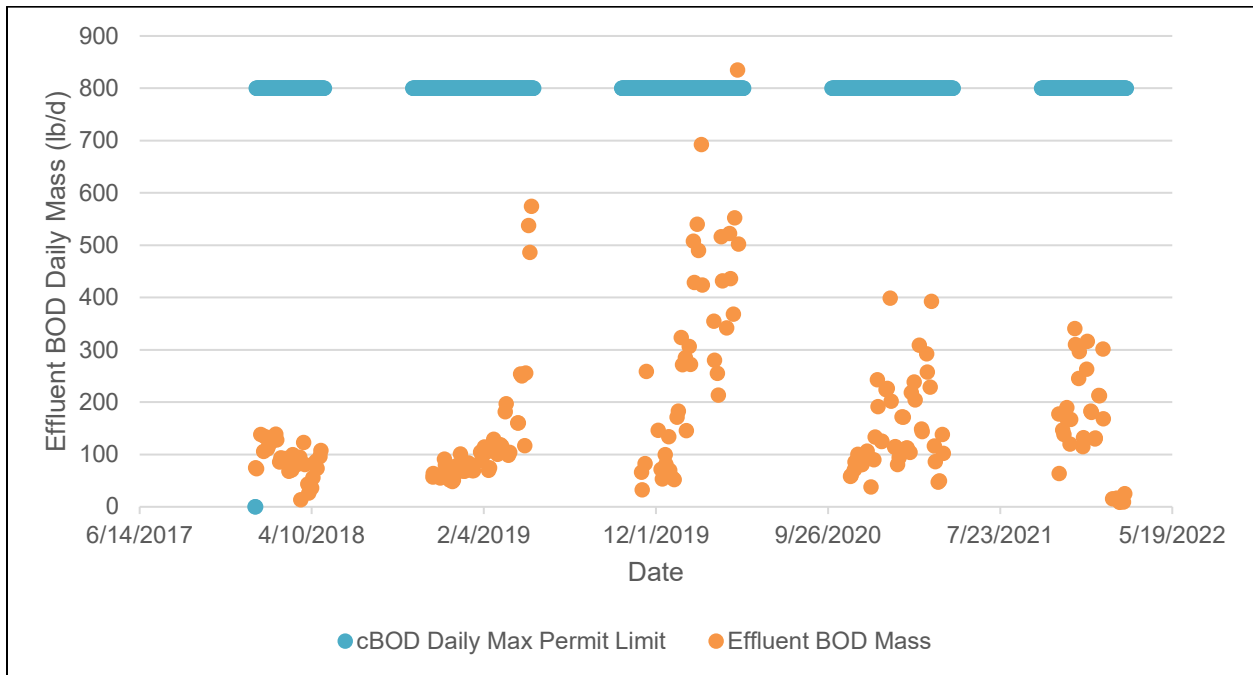




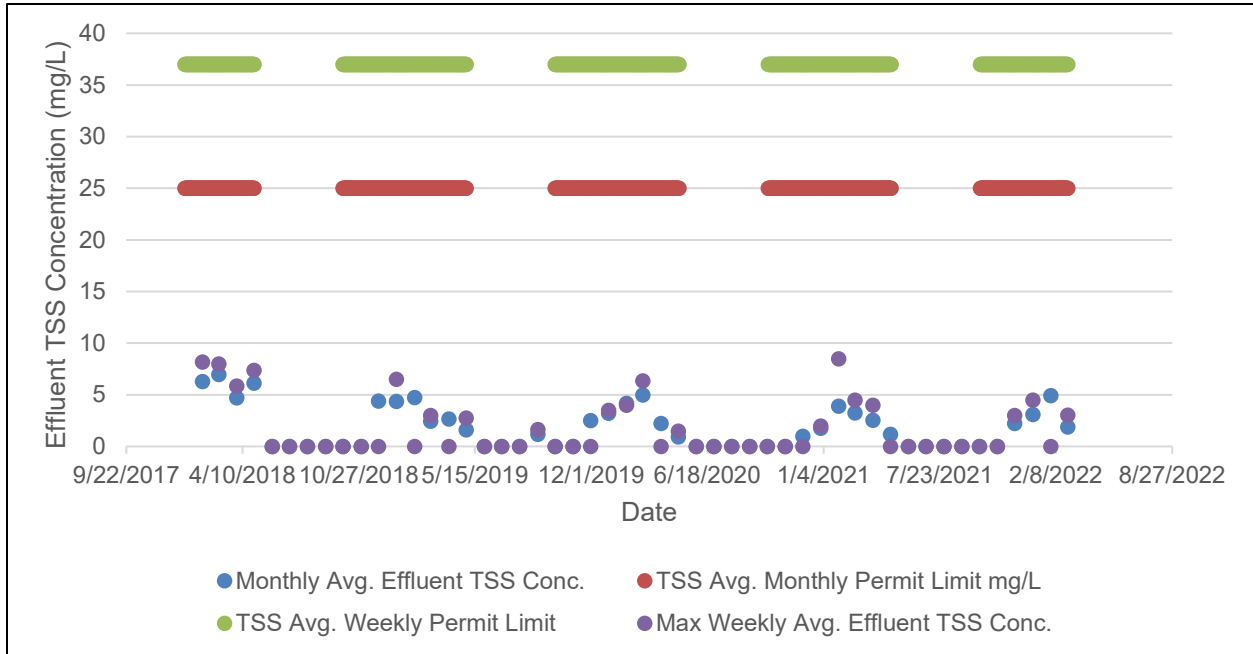
**FIGURE 3.1.2  
EFFLUENT BOD<sub>5</sub> PERFORMANCE – MASS LOAD (AVG. MONTHLY AND WEEKLY)**



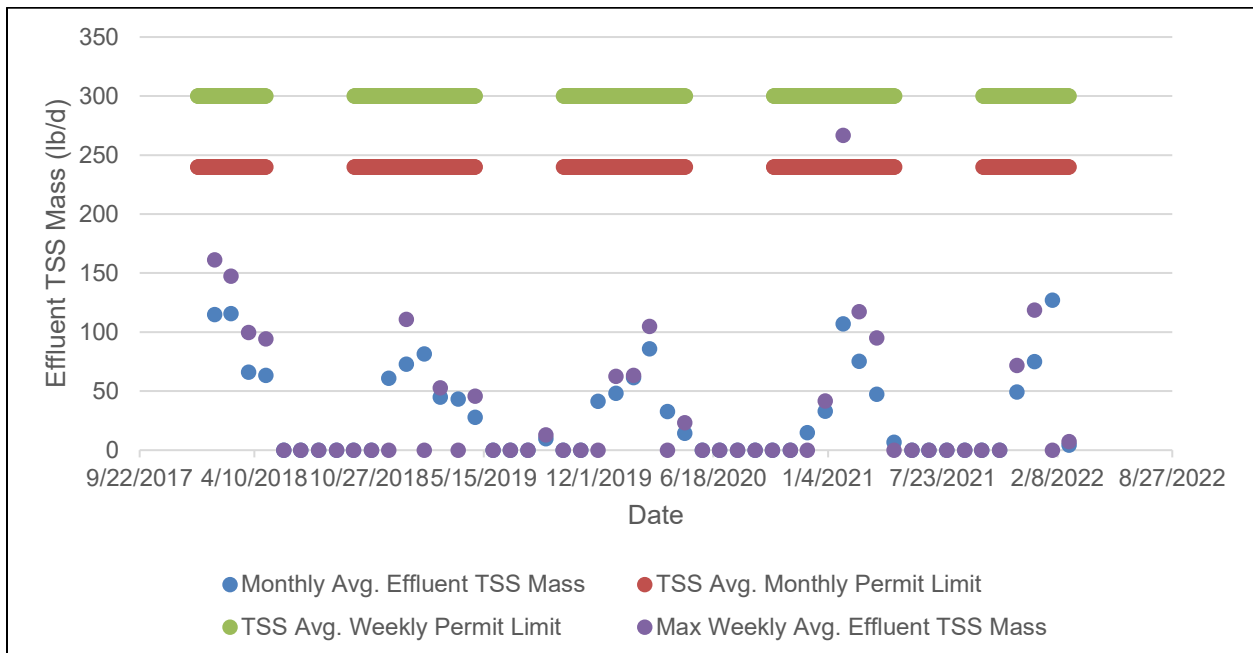
**FIGURE 3.1.3  
EFFLUENT BOD<sub>5</sub> PERFORMANCE – MASS LOAD (DAILY MAXIMUM)**



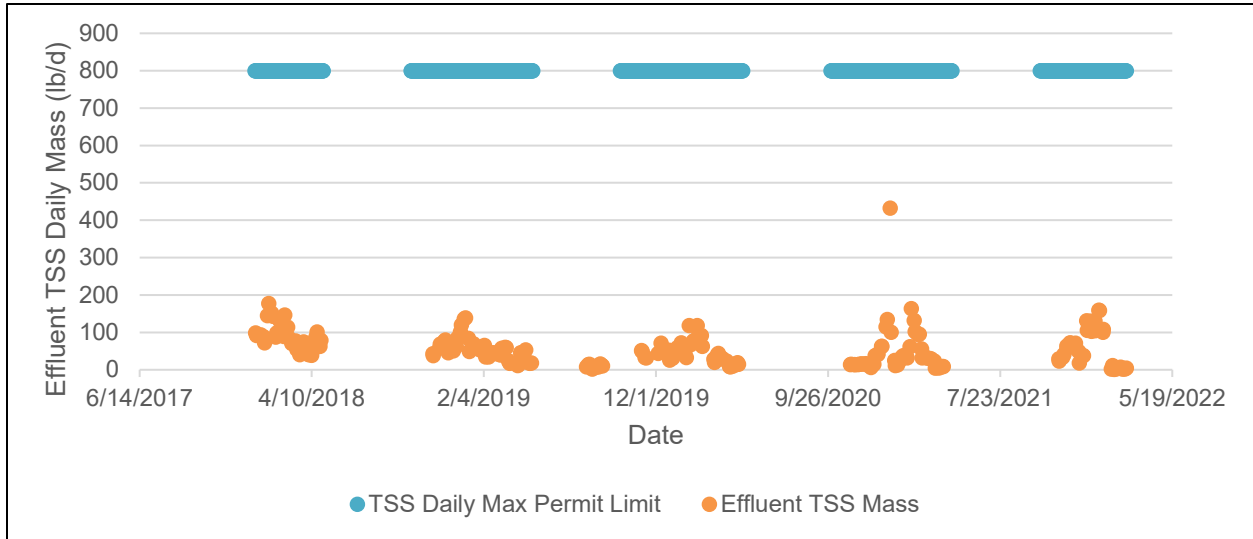
**FIGURE 3.1.4  
EFFLUENT TSS PERFORMANCE – CONCENTRATION**



**FIGURE 3.1.5  
EFFLUENT TSS PERFORMANCE – MASS LOAD (AVG. MONTHLY AND WEEKLY)**



**FIGURE 3.1.6  
EFFLUENT TSS PERFORMANCE – MASS LOAD (DAILY MAXIMUM)**

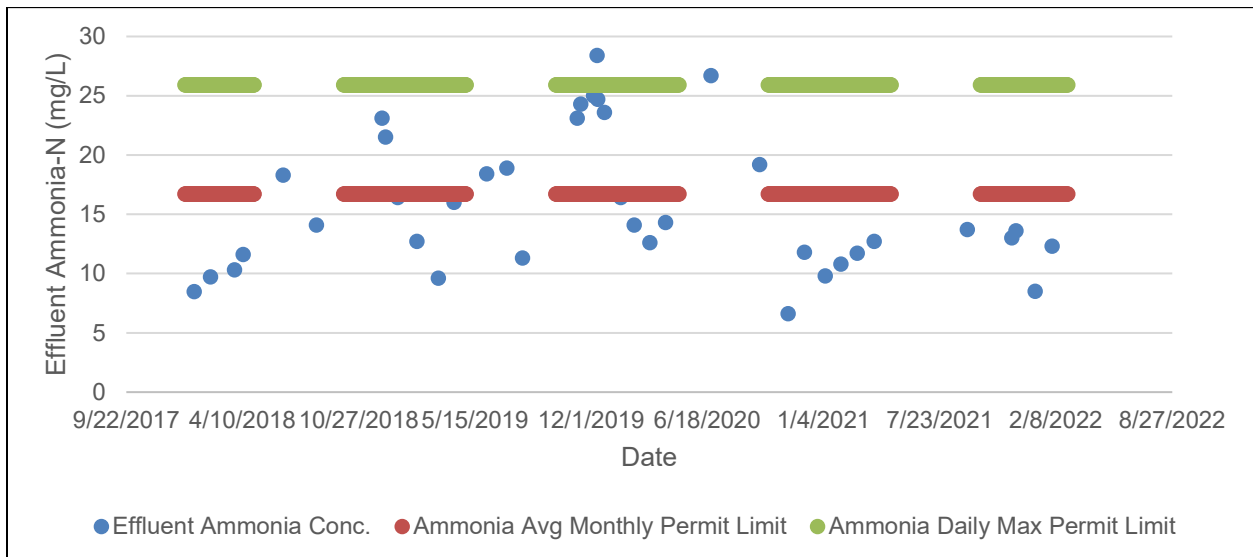


Based on the above data, the WWTP has demonstrated that it can perform in compliance with the effluent interim BOD<sub>5</sub> and TSS discharge limit as set forth in the MAO. The BOD<sub>5</sub>/TSS exceedances in late 2019 and early 2020 coincided with the removal of a large amount of biosolids from the lagoons, which ultimately upset the biological process. The City has since adjusted operational strategies to avoid future upsets related to biosolids removal.

**3.2 Effluent Ammonia Performance**

Effluent ammonia performance from 2018 through 2021 is summarized in Figure 3.2.1. The City experienced nitrification issues in November and December 2019, but has since operated in compliance with respect to effluent ammonia in 2020 and 2021.

**FIGURE 3.2.1  
EFFLUENT AMMONIA PERFORMANCE**

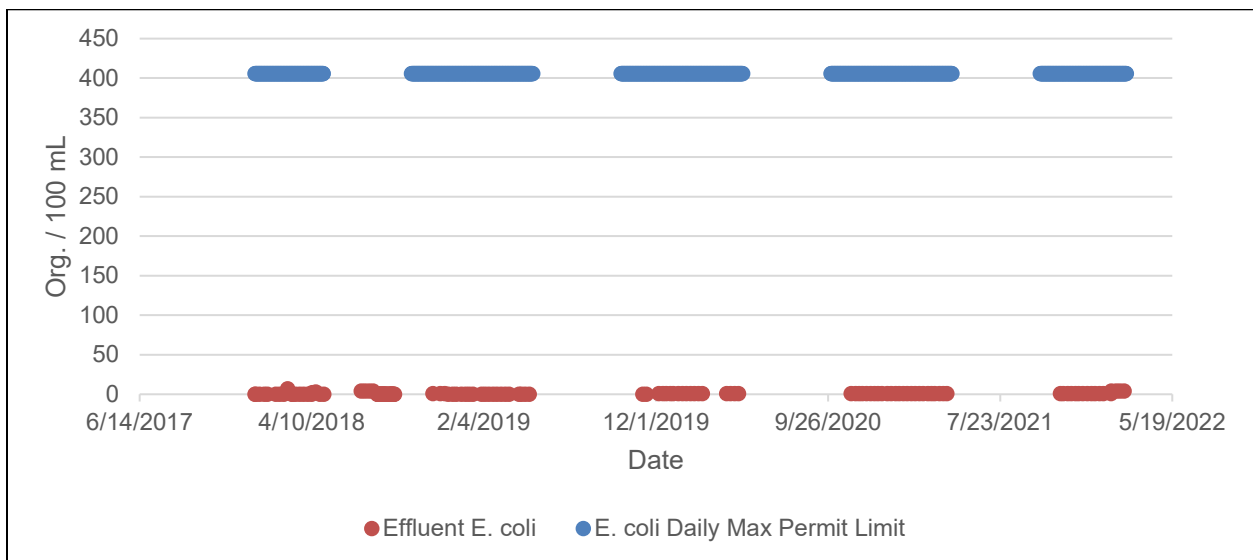


Similar to effluent BOD/TSS, effluent ammonia values in late 2019 and early 2020 coincided with lagoon solids removal. The City has since adjusted operational procedures to avoid future compliance issues. Based on the above data, the WWTP has demonstrated that it can perform in compliance with the effluent ammonia discharge limit.

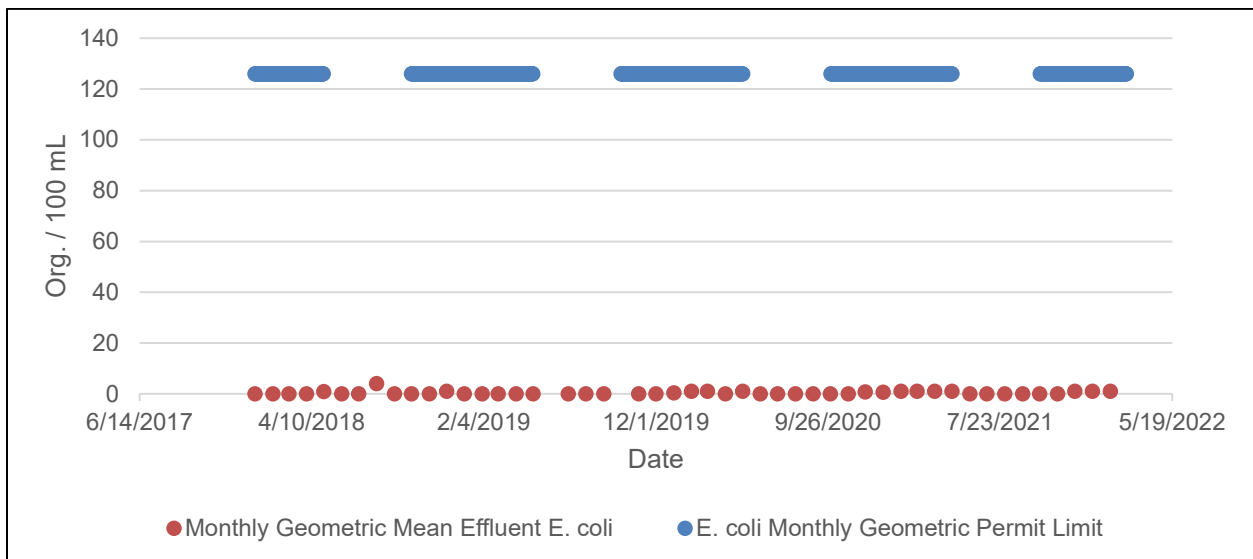
### 3.3 Effluent *E. coli* Performance

Effluent *E. coli* performance is summarized in Figures 3.3.1 and 3.3.2. The City has not experienced issues with achieving effluent *E. coli* discharge limits when discharging to the Molalla River.

**FIGURE 3.3.1  
EFFLUENT *E. COLI* PERFORMANCE (DAILY MAXIMUM)**



**FIGURE 3.3.2  
EFFLUENT *E. COLI* PERFORMANCE (MONTHLY GEOMETRIC MEAN)**

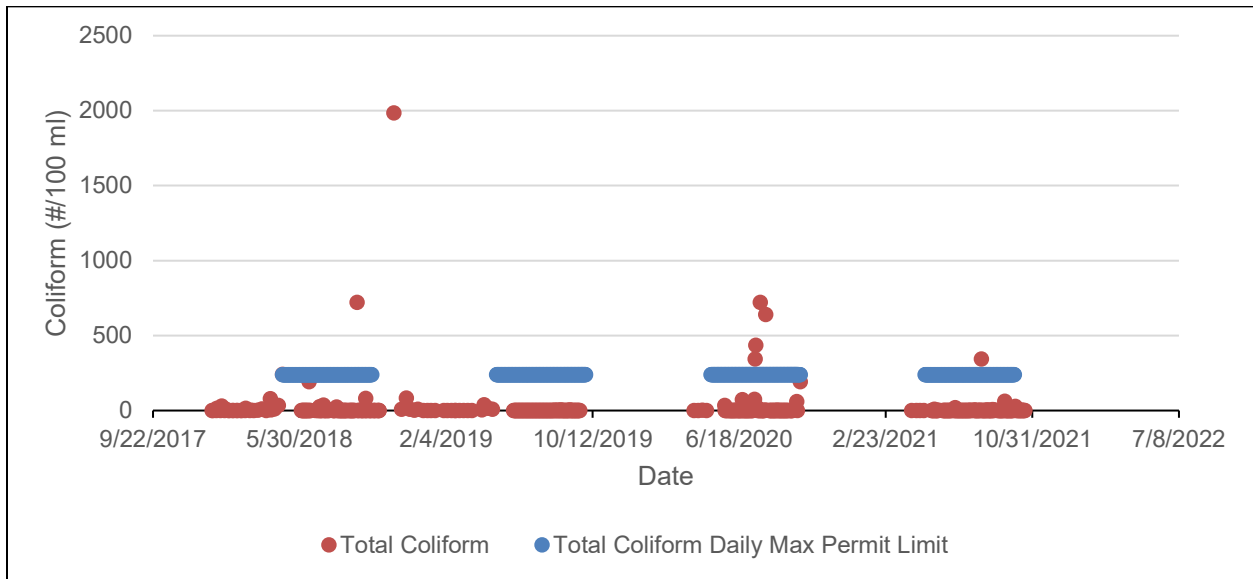


Based on the above data, the WWTP has demonstrated that it can perform in compliance with the effluent *E. coli* discharge limit.

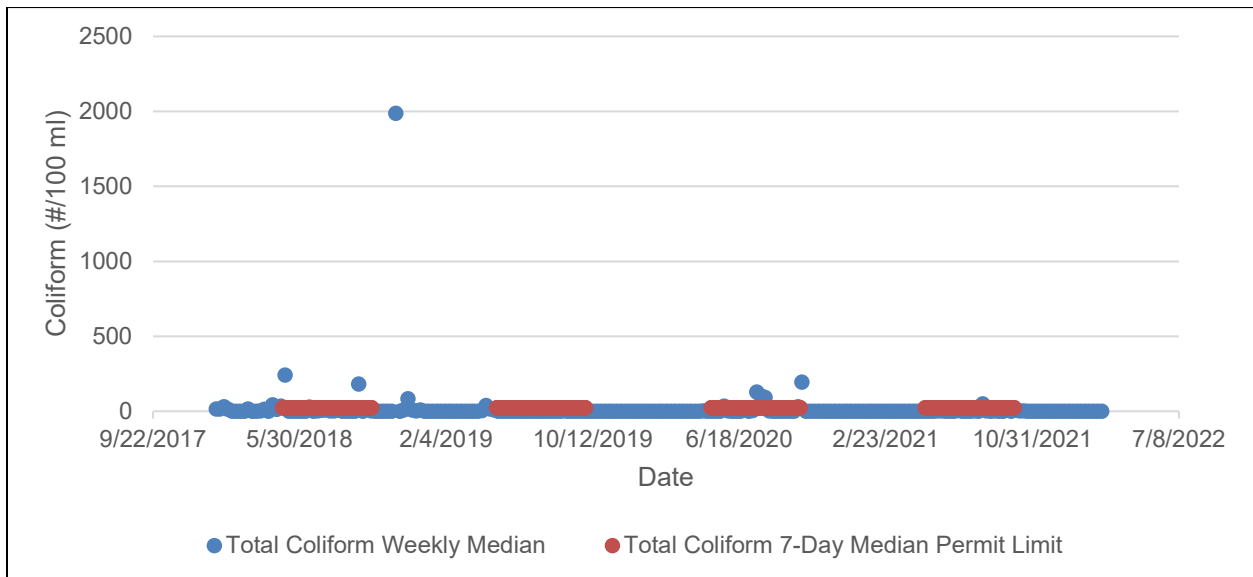
### 3.4 Effluent Total Coliform Performance

Effluent total coliform data was reviewed to evaluate the existing WWTP's ability to perform in compliance with the discharge permit limits. Figures 3.4.1 and 3.4.2 illustrate the WWTP's effluent total coliform data.

**FIGURE 3.4.1  
EFFLUENT TOTAL COLIFORM PERFORMANCE (DAILY MAXIMUM)**



**FIGURE 3.4.2  
EFFLUENT TOTAL COLIFORM PERFORMANCE (7-DAY MEDIAN)**



Based on the above data, the WWTP has demonstrated that it can perform in compliance with the effluent total coliform discharge limit.

**3.5 Out of Season Discharge**

For the time period 2018 through 2021, the City has not needed to discharge to the Molalla River during the non-discharge period stipulated in the NPDES permit. The MAO does state that out of season discharges not authorized by the NPDES permit that occur in the months of May, June, and October will be addressed per DEQ’s Enforcement Guidance Internal Management Directive in effect at the time of the violation.

**4. Cascade Place Apartments and 1000 West Main Developments**

The additional (estimated) flows and loads generated by the proposed Cascade Place Apartments and 1000 West Main developments are summarized in this section. The development consists of 214 EDUs. The City anticipates that 160 EDUs will be connected to the City’s sewer system in 2022, with the balance connected in 2023.

The number of EDUs is converted to population assuming 2.72 capita per EDU, based on the United States Census Bureau. This equates to an additional total (estimated) population of 582 people. The projected additional flows, calculated based on per capita flows from 2018 through 2021, are summarized in Table 4.0.1.

**TABLE 4.0.1  
ADDITIONAL FLOWS – CASCADE PLACE APARTMENTS AND 1000 WEST MAIN DEVELOPMENTS**

<b>Parameter</b>	<b>Value (MGD)</b>
ADWF	0.04
AWWF	0.08
MMDWF	0.05
MMWWF	0.11
PDAF	0.32

The impact of the Cascade Place Apartments and 1000 West Main developments on ADWF, AWWF, MMDWF, MMWWF, and PDAF conditions is analyzed in Table 4.0.2. The total estimated percent increase in flows due to contribution from the Cascade Place Apartments and 1000 West Main developments is approximately 6%. This is based on the assumption that per capita flows will remain consistent with values experienced from 2018 through 2021.

**TABLE 4.0.2  
IMPACT OF ADDITIONAL FLOWS – CASCADE PLACE APARTMENTS AND 1000 WEST MAIN  
DEVELOPMENTS**

Parameter	Estimated Additional Flow (MGD)	2018-2021 Flow (MGD)	Estimated Total Flow Projection (MGD)	Estimated Percent Increase in Flow (%)
ADWF	0.04	0.62	0.66	6.5%
AWWF	0.08	1.32	1.4	6.1%
MMDWF	0.05	0.81	0.86	6.2%
MMWWF	0.11	1.89	2	5.8%
PDAF	0.32	5.56	5.88	5.8%

The estimated total flow projection compared to the 2007 WWTP Improvements design flows is summarized in Table 4.0.3. As shown in Table 4.0.3, based on 2018 through 2021 data, for the past four years influent flows have been significantly less than the capacity listed in the 2007 WWTP Improvements design data.

**TABLE 4.0.3  
PROJECTED TOTAL FLOWS COMPARED TO 2007 DESIGN DATA**

Parameter	Estimated Additional Flow (MGD)	2018-2021 Flow (MGD)	Estimated Total Flow Projection (MGD)	2007 Design Data (MGD)	Estimated Total Flow as a Percentage of 2007 Design Data (%)
ADWF	0.04	0.62	0.66	1.4	47%
AWWF	0.08	1.32	1.4	2.3	61%
MMDWF	0.05	0.81	0.86	3.0	29%
MMWWF	0.11	1.89	2	4.1	49%
PDAF	0.32	5.56	5.88	10.3	57%

## 5. Conclusion

This WWTP performance evaluation analyzes the ability of the existing WWTP to comply with the NPDES permit as modified by the MAO, assuming that an additional 214 EDUs are connected to the City's wastewater collection system. It is assumed that future influent flows and loads will remain consistent with 2018 through 2021 values, to take into account recently implemented infrastructure improvement projects.

Design data included in the 2007 WWTP Improvement drawings was used, in part, in the analysis. The 214 EDUs is estimated to increase influent flows by approximately six percent, again, based on 2018-2021 flows. Even with a six percent increase in flows, the estimated future flows will remain considerably less than the 2007 WWTP Improvements design data. Influent flows from 2018 through 2021 have been considerably less than the design data specified in the 2007 WWTP Improvement record drawings.

No influent loading information is included in the 2007 WWTP Improvements design data. However, the 2007 WWTP Improvements are based upon the treatment of residential strength wastewater. Therefore, influent flows were used as the primary basis of this evaluation.

Since 2018, the City has completed several collection system improvement projects that have resulted in reduced infiltration and inflow, thereby freeing up capacity and improving the performance of the WWTP. The City has also removed biosolids from the lagoons, and addressed deficiencies with the tertiary treatment systems. Overall, recent collection and treatment system improvements have facilitated better WWTP performance, and recovered capacity previously occupied.

With the MAO, and amendment of the RWUP to target Class C recycled water, the treatment objectives are currently less stringent than historically imposed discharge limits, or target effluent quality expectations specified in the 2007 WWTP Improvement drawings. The MAO and Class C recycled water requirements release capacity previously trapped by strict limits, and have allowed the City to more reliably achieve effluent quality requirements.

Effluent performance data was also reviewed to ascertain the WWTP's recent ability to comply with the MAO, and to determine whether or not additional capacity is available. Based on the influent flows and loads from the time period 2018 through 2021, when properly operated and maintained, the WWTP has demonstrated that it is capable of achieving compliance with the NPDES permit as modified by the MAO.

Based on 2018 through 2021 flows, and the 2007 WWTP Improvement design data, compliance with the NPDES permit as modified by the MAO, with an additional 214 EDUs, is attainable based on the following assumptions:

1. Influent flows and loads remain consistent with 2018 through 2021 values.
2. City continues to implement collection system improvement projects to mitigate I/I.
3. Proper operation and maintenance activities.
4. Ongoing solids removal from the lagoons.

END OF MEMORANDUM