City of Sunnyvale | Environmental Services Department



Water Pollution Control Plant

Plant Compliance

Annual NPDES Report
R2-2020-0002

Sunnyvale

2021

2021 ANNUAL NPDES REPORT

City of Sunnyvale

Prepared for:

Mr. Michael Montgomery

California Regional Water Quality Control Board

San Francisco Bay Region

1515 Clay Street, Suite #1400

Oakland, CA 94612

Prepared by:

City of Sunnyvale

Environmental Services Department

Regulatory Programs Division

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February 1, 2022

Sunnyvale

Water Pollution Control Plant
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February 1, 2022

Mr. Michael Montgomery
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite #1400
Oakland, CA 94612

Attn: NPDES Division

Re: 2021 Annual Self-Monitoring Report, City of Sunnyvale Water Pollution Control Plant

The attached 2021 Annual Self-Monitoring Report is submitted in accordance with the requirements of Order No. R2-2020-0002 for the City of Sunnyvale Water Pollution Control Plant.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact me at (408) 730-7788.

Sincerely,

RWikramanayake
RWikramanayake (Feb 1, 2022 15:00 PST)

Rohan Wikramanayake
WPCP Division Manager

Attachment: 2021 Annual NPDES Report

Table of Contents

List of Figures

LIST OF TABLES

I. INTRODUCTION

1.0. BACKGROUND

The 2021 Annual National Pollutant Discharge Elimination System (NPDES) Report for the City of Sunnyvale (City) Water Pollution Control Plant (WPCP) is prepared in accordance with NPDES Permit No. CA0037621, San Francisco Bay Regional Water Quality Control Board (RWQCB) R2-2020-0002 (effective April 1, 2020). This report summarizes the monitoring results from the January 1 to December 31, 2021 reporting period and has been divided into six chapters to address the requirements contained in Section V.C.1.f of Attachment G, as well as Provisions VI.C.2 (Effluent Characterization Study and Report) and VI.C.4.b (Sludge and Biosolids Management) of the Order.

San Francisco Bay Mercury and PCBs Watershed Permit

The City is also subject to Waste Discharge Requirements of the Mercury and PCB Watershed Permit No. CA0038849, RWQCB Order No. R2-2017-0041. This permit's annual reporting requirements may be met either in the Annual NPDES Report or through participation in a group report submitted by the Bay Area Clean Water Agencies (BACWA). The City meets these reporting requirements with the reporting summarized in **Chapter II, Section 2.1.4** and **Section 2.1.5**.

San Francisco Bay Nutrients Watershed Permit

The City is also subject to Waste Discharge Requirements of the Nutrient Watershed Permit No. CA0038873, RWQCB Order No. R2-2019-0017. As allowed by the annual reporting requirements of this Order, the City participates in the 2021 Group Annual Report that will be prepared and submitted by BACWA by February 1, 2022. Nutrient data are also reported electronically in the California Integrated Water Quality System (CIWQS) via monthly Self-Monitoring Reports (SMRs) and are being presented and discussed in **Chapter II, Section 1.5**.

Alternate Monitoring Program

The City has elected to participate in the Alternate Monitoring Program, RWQCB Order No. R2-2016-0008. The Order establishes alternative monitoring requirements for municipal wastewater discharges subject to RWQCB Permit No. CA0038849. Participating wastewater treatment facilities can reduce their effluent monitoring costs for most organic priority pollutants and chronic toxicity species rescreening. In exchange for the reduced monitoring requirements, facilities make supplemental payments to the Regional Monitoring Program (RMP) for regional studies to inform management decisions about water quality in the San Francisco Bay.

2.0. FACILITY DESCRIPTION

The City owns and operates the Donald M. Sommers WPCP, located at 1444 Borregas Avenue, Sunnyvale, CA 94088 (**Figure 1**). The WPCP is one of 37 Publicly Owned Treatment Works (POTWs) that discharge to the San Francisco Bay. Located in the Lower South Bay subembayment, the WPCP is considered a shallow

Figure 1: WPCP Site Location Map

water discharger and is therefore subject to more stringent treatment standards compared to deep-water dischargers (**Figure 2**).

Figure 2: POTWs located in the Bay Area

The WPCP was originally constructed in 1956. Over the years, the City has periodically increased treatment capacity as Sunnyvale's population has grown to 153,827 (2021) and has incorporated new technologies in wastewater treatment processes to improve effluent water quality. Residential, commercial, and industrial wastewater collected from the surrounding service areas, including Rancho Rinconada and Moffett Field, enters the WPCP via 295 miles of gravity sewer mains and interceptors. Wastewater is subsequently treated to tertiary standards before being discharged to Moffett Channel, a tributary to South San Francisco Bay via Guadalupe Slough. The average dry weather flow design capacity of the WPCP is 29.5 million gallons per day (MGD), which also corresponds to the facility's permitted effluent capacity. The peak wet weather design capacity of the WPCP is 40 MGD with a proven capability of handling instantaneous flows of 55 MGD.

2.1. Wastewater Treatment Processes

The WPCP is comprised of distinct process areas, including preliminary, primary, secondary, tertiary, and solids processing facilities (**Figure 4**). A subset of treatment units in these process areas are used for recycled water production. Wastewater entering the WPCP is treated using a combination of physical, biological, and chemical processes to remove pollutants according to the process flow diagram shown in **Figure 3**. More detailed Liquids and Solids Process Flow Diagrams are presented in **Attachment A**.

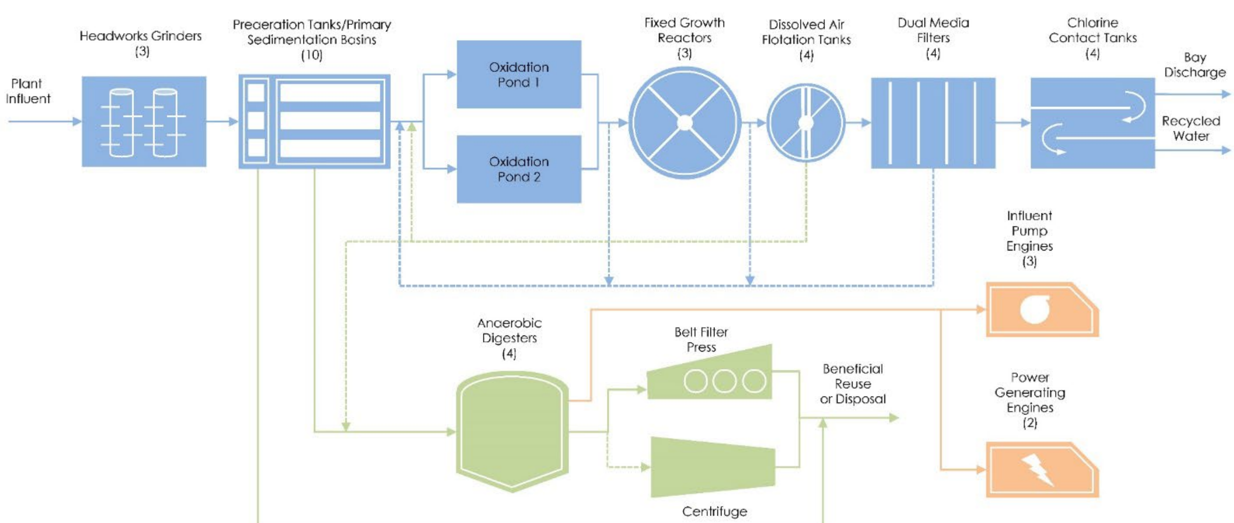


Figure 3: WPCP Process Flow Diagram. Blue lines correspond to liquid, green lines to solids flows and orange lines to gas flows. Dashed lines indicate waste/return flows or alternate flow path

Figure 4: Aerial photo of WPCP and various treatment processes

The City is in the process of implementing a 20-year Capital Improvement Program (CIP) known as the Sunnyvale Cleanwater Program that will repair or replace the majority of WPCP facilities to address rehabilitation and repair, as well as anticipated treatment needs. Individual CIP projects are referenced throughout this report and are described in more detail in **Chapter IV.**

2.1.1. Preliminary and Primary Treatment

The Preliminary and Primary Treatment Facilities were originally constructed in 1956 to provide influent screening/grinding, raw sewage pumping and metering, preaerated grit removal, and primary sedimentation. The facilities were expanded several times, most recently in 1984 with the construction of the tenth sedimentation basin, grit handling equipment, and the Auxiliary Pump Station (APS).

Figure 5: Barrel grinders (top), and Preaeration Basins and Primary Sedimentation Tanks (bottom)

Wastewater from the sanitary sewer collection system is primarily conveyed to the WPCP by gravity and enters the Headworks 30 feet below grade where barrel grinders break down large debris. Gas-driven (biogas) centrifugal pumps convey the raw sewage into the Preaeration Basins sequent Primary Sedimentation Tanks (**Figure 5**). Service air is injected into wastewater in the Preaeration Basins to discourage septic conditions and odors, and to remove grit (typically inorganic, heavy solids such as sand, gravel, coffee grounds, etc.) that could otherwise damage downstream pumping equipment and accumulate inside anaerobic digesters. Grit accumulates on the bottom of the basins and is conveyed to a screw press where it is dewatered before being hauled offsite for landfill disposal. Aerated wastewater then flows into the Primary Sedimentation Tanks, where the velocity is slowed to allow suspended solids to either rise to the surface (floatable solids/scum) or settle to the bottom of the tanks (settable solids/sludge). Floatable solids are skimmed off the surface while settled solids are removed from the bottom of the tanks and pumped to anaerobic digesters for further treatment. Refer to **Section 2.1.4** of this Chapter for additional information on solids handling. The clarified wastewater (primary effluent) from each basin is collected by launders and conveyed via a common channel into a pipeline that leads to the Oxidation Ponds where it undergoes secondary treatment. During dry weather conditions (May-October), only five of the ten Preaeration Basins/Sedimentation Tanks are operated on any given day.

If the Headworks is unable to handle the incoming wastewater flow due to mechanical failure or excessive flows, the APS is placed in service to convey wastewater from the collection system into the Preaeration Basins and Primary Sedimentation Tanks. The APS consists of a vertical bar screen for removing large floatable and suspended debris and an electric motor-driven centrifugal submersible pump to convey the wastewater. Screenings are hand-separated and hauled off-site for landfill disposal.

Construction of a new Headworks and Primary Treatment Facilities is currently underway with a projected completion year of 2022 (**Chapter IV, Section 3.0**). As a part of this project, a new 2 MW diesel generator will replace the existing 1 MW generator installed in 2018 as part of the Emergency Flow Management Project. Unlike the 1 MW generator, which can only be used to power specific areas of the WPCP that experience power outages, the 2 MW generator has the capability to provide emergency power to the entire WPCP in the event of a power loss. This project will also address Title V air regulatory requirements by replacing three combustion engines that power the influent pumps with electric motor-driven pumps.

2.1.2. Secondary Treatment

Primary effluent undergoes secondary (biological) treatment in two Oxidation Ponds that have a combined surface area of roughly 412 acres (**Figure 6**). Primary effluent is initially discharged into a distribution channel and conveyed to the ponds through a series of cross-over pipes embedded in pond levees. Return channels connected to each pond collect the treated wastewater. The return channel connected to the smaller pond (Pond 1) redistributes the treated wastewater into the distribution channel where it is mixed with primary effluent and recirculated throughout the system. Treated wastewater entering the return channel connected to the larger pond (Pond 2) is convey by the Pond Effluent Pump Station to downstream treatment processes. This in effect creates a single pond system. The Oxidation Ponds were constructed in their present form in 1968 and designed to treat high biochemical oxygen

Figure 6: Oxidation Ponds, including the return/distribution channel, Pond Effluent Pump Station, and surface aerators

demand (BOD) loadings during the summer canning season. BOD loadings were greatly reduced with the departure of the canneries in 1983. The original surface aerators (2,500 hp of total surface aeration capacity) were replaced by seven smaller (15 hp) aerators located in the distribution and return channels that help to break apart algal mats that otherwise disrupt wastewater conveyance and to supplement aeration provided by microalgae and atmospheric diffusion.

Ammonia and organic material are readily degraded by aerobic and anaerobic bacteria through processes of nitrification and denitrification that occur throughout pond simultaneously. Ammonia removal in the Oxidation Ponds is subject to seasonal variability, with the highest removal rates observed in the warmer summer months and the lowest in the colder winter months. BOD removal is less susceptible to the same seasonal fluctuations. The average detention time of the Oxidation Ponds is 30-45 days and is dependent on flows, operating depth, and other factors.

The City implements a pond dredging program to remove solids that have accumulated in the Oxidation Ponds from Primary Effluent and various process return flows, including flocculated solids and filter backwash, thereby recovering lost volume and improving overall treatment efficacy. Dredged solids are processed on-site before being hauled off-site as Class B biosolids. Refer to **Section 2.1.4** of this Chapter for more information on solids handling. The City manages a maintenance program to address erosion along the levees that delineate the Oxidation Ponds and are essential to their continued performance (**Chapter IV, Section 8.0**).

Following treatment in the Oxidation Ponds, effluent is then pumped to Fixed Growth Reactors (FGRs), commonly known as trickling filters, which provide additional nitrification of residual ammonia. The FGRs are comprised of plastic cross-flow media (**Figure 7**) on which a film of microorganisms (biofilm) attach and readily convert ammonia (NH_3) to nitrate (NO_3^-). During the colder wet weather season, the nitrification efficacy of the Oxidation Ponds is reduced (or stops altogether), and the FGRs provide the majority of nitrification needed to meet ammonia discharge limits (**Chapter II, Section 1.4**).

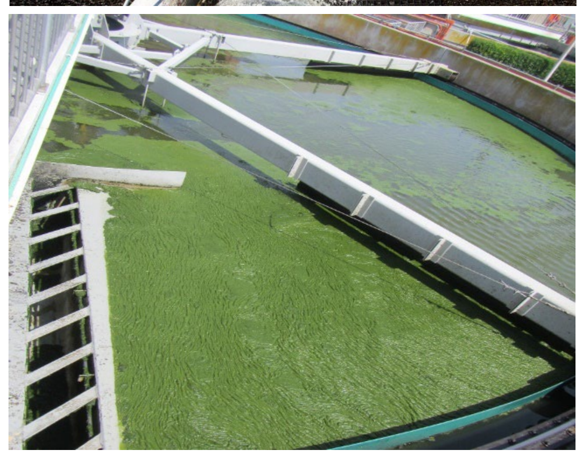


Figure 8: Algae being skimmed off the surface of wastewater in a Dissolved Air Flotation Tank

FGR effluent flows by gravity to the Dissolved Air Flotation Tanks (DAFTs), where compressed air and polymer are introduced to coagulate and flocculate biological solids (algae and bacteria) generated during treatment in the Oxidation Ponds and FGRs (**Figure 8**). Flocs rise to the water surface, are skimmed into troughs, and returned to the Oxidation Ponds via the 36-inch Pond Return Line along with filter backwash water and other return flows.

2.1.3. Tertiary Treatment

The Tertiary Treatment Facilities were originally constructed in 1978 and then expanded in 1984 to provide additional treatment of Oxidation Pond effluent. Additional improvements were also made in the 1990s and 2018 to allow for the production of recycled water. As a final polishing step, clarified effluent from the DAFTs is conveyed to the Dual Media Filters (DMFs), which provide additional removal of residual algae and particulate matter via gravity filtration through anthracite (top, coarse layer) and sand (bottom, fine layer) (**Figure 9**). The filters are routinely backwashed to remove accumulated solids, with the backwash water being returned to the Oxidation Ponds.

Figure 9: Dual Media Filters treating wastewater

Effluent from the DMFs is disinfected with liquid sodium hypochlorite for at least one hour in a series of Chlorine Contact Tanks (CCTs) before dechlorination with sodium bisulfite, and discharged to Moffett Channel, a tributary to the San Francisco Bay via Guadalupe Slough (**Figure 10**). A portion of the filtered wastewater undergoes additional treatment in dedicated CCTs to meet the requirements for disinfected tertiary recycled water as specified in Title 22 of the California Code of Regulations Section 2.4. Furthermore, a portion of the disinfected wastewater is partially dechlorinated and redistributed throughout the WPCP as process water for filter backwashing, engine cooling, and other purposes.

In 2018, the City completed a project to improve its disinfection and recycled water production facilities, which included replacement of gaseous chlorine with liquid sodium hypochlorite as well as other

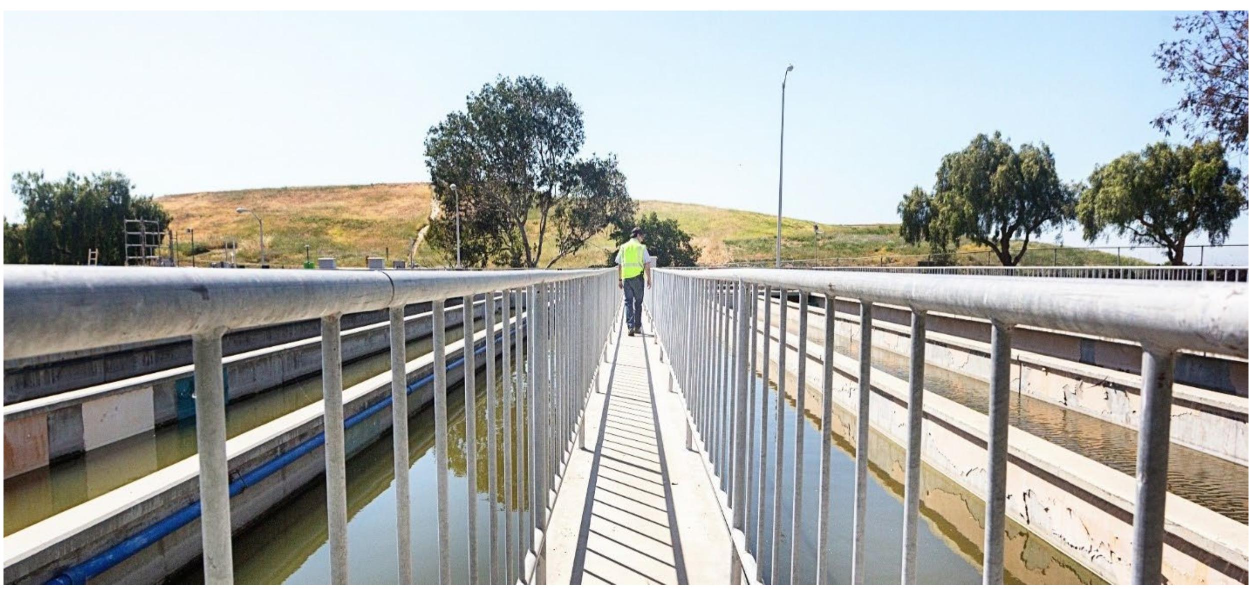


Figure 10: Wastewater being disinfected in the Chlorine Contact Tanks prior to discharge into Moffett Channel

mechanical, electrical, and instrumentation and control improvements. The City also added a second sodium bisulfite dosing location to provide additional flexibility and reliability to meet the final effluent residual chlorine discharge limit.

2.1.4. Solids Processing

Solids removed during primary treatment are fed into primary anaerobic digesters and detained for approximately 35 to 40 days at a temperature around 100 °F. Primary digestion is typically followed by additional treatment in a secondary digester for 12 to 15 days. Within the digesters, anaerobic bacteria degrade organic matter and produce biogas, a mixture of methane, carbon dioxide, and hydrogen sulfide gases in addition to stabilized, nutrient rich biosolids and water.

Solids Processing

Disposal Type	Tonnage (Dry Tons)
Land Application	2,569
Compost	---
Monofill	---
Landfill	---
Annual Total	*2,569*

A portion of the biogas produced in the anaerobic digesters powers the three main influent engines. Each engine drives a dedicated centrifugal pump that lifts wastewater into the Headworks from the sanitary sewer collection system in addition to driving blowers that aerate the Preaeration Basins. Exhaust heat recovered from the main influent engines and jacket water from the Power Generation Facility (PGF) engines is captured and used to maintain a nearly constant temperature in the digesters. The remainder of the biogas is blended with landfill gas from the adjacent closed landfill and air-blended natural gas. This gas mixture is utilized by two engine generators that comprise the PGF. The PGF produces 1.2 MW of power on average, which satisfies most of the WPCP's power demand and offsets its purchases from PG&E and Silicon Valley Clean Energy.

Currently, all biosolids are mechanically dewatered by Synagro using either a belt filter press or centrifuge. Filtrate and centrate are returned to the Oxidation Ponds for additional treatment. A solids process flow diagram is included in **Attachment A**.

Biosolids produced at the WPCP undergo a series of analytical tests prior to being hauled off-site to ensure compliance with regulations set forth in 40 CFR Part 503. Biosolids are typically disposed of through a combination of land application, which includes agricultural application and compost, and surface disposal in a landfill. The location of the disposal site varies depending on availability and the composition of the solids. In a typical year, the majority of biosolids produced at the WPCP are land applied to agricultural fields, with a much smaller portion being sent to landfill disposal or for further treatment off-site in order to meet Class A requirements for resale as compost. The City also has the option of disposing of biosolids through surface disposal in the Sunnyvale Biosolids Monofill (SBM). Historically, the SBM has been used for surface disposal of biosolids produced when an anaerobic digester is cleaned-out, though it has other approved uses not limited to this biosolids stream. The frequency at which a digester is cleaned-out can vary depending on the feed rate and composition of the raw sludge and scum, but on average occurs every 3 to 4 years.

During the 2021 reporting period, the WPCP produced 2,569 dry tons of biosolids. Of the total, 2,292 dry tons were dredged from the Oxidation Ponds and 277 dry tons were removed from the anaerobic digesters. All 2,569 dry tons of biosolids produced in 2021 were land applied in Sacramento County. For additional information on biosolids management at the WPCP, refer to the *Biosolids Management Annual Report* for 2021, scheduled for submittal by February 19, 2022, per Provision VI.C.4.b of Order No. R2-2020-0002.

2.2. Recycled Water Production

The WPCP historically operated in two different treatment modes: 1) San Francisco Bay discharge, or 2) recycled water production. In late 2018, the WPCP completed an improvement project that allows for the simultaneous production and distribution of recycled water and discharge to San Francisco Bay, as well as improvements to the chlorination and dechlorination systems. Under the new configuration, a portion of the FGR effluent is sent to a dedicated DAFT, a pair of DMFs, and two of the CCTs that achieve a level of treatment that meet the requirements for disinfected tertiary recycled water as specified in CCR Title 22 and in accordance with the water reclamation requirements in Regional Water Board Order No. 94-069. The facilities dedicated to recycled water production can be switched quickly to NPDES discharge if needed. In the recycled water steam, the polymer dose, chlorine dose, and chlorine contact time are adjusted accordingly to meet the more stringent treatment requirements. As a final production step, recycled water is partially dechlorinated with sodium bisulfite prior to entering the distribution system.

Recycled Water

Flow Type	Volume (MG)
Recycled Water Produced *WPCP*	124
Potable Water Added *WPCP*	26
Potable Water Added *San Lucar Facility*	177
Total Delivered	***327***

Recycled water is distributed in "purple pipes" throughout the service area for irrigation of private and public landscapes, parks, and golf courses for use in decorative ponds and for other approved uses. Typically around 8% of the daily wastewater flow is diverted for recycled water. In addition, disinfected secondary recycled water (No. 3 Water) is partially dechlorinated and reused internally for filter backwashing, engine cooling, and other purposes. Use of No. 3 Water is relatively constant throughout the year with an average annual use around 250-300 MG.

During the 2021 reporting period, the WPCP produced a total of 124 MG of recycled water and delivered 327 MG to the recycled water system. The difference represents potable water additions made at the WPCP or the off-site San Lucar Facility to satisfy total system demand (**Figure 11**). In 2021, recycled water production at the WPCP was lower than previous years due to treatment challenges related to algae populations discussed further in **Chapter II, Section 1.3**. and the completion of emergency repairs related to the unexpected failure of the Secondary Effluent Pipeline (**Chapter II, Section 2.3**). However, overall demand for recycled water, as reflected in the data for total recycled water system deliveries, was relatively consistent with previous years despite the ongoing COVID-19 pandemic and the reductions in the daily workforce influx to the City. For additional information on recycled water production at the WPCP, refer to the *Recycled Water Annual Report* for 2021, scheduled for submittal to the RWQCB by March 15, 2022, as well as submittal on the State Water Board's GeoTracker system by April 30, 2022, per the requirement of Sections VIII and IX.D. of Attachment E of the current NPDES permit.

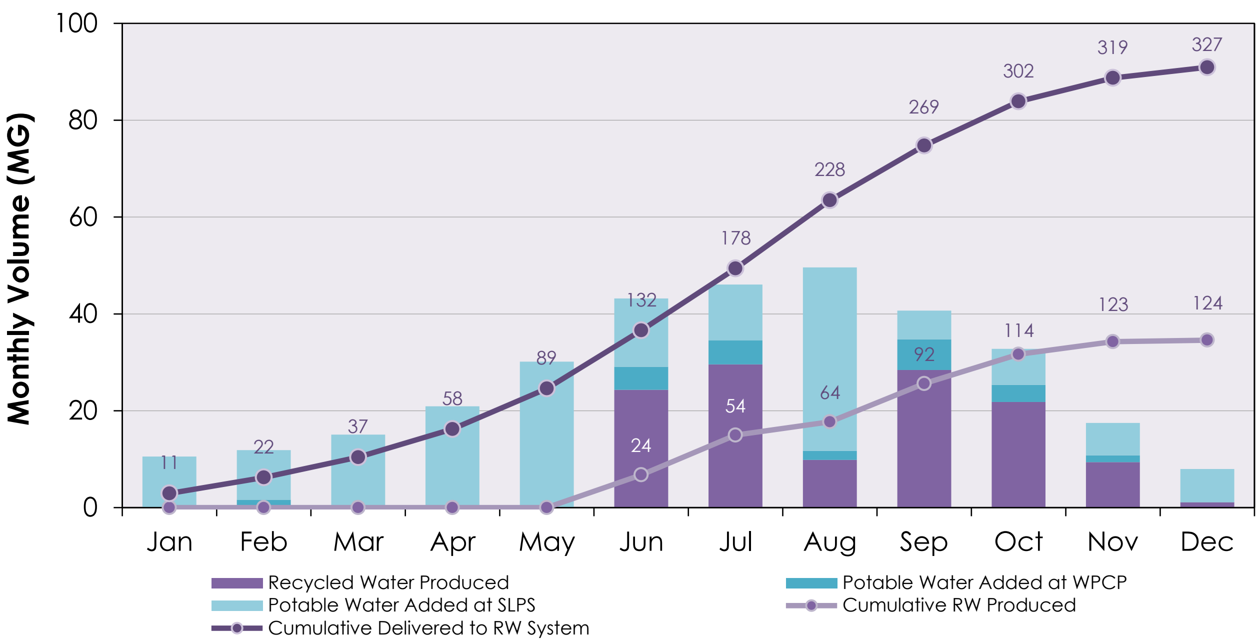


Figure 11: Recycled water production and distribution in 2021. The difference between produced and delivered represents potable water added at either the WPCP or SLPS

2.3. WPCP Laboratory

The WPCP operates an on-site laboratory that analyzes samples for monitoring treatment process performance and permit compliance, industrial pretreatment samples collected from industrial facilities that discharge to the sanitary sewer system, and City drinking water samples to monitor for compliance with drinking water regulatory standards. A list of the Laboratory's approved analyses and the current environmental certification is included in **Attachment B**. The laboratory is preparing to transition to the Environmental Laboratory Accreditation Program's (ELAP) newly adopted 2016 TNI standard by the required date of December 31, 2023.

The laboratory utilizes a Laboratory Information Management System (LIMS) to effectively manage data from different analyses and instruments and generate lab reports. As part of the WPCP rebuild effort, design of the Cleanwater Center, which includes a new Administration, Laboratory, and Maintenance facilities within one building, is 90% complete (**Chapter IV, Section 5.0**). Construction of the Cleanwater Center has been deferred to prioritize the Condition Assessment and Existing Plant Rehabilitation Project as well as the Secondary Treatment and Dewatering Facilities Project.

2.4. Stormwater Management

All stormwater collected from within the WPCP, as well as from storm inlets on Carl Road just outside WPCP boundaries and the Sunnyvale biosolids monofill, is directed to the Headworks. Therefore, coverage under the statewide permit for discharges of stormwater associated with industrial activities (NPDES General Permit No. CAS000001) is not required.

2.5. Facility Condition Assessment and Ongoing Plant Rehabilitation

Due to the overall age of facilities at the WPCP, critical elements of the existing treatment processes need to be rehabilitated or replaced to maintain their operation until they are fully replaced with the final plant build-out (2035±). In 2021, the WPCP completed 100% design of the Plant Rehabilitation Project, and construction will start in the fourth quarter of 2022. Refer to **Chapter IV, Section 2.0** for additional information on the project.

II. PLANT PERFORMANCE AND COMPLIANCE

1.0. PLANT PERFORMANCE

The WPCP continues to maintain a high level of performance as discussed herein. Compliance with permit limits is discussed in **Section 2.0** of this Chapter.

1.1. WPCP Wastewater Flows

The WPCP is designed and permitted for a daily average dry weather effluent flow of 29.5 MGD and has a peak wet weather flow design capacity of 40.0 MGD.

Overall, the WPCP treated 4,569 MG of influent wastewater during this reporting period at an average rate of 12.5 MGD and discharged an average of 10.6 MGD. The daily maximum influent flow rate of 19.3 MGD occurred on January 28, 2021. The influent peak hourly flow rate of 29.5 MGD and an instantaneous flow rate of 30.0 MGD occurred on October 24, 2021 and were associated with one of the heaviest storm events of the year where more than one inch of rainfall was recorded over 24-hours.

WPCP Flow Rates

Flow Type (MGD)	Influent	Effluent
Average Daily	12.5	10.6
Average Dry Weather	12.0	9.1
Average Wet Weather	12.8	11.4
Average Daily Max	19.3	20.5
Peak-Hourly Max	29.5	---
Instantaneous Max	30.0	---
Total Treated (MG)	4,569	---

Average daily influent and effluent flow rates are shown in **Figure 12A**. A comparison between influent and effluent flow rates reflects the seasonal effects of recycled water production and evaporation from the Oxidation Ponds. For example, during summer months (May-Aug), when recycled water production and evaporation rates are highest, influent flow rates exceed effluent flows by the greatest margins. Influent flows are also influenced by seasonal precipitation patterns, resulting in higher flow rates during the wet weather season. Effluent flow rates typically follow influent flow trends during the wet weather season but are often much higher in order to offset precipitation directly into the Oxidation Ponds and maintain a relatively consistent operating depth. The large variation in effluent flow rates reflects the storage capacity of and evaporation (estimated at 1-2 MGD on average) from the Oxidation Ponds, as well as recycled water production. Effluent flow rates below 8 MGD are a result of the WPCP's Flow Management Strategy and oftentimes reflect a shutdown of the Tertiary Treatment Facilities. Zero-discharges, which correspond to a shutdown of the Tertiary Treatment Facilities are included in **Figure 12A** and are used in the calculation of average flows. The storage capacity of the Oxidation Ponds (50-100 MG depending on depth) forms the cornerstone of the WPCP's Flow Management Strategy, which allows Operations staff to maintain water elevation for optimal treatment and required storage,

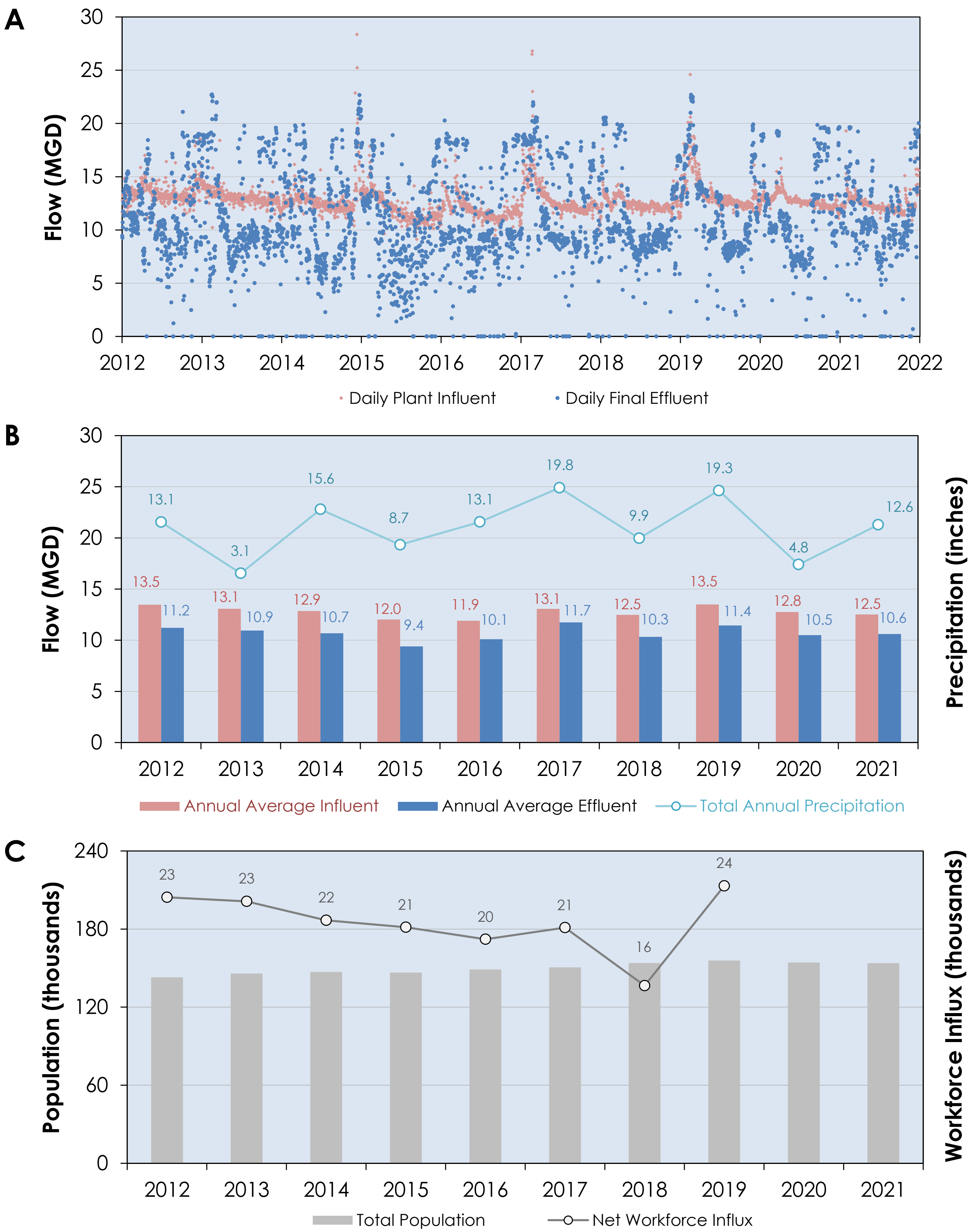


Figure 12: WPCP Wastewater Flow Rate Trends from 2012-2021. A) Daily and B) Annual Average Influent and Effluent Wastewater Flows through the WPCP from 2012-2021. C) Total Population and Net Workforce Influx (thousands) in Sunnyvale from 2012-2021 (net workforce influx data not yet available for 2010-2021)

Tertiary Treatment Facilities at a constant flow rate (flow equalization), and maintain flexibility to repair and rehabilitate the Tertiary Treatment Facilities.

Average daily influent flow rates during the 2021 reporting period remained well within the design capacity of the WPCP and were relatively consistent with a 10-year average of 12.8 MGD (**Figure 12B**). Flows in 2021 were slightly lower than 2020. This is primarily attributed to a slight decrease in population and an assumed reduction in daily net workforce influx as a result of the continued COVID-19 pandemic. For example, the City experienced a growth rate of -0.3%, which is a reversal from the more than 1% increases observed between 2016 and 2019 and continues the trend of population reduction as seen in 2020 (**Figure 12C**). Moreover, the City's typical daily net workforce influx of approximately 21,000 (15%) non-resident workers[1] was likely reduced significantly during 2021 in response to the continued COVID-19 pandemic, as commuter behavior has favored increased teleworking from home. The reduction of influent flows from 2020 to 2021 also reflects a beginning response to the current drought. Influent flows follow potable water use. **Figure 13** shows the sharp response to the drought in 2015-2016 and the rebound post-drought.

Daily effluent flow rates in **Figure 12A** departed from trends seen in the previous two years most significantly between April and June of 2021. The higher effluent flows observed follow the completion of emergency repairs to the Secondary Effluent Line (**Chapter II, Section 2.3)** as the WPCP processed flows accumulated in the Oxidation ponds during repairs. The storage capacity of the Oxidation ponds is the primary reason that effluent flow rates are largely decoupled from influent flows. The annual average effluent flow rate of 10.6 MGD is also consistent with the 10-year average of 10.7 MGD shown in **Figure 12B** and well within the permitted capacity of 29.5 MGD.

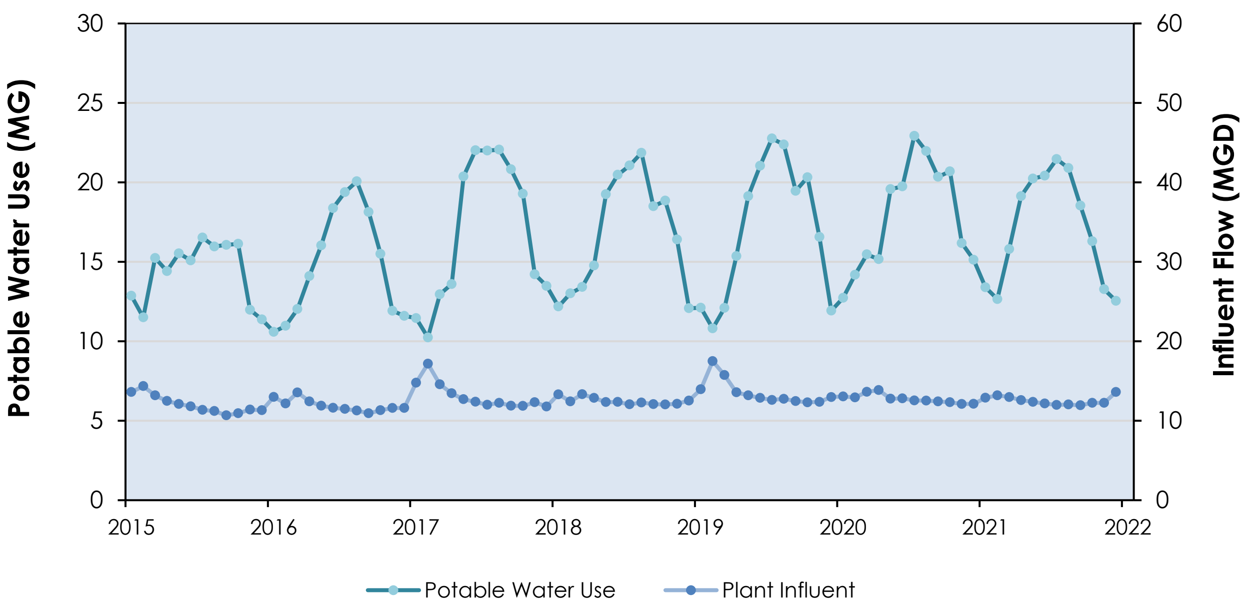


Figure 13: Monthly Average Citywide Potable Water Use and WPCP Influent Flows from 2015-2021

[1] Calculated as an annual average from U.S. Census Bureau data available from 2002-2019 (https://onthemap.ces.census.gov/). Daily workforce influx data unavailable for 2020-2021 and are anticipated to be lower due to the COVID-19 pandemic.

1.2. Carbonaceous Biochemical Oxygen Demand

CBOD		
Type	Limit	Performance
% Removal:	85%	98%
Daily (MDEL):	20 mg/L	2.0 – 12.5 mg/L
Monthly (AMEL):	10 mg/L	2.9 – 7.2 mg/L

Carbonaceous biochemical oxygen demand (CBOD) measures organic content in wastewater and is used by the RWQCB as one of the parameters for evaluating and regulating WPCP performance.

Figure 14 summarizes CBOD concentration data and removal performance from 2017 to 2021. Influent and effluent CBOD samples are collected as flow-weighted composites over a 24-hour period. In mid-2019 rag accumulation on the composite sampler intake line was identified as a contributing factor to high CBOD data variability, resulting in adjustments to the orientation of the intake tubing within the influent channel in conjuncture with a more rigorous tubing replacement schedule. Data variability subsequently reduced and remained more stable through 2021. Despite the influences from the COVID-19 pandemic, influent CBOD concentrations remained relatively consistent, indicating a high degree of precision was also maintained during the 2021 reporting periods. In fact, data variability during the 2021 reporting period remained among the lowest observed in the last 5-years and may also reflect a less variable daily commuter workforce influx during the ongoing COVID-19 pandemic.

As shown in **Figure 14A** and **Figure 14B**, influent CBOD concentrations were significantly lower in 2021 as compared to previous years, with an annual average of 208 mg/L, continuing a trend first observed in 2020. This reduction is attributed to the continued COIVD-19 pandemic as the observed variations in CBOD influent concentrations generally followed the shift in commuter behavior to favor more teleworking.

Effluent daily and average monthly CBOD concentrations remained well below permit limits as also shown in **Figure 14A** and **Figure 14B.** The percent removal of CBOD, as measured by the difference between influent and effluent concentrations, remained well above the minimum monthly average removal rate of 85% with an average of 98% (**Figure 14C**). Effluent concentrations demonstrated a general trend of lower removal during the colder months and higher removal during the warmer months, which is a typical pattern of the unique secondary treatment system at the WPCP. Biological activity in the secondary treatment processes declines during the colder months, resulting in somewhat lower removal rates compared to the summer months. Seasonal patterns exhibited a stronger influence on effluent CBOD concentrations than the COVID-19 pandemic due to the decoupling of influent and effluent concentrations created by the long detention times of the Oxidation Ponds.

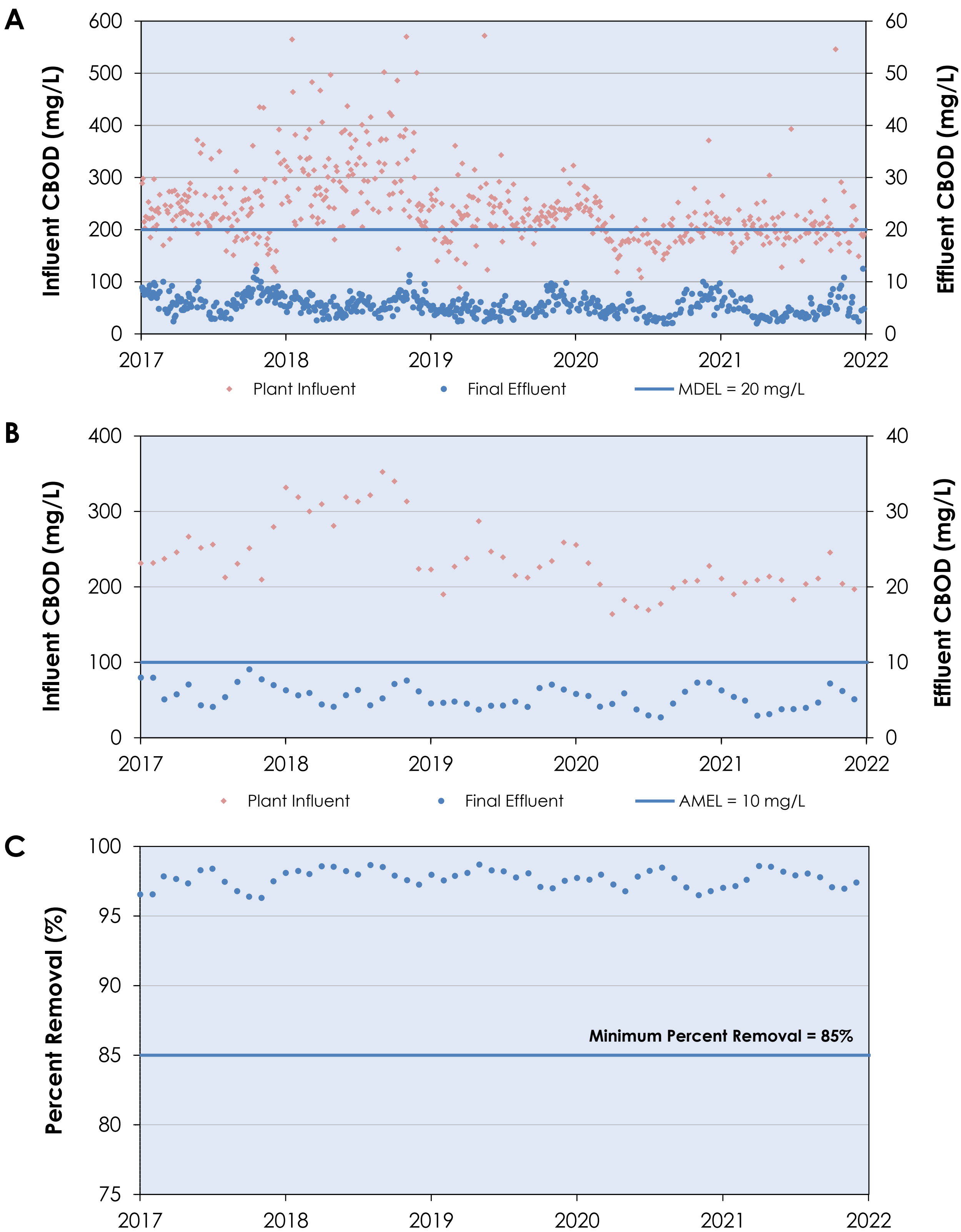


Figure 14: CBOD Trends through the WPCP from 2017-2021. A) Daily and B) Average Monthly Influent and Effluent CBOD (mg/L) through the WPCP from 2017-2021. C) Average Monthly Effluent Percent Removal of CBOD from 2017-2021

Figure 15 summarizes daily and annual influent and effluent CBOD loading rates as measured in kilograms per day (kg/day) and kilograms per year (kg/yr) from 2017 to 2021. Influent CBOD loading rates shown in **Figure 15A** exhibited a pattern similar to those observed for concentrations, despite influent flows remaining relatively consistent with previous years, suggesting that concentrations were a more significant driver of loading rates than flows in 2021. Influent loading rates in 2021 remained similar with those seen in 2020, continuing a slight downward trend over the last 5-years as shown in the average annual loading rates in **Figure 15B**. Effluent loading rates remained more consistent across the same period, but also show a slight reduction trend.

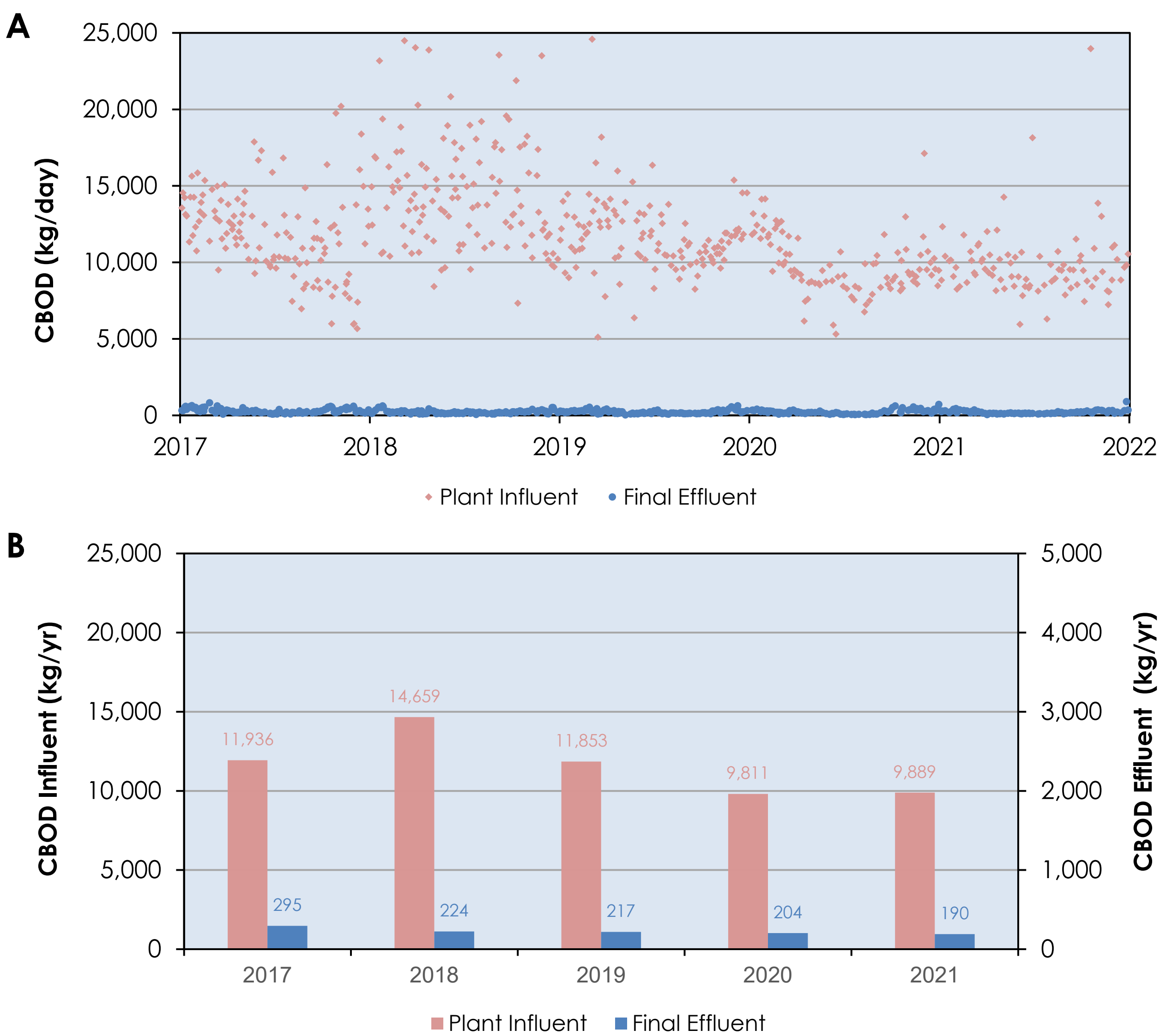


Figure 15: Average A) Daily and B) Annual CBOD Loading Rates from 2017-2021

1.3. Total Suspended Solids

TSS		
Type	Limit	Performance
% Removal:	85%	95%
Daily (MDEL):	30 mg/L	5.2 – 19.2 mg/L
Monthly (AMEL):	20 mg/L	9.8 – 15.3 mg/L

Total suspended solids (TSS) is a measure of the suspended solids content of wastewater that will not pass through a standard laboratory glass fiber filter. Similar to CBOD, TSS is used by the RWQCB for evaluating and regulating the WPCP's performance.

Figure 16 summarizes TSS concentration data and removal performance from 2017 to 2021. Influent and effluent TSS samples are collected as flow-weighted composites over a 24-hour period. As with CBOD, data variability observed in 2018 was significantly reduced following adjustments made to the influent sampler intake line in mid-2019 to reduce rag accumulation and promote data accuracy. In typical years, influent TSS concentrations exhibit a seasonal pattern, wherein higher concentrations of TSS observed in late winter and early spring give way to lower summer and fall concentrations. These patterns coincide with heavy rainfall which can contribute to scouring of accumulated sediment (grit) within the collection system. The spike gradually subsides as the rainy season gives way to the drier summer months and flows decrease. Occasionally, a second rise in concentration will appear toward the end of the summer months (Aug-Sep) and is attributed to enhanced water conservation efforts. This pattern was not as readily apparent during the 2021 reporting period, and influent TSS concentrations instead appear to have followed the same general pattern as CBOD as a result of the continued COVID-19 pandemic and slow return to previous workforce influx patterns.

As shown in **Figure 16A** and **Figure 16B**, effluent daily average and monthly average TSS concentrations remained below their respective permit limits, ranging from 5.2 to 19.2 mg/L and 9.8 to 15.3 mg/L, respectively. The percent removal of TSS, as measured by the difference between monthly average influent and effluent concentrations, remained well above the minimum removal rate of 85% at an average of 95% (**Figure 16C**). These observations indicate a high level of performance. Effluent TSS concentrations from 2017 to 2021 show a relatively consistent seasonal trend with higher concentrations measured in the colder months as compared with the warmer months. While effluent TSS trends are similar to influent trends, the mechanism is different and somewhat counter-intuitive. Algae grown in the Oxidation Ponds represent the largest fraction of residual solids in secondary effluent and are conveyed to the WPCP's tertiary treatment for additional treatment prior to discharge. Algae growth is usually highest during the warmer months, suggesting that the highest TSS concentrations during the year would be observed during those months. However, the dominant species of algae grown within the Oxidation Ponds typically undergoes a seasonal shift between summer and winter. In the summer months, colonial algal species (i.e. *Scenedesmus sp.*) dominate and are readily harvested and removed by the DAFTs and DMFs; whereas, single cell algal species (i.e. *Chlorella sp.*) dominate during the winter months and are more challenging to remove. Operations staff typically respond to seasonal shifts by adjusting polymer and chlorine dosing in the DAFTs and CCTs to provide a margin of safety for meeting daily and monthly TSS permit limits, as well as turbidity limits discussed in more detail in **Section 2.1**.

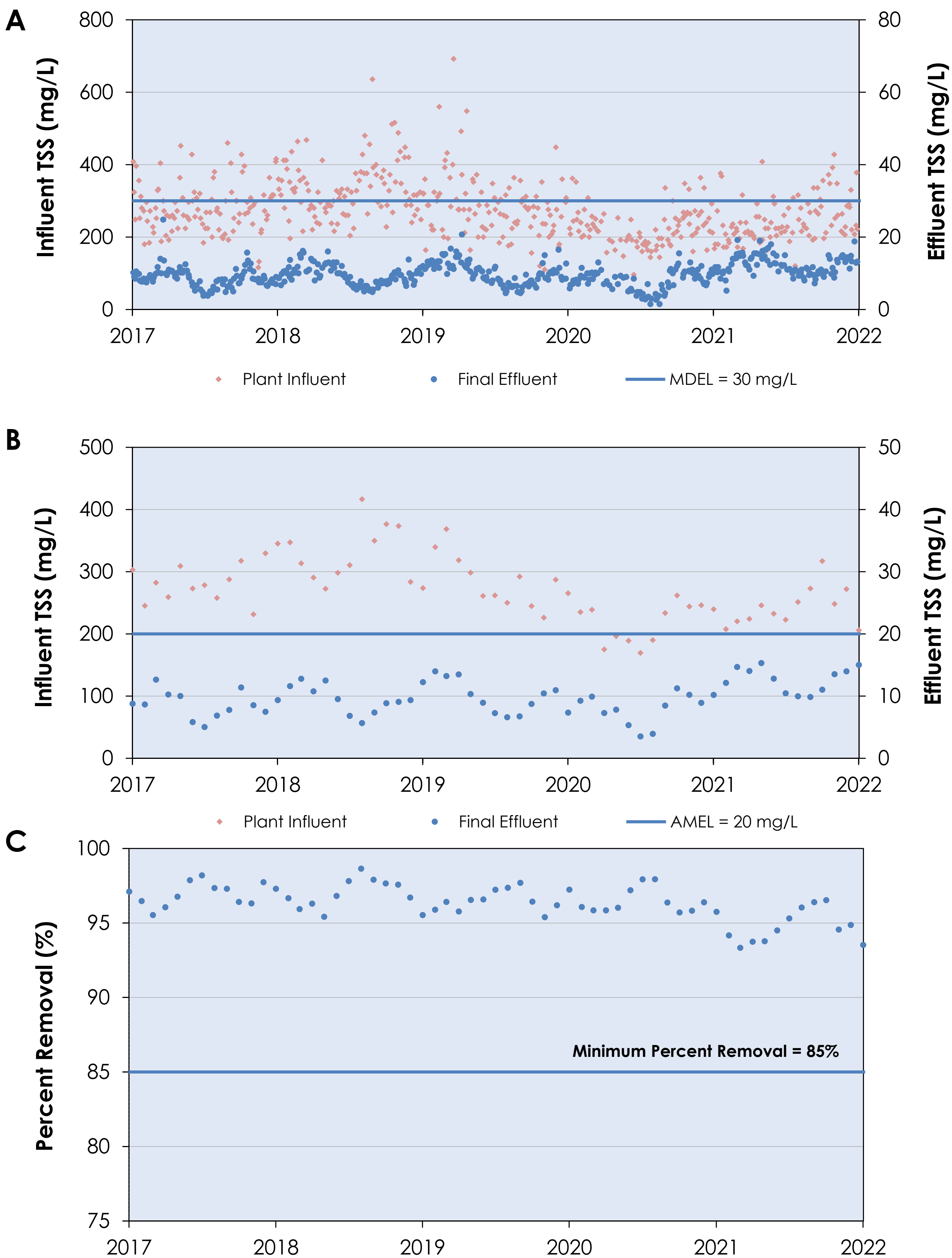


Figure 16: TSS Trends through the WPCP from 2017-2021. A) Daily and B) Average Monthly Influent and Effluent TSS (mg/L) through the WPCP from 2017-2021. C) Average Monthly Effluent Percent Removal of TSS from 2017-2021

The WPCP TSS removal rate in 2021 was well above the permit requirement but lower than in recent years. This may be due to a change in algae species observed in the Oxidation Ponds. Beginning in April, the WPCP observed a species of single cell algae belonging to the picoplankton class that rapidly began to dominate the community in the Oxidation Ponds and outcompete other algae species that are generally easier to remove in DAFTs. The emergence of this new species created significant operational challenges in managing effluent TSS and turbidity. The current polymer being used at the WPCP, which has been applied successfully for nearly a decade, was less effective at promoting the formation of large flocs of the novel species. This was a major contributing factor to the higher effluent TSS concentrations observed during this reporting period as compared with previous years. By adjusting polymer dose and dissolved air rates in the DAFT units, and adding a filter aid at the DMFs, the WPCP was still able to meet discharge limits. The City is in the process of reevaluating its current polymer and other process controls in response to the challenging circumstances. Despite these challenges, the WPCP has been able to maintain effective treatment and remain below discharge limits throughout the 2021 reporting period.

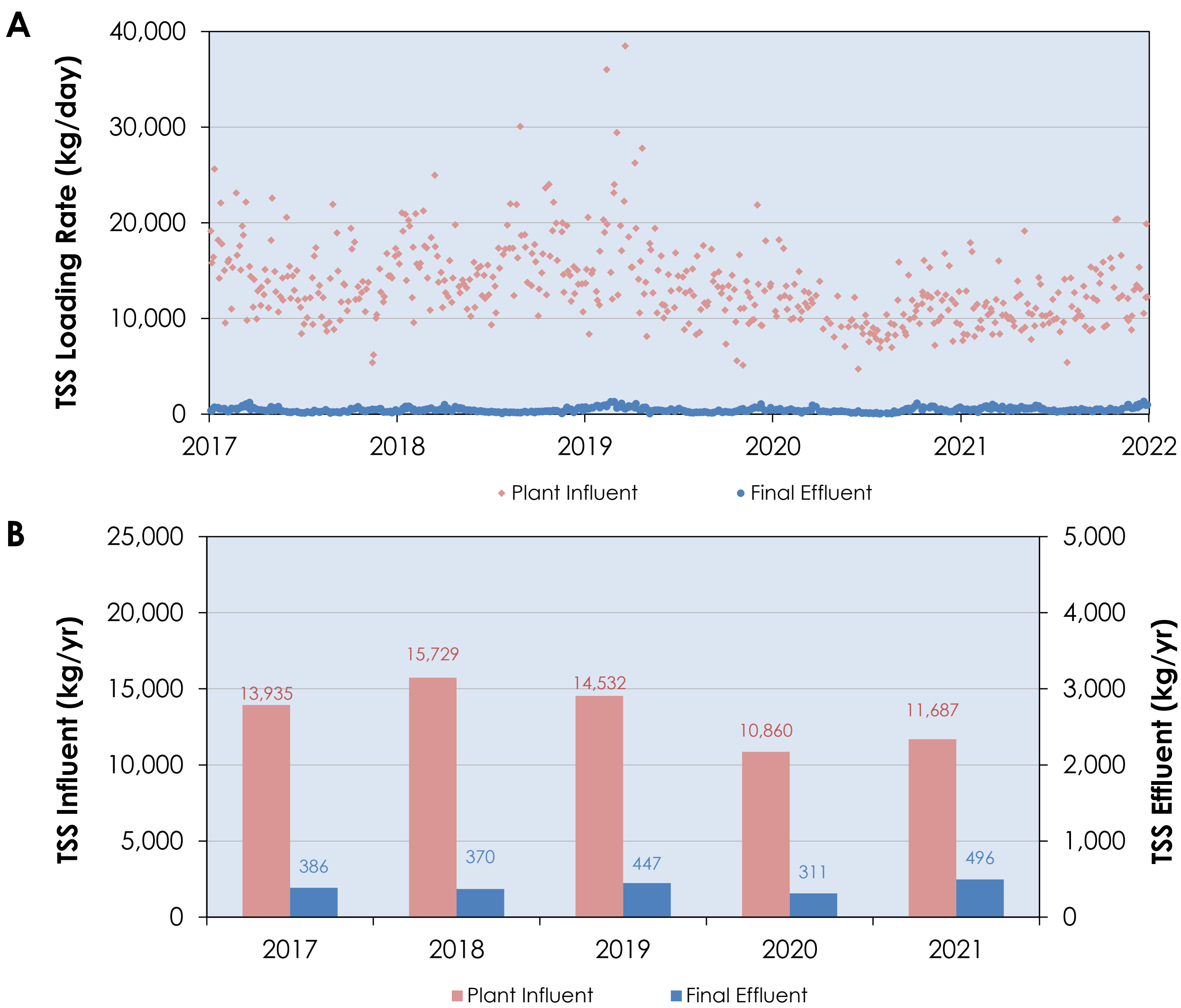


Figure 17: Average A) Daily and B) Annual TSS Loading Rates from 2017-2021

Figure 17 summarizes daily and annual influent and effluent TSS loading rates as measured in kilograms per day (kg/day) and kilograms per year (kg/yr) from 2017 to 2021. Influent TSS loading rates shown in **Figure 17A** exhibited a pattern similar to those observed for concentrations, despite influent flows remaining relatively consistent with previous years, indicating that concentrations were a more significant driver of loading rates than flows in 2021. Overall, influent loading rates over the last 5-years exhibited a downward trend as shown in the average annual loading rates in **Figure 17B**; whereas, effluent displayed a higher than normal loading rate compared to the last 5-years which is attributed to the presence of the more challenging algae species.

1.4. Total Ammonia

Ammonia removal occurs in both the Oxidation Ponds and the FGRs. In the Oxidation Ponds, ammonia removal is achieved through biological nitrification as well as uptake by algae, and as a result it is highly susceptible to seasonal fluctuations. Lower removal rates occur during the fall/winter (Oct-May) when ambient temperatures are low and daytime is shorter; whereas, higher removal rates occur during the summer (Jun-Sep) when ambient temperatures are high and daytime is longer. Consequently, nitrification in the FGRs is the primary process of ammonia removal between October and May. A small additional increment of ammonia removal occurs in the DMFs, so concentrations in the final effluent are slightly lower than that in the FGR effluent. The WPCP's NPDES permit includes seasonal performance limits for ammonia that reflect the seasonal variability in the performance of the two processes. A review of the data and a discussion of performance optimization strategies is provided below.

Ammonia

Type	Limit	Performance
Daily (MDEL):	26 mg/L (Oct-May) 5 mg/L (Jun-Sept)	0.10 – 12.3 mg/L 0.08 – 2.55 mg/L
Monthly (AMEL):	18 mg/L (Oct-May) 2 mg/L (Jun-Sept)	0.24 – 10.6 mg/L 0.18 - 0.86 mg/L

1.4.1. Data Review

Figure 18 summarizes ammonia concentration data and removal performance trends. As shown in **Figure 18A** and **Figure 18B**, influent ammonia trends were also influenced by the continued COVID-19 pandemic, similar to CBOD and TSS, with reduced concentrations compared to the period before 2020. As is also shown in these figures, daily and average monthly effluent ammonia concentrations in 2021 remained below their respective seasonal permit limits, ranging from 0.10 to 12.3 mg/L (Oct-May) and 0.10 to 2.55 mg/L (Jun-Sep) daily and 0.24 to 10.6 mg/L (Oct-May) and 0.18 to 0.86 mg/L (Jun-Sep) monthly.

Figure 18C depicts removal performance of the Oxidation Ponds and FGRs from 2017 through 2021. Seasonal removal trends are clearly visible, with the Oxidation Ponds demonstrating ammonia removal from March to October, and the FGRs removing most of the ammonia during the remainder of the year. The seasonal increase in effluent ammonia from the Oxidation Ponds is typical and attributed to low ambient temperatures and sunlight throughout the majority of January and February as well as November and December 2021. The seasonal effects on the Oxidation Ponds with respect to ammonia removal are

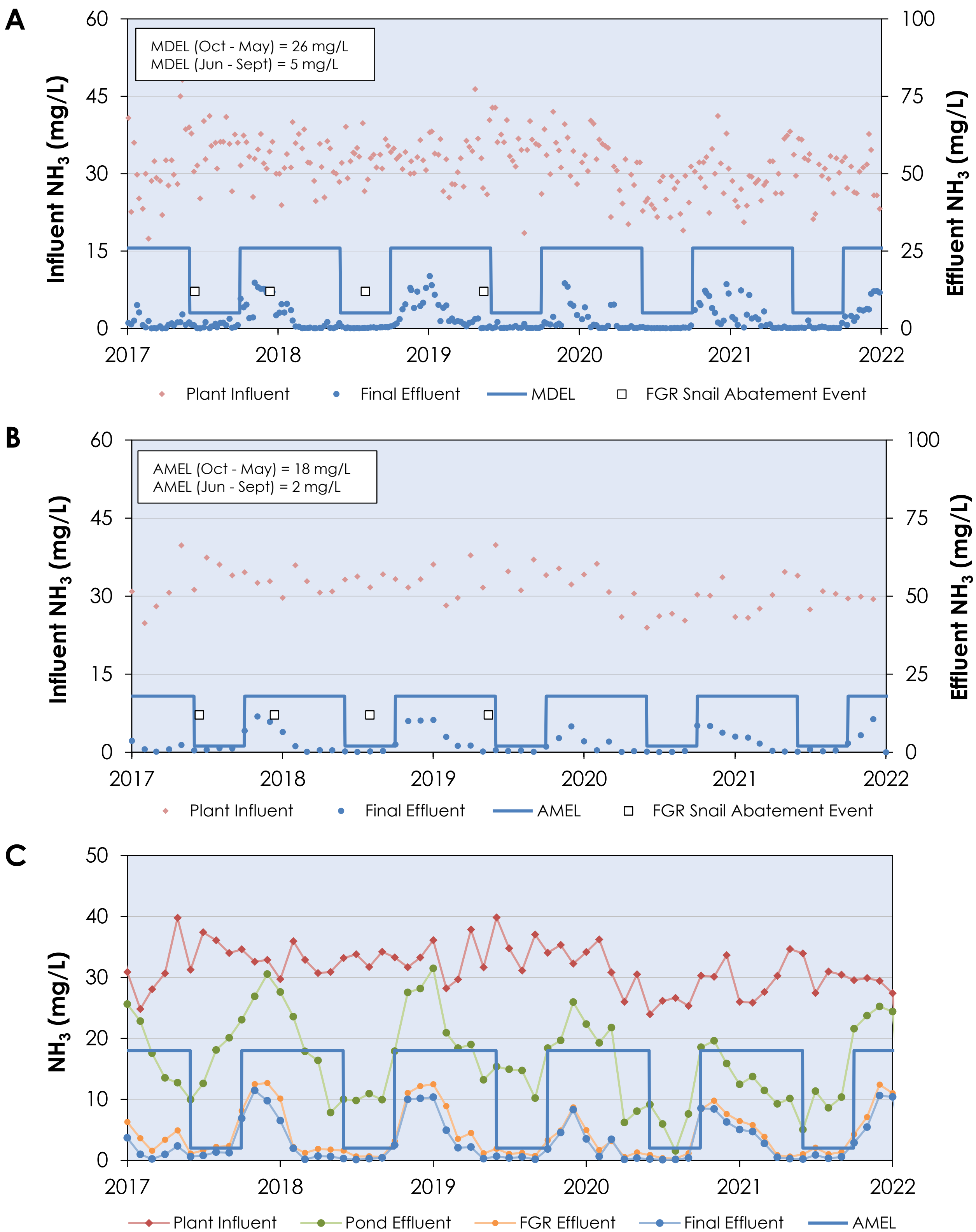


Figure 18: Ammonia Trends at the WPCP from 2017-2021. A) Daily and B) Monthly Average Influent and Effluent Total Ammonia from 2017-2021. C) Monthly Average Total Ammonia from Pond, FGR, and Final Effluent from 2017-2021.

also apparent in the FGRs and can be compounded by snail predation on nitrifying bacteria as described in more detail in the *Strategies to Enhance Performance* section below. The WPCP did not perform any snail control events during the 2021 reporting period as FGR ammonia data did not indicate significant nitrifier predation that would jeopardize FGR performance. The Oxidation Ponds exhibited a high level of performance in 2021 as indicated by low effluent concentrations that appear to have also offset the need for a snail abatement event.

Figure 19 summarizes average daily (kg/day) and annual (kg/yr) influent and effluent ammonia loading rates from 2017 to 2021. Influent ammonia loading rates shown in **Figure 19A** exhibited a pattern similar to those observed for concentrations, despite influent flows remaining relatively consistent with previous years, indicating that concentrations were a more significant driver of loading rates than flows in 2021. Overall, influent loading rates over the last 5-years exhibited a downward trend as shown in the average annual loading rates in **Figure 19B**, whereas, effluent loading rates remained relatively consistent across the same time period.

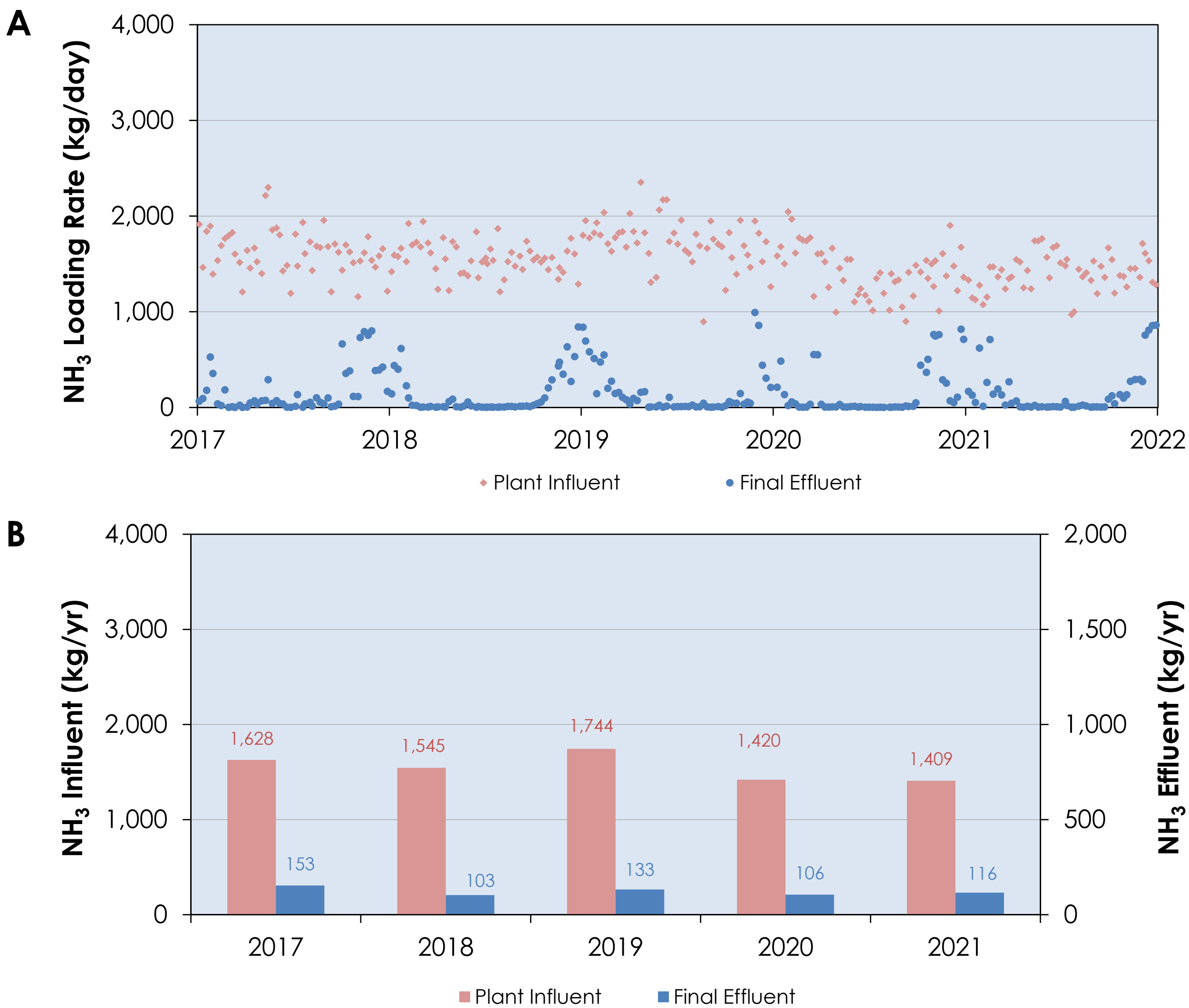


Figure 19: Average A) Daily and B) Annual Ammonia Loading Rates from 2017-2021

Effluent ammonia loading rates in general are variable, with the higher values generally occurring during the wet weather season and lower values generally occurring during the dry weather season, reflecting the seasonal nature of the Oxidation Ponds and FGRs performance. Despite the increased algae presence in the Oxidation Ponds in 2021, there was minimal impact to ammonia removal, and loading trends are similar to those observed for CBOD. Additional information pertaining to ammonia and other nutrient trends is presented in **Section 1.5** of this Chapter and is available in the *2021 Nutrient Watershed Permit Annual Report* submitted by BACWA.

1.4.2. Performance Optimization Strategies

Oxidation Pond Dredging

Ammonia removal in the Oxidation Ponds is highly variable and seasonal in nature. Although variability in weather patterns plays a significant role, the loss of volume due to solids deposition over time has likely impacted performance by reducing the "working" capacity of the Oxidation Ponds. The Oxidation Ponds are the WPCP's primary mechanism for CBOD removal and promote ammonia removal by direct assimilation into photosynthetic algae cells as well as bacterial nitrification. As such, maintaining a sufficient water column and working volume is a performance essential and one of the only control variables for an open system of this type.

There are numerous entry routes for solids, including algae growth within the Oxidation Ponds, float (flocculated solids) skimmed from the DAFTs, DMF backwash water, solids handling wash water, and digester supernatant. Consequently, the City began a long-term dredging project in 2012 to restore capacity to the Oxidation Ponds (**Chapter IV, Section 7.0**). Dredging continued during this reporting period but was restricted to the wet weather season to avoid releasing ammonia from sediments in excess of the FGRs' processing capacity. A total of 2,292 dry tons of biosolids were removed from the Oxidation Ponds and were re-used for agricultural land application in 2021.

Snail Control Program

Trickling filters, such as the FGRs, are prone to declining ammonia removal performance due in large part to snail predation on nitrifying bacteria that attach to the plastic growth media. As a result, the City periodically performs snail removal treatments. During a treatment event, the FGRs are placed into recirculation mode and effluent from the Oxidation Ponds is dosed with ammonium sulfate (approx. 8-9 tons at 40% solution) and sodium hydroxide (approx. 7 tons at 25% solution) in a batch process. The rise in pH from the sodium hydroxide effectively converts the ammonium sulfate to ammonia, which is toxic to the snails but beneficial to nitrifying bacteria up to a certain point. Snail shells and other solids are collected in the FGR distribution structure and wasted to the Oxidation Ponds, which help contribute a carbonate source to facilitate secondary treatment and provide beneficial reuse for the pond ecosystem.

In a given year, the WPCP will typically perform one or two snail treatment events. The first typically occurs in spring and the second in fall during seasonal shifts when the potential decline in Oxidation Pond performance is at its highest and seasonal limits become more stringent. The timing of these events is dependent on performance data and may not occur at all, as in the case of 2021, if ammonia removal is high and the WPCP is able to meet its seasonal limit. The WPCP plans to continue performing these control events as needed as long as the FGRs are required to provide nitrification.

1.5. Nutrient Summary

In addition to the current NPDES permit, the City is also subject to Waste Discharge Requirements of the Nutrient Watershed Permit No. CA0038873, RWQCB Order No. R2-2019-0017. The purpose of the Nutrient Watershed Permit is to track and evaluate Bay Area POTWs' treatment performance, fund nutrient monitoring programs, support load response modeling, and conduct treatment plant optimization and upgrade studies for nutrient removal. Information pertaining to the Nutrient Watershed Permit is prepared in a separate annual report by BACWA and reported electronically in CIWQS. The following summary is provided as an additional indicator of plant performance and in support of the trends presented in previous Sections.

The issuance of Order No. R2-2019-0017 shifted the focus of the previous RWQCB Order No. R2-2014-0014 from monitoring effluent total nitrogen (TN) to total inorganic nitrogen (TIN) and required influent monitoring of additional parameters including total phosphorus (TP). Since nitrogen is the growth-limiting nutrient for phytoplankton in the San Francisco Bay, a planning level target (PLT) was established for TIN, which is the bioavailable form of nitrogen. This Order did not establish numeric effluent limits, primarily due to the current uncertainties as to whether TIN is causing or contributing to impairment in the San Francisco Bay. The PLT is intended to forecast nutrient discharge performance in 2024 and provide an indication of potential future effluent limitations that ongoing performance can be measured against, such that the City can implement necessary early actions to reduce nutrients in current or future facility planning efforts. The PLTs allow time for additional scientific studies to understand the connectivity between nutrient discharges and potential impairment of the San Francisco Bay and an evaluation of cost-effective nutrient management opportunities.

The Nutrient Watershed Permit established PLTs using a two-step process. For Sunnyvale, the first step established a baseline of 630 kg/day from the maximum dry season average effluent TIN load measured between May 1, 2014 and September 30, 2017. Only dry season discharge data were used to calculate the PLT because it more accurately defines the current performance of treatment when accounting for variability in nutrient discharges caused by increased influent flows and lower temperatures during wet weather. This is also the time during the year when algae growth resulting from nutrient discharges is more likely to contribute to adverse conditions in the San Francisco Bay. In the second step, a 15% growth factor was added to the baseline to account for a projected population growth rate of 1.5% over the next 10 years, resulting in the WPCP's PLT of 730 kg/day.

Nitrogen

Total Inorganic Nitrogen	
Average Dry Weather Effluent Load	420 kg/day
Planning Level Target (PLT)	730 kg/day
% Removal	34%

Total Inorganic Nitrogen (TIN) is the measure of the total concentration of ammonia (NH3) and nitrate and nitrite (NOx); whereas, total nitrogen (TN) is a measure of TIN and the organic fraction of nitrogen (Org-N). Influent TN consists primarily of ammonia and Org-N, with the contribution from NOx being negligible, as illustrated in **Figure 20A.** On average, Org-N comprises 40% of influent nitrogen with ammonia making up the remaining 60%. The composition of nitrogen in the effluent differs, as nitrification occurs in the Oxidation Ponds and FGRs, resulting in ammonia being largely oxidized to NOx. In this case, nitrate (NO_3) is the dominant form of oxidized nitrogen in the effluent, averaging 98% of NOx and roughly 85% of TIN. Effluent TIN is subject to seasonal variability for reasons discussed below.

Figure 20A shows average monthly influent nitrogen concentrations collected as flow-weighted composite samples over a 24-hour period. In the current Nutrient Watershed Permit, influent Total Kjeldahl Nitrogen (TKN) monitoring was retained from the previous order and is considered equivalent to influent TN since NOx has been shown to be negligible. As such, influent TKN is simply referred to as TN for the purposes of this report. Monthly average influent TN concentrations in 2021 ranged from 41 to 53 mg/L with an annual average of 46 mg/L. In general, influent TN concentrations exhibited the same pattern as CBOD, TSS, and ammonia and are likewise attributed to the same COVID-19 factors. The 2021 trends are a departure of those observed prior to 2020, wherein higher TN concentrations predominate in the summer, with lower concentrations in the winter, and are inverse to influent flow patterns. Unlike previous years (Sep-Oct 2017, Jun-Jul 2018, and Apr 2019), there were no observable spikes in influent TN.

Monthly average effluent TIN and TN concentrations are separated into the dominant forms of nitrogen (NOx, NH3, and Org-N) in **Figure 20B**. The seasonal influence on nitrification at the WPCP becomes more apparent at this scale, with influent ammonia concentrations converting to NOx in the warmer dry weather months under more kinetically favorable biological conditions and then remaining more dominant in the colder wet weather months. Denitrification is also apparent in the dry weather months, as decreases in ammonia are not fully offset by increases in NOx, thereby driving down TIN concentrations. Though not shown graphically in this report, process data indicate that the majority of denitrification occurs in the Oxidation Ponds during the dry weather months and to a lesser degree in the DMFs where anaerobic conditions can develop. The FGRs and DAFTs promote aerobic conditions through mechanical turbulence and the introduction of dissolved air, which favor nitrification rather than denitrification. Effluent TIN concentrations during the 2021 reporting period were relatively consistent with previous years, ranging from 9.7 to 31 mg/L and an annual average of 20 mg/L. Average dry weather effluent TIN concentrations averaged 12 mg/L, which is also consistent with previous years and reflects the seasonality of the nitrification/denitrification processes at the WPCP.

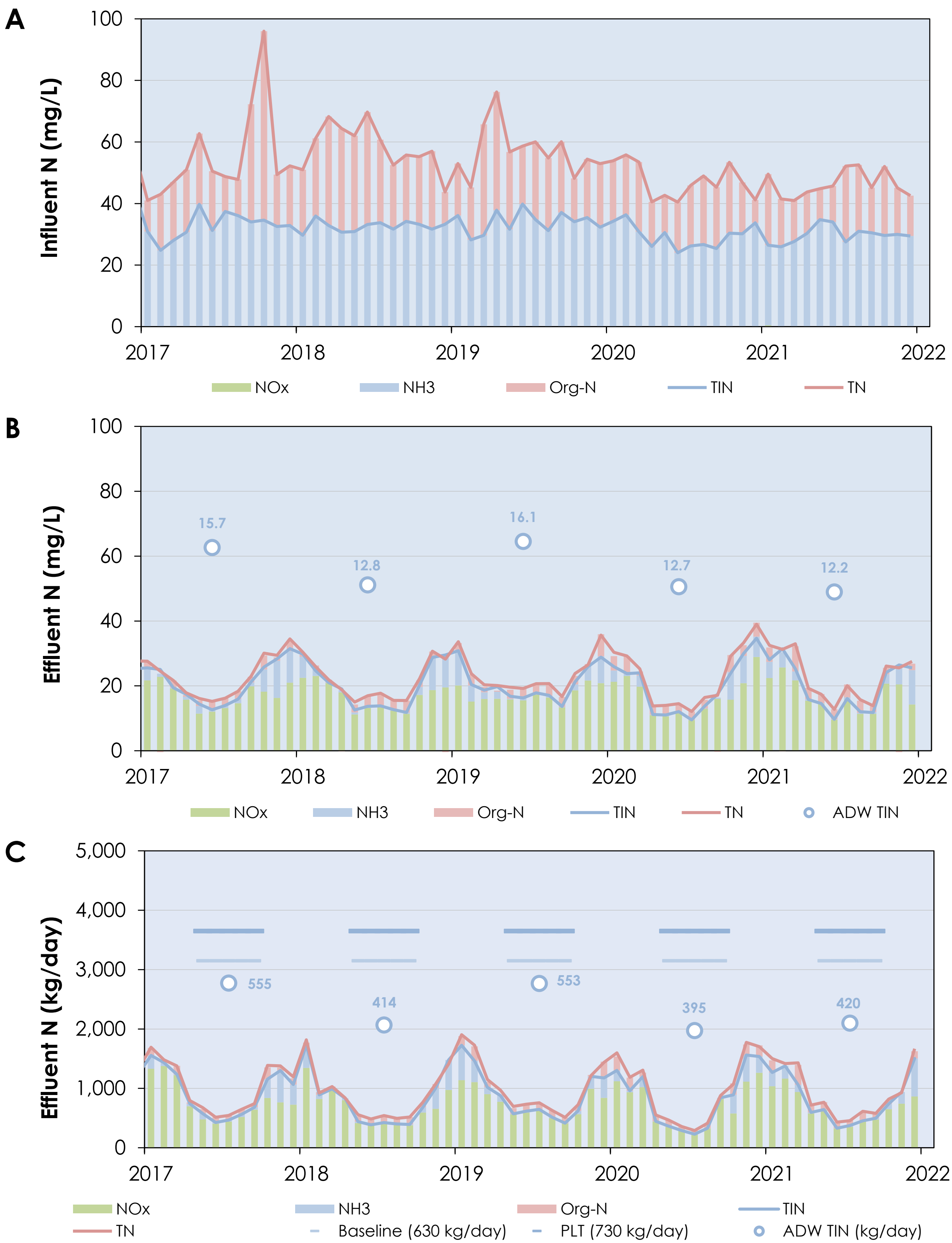


Figure 20: Nitrogen Trends at the WPCP from 2017-2021. A) Monthly Average Influent Nitrogen Concentrations. B) Speciated Monthly Average Effluent Nitrogen Concentrations and C) Effluent Nitrogen Loading Rates with ADW TIN and PLT

Average monthly effluent nitrogen loading rates shown in **Figure 20C** are a product of the seasonal nitrification/denitrification experienced at the WPCP as well as variations in flow rates associated with recycled water production and the Flow Management Strategy. Consequently, the loading rate curve peaks in the wet weather months when demand for recycled water is low and biological activity (nitrification/denitrification) slows. Higher loading rates are also observed in the wet weather months as effluent flows tend to be higher in order to offset increases operating depth of the Oxidation Ponds resulting from precipitation directly into the Oxidation Ponds and inflow/infiltration contributions to influent flows. Conversely, effluent loads are lowest during the dry weather months when recycled water production and biological activity are high but precipitation and influent flows are low. **Figure 20C** also shows the annual average dry weather (ADW) effluent TIN load in relation to the current performance (baseline) as well as the PLT. The calculated effluent ADW loads during the 2021 reporting period remained below the PLT at 420 kg/day. TIN removal efficiency, as measured by the difference between annual average influent and effluent concentrations, was approximately 34%. Reductions in influent ammonia that would otherwise drive down effluent TIN concentrations are offset by the production of NOx as a result of nitrification in the Oxidation Ponds and FGRs. TN removal efficiency, on the other hand, remained relatively high around 50%, with most reductions in the form of Org-N.

Phosphorous

Average monthly influent and effluent total phosphorous (TP) concentrations are shown in **Figure 21A**. The WPCP began voluntarily analyzing for influent TP during 2015 to complement the monitoring requirements in the previous Nutrient Watershed Permit, RWQCB Order No. R2-2014-0014 and support nutrient discussions with a more complete dataset. Since then, influent TP monitoring requirements have been incorporated into the current Nutrient Watershed Permit, RWQCB Order No. R2-2019-0017. TP is less influenced by seasonal variation as compared to nitrogen. Influent TP data indicate relatively consistent concentrations ranging from 4.5 to 7.1 mg/L and averaging 5.6 mg/L.

Total Phosphorous	
Annual Average Effluent	**4.7 mg/L**
Annual Average Effluent Load	**188 kg/day**
% Removal	**18%**

As shown in **Figure 21B**, average monthly effluent TP concentrations ranged from 2.6 to 6.5 mg/L with an annual average of 4.7 mg/L. Effluent TP concentrations have been separated into the dominant forms of orthophosphate (Ortho-P) and organic phosphorous (Org-P). Ortho-P, also known as dissolved reactive phosphorous, represents the form of phosphorous that is readily available for biological growth and comprises the largest fraction of effluent TP. Analysis of the various forms of phosphorus began in 2013 and ended in July 2019 when RWQCB Order No. R2-2019-0017 became effective and shifted the focus solely to TP. During the 2021 reporting period, effluent TP concentrations peaked in warmer months and were complimented by lower concentrations during the colder months. Effluent TP concentrations trended closely with influent concentrations and were only slightly lower on average. The approximate

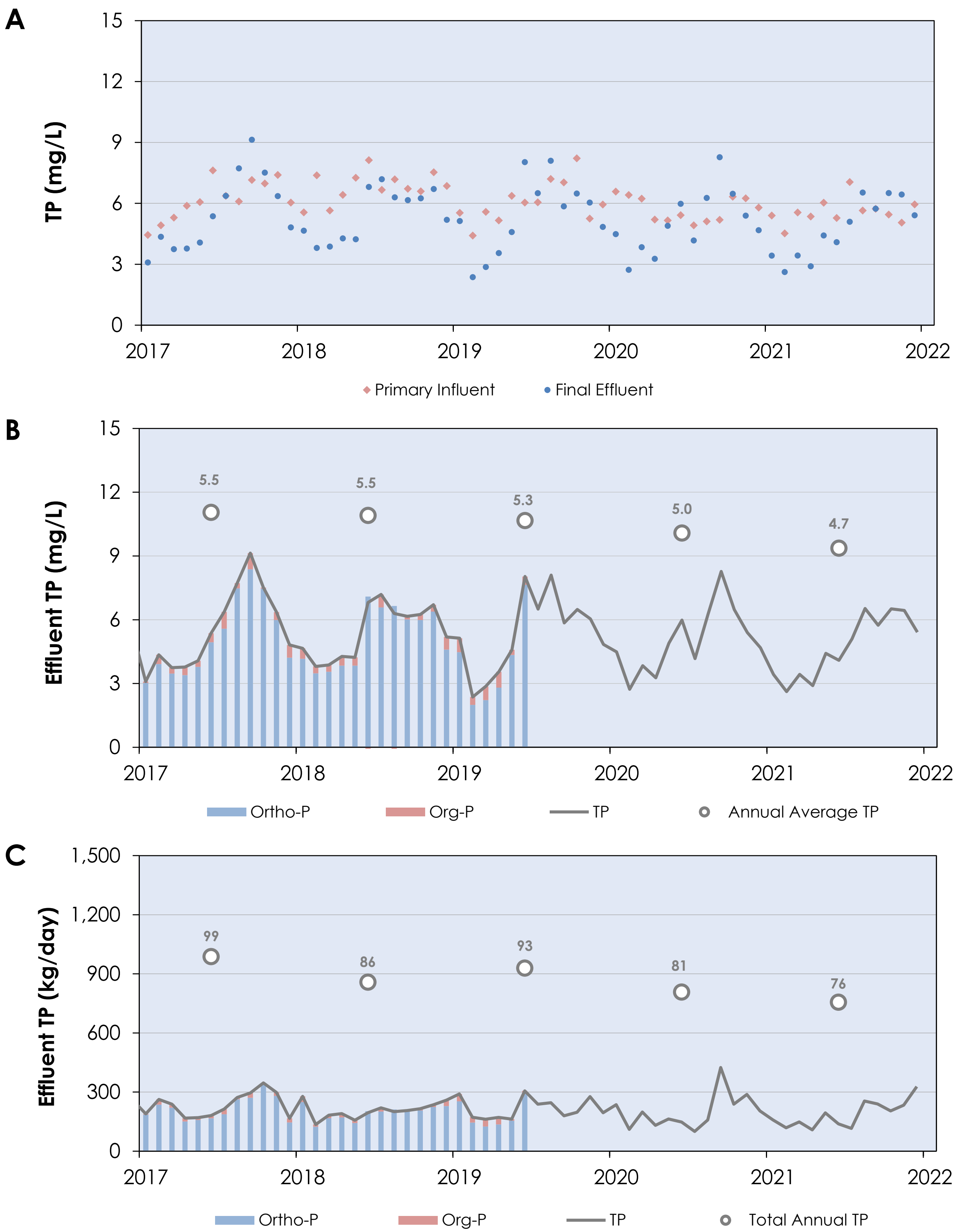


Figure 21: Phosphorous Trends at the WPCP from 2017-2021. A) Monthly Average Influent and Effluent TP Concentrations. B) Speciated Monthly Average Effluent Phosphorous Concentrations and C) Loading Rates with Annual Total TP Loads

18% difference between influent and effluent levels is consistent with previous years and reflective of incidental removal of phosphorus at various stages throughout the treatment process.

Average and total annual phosphorous loading rates are shown in **Figure 21C**. Overall, average TP loading rates have remained relatively consistent around 188 kg/day with approximately 76 tons of TP being discharged during the 2021 reporting period. Unlike TIN, there were no PLTs established for phosphorous loads in the current Order.

1.6. Plant Performance Summary

The WPCP maintained a high level of pollutant removal efficiency during the 2021 reporting period. Influent pollutant data collected during 2021 exhibited much less variability than in previous years, suggesting a high level of accuracy and confirming the success of new preventative maintenance measures placed on the composite sampler in 2019. Pollutant trends generally followed the same patterns and strongly correlated with the various restrictions due to the ongoing COVID-19 pandemic that likely dampened Sunnyvale's typical large net influx of daytime workforce. Influent flow rates remained relatively consistent throughout 2021 and with previous years despite changes to commuter patterns and local business operations brought about by the COVID pandemic. Overall, effluent loads also remained relatively consistent with previous years due primarily to the decoupling effect of the long detention time created by the Oxidation Ponds and the associated Flow Management Strategy. Despite the challenges presented by the novel algae species, the WPCP managed to adapt and adjust its process control strategies such that compliance with TSS and turbidity limits as well as all other effluent limits were maintained in 2021.

2.0. PERMIT COMPLIANCE

All required monitoring data were reported electronically to CIWQS via monthly SMRs. Per Attachment G, Provision V.C.1.h.3 of the current NPDES permit, such reporting removes the requirement for tabular and graphical summaries of monitoring data in this report. The following tabular and graphical summaries are included here for informational purposes.

2.1. Effluent Limitations

Table 1 summarizes effluent compliance sampling conducted during 2021, including regulatory limits, the range of sample results, and the number of samples collected and exceedances. During 2021, the WPCP maintained a high degree of performance with no exceedances of regulatory limits.

Table 1: Effluent Monitoring Summary and Compliance with Discharge Limits in 2021

Parameter Class	Parameter	Parameter Limit Type	Parameter Limit	2021 Final Effluent			Number of Samples[1] / Exceedance
				Min	Avg	Max	
Standard	CBOD	MDEL (mg/L)	20	<2.0	4.7	12.5	87 / 0
		AMEL (mg/L)	10	2.9	4.8	7.2	12 / 0
		Percent Removal (%)	85	97	98	99	12 / 0
	TSS	MDEL (mg/L)	30	5.2	12.3	19.2	100 / 0
		AMEL (mg/L)	20	9.8	12.3	15.3	12 / 0
		Percent Removal (%)	85	93	95	97	12 / 0
	Ammonia (as N)	MDEL [Oct-May] (mg/L)	26	<0.1	4.6	12.3	34 / 0
		AMEL [Oct-May] (mg/L)	18	0.2	4	10.6	8 / 0
		MDEL [Jun-Sept] (mg/L)	5.0	<0.1	0.4	2.6	18 / 0
		AMEL [Jun-Sept] (mg/L)	2.0	0.2	0.5	0.9	4 / 0
	Oil & Grease	MDEL (mg/L)	10	<1.5	<1.5	<1.5	4 / 0
		AMEL (mg/L)	5.0	<1.5	<1.5	<1.5	4 / 0
	Turbidity[3]	MDEL [Oct-May] (NTU)	10 (TSS ≥20 mg/L)	1.7	11	15.7	35 / 0
		MDEL [Jun-Sep] (NTU)	10	3.3	7.8	10	22 / 0
	pH[1]	Max / Min	8.5 / 6.5	6.8	7.2	7.6	344 / 0
	Cl_2 Residual[1]	IMEL (mg/L)	0.0	0.0	0.0	0.0	344 / 0
	Enterococci	90th percentile (month) [MPN/100 mL]	110	1.0	7.8	16	12 / 0
		6-wk Rolling GeoMean (MPN/100mL)	30	1.1	2.6	5.3	47 / 0
Toxicity	Acute Toxicity	90th% (% Survival)	70	100	100	100	4 / 0
		Moving Median (% Survival)	90	100	100	100	4 / 0
Organics	Cyanide	MDEL (ug/L)	17	<1.2	1.8	6.8	12 / 0
		AMEL (ug/L)	7.0	<1.2	1.8	6.8	12 / 0
	Dioxin TEQ[2]	AMEL (ug/L)	1.4×10^{-8}	---	---	---	--- / ---
		MDEL (ug/L)	2.8×10^{-8}	---	---	---	--- / ---
Metals	Copper	MDEL (ug/L)	19	1.4	2.7	4.8	13 / 0
		AMEL (ug/L)	10	1.4	2.6	4.6	13 / 0
	Mercury	AMEL (ug/L)	0.025	0.0002 J	0.0010	0.0023	12 / 0
		AAEL (kg/yr)	0.120	---	---	0.013	1 / 0
	Nickel	MDEL (ug/L)	33	2.4	4.8	26	13 / 0
		AMEL (ug/L)	24	2.4	4.1	14.4	13 / 0

Notes:
1: Sample collection required only during active discharge – sample count below 365 indicates periods of zero discharge to San Francisco Bay
2: Sampling conducted for Dioxin TEQ once every permit cycle (RWQCB Order R2-2016-0008); sampling for current permit (Order No. R2-2020-0002) pending
3: The 10 NTU limit for turbidity is not applied during June 1 through September 30 if concurrent effluent TSS concentrations are less than 20 mg/L
AAEL: Average annual effluent limit; AMEL: Average monthly effluent limit; AWEL: Average weekly effluent limit; IMEL: Instantaneous maximum effluent limit
MDEL: Maximum daily effluent limit
J: Analyte detected, but not quantifiable
<#: Analytical results less than the laboratory detection limit
---: Indicates that data are not available or applicable

2.1.1. Constituent Removal

Figure 22 through **Figure 26** show constituent removal and corresponding effluent limits (MDEL, AMEL) and water quality objectives (WQOs) for priority pollutants in Table B of Attachment G. WQOs are numerical standards established in the California Toxics Rule or other governing documents to protect water quality, aquatic life, and human health in the receiving water. They are distinct from effluent limitations even though they form the basis for effluent limitations, if required. Provision VI.C.2.a requires an annual evaluation of effluent characteristics to identify any significant increases in pollutant concentrations over past performance that would invalidate the conclusions of the current Order's reasonable potential analysis and cause or contribute to an exceedance of WQOs. During the 2021 reporting period, effluent from the WPCP was compliant will all limitations and remained below WQOs. There were two separate instances where effluent nickel and cyanide concentrations were temporarily elevated but did not result in a significant increase over past performance.

During the reporting period, the nickel concentration in the monthly effluent compliance sample collected on January 13, 2021, was 26.0 µg/L, exceeding the AMEL of 24 µg/L. Sunnyvale initiated accelerated monitoring of the WPCP effluent per the requirements in Attachment G, Provision III.A.3.b.i. The accelerated monitoring sample collected on January 21, 2021, measured an effluent nickel concentration of 2.8 µg/L. Accelerated monitoring was then discontinued as the average monthly nickel concentration for January dropped to 14.4 µg/L. and was below the AMEL.

In June and July, effluent cyanide concentrations were elevated and approached the AMEL. Based on a review of process data collected during the 2021 reporting period, the elevated cyanide concentrations are primarily attributed to low ammonia levels in the Oxidation Pond and FGR effluents coupled with a higher dose of chlorine. Cyanide can be generated in the treatment process from cyanide precursors during the disinfection and chlorination process, as well as from analytical interferences from sodium hydroxide (NaOH) that is used from a preservative. This generally occurs when a free chlorine state is reached due to the absence of ammonia and the formation of chloramines. During these months, the WPCP was responding to process impacts from the emergence of a novel picoplankton species of pond algae and troubleshooting control strategies that would keep effluent turbidity within the 10 NTU limit, including a higher dose of sodium hypochlorite in the CCTs. Ultimately, in response to the algae the WPCP selected a different control strategy less reliant on sodium hypochlorite, which involved adjusting the polymer dose and the adding a filter aid at the DMFs.

In July 2021, the monthly influent sample result for lead was 91 µg/L. This sample result was concluded to be an outlier and was attributed to unusual levels of sediment observed in the sample. Subsequent samples returned to normal levels, and the July influent lead spike was determined to be anomalous.

Section VI.C of the current NPDES permit Fact Sheet establishes priority pollutant monitoring requirements and frequencies. The City has opted to participate in the *Alternate Monitoring and Reporting Requirements for Municipal Wastewater Discharges* Order No. R2-2016-0008, which changes the monitoring frequency to once-per-permit in exchange for diverting the analytical costs associated with priority pollutant monitoring to supplement the Regional Monitoring Program. The City has not yet

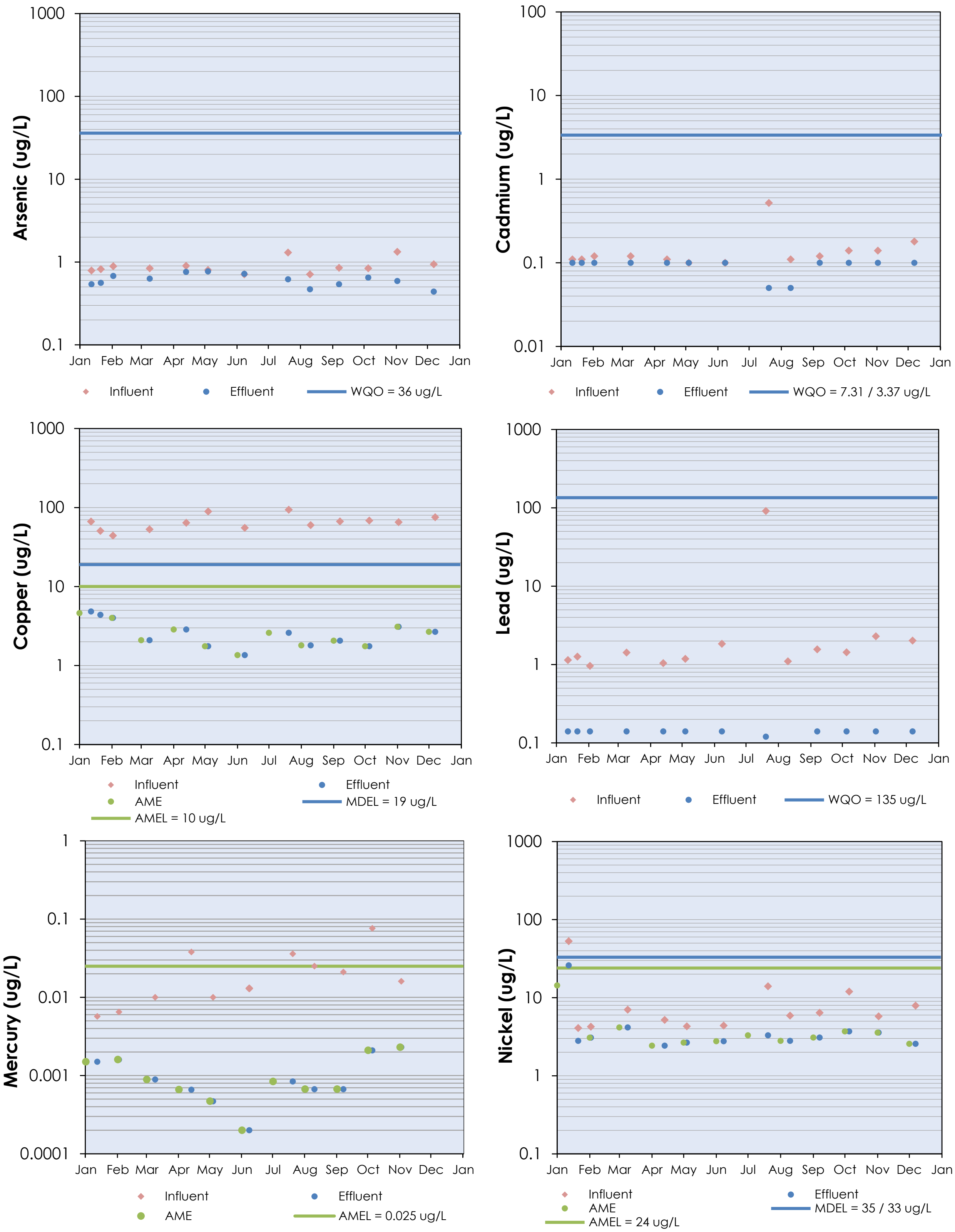


Figure 22: Select Metal Pollutants measured during 2021

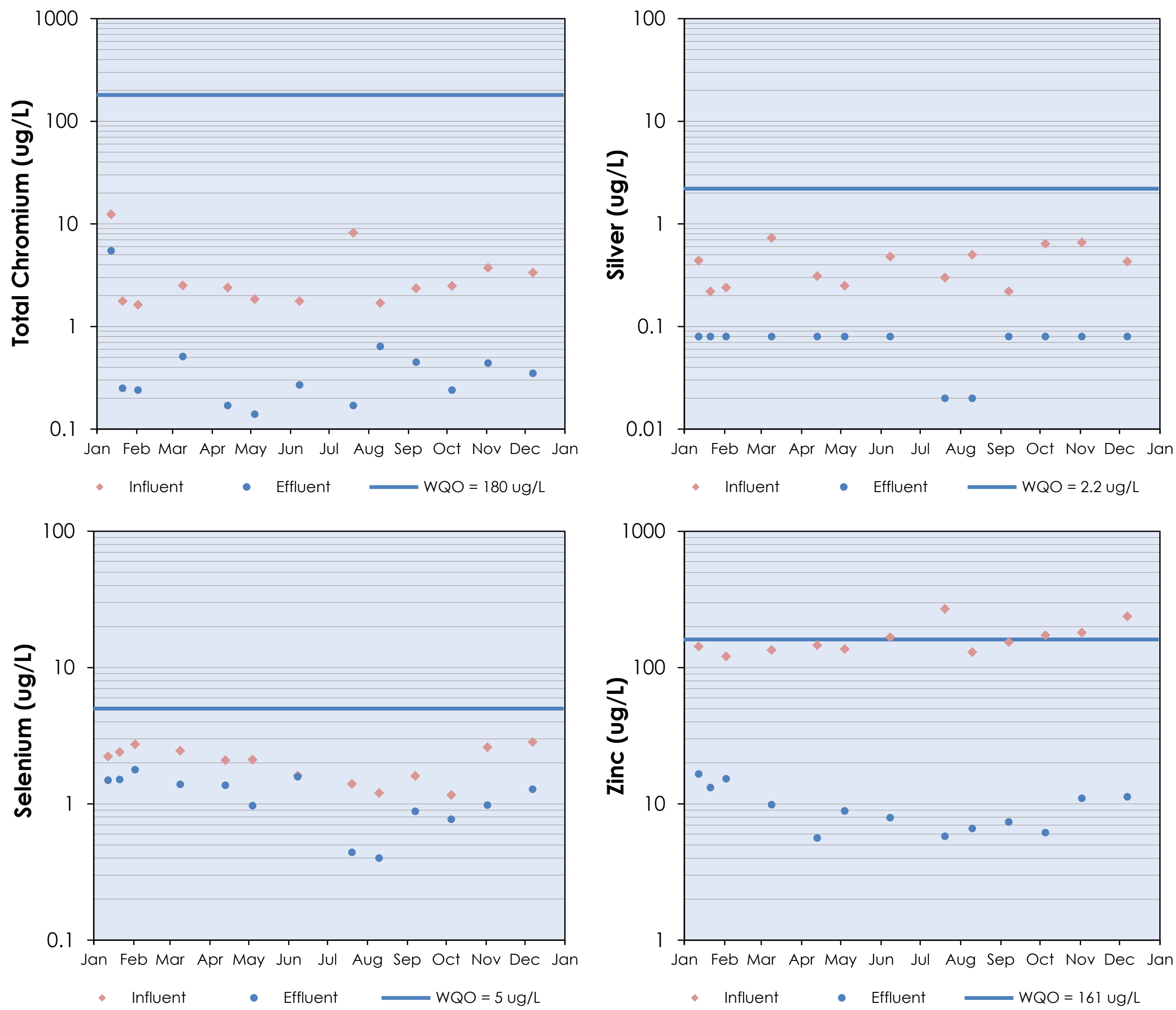


Figure 23: Select Metal Pollutants measured during 2021. Total Chromium WQO is for Chromium (III)

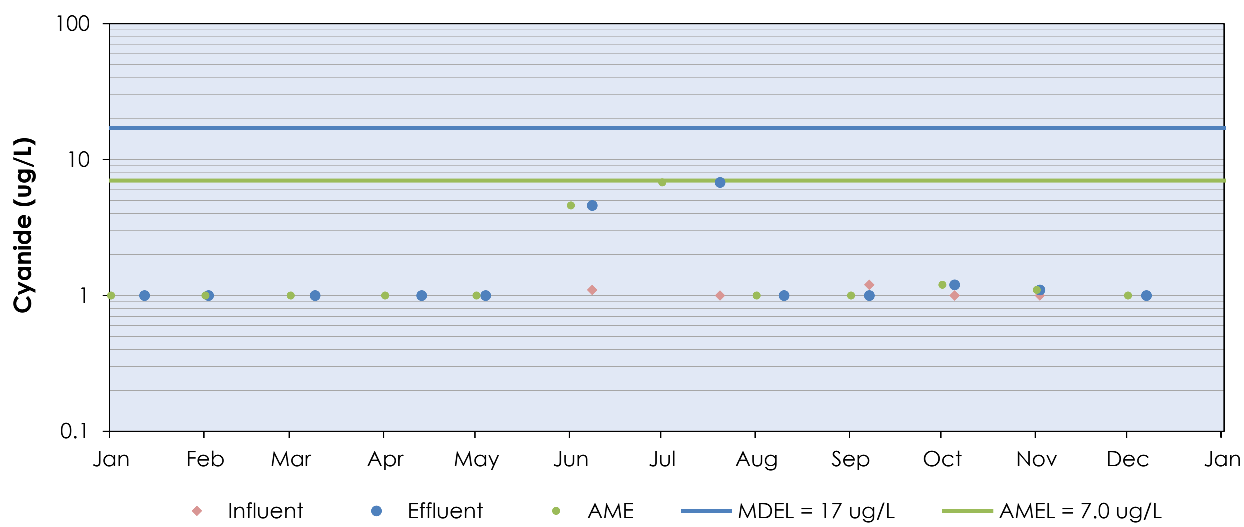


Figure 24: Cyanide trends during 2021

performed this monitoring under its current permit and last conducted this monitoring in 2014 and 2015 as reported under the previous NPDES permit.

Figure 25 shows data from common physical parameters collected as grab samples at the WPCP, of which only turbidity (**Figure 25A**) and pH (**Figure 25B**) have effluent limits. Influent and effluent temperature data (**Figure 25C**) are relevant for evaluating trends in biological treatment performance and are included in this report for informational purposes only. The variability in turbidity data shown in **Figure 25A** is a function of polymer dosing in the DAFTs, which is generally correlated with the dominant form of algae present. Prior to improvements completed in 2018, the production of recycled water heavily influenced effluent turbidity during the dry season because the WPCP was not configured for simultaneous production of recycled water and NPDES discharge. Consequently, during periods of recycled water production, all flow was treated to CCR Title 22 standards (2 NTU) beginning in the DAFTs. During the transition from recycled water production back to NPDES discharge, 2 NTU effluent would be discharged. Under the current configuration, both recycled water production/distribution and NPDES discharge can occur simultaneously.

The current NPDES permit updated how the 10 NTU turbidity limit is applied. The limit is continuously applied during the dry weather season (Jun-Sep) but applied during the wet weather season (Oct-May) only when effluent TSS exceeds 20 mg/L. This approach is illustrated in **Figure 25A** and reflects a defining treatment feature of the Oxidation Ponds. Algae generally undergo seasonal shifts that follow ambient weather conditions, such that colonial species that are easily harvested in the DAFTs and filtered-out in the DMFs predominate during the dry weather season with more solitary species that challenge removal efficiencies predominating in the wet weather season. This generally results in higher effluent turbidity and TSS during the winter months as compared with the summer months since algae form a larger fraction of solids during these months. In 2021, these general trends were impacted by the emergence of the picoplankton algae species as discussed in **Chapter II, Section 1.3** and contributed to higher effluent turbidity throughout the year as seen in **Figure 25A.** With adjustments to the operational treatment strategy in response to the algae species, the WPCP adhered to the conditional turbidity limits throughout 2021.

Effluent pH values occasionally approach the lower discharge limit of 6.5 as shown in **Figure 25B**. The depression in pH was historically attributed to the use of chlorine gas (which depresses pH) for disinfection, coupled with the more stringent Title 22 water quality requirements associated with recycled water production, which required higher chlorine doses. As of 2018, disinfection for recycled water production is now separate from disinfection for discharge to the San Francisco Bay, and sodium hypochlorite (which does not depress pH) is now used rather than chlorine gas. Seasonal variations in effluent pH still occur with lower pH observed in the wet weather months, but pH levels are not expected to approach the lower pH limit to the degree that occurred in the past.

Influent and effluent temperatures at the WPCP vary seasonally but follow the same general pattern (**Figure 25C**). The significant difference between the influent and effluent temperatures is the result of the long residence time in the Oxidation Ponds. On average, primary effluent is held in the Oxidation Ponds for 30-45 days. In contrast, wastewater passes through primary treatment and reaches secondary treatment in the Oxidation Ponds within 1-2 hours on average. As a result, the wastewater undergoing secondary treatment is heavily influenced by ambient temperatures and carried through to the final effluent.

Enterococcus limits were changed from the previous 30-day geomean limit of 35 MPN/100 mL with the reissuance of the NPDES permit in April 2020. While the required sampling frequency remains the same (5 sample per week), compliance is now evaluated against a 30-day 90^{th} percentile limit of 110 MPN/100 mL and a 6-week rolling geometric mean limit of 30 MPN/100 mL, evaluated weekly. Compliance with these new limits was maintained during the 2021 reporting period. Occasional spikes in the daily samples contributed to the higher calculated values observed in **Figure 26** and have been correlated with regrowth in the flow-through sampling system rather than effluent water quality. To avoid these anomalies, the WPCP has implemented more rigorous preventative maintenance cleaning protocols for the sampling system.

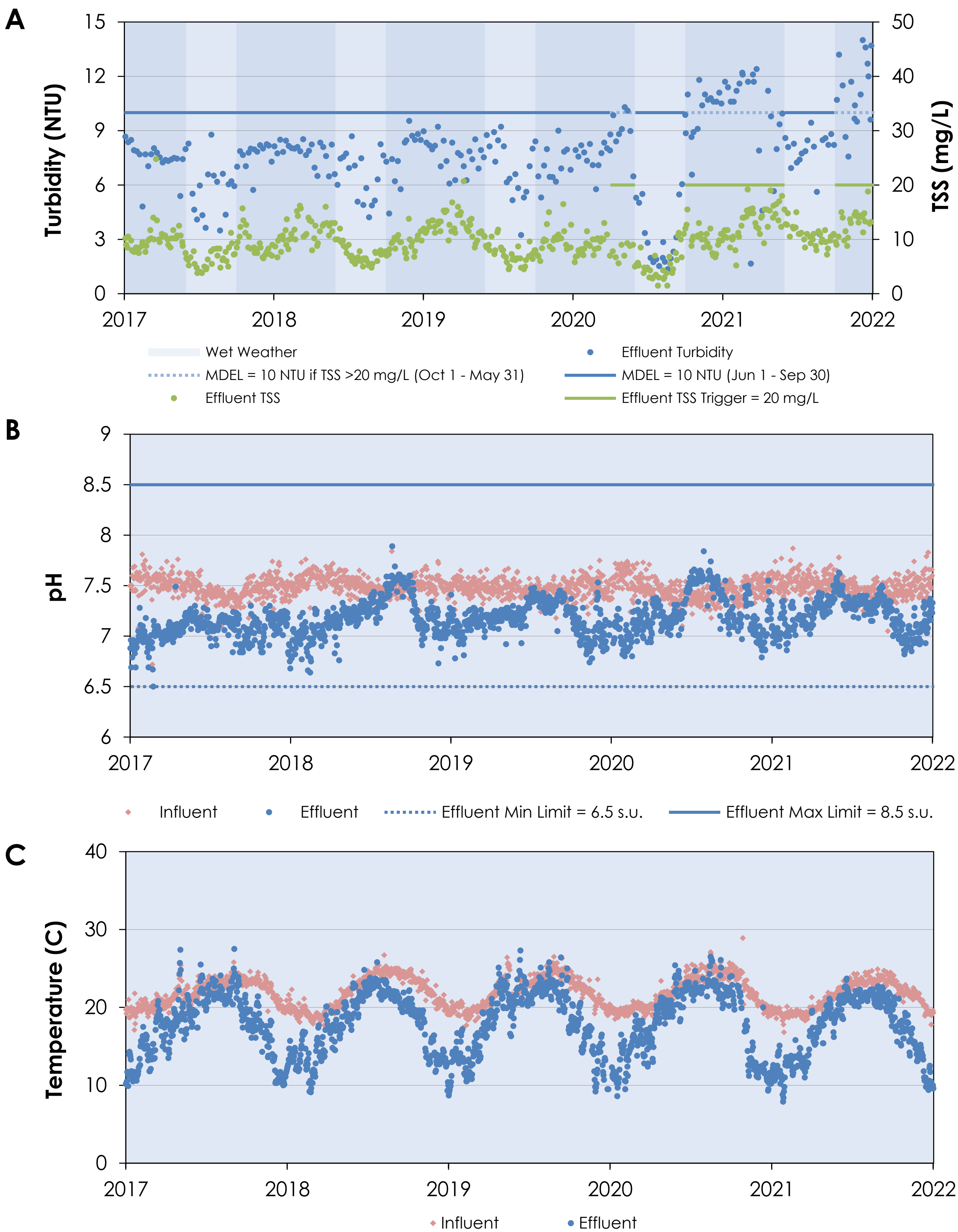


Figure 25: Turbidity, pH, and Temperature trends from 2017-2021

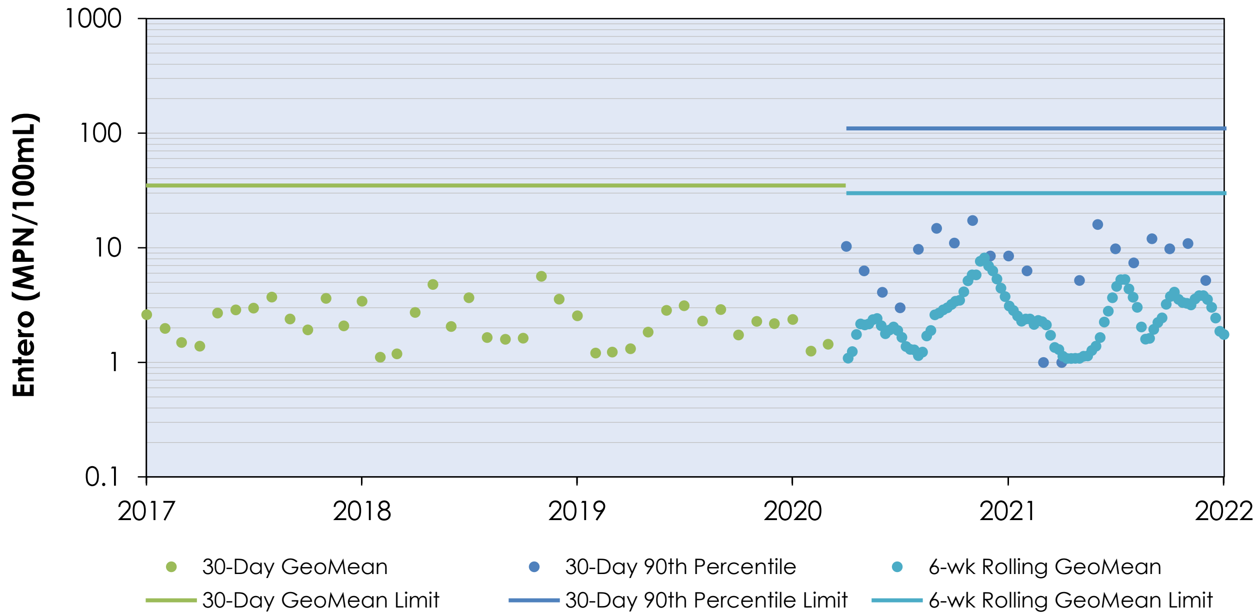


Figure 26: Enterococcus trends from 2017-2021

2.1.2. Chronic Toxicity Effluent Triggers

The required frequency of chronic toxicity testing changed from monthly to quarterly under the reissued NPDES permit beginning April 1, 2020. *Thalassiosira pseudonana*, a marine alga (diatom) was selected as the most sensitive species based on a chronic toxicity screening testing conducted during the 2014 permit renewal process (**Figure 27**). The chronic toxicity test is conducted by the City's contract laboratory, Pacific Ecorisk Laboratory (PERL), and is performed over a four-day period with growth measured as the endpoint.

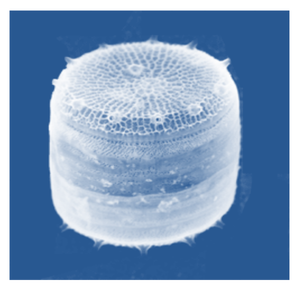


Figure 27: *Thalassiosira pseudonana*

As required by the current NPDES permit, the City developed a Generic TRE Workplan, which includes a six-tiered approach for evaluating and responding to chronic toxicity events. The basic approach is to start at Tier 1 (accelerated monitoring) and Tier 2 (review of available effluent data, examination of operational practices and process chemical use) to identify potential causes or sources of toxicity before moving on to more complex and costly laboratory investigations or potential operational or physical modifications. The workplan further requires the implementation of a Toxicity Identification Evaluation (TIE) upon exceedance of a trigger value of 1.25 toxicity units (TUc) based on EC_{50} or IC_{50}[2] values.

[2] EC_{50} is the concentration which results in 50% of the maximal response. IC_{50} is the concentration which results in a 50% reduction in growth or growth rate.

Provision V.B.3.b. in Attachment E of the current NPDES permit contains effluent triggers if the single test maximum exceeds 2.0 TUc or the three-sample median exceeds 1.0 TUc based on the IC_{25}[3]. If either condition is triggered, the City must implement an accelerated monitoring schedule for chronic toxicity testing of once-per-month and submit an event-specific Toxicity Reduction Evaluation (TRE) Workplan to the RWQCB within 30 days of detecting toxicity. The City may only return to routine (quarterly) monitoring of chronic toxicity if results from the accelerated monitoring fail to confirm toxicity and do not exceed the permit triggers described above. The City must implement the TRE Workplan if the accelerated monitoring confirms toxicity and initiate investigative and corrective actions until toxicity results are shown to be below trigger levels or as directed by the Executive Officer.

As shown in **Table 2,** the single sample maximum of 2.0 TUc and three-sample median of 1.0 TUc were not exceeded in any given quarter during the 2021 reporting period. Toxicity was detected at very low levels during the month of August at 1.4 TUc which did not exceed the permit triggers. The subsequent test conducted in October did not detect toxicity, maintaining the 3-sample median below the permit trigger of <1.0 TUC.

Table 2: Summary of Chronic Toxicity Testing Results for WPCP Effluent during 2021

Test #	Sample Date	Growth TU_c	3-Sample Median (Growth TU_c)
1	1/13/2021	<1.0	<1.0
2	5/6/2021	<1.0	<1.0
3	8/11/2021	1.4	<1.0
4	10/6/2021	<1.0	<1.0

2.1.3. Effluent Residual Chlorine

There were no "on-the-hour" residual chlorine excursions of the IMEL during the 2021 reporting period.

2.1.4. Mercury Effluent Limitations and Trigger

The WPCP continues to be an active member of BACWA and participates in the annual submittal of water quality data pertaining to mercury discharge. In accordance with the Mercury and PCBs Watershed Permit, effluent mercury concentrations are measured monthly for regulatory compliance and shown in **Figure 28.** Influent concentrations and loading rates have been included for evaluating removal performance over the reporting period. As shown in **Figure 28A**, effluent mercury concentrations remained below the average monthly trigger (0.011 ug/L) and limit (0.025 ug/L) and were significantly lower than influent concentrations. Similarly, the cumulative annual effluent mercury load of 0.0149 kg/yr is well below the permit limit of 0.12 kg/yr and significantly lower than influent loads (**Figure 28B**).

[3] IC stands for inhibition concentration. IC_{25} is the statistical calculation of the effluent concentration which causes a 25% reduction in growth or reproduction of test organisms.

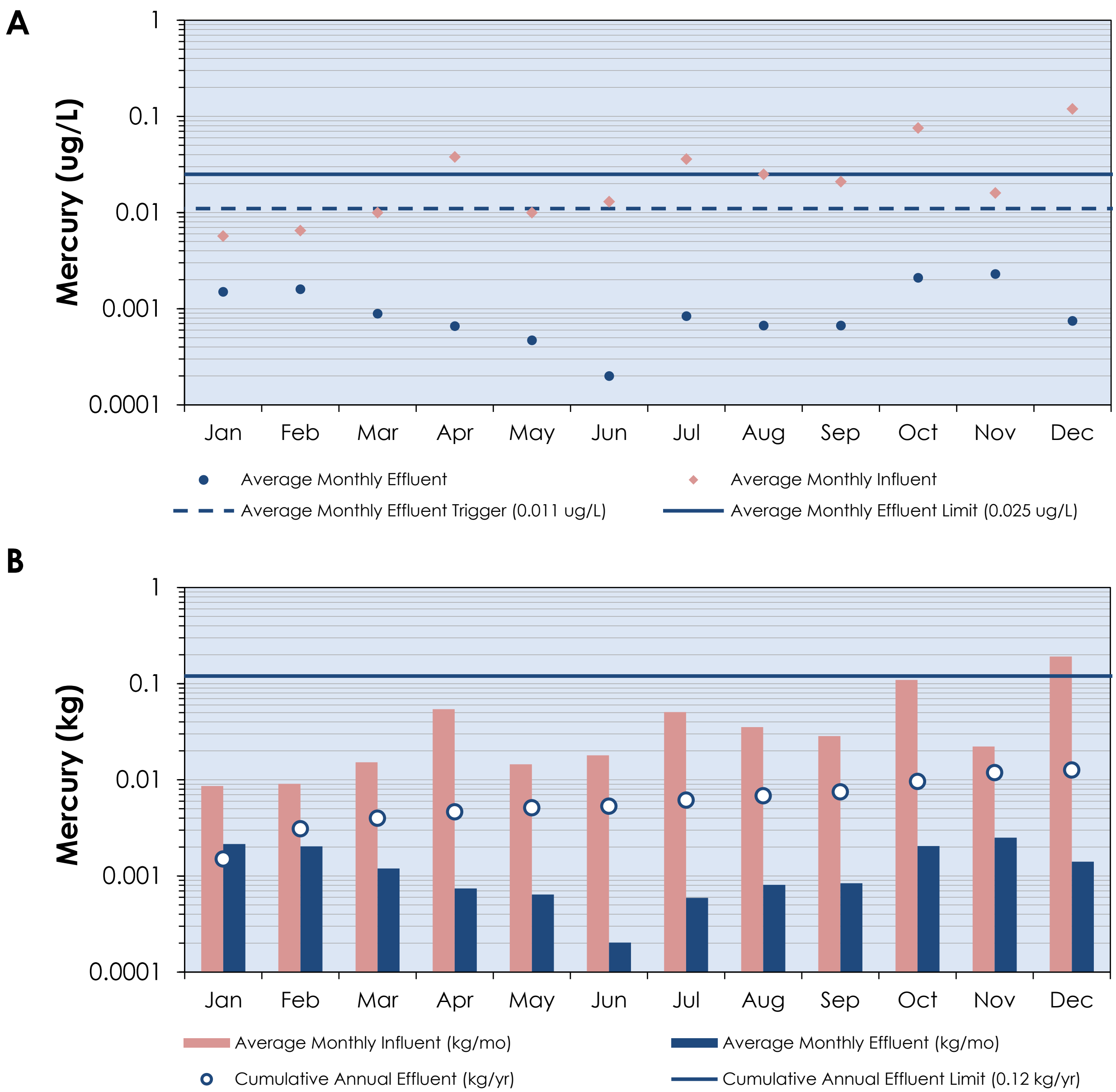


Figure 28: Influent and Effluent Mercury A) Concentration and B) Loading Rate Trends during 2021

2.1.5. PCB Effluent Limitations

In accordance with the Mercury and PCBs Watershed Permit, the WPCP is also required to measure and report total PCBs as congeners semi-annually using EPA Proposed Method 1668c. Results from this method are provided to the RWQCB for informational purposes and are used to verify assumptions and evaluate the need to refine wasteload allocations. The requirement for monitoring of PCBs as Aroclors for compliance with effluent limitations was reduced to once per permit cycle by the *Alternate Monitoring and Reporting Requirements for Municipal Wastewater Discharges* Order No. R2-2016-0008. PCBs as Aroclor data were submitted in 2015 under the previous NPDES permit (Order No. R2-2014-0035) to satisfy the once-per-permit-cycle requirement established in Provision VI.C.1. The WPCP has not yet conducted the requisite monitoring under the reissued NPDES permit (Order No. R2-2020-0002) and will include the results in a subsequent annual report once they are available.

2.2. Unauthorized Discharge

California Code of Regulations, Title 23, Section 2250(b), defines an unauthorized discharge to be a discharge not regulated by waste discharge requirements, of treated, partially treated, or untreated wastewater resulting from the intentional or unintentional diversion of wastewater from a collection, treatment or disposal system. Per Section V.E.2 of Attachment G, the WPCP is required to notify various agencies in the event of an unauthorized wastewater treatment plant discharge. The WPCP did not experience any unauthorized discharges during the 2021 reporting period.

2.3. Secondary Effluent Pipeline Rupture

On July 30, 2020, the City confirmed that a rupture in the Secondary Effluent Pipeline resulted in the unauthorized discharge of approximately 293,000 gallons of substantially treated secondary effluent into a U.S. Fish and Wildlife conveyance channel (FWS Channel). In response, Sunnyvale constructed an intermediate solution under emergency authorizations from various regulatory agencies that was completed in April 2021. The intermediate solution consists of dual 24-inch HDPE pipelines across the FWS Channel and a new utility bridge across Moffett Channel (**Figure 29**).The intermediate solution is expected to be in place for approximately 2-4 years to provide enough time for Sunnyvale to design, permit, and construct a permanent solution that also fits into planned facility upgrades within the Cleanwater Program.

Figure 29: Alignment of WPCP process piping and point of unauthorized discharge in FWS Channel

In February 2021, the City entered into a Settlement Agreement with the RWQCB (Order No. R2-2021-1002) to resolve the violation alleged due the secondary effluent line break and to address the imposition of financial penalties. As stipulated in the Order, the City paid half of the $187,000 penalty to the State Water Resources Control Board in March 2021 and has allocated the remaining $93,500 to a Supplemental Environmental Project (SEP) for the *Green Stormwater Infrastructure at Wolfe/Stewart Intersection* project. The SEP will integrate green stormwater infrastructure into a planned traffic improvement project to reduce vehicular speed by changing a right-hand-turn slip lane to a traditional intersection right turn. Stormwater runoff from adjacent streets will flow into a landscaped area for treatment prior to discharge into the subsurface storm drain system. The outcome will be approximately 2,000 square feet of treatment area (serving to disconnect approximately 15,000 square feet of impervious area). Quarterly progress reports are required to be reported to the RWQCB through the WPCP's SMRs in accordance with the schedule shown in **Table 3**. Sunnyvale met all of its reporting obligations for 2021.

Table 3: SEP Reports due to RWQCB under Order No. R2-2021-1002

Due Date	Report Description
July 30, 2021	Quarterly Report 1 – Description of SEP activities from the start of the project through June 2021.
November 1, 2021	Quarterly Report 2 – Description of SEP activities during July through September 2021.
January 31, 2022	Quarterly Report 3 – Description of SEP activities during October through December 2021, including assessment of Final Design Completion milestone.
May 2, 2022	Quarterly Report 4 – Description of SEP activities during January through March 2022, including assessment of Construction Award milestone.
August 1, 2022	Quarterly Report 5 – Description of SEP activities during April through June 2022.
October 31, 2022	Quarterly Report 6 – Description of SEP activities during July through August 2022.
January 31, 2023	Quarterly Report 7 – Description of SEP activities during October through December 2022.
May 1, 2023	Final Completion Report –Description of SEP activities during January through March 2023, including assessment of Construction Completion milestone. Report shall also include a summary of all completed tasks, final project implementation costs, an evaluation of the project's success criteria (amount of impervious surface area treated), photographs documenting the completed project, and a certified statement of SEP completion as required in section III, paragraph 6, of the Stipulated Order approving this project as a SEP.

2.4. Avian Botulism Control Program

In accordance with Provision VI.C.5.A of the current NPDES permit, Sunnyvale submits an annual *Avian Botulism Control Program Report* by February 28 for the preceding year. The program consists of monitoring for the occurrence of avian botulism and the collection of sick or dead birds and other dead vertebrates found along Guadalupe Slough, Moffett Channel, and the Oxidation Ponds and levees. Controls to limit the outbreak and spread of this disease consist primarily of the collection and proper disposal of sick and dead birds. The San Francisco Bay Bird Observatory was contracted by the City to locate and collect sick birds and dead vertebrates from June through November of 2021 when the potential for outbreak is the highest. WPCP Operations and Laboratory staff also conduct weekly surveys throughout the year around the Oxidation Ponds and collect sick, injured, or dead birds and mammals. No cases of avian botulism were identified during the 2021 reporting period.

III. FACILITY REPORTS

1.0. OPERATION AND MAINTENANCE MANUAL

During the 2021 reporting period, the WPCP continued to add content to its electronic O&M Manual (EOMM). The EOMM was developed in Atlassian Confluence, a cloud-based knowledge management application. The EOMM seamlessly links to supporting information on the City's SharePoint network or other external web sites. Compared to the previous hard copy O&M Manual, the EOMM provides enhanced functionality and greatly facilitates the updating process by eliminating multiple hard copies of the manual. This results in an intuitive, centralized interface that provides easy access to all relevant O&M Materials, including content from the earlier manual, SOPs, record drawings, equipment information and manuals, and permits etc., in an electronic format.

Similar to the previous hard copy manual, the EOMM is organized into sections (pages) that correspond to individual treatment unit processes and plant-wide utilities. There are also several pages related to training, and an overview page that provides general information about the WPCP and its programs. The unit process pages share a common template that make extensive use of "expanding" headings. Once headings are clicked on, detailed content including links to internal and external content become visible. The main elements of the common template are: Introduction (Purpose & Goals and Theory of Operation), Description of Process (including design criteria), Process Control, Operating Procedures, and Other Reference Materials

EOMM pages for the existing secondary and tertiary processes and plant utilities were originally developed with content from the previous manual, with additional features supported by the Confluence application. In 2021, the process of updating and expanding those pages continued. The EOMM is now the official O&M Manual for all secondary, tertiary, and related support processes. The previous O&M Manual's headworks, influent pumping, and primary treatment sections were not incorporated into the EOMM as those facilities are to be decommissioned in 2022. The earlier sections remain accessible in the previous manual until decommissioning.

Development of pages for the new Headworks and Primary Treatment Facilities began in 2020 and continued through 2021. The new pages include:

- Headworks and Primary Treatment Facility (Introductory Page)
- Screenings Facility
- Influent Pumping
- Grit Facility
- Primary Sedimentation
- Odor Control
- Influent Sampling
- Standby Generator
- Slide Gates

The Site Electrical System page was also updated to incorporate new content from the Project. The Headworks and Primary Treatment Facilities Project is now in the final testing and commissioning phase and is expected to come on line in early 2022. Additional content related to operating procedures for the new facilities will be added to the above pages as those procedures are finalized. Additional photos, which are used extensively in the EOMM, will also be incorporated.

In addition to the WPCP O&M Manual, the WPCP maintains an Operator in Training (OIT) Manual. This manual includes 32 "Ops Tasks" that address specific tasks in a highly detailed manner. New Operators must demonstrate proficiency in each Ops Task before being allowed to perform the task independently. These Ops Tasks are reviewed annually and updated as needed. No substantial updates were made to the Ops Tasks during the 2021 reporting period. Ops Tasks are kept on the WPCP network at J:\ESD\WPCP\General\Operations\OPS Training\OIT Manual\OIT Manual Updated.

The WPCP also maintains a series of Standard Operating Procedures (SOPs), which contain detailed instructions for certain operational and administrative tasks not limited to Operations and Maintenance staff. Updating of SOPs is an ongoing process. In addition, every Operator is required to perform an annual review of every SOP. This process is tracked by support staff. These reviews feed into the annual SOP updating process. Electronic versions of the WPCP SOPs are kept at J:\ESD\WPCP\WPCPData\SOPs\SOP - signed PDF. The following is a list of SOPs that were updated, created, or deleted during this reporting period:

SOPs Updated

- SOP #3035: Landfill, Digester, and Air Blended Natural Gas Sampling
- SOP #3039: Recycled Water Fill Station Program
- SOP #3045: Solids Process Monitoring and Removal Procedures

2.0. PLANT MAINTENANCE PROGRAM

During the 2021 reporting period, the Plant Maintenance Program continued to utilize the Infor Enterprise Asset Management System (EAMS) implemented in 2018. Infor EAMS provides the functions of a computerized maintenance system (CMMS), including work order generation/tracking and other maintenance data management functions, advanced features for asset tracking and life-cycle management, proactive and condition-based maintenance, materials and supplies purchasing, and other features (**Chapter IV, Section 10.0**). Maintenance and Operations staff use iPad handheld tablets with the Infor EAM Mobile app to interface with the Asset Management System. The tablets provide a field interface to work orders for corrective maintenance (CM) and preventative maintenance (PM) procedures, equipment information (via a bar-code reader), and expedited data entry for work orders and other maintenance/process control measurements. The tablets continue to be used by the Maintenance staff for on-line trainings and meetings due to the COVID-19 pandemic gathering limitations.

The Operations and Maintenance staff continues to review and develop the Preventative Maintenance program to provide improved reporting on asset condition and work history. The WPCP places a strong emphasis on preventative maintenance to achieve high mechanical reliability. Staff members from both

Operations and Maintenance sections perform preventative maintenance functions. There are currently more than 3,400 pieces of equipment identified in the Infor EAMS equipment database. The system has improved the efficiency of the WPCP's Maintenance Program and contributes to WPCP reliability through more timely access to maintenance information and work order status, better inventory control, and proactive maintenance. As shown in **Table 4**, the WPCP maintained a high level of efficiency by completing most of the work orders issued in 2021. During the 2021 reporting period, the Maintenance group generated approximately 2,098 corrective and preventative maintenance related work orders, of which 2,027 were completed in the same year (97%). In addition, the Operations group completed 6,193 PMs of the 6,701 that were generated (92%). The remaining work orders will be carried over into 2022 and completed according to schedule.

Table 4: Tabulation of 2021 Work Orders Issued and Completed

2020	**PM** (Maintenance)	**CM** (Maintenance)	**PM** (Operations)
Completed	1,229	798	6,193
Released/On Hold/Waiting for Parts	37	34	97
Total Work Orders	1,266	832	6,701
% Completed	97%	96%	92%

The WPCP also uses an on-line system (D-A Lube) for tracking results from laboratory analysis of lubricating oil removed from WPCP equipment under the preventative maintenance program. D-A Lube provides rapid reporting of analytical results, and flags high contaminant levels and other conditions that may indicate mechanical problems (e.g. excessive wear, presence of moisture, etc.).

Some of the more significant maintenance and upgrades to WPCP equipment in 2021 included:

- Plant electrical switchgear testing
- Sulliar service air compressor #6 replacement
- Top End overhaul of the #2 Power Generator Unit
- Rehabilitation of #3 and #2 Pond Effluent Pumps
- Rehabilitation of #1 Digester Mix pump
- Top end overhaul of the #3 Main Influent Pump Engine
- Rehabilitation of #3 Fix Growth Reactor Pump and Motor
- Vegetation cleanup of the WPCP Oxidation Pond Channel
- Laboratory water piping replacement
- Completion of the temporary WPCP Oxidation Pond Effluent Piping Project

3.0. WASTEWATER FACILITIES REVIEW AND EVALUATION

Provision VI.C.4.a requires that the City regularly review and evaluate its wastewater facilities and operational practices to ensure that the wastewater collection, treatment, and disposal facilities are adequately staffed, supervised, financed, operated, maintained, repaired, and upgraded as necessary to provide adequate and reliable transport, treatment, and disposal of all wastewater from both existing and planned future wastewater sources under the City's service responsibilities.

The responsibility to conduct reviews of the WPCP, to develop goals, objectives and priorities, to formulate rules and procedures, and to maintain budgetary control are explicitly listed as duties of the ESD Division Managers (WPCP, Water and Sewer Services, Solid Waste Programs, and Regulatory Programs) and section managers within these Divisions. In some cases, assistance for the review and evaluation process is provided through special studies conducted by outside consultants, such as the WPCP's Master Planning and Condition Assessment efforts. These efforts are described elsewhere in this annual report. The Environmental Management Chapter of the City's General Plan also plays a role by establishing long-term goals and policies and providing action statements designed to ensure their implementation. For the sewer system, metrics used to assess the effectiveness of collection system operations are described in the City's Sewer System Management Plan, which is audited on a biennial basis. Results of the current evaluation are summarized below, in other sections of this annual report, and in other regulatory and planning documents. The City believes that current staff allocation and supervision are sufficient to perform its mission and meet the requirements listed above.

Facility Upgrades

Numerous WPCP upgrade projects, as well as the City's current Master Plan for the WPCP rebuild are currently in progress as described in **Chapter IV**.

Financing

The WPCP and associated collection system are financed by revenues generated from fees collected from users of the sanitary sewer system. Sewer rates are evaluated periodically by a financial consultant to determine if revenues are sufficient to support current and future operations and maintenance, equipment replacement, and planned capital improvements. The City also uses State Revolving Funds (SRF) and Water Infrastructure Finance and Innovation Act (WIFIA) loans to finance elements of the Cleanwater Program.

Utility rates are typically adjusted by the City Council each fiscal year to keep revenues and expenditures in balance. The Council adopted new utility rates effective on July 1, 2021, approving an overall 3% increase in the sewer service rate for Fiscal Year 2021-2022. The actual rate increases vary by customer class and reflect needed improvements to the City's aging infrastructure and increases in operating and regulatory compliance costs. This translates into a monthly increase of \$2.14 (\$55.52 per month total) for an average single-family residence and \$1.48 (\$38.44 per month total) for multi-family residences.

Capital and operating budgets are projected over a 20-year horizon and are updated on an alternating biennial cycle. The current capital budget projections include funding for major WPCP reconstruction and/or rehabilitation projects, which were ongoing in 2021. City budgets also provide for ongoing rehabilitation of the sewer system.

Staffing and Supervision

The WPCP is operated and maintained by the WPCP Division, with laboratory, pretreatment, regulatory, and technical support from the Regulatory Programs Division of ESD. Staffing is as follows:

Division Managers	The WPCP Division Manager is responsible for the overall operation and maintenance of the WPCP. The Regulatory Programs Division Manager supports the WPCP Division on regulatory issues, and has responsibility for the Laboratory, Pretreatment Program, and Compliance Programs, which also operate at the WPCP. Both Managers report to the ESD Director.
WPCP Managers	The WPCP Operations Manager (who also serves as the Chief Plant Operator) and WPCP Maintenance Manager report to the WPCP Division Manager. The Lab Manager reports to the Regulatory Programs Division Manager.
Operations Staff	25 full-time Operators, including two Principal Operators, four Senior Operators, and 19 Operators. In addition, there is one Utility Worker.
Maintenance Staff	One Senior Mechanic, eight Mechanics, and one Senior Storekeeper.
Laboratory Staff	Two Senior Environmental Chemists, three Chemists, and three Lab/Field Technicians.
Pretreatment/Compliance Inspection Staff	One Senior Inspector, five Environmental Compliance Inspectors, and two Lab/Field Technicians.
Compliance and Technical Support Staff	Three Environmental Engineering Coordinators and one WPCP Control Systems Integrator.

Operations

WPCP operations are performed by a highly skilled group of State Water Resources Control Board-certified Wastewater Operators organized into five shifts (Days I, Days II, Graves I, Graves II, and a training and coverage shift). Five Operators are assigned to cover each of the four, 12-hour shift schedules, including at least one Senior or Principal Operator (both the Senior and Principal Operators are Shift Supervisors as defined by the SWRCB). The WPCP places major emphasis on training new and existing Operators to develop and maintain a high level of operational skill. The Operator in Training (OIT) Program provides both mentoring and rigorous training in all areas of WPCP operations. The WPCP Operation & Maintenance (O&M) Manual and OIT Training Manual are key elements of the OIT Program. In addition to demonstrating an understanding of the concepts and practices in the O&M Manual, OITs must also be familiar with all applicable Standard Operating Procedures (SOPs) and be trained by veteran operators and then be signed-off by a shift supervisor in 32 task-specific SOPs before being allowed to perform those tasks independently. All OITs work with other highly trained veteran operators that provide direct supervision as defined by the SWRCB. Safety training is an ongoing and mandatory process for all Operators, and numerous elective training and career advancement opportunities are also provided.

Operators perform all routine WPCP operational tasks, special assignments and are responsible for preventative maintenance, as described under the Plant Maintenance Program in **Section 2.0** of this Chapter. Operators receive ongoing support from the WPCP Chief Plant Operator, Division Manager, Support Services staff, and outside consultants.

Maintenance

WPCP maintenance is performed by a skilled crew of eight journey-level Maintenance Mechanics under the supervision of one Senior Mechanic with the direction of the WPCP Maintenance Manager. Maintenance staff is responsible for the corrective maintenance and major preventive maintenance tasks, with certain specialty maintenance functions (such as PGF engine overhauls) performed by outside contractors. Maintenance staff has mandatory training requirements in addition to opportunities for elective trainings. The Maintenance section currently uses the Infor EAMS CMMS, as described under the Plant Maintenance Program. WPCP Maintenance staff work collaboratively with the Water and Sewer Systems Division to maintain the wastewater and stormwater sewer systems. The Division also utilizes outside contractors for specialty services and receives engineering and regulatory support from other City work units and consultants.

Collection System

The sanitary sewer collection system is operated and maintained by the ESD Water and Sewer Systems Division whose offices are located at the City's Corporation Yard. WPCP and Water and Sewer services are supported by administrative staff at the WPCP and Corporation Yard, the ESD Director, the ESD Regulatory Programs Division, the Department of Public Works Engineering Division (providing engineering support for CIP projects), and staff from other City Departments. The City also has contracts with various consultant firms for technical and regulatory support, planning studies, engineering design for CIP projects, and other needs. Staffing is as follows (wastewater-related positions only):

Division Managers	The Water and Sewer Systems Division Manager is responsible for the overall operation and maintenance of the potable water distribution, sanitary sewer and storm water collection systems, and shares responsibility with the WPCP Division Manager for the production of recycled water. The Division Manager reports to the ESD Director.
Managers	The Senior Environmental Engineer whose role includes acting as the Wastewater Operations Manager reports to the Water and Sewer Systems Division Manager.
Operations and Maintenance Staff	13 full-time workers, including a Wastewater Collections Supervisor, two Wastewater Collections Crew Leaders, three Senior Wastewater Collections Workers, and seven Maintenance Worker I/II.

Shared Technical Support and Maintenance Staff

Several positions in the Water Program and at the WPCP provide shared support services to the Wastewater Collections program. These include: one Senior Mechanic, eight Mechanics, and one Senior Storekeeper who are shared between the WPCP and the Wastewater Operations program. In addition, one Senior Civil Engineer, one Water Distribution Supervisor, one Water Distribution Crew Leader, one Senior Water Distribution Worker, and two water distribution Workers are shared between the Water Program and Wastewater Operations program.

A series of prioritized CIP projects have been developed for the sewer system in addition to allocating funding annually for ongoing emergency or incidental sewer repair and rehabilitation. In 2018, the City completed construction of the 2016-2017 Sanitary Sewer Main Replacement Phase 4 project, and the Baylands Storm Pump Station No. 2 Rehabilitation Project. In addition, the City solicited bids for the Storm Pump Station No. 1 upgrade project which is addressing the immediate needs identified in a previous condition assessment project. The project includes seismic upgrades, the replacement of discharge piping and inlet grating to protect wet wells, completed the design of the Lawrence Sanitary Sewer Trunk Main Rehabilitation Phase 1 project. On December 8, 2020, the City council awarded $4.1 million contract for construction.

In 2019, the City began design of the 2019-2020 Sanitary Sewer Main Replacement project. As a part of the project, approximately 4,900 linear feet will be replaced at a budgeted cost of $4.7 million. In 2019, the City completed the Sanitary Sewer Siphon Cleaning Phase I Project, and an additional $743,000 was budgeted to complete the siphon cleaning in 2021. In addition, the City awarded a contract to upgrade and expand its sanitary sewer hydraulic model which will be completed in 2022. The City also manages its own construction crews and performs point repairs regularly, as well as manhole and lateral repairs.

4.0. CONTINGENCY PLAN

During the 2021 reporting period, the City made significant revisions to the Contingency Plan to reflect current operational practices and equipment at the WPCP. The update was originally planned to be completed as part of the Headworks and Primary Treatment Facilities Project[4] commissioning packet submitted to the RWQCB per Provision VI.C.5.d of the current permit. However, due to construction delays primarily associated with difficulties in PG&E negotiations, necessary updates to the existing facilities were completed in 2021 that do not reflect the new facilities. The City will perform a similar update following the commissioning process and operational experience with the new facilities in 2022. The WPCP will continue its practice of reviewing the Contingency Plan annually and updating to reflect substantive changes to operational practices and equipment.

[4] The Headworks and Primary Treatment Facilities Project will enhance overall treatment reliability through new influent pumping facilities, use of influent screens, a new electrical distribution system (initially for the primary facilities and later to be expanded to the entire plant), and a permanently installed 2 MW back-up power system that will be able to service all the WPCP's electrical loads.

5.0. SPILL PREVENTION CONTROL AND COUNTERMEASURE

The Spill Prevention Control and Countermeasure (SPCC) Plan is documented in the Contingency Plan and has not changed. The SPCC Plan also addresses spill response for non-wastewater spills at the WPCP.

IV. SUNNYVALE CAPITAL IMPROVEMENT PROGRAM

1.0. OVERVIEW

The original components of the WPCP were completed in 1956 and many are still in service. Most of the other major components of the WPCP were completed over the subsequent 15-20 years. Based on a 2006 Asset Condition Assessment Report, the City began implementing several rehabilitation projects and developed a long-term Strategic Infrastructure Plan to serve as a road map for the physical improvements and process enhancements needed to maintain a high level of treatment and to meet current and expected regulatory requirements and stewardship objectives. To help implement the Strategic Infrastructure Plan, in 2013, the City secured the professional services of an engineering design team of consultants to develop a Capital Improvement Program (CIP) and comprehensive Master Plan, which included the "basis of design" development for the various process areas to be rebuilt and a Programmatic Environmental Impact Report.

The City Council approved the WPCP's Master Plan and PEIR in August 2016, thereby authorizing the City to begin implementing the design and construction of the various components necessary to complete the massive 20-year reconstruction project, also known as the Sunnyvale Cleanwater Program (CWP). With an estimated cost of approximately $850 million, the CWP will replace the WPCP's aging infrastructure and operation. **Table 5** lists current major projects within the CIP, including several from the CWP. Key projects currently underway and recently completed are highlighted in the table and presented in Fact Sheets[5].

Figure 30: View of the WPCP Looking East

[5] CIP information gathered from the *Adopted Budget and Resource Allocation Plan for the City of Sunnyvale Fiscal Year 2021-2022, Volume II – Project Budget*.

Table 5: Summary of select CIP Projects at the WPCP

CIP Project Name	Estimated Project Life Total Cost	Status	Estimated Completion Date	Treatment Process Improvements					
				Headworks	Primary	Secondary	Tertiary	Solids Handling	PGF
Condition Assessment and Existing Plant Rehabilitation	$ 71,697,170	A	2024			X	X		
Headworks and Primary Treatment Facilities	$ 123,182,399	A	2022	X	X				
Secondary Treatment and Dewatering Facilities	$274,259,177	A	2026			X	X	X	
Cleanwater Center (Stage 1)	$ 4,553,092	A	2022	X	X	X	X	X	X
Biosolids Processing	$ 24,197,961	A	2026		X	X		X	
Levee Rehabilitation	$ 9,416,728	A	2028			X			
Electronic O&M Manual	$ 514,080	A	2021	X	X	X	X	X	X
Solids/Dewatering Repairs	$ 575,000	A	2021					X	
CWP Program Management	$ 66,700,591	A	2030	X	X	X	X	X	X
CWP Construction Management	$ 35,566,001	A	2030	X	X				
Waste Gas Burner Replacement	$ 3,396,134	A	2026						X
Primary Process Repairs	$ 562,441	A	2021		X				
Secondary Process Repairs	$ 844,809	A	2023			X			
Tertiary Process Repairs	$ 2,855,716	A	2023				X		
Support Facilities Repairs	$ 1,282,834	A	2025	X	X	X	X	X	X
CIP Total	***$ 620,695,894***								

Notes:

1) Rows highlighted indicate key projects presented in Fact Sheets in the following section.
2) Status Legend: A = Active, C =Completed

2.0. CONDITION ASSESSMENT & EXISTING PLANT REHABILITATION

SUNNYVALE

CLEANWATER

PROGRAM

ASSESSMENT CONTRACTOR

AECOM

REHABILITATION DESIGN

Carollo Engineers

Brown and Caldwell

START DATE

May 2017

PROJECT STATUS

Condition Assessment

Completed

Nov 2017

Rehabilitation Design

In Progress

100% Design

Facilities Rehabilitation

Pending

Bidding - Spring 2022

Sunnyvale

Condition Assessment and Existing Plant Rehabilitation

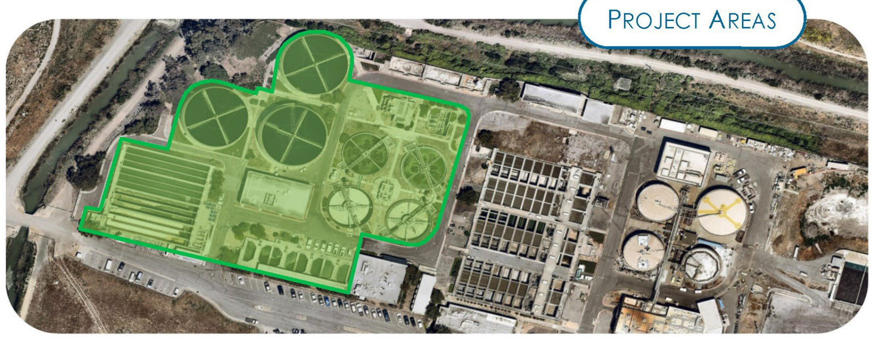
WHAT IS IT?

Under the Condition Assessment project, the contractor performed physical assessments of critical equipment and structures within the secondary and tertiary process areas of the WPCP. Their findings and recommendations are being used to refine the scope for facility rehabilitation project, which will ensure the plant facilities remain functional until Stage 2 of the Secondary treatment facilities are complete or through 2035±.

WHY?

Due to the age of overall facilities at the WPCP, critical elements of the existing treatment processes need to be rehabilitated or replaced to maintain permit compliance and keep them operational until they are fully replaced with the final build-out of all the conventional activated sludge (CAS) facilities (2035±). Furthermore, the WPCP's Master Plan identified more than 30 capital improvement projects, of which a detailed condition assessment was needed to further quantify existing conditions prior to implementing facilities rehabilitation projects.

PROJECT AREAS



3.0. HEADWORKS AND PRIMARY TREATMENT FACILITIES

SUNNYVALE
CLEANWATER
PROGRAM

DESIGN FIRM

Carollo Engineers

CONSTRUCTION FIRMS

Anderson Pacific (P1)
OVERAA (P2)

START DATE

July 2016

PROJECT STATUS

Package 1

Completed
October 2017

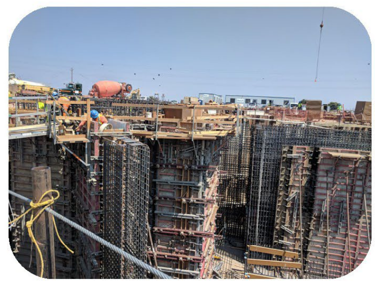
Package 2

In Progress
Start-up &
Commissioning

Sunnyvale

Headworks and Primary Treatment Facilities

WHAT IS IT?



The Headworks and Primary Treatment Facilities project includes the phased design and construction of new headworks, primary sedimentation tanks, influent pump station, grit removal facilities, and associated electrical, mechanical, and control systems. Along with the use of modern sedimentation tank design for solids removal, the new facilities will improve protection of downstream processes and biosolids quality through use of bar screens and high-efficiency grit basins. This project also includes the construction of the first phase of a flood wall that will ultimately surround and protect the WPCP from future flood events.

WHY?

Much of these facilities were part of the original plant built in 1956 and do not meet current seismic requirements, leaving them vulnerable to earthquake damage. The concrete in these tanks is eroding and exposing the reinforced steel inside the structures. Full replacement and relocation of these facilities as recommended in the WPCP's Strategic Infrastructure Plan (2010) is currently underway and expected to be complete in summer 2022.

4.0. SECONDARY TREATMENT AND DEWATERING FACILITIES

SUNNYVALE

CLEANWATER

PROGRAM

DESIGN FIRM

Carollo Engineers

CONSTRUCTION FIRMS

TBD

START DATE

Aug 2016

PROJECT STATUS

Design

In Progress

100% Design

Site Preparation Package

Main Package

Pending

Bidding - Spring 2022

Sunnyvale

Secondary Treatment and Dewatering Facilities

WHAT IS IT?

This project will be split into two Packages due to its size, complexity, and space constraints. The Site Preparation Package includes the demolition of existing facilities and construction of temporary offices and Maintenance Building. The Main Package will include the design and construction of a Conventional Activated Sludge (CAS) system and Thickening and Dewatering Facility. This project will also include the construction of a DEMON sidestream treatment system, digested sludge storage tank, 2 MW emergency generator, odor control facility, and associated appurtenances along with other various improvements to existing facilities. The remaining segments of the flood wall will are also part of this Project.

WHY?

This project will improve the reliability and performance of secondary treatment at the WPCP while also providing contingencies for meeting anticipated future regulatory requirements. The CAS system will be operated in parallel with the existing secondary system in a split flow configuration, with the CAS system forming the main secondary treatment process. Once the CAS system is completed, a Thickening and Dewatering Facility will be constructed to process the additional biosolids generated during anaerobic digestion with support from a DEMON system to process associated nitrogen loads. Odors will be abated by the odor control facility.

PROJECT AREAS

5.0. CLEANWATER CENTER

SUNNYVALE
CLEANWATER
PROGRAM

DESIGN FIRM
MWA Architects

CONSTRUCTION FIRM
TBD

START DATE
September 2017

PROJECT STATUS
Design
In Progress
90% Design

Construction
Pending

Sunnyvale

Cleanwater Center

WHAT IS IT?

The Cleanwater will provide a much needed facility update to the WPCP by replacing the functionality of the existing Admin Building, Laboratory, and Maintenance Shop under one roof. Additional offices will be added to provide a common space to foster collaboration amongst various groups from within the WPCP and Regulatory Programs Divisions that are presently spread across different facilities. The Cleanwater Center will be designed to meet U.S. Green Building Council LEED standards.

WHY?

The City is engaged in the Sunnyvale Cleanwater Program to renovate the existing WPCP in order to reliably treat and dispose of municipal sewage over the next 30 or more years. The current Administration Building is outdated and in the path of the new floodwall. Construction of a new Administration, Laboratory, and Maintenance Building will not only provide a much needed facility update, but will also provide additional office space for City staff that are currently spread across various facilities.

PROJECT AREAS

6.0. OXIDATION POND AND DIGESTER DEWATERING

SUNNYVALE CAPITAL IMPROVEMENT PROGRAM

CONTRACTOR
Synagro

START DATE
January 2014

PROJECT STATUS
In progress

Solids Dewatering

WHAT IS IT?

The Synagro Dewatering project was initiated in 2009 to address the accumulation of solids in the Oxidation Ponds through dredging and dewatering with a centrifuge prior to hauling off-site for beneficial reuse. No solids had been removed since the ponds were converted for use as a secondary treatment process in the late 1960s. In late February, 2015, Synagro's processing work site was relocated to the north side of the Primary Sedimentation Basins to make way for the new Primary Treatment Facilities. In addition to pond solids, Synagro began dewatering digester solids on a belt filter press following their relocation. Previously, digester solids were dewatered by Operations staff in a system that used slotted dewatering tiles to drain excess water before moving them to a solar drying tarmac. The new configuration will likely continue until the new dewatering facility is constructed.

WHY?

According to a 2006 study, solids carried over from various stages in the WPCP's treatment process have accumulated to an estimated 35-45% of pond volume, resulting in a decline in treatment capacity and efficacy.

7.0. LEVEE MAINTENANCE PROGRAM

SUNNYVALE

CAPITAL IMPROVEMENT

PROGRAM

ASSESSMENT FIRM

Cal Engineering & Geology, Inc. and NVS

DEVELOPMENT FIRM

HDR

START DATE

April 2016

PROJECT STATUS

O&M Manual

Completed

November 2018

Levee Repairs

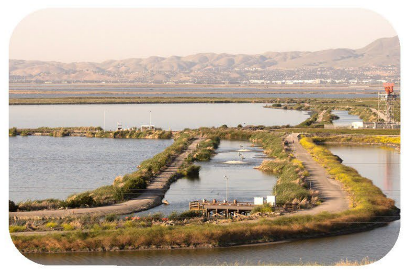
In Progress

Pending City Council Approval

Sunnyvale

Levee Rehabilitation

WHAT IS IT?



The City has developed the Operation and Maintenance Manual of Oxidation Pond Levees (O&M) to assist in managing repairs and maintenance efforts for the existing levees surrounding the Water Pollution Control Plant (WPCP) ponds. The 440 acres of Oxidation Ponds at the WPCP are enclosed by inner and outer levee roads that are in various stages of erosion. The inner levees form the pond distribution and recirculation channels, and the outer levees are responsible for containing the wastewater and preventing its release into the environment. In 2016, contractors completed the Levee Asset Management Plan (LAMP), a comprehensive condition assessment of the city roads and bridges, which included the WPCP pond levees. The City has used the results to complete a corresponding digital GIS mapping and O&M to successfully monitor and maintain the levees for the next 20 plus years.

WHY?

The levee roads are critical to the successful operation of the WPCP for the next 20 plus years. These levees are in various stages of erosion and require immediate attention to safeguard public and WPCP staff safety.

PROJECT AREAS

8.0. ELECTRONIC O&M MANUAL

SUNNYVALE

CAPITAL IMPROVEMENT

PROGRAM

CONTRACTOR

Atlassian

START DATE

August 2018

PROJECT STATUS

In Progress

Sunnyvale

Electronic O&M Manual

WHAT IS IT?

This project includes the implementation of a comprehensive Electronic Operations & Maintenance Manual for the WPCP to replace the current limited, narrative-based, paper O&M manual. The goal of the electronic O&M manual is to develop a living document repository and interface where information pertinent to operations and maintenance is located and that leverages information in the City's other enterprise applications. Quick access to facility documentation is imperative to effective process operations and troubleshooting by reducing the amount of time spent searching through endless folders of partially obsolete information.

WHY?

With the reconstruction of the Water Pollution Control Plant already underway, an intuitive method of storing and retrieving all of the facility documentation is needed. With significant changes in nearly every future process, Operations and Maintenance staff will need a centralized, user friendly, interface that allows access to SOPs, record drawings, equipment information, process control descriptions, operating manuals, regulatory information and historical data from LIMS, EAMS/CMMS and SCADA. An electronic O&M manual would facilitate training new employees, refreshing the knowledge of existing staff and function as an up-to-date reference for a wide variety of information.

PROJECT AREAS

9.0. ASSET MANAGEMENT PROGRAM

SUNNYVALE

CAPITAL IMPROVEMENT

PROGRAM

CONTRACTOR

The Arcanum Group

START DATE

May 2017

PROJECT STATUS

<u>Go-Live</u>

Completed

March 2018

<u>Single Sign-On (SSO)</u>

Completed

June 2019

Sunnyvale

Asset Management Program

WHAT IS IT?

WPCP infrastructure consists of approximately 3,225 assets that each have life expectancy and maintenance needs. The WPCP's Asset Management Program is a strategic, organization-wide program that achieves an appropriate balance of risk, cost, performance and longevity to maximize asset value. The WPCP's Asset Management Program is supported by an Asset Information System, which is the main business process tool used for tracking asset maintenance needs, repair costs, and life cycle costs used in evaluating replacement versus repair decisions at the Plant. The project is intended to update the Asset Management Program at the WPCP and upgrade the existing, outdated and unsupported Maximo Asset Management System with a new Enterprise Asset Management System (EAMS) that will better align with the needs of the new Plant being built as part of the Clean Water Program. 'Infor EAM' was selected as the new EAMS and went live in March of 2018.

WHY?

The WPCP's Asset Management Program contributes to the economic health of the WPCP by keeping its facilities and infrastructure functioning effectively at the lowest life cycle cost. The WPCP's Asset Information System received its last major upgrade at the WPCP in 1999 and has not been supported by the manufacturer since 2008. City IT staff assessed the current Maximo system as unstable and prone to frequent failures causing significant disruption to work flow and availability of assets in a critical situation.

PROJECT AREAS

V. PERMIT SPECIAL STUDIES

Neither the current Order (R2-2020-0002) nor the most previous Order (R2-2014-0035) contained requirements for the City to conduct any special studies. Under Order R2-2009-0061, the City was required to perform several special studies, including 1) Chronic Toxicity Identification and Toxicity Reduction Study; 2) Receiving Water Ammonia Characterization Study; and 3) Total Suspended Solids Removal Study. All of these special studies were completed and reported prior to 2015.

VI. OTHER STUDIES AND PROGRAMS

1.0. EFFLUENT CHARACTERIZATION STUDY AND REPORT

The WPCP is required under Provision VI.C.2 of its current NPDES permit to continue to characterize and evaluate the final effluent to verify that the reasonable potential analysis conclusions of the current Order remain valid and to inform the next permit issuance. No priority pollutant data other than the parameters listed in **Chapter II** were collected in 2021 as the WPCP elected participate in the *Alternate Monitoring and Reporting Requirements for Municipal Wastewater Discharges (Order No. R2-2016-0008)* and divert the analytical costs associated with priority pollutant monitoring to supplement the Regional Monitoring Program. This requirement was previously satisfied under Order R2-2014-0035 with monitoring performed in 2015, and data showed no significant increases were observed between the datasets where analytical results were above detection limits.

2.0. NUTRIENT MONITORING FOR REGIONAL NUTRIENT PERMIT

In 2021, the City continued to collect influent and effluent samples for analysis of nutrients in accordance with the Order R2-2019-0017. As required by that Order, results from the WPCP's ongoing monitoring are submitted electronically to CIWQS in monthly SMRs. These results are compiled by BACWA into a group annual report and submitted to the RWQCB. In addition, the WPCP has elected to include nutrient data in **Chapter II, Section 1.5** of this report.

3.0. REGIONAL WATER MONITORING PROGRAM

Provision VI in Attachment E of the WPCP's current NPDES permit requires the City to continue its participation in the Regional Water Monitoring Program (RMP), which was formally established in 1993 and is the only comprehensive environmental monitoring program to measure pollutants and trends in the SF Bay. The goal of the RMP is to collect data and communicate information about water quality in the SF Bay in support of management decisions. The accomplishments of the RMP over the past two years are summarized in The Pulse of the Bay report.

In March 2016, the Water Board adopted Order R2-2016-0008, establishing an alternative monitoring requirement (AMR) for municipal wastewater discharges to San Francisco Bay and its tributaries, in exchange for a set schedule of increased payments to the RMP. Participating wastewater treatment facilities who opt-in to this alternative can reduce their effluent monitoring costs for most organic priority pollutants and chronic toxicity species rescreening. In exchange for the reduced monitoring requirements, facilities make supplemental payments to the RMP for regional studies to inform management decisions about water quality in the Bay. Through these financial contributions, the RMP is able to conduct regional monitoring to assess the cumulative impact of multiple sources of pollutants to the SF Bay. The City's RMP participation is documented in a letter issued by BACWA annually, located at https://bacwa.org/wp-content/uploads/2022/01/BACWA-NPDES-Permit-Letter-2022-with-SFEI-attach.pdf

ATTACHMENTS

ATTACHMENT A

Wastewater Treatment Process Schematic

Solids Treatment Process Schematic

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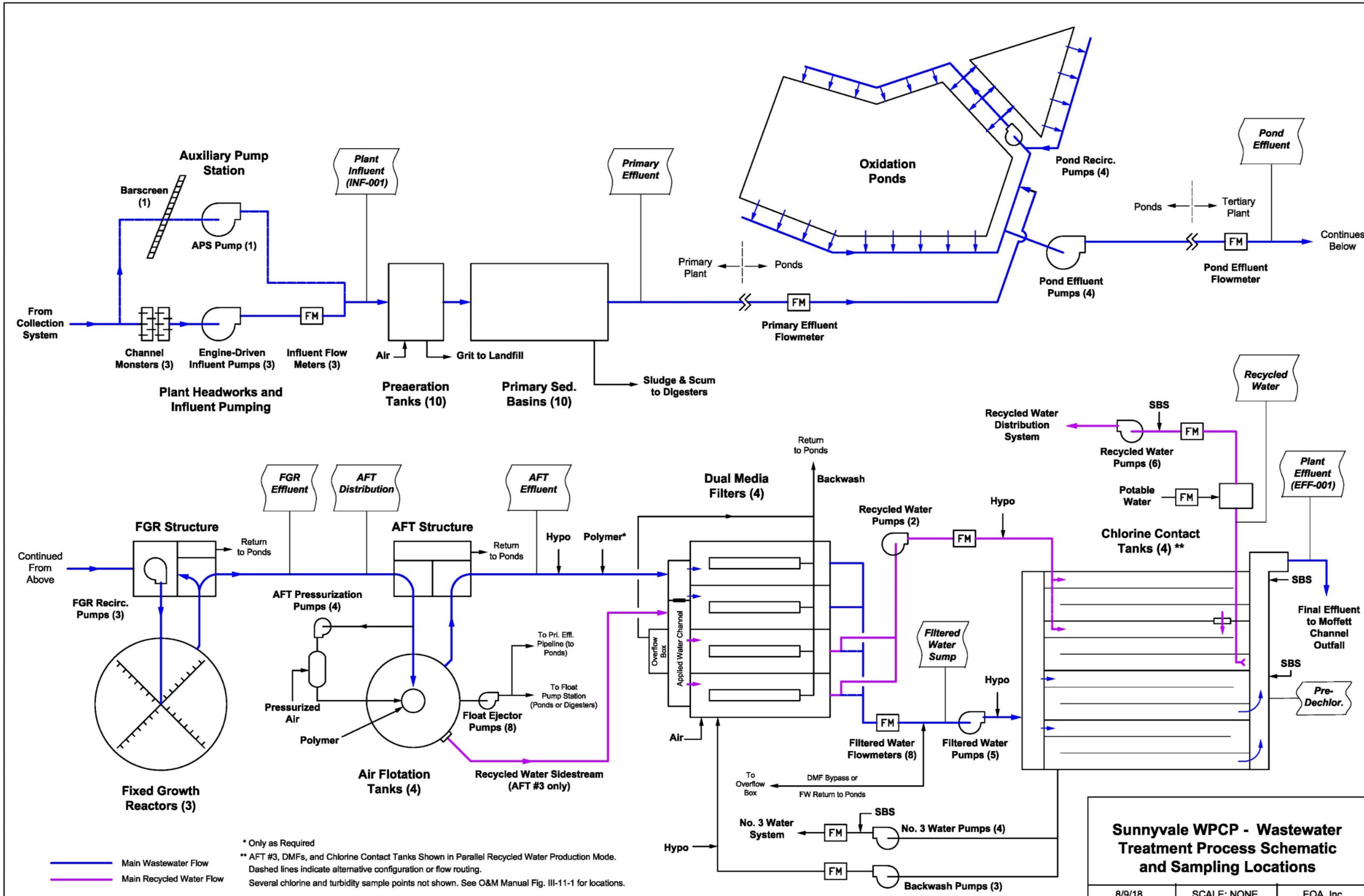
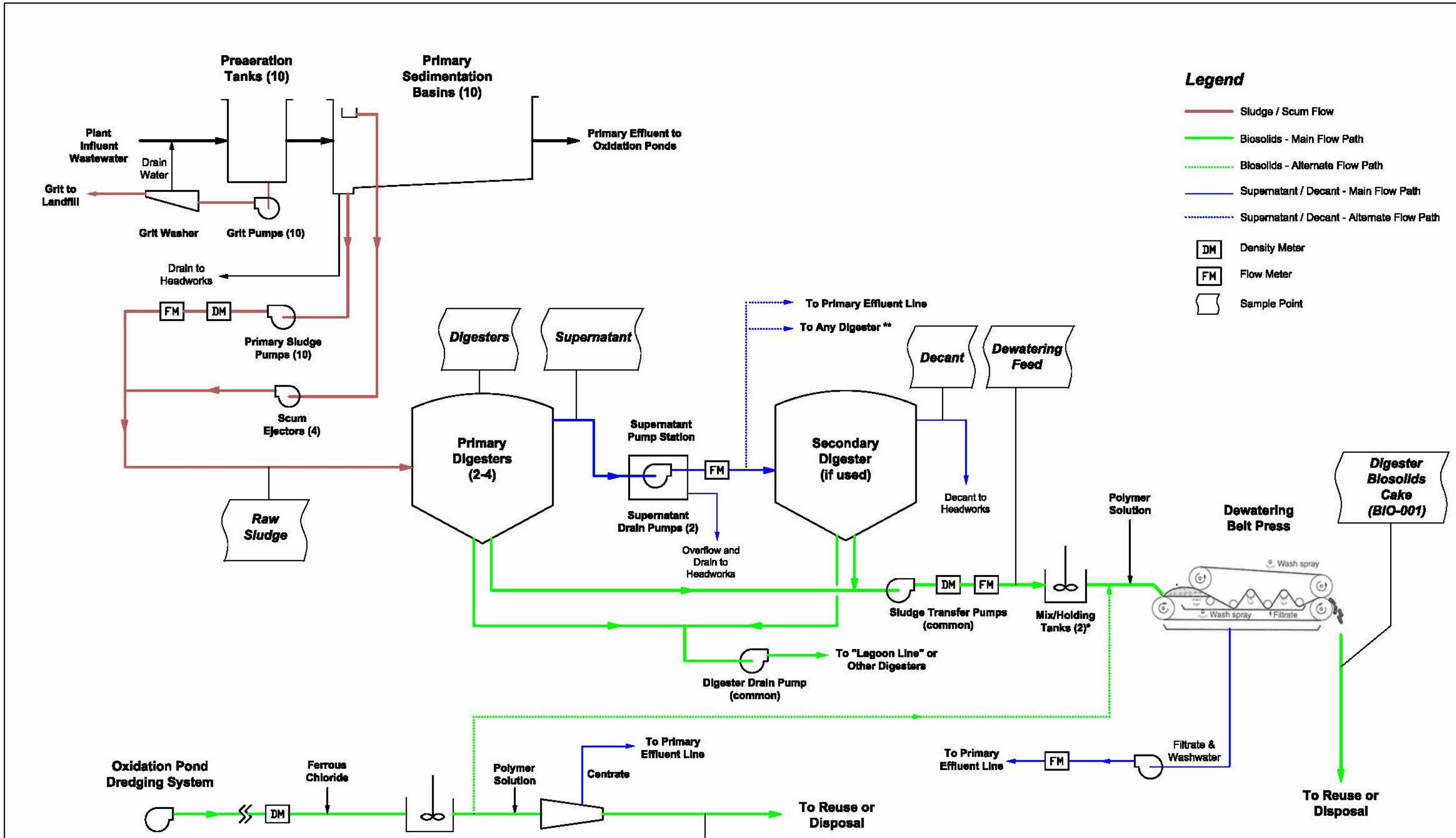


Auxiliary Pump Station
Barscreen (1)
APS Pump (1)
Plant Influent (INF-001)
Primary Effluent
Oxidation Ponds
Pond Recirc. Pumps (4)
Pond Effluent
Ponds
Tertiary Plant
Continues Below
Pond Effluent Flowmeter
Pond Effluent Pumps (4)
Primary Plant
Ponds
Primary Effluent Flowmeter
From Collection System
Channel Monsters (3)
Engine-Driven Influent Pumps (3)
Influent Flow Meters (3)
Air
Grit to Landfill
Sludge & Scum to Digesters
Plant Headworks and Influent Pumping
Preaeration Tanks (10)
Primary Sed. Basins (10)
Recycled Water
Recycled Water Distribution System
SBS
Recycled Water Pumps (6)
Potable Water
Plant Effluent (EFF-001)
Return to Ponds
Backwash
Dual Media Filters (4)
FGR Effluent
AFT Distribution
AFT Effluent
FGR Structure
AFT Structure
Continued From Above
Return to Ponds
Return to Ponds
Hypo
Polymer*
Recycled Water Pumps (2)
Hypo
Chlorine Contact Tanks (4) **
SBS
Final Effluent to Moffett Channel Outfall
FGR Recirc. Pumps (3)
AFT Pressurization Pumps (4)
To Pri. Effl. Pipeline (to Ponds)
To Float Pump Station (Ponds or Digesters)
Overflow Box
Applied Water Channel
Filtered Water Sump
Hypo
SBS
Pre-Dechlor.
Pressurized Air
Polymer
Float Ejector Pumps (8)
Air
Filtered Water Flowmeters (8)
Filtered Water Pumps (5)
Fixed Growth Reactors (3)
Air Flotation Tanks (4)
Recycled Water Sidestream (AFT #3 only)
To Overflow Box
DMF Bypass or FW Return to Ponds
SBS
No. 3 Water System
No. 3 Water Pumps (4)
Hypo
Backwash Pumps (3)
FM
Main Wastewater Flow
Main Recycled Water Flow
* Only as Required
** AFT #3, DMFs, and Chlorine Contact Tanks Shown in Parallel Recycled Water Production Mode.
Dashed lines indicate alternative configuration or flow routing.
Several chlorine and turbidity sample points not shown. See O&M Manual Fig. III-11-1 for locations.
Sunnyvale WPCP - Wastewater Treatment Process Schematic and Sampling Locations
8/9/18
SCALE: NONE
EOA, Inc.



NOTES:

Digester piping is simplified for this schematic.

* Mix/Holding tanks for pond and digester solids are shown separate for clarity, but are actually the same tanks.

** Any digester can be configured as either a primary or secondary digester.

Sunnyvale WPCP - Solids Treatment Process Schematic and Sampling Locations

1/28/20	Scale: None	EOA, Inc.

ATTACHMENT B

WPCP Certificate of Environmental Accreditation

WPCP Approved Analyses

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CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

CERTIFICATE OF ENVIRONMENTAL LABORATORY ACCREDITATION

Is hereby granted to

City of Sunnyvale Environmental Laboratory

Regulatory Programs Division

1444 Borregas Avenue

Sunnyvale, CA 94088

Scope of the certificate is limited to the
"Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on compliance with applicable laws and regulations, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **1340**

Effective Date: **11/1/2020**

Expiration Date: **10/31/2022**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

CALIFORNIA STATE
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Fields of Accreditation

City of Sunnyvale Environmental Laboratory
Regulatory Programs Division
1444 Borregas Avenue
Sunnyvale, CA 94088
Phone: 4087307260

Certificate Number: 1340
Expiration Date: 10/31/2022

Field of Accreditation: 101 - Microbiology of Drinking Water

101.010	002	Heterotrophic Bacteria	SimPlate
101.050	001	Total Coliform P/A	SM 9223 B Colilert
101.050	002	E. coli P/A	SM 9223 B Colilert
101.050	003	Total Coliform (Enumeration)	SM 9223 B Colilert
101.050	004	E. coli (Enumeration)	SM 9223 B Colilert

Field of Accreditation: 102 - Inorganic Chemistry of Drinking Water

102.030	003	Chloride	EPA 300.0
102.030	006	Nitrate (as N)	EPA 300.0
102.030	008	Phosphate, Ortho (as P)	EPA 300.0
102.030	009	Sulfate (as SO4)	EPA 300.0
102.095	001	Turbidity	SM 2130 B-2001
102.100	001	Alkalinity	SM 2320 B-1997
102.121	001	Hardness	SM 2340 C-1997
102.130	001	Specific Conductance	SM 2510 B-1997
102.148	001	Calcium	SM 3500-Ca B-1997
102.175	001	Chlorine, Free	SM 4500-Cl G-2000
102.175	002	Chlorine, Total Residual	SM 4500-Cl G-2000
102.203	001	Hydrogen Ion (pH)	SM 4500-H+ B-2000
102.220	001	Nitrite (as N)	SM 4500-NO2 B-2000

Field of Accreditation: 103 - Toxic Chemical Elements of Drinking Water

103.140	001	Aluminum	EPA 200.8
103.140	002	Antimony	EPA 200.8
103.140	003	Arsenic	EPA 200.8
103.140	004	Barium	EPA 200.8
103.140	005	Beryllium	EPA 200.8
103.140	006	Cadmium	EPA 200.8
103.140	007	Chromium	EPA 200.8
103.140	008	Copper	EPA 200.8
103.140	009	Lead	EPA 200.8
103.140	010	Manganese	EPA 200.8
103.140	012	Nickel	EPA 200.8
103.140	013	Selenium	EPA 200.8
103.140	014	Silver	EPA 200.8

As of 11/1/2021 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

103.140	015	Thallium	EPA 200.8
103.140	016	Zinc	EPA 200.8
103.140	017	Boron	EPA 200.8
103.140	018	Vanadium	EPA 200.8

Field of Accreditation: 104 - Volatile Organic Chemistry of Drinking Water

104.040	001	Benzene	EPA 524.2
104.040	007	n-Butylbenzene	EPA 524.2
104.040	008	sec-Butylbenzene	EPA 524.2
104.040	009	tert-Butylbenzene	EPA 524.2
104.040	010	Carbon Tetrachloride	EPA 524.2
104.040	011	Chlorobenzene	EPA 524.2
104.040	015	2-Chlorotoluene	EPA 524.2
104.040	016	4-Chlorotoluene	EPA 524.2
104.040	019	1,3-Dichlorobenzene	EPA 524.2
104.040	020	1,2-Dichlorobenzene	EPA 524.2
104.040	021	1,4-Dichlorobenzene	EPA 524.2
104.040	022	Dichlorodifluoromethane	EPA 524.2
104.040	023	1,1-Dichloroethane	EPA 524.2
104.040	024	1,2-Dichloroethane (Ethylene Dichloride)	EPA 524.2
104.040	025	1,1-Dichloroethylene (1,1-Dichloroethene)	EPA 524.2
104.040	026	cis-1,2-Dichloroethylene (cis 1,2 Dichloroethene)	EPA 524.2
104.040	027	trans-1,2-Dichloroethylene (trans- 1,2 Dichloroethene)	EPA 524.2
104.040	028	Dichloromethane (Methylene Chloride)	EPA 524.2
104.040	029	1,2-Dichloropropane	EPA 524.2
104.040	033	cis-1,3-Dichloropropylene (cis 1,3 Dichloropropene)	EPA 524.2
104.040	034	trans-1,3-Dichloropropylene (trans-1,3 Dichloropropene)	EPA 524.2
104.040	035	Ethylbenzene	EPA 524.2
104.040	037	Isopropylbenzene	EPA 524.2
104.040	039	Naphthalene	EPA 524.2
104.040	041	N-propylbenzene	EPA 524.2
104.040	042	Styrene	EPA 524.2
104.040	043	1,1,1,2-Tetrachloroethane	EPA 524.2
104.040	044	1,1,2,2-Tetrachloroethane	EPA 524.2
104.040	045	Tetrachloroethylene (Tetrachloroethene)	EPA 524.2
104.040	046	Toluene	EPA 524.2
104.040	047	1,2,3-Trichlorobenzene	EPA 524.2
104.040	048	1,2,4-Trichlorobenzene	EPA 524.2
104.040	049	1,1,1-Trichloroethane	EPA 524.2
104.040	050	1,1,2-Trichloroethane	EPA 524.2
104.040	051	Trichloroethylene (Trichloroethene)	EPA 524.2
104.040	052	Trichlorofluoromethane	EPA 524.2
104.040	054	1,2,4-Trimethylbenzene	EPA 524.2

104.040	055	1,3,5-Trimethylbenzene	EPA 524.2
104.040	056	Vinyl Chloride	EPA 524.2
104.040	058	m-Xylene	EPA 524.2
104.040	059	o-Xylene	EPA 524.2
104.040	060	p-Xylene	EPA 524.2
104.045	001	Bromodichloromethane	EPA 524.2
104.045	002	Bromoform	EPA 524.2
104.045	003	Chloroform	EPA 524.2
104.045	004	Dibromochloromethane (Chlorodibromomethane)	EPA 524.2
104.050	002	Methyl tert-butyl Ether (MTBE)	EPA 524.2
104.050	005	Trichlorotrifluoroethane (Freon 113)	EPA 524.2

Field of Accreditation:107 - Microbiological Methods for Non-Potable Water and Sewage Sludge

107.017	001	Enterococci	Enterolert

Field of Accreditation:108 - Inorganic Constituents in Non-Potable Water

108.007	001	Residue, Volatile	EPA 160.4 (1971)
108.015	001	Calcium	EPA 200.8 (1994 Rev. 5.4)
108.015	002	Magnesium	EPA 200.8 (1994 Rev. 5.4)
108.015	003	Potassium	EPA 200.8 (1994 Rev. 5.4)
108.015	005	Sodium	EPA 200.8 (1994 Rev. 5.4)
108.047	001	Phenols, Total	EPA 420.1 (1978 Rev. 1.0)
108.059	001	Turbidity	SM 2130 B-2011
108.063	001	Alkalinity	SM 2320 B-2011
108.067	001	Hardness	SM 2340 C-2011
108.069	001	Specific Conductance	SM 2510 B-2011
108.071	001	Residue, Total	SM 2540 B-2011
108.073	001	Residue, Filterable TDS	SM 2540 C-2011
108.075	001	Residue, Non-filterable TSS	SM 2540 D-2011
108.087	001	Calcium	SM 3500-Ca B-2011
108.105	001	Chlorine, Total Residual	SM 4500-Cl C-2011
108.125	001	Cyanide, Total	SM 4500-CN E-2011
108.131	001	Fluoride	SM 4500-F C-2011
108.137	001	Hydrogen Ion (pH)	SM 4500-H+ B-2011
108.140	001	Ammonia (as N)	SM 4500-NH3 D-2011
108.153	001	Nitrite (as N)	SM 4500-NO2 B-2011
108.165	001	Oxygen, Dissolved	SM 4500-O C-2011
108.173	001	Oxygen, Dissolved	SM 4500-O G-2011
108.175	001	Phosphate,Ortho (as P)	SM 4500-P E-2011
108.175	002	Phosphorus,Total	SM 4500-P E-2011
108.207	001	Biochemical Oxygen Demand	SM 5210 B-2011
108.207	002	Carbonaceous BOD	SM 5210 B-2011
108.215	001	Organic Carbon-Total (TOC)	SM 5310 B-2011
108.251	001	Oxygen, Dissolved	ASTM D888-09C

108.325	001	Chemical Oxygen Demand	Hach 8000
108.331	001	Kjeldahl Nitrogen,Total (as N)	Hach 10242

Field of Accreditation:109 - Metals and Trace Elements in Non-Potable Water

109.625	001	Aluminum	EPA 200.8 (1994 Rev. 5.4)
109.625	002	Antimony	EPA 200.8 (1994 Rev. 5.4)
109.625	003	Arsenic	EPA 200.8 (1994 Rev. 5.4)
109.625	004	Barium	EPA 200.8 (1994 Rev. 5.4)
109.625	005	Beryllium	EPA 200.8 (1994 Rev. 5.4)
109.625	007	Cadmium	EPA 200.8 (1994 Rev. 5.4)
109.625	008	Chromium	EPA 200.8 (1994 Rev. 5.4)
109.625	009	Cobalt	EPA 200.8 (1994 Rev. 5.4)
109.625	010	Copper	EPA 200.8 (1994 Rev. 5.4)
109.625	012	Iron	EPA 200.8 (1994 Rev. 5.4)
109.625	013	Lead	EPA 200.8 (1994 Rev. 5.4)
109.625	014	Manganese	EPA 200.8 (1994 Rev. 5.4)
109.625	015	Molybdenum	EPA 200.8 (1994 Rev. 5.4)
109.625	016	Nickel	EPA 200.8 (1994 Rev. 5.4)
109.625	017	Selenium	EPA 200.8 (1994 Rev. 5.4)
109.625	018	Silver	EPA 200.8 (1994 Rev. 5.4)
109.625	019	Thallium	EPA 200.8 (1994 Rev. 5.4)
109.625	022	Vanadium	EPA 200.8 (1994 Rev. 5.4)
109.625	023	Zinc	EPA 200.8 (1994 Rev. 5.4)

Field of Accreditation:110 - Volatile Organic Constituents in Non-Potable Water

110.040	005	Benzene	EPA 624.1
110.040	006	Bromodichloromethane	EPA 624.1
110.040	007	Bromoform	EPA 624.1
110.040	008	Bromomethane (Methyl Bromide)	EPA 624.1
110.040	010	Carbon Tetrachloride	EPA 624.1
110.040	011	Chlorobenzene	EPA 624.1
110.040	012	Chloroethane	EPA 624.1
110.040	013	2-Chloroethyl vinyl Ether	EPA 624.1
110.040	014	Chloroform	EPA 624.1
110.040	015	Chloromethane (Methyl Chloride)	EPA 624.1
110.040	016	Dibromochloromethane (Chlorodibromomethane)	EPA 624.1
110.040	017	1,2-Dichlorobenzene	EPA 624.1
110.040	018	1,3-Dichlorobenzene	EPA 624.1
110.040	019	1,4-Dichlorobenzene	EPA 624.1
110.040	020	1,1-Dichloroethane	EPA 624.1
110.040	021	1,2-Dichloroethane (Ethylene Dichloride)	EPA 624.1
110.040	022	1,1-Dichloroethylene (1,1-Dichloroethene)	EPA 624.1
110.040	023	trans-1,2-Dichloroethylene (trans- 1,2 Dichloroethene)	EPA 624.1
110.040	024	1,2-Dichloropropane	EPA 624.1

As of 11/1/2021 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

110.040	025	cis-1,3-Dichloropropylene (cis 1,3 Dichloropropene)	EPA 624.1
110.040	026	trans-1,3-Dichloropropylene (trans-1,3 Dichloropropene)	EPA 624.1
110.040	029	Ethylbenzene	EPA 624.1
110.040	031	Methylene Chloride (Dichloromethane)	EPA 624.1
110.040	034	1,1,2,2-Tetrachloroethane	EPA 624.1
110.040	035	Tetrachloroethylene (Tetrachloroethene)	EPA 624.1
110.040	037	Toluene	EPA 624.1
110.040	038	1,1,1-Trichloroethane	EPA 624.1
110.040	039	1,1,2-Trichloroethane	EPA 624.1
110.040	040	Trichloroethylene (Trichloroethene)	EPA 624.1
110.040	041	Vinyl Chloride	EPA 624.1
110.040	045	Trichlorofluoromethane	EPA 624.1

Field of Accreditation: 113 - Environmental Toxicity Methods

113.013	003C	Rainbow trout (O. mykiss)	EPA 2019.0, Continuous Flow

Field of Accreditation: 126 - Microbiological Methods for Ambient Water

126.015	001	E. coli (Enumeration)	Colilert
126.019	001	Enterococci	Enterolert

As of 11/1/2021 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.