Bay Area Clean Water Agencies
Nutrient Reduction Study

Group Annual Report

Nutrient Watershed Permit Annual Report

2023

February 1, 2024

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1 Introduction

On May 8, 2019, the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) adopted the Nutrient Watershed Permit, also known as National Pollutant Discharge Elimination System (NPDES) Permit No. CA0038873, Regional Water Board Order No. R2-2019-0017. This permit replaces the previous permit under Order No. R2-2014-0014, which expired on June 30, 2019. The updated Nutrient Watershed Permit (Permit) became effective on July 1, 2019, and it covers each municipal Publicly Owned Treatment Works (POTW) that discharges to the San Francisco Bay and its tributaries. The purpose of this Nutrient Watershed Permit is to track and evaluate treatment plant performance, fund nutrient research and monitoring programs, support load response modeling, and evaluate nutrient reduction potential of recycled water and natural systems.

One of the requirements of the Permit is the reporting and analysis of influent and effluent nutrient monitoring data, and concentration and loading trends. Each agency's nutrient loads must also be compared to total POTW loads in their respective Subembayment, as defined in the Permit. An annual report is required to provide an ongoing record of these data and analyses.

The purpose of this Group Annual Report is to fulfill the reporting and analysis requirement of the Permit for the participating agencies for the period between Oct 1, 2012 and Sept 30, 2023. This report is focused on the addition of the most recent dataset from Oct 1, 2022 through Sept 30, 2023. This report includes the following sections:

- **Section 2 – Background.** This section includes relevant background information on the requirements of the Permit.
- **Section 3 – Approach.** This section presents the approach to obtain data, the constituents of interest, data confirmation, seasonality analysis, and statistical trending.
- **Section 4 – Influent Data Review Findings.** This section presents the influent data for each discharger as well as the annual and dry season averages for the Influent Flow, Total Ammonia, Nitrite plus Nitrate, Total Inorganic Nitrogen, Total Kjeldahl Nitrogen, Total Nitrogen, and Total Phosphorus. In addition, the contributing flows and loads for each discharger are presented in comparison to the other dischargers in its respective Subembayment.
- **Section 5 – Discharge Data Review Findings.** This section presents the discharge data for each discharger as well as the annual and seasonal averages for the Discharge Flow, Total Ammonia, Nitrite plus Nitrate, Total Inorganic Nitrogen, and Total Phosphorus. In addition, the contributing flows and loads for each discharger are presented in comparison to the other dischargers in its respective Subembayment.
- **Section 6 – Recycled Water Data Review Findings.** This section presents the recycled water flows and loads for each discharger as well as the annual and dry season averages. The flows are listed as million gallons per day (mgd). Furthermore, the nutrient load reductions associated with recycled water volumes are included for Total Ammonia, Nitrite plus Nitrate, Total Inorganic Nitrogen, and Total Phosphorus. While reporting recycled water is not a permit requirement per se, quantifying such information will advance the understanding of volumes and potentially nutrient loads diverted from the Bay.

- **Section 7 – Discussion.** This section includes a discussion of the data presented in Sections 4, 5, and 6.
- **Section 8 – Summary.** This section provides a brief summary of the findings, discussion, and recommendations that will improve the data collection and analysis in future years.
- **Appendix.** A separate section is provided in the appendix to present the data and analysis for each of the 34 POTW dischargers to the Bay subject to Permit requirements.

2 Background

The Permit applies to the municipal wastewater dischargers and specific facilities identified in Table 2-1. In addition, the location of each discharger is shown in Figure 2-1.

Table 2-1. Municipal Wastewater Dischargers Included in the Nutrient Watershed Permit

Discharger Name (Abbreviation)	POTW Facility Name	Minor / Major[(a)]
American Canyon, City of (American Canyon)	Wastewater Treatment and Reclamation Facility	Major
Benicia, City of (Benicia)	Benicia Wastewater Treatment Plant	Major
Burlingame, City of (Burlingame)	Burlingame Wastewater Treatment Plant	Major
Central Contra Costa Sanitary District (Central San)	Central Contra Costa Sanitary District Wastewater Treatment Plant	Major
Central Marin Sanitation Agency (CMSA)	Central Marin Sanitation Agency Wastewater Treatment Plant	Major
Crockett Community Services District (Port Costa)	Port Costa Wastewater Treatment Plant	Minor
Delta Diablo (Delta Diablo)	Delta Diablo Wastewater Treatment Plant	Major
East Bay Dischargers Authority (EBDA): Cities of Hayward and San Leandro; Oro Loma Sanitary District; Castro Valley Sanitary District; Union Sanitary District; East Bay Regional Parks District; Livermore-Amador Valley Water Management Agency; Dublin San Ramon Services District; and City of Livermore	EBDA Common Outfall	Major
	Hayward Water Pollution Control Facility	
	San Leandro Water Pollution Control Plant	
	Oro Loma/Castro Valley Sanitary Districts Water Pollution Control Plant	
	Raymond A. Boege Alvarado Wastewater Treatment Plant	
	Hayward Marsh	
	Livermore-Amador Valley Water Management Agency Export and Storage Facilities	
	Dublin San Ramon Services District Wastewater Treatment Plant	
	City of Livermore Water Reclamation Plant	
East Bay Municipal Utility District (EBMUD)	East Bay Municipal Utility District, Special District No. 1 Wastewater Treatment Plant	Major
Fairfield-Suisun Sewer District (FSSD)	Fairfield-Suisun Wastewater Treatment Plant	Major
Las Gallinas Valley Sanitary District (Las Gallinas)	Las Gallinas Valley Sanitary District Sewage Treatment Plant	Major
Marin County (Paradise Cove), Sanitary District No. 5 of	Paradise Cove Treatment Plant	Minor
Marin County (Tiburon), Sanitary District No. 5 of	Wastewater Treatment Plant	Minor
Millbrae, City of (Millbrae)	Water Pollution Control Plant	Major
Mt. View Sanitary District (Mt View)	Mt View Sanitary District Wastewater Treatment Plant	Major
Napa Sanitation District (Napa)	Soscol Water Recycling Facility	Major
Novato Sanitary District (Novato)	Novato Sanitary District Wastewater Treatment Plant	Major
Palo Alto, City of (Palo Alto)	Palo Alto Regional Water Quality Control Plant	Major
Petaluma, City of (Petaluma)	Municipal Wastewater Treatment Plant	Major

Discharger Name (Abbreviation)	POTW Facility Name	Minor / Major[(a)]
Pinole, City of (Pinole)	Pinole-Hercules Water Pollution Control Plant	Major
Rodeo Sanitary District (Rodeo)	Rodeo Sanitary District Water Pollution Control Facility	Major
San Francisco (San Francisco International Airport), City and County of (SFO Airport)	Mel Leong Treatment Plant, Sanitary Plant	Major
San Francisco (Southeast Plant), City and County of (SFPUC Southeast)	Southeast Water Pollution Control Plant	Major
San Jose/Santa Clara Water Pollution Control Plant and Cities of San Jose and Santa Clara (San Jose)	San Jose/Santa Clara Water Pollution Control Plant	Major
San Mateo, City of (San Mateo)	City of San Mateo Wastewater Treatment Plant	Major
Sausalito-Marin City Sanitary District (SMCSD)	Sausalito-Marin City Sanitary District Wastewater Treatment Plant	Major
Sewerage Agency of Southern Marin (SASM)	Sewerage Agency of Southern Marin Wastewater Treatment Plant	Major
Silicon Valley Clean Water (SVCW)	Silicon Valley Clean Water Wastewater Treatment Plant	Major
Sonoma Valley County Sanitary District (Sonoma Valley)	Municipal Wastewater Treatment Plant	Major
South San Francisco and San Bruno, Cities of (South SF)	South San Francisco and San Bruno Water Quality Control Plant	Major
Sunnyvale, City of (Sunnyvale)	Sunnyvale Water Pollution Control Plant	Major
U.S. Department of Navy (Treasure Island)	Treasure Island Wastewater Treatment Plant	Major
Vallejo Flood and Wastewater District (Vallejo)	Vallejo Wastewater Treatment Plant	Major
West County Agency (West County) (West County Wastewater District and City of Richmond Municipal Sewer District)	West County Agency Combined Outfall	Major
	West County Wastewater District Treatment Plant	
	Richmond Municipal Sewer District Water Pollution Control Plant	

(a) As defined in the Permit (Minor dischargers have a permitted average dry weather flow (ADWF) capacity <1 mgd; Major dischargers have a permitted ADWF capacity $\geq$1 mgd).

The Permit has specific influent and effluent monitoring requirements. Each agency covered by the Permit is required to report the following constituents in their effluent:

1. Flow
2. Ammonia as Nitrogen
3. Nitrate/Nitrite as Nitrogen
4. Total Inorganic Nitrogen as Nitrogen (Calculated Value)
5. Total Phosphorus

Each agency with a facility design flow of more than 10 mgd is required to report the following constituents in their influent:

1. Flow
2. Ammonia as Nitrogen
3. Nitrate/Nitrite as Nitrogen
4. Total Inorganic Nitrogen (Calculated Value)
5. Total Kjeldahl Nitrogen
6. Total Nitrogen (Calculated Value)
7. Total Phosphorus

Figure 2-1. Location of Dischargers

Note: All Five Subembayments are shown with delineation by the dark blue solid line

Major municipal dischargers having a permitted or design flow greater than 10 mgd are required to sample effluent twice per month, and influent once per quarter. Major municipal dischargers having a flow greater than or equal to 1 mgd but less than or equal to 10 mgd are required to sample effluent once per month. Minor municipal discharges, defined as those with a flow less than 1 mgd, are required to monitor effluent twice per year. In addition, dischargers are required to sample only during the months of the year when they are discharging. The data collected must be submitted monthly on the Regional Water Board's California Integrated Water Quality System (CIWQS) online data reporting tool.

Prior to the sampling required under the Permit, the dischargers were required to perform similar sampling and data collection. This early data collection was required under the Regional Water Board's Section 13267 Letter, dated March 2, 2012.[1]

Together, the Permits data and the Section 13267 Letter data, form the dataset for the analysis and reporting in this Group Annual Report. Additional information regarding the data sources and data confirmation is included in Section 3.

Per Attachment E, Section IV.B.1.b., of the Permit, the Group Annual Report must include the following:

ii. Summary tables depicting the Discharger's annual and monthly flows, nutrient concentrations, and nutrient mass loads, calculated as described in Attachment G section VIII.A (Arithmetic Calculations) of individual NPDES permits. The summary tables shall cover October 1 before the preceding year through September 30 of the preceding year and at least the previous five years of available data. Each Discharger shall document its nutrient loads relative to other facilities covered by this Order that discharge into the same Subembayment (i.e., Suisun Bay, San Pablo Bay, Central Bay, South Bay, and Lower South Bay). These Subembayment delineations may be refined through Provision VI.C.4 of the Order, in which case each Discharger shall document loads relative to the most recent delineation. Nutrient data from other Dischargers may be obtained from the State Water Board's California Integrated Water Quality System (CIWQS) website (https://www.waterboards.ca.gov/ciwqs/index.html).

iii. Analysis of nutrient trends and load variability, and assessment as to whether nutrient mass discharges are increasing or decreasing.

iv. Status and plans for investigation if the trend analysis shows a significant change in nutrient loading. In such cases, the Discharger shall investigate the cause. In the annual reports, the Discharger shall set forth its plans for investigation and report its results, providing necessary updates in subsequent annual reports. The investigation shall include, at a minimum, whether treatment process changes, increasing or decreasing water reclamation, or changes in total influent flow related to water conservation, population growth, transient work community, new industry, or wet weather flows have reduced or increased nutrient discharges.

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[1] Wolfe, Bruce. (2012) Letter: Water Code Section 13267 Technical Report Order Requiring Submittal of Information on Nutrients in Wastewater Discharges. March 2, 2012. https://www.waterboards.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2019/R2-2019-0017.pdf

3 Approach

The sources of data, as well as the approach for data confirmation, analysis of seasonality, and statistical trending are presented in the subsections herein.

3.1 Data Sources

Data from Oct 2012 to Sept 2023 were compiled from two different sources: the Section 13267 Letter data requirements and the subsequent Permits. The Section 13267 Letter data include the initial two years (Oct 2012 through June 2014) and the Permits data include the subsequent years (July 2014 through Sept 2023). The sampling requirements and frequency differ between the two datasets. The Permit data collection requirements were updated as of July 1, 2019 per the second Permit. The updated NPDES permit (R2-2019-0017) included the following significant changes:

1) The yearly reporting period has been changed from Jul-Jun to Oct-Sep. This was implemented to more accurately reflect seasonal changes from year to year (see Section 3.4 for discussion on Seasonality). As a result, the initial few months of the Section 13267 Letter data (July 2012 through September 2013) were excluded from further analysis.
2) Soluble Reactive Phosphorus (Ortho-P) and TKN effluent data are no longer required.
3) Total Inorganic Nitrogen (TIN) will be calculated as the basis for effluent nitrogen concentration, as opposed to Total Nitrogen (TN).
4) Quarterly influent nutrient reporting is required for dischargers with a permitted or design flow of greater than 10 mgd (n = 15 POTW dischargers out of 34 POTWs).

A comparison for the sampling requirements for each dataset is summarized in Table 3-1.

Table 3-1. Comparison of Sampling Requirements between the Section 13267 Letter and Nutrient Watershed Permits

Parameter	Section 13267 Letter Data	Nutrient Watershed Permit Data (2014; R2-2014-0014)	Nutrient Watershed Permit Data (2019; R2-2019-0017))
Major Dischargers and Sampling Frequency	1) Flows $\geq$5 mgd permitted capacity a. Year-round dischargers: Sample twice per month and two additional samples each wet season during peak wet weather flow conditions b. Seasonal dischargers: Sample twice per month during discharge (wet) season; sample once during non-discharge (dry) season 2) Flows between 1 and 5 mgd permitted capacity a. Year-round dischargers: Sample	1) Flows >10 mgd permitted capacity must sample effluent twice per month 2) Flows between 1 and 10 mgd permitted capacity must sample effluent once per month	1) Flows >10 mgd permitted capacity must sample effluent twice per month, and influent once per quarter. 2) Flows between 1 and 10 mgd permitted capacity must sample effluent once per month.

Parameter	Section 13267 Letter Data	Nutrient Watershed Permit Data (2014; R2-2014-0014)	Nutrient Watershed Permit Data (2019; R2-2019-0017))
	twice per month and two additional samples each wet season during peak wet weather flow conditions b. Seasonal dischargers: Sample twice per month during discharge (wet) season; sample once during non-discharge (dry) season		
Minor Dischargers and Sampling Frequency	1) Flows <1 mgd permitted capacity a. Year-round dischargers: Sample once per month b. Seasonal dischargers: Sample once per month during discharge (wet) season; sample once during non-discharge (dry) season	1) Flows <1 mgd permitted capacity must sample twice per year	1) Flows <1 mgd permitted capacity must sample twice per year
Non-Nutrient Sampling Parameters	Flow pH Temperature	Flow	Flow
Nitrogen Species and Sample Type	1) Total Ammonia (NH3 plus NH4+, reported as N) – Composite Sample 2) Total Dissolved Nitrogen (TDN, reported as N) – Composite Sample 3) Total Kjeldahl Nitrogen (TKN, reported as N) – Composite Sample 4) Soluble Kjeldahl Nitrogen (SKN, reported as N) – Composite Sample 5) Nitrate (NO3-, reported as N) – Composite Sample 6) Nitrite (NO2-, reported as N) – Composite Sample 7) Urea (limited to 5 largest dischargers, reported as N) – Composite Sample	1) Total Ammonia (NH3 plus NH4+, reported as N) – Composite Sample 2) Total Kjeldahl Nitrogen (TKN) – Composite Sample 3) Nitrate (NO3-) plus Nitrite (NO2-) (NOx, reported as N) – Composite Sample 4) Total Nitrogen (TN, calculated) – Composite Sample	Influent and Effluent: 1) Total Ammonia (NH3 plus NH4+, reported as N) – Composite Sample 2) Nitrate (NO3-) plus Nitrite (NO2-) (NOx, reported as N) – Composite Sample Influent Only: 1) Total Kjeldahl Nitrogen (TKN) – Composite Sample Effluent Only: 1) Total Inorganic Nitrogen (TIN) – Calculated, Total Ammonia + Nitrate and Nitrite
Phosphorus Species and Sample Type	1) Total Phosphorus (TP) – Composite Sample 2) Soluble Total Phosphorus (STP; reported as P) – Composite Sample	1) Soluble Reactive Phosphorus (SRP, reported as P) – Grab Sample 2) Total Phosphorus (TP) –	1) Total Phosphorus (TP) – Composite Sample

Parameter	Section 13267 Letter Data	Nutrient Watershed Permit Data (2014; R2-2014-0014)	Nutrient Watershed Permit Data (2019; R2-2019-0017))
	3) Dissolved Orthophosphate (reported as P) – Composite or Grab Sample 4) Total Orthophosphate (reported as P) – Composite Sample	Composite Sample	
Recycled Water Volumes	Not required	Not required	Not required. Included in the Group Annual Report for Year 2021 and beyond.

3.2 Measurement Methodologies

A list of the measurement methodologies is presented in Table 3-2.

Table 3-2. List of Parameters, Methodology, and Sample Type

Parameter	Location	Measured or Calculated	Sample Type	Method [(a,b)]	Calculation
Flow	Influent, Effluent, and Recycled Water	Both (plant specific)	Continuous	--	--
Total Ammonia	Influent/Effluent	Measured[(c)]	24-hr Composite	4500-NH3 EPA 350.1	--
TKN	Influent Only	Both (plant-specific) [(c)]	24-hr Composite	4500-N(org)	--
NOx	Influent/Effluent	Measured[(c)]	24-hr Composite	4500-N	--
TIN	Effluent Only	Calculated[(c)]	24-hr Composite	Calculated	$TIN = Ammonia + NOx$
TN	Influent Only	Calculated[(c)]	24-hr Composite	Calculated	$TN = TKN + NOx$
TP	Influent/Effluent	Measured[(c)]	24-hr Composite	4500-P	--

a. Standard Methods for the Examination of Water and Wastewater 2017-23rd Edition, American Public Health Association/American Water Works Association/Water Environment Federation, Washington, D.C.
b. Dischargers may propose other U.S. EPA-approved analytical methods, if available, with detection limits low enough to quantify concentrations in wastewater.
c. For plants with only flow and concentration values available, loads were manually calculated for daily values and/or using average monthly flow and concentration values.

3.3 Data Confirmation

Once the data from each discharger were collected and compiled, the data were summarized and provided to each participating discharger for review and confirmation. The data presented in this Group Annual Report reflect additions and corrections provided by the participating agencies.

3.4 Seasonality

The seasonal variations in the data were examined by dividing the data into a dry and wet season. Understanding seasonality is critical for the analysis of nutrient discharges because of the following factors:

- The dry season is reflective of the base sanitary flows and loads from residential population and industrial contributions to wastewater. In contrast, the increased flows during wet weather events are attributed to inflow and infiltration (I&I) during such events, which can bias the discharge results.
- Wastewater treatment facilities are typically better suited to remove nutrient loads (if deemed necessary) during the warmer, dry season when the biological treatment kinetics are more favorable and there are fewer (if any) peak flow events.
- The Nutrient Management Strategy led by the San Francisco Estuary Institute (SFEI) is currently underway to evaluate San Francisco Bay's resilience to nutrients. It is expected to be less sensitive to nutrients during the wet season because the water is cooler, light irradiance in the Bay is reduced, turbidity in the Bay is elevated, and the hydraulic residence time in the Bay is reduced.

Seasonality is defined in the participating agencies' NPDES permits in different ways; furthermore, not all the permits have a seasonal definition. To provide a consistent basis for the purposes of this Group Annual Report, the seasonal definition presented in Table F-5 of the Permit (R2-2019-0017; CA0038873) was used. The wet and dry seasons are defined as follows:

- Dry season: May 1 through September 30
- Wet season: October 1 through April 30

3.5 Subembayments

The historical delineation of Subembayments by geographic locations (specifically bridges) is used throughout this report. The Subembayment delineations are derived from the San Francisco Bay Basin Plan[2] and are not necessarily indicative of the Bay's hydraulics or ecosystems. Subembayments are included merely to describe the overall geographic distribution of flows and loads across the Bay.

3.6 Influent Data

Influent monitoring data were included for the first time as part of the 2020 Group Annual Report. The data are limited to plants that have a permitted ADWF capacity of greater than 10 mgd (n = 15 POTW dischargers out of 34 POTW dischargers). Note: these 15 POTWs with an ADWF permitted capacity of greater than 10 mgd represents approximately 90+/- percent of the overall Baywide discharge flow. The influent sampling has been required quarterly beginning in July 2019. Note: samples need only to be collected when discharging (i.e., seasonal Dischargers shall collect samples only during the discharge season). For instances where dischargers provided more than the minimum influent sampling data requested, that information is provided in this report.

[2] State Water Resources Control Board. (2019) *Figure 2-2: Hydraulic Planning Areas*. [Chapter 2: Beneficial Uses (ca.gov)]

3.7 Recycled Water

Recycled water volumes are included for the second time as part of this 2023 Group Annual Report. While not a permit requirement per se, recycled water volumes are of interest in nutrient management across the Bay to identify nutrient loads diverted from Bay discharge. Data was downloaded from the State Water Board's Recycled Water website for all 34 dischargers (https://www.waterboards.ca.gov/water_issues/programs/recycled_water/volumetric_annual_reporting.html).

Recycled water monthly volumes are listed as acre-feet and mgd. The volumes are not broken out by various recycled water user types within the main report. The basis for only showing the total volumes is the data is limited to total volumes for monthly values. While the State Water Board site does provide a breakdown by recycled water user type, it is limited to volumes over an entire calendar year (not by monthly volumes). In order to better understand recycled water uses for each individual discharger, the individual plant reports in Appendix A present the various recycled water user volumes by calendar year. The various recycled water uses as defined by the State Water Resources Control Board are as follows[3]:

- Golf course: includes irrigation of golf courses, whether public or private. Water used to maintain aesthetic impoundments within golf courses is also included with golf course irrigation.
- Landscape irrigation: includes parks, sports fields, green belts, landscaped areas. Irrigation of parks, schools, cemeteries, churches, residential, streetscapes, slope protection, or public facilities. Golf course irrigation is not included. Water to maintain aesthetic impoundments within landscaped areas is included with landscape irrigation. Fill stations primarily used for public use should be classified as landscape irrigation.
- Commercial: includes dual-plumbed projects, fire protection, other uses at commercial facilities not included in other categories. Includes uses by commercial water users, except landscape irrigation. A commercial water user is a water user that provides or distributes a product or service. Examples of commercial water uses are commercial building use (toilets, HVAC, etc.), car washes, laundries, and retail nurseries. Landscape irrigation of commercial building areas is to be classified as landscape irrigation if it is separately metered or if landscape is the dominant use of mixed uses served by a single meter. Fill stations, if they are primarily used for commercial use, should be classified as commercial use.
- Industrial: includes cooling towers and process water (including process water at wastewater treatment plants). Includes uses by industrial water users, except landscape irrigation and geothermal energy production. An industrial user is a water user that is primarily a manufacturer or processor of materials. Examples of industrial water uses are cooling towers, oil refining, process water, and mining. Landscape irrigation of industrial building areas is to be classified as landscape irrigation if it is separately metered or if landscape is the dominant use of mixed uses served by a single meter.

[3] State Water Resources Control Board. (2020) *Volumetric Annual Report of Wastewater and Recycled Water: Help Guide for Volumetric Annual Report in GeoTracker.* February 8, 2021. https://www.waterboards.ca.gov/water_issues/programs/recycled_water/docs/2020/var_helpguide.pdf

- Agricultural: includes irrigation, frost protection, agricultural reservoir augmentation. Irrigation of food, fiber, and fodder crops, and pastureland. This also includes Christmas tree production, pasture for farm animals, and wholesale plant nurseries.
- Potable Reuse: represents groundwater recharge, surface water augmentation, or direct potable reuse.
- Other: represents any not listed

The total volumes for each month and overall are calculated.

3.8 Trend Analysis

The Permit requires trending analysis with each report for both influent and effluent. Trending analysis was not performed on influent data in the past as the data was limited. This year's Group Annual Report includes trending analysis similar to the approach used for discharge. Details on the approach at the end of this subsection. Influent trending analysis includes quarterly data from July 2019 through September 2023 (17 quarters over 51 months). Note: the influent sampling is limited to POTWs with a permitted capacity of greater than 10 mgd.

The discharge data were evaluated to identify evidence of trends over the past ten years. Due to the change in sampling frequency between the Section 13267 Letter data and both Watershed Permit requirements, there is an inconsistency in the reporting of flows and loads during the wet season. Specifically, the Section 13267 Letter data required that in addition to normal monthly sampling, two additional samples be taken in the wet season during peak wet weather events. This requirement is not included in either Watershed Permits. As a result, an artificial bias has been introduced that was expected to overestimate the wet season load. A sensitivity analysis was performed several years back for each Subembayment to confirm this bias. Based on that analysis, it was confirmed that the peak wet weather events do impact the trend analysis because the dataset is not large enough to offset such a large load. For example, there are a few instances (e.g., Lower South Bay ammonia loading) where the Section 13267 Letter data was several times greater than the annual average values and disproportionately skewed the trending analysis. As a result, the trend analysis was limited to the dry season, which best represents the actual base sanitary wastewater flows and loads for each plant.

The approach used to evaluate trend significance was the slope of a regression line. The slope was determined using the method of least squares.[4] The sample set size varies for influent versus discharge (n = 17 for 4.25 years of influent sampling; n = 55 for the eleven years of discharge data). An alpha of 0.05 was assumed which denotes that a 5 percent risk of concluding that a difference exists when there is no actual difference. A trend was denoted significant if the p-value was less than alpha. Furthermore, the percent change with respect to average value was included to serve as a reference or baseline for the extent of change over time.

[4] Montgomery, D.C.; Peck, E.A.; Vining, G.G. (2012) Introduction to Linear Regression Analysis. Published by John Wiley and Sons, Inc. Hoboken, NJ. Pages 12-66.

4 Influent Data Review Findings

This section presents a data discussion for the following Influent parameters:

1. Influent Flow (reported as mgd)
2. Total Ammonia (reported as kg N/d)
3. Nitrate plus Nitrite (NOx, reported as kg N/d)
4. Total Inorganic Nitrogen (TIN, reported as kg N/d)
5. Total Kjeldahl Nitrogen (TKN; reported as kg N/d)
6. Total Nitrogen (TN, reported as kg N/d)
7. Total Phosphorus (TP, reported as kg P/d)

The subsections that follow present data for each parameter as a historical plot for each Subembayment and the Bay, as well in a tabular format by POTW and for each of the five Subembayments. The data are presented for both the annual average (October 1 through September 30 of the following year) and dry season average (May 1 through September 30 of the same year).

There are several limitations for the overall influent dataset as follows:

- Small size of dataset (quarterly sampling began in July 2019; n = 17). Furthermore, the global pandemic impacts more than half of the sampling quarters.
- The data is limited to dischargers with a permitted ADWF capacity of greater than 10 mgd (15 out of a possible 34 dischargers; the permitted capacity for such dischargers represents 92 percent of the Bay discharge permitted capacity).
- Quarterly sampling was not conducted by all POTWs in the same month. To reconcile such time variance, a quarterly average was assumed while plotting loads (e.g., refer to Figure 4-2).
- There are a few instances where sampling for a particular nutrient did not occur (e.g., Palo Alto did not sample ammonia during the first quarter of sampling from July through September 2019).
- Analytical issues with the influent sampling matrix. Specifically, the discharge matrix is relatively cleaner compared to raw influent and is subsequently less prone to analytical issues. There are a couple instances in particular for the 2020/2021 dataset where ammonia values were greater than TKN for the same sample. This indicates an analytical and/or sampling issue, since TKN is the sum of ammonia and organic nitrogen. Such analytical issues can skew the trending.

A discussion of the results is provided in Section 7.3.

4.1 Flow

The historical average monthly influent flows from July 2019 through September 2023 are presented in Figure 4-1. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent flows were calculated based on reported flows in Table 4-1 and Table 4-2, respectively. In addition, the annual average and dry season average monthly influent flows for each Subembayment are provided in Table 4-3 and Table 4-4, respectively.

A summary of the influent data review findings is as follows **(new findings for 2022/2023 in bold)**:

- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded for 2018/2019.
- All the dischargers with ADWF permitted capacity greater than 10 mgd provide average monthly data for each month evaluated (July 2019 through September 2023; see Table 4-1 and Table 4-2).
- The influent average monthly flows are the largest during the wet season (October 1 through April 30 of the following year; refer to Figure 4-1). This was anticipated as flows tend to increase during wet weather events. **The relatively large wet weather events this past year resulted in relatively large increases in average monthly flows (emphasis on January 2023 and March 2023). The elevated wet season flows carried through the dry season flows as those were higher than the last several dry seasons.**
- **<u>Average Annual Flows:</u> the average annual flows had a significant increase of approximately 72 mgd as compared to the 2021/2022 dataset resulting in the highest average annual flows since sampling began in July 2019. Of the large POTWs, San Jose (Lower South Bay Discharger) and SFPUC Southeast (South Bay Discharger) had the most pronounced increase at 14 and 12 mgd, respectively. Other large POTWs (EBMUD, EBDA, and Central San) all had a 9 to 10 mgd increase in average annual flows. Most other POTWs had a nominal 1 to 3 mgd increase in average annual flows.**
- **<u>Dry Season Flows:</u> the 2023 dry season average flows were the second highest since sampling began in July 2019. The largest POTW (San Jose, Lower South Bay Discharger) had a nearly 38 percent increase in influent flow (approximately 17 mgd increase). Other large POTWs (EBMUD, SFPUC Southeast, and EBDA) had a 3 to 5 mgd increase in dry season average flows. Several other POTWs had a nominal 1 to 2 mgd increase in dry season average flows.**
- **<u>Dry Season Trending:</u> this is the first year when dry season trending analysis was performed for influent flows. Trending analysis suggests that all the Subembayments, including Baywide, have no emerging trend over the 5-year dry season dataset.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2019 (see Section 3.8).
- The South Bay and Lower South Bay together account for over half of the influent flows, regardless of season (see Table 4-3 and Table 4-4).

A discussion of the results is provided in Section 7.3.

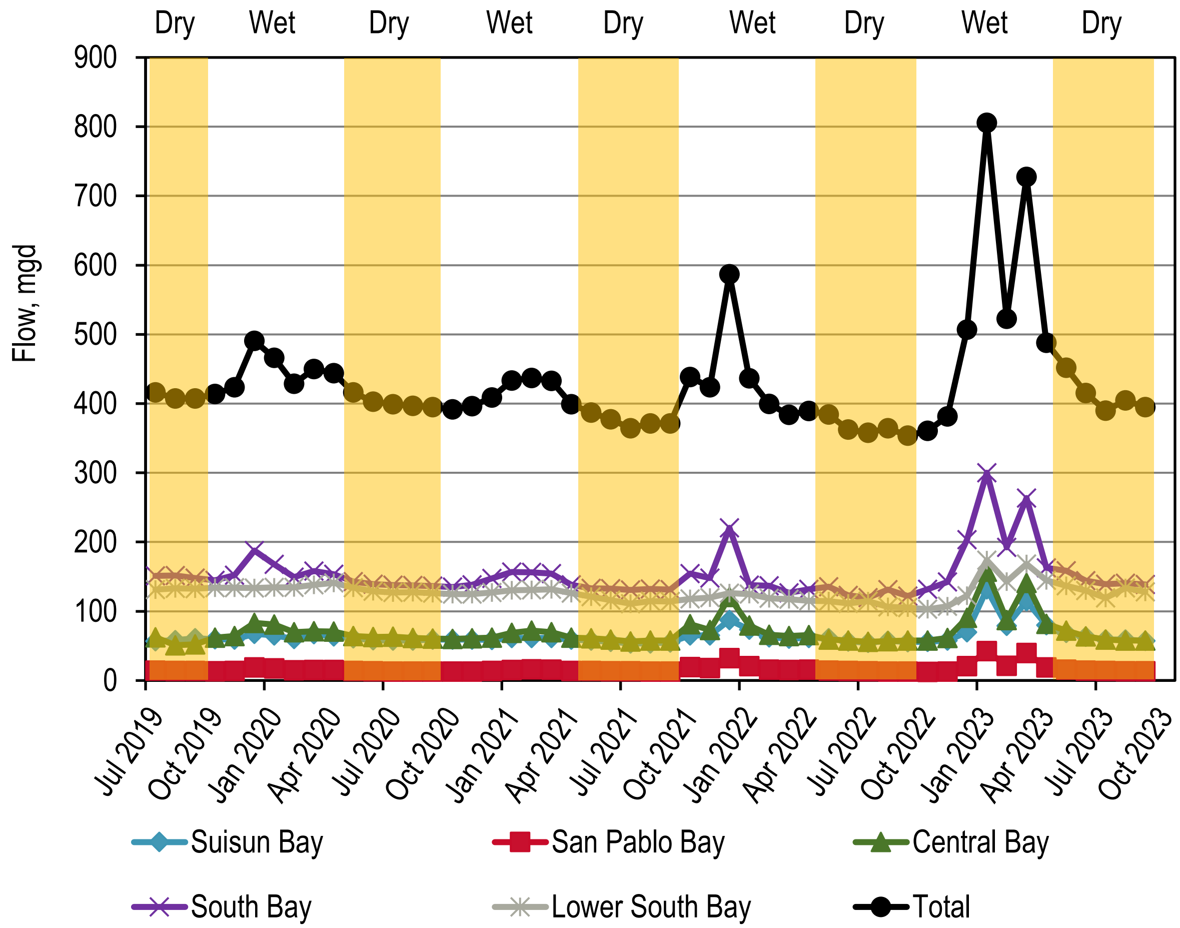

Figure 4-1. Influent: Historical Average Monthly Flow Values

Table 4-1. Influent: Annual Average Flows to each Plant (mgd)*

Discharger	Subembayment	Permitted Capacity [(a)]	2018/ 2019 [(a), (b)]	2019/ 2020 [(b)]	2020/ 2021 [(b)]	2021/ 2022 [(b)]	2022/ 2023 [(b)]
American Canyon	San Pablo Bay	2.5	*	--	--	--	--
Benicia	San Pablo Bay	4.5	*	--	--	--	--
Burlingame	South Bay	5.5	*	--	--	--	--
Central San	Suisun Bay	53.8	*	36.1	32.9	35.4	43.9
CMSA	Central Bay	10	*	--	--	--	--
Port Costa	San Pablo Bay	0.033	*	--	--	--	--
Delta Diablo	Suisun Bay	19.5	*	12.7	13.2	14.1	14.3
EBDA	South Bay	107.8	*	65.5	64.1	64.2	74.4
EBMUD	Central Bay	120	*	53.8	49.4	54.9	64.3
FSSD	Suisun Bay	23.7	*	12.6	11.9	13.9	16.6
Las Gallinas[(c)]	San Pablo Bay	2.92	*	--	--	--	--
Paradise Cove	Central Bay	0.04	*	--	--	--	--
Tiburon	Central Bay	0.98	*	--	--	--	--
Millbrae	South Bay	3	*	--	--	--	--
Mt. View	Suisun Bay	3.2	*	--	--	--	--
Napa[(c)]	San Pablo Bay	15.4	*	6.27	6.04	7.44	9.05
Novato	San Pablo Bay	7	*	--	--	--	--
Palo Alto	Lower South Bay	39	*	17.6	16.6	16.9	20.3
Petaluma[(c)]	San Pablo Bay	6.7	*	--	--	--	--
Pinole	San Pablo Bay	4.06	*	--	--	--	--
Rodeo	San Pablo Bay	1.14	*	--	--	--	--
SFO Airport	South Bay	2.2	*	--	--	--	--
SFPUC Southeast	South Bay	85.4	*	54.3	48.1	52.6	64.4
San Jose	Lower South Bay	167	*	102	94.3	86.7	100
San Mateo	South Bay	15.7	*	10.6	9.55	10.4	13.3
SMCSD	Central Bay	1.8	*	--	--	--	--
SASM	Central Bay	3.6	*	--	--	--	--
SVCW	South Bay	29	*	12.8	12.0	13.8	15.4
Sonoma Valley[(c)]	San Pablo Bay	3	*	--	--	--	--
South SF	South Bay	13	*	7.35	6.71	7.66	8.90
Sunnyvale	Lower South Bay	29.5	*	12.9	12.4	12.3	13.5
Treasure Island	Central Bay	2	*	--	--	--	--
Vallejo	San Pablo Bay	15.5	*	8.29	7.85	9.55	10.8
West County	Central Bay	28.5	*	14.1	12.9	14.9	18.0
Total [(d)]		**827**	*** [(e)]**	**427**	**398**	**415**	**487**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Totals not provided due to an incomplete dataset.

Table 4-2. Influent: Dry Season Average Flows to each Plant (mgd)*

Discharger	Subembayment	Permitted Capacity [(a)]	2019 [(a), (b), *]	2020 [(a), (b)]	2021 [(a), (b)]	2022 [(a), (b)]	2023 [(a), (b)]
American Canyon	San Pablo Bay	2.5	--	--	--	--	--
Benicia	San Pablo Bay	4.5	--	--	--	--	--
Burlingame	South Bay	5.5	--	--	--	--	--
Central San	Suisun Bay	53.8	34.7	33.8	30.7	31.5	34.6
CMSA	Central Bay	10	--	--	--	--	--
Port Costa	San Pablo Bay	0.033	--	--	--	--	--
Delta Diablo	Suisun Bay	19.5	12.6	13.0	13.2	13.5	13.6
EBDA	South Bay	107.8	69.4	64.3	63.0	60.8	66.1
EBMUD	Central Bay	120	50.9	49.6	46.6	45.7	48.7
FSSD	Suisun Bay	23.7	11.4	12.0	11.3	12.0	13.4
Las Gallinas[(c)]	San Pablo Bay	2.92	--	--	--	--	--
Paradise Cove	Central Bay	0.04	--	--	--	--	--
Tiburon	Central Bay	0.98	--	--	--	--	--
Millbrae	South Bay	3	--	--	--	--	--
Mt. View	Suisun Bay	3.2	--	--	--	--	--
Napa[(c)]	San Pablo Bay	15.4	6.28	5.50	5.60	5.94	6.33
Novato	San Pablo Bay	7	--	--	--	--	--
Palo Alto	Lower South Bay	39	18.5	16.3	16.0	16.5	18.2
Petaluma[(c)]	San Pablo Bay	6.7	--	--	--	--	--
Pinole	San Pablo Bay	4.06	--	--	--	--	--
Rodeo	San Pablo Bay	1.14	--	--	--	--	--
SFO Airport	South Bay	2.2	--	--	--	--	--
SFPUC Southeast	South Bay	85.4	51.6	45.3	42.4	44.4	48.2
San Jose	Lower South Bay	167	101	99.8	87.9	82.3	99.1
San Mateo	South Bay	15.7	9.38	9.93	9.15	9.17	10.5
SMCSD	Central Bay	1.8	--	--	--	--	--
SASM	Central Bay	3.6	--	--	--	--	--
SVCW	South Bay	29	12.5	12.1	11.1	11.9	11.9
Sonoma Valley[(c)]	San Pablo Bay	3	--	--	--	--	--
South SF	South Bay	13	7.29	6.97	6.45	7.17	7.56
Sunnyvale	Lower South Bay	29.5	12.6	12.6	12.1	11.7	12.1
Treasure Island	Central Bay	2	--	--	--	--	--
Vallejo	San Pablo Bay	15.5	7.74	7.75	7.66	7.42	7.77
West County	Central Bay	28.5	12.6	12.9	11.8	11.8	13.3
Total [(d)]		**827**	**419**	**402**	**375**	**372**	**411**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 4-3. Influent: Annual Average Flows by Subembayment, Flow (mgd)*

Subembayment	Permitted Capacity [(a)]	2018/ 2019 [(a)]	2019/ 2020 [(a)]	2020/ 2021 [(a)]	2021/ 2022 [(a)]	2022/ 2023 [(a)]
Suisun Bay	100	*	61.4	58.0	63.4	74.7
San Pablo Bay	62.8	*	14.6	13.9	17.0	19.9
Central Bay	167	*	67.9	62.3	69.8	82.3
South Bay	262	*	151	141	149	176
Lower South Bay	236	*	133	123	116	134
Total	**827**	*****	**427**	**398**	**415**	**487**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

Table 4-4. Influent: Dry Season Average Flows by Subembayment, Flow (mgd)*

Subembayment	Permitted Capacity [(a)]	2019 [(a),*]	2020 [(a)]	2021 [(a)]	2022 [(a)]	2023 [(a)]	Trend [(b,c)]
Suisun Bay	100	58.7	58.8	55.2	57.0	61.5	None
San Pablo Bay	62.8	14.0	13.2	13.3	13.4	14.1	None
Central Bay	167	63.6	62.6	58.4	57.5	62.0	None
South Bay	262	150	139	132	133	144	None
Lower South Bay	236	132	129	116	110	129	None
Total	**827**	**419**	**402**	**375**	**372**	**411**	**None**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is at a minimum 17 (quarterly). Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.

c. The percent change represents the change per year as a percentage of the average value over the entire dataset (2019-2023) (not considered if trend is “None”).

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4.2 Total Ammonia

The historical average quarterly influent ammonia loads from July 2019 through September 2023 are presented in Figure 4-2. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-5 and Table 4-6, respectively.

A summary of the influent data review findings is as follows **(new findings for 2022/2023 in bold)**:

- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- There are a few instances of missing data per plant (see Table 4-5 and Table 4-6; primarily from 2019). Despite missing data in 2019, the average annual loads from 2019/2020 and dry season loads from 2019 represent the largest loads.
- **The quarterly sampling makes it challenging to infer any impacts on influent nutrient loads from the relatively large wet weather events this past year in December 2022, January 2023, and March 2023.**
- **<u>Average Annual Loads:</u> overall increase since last year of approximately 300 kg N/d. The largest increase was from San Jose (Lower South Bay Discharger; 900 kg N/d increase compared to the previous year), followed by SFPUC Southeast (South Bay Discharger; 590 kg N/d increase compared to the previous year). In contrast, EBMUD (Central Bay Discharger) and EBDA (South Bay Discharger) average annual loads decreased approximately 490 kg N/d and 420 kg N/d, respectively. Furthermore, EBMUD also made additional changes to its high-strength waste receiving that is not reflected in this data set.**
- **<u>Dry Season Loads:</u> the 2023 dry season loads were the lowest since sampling began in July 2019 with an overall decrease of 600 kg N/d compared to last year. EBDA (South Bay Discharger) had the largest reduction in dry season loads since last year with an approximate 770 kg N/d reduction compared to last year. In contrast, San Jose average annual loads increased approximately 540 kg N/d. Besides those listed, the other treatment plants all had modest increases/decreases of up to 210 kg N/d.**
- **<u>Dry Season Trending:</u> this is the first year when dry season trending analysis was performed for the influent ammonia loads. Trending analysis suggests that all the Subembayments and Baywide have no emerging trend over the 5-year dry season dataset.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2019 (see Section 3.8).
- Similar to flow, the South Bay and Lower South Bay together account for over half of the influent ammonia loads, regardless of season (see Table 4-7 and Table 4-8).

A discussion of the results is provided in Section 7.3.

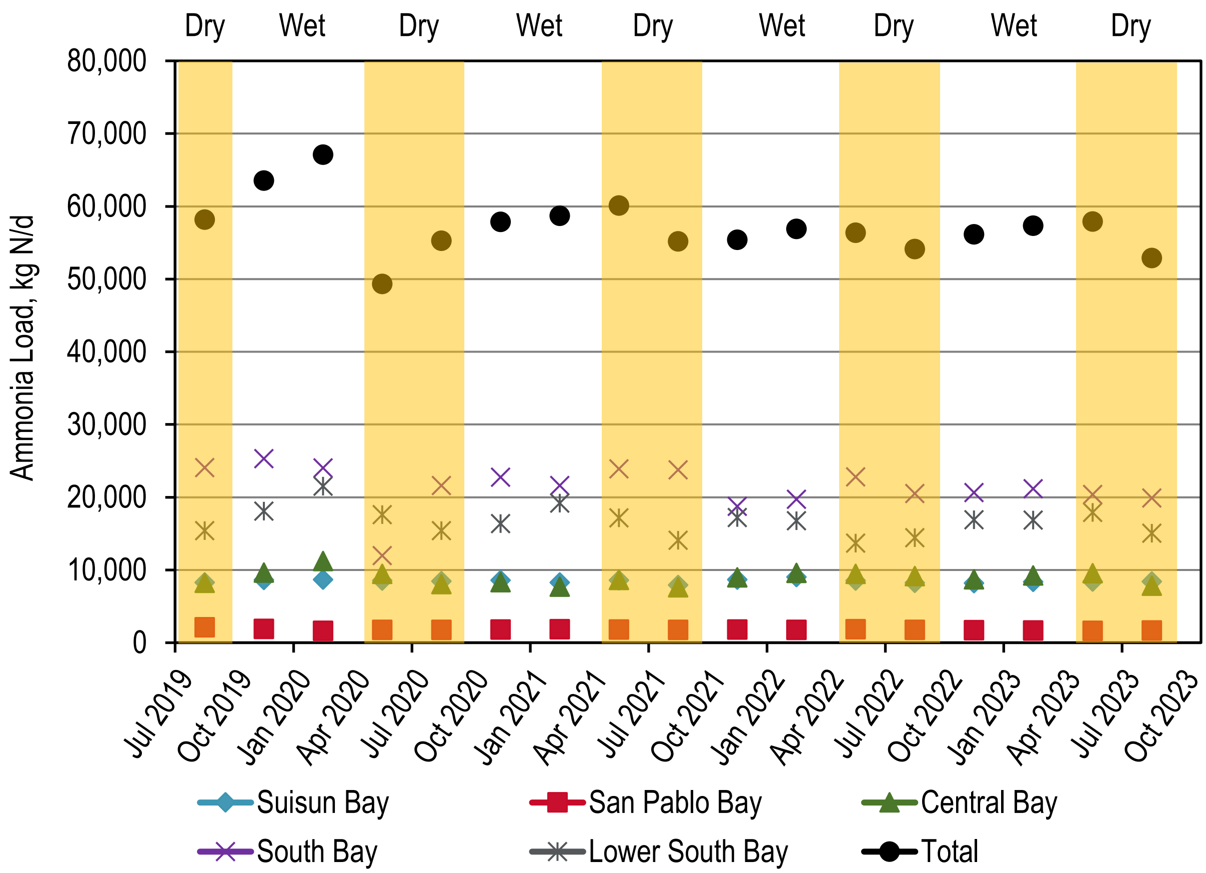

Figure 4-2. Influent: Historical Average Monthly Total Ammonia Loads

Table 4-5. Influent: Annual Average Loads to each Plant, Total Ammonia (kg N/d)

Discharger	Subembayment	Permitted Capacity [(a)]	2018/ 2019 [(a), (b)]	2019/ 2020 [(b)]	2020/ 2021 [(b)]	2021/ 2022 [(b)]	2022/ 2023 [(b)]
American Canyon	San Pablo Bay	2.5	*	--	--	--	--
Benicia	San Pablo Bay	4.5	*	--	--	--	--
Burlingame	South Bay	5.5	*	--	--	--	--
Central San	Suisun Bay	53.8	*	5,100	4,920	4,830	4,790
CMSA	Central Bay	10	*	--	--	--	--
Port Costa	San Pablo Bay	0.033	*	--	--	--	--
Delta Diablo	Suisun Bay	19.5	*	1,840	1,830	2,040	1,920
EBDA	South Bay	107.8	*	9,390	9,530	9,600	9,180
EBMUD	Central Bay	120	*	7,460	6,340	7,490	7,000
FSSD	Suisun Bay	23.7	*	1,640	1,600	1,760	1,640
Las Gallinas[(c)]	San Pablo Bay	2.92	*	--	--	--	--
Paradise Cove	Central Bay	0.04	*	--	--	--	--
Tiburon	Central Bay	0.98	*	--	--	--	--
Millbrae	South Bay	3	*	--	--	--	--
Mt. View	Suisun Bay	3.2	*	--	--	--	--
Napa[(c)]	San Pablo Bay	15.4	*	820	876	877	808
Novato	San Pablo Bay	7	*	--	--	--	--
Palo Alto	Lower South Bay	39	*	2,300	2,210	2,380	2,530
Petaluma[(c)]	San Pablo Bay	6.7	*	--	--	--	--
Pinole	San Pablo Bay	4.06	*	--	--	--	--
Rodeo	San Pablo Bay	1.14	*	--	--	--	--
SFO Airport	South Bay	2.2	*	--	--	--	--
SFPUC Southeast	South Bay	85.4	*	8,750	8,820	5,570	6,160
San Jose	Lower South Bay	167	*	14,300	13,200	11,700	12,600
San Mateo	South Bay	15.7	*	1,590	1,440	1,490	1,410
SMCSD	Central Bay	1.8	*	--	--	--	--
SASM	Central Bay	3.6	*	--	--	--	--
SVCW	South Bay	29	*	2,410	2,490	2,600	2,400
Sonoma Valley[(c)]	San Pablo Bay	3	*	--	--	--	--
South SF	South Bay	13	*	1,030	971	1,170	1,300
Sunnyvale	Lower South Bay	29.5	*	1,500	1,390	1,500	1,550
Treasure Island	Central Bay	2	*	--	--	--	--
Vallejo	San Pablo Bay	15.5	*	966	954	926	872
West County	Central Bay	28.5	*	1,850	1,760	1,760	1,840
Total [(d)]		**827**	* [(e)]	**61,000**	**58,300**	**55,700**	**56,000**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. 8Totals not provided due to an incomplete dataset.

Table 4-6. Influent: Dry Season Average Loads to each Plant, Total Ammonia (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2019 (b), *	2020 (b)	2021 (b)	2022 (b)	2023 (b)
American Canyon	San Pablo Bay	2.5	--	--	--	--	--
Benicia	San Pablo Bay	4.5	--	--	--	--	--
Burlingame	South Bay	5.5	--	--	--	--	--
Central San	Suisun Bay	53.8	4,810	4,980	4,700	4,790	4,680
CMSA	Central Bay	10	--	--	--	--	--
Port Costa	San Pablo Bay	0.033	--	--	--	--	--
Delta Diablo	Suisun Bay	19.5	1,820	1,910	1,830	1,880	2,010
EBDA	South Bay	107.8	6,580	8,880	9,420	9,370	9,260
EBMUD	Central Bay	120	6,530	6,760	6,410	7,540	6,780
FSSD	Suisun Bay	23.7	1,680	1,530	1,710	1,720	1,730
Las Gallinas(c)	San Pablo Bay	2.92	--	--	--	--	--
Paradise Cove	Central Bay	0.04	--	--	--	--	--
Tiburon	Central Bay	0.98	--	--	--	--	--
Millbrae	South Bay	3	--	--	--	--	--
Mt. View	Suisun Bay	3.2	--	--	--	--	--
Napa(c)	San Pablo Bay	15.4	1,050	770	897	919	861
Novato	San Pablo Bay	7	--	--	--	--	--
Palo Alto	Lower South Bay	39	(e)	2,110	2,240	2,470	2,540
Petaluma(c)	San Pablo Bay	6.7	--	--	--	--	--
Pinole	San Pablo Bay	4.06	--	--	--	--	--
Rodeo	San Pablo Bay	1.14	--	--	--	--	--
SFO Airport	South Bay	2.2	--	--	--	--	--
SFPUC Southeast	South Bay	85.4	10,000	8,330	9,750	6,250	6,040
San Jose	Lower South Bay	167	13,600	12,100	10,600	10,300	10,800
San Mateo	South Bay	15.7	1,440	1,430	1,390	1,320	1,430
SMCSD	Central Bay	1.8	--	--	--	--	--
SASM	Central Bay	3.6	--	--	--	--	--
SVCW	South Bay	29	2,550	2,090	2,660	2,460	2,250
Sonoma Valley(c)	San Pablo Bay	3	--	--	--	--	--
South SF	South Bay	13	1,020	988	909	1,310	1,190
Sunnyvale	Lower South Bay	29.5	1,820	1,180	1,340	1,530	1,670
Treasure Island	Central Bay	2	--	--	--	--	--
Vallejo	San Pablo Bay	15.5	1,060	988	908	883	891
West County	Central Bay	28.5	1,720	1,750	1,720	1,790	1,770
Total (d)		**827**	**58,200**	**55,800**	**56,400**	**54,500**	**53,900**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Permit required data not provided.

Table 4-7. Influent: Annual Average Total Ammonia Loads by Subembayment (kg N/d)*,**

Subembayment	2018/2019 [a]	2019/2020 [a]	2020/2021 [a]	2021/2022 [a]	2022/2023 [a]
Suisun Bay	*	8,580	8,350	8,620	8,350
San Pablo Bay	*	1,790	1,830	1,800	1,680
Central Bay	*	9,310	8,100	9,310	8,840
South Bay	*	23,200	23,200	20,400	20,500
Lower South Bay	*	18,200	16,800	15,500	16,700
Total	*	**61,000**	**58,300**	**55,700**	**56,000**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

** Refer to Table 4-5 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

Table 4-8. Influent: Dry Season Average Total Ammonia Loads by Subembayment (kg N/d)*,**

Subembayment	2019 [a],*	2020 [a]	2021 [a]	2022 [a]	2023 [a]	Trend [b]
Suisun Bay	8,300	8,420	8,240	8,380	8,420	None
San Pablo Bay	2,100	1,760	1,810	1,780	1,750	None
Central Bay	8,250	8,520	8,130	9,330	8,540	None
South Bay	24,100	21,700	24,100	20,700	20,200	None
Lower South Bay	15,400	15,400	14,100	14,300	15,000	None
Total	**58,200**	**55,800**	**56,400**	**54,500**	**53,900**	**None**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

** Refer to Table 4-6 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is up to 10. Where “None” is stated, the limited dataset does not indicate a statistically relevant. Trend analysis based on the approach discussed in Section 3.8.The percent change represents the change per year as a percentage of the average value over the entire dataset (2019-2023) (not listed if trend is “None”).

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4.3 Nitrate + Nitrite (NOx)

The historical average quarterly influent NOx loads from July 2019 through September 2023 are presented in Figure 4-3. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-9 and Table 4-10, respectively.

A summary of the influent data review findings is as follows **(new findings for 2022/2023 in bold)**:

- Influent NOx loads and concentrations have the smallest relative contribution of the nitrogen species measured. On average, the influent NOx loads contribute less than 2 percent to the influent total nitrogen loads (data not shown).
- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- There are a few instances of missing data per plant (see Table 4-9 and Table 4-10; primarily from 2019). Despite missing data in 2019, the Baywide average annual loads from 2019/2020 and dry season loads from 2019 represent the largest loads. As previously noted, seasonal dischargers only need to collect samples when discharging (e.g., Napa typically does not discharge during the dry season and as such does not have influent NOx data).
- **<u>Average Annual:</u> this past year's data increased from the past couple years with the average annual values comparable to the first year of sampling. The loads increased approximately 650 kg N/d from last year with EBMUD (Central Bay Discharger) having the most profound increases at approximately 450 kg N/d. The other POTWs had individual nominal increases/decreases of less than 100 kg N/d.**
- **<u>Dry Season:</u> overall increase since last year of approximately 300 kg N/d with EBMUD (Central Bay Discharger) having the most profound increase at approximately 430 kg N/d. In contrast, San Jose saw a 260 kg N/d decline in dry season loads. Such a reduction at San Jose is in question as the plant experienced plugging issues with a new autosampler in 2023 which has since been resolved. Despite this past year's increase, the dry season loads are less than half of the first year of sampling values.**
- **<u>Dry Season Trending:</u> this is the first year when dry season trending analysis was performed for the influent NOx loads. Trending analysis suggests the South Bay Subembayment has a downward trend over the 5-year dry season dataset. This was expected considering the reductions at SFPUC Southeast. The other Subembayments and Baywide did not have any emerging trends.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2019 (see Section 3.8).
- The Central Bay and Lower South Bay together account for over half of the influent NOx loads, regardless of season (see Table 4-11 and Table 4-12).

A discussion of the results is provided in Section 7.3.

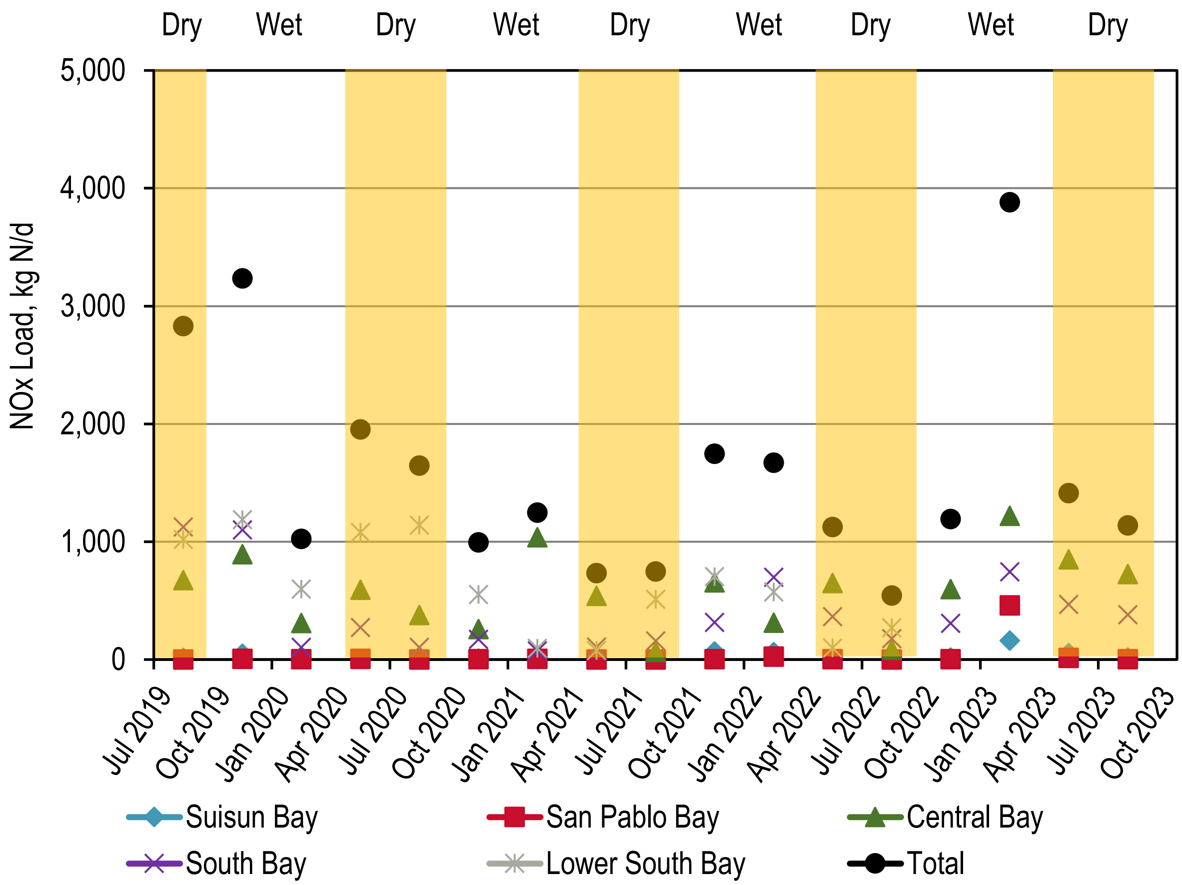

Figure 4-3. Influent: Historical Average Monthly NOx Loads

Table 4-9. Influent: Annual Average Loads to each Plant, NOx (kg N/d)*

Discharger	Subembayment	Permitted Capacity [a]	2018/ 2019 [a], [b]	2019/ 2020 [b]	2020/ 2021 [b]	2021/ 2022 [b]	2022/ 2023 [b]
American Canyon	San Pablo Bay	2.5	*	--	--	--	--
Benicia	San Pablo Bay	4.5	*	--	--	--	--
Burlingame	South Bay	5.5	*	--	--	--	--
Central San	Suisun Bay	53.8	*	1.89	2.94	7.58	45.1
CMSA	Central Bay	10	*	--	--	--	--
Port Costa	San Pablo Bay	0.033	*	--	--	--	--
Delta Diablo	Suisun Bay	19.5	*	12.8	5.31	24.3	9.65
EBDA	South Bay	107.8	*	46.9	84.0	114	195
EBMUD	Central Bay	120	*	520	450	390	838
FSSD	Suisun Bay	23.7	*	7.24	8.47	7.78	7.78
Las Gallinas[c]	San Pablo Bay	2.92	*	--	--	--	--
Paradise Cove	Central Bay	0.04	*	--	--	--	--
Tiburon	Central Bay	0.98	*	--	--	--	--
Millbrae	South Bay	3	*	--	--	--	--
Mt. View	Suisun Bay	3.2	*	--	--	--	--
Napa[c]	San Pablo Bay	15.4	*	2.30	1.54	3.34	16.3
Novato	San Pablo Bay	7	*	--	--	--	--
Palo Alto	Lower South Bay	39	*	16.4	7.29	34.1	31.9
Petaluma[c]	San Pablo Bay	6.7	*	--	--	--	--
Pinole	San Pablo Bay	4.06	*	--	--	--	--
Rodeo	San Pablo Bay	1.14	*	--	--	--	--
SFO Airport	South Bay	2.2	*	--	--	--	--
SFPUC Southeast	South Bay	85.4	*	295	41.7	218	182
San Jose	Lower South Bay	167	*	982	299	375	362
San Mateo	South Bay	15.7	*	22.3	4.61	7.59	66.2
SMCSD	Central Bay	1.8	*	--	--	--	--
SASM	Central Bay	3.6	*	--	--	--	--
SVCW	South Bay	29	*	47.0	4.95	47.9	16.9
Sonoma Valley[c]	San Pablo Bay	3	*	--	--	--	--
South SF	South Bay	13	*	6.48	3.73	2.39	13.0
Sunnyvale	Lower South Bay	29.5	*	2.87	2.98	2.00	6.25
Treasure Island	Central Bay	2	*	--	--	--	--
Vallejo	San Pablo Bay	15.5	*	2.01	1.37	6.36	108
West County	Central Bay	28.5	*	23.7	25.7	34.5	25.7
Total [d]		**827**	*** [e]**	**1,990**	**944**	**1,270**	**1,920**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Totals not provided due to an incomplete dataset.

Table 4-10. Influent: Dry Season Average Loads to each Plant, NOx (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2019 (a), (b), *	2020 (a), (b)	2021 (a), (b)	2022 (a), (b)	2023 (a), (b)
American Canyon	San Pablo Bay	2.5	--	--	--	--	--
Benicia	San Pablo Bay	4.5	--	--	--	--	--
Burlingame	South Bay	5.5	--	--	--	--	--
Central San	Suisun Bay	53.8	2.71	2.11	1.79	2.32	25.6
CMSA	Central Bay	10	--	--	--	--	--
Port Costa	San Pablo Bay	0.033	--	--	--	--	--
Delta Diablo	Suisun Bay	19.5	2.93	3.12	3.32	3.28	4.87
EBDA	South Bay	107.8	(e)	55.0	63.5	76.6	159
EBMUD	Central Bay	120	649	467	290	352	785
FSSD	Suisun Bay	23.7	7.18	11.1	6.76	7.78	7.78
Las Gallinas(c)	San Pablo Bay	2.92	--	--	--	--	--
Paradise Cove	Central Bay	0.04	--	--	--	--	--
Tiburon	Central Bay	0.98	--	--	--	--	--
Millbrae	South Bay	3	--	--	--	--	--
Mt. View	Suisun Bay	3.2	--	--	--	--	--
Napa(c)	San Pablo Bay	15.4	--	--	--	--	--
Novato	San Pablo Bay	7	--	--	--	--	--
Palo Alto	Lower South Bay	39	(e)	2.68	6.83	44.1	7.51
Petaluma(c)	San Pablo Bay	6.7	--	--	--	--	--
Pinole	San Pablo Bay	4.06	--	--	--	--	--
Rodeo	San Pablo Bay	1.14	--	--	--	--	--
SFO Airport	South Bay	2.2	--	--	--	--	--
SFPUC Southeast	South Bay	85.4	1,080	28.0	88.5	134	217
San Jose	Lower South Bay	167	1,020	1,130	501	261	3.33(f)
San Mateo	South Bay	15.7	7.98	5.10	1.73	3.43	1.84
SMCSD	Central Bay	1.8	--	--	--	--	--
SASM	Central Bay	3.6	--	--	--	--	--
SVCW	South Bay	29	37.1	22.5	9.90	47.4	7.84
Sonoma Valley(c)	San Pablo Bay	3	--	--	--	--	--
South SF	South Bay	13	1.11	5.75	2.45	1.94	12.8
Sunnyvale	Lower South Bay	29.5	(e)	2.94	0.407	1.41	1.93
Treasure Island	Central Bay	2	--	--	--	--	--
Vallejo	San Pablo Bay	15.5	(e)	1.09	<1	1.40	4.25
West County	Central Bay	28.5	25.2	18.3	13.2	14.0	14.4
Total (d)		**827**	**2,830**	**1,760**	**990**	**950**	**1,250**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Permit required data not provided.

f. Atypically low 2023 nitrate plus nitrite load for San Jose attributed to the new autosampler plugging issue.

Table 4-11. Influent: Annual Average NOx Loads by Subembayment (kg N/d)*,**

Subembayment	2018/2019 (a)	2019/2020 (a)	2020/2021 (a)	2021/2022 (a)	2022/2023 (a)
Suisun Bay	*	22.0	16.7	39.6	62.6
San Pablo Bay	*	4.31	2.91	9.70	125
Central Bay	*	543	476	425	864
South Bay	*	418	139	390	472
Lower South Bay	*	1,000	309	411	400
Total	*****	**1,990**	**944**	**1,270**	**1,920**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

** Refer to Table 4-9 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

Table 4-12. Influent: Dry Season Average NOx Loads by Subembayment (kg N/d)*,**

Subembayment	2019 (a),*	2020 (a)	2021 (a)	2022 (a)	2023 (a)	Trend (b)
Suisun Bay	12.8	16.3	11.9	13.4	38.2	None
San Pablo Bay	<1	1.09	<1	1.40	4.25	None
Central Bay	674	485	303	366	799	None
South Bay	1,120	116	166	263	398	Down (-32%/yr)
Lower South Bay	1,020	1,140	508	306	12.8 (c)	None
Total	**2,830**	**1,760**	**990**	**950**	**1,250**	**None**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

** Refer to Table 4-10 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is up to 10. Where “None” is stated, the limited dataset does not indicate a statistically relevant. Trend analysis based on the approach discussed in Section 3.8. The percent change represents the change per year as a percentage of the average value over the entire dataset (2019-2023) (not listed if trend is “None”).

c. Atypically low 2023 nitrate plus nitrite load for San Jose attributed to the new autosampler plugging issue.

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4.4 Total Inorganic Nitrogen (TIN)

TIN is calculated by adding the ammonia and NOx concentrations. The historical average quarterly influent TIN loads from July 2019 through September 2023 are presented in Figure 4-4. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-13 and Table 4-14, respectively.

A summary of the influent data review findings is as follows **(new findings for 2022/2023 in bold)**:

- Influent TIN loads and concentrations contribute on average approximately two-thirds of the total nitrogen concentrations and loads (data not shown).
- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- There are a few instances of missing data per plant that inform the TIN calculation (TIN = ammonia + nitrate + nitrite; refer Table 4-13 and Table 4-14). Specifically, EBDA, Palo Alto, and Vallejo failed to report. As such, the dry season TIN total loads for 2019 appear to be the lowest. Since failing to report in 2019, all dischargers required to report values have provided such data. As previously noted, seasonal dischargers only need to collect samples when discharging (e.g., Napa typically does not discharge during the dry season and as such does not have influent TIN data).
- **Average Annual Loads: this past year's loads increased approximately 500 kg N/d since last year. The largest increments are from San Jose (nearly 900 kg N/d; Lower South Bay Discharger) and SFPUC Southeast (nearly 600 kg N/d since last year; South Bay Discharger). In contrast, EBDA (South Bay Discharger) saw a decrease of approximately 700 kg N/d since last year.**
- **Dry Season Loads: this past year's loads are comparable to last year as evidenced by an approximately 100 kg N/d increase. The largest incremental load increase were for San Jose (Lower South Bay Discharger) and Vallejo (San Pablo Bay Discharger) at approximately 280 kg N/d and 270 kg N/d, respectively. In contrast, the largest reductions were for EBMUD (Central Bay Discharger) and SVCW (South Bay Discharger) at approximately 330 kg N/d and 260kg N/d, respectively. Furthermore, EBMUD also made additional changes to its high-strength waste receiving that is not reflected in this data set.**
- **Dry Season Trending: this is the first year when dry season trending analysis was performed for the influent TIN loads. Trending analysis suggests that all the Subembayments, including Baywide, have no emerging trends over the 5-year dry season dataset.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2019 (see Section 3.8).
- Similar to flow and ammonia loads, the South Bay and Lower South Bay accounts for over half of the influent TIN loads, regardless of season (see Table 4-15 and Table 4-16).

A discussion of the results is provided in Section 7.3.

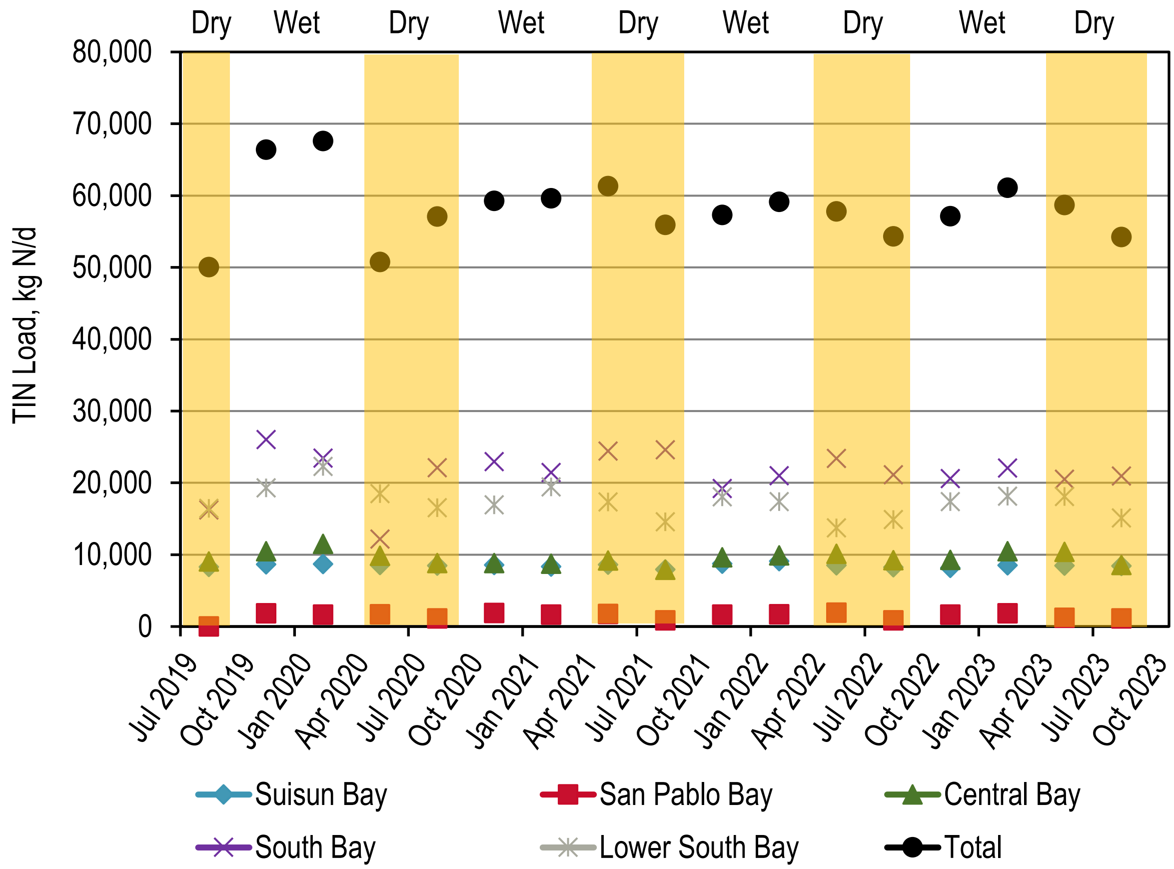

Figure 4-4. Influent: Historical Average Monthly TIN Loads

Table 4-13. Influent: Annual Average Loads to each Plant, TIN (kg N/d)*

Discharger	Subembayment	Permitted Capacity [a]	2018/ 2019 [a], [b]	2019/ 2020 [b]	2020/ 2021 [b]	2021/ 2022 [b]	2022/ 2023 [b]
American Canyon	San Pablo Bay	2.5	*	--	--	--	--
Benicia	San Pablo Bay	4.5	*	--	--	--	--
Burlingame	South Bay	5.5	*	--	--	--	--
Central San	Suisun Bay	53.8	*	5,100	4,930	4,840	4,840
CMSA	Central Bay	10	*	--	--	--	--
Port Costa	San Pablo Bay	0.033	*	--	--	--	--
Delta Diablo	Suisun Bay	19.5	*	1,850	1,840	2,060	1,930
EBDA	South Bay	107.8	*	9,250	9,780	10,100	9,380
EBMUD	Central Bay	120	*	8,260	6,830	7,880	7,840
FSSD	Suisun Bay	23.7	*	1,640	1,610	1,760	1,650
Las Gallinas[c]	San Pablo Bay	2.92	*	--	--	--	--
Paradise Cove	Central Bay	0.04	*	--	--	--	--
Tiburon	Central Bay	0.98	*	--	--	--	--
Millbrae	South Bay	3	*	--	--	--	--
Mt. View	Suisun Bay	3.2	*	--	--	--	--
Napa[c]	San Pablo Bay	15.4	*	815	871	859	706
Novato	San Pablo Bay	7	*	--	--	--	--
Palo Alto	Lower South Bay	39	*	2,330	2,270	2,490	2,670
Petaluma[c]	San Pablo Bay	6.7	*	--	--	--	--
Pinole	San Pablo Bay	4.06	*	--	--	--	--
Rodeo	San Pablo Bay	1.14	*	--	--	--	--
SFO Airport	South Bay	2.2	*	--	--	--	--
SFPUC Southeast	South Bay	85.4	*	9,050	8,860	5,790	6,340
San Jose	Lower South Bay	167	*	15,300	13,500	12,000	13,000
San Mateo	South Bay	15.7	*	1,610	1,450	1,500	1,470
SMCSD	Central Bay	1.8	*	--	--	--	--
SASM	Central Bay	3.6	*	--	--	--	--
SVCW	South Bay	29	*	2,460	2,490	2,660	2,420
Sonoma Valley[c]	San Pablo Bay	3	*	--	--	--	--
South SF	South Bay	13	*	1,010	1,020	1,160	1,350
Sunnyvale	Lower South Bay	29.5	*	1,510	1,400	1,500	1,560
Treasure Island	Central Bay	2	*	--	--	--	--
Vallejo	San Pablo Bay	15.5	*	978	891	887	934
West County	Central Bay	28.5	*	1,910	1,850	1,850	1,870
Total [d]		**827**	*** [e]**	**63,100**	**59,600**	**57,400**	**57,900**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Totals not provided due to an incomplete dataset.

Table 4-14. Influent: Dry Season Average Loads to each Plant, TIN (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2019 (a), (b), *	2020 (a), (b)	2021 (a), (b)	2022 (a), (b)	2023 (a), (b)
American Canyon	San Pablo Bay	2.5	--	--	--	--	--
Benicia	San Pablo Bay	4.5	--	--	--	--	--
Burlingame	South Bay	5.5	--	--	--	--	--
Central San	Suisun Bay	53.8	4,810	4,980	4,700	4,790	4,710
CMSA	Central Bay	10	--	--	--	--	--
Port Costa	San Pablo Bay	0.033	--	--	--	--	--
Delta Diablo	Suisun Bay	19.5	1,820	1,910	1,850	1,870	2,020
EBDA	South Bay	107.8	(e)	9,330	9,830	9,920	9,670
EBMUD	Central Bay	120	7,180	7,450	6,700	7,890	7,560
FSSD	Suisun Bay	23.7	1,690	1,540	1,710	1,720	1,740
Las Gallinas(c)	San Pablo Bay	2.92	--	--	--	--	--
Paradise Cove	Central Bay	0.04	--	--	--	--	--
Tiburon	Central Bay	0.98	--	--	--	--	--
Millbrae	South Bay	3	--	--	--	--	--
Mt. View	Suisun Bay	3.2	--	--	--	--	--
Napa(c)	San Pablo Bay	15.4	--	--	--	--	--
Novato	San Pablo Bay	7	--	--	--	--	--
Palo Alto	Lower South Bay	39	(e)	2,050	2,270	2,500	2,630
Petaluma(c)	San Pablo Bay	6.7	--	--	--	--	--
Pinole	San Pablo Bay	4.06	--	--	--	--	--
Rodeo	San Pablo Bay	1.14	--	--	--	--	--
SFO Airport	South Bay	2.2	--	--	--	--	--
SFPUC Southeast	South Bay	85.4	11,100	8,350	9,840	6,390	6,260
San Jose	Lower South Bay	167	14,600	13,200	11,100	10,600	10,800
San Mateo	South Bay	15.7	1,440	1,430	1,390	1,330	1,440
SMCSD	Central Bay	1.8	--	--	--	--	--
SASM	Central Bay	3.6	--	--	--	--	--
SVCW	South Bay	29	2,590	2,110	2,670	2,510	2,250
Sonoma Valley(c)	San Pablo Bay	3	--	--	--	--	--
South SF	South Bay	13	1,070	989	1,150	1,180	1,200
Sunnyvale	Lower South Bay	29.5	1,820	1,180	1,340	1,530	1,670
Treasure Island	Central Bay	2	--	--	--	--	--
Vallejo	San Pablo Bay	15.5	(e)	1,140	849	840	1,110
West County	Central Bay	28.5	1,900	1,900	1,850	1,800	1,780
Total (d)		**827**	**50,100**	**57,600**	**57,200**	**54,800**	**54,900**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Permit required data not provided.

Table 4-15. Influent: Annual Average TIN Loads by Subembayment (kg N/d)*,**

Subembayment	2018/2019 [a]	2019/2020 [a]	2020/2021 [a]	2021/2022 [a]	2022/2023 [a]
Suisun Bay	*	8,600	8,370	8,660	8,410
San Pablo Bay	*	1,790	1,760	1,750	1,640
Central Bay	*	10,200	8,680	9,730	9,700
South Bay	*	23,400	23,600	21,200	21,000
Lower South Bay	*	19,200	17,100	16,000	17,200
Total	*****	**63,100**	**59,600**	**57,400**	**57,900**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

** Refer to Table 4-13 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

Table 4-16. Influent: Dry Season Average TIN Loads by Subembayment (kg N/d)* ,**

Subembayment	2019 [a],*	2020 [a]	2021 [a]	2022 [a]	2023 [a]	Trend [b]
Suisun Bay	8,310	8,430	8,260	8,390	8,460	None
San Pablo Bay	0	1,140	849	840	1,110	None
Central Bay	9,080	9,350	8,550	9,690	9,340	None
South Bay	16,200	22,200	24,900	21,300	20,800	None
Lower South Bay	16,500	16,500	14,700	14,600	15,100	None
Total	**50,100**	**57,600**	**57,200**	**54,800**	**54,900**	**None**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

** Refer to Table 4-14 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is up to 10. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend. The percent change represents the change per year as a percentage of the average value over the entire dataset (2019-2023) (not considered if trend is “None”).

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4.5 Total Kjeldahl Nitrogen (TKN)

The TKN represents the sum of the total ammonia and organic nitrogen species. The historical average quarterly influent TKN loads from July 2019 through September 2023 are presented in Figure 4-5. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-17 and Table 4-18, respectively.

A summary of the influent data review findings is as follows **(new findings for 2022/2023 in bold)**:

- Influent TKN loads and concentrations have the largest relative contribution for the nitrogen species measured. On average, the influent TKN loads contribute greater than 92 percent to the influent total nitrogen loads (data not shown).
- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- Similar to NOx and TIN, there are a few instances of missing data per plant (Table 4-17 and Table 4-18; primarily from 2019). Since failing to report in 2019, all dischargers required to report values have provided such data. As previously noted, seasonal dischargers only need to collect samples when discharging (e.g., Napa typically does not discharge during the dry season and as such does not have influent TKN data).
- There are concerns that SFPUC Southeast data since 2021 might have a sampling artifact as there are ELAP-certified samples for which the TKN<Ammonia.
- **<u>Average Annual Loads:</u> the overall loads from comparable with the previous year as evidenced by a marginal increase of approximately 400 kg N/d. The largest increases occurred at SFPUC Southeast (South Bay Discharger) and West County (Central Bay Discharger) where both had increases of greater than 800 kg N/d. In contrast, the largest decrease occurred at EBDA (South Bay Discharger) of approximately 1,200 kg N/d.**
- **<u>Dry Season Loads:</u> the dry season overall loads showed a more profound change compared to last year with a decrease of approximately 4,700 kg N/d. The two largest contributors to this decrease since last year were EBMUD (Central Bay Discharger) and San Jose (Lower South Bay Discharger) with increases of approximately 1,600 kg N/d and 2,000 kg N/d, respectively. EBMUD also made additional changes to its high-strength waste receiving that is not reflected in this data set.**
- **<u>Dry Season Trending:</u> this is the first year when dry season trending analysis was performed for the influent TKN loads. Trending analysis suggests that only Suisun Bay had an emerging trend, which is a downward trend over the 5-year dry season dataset.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2019 (see Section 3.8).
- Similar to flow, ammonia, and TIN loads, the South Bay and Lower South Bay accounts for over half of the influent TKN loads, regardless of season (see Table 4-19 and Table 4-20).

A discussion of the results is provided in Section 7.3.

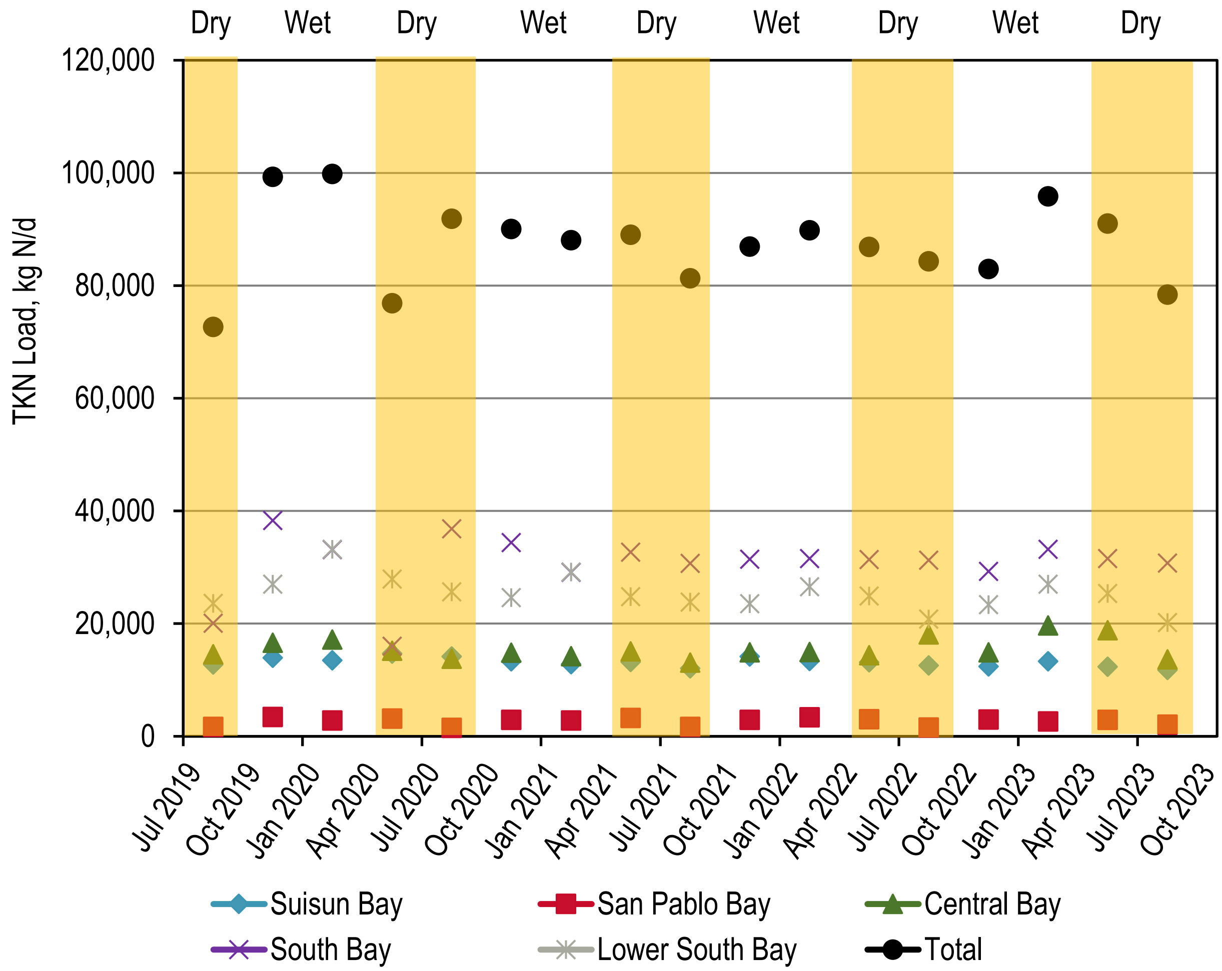

Figure 4-5. Influent: Historical Average Monthly TKN Loads

Table 4-17. Influent: Annual Average Loads to each Plant, TKN (kg N/d)*

Discharger	Subembayment	Permitted Capacity [(a)]	2018/ 2019 [(a), (b)]	2019/ 2020 [(b)]	2020/ 2021 [(b)]	2021/ 2022 [(b)]	2022/ 2023 [(b)]
American Canyon	San Pablo Bay	2.5	*	--	--	--	--
Benicia	San Pablo Bay	4.5	*	--	--	--	--
Burlingame	South Bay	5.5	*	--	--	--	--
Central San	Suisun Bay	53.8	*	7,440	6,870	7,010	6,730
CMSA	Central Bay	10	*	--	--	--	--
Port Costa	San Pablo Bay	0.033	*	--	--	--	--
Delta Diablo	Suisun Bay	19.5	*	3,530	3,210	3,420	3,060
EBDA	South Bay	107.8	*	16,600	15,100	15,500	14,300
EBMUD	Central Bay	120	*	12,500	11,400	12,800	13,500
FSSD	Suisun Bay	23.7	*	3,100	2,730	2,910	2,700
Las Gallinas[(c)]	San Pablo Bay	2.92	*	--	--	--	--
Paradise Cove	Central Bay	0.04	*	--	--	--	--
Tiburon	Central Bay	0.98	*	--	--	--	--
Millbrae	South Bay	3	*	--	--	--	--
Mt. View	Suisun Bay	3.2	*	--	--	--	--
Napa[(c)]	San Pablo Bay	15.4	*	1,480	1,370	1,410	1,340
Novato	San Pablo Bay	7	*	--	--	--	--
Palo Alto	Lower South Bay	39	*	4,070	3,490	3,730	3,770
Petaluma[(c)]	San Pablo Bay	6.7	*	--	--	--	--
Pinole	San Pablo Bay	4.06	*	--	--	--	--
Rodeo	San Pablo Bay	1.14	*	--	--	--	--
SFO Airport	South Bay	2.2	*	--	--	--	--
SFPUC Southeast	South Bay	85.4	*	12,000	10,100	8,670	9,530
San Jose	Lower South Bay	167	*	22,000	20,000	18,100	17,700
San Mateo	South Bay	15.7	*	2,500	2,090	2,340	2,320
SMCSD	Central Bay	1.8	*	--	--	--	--
SASM	Central Bay	3.6	*	--	--	--	--
SVCW	South Bay	29	*	2,840	2,980	3,210	3,160
Sonoma Valley[(c)]	San Pablo Bay	3	*	--	--	--	--
South SF	South Bay	13	*	1,420	1,400	1,590	1,760
Sunnyvale	Lower South Bay	29.5	*	2,360	2,180	2,090	2,480
Treasure Island	Central Bay	2	*	--	--	--	--
Vallejo	San Pablo Bay	15.5	*	1,600	1,630	1,660	1,640
West County	Central Bay	28.5	*	3,200	2,910	2,810	3,650
Total [(d)]		**827**	*** [(e)]**	**96,600**	**87,500**	**87,300**	**87,700**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Totals not provided due to an incomplete dataset.

Table 4-18. Influent: Dry Season Loads to each Plant, TKN (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2019 (a), (b), *	2020 (a), (b)	2021 (a), (b)	2022 (a), (b)	2023 (a), (b)
American Canyon	San Pablo Bay	2.5	--	--	--	--	--
Benicia	San Pablo Bay	4.5	--	--	--	--	--
Burlingame	South Bay	5.5	--	--	--	--	--
Central San	Suisun Bay	53.8	6,890	6,950	6,760	6,770	6,370
CMSA	Central Bay	10	--	--	--	--	--
Port Costa	San Pablo Bay	0.033	--	--	--	--	--
Delta Diablo	Suisun Bay	19.5	3,250	3,980	3,070	3,280	3,040
EBDA	South Bay	107.8	(e)	18,500	15,300	14,900	14,900
EBMUD	Central Bay	120	10,800	11,400	11,200	13,500	11,900
FSSD	Suisun Bay	23.7	2,630	3,110	2,690	2,820	2,480
Las Gallinas(c)	San Pablo Bay	2.92	--	--	--	--	--
Paradise Cove	Central Bay	0.04	--	--	--	--	--
Tiburon	Central Bay	0.98	--	--	--	--	--
Millbrae	South Bay	3	--	--	--	--	--
Mt. View	Suisun Bay	3.2	--	--	--	--	--
Napa(c)	San Pablo Bay	15.4	--	--	--	1,610	--
Novato	San Pablo Bay	7	--	--	--	--	--
Palo Alto	Lower South Bay	39	(e)	3,950	3,620	3,660	3,820
Petaluma(c)	San Pablo Bay	6.7	--	--	--	--	--
Pinole	San Pablo Bay	4.06	--	--	--	--	--
Rodeo	San Pablo Bay	1.14	--	--	--	--	--
SFO Airport	South Bay	2.2	--	--	--	--	--
SFPUC Southeast	South Bay	85.4	13,800	12,000	9,970	8,960	8,680
San Jose	Lower South Bay	167	20,800	19,000	18,200	15,600	13,600
San Mateo	South Bay	15.7	1,720	2,260	1,970	1,990	2,240
SMCSD	Central Bay	1.8	--	--	--	--	--
SASM	Central Bay	3.6	--	--	--	--	--
SVCW	South Bay	29	3,090	2,590	2,920	3,200	2,840
Sonoma Valley(c)	San Pablo Bay	3	--	--	--	--	--
South SF	South Bay	13	1,500	1,400	1,480	1,790	1,810
Sunnyvale	Lower South Bay	29.5	2,820	2,120	2,210	2,180	2,550
Treasure Island	Central Bay	2	--	--	--	--	--
Vallejo	San Pablo Bay	15.5	1,690	1,500	1,670	1,580	2,040
West County	Central Bay	28.5	3,760	3,120	2,860	2,750	3,610
Total (d)		**827**	**72,700**	**91,900**	**83,900**	**84,600**	**79,900**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Permit required data not provided.

Table 4-19. Influent: Annual Average TKN Loads by Subembayment (kg N/d)*,**

Subembayment	2018/2019 (a)	2019/2020 (a)	2020/2021 (a)	2021/2022 (a)	2022/2023 (a)
Suisun Bay	*	14,100	12,800	13,300	12,500
San Pablo Bay	*	3,090	3,010	3,070	2,990
Central Bay	*	15,700	14,300	15,600	17,100
South Bay	*	35,300	31,700	31,300	31,100
Lower South Bay	*	28,400	25,700	23,900	24,000
Total	*	**96,600**	**87,500**	**87,300**	**87,600**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

** Refer to Table 4-17 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

Table 4-20. Influent: Dry Season Average TKN Loads by Subembayment (kg N/d)*,**

Subembayment	2019 (a), *	2020 (a)	2021 (a)	2022 (a)	2023 (a)	Trend (b)
Suisun Bay	12,800	14,000	12,500	12,900	11,900	Down (-2.3%/yr)
San Pablo Bay	1,690	1,500	1,670	3,190	2,040	None
Central Bay	14,600	14,500	14,100	16,200	15,500	None
South Bay	20,100	36,700	31,700	30,800	30,500	None
Lower South Bay	23,600	25,100	24,000	21,400	20,000	None
Total	**72,700**	**91,900**	**83,900**	**84,600**	**79,600**	**None**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

** Refer to Table 4-18 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is up to 10. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend. The percent change represents the change per year as a percentage of the average value over the entire dataset (2019-2023) (not considered if trend is “None”).

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4.6 Total Nitrogen (TN)

Total nitrogen is included as a metric for the influent (but not discharge) as it captures the organic nitrogen loading into the plant. The majority of influent organic nitrogen is oxidized to ammonia in the treatment plant. The historical average quarterly influent TN loads from July 2019 through September 2023 are presented in Figure 4-6. A relatively small portion of this organic nitrogen leaves with discharge as residual organic nitrogen (typically about 1.5 to 3.5 mg N/L). While this represents a relatively small proportion of discharge, it is an important component for the nitrogen balance within the treatment plant. It is calculated by adding the TKN and NOx concentrations.

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-21 and Table 4-22, respectively.

A summary of the influent data review findings is as follows **(new findings for 2022/2023 in bold)**:

- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- Similar to NOx, TIN, and TKN, there are a few instances of missing data per plant that inform the TN calculation (TN = TKN + nitrate + nitrite; refer Table 4-21 and Table 4-22). Since failing to report in 2019, all dischargers required to report values have provided such data. As previously noted, seasonal dischargers only need to collect samples when discharging (e.g., Napa typically does not discharge during the dry season and as such does not have influent TN data).
- As previously noted, there are concerns that SFPUC Southeast data since 2021 might have a sampling artifact as there are ELAP-certified samples for which the TKN<Ammonia. Such values will impact TN values as TN equals the sum of TKN and Nitrite+Nitrate.
- **<u>Average Annual Loads:</u> the overall loads increased 1,100 kg N/d since last year. Note: 2020/2021 and 2021/2022 overall loads were the same (88,500 kg N/d). Despite this year's increase, the loads are still approximately 9,000 kg N/d less than the 2019/2020 dataset. EBMUD (Central Bay Discharger) had the largest increase since last year at approximately 1,100 kg N/d. This was followed by West County (Central Bay Discharger) and SFPUC Southeast (South Bay Discharger) with increases of approximately 800 kg N/d for each discharger. In contrast, EBDA (South Bay Discharger) had a reduction from last year of approximately 1,100 kg N/d.**
- **<u>Dry Season Loads:</u> unlike average loads, the overall dry season loads decreased by approximately 2,900 kg N/d since the 2022 dry season. San Jose (Lower South Bay Discharger) and EBMUD (Central Bay Discharger) had the largest decrease in loads at approximately 2,300 kg N/d and 1,200 kg N/d, respectively. Furthermore, EBMUD also made additional changes to its high-strength waste receiving that is not reflected in this data set.**
- **<u>Dry Season Trending:</u> this is the first year when dry season trending analysis was performed for the influent TN loads. Trending analysis suggests that only Suisun Bay had an emerging trend, which is a downward trend over the 5-year dry season dataset.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2019 (see Section 3.8).

- Similar to flow, ammonia, TIN, and TKN loads, the South Bay and Lower South Bay accounts for over half of the influent TKN loads, regardless of season (see Table 4-23 and Table 4-24).

A discussion of the results is provided in Section 7.3.

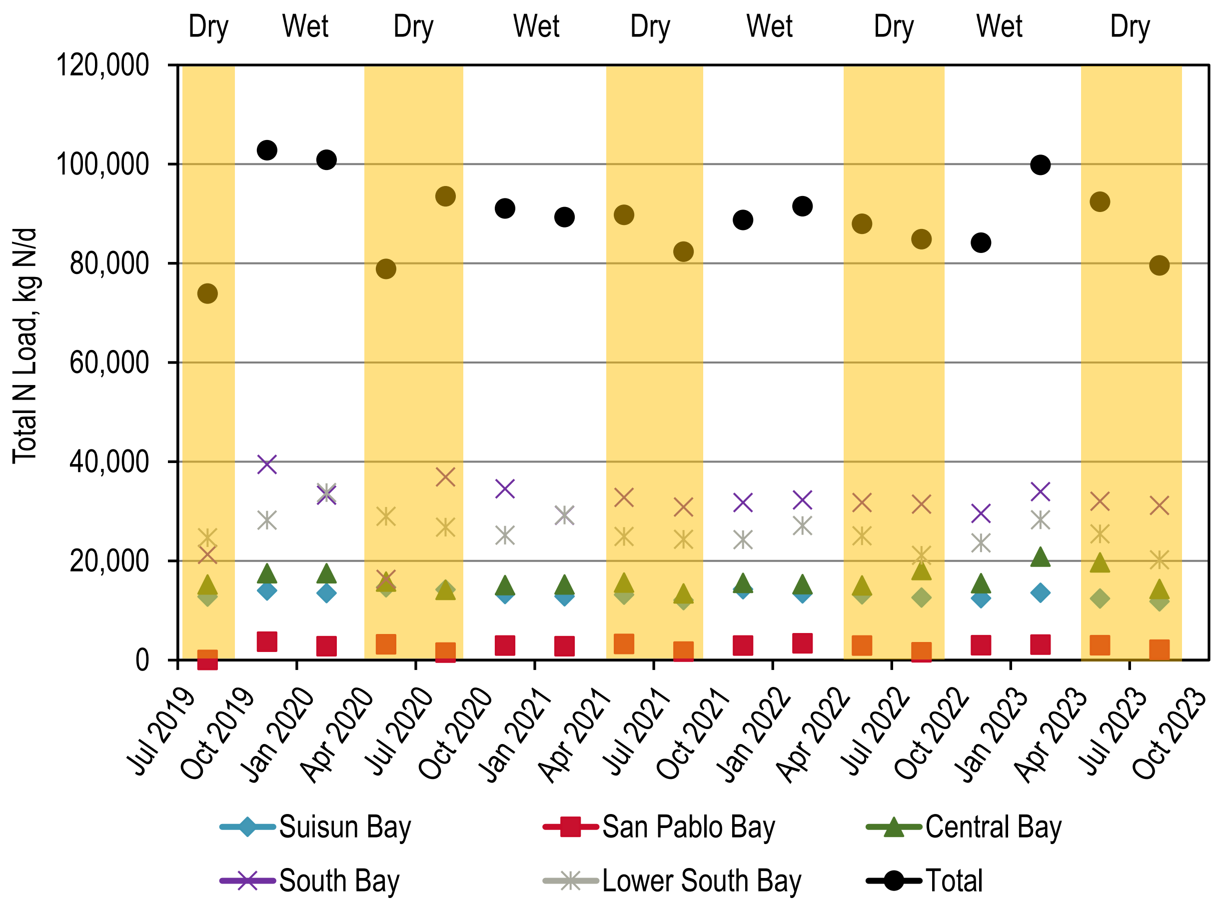

Figure 4-6. Influent: Historical Average Monthly Total N Loads

Table 4-21. Influent: Annual Average Loads to each Plant, TN (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2018/ 2019 (a), (b)	2019/ 2020 (b)	2020/ 2021 (b)	2021/ 2022 (b)	2022/ 2023 (b)
American Canyon	San Pablo Bay	2.5	*	--	--	--	--
Benicia	San Pablo Bay	4.5	*	--	--	--	--
Burlingame	South Bay	5.5	*	--	--	--	--
Central San	Suisun Bay	53.8	*	7,440	6,870	7,020	6,780
CMSA	Central Bay	10	*	--	--	--	--
Port Costa	San Pablo Bay	0.033	*	--	--	--	--
Delta Diablo	Suisun Bay	19.5	*	3,540	3,210	3,460	3,070
EBDA	South Bay	107.8	*	16,600	15,200	15,600	14,500
EBMUD	Central Bay	120	*	13,000	11,800	13,200	14,300
FSSD	Suisun Bay	23.7	*	3,110	2,740	2,920	2,710
Las Gallinas(c)	San Pablo Bay	2.92	*	--	--	--	--
Paradise Cove	Central Bay	0.04	*	--	--	--	--
Tiburon	Central Bay	0.98	*	--	--	--	--
Millbrae	South Bay	3	*	--	--	--	--
Mt. View	Suisun Bay	3.2	*	--	--	--	--
Napa(c)	San Pablo Bay	15.4	*	1,570	1,380	1,370	1,360
Novato	San Pablo Bay	7	*	--	--	--	--
Palo Alto	Lower South Bay	39	*	4,090	3,500	3,770	3,800
Petaluma(c)	San Pablo Bay	6.7	*	--	--	--	--
Pinole	San Pablo Bay	4.06	*	--	--	--	--
Rodeo	San Pablo Bay	1.14	*	--	--	--	--
SFO Airport	South Bay	2.2	*	--	--	--	--
SFPUC Southeast	South Bay	85.4	*	12,300	10,100	8,890	9,710
San Jose	Lower South Bay	167	*	23,000	20,300	18,500	18,100
San Mateo	South Bay	15.7	*	2,520	2,090	2,350	2,380
SMCSD	Central Bay	1.8	*	--	--	--	--
SASM	Central Bay	3.6	*	--	--	--	--
SVCW	South Bay	29	*	2,890	2,980	3,260	3,170
Sonoma Valley(c)	San Pablo Bay	3	*	--	--	--	--
South SF	South Bay	13	*	1,430	1,410	1,590	1,780
Sunnyvale	Lower South Bay	29.5	*	2,370	2,180	2,090	2,490
Treasure Island	Central Bay	2	*	--	--	--	--
Vallejo	San Pablo Bay	15.5	*	1,600	1,630	1,670	1,750
West County	Central Bay	28.5	*	3,220	3,010	2,850	3,680
Total (d)		**827**	* (e)	**98,700**	**88,500**	**88,500**	**89,600**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Totals not provided due to an incomplete dataset.

Table 4-22. Influent: Dry Season Average Loads to each Plant, TN (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2019 (a), (b), *	2020 (a), (b)	2021 (a), (b)	2022 (a), (b)	2023 (a), (b)
American Canyon	San Pablo Bay	2.5	--	--	--	--	--
Benicia	San Pablo Bay	4.5	--	--	--	--	--
Burlingame	South Bay	5.5	--	--	--	--	--
Central San	Suisun Bay	53.8	6,890	6,950	6,760	6,780	6,380
CMSA	Central Bay	10	--	--	--	--	--
Port Costa	San Pablo Bay	0.033	--	--	--	--	--
Delta Diablo	Suisun Bay	19.5	3,250	3,980	3,070	3,340	3,050
EBDA	South Bay	107.8	(e)	18,500	15,400	15,000	15,000
EBMUD	Central Bay	120	11,400	11,800	11,500	13,900	12,700
FSSD	Suisun Bay	23.7	2,640	3,120	2,700	2,830	2,490
Las Gallinas(c)	San Pablo Bay	2.92	--	--	--	--	--
Paradise Cove	Central Bay	0.04	--	--	--	--	--
Tiburon	Central Bay	0.98	--	--	--	--	--
Millbrae	South Bay	3	--	--	--	--	--
Mt. View	Suisun Bay	3.2	--	--	--	--	--
Napa(c)	San Pablo Bay	15.4	--	--	--	--	--
Novato	San Pablo Bay	7	--	--	--	--	--
Palo Alto	Lower South Bay	39	(e)	3,950	3,620	3,700	3,830
Petaluma(c)	San Pablo Bay	6.7	--	--	--	--	--
Pinole	San Pablo Bay	4.06	--	--	--	--	--
Rodeo	San Pablo Bay	1.14	--	--	--	--	--
SFO Airport	South Bay	2.2	--	--	--	--	--
SFPUC Southeast	South Bay	85.4	14,900	12,000	10,100	9,090	8,890
San Jose	Lower South Bay	167	21,800	20,200	18,700	15,900	13,600
San Mateo	South Bay	15.7	1,720	2,260	1,970	1,990	2,240
SMCSD	Central Bay	1.8	--	--	--	--	--
SASM	Central Bay	3.6	--	--	--	--	--
SVCW	South Bay	29	3,130	2,610	2,930	3,250	2,850
Sonoma Valley(c)	San Pablo Bay	3	--	--	--	--	--
South SF	South Bay	13	1,510	1,410	1,480	1,790	1,830
Sunnyvale	Lower South Bay	29.5	2,820	2,120	2,210	2,180	2,550
Treasure Island	Central Bay	2	--	--	--	--	--
Vallejo	San Pablo Bay	15.5	(e)	1,500	1,670	1,580	2,050
West County	Central Bay	28.5	3,790	3,140	3,020	2,760	3,630
Total (d)		**827**	**73,900**	**93,600**	**85,100**	**84,000**	**81,100**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Permit required data not provided.

Table 4-23. Influent: Annual Average TN Loads by Subembayment (kg N/d)*,**

Subembayment	2018/2019 (a)	2019/2020 (a)	2020/2021 (a)	2021/2022 (a)	2022/2023 (a)
Suisun Bay	*	14,100	12,800	13,400	12,600
San Pablo Bay	*	3,170	3,010	3,030	3,110
Central Bay	*	16,200	14,900	16,000	18,000
South Bay	*	35,700	31,800	31,700	31,600
Lower South Bay	*	29,400	26,000	24,400	24,400
Total	*****	**98,700**	**88,500**	**88,500**	**89,600**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

** Refer to Table 4-21 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

Table 4-24. Influent: Dry Season Average TN Loads by Subembayment (kg N/d)*,**

Subembayment	2019 (a),*	2020 (a)	2021 (a)	2022 (a)	2023 (a)	Trend (b)
Suisun Bay	12,800	14,100	12,500	12,900	11,900	Down (-2.2%/yr)
San Pablo Bay	--*	1,500	1,670	1,580	2,050	None
Central Bay	15,200	15,000	14,500	16,600	16,300	None
South Bay	21,300	36,800	31,800	31,100	30,900	None
Lower South Bay	24,600	26,200	24,500	21,800	20,000	None
Total	**73,900**	**93,600**	**85,100**	**84,000**	**81,100**	**None**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond. Neither San Pablo Bay discharger that monitors influent parameters (Napa and Vallejo) measured TN during the 2019 dry season.

** Refer to Table 4-22 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is up to 10. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend. The percent change represents the change per year as a percentage of the average value over the entire dataset (2019-2023) (not considered if trend is “None”).

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4.7 Total Phosphorus (TP)

The historical average quarterly influent TP loads from July 2019 through September 2023 are presented in Figure 4-7. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-25 and Table 4-26, respectively.

A summary of the influent data review findings is as follows **(new findings for 2022/2023 in bold)**:

- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- Similar to NOx, TIN, TKN, and TN, there are a few instances of missing data per plant (refer to Table 4-25 and Table 4-26; primarily from 2019). Since failing to report in 2019, all dischargers required to report values have provided such data. As previously noted, seasonal dischargers only need to collect samples when discharging (e.g., Napa typically does not discharge during the dry season and as such does not have influent TP data).
- **<u>Average Annual Loads:</u> the overall loads from comparable with the previous year as evidenced by a marginal increase of approximately 100 kg P/d. Despite an increase compared to last year, this past year's loads were still less than the 2019/2020 average annual value. The largest contributor to this year's increase was from EBMUD (Central Bay Discharger) whose load increased 600 kg P/d.**
- **<u>Dry Season Loads:</u> the dry season overall loads showed a more profound change compared to last year with a decrease of approximately 1,400 kg P/d. The largest contributor to the decrease compared to last year was from San Jose (Lower South Bay Discharger) with a reduction of approximately 840 kg P/d.**
- **<u>Dry Season Trending:</u> this is the first year when dry season trending analysis was performed for the influent ammonia loads. Trending analysis suggests that only Suisun Bay had an emerging trend, which is a downward trend over the 5-year dry season dataset.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2019 (see Section 3.8).
- Similar to flow, ammonia, TIN, TKN, and TN loads, the South Bay and Lower South Bay accounts for over half of the influent TP loads, regardless of season (see Table 4-27 and Table 4-28).

A discussion of the results is provided in Section 7.3.

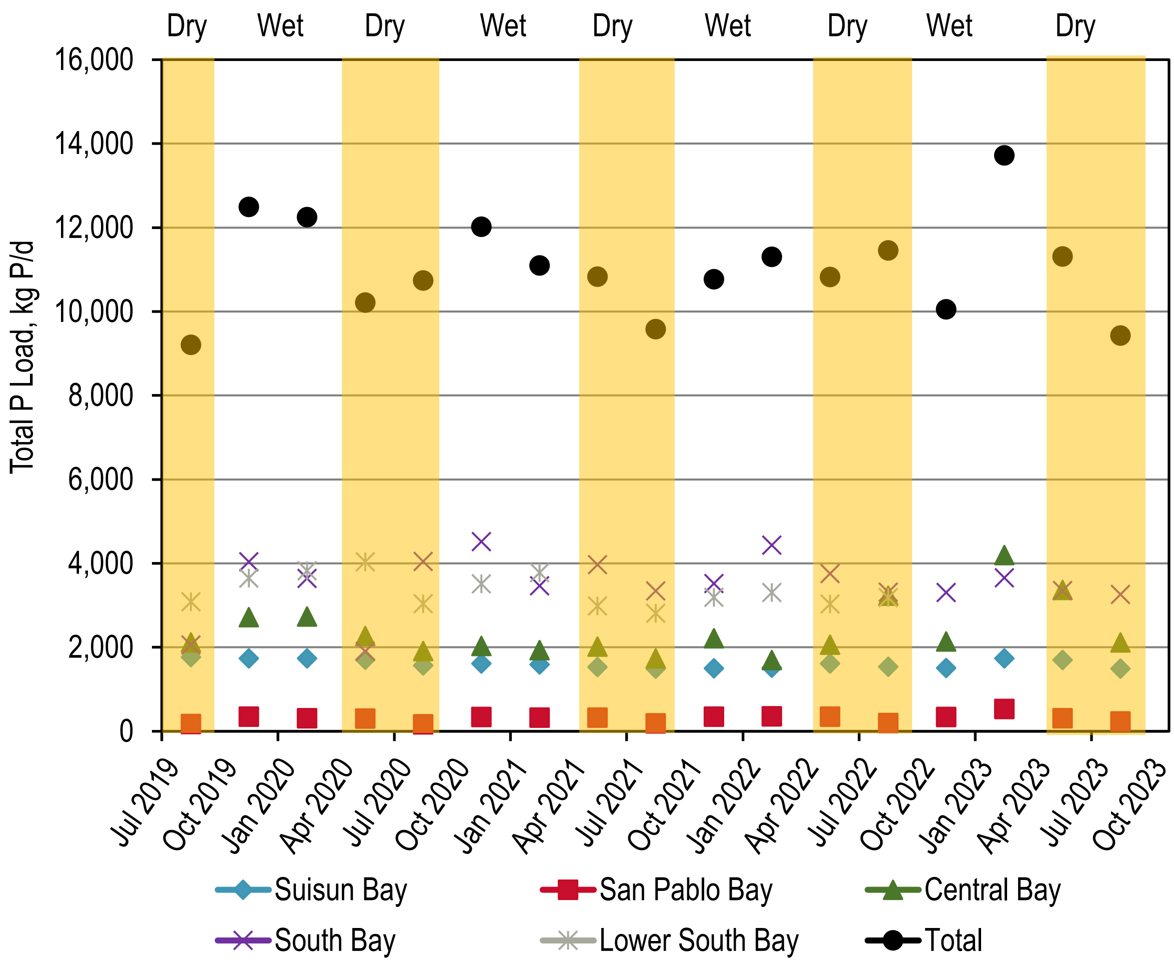

Figure 4-7. Influent: Historical Average Monthly Total P Loads for Evaluation Period

Table 4-25. Influent: Annual Average Loads to each Plant, TP (kg P/d)

Discharger	Subembayment	Permitted Capacity [a]	2018/ 2019 [a], [b]	2019/ 2020 [b]	2020/ 2021 [b]	2021/ 2022 [b]	2022/ 2023 [b]
American Canyon	San Pablo Bay	2.5	*	--	--	--	--
Benicia	San Pablo Bay	4.5	*	--	--	--	--
Burlingame	South Bay	5.5	*	--	--	--	--
Central San	Suisun Bay	53.8	*	981	823	785	871
CMSA	Central Bay	10	*	--	--	--	--
Port Costa	San Pablo Bay	0.033	*	--	--	--	--
Delta Diablo	Suisun Bay	19.5	*	339	362	353	344
EBDA	South Bay	107.8	*	1,620	1,630	1,650	1,580
EBMUD	Central Bay	120	*	1,960	1,580	1,960	2,560
FSSD	Suisun Bay	23.7	*	369	373	403	392
Las Gallinas[c]	San Pablo Bay	2.92	*	--	--	--	--
Paradise Cove	Central Bay	0.04	*	--	--	--	--
Tiburon	Central Bay	0.98	*	--	--	--	--
Millbrae	South Bay	3	*	--	--	--	--
Mt. View	Suisun Bay	3.2	*	--	--	--	--
Napa[c]	San Pablo Bay	15.4	*	146	150	160	227
Novato	San Pablo Bay	7	*	--	--	--	--
Palo Alto	Lower South Bay	39	*	410	368	409	442
Petaluma[c]	San Pablo Bay	6.7	*	--	--	--	--
Pinole	San Pablo Bay	4.06	*	--	--	--	--
Rodeo	San Pablo Bay	1.14	*	--	--	--	--
SFO Airport	South Bay	2.2	*	--	--	--	--
SFPUC Southeast	South Bay	85.4	*	1,330	1,270	1,260	1,060
San Jose	Lower South Bay	167	*	2,940	2,650	2,490	2,090
San Mateo	South Bay	15.7	*	246	226	242	221
SMCSD	Central Bay	1.8	*	--	--	--	--
SASM	Central Bay	3.6	*	--	--	--	--
SVCW	South Bay	29	*	387	390	369	327
Sonoma Valley[c]	San Pablo Bay	3	*	--	--	--	--
South SF	South Bay	13	*	234	224	232	193
Sunnyvale	Lower South Bay	29.5	*	283	267	280	291
Treasure Island	Central Bay	2	*	--	--	--	--
Vallejo	San Pablo Bay	15.5	*	173	185	191	182
West County	Central Bay	28.5	*	347	357	340	434
Total [d]		**827**	*** [e]**	**11,800**	**10,900**	**11,100**	**11,200**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Totals not provided due to an incomplete dataset.

Table 4-26. Influent: Dry Season Average Loads to each Plant, TP (kg P/d)*

Discharger	Subembayment	Permitted Capacity (a)	2019 (a), (b),*	2020 (a), (b)	2021 (a), (b)	2022 (a), (b)	2023 (a), (b)
American Canyon	San Pablo Bay	2.5	--	--	--	--	--
Benicia	San Pablo Bay	4.5	--	--	--	--	--
Burlingame	South Bay	5.5	--	--	--	--	--
Central San	Suisun Bay	53.8	1,030	875	783	793	813
CMSA	Central Bay	10	--	--	--	--	--
Port Costa	San Pablo Bay	0.033	--	--	--	--	--
Delta Diablo	Suisun Bay	19.5	361	367	367	380	341
EBDA	South Bay	107.8	(e)	1,670	1,700	1,570	1,670
EBMUD	Central Bay	120	1,800	1,690	1,530	2,340	2,060
FSSD	Suisun Bay	23.7	372	371	381	402	382
Las Gallinas(c)	San Pablo Bay	2.92	--	--	--	--	--
Paradise Cove	Central Bay	0.04	--	--	--	--	--
Tiburon	Central Bay	0.98	--	--	--	--	--
Millbrae	South Bay	3	--	--	--	--	--
Mt. View	Suisun Bay	3.2	--	--	--	--	--
Napa(c)	San Pablo Bay	15.4	--	--	--	175	--
Novato	San Pablo Bay	7	--	--	--	--	--
Palo Alto	Lower South Bay	39	(e)	352	377	422	437
Petaluma(c)	San Pablo Bay	6.7	--	--	--	--	--
Pinole	San Pablo Bay	4.06	--	--	--	--	--
Rodeo	San Pablo Bay	1.14	--	--	--	--	--
SFO Airport	South Bay	2.2	--	--	--	--	--
SFPUC Southeast	South Bay	85.4	1,300	1,550	960	947	790
San Jose	Lower South Bay	167	2,770	2,460	2,200	2,440	1,600
San Mateo	South Bay	15.7	223	218	207	212	213
SMCSD	Central Bay	1.8	--	--	--	--	--
SASM	Central Bay	3.6	--	--	--	--	--
SVCW	South Bay	29	329	367	370	346	268
Sonoma Valley(c)	San Pablo Bay	3	--	--	--	--	--
South SF	South Bay	13	209	228	226	255	188
Sunnyvale	Lower South Bay	29.5	322	245	269	302	289
Treasure Island	Central Bay	2	--	--	--	--	--
Vallejo	San Pablo Bay	15.5	175	167	191	193	232
West County	Central Bay	28.5	321	333	345	313	441
Total (d)		**827**	**9,210**	**10,900**	**9,910**	**11,100**	**9,720**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data not required as such dischargers have a permitted capacity of less than 10 mgd, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Permit required data not provided.

Table 4-27. Influent: Annual Average TP Loads by Subembayment (kg P/d)*,**

Subembayment	2018/2019 [(a)]	2019/2020 [(a)]	2020/2021 [(a)]	2021/2022 [(a)]	2022/2023 [(a)]
Suisun Bay	*	1,690	1,560	1,540	1,610
San Pablo Bay	*	319	334	350	409
Central Bay	*	2,310	1,940	2,300	2,990
South Bay	*	3,820	3,740	3,760	3,380
Lower South Bay	*	3,640	3,280	3,180	2,820
Total	*****	**11,800**	**10,900**	**11,100**	**11,200**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

** Refer to Table 4-25 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

Table 4-28. Influent: Dry Season Average TP Loads by Subembayment (kg P/d)*,**

Subembayment	2019 [(a),*]	2020 [(a)]	2021 [(a)]	2022 [(a)]	2023 [(a)]	Trend [(b)]
Suisun Bay	1,770	1,610	1,530	1,580	1,540	Down (-3.1%/yr)
San Pablo Bay	175	167	191	368	232	None
Central Bay	2,120	2,020	1,880	2,650	2,500	None
South Bay	2,060	4,040	3,470	3,330	3,130	None
Lower South Bay	3,090	3,060	2,840	3,170	2,320	None
Total	**9,210**	**10,900**	**9,910**	**11,100**	**9,720**	**None**

* 2019 dataset limited to July through September compared against May through September for 2020 and beyond.

** Refer to Table 4-26 for a list of dischargers that did not sample for each timeframe.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is up to 10. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend. The percent change represents the change per year as a percentage of the average value over the entire dataset (2019-2023) (not considered if trend is “None”).

5 Discharge Data Review Findings

This section presents a discussion of the data for the following discharge parameters:

1. Discharge Flow (reported as mgd)
2. Total Ammonia (reported as kg N/d)
3. Nitrate plus Nitrite (NOx, reported as kg N/d)
4. Total Inorganic Nitrogen (reported as kg N/d)
5. Total Phosphorus (reported as kg P/d)

Data on flow (as mgd), load (as kg/d), and concentrations (mg/L) are summarized for each discharger (concentrations by Subembayment only), as well as for each of the five Subembayments. The data are also presented for both the annual average and dry season average. Data are presented based on the period of collection; for example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.

Following the subsections on each parameter, subsection 5.6 provides the relative contribution of flow and loads for each discharger by Subembayment. This was not included with the influent as the data does not include all the POTWs.

As previously described, the trend analysis presented in the following subsections is based on the Dry Season (a minimum of 55 samples for all major dischargers (>1 mgd permitted capacity ADWF)).

Since the first Group Annual Report submitted in 2015, there have been several data amendments within CIWQS and the Group Annual Reports as follows:

- Data from the City of Palo Alto, the City of San Mateo, and Napa Sanitation District submitted under the 2015 Group Annual Report Submittal were initially updated in the 2016 Report with updated data that are reflected in this report.
- Data from the Rodeo Sanitary District 2014-2016 datasets were updated with values that are reflected in this report.
- Ammonia data for June 2017 from Sausalito Marin City Sanitation District were updated with values that are reflected in this report.
- Flow data from Tiburon for the 2014/2015 and 2015/2016 were inaccurately reported in the 2017 Group Annual Report. This report reflects the accurate data from CIWQS.
- Flow data for Mt View Sanitary District for a portion of the 2018 dry season and the 2018/2019 dataset were inaccurately reported in the 2018 and 2019 Group Annual Reports. This report reflects the accurate data since updated in CIWQS.

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5.1 Flow

The historical average monthly discharge flows from October 2012 through September 2023 are presented in Figure 5-1. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge flows were calculated based on reported flows in Table 5-1 and Table 5-2, respectively. In addition, the annual average and dry season average monthly discharge flows for each Subembayment are provided in Table 5-3 and Table 5-4, respectively.

A summary of the discharge data review findings is as follows **(new findings for 2022/2023 in bold)**:

- It is well documented that influent/discharge flows typically increase with precipitation (discussed in Section 7.1). During relatively wet years (e.g., 2016/2017 and 2022/2023), the average monthly discharge flows have been the highest since sampling began in 2012. **This past year experienced three relatively wet months (December 2022, January 2023, and March 2023) resulting in the highest precipitation since sampling began in 2012.**
- <u>**Average Annual Flows:**</u> **the average annual flows were the second highest in 2022/2023 with an increase of 80 mgd compared to 2021/2022 values (refer to Table 5-3). All 34 dischargers had an increase in average annual flows this past year with the largest increase occurring for San Jose (Lower South Bay Discharger) at approximately 15 mgd. Compared to the 11-year average (10/2012 through 09/2023), this past year's average annual values were approximately 41 mgd higher.**
- <u>**Dry Season Flows:**</u> **similar to average annual flows, dry season flows increased compared to the previous year with an increase of approximately 44 mgd (refer to Table 5-4). The dry season flows this past year are approximately 10 mgd more than the 11-year average (10/2012 through 09/2023). The largest increase occurred for San Jose (Lower South Bay Discharger) at approximately 16 mgd.**
- **Lower South Bay had the largest increase in the annual average discharge flow and dry season discharge flow (22 mgd increase and 19 mgd increase, respectively) as compared to 2021/2022.**
- <u>**Dry Season Trending:**</u> **the dry season trending analysis suggests that South Bay and Lower South Bay have a downward trend when evaluated for the entire 11-year dry season. The extent of downward trends is not as profound as last year's Group Annual Report which is attributed to this past year's relatively wet year.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2012 (see Section 3.8).
- Dischargers to South Bay and Lower South Bay Subembayments account for over half of discharge flow to San Francisco Bay (refer to Figure 5-1 and/or Table 5-3).

A discussion of the results is provided in Section 7.5.

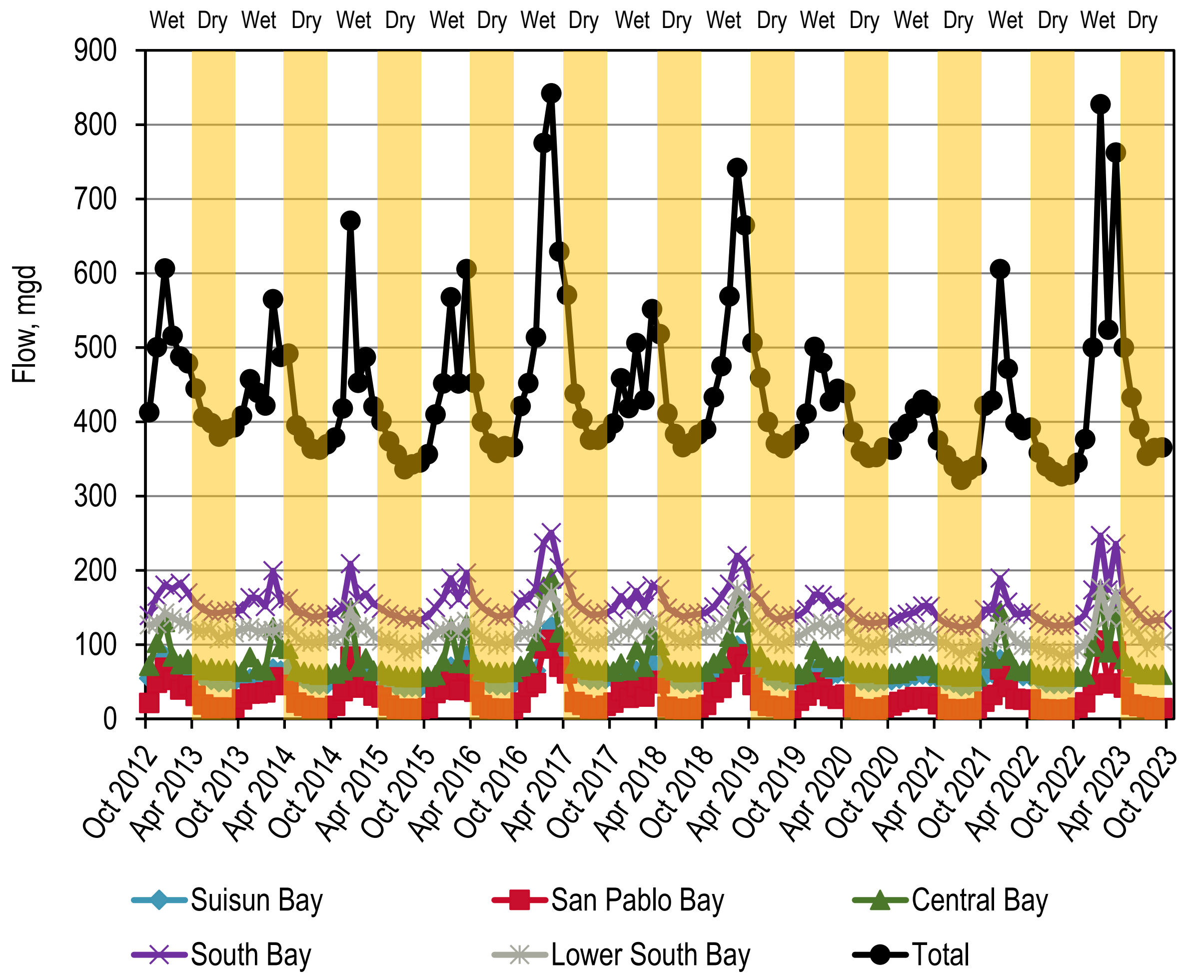

Figure 5-1. Discharge: Average Monthly Discharge Flows

Table 5-1. Discharge: Annual Average Flows by Discharger (mgd)

Discharger	Subembayment	Permitted Capacity [a]	2012/ 2013 [b,c]	2013/ 2014 [b,c]	2014/ 2015 [b,c]	2015/ 2016 [b,c]	2016/ 2017 [b,c]	2017/ 2018 [b,c]	2018/ 2019 [b,c]	2019/ 2020 [b,c]	2020/ 2021 [b,c]	2021/ 2022 [b,c]	2022/ 2023 [b,c]	11-Year Average
American Canyon	San Pablo Bay	2.5	1.47	1.36	1.45	1.44	1.77	1.39	1.58	1.22	1.13	1.27	1.62	1.43
Benicia	San Pablo Bay	4.5	2.18	2.04	1.98	2.00	2.46	1.99	2.23	1.80	1.67	1.79	2.28	2.04
Burlingame	South Bay	5.5	3.03	2.91	2.96	2.84	3.62	2.74	2.99	2.44	2.12	2.53	3.15	2.85
Central San	Suisun Bay	53.8	37.5	35.5	32.8	33.7	43.5	34.9	38.6	33.3	31.4	34.1	42.8	36.2
CMSA	Central Bay	10	7.66	5.84	6.97	8.05	13.4	9.16	12.0	9.01	7.42	9.53	11.42	9.14
Port Costa	San Pablo Bay	0.033	0.00682	0.00630	0.0102	0.0165	0.0308	0.0197	0.0240	0.0296	0.0145	0.0200	0.0409	0.0199
Delta Diablo	Suisun Bay	19.5	6.83	6.12	7.38	7.21	9.88	9.04	8.74	8.17	7.41	7.84	9.01	7.97
EBDA	South Bay	107.8	62.2	58.5	59.1	61.0	68.1	60.5	65.0	62.1	60.2	62.0	71.5	62.7
EBMUD	Central Bay	120	58.3	56.2	51.5	53.4	66.1	52.0	58.0	48.1	45.3	51.5	60.0	54.6
FSSD	Suisun Bay	23.7	13.2	12.4	12.1	13.0	17.0	13.4	15.4	12.9	12.3	13.9	17.4	13.9
Las Gallinas[d]	San Pablo Bay	2.92	1.37	1.19	1.25	1.66	2.86	1.35	2.62	1.93	1.44	1.38	2.14	1.74
Paradise Cove	Central Bay	0.04	0.0144	0.0138	0.0135	0.0129	0.0148	0.0159	0.0166	0.0149	0.0144	0.0141	0.0145	0.0145
Tiburon	Central Bay	0.98	0.587	0.592	0.665	0.551	0.791	0.641	0.670	0.573	0.526	0.592	0.714	0.627
Millbrae	South Bay	3	1.58	1.65	1.35	1.49	1.87	1.48	1.73	1.48	1.38	1.54	1.76	1.58
Mt. View	Suisun Bay	3.2	1.34	1.27	1.26	1.20	1.53	1.27	1.36	1.19	1.02	1.08	1.34	1.26
Napa[d]	San Pablo Bay	15.4	5.05	4.60	5.30	6.04	8.94	4.55	7.42	3.54	1.28	3.16	6.46	5.12
Novato[d]	San Pablo Bay	7	3.18	2.89	3.33	2.94	5.08	2.98	4.78	2.75	2.04	2.52	4.82	3.39
Palo Alto	Lower South Bay	39	21.5	19.2	18.9	22.4	23.2	19.1	21.9	19.5	17.1	17.0	21.8	20.1
Petaluma[d]	San Pablo Bay	6.7	3.67	4.32	3.18	2.83	4.63	3.18	4.02	2.89	1.61	2.25	3.59	3.29
Pinole	San Pablo Bay	4.06	2.57	2.60	2.39	2.40	2.98	2.50	2.78	2.27	2.20	2.73	3.11	2.59
Rodeo	San Pablo Bay	1.14	0.650	0.593	0.603	0.601	0.805	0.587	0.680	0.551	0.527	0.572	0.741	0.628
SFO Airport	South Bay	2.2	1.13	1.17	1.02	1.10	1.25	1.15	1.22	0.943	0.748	0.900	1.05	1.06
SFPUC Southeast	South Bay	85.4	56.9	58.9	55.3	56.6	63.0	56.5	55.5	46.8	42.2	44.3	48.3	53.1
San Jose	Lower South Bay	167	91.5	84.3	81.3	80.3	90.4	87.5	93.8	84.4	76.1	73.1	87.9	84.6
San Mateo	South Bay	15.7	10.8	9.73	10.2	10.3	12.3	10.4	11.6	9.92	9.19	9.99	12.1	10.6
SMCSD	Central Bay	1.8	1.52	1.25	1.19	1.27	1.52	1.14	1.30	1.03	1.09	1.09	1.21	1.24
SASM	Central Bay	3.6	2.19	2.69	2.35	2.49	3.09	2.26	2.67	2.14	2.08	2.43	2.86	2.48
SVCW	South Bay	29	12.9	12.2	12.8	14.1	16.0	13.9	15.6	13.7	12.5	13.1	16.1	13.9
Sonoma Valley[d]	San Pablo Bay	3	1.59	1.29	0.317	0.567	2.22	0	1.48	0	0	0.339	1.760	0.870
South SF	South Bay	13	8.99	8.68	8.43	8.25	8.98	7.60	8.55	7.34	6.72	7.66	8.90	8.19
Sunnyvale	Lower South Bay	29.5	10.8	10.8	10.2	10.2	11.9	10.5	11.6	10.1	10.7	10.6	12.9	10.9
Treasure Island	Central Bay	2	0.312	0.323	0.324	0.330	0.375	0.313	0.412	0.285	0.234	0.320	0.402	0.330
Vallejo	San Pablo Bay	15.5	10.4	9.14	10.0	9.70	12.6	9.06	10.1	8.51	7.80	9.55	10.84	9.78
West County	Central Bay	28.5	8.32	8.27	7.40	10.1	13.1	9.93	13.3	7.37	6.29	8.75	8.74	9.23
Total [e]		**827**	**451**	**428**	**415**	**430**	**515**	**433**	**480**	**408**	**374**	**399**	**479**	**438**

a. Based on ADWF permitted capacity.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.

c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.

d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

e. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-2. Discharge: Dry Season Average Flows by Discharger (mgd)

Discharger	Subembayment	Permitted Capacity [a]	2013 [b,c]	2014 [b,c]	2015 [b,c]	2016 [b,c]	2017 [b,c]	2018 [b,c]	2019 [b,c]	2020 [b,c]	2021 [b,c]	2022 [b,c]	2023 [b,c]	11-Year Average
American Canyon	San Pablo Bay	2.5	1.19	1.18	1.14	1.04	1.12	1.09	1.17	0.949	0.892	0.796	1.04	1.06
Benicia	San Pablo Bay	4.5	1.99	1.85	1.68	1.83	1.92	1.82	1.90	1.68	1.58	1.55	1.77	1.78
Burlingame	South Bay	5.5	2.82	2.55	2.57	2.54	2.84	2.49	2.49	2.20	1.91	2.03	2.13	2.42
Central San	Suisun Bay	53.8	34.1	32.6	28.1	30.1	33.9	31.2	32.8	31.5	28.7	29.5	33.7	31.5
CMSA	Central Bay	10	5.59	4.97	4.71	5.72	7.49	6.93	7.96	7.14	6.08	6.15	6.86	6.33
Port Costa	San Pablo Bay	0.033	0.00496	0.00400	0.00868	0.0157	0.0147	0.0208	0.0149	0.0149	0.0118	0.0188	0.0236	0.0139
Delta Diablo	Suisun Bay	19.5	6.19	5.72	5.89	6.24	8.81	7.43	8.28	8.00	6.48	6.72	8.41	7.11
EBDA	South Bay	107.8	55.6	50.8	51.3	53.3	53.0	54.9	56.4	56.4	55.2	54.0	59.1	54.5
EBMUD	Central Bay	120	50.0	47.1	43.5	45.4	48.1	45.9	48.3	45.3	42.4	42.8	45.6	45.9
FSSD	Suisun Bay	23.7	10.3	10.2	9.12	10.2	12.2	11.7	12.8	11.3	10.8	11.4	13.6	11.2
Las Gallinas[d]	San Pablo Bay	2.92	0	0	0	0	0.407	0	0.750	0.405	0	0	0.000	0.142
Paradise Cove	Central Bay	0.04	0.0140	0.0130	0.0126	0.0129	0.0125	0.0183	0.0149	0.0154	0.0127	0.0132	0.0125	0.0138
Tiburon	Central Bay	0.98	0.532	0.542	0.545	0.551	0.558	0.547	-	0.537	0.485	0.473	0.558	0.533
Millbrae	South Bay	3	1.53	1.25	1.19	1.40	1.42	1.30	1.48	1.37	1.32	1.33	1.44	1.37
Mt. View	Suisun Bay	3.2	1.14	1.21	1.12	1.22	1.25	1.19	1.20	1.11	0.979	1.00	1.05	1.13
Napa[d]	San Pablo Bay	15.4	0	1.20	0	0	0	0	0	0	0	0	0	0.109
Novato[d]	San Pablo Bay	7	0.806	0.743	0.736	0.763	2.28	0.779	2.30	0.503	0.264	0	2.22	1.04
Palo Alto	Lower South Bay	39	22.5	19.6	18.5	21.6	18.9	19.5	17.4	17.5	17.0	16.1	18.4	18.8
Petaluma[d]	San Pablo Bay	6.7	0	0	0	0	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	4.06	2.50	2.33	2.09	2.20	2.36	2.27	2.50	2.22	2.11	2.44	2.46	2.32
Rodeo	San Pablo Bay	1.14	0.572	0.551	0.491	0.523	0.552	0.526	0.550	0.540	0.496	0.486	0.546	0.530
SFO Airport	South Bay	2.2	1.07	1.13	0.949	1.06	1.14	1.12	1.17	0.665	0.688	0.915	0.990	0.991
SFPUC Southeast	South Bay	85.4	53.3	56.0	52.8	54.6	57.1	52.9	49.6	42.0	40.4	42.2	44.4	49.6
San Jose	Lower South Bay	167	83.6	77.2	72.1	74.6	80.1	81.9	83.4	77.2	68.3	64.3	80.4	76.7
San Mateo	South Bay	15.7	10.0	9.18	8.52	9.18	9.63	9.68	9.97	9.52	8.52	8.66	9.53	9.31
SMCSD	Central Bay	1.8	1.22	1.06	1.03	1.11	1.13	1.02	1.06	0.943	1.08	0.885	0.96	1.05
SASM	Central Bay	3.6	1.95	1.87	1.74	1.77	1.94	1.79	1.70	1.98	1.80	1.80	1.94	1.84
SVCW	South Bay	29	11.8	11.0	11.9	12.5	13.1	12.5	13.3	12.6	11.3	11.4	12.7	12.2
Sonoma Valley[d]	San Pablo Bay	3	0	0	0	0	0.0549	0	0	0	0	0	0.0741	0.0117
South SF	South Bay	13	8.43	8.34	7.46	7.41	7.13	7.21	7.50	6.97	6.45	7.17	7.57	7.42
Sunnyvale	Lower South Bay	29.5	9.02	8.94	7.71	8.04	9.34	8.54	9.06	8.38	9.57	9.56	9.78	8.90
Treasure Island	Central Bay	2	0.281	0.296	0.275	0.273	0.277	0.306	0.307	0.253	0.238	0.272	0.323	0.282
Vallejo	San Pablo Bay	15.5	8.75	8.73	8.21	8.40	8.70	7.94	8.10	7.75	7.66	7.42	7.77	8.13
West County	Central Bay	28.5	6.55	6.09	5.61	8.74	8.65	8.67	10.2	6.16	5.76	5.53	6.11	7.09
Total [e]		**827**	**393**	**374**	**351**	**372**	**396**	**383**	**394**	**363**	**339**	**337**	**381**	**371**

a. Based on ADWF permitted capacity.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.

c. Based on average values from May 1 through September 30.

d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

e. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-3. Discharge: Annual Average by Subembayment, Flow (mgd)

Subembayment	Permitted Capacity [a]	2012/ 2013 [b]	2013/ 2014 [b]	2014/ 2015 [b]	2015/ 2016 [b]	2016/ 2017 [b]	2017/ 2018 [b]	2018/ 2019 [b]	2019/ 2020 [b]	2020/ 2021 [b]	2021/ 2022 [b]	2022/ 2023 [b]	11-Year Average
Suisun Bay	100	58.9	55.3	53.5	55.1	71.9	58.6	64.1	55.6	52.1	56.9	70.5	59.3
San Pablo Bay [c]	62.8	32.1	30.0	29.8	30.2	44.4	27.6	37.7	25.5	19.7	25.6	37.4	30.9
Central Bay	167	78.9	75.2	70.3	75.9	98.3	75.3	88.4	68.5	62.9	74.2	85.4	77.6
South Bay	262	157	154	151	156	175	154	162	145	135	142	163	154
Lower South Bay	236	124	114	110	113	125	117	127	114	104	101	123	116
Total	**827**	**451**	**428**	**415**	**430**	**515**	**433**	**480**	**408**	**374**	**399**	**479**	**438**

a. Based on ADWF permitted capacity.
b. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
c. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-4. Discharge: Dry Season by Subembayment, Flow (mgd)

Subembayment	Permitted Capacity [a]	2013 [b]	2014 [b]	2015 [b]	2016 [b]	2017 [b]	2018 [b]	2019 [b]	2020 [b]	2021 [b]	2022 [b]	2023 [b]	11-Year Average	Trend [d,e]
Suisun Bay	100	51.7	49.8	44.2	47.8	56.1	51.6	55.1	51.9	47.0	48.7	56.7	51.0	None
San Pablo Bay [c]	62.8	15.8	16.6	14.4	14.8	17.4	14.5	17.3	14.1	13.1	12.7	15.9	15.1	None
Central Bay	167	66.1	61.9	57.3	63.5	68.2	64.9	69.5	62.4	57.9	58.0	62.4	63.0	None
South Bay	262	145	140	137	142	145	142	142	132	126	128	138	138	Down (-0.9%/yr)
Lower South Bay	236	115	106	98.3	104	108	110	110	103	94.9	90.0	109	104	Down (-0.9%/yr)
Total	**827**	**393**	**374**	**351**	**372**	**396**	**383**	**394**	**363**	**339**	**337**	**381**	**371**	**None**

a. Based on ADWF permitted capacity.
b. Based on average values from May 1 through September 30.
c. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.
d. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 55. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.
e. The percent change represents the change per year as a percentage of the average value over the entire dataset (2013-2023) (not considered if trend is "None").

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5.2 Total Ammonia

The historical average monthly discharge loads from October 2012 through September 2023 are presented in Figure 5-2. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge loads were calculated based on reported loads in Table 5-5 and Table 5-6, respectively. In addition, the annual average and dry season average monthly discharge loads and concentrations for each Subembayment are provided in Table 5-7 through Table 5-10, respectively.

A summary of the discharge data review findings is as follows **(new findings for 2022/2023 in bold)**:

- **The average annual and dry season values for this past year were the second lowest and lowest, respectively, since sampling began in 2012 (refer to Table 5-5 and Table 5-6, respectively).** The total annual average and dry season ammonia loads increased from 2012/2013 to 2016/2017 season, remained relatively steady between 2016/2017 and 2018/2019, declined to their second lowest value in 2020/2021, increased in 2021/2022, **and again decreased to their second lowest value since sampling began in 2012**.
- **<u>Average Annual Loads:</u> the loads for this past year were the second lowest since sampling began in 2012 (refer to Table 5-5). The decrease compared to the previous year (2021/2022) was approximately 1,900 kg N/d. The two largest contributors to the decrease were EBMUD (Central Bay Discharger) and SFPUC Southeast (South Bay Discharger) at 1,460 kg N/d and 440 kg N/d, respectively, compared to last year. The reductions at EBMUD (Central Bay Discharger) are attributed to two independent efforts: i) EBMUD stopped accepting trucked waste with relatively high nitrogenous compounds (e.g., animal blood waste) and ii) the treatment plant began treating up to 50 percent of the dry season plant flow via split treatment with biological nitrification/denitrification**.
- **<u>Dry Season Loads:</u> the loads for this past year were tied for the lowest since sampling began in 2012 (refer to Table 5-6). The overall loads decreased approximately 3,400 kg N/d compared to last year. Similar to average annual, the two largest contributors to the decrease are EBMUD (Central Bay Discharger) and Central San (Suisan Bay Discharger) with a decrease of 2,900 kg N/d and 540 kg N/d, respectively, compared to last year. The profound reduction at EBMUD (Central Bay Discharger) is attributed to the reasons referenced in the average annual loads section.**
- **<u>Dry Season Trending:</u> the dry season trending analysis suggests that San Pablo Bay has an upward trend when evaluated over the entire 11-years of dry season data. In contrast, the South Bay dry season trending suggests a downward trend with SFPUC Southeast having the largest reductions to the South Bay since the start of the global pandemic. Baywide, the trending analysis suggests no emerging trend over the entire 11-years of dry season data.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2012 (see Section 3.8).
- Dischargers to the South Bay Subembayment account for over half of the load discharged to the Bay, regardless of annual or dry season average (refer to Figure 5-2, Table 5-7, or Table 5-8).

- The nutrient concentrations are calculated based on flow-weighted values (refer to Table 5-9 and Table 5-10). The key findings on concentrations are as follows:
  - **The most recent dataset has discharge concentrations that are at or near the lowest levels for all Subembayments since sampling began in 2012 (except San Pablo and Lower South Bays). The relatively low discharge concentrations this past year is attributed to this past year's relatively wet year that has resulted in a higher dilution.** Furthermore, all the Lower South Bay dischargers are required to fully nitrify (i.e., ammonia values less than 2 mg N/L on average) which is why the concentrations have been reliably less than 1.3 mg N/L since sampling began in 2012.
  - Dischargers to Central Bay usually have the highest discharge concentrations of all the Subembayments. **However, discharge concentrations this past year were the highest for South Bay (regardless of average period). This change is attributed to EBMUD's efforts in the Central Bay as previously noted in the average annual loads section.**

An overall discussion of the results is provided in Section 7.5.2.

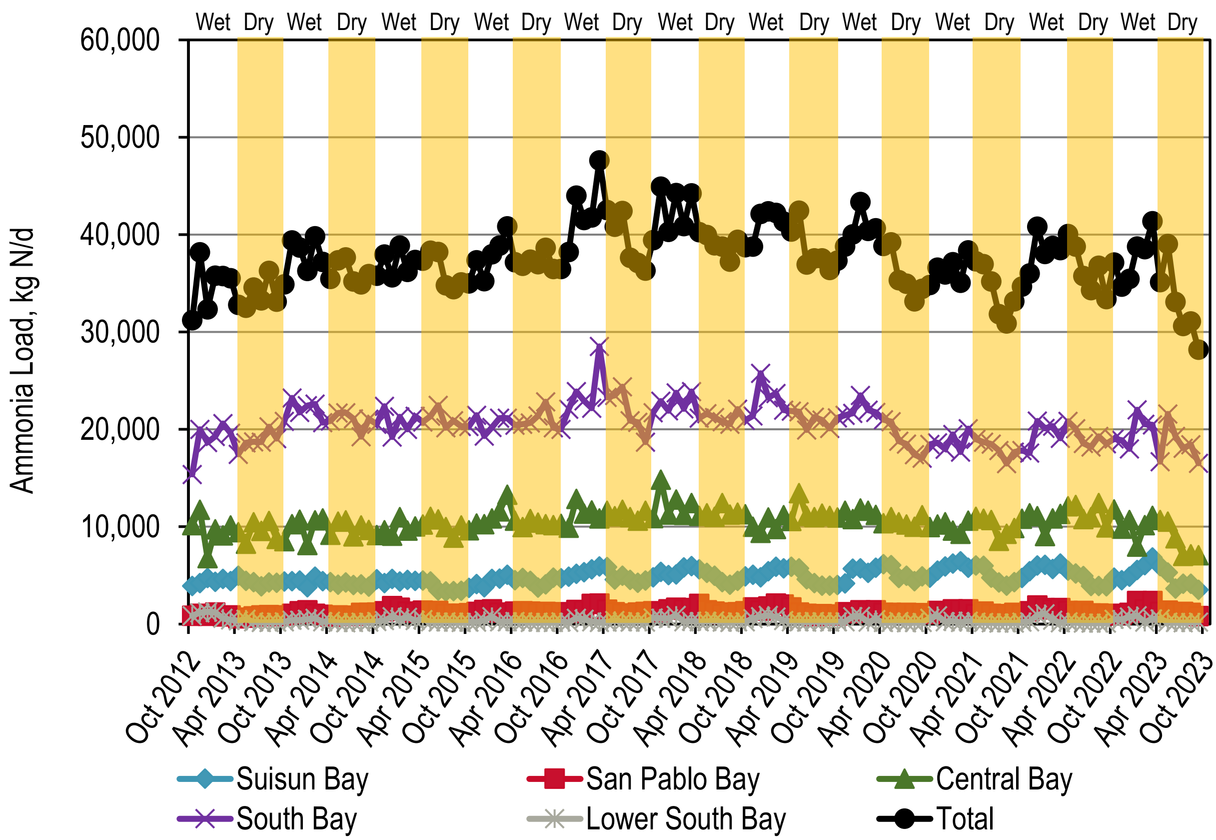

Figure 5-2. Discharge: Average Monthly Discharge Total Ammonia Loads

Table 5-5. Discharge: Annual Average by Discharger, Total Ammonia (kg N/d)

Discharger	Subembayment	2012/ 2013 [a,b]	2013/ 2014 [a,b]	2014/ 2015 [a,b]	2015/ 2016 [a,b]	2016/ 2017 [a,b]	2017/ 2018 [a,b]	2018/ 2019 [a,b]	2019/ 2020 [a,b]	2020/ 2021 [a,b]	2021/ 2022 [a,b]	2022/ 2023 [a,b]	11-Year Average
American Canyon	San Pablo Bay	1.77	5.43	3.25	1.54	2.31	4.83	4.12	1.33	0.390	0.650	1.82	2.49
Benicia	San Pablo Bay	190	159	186	194	175	216	187	174	200	165	193	185
Burlingame	South Bay	305	251	259	274	323	320	351	240	243	284	277	284
Central San	Suisun Bay	3,610	3,510	3,210	3,490	3,610	3,560	3,530	3,870	4,210	4,070	3,660	3,670
CMSA	Central Bay	720	779	603	753	1,010	861	1,060	1,070	987	993	971	892
Port Costa	San Pablo Bay	0.255	0.337	0.344	0.431	0.716	0.885	0.565	3.65	0.793	0.594	0.811	0.853
Delta Diablo	Suisun Bay	757	740	903	873	1,420	1,500	1,480	1,290	1,130	1,050	1,270	1,130
EBDA	South Bay	6,820	7,010	7,320	7,330	7,320	7,830	7,680	8,070	6,670	7,010	7,180	7,290
EBMUD	Central Bay	8,070	8,350	8,630	9,010	9,390	10,100	8,810	8,920	8,130	9,190	7,730	8,760
FSSD	Suisun Bay	1.45	1.68	1.56	1.91	2.67	7.66	9.09	5.17	3.85	15.0	18.02	6.19
Las Gallinas[c]	San Pablo Bay	10.7	14.8	11.6	23.4	34.7	34.6	54.1	31.8	43.9	17.4	19.8	27.0
Paradise Cove	Central Bay	0.443	0.249	0.0102	1.35	0.0386	0.0197	0.0452	0.0624	0.155	0.367	0.114	0.259
Tiburon	Central Bay	40.2	48.3	53.0	55.0	33.6	55.1	48.7	29.4	32.3	31.8	33.3	41.9
Millbrae	South Bay	237	233	237	265	292	260	284	281	269	232	250	258
Mt. View	Suisun Bay	3.09	0.824	2.08	3.80	2.61	2.53	4.25	3.60	3.90	1.25	1.99	2.72
Napa[c]	San Pablo Bay	44.1	17.0	6.35	16.5	103	38.1	158	25.0	8.52	34.4	85.2	48.8
Novato[c]	San Pablo Bay	7.25	10.0	17.5	6.92	40.6	16.5	57.1	23.1	22.1	23.3	70.8	26.8
Palo Alto	Lower South Bay	13.4	12.8	17.7	17.6	12.0	15.8	10.6	8.90	12.3	9.11	23.5	14.0
Petaluma[c]	San Pablo Bay	3.22	7.17	2.82	5.43	2.57	3.15	7.47	2.94	2.22	4.42	3.21	4.06
Pinole	San Pablo Bay	187	202	229	258	242	273	115	171	218	381	349	239
Rodeo	San Pablo Bay	3.47	5.05	3.76	6.96	9.30	3.84	4.78	18.5	11.9	32.7	31.2	11.9
SFO Airport	South Bay	227	242	132	141	212	115	82.4	3.75	50.5	68.1	157	130
SFPUC Southeast	South Bay	7,280	9,580	8,630	8,400	9,780	8,460	8,380	7,110	6,400	6,800	6,360	7,930
San Jose	Lower South Bay	280	204	197	232	183	206	215	197	139	131	159	195
San Mateo	South Bay	1,320	1,300	1,210	1,110	1,250	1,320	1,520	1,210	1,250	1,250	1,090	1,260
SMCSD	Central Bay	51.0	41.6	50.2	44.7	73.7	94.8	72.8	73.2	75.8	60.6	38.4	61.5
SASM	Central Bay	49.5	45.5	39.0	62.2	26.7	67.2	107	85.6	91.8	116	106.8	72.5
SVCW	South Bay	1,900	1,980	2,240	2,540	2,390	2,670	2,610	2,560	2,380	2,620	2,520	2,400
Sonoma Valley[c]	San Pablo Bay	1.53	2.45	0.178	0.130	0.788	0	0.411	0	0	0.130	0.839	0.587
South SF	South Bay	772	828	863	746	1,030	1,000	1,010	943	1,110	1,020	1,288	964
Sunnyvale	Lower South Bay	305	86.5	163	30.0	101	171	196	116	133	184	213	154
Treasure Island	Central Bay	0.883	2.61	8.36	8.51	5.09	4.76	4.44	3.64	3.22	3.50	4.18	4.47
Vallejo	San Pablo Bay	426	622	854	749	784	845	849	732	733	674	626	718
West County	Central Bay	650	651	620	812	720	705	877	769	714	694	516	703
Total [d]		**34,300**	**37,000**	**36,700**	**37,500**	**40,600**	**40,800**	**39,800**	**38,000**	**35,300**	**37,200**	**35,300**	**37,500**

a. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.

b. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.

c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-6. Discharge: Dry Season by Discharger, Total Ammonia (kg N/d)

Discharger	Subembayment	2013 [(a,b)]	2014 [(a,b)]	2015 [(a,b)]	2016 [(a,b)]	2017 [(a,b)]	2018 [(a,b)]	2019 [(a,b)]	2020 [(a,b)]	2021 [(a,b)]	2022 [(a,b)]	2023 [(a,b)]	11-Year Average
American Canyon	San Pablo Bay	1.56	2.21	2.06	1.13	1.74	2.93	1.93	0.990	0.374	0.454	1.72	1.55
Benicia	San Pablo Bay	190	149	143	192	195	195	140	188	199	157	221	179
Burlingame	South Bay	311	209	241	246	220	366	224	219	214	216	234	246
Central San	Suisun Bay	3,540	3,390	2,960	3,510	3,240	3,250	3,170	3,740	3,830	3,520	2,980	3,380
CMSA	Central Bay	740	780	619	915	1,020	815	1,020	1,060	993	998	959	902
Port Costa	San Pablo Bay	0.319	0.0381	0.133	--	0.290	0.296	0.461	0.749	0.613	0.525	0.552	0.398
Delta Diablo	Suisun Bay	709	674	650	858	1,320	1,360	1,310	1,280	839	846	1,170	1,000
EBDA	South Bay	6,290	6,500	7,210	6,620	6,250	7,320	7,260	6,820	5,950	6,190	6,470	6,630
EBMUD	Central Bay	8,020	8,490	8,770	8,480	9,340	9,770	9,460	8,610	7,940	9,380	6,460	8,610
FSSD	Suisun Bay	0.938	1.27	1.02	1.26	1.84	6.83	7.41	3.18	3.47	12.1	13.09	4.76
Las Gallinas[(c)]	San Pablo Bay	0	0	0	0	2.32	0	11.2	0.722	0	0	0.00	1.29
Paradise Cove	Central Bay	0.0284	0.249	0.0119	1.35	0.0169	0.0197	0.0677	0.121	0.258	0.0541	0.016	0.199
Tiburon	Central Bay	32.2	48.3	46.2	55.0	29.4	57.2	-	27.5	43.3	33.2	21.3	39.4
Millbrae	South Bay	243	206	235	292	290	249	305	266	274	242	245	259
Mt. View	Suisun Bay	1.31	0.754	2.21	3.66	1.19	3.49	4.39	3.40	1.81	1.35	0.91	2.22
Napa[(c)]	San Pablo Bay	0	0.415	0	0	0	0	0	0	0	0	0.0000	0.0378
Novato[(c)]	San Pablo Bay	0.305	2.39	1.20	0.902	18.0	2.40	20.5	5.15	1.44	0	12.00	5.87
Palo Alto	Lower South Bay	15.1	13.1	17.3	25.8	13.3	26.1	8.29	8.32	9.39	11.6	22.8	15.6
Petaluma[(c)]	San Pablo Bay	0	0	0	0	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	210	203	220	332	191	266	60.9	174	209	332	325	229
Rodeo	San Pablo Bay	0.780	3.66	2.14	5.44	5.24	1.26	3.80	36.2	13.8	19.8	29.6	11.0
SFO Airport	South Bay	234	263	142	192	337	48.9	146	3.84	61.7	82.5	210	156
SFPUC Southeast	South Bay	7,910	9,580	8,930	9,300	10,100	8,670	7,980	6,730	6,770	7,300	6,880	8,200
San Jose	Lower South Bay	229	158	182	162	197	211	222	172	116	94.5	131	170
San Mateo	South Bay	1,530	1,480	1,200	1,290	1,190	1,420	1,550	1,240	1,030	1,260	1,190	1,310
SMCSD	Central Bay	49.3	50.2	45.8	59.3	105	132	126	66.3	69.1	52.5	35.0	71.9
SASM	Central Bay	54.4	32.7	25.1	49.8	22.1	100	132	94.6	73.0	164	71.0	74.4
SVCW	South Bay	1,760	1,900	2,310	2,470	2,390	2,300	2,480	2,320	2,470	2,410	2,510	2,300
Sonoma Valley[(c)]	San Pablo Bay	0	0	0	0	0.0182	0	0	0	0	0	0.03367	0.00472
South SF	South Bay	781	827	775	716	852	882	864	895	1,070	1,230	1,038	903
Sunnyvale	Lower South Bay	16.8	11.8	12.5	15.6	60.8	9.43	2.97	5.38	12.5	16.7	23.4	17.1
Treasure Island	Central Bay	1.23	4.55	10.5	4.16	4.05	6.65	3.41	3.81	3.73	3.01	4.02	4.47
Vallejo	San Pablo Bay	435	645	795	705	752	767	791	722	692	600	579	680
West County	Central Bay	653	639	665	815	725	678	871	712	714	645	576	699
Total [(d)]		**34,000**	**36,300**	**36,200**	**37,300**	**38,900**	**38,900**	**38,200**	**35,400**	**33,600**	**35,800**	**32,400**	**36,100**

a. Data are presented in detail and summarized for each plant in the Appendix. A “--“ indicates data were not available, whereas a “0” indicates a value of zero.

b. Based on average values from May 1 through September 30.

c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-7. Discharge: Annual Average by Subembayment, Total Ammonia (kg N/d)

Subembayment	2012/ 2013 [(a)]	2013/ 2014 [(a)]	2014/ 2015 [(a)]	2015/ 2016 [(a)]	2016/ 2017 [(a)]	2017/ 2018 [(a)]	2018/ 2019 [(a)]	2019/ 2020 [(a)]	2020/ 2021 [(a)]	2021/ 2022 [(a)]	2022/ 2023 [(a)]	11-Year Average
Suisun Bay	4,380	4,250	4,120	4,370	5,030	5,080	5,020	5,170	5,340	5,140	4,950	4,800
San Pablo Bay [(b)]	874	1,040	1,320	1,260	1,390	1,440	1,440	1,180	1,240	1,330	1,380	1,260
Central Bay	9,570	9,870	9,960	10,700	11,200	11,900	11,000	11,000	10,000	11,100	9,400	10,500
South Bay	18,900	21,400	20,900	20,800	22,600	22,000	21,900	20,400	18,400	19,300	19,100	20,500
Lower South Bay	598	303	378	280	296	393	421	321	284	325	396	363
Total	**34,300**	**37,000**	**36,700**	**37,500**	**40,600**	**40,800**	**39,800**	**38,000**	**35,300**	**37,200**	**35,300**	**37,500**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-8. Discharge: Dry Season by Subembayment, Total Ammonia (kg N/d)

Subembayment	2013 [(a)]	2014 [(a)]	2015 [(a)]	2016 [(a)]	2017 [(a)]	2018 [(a)]	2019 [(a)]	2020 [(a)]	2021 [(a)]	2022 [(a)]	2023 [(a)]	11-Year Average	Trend [(c,d)]
Suisun Bay	4,250	4,070	3,610	4,380	4,570	4,620	4,500	5,020	4,680	4,380	4,160	4,380	None
San Pablo Bay [(b)]	835	1,000	1,160	1,240	1,160	1,230	1,030	1,130	1,120	1,110	1,170	1,110	Up (1.3%/yr)
Central Bay	9,540	10,000	10,200	10,300	11,200	11,600	11,600	10,600	9,840	11,300	8,120	10,400	None
South Bay	19,100	21,000	21,000	21,100	21,600	21,300	20,800	18,500	17,800	18,900	18,800	20,000	Down (-1.1%/yr)
Lower South Bay [(e)]	260	183	212	203	271	246	233	186	138	123	177	203	-- [(e)]
Total	**34,000**	**36,300**	**36,200**	**37,300**	**38,900**	**38,900**	**38,200**	**35,400**	**33,600**	**35,800**	**32,400**	**36,100**	**None**

a. Based on average values from May 1 through September 30.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 55. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

d. The percent change represents the change per year as a percentage of the average value over the entire dataset (2013-2022) (not considered if trend is "None").

e. Dischargers to the Lower South Bay are all required to fully nitrify. As such, no trending analysis was performed on the Lower South Bay.

Table 5-9. Discharge: Annual Average by Subembayment, Total Ammonia (mg N/L)

Subembayment	2012/ 2013 (a,b)	2013/ 2014 (a,b)	2014/ 2015 (a,b)	2015/ 2016 (a,b)	2016/ 2017 (a,b)	2017/ 2018 (a,b)	2018/ 2019 (a,b)	2019/ 2020 (a,b)	2020/ 2021 (a,b)	2021/ 2022 (a,b)	2022/ 2023 (a,b)	11-Year Average (b)
Suisun Bay	19.6	20.3	20.3	21.0	18.5	22.9	20.7	24.5	27.1	23.9	18.6	21.4
San Pablo Bay (c)	7.21	9.20	11.7	11.0	8.31	13.7	10.1	12.3	16.6	13.8	9.76	10.8
Central Bay	32.1	34.8	37.6	37.2	30.3	41.6	32.8	42.2	42.2	39.5	29.1	35.9
South Bay	31.6	36.8	36.5	35.3	34.1	37.6	35.7	37.3	36.0	35.8	31.0	35.2
Lower South Bay	1.28	0.701	0.905	0.654	0.624	0.886	0.875	0.745	0.723	0.852	0.852	0.830
Total	**20.1**	**22.8**	**23.4**	**23.0**	**20.8**	**24.9**	**21.9**	**24.6**	**24.9**	**24.6**	**19.5**	**22.6**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
b. Calculation based on a flow-weighted average values.
c. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-10. Discharge: Dry Season by Subembayment, Total Ammonia (mg N/L)

Subembayment	2013 (a,b)	2014 (a,b)	2015 (a,b)	2016 (a,b)	2017 (a,b)	2018 (a,b)	2019 (a,b)	2020 (a,b)	2021 (a,b)	2022 (a,b)	2023 (a,b)	11-Year Average (b)
Suisun Bay	21.7	21.6	21.6	24.2	21.5	23.7	21.6	25.6	26.3	23.8	19.4	22.7
San Pablo Bay (d)	14.0	16.0	21.4	22.1	17.7	22.6	15.7	21.2	22.7	23.1	19.4	19.4
Central Bay	38.2	42.9	46.8	43.1	43.6	46.9	44.1	44.8	44.9	51.4	34.4	43.6
South Bay	34.9	39.5	40.7	39.3	39.3	39.5	38.8	37.1	37.5	39.1	36.0	38.3
Lower South Bay	0.598	0.458	0.569	0.516	0.662	0.592	0.560	0.476	0.383	0.360	0.431	0.514
Total	**22.8**	**25.6**	**27.3**	**26.5**	**26.0**	**26.8**	**25.6**	**25.8**	**26.2**	**28.1**	**22.5**	**25.7**

a. Based on average values from May 1 through September 30.
b. Calculation based on a flow-weighted average values.
c. Dry season trending not applied to concentrations as the emphasis is on load. Focusing on concentration is limiting as it does not consider the impact of flow.
d. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

5.3 Nitrate + Nitrite (NOx)

The historical average monthly discharge loads from October 2012 through September 2023 are presented in Figure 5-3. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge loads were calculated based on reported loads in Table 5-11 and Table 5-12, respectively. In addition, the annual average and dry season average monthly discharge loads and concentrations for each Subembayment are provided in Table 5-13 through Table 5-16, respectively.

A summary of the discharge data review findings is as follows **(new findings for 2022/2023 in bold):**

- **Both the annual average and dry season loads for 2022/2023 had the second largest and largest increase as compared to the last year, respectively, since sampling began in 2012 (i.e., October 2012 through September 2023; refer to Table 5-11 through Table 5-14).**
- **Average Annual Loads: average annual loads (refer to Table 5-11) increased approximately 1,700 kg N/d compared to last year. However, this past year's dataset was still 1,000 kg N/d lower than the 11-year average.** The highest loads occurred during the first year of sampling and have subsequently decreased annually ever since (except for excursions in 2016/2017, 2018/2019, and 2022/2023). **The largest contributor to this increase since last year was San Jose (Lower South Bay discharger) which had an increase of 300 kg N/d.**
- **Dry Season Loads: average annual loads (refer to Table 5-12) increased approximately 2,100 kg N/d compared to last year. However, this past year's data was still 300 kg N/d lower than the 11-year average.** The highest loads occurred during the first year of sampling and have subsequently decreased annually ever since (except for an excursion in 2015 and 2023). **Similar to average annual, the largest contributor in this increase was from San Jose (Lower South Bay discharger) with an increase of approximately 890 kg N/d.**
- **Dry Season Trending: the dry season trending analysis for all the Subembayments (except Central Bay) and Baywide suggests a downward trend when evaluated over the entire 11-years of dry season data. The lack of trend for Central Bay was anticipated as EBMUD (Central Bay Discharger) is now producing more NOx due to converting ammonia to NOx via biological nitrification.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2012 (see Section 3.8).
- The nutrient concentrations are calculated based on flow-weighted values (refer to Table 5-15 and Table 5-16). The key findings on concentrations are as follows:
  - **The most recent dataset has the lowest average annual concentrations since sampling began in 2012. The relatively low discharge concentrations this past year is attributed to this past year's relatively wet year that has resulted in a higher dilution of loads coupled with EBMUD (Central Bay Discharger) not nitrifying during the wet season.**

- **Dischargers to Lower South Bay have the highest discharge concentrations compared to the dischargers to other Subembayments as all of them fully nitrify (i.e., biologically remove ammonia to values less than 2 mg N/L on average)**
- **Dischargers to both Suisun Bay and San Pablo Bay have flow-weighted discharge concentrations greater than 5 mg N/L as both Subembayments have some dischargers that fully nitrify and convert the ammonia to nitrite plus nitrate (e.g., Petaluma).**
- **Dischargers to Central Bay had the second highest NOx concentrations since sampling began in 2012. This is attributed to EBMUD (Central Bay Discharger) nitrifying during the dry season.**
- **As agencies implement nitrification technologies (e.g., Oro Loma/Castro Valley Sanitary District), the discharge NOx concentrations (and loads) will increase as the ammonia is biologically converted to nitrite plus nitrate. In such instances, the TIN concentrations (and loads) are anticipated to decline.**

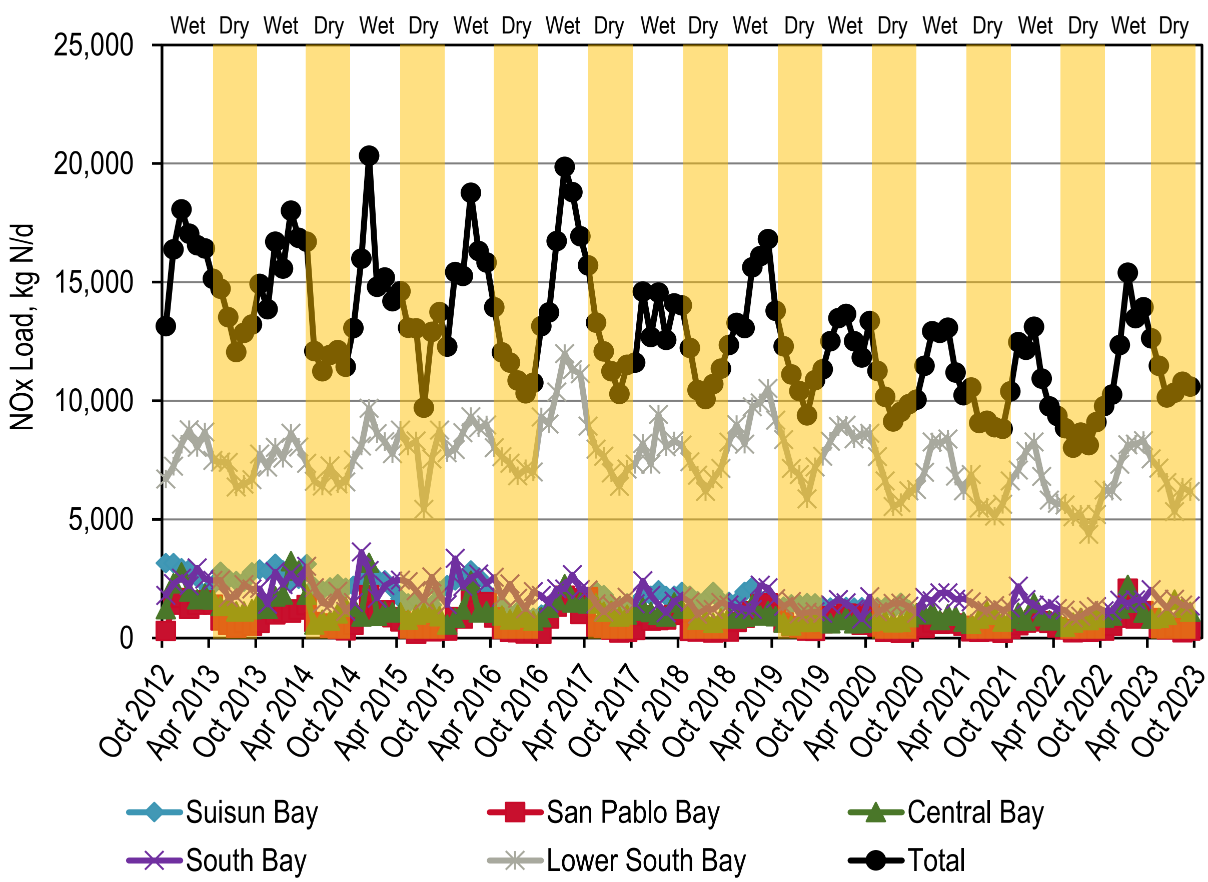

Figure 5-3. Discharge: Average Monthly Discharge NOx Loads

Table 5-11. Discharge: Annual Average Values by Discharger, NOx (kg N/d)

Discharger	Subembayment	2012/ 2013 (a,b)	2013/ 2014 (a,b)	2014/ 2015 (a,b)	2015/ 2016 (a,b)	2016/ 2017 (a,b)	2017/ 2018 (a,b)	2018/ 2019 (a,b)	2019/ 2020 (a,b)	2020/ 2021 (a,b)	2021/ 2022 (a,b)	2022/ 2023 (a,b)	11-Year Average
American Canyon	San Pablo Bay	68.6	74.9	41.2	30.6	39.1	31.9	33.2	31.8	17.5	18.3	28.5	37.8
Benicia	San Pablo Bay	35.1	45.5	47.5	39.3	67.9	35.2	34.5	37.3	28.4	46.2	20.0	39.7
Burlingame	South Bay	92.9	182	33.2	18.0	43.0	39.2	115	220	145	51.8	36.1	88.7
Central San	Suisun Bay	270	293	461	309	392	284	255	108	55.8	94.9	263	253
CMSA	Central Bay	124	67.2	158	115	171	125	58.4	95.2	104	70.3	58.4	104
Port Costa	San Pablo Bay	0	0	0	1.30	1.13	0.700	0.143	0.573	0.776	0.744	0.935	0.573
Delta Diablo	Suisun Bay	936	774	382	450	31.4	34.1	48.2	46.1	68.6	55.0	39.5	260
EBDA	South Bay	1,050	822	994	1,070	1,000	852	818	748	1,050	885	943	931
EBMUD	Central Bay	1,120	1,090	763	521	517	573	517	391	556	584	845	680
FSSD	Suisun Bay	1,310	1,330	1,030	874	914	1,290	1,120	1,030	1,010	1,110	1,050	1,100
Las Gallinas(c)	San Pablo Bay	118	104	85.9	97.7	104	101	114	136	96.5	44.5	59.5	96.4
Paradise Cove	Central Bay	1.64	0	2.53	0.180	2.21	2.11	1.77	1.65	1.39	0.599	1.11	1.38
Tiburon	Central Bay	18.6	7.78	4.81	7.60	11.5	0.382	1.04	22.5	0.581	17.5	5.40	8.88
Millbrae	South Bay	3.37	1.30	2.14	2.14	2.28	0.766	2.10	6.85	9.95	12.8	13.7	5.22
Mt. View	Suisun Bay	118	128	117	119	139	122	111	116	95.7	69.3	82.7	111
Napa(c)	San Pablo Bay	129	158	165	154	156	123	149	127	36.5	84.6	135	129
Novato(c)	San Pablo Bay	137	126	150	132	157	114	124	85.3	64.8	63.4	122	116
Palo Alto	Lower South Bay	2,340	2,150	2,110	2,630	2,550	2,160	2,300	2,220	1,940	2,140	2,400	2,270
Petaluma(c)	San Pablo Bay	22.0	4.61	20.4	10.1	13.8	1.72	16.7	3.74	3.09	2.71	12.7	10.1
Pinole	San Pablo Bay	114	93.1	48.4	51.4	78.1	44.1	104	60.3	54.7	28.6	30.5	64.3
Rodeo	San Pablo Bay	32.9	25.6	29.5	23.4	35.1	28.7	33.5	20.1	19.6	18.3	22.8	26.3
SFO Airport	South Bay	23.6	15.4	22.0	20.6	13.6	23.8	24.6	21.5	4.63	4.75	2.39	16.1
SFPUC Southeast	South Bay	645	757	963	648	484	401	399	122	112	94.8	137	433
San Jose	Lower South Bay	4,520	4,570	5,390	4,760	5,610	4,720	5,290	4,680	3,940	3,320	3,620	4,580
San Mateo	South Bay	129	102	94.8	190	105	112	12.7	121	122	139	267	127
SMCSD	Central Bay	77.4	76.2	76.8	87.6	62.3	41.4	62.3	50.5	63.0	55.1	72.8	66.0
SASM	Central Bay	162	158	134	172	138	110	92.7	115	124	99.6	138	131
SVCW	South Bay	75.7	67.3	62.3	53.0	68.8	23.3	25.9	23.9	33.9	51.4	49.0	48.6
Sonoma Valley(c)	San Pablo Bay	27.9	6.76	23.1	10.5	81.2	0	29.5	0	0	0.790	71.3	22.8
South SF	South Bay	211	104	76.8	151	44.1	34.0	32.7	61.0	13.5	55.7	44.8	75.3
Sunnyvale	Lower South Bay	589	611	563	562	852	707	769	694	766	669	937	702
Treasure Island	Central Bay	9.96	11.2	10.6	8.91	11.2	7.22	8.73	17.3	15.8	13.4	21.0	12.3
Vallejo	San Pablo Bay	341	224	106	153	122	95.0	105	114	111	152	188	155
West County	Central Bay	114	150	56.0	144	434	169	121	40.6	27.1	27.8	67.9	123
Total (d)		**14,900**	**14,300**	**14,200**	**13,600**	**14,500**	**12,400**	**12,900**	**11,600**	**10,700**	**10,100**	**11,800**	**12,800**

a. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.

b. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.

c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-12. Discharge: Dry Season Discharges by Discharger, NOx (kg N/d)

Discharger	Subembayment	2013 (a,b)	2014 (a,b)	2015 (a,b)	2016 (a,b)	2017 (a,b)	2018 (a,b)	2019 (a,b)	2020 (a,b)	2021 (a,b)	2022 (a,b)	2023 (a,b)	11-Year Average
American Canyon	San Pablo Bay	109	77.5	28.7	19.0	23.0	28.6	27.3	18.4	15.0	10.8	13.3	33.7
Benicia	San Pablo Bay	36.0	50.0	54.8	39.3	45.8	41.0	56.5	33.6	28.0	46.8	10.1	40.2
Burlingame	South Bay	125	78.2	31.6	27.9	50.6	22.7	227	243	48.5	81.5	43.7	89.1
Central San	Suisun Bay	181	243	417	196	368	302	247	154	64.4	175	450	254
CMSA	Central Bay	104	60.5	103	48.8	196	139	68.5	105	111	89.0	37.3	96.4
Port Costa	San Pablo Bay	--	--	--	--	--	--	0.203	0.769	--	--	0.591	0.391
Delta Diablo	Suisun Bay	925	807	219	69.0	27.0	47.2	51.0	47.4	107	99.9	26.9	221
EBDA	South Bay	880	696	656	821	685	712	616	821	926	696	856	761
EBMUD	Central Bay	888	581	614	478	418	472	421	368	481	505	813	549
FSSD	Suisun Bay	1,360	968	806	653	1,080	1,230	1,010	966	901	1,030	871	989
Las Gallinas(c)	San Pablo Bay	0	0	0	0	6.67	0	42.9	46.1	0	0	0	8.70
Paradise Cove	Central Bay	2.49	0.0374	2.60	0.180	2.60	2.11	2.09	0.848	0.545	0.783	2.20	1.50
Tiburon	Central Bay	14.5	7.78	6.99	7.60	15.6	0.339		26.3	0.0727	0.681	14.5	9.45
Millbrae	South Bay	4.31	1.20	1.58	0.672	0.887	0.923	2.32	9.60	1.64	2.53	8.58	3.11
Mt. View	Suisun Bay	99.6	112	101	118	115	107	101	123	88.5	40.3	55.6	96.5
Napa(c)	San Pablo Bay	0	49.7	0	0	0	0	0	0	0	0	0	4.52
Novato(c)	San Pablo Bay	39.6	39.9	36.3	37.3	80.1	40.7	62.0	17.9	6.77	0	106	42.4
Palo Alto	Lower South Bay	2,530	2,130	2,210	2,620	2,110	2,190	1,940	1,920	1,990	2,220	2,280	2,190
Petaluma(c)	San Pablo Bay	0	0	0	0	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	133	103	47.2	9.16	44.2	55.8	109	68.4	71.9	37.3	24.8	64.0
Rodeo	San Pablo Bay	25.6	24.4	24.8	22.8	26.3	28.2	32.0	10.2	20.2	19.6	19.0	23.0
SFO Airport	South Bay	23.1	21.8	23.3	13.1	6.26	40.3	23.1	15.6	6.68	8.06	2.07	16.7
SFPUC Southeast	South Bay	738	688	1,100	581	455	381	267	49.2	66.9	102	151	416
San Jose	Lower South Bay	3,990	4,180	5,100	4,250	4,530	4,290	4,540	4,030	3,310	2,440	3,330	4,000
San Mateo	South Bay	6.26	5.81	77.9	78.9	94.1	61.4	4.83	76.8	195	83.0	255	85.4
SMCSD	Central Bay	83.8	72.5	88.9	81.6	42.4	15.2	32.5	56.0	75.2	59.8	76.0	62.2
SASM	Central Bay	136	130	126	140	132	79.0	43.7	140	146	56.9	154	117
SVCW	South Bay	121	40.6	74.1	45.3	55.2	18.4	26.6	30.1	31.8	54.0	57.4	50.4
Sonoma Valley(c)	San Pablo Bay	0	0	0	0	4.20	0	0	0	0	0	2.30	0.591
South SF	South Bay	135	79.3	104	198	66.4	49.2	43.4	79.9	22.0	45.5	75.0	81.6
Sunnyvale	Lower South Bay	344	359	312	325	569	382	614	385	433	443	696	442
Treasure Island	Central Bay	8.69	9.76	10.4	9.86	10.6	6.94	10.7	16.7	15.7	16.9	21.6	12.5
Vallejo	San Pablo Bay	317	206	104	131	118	86.5	110	98.3	122	169	175	149
West County	Central Bay	9.57	23.9	18.2	102	315	128	84.2	45.9	9.05	12.7	51.8	72.8
Total (d)		**13,300**	**11,800**	**12,500**	**11,100**	**11,700**	**11,000**	**10,800**	**10,000**	**9,290**	**8,540**	**10,700**	**11,000**

a. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
b. Based on average values from May 1 through September 30.
c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-13. Discharge: Annual Average by Subembayment, NOx (kg N/d)

Subembayment	2012/ 2013 [(a)]	2013/ 2014 [(a)]	2014/ 2015 [(a)]	2015/ 2016 [(a)]	2016/ 2017 [(a)]	2017/ 2018 [(a)]	2018/ 2019 [(a)]	2019/ 2020 [(a)]	2020/ 2021 [(a)]	2021/ 2022 [(a)]	2022/ 2023 [(a)]	11-Year Average
Suisun Bay	2,630	2,530	1,990	1,750	1,480	1,730	1,580	1,300	1,230	1,330	1,430	1,720
San Pablo Bay [(b)]	986	828	718	702	854	575	748	616	433	460	691	699
Central Bay	1,630	1,560	1,200	1,050	1,350	1,030	863	734	891	870	1,210	1,127
South Bay	2,230	2,050	2,250	2,150	1,770	1,490	1,430	1,320	1,490	1,300	1,490	1,720
Lower South Bay	7,450	7,330	8,070	7,960	9,010	7,590	8,350	7,590	6,650	6,130	6,950	7,550
Total	**14,900**	**14,300**	**14,200**	**13,600**	**14,500**	**12,400**	**12,900**	**11,600**	**10,700**	**10,100**	**11,800**	**12,800**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-14. Discharge: Dry Season by Subembayment, NOx (kg N/d)

Subembayment	2013 [(a)]	2014 [(a)]	2015 [(a)]	2016 [(a)]	2017 [(a)]	2018 [(a)]	2019 [(a)]	2020 [(a)]	2021 [(a)]	2022 [(a)]	2023 [(a)]	11-Year Average	Trend [(c,d)]
Suisun Bay	2,560	2,130	1,540	1,040	1,590	1,690	1,410	1,290	1,160	1,350	1,400	1,560	Down (-5.7%/yr)
San Pablo Bay [(b)]	572	479	296	259	348	281	440	294	264	284	352	366	Down (-6.3%/yr)
Central Bay	1,240	879	965	862	1,120	843	663	758	838	742	1,170	920	None
South Bay	2,030	1,610	2,070	1,770	1,410	1,290	1,210	1,330	1,300	1,070	1,450	1,500	Down (-5.1%/yr)
Lower South Bay	6,870	6,660	7,620	7,190	7,210	6,860	7,090	6,340	5,730	5,100	6,310	6,640	Down (-2.3%/yr)
Total	**13,300**	**11,800**	**12,500**	**11,100**	**11,700**	**11,000**	**10,800**	**10,000**	**9,290**	**8,540**	**10,700**	**10,980**	**Down (-3.3%/yr)**

a. Based on average values from May 1 through September 30.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.
c. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 55. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.
d. The percent change represents the change per year as a percentage of the average value over the entire dataset (2013-2022) (not considered if trend is “None”).

Table 5-15. Discharge: Annual Average by Subembayment, NOx (mg N/L)

Subembayment	2012/ 2013 (a,b)	2013/ 2014 (a,b)	2014/ 2015 (a,b)	2015/ 2016 (a,b)	2016/ 2017 (a,b)	2017/ 2018 (a,b)	2018/ 2019 (a,b)	2019/ 2020 (a,b)	2020/ 2021 (a,b)	2021/ 2022 (a,b)	2022/ 2023 (a,b)	11-Year Average (b)
Suisun Bay	11.8	12.1	9.81	8.41	5.43	7.82	6.32	6.18	6.22	6.16	5.36	7.66
San Pablo Bay (c)	8.44	7.59	6.36	6.15	5.08	5.51	5.24	6.38	5.81	4.75	4.88	5.97
Central Bay	5.46	5.49	4.52	3.66	3.62	3.60	2.58	2.83	3.74	3.09	3.75	3.84
South Bay	3.75	3.53	3.93	3.65	2.66	2.55	2.33	2.42	2.92	2.41	2.42	2.96
Lower South Bay	15.9	17.0	19.3	18.6	19.0	17.1	17.3	17.6	16.9	16.1	15.0	17.3
Total	**8.77**	**8.84**	**9.05**	**8.37**	**7.41**	**7.57**	**7.12**	**7.48**	**7.56**	**6.67**	**6.50**	**7.74**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
b. Calculation based on a flow-weighted average values.
c. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-16. Discharge: Dry Season by Subembayment, NOx (mg N/L)

Subembayment	2013 (a,b)	2014 (a,b)	2015 (a,b)	2016 (a,b)	2017 (a,b)	2018 (a,b)	2019 (a,b)	2020 (a,b)	2021 (a,b)	2022 (a,b)	2023 (a,b)	11-Year Average (b)
Suisun Bay	13.1	11.3	9.22	5.73	7.49	8.64	6.76	6.57	6.52	7.31	6.53	8.09
San Pablo Bay (d)	11.0	8.78	5.45	4.63	5.28	5.13	6.72	5.52	5.36	5.89	5.84	6.40
Central Bay	4.98	3.78	4.46	3.61	4.38	3.42	2.52	3.21	3.83	3.38	4.96	3.86
South Bay	3.72	3.04	3.99	3.28	2.57	2.39	2.25	2.66	2.73	2.22	2.78	2.88
Lower South Bay	15.8	16.7	20.5	18.2	17.6	16.5	17.0	16.2	16.0	15.0	15.3	16.8
Total	**8.98**	**8.36**	**9.41**	**7.89**	**7.81**	**7.56**	**7.26**	**7.28**	**7.25**	**6.69**	**7.40**	**7.82**

a. Based on average values from May 1 through September 30.
b. Calculation based on a flow-weighted average values.
c. Dry season trending not applied to concentrations as the emphasis is on load. Focusing on concentration is limiting as it does not consider the impact of flow.
d. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

5.4 Total Inorganic Nitrogen (TIN)

The historical average monthly discharge loads from October 2012 through September 2023 are presented in Figure 5-4. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge loads were calculated based on reported loads in Table 5-17 and Table 5-18, respectively. In addition, the annual average and dry season average monthly discharge loads and concentrations for each Subembayment are provided in Table 5-19 through Table 5-22, respectively.

A summary of the discharge data review findings is as follows **(new findings for 2022/2023 in bold)**:

- **Both the average annual and dry season loads decreased compared to last year (refer to Table 5-17 and Table 5-18, respectively). Note, the 2022/2023 loads were the second lowest since sampling began in 2012 (regardless of average annual or dry season).** The total annual average and dry season TIN discharge increased from 2012/2013 to 2016/2017 season, remained relatively steady between 2016/2017 and 2018/2019, declined through 2020/2021, followed by an increase in 2021/2022, **and the loads declined again in 2022/2023**.
- **<u>Average Annual Loads:</u> the 2022/2023 loads were the second lowest since sampling began in 2012 (refer to Table 5-17; regardless of average annual or dry season). The overall loads decreased approximately 200 kg N/d compared to last year. This past year's dataset was 3,300 kg N/d lower than the 11-year average. The largest contributor to the load decrease was from EBMUD (Central Bay Discharger) at approximately 1,340 kg N/d. As previously noted in Section 5.2, reductions at EBMUD (Central Bay Discharger) are attributed to two independent efforts: i) EBMUD stopped accepting trucked waste with relatively high nitrogenous compounds (e.g., animal blood waste) and ii) the treatment plant began treating up to 50 percent of the dry season plant flow via split treatment with biological nitrification/denitrification.**
- **<u>Dry Season Loads:</u> the 2023 loads were the second lowest since sampling began in 2012 (refer to Table 5-18). The overall loads decreased approximately 1,100 kg N/d compared to last year. In fact, this past year's dataset was 3,900 kg N/d lower than the 11-year average. The largest contributor to the load decrease was from EBMUD (Central Bay Discharger) at 2,640 kg N/d for the reasons previously noted above. In contrast, San Jose (Lower South Bay Discharger) had an increase of 930 kg N/d compared to the last year.**
- **<u>Dry Season Trending:</u> the dry season trending analysis suggests South Bay, Lower South Bay, and Baywide have a downward trend over the entire 11-years of dry season data. The previous year's Group Annual Report had the Central Bay trending upwards. Given the recent optimization efforts at EBMUD, the Central Bay has pivoted from an upward to no trend. Baywide, the trending analysis suggests no emerging trend over the entire 11-years of dry season data.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2012 (see Section 3.8).
- The South Bay Subembayment accounts for nearly half of the load discharged to San Francisco Bay (refer to Figure 5-4 and/or Table 5-20). It experienced an increase of about

600 kg N/d for both average annual and dry season values in 2021/2022 as compared to 2020/2021.

- The discharge nutrient concentrations are calculated based on flow-weighted values (refer to Table 5-21 and Table 5-22). The key findings on concentrations are as follows:
  - **The most recent dataset has the lowest concentrations since sampling began in 2012 (regardless of average annual or dry season). The relatively low discharge concentrations this past year is attributed to this past year's relatively wet year that has resulted in a higher dilution of loads coupled with the optimization efforts at EBMUD (Central Bay Discharger).**
  - **A comparison between last year and this year's levels for each Subembayment suggests that dry season concentrations decreased for all the Subembayments except for Lower South Bay. This is because of the increase in dry season loads for San Jose which discharges to Lower South Bay, as noted previously.**
  - Central Bay Dischargers have the highest flow-weighted discharge concentrations of the Subembayments. Several dischargers in the Central Bay Subembayment, such as EBMUD, receive trucked waste **(albeit lesser than in the past)** which can increase discharge concentrations/loads.

A discussion of the results is provided in Section 7.5.4.

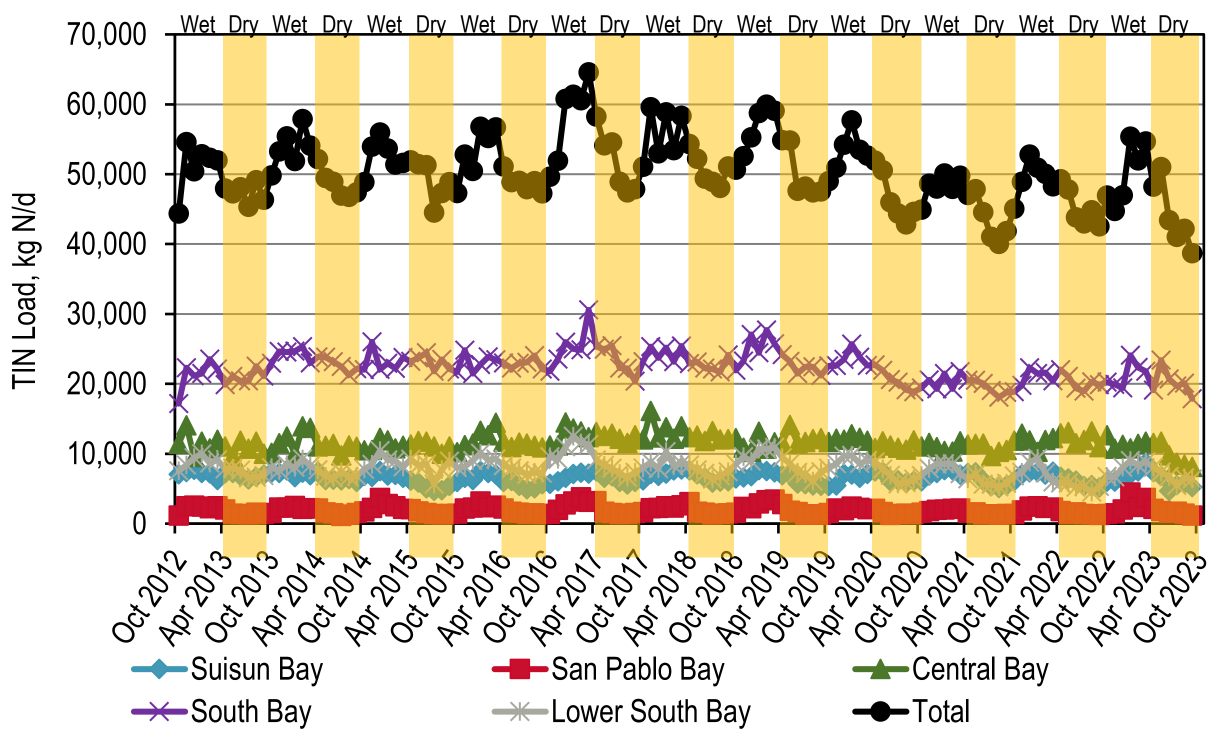

Figure 5-4. Discharge: Average Monthly Discharge TIN Loads

Table 5-17. Discharge: Annual Average by Discharger, TIN (kg N/d)

Discharger	Subembayment	2012/ 2013 (a,b)	2013/ 2014 (a,b)	2014/ 2015 (a,b)	2015/ 2016 (a,b)	2016/ 2017 (a,b)	2017/ 2018 (a,b)	2018/ 2019 (a,b)	2019/ 2020 (a,b)	2020/ 2021 (a,b)	2021/ 2022 (a,b)	2022/ 2023 (a,b)	11-Year Average
American Canyon	San Pablo Bay	70.4	80.3	44.4	32.2	41.4	36.8	37.3	33.1	17.8	18.9	30.3	40.3
Benicia	San Pablo Bay	225	205	234	233	243	251	222	211	228	211	212	225
Burlingame	South Bay	397	433	292	292	366	359	466	460	402	349	313	375
Central San	Suisun Bay	3,880	3,810	3,680	3,800	4,000	3,840	3,790	3,980	4,260	4,160	3,920	3,920
CMSA	Central Bay	844	846	761	869	1,180	986	1,120	1,170	1,090	1,030	1,020	992
Port Costa	San Pablo Bay	0	0	0	1.52	2.06	1.99	0.705	1.45	1.29	2.22	1.61	1.17
Delta Diablo	Suisun Bay	1,690	1,510	1,290	1,320	1,450	1,520	1,500	1,330	1,210	1,100	1,310	1,390
EBDA	South Bay	7,880	7,830	8,320	8,400	8,320	8,700	8,570	8,950	7,710	7,900	8,140	8,250
EBMUD	Central Bay	9,190	9,440	9,390	9,530	9,910	10,700	9,340	9,320	8,630	9,890	8,550	9,440
FSSD	Suisun Bay	1,310	1,330	1,030	876	916	1,320	1,130	1,040	1,010	1,120	1,060	1,100
Las Gallinas(c)	San Pablo Bay	129	118	97.5	121	138	135	153	160	128	53.1	64.0	118
Paradise Cove	Central Bay	2.08	0.287	2.54	1.53	2.25	2.11	1.80	1.89	1.62	0.856	1.14	1.65
Tiburon	Central Bay	58.8	56.1	57.8	62.6	45.1	55.5	49.7	33.7	41.2	56.8	48.2	51.4
Millbrae	South Bay	241	234	239	267	294	261	286	288	278	245	264	263
Mt. View	Suisun Bay	121	129	119	122	142	125	115	112	99.2	70.6	84.7	113
Napa(c)	San Pablo Bay	173	175	172	170	259	161	309	152	41.1	119	220	178
Novato(c)	San Pablo Bay	144	136	167	139	197	130	198	112	94.5	92.2	224	149
Palo Alto	Lower South Bay	2,360	2,160	2,130	2,650	2,560	2,180	2,310	2,220	1,950	2,150	2,420	2,280
Petaluma(c)	San Pablo Bay	25.3	11.8	24.8	15.6	16.3	4.87	24.2	6.68	5.31	7.14	15.9	14.3
Pinole	San Pablo Bay	301	289	278	309	320	317	227	232	273	410	380	303
Rodeo	San Pablo Bay	36.4	30.6	33.3	30.4	45.4	32.6	38.3	38.7	31.4	50.8	54.4	38.4
SFO Airport	South Bay	250	257	154	162	226	139	107	25.2	55.1	72.8	160	146
SFPUC Southeast	South Bay	7,920	10,300	9,590	9,050	10,300	8,860	8,850	7,210	6,500	6,880	6,500	8,360
San Jose	Lower South Bay	4,800	4,770	5,590	5,000	5,790	4,920	5,500	4,880	4,080	3,450	3,780	4,780
San Mateo	South Bay	1,450	1,400	1,310	1,300	1,350	1,430	1,530	1,330	1,380	1,390	1,360	1,380
SMCSD	Central Bay	128	118	127	132	136	137	134	124	141	116	116	128
SASM	Central Bay	212	204	173	234	164	187	211	219	227	227	251	210
SVCW	South Bay	1,970	2,050	2,300	2,590	2,460	2,690	2,640	2,590	2,410	2,670	2,570	2,450
Sonoma Valley(c)	San Pablo Bay	29.5	9.21	23.3	10.6	82.0	0	29.9	0	0	0.871	72.2	23.4
South SF	South Bay	983	933	940	897	1,070	1,060	1,310	1,160	1,160	1,030	1,400	1,090
Sunnyvale	Lower South Bay	894	697	726	592	952	878	964	810	900	846	1,150	855
Treasure Island	Central Bay	10.8	13.9	19.0	17.4	16.3	12.0	13.9	20.9	19.0	16.9	25.2	16.8
Vallejo	San Pablo Bay	768	846	961	901	906	931	928	851	849	826	813	871
West County	Central Bay	764	801	676	956	1,150	873	997	799	761	763	584	830
Total (d)		**49,300**	**51,300**	**50,900**	**51,100**	**55,000**	**53,200**	**53,100**	**49,900**	**46,000**	**47,300**	**47,100**	**50,400**

a. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
b. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-18. Discharge: Dry Season by Discharger, TIN (kg N/d)

Discharger	Subembayment	2013 [a,b]	2014 [a,b]	2015 [a,b]	2016 [a,b]	2017 [a,b]	2018 [a,b]	2019 [a,b]	2020 [a,b]	2021 [a,b]	2022 [a,b]	2023 [a,b]	11-Year Average
American Canyon	San Pablo Bay	111	79.7	30.7	20.1	24.7	31.8	29.2	19.4	15.4	11.3	15.0	35.3
Benicia	San Pablo Bay	226	199	198	231	240	236	197	221	227	204	230	219
Burlingame	South Bay	436	288	273	273	271	389	450	462	297	253	278	334
Central San	Suisun Bay	3,720	3,630	3,380	3,710	3,610	3,550	3,420	3,890	3,900	3,690	3,430	3,630
CMSA	Central Bay	844	841	721	964	1,220	954	1,090	1,170	1,100	1,090	997	999
Port Costa	San Pablo Bay	--	0.0381	--	--	--	--	0.552	2.15	--			0.913
Delta Diablo	Suisun Bay	1,630	1,480	869	927	1,350	1,370	1,310	1,320	979	944	1,200	1,220
EBDA	South Bay	7,170	7,190	7,870	7,440	6,940	8,080	7,880	7,700	6,870	6,890	7,320	7,400
EBMUD	Central Bay	8,910	9,070	9,390	8,960	9,760	10,200	9,900	8,960	8,410	9,960	7,330	9,170
FSSD	Suisun Bay	1,360	969	807	655	1,080	1,270	1,020	969	905	1,040	884	997
Las Gallinas[c]	San Pablo Bay	0	0	0	0	8.99	0	51.4	47.1	0	0	0	9.77
Paradise Cove	Central Bay	2.52	0.287	2.61	1.53	2.62	2.11	2.13	1.31	0.977	0.877	2.22	1.74
Tiburon	Central Bay	46.8	56.1	53.2	62.6	45.0	57.6		27.7	45.5	46.7	43.5	48.5
Millbrae	South Bay	247	207	236	293	291	250	307	276	276	245	254	262
Mt. View	Suisun Bay	101	112	103	122	116	110	106	108	90.4	41.6	56.5	97.0
Napa[c]	San Pablo Bay	0	50.1	0	0	0	0	0	0	0	0	0	4.56
Novato[c]	San Pablo Bay	39.9	42.3	37.5	38.2	98.2	43.1	100.0	23.1	8.21	0	118	49.9
Palo Alto	Lower South Bay	2,550	2,140	2,230	2,640	2,120	2,210	1,950	1,930	2,000	2,230	2,300	2,210
Petaluma[c]	San Pablo Bay	0	0	0	0	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	342	287	267	341	235	322	170	243	281	369	350	292
Rodeo	San Pablo Bay	26.4	28.1	26.9	28.2	31.9	29.4	35.8	46.2	33.8	39.2	48.8	34.1
SFO Airport	South Bay	257	285	165	205	343	89.2	169	19.4	68.4	90.5	212	173
SFPUC Southeast	South Bay	8,650	10,300	10,000	9,880	10,600	9,050	8,260	6,780	6,840	7,400	7,040	8,610
San Jose	Lower South Bay	4,220	4,330	5,280	4,410	4,730	4,510	4,760	4,200	3,430	2,530	3,460	4,170
San Mateo	South Bay	1,540	1,490	1,280	1,370	1,280	1,480	1,560	1,320	1,230	1,340	1,450	1,390
SMCSD	Central Bay	133	123	135	141	148	148	155	123	149	110	114	134
SASM	Central Bay	191	162	151	190	154	203	187	253	221	246	235	199
SVCW	South Bay	1,880	1,940	2,380	2,510	2,440	2,320	2,500	2,350	2,500	2,460	2,560	2,350
Sonoma Valley[c]	San Pablo Bay	0	0	0	0	4.21	0	0	0	0	0	2.33	0.595
South SF	South Bay	916	906	879	915	919	995	1,020	1,250	1,220	1,220	1,230	1,040
Sunnyvale	Lower South Bay	360	371	324	341	630	392	617	391	446	460	720	459
Treasure Island	Central Bay	9.92	14.3	20.9	14.0	14.6	13.6	14.1	20.5	19.4	19.9	25.6	17.0
Vallejo	San Pablo Bay	751	851	899	837	870	831	900	821	814	769	755	827
West County	Central Bay	663	663	683	918	1,040	806	955	731	734	692	628	774
Total [d]		**47,300**	**48,100**	**48,700**	**48,400**	**50,600**	**50,000**	**49,100**	**45,700**	**43,100**	**44,400**	**43,300**	**47,200**

a. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
b. Based on average values from May 1 through September 30.
c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-19. Discharge: Annual Average by Subembayment, TIN (kg N/d)

Subembayment	2012/ 2013 [a]	2013/ 2014 [a]	2014/ 2015 [a]	2015/ 2016 [a]	2016/ 2017 [a]	2017/ 2018 [a]	2018/ 2019 [a]	2019/ 2020 [a]	2020/ 2021 [a]	2021/ 2022 [a]	2022/ 2023 [a]	11-Year Average
Suisun Bay	7,010	6,780	6,110	6,120	6,510	6,800	6,540	6,460	6,580	6,460	6,380	6,520
San Pablo Bay [b]	1,860	1,830	2,030	1,960	2,250	2,000	2,170	1,800	1,670	1,790	2,090	1,960
Central Bay	11,200	11,400	11,200	11,700	12,600	12,900	11,900	11,700	10,900	12,100	10,600	11,700
South Bay	21,100	23,500	23,100	23,000	24,400	23,500	23,800	22,000	19,900	20,500	20,700	22,300
Lower South Bay	8,050	7,630	8,440	8,240	9,310	7,980	8,770	7,910	6,930	6,450	7,350	7,920
Total	**49,300**	**51,300**	**50,900**	**51,100**	**55,000**	**53,200**	**53,100**	**49,900**	**46,000**	**47,300**	**47,100**	**50,400**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-20. Discharge: Dry Season by Subembayment, TIN (kg N/d)

Subembayment	2013 [a]	2014 [a]	2015 [a]	2016 [a]	2017 [a]	2018 [a]	2019 [a]	2020 [a]	2021 [a]	2022 [a]	2023 [a]	11-Year Average	Trend [c,d]
Suisun Bay	6,810	6,200	5,160	5,410	6,160	6,300	5,850	6,290	5,870	5,720	5,570	5,940	None
San Pablo Bay [b]	1,410	1,390	1,460	1,500	1,510	1,490	1,480	1,420	1,380	1,390	1,520	1,470	None
Central Bay	10,800	10,900	11,100	11,200	12,300	12,400	12,300	11,300	10,700	12,200	9,370	11,300	None
South Bay	21,100	22,600	23,100	22,900	23,100	22,700	22,200	20,200	19,300	19,900	20,300	21,600	Down (-1.4%/yr)
Lower South Bay	7,130	6,850	7,840	7,390	7,480	7,110	7,320	6,520	5,870	5,220	6,490	6,840	Down (-2.3%/yr)
Total	**47,300**	**48,100**	**48,700**	**48,400**	**50,600**	**50,000**	**49,100**	**45,700**	**43,100**	**44,400**	**43,300**	**47,200**	**None**

a. Based on average values from May 1 through September 30.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.
c. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 55. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.
d. The percent change represents the change per year as a percentage of the average value over the entire dataset (2013-2022) (not considered if trend is “None”).

Table 5-21. Discharge: Annual Average by Subembayment, TIN (mg N/L)

Subembayment	2012/ 2013 (a,b)	2013/ 2014 (a,b)	2014/ 2015 (a,b)	2015/ 2016 (a,b)	2016/ 2017 (a,b)	2017/ 2018 (a,b)	2018/ 2019 (a,b)	2019/ 2020 (a,b)	2020/ 2021 (a,b)	2021/ 2022 (a,b)	2022/ 2023 (a,b)	11-Year Average (b)
Suisun Bay	31.4	32.4	30.2	29.4	23.9	30.7	26.9	30.7	33.4	30.0	23.9	29.1
San Pablo Bay (c)	15.6	16.7	18.0	17.2	13.4	19.2	15.2	18.6	22.4	18.5	14.8	16.8
Central Bay	37.6	40.3	42.1	40.9	33.9	45.2	35.5	45.0	45.8	43.1	32.8	39.7
South Bay	35.4	40.4	40.4	38.9	36.7	40.3	38.7	40.2	38.9	38.2	33.6	38.3
Lower South Bay	17.2	17.7	20.2	19.3	19.6	18.0	18.2	18.3	17.6	16.9	15.8	18.1
Total	**28.8**	**31.6**	**32.4**	**31.4**	**28.2**	**32.5**	**29.3**	**32.3**	**32.5**	**31.3**	**26.0**	**30.4**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
b. Calculation based on a flow-weighted average values.
c. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-22. Discharge: Dry Season by Subembayment, TIN (mg N/L)

Subembayment	2013 (a,b)	2014 (a,b)	2015 (a,b)	2016 (a,b)	2017 (a,b)	2018 (a,b)	2019 (a,b)	2020 (a,b)	2021 (a,b)	2022 (a,b)	2023 (a,b)	11-Year Average (b)
Suisun Bay	34.8	32.9	30.8	29.9	29.0	32.3	28.0	32.0	33.0	31.1	25.9	30.8
San Pablo Bay (d)	25.0	24.5	26.9	26.8	23.0	27.3	22.7	26.7	28.0	28.9	25.2	25.7
Central Bay	43.2	46.6	51.3	46.8	48.0	50.3	46.7	47.8	48.8	55.5	39.7	47.6
South Bay	38.6	42.5	44.7	42.6	41.9	42.1	41.3	40.5	40.5	41.1	39.0	41.3
Lower South Bay	16.4	17.1	21.1	18.7	18.3	17.1	17.6	16.7	16.3	15.3	15.8	17.3
Total	**31.8**	**34.0**	**36.7**	**34.4**	**33.8**	**34.4**	**33.0**	**33.2**	**33.6**	**34.8**	**30.0**	**33.6**

a. Based on average values from May 1 through September 30.
b. Calculation based on a flow-weighted average values.
c. Dry season trending not applied to concentrations as the emphasis is on load. Focusing on concentration is limiting as it does not consider the impact of flow.
d. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

5.5 Total Phosphorus (TP)

The historical average monthly discharge loads from October 2012 through September 2023 are presented in Figure 5-5. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge loads were calculated based on reported loads in Table 5-23 and Table 5-24, respectively. In addition, the annual average and dry season average monthly discharge loads and concentrations for each Subembayment are provided in Table 5-25 and Table 5-28, respectively.

A summary of the discharge data review findings is as follows **(new findings for 2022/2023 in bold)**:

- Unlike the nitrogen species whose loads appear to be tied to precipitation, drought, etc., TP loads appear to be more random from year to year. Such variability is attributed to TP removal mechanisms. For example, at facilities that occasionally use chemicals for odor control (e.g., ferric chloride in the collection system), the chemical addition binds a portion of TP and subsequently reduces loads when chemicals are applied. Furthermore, facilities with anaerobic selectors in their activated sludge process to improve solids settleability also reduces TP loads. This biological feature can be “finicky” at plants and lead to variable TP load reduction.
- **<u>Average Annual Loads:</u> the overall loads increased approximately 195 kg P/d compared to last year. Despite the increase, the 2022/2023 loads were still 190 kg P/d lower than the 11-year average. The largest contributor to the increase was EBMUD (Central Bay Discharger) at 234 kg P/d more than 2021/2022. Such an increase was anticipated as EBMUD’s anaerobic selector which has historically removed TP is now reducing TIN loads instead during the dry season. Note: South SF installed an anerobic selector in 2021 to improve solids settleability and their TP loads have since declined.**
- **<u>Dry Season Loads:</u> the overall loads increased approximately 460 kg P/d compared to last year. In fact, the 2023 loads were 79 kg P/d higher than the 11-year average. Similar to average annual, the largest contributor to the increase was EBMUD (Central Bay Discharger) at 351 kg P/d less than the previous year for the reasons previously stated. As previously noted, South SF installed an anerobic selector in 2021 to improve solids settleability and their TP loads have since declined.**
- **<u>Dry Season Trending:</u> the dry season trending analysis is variable across Subembayments and Baywide. The trending analysis suggests that Suisun Bay, San Pablo Bay, South Bay, and Baywide has no trending over the entire 11-years of dry season data. The Lower South Bay data suggests downward trending over the entire 11-years of dry season data. In contrast, Central Bay suggests an upwards trending over the entire 11-years of dry season data. The upward trending in the Central Bay is likely attributed to EBMUD using the anaerobic selector for TIN load reduction over TP load reduction.** This trending is based on the least-squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2012 (see Section 3.8).
- The Central Bay and South Bay Subembayments account for over half of the TP loads discharged to the Bay (refer to Figure 5-5 or Table 5-26).

◆ The nutrient discharge concentrations are calculated based on flow-weighted values (refer to Table 5-27 and Table 5-28).

- Agencies across the Bay reduce phosphorus loads through a combination of chemical and biological processes.
- **The most recent average annual and dry season datasets showed for most Subembayments a decline in concentrations compared to the previous year's dataset (except for Central Bay). This increase in the Central Bay was anticipated due to the previously stated optimization efforts at EBMUD (Central Bay Discharger). Overall, the Baywide dry season value is comparable to the 11-year average.**
- Dischargers to the Central Bay have the highest discharge concentrations across the Subembayments. Several dischargers in the Central Bay Subembayment, such as EBMUD, receive trucked waste **(albeit less than in the past)** which can increase discharge concentrations/loads.

A discussion of the results is provided in Section 7.5.5.

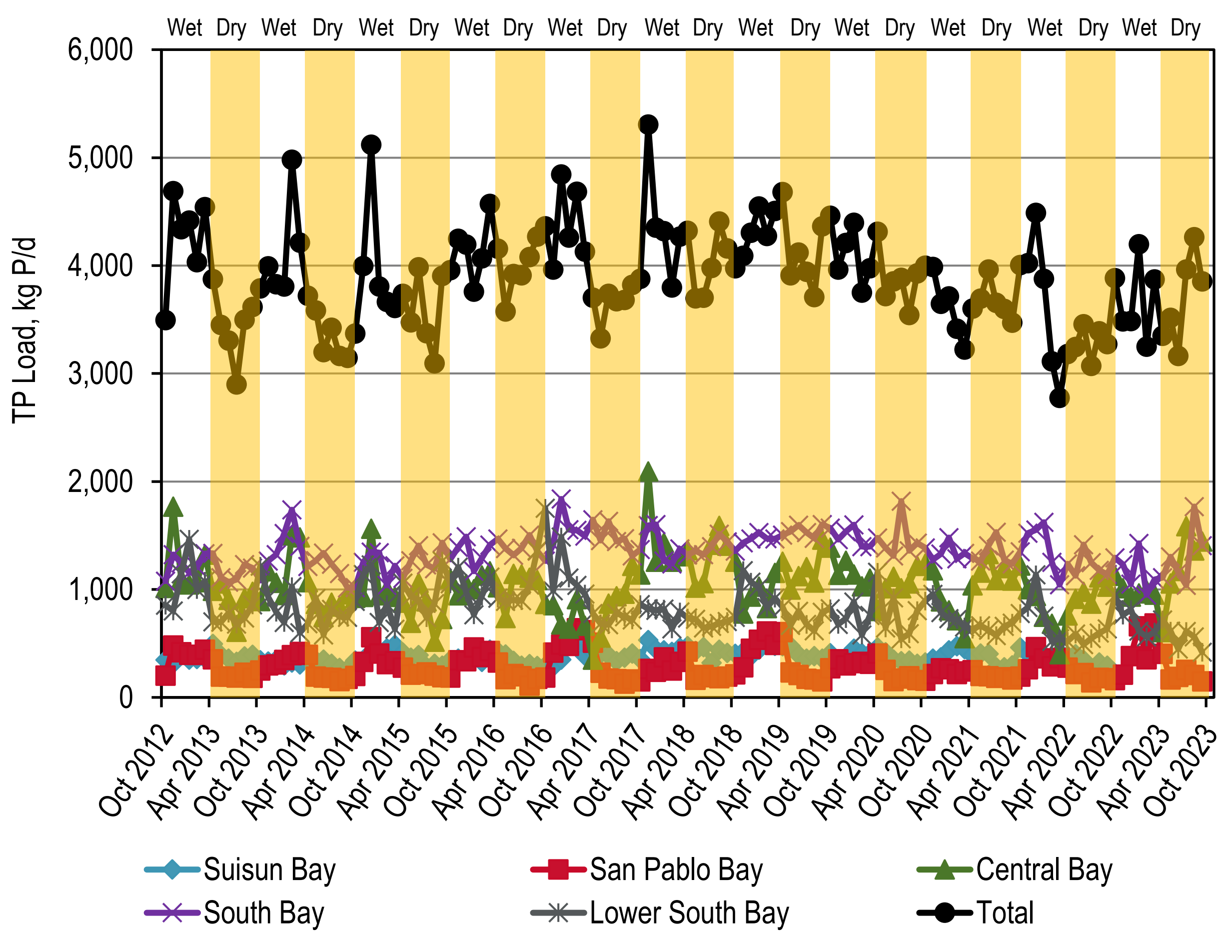

Figure 5-5. Discharge: Average Monthly Discharge TP Loads

Table 5-23. Discharge: Annual Average by Discharger, TP (kg P/d)

Discharger	Subembayment	2012/ 2013 [a,b]	2013/ 2014 [a,b]	2014/ 2015 [a,b]	2015/ 2016 [a,b]	2016/ 2017 [a,b]	2017/ 2018 [a,b]	2018/ 2019 [a,b]	2019/ 2020 [a,b]	2020/ 2021 [a,b]	2021/ 2022 [a,b]	2022/ 2023 [a,b]	11-Year Average
American Canyon	San Pablo Bay	29.0	17.9	28.7	27.6	24.0	26.0	23.4	24.7	15.5	18.5	22.4	23.4
Benicia	San Pablo Bay	25.2	25.7	26.2	15.1	16.5	15.7	19.2	15.9	15.4	21.4	17.4	19.4
Burlingame	South Bay	101	110	25.4	22.2	29.2	32.4	31.0	36.1	33.2	30.2	28.7	43.7
Central San	Suisun Bay	133	87.7	127	109	127	122	137	121	141	146	151	127
CMSA	Central Bay	92.4	81.7	94.2	84.5	106	100	108	123	127	128	116	106
Port Costa	San Pablo Bay	0	0	0	0.598	0.479	0.352	0.226	0.777	0.200	0.289	0.154	0.280
Delta Diablo	Suisun Bay	31.1	27.1	36.7	29.4	51.5	60.6	42.6	50.3	33.6	22.8	39.3	38.6
EBDA	South Bay	544	534	501	551	642	534	534	583	636	603	577	567
EBMUD	Central Bay	843	824	718	827	538	1,100	818	856	775	618	852	797
FSSD	Suisun Bay	194	190	198	200	197	235	235	201	186	192	196	202
Las Gallinas[c]	San Pablo Bay	19.7	17.2	14.6	22.6	21.5	16.5	23.8	27.8	19.6	16.2	13.6	19.4
Paradise Cove	Central Bay	0.270	--	0.358	0.223	0.495	0.490	0.246	0.301	0.270	0.187	0.248	0.281
Tiburon	Central Bay	8.36	7.88	8.44	9.20	8.56	7.84	6.21	5.60	6.45	9.08	3.18	7.35
Millbrae	South Bay	16.5	13.5	13.0	12.0	11.9	7.41	17.9	19.8	15.6	13.9	14.5	14.2
Mt. View	Suisun Bay	18.2	17.0	16.2	15.4	13.5	15.2	10.0	12.0	12.6	11.3	8.00	13.6
Napa[c]	San Pablo Bay	22.5	14.4	25.3	34.6	58.7	22.4	86.1	37.8	8.98	25.4	71.6	37.1
Novato[c]	San Pablo Bay	15.7	10.9	20.6	9.59	12.9	2.74	13.9	6.62	1.62	7.26	11.6	10.3
Palo Alto	Lower South Bay	346	352	352	445	397	362	372	343	306	322	337	358
Petaluma[c]	San Pablo Bay	27.5	31.0	24.6	19.1	24.7	16.1	21.3	11.5	4.12	12.3	28.0	20.0
Pinole	San Pablo Bay	29.6	17.3	15.2	16.4	24.6	29.2	33.4	29.6	28.8	38.0	32.0	26.7
Rodeo	San Pablo Bay	8.36	8.01	7.95	8.37	8.75	7.58	9.43	9.17	7.50	5.83	8.00	8.09
SFO Airport	South Bay	17.5	13.4	8.97	9.69	16.2	32.0	35.5	18.2	7.10	4.33	11.1	15.8
SFPUC Southeast	South Bay	67.2	164	205	271	332	287	389	279	146	231	222	236
San Jose	Lower South Bay	354	246	370	368	322	154	243	220	162	139	137	247
San Mateo	South Bay	128	127	122	142	125	133	114	130	130	139	131	129
SMCSD	Central Bay	23.4	18.5	17.0	17.2	16.5	19.3	14.8	13.4	15.4	19.6	19.6	17.7
SASM	Central Bay	45.2	45.6	40.5	51.6	38.1	40.5	37.5	37.9	44.3	40.7	38.5	41.8
SVCW	South Bay	174	172	189	213	218	234	242	244	217	225	210	213
Sonoma Valley[c]	San Pablo Bay	16.5	10.5	2.83	2.51	21.3	0	5.35	0	0	1.87	8.34	6.28
South SF	South Bay	149	160	171	150	133	138	134	168	156	60.5	41.0	133
Sunnyvale	Lower South Bay	200	214	213	193	257	225	231	198	247	201	166	213
Treasure Island	Central Bay	1.57	3.01	3.70	4.10	4.50	3.32	3.08	3.32	2.82	2.93	3.17	3.23
Vallejo	San Pablo Bay	126	129	123	121	139	110	107	107	111	117	107	118
West County	Central Bay	53.4	60.7	46.6	67.6	88.5	101	110	71.9	57.6	76.6	73.3	73.3
Total [d]		**3,860**	**3,750**	**3,770**	**4,070**	**4,020**	**4,190**	**4,210**	**4,010**	**3,670**	**3,500**	**3,700**	**3,890**

a. Data are presented in detail and summarized for each plant in the Appendix. A “--“ indicates data were not available, whereas a “0” indicates a value of zero.
b. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-24. Discharge: Dry Season by Discharger, TP (kg P/d)

Discharger	Subembayment	2013 (a,b)	2014 (a,b)	2015 (a,b)	2016 (a,b)	2017 (a,b)	2018 (a,b)	2019 (a,b)	2020 (a,b)	2021 (a,b)	2022 (a,b)	2023 (a,b)	11-Year Average
American Canyon	San Pablo Bay	47.4	8.23	29.1	15.4	14.5	24.8	16.2	19.9	14.8	11.0	15.3	19.7
Benicia	San Pablo Bay	23.9	23.9	20.4	16.4	8.96	9.68	13.1	15.0	10.4	20.9	23.0	16.9
Burlingame	South Bay	125	32.4	31.5	13.9	18.1	26.4	27.5	31.4	19.1	31.3	25.4	34.7
Central San	Suisun Bay	125	90.3	112	108	107	116	111	93.6	117	116	145	113
CMSA	Central Bay	101	79.6	89.3	87.5	127	112	109	129	133	125	123	111
Port Costa	San Pablo Bay	--	0	--	--	--	--	0.138	0.587	--		0.00366	0.182
Delta Diablo	Suisun Bay	27.7	27.2	27.8	28.1	51.1	51.2	47.0	49.5	24.0	18.7	48.5	36.4
EBDA	South Bay	490	494	480	546	533	505	555	592	627	557	583	542
EBMUD	Central Bay	668	668	576	813	643	1,030	938	820	905	711	1,060	803
FSSD	Suisun Bay	201	174	172	175	211	233	227	196	179	181	168	192
Las Gallinas(c)	San Pablo Bay	0	0	0	0	0.844	0	10.8	8.69	0	0	0	1.85
Paradise Cove	Central Bay	0.334	0.0384	0.377	0.223	0.592	0.490	0.305	0.303	0.232	0.252	0.324	0.316
Tiburon	Central Bay	7.62	7.88	8.34	9.20	8.18	8.90	--	4.61	6.00	8.01	2.90	7.16
Millbrae	South Bay	19.2	13.0	14.2	11.8	15.1	7.83	22.4	20.0	16.6	10.2	13.3	14.9
Mt. View	Suisun Bay	17.8	17.6	18.2	16.8	11.3	14.7	9.47	13.0	12.7	10.4	6.57	13.5
Napa(c)	San Pablo Bay	0	3.77	0	0	0	0	0	0	0	0	0	0.343
Novato(c)	San Pablo Bay	1.06	1.62	0.800	1.24	2.46	0.305	1.71	0.229	0.130	0	16.8	2.39
Palo Alto	Lower South Bay	386	381	381	450	354	382	311	296	327	334	325	357
Petaluma(c)	San Pablo Bay	0	0	0	0	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	30.6	18.7	17.6	16.3	21.1	34.2	33.4	30.7	37.7	42.2	26.6	28.1
Rodeo	San Pablo Bay	6.98	7.73	9.24	8.63	6.23	7.07	9.71	10.6	4.60	3.80	6.60	7.38
SFO Airport	South Bay	25.0	8.95	8.79	4.12	21.6	42.4	33.7	8.42	8.72	4.04	18.5	16.8
SFPUC Southeast	South Bay	24.0	184	263	322	395	321	433	287	149	260	297	267
San Jose	Lower South Bay	185	196	384	397	111	113	151	216	100	55.2	79.0	181
San Mateo	South Bay	128	136	129	137	129	139	127	122	128	126	144	131
SMCSD	Central Bay	24.8	20.0	18.5	18.9	19.0	19.3	17.2	13.9	17.3	19.6	21.1	19.1
SASM	Central Bay	50.3	43.3	40.5	43.0	40.2	40.9	32.9	43.0	43.4	35.3	38.1	41.0
SVCW	South Bay	185	161	217	191	211	237	226	225	210	214	226	209
Sonoma Valley(c)	San Pablo Bay	0	0	0	0	0.711	0	0	0	0	0	1.23	0.177
South SF	South Bay	145	170	163	161	140	127	124	176	184	20.2	27.6	131
Sunnyvale	Lower South Bay	180	183	177	172	256	189	248	189	215	182	127	192
Treasure Island	Central Bay	1.27	2.84	3.99	4.46	4.74	3.61	2.80	3.34	2.98	2.58	3.71	3.30
Vallejo	San Pablo Bay	125	123	133	116	120	110	101	104	120	111	105	115
West County	Central Bay	45.5	42.0	46.5	75.2	72.9	94.1	72.4	73.3	68.5	85.8	75.4	68.3
Total (d)		**3,400**	**3,320**	**3,570**	**3,960**	**3,660**	**4,000**	**4,010**	**3,790**	**3,680**	**3,300**	**3,760**	**3,680**

a. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
b. Based on average values from May 1 through September 30.
c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-25. Discharge: Annual Average by Subembayment, TP (kg P/d)

Subembayment	2012/ 2013 [a]	2013/ 2014 [a]	2014/ 2015 [a]	2015/ 2016 [a]	2016/ 2017 [a]	2017/ 2018 [a]	2018/ 2019 [a]	2019/ 2020 [a]	2020/ 2021 [a]	2021/ 2022 [a]	2022/ 2023 [a]	11-Year Average
Suisun Bay	377	322	378	354	389	434	426	385	373	372	394	382
San Pablo Bay [b]	307	275	289	277	352	247	343	270	213	264	320	289
Central Bay	1,070	1,030	923	1,050	793	1,370	1,100	1,110	1,030	900	1,110	1,046
South Bay	1,200	1,300	1,220	1,370	1,510	1,400	1,500	1,480	1,340	1,310	1,240	1,350
Lower South Bay	900	811	935	1,010	976	741	846	760	715	662	640	818
Total	**3,860**	**3,750**	**3,770**	**4,070**	**4,020**	**4,190**	**4,210**	**4,010**	**3,670**	**3,500**	**3,700**	**3,890**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-26. Discharge: Dry Season Average by Subembayment, TP (kg P/d)

Subembayment	2013 [a]	2014 [a]	2015 [a]	2016 [a]	2017 [a]	2018 [a]	2019 [a]	2020 [a]	2021 [a]	2022 [a]	2023 [a]	11-Year Average	Trend [c,d]
Suisun Bay	372	309	330	328	381	415	394	352	333	327	368	355	None
San Pablo Bay [b]	197	177	210	174	175	186	186	189	188	189	195	192	None
Central Bay	894	858	778	1,040	909	1,310	1,170	1,090	1,180	990	1,330	1,052	Up (3.6%/yr)
South Bay	1,140	1,200	1,260	1,390	1,460	1,410	1,550	1,460	1,340	1,220	1,330	1,350	None
Lower South Bay	750	760	943	1,020	721	684	710	701	642	572	531	730	Down (-4.2%/yr)
Total	**3,400**	**3,320**	**3,570**	**3,960**	**3,660**	**4,000**	**4,010**	**3,790**	**3,680**	**3,300**	**3,760**	**3,680**	**None**

a. Based on average values from May 1 through September 30.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.
c. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 55. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.
d. The percent change represents the change per year as a percentage of the average value over the entire dataset (2013-2022) (not considered if trend is "None").

Table 5-27. Discharge: Annual Average by Subembayment, TP (mg P/L)

Subembayment	2012/ 2013 (a,b)	2013/ 2014 (a,b)	2014/ 2015 (a,b)	2015/ 2016 (a,b)	2016/ 2017 (a,b)	2017/ 2018 (a,b)	2018/ 2019 (a,b)	2019/ 2020 (a,b)	2020/ 2021 (a,b)	2021/ 2022 (a,b)	2022/ 2023 (a,b)	11-Year Average (b)
Suisun Bay	1.69	1.54	1.87	1.70	1.43	1.96	1.75	1.83	1.89	1.73	1.48	1.70
San Pablo Bay (c)	2.63	2.48	2.56	2.43	2.10	2.36	2.41	2.80	2.86	2.73	2.26	2.47
Central Bay	3.58	3.66	3.49	3.68	2.15	4.79	3.28	4.29	4.32	3.19	3.42	3.56
South Bay	2.01	2.23	2.16	2.32	2.27	2.40	2.44	2.70	2.62	2.43	2.01	2.32
Lower South Bay	1.92	1.88	2.24	2.35	2.06	1.67	1.76	1.76	1.82	1.74	1.38	1.87
Total	**2.26**	**2.31**	**2.40**	**2.50**	**2.06**	**2.56**	**2.32**	**2.59**	**2.60**	**2.32**	**2.04**	**2.35**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.
b. Calculation based on a flow-weighted average values.
c. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 5-28. Discharge: Dry Season by Subembayment, TP (mg P/L)

Subembayment	2013 (a,b)	2014 (a,b)	2015 (a,b)	2016 (a,b)	2017 (a,b)	2018 (a,b)	2019 (a,b)	2020 (a,b)	2021 (a,b)	2022 (a,b)	2023 (a,b)	11-Year Average (b)
Suisun Bay	1.90	1.64	1.97	1.81	1.79	2.13	1.89	1.79	1.87	1.77	1.71	1.84
San Pablo Bay (d)	3.93	2.99	3.88	3.11	2.65	3.41	2.84	3.56	3.81	3.92	3.24	3.36
Central Bay	3.59	3.69	3.60	4.37	3.55	5.29	4.46	4.61	5.37	4.50	5.62	4.41
South Bay	2.08	2.26	2.52	2.58	2.66	2.61	2.88	2.93	2.82	2.52	2.56	2.58
Lower South Bay	1.72	1.90	2.53	2.58	1.76	1.64	1.71	1.80	1.79	1.68	1.29	1.85
Total	**2.28**	**2.34**	**2.69**	**2.81**	**2.44**	**2.76**	**2.69**	**2.76**	**2.87**	**2.58**	**2.60**	**2.62**

a. Based on average values from May 1 through September 30.
b. Calculation based on a flow-weighted average values.
c. Dry season trending not applied to concentrations as the emphasis is on load. Focusing on concentration is limiting as it does not consider the impact of flow.
d. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

5.6 Flows and Nutrient Loads Distribution by Subembayment

Flows and nutrient discharge loading for select nitrogen species and total phosphorus has been analyzed by Subembayment to demonstrate the relative contributions for each discharger. In this section, loading diagrams illustrate the discharge loads over time for the past eleven years (Oct 2012 through Sept 2023).

The cumulative figures in the following subsections are organized by Subembayment and present the relative contribution of each discharger within its respective Subembayment for flow, ammonia, TIN, and TP.

5.6.1 Suisun Bay

The average monthly discharge to Suisun Bay by discharger for flow, ammonia, TIN, and TP is provided in Figure 5-6 through Figure 5-9. Flows to Suisun Bay are dominated by the Central San discharge and followed, in terms of magnitude, by FSSD and Delta Diablo. Central San also discharges the largest loads of ammonia and TIN. FSSD discharges the largest TP load to Suisun Bay, followed by Central San.

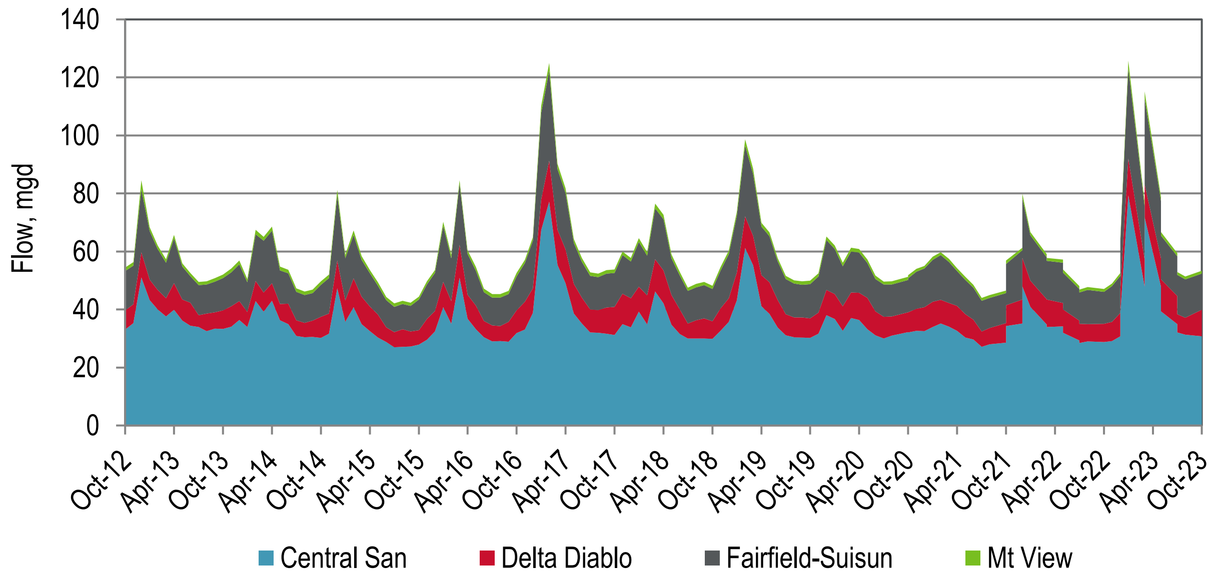

Figure 5-6. Flow Contribution by Discharger to Suisun Bay

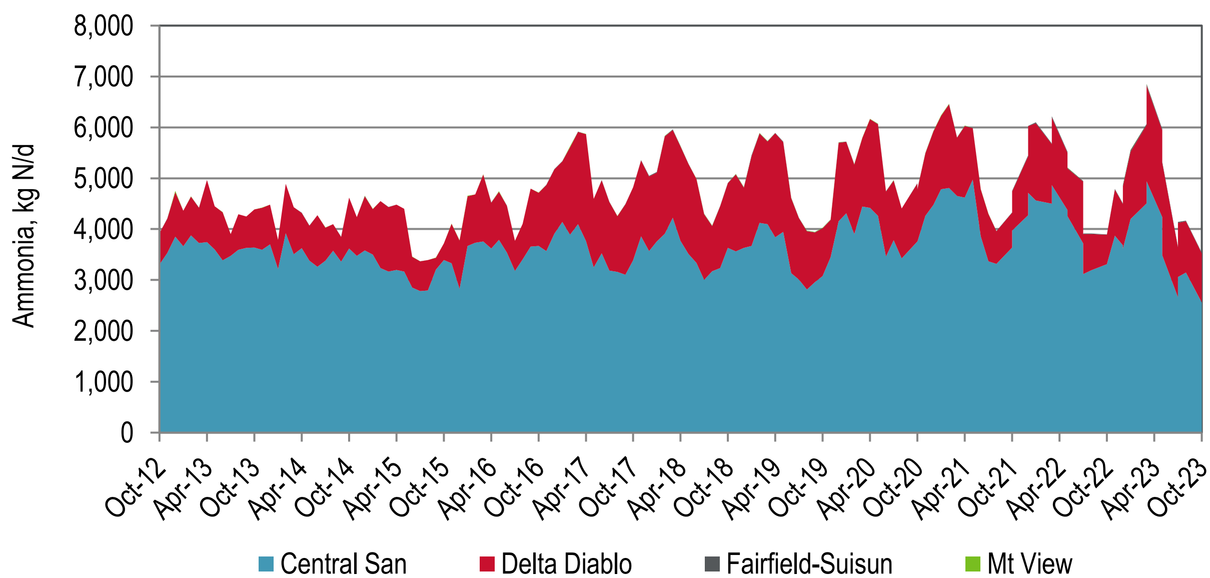

Figure 5-7. Ammonia Load Contribution by Discharger to Suisun Bay

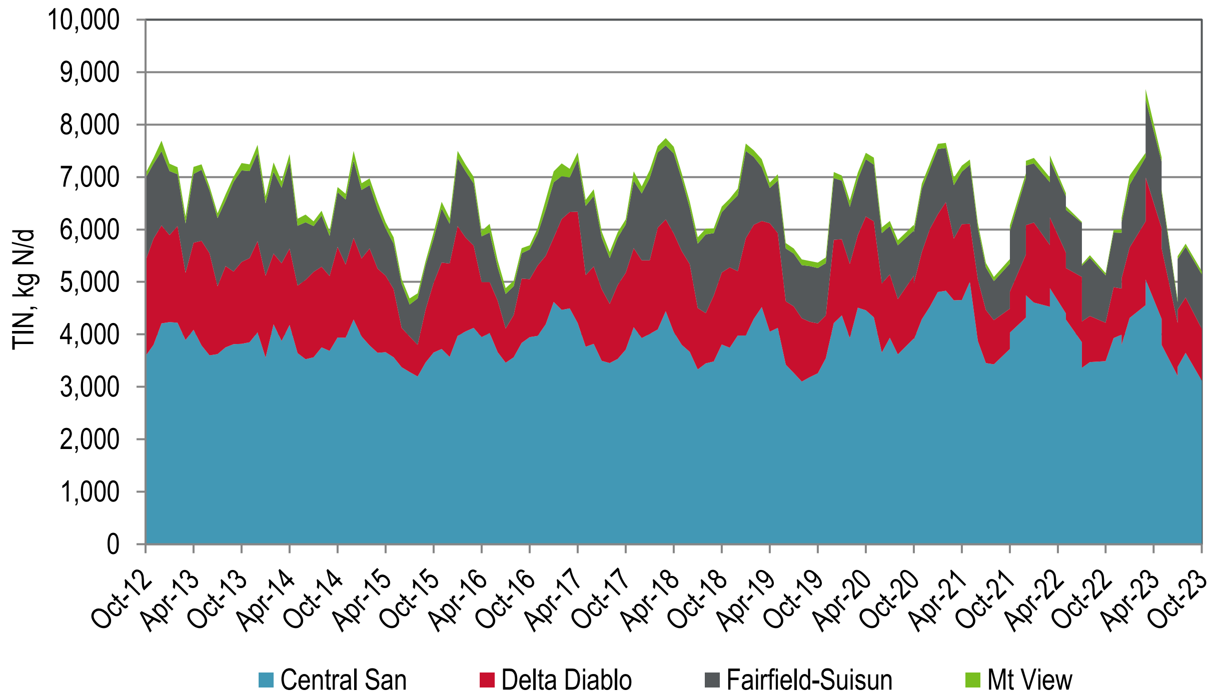

Figure 5-8. TIN Load Contribution by Discharger to Suisun Bay

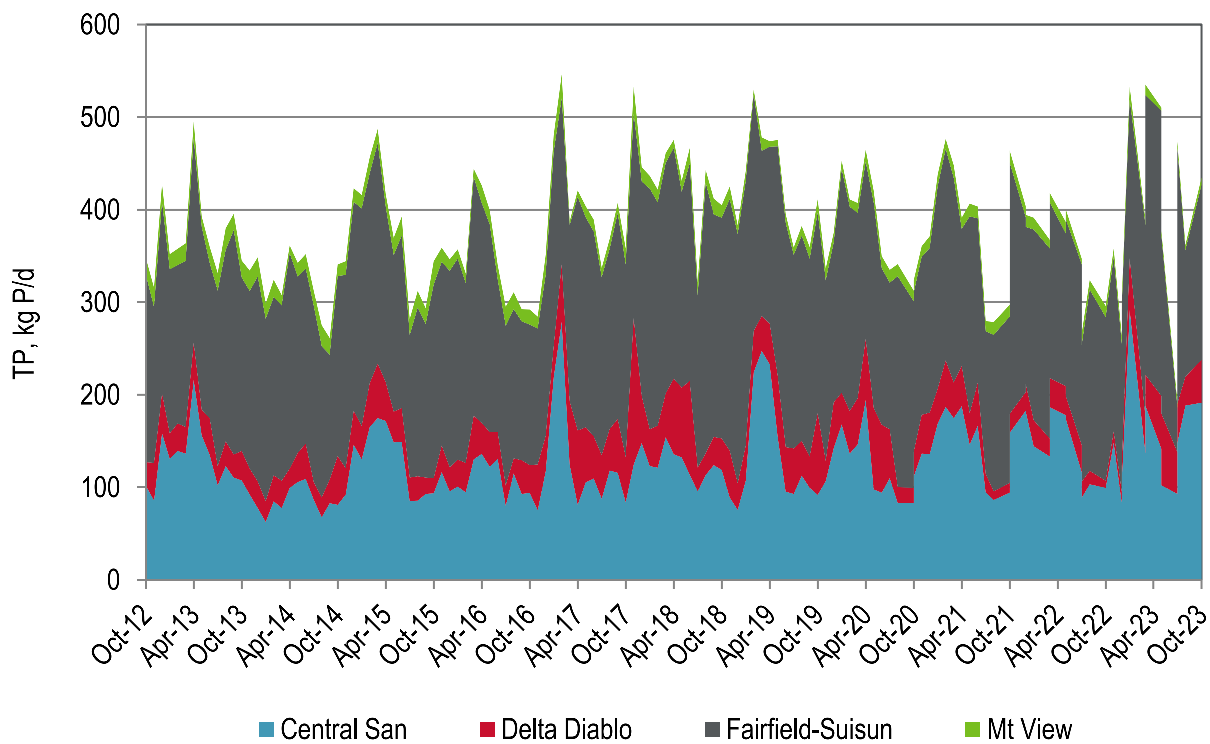

Figure 5-9. TP Load Contribution by Discharger to Suisun Bay

5.6.2 San Pablo Bay

The average monthly discharge to San Pablo Bay by discharger for discharge flows and loads are provided in Figure 5-10 through Figure 5-13. Figure 5-10 clearly demonstrates the seasonal discharges at Las Gallinas, Napa, Petaluma, and Sonoma Valley. Similar to flow, TIN and TP loads to San Pablo Bay appear to exhibit a significant seasonal pattern with higher wintertime loads.

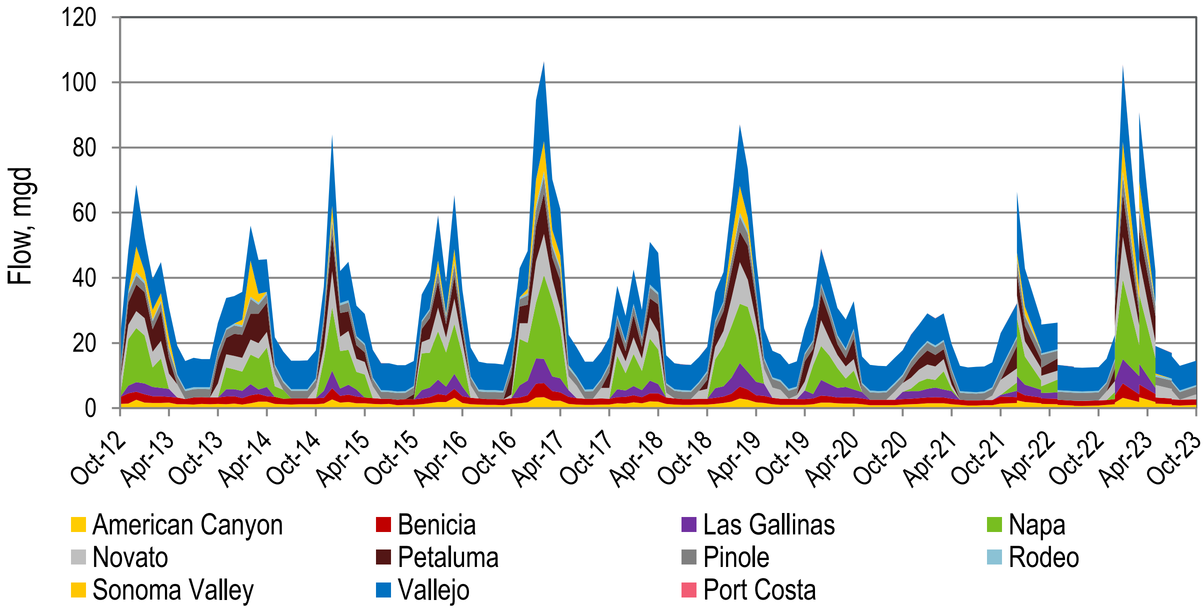

Figure 5-10. Flow Contribution by Discharger to San Pablo Bay

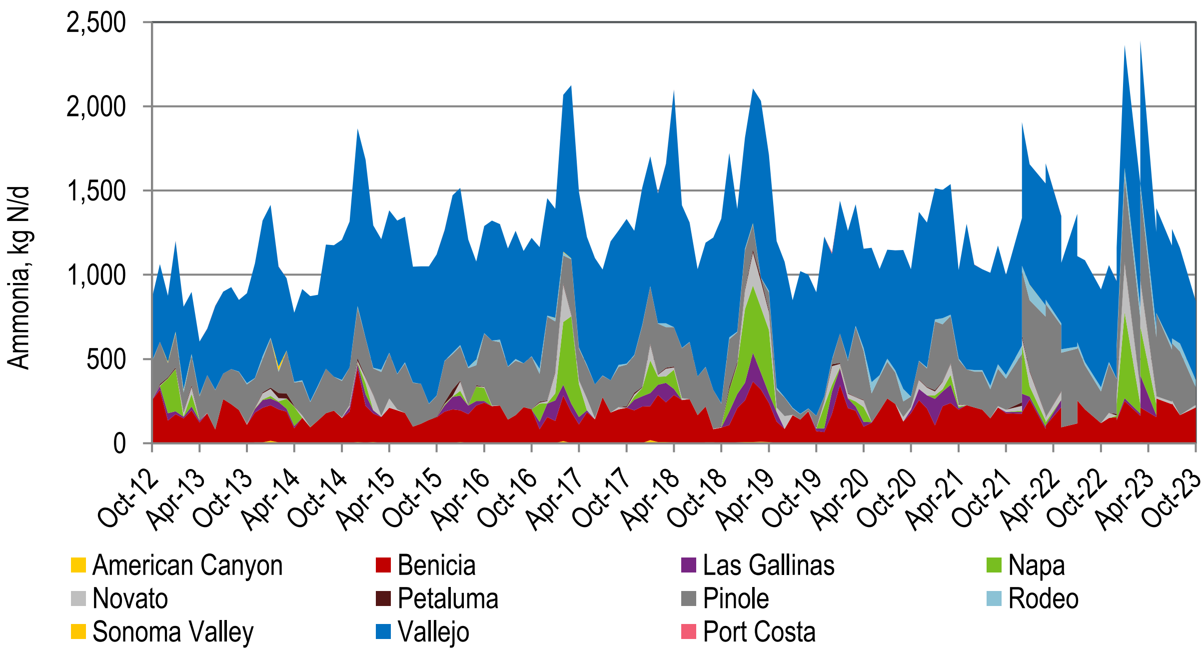

Figure 5-11. Ammonia Load Contribution by Discharger to San Pablo Bay

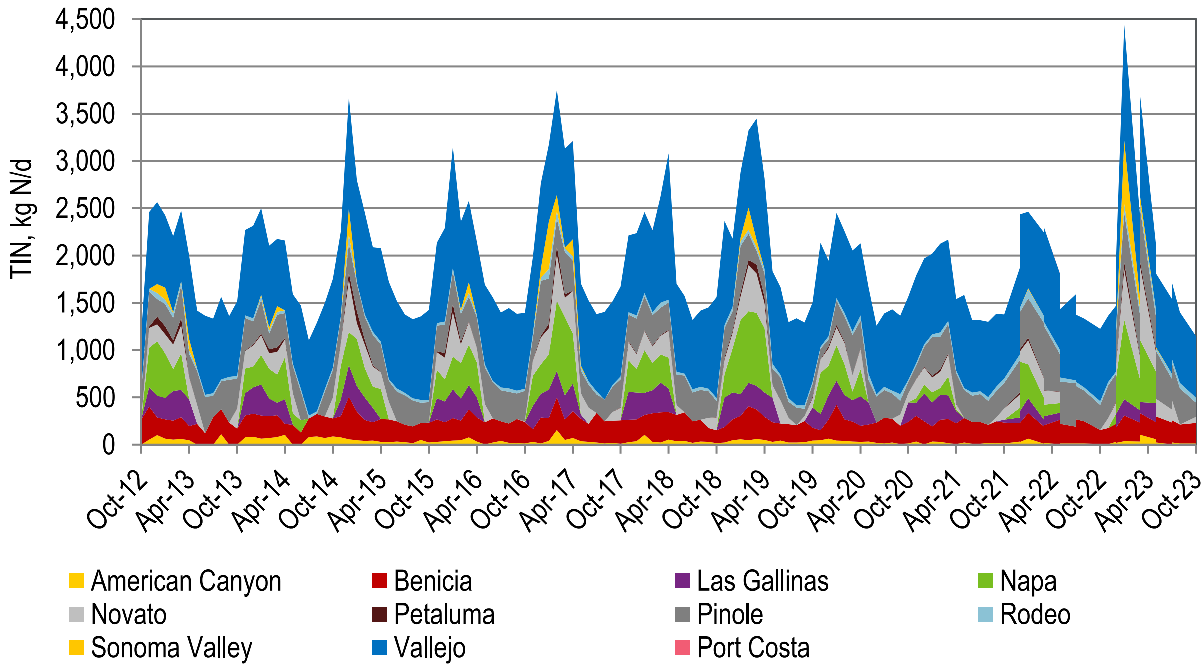

Figure 5-12. TIN Load Contribution by Discharger to San Pablo Bay

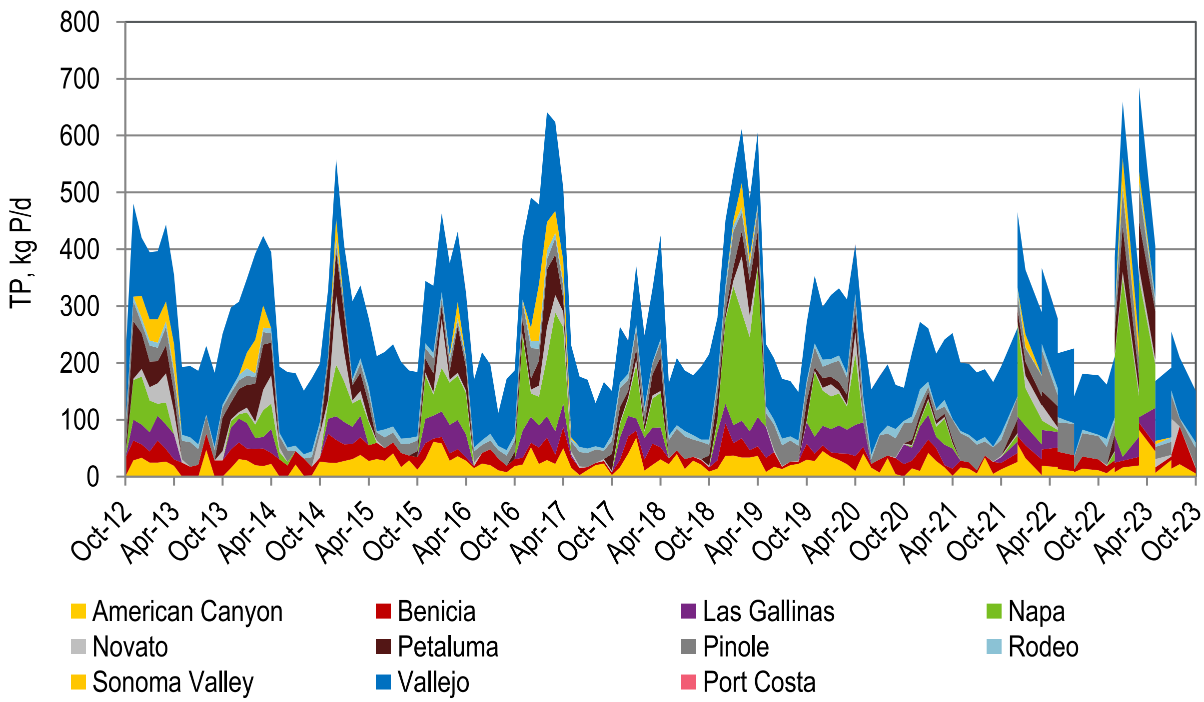

Figure 5-13. TP Load Contribution by Discharger to San Pablo Bay

5.6.3 Central Bay

The average monthly discharge to Central Bay by discharger for discharge flows and loads are provided in Figure 5-14 through Figure 5-17. Discharge flows and loads to the Central Bay are dominated by EBMUD.

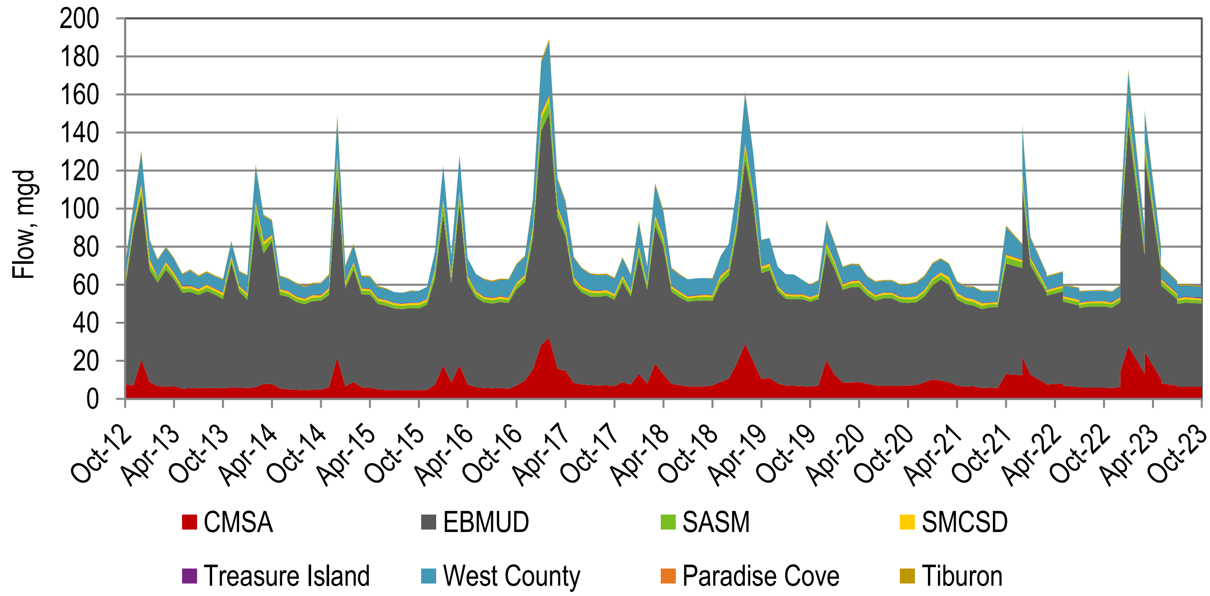

Figure 5-14. Flow Contribution by Discharger to Central Bay

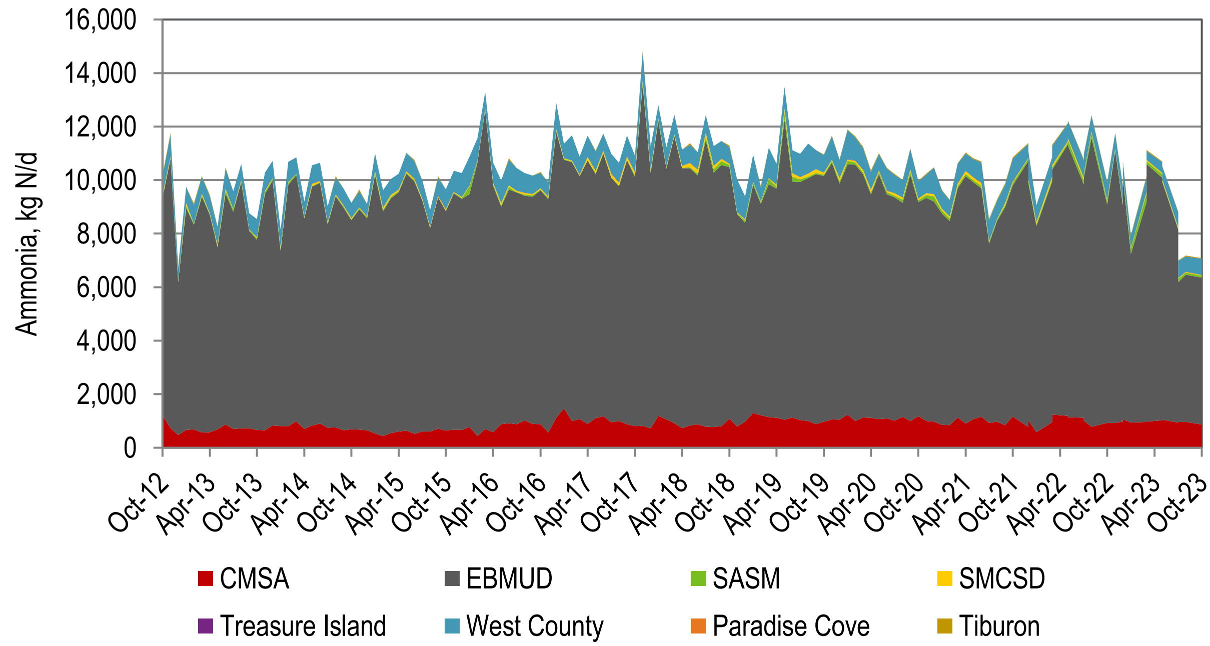

Figure 5-15. Ammonia Load Contribution by Discharger to Central Bay

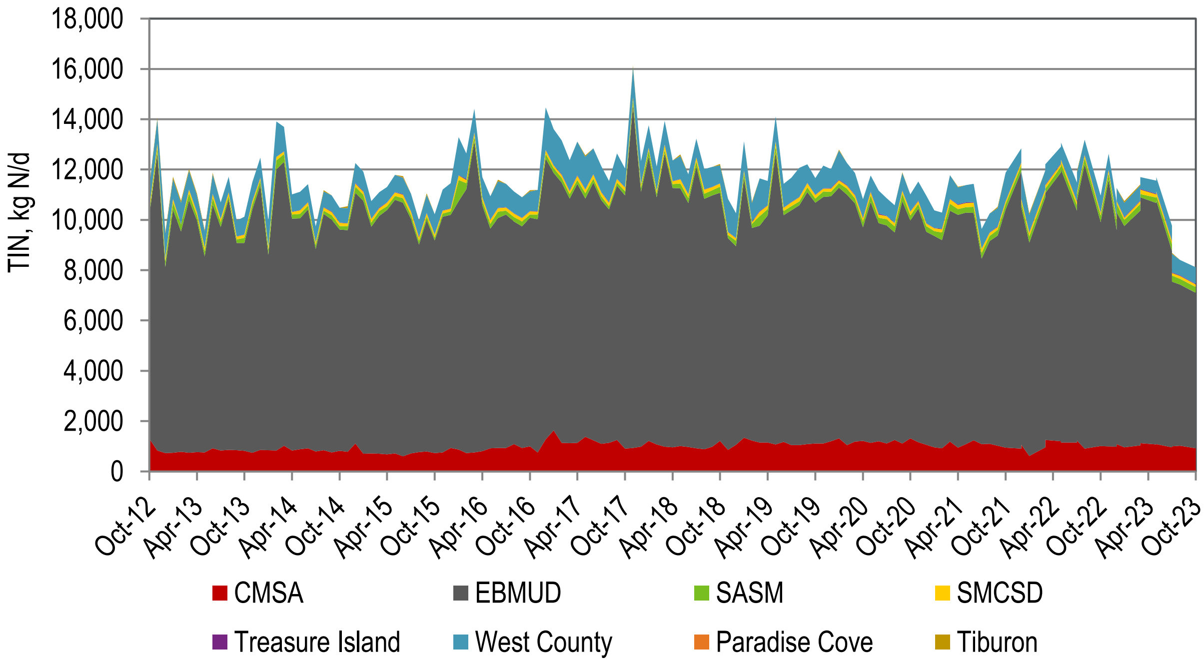

Figure 5-16. TIN Load Contribution by Discharger to Central Bay

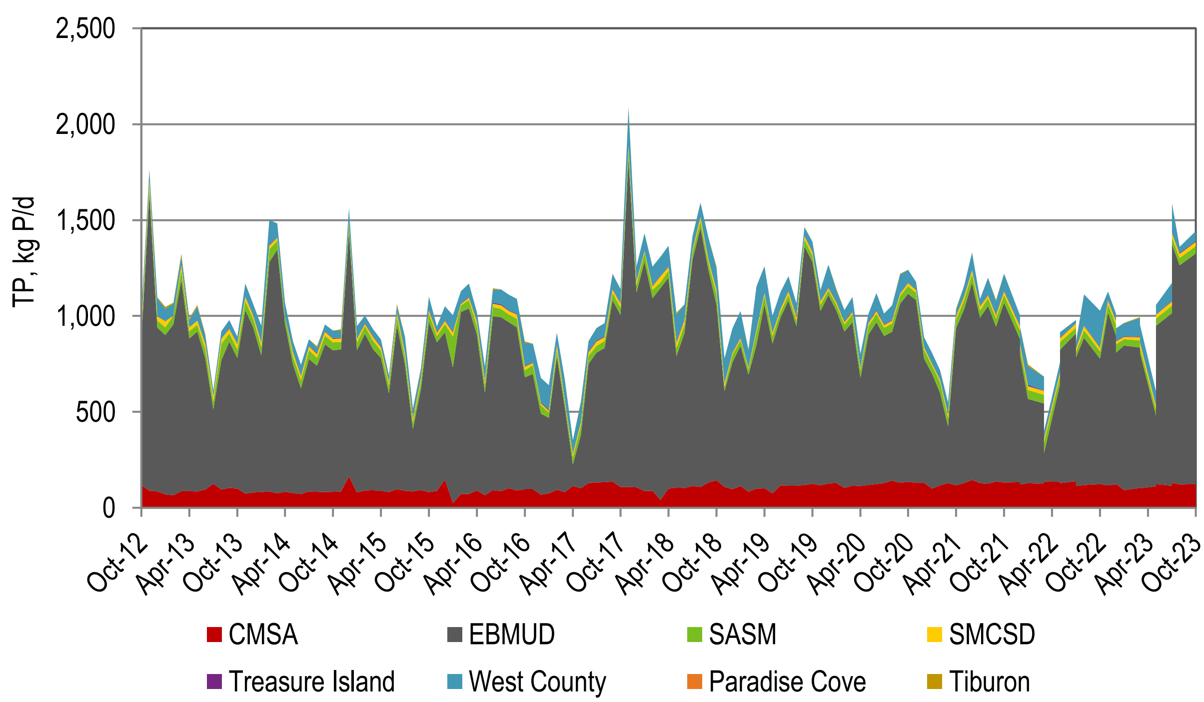

Figure 5-17. TP Load Contribution by Discharger to Central Bay

5.6.4 South Bay

The average monthly discharge to South Bay by discharger for discharge flows and loads are provided in Figure 5-18 through Figure 5-21. In the South Bay, the largest wastewater discharges are from the SFPUC Southeast Plant and EBDA. Ammonia and TIN loads to the South Bay are also largest from the SFPUC Southeast Plant and EBDA. The TP discharges to the South Bay have the largest contribution from EBDA, followed by relatively equal contributions between SFPUC Southeast Plant, San Mateo, SVCW, and South SF. SFPUC's TP loads are a lower proportion of the total compared to flow, ammonia, and TIN.

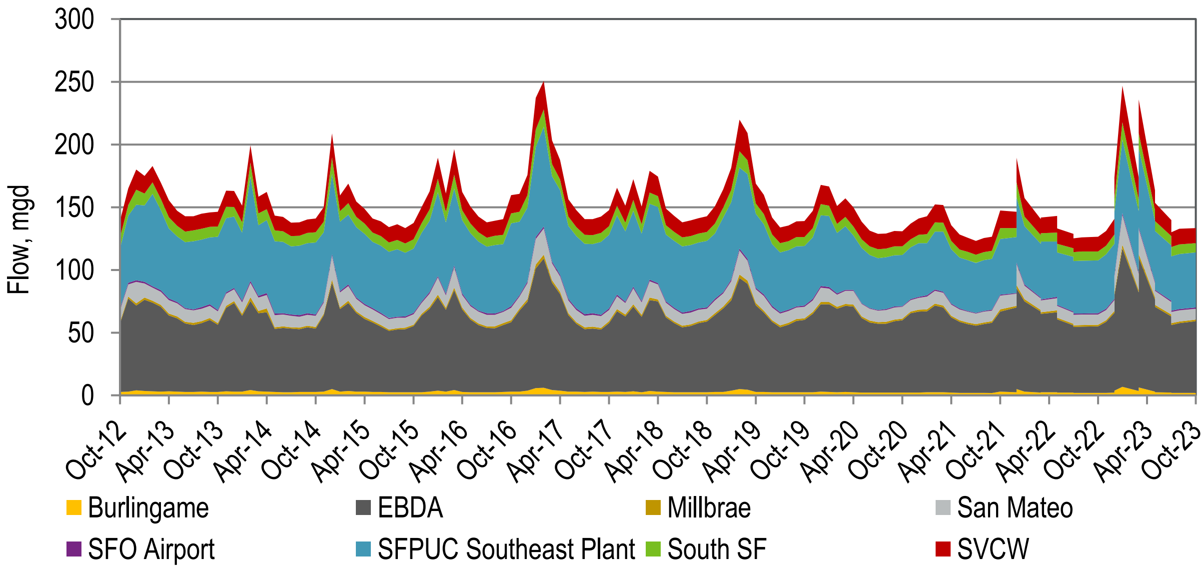

Figure 5-18. Flow Contribution by Discharger to South Bay

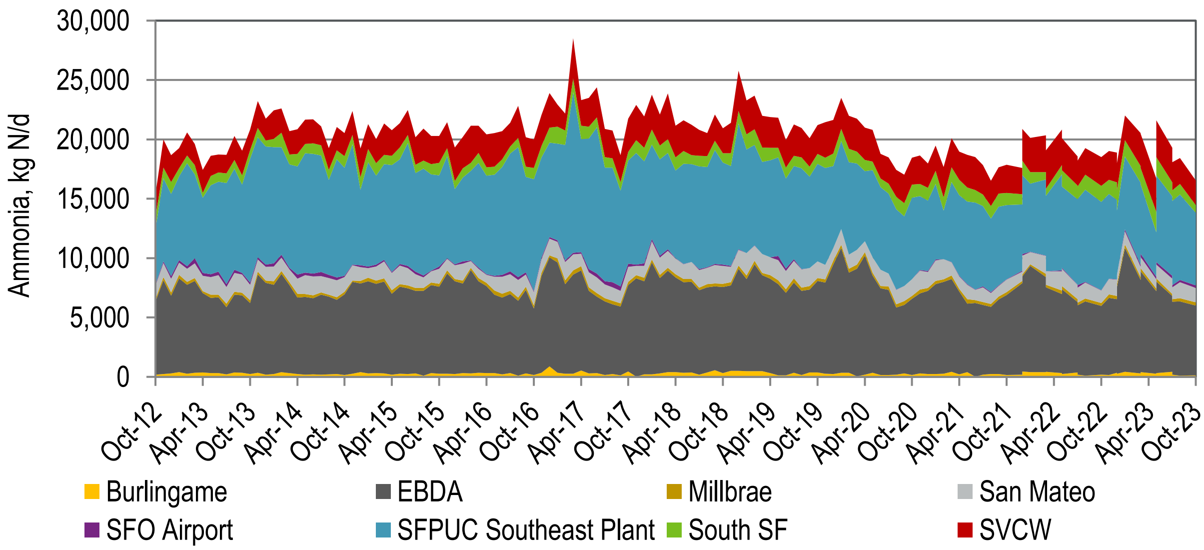

Figure 5-19. Ammonia Load Contribution by Discharger to South Bay

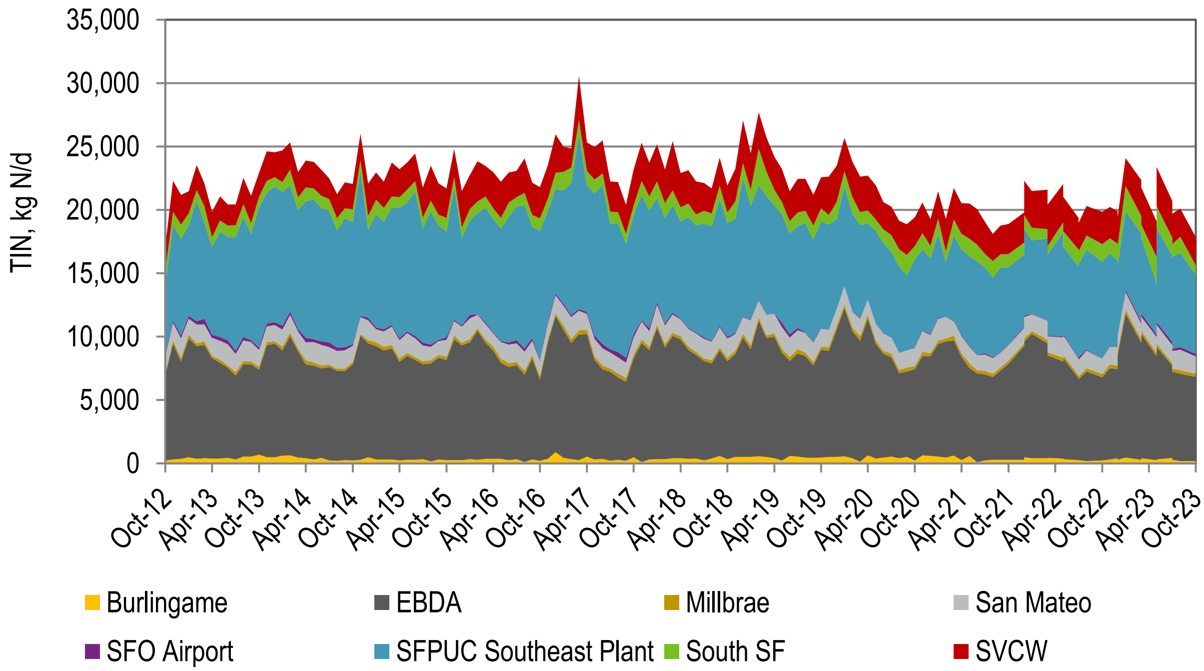

Figure 5-20. TIN Load Contribution by Discharger to South Bay

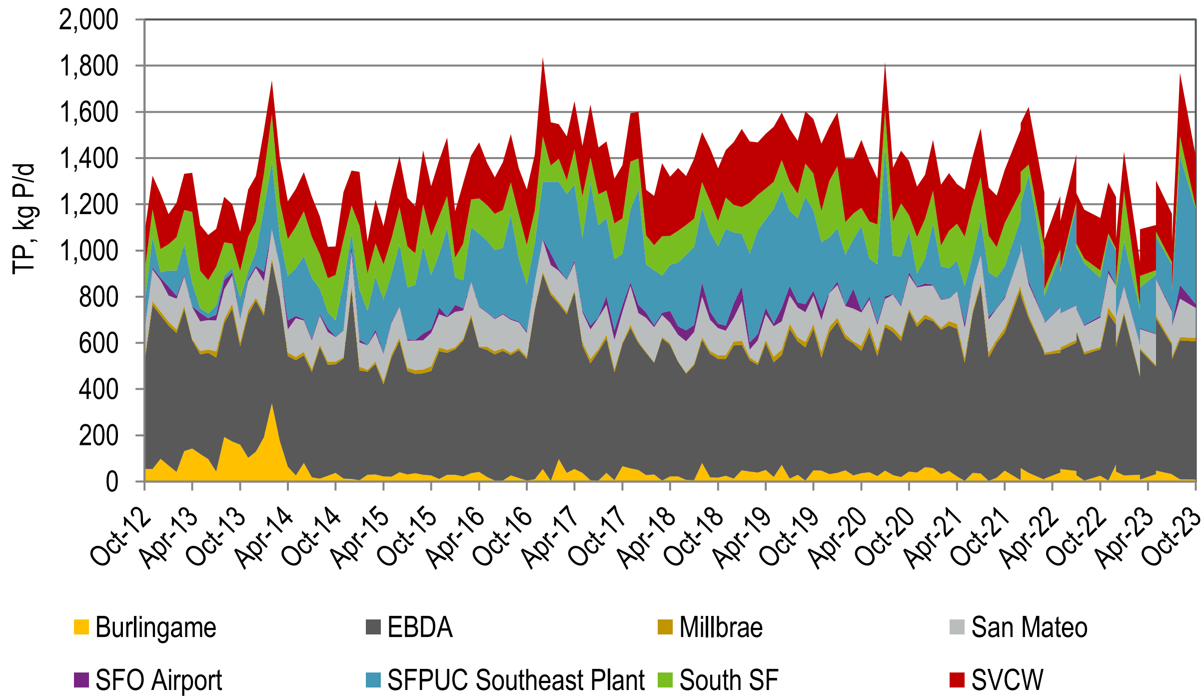

Figure 5-21. TP Load Contribution by Discharger to South Bay

5.6.5 Lower South Bay

The average monthly discharge to Lower South Bay by discharger for discharge flows and loads are provided in Figure 5-22 through Figure 5-25. Lower South Bay wastewater flows are dominated by San Jose. San Jose also discharges the largest TIN load. Sunnyvale and San Jose's ammonia loads exhibit a significant seasonal pattern. San Jose's TIN loads were sporadic (e.g., July 2015), which is likely attributed to the biological nitrogen removal step feed process, but it has been more stable in recent years. Palo Alto is the largest discharger of TP to Lower South Bay, followed by San Jose and Sunnyvale.

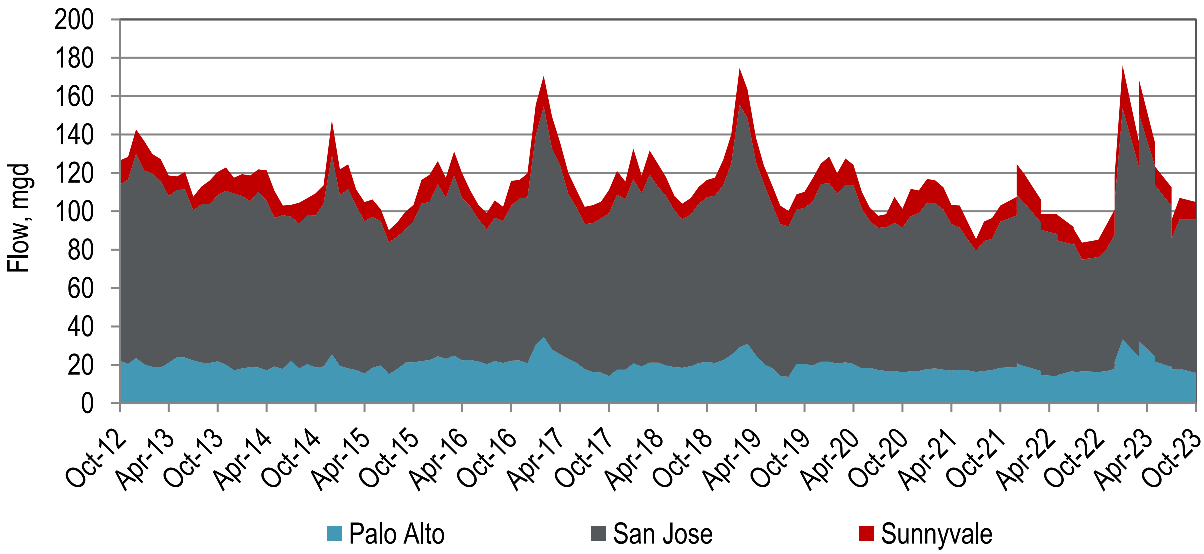

Figure 5-22. Flow Contribution by Discharger to Lower South Bay

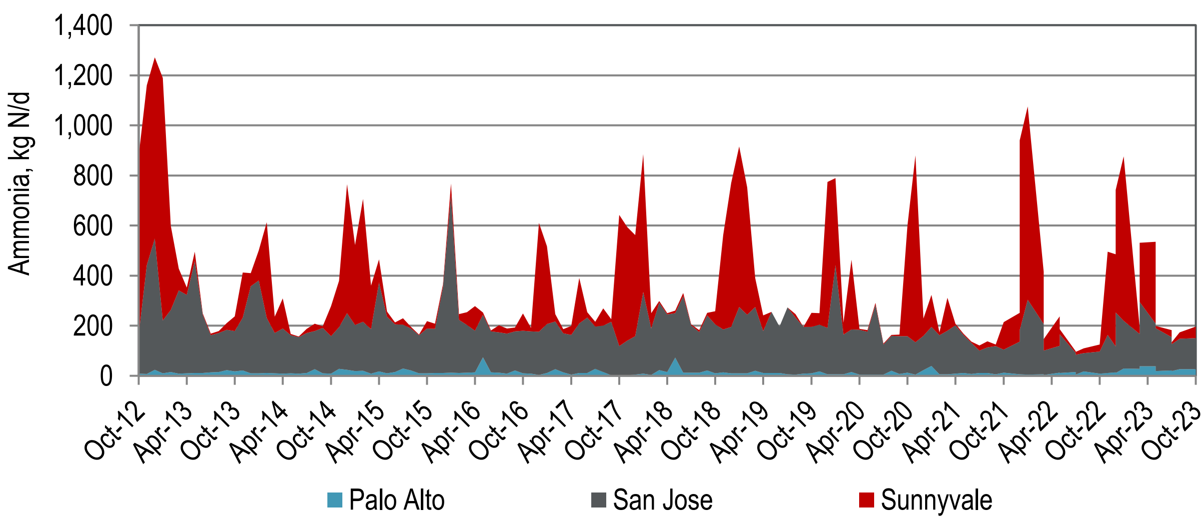

Figure 5-23. Ammonia Load Contribution by Discharger to Lower South Bay

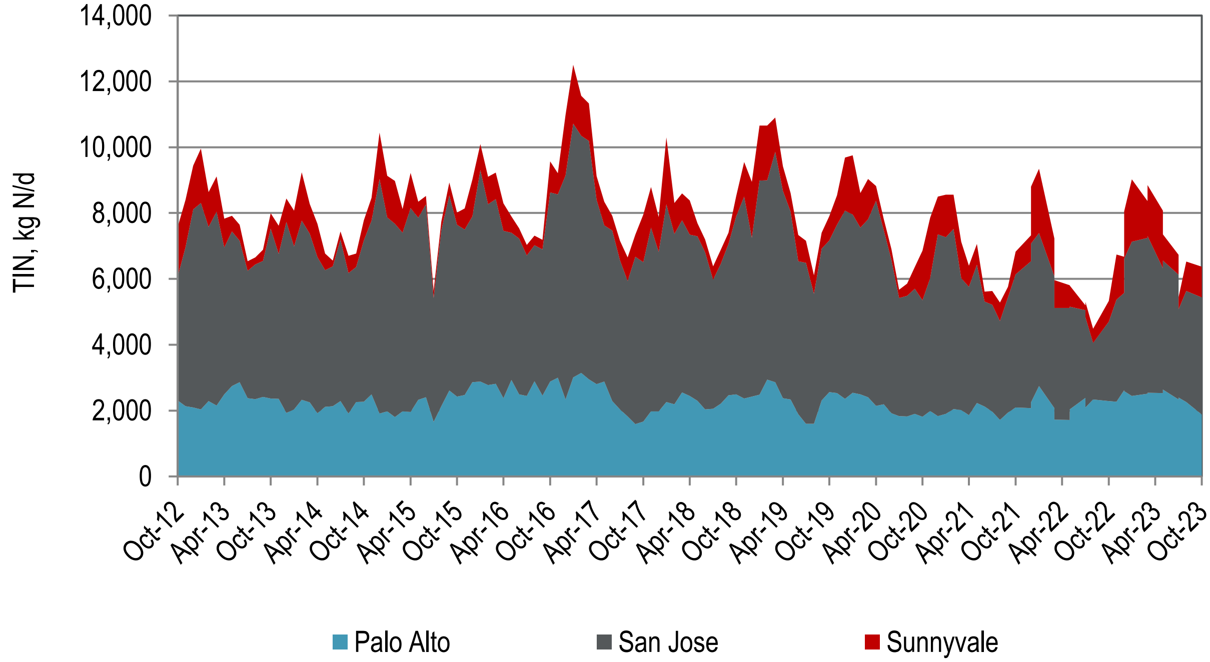

Figure 5-24. TIN Load Contribution by Discharger to Lower South Bay

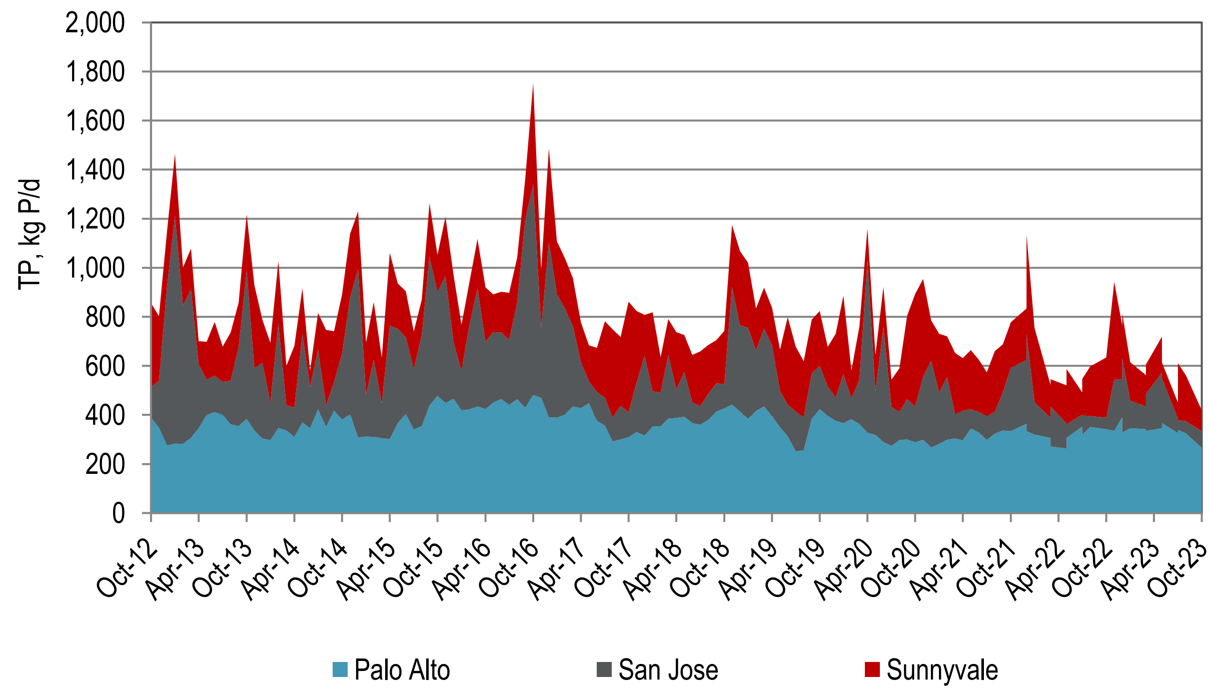

Figure 5-25. TP Load Contribution by Discharger to Lower South Bay

6 Recycled Water Data Review Findings

As previously noted in Section 3.7, this is the second Group Annual Report that includes data from the State Water Board[5]. It is important to note that this data source is one year behind the Group Annual Report. In addition to recycled water volumes, this Group Annual Report relied on the 2019/2020, 2020/2021, and 2021/2022 datasets to quantify the corresponding load reductions to the Bay from recycled water. Similar to Sections 4 and 5, the average annual and dry season flows and loads are provided in the subsections that follow.

The approach used to compile and present recycled water data is as follows:

- The recycled water volumes are presented as flow (mgd) to stay consistent with the other sections of this report.
- There are instances when the nutrient loads associated with recycled water applications end up in the Bay. For example, there could be an industrial application that use recycled water laden with nutrients for chillers. The chiller water that has nutrients is eventually exhausted and discharged to the Bay. This analysis attempts to exclude such recycled water nutrient loads that end up in the Bay. Assumptions made for flows and loads diverted from the Bay by each discharger are detailed in their respective Appendix.
- The dry season represents 153 days. The duration is critical when one calculates the average flow (mgd) during the dry season or year-round (for average annual).

Since including recycled water into the Group Annual Report, there are several data amendments within the Group Annual Reports as follows:

- Data from EBDA (South Bay Discharger) has been amended since last year's 2022 Group Annual Report with plant specific effluent concentrations instead of EBDA effluent concentrations.
- Similar to EBDA, data from the West County Common Outfall (San Pablo Bay Discharger) has been amended since last year's 2022 Group Annual Report with West County Water Pollution Control Plant specific effluent concentrations (instead of West County Common Outfall effluent concentrations, which also include Richmond). Furthermore, the recycled water users for the West County Wastewater Treatment Plant was expanded to include the North Richmond WRP.
- Nutrient loads associated recycled water for the various San Pablo Bay Dischargers that do not discharge during the dry season are included in this and future Group Annual Reports. Such nutrient loads associated with recycled water were inadvertently excluded in previous Group Annual Reports.

[5] State Water Resources Control Board. (2020) Volumetric Annual Report of Wastewater and Recycled Water - Annual Volumetric Report Effluent - California Open Data

6.1 Flow

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) recycled water flows are provided in Table 6-1 and Table 6-2, respectively. In addition, the annual average and dry season average monthly recycled water flows for each Subembayment are provided in Table 6-3 and Table 6-4, respectively. An additional set of tables is provided in Table 6-5 and Table 6-6 that offers the percent reduction of flow/load diverted from the Bay from recycled water.

A summary of the recycled water data review findings is as follows:

- The volume and percentage of water that is used by reuse customers is seasonally dependent. Example calculations for the percent of treated water that is diverted from the Bay and sent to reuse customers is as follows:
  - Average Annual (Example for 2020/2021 dataset): recycled water constitutes a diversion of approximately 11 percent of flow from the Bay (average annual flow = 374 mgd; recycled water = 48 mgd):

$$11\ Percent = \frac{48\ \text{mgd}}{(48\ \text{mgd} + 374\ \text{mgd})}$$

  - Dry Season (Example for 2021 dataset): recycled water constitutes a diversion of approximately 16 percent of flow from the Bay (dry season average flow = 339 mgd; recycled water dry season average flow = 65 mgd)

$$16\ Percent = \frac{65\ \text{mgd}}{(65\ \text{mgd} + 339\ \text{mgd})}$$

- The recycled water flows are seasonally dependent as evidenced by an increase of approximately 35 percent from average annual to dry season volumes. San Pablo and South Bays have the most pronounced seasonality impacts over the timeframe presented.
- West County (Central Bay Discharger): data has been amended since last year's 2022 Group Annual Report with recycled water volumes for both the Richmond Advanced Recycled Expansion (RARE) and the North Richmond Water Reclamation Plant. The previous reports were limited to recycled water volumes from RARE. As such, recycled water diversions have increased from previous reports.
- During the dry season when recycled water volumes are at their peak, the recycled water volumes by Subembayment are as follows (based on the 3-year average): Lower South Bay > South Bay > San Pablo Bay > Suisun Bay > Central Bay.
- The percentage of loads diverted from the Bay by reuse ranges from 10 to 16 percent Baywide (regardless of average annual or dry season averaging period; refer to Table 6-5 and Table 6-6).

Table 6-1. Recycled Water: Annual Average Flows Diverted from the Bay (mgd)

Discharger	Subembayment	Treatment Plant Permitted Capacity [(a)]	2019/ 2020 [(b,c)]	2020/ 2021 [(b,c)]	2021/ 2022 [(b,c)]	3-Year Average
American Canyon	San Pablo Bay	2.5	0.4	0.4	0.4	0.4
Benicia[(f)]	San Pablo Bay	4.5	--	--	--	--
Burlingame[(f)]	South Bay	5.5	--	--	--	--
Central San	Suisun Bay	53.8	1.6	1.7	1.7	1.7
CMSA	Central Bay	10	1.1	1.1	1.0	1.0
Port Costa[(f)]	San Pablo Bay	0.033	--	--	--	--
Delta Diablo[(g)]	Suisun Bay	19.5	4.1	4.9	4.9	4.6
EBDA	South Bay	107.8	8.5	9.3	8.6	8.8
EBMUD[(g)]	Central Bay	120	0.8	0.8	0.3	0.6
FSSD	Suisun Bay	23.7	0.9	0.9	0.6	0.8
Las Gallinas[(d)]	San Pablo Bay	2.92	0.4	0.7	1.0	0.7
Paradise Cove[(f)]	Central Bay	0.04	--	--	--	--
Tiburon[(f)]	Central Bay	0.98	--	--	--	--
Millbrae[(f)]	South Bay	3	--	--	--	--
Mt. View[(f)]	Suisun Bay	3.2	--	--	--	--
Napa[(d)]	San Pablo Bay	15.4	2.7	3.5	2.8	3.0
Novato	San Pablo Bay	7	1.7	1.8	2.1	1.9
Palo Alto	Lower South Bay	39	0.7	0.7	0.7	0.7
Petaluma[(d)]	San Pablo Bay	6.7	1.7	2.1	1.8	1.9
Pinole[(f)]	San Pablo Bay	4.06	--	--	--	--
Rodeo[(f)]	San Pablo Bay	1.14	--	--	--	--
SFO Airport	South Bay	2.2	--	<0.01	--	<0.01
SFPUC Southeast[(f)]	South Bay	85.4	--	--	--	--
San Jose	Lower South Bay	167	11	12	11	11
San Mateo[(f)]	South Bay	15.7	--	--	--	--
SMCSD[(f)]	Central Bay	1.8	--	--	--	--
SASM	Central Bay	3.6	0.03	0.02	0.03	0.03
SVCW	South Bay	29	0.8	0.7	0.6	0.7
Sonoma Valley[(d)]	San Pablo Bay	3	1.2	1.4	1.7	1.4
South SF[(f)]	South Bay	13	--	--	--	--
Sunnyvale	Lower South Bay	29.5	0.8	0.8	0.3	0.6
Treasure Island[(f)]	Central Bay	2	--	--	--	--
Vallejo[(f)]	San Pablo Bay	15.5	--	--	--	--
West County	Central Bay	28.5	5.3	5.2	4.8	5.1
Total [(e)]		**827**	**43**	**48**	**45**	**45**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
e. The total values might vary from the sum of the listed values by plant due to rounding.
f. This discharger does not produce recycled water.
g. Assumes that a portion of flow from industrial application is not diverted from the Bay.

Table 6-2. Recycled Water: Dry Season Flows Diverted from the Bay (mgd)

Discharger	Subembayment	Treatment Plant Permitted Capacity [(a)]	2019 [(b,c)]	2020 [(b,c)]	2021 [(b,c)]	2022 [(b,c)]	4-Year Average
American Canyon	San Pablo Bay	2.5	0.4	0.6	0.7	0.7	0.6
Benicia[(f)]	San Pablo Bay	4.5	--	--	--	--	--
Burlingame[(f)]	South Bay	5.5	--	--	--	--	--
Central San	Suisun Bay	53.8	2.2	2.1	2.3	2.3	2.2
CMSA	Central Bay	10	1.1	1.1	1.1	1.0	1.1
Port Costa[(f)]	San Pablo Bay	0.033	--	--	--	--	--
Delta Diablo[(g)]	Suisun Bay	19.5	3.7	4.3	5.7	5.5	4.8
EBDA	South Bay	107.8	13.0	13.0	13.0	13.0	13.0
EBMUD[(g)]	Central Bay	120	0.9	0.8	0.8	0.3	0.7
FSSD	Suisun Bay	23.7	1.2	1.8	1.7	1.1	1.4
Las Gallinas[(d)]	San Pablo Bay	2.92	0.8	0.7	1.5	1.7	1.2
Paradise Cove[(f)]	Central Bay	0.04	--	--	--	--	--
Tiburon[(f)]	Central Bay	0.98	--	--	--	--	--
Millbrae[(f)]	South Bay	3	--	--	--	--	--
Mt. View[(f)]	Suisun Bay	3.2	--	--	--	--	--
Napa[(d)]	San Pablo Bay	15.4	3.8	4.6	5.9	5.0	4.8
Novato	San Pablo Bay	7	1.6	3.1	2.9	3.4	2.7
Palo Alto	Lower South Bay	39	1.1	1.1	1.1	1.2	1.1
Petaluma[(d)]	San Pablo Bay	6.7	2.3	3.2	3.4	2.7	2.9
Pinole[(f)]	San Pablo Bay	4.06	--	--	--	--	--
Rodeo[(f)]	San Pablo Bay	1.14	--	--	--	--	--
SFO Airport	South Bay	2.2	--	--	<0.01	--	<0.01
SFPUC Southeast[(f)]	South Bay	85.4	--	--	--	--	--
San Jose	Lower South Bay	167	15	16	16	16	15
San Mateo[(f)]	South Bay	15.7	--	--	--	--	--
SMCSD[(f)]	Central Bay	1.8	--	--	--	--	--
SASM	Central Bay	3.6	0.05	0.03	0.03	0.03	0.04
SVCW	South Bay	29	1.1	0.9	1.1	1.0	1.0
Sonoma Valley[(d)]	San Pablo Bay	3	1.5	1.7	2.0	1.8	1.8
South SF[(f)]	South Bay	13	--	--	--	--	--
Sunnyvale	Lower South Bay	29.5	0.9	1.2	0.8	0.4	0.8
Treasure Island[(f)]	Central Bay	2	--	--	--	--	--
Vallejo[(f)]	San Pablo Bay	15.5	--	--	--	--	--
West County	Central Bay	28.5	5.0	5.3	5.0	4.5	5.0
Total [(e)]		**827**	**56**	**61**	**65**	**62**	**61**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
e. The total values might vary from the sum of the listed values by plant due to rounding.
f. This discharger does not produce recycled water.
g. Assumes that a portion of flow from industrial application is not diverted from the Bay.

Table 6-3. Recycled Water: Annual Average Flows by Subembayment, Flow (mgd)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 [(a)]	2020/2021 [(a)]	2021/2022 [(a)]	3-Year Average
Suisun Bay	100	6.5	7.5	7.2	7.1
San Pablo Bay [(b)]	62.8	8.2	10	9.8	9.3
Central Bay	167	7.2	7.0	6.1	6.8
South Bay	262	9.2	10	9.3	9.5
Lower South Bay	236	12	13	12	13
Total	**827**	**43**	**48**	**45**	**45**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-4. Recycled Water: Dry Season Average Flows by Subembayment, Flow (mgd)

Subembayment	Treatment Plant Permitted Capacity	2019 [(a)]	2020 [(a)]	2021 [(a)]	2022 [(a)]	4-Year Average
Suisun Bay	100	7.2	8.1	9.7	9.0	8.5
San Pablo Bay [(b)]	62.8	10	14	16	15	14
Central Bay	167	7.0	7.3	6.9	5.8	6.7
South Bay	262	15	14	14	14	14
Lower South Bay	236	17	18	17	17	17
Total	**827**	**56**	**61**	**65**	**62**	**61**

a. Each reporting year represents the period between May 1 and September 30 of the indicated year.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-5. Recycled Water: Percent of Annual Average Flows Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 (a,c) %	2020/2021 (a,c) %	2021/2022 (a,c) %	3-Year Average, %
Suisun Bay	100	11%	13%	11%	11%
San Pablo Bay (b)	62.8	24%	34%	28%	23%
Central Bay	167	9%	10%	8%	8%
South Bay	262	6%	7%	6%	6%
Lower South Bay	236	10%	11%	11%	10%
Total	**827**	**10%**	**11%**	**10%**	**9%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

Table 6-6. Recycled Water: Percent of Dry Season Average Flows Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019 (a,c) %	2020 (a,c) %	2021 (a,c) %	2022 (a,c) %	4-Year Average, %
Suisun Bay	100	12%	15%	17%	14%	14%
San Pablo Bay (b)	62.8	42%	52%	56%	49%	48%
Central Bay	167	10%	11%	11%	9%	10%
South Bay	262	10%	10%	10%	9%	9%
Lower South Bay	236	14%	16%	16%	14%	14%
Total	**827**	**13%**	**15%**	**16%**	**14%**	**14%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

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6.2 Total Ammonia

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) recycled water ammonia loads are provided in Table 6-7 and Table 6-8, respectively. In addition, the annual average and dry season average monthly recycled water ammonia loads for each Subembayment are provided in Table 6-9 and Table 6-10, respectively. An additional set of tables is provided in Table 6-11 and Table 6-12 that offers the percent reduction of flow/load diverted from the Bay from recycled water.

A summary of the recycled water data review findings is as follows:

- The volume and percentage of water that is used by reuse customers is seasonally dependent. Example calculations for the percent of treated water that is diverted from the Bay and sent to reuse customers is as follows:
  - Average Annual (Example for 2020/2021 dataset): recycled water constitutes a diversion of approximately 5 percent of ammonia load from the Bay (average annual discharge load = 35,300 kg N/d; recycled water average annual load = 1,900 kg N/d):

$$5\ Percent = \frac{1{,}900\ \mathrm{kg\ N/d}}{(1{,}900\ \mathrm{kg\ N/d} + 35{,}300\ \mathrm{kg\ N/d})}$$

  - Dry Season (Example for 2021 dataset): recycled water constitutes a diversion of approximately 7 percent of ammonia load from the Bay (dry season average discharge load = 33,600 kg N/d; recycled water dry season average load = 2,500 kg N/d)

$$7\ Percent = 1 - \frac{2{,}500\ \mathrm{kg\ N/d}}{(2{,}500\ \mathrm{kg\ N/d} + 33{,}600\mathrm{kg\ N/d})}$$

- The recycled water flows are seasonally dependent as evidenced by an increase of nearly 40 percent from average annual to dry season loads. San Pablo and South Bays have the most pronounced seasonality impacts over the timeframe presented.
- EBDA (South Bay Discharger): data has been amended since last year's 2022 Group Annual Report with plant specific effluent concentrations (instead of EBDA effluent concentrations). As such, the recycled water diversions increased for EBDA as concentrations for the EBDA members with the largest recycled water production (e.g., Dublin San Ramon Services District) are typically higher than the EBDA discharge concentration.
- West County (Central Bay Discharger): data has been amended since last year's 2022 Group Annual Report with plant specific effluent concentrations (instead of West County Common Outfall). The recycled water loads have decreased as the West County Wastewater Treatment Plant typically has lower effluent concentrations than common outfall.
- During the dry season when recycled water volumes are at their peak, the ammonia loads by Subembayment are as follows (based on the 3-year average): South Bay > Suisun Bay > Central Bay > San Pablo Bay > Lower South Bay. Note: Despite having the highest dry season recycled water volumes, the Lower South Bay has the second to lowest amount of ammonia loads diverted from the Bay as all Lower South Bay dischargers reliably nitrify.
- The percentage of loads diverted from the Bay by reuse ranges from 4 to 7 percent Baywide (regardless of averaging period; refer to Table 6-11 and Table 6-12).

Table 6-7. Recycled Water: Annual Average Total Ammonia Loads Diverted from the Bay (kg N/day)

Discharger	Subembayment	2019/2020 (b,c)	2020/2021 (b,c)	2021/2022 (b,c)	3-Year Average
American Canyon	San Pablo Bay	0.3	0.2	0.2	0.2
Benicia(f)	San Pablo Bay	--	--	--	--
Burlingame(f)	South Bay	--	--	--	--
Central San	Suisun Bay	180	230	210	210
CMSA	Central Bay	140	150	120	140
Port Costa(f)	San Pablo Bay	--	--	--	--
Delta Diablo(g)	Suisun Bay	58	67	59	61
EBDA	South Bay	1,000	1,100	1,700	1,300
EBMUD	Central Bay	140	140	64	110
FSSD	Suisun Bay	0.3	0.3	0.7	0.4
Las Gallinas(d)	San Pablo Bay	5	19	12	12
Paradise Cove(f)	Central Bay	--	--	--	--
Tiburon(f)	Central Bay	--	--	--	--
Millbrae(f)	South Bay	--	--	--	--
Mt. View(f)	Suisun Bay	--	--	--	--
Napa(d)	San Pablo Bay	22	22	19	21
Novato	San Pablo Bay	17	14	17	16
Palo Alto	Lower South Bay	0.3	0.4	0.5	0.4
Petaluma(d)	San Pablo Bay	2	3	3	2
Pinole(f)	San Pablo Bay	--	--	--	--
Rodeo(f)	San Pablo Bay	--	--	--	--
SFO Airport	South Bay	--	<0.1	--	<0.1
SFPUC Southeast(f)	South Bay	--	--	--	--
San Jose	Lower South Bay	24	21	18	21
San Mateo(f)	South Bay	--	--	--	--
SMCSD(f)	Central Bay	--	--	--	--
SASM	Central Bay	1	1	2	1
SVCW	South Bay	140	140	130	130
Sonoma Valley(d)	San Pablo Bay	0.5	1	2	1
South SF(f)	South Bay	--	--	--	--
Sunnyvale	Lower South Bay	1	1	3	2
Treasure Island(f)	Central Bay	--	--	--	--
Vallejo(f)	San Pablo Bay	--	--	--	--
West County	Central Bay	10	10	9	10
Total (e)		**1,800**	**1,900**	**2,400**	**2,000**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
e. The total values might vary from the sum of the listed values by plant due to rounding.
f. This discharger does not produce recycled water.
g. Assumes that a portion of load from industrial application is not diverted from the Bay.

Table 6-8. Recycled Water: Dry Season Total Ammonia Loads Diverted from the Bay (kg N/day)

Discharger	Subembayment	2019 (b)	2020 (b)	2021 (b)	2022 (b)	4-Year Average
American Canyon	San Pablo Bay	0.6	0.5	0.3	0.4	0.4
Benicia(f)	San Pablo Bay	--	--	--	--	--
Burlingame(f)	South Bay	--	--	--	--	--
Central San	Suisun Bay	210	250	310	280	260
CMSA	Central Bay	140	170	180	170	160
Port Costa(f)	San Pablo Bay	--	--	--	--	--
Delta Diablo(g)	Suisun Bay	54	62	69	64	62
EBDA	South Bay	2,200	1,200	1,400	2,800	1,900
EBMUD	Central Bay	170	150	150	59	130
FSSD	Suisun Bay	0.7	0.5	0.5	1.2	0.7
Las Gallinas(d)	San Pablo Bay	15	11	40	21	22
Paradise Cove(f)	Central Bay	--	--	--	--	--
Tiburon(f)	Central Bay	--	--	--	--	--
Millbrae(f)	South Bay	--	--	--	--	--
Mt. View(f)	Suisun Bay	--	--	--	--	--
Napa(d)	San Pablo Bay	77	33	35	36	45
Novato	San Pablo Bay	6	31	21	26	21
Palo Alto	Lower South Bay	0.5	0.5	0.6	0.8	0.6
Petaluma(d)	San Pablo Bay	4	3	4	4	4
Pinole(f)	San Pablo Bay	--	--	--	--	--
Rodeo(f)	San Pablo Bay	--	--	--	--	--
SFO Airport	South Bay	--	--	<0.1	--	<0.1
SFPUC Southeast(f)	South Bay	--	--	--	--	--
San Jose	Lower South Bay	41	35	26	22	31
San Mateo(f)	South Bay	--	--	--	--	--
SMCSD(f)	Central Bay	--	--	--	--	--
SASM	Central Bay	4	2	1	3	2
SVCW	South Bay	210	160	240	200	200
Sonoma Valley(d)	San Pablo Bay	0.6	0.7	0.7	0.8	0.7
South SF(f)	South Bay	--	--	--	--	--
Sunnyvale	Lower South Bay	1	1	1	1	1
Treasure Island(f)	Central Bay	--	--	--	--	--
Vallejo(f)	San Pablo Bay	--	--	--	--	--
West County	Central Bay	10	10	9	9	9
Total (e)		**3,100**	**2,100**	**2,500**	**3,600**	**2,800**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
e. The total values might vary from the sum of the listed values by plant due to rounding.
f. This discharger does not produce recycled water.
g. Assumes that a portion of load from industrial application is not diverted from the Bay.

Table 6-9. Recycled Water: Annual Average Total Ammonia Loads by Subembayment, Flow (kg N/d)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 [(a)]	2020/2021 [(a)]	2021/2022 [(a)]	3-Year Average
Suisun Bay	100	240	300	270	270
San Pablo Bay [(b)]	62.8	47	59	52	53
Central Bay	167	290	300	200	260
South Bay	262	1,200	1,300	1,900	1,400
Lower South Bay	236	26	23	21	23
Total	**827**	**1,800**	**1,900**	**2,400**	**2,000**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-10. Recycled Water: Dry Season Average Total Ammonia Loads by Subembayment, Flow (kg N/d)

Subembayment	Treatment Plant Permitted Capacity	2019 [(a)]	2020 [(a)]	2021 [(a)]	2022 [(a)]	4-Year Average
Suisun Bay	100	270	310	380	340	320
San Pablo Bay [(b)]	62.8	100	79	100	87	93
Central Bay	167	320	320	340	240	310
South Bay	262	2,400	1,400	1,700	3,000	2,100
Lower South Bay	236	42	36	28	24	32
Total	**827**	**3,100**	**2,100**	**2,500**	**3,600**	**2,800**

a. Each reporting year represents the period between May 1 and September 30 of the indicated year.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-11. Recycled Water: Percent of Annual Average Total Ammonia Loads Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 (a,c) %	2020/2021 (a,c) %	2021/2022 (a,c) %	3-Year Average, %
Suisun Bay	100	4%	5%	5%	5%
San Pablo Bay (b)	62.8	4%	5%	4%	4%
Central Bay	167	3%	3%	2%	2%
South Bay	262	5%	6%	9%	7%
Lower South Bay	236	7%	7%	6%	7%
Total	**827**	**4%**	**5%**	**6%**	**5%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

Table 6-12. Recycled Water: Percent of Dry Season Average Total Ammonia Loads Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019 (a,c) %	2020 (a,c) %	2021 (a,c) %	2022 (a,c) %	4-Year Average, %
Suisun Bay	100	6%	6%	7%	7%	6%
San Pablo Bay (b)	62.8	9%	7%	8%	7%	8%
Central Bay	167	3%	3%	3%	2%	3%
South Bay	262	10%	7%	9%	14%	10%
Lower South Bay	236	15%	16%	17%	16%	15%
Total	**827**	**8%**	**6%**	**7%**	**9%**	**7%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

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6.3 Nitrate + Nitrite (NOx)

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) recycled water NOx loads are provided in Table 6-13 and Table 6-14, respectively. In addition, the annual average and dry season average monthly recycled water NOx loads for each Subembayment are provided in Table 6-15 and Table 6-16, respectively. An additional set of tables is provided in Table 6-17 and Table 6-18 that offers the percent reduction of flow/load diverted from the Bay from recycled water.

A summary of the recycled water data review findings is as follows:

- The volume and percentage of water that is used by reuse customers is seasonally dependent. Example calculations for the percent of treated water that is diverted from the Bay and sent to reuse customers is as follows:
  - Average Annual (Example for 2020/2021 dataset): recycled water constitutes a diversion of approximately 12 percent of NOx load from the Bay (average annual discharge load = 10,700 kg N/d; recycled water average annual load = 1,500 kg N/d):

$$12\ Percent = \frac{1{,}500\ \mathrm{kg\ N/d}}{(1{,}500\ \mathrm{kg\ N/d} + 10{,}700\ \mathrm{kg\ N/d})}$$

  - Dry Season (Example for 2021 dataset): recycled water constitutes a diversion of approximately 18 percent of NOx load from the Bay (dry season average discharge load = 9,290 kg N/d; recycled water dry season average load = 2,000 kg N/d)

$$18\ Percent = 1 - \frac{2{,}000\ \mathrm{kg\ N/d}}{(2{,}000\ \mathrm{kg\ N/d} + 9{,}290\mathrm{kg\ N/d})}$$

- The recycled water flows are seasonally dependent as evidenced by an increase of approximately 34 percent from average annual to dry season loads. Suisun Bay has the most pronounced seasonality impact over the timeframe presented.
- EBDA (South Bay Discharger): data has been amended since last year’s 2022 Group Annual Report with plant specific effluent concentrations (instead of EBDA effluent concentrations). Recycled water diversions decreased as concentrations for the EBDA members with the largest recycled water production are typically lower than the EBDA discharge concentration.
- West County (Central Bay Discharger): data has been amended since last year’s 2022 Group Annual Report with plant specific effluent concentrations (instead of West County Common Outfall). As such, recycled diversions increased as the West County Wastewater Treatment Plant typically has higher effluent concentrations than the common outfall.
- During the dry season when recycled water volumes are at their peak, the recycled water NOx loads by Subembayment are as follows (based on the 3-year average): Lower South Bay > San Pablo Bay > Central Bay > Suisun Bay > South Bay. Unlike ammonia, the Lower South Bay has both the largest flow and NOx loads diverted from the Bay by reuse as all Lower South Bay dischargers reliably remove ammonia and form NOx prior to reuse.
- The percentage of loads diverted from the Bay by reuse ranges from 11 to 18 percent Baywide (regardless of average annual or dry season averaging period; refer to Table 6-17 and Table 6-18).

Table 6-13. Recycled Water: Annual Average Nitrate + Nitrite Loads Diverted from the Bay (kg N/day)

Discharger	Subembayment	2019/2020 (b,c)	2020/2021 (b,c)	2021/2022 (b,c)	3-Year Average
American Canyon	San Pablo Bay	9	6	6	7
Benicia(f)	San Pablo Bay	--	--	--	--
Burlingame(f)	South Bay	--	--	--	--
Central San	Suisun Bay	6	4	7	6
CMSA	Central Bay	13	16	9	13
Port Costa(f)	San Pablo Bay	--	--	--	--
Delta Diablo(g)	Suisun Bay	2	5	4	4
EBDA	South Bay	83	83	83	83
EBMUD	Central Bay	6	10	4	7
FSSD	Suisun Bay	77	75	55	69
Las Gallinas(d)	San Pablo Bay	34	50	31	38
Paradise Cove(f)	Central Bay	--	--	--	--
Tiburon(f)	Central Bay	--	--	--	--
Millbrae(f)	South Bay	--	--	--	--
Mt. View(f)	Suisun Bay	--	--	--	--
Napa(d)	San Pablo Bay	87	120	100	100
Novato	San Pablo Bay	63	62	73	66
Palo Alto	Lower South Bay	72	77	94	81
Petaluma(d)	San Pablo Bay	2	4	2	3
Pinole(f)	San Pablo Bay	--	--	--	--
Rodeo(f)	San Pablo Bay	--	--	--	--
SFO Airport	South Bay	--	<1	--	<1
SFPUC Southeast(f)	South Bay	--	--	--	--
San Jose	Lower South Bay	590	580	470	550
San Mateo(f)	South Bay	--	--	--	--
SMCSD(f)	Central Bay	--	--	--	--
SASM	Central Bay	2	2	1	2
SVCW	South Bay	2	2	2	2
Sonoma Valley(d)	San Pablo Bay	49	65	53	56
South SF(f)	South Bay	--	--	--	--
Sunnyvale	Lower South Bay	37	33	20	30
Treasure Island(f)	Central Bay	--	--	--	--
Vallejo(f)	San Pablo Bay	--	--	--	--
West County	Central Bay	330	320	300	320
Total (e)		**1,500**	**1,500**	**1,300**	**1,400**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
e. The total values might vary from the sum of the listed values by plant due to rounding.
f. This discharger does not produce recycled water.
g. Assumes that a portion of load from industrial application is not diverted from the Bay.

Table 6-14. Recycled Water: Dry Season Nitrate + Nitrite Loads Diverted from the Bay (kg N/day)

Discharger	Subembayment	2019 [(b)]	2020 [(b)]	2021 [(b)]	2022 [(b)]	4-Year Average
American Canyon	San Pablo Bay	9	10	10	9	10
Benicia[(f)]	San Pablo Bay	--	--	--	--	--
Burlingame[(f)]	South Bay	--	--	--	--	--
Central San	Suisun Bay	17	11	5	14	12
CMSA	Central Bay	11	16	21	16	16
Port Costa[(f)]	San Pablo Bay	--	--	--	--	--
Delta Diablo[(g)]	Suisun Bay	3	3	10	9	6
EBDA	South Bay	32	190	43	230	120
EBMUD	Central Bay	8	6	9	3	7
FSSD	Suisun Bay	100	150	140	100	120
Las Gallinas[(d)]	San Pablo Bay	41	59	100	54	64
Paradise Cove[(f)]	Central Bay	--	--	--	--	--
Tiburon[(f)]	Central Bay	--	--	--	--	--
Millbrae[(f)]	South Bay	--	--	--	--	--
Mt. View[(f)]	Suisun Bay	--	--	--	--	--
Napa[(d)]	San Pablo Bay	71	150	220	180	150
Novato	San Pablo Bay	53	110	100	120	96
Palo Alto	Lower South Bay	120	120	120	160	130
Petaluma[(d)]	San Pablo Bay	7	4	6	3	5
Pinole[(f)]	San Pablo Bay	--	--	--	--	--
Rodeo[(f)]	San Pablo Bay	--	--	--	--	--
SFO Airport	South Bay	--	--	<1	--	<1
SFPUC Southeast[(f)]	South Bay	--	--	--	--	--
San Jose	Lower South Bay	810	800	750	580	740
San Mateo[(f)]	South Bay	--	--	--	--	--
SMCSD[(f)]	Central Bay	--	--	--	--	--
SASM	Central Bay	2	2	2	1	2
SVCW	South Bay	2	2	3	5	3
Sonoma Valley[(d)]	San Pablo Bay	48	88	97	73	76
South SF[(f)]	South Bay	--	--	--	--	--
Sunnyvale	Lower South Bay	61	50	33	23	42
Treasure Island[(f)]	Central Bay	--	--	--	--	--
Vallejo[(f)]	San Pablo Bay	--	--	--	--	--
West County	Central Bay	310	330	310	280	310
Total [(e)]		**1,700**	**2,100**	**2,000**	**1,900**	**1,900**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A “--“ indicates data were not available, whereas a “0” indicates a value of zero.
c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
e. The total values might vary from the sum of the listed values by plant due to rounding.
f. This discharger does not produce recycled water.
g. Assumes that a portion of load from industrial application is not diverted from the Bay.

Table 6-15. Recycled Water: Annual Average Nitrate + Nitrite Loads by Subembayment, Flow (kg N/d)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 [a]	2020/2021 [a]	2021/2022 [a]	3-Year Average
Suisun Bay	100	85	84	66	78
San Pablo Bay [b]	62.8	240	300	270	270
Central Bay	167	350	350	310	340
South Bay	262	85	85	86	85
Lower South Bay	236	700	690	580	660
Total	**827**	**1,500**	**1,500**	**1,300**	**1,400**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-16. Recycled Water: Dry Season Average Nitrate + Nitrite Loads by Subembayment, Flow (kg N/d)

Subembayment	Treatment Plant Permitted Capacity	2019 [a]	2020 [a]	2021 [a]	2022 [a]	4-Year Average
Suisun Bay	100	120	160	150	120	140
San Pablo Bay [b]	62.8	230	420	540	430	400
Central Bay	167	330	360	340	300	330
South Bay	262	34	190	46	230	120
Lower South Bay	236	990	970	910	760	910
Total	**827**	**1,700**	**2,100**	**2,000**	**1,900**	**1,900**

a. Each reporting year represents the period between May 1 and September 30 of the indicated year.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-17. Recycled Water: Percent of Annual Average Nitrate + Nitrite Loads Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 (a,c) %	2020/2021 (a,c) %	2021/2022 (a,c) %	3-Year Average, %
Suisun Bay	100	6%	6%	5%	6%
San Pablo Bay (b)	62.8	28%	41%	37%	34%
Central Bay	167	32%	28%	26%	29%
South Bay	262	6%	5%	6%	6%
Lower South Bay	236	8%	9%	9%	8%
Total	**827**	**11%**	**12%**	**12%**	**11%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.
c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

Table 6-18. Recycled Water: Percent of Dry Season Average Nitrate + Nitrite Loads Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019 (a,c) %	2020 (a,c) %	2021 (a,c) %	2022 (a,c) %	4-Year Average, %
Suisun Bay	100	8%	11%	12%	8%	10%
San Pablo Bay (b)	62.8	34%	59%	67%	61%	55%
Central Bay	167	33%	32%	29%	29%	31%
South Bay	262	3%	12%	3%	18%	9%
Lower South Bay	236	12%	13%	14%	13%	12%
Total	**827**	**14%**	**17%**	**18%**	**18%**	**16%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.
c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

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6.4 Total Inorganic Nitrogen (TIN)

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) recycled water TIN loads are provided in Table 6-19 and Table 6-20, respectively. In addition, the annual average and dry season average monthly recycled water TIN loads for each Subembayment are provided in Table 6-21 and Table 6-22, respectively. An additional set of tables is provided in Table 6-23 and Table 6-24 that offers the percent reduction of flow/load diverted from the Bay from recycled water.

A summary of the recycled water data review findings is as follows:

- The volume and percentage of water that is used by reuse customers is seasonally dependent. Example calculations for the percent of treated water that is diverted from the Bay and sent to reuse customers is as follows:
  - Average Annual (Example for 2020/2021 dataset): recycled water constitutes a diversion of approximately 7 percent of TIN load from the Bay (average annual discharge load = 46,000 kg N/d; recycled water average annual load = 3,400 kg N/d):

$$7\ Percent = \frac{3{,}400 \text{ kg N/d}}{(3{,}400 \text{ kg N/d} + 46{,}000 \text{ kg N/d})}$$

  - Dry Season (Example for 2021 dataset): recycled water constitutes a diversion of approximately 9 percent of TIN load from the Bay (dry season average discharge load = 43,100 kg N/d; recycled water dry season average load = 4,500 kg N/d)

$$9\ Percent = 1 - \frac{4{,}500 \text{ kg N/d}}{(4{,}500 \text{ kg N/d} + 43{,}100\text{kg N/d})}$$

- The recycled water flows are seasonally dependent as evidenced by an increase of nearly 40 percent from average annual to dry season loads. South Bay has the most pronounced seasonality impact over the timeframe presented.
- EBDA (South Bay Discharger): data has been amended since last year's 2022 Group Annual Report with plant specific effluent concentrations (instead of EBDA effluent concentrations). Recycled water diversions increased for EBDA (emphasis on dry season) as TIN concentrations were higher than in previous years.
- West County (Central Bay Discharger): data has been amended since last year's 2022 Group Annual Report with plant specific effluent concentrations (instead of West County Common Outfall). Despite an increase in recycled water volumes (refer to Section 6.1), recycled water diversions were comparable to the previous report as the West County Wastewater Treatment Plant has lower effluent values than the common outfall.
- During the dry season when recycled water volumes are at their peak, the recycled water TIN loads by Subembayment are as follows (based on the 3-year average): South Bay > Lower South Bay > Central Bay > San Pablo Bay > Suisun Bay.
- The percentage of loads diverted from the Bay by reuse ranges from 6 to 11 percent Baywide (regardless of average annual or dry season averaging period; refer to Table 6-23 and Table 6-24). The percentages are more in alignment with ammonia values associated with recycled water.

Table 6-19. Recycled Water: Annual Average TIN Loads Diverted from the Bay (kg N/day)

Discharger	Subembayment	2019/2020 (b,c)	2020/2021 (b,c)	2021/2022 (b,c)	3-Year Average
American Canyon	San Pablo Bay	9	7	6	7
Benicia(f)	San Pablo Bay	--	--	--	--
Burlingame(f)	South Bay	--	--	--	--
Central San	Suisun Bay	190	230	220	210
CMSA	Central Bay	150	160	130	150
Port Costa(f)	San Pablo Bay	--	--	--	--
Delta Diablo(g)	Suisun Bay	60	73	63	65
EBDA	South Bay	1,100	1,200	1,800	1,400
EBMUD	Central Bay	150	150	69	120
FSSD	Suisun Bay	77	76	56	69
Las Gallinas(d)	San Pablo Bay	38	60	29	42
Paradise Cove(f)	Central Bay	--	--	--	--
Tiburon(f)	Central Bay	--	--	--	--
Millbrae(f)	South Bay	--	--	--	--
Mt. View(f)	Suisun Bay	--	--	--	--
Napa(d)	San Pablo Bay	110	140	120	120
Novato	San Pablo Bay	80	77	90	82
Palo Alto	Lower South Bay	73	77	95	81
Petaluma(d)	San Pablo Bay	4	7	5	5
Pinole(f)	San Pablo Bay	--	--	--	--
Rodeo(f)	San Pablo Bay	--	--	--	--
SFO Airport	South Bay	--	0.0	--	0.0
SFPUC Southeast(f)	South Bay	--	--	--	--
San Jose	Lower South Bay	610	600	480	570
San Mateo(f)	South Bay	--	--	--	--
SMCSD(f)	Central Bay	--	--	--	--
SASM	Central Bay	4	3	3	3
SVCW	South Bay	140	140	130	140
Sonoma Valley(d)	San Pablo Bay	49	68	57	58
South SF(f)	South Bay	--	--	--	--
Sunnyvale	Lower South Bay	38	35	23	32
Treasure Island(f)	Central Bay	--	--	--	--
Vallejo(f)	San Pablo Bay	--	--	--	--
West County	Central Bay	340	330	310	330
Total (e)		**3,200**	**3,400**	**3,700**	**3,500**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
e. The total values might vary from the sum of the listed values by plant due to rounding.
f. This discharger does not produce recycled water.
g. Assumes that a portion of load from industrial application is not diverted from the Bay.

Table 6-20. Recycled Water: Dry Season TIN Loads Diverted from the Bay (kg N/day)

Discharger	Subembayment	2019 [b]	2020 [b]	2021 [b]	2022 [b]	4-Year Average
American Canyon	San Pablo Bay	9	11	11	10	10
Benicia[f]	San Pablo Bay	--	--	--	--	--
Burlingame[f]	South Bay	--	--	--	--	--
Central San	Suisun Bay	230	260	310	290	270
CMSA	Central Bay	150	180	200	180	180
Port Costa[f]	San Pablo Bay	--	--	--	--	--
Delta Diablo[g]	Suisun Bay	55	65	81	72	68
EBDA	South Bay	2,200	1,400	1,500	3,000	2,000
EBMUD	Central Bay	180	150	160	62	140
FSSD	Suisun Bay	100	150	140	100	120
Las Gallinas[d]	San Pablo Bay	54	66	130	42	72
Paradise Cove[f]	Central Bay	--	--	--	--	--
Tiburon[f]	Central Bay	--	--	--	--	--
Millbrae[f]	South Bay	--	--	--	--	--
Mt. View[f]	Suisun Bay	--	--	--	--	--
Napa[d]	San Pablo Bay	140	180	260	210	200
Novato	San Pablo Bay	63	140	120	150	120
Palo Alto	Lower South Bay	120	120	120	160	130
Petaluma[d]	San Pablo Bay	10	7	10	7	9
Pinole[f]	San Pablo Bay	--	--	--	--	--
Rodeo[f]	San Pablo Bay	--	--	--	--	--
SFO Airport	South Bay	--	--	0.0	--	0.0
SFPUC Southeast[f]	South Bay	--	--	--	--	--
San Jose	Lower South Bay	850	840	780	600	770
San Mateo[f]	South Bay	--	--	--	--	--
SMCSD[f]	Central Bay	--	--	--	--	--
SASM	Central Bay	6	4	4	4	4
SVCW	South Bay	210	160	250	200	210
Sonoma Valley[d]	San Pablo Bay	49	88	98	73	77
South SF[f]	South Bay	--	--	--	--	--
Sunnyvale	Lower South Bay	62	51	35	24	43
Treasure Island[f]	Central Bay	--	--	--	--	--
Vallejo[f]	San Pablo Bay	--	--	--	--	--
West County	Central Bay	320	340	320	290	320
Total [e]		**4,800**	**4,200**	**4,500**	**5,500**	**4,700**

a. Based on ADWF permitted capacity.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.

c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

e. The total values might vary from the sum of the listed values by plant due to rounding.

f. This discharger does not produce recycled water.

g. Assumes that a portion of load from industrial application is not diverted from the Bay.

Table 6-21. Recycled Water: Annual Average TIN Loads by Subembayment, Flow (kg N/d)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 [a]	2020/2021 [a]	2021/2022 [a]	3-Year Average
Suisun Bay	100	320	380	330	350
San Pablo Bay [b]	62.8	280	360	310	310
Central Bay	167	640	650	510	600
South Bay	262	1,300	1,300	2,000	1,500
Lower South Bay	236	720	720	600	680
Total	**827**	**3,200**	**3,400**	**3,700**	**3,400**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-22. Recycled Water: Dry Season Average TIN Loads by Subembayment, Flow (kg N/d)

Subembayment	Treatment Plant Permitted Capacity	2019 [a]	2020 [a]	2021 [a]	2022 [a]	4-Year Average
Suisun Bay	100	390	470	530	470	470
San Pablo Bay [b]	62.8	330	490	620	490	480
Central Bay	167	660	680	680	540	640
South Bay	262	2,400	1,500	1,700	3,200	2,200
Lower South Bay	236	1,000	1,000	940	790	940
Total	**827**	**4,800**	**4,200**	**4,500**	**5,500**	**4,700**

a. Each reporting year represents the period between May 1 and September 30 of the indicated year.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-23. Recycled Water: Percent of Annual Average TIN Loads Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 (a,c) %	2020/2021 (a,c) %	2021/2022 (a,c) %	3-Year Average, %
Suisun Bay	100	5%	5%	5%	5%
San Pablo Bay (b)	62.8	13%	18%	15%	15%
Central Bay	167	5%	6%	4%	5%
South Bay	262	5%	6%	9%	7%
Lower South Bay	236	8%	9%	9%	8%
Total	**827**	**6%**	**7%**	**7%**	**7%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

Table 6-24. Recycled Water: Percent of Dry Season Average TIN Loads Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019 (a,c) %	2020 (a,c) %	2021 (a,c) %	2022 (a,c) %	4-Year Average, %
Suisun Bay	100	6%	7%	8%	8%	7%
San Pablo Bay (b)	62.8	18%	26%	31%	26%	25%
Central Bay	167	5%	6%	6%	4%	5%
South Bay	262	10%	7%	8%	14%	10%
Lower South Bay	236	12%	13%	14%	13%	13%
Total	**827**	**9%**	**8%**	**9%**	**11%**	**9%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

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6.5 Total Phosphorus

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) recycled water TP loads are provided in Table 6-25 and Table 6-26, respectively. In addition, the annual average and dry season average monthly recycled water TP loads for each Subembayment are provided in Table 6-27 and Table 6-28, respectively. An additional set of tables is provided in Table 6-29 and Table 6-30 that offers the percent reduction of flow/load diverted from the Bay from recycled water.

A summary of the recycled water data review findings is as follows:

- The volume and percentage of water that is used by reuse customers is seasonally dependent. Example calculations for the percent of treated water that is diverted from the Bay and sent to reuse customers is as follows:
  - Average Annual (Example for 2020/2021 dataset): recycled water constitutes a diversion of approximately 7 percent of Total P load from the Bay (average annual discharge load = 3,670 kg P/d; recycled water average annual load = 270 kg P/d):

$$7\ Percent = \frac{270\ \mathrm{kg\ P/d}}{(270\ \mathrm{kg\ P/d} + 3{,}670\ \mathrm{kg\ P/d})}$$

  - Dry Season (Example for 2021 dataset): recycled water constitutes a diversion of approximately 9 percent of Total P load from the Bay (dry season average discharge load = 3,680 kg P/d; recycled water dry season average load = 370 kg P/d)

$$9\ Percent = 1 - \frac{370\ \mathrm{kg\ P/d}}{(370\ \mathrm{kg\ P/d} + 3{,}680\ \mathrm{kg\ P/d})}$$

- The recycled water flows are seasonally dependent as evidenced by an increase of approximately 34 percent from average annual to dry season loads. South and Suisun Bays have the most pronounced seasonality impacts over the timeframe presented.
- EBDA (South Bay Discharger): data has been amended since last year's 2022 Group Annual Report with plant specific effluent concentrations (instead of EBDA effluent concentrations). As such, the recycled water diversions decreased for EBDA as EBDA members with the largest recycled water production are typically lower than the EBDA discharge concentration.
- West County (Central Bay Discharger): data has been amended since last year's 2022 Group Annual Report with plant specific effluent concentrations (instead of West County Common Outfall). Despite an increase in recycled water volumes (refer to Section 6.1), recycled water diversions were comparable to the previous report as the West County Wastewater Treatment Plant has lower effluent values than the common outfall.
- During the dry season when recycled water volumes are at their peak, the recycled water TP loads by Subembayment are as follows (based on the 3-year average): San Pablo Bay > South Bay > Lower South Bay > Central Bay > Suisun Bay.
- The percentage of loads diverted from the Bay by reuse ranges from 6 to 9 percent Baywide (regardless of average annual or dry season averaging period; refer to Table 6-29 and Table 6-30). The percentages align with ammonia/TIN load values associated with recycled water.

Table 6-25. Recycled Water: Annual Average Total P Loads Diverted from the Bay (kg P/day)

Discharger	Subembayment	2019/2020 [b,c]	2020/2021 [b,c]	2021/2022 [b,c]	3-Year Average
American Canyon	San Pablo Bay	7	6	6	6
Benicia[f]	San Pablo Bay	--	--	--	--
Burlingame[f]	South Bay	--	--	--	--
Central San	Suisun Bay	5	8	7	7
CMSA	Central Bay	16	19	16	17
Port Costa[f]	San Pablo Bay	--	--	--	--
Delta Diablo[g]	Suisun Bay	2	2	1	2
EBDA	South Bay	42	49	53	48
EBMUD	Central Bay	13	14	4	10
FSSD	Suisun Bay	15	14	10	13
Las Gallinas[d]	San Pablo Bay	7	10	12	10
Paradise Cove[f]	Central Bay	--	--	--	--
Tiburon[f]	Central Bay	--	--	--	--
Millbrae[f]	South Bay	--	--	--	--
Mt. View[f]	Suisun Bay	--	--	--	--
Napa[d]	San Pablo Bay	32	27	18	26
Novato	San Pablo Bay	1	1	2	2
Palo Alto	Lower South Bay	11	12	14	13
Petaluma[d]	San Pablo Bay	7	5	12	8
Pinole[f]	San Pablo Bay	--	--	--	--
Rodeo[f]	San Pablo Bay	--	--	--	--
SFO Airport	South Bay	--	0	--	0
SFPUC Southeast[f]	South Bay	--	--	--	--
San Jose	Lower South Bay	29	22	17	23
San Mateo[f]	South Bay	--	--	--	--
SMCSD[f]	Central Bay	--	--	--	--
SASM	Central Bay	1	1	1	1
SVCW	South Bay	13	12	11	12
Sonoma Valley[d]	San Pablo Bay	23	33	31	29
South SF[f]	South Bay	--	--	--	--
Sunnyvale	Lower South Bay	15	18	8	14
Treasure Island[f]	Central Bay	--	--	--	--
Vallejo[f]	San Pablo Bay	--	--	--	--
West County	Central Bay	20	20	18	19
Total [e]		**260**	**270**	**240**	**260**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.
c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
e. The total values might vary from the sum of the listed values by plant due to rounding.
f. This discharger does not produce recycled water.
g. Assumes that a portion of load from industrial application is not diverted from the Bay.

Table 6-26. Recycled Water: Dry Season Total P Loads Diverted from the Bay (kg P/day)

Discharger	Subembayment	2019 (b)	2020 (b)	2021 (b)	2022 (b)	4-Year Average
American Canyon	San Pablo Bay	6	11	11	9	9
Benicia(f)	San Pablo Bay	--	--	--	--	--
Burlingame(f)	South Bay	--	--	--	--	--
Central San	Suisun Bay	7	6	10	9	8
CMSA	Central Bay	15	20	25	21	20
Port Costa(f)	San Pablo Bay	--	--	--	--	--
Delta Diablo(g)	Suisun Bay	2	2	2	1	2
EBDA	South Bay	74	50	50	77	63
EBMUD	Central Bay	17	14	17	5	13
FSSD	Suisun Bay	23	30	27	18	25
Las Gallinas(d)	San Pablo Bay	9	12	21	20	15
Paradise Cove(f)	Central Bay	--	--	--	--	--
Tiburon(f)	Central Bay	--	--	--	--	--
Millbrae(f)	South Bay	--	--	--	--	--
Mt. View(f)	Suisun Bay	--	--	--	--	--
Napa(d)	San Pablo Bay	36	49	44	33	41
Novato	San Pablo Bay	1	1	2	2	2
Palo Alto	Lower South Bay	19	18	20	25	20
Petaluma(d)	San Pablo Bay	10	13	8	18	12
Pinole(f)	San Pablo Bay	--	--	--	--	--
Rodeo(f)	San Pablo Bay	--	--	--	--	--
SFO Airport	South Bay	--	--	0	--	0
SFPUC Southeast(f)	South Bay	--	--	--	--	--
San Jose	Lower South Bay	28	44	23	13	27
San Mateo(f)	South Bay	--	--	--	--	--
SMCSD(f)	Central Bay	--	--	--	--	--
SASM	Central Bay	1	1	1	1	1
SVCW	South Bay	19	15	21	18	18
Sonoma Valley(d)	San Pablo Bay	9	35	49	35	32
South SF(f)	South Bay	--	--	--	--	--
Sunnyvale	Lower South Bay	26	24	18	10	19
Treasure Island(f)	Central Bay	--	--	--	--	--
Vallejo(f)	San Pablo Bay	--	--	--	--	--
West County	Central Bay	19	20	19	17	19
Total (e)		**320**	**370**	**370**	**330**	**350**

a. Based on ADWF permitted capacity.

b. Data are presented in detail and summarized for each plant in the Appendix. A "--" indicates data were not available, whereas a "0" indicates a value of zero.

c. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

d. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

e. The total values might vary from the sum of the listed values by plant due to rounding.

f. This discharger does not produce recycled water.

g. Assumes that a portion of load from industrial application is not diverted from the Bay.

Table 6-27. Recycled Water: Annual Average Total P Loads by Subembayment, Flow (kg P/d)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 [(a)]	2020/2021 [(a)]	2021/2022 [(a)]	4-Year Average
Suisun Bay	100	18	16	11	15
San Pablo Bay [(b)]	62.8	78	83	81	80
Central Bay	167	51	53	38	47
South Bay	262	60	69	72	67
Lower South Bay	236	55	53	38	49
Total	**827**	**260**	**270**	**240**	**260**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-28. Recycled Water: Dry Season Average Total P Loads by Subembayment, Flow (kg P/d)

Subembayment	Treatment Plant Permitted Capacity	2019 [(a)]	2020 [(a)]	2021 [(a)]	2022 [(a)]	4-Year Average
Suisun Bay	100	32	39	39	28	34
San Pablo Bay [(b)]	62.8	72	120	130	120	110
Central Bay	167	52	55	61	43	53
South Bay	262	93	66	71	95	81
Lower South Bay	236	73	85	62	48	67
Total	**827**	**320**	**370**	**370**	**330**	**350**

a. Each reporting year represents the period between May 1 and September 30 of the indicated year.
b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

Table 6-29. Recycled Water: Percent of Annual Average Total P Loads Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019/2020 (a,c) %	2020/2021 (a,c) %	2021/2022 (a,c) %	3-Year Average %
Suisun Bay	100	4%	4%	3%	4%
San Pablo Bay (b)	62.8	22%	28%	23%	25%
Central Bay	167	4%	5%	4%	4%
South Bay	262	4%	5%	5%	5%
Lower South Bay	236	7%	7%	5%	6%
Total	**827**	**6%**	**7%**	**6%**	**6%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

Table 6-30. Recycled Water: Percent of Dry Season Average Total P Loads Diverted from each Subembayment, Flow (%)

Subembayment	Treatment Plant Permitted Capacity	2019 (a,c) %	2020 (a,c) %	2021 (a,c) %	2022 (a,c) %	4-Year Average, %
Suisun Bay	100	7%	10%	10%	8%	9%
San Pablo Bay (b)	62.8	28%	39%	42%	38%	37%
Central Bay	167	4%	5%	5%	4%	4%
South Bay	262	6%	4%	5%	7%	5%
Lower South Bay	236	9%	11%	9%	8%	9%
Total	**827**	**7%**	**9%**	**9%**	**9%**	**8%**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. Several of the plants that discharge to San Pablo Bay have no discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The percent diverted is based on the recycled water value divided by the sum of recycled water value and discharge value.

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7 Discussion

A plot of the historical monthly average of daily discharge flow, ammonia, NOx, TIN, and TP loads are presented in Figure 7-1. The 2022/2023 values reverted to the 2020/2021 values (except for flow) which are some of the lowest loads since sampling began in 2012. The 2022/2023 flow values were relatively high due to greater than usual precipitation over the 2022/2023 wet season. The relatively low loads compared to the eleven-year average is attributed to a blend of the following: i) several treatment plants implementing nutrient load reduction strategies (e.g., Oro Loma/Castro Valley Sanitary District), ii) optimization of treatment plants for nutrient management (e.g., San Jose, EBMUD, etc.), ii) piloting (e.g., Oro Loma/Castro Valley Sanitary District), iv) global pandemic, v) recycled water, and vi) others.

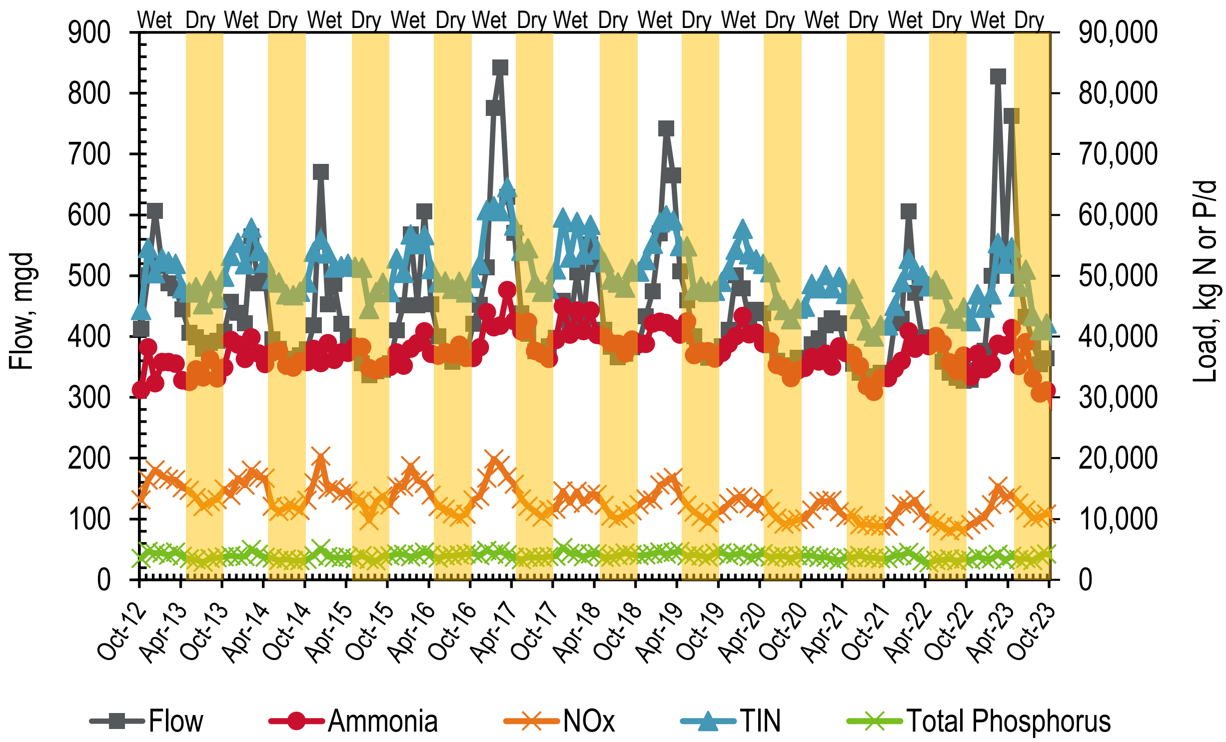

Figure 7-1. Historical Average Monthly Daily Discharge Flows and Loads

Historically, the ammonia, NOx, and TIN loads tend to track with the flows. For example, during peak wet weather events, both the flow and nitrogen loads typically increase. However, the limited dataset during wet weather events restricts confidence in the strength of this relationship. It is unknown whether the trend would be as evident with increased sampling frequency where the impacts from an initial scouring event in the collection system due to wet weather would be reduced and dilution increased (similar to the “first flush” in stormwater collection systems). Additional data would be needed to further understand the correlation between flow and loads during peak wet weather events.

The following subsections present observations of each parameter considered, including outliers, seasonality, and the role of the largest dischargers.

7.1 Annual Precipitation

A plot of the historical precipitation for the nutrient sampling period (October 2012 through September 2023) is provided in Figure 7-2. The precipitation this past year (Oct 1, 2022 through Sept 30, 2023) was greater than the two previous years combined (Oct 1, 2020 through Sept 30, 2022). As such, the dry season influent/discharge volumes increased compared to the previous few years. Note: the amount of rainfall seen across the Bay Area will vary and the data in Figure 7-2 are limited to a single location.

The impacts of relatively low precipitation are well-documented on wastewater treatment plants. The most notable impact is relatively low peak flows with respect to ADWF. While the influent data should capture such variability, the available dataset is limited so it is more prudent to review the discharge flow data. While several agencies do not discharge all of their influent, it remains a reasonable metric for comparing the impact of historical precipitation.

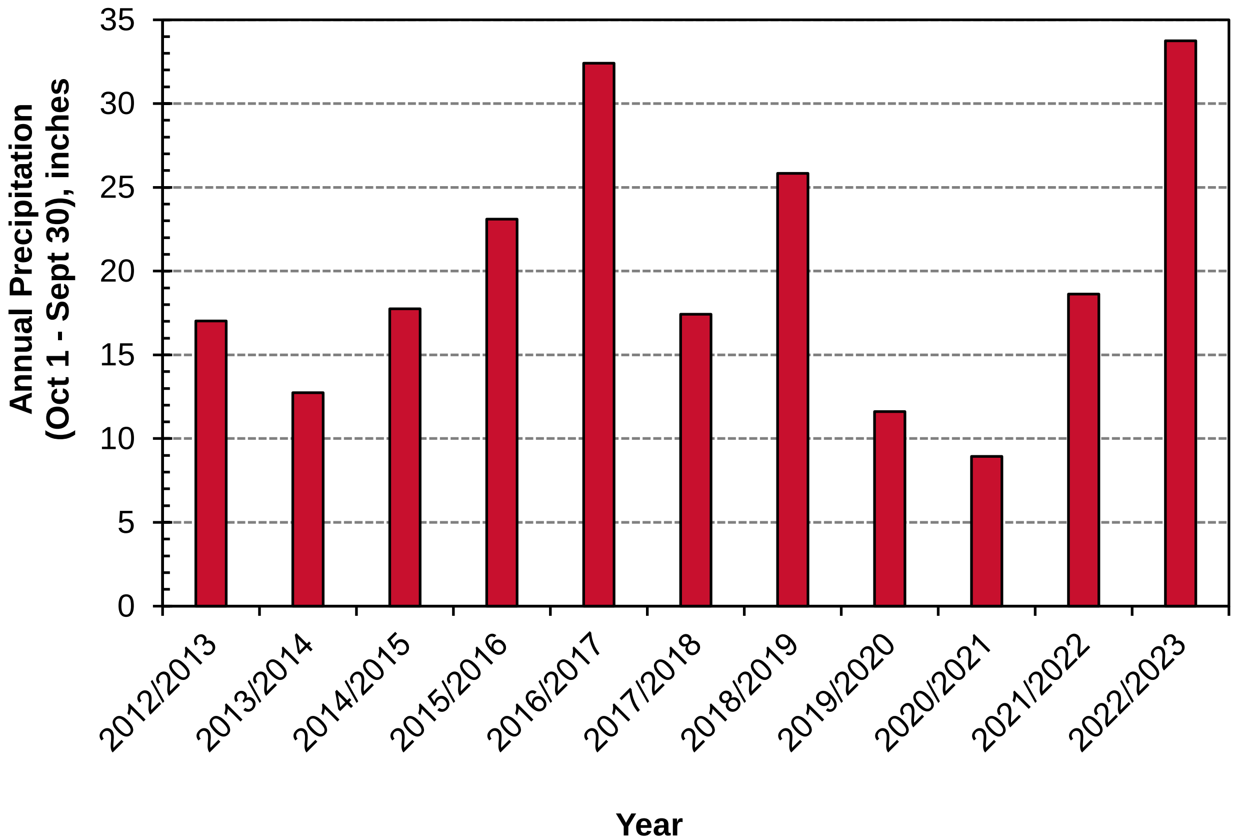

Figure 7-2. Historical Annual Precipitation in the Bay Area (Adapted from Golden Gate Weather Services)

7.2 Trending Statistics

The method of least squares trend analysis is intended to identify potential significant trends. Verifying the trends would require a more rigorous statistical approach than applied for this report. While effective as a first step for identifying potential significant trends, the method of least squares does not verify whether regression assumptions of normality and independence of errors have been satisfied. The recommended next steps if trend verification is required:

1) Evaluate whether the data need to be transformed (e.g., natural log) to provide context on whether data are conforming to the distributional assumptions of the modeling errors. A probability plot of errors will provide context on whether data are conforming to the errors.
2) Perform a more thorough statistical analysis to validate data and perform a more rigorous statistical analysis for a time series correlation.

Given that that data during the global pandemic (specifically during shelter in place) might include outliers, all identified trends will need to be carefully watched in the coming years to see how they evolve.

7.3 Agencies that have Implemented Nutrient Load Management Upgrades and/or Optimization

Multiple agencies have designed and implemented nutrient load management upgrades over the last several years as follows (listed alphabetically):

- **East Bay Municipal Utility District Water Pollution Control Plant:**
  - EBMUD stopped accepting trucked waste with relatively high nitrogenous compounds (e.g., animal blood waste)
  - The treatment plant began treating up to 50 percent of the dry season plant flow via split treatment with biological nitrification/denitrification.
- **Oro Loma/Castro Valley Sanitary Districts Water Pollution Control Plant:**
  - Implemented an ammonia and TIN load reduction technology by modifying and expanding their existing activated sludge system in the Summer of 2020. The technology upgrade is known as the Modified Ludzack-Ettinger system.
  - Implemented a sidestream full-scale demonstration using Microvi's MicroNiche Engineering™ (MNE) technology that reduces the ammonia load associated with their biosolids dewatering return stream in 2019.
- **Palo Alto Regional Water Quality Control Plant:** began construction in 2023 on a nearly $200 Mil treatment plant upgrade. The upgrade includes replacement of various aged equipment and other capital improvements, including expansion of the activated sludge process to reduce TIN loads, construction of a new headworks facility, and relining of an aging joint intercepting sewer. While Palo Alto already reliably removes ammonia, these upgrades will reduce their TIN loads. The upgrades are anticipated to take approximately 5 years to implement.
- **Pinole-Hercules Water Pollution Control Plant:** implemented an ammonia and TIN load reduction technology by modifying and expanding their existing activated sludge system in Spring 2019. The technology upgrade is known as the Modified Ludzack-Ettinger (MLE) system. This year's dataset suggests that this facility is not yet operating in nutrient removal mode. The plant is actively developing a plan to increase the solids residence time seasonally in the MLE to foster ammonia/TIN load reduction.

- **San Jose-Santa Clara Regional Wastewater Facility:** began optimization in 2019 within the existing Biological Nutrient Removal (BNR) system which has been tested and subsequently improved upon in 2020, 2021, and 2022. The 2023 dry season loads were 600 kg N/d lower than the 11-year average. Optimization of TIN load reduction has been achieved by the following:
  - Reduction in DO set-points for the BNR aeration basins, implemented through reduced fine-bubble diffuser aeration. The reduced DO along with reconfiguring aeration basins with baffles to improve mixing under reduced aeration conditions has increased denitrification zones and fostered additional TIN reduction.
  - Reduced aeration in the mixed liquor channels has also fostered additional TIN and TP load reductions.
  - In addition, secondary blowers, meters, process controls, and clarifiers have been or are currently undergoing substantial rehabilitation or replacement as part of the Facility CIP, which has aided further reduction of nutrient loads by providing better process control.

  The results of the recent optimizations are evident as both nitrogen species loads and phosphorus loads continue to decline. For example, the 2021 dry season TIN and TP loads are approximately 20% and 50%, respectively, less than the 2020 dry season loads.
- **San Leandro Water Pollution Control Plant:** in the process of implementing a nature-based solution which will support habitat restoration and nutrient management. This project is in construction and expected to be completed in year 2024.
- **San Mateo Wastewater Treatment Plant:** began construction in 2021 for a plant upgrade that will incorporate nutrient management technologies. Construction and commissioning are slated to be completed in 2025.
- **South San Francisco - San Bruno Water Quality Control Plant:** completed in 2022 the construction of an anaerobic selector within their activated sludge process. The anaerobic selector was added to improve solids settleability in their secondary clarifiers. The anaerobic selector also facilitates enhanced biological phosphorus removal as evidenced by a TP load reduction of greater than 85 percent since commissioning.
- **Union Sanitary District:** began construction in 2022 for a BNR through the Enhanced Treatment and Site Upgrade (ETSU) program. Phase 1 of ETSU began construction in 2022; the anticipated completion date is 2029. Phase 1 of ETSU includes retrofits of existing aeration basins to operate with an anaerobic selector and BNR process, new clarifiers, and new chlorination and dechlorination facilities. The estimated capital cost is $482M. The estimated TIN reduction is 44-50%.
- **West County Treatment Plant:** completed several plant expansion and upgrade projects in late 2017. The expansion and upgrades increased nutrient load reduction by enhancing the nitrification reliability and facilitated denitrification by a MLE process configuration. The plant is in design for further plant treatment performance improvements that should reduce nutrient discharge loads.

This list is limited to agencies that are in construction and/or have optimized their nutrient load management strategies. There are several agencies that are in the process of designing nutrient load management upgrades (e.g., Central San is replacing their aeration system and repurposing tankage to foster step-feed treatment).

7.4 Influent Analysis

Overall, the inclusion of influent data has bolstered the evaluation and it offers a means to track load reduction across treatment plants. At this stage, the dataset has several limitations as follows:

- Limited to a minimum of 17 samples (quarterly sampling began in July 2019).
- The global pandemic impacts nearly half of the sampling quarters.
- Since dischargers sample during different months, developing historical load plots requires plotting quarterly averages (e.g., refer to Figure 4-2 for an example plot).
- There are a few instances during the first year of sampling where sampling for a particular nutrient did not occur (e.g., Palo Alto did not sample ammonia during the first quarter of sampling from July through September 2019). This issue seems to have sorted itself out this past year.
- Analytical measurement issues with the influent sampling matrix. Specifically, the discharge matrix is considerably cleaner compared to raw influent and as a result is less prone to analytical issues. There are a couple instances where ammonia values this past year were greater than TKN for the same sample. This is not possible as TKN is the sum of ammonia and organic nitrogen. Such analytical issues can skew the trending.

As such challenges are addressed and the dataset grows, the analysis will be more exhaustive, and it will provide valuable information to inform the nutrient management conversation.

Despite the data challenges, dry season trending analysis was performed. In all cases, no emerging Baywide trends were observed. Note, the trending analysis was performed over five successive dry seasons for flow, whereas the nutrient trending analysis excluded the 2019 dataset due to the missing nutrient samples. Furthermore, the dry season trending is limited to no more than two samples per year, so it is limiting. As the dataset grows, this trending analysis will be more relevant.

7.5 Discharge Analysis

The discharge analysis includes subsections for each parameter monitored.

7.5.1 Flow

The total annual average discharge has ranged from 374 mgd to 515 mgd over the eleven-year period (average of 438 mgd). The dry season discharge flows to the Bay declined from 2012/2013 to 2014/2015, increased in 2015/2016 and 2016/2017 due to the unusually high precipitation during these periods, stayed relatively steady until 2018/2019, declined to record low values until 20202/2021 due to the ongoing drought, and increased the past two years (2021/2022 and 2022/2023). The increase the past two years is attributed to the extent of precipitation this past wet season.

The dry season discharge ranged from 337 mgd to 396 mgd for the eleven-year period (average of 371 mgd). The total dry season discharge flows have steadily declined since peaking in 2017 until last summer. The 2023 dry season values reverted to 2018 levels due primarily to the extent of precipitation this past wet season that resulted in relatively high groundwater levels through June. After June 2023, the Baywide average monthly flows were 361 mgd for the last three months of the dry season (compared to 381 mgd for the 2023 dry season).

The South Bay and Lower South Bay Subembayments received the highest flows, making up approximately 60 percent of the total flow discharged to the Bay. The largest discharger is San Jose, followed by EBDA, EBMUD, and SFPUC Southeast. San Pablo Bay has the largest portion of recycled water diversion during the dry season; several plants divert all flow and have zero dry season discharge. For example, discharge flows to San Pablo Bay for the dry season are approximately 50 percent less than average annual discharge flows to San Pablo Bay.

The dry season flow trends suggest a downward trend for South Bay and Lower South Bay. The other Subembayments and Baywide suggest no significant trending for flow.

7.5.2 Total Ammonia

The total annual average ammonia discharge ranged from approximately 34,300 kg N/d to 40,800 kg N/d over the eleven-year period (average of 37,500 kg N/d). The dry season average ammonia discharge ranged from approximately 32,400 kg N/d to 38,900 kg N/d over the eleven-year period (average of 36,100 kg N/d). The 2023 dry season ammonia loads were the lowest since sampling began in 2012. A significant contribution to this 2023 reduction were the optimization efforts at EBMUD (Central Bay Discharger; refer to Section 7.3).

The Central Bay and South Bay Subembayments receive the highest ammonia load contributions across the Bay, making up 80 to 85 percent of the total ammonia discharged to the Bay. The largest overall ammonia discharge contributors are EBMUD (Central Bay Discharger) and SFPUC Southeast (South Bay) (each making up 20 to 25 percent of the total ammonia discharged to the Bay).

The dry season ammonia loads over the entire eleven-year dry season dataset appear to be statistically trending upwards for San Pablo Bay. It is important to note that the dry season ammonia loads declined this past year for Central Bay primarily due to optimization efforts at EBMUD. In contrast, the South Bay dry season loads over the entire eleven-year dry season dataset appear to be statistically trending downwards. Baywide, there do not appear to be any emerging trends.

There are several agencies that have brought online new systems (e.g., Pinole, Oro Loma/Castro Valley Sanitary District, etc.) and/or are in the design/construction phase (e.g., San Mateo, San Leandro, etc.) for ammonia and TIN load reduction. Furthermore, EBMUD (Central Bay Discharger) has been actively optimizing their facility during the dry season as previously noted. Such changes across the Bay should result in reductions in future ammonia and TIN loads, albeit with the potential to increase in NOx loads.

7.5.3 Nitrate + Nitrite (NOx)

The total annual average NOx discharge ranged from approximately 10,100 kg N/d to 15,000 kg N/d over the eleven-year period (average of 12,800 kg N/d). The total dry season average ammonia discharge ranged from approximately 8,500 kg N/d to 13,400 kg N/d over the eleven-year period (average of 11,000 kg N/d). Despite steady annual reductions in NOx loads, the 2022/2023 NOx loads increased compared to the 2021/2022 NOx loads (albeit still below the eleven-year average).

The Lower South Bay Subembayment receives the highest NOx load contributions across the Bay, making up 50 to 65 percent of the total NOx discharged to the Bay. The relatively large contribution compared to other Subembayments was anticipated as all three POTWs in the Lower South Bay are required to fully nitrify and remove ammonia. The ammonia load is converted to NOx and subsequently removed for those plants that perform denitrification. The largest overall NOx discharger is San Jose which makes up 30 to 35 percent of NOx discharged to the Bay, followed by Palo Alto which contributes 15 to 20 percent of the NOx discharged to the Bay.

The dry season NOx loads over the entire eleven-year dry season dataset appear to be statistically trending downwards for all the Subembayments (except for Central Bay), as well as Baywide.

There are several agencies that have brought online new systems (e.g., Pinole, Oro Loma/Castro Valley Sanitary District, etc.) and/or are in the design/construction phase (e.g., San Mateo, San Leandro, etc.) for ammonia and TIN load reduction. Furthermore, EBMUD (Central Bay Discharger) has been actively optimizing their facility during the dry season as previously noted. Such changes across the Bay should result in reductions in future ammonia and TIN loads, albeit with the potential to increase in NOx loads.

7.5.4 Total Inorganic Nitrogen (TIN)

The total annual average TIN discharge ranged from 46,000 kg N/d to 55,000 kg N/d for the eleven-year period (average of 50,400 kg N/d). The total dry season average TIN discharge ranged from 43,100 kg N/d to 50,600 kg N/d for the eleven-year period (average of 47,200 kg N/d). The 2023 dry season ammonia loads were the second lowest since sampling began in 2012 (lowest was the 2021 dry season). A significant contribution to this 2023 reduction were the optimization efforts at EBMUD (Central Bay Discharger; refer to Section 7.3).

The Central Bay and South Bay Subembayments receive the highest TIN loads, making up 65 to 75 of the TIN loads discharged to the Bay. Similar to ammonia, the largest overall TIN discharge contributors are EBMUD (Central Bay Discharger) and SFPUC Southeast (South Bay) (each making up 15 to 20 percent of the total ammonia discharged to the Bay, respectively).

There are instances where the TIN values do not necessarily reflect the sum of ammonia and NOx (as discussed in Section 3.2). Such instances occur when agencies sample for only one of the nitrogen species that are used to calculate TIN (ammonia and NOx). In most cases, the agencies sample more frequently for ammonia. The average monthly ammonia loads are based on the average for each sampling event during that particular month. In contrast, TIN loads are only calculated for sampling days when both ammonia and NOx are sampled. Such a discrepancy in sampling frequency can result in average monthly values where TIN does not equal ammonia plus NOx.

The seasonal difference in TIN discharges from the wet to the dry season (based on the percent difference) are most pronounced in San Pablo Bay and the Lower South Bay. San Pablo Bay has the most significant seasonal load reduction, as evidenced by an approximately 25 to 35 percent reduction from the wet to the dry season. Similar to ammonia, this is attributed to a combination of more effective nitrification/denitrification during the dry season and seasonal use of recycled water, which diverts loads for the Bay. A large proportion of POTWs that discharge to San Pablo Bay do not discharge during the dry season (e.g., Petaluma).

The dry season TIN loads over the entire eleven-year dataset appear to be statistically decreasing for the South Bay, Lower South Bay, and Baywide. Central Bay, Suisun Bay, and San Pablo Bay showed no significant trending over the entire dry season eleven-year dataset.

There are several agencies that have brought online new systems (e.g., Pinole, Oro Loma/Castro Valley Sanitary District, etc.) and/or are in the design/construction phase (e.g., San Mateo, San Leandro, etc.) for ammonia and TIN load reduction. Furthermore, EBMUD (Central Bay Discharger) has been actively optimizing their facility during the dry season as previously noted. Such changes across the Bay should result in reductions in future ammonia and TIN loads, albeit with the potential to increase in NOx loads.

7.5.5 Total Phosphorus (TP)

The total annual average TP discharge ranged from approximately 3,500 kg P/d to 4,210 kg P/d for the eleven-year period (average of 3,890 kg P/d). The total dry season average TP discharge ranged from approximately 3,300 kg P/d to 4,010 kg P/d over the eleven-year period (average of 3,680 kg P/d).

As previously stated in Section 5.5, TP loads appear to be more random from year to year compared to the nitrogen species. Such variability is attributed to TP removal mechanisms. For example, at facilities that occasionally use chemicals for odor control (e.g., ferric chloride in the collection system), the chemical addition binds a portion of TP and subsequently reduces loads when chemicals are applied. Furthermore, facilities with anaerobic selectors in their activated sludge process to improve solids settleability also reduces TP loads. This biological feature can be “finicky” at plants and lead to variable TP load reduction.

The Central Bay and South Bay Subembayments receive the highest TP load contributions across the Bay, making up 55 to 65 percent of the TP discharged to the Bay. The largest overall TP discharger is EBMUD (Central Bay Discharger) which makes up 15 to 25 percent of the TP discharged to the Bay, followed by EBDA which makes up 10 to 15 percent of the TP discharged to the Bay

The dry season trending analysis is variable across Subembayments and Baywide. The trending analysis suggests that Suisun Bay, San Pablo Bay, South Bay and Baywide have no trending over the entire 11-years of dry season data. The Lower South Bay data suggests downward trending over the entire 11-years of dry season data. In contrast, Central Bay suggests an upwards trending over the entire 11-years of dry season data. The upward trending in the Central Bay is likely attributed to EBMUD using the anaerobic selector for TIN load reduction over TP load reduction.

During the first half of the 2022 calendar year, South San Francisco completed construction of an anaerobic selector within their activated sludge process. Since commissioning the anaerobic selector, South San Francisco has enhanced their TP load reduction as evidenced by removal rates of 85 percent or higher.

7.6 Recycled Water Analysis

This is the third Group Annual Report that has included recycled water information. The inclusion of recycled water flows and nutrient loads diverted from the Bay is not a Permit requirement per se, but it has been included to assist with nutrient management efforts. The first year of included recycled water information (submitted February 1, 2022) was based on a request for information. Last year’s Group Annual Report (submitted in February 2023) and Group Annual Reports moving forward are/will be based on recycled water volumes from the State Water Board.[3]

The distribution of recycled water volumes/flows by Subembayments are as follows (based on 3-year average annual values): Lower South Bay > South Bay > San Pablo Bay > Suisun Bay >

Central Bay. Note: the order can adjust from year to year. The annual average percent flow and loads diverted from the Bay due to recycled water ranges from 4 to 12 percent (regardless of parameter: flow or nutrient load). Of the parameters, flow has the highest percentage diverted from the Bay due to reuse, followed by NOx loads. As for the dry season, the percent flow and loads diverted from the Bay due to recycled water increases compared to average annual as evidenced by values that range from 6 to 18 percent (regardless of parameter: flow or nutrient load).

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8 Summary

The 2023 Group Annual Report includes data from October 2012 through September 2023. Influent flows and loads are required as part of the Second Permit (R2-2019-0017) for plants with a permitted ADWF capacity of greater than 10 mgd. The influent dataset is limited because the new permit came into effect in July 2019. Sampling challenges are a blend of confidence in the results, as well as obtaining all the quarterly sampling data. Additionally, this is the third Group Annual Report that includes recycled water data. While not a permit requirement, the recycled water component is included to assist with informing nutrient management across the Bay.

It is important to recognize that a portion of the 2019/2020 and all of the 2020/2021 dataset includes data influenced by the global pandemic (COVID-19) that started in March 2020. Given that, any emerging trends need to be carefully considered in the coming years to evaluate whether the 2019/2020 and 2020/2021 datasets were outliers. As a result, the future of influent/discharge flows and loads is unclear and the trends that have been tracked for the past several years may be impacted.

8.1 Influent

Table 8-1 and Table 8-2 present overall summaries of the annual average and dry season influent flows and nutrient loads, respectively, between July 2019 and September 2023. Similarly, Table 8-3 and Table 8-4 present summaries of the corresponding dry season and annual average constituent concentrations, respectively, for the same period. The concentrations were calculated by dividing the loads by the flows for the appropriate averaging period.

As previously noted, the influent data are limited both in timeframe for the initial dataset (July 2019 through September 2023), sampling frequency (required quarterly), and limited applicability (the sample set only includes POTWs that have a permitted ADWF capacity of greater than 10 mgd). During the initial year of sampling, several dischargers had missing data. Since this initial year, all the dischargers have addressed sampling requirements (except for Napa which is not required to collect influent samples when not discharging during the dry season).

Given that the initial dry season dataset is limited to a partial dry season (July 2019 through September 2019) and three complete dry seasons (2020 through 2023), the trending analysis is somewhat limiting (refer to Section 7.4). Despite this limitation, trending was applied for the quarterly dry season data. The trending analysis resulted in having no emerging dry season trends. Future group annual reports will have a more extensive dataset.

As previously noted, this past year had relatively high levels of precipitation which resulted in the highest influent flows since sampling began. Subsequently, the nutrient concentrations are the most dilute since sampling began (except for NOx levels). It is unclear as to why the NOx concentrations are higher than past year with the elevated flows.

Table 8-1. Influent: Summary of Average Annual Flow and Loads *

Constituent	2018 / 2019 (a,b) *	2019 / 2020 (a,b)	2020 / 2021 (a,b)	2021 / 2022 (a,b)	2022 / 2023 (a,b)	4-Year Average (a,b)
Flow, mgd	*	427	398	415	487	432
Ammonia, kg N/d	*	61,000	58,200	55,700	56,000	57,700
NOx, kg N/d	*	1,990	943	1,270	1,920	1,530
TIN, kg N/d (c)	*	63,100	59,500	57,400	57,900	59,500
TKN, kg N/d	*	96,600	87,400	87,300	87,700	89,700
TN, kg N/d	*	98,700	88,400	88,500	89,600	91,300
TP, kg P/d	*	11,800	10,800	11,100	11,200	11,200

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Limited to POTWs with a permitted capacity greater than 10 mgd.

b. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

c. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

Table 8-2. Influent: Summary of Dry Season Flow and Loads *

Constituent	2019 (a,b) *	2020 (a,b)	2021 (a,b)	2022 (a,b)	2023 (a,b)	5-Year Average (a,b)	Trend (d)
Flow, mgd	419	402	374	372	411	396	None
Ammonia, kg N/d	58,200	55,800	56,400	54,500	53,900	55,800	None
NOx, kg N/d	2,830	1,760	989	950	1,250	1,560	None
TIN, kg N/d (c)	50,100	57,600	57,100	54,800	54,900	54,900	None
TKN, kg N/d	72,700	91,900	83,900	84,600	79,900	82,600	None
TN, kg N/d	73,900	93,600	85,000	84,000	81,100	83,500	None
TP, kg P/d	9,210	10,900	9,910	11,100	9,720	10,200	None

* 2019 dataset limited to July through September compared against May through September for 2019/2020.

a. Limited to POTWs with a permitted capacity greater than 10 mgd.

b. The dry season represents May 1 through September 30 for each calendar year.

c. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

d. Trend analysis based on the approach discussed in Section 3.8. Note: the trending analysis is limited to dry season data for 2020, 2021, 2022, and 2023 as several data was missing for the 2019 dry season.

Table 8-3. Influent: Summary of Average Annual Flow and Concentrations *

Constituent	2018 / 2019 (a,b) *	2019 / 2020 (a,b,c)	2020 / 2021 (a,b,c)	2021 / 2022 (a,b,c)	2022 / 2023 (a,b,c)	4-Year Average (a,b,c)
Flow, mgd	*	427	398	415	487	432
Ammonia, mg N/L	*	37.7	38.7	35.5	30.4	35.3
NOx, mg N/L	*	1.23	0.627	0.812	1.04	0.938
TIN, mg N/L (d)	*	39.0	39.5	36.5	31.4	36.4
TKN, mg N/L	*	59.7	58.1	55.6	47.5	54.9
TN, mg N/L	*	61.0	58.8	56.4	48.6	55.9
TP, mg P/L	*	7.28	7.21	7.09	6.08	6.88

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Limited to POTWs with a permitted capacity greater than 10 mgd.

b. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

c. The concentrations calculation is based on a flow-weighted average (limited to agencies that provided load data for the averaging period).

d. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

Table 8-4. Influent: Summary of Dry Season Flow and Concentrations *

Constituent	2019 (a,b,c) **	2020 (a,b,c)	2021 (a,b,c)	2022 (a,b,c)	2023 (a,b,c)	5-Year Average (a,b,c)
Flow, mgd	419	402	374	372	411	396
Ammonia, mg N/L	36.7	36.7	39.8	38.7	34.6	37.2
NOx, mg N/L	1.79	1.16	0.698	0.675	0.805	1.039
TIN, mg N/L (d)	31.6	37.9	40.3	39.0	35.2	36.7
TKN, mg N/L	45.9	60.4	59.2	60.1	51.3	55.1
TN, mg N/L	46.6	61.5	60.0	59.7	52.1	55.8
TP, mg P/L	5.81	7.16	6.99	7.88	6.24	6.79

* Dry season trending not applied to concentrations as the emphasis is on load. Focusing on concentration is limiting as it does not consider the impact of flow.

** 2019 dataset limited to July through September compared against May through September for 2019/2020

a. Limited to POTWs with a permitted capacity greater than 10 mgd.

b. The dry season represents May 1 through September 30 for each calendar year.

c. The concentrations calculation is based on a flow-weighted average (limited to agencies that provided load data for the averaging period).

d. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

8.2 Discharge

Table 8-5 and Table 8-6 present overall summaries of the annual average and dry season flows and nutrient loads discharged to the San Francisco Bay, respectively, between October 2012 and September 2023. Similarly, Table 8-7 and Table 8-8 present summaries of the corresponding dry season and annual average constituent concentrations, respectively, for the same period. The concentrations were calculated by dividing the loads by the flows for the appropriate averaging period.

The largest dischargers dominate the nutrient loading. Generally, three to four large dischargers contribute more than 70 percent of the nutrient loads. The ammonia and NOx loading of are impacted by plants that nitrify. Those plants that nitrify have the lowest ammonia discharge concentrations (e.g., all the plants that discharge to the Lower South Bay) and conversely the highest NOx concentrations (e.g., Palo Alto).

Seasonal variations are pronounced, albeit not as pronounced during relatively dry years. In general, dry season loads are lower than wet season loads. This is attributed to two factors: 1) the higher flows experienced during wet weather events impact the wet season flows, as well as the loads during such events due to scouring in the collection system and 2) during the dry season, water reuse diverts nutrient loads away from the Bay. In some instances, agencies have achieved zero discharge during the summer months (e.g., Petaluma). The recycled water sections capture the extent of such nutrient load diversions from the Bay (e.g., refer to Section 8.3).

As for overall trends, the flows and loads reached their highest levels for both dry season average and annual average during the 2016/2017 dataset. The 2016/2017 dataset represents one of the wettest years on record for Northern California (refer to Section 7.1). As such, it represents the highest annual average flow for the period, which also led to higher groundwater levels and in turn higher flows during the dry season. Since 2016/2017, the datasets remained stable or declined each year through 2020/2021. The 2021/2022 dataset showed the first increase compared to the previous year flow. With the exception of flow, the 2022/2023 dataset reverted to loads in line with the 2020/2021 dataset.

Table 8-5. Discharge: Summary of Average Annual Flow and Loads to the Bay

Constituent	2012 / 2013 [(a)]	2013 / 2014 [(a)]	2014 / 2015 [(a)]	2015 / 2016 [(a)]	2016 / 2017 [(a)]	2017 / 2018 [(a)]	2018 / 2019 [(a)]	2019 / 2020 [(a)]	2020 / 2021 [(a)]	2021 / 2022[(a)]	2022 / 2023[(a)]	11-Year Average
Flow, mgd	451	428	415	430	515	433	480	408	374	399	479	438
Ammonia, kg N/d	34,300	37,000	36,700	37,500	40,600	40,800	39,800	38,000	35,300	37,200	35,300	37,500
NOx, kg N/d	14,900	14,300	14,200	13,600	14,500	12,400	12,900	11,600	10,700	10,100	11,800	12,800
TIN, kg N/d [(b)]	49,300	51,300	50,900	51,100	55,000	53,200	53,100	49,900	46,000	47,300	47,100	50,400
TP, kg P/d	3,860	3,750	3,770	4,070	4,020	4,190	4,210	4,010	3,670	3,500	3,700	3,890

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.

b. The TIN values do not necessarily equal ammonia plus NOx due to a combination of rounding and instances when ammonia was sampled more frequently than NOx.

Table 8-6. Discharge: Summary of Dry Season Flow and Loads to the Bay

Constituent	2013 [(a)]	2014 [(a)]	2015 [(a)]	2016 [(a)]	2017 [(a)]	2018 [(a)]	2019 [(a)]	2020 [(a)]	2021 [(a)]	2022 [(a)]	2023 [(a)]	Trend [(b, c)]	11-Year Average
Flow, mgd	393	374	351	372	396	383	394	363	339	337	381	None	371
Ammonia, kg N/d	34,000	36,300	36,200	37,300	38,900	38,900	38,200	35,400	33,600	35,800	32,400	None	36,100
NOx, kg N/d	13,300	11,800	12,500	11,100	11,700	11,000	10,800	10,000	9,290	8,540	10,700	Down (-3.3%/yr)	11,000
TIN, kg N/d [(d)]	47,300	48,100	48,700	48,400	50,600	50,000	49,200	45,700	43,100	44,400	43,300	Down (-1.1%/yr)	47,200
TP, kg P/d	3,400	3,320	3,570	3,960	3,660	4,000	4,010	3,790	3,680	3,300	3,760	None	3,680

a. The dry season represents May 1 through September 30 for each calendar year.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 55. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.

c. The percent change represents the change per year as a percentage of the average value over the entire dataset (2012-2023) (not considered if trend is “None”).

d. The TIN values do not necessarily equal ammonia plus NOx due to a combination of rounding and instances when ammonia was sampled more frequently than NOx.

Table 8-7. Discharge: Summary of Average Annual Flow and Concentrations to the Bay

Constituent	2012 / 2013 [(a)]	2013 / 2014 [(a)]	2014 / 2015 [(a)]	2015 / 2016 [(a)]	2016 / 2017 [(a)]	2017 / 2018 [(a)]	2018 / 2019 [(a)]	2019 / 2020 [(a)]	2020 / 2021 [(a)]	2021 / 2022 [(a)]	2022 / 2023 [(a)]	11-Year Average
Flow, mgd	451	428	415	430	515	433	480	408	374	399	479	438
Ammonia, mg N/L	20.1	22.8	23.4	23.0	20.8	24.9	21.9	24.6	24.9	24.6	19.5	22.8
NOx, mg N/L	8.77	8.84	9.05	8.37	7.41	7.57	7.12	7.48	7.56	6.67	6.50	7.86
TIN, mg N/L [(b)]	28.8	31.6	32.4	31.4	28.2	32.5	29.3	32.3	32.5	31.3	26.0	30.7
TP, mg P/L	2.26	2.31	2.40	2.50	2.06	2.56	2.32	2.59	2.60	2.32	2.04	2.37

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

Table 8-8. Discharge: Summary of Dry Season Flow and Concentrations to the Bay*

Constituent	2013 [(a)]	2014 [(a)]	2015 [(a)]	2016 [(a)]	2017 [(a)]	2018 [(a)]	2019 [(a)]	2020 [(a)]	2021 [(a)]	2022 [(a)]	2023 [(a)]	Trend [(b, c)]	11-Year Average
Flow, mgd	393	374	351	372	396	383	393	363	339	337	381	None	371
Ammonia, mg N/L	22.8	25.6	27.3	26.5	26.0	26.8	25.6	25.8	26.2	28.1	22.5	None	25.7
NOx, mg N/L	8.98	8.36	9.41	7.89	7.81	7.56	7.26	7.28	7.25	6.69	7.40	Down (-2.7%/yr)	7.81
TIN, mg N/L [(b)]	31.8	34.0	36.7	34.4	33.8	34.4	33.0	33.2	33.6	34.8	30.0	None	33.6
TP, mg P/L	2.28	2.34	2.69	2.81	2.44	2.76	2.69	2.76	2.87	2.58	2.60	Up (1.1%/yr)	2.62

** Dry season trending not applied to concentrations as the emphasis is on load. Focusing on concentration is limiting as it does not consider the impact of flow.

a. The dry season represents May 1 through September 30 for each calendar year.

b. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

8.3 Recycled Water

As previously stated in Section 7.6, this and future Group Annual Reports will rely on the readily available recycled water volumes from the State Water Board.[3] This report couples those recycled water volumes with effluent nutrient concentrations from this effort to quantify the corresponding recycled water nutrient loads.

The distribution of recycled water volumes/flows by Subembayments are as follows (based on 3-year average annual values): Lower South Bay > South Bay > San Pablo Bay > Suisun Bay > Central Bay. Note: the order can adjust from year to year. Table 8-9 and Table 8-10 present overall summaries of the annual average and dry season recycled water flows and nutrient loads diverted from the San Francisco Bay, respectively, between October 2019 and September 2022. For all parameters, the daily average flow and/or loads increase from average annual to dry season conditions. This was anticipated due to the seasonal nature of recycled water, whereby reuse demands are typically highest during the dry season.

To better understand the contribution that recycled water has on nutrient management, Table 8-11 and Table 8-12 provide the percent flow and loads diverted from the San Francisco Bay due to recycled water. The percent diverted values are calculated by dividing the recycled water load by the sum of the recycled water and discharge loads. An example calculation based on the average annual 2020/2021 dataset (average annual flow = 374 mgd; recycled water = 48 mgd) is as follows:

$$11\ Percent = \frac{48\text{ mgd}}{(48\text{ mgd} + 374\text{ mgd})}$$

The annual average percent flow and loads diverted from the Bay due to recycled water ranges from 4 to 12 percent (regardless of parameter: flow or nutrient load). Of the parameters, flow has the highest percentage diverted from the Bay due to reuse, followed by NOx loads. As for the dry season, the percent flow and loads diverted from the Bay due to recycled water increases compared to average annual as evidenced by values that range from 6 to 18 percent (regardless of parameter). Similar to average annual, the dry season flow has the highest percentage diverted from the Bay due to reuse, followed by dry season NOx loads.

Table 8-9. Recycled Water: Annual Average Flow and Loads Diverted from the Bay

Parameter	2019/2020 [a]	2020/2021 [a]	2021/2022 [a]	3-Year Average
Flow, mgd	43	48	45	45
Ammonia, kg N/d	1,800	1,900	2,400	2,000
NOx, kg N/d	1,500	1,500	1,300	1,400
TIN, kg N/d [b]	3,200	3,400	3,700	3,500
Total P, kg P/d	260	270	240	260

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

b. The TIN values do not necessarily equal ammonia plus NOx due to a combination of rounding and instances when ammonia was sampled more frequently than NOx.

Table 8-10. Recycled Water: Dry Season Average Flow and Loads Diverted from the Bay

Parameter	2019 [a]	2020 [a]	2021 [a]	2022 [a]	4-Year Average
Flow, mgd	56	61	65	62	61
Ammonia, kg N/d	3,100	2,100	2,500	3,600	2,800
NOx, kg N/d	1,700	2,100	2,000	1,900	1,900
TIN, kg N/d [b]	4,800	4,200	4,500	5,500	4,700
Total P, kg P/d	320	370	370	330	350

a. The dry season represents May 1 through September 30 for each calendar year.

b. The TIN values do not necessarily equal ammonia plus NOx due to a combination of rounding and instances when ammonia was sampled more frequently than NOx.

Table 8-11. Recycled Water: Percent of Annual Average Flow and Loads Diverted from the Bay (%)

Parameter	2019/2020 (a,c) %	2020/2021 (a,c) %	2021/2022 (a,c) %	3-Year Average %
Flow	10%	11%	10%	9%
Ammonia	4%	5%	6%	5%
NOx	11%	12%	12%	11%
TIN (b)	6%	7%	7%	7%
Total P	6%	7%	6%	6%

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.
b. The TIN values do not necessarily equal ammonia plus NOx due to a combination of rounding and instances when ammonia was sampled more frequently than NOx.
c. The percent diverted from the Bay due to recycled water is based on the recycled water value divided by the sum of recycled water value and discharge value.

Table 8-12. Recycled Water: Percent of Dry Season Average Flow and Loads Diverted from the Bay (%)

Parameter	2019 (a,c) %	2020 (a,c) %	2021 (ac) %	2022 (ac) %	4-Year Average %
Flow	13%	15%	16%	14%	14%
Ammonia	8%	6%	7%	9%	7%
NOx	14%	17%	18%	18%	16%
TIN (b)	9%	8%	9%	11%	9%
Total P	7%	9%	9%	9%	8%

a. The dry season represents May 1 through September 30 for each calendar year.
b. The TIN values do not necessarily equal ammonia plus NOx due to a combination of rounding and instances when ammonia was sampled more frequently than NOx.
c. The percent diverted from the Bay due to recycled water is based on the recycled water value divided by the sum of recycled water value and discharge value.

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Appendix A. Evaluation for Individual Dischargers

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1 City of American Canyon

American Canyon discharges to San Pablo Bay and serves approximately 5,562 connections. The plant is rated for an ADWF capacity of 2.5 mgd and a peak permitted wet weather flow of 5.0 mgd. This past year's dry season had a flow of approximately 1.0 mgd. The plant is a nitrifying and denitrifying MBR plant.

The following observations are made based upon the figures and tables in the subsequent pages:

- Discharge:
  - There are 8 missing monthly average nutrient load samples per nutrient up to June 2014, after which no monthly sampling requirements have been missed.
  - The average annual and monthly dry season flow values increased for 2022/2023 as the wet season had relatively high precipitation levels.NOx is the majority of the nitrogen species discharged, regardless of season. This is expected since this plant fully nitrifies and converts ammonia to NOx.
  - Total phosphorus concentrations are wide ranging (less than 1 mg P/L to 11 mg P/L).
  - Based on Table 1-1 statistics for the entire dry season dataset, the flow, nitrate plus nitrite, and TIN loads are trending downwards. The ammonia and Total P loads do not appear to have any emerging trends.
- Recycled Water:
  - Based on Table 1-2, the plant averaged 0.39 mgd of recycled water over the 2022 calendar year. Recycled water uses included landscape irrigation, industrial application, agricultural irrigation, and other non-potable uses within the plant (e.g., plumbing).
  - Based on Table 1-3 through Table 1-5, the plant diverted <1 kg ammonia-N/d, 6 kg TIN/d, and 4 kg P/d away from the San Francisco Bay in 2022.

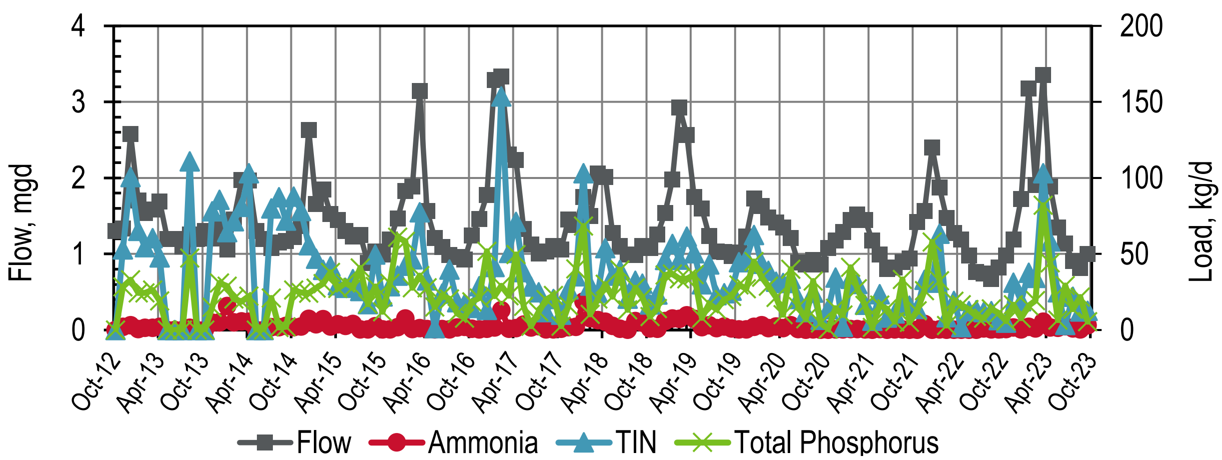

Figure 1-1. Discharge: American Canyon Monthly Flows and Loads

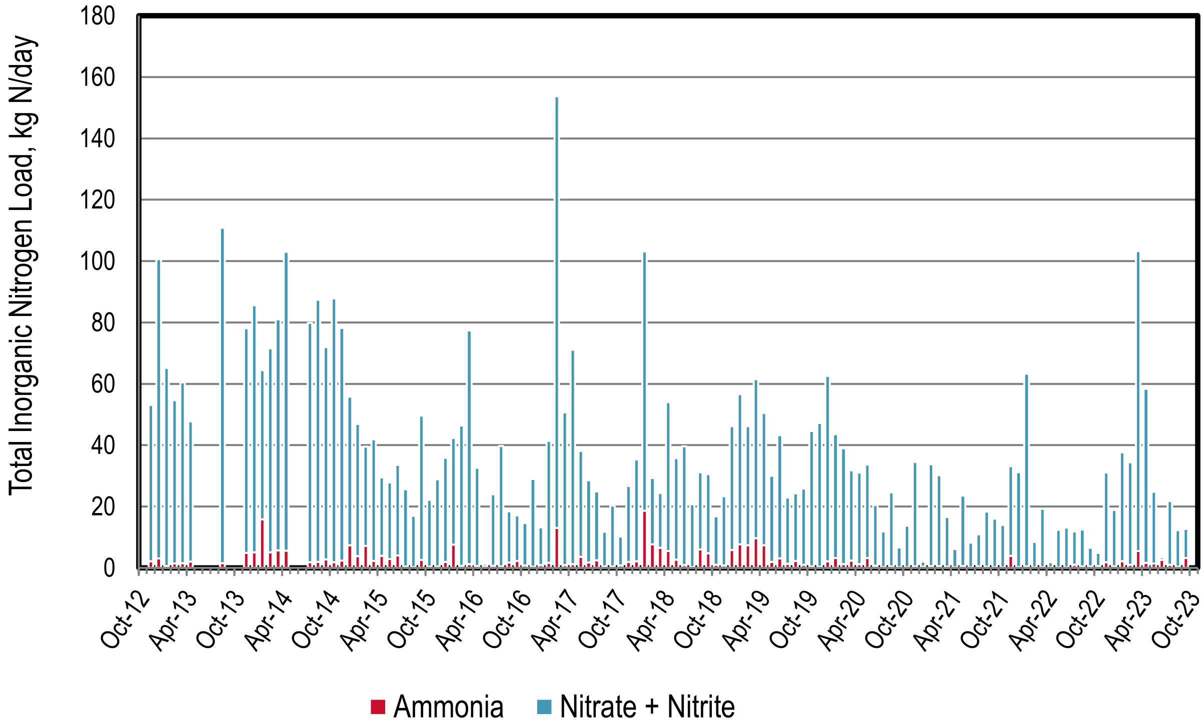

Figure 1-2. Discharge: American Canyon Monthly Nitrogen Loads

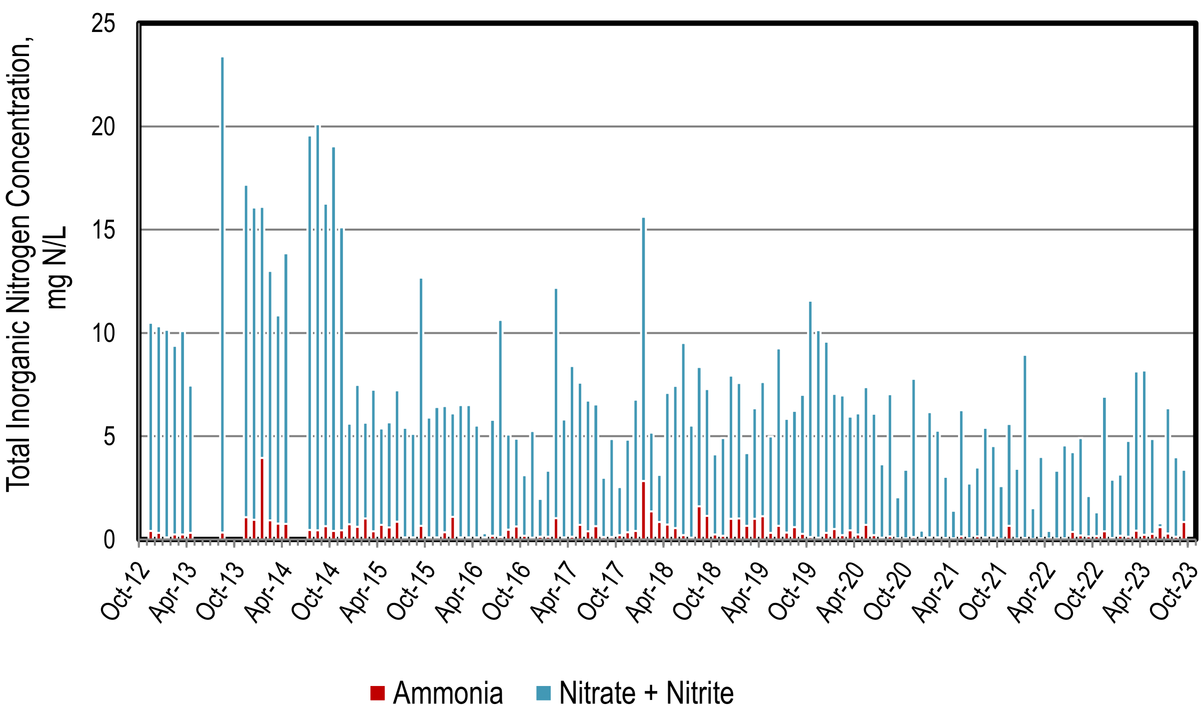

Figure 1-3. Discharge: American Canyon Monthly Nitrogen Concentrations

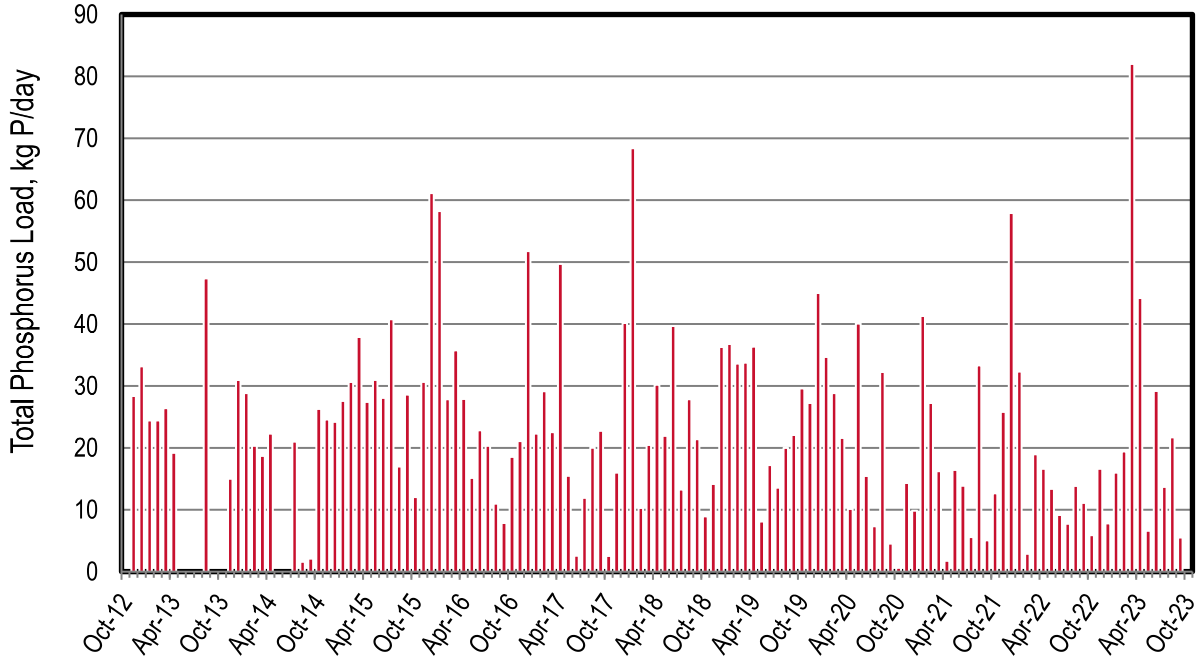

Figure 1-4. Discharge: American Canyon Monthly Phosphorus Loads

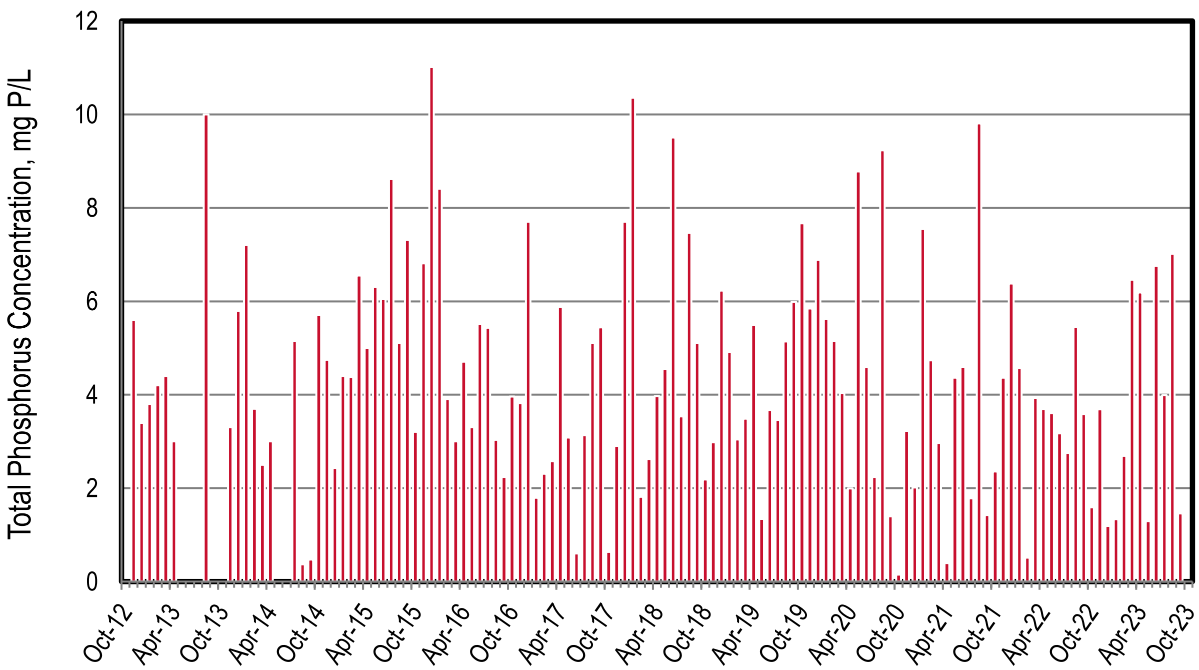

Figure 1-5. Discharge: American Canyon Monthly Phosphorus Concentration

Table 1-1. Discharge: American Canyon Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.30	--	--	--	--
Nov-12	1.34	2.13	51.0	53.1	28.4
Dec-12	2.58	3.12	97.5	101	33.2
Jan-13	1.70	0.643	64.6	65.2	24.4
Feb-13	1.54	1.40	53.2	54.6	24.4
Mar-13	1.59	1.50	59.0	60.5	26.4
Apr-13	1.69	2.05	45.7	47.7	19.2
May-13	1.20	--	--	--	--
Jun-13	1.20	--	--	--	--
Jul-13	1.10	--	--	--	--
Aug-13	1.25	1.56	109	111	47.4
Sep-13	1.20	--	--	--	--
Oct-13	1.30	--	--	--	--
Nov-13	1.20	4.91	73.2	78.1	15.0
Dec-13	1.41	5.12	80.5	85.6	30.9
Jan-14	1.06	15.8	48.6	64.4	28.8
Feb-14	1.46	5.06	66.4	71.5	20.3
Mar-14	1.98	5.75	75.3	81.0	18.7
Apr-14	1.97	5.58	97.5	103	22.3
May-14	1.30	--	--	--	--
Jun-14	1.20	--	--	--	--
Jul-14	1.08	1.88	78.0	79.9	21.0
Aug-14	1.15	1.91	85.5	87.4	1.60
Sep-14	1.17	2.83	69.1	71.9	2.10
Oct-14	1.22	1.89	85.9	87.8	26.3
Nov-14	1.37	2.33	75.9	78.2	24.6
Dec-14	2.63	7.36	48.4	55.8	24.2
Jan-15	1.66	3.83	43.1	46.9	27.6
Feb-15	1.85	7.13	32.4	39.5	30.6
Mar-15	1.53	2.26	39.7	42.0	37.9
Apr-15	1.45	3.89	25.6	29.5	27.4
May-15	1.30	2.85	25.0	27.9	31.0
Jun-15	1.23	4.04	29.5	33.5	28.1
Jul-15	1.25	0.474	25.1	25.6	40.8
Aug-15	0.879	0.333	16.6	17.0	17.0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-15	1.04	2.59	47.0	49.6	28.6
Oct-15	0.993	0.376	21.8	22.2	12.0
Nov-15	1.19	0.451	28.4	28.9	30.7
Dec-15	1.47	1.94	33.9	35.8	61.1
Jan-16	1.83	7.63	34.7	42.3	58.3
Feb-16	1.89	0.714	45.7	46.4	27.9
Mar-16	3.15	1.19	76.2	77.4	35.7
Apr-16	1.57	0.593	32.0	32.6	27.9
May-16	1.21	0.458	0.916	1.37	15.1
Jun-16	1.10	0.746	23.2	24.0	22.8
Jul-16	0.989	0.462	39.3	39.7	20.3
Aug-16	0.958	1.74	16.7	18.4	11.0
Sep-16	0.927	2.22	14.9	17.1	7.85
Oct-16	1.24	0.825	13.7	14.6	18.6
Nov-16	1.46	0.438	28.5	28.9	21.0
Dec-16	1.78	0.941	12.2	13.2	51.7
Jan-17	3.29	1.59	39.8	41.4	22.3
Feb-17	3.34	13.1	141	154	29.1
Mar-17	2.31	0.938	49.7	50.6	22.5
Apr-17	2.24	1.18	69.9	71.1	49.7
May-17	1.33	3.57	34.5	38.1	15.5
Jun-17	1.12	1.70	26.8	28.5	2.56
Jul-17	1.01	2.45	22.4	24.9	11.9
Aug-17	1.04	0.488	11.2	11.7	20.0
Sep-17	1.11	0.484	19.9	20.3	22.8
Oct-17	1.06	0.846	9.31	10.2	2.54
Nov-17	1.46	1.94	24.7	26.6	16.0
Dec-17	1.38	2.17	33.1	35.3	40.2
Jan-18	1.75	18.6	84.5	103	68.4
Feb-18	1.50	7.71	21.6	29.3	10.3
Mar-18	2.06	6.59	17.8	24.4	20.4
Apr-18	2.01	5.49	48.5	54.0	30.2
May-18	1.27	2.68	33.1	35.8	21.9
Jun-18	1.10	0.881	38.8	39.7	39.7
Jul-18	0.993	0.324	20.4	20.7	13.3
Aug-18	0.986	5.98	25.2	32.5	27.8

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-18	1.11	4.76	25.8	30.5	21.4
Oct-18	1.08	1.02	15.8	16.8	8.90
Nov-18	1.26	0.832	22.5	23.3	14.1
Dec-18	1.54	5.85	40.3	46.2	36.3
Jan-19	1.98	7.66	49.0	56.7	36.8
Feb-19	2.93	7.35	38.9	46.2	33.6
Mar-19	2.56	9.65	51.9	61.5	33.8
Apr-19	1.75	7.42	43.0	50.4	36.4
May-19	1.59	1.91	28.1	30.0	8.10
Jun-19	1.24	3.13	40.1	43.3	17.2
Jul-19	1.04	1.29	21.6	22.9	13.6
Aug-19	1.03	2.31	21.9	24.2	20.0
Sep-19	0.975	1.02	24.8	25.8	22.1
Oct-19	1.02	0.442	44.2	44.6	29.6
Nov-19	1.23	0.425	46.8	47.2	27.2
Dec-19	1.73	2.11	60.5	62.6	45.0
Jan-20	1.64	3.16	40.4	43.6	34.7
Feb-20	1.48	1.20	37.8	39.0	28.8
Mar-20	1.41	2.40	29.4	31.8	21.6
Apr-20	1.35	1.27	29.8	31.0	10.1
May-20	1.21	3.22	30.4	33.6	40.1
Jun-20	0.890	0.718	19.8	20.5	15.4
Jul-20	0.865	0.305	11.6	11.9	7.32
Aug-20	0.923	0.511	24.0	24.5	32.2
Sep-20	0.858	0.190	6.46	6.65	4.56
Oct-20	1.08	0.199	13.6	13.8	0.598
Nov-20	1.17	0.494	34.1	34.5	14.3
Dec-20	1.29	0.351	1.76	2.11	9.83
Jan-21	1.45	0.582	33.2	33.7	41.3
Feb-21	1.52	0.605	29.7	30.3	27.2
Mar-21	1.45	0.361	16.2	16.6	16.2
Apr-21	1.18	0.220	5.93	6.15	1.76
May-21	0.994	0.547	23.0	23.5	16.4
Jun-21	0.798	0.190	7.98	8.17	13.9
Jul-21	0.827	0.463	10.4	10.9	5.56
Aug-21	0.898	0.374	18.0	18.3	33.3

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-21	0.941	0.298	15.8	16.1	5.06
Oct-21	1.42	0.176	13.7	13.9	12.7
Nov-21	1.56	3.93	29.2	33.1	25.8
Dec-21	2.40	0.308	30.8	31.1	58.0
Jan-22	1.87	0.462	62.8	63.3	32.3
Feb-22	1.47	0.159	8.27	8.43	2.86
Mar-22	1.27	0.296	18.9	19.2	18.9
Apr-22	1.19	0.203	1.62	1.83	16.6
May-22	0.982	0.146	12.2	12.4	13.4
Jun-22	0.764	0.148	13.0	13.1	9.15
Jul-22	0.743	1.03	10.8	11.9	7.73
Aug-22	0.671	0.503	11.9	12.4	13.8
Sep-22	0.820	0.444	6.07	6.51	11.1
Oct-22	0.983	0.600	4.30	4.90	5.90
Nov-22	1.19	1.80	29.3	31.1	16.6
Dec-22	1.73	0.500	18.4	18.9	7.80
Jan-23	3.17	2.20	35.4	37.6	16.0
Feb-23	1.91	1.00	33.4	34.4	19.4
Mar-23	3.36	5.50	97.7	103	82.0
Apr-23	1.89	1.60	56.8	58.4	44.2
May-23	1.35	1.40	23.4	24.8	6.60
Jun-23	1.14	2.60	0.800	3.40	29.2
Jul-23	0.908	1.00	20.8	21.8	13.7
Aug-23	0.818	0.400	11.9	12.3	21.7
Sep-23	1.00	3.20	9.50	12.7	5.50
Dry Season Average	**1.06**	**1.53**	**25.8**	**27.3**	**17.9**
Dry Season Trend	**Down**	**None**	**Down**	**Down**	**None**
Wet Season Average	**1.69**	**3.06**	**42.1**	**45.1**	**26.9**
Average Annual	**1.43**	**2.45**	**35.6**	**38.1**	**23.3**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

Table 1-2. Recycled Water: American Canyon Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet/yr (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	211 (0.19)	--	58 (0.05)	2 (≤0.01)	--	15 (≤0.01)	286 (0.25)
2020	--	251 (0.22)	--	123 (0.11)	16 (≤0.01)	--	9 (≤0.01)	399 (0.35)
2021	--	316 (0.28)	--	103 (0.09)	17 (≤0.01)	--	32 (0.03)	468 (0.41)
2022	--	279 (0.25)	--	97 (0.09)	15 (≤0.01)		45 (0.04)	436 (0.39)
Average	--	264 (0.24)	--	95 (0.08)	12 (≤0.01)	--	25 (0.02)	397 (0.35)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 1-3. Recycled Water: American Canyon Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	<1	<1	--	<1	<1
2020	--	<1	--	<1	<1	--	<1	<1
2021	--	<1	--	<1	<1	--	<1	<1
2022	--	<1	--	<1	<1	--	<1	<1
Average	--	<1	--	<1	<1	--	<1	<1

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 1-4. Recycled Water: American Canyon Yearly Recycled Water TIN Load Diverted from the Bay

Year**	TIN Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	5	--	1	0.00	--	<1	7
2020	--	5	--	2	0.21	--	<1	7
2021	--	4	--	1	0.16	--	<1	6
2022	--	4	--	1	0.15	--	<1	6
Average	--	4	--	2	0.13	--	<1	7

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 1-5. Recycled Water: American Canyon Yearly Recycled Water Total Phosphorus Load Diverted from the Bay

Year**	Total Phosphorus Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	3	--	1	<1	--	<1	4
2020	--	3	--	2	<1	--	<1	5
2021	--	5	--	2	<1	--	1	7
2022	--	3	--	1	<1	--	<1	4
Average	--	4	--	1	<1	--	<1	5

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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2 City of Benicia

Benicia discharges to San Pablo Bay and it serves approximately 9,306 service connections. The plant has a permitted ADWF capacity of 4.5 mgd and 11 mgd wet weather design flow capacity. It has a current dry season flow of approximately 1.8 mgd. The plant performs secondary treatment using a combination of activated sludge and rotating biological contractors.

The following observations are made based upon the figures and tables in the subsequent pages:

- Discharge
  - The average monthly dry season flow values increased for 2022/2023 due to overall higher precipitation in 2022/2023.
  - Wet season loads are greater and more variable year to year than the dry season loads.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
  - Based on Table 2-1 statistics for the entire dry season dataset, dry season flow is trending downwards. The dry season ammonia, nitrite plus nitrate, TIN loads, and TP loads over the entire dataset do not appear to have any emerging trends.
  - Ammonia concentrations vary in the range of 8 to 46 mg N/L throughout the year.
  - Total phosphorus concentrations range from less than 1 mg P/L to over 10 mg P/L.
- Recycled Water: No recycled water was produced or distributed this past year.

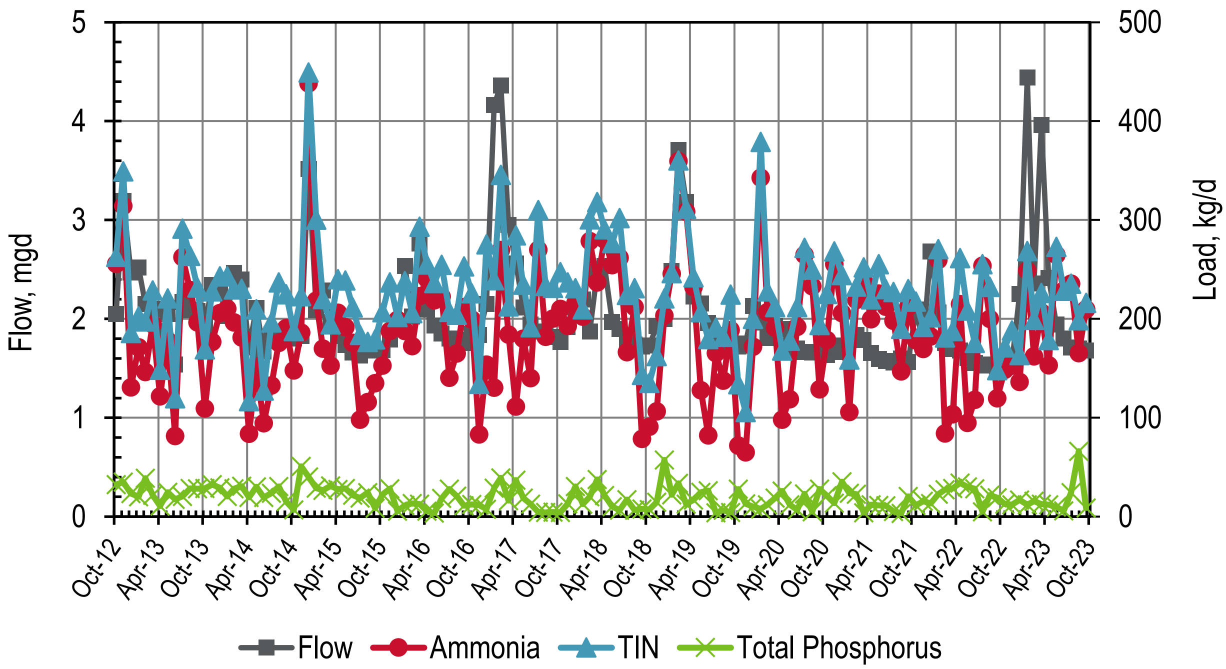

Figure 2-1. Discharge: Benicia Monthly Flows and Loads

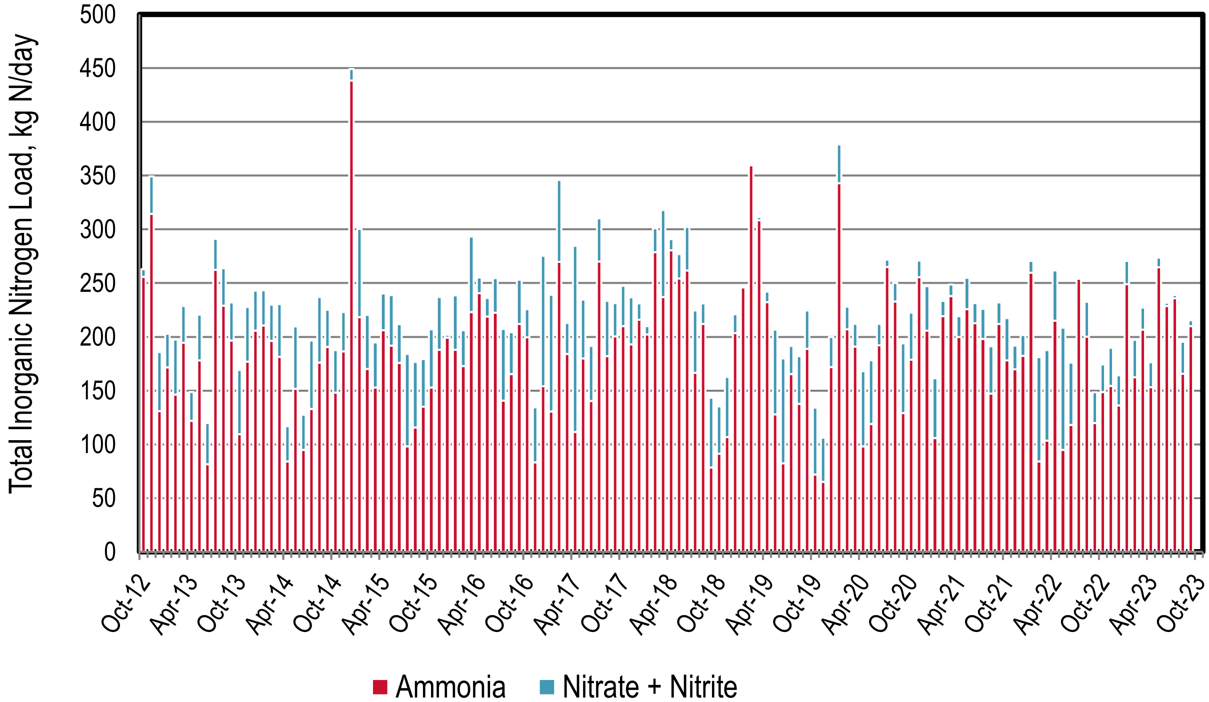

Figure 2-2. Discharge: Benicia Monthly Nitrogen Loads

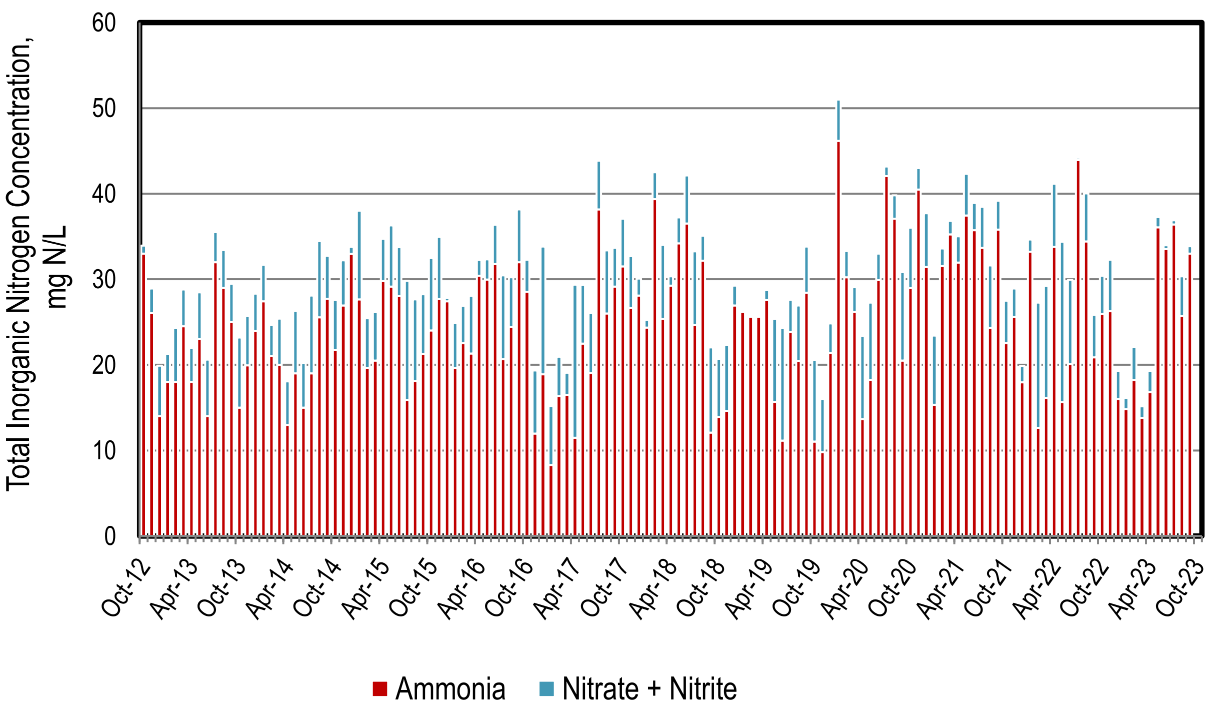

Figure 2-3. Discharge: Benicia Monthly Nitrogen Concentrations

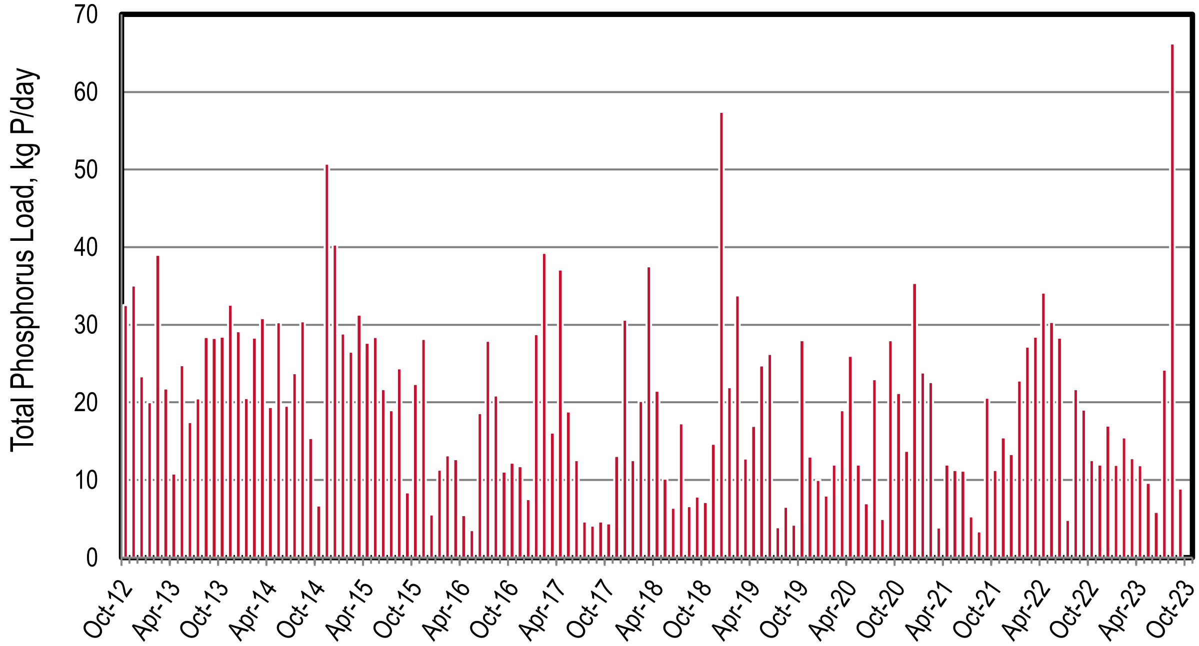

Figure 2-4. Discharge: Benicia Monthly Phosphorus Loads

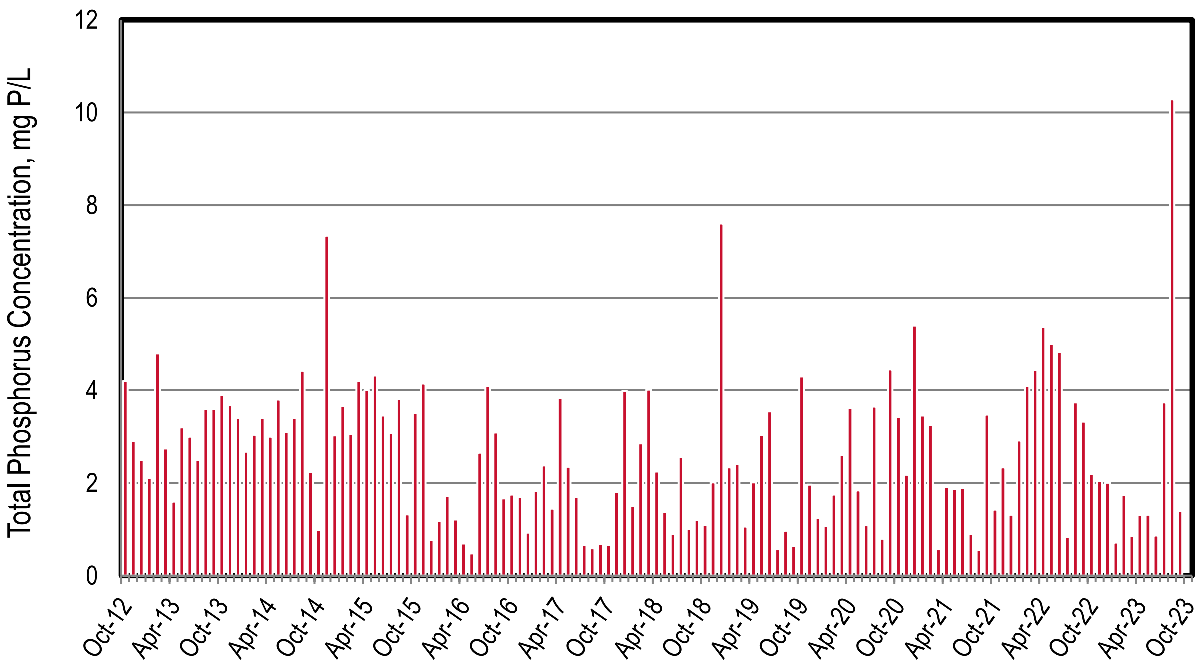

Figure 2-5. Discharge: Benicia Monthly Phosphorus Concentrations

Table 2-1. Discharge: Benicia Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	2.05	256	7.13	263	32.5
Nov-12	3.20	314	34.9	349	35.1
Dec-12	2.47	131	55.1	186	23.3
Jan-13	2.52	171	31.3	203	20.0
Feb-13	2.15	146	51.2	197	39.0
Mar-13	2.10	195	34.3	229	21.8
Apr-13	1.79	122	26.9	149	10.8
May-13	2.05	178	42.5	221	24.8
Jun-13	1.54	81.5	38.4	120	17.5
Jul-13	2.17	262	28.8	291	20.5
Aug-13	2.09	229	34.8	264	28.4
Sep-13	2.08	197	35.3	232	28.3
Oct-13	1.93	109	59.8	169	28.5
Nov-13	2.35	177	51.0	228	32.6
Dec-13	2.27	206	37.2	243	29.2
Jan-14	2.03	210	32.8	243	20.5
Feb-14	2.47	196	33.4	230	28.3
Mar-14	2.40	181	49.0	230	30.8
Apr-14	1.71	84.0	32.9	117	19.4
May-14	2.11	152	58.2	210	30.3
Jun-14	1.67	94.7	32.8	128	19.6
Jul-14	1.85	133	63.6	197	23.8
Aug-14	1.82	176	61.0	237	30.5
Sep-14	1.82	191	34.5	225	15.4
Oct-14	1.80	148	39.7	188	6.73
Nov-14	1.83	186	36.6	223	50.8
Dec-14	3.52	438	10.9	449	40.3
Jan-15	2.09	218	82.1	300	28.9
Feb-15	2.29	170	50.2	220	26.5
Mar-15	1.97	153	42.0	195	31.3
Apr-15	1.83	206	34.1	240	27.7
May-15	1.74	192	47.0	239	28.4
Jun-15	1.66	176	35.9	212	21.7
Jul-15	1.63	98.1	85.9	184	19.0
Aug-15	1.69	116	60.9	177	24.4

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-15	1.68	135	44.4	179	8.41
Oct-15	1.68	153	54.0	207	22.3
Nov-15	1.79	188	49.1	237	28.2
Dec-15	1.92	199	2.69	202	5.58
Jan-16	2.54	188	50.5	238	11.3
Feb-16	2.03	173	33.3	206	13.2
Mar-16	2.77	223	70.4	293	12.7
Apr-16	2.09	241	14.7	255	5.48
May-16	1.93	219	17.3	236	3.52
Jun-16	1.85	223	32.2	255	18.6
Jul-16	1.80	141	66.8	207	27.9
Aug-16	1.79	165	39.1	204	20.9
Sep-16	1.75	212	41.0	253	11.1
Oct-16	1.85	199	26.4	226	12.2
Nov-16	1.84	83.1	51.3	134	11.8
Dec-16	2.15	154	122	275	7.53
Jan-17	4.16	131	109	239	28.8
Feb-17	4.36	270	76.0	346	39.2
Mar-17	2.95	184	28.8	213	16.1
Apr-17	2.56	111	173	285	37.1
May-17	2.12	180	54.8	235	18.8
Jun-17	1.95	140	51.4	192	12.5
Jul-17	1.87	270	40.1	310	4.64
Aug-17	1.85	182	51.5	234	4.13
Sep-17	1.82	200	31.2	232	4.65
Oct-17	1.76	210	37.3	247	4.40
Nov-17	1.92	193	44.0	237	13.1
Dec-17	2.03	216	15.3	231	30.6
Jan-18	2.20	202	7.55	210	12.5
Feb-18	1.87	279	22.3	301	20.2
Mar-18	2.47	237	81.0	318	37.5
Apr-18	2.53	280	10.3	291	21.5
May-18	1.97	254	22.5	277	10.2
Jun-18	1.90	262	40.4	302	6.41
Jul-18	1.79	167	58.0	224	17.3
Aug-18	1.74	212	19.2	231	6.62

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-18	1.72	78.6	64.8	143	7.86
Oct-18	1.73	91.1	44.3	135	7.16
Nov-18	1.93	107	56.0	163	14.7
Dec-18	2.00	203	17.4	221	57.4
Jan-19	2.48	246	0.615	246	22.0
Feb-19	3.71	360	0.763	360	33.8
Mar-19	3.19	308	3.08	312	12.8
Apr-19	2.23	232	9.83	242	17.0
May-19	2.16	128	79.1	207	24.8
Jun-19	1.96	82.4	97.4	180	26.2
Jul-19	1.84	165	26.2	192	3.93
Aug-19	1.79	138	44.1	182	6.54
Sep-19	1.76	189	35.8	225	4.23
Oct-19	1.72	72.0	62.0	134	28.0
Nov-19	1.75	65.0	41.0	106	13.0
Dec-19	2.13	172	28.0	200	10.0
Jan-20	1.97	343	36.0	379	8.00
Feb-20	1.81	207	21.0	228	12.0
Mar-20	1.93	191	21.0	212	19.0
Apr-20	1.90	98.0	70.0	168	26.0
May-20	1.73	119	59.0	178	12.0
Jun-20	1.70	192	20.0	212	7.00
Jul-20	1.67	265	7.00	272	23.0
Aug-20	1.66	233	17.0	250	5.00
Sep-20	1.67	129	65.0	194	28.0
Oct-20	1.63	179	43.7	225	21.2
Nov-20	1.67	255	15.7	268	13.8
Dec-20	1.73	206	41.2	245	35.4
Jan-21	1.83	106	55.6	159	23.8
Feb-21	1.84	219	14.4	233	22.6
Mar-21	1.79	238	10.5	252	3.85
Apr-21	1.66	200	19.3	220	12.0
May-21	1.59	226	29.1	256	11.3
Jun-21	1.57	213	18.9	230	11.2
Jul-21	1.56	198	28.0	227	5.30
Aug-21	1.60	147	44.1	190	3.37

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-21	1.57	212	20.0	230	20.6
Oct-21	2.09	178	39.2	217	11.3
Nov-21	1.76	170	22.1	192	15.5
Dec-21	2.68	182	19.4	202	13.4
Jan-22	2.07	260	11.0	271	22.8
Feb-22	1.76	84.1	97.1	181	27.2
Mar-22	1.70	104	84.1	188	28.5
Apr-22	1.68	215	46.8	262	34.1
May-22	1.60	94.8	114	209	30.3
Jun-22	1.55	118	57.9	176	28.3
Jul-22	1.53	254	1.54	255	4.84
Aug-22	1.54	200	32.6	233	21.7
Sep-22	1.52	120	28.3	148	19.1
Oct-22	1.52	149	25.7	171	12.6
Nov-22	1.55	154	35.4	189	12.0
Dec-22	2.25	136	27.9	164	17.0
Jan-23	4.45	249	21.9	269	11.9
Feb-23	2.36	162	34.7	199	15.5
Mar-23	3.96	207	20.7	226	12.8
Apr-23	2.42	153	23.0	179	11.9
May-23	1.94	265	8.83	273	9.63
Jun-23	1.80	229	3.19	229	5.89
Jul-23	1.71	236	3.14	236	24.2
Aug-23	1.70	166	29.8	199	66.2
Sep-23	1.68	210	5.47	216	8.90
Dry Season Average	**1.78**	**179**	**40.2**	**219**	**16.9**
Dry Season Trend	**Down**	**None**	**None**	**None**	**None**
Wet Season Average	**2.22**	**190**	**39.4**	**229**	**21.2**
Average Annual	**2.04**	**185**	**39.7**	**225**	**19.4**

* The City of Benicia has sampled more intensively since September 2015 than required under the Nutrient Watershed Permit. This data represents the average monthly loads during this intensive sampling period.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

No recycled water was produced or distributed this past year.

3 City of Burlingame

Burlingame discharges to South Bay and it serves approximately 16,000 service connections. The plant has a permitted ADWF capacity of 5.5 mgd and a peak permitted wet weather flow of 16 mgd. It has a current dry season flow of approximately 2.1 mgd. The plant performs secondary treatment using activated sludge.

The following observations are made based upon the figures and tables in the subsequent pages:

- Discharge
  - Both nitrogen and phosphorus loads increase with flow during wet weather events.
  - Wet season loads are greater and more variable year to year than the dry season loads.
  - Based on the table and figures with the average monthly values, there appears to be a dry season downward trend for flow and TP loads, with a stark TP load reduction beginning in spring 2014 (attributed to sampling methodology).
  - Ammonia is typically the majority of the nitrogen species discharged, regardless of season. However, from about 8/2013 - 6/2014 and 6/2019 – 03/2020 the NOx load and concentration were significantly higher than in other shown years, indicating the potential occurrence of nitrification during such periods.
  - Total phosphorus concentrations were typically above 10 mg P/L in the first two reporting years and then dropped to reliably less than 10 mg P/L in the subsequent years. This decrease in concentration is largely attributed to the change in sampling methodology between the Section 13267 Letter data and the Nutrient Watershed Permit dataset.
- Recycled Water: No recycled water was produced or distributed this past year.

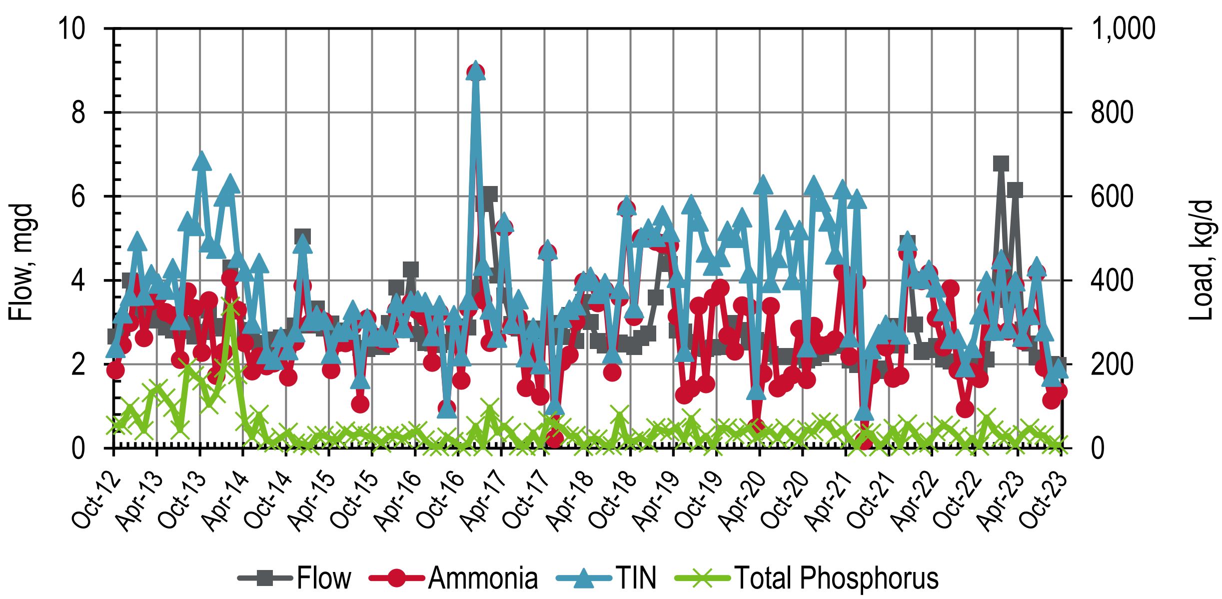

Figure 3-1. Discharge: Burlingame Monthly Flows and Loads

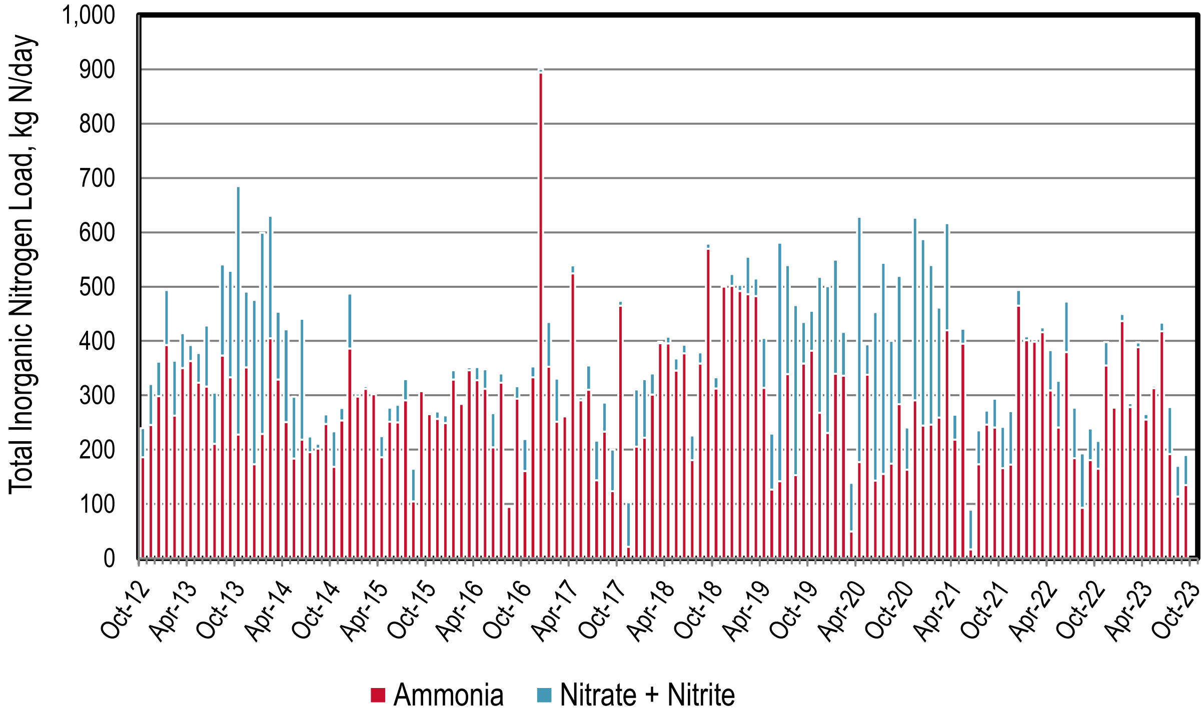

Figure 3-2. Discharge: Burlingame Monthly Nitrogen Loads

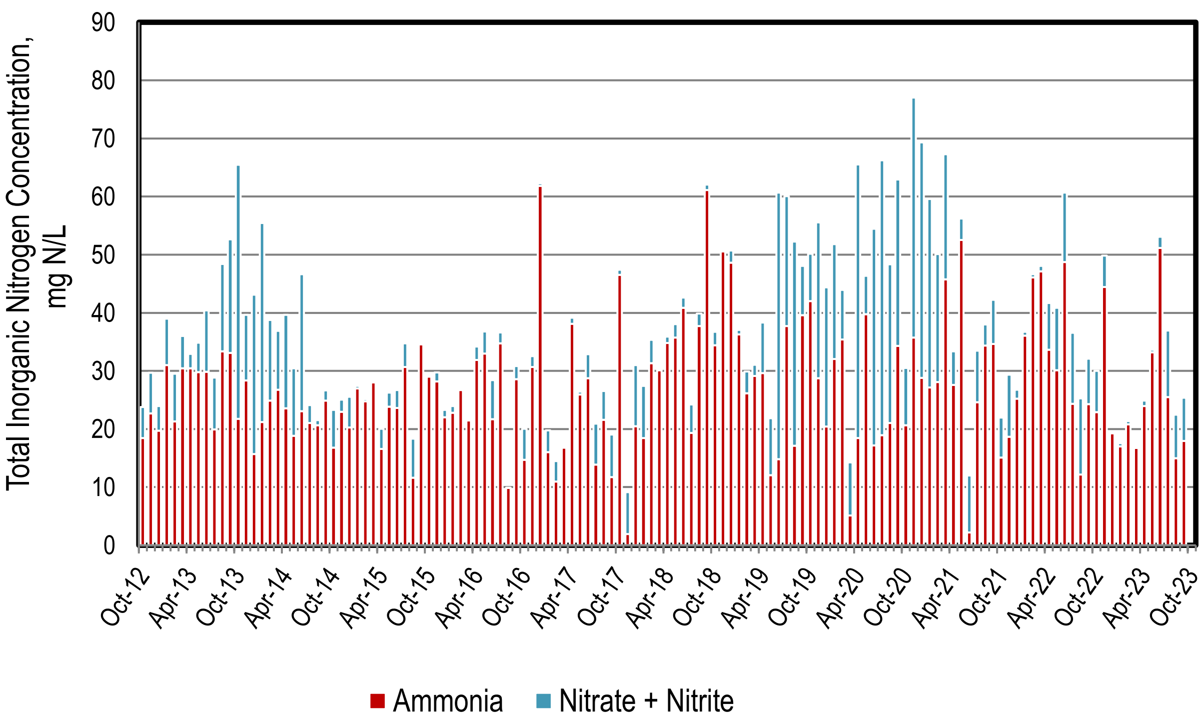

Figure 3-3. Discharge: Burlingame Monthly Nitrogen Concentrations

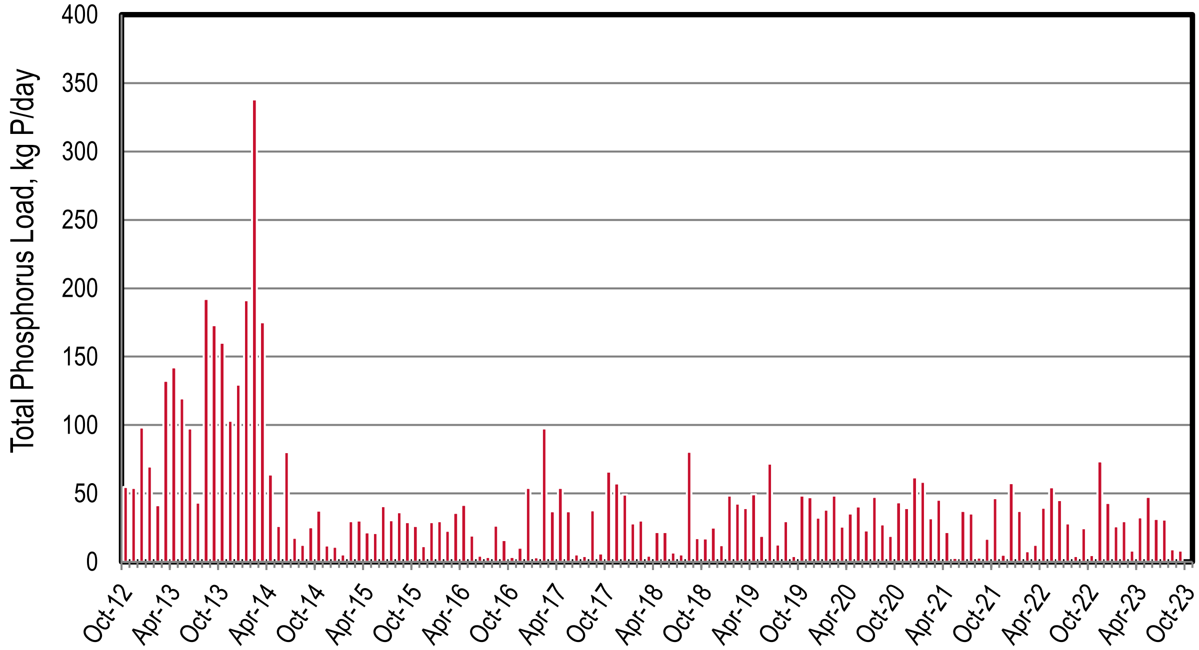

Figure 3-4. Discharge: Burlingame Monthly Phosphorus Loads

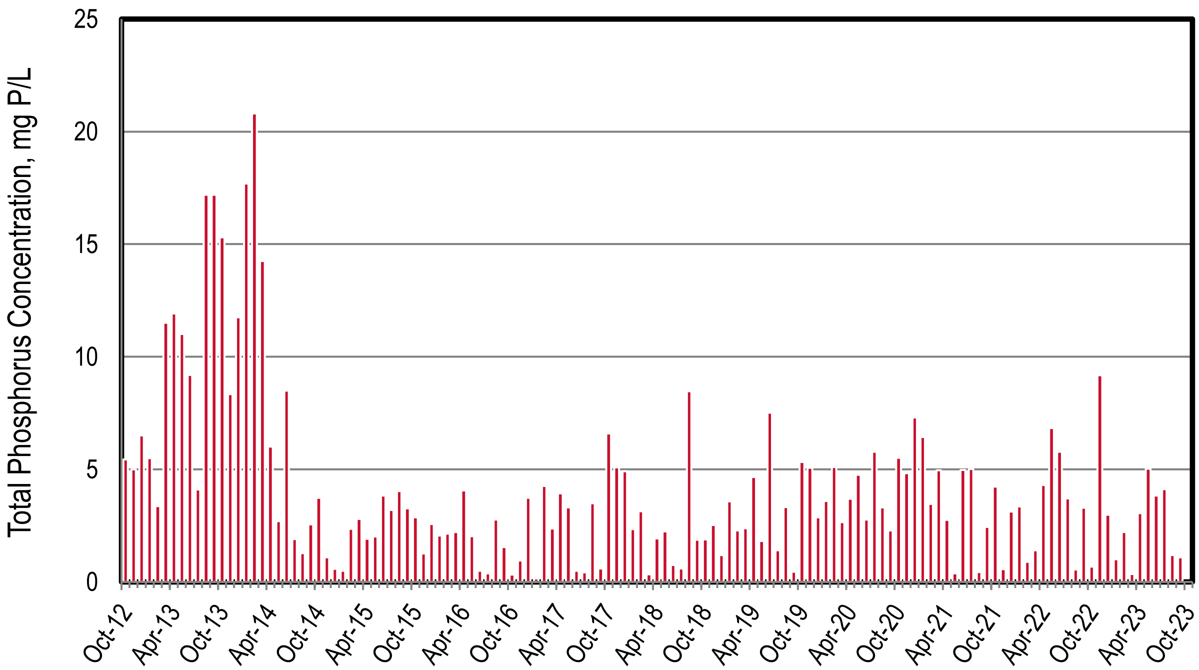

Figure 3-5. Discharge: Burlingame Monthly Phosphorus Concentrations

Table 3-1. Discharge: Burlingame Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	2.66	186	53.5	239	54.7
Nov-12	2.86	245	75.7	321	54.1
Dec-12	4.00	299	63.6	362	98.3
Jan-13	3.35	393	101	494	69.6
Feb-13	3.26	263	101	364	41.4
Mar-13	3.04	350	64.0	414	132
Apr-13	3.16	363	29.3	392	142
May-13	2.87	323	54.7	378	119
Jun-13	2.80	316	112	428	97.5
Jul-13	2.80	211	94.2	305	43.3
Aug-13	2.96	373	168	541	192
Sep-13	2.66	333	197	529	173
Oct-13	2.77	228	457	685	160
Nov-13	3.28	351	139	491	103
Dec-13	2.92	173	303	475	130
Jan-14	2.86	229	370	599	191
Feb-14	4.30	405	226	631	338
Mar-14	3.25	329	125	454	175
Apr-14	2.81	251	171	421	63.9
May-14	2.58	184	114	297	26.3
Jun-14	2.50	218	223	441	80.3
Jul-14	2.46	195	28.9	224	17.7
Aug-14	2.59	202	8.56	211	12.5
Sep-14	2.63	248	17.3	265	25.4
Oct-14	2.65	169	65.0	234	37.4
Nov-14	2.92	254	22.9	276	12.0
Dec-14	5.04	386	101	487	11.0
Jan-15	2.92	298	5.15	303	5.50
Feb-15	3.33	312	4.73	317	29.7
Mar-15	2.85	302	2.69	305	30.1
Apr-15	2.97	186	39.0	225	21.5
May-15	2.79	251	25.8	277	21.2
Jun-15	2.80	250	32.4	283	40.6
Jul-15	2.51	291	38.7	330	30.3
Aug-15	2.38	105	60.2	165	36.3

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-15	2.36	308	0.727	309	29.1
Oct-15	2.42	266	0.683	266	26.2
Nov-15	2.41	257	13.6	270	11.5
Dec-15	2.99	249	14.1	263	29.1
Jan-16	3.82	329	16.7	346	29.7
Feb-16	2.82	284	1.76	286	22.8
Mar-16	4.26	346	5.12	351	35.7
Apr-16	2.72	328	24.2	352	41.7
May-16	2.50	312	35.7	348	19.2
Jun-16	2.49	204	63.2	267	4.60
Jul-16	2.46	323	17.4	340	3.56
Aug-16	2.54	94.6	0.185	94.8	26.5
Sep-16	2.72	294	23.1	317	15.8
Oct-16	2.89	161	58.5	219	3.53
Nov-16	2.87	333	20.1	353	10.4
Dec-16	3.83	894	6.25	901	53.9
Jan-17	5.82	353	82.0	435	3.35
Feb-17	6.05	251	79.7	331	97.4
Mar-17	4.11	261	1.92	263	36.9
Apr-17	3.64	525	14.3	539	54.1
May-17	2.96	291	5.33	296	37.1
Jun-17	2.86	311	44.4	355	5.39
Jul-17	2.74	144	72.8	217	4.33
Aug-17	2.86	233	53.9	287	37.7
Sep-17	2.78	123	76.8	200	6.19
Oct-17	2.64	465	8.83	474	65.9
Nov-17	2.97	21.5	81.5	103	57.2
Dec-17	2.65	205	106	311	49.2
Jan-18	3.18	222	108	330	28.2
Feb-18	2.55	302	38.4	340	30.2
Mar-18	3.48	396	2.27	398	4.41
Apr-18	3.01	396	12.6	408	21.9
May-18	2.56	346	22.2	368	21.7
Jun-18	2.44	377	16.2	393	6.88
Jul-18	2.47	181	45.7	226	5.51
Aug-18	2.51	359	20.3	379	80.4

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-18	2.47	570	9.05	579	17.5
Oct-18	2.40	313	20.5	333	17.2
Nov-18	2.62	501	1.36	502	25.0
Dec-18	2.73	502	21.3	523	12.3
Jan-19	3.59	492	11.0	503	48.5
Feb-19	4.91	486	68.8	555	42.5
Mar-19	4.38	483	32.2	515	39.4
Apr-19	2.80	314	91.9	406	49.3
May-19	2.78	126	103	230	19.1
Jun-19	2.53	142	439	581	71.9
Jul-19	2.38	339	201	540	12.6
Aug-19	2.36	153	313	466	29.7
Sep-19	2.40	359	76.3	435	4.14
Oct-19	2.40	382	73.6	455	48.4
Nov-19	2.47	268	250	518	47.3
Dec-19	2.99	231	270	501	32.3
Jan-20	2.81	340	210	550	38.1
Feb-20	2.51	336	81.0	417	48.4
Mar-20	2.57	49.8	89.2	139	25.8
Apr-20	2.54	177	452	629	35.4
May-20	2.25	338	56.0	394	40.5
Jun-20	2.20	143	310	453	23.1
Jul-20	2.17	155	388	544	47.5
Aug-20	2.19	174	226	400	27.4
Sep-20	2.18	284	236	520	18.9
Oct-20	2.08	163	77.6	241	43.5
Nov-20	2.15	291	336	627	39.3
Dec-20	2.24	244	343	588	61.8
Jan-21	2.40	246	294	540	58.4
Feb-21	2.44	259	203	462	31.9
Mar-21	2.43	420	197	617	45.5
Apr-21	2.09	218	45.9	264	21.8
May-21	1.99	395	27.6	594	2.91
Jun-21	1.98	16.7	73.0	89.8	37.3
Jul-21	1.86	173	62.3	236	35.3
Aug-21	1.89	246	26.2	272	3.11

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-21	1.84	241	53.1	294	17.0
Oct-21	2.91	166	75.9***	282***	46.7
Nov-21	2.44	172	98.6	271	5.27
Dec-21	4.88	465	29.1	494	57.6
Jan-22	2.94	402	6.89	409	37.3
Feb-22	2.29	399	4.61	403	7.71
Mar-22	2.34	416	859	1,280	12.4
Apr-22	2.43	309	73.9	383	39.5
May-22	2.11	241	85.9	327	54.6
Jun-22	2.06	380	93.0***	260***	45.1
Jul-22	2.01	185	93.0***	260***	28.1
Aug-22	2.02	93.1	100	193	4.19
Sep-22	1.97	181	58.6	239	24.6
Oct-22	1.90	165	51.0	319	4.87
Nov-22	2.11	355	43.4	398	73.3
Dec-22	3.81	277	2.96	280	43.0
Jan-23	6.78	437	13.1	450	25.9
Feb-23	3.53	278	7.42	286	29.7
Mar-23	6.15	389	8.52	397	8.22
Apr-23	2.82	256	9.99	266	32.5
May-23	2.50	313	4.14	317	47.5
Jun-23	2.16	418	15.7	434	31.3
Jul-23	1.99	192	86.4	278	31.0
Aug-23	2.01	114	56.8	170	9.08
Sep-23	1.99	135	55.5	190	8.24
Dry Season Average	**2.42**	**246**	**89.5**	**334**	**34.7**
Dry Season Trend **	**Down**	**None**	**None**	**None**	**Down**
Wet Season Average	**3.16**	**312**	**88.6**	**301**	**50.0**
Average Annual	**2.85**	**284**	**89.0**	**178**	**43.7**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** No nitrate plus nitrate and TIN samples taken during these months. In order to provide a complete dataset, the average of the months prior and post sampling for the missed months was used.

Recycled Water

No recycled water was produced or distributed this past year.

4 Central Contra Costa Sanitary District (Central San)

Central San discharges to Suisun Bay, and it serves approximately 118,000 service connections. The plant has a permitted ADWF capacity of 53.8 mgd. It has a current dry season discharge flow of approximately 33.7 mgd (2023 average dry season flow). The plant performs secondary treatment using activated sludge.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent and Load Reduction Across the Plant:
  - Note: influent flow and loads limited to data since July 2019; quarterly sampling is required but agency samples at a higher frequency for various parameters.
  - Based on Table 4-1's statistical analysis for the entire dry season dataset, TP has a downward trend with no apparent trend for all other parameters.
  - Influent flows were the highest this past year since sampling began in July 2019. This was expected given how relatively wet this past wet season was.
  - The average monthly flow reduction across the plant ranges from 0 to 19 percent. This reduction is attributed to recycled water, water bound with biosolids, evaporation, etc.
  - The average monthly nitrogen load reduction values across the plant ranges from 26 to 60 percent. This load reduction is attributed primarily to biological assimilation in the activated sludge system, occasional nitrification (emphasis on the dry season), and load diversion with recycled water.
  - The monthly average phosphorus load reduction across the plant ranges from 66 to 93 percent. This reduction is primarily attributed to biological phosphorus removal in the activated sludge system which has an anaerobic selector to improve settleability.
- Discharge:
  - Ammonia and TIN loads typically increase with flow during wet weather events.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant is not designed to nitrify.
  - Based on Table 4-2's statistics for the entire dry season dataset, none of the parameters appear to have any emerging trends.
  - The 2023 dry season ammonia loads were the second lowest since sampling began in 2012. The 2023 dry season ammonia concentrations were the second lowest since sampling began in 2012 (averaged 23 mg N/L).
  - The 2023 dry season TIN loads were comparable to pre-pandemic levels and the second lowest since sampling began in 2012. Furthermore, the 2023 dry season TIN concentrations were the lowest since sampling began in 2012 (averaged 27 mg N/L).
  - Total phosphorus concentrations are generally less than 1.6 mg P/L. This indicates the plant is reliably removing phosphorus.

- Recycled Water:
  - Based on Table 1-2, the plant has averaged 1.7 mgd of recycled water from 2019 - 2022. Recycled water uses included golf course irrigation, landscape irrigation, industrial applications, agricultural irrigation, and other non-potable uses such as a commercial residential truck fill program, sewer flushing, and a dust control/fill station.
  - Based on Table 4-4 through Table 4-6, the plant has diverted from the Bay via recycled water 192 kg ammonia-N/d, 198 kg TIN-N/d, and 7 kg P/d on average from 2019 - 2022.

Influent

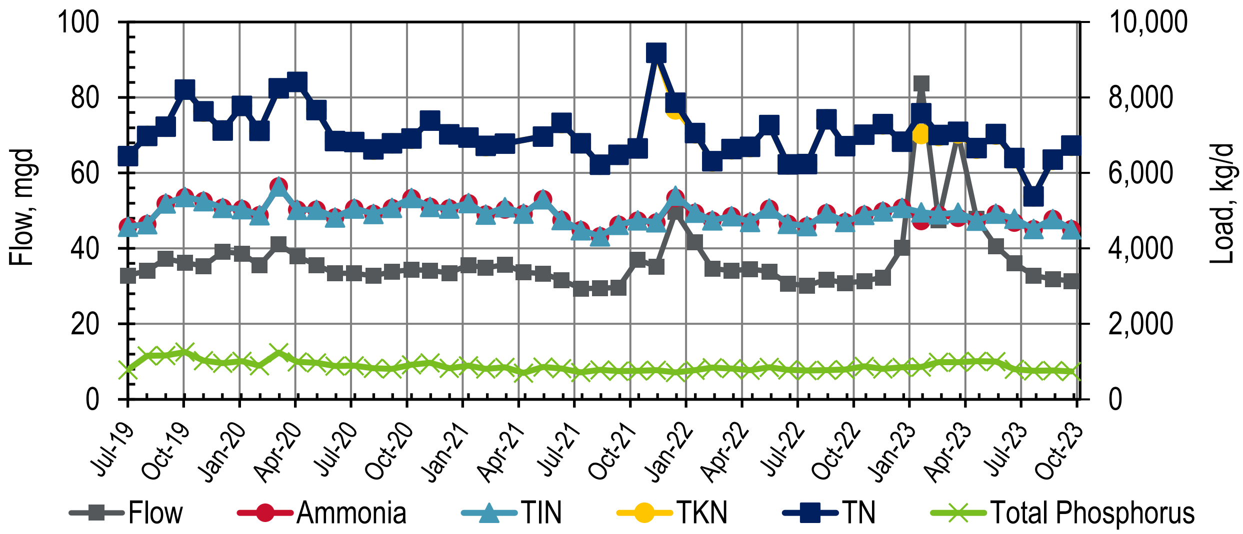

Figure 4-1. Influent: Central San Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N loads and thus are challenging to see.

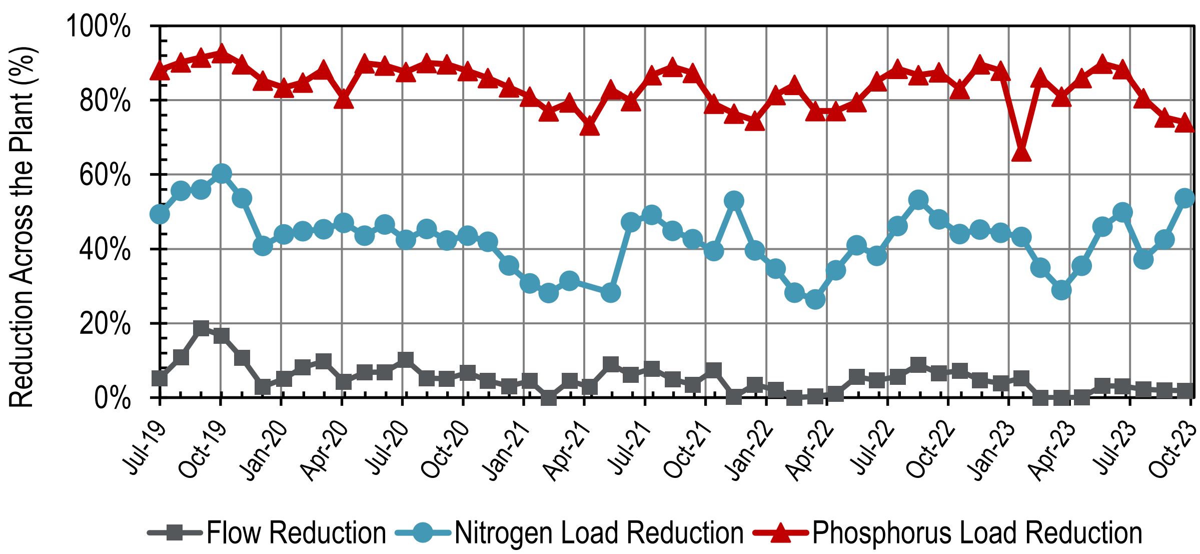

Figure 4-2. Influent: Central San Monthly Reductions Across the Plant

Note: Influent Total N was compared against Discharge TIN for calculating nitrogen load reduction.

Table 4-1. Influent: Central San Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	32.8	4,580	4.73	4,580	6,450	6,450	784
Aug-19	34.1	4,650	0.591	4,650	6,990	6,990	1,150
Sep-19	37.3	5,190	2.82	5,190	7,230	7,230	1,160
Oct-19	36.2	5,360	2.50	5,360	8,210	8,210	1,250
Nov-19	35.4	5,260	1.17	5,260	7,630	7,630	1,030
Dec-19	39.1	5,080	1.14	5,080	7,130	7,130	965
Jan-20	38.7	5,040	2.24	5,040	7,780	7,780	1,010
Feb-20	35.5	4,890	1.08	4,890	7,120	7,120	895
Mar-20	41.1	5,650	2.68	5,650	8,240	8,240	1,240
Apr-20	37.9	5,030	1.34	5,030	8,410	8,420	993
May-20	35.6	5,030	0.959	5,030	7,670	7,670	970
Jun-20	33.4	4,820	0.950	4,820	6,850	6,850	882
Jul-20	33.4	5,060	1.12	5,060	6,830	6,830	889
Aug-20	32.7	4,910	3.16	4,920	6,620	6,630	829
Sep-20	33.8	5,070	4.36	5,070	6,790	6,790	806
Oct-20	34.3	5,330	4.48	5,340	6,910	6,910	922
Nov-20	34.2	5,100	1.19	5,110	7,390	7,390	970
Dec-20	33.5	5,060	3.00	5,070	7,020	7,030	822
Jan-21	35.6	5,190	7.10	5,200	6,940	6,940	889
Feb-21	34.9	4,900	4.58	4,900	6,720	6,720	812
Mar-21	35.7	5,040	2.83	5,090	6,780	6,780	850
Apr-21	33.7	4,920	3.17	4,920	--	--	701
May-21	33.3	5,300	2.08	5,310	6,970	6,970	856
Jun-21	31.6	4,760	1.27	4,760	7,330	7,330	819
Jul-21	29.4	4,480	0.565	4,480	6,790	6,790	712
Aug-21	29.4	4,320	3.60	4,320	6,220	6,220	780
Sep-21	29.6	4,630	1.45	4,630	6,490	6,490	746
Oct-21	37.0	4,740	7.31	4,750	6,650	6,660	759
Nov-21	35.2	4,690	6.99	4,700	9,170	9,180	774
Dec-21	49.7	5,340	44.8	5,400	7,690	7,860	714
Jan-22	41.7	4,950	8.62	4,950	7,050	7,060	775
Feb-22	34.7	4,740	7.42	4,750	6,310	6,310	841
Mar-22	34.1	4,850	1.08	4,860	6,630	6,630	817
Apr-22	34.6	4,700	3.19	4,700	6,690	6,690	778
May-22	33.9	5,060	2.09	5,060	7,270	7,270	849

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jun-22	30.7	4,650	1.43	4,650	6,230	6,230	780
Jul-22	30.1	4,590	2.96	4,590	6,240	6,240	767
Aug-22	31.8	4,930	2.44	4,940	7,420	7,420	776
Sep-22	30.8	4,700	2.67	4,700	6,710	6,710	794
Oct-22	31.4	4,890	2.34	4,900	7,020	7,020	875
Nov-22	32.3	4,980	3.36	4,990	7,290	7,300	812
Dec-22	40.2	5,080	3.33	5,080	6,830	6,830	852
Jan-23	83.8	4,730	233	4,960	7,040	7,590	863
Feb-23	47.5	4,900	16.8	4,910	6,990	7,010	989
Mar-23	70.5	4,810	137	4,950	7,050	7,090	990
Apr-23	47.9	4,720	17.5	4,740	6,650	6,660	1,010
May-23	40.6	4,910	10.8	4,930	7,020	7,040	1,000
Jun-23	36.1	4,690	106	4,790	6,390	6,400	797
Jul-23	32.8	4,510	2.56	4,520	5,380	5,380	760
Aug-23	31.9	4,780	3.72	4,780	6,350	6,360	764
Sep-23	31.4	4,510	4.29	4,510	6,720	6,730	741
Dry Season Average	**32.9**	**4,790**	**7.26**	**4,800**	**6,740**	**6,740**	**844**
Dry Season Trend * **	**None**	**None**	**None**	**None**	**None**	**None**	**Down**
Wet Season Average	**40.2**	**5,000**	**19.0**	**5,020**	**7,240**	**7,270**	**900**
Average Annual	**36.9**	**4,900**	**13.7**	**4,920**	**7,010**	**7,020**	**875**

* Central San typically samples more than the required influent quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

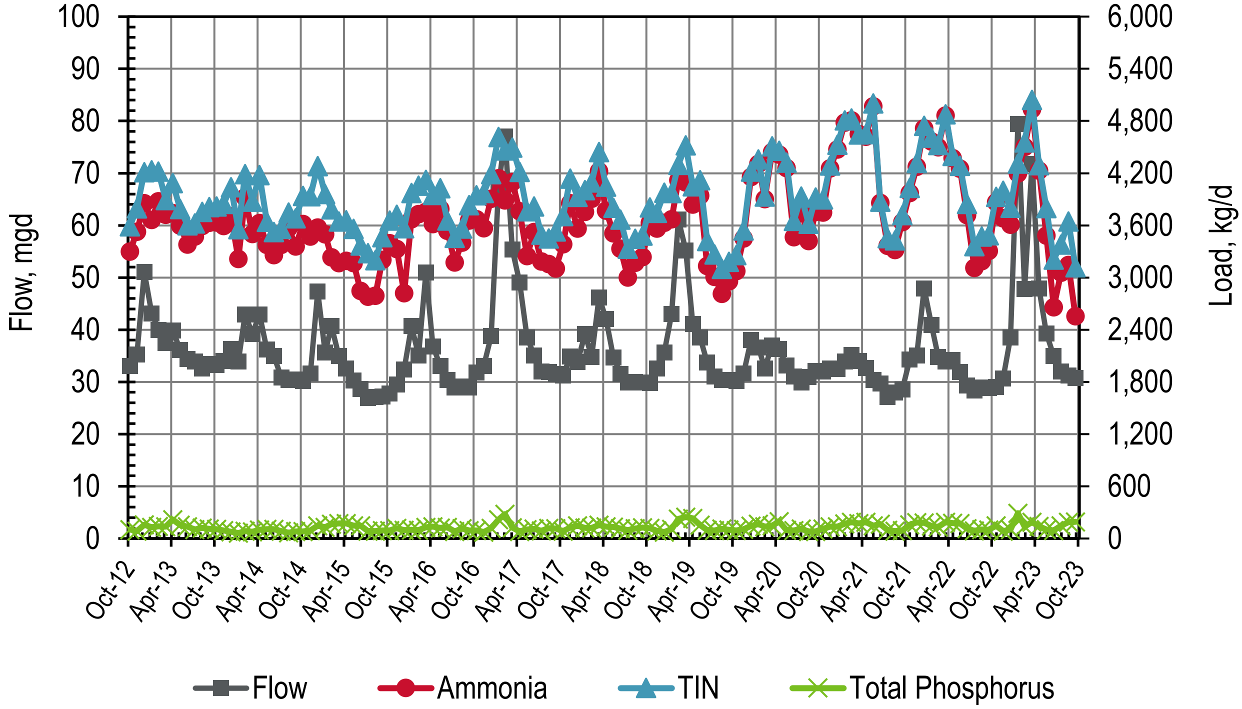

Figure 4-3. Discharge: Central San Monthly Flows and Loads

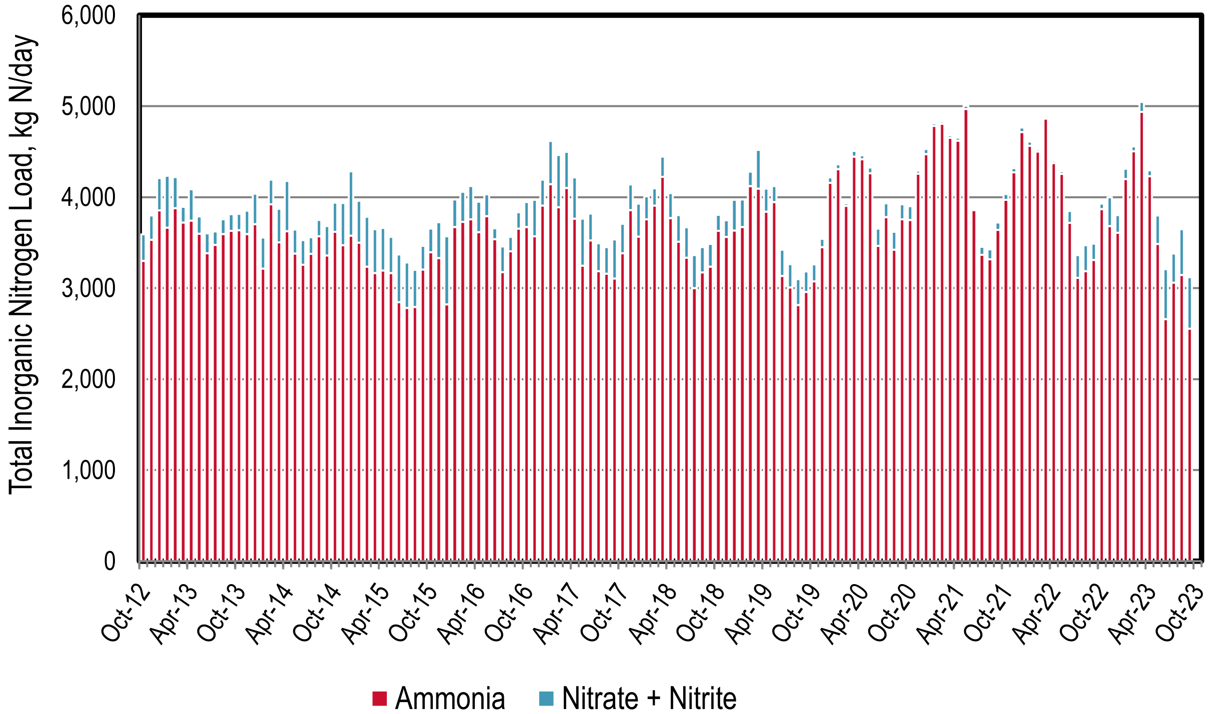

Figure 4-4. Discharge: Central San Monthly Nitrogen Loads

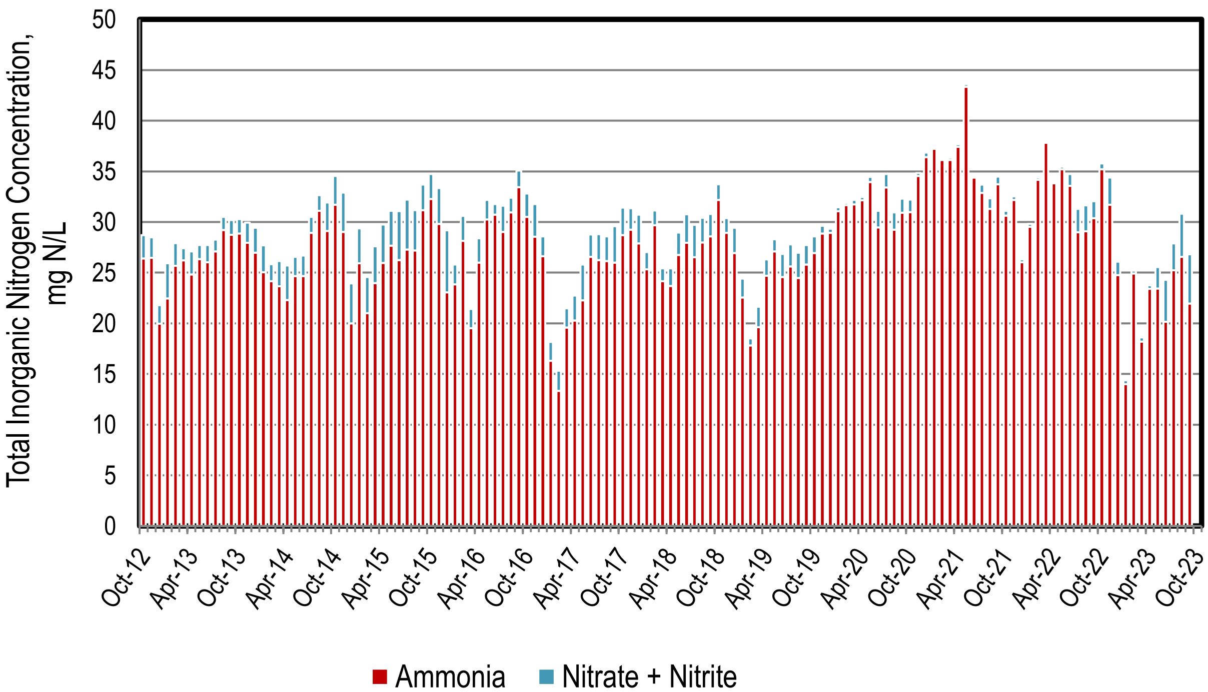

Figure 4-5. Discharge: Central San Monthly Nitrogen Concentrations

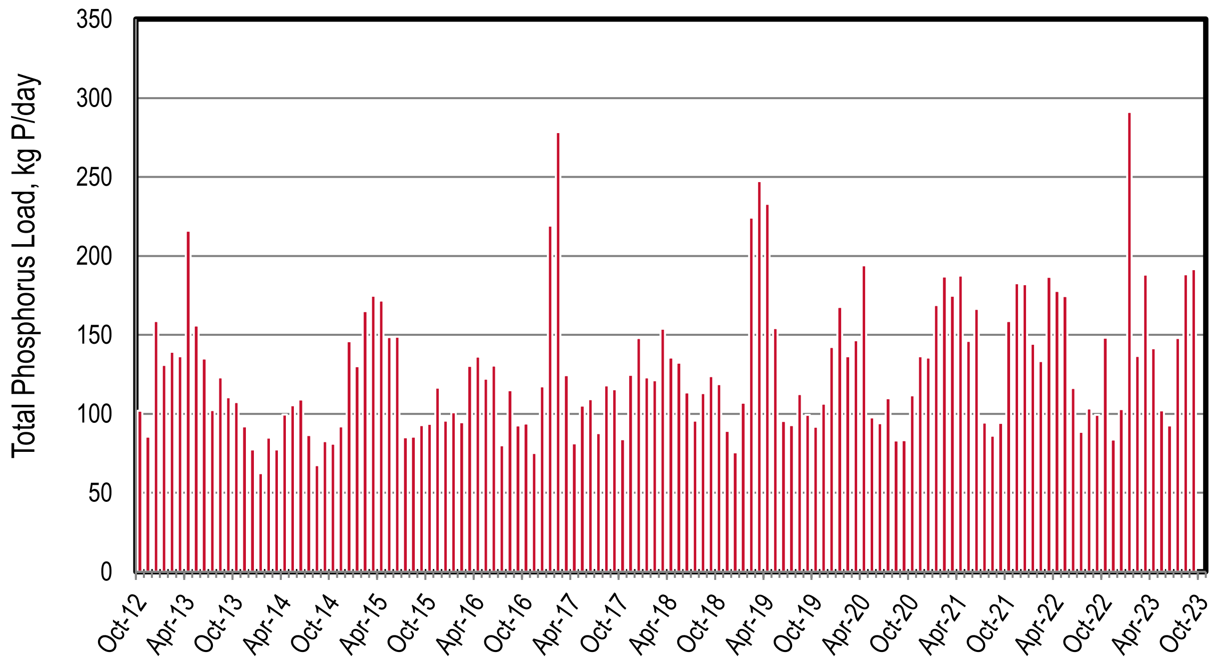

Figure 4-6. Discharge: Central San Monthly Phosphorus Loads

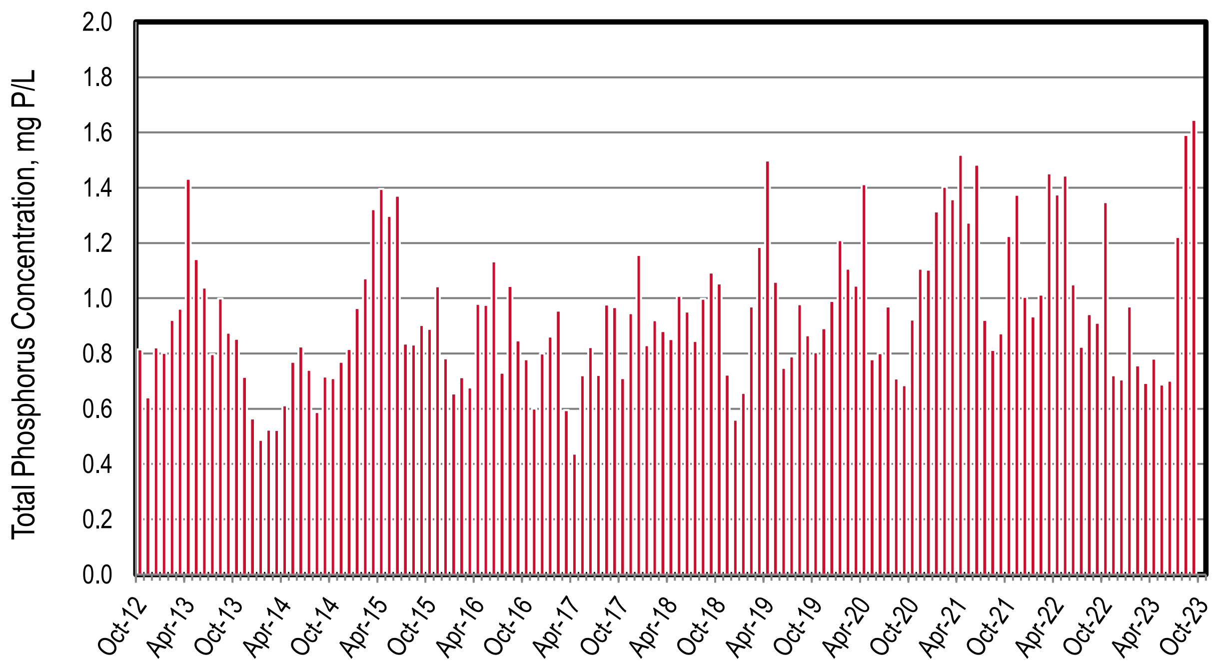

Figure 1-7. Discharge: Central San Monthly Phosphorus Concentrations

Table 4-2. Discharge: Central San Monthly Flows and Loads

Month, Year	Flow	Ammonia***	Nitrate + Nitrite	TIN*, ***	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	33.1	3,300	290	3,590	102
Nov-12	35.3	3,530	269	3,800	85.5
Dec-12	51.1	3,850	357	4,210	159
Jan-13	43.2	3,670	569	4,240	131
Feb-13	40.0	3,880	340	4,220	139
Mar-13	37.6	3,720	170	3,890	137
Apr-13	39.9	3,740	344	4,090	216
May-13	36.1	3,600	191	3,790	156
Jun-13	34.4	3,380	220	3,600	135
Jul-13	33.9	3,470	149	3,620	102
Aug-13	32.6	3,600	160	3,760	123
Sep-13	33.4	3,630	184	3,810	111
Oct-13	33.3	3,640	182	3,820	108
Nov-13	34.0	3,600	255	3,850	92.0
Dec-13	36.3	3,700	336	4,040	77.5
Jan-14	34.0	3,220	342	3,560	62.5
Feb-14	42.9	3,920	270	4,190	85.0
Mar-14	39.2	3,500	370	3,870	77.5
Apr-14	43.0	3,630	550	4,180	99.5
May-14	36.3	3,380	264	3,640	106
Jun-14	35.0	3,260	268	3,530	109
Jul-14	30.9	3,380	182	3,560	86.5
Aug-14	30.4	3,570	178	3,750	67.6
Sep-14	30.5	3,360	325	3,680	82.7
Oct-14	30.2	3,620	323	3,940	81.1
Nov-14	31.7	3,470	465	3,940	92.1
Dec-14	47.3	3,580	705	4,280	146
Jan-15	35.7	3,500	463	3,960	130
Feb-15	40.7	3,240	550	3,790	165
Mar-15	35.0	3,170	479	3,650	175
Apr-15	32.6	3,200	467	3,660	172
May-15	30.3	3,170	395	3,560	149
Jun-15	28.7	2,850	524	3,370	149
Jul-15	27.0	2,780	501	3,280	85.2
Aug-15	27.2	2,790	406	3,200	85.5

Month, Year	Flow	Ammonia***	Nitrate + Nitrite	TIN*, ***	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-15	27.2	3,210	260	3,470	92.9
Oct-15	27.8	3,400	260	3,660	93.6
Nov-15	29.6	3,330	393	3,720	116
Dec-15	32.4	2,820	747	3,570	95.7
Jan-16	40.7	3,670	302	3,970	101
Feb-16	35.1	3,730	327	4,060	94.7
Mar-16	50.9	3,760	365	4,120	130
Apr-16	36.8	3,620	333	3,950	136
May-16	33.1	3,790	239	4,030	122
Jun-16	30.5	3,540	120	3,660	130
Jul-16	29.0	3,180	283	3,460	80.0
Aug-16	29.1	3,410	159	3,560	115
Sep-16	28.9	3,660	178	3,830	92.7
Oct-16	31.8	3,670	277	3,950	93.9
Nov-16	33.1	3,570	402	3,970	75.1
Dec-16	38.8	3,910	284	4,190	117
Jan-17	67.3	4,140	475	4,620	219
Feb-17	77.1	3,890	574	4,460	278
Mar-17	55.4	4,100	397	4,500	124
Apr-17	49.1	3,760	454	4,220	81.2
May-17	38.6	3,250	515	3,760	105
Jun-17	35.1	3,520	296	3,820	109
Jul-17	32.1	3,190	309	3,490	87.7
Aug-17	32.0	3,160	293	3,450	118
Sep-17	31.6	3,110	428	3,530	116
Oct-17	31.2	3,390	323	3,710	83.9
Nov-17	34.9	3,860	282	4,140	125
Dec-17	33.8	3,570	363	3,930	148
Jan-18	39.2	3,760	252	4,010	123
Feb-18	34.8	3,910	188	4,100	121
Mar-18	46.2	4,220	221	4,440	154
Apr-18	42.1	3,770	274	4,050	136
May-18	34.7	3,510	292	3,800	132
Jun-18	31.6	3,340	333	3,670	114
Jul-18	29.9	3,000	362	3,330	95.7
Aug-18	30.0	3,170	277	3,450	113

Month, Year	Flow	Ammonia***	Nitrate + Nitrite	TIN*, ***	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-18	30.0	3,240	247	3,480	124
Oct-18	29.9	3,630	178	3,810	119
Nov-18	32.6	3,560	180	3,740	89.2
Dec-18	35.7	3,630	336	3,980	75.5
Jan-19	43.1	3,670	303	3,980	107
Feb-19	61.2	4,120	156	4,300	224
Mar-19	55.2	4,100	425	4,520	247
Apr-19	41.1	3,840	252	4,050	233
May-19	38.5	3,940	177	4,120	154
Jun-19	33.7	3,130	289	3,420	95.4
Jul-19	31.1	3,010	257	3,270	92.8
Aug-19	30.4	2,810	287	3,100	113
Sep-19	30.3	2,960	223	3,180	99.4
Oct-19	30.2	3,070	187	3,260	91.8
Nov-19	31.6	3,450	90.6	3,540	107
Dec-19	38.0	4,160	62.1	4,220	142
Jan-20	36.7	4,310	52.4	4,360	168
Feb-20	32.6	3,900	28.3	3,930	136
Mar-20	37.1	4,440	65.0	4,510	146
Apr-20	36.3	4,420	44.6	4,460	194
May-20	33.2	4,260	62.7	4,330	97.8
Jun-20	31.1	3,460	191	3,660	94.2
Jul-20	30.0	3,780	152	3,930	110
Aug-20	31.0	3,420	199	3,620	83.1
Sep-20	32.2	3,760	166	3,920	83.2
Oct-20	32.0	3,750	150	3,900	112
Nov-20	32.6	4,260	33.3	4,290	136
Dec-20	32.5	4,470	54.1	4,530	136
Jan-21	34.0	4,780	25.2	4,810	169
Feb-21	35.2	4,810	24.4	4,830	187
Mar-21	34.1	4,650	28.9	4,650	175
Apr-21	32.7	4,620	31.7	4,650	188
May-21	30.3	4,970	32.5	5,000	146
Jun-21	29.7	3,860	13.2	3,870	166
Jul-21	27.1	3,370	86.1	3,450	94.4
Aug-21	28.0	3,320	110	3,430	86.2

Month, Year	Flow	Ammonia***	Nitrate + Nitrite	TIN*, ***	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-21	28.6	3,640	79.5	3,720	94.2
Oct-21	34.3	3,970	61.3	4,030	159
Nov-21	35.1	4,270	46.5	4,320	183
Dec-21	47.9	4,720	49.2	4,750	182
Jan-22	40.9	4,570	43.4	4,610	144
Feb-22	34.8	4,500	27.3	4,530	133
Mar-22	34.0	4,860	15.8	4,880	187
Apr-22	34.2	4,380	23.0	4,400	178
May-22	32.0	4,250	30.8	4,290	174
Jun-22	29.3	3,720	131	3,850	116
Jul-22	28.4	3,110	247	3,360	88.6
Aug-22	29.0	3,190	284	3,470	103
Sep-22	28.8	3,310	180	3,490	99.3
Oct-22	29.1	3,870	61.8	3,930	148
Nov-22	30.8	3,680	314	4,000	83.8
Dec-22	38.6	3,610	192	3,800	103
Jan-23	79.4	4,200	112	4,310	291
Feb-23	47.8	4,510	51.4	4,560	137
Mar-23	71.8	4,940	106	5,040	188
Apr-23	47.9	4,230	62.9	4,300	142
May-23	39.3	3,480	316	3,800	102
Jun-23	35.0	2,660	548	3,210	92.7
Jul-23	32.1	3,060	321	3,380	148
Aug-23	31.3	3,150	501	3,650	188
Sep-23	30.8	2,560	563	3,120	192
Dry Season Average	**31.5**	**3,380**	**254**	**3,630**	**113**
Dry Season Trend **	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**39.5**	**3,880**	**253**	**4,130**	**138**
Average Annual	**36.2**	**3,670**	**253**	**3,920**	**127**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** The statistical analysis does not capture the ammonia and TIN load increase associated with the 2020 dry season.

Recycled Water

Table 4-3. Recycled Water: Central San Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet/yr (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	342 (0.31)	237 (0.21)	--	1,020 (0.91)	2 (≤0.01)	--	180 (0.16)	1,780 (1.59)
2020	373 (0.33)	242 (0.22)	--	924 (0.82)	3 (≤0.01)	--	262 (0.23)	1,800 (1.60)
2021	411 (0.37)	248 (0.22)	--	1,000 (0.89)	7 (0.01)	--	221 (0.20)	1,890 (1.69)
2022	355 (0.32)	264 (0.24)	--	1070 (0.96)	9 (0.01)	--	265 (0.24)	1,960 (1.77)
Average	370 (0.33)	248 (0.22)	--	1,000 (0.90)	5 (≤0.01)	--	232 (0.21)	1,860 (1.66)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 4-4. Recycled Water: Central San Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	28	19	--	83	<1	--	15	145
2020	40	27	--	100	<1	--	28	194
2021	48	28	--	116	1	--	26	217
2022	39	29	--	116	1	--	29	214
Average	39	25	--	103	<1	--	24	192

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 4-5. Recycled Water: Central San Yearly Recycled Water TIN Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	30	20	--	88	<1	--	16	154
2020	41	27	--	102	<1	--	29	199
2021	48	29	--	115	1	--	26	219
2022	40	30	--	120	1	--	30	221
Average	40	27	--	106	<1	--	25	198

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 4-6. Recycled Water: Central San Yearly Recycled Water Total Phosphorus Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	1	1	--	3	<1	--	1	6
2020	1	1	--	3	<1	--	1	6
2021	2	1	--	4	<1	--	1	8
2022	1	1	--	4	<1	--	1	7
Average	1	1	--	4	<1	--	1	7

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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5 Central Marin Sanitation Agency (CMSA)

CMSA discharges to the Central Bay Subembayment and serves approximately 105,000 people via 52,200 service connections. The plant has a permitted ADWF capacity of 10.0 mgd. This past dry season average discharge flow was approximately 6.9 mgd. The plant performs secondary treatment using a trickling filter and activated sludge process.

The following observations are made based upon the figures and tables in the subsequent pages:

- Discharge
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since the plant was not designed to nitrify (some nitrification does occur in the secondary process, most likely in the biotowers).
  - Ammonia/TIN concentrations increase during the dry weather season as flows decline. Total phosphorus concentrations range from less than 1 mg P/L to 6.4 mg P/L.
  - Based on Table 5-1 statistics for the entire long term dry season dataset, all the monitored parameters are trending upwards (except for nitrate plus nitrite) although recent year over year increases from the prior 2020-2021 reporting period indicate statistically insignificant increases (i.e., 1 percent or less)
- Recycled Water:
  - Based on Table 1-2, the plant averages approximately 1.1 mgd of recycled water. Recycled water uses included landscape irrigation, industrial on-site application, and other off-site non-potable uses such as sewer flushing and dust control. However, only 0.02 mgd is diverted from the Bay as most volume is returned to the plant.
  - Based on Table 5-3, Table 5-4, and Table 5-5 respectively, in the 2022 reporting period the plant diverted on average 3 kg ammonia-N/d, 3 kg TIN-N/d, and <1 kg P/d away from the Bay through recycled water.

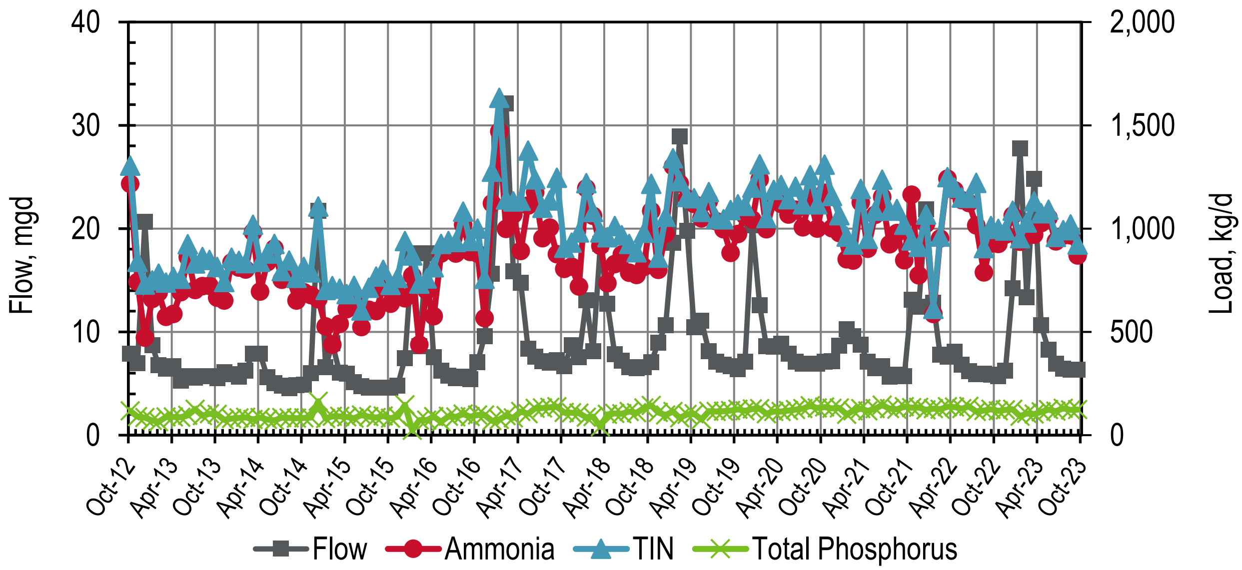

Figure 5-1. Discharge: CMSA Monthly Flows and Loads

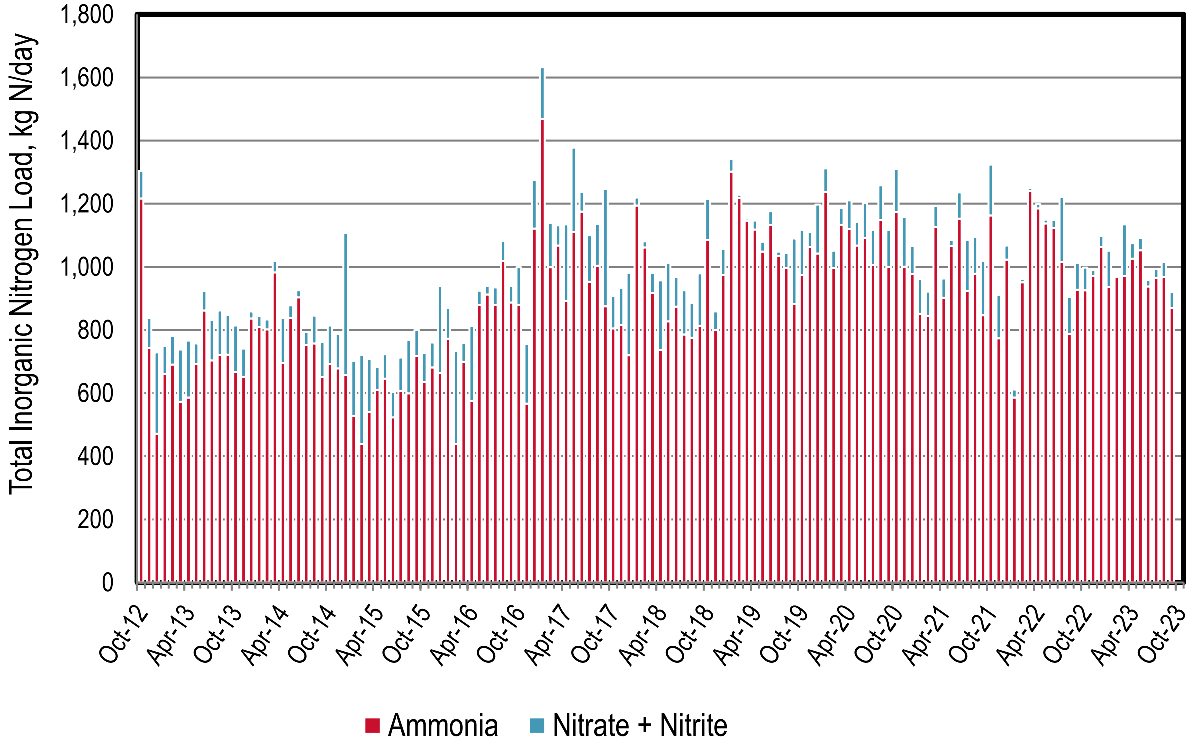

Figure 5-2. Discharge: CMSA Monthly Nitrogen Loads

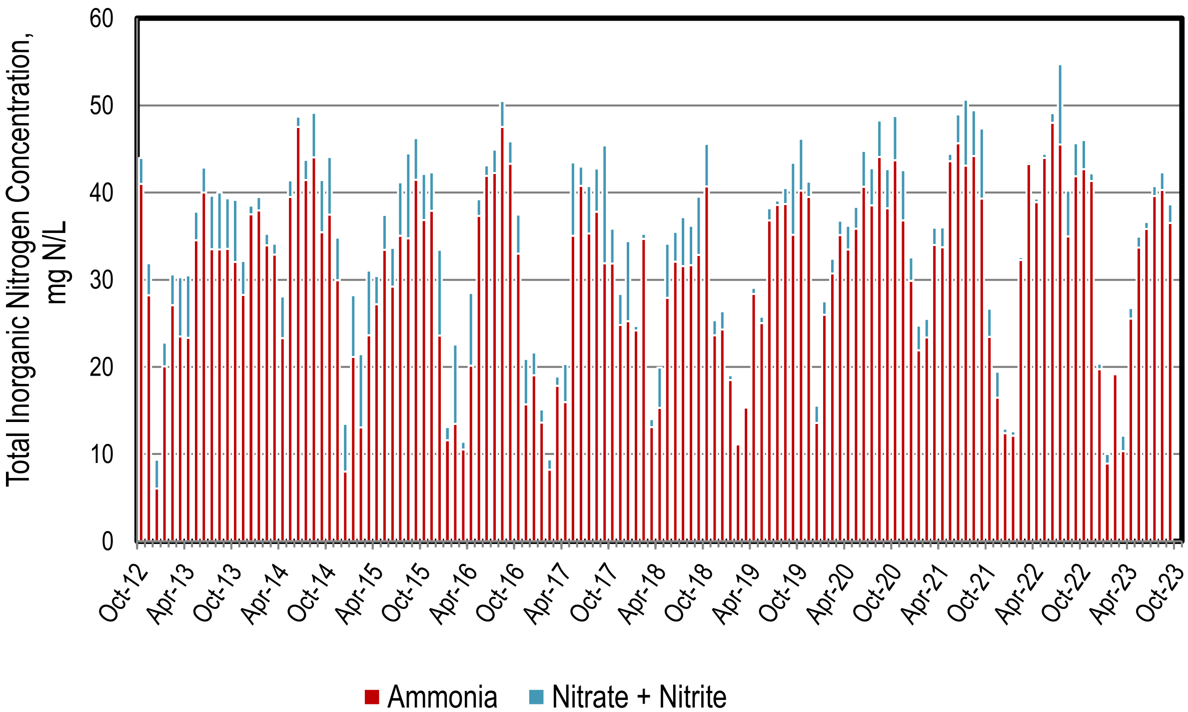

Figure 5-3. Discharge: CMSA Monthly Nitrogen Concentrations

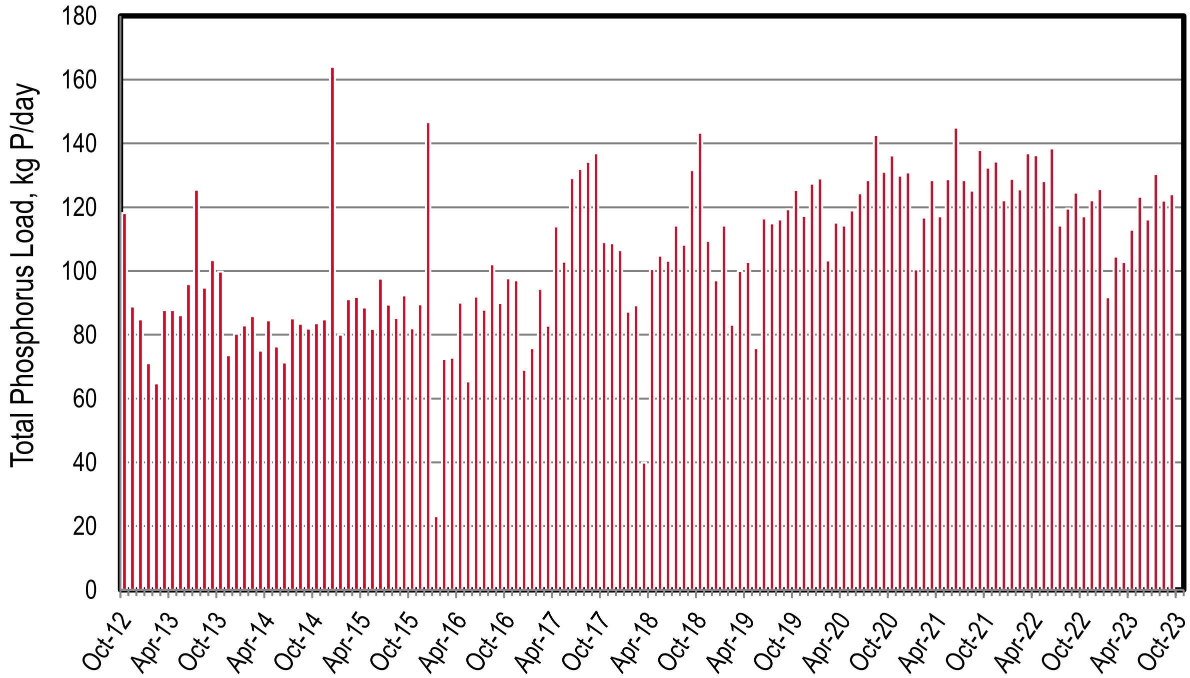

Figure 5-4. Discharge: CMSA Monthly Phosphorus Loads

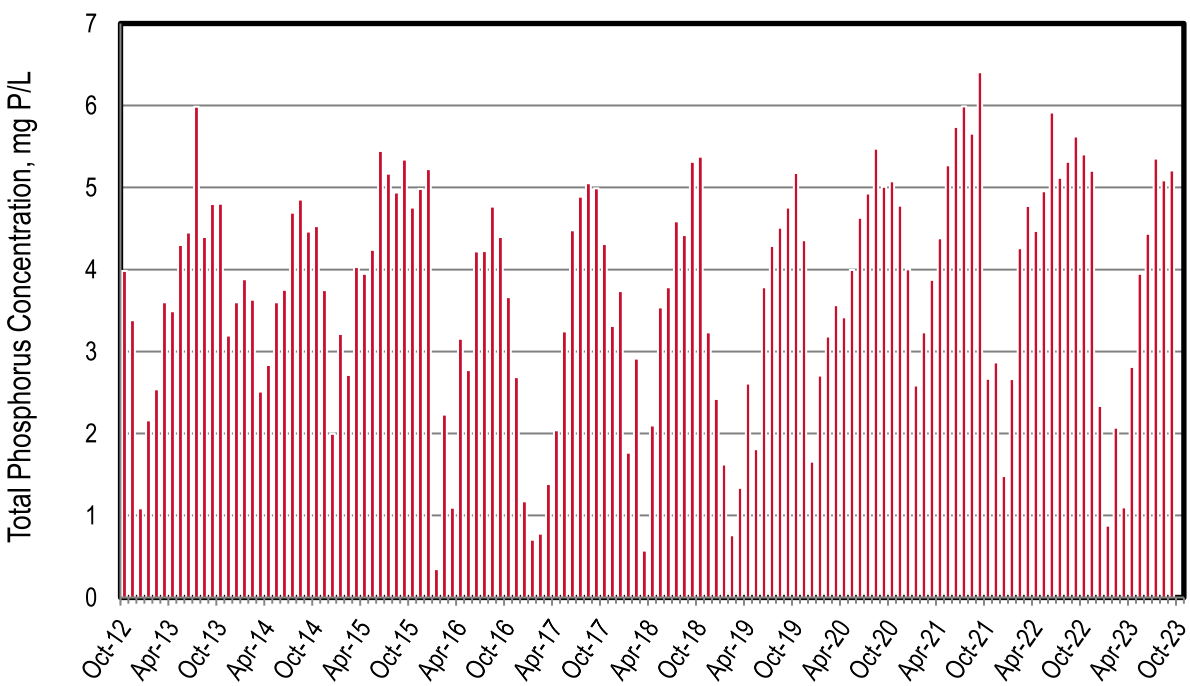

Figure 5-5. Discharge: CMSA Monthly Phosphorus Concentrations

Table 5-1. Discharge: CMSA Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	7.85	1,220	87.5	1,300	118
Nov-12	6.95	742	96.3	838	88.9
Dec-12	20.7	471	258	729	84.9
Jan-13	8.70	660	89.3	749	71.1
Feb-13	6.75	691	90.2	781	64.8
Mar-13	6.45	573	165	738	87.7
Apr-13	6.65	586	180	767	87.8
May-13	5.30	692	65.2	757	86.1
Jun-13	5.70	862	61.6	923	95.9
Jul-13	5.55	703	128	831	126
Aug-13	5.70	721	140	862	94.8
Sep-13	5.70	722	125	847	103
Oct-13	5.50	666	148	814	99.8
Nov-13	6.10	652	89.5	741	73.7
Dec-13	5.90	836	22.4	859	80.3
Jan-14	5.65	810	32.8	843	82.9
Feb-14	6.25	802	31.0	833	85.8
Mar-14	7.90	982	36.5	1,020	75.0
Apr-14	7.90	695	143	838	84.6
May-14	5.61	838	40.6	878	76.3
Jun-14	5.03	903	22.6	926	71.3
Jul-14	4.80	752	41.9	794	85.1
Aug-14	4.55	757	87.6	845	83.4
Sep-14	4.86	651	110	761	82.0
Oct-14	4.89	692	122	814	83.7
Nov-14	5.99	678	110	788	84.9
Dec-14	21.7	658	449	1,110	164
Jan-15	6.59	527	176	703	80.1
Feb-15	8.89	439	283	721	91.2
Mar-15	6.03	539	169	708	91.9
Apr-15	5.93	610	72.4	682	88.5
May-15	5.11	645	77.0	722	81.9
Jun-15	4.74	524	79.5	603	97.6
Jul-15	4.58	607	106	713	89.5
Aug-15	4.57	600	168	768	85.2
Sep-15	4.58	718	82.6	800	92.4

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	4.56	636	91.4	727	82.1
Nov-15	4.76	681	79.6	761	89.6
Dec-15	7.43	663	277	939	147
Jan-16	17.6	772	98.1	870	23.1
Feb-16	8.59	438	296	733	72.4
Mar-16	17.6	700	58.8	758	72.8
Apr-16	7.55	575	238	813	90.1
May-16	6.24	880	45.1	925	65.4
Jun-16	5.76	913	26.8	940	92.0
Jul-16	5.51	879	55.7	935	87.9
Aug-16	5.67	1,020	63.8	1,080	102
Sep-16	5.42	887	52.5	939	90.0
Oct-16	7.05	880	120	999	97.7
Nov-16	9.56	567	189	756	97.1
Dec-16	15.6	1,120	154	1,280	69.0
Jan-17	28.6	1,470	163	1,630	75.8
Feb-17	32.1	999	141	1,140	94.4
Mar-17	15.8	1,070	63.7	1,130	82.8
Apr-17	14.8	892	243	1,130	114
May-17	8.39	1,110	267	1,380	103
Jun-17	7.62	1,170	63.5	1,240	129
Jul-17	7.15	953	147	1,100	132
Aug-17	7.03	1,000	132	1,140	134
Sep-17	7.26	875	371	1,250	137
Oct-17	6.69	805	102	907	109
Nov-17	8.69	816	117	932	109
Dec-17	7.54	720	261	982	107
Jan-18	13.1	1,190	25.5	1,220	87.3
Feb-18	8.10	1,060	18.6	1,080	89.2
Mar-18	18.5	916	64.3	981	39.9
Apr-18	12.7	736	222	957	101
May-18	7.84	828	184	1,010	105
Jun-18	7.21	874	93.3	967	103
Jul-18	6.59	786	139	926	114
Aug-18	6.48	776	110	886	108
Sep-18	6.55	813	166	979	132
Oct-18	7.06	1,090	131	1,220	143

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	8.96	800	58.5	859	109
Dec-18	10.6	974	83.3	1,060	97.1
Jan-19	18.6	1,300	39.5	1,340	114
Feb-19	28.9	1,220	11.3	1,230	83.1
Mar-19	19.8	1,150	7.27	1,150	100.0
Apr-19	10.4	1,120	28.4	1,150	103
May-19	11.1	1,050	31.0	1,080	75.8
Jun-19	8.14	1,130	43.4	1,180	116
Jul-19	7.10	1,030	13.4	1,050	115
Aug-19	6.82	997	47.5	1,040	116
Sep-19	6.64	882	207	1,090	119
Oct-19	6.40	974	144	1,120	125
Nov-19	7.12	1,060	47.6	1,110	117
Dec-19	20.3	1,040	155	1,200	127
Jan-20	12.6	1,240	73.8	1,310	129
Feb-20	8.59	997	54.5	1,050	103
Mar-20	8.54	1,130	53.4	1,190	115
Apr-20	8.85	1,120	91.6	1,210	114
May-20	7.88	1,070	74.6	1,140	119
Jun-20	7.10	1,090	110	1,200	124
Jul-20	6.90	1,010	111	1,120	129
Aug-20	6.89	1,150	109	1,260	143
Sep-20	6.93	1,000	118	1,120	131
Oct-20	7.10	1,170	137	1,310	136
Nov-20	7.19	1,000	157	1,160	130
Dec-20	8.66	977	88.1	1,070	131
Jan-21	10.3	852	110	961	100
Feb-21	9.56	844	77.6	922	117
Mar-21	8.77	1,130	65.7	1,190	128
Apr-21	7.08	902	60.7	950	117
May-21	6.47	1,070	20.6	1,090	129
Jun-21	6.68	1,150	83.4	1,240	145
Jul-21	5.67	924	163	1,090	128
Aug-21	5.86	979	116	1,090	125
Sep-21	5.70	847	172	1,020	138
Oct-21	13.1	1,160	161	942	132
Nov-21	12.4	773	138	912	134

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	21.8	1,020	44.4	1,070	122
Jan-22	12.8	586	24.6	611	129
Feb-22	7.80	951	9.65	961	126
Mar-22	7.59	1,240	7.39	1,250	137
Apr-22	8.06	1,190	12.9	1,200	136
May-22	6.84	1,140	12.0	1,150	128
Jun-22	6.19	1,120	25.8	1,150	138
Jul-22	5.90	1,020	205	1,220	114
Aug-22	5.95	787	118	906	120
Sep-22	5.86	928	84.0	1,010	125
Oct-22	5.73	926	72.1	998	117
Nov-22	6.21	970	20.4	991	122
Dec-22	14.2	1,060	34.9	1,090	126
Jan-23	27.8	936	116	954	91.8
Feb-23	13.3	967	58.1	1,030	104
Mar-23	24.8	970	164	1,130	103
Apr-23	10.6	1,030	48.3	1,070	113
May-23	8.26	1,050	38.3	1,090	123
Jun-23	6.93	938	21.5	959	116
Jul-23	6.45	965	27.6	993	130
Aug-23	6.35	968	48.4	1,020	122
Sep-23	6.30	870	50.8	922	124
Dry Season Average	**6.33**	**902**	**96.4**	**999**	**111**
Dry Season Trend**	**Up**	**Up**	**None**	**Up**	**Up**
Wet Season Average	**11.1**	**884**	**110**	**988**	**102**
Average Annual	**9.14**	**892**	**104**	**992**	**106**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

Table 5-2. Recycled Water: CMSA Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	26 (0.02)	--	--***	--	--	--***	26 (0.02)
2020	--	29 (0.03)	--	--***	--	--	--***	29 (0.03)
2021	--	25 (0.02)	--	--***	--	--	--***	25 (0.02)
2022	--	25 (0.02)	--	--***	--	--	--**	25 (0.02)
Average	--	27 (0.02)	--	--***	--	--	--***	26 (0.02)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** CMSA has a recycled water Industrial Application user (averages approximately 1,180 AF per year (1.05 mgd)) and an Other Non-Potable Uses" user (averages approximately 2 AF per year (<0.01 mgd)). In both applications, the flows are not diverted from the Bay and thus not included as part of this effort.**

Table 5-3. Recycled Water: CMSA Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	2	--	--***	--	--	--***	2
2020	--	4	--	--***	--	--	--***	4
2021	--	2	--	--***	--	--	--***	2
2022	--	3	--	--***	--	--	--***	3
Average	--	3	--	--***	--	--	--***	3

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** CMSA has a recycled water Industrial Application user (averages approximately 127 kg N/d) and an Other Non-Potable Uses" user (averages approximately <1 kg N/d). In both applications, the loads are not diverted from the Bay and thus not included as part of this effort.**

Table 5-4. Recycled Water: CMSA Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	2	--	--***	--	--	--***	2
2020	--	4	--	--***	--	--	--***	4
2021	--	2	--	--***	--	--	--***	2
2022	--	3	--	--***	--	--	--***	3
Average	--	3	--	--***	--	--	--***	3

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** CMSA has a recycled water Industrial Application user (averages approximately 138 kg N/d) and an Other Non-Potable Uses" user (averages approximately <1 kg N/d). In both applications, the loads are not diverted from the Bay and thus not included as part of this effort.**

Table 5-5. Recycled Water: CMSA Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	--***	--	--	--***	<1
2020	--	<1	--	--***	--	--	--***	<1
2021	--	<1	--	--***	--	--	--***	<1
2022	--	<1	--	--***	--	--	--***	<1
Average	--	<1	--	--***	--	--	--***	<1

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** CMSA has a recycled water Industrial Application user (averages approximately 15 kg P/d) and an Other Non-Potable Uses" user (averages approximately <1 kg P/d). In both applications, the loads are not diverted from the Bay and thus not included as part of this effort.**

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6 Crockett Community Services District - Port Costa

The Crockett Community Services District serves two distinct separate communities, the town of Crockett and the town of Port Costa, each with their own treatment plant facilities. The Crockett Sanitary Department is excluded from the requirements of the Nutrient NPDES Order No. R2-2014-0014 as it shares use of an industrial wastewater treatment plant with C&H Sugar which has submitted its own sampling plan. The town of Port Costa has its own municipal wastewater treatment plant which is covered under the Nutrient NPDES Order. This analysis focuses on Port Costa.

The Community of Port Costa uses the Port Costa Wastewater Treatment Plant to discharge to the Carquinez Straight, which is connected to San Pablo Bay. The service area population is approximately 250 people. The plant has a permitted ADWF capacity of 0.033 mgd. This past dry season average discharge flow was approximately 0.024 mgd. The plant performs secondary treatment using a septic tank for solids separation, followed by filtration and disinfection.

Port Costa was exempt from the Section 13267 Letter sampling requirements due to their permitted capacity flow (<1 mgd). The following observations are made based upon the available data presented in figures and table in the subsequent pages:

- Discharge
  - The dataset is limited to flow, ammonia a few times per year, and most recently occasional TIN and TP samples.
  - Ammonia loads typically increase with flow during wet weather events. There is insufficient TIN and TP data to comment on trends.
  - Based on Table 6-1's statistics for the entire dry season dataset, dry season flows and ammonia loads over the entire dataset are trending upwards.
- Recycled Water: No recycled water was produced or distributed this past year.

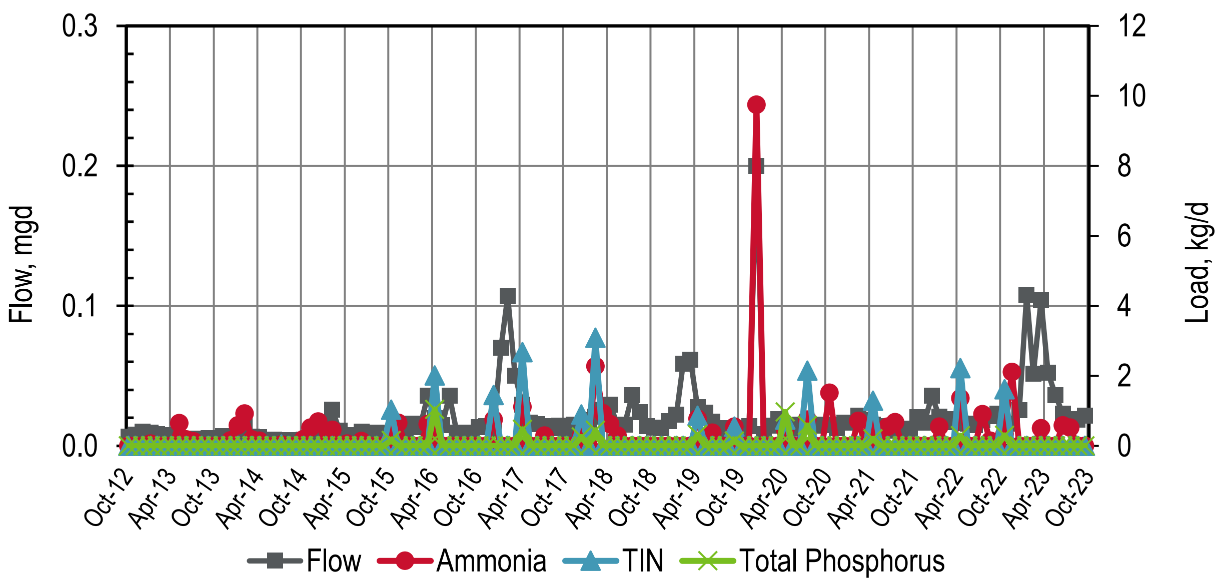

Figure 6-1. Discharge: Port Costa Monthly Flows and Loads

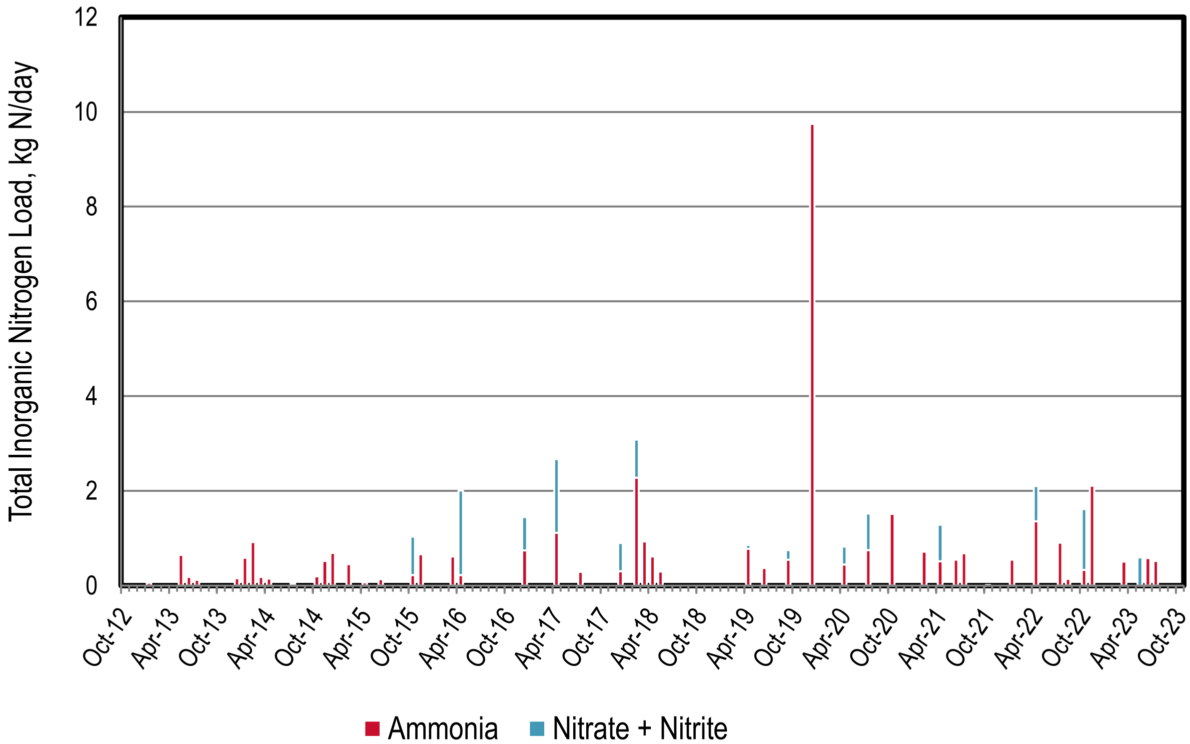

Figure 6-2. Discharge: Port Costa Monthly Ammonia Loads

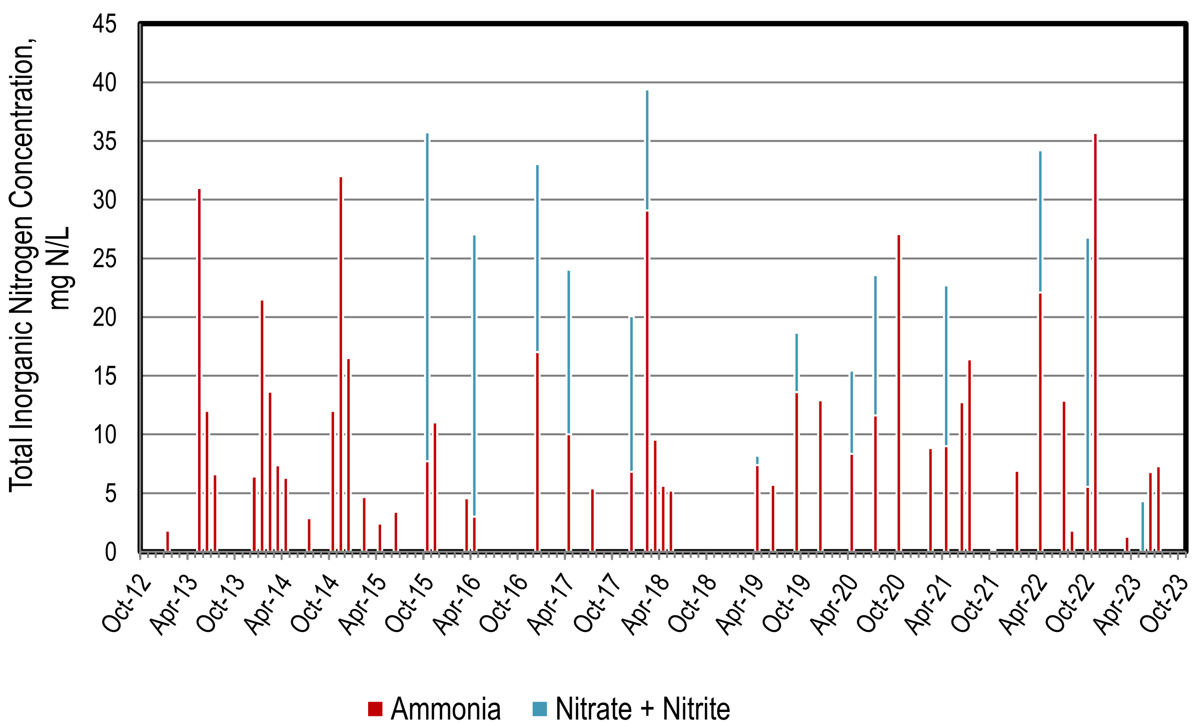

Figure 6-3. Discharge: Port Costa Monthly Ammonia Concentrations

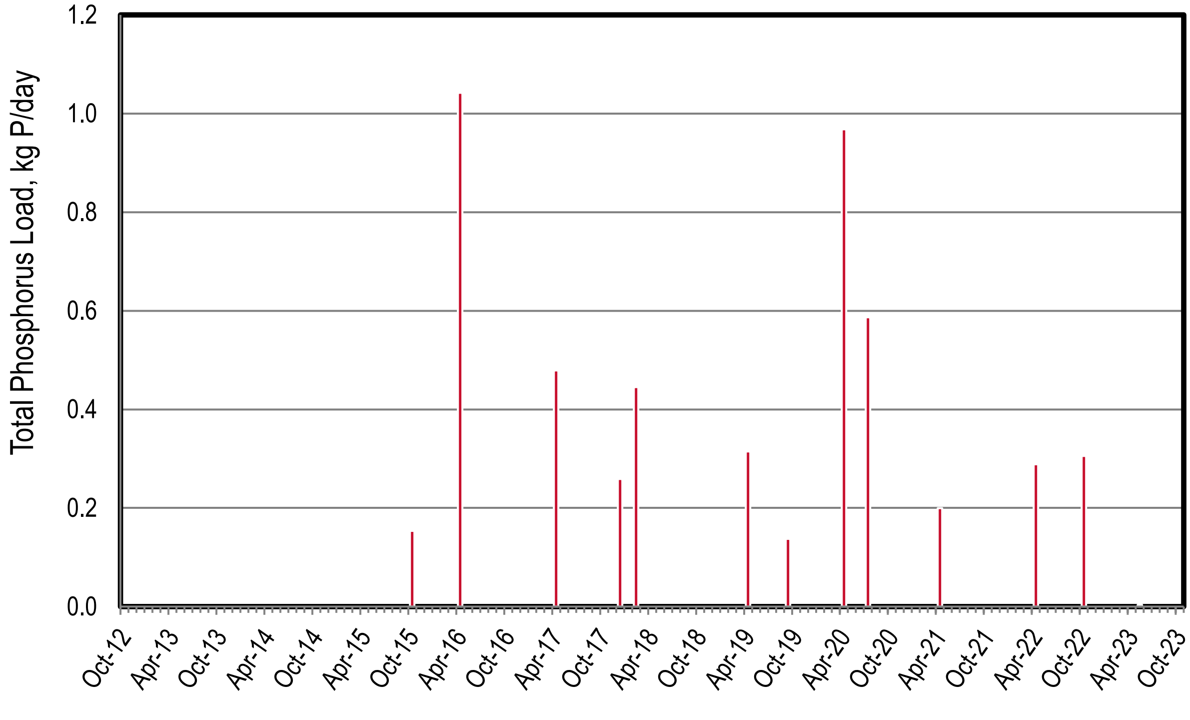

Figure 6-4. Discharge: Port Costa Monthly Phosphorus Loads

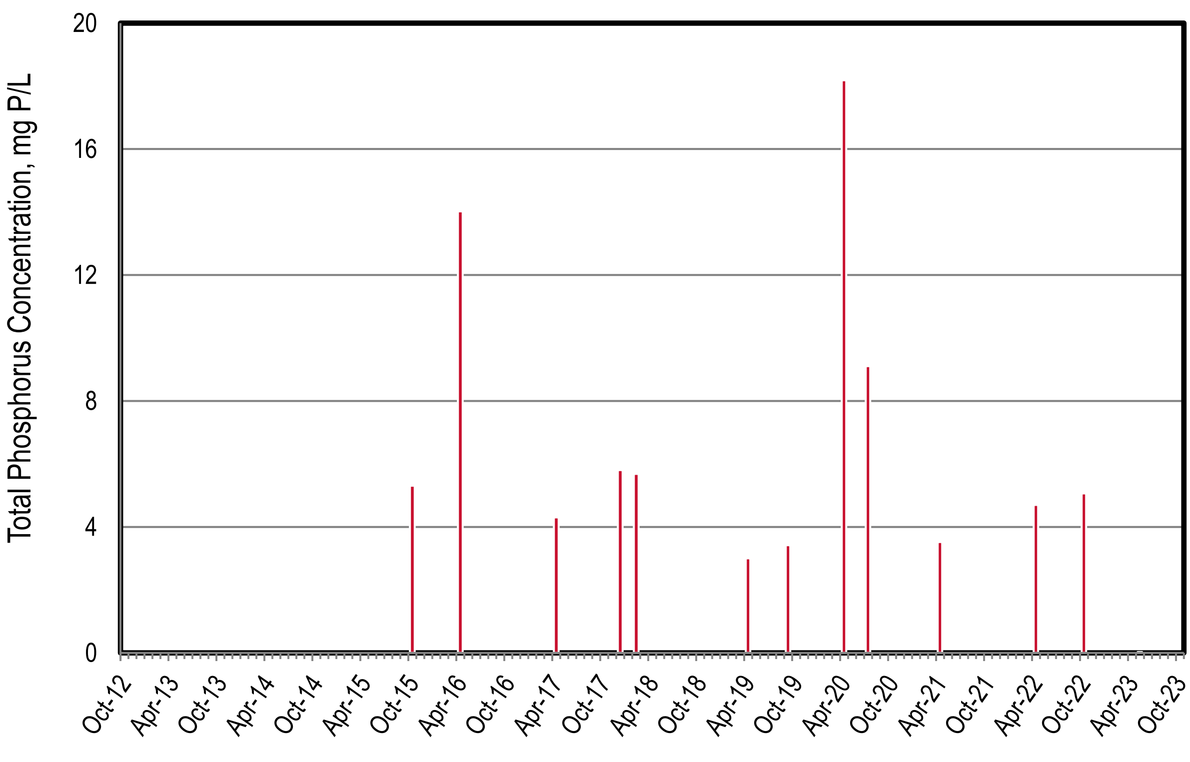

Figure 6-5. Discharge: Port Costa Monthly Phosphorus Concentrations

Table 6-1. Discharge: Port Costa Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.00640	--	--	--	--
Nov-12	0.00795	--	--	--	--
Dec-12	0.0103	--	--	--	--
Jan-13	0.00934	0.0636	--	--	--
Feb-13	0.00855	--	--	--	--
Mar-13	0.00780	--	--	--	--
Apr-13	0.00680	--	--	--	--
May-13	0.00555	0.650	--	--	--
Jun-13	0.00405	0.184	--	--	--
Jul-13	0.00497	0.124	--	--	--
Aug-13	0.00483	--	--	--	--
Sep-13	0.00538	--	--	--	--
Oct-13	0.00473	--	--	--	--
Nov-13	0.00688	--	--	--	--
Dec-13	0.00631	0.153	--	--	--
Jan-14	0.00720	0.585	--	--	--
Feb-14	0.0179	0.920	--	--	--
Mar-14	0.00644	0.179	--	--	--
Apr-14	0.00622	0.148	--	--	--
May-14	0.00409	--	--	--	--
Jun-14	0.00456	--	--	--	--
Jul-14	0.00354	0.0381	--	0.0381	--
Aug-14	0.00419	--	--	--	--
Sep-14	0.00361	--	--	--	--
Oct-14	0.00430	0.195	--	--	--
Nov-14	0.00433	0.524	--	--	--
Dec-14	0.0111	0.691	--	--	--
Jan-15	0.0153	--	--	--	--
Feb-15	0.0259	0.455	--	--	--
Mar-15	0.0108	--	--	--	--
Apr-15	0.00747	0.0678	--	--	--
May-15	0.00695	--	--	--	--
Jun-15	0.0103	0.133	--	--	--
Jul-15	0.00829	--	--	--	--
Aug-15	0.00941	--	--	--	--
Sep-15	0.00838	--	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.00765	0.223	0.810	1.03	0.153
Nov-15	0.0159	0.660	--	--	--
Dec-15	0.0118	--	--	--	--
Jan-16	0.0159	--	--	--	--
Feb-16	0.0133	--	--	--	--
Mar-16	0.0359	0.618	--	--	--
Apr-16	0.0197	0.223	1.79	2.01	1.04
May-16	0.0147	--	--	--	--
Jun-16	0.0359	--	--	--	--
Jul-16	0.00966	--	--	--	--
Aug-16	0.00964	--	--	--	--
Sep-16	0.00859	--	--	--	--
Oct-16	0.0132	--	--	--	--
Nov-16	0.0142	--	--	--	--
Dec-16	0.0116	0.746	0.702	1.45	
Jan-17	0.0702	--	--	--	--
Feb-17	0.107	--	--	--	--
Mar-17	0.0503	--	--	--	--
Apr-17	0.0294	1.11	1.56	2.67	0.479
May-17	0.0166	--	--	--	--
Jun-17	0.0156	--	--	--	--
Jul-17	0.0142	0.290	--	--	--
Aug-17	0.0127	--	--	--	--
Sep-17	0.0143	--	--	--	--
Oct-17	0.0117	--	--	--	--
Nov-17	0.0151	--	--	--	--
Dec-17	0.0118	0.304	0.591	0.896	0.259
Jan-18	0.0182	--	--	--	--
Feb-18	0.0207	2.28	0.808	3.09	0.445
Mar-18	0.0258	0.932	--	--	--
Apr-18	0.0292	0.618	--	--	--
May-18	0.0151	0.296	--	--	--
Jun-18	0.0150	--	--	--	--
Jul-18	0.0361	--	--	--	--
Aug-18	0.0242	--	--	--	--
Sep-18	0.0138	--	--	--	--
Oct-18	0.0131	--	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0.0127	--	--	--	--
Dec-18	0.0176	--	--	--	--
Jan-19	0.0224	--	--	--	--
Feb-19	0.0587	--	--	--	--
Mar-19	0.0614	--	--	--	--
Apr-19	0.0277	0.775	0.0824	0.858	0.315
May-19	0.0237	--	--	--	--
Jun-19	0.0174	0.374	--	--	--
Jul-19	0.0128	--	--	--	--
Aug-19	0.0100	--	--	--	--
Sep-19	0.0106	0.547	0.203	0.552	0.138
Oct-19	0.0110	--	--	--	--
Nov-19	0.0141	--	--	--	--
Dec-19	0.200	9.75	--	--	--
Jan-20	0.00847	--	--	--	--
Feb-20	0.0144	--	--	--	--
Mar-20	0.0193	--	--	--	--
Apr-20	0.0141	0.444	0.378	0.746	0.968
May-20	0.0123	--	--	--	--
Jun-20	0.0152	--	--	--	--
Jul-20	0.0170	0.749	0.769	2.15	0.587
Aug-20	0.0144	--	--	--	--
Sep-20	0.0155	--	--	--	--
Oct-20	0.0148	1.51	--	--	--
Nov-20	0.0127	--	--	--	--
Dec-20	0.0165	--	--	--	--
Jan-21	0.0165	--	--	--	--
Feb-21	0.0214	0.715	--	--	--
Mar-21	0.0187	--	--	--	--
Apr-21	0.0150	0.511	0.776	1.29	0.200
May-21	0.0139	--	--	--	--
Jun-21	0.0113	0.546	--	--	--
Jul-21	0.0110	0.680	--	--	--
Aug-21	0.0106	--	--	--	--
Sep-21	0.0120	--	--	--	--
Oct-21	0.0204	0.0118			
Nov-21	0.0165				

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	0.0359				
Jan-22	0.0211	0.550			
Feb-22	0.0191				
Mar-22	0.0169				
Apr-22	0.0163	1.36	0.744	2.22	0.289
May-22	0.0161				
Jun-22	0.0149				
Jul-22	0.0186	0.905			
Aug-22	0.0213	0.144			
Sep-22	0.0231				
Oct-22	0.0160	0.334	1.28	1.61	0.305
Nov-22	0.0157	2.11			
Dec-22	0.0256				
Jan-23	0.108				
Feb-23	0.0514				
Mar-23	0.104	0.506			
Apr-23	0.0520				
May-23	0.0363		0.591		0.00366
Jun-23	0.0228	0.583			
Jul-23	0.0189	0.522			
Aug-23	0.0186				
Sep-23	0.0216				
Dry Season Average	**0.0139**	**0.423**	**0.521**	**0.913**	**0.243**
Dry Season Trend **,***	**Up**	**Up**	**None**	**None**	**None**
Wet Season Average	**0.0243**	**0.917**	**0.865**	**1.62**	**0.445**
Average Annual	**0.0199**	**0.756**	**0.791**	**1.47**	**0.399**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis. There is insufficient data for a trending analysis for nutrients other than Ammonia.

*** Insufficient sampling to perform trending analysis.

Recycled Water

No recycled water was produced or distributed this past year.

7 Delta Diablo

Delta Diablo discharges to New York Slough (part of the Suisun Bay) and serves approximately 57,700 service connections throughout Antioch, Pittsburg, and Bay Point. The plant has a permitted ADWF capacity of 19.5 mgd. The average discharge flow this past dry season was approximately 8.4 mgd. The plant performs secondary treatment using trickling filters, followed by activated sludge. Secondary effluent (up to 12.8 mgd) is diverted upstream of the disinfection process and sent for tertiary treatment prior to distribution to recycled water users. Approximately 90% of the recycled water is sent to two power plants for use in their cooling towers. The blowdown from the cooling towers is returned to the secondary treatment plant, blended with secondary effluent, and disinfected prior to discharge.

The following observations on influent and discharge are made based upon the figures and tables in the subsequent pages:

- Influent:
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters. Based on this limited dataset, there is an emerging dry season upward trend for flow. None of the nutrient parameters have emerging trends.
  - The overall plant reduction in effluent flow ranges from 16 to 60 percent, depending on the quantity of water diverted to the cooling towers and other recycled water customers.
  - The nitrogen loads are reduced approximately 45 to 80 percent. This is largely attributed to a combination of biological assimilation and recycled water.
  - The total phosphorus load reductions across the plant are on the order of 80 to 95+ percent (with the exception of October 2019). This is largely attributed to chemical precipitation and removal at the plant, biological assimilation, and recycled water.
- Discharge:
  - The variability of nitrogen species in the effluent is due to the power plant cooling towers going in and out of nitrification and possible denitrification occurring sporadically. Since the summer of 2016, the predominant form of nitrogen returned with power plant blowdown has been the ammonia species due to the cessation of nitrification; however, there still appears to be unexplained reductions of TIN occurring in the cooling towers.
  - Nutrient loads typically increase with flow during wet weather events.
  - TIN concentrations are variable, ranging from 27 to 84 mg N/L. This is largely due to the variability associated with the ratio of blowdown to secondary effluent.
  - TP concentrations are generally less than 2 mg P/L, which suggests that the plant is removing phosphorus as previously noted.
  - Based on Table 7-2 statistics for the entire dry season dataset, flows and ammonia loads are trending upwards, nitrite plus nitrate and TIN loads are trending downwards, and TP loads have no trends.

- Recycled Water:
  - Based on Table 1-2, the plant averaged approximately 5.0 mgd in 2022 of recycled water that is diverted from the Bay. Users include Golf Course Irrigation, Landscape Irrigation, Commercial, and Industrial customers.
  - Based on Table 5-3 through Table 5-5, the average load diverted from the Bay in 2022 was 56 kg ammonia-N/d, 60 kg TIN-N/d, and 1 kg P/d.

Influent

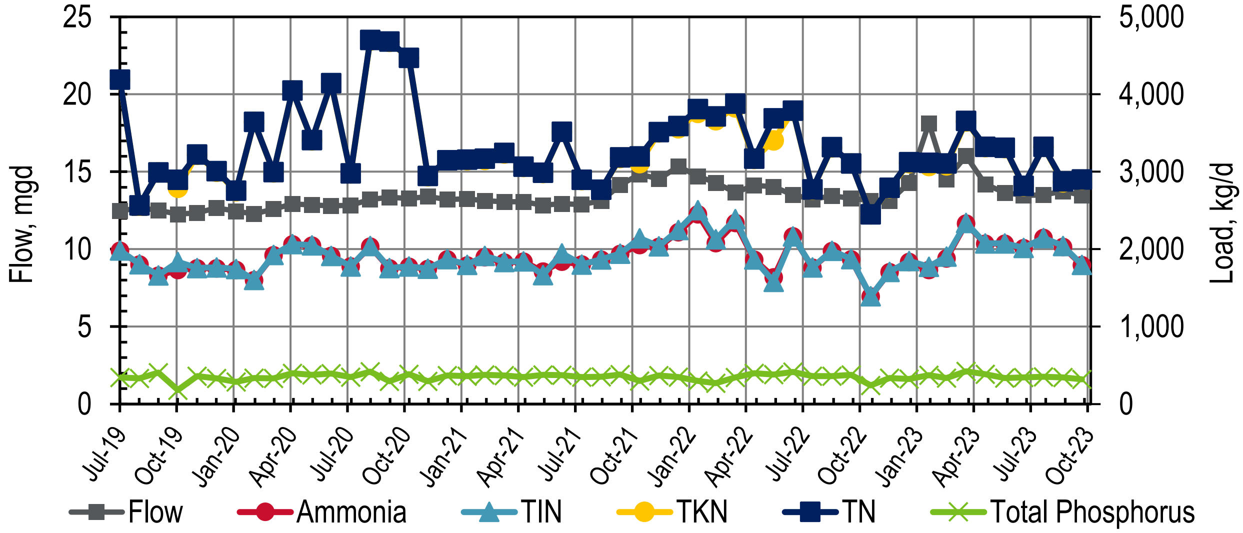

Figure 7-1. Influent: Delta Diablo Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N loads and thus are not visible.

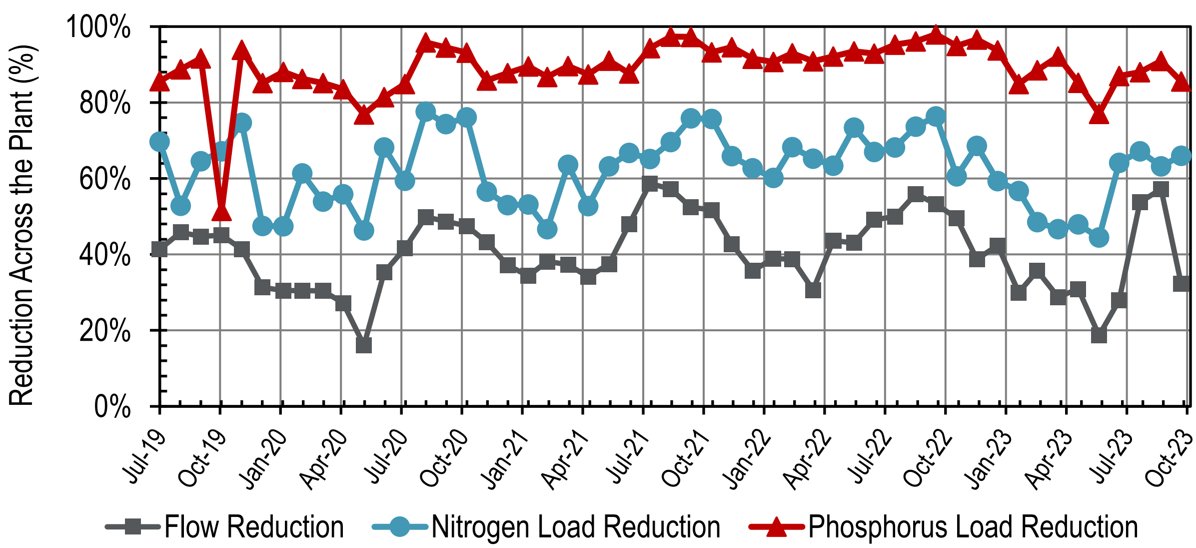

Figure 7-2. Influent: Delta Diablo Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 7-1. Influent: Delta Diablo Monthly Flows and Loads

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	12.5	1,980	3.27	1,980	4,188	4,190	344
Aug-19	12.7	1,800	3.35	1,810	2,562	2,565	333
Sep-19	12.5	1,660	2.18	1,660	2,992	2,994	407
Oct-19	12.3	1,730	106.00	1,840	2,793	2,899	182
Nov-19	12.4	1,750	4.72	1,760	3,222	3,227	362
Dec-19	12.7	1,760	9.47	1,770	3,000	3,009	334
Jan-20	12.4	1,730	9.95	1,740	2,748	2,758	289
Feb-20	12.3	1,600	2.58	1,600	3,645	3,647	335
Mar-20	12.6	1,920	3.74	1,930	2,994	2,997	334
Apr-20	12.9	2,060	2.25	2,070	4,051	4,053	401
May-20	12.9	2,050	2.31	2,050	3,407	3,408	380
Jun-20	12.8	1,910	1.90	1,920	4,144	4,145	394
Jul-20	12.8	1,780	1.92	1,780	2,981	2,982	349
Aug-20	13.2	2,040	5.42	2,040	4,698	4,702.	418
Sep-20	13.4	1,750	4.03	1,760	4,677	4,681	296
Oct-20	13.3	1,780	2.37	1,780	4,470	4,470	385
Nov-20	13.4	1,740	3.52	1,750	2,940	2,950	294
Dec-20	13.2	1,870	2.00	1,870	3,150	3,150	369
Jan-21	13.2	1,790	9.03	1,800	3,150	3,160	361
Feb-21	13.1	1,900	17.20	1,920	3,150	3,170	377
Mar-21	13.1	1,830	8.06	1,840	3,240	3,240	368
Apr-21	13.1	1,840	4.89	1,850	3,060	3,070	348
May-21	12.8	1,710	1.86	1,670	2,990	2,990	378
Jun-21	12.9	1,840	2.05	1,950	3,520	3,520	376
Jul-21	12.9	1,800	2.41	1,800	2,900	2,900	347
Aug-21	13.1	1,870	3.30	1,870	2,770	2,770	353
Sep-21	14.1	1,940	6.98	1,950	3,180	3,190	383
Oct-21	14.8	2,060	87.70	2,140	3,110	3,200	301
Nov-21	14.5	2,030	6.56	2,040	3,510	3,520	368
Dec-21	15.3	2,220	28.30	2,250	3,560	3,590	348
Jan-22	14.7	2,450	51.10	2,500	3,760	3,810	301
Feb-22	14.3	2,080	48.30	2,130	3,670	3,720	272
Mar-22	13.7	2,340	48.90	2,390	3,830	3,880	343
Apr-22	14.1	1,870	3.72	1,870	3,170	3,170	398
May-22	14.0	1,640	2.95	1,580	3,410	3,690	381

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jun-22	13.5	2,170	2.88	2,170	3,790	3,790	417
Jul-22	13.2	1,760	4.63	1,770	2,770	2,770	362
Aug-22	13.4	1,980	2.27	1,980	3,320	3,320	363
Sep-22	13.3	1,870	3.67	1,870	3,110	3,110	376
Oct-22	13.1	1,390	1.81	1,390	2,450	2,450	243
Nov-22	13.1	1,700	2.93	1,710	2,790	2,790	338
Dec-22	14.3	1,840	11.50	1,850	3,110	3,120	324
Jan-23	18.1	1,730	40.50	1,770	3,080	3,120	372
Feb-23	14.5	1,880	23.30	1,910	3,090	3,110	338
Mar-23	16.0	2,330	8.53	2,340	3,650	3,660	424
Apr-23	14.2	2,070	2.96	2,070	3,320	3,320	387
May-23	13.7	2,070	3.21	2,080	3,310	3,310	338
Jun-23	13.5	2,020	2.66	2,020	2,820	2,820	346
Jul-23	13.5	2,150	1.02	2,150	3,320	3,320	353
Aug-23	13.7	2,030	13.40	2,040	2,870	2,880	345
Sep-23	13.5	1,790	4.03	1,800	2,900	2,900	320
Dry Season Average	**13.2**	**1,900**	**3.55**	**1,900**	**3,330**	**3,350**	**363**
Dry Season Trend * **	**Up**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**13.7**	**1,900**	**19.7**	**1,920**	**3,280**	**3,300**	**339**
Average Annual	**13.5**	**1,900**	**12.4**	**1,910**	**3,300**	**3,320**	**350**

* Delta Diablo typically samples more than the required influent quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

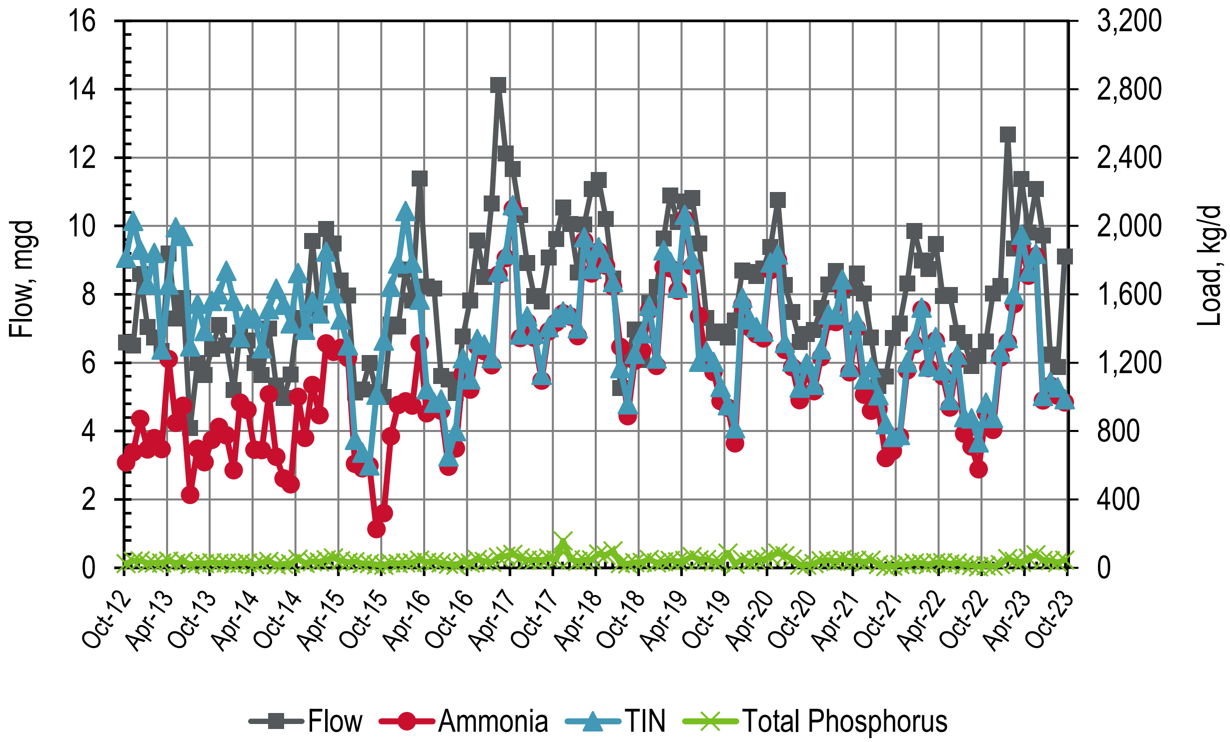

Figure 7-3. Discharge: Delta Diablo Monthly Flows and Loads

Table 7-2. Discharge: Delta Diablo Monthly Flows and Loads

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	6.60	618	1,200.0	1,820	24.9
Nov-12	6.50	677	1,350.0	2,030	40.9
Dec-12	8.60	872	991.0	1,860	43.2
Jan-13	7.05	694	967.0	1,660	27.2
Feb-13	6.73	760	1,080.0	1,840	29.7
Mar-13	6.35	697	582.0	1,280	28.7
Apr-13	9.20	1,220	437.0	1,660	40.2
May-13	7.30	850	1,140.0	1,990	27.6
Jun-13	7.90	948	995.0	1,940	39.4
Jul-13	4.10	429	868.0	1,300	20.1
Aug-13	6.00	697	850.0	1,550	26.7
Sep-13	5.65	619	767.0	1,390	24.7
Oct-13	6.40	750	812.0	1,560	31.5
Nov-13	7.10	824	778.0	1,600	28.3
Dec-13	6.50	776	963.0	1,740	28.9
Jan-14	5.20	573	990.0	1,560	22.5
Feb-14	6.90	966	385.0	1,350	27.8
Mar-14	6.67	925	559.0	1,480	29.6
Apr-14	6.00	693	767.0	1,460	20.8
May-14	5.65	690	596.0	1,290	31.8
Jun-14	7.00	1,020	498.0	1,510	38.0
Jul-14	5.34	651	982.0	1,630	19.0
Aug-14	4.97	524	1,020.0	1,540	21.5
Sep-14	5.66	490	942.0	1,430	25.7
Oct-14	7.32	1,000	725.0	1,730	52.7
Nov-14	6.94	761	633.0	1,390	28.4
Dec-14	9.56	1,070	488.0	1,560	36.8
Jan-15	7.44	894	595.0	1,490	35.9
Feb-15	9.91	1,310	538.0	1,850	47.3
Mar-15	9.50	1,270	341.0	1,610	58.8
Apr-15	8.40	1,290	167.0	1,450	41.9
May-15	7.97	1,230	73.8	1,300	33.0
Jun-15	5.13	609	142.0	751	36.8
Jul-15	5.22	583	92.7	676	25.4
Aug-15	6.00	599	1.4	601	26.2
Sep-15	5.15	228	787.0	1,010	17.6

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	4.99	322	1,010.0	1,330	16.2
Nov-15	7.13	771	875.0	1,650	28.6
Dec-15	7.07	954	828.0	1,780	25.7
Jan-16	8.73	975	1,110.0	2,090	29.0
Feb-16	7.83	951	834.0	1,780	31.8
Mar-16	11.40	1,310	256.0	1,570	47.0
Apr-16	8.23	905	141.0	1,050	33.6
May-16	8.18	940	28.2	968	37.2
Jun-16	5.62	921	64.4	985	29.1
Jul-16	5.51	593	59.9	653	21.6
Aug-16	5.11	699	102.0	801	16.2
Sep-16	6.76	1,140	89.9	1,230	36.4
Oct-16	7.83	1,040	60.0	1,100	30.2
Nov-16	9.59	1,300	43.5	1,340	49.5
Dec-16	8.50	1,270	36.7	1,310	37.9
Jan-17	10.70	1,190	41.1	1,230	33.5
Feb-17	14.10	1,720	18.9	1,730	62.4
Mar-17	12.10	1,810	22.5	1,840	68.4
Apr-17	11.70	2,100	19.5	2,120	80.2
May-17	10.30	1,350	19.5	1,370	59.6
Jun-17	8.92	1,440	34.7	1,470	45.8
Jul-17	7.95	1,350	22.1	1,370	47.0
Aug-17	7.79	1,100	34.7	1,130	44.8
Sep-17	9.07	1,380	23.8	1,410	58.1
Oct-17	9.63	1,440	32.0	1,470	48.5
Nov-17	10.60	1,490	11.1	1,500	158.0
Dec-17	10.10	1,470	12.8	1,480	50.6
Jan-18	8.64	1,360	45.8	1,400	39.6
Feb-18	10.00	1,910	21.7	1,940	45.3
Mar-18	11.10	1,720	26.3	1,750	47.6
Apr-18	11.40	1,850	23.6	1,880	81.8
May-18	10.20	1,770	17.6	1,790	75.1
Jun-18	8.47	1,650	25.6	1,670	101.0
Jul-18	5.27	1,290	82.6	1,170	25.4
Aug-18	6.24	888	69.2	957	23.6
Sep-18	6.98	1,210	40.8	1,250	30.6
Oct-18	6.08	1,270	104.0	1,370	33.8

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	7.76	1,510	26.2	1,530	50.3
Dec-18	8.23	1,180	43.2	1,230	28.7
Jan-19	9.64	1,760	71.9	1,860	37.7
Feb-19	10.90	1,750	36.2	1,790	44.6
Mar-19	10.10	1,620	16.6	1,640	37.5
Apr-19	10.70	2,040	25.3	2,070	43.6
May-19	10.80	1,760	27.8	1,810	66.3
Jun-19	9.49	1,480	25.0	1,210	48.0
Jul-19	7.31	1,210	61.8	1,270	49.3
Aug-19	6.87	1,150	58.2	1,210	37.4
Sep-19	6.91	977	82.2	1,060	34.0
Oct-19	6.74	938	13.6	952	88.1
Nov-19	7.24	730	86.9	817	22.0
Dec-19	8.71	1,540	42.7	1,580	49.6
Jan-20	8.65	1,410	46.7	1,450	34.3
Feb-20	8.54	1,370	42.0	1,410	46.1
Mar-20	8.77	1,340	39.3	1,380	49.8
Apr-20	9.40	1,740	44.8	1,790	66.0
May-20	10.80	1,800	33.2	1,830	87.8
Jun-20	8.28	1,280	41.3	1,320	73.3
Jul-20	7.50	1,170	35.2	1,210	52.7
Aug-20	6.62	982	72.9	1,050	17.2
Sep-20	6.91	1,140	54.5	1,200	16.3
Oct-20	6.96	1,030	37.6	1,070	26.4
Nov-20	7.61	1,230	48.3	1,280	41.8
Dec-20	8.30	1,440	40.4	1,480	45.1
Jan-21	8.69	1,440	43.3	1,480	37.9
Feb-21	8.12	1,640	44.8	1,690	50.1
Mar-21	8.19	1,150	31.5	1,180	38.2
Apr-21	8.61	1,400	42.1	1,450	43.8
May-21	8.03	1,010	34.0	1,100	33.8
Jun-21	6.74	921	142.0	1,170	46.4
Jul-21	5.32	930	79.7	1,010	19.8
Aug-21	5.61	644	197.0	841	9.4
Sep-21	6.73	685	82.4	768	10.4
Oct-21	7.16	769	9.7	778	20.4
Nov-21	8.33	1,160	47.3	1,200	20.0

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	9.87	1,310	27.6	1,340	29.5
Jan-22	8.99	1,510	10.7	1,520	27.9
Feb-22	8.75	1,170	9.9	1,180	19.2
Mar-22	9.48	1,330	21.6	1,350	31.4
Apr-22	7.96	1,120	33.2	1,160	31.4
May-22	7.99	940	41.9	982	24.7
Jun-22	6.87	1,220	31.3	1,250	29.5
Jul-22	6.62	786	105.0	882	17.3
Aug-22	5.91	711	164.0	875	14.2
Sep-22	6.21	578	157.0	734	7.7
Oct-22	6.62	907	59.3	967	12.3
Nov-22	8.03	809	68.3	877	11.4
Dec-22	8.24	1,230	34.7	1,270	20.3
Jan-23	12.70	1,320	26.4	1,350	56.1
Feb-23	9.34	1,540	57.6	1,600	38.8
Mar-23	11.40	1,880	68.2	1,950	33.3
Apr-23	9.81	1,710	24.7	1,730	57.1
May-23	11.10	1,820	16.5	1,840	77.6
Jun-23	9.72	980	25.8	1,010	45.0
Jul-23	6.24	1,070	24.1	1,090	42.3
Aug-23	5.88	1,010	48.3	1,060	31.2
Sep-23	9.11	969	19.8	988	46.3
Dry Season Average	**7.11**	**1,000**	**221**	**1,220**	**36.4**
Dry Season Trend * **	**Up**	**Up**	**Down**	**Down**	**None**
Wet Season Average	**8.58**	**1,220**	**289**	**1,510**	**40.2**
Average Annual	**7.97**	**1,130**	**260**	**1,390**	**38.6**

* Delta Diablo typically samples each month more than the required frequency for ammonia. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

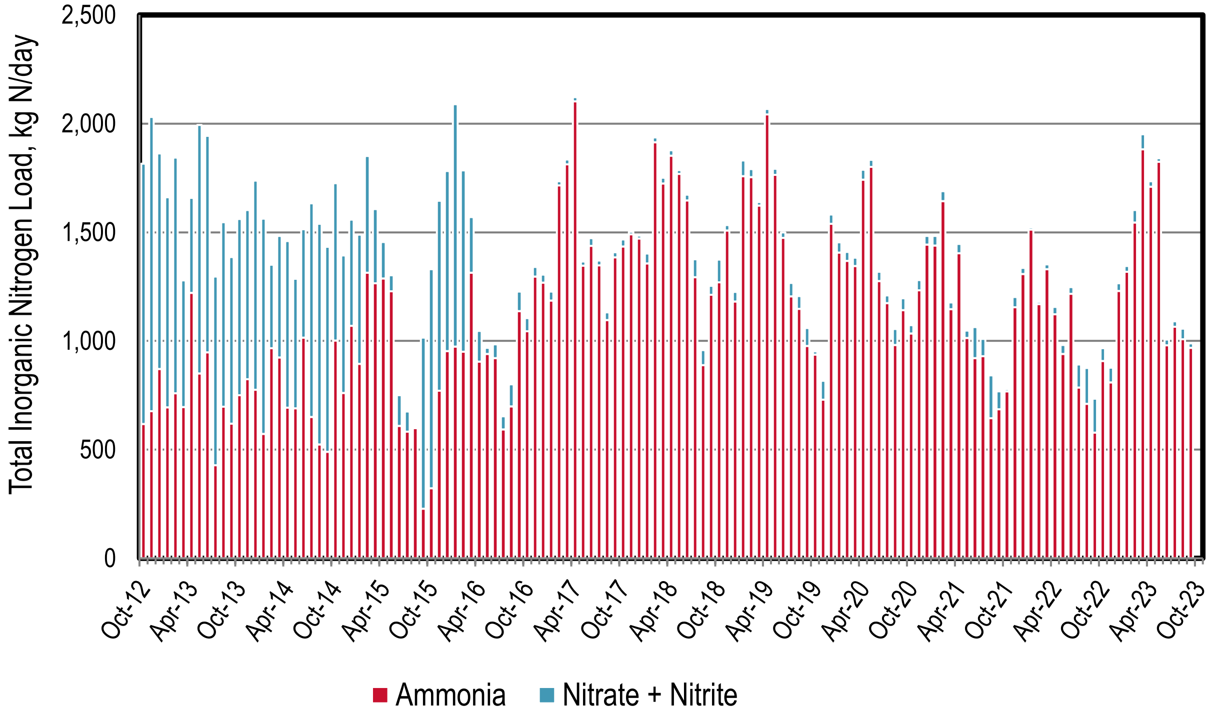

Figure 7-4. Discharge: Delta Diablo Monthly Nitrogen Loads

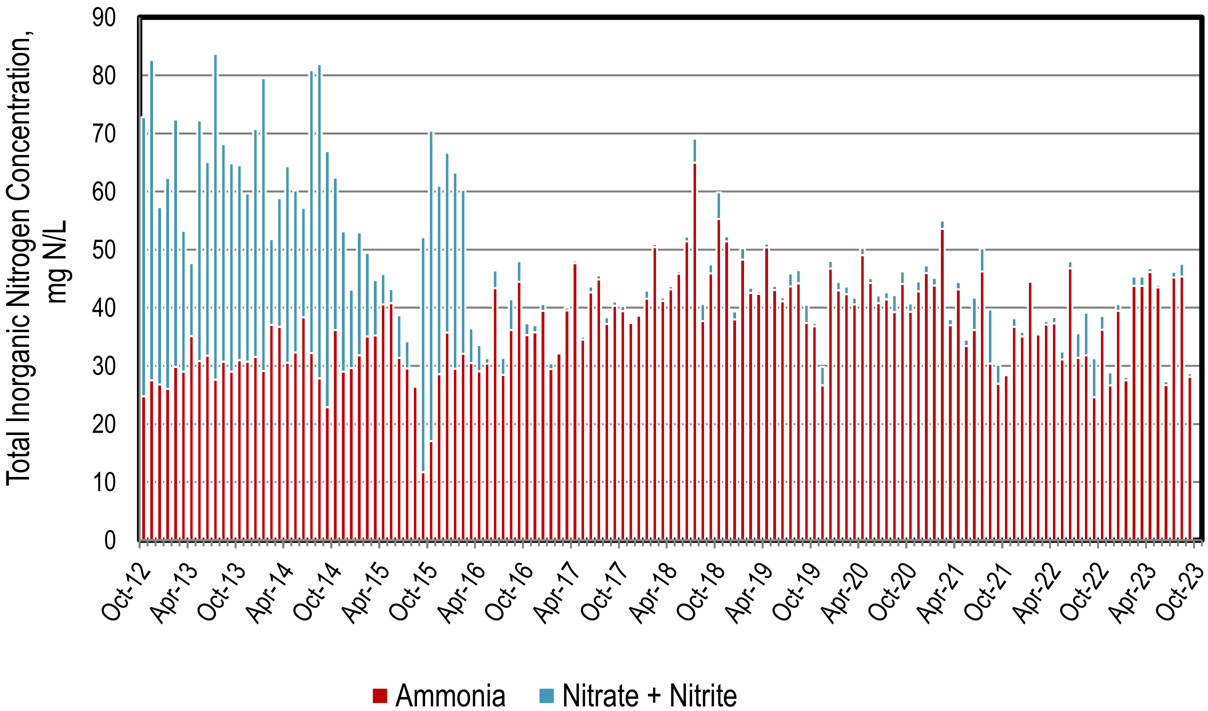

Figure 7-5. Discharge: Delta Diablo Monthly Nitrogen Concentrations

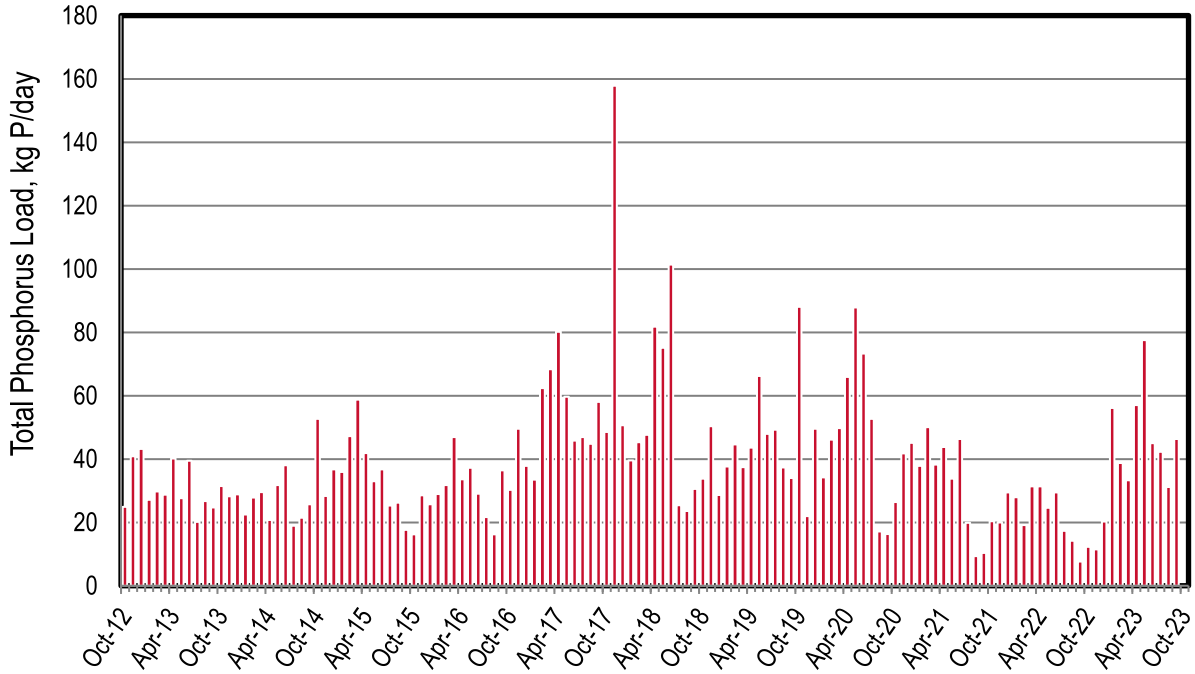

Figure 7-6. Discharge: Delta Diablo Monthly Phosphorus Loads

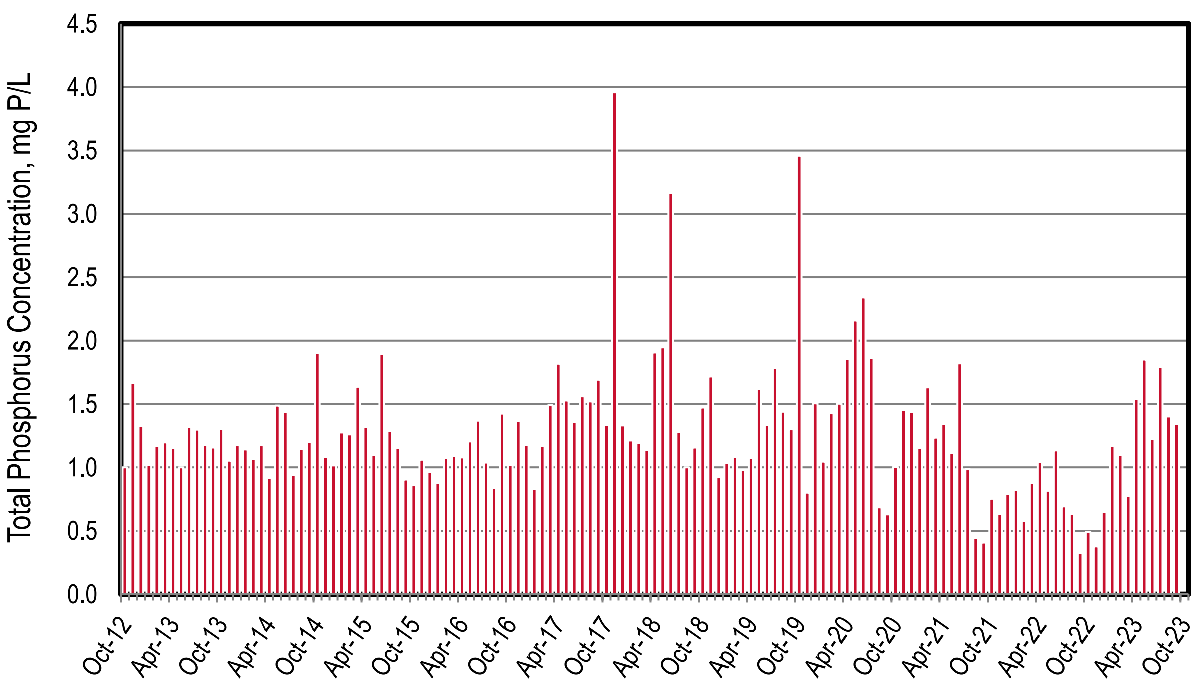

Figure 7-7. Discharge: Delta Diablo Monthly Phosphorus Concentrations

Recycled Water

Table 7-3. Recycled Water: Delta Diablo Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	54.8 (0.05)	228 (0.20)	--	3,840 (3.43)	--	--	119 (0.11)	4,240 (3.79)
2020	203 (0.18)	256 (0.23)	--	4,340 (3.88)	--	--	26.7 (0.02)	4,830 (4.31)
2021	246 (0.22)	273 (0.24)	--	5,220 (4.66)	--	--	2.6 (<0.01)	5,740 (5.12)
2022	215 (0.19)	259 (0.23)	--	5,160 (4.61)	--	--	2.6 (<0.01)	5,640 (5.03)
Average	180 (0.16)	254 (0.23)	--	4,640 (4.15)	--	--	37.7 (0.03)	5,110 (4.56)

* Assumes 100% of the recycled flow is diverted from the Bay for all but the Industrial Application. The analysis assumed 65% of the recycled flow sent to Industrial Application was diverted from the Bay.

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 7-4. Recycled Water: Delta Diablo Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	8	31	--	--	--	--	17	57
2020	28	36	--	--	--	--	3	68
2021	29	32	--	--	--	--	1	63
2022	27	32	--	--	--	--	1	61
Average	23	33	--	--	--	--	6	62

* Assumes 100% of the recycled nutrient load is diverted from the Bay for all but the Industrial Application. The analysis conservatively assumed 0% of the recycled nutrient load sent to Industrial Application was diverted from the Bay. Preliminary analysis suggests that the Industrial Application may be removing some nutrient load; however, additional studies are needed to quantify the nutrient load diverted from the Bay.

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 7-5. Recycled Water: Delta Diablo Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	8	32	--	--	--	--	18	58
2020	29	37	--	--	--	--	3	69
2021	31	34	--	--	--	--	1	66
2022	27	33	--	--	--	--	1	63
Average	24	34	--	--	--	--	6	64

* Assumes 100% of the recycled nutrient load is diverted from the Bay for all but the Industrial Application. The analysis conservatively assumed 0% of the recycled nutrient load sent to Industrial Application was diverted from the Bay. Preliminary analysis suggests that the Industrial Application may be removing some nutrient load; however, additional studies are needed to quantify the nutrient load diverted from the Bay.

** **Calendar year as opposed to California's water year (October 1 through September 30)**

Table 7-6. Recycled Water: Delta Diablo Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	<1	<1	--	--	--	--	<1	<1
2020	<1	<1	--	--	--	--	<1	<1
2021	<1	<1	--	--	--	--	<1	<1
2022	<1	<1	--	--	--	--	<1	<1
				--				
Average	<1	<1	--	--	--	--	<1	<1

* Assumes 100% of the recycled nutrient load is diverted from the Bay for all but the Industrial Application. The analysis conservatively assumed 0% of the recycled nutrient load sent to Industrial Application was diverted from the Bay. Preliminary analysis suggests that the Industrial Application may be removing some nutrient load; however, additional studies are needed to quantify the nutrient load diverted from the Bay.

** **Calendar year as opposed to California's water year (October 1 through September 30)**

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8 East Bay Dischargers Authority (EBDA)

EBDA discharges to the South Bay. EBDA has a permitted ADWF capacity of 107.8 mgd and a peak wet weather capacity of 189.1 mgd. The average dry season flow this past year was 59.1 mgd. EBDA's discharge is a combined flow from six wastewater treatment plants: EBDA members City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District. The contributing plants have various types of secondary treatment.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent:
  - Note: limited to quarterly data since July 2019. Based on the limited dataset in Table 8-1, none of the monitored parameters have any emerging trends.
  - The flow reduction is seasonally influenced. The flows are reduced by up to 27 percent during the dry season, which is primarily attributed to recycled water.
  - Nitrogen load reductions across the plants have also been historically seasonally dependent (range from 35 to 65 percent load reductions across the plants).
  - Phosphorus load reductions across the plants have been relatively stable, with values ranging from 60 to 75 percent. Several EBDA members perform phosphorus removal.
- Discharge:
  - The average monthly flows for 2022/2023 were the highest (both year-round and dry season) since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - The wet season flows are 10 to 20 mgd higher than the dry season due to a combination of recycled water demand during the dry season and a lack of inflow and infiltration.
  - Nitrogen loads typically increase with flow during wet weather events. This is attributed to a combination of scouring in the collection system and biological washout concerns for facilities performing nitrogen load reduction (e.g., Oro Loma/Castro Valley Sanitary District).
  - Ammonia represents the majority of the nitrogen species discharged, regardless of season. This would be expected since the EBDA plants were not designed to nitrify (with the exception of the recent upgrades at Oro Loma/Castro Valley Sanitary District).
  - Based on Table 8-2 statistics for the entire dry season dataset, there appears to be an upward trend for flows and TP loads. The upward trend in flows was driven by the extremely wet year in 2022/2023. The increase in TP loads was expected, as Oro Loma/Castro Valley Sanitary District replaced TP load reduction capabilities with ammonia/TIN load reduction capabilities as part of their recent upgrades. While the statistics for the entire dry season dataset currently show no significant trends for ammonia or TIN, the Oro Loma/Castro Valley Sanitary District upgrade has provided reliable year-round reduction.
- Recycled Water:
  - Based on Table 8-3, EBDA and its member agencies have averaged 8.9 mgd of Recycled Water over the 2019-2022 calendar years. Users include Golf Course, Landscape Irrigation, Industrial, and Other. The EBDA contributors with the largest recycled water volumes/flows are the City of Livermore and Dublin San Ramon Services District.

- Based on Table 8-4 through Table 8-6, EBDA and its member agencies have averaged 1,360 kg ammonia-N/d, 1,390 kg TIN-N/d, and 81 kg P/d diverted from the Bay through recycled water over the 2019-2022 calendar years.

Influent

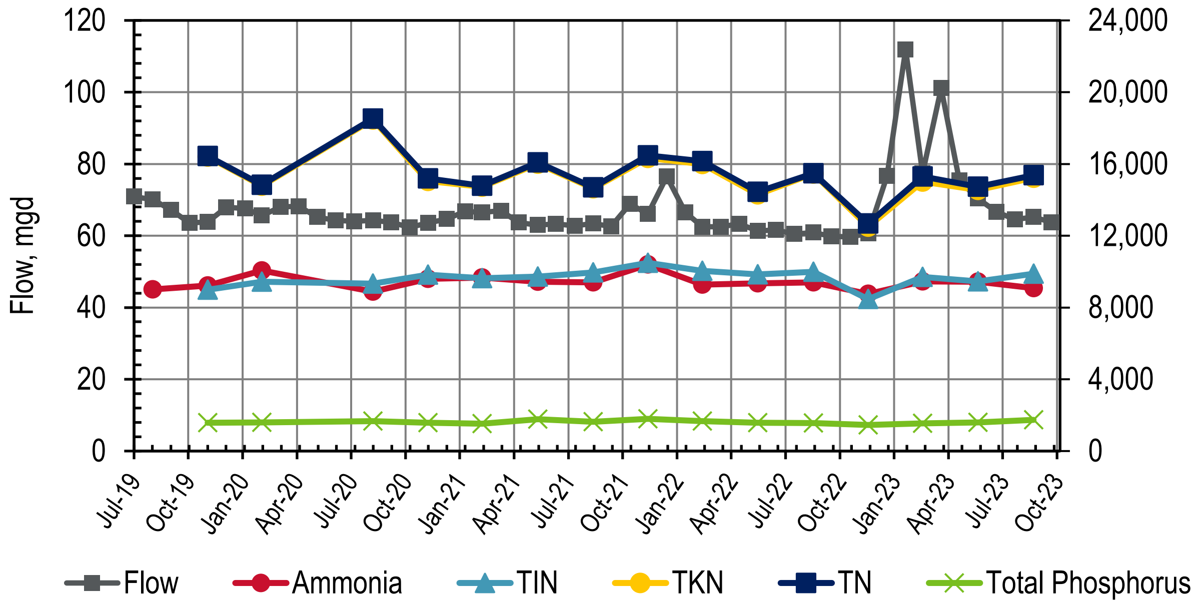

Figure 8-1. Influent: EBDA Monthly Flows and Loads

Note 1: Values are only provided for months when all six agencies sampled. Loads are summed for all agencies.

Note 2: The TKN/TN loads are comparable. The TKN values are located behind the TN load lines.

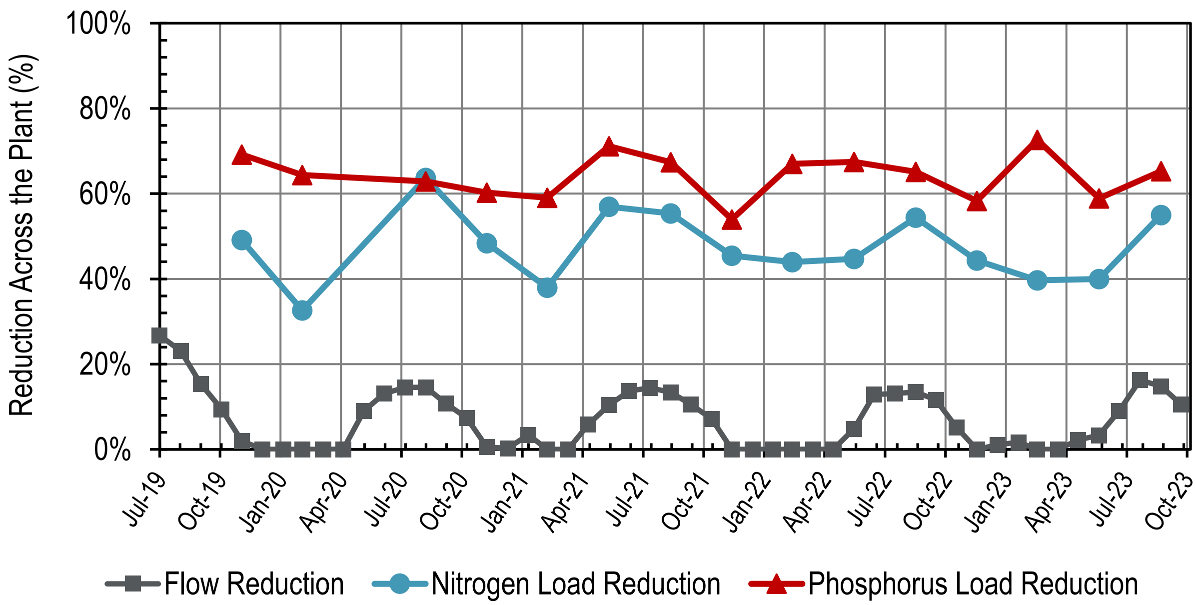

Figure 8-2. Influent: EBDA Monthly Reductions Across the Plants

Note: Influent Total N for the sum of all agencies was compared against EBDA Discharge TIN for calculating nitrogen load reduction.

Table 8-1. Influent: EBDA Members' Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN **	TKN	Total N **	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	70.8	--	--	--	--	--	--
Aug-19	70.1	9,020	--	--	--	--	--
Sep-19	67.2	--	--	--	--	--	--
Oct-19	63.6	--	--	--	--	--	--
Nov-19	63.9	9,230	28.4	8,990	16,400	16,400	1,580
Dec-19	67.9	--	--	--	--	--	--
Jan-20	67.6	--	--	--	--	--	--
Feb-20	65.6	10,100	57.4	9,430	14,800	14,800	1,600
Mar-20	68.0	--	--	--	--	--	--
Apr-20	68.2	--	--	--	--	--	--
May-20	65.2	--	--	--	--	--	--
Jun-20	64.3	--	--	--	--	--	--
Jul-20	64.0	--	--	--	--	--	--
Aug-20	64.3	8,880	55.0	9,330	18,500	18,500	1,670
Sep-20	63.8	--	--	--	--	--	--
Oct-20	62.3	--	--	--	--	--	--
Nov-20	63.6	9,590	153	9,830	15,000	15,200	1,580
Dec-20	64.7	--	--	--	--	--	--
Jan-21	66.8	--	--	--	--	--	--
Feb-21	66.5	9,660	56.2	9,630	14,700	14,800	1,530
Mar-21	67.0	--	--	--	--	--	--
Apr-21	63.7	--	--	--	--	--	--
May-21	62.9	9,440	74.1	9,720	16,000	16,100	1,770
Jun-21	63.3	--	--	--	--	--	--
Jul-21	62.7	--	--	--	--	--	--
Aug-21	63.4	9,400	52.8	9,940	14,600	14,700	1,640
Sept-21	62.3	--	--	--	--	--	--
Oct-21	68.8	--	--	--	--	--	--
Nov-21	66.0	10,400	143	10,500	16,300	16,500	1,790
Dec-21	76.5	--	--	--	--	--	--
Jan-22	66.5	--	--	--	--	--	--
Feb-22	62.5	9,280	161	10,000	16,000	16,200	1,670
Mar-22	62.5	--	--	--	--	--	--
Apr-22	63.3	--	--	--	--	--	--
May-22	61.4	9,340	140	9,850	14,300	14,400	1,580
Jun-22	61.7	--	--	--	--	--	--
Jul-22	60.4	--	--	--	--	--	--
Aug-22	60.9	9,410	13.3	9,990	15,500	15,500	1,560

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN **	TKN	Total N **	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Sep-22	59.8	--	--	--	--	--	--
Oct-22	59.7	--	--	--	--	--	--
Nov-22	60.7	8,760	164	8,470	12,500	12,700	1,450
Dec-22	76.7	--	--	--	--	--	--
Jan-23	112	--	--	--	--	--	--
Feb-23	77.4	9,450	297	9,710	15,000	15,300	1,550
Mar-23	101	--	--	--	--	--	--
Apr-23	75.4	--	--	--	--	--	--
May-23	70.4	9,440	189	9,450	14,500	14,700	1,600
Jun-23	66.7	--	--	--	--	--	--
Jul-23	64.6	--	--	--	--	--	--
Aug-23	65.1	9,090	129	9,890	15,200	15,400	1,730
Sep-23	63.7	--	--	--	--	--	--
Dry Season Average	**64.3**	**9,250**	**93.3**	**9,740**	**15,500**	**15,600**	**1,650**
Dry Season Trend * **	**None**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**69.6**	**9,550**	**132**	**9,570**	**15,100**	**15,200**	**1,600**
Average Annual	**67.2**	**9,400**	**114**	**9,650**	**15,300**	**15,400**	**1,620**

* Agencies that Contribute to EBDA: City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District. Values are only provided for months where all agencies sampled.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads.

Discharge

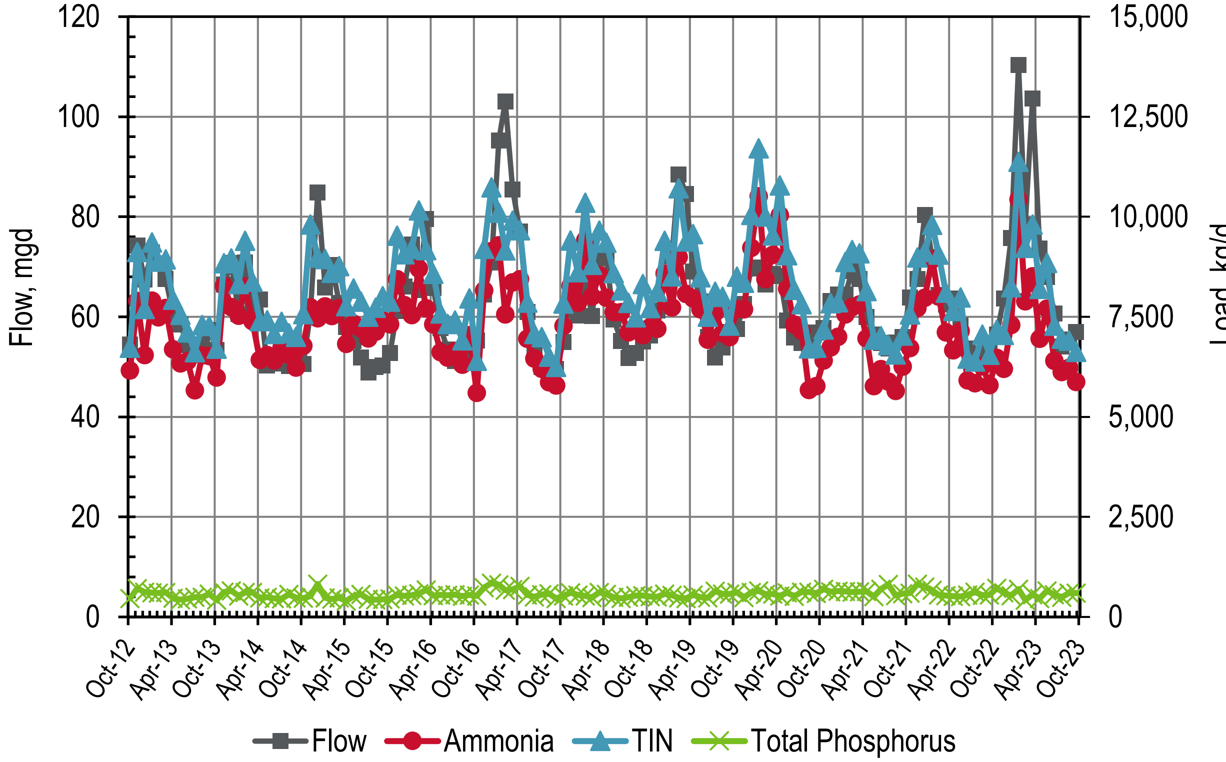

Figure 8-3. Discharge: EBDA Monthly Flows and Loads

Table 8-2. Discharge: EBDA Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	54.5	6,160	568	6,730	462
Nov-12	74.3	7,900	1,230	9,130	710
Dec-12	67.5	6,550	1,150	7,700	621
Jan-13	72.9	7,900	1,460	9,360	606
Feb-13	70.7	7,490	1,390	8,880	601
Mar-13	67.6	7,730	1,210	8,940	613
Apr-13	60.6	6,690	1,240	7,930	469
May-13	58.5	6,340	1,220	7,560	431
Jun-13	54.5	6,400	719	7,120	459
Jul-13	53.3	5,670	953	6,620	493
Aug-13	54.5	6,540	763	7,300	494
Sep-13	57.5	6,520	750	7,270	575
Oct-13	53.4	5,990	715	6,700	425
Nov-13	66.5	8,270	567	8,840	621
Dec-13	70.7	7,740	1,220	8,960	654
Jan-14	60.6	7,530	789	8,320	526
Feb-14	70.9	8,260	1,150	9,410	616
Mar-14	62.3	7,400	986	8,380	616
Apr-14	63.5	6,430	966	7,390	480
May-14	50.3	6,550	873	7,420	499
Jun-14	51.2	6,410	660	7,070	465
Jul-14	50.7	6,730	649	7,380	456
Aug-14	50.2	6,560	534	7,090	570
Sep-14	51.5	6,240	765	7,000	481
Oct-14	50.6	6,780	795	7,570	470
Nov-14	60.7	7,740	2,070	9,810	520
Dec-14	84.9	7,470	1,520	8,990	821
Jan-15	65.9	7,770	1,180	8,950	476
Feb-15	70.4	7,520	1,080	8,600	446
Mar-15	62.8	7,720	1,050	8,770	479
Apr-15	58.0	6,820	948	7,770	399
May-15	55.2	7,340	874	8,210	517
Jun-15	51.9	7,220	667	7,880	569
Jul-15	48.8	6,970	540	7,510	448
Aug-15	50.0	7,130	594	7,730	429
Sep-15	50.3	7,410	609	8,020	439

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	52.8	7,320	564	7,880	452
Nov-15	61.2	8,440	1,080	9,530	552
Dec-15	66.1	7,790	1,270	9,070	529
Jan-16	74.4	7,550	1,660	9,200	543
Feb-16	65.4	8,710	1,450	10,200	586
Mar-16	79.6	7,710	1,450	9,170	676
Apr-16	65.8	7,310	1,260	8,580	539
May-16	57.7	6,620	972	7,590	550
Jun-16	53.5	6,480	845	7,330	545
Jul-16	51.2	6,650	763	7,410	562
Aug-16	51.0	6,310	608	6,920	520
Sep-16	53.3	7,040	916	7,960	552
Oct-16	55.3	5,600	802	6,410	527
Nov-16	64.5	8,170	1,040	9,200	736
Dec-16	70.9	9,140	1,600	10,700	845
Jan-17	95.3	9,290	819	10,100	803
Feb-17	103	7,560	1,600	9,160	672
Mar-17	85.5	8,360	1,540	9,910	687
Apr-17	77.1	8,440	1,220	9,670	767
May-17	61.0	6,960	905	7,860	552
Jun-17	54.1	6,460	617	7,080	506
Jul-17	50.0	6,200	797	7,000	559
Aug-17	50.5	5,870	638	6,500	580
Sep-17	49.6	5,790	467	6,260	466
Oct-17	55.0	7,280	559	7,830	528
Nov-17	64.1	8,280	1,130	9,410	608
Dec-17	60.3	7,850	767	8,620	550
Jan-18	67.7	9,420	937	10,400	529
Feb-18	60.2	8,010	785	8,800	485
Mar-18	72.4	8,550	1,110	9,660	615
Apr-18	71.9	7,980	1,370	9,360	569
May-18	59.5	7,620	972	8,590	497
Jun-18	55.2	7,620	545	8,160	461
Jul-18	51.8	7,120	686	7,850	498
Aug-18	52.8	7,190	415	7,490	533
Sep-18	55.1	7,040	942	8,330	535
Oct-18	56.3	7,240	849	7,720	514

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	61.3	7,210	647	8,130	506
Dec-18	66.5	8,590	810	9,400	577
Jan-19	72.2	7,740	777	8,520	544
Feb-19	88.5	9,000	1,430	10,700	483
Mar-19	84.6	8,080	1,120	9,390	465
Apr-19	69.1	7,960	1,110	9,570	549
May-19	63.1	7,690	872	8,490	497
Jun-19	55.9	6,930	665	7,510	476
Jul-19	51.9	7,610	473	8,130	648
Aug-19	53.9	7,090	523	8,000	576
Sep-19	56.9	7,000	548	7,280	577
Oct-19	57.6	7,700	629	8,510	613
Nov-19	62.6	7,690	722	8,360	488
Dec-19	69.7	9,220	823	10,000	614
Jan-20	69.9	10,500	667	11,700	652
Feb-20	66.5	8,440	804	10,000	571
Mar-20	68.6	9,050	483	9,540	572
Apr-20	68.2	10,000	745	10,800	531
May-20	59.3	8,200	843	9,050	607
Jun-20	55.9	7,310	602	8,180	519
Jul-20	54.7	7,160	663	7,820	623
Aug-20	54.9	5,680	1,040	6,720	621
Sep-20	56.9	5,780	956	6,730	590
Oct-20	57.7	6,410	779	7,190	694
Nov-20	63.2	6,740	1,100	7,840	630
Dec-20	64.5	7,000	868	7,870	644
Jan-21	64.5	7,560	1,310	8,880	636
Feb-21	69.2	7,750	1,430	9,170	626
Mar-21	67.5	7,810	1,280	9,090	630
Apr-21	60.0	6,960	1,180	8,140	640
May-21	56.4	5,770	1,200	6,930	511
Jun-21	54.7	6,200	826	7,020	692
Jul-21	53.7	5,880	919	6,800	815
Aug-21	54.9	5,650	913	6,560	534
Sep-21	56.0	6,260	775	7,040	583
Oct-21	63.9	6,720	840	7,560	599
Nov-21	67.5	7,720	1,270	8,990	826

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	80.4	7,980	1,150	9,130	749
Jan-22	72.0	8,940	866	9,800	670
Feb-22	64.4	8,010	1,050	9,060	551
Mar-22	62.5	7,120	990	8,110	536
Apr-22	63.7	6,670	979	7,650	517
May-22	58.4	7,150	838	7,990	514
Jun-22	53.7	5,920	541	6,460	555
Jul-22	52.5	5,840	548	6,390	623
Aug-22	52.7	6,270	791	7,060	546
Sep-22	52.9	5,790	765	6,560	548
Oct-22	56.6	6,480	701	7,180	722
Nov-22	63.6	6,200	851	7,050	606
Dec-22	75.8	7,300	948	8,240	539
Jan-23	110	10,400	947	11,400	697
Feb-23	78.4	7,890	1,050	9,230	423
Mar-23	104	8,510	1,300	9,810	561
Apr-23	73.7	6,960	1,240	8,200	465
May-23	68.0	7,710	1,140	8,850	658
Jun-23	60.7	6,400	885	7,290	559
Jul-23	54.1	6,120	833	6,960	499
Aug-23	55.5	6,230	675	6,910	602
Sep-23	57.0	5,880	749	6,630	600
Dry Season Average	**54.5**	**6,630**	**761**	**7,400**	**542**
Dry Season Trend **	**Up**	**None**	**None**	**None**	**Up**
Wet Season Average	**68.6**	**7,770**	**1,050**	**8,860**	**585**
Average Annual	**62.7**	**7,290**	**931**	**8,250**	**567**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

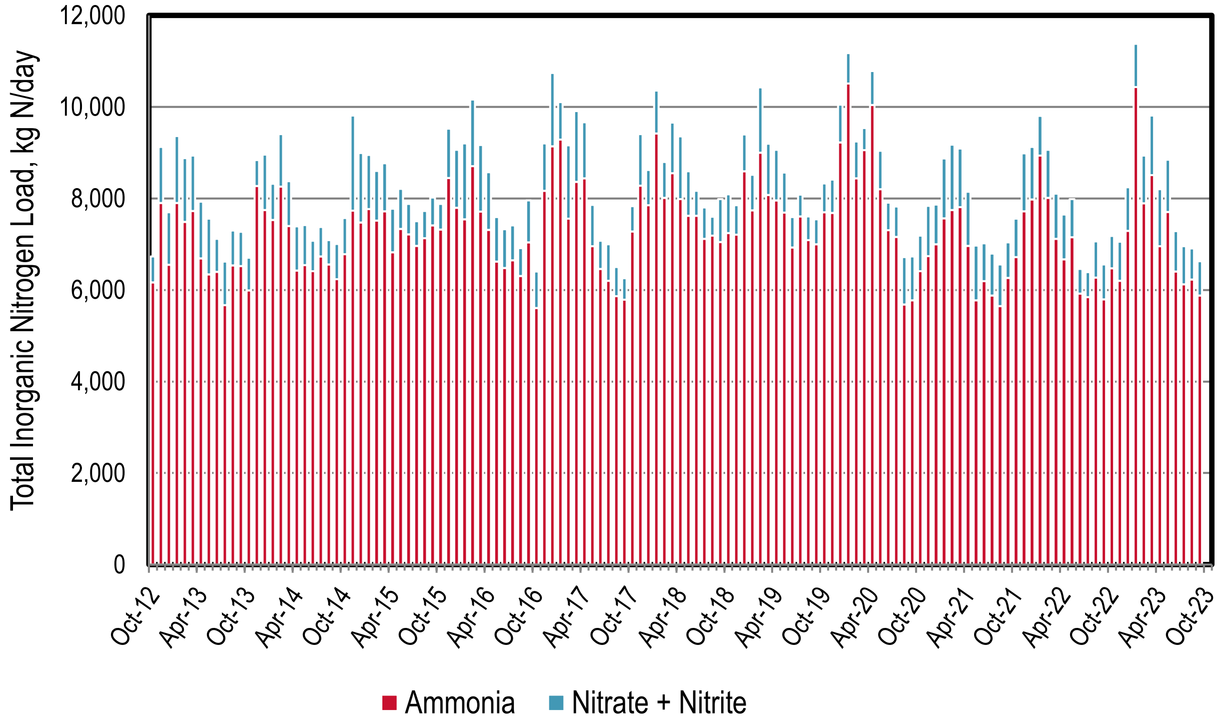

Figure 8-4. Discharge: EBDA Monthly Nitrogen Loads

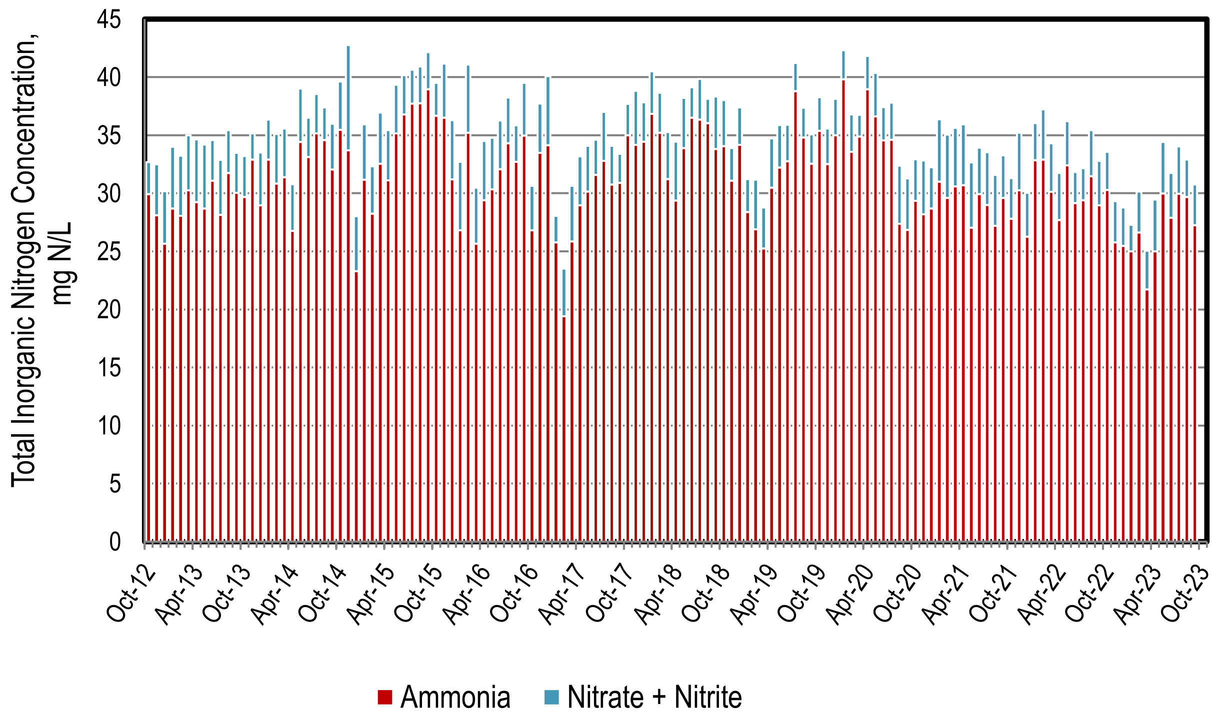

Figure 8-5. Discharge: EBDA Monthly Nitrogen Concentrations

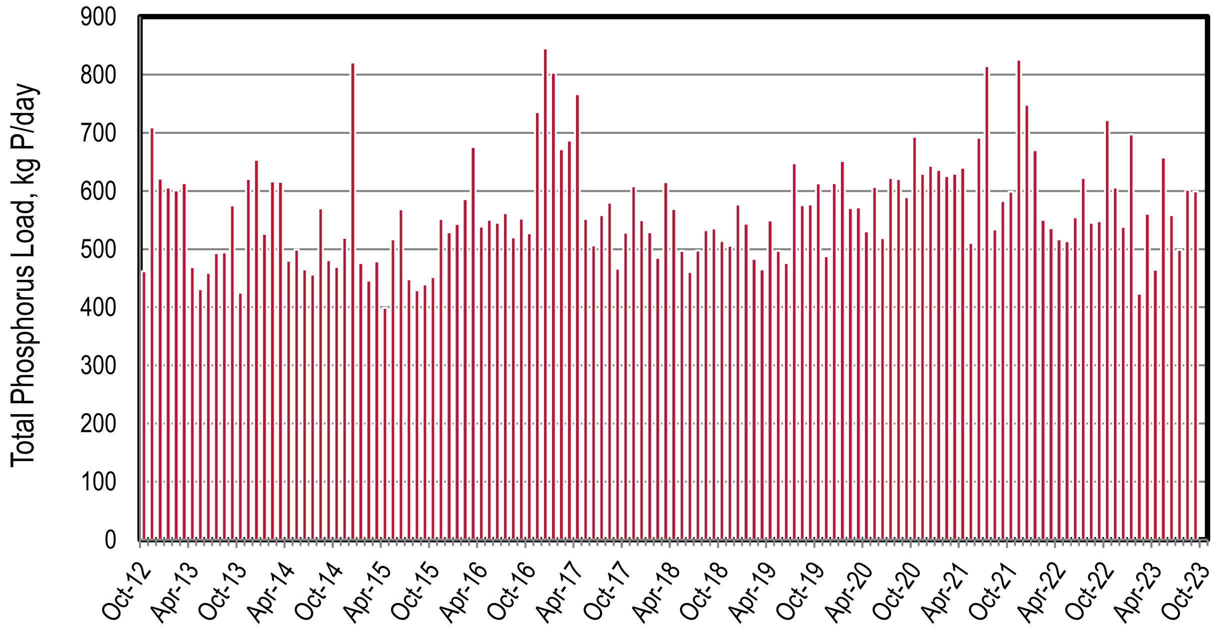

Figure 8-6. Discharge: EBDA Monthly Phosphorus Loads

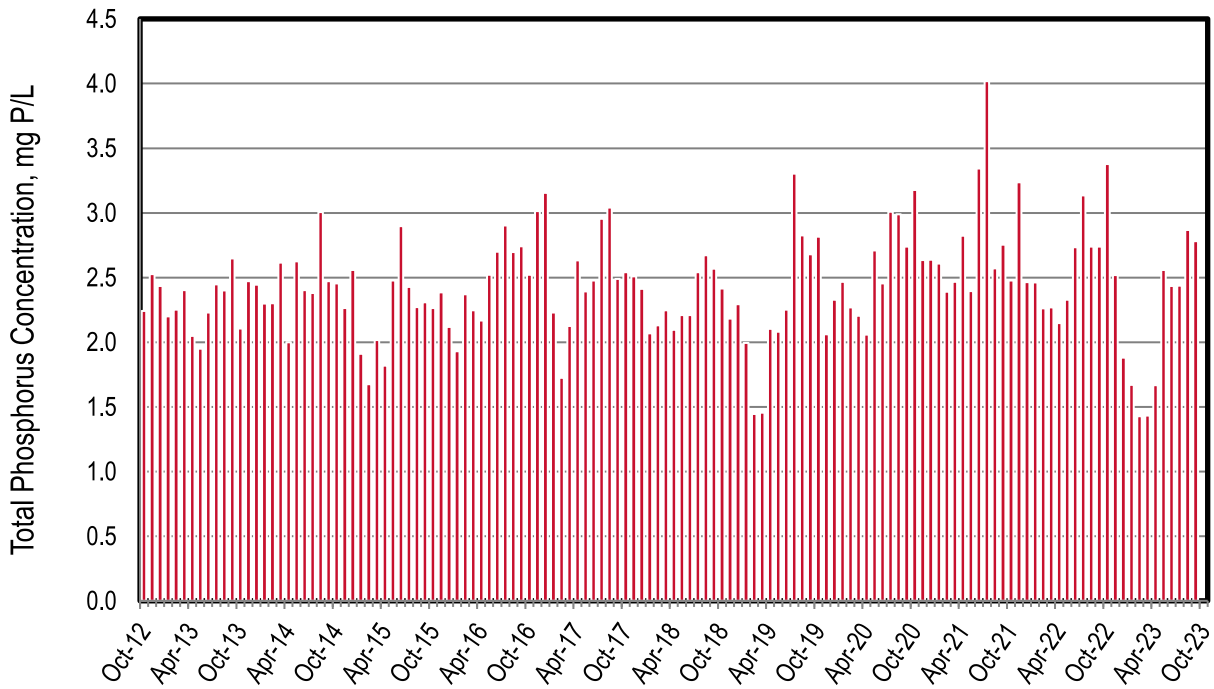

Figure 8-7. Discharge: EBDA Monthly Phosphorus Concentrations

Recycled Water

Table 8-3. Recycled Water: EBDA Yearly Recycled Water Flows Diverted from the Bay*

Year**	Flow Diverted***, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	1,270 (1.1)	4,410 (3.9)	--	2,900 (2.6)	--	--	2,150 (1.9)	10,720 (9.6)
2020	1,200 (1.1)	4,250 (3.8)	--	3,220 (2.9)	668 (0.6)	--	166 (0.15)	9,500 (8.5)
2021	1,340 (1.2)	5,630 (5.0)	--	2,530 (2.3)	--	--	155 (0.14)	9,660 (8.6)
2022	1,260 (1.1)	5,180 (4.6)	--	3,140 (2.8)	--	--	537 (0.5)	10,120 (9.0)
Average	1,270 (1.1)	4,870 (4.3)		2,950 (2.6)	167 (0.2)	--	750 (0.7)	10,000 (8.9)

*** Agencies that Contribute to EBDA: City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District. The recycled water values represent the sum of EBDA's member agencies.**

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** Assumes 100% of the recycled flow is diverted from the Bay**

Table 8-4. Recycled Water: EBDA Yearly Recycled Water Ammonia Load Diverted from the Bay*

Year**	Average Ammonia Load Diverted***, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	150	456	--	359	--	--	232	1,260
2020	166	560	--	459	113	--	18	1,320
2021	184	828	--	346	--	--	15	1,381
2022	188	727	--	468	--	--		1,473
Average	172	643	--	408	28	--	88	1,359

*** Agencies that Contribute to EBDA: City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District. The recycled water values represent the sum of EBDA's member agencies.**

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** Assumes 100% of the recycled flow is diverted from the Bay**

Table 8-5. Recycled Water: EBDA Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay*

Year**	Average Total Inorganic Nitrogen Load Diverted***, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	151	465	--	375	--	--	285	1,276
2020	168	569	--	479	116	--	23	1,355
2021	186	832	--	352	--	--	23	1,394
2022	193	766	--	481	--	--	93	1,533
Average	175	658	--	422	29	--	106	1,389

*** Agencies that Contribute to EBDA: City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District. The recycled water values represent the sum of EBDA's member agencies.**

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** Assumes 100% of the recycled flow is diverted from the Bay**

Table 8-6. Recycled Water: EBDA Yearly Recycled Water Total P Load Diverted from the Bay*

Year**	Average Total P Load Diverted***, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	6	8	--	21	--	--	19	54
2020	8	20	--	27	2	--	1	57
2021	9	25	--	21	--	--	1	55
2022	6	31	--	119	--	--	2	157
Average	7	21	--	47	<1	--	5	81

*** Agencies that Contribute to EBDA: City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District. The recycled water values represent the sum of EBDA's member agencies.**

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** Assumes 100% of the recycled flow is diverted from the Bay**

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9 East Bay Municipal Utility District (EBMUD)

EBMUD discharges to the Central Bay. They have an ADWF permitted capacity of 120 mgd and a peak wet weather capacity of 320 mgd. It has a current dry season discharge flow of approximately 46 mgd. The plant performs secondary treatment using a high purity oxygen system. This plant accepts high-strength (organic) trucked wastes to its anaerobic digesters for renewable energy production. These wastes contribute to the plant discharge nutrient loads.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent
  - Note: limited to sampling since July 2019; quarterly sampling required at a minimum.
  - The influent flows and loads do not include the high-strength (organic) trucked wastes that are sent to EBMUD's anaerobic digesters for renewable energy production.
  - Load Reduction Across the Plant: not performed for EBMUD as data on the high-strength (organic) trucked waste is not captured in the influent values. This calculation would not reflect actual load reduction across the plant.
  - Based on Table 9-1 statistics, there are no dry season trends.
- Discharge
  - Wet season loads are typically greater than the dry season loads.
  - Nitrogen loads typically increase with flow during wet weather events.
  - The ammonia and TIN loads were the lowest this past dry season since sampling began in 2012. This reduction is attributed to two independent efforts: i) EBMUD stopped accepted trucked waste with relatively high nitrogenous compounds (e.g., animal blood waste) and ii) the treatment plant began treating up to 50 percent of the plant flow via split treatment during dry season with biological nitrification/denitrification. EBMUD performed initial piloting of the latter in 2020, 2021, and 2022. 2023 was the first dry season of using half of the secondary treatment system for nitrification/denitrification. The results were promising with the intention of continuing this effort.
  - Based on Table 9-2 statistics for the entire dry season dataset, flow appears to be trending downward, whereas TP appears to be trending upwards. The increase in TP was expected as the unit process historically used for TP reduction is now being used for TIN load reduction. While this past dry season's ammonia and TIN loads were the lowest since sampling began, it will require more than one year of reduced loads to impact the entire dry season dataset trending results.
- Recycled Water:
  - Based on Table 1-2, the plant has averaged <1 mgd of Recycled Water from 2019-2022 calendar years that results in flow and/or load diversions from the Bay. Users include Landscape Irrigation and Industrial Applications.
  - Based on Table 5-3 through Table 5-5, the plant has averaged the diversion of 108 kg ammonia-N/d, 114 kg TIN-N/d, and 10 kg P/d from the Bay over the 2019-2022 calendar years via recycled water.

Influent

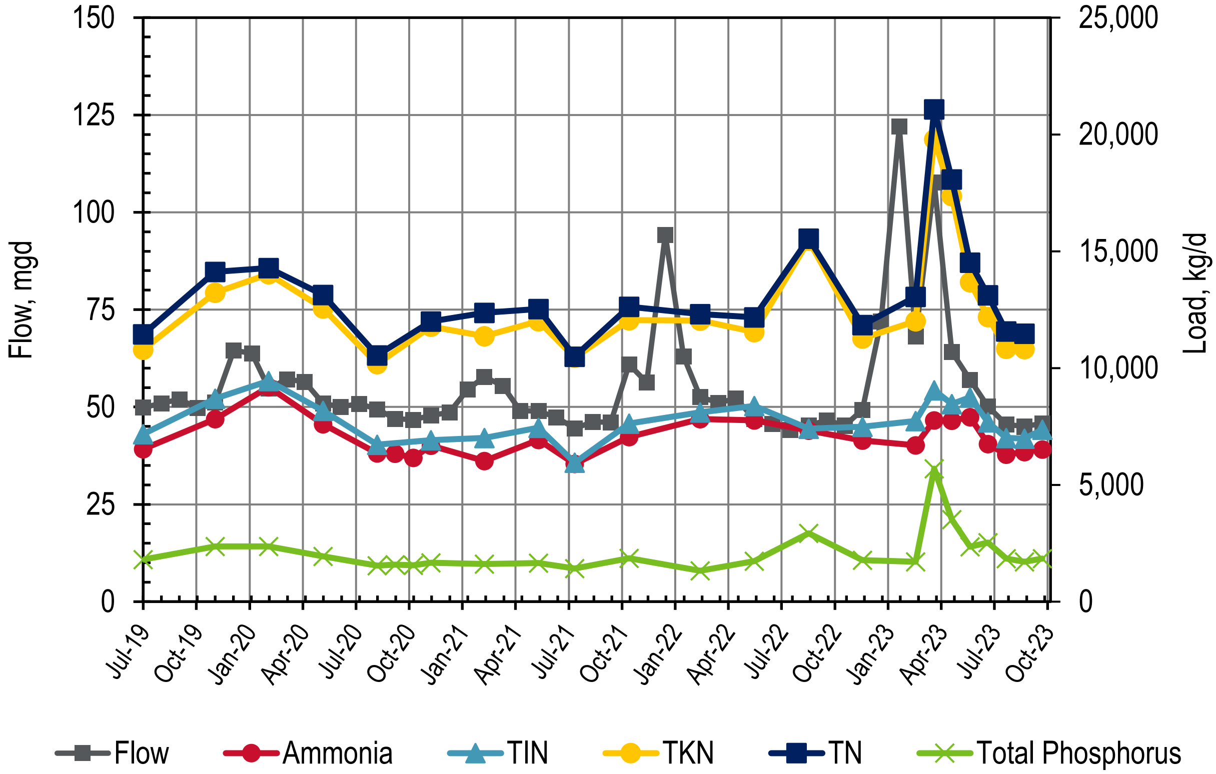

Figure 9-1. Influent: EBMUD Monthly Flows and Loads

Note: the quarterly nutrient data for July – September 2021 was provided in July 2021 samples.

Table 9-1. Influent: EBMUD Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	49.8	6,530	649	7,180	10,800	11,400	1,800
Aug-19	51.0	--	--	--	--	--	--
Sep-19	52.0	--	--	--	--	--	--
Oct-19	49.8	--	--	--	--	--	--
Nov-19	51.2	7,810	886	8,700	13,200	14,100	2,360
Dec-19	64.6	--	--	--	--	--	--
Jan-20	63.8	--	--	--	--	--	--
Feb-20	54.8	9,190	259	9,450	14,000	14,300	2,370
Mar-20	57.1	--	--	--	--	--	--
Apr-20	56.5	--	--	--	--	--	--
May-20	51.0	7,600	571	8,170	12,600	13,100	1,950
Jun-20	50.0	--	--	--	--	--	--
Jul-20	50.8	--	--	--	--	--	--
Aug-20	49.4	6,360	363	6,720	10,200	10,500	1,540
Sep-20	47.0	6,340	--	--	--	--	1,580
Oct-20	46.7	6,160	--	--	--	--	1,560
Nov-20	47.8	6,680	227	6,910	11,800	12,000	1,670
Dec-20	48.6	--	--	--	--	--	--
Jan-21	54.5	--	--	--	--	--	--
Feb-21	57.8	6,020	994	7,010	11,400	12,400	1,610
Mar-21	55.5	--	--	--	--	--	--
Apr-21	49.1	--	--	--	--	--	--
May-21	48.9	6,920	527	7,450	12,000	12,500	1,650
Jun-21	47.3	--	--	--	--	--	--
Jul-21	44.5	5,900	53.3	5,950	10,400	10,500	1,420
Aug-21	46.2	--	--	--	--	--	--
Sep-21	46.1	--	--	--	--	--	--
Oct-21	61.0	7,050	575	7,620	12,100	12,600	1,850
Nov-21	56.3	--	--	--	--	--	--
Dec-21	94.3	--	--	--	--	--	--
Jan-22	63.0	--	--	--	--	--	--
Feb-22	52.6	7,820	281	8,100	12,000	12,300	1,320
Mar-22	51.1	--	--	--	--	--	--
Apr-22	52.2	--	--	--	--	--	--
May-22	46.9	7,760	625	8,380	11,500	12,200	1,740
Jun-22	45.7	--	--	--	--	--	--

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	44.2	--	--	--	--	--	--
Aug-22	45.3	7,320	79.7	7,400	15,500	15,500	2,930
Sep-22	46.6	--	--	--	--	--	--
Oct-22	45.3	--	--	--	--	--	--
Nov-22	49.3	6,900	581	7,490	11,300	11,800	1,780
Dec-22	72.0	--	--	--	--	--	--
Jan-23	122	--	--	--	--	--	--
Feb-23	68.2	6,700	1,040	7,730	12,000	13,000	1,710
Mar-23	108	7,760	1,280	9,050	19,800	21,100	5,700
Apr-23	64.1	7,750	711	8,460	17,400	18,100	3,520
May-23	57.0	7,900	841	8,740	13,700	14,500	2,350
Jun-23	50.1	6,750	937	7,690	12,200	13,100	2,530
Jul-23	45.5	6,290	720	7,010	10,800	11,600	1,850
Aug-23	45.0	6,410	577	6,990	10,800	11,500	1,700
Sep-23	45.7	6,520	850	7,370	--	--	1,850
Dry Season Average	**48.1**	**6,820**	**566**	**7,420**	**11,900**	**12,400**	**1,920**
Dry Season Trend * **	**None**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**61.3**	**7,260**	**684**	**8,050**	**13,500**	**14,200**	**2,310**
Average Annual	**55.3**	**7,020**	**620**	**7,710**	**12,600**	**13,300**	**2,100**

* EBMUD occasionally samples more than the required influent quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

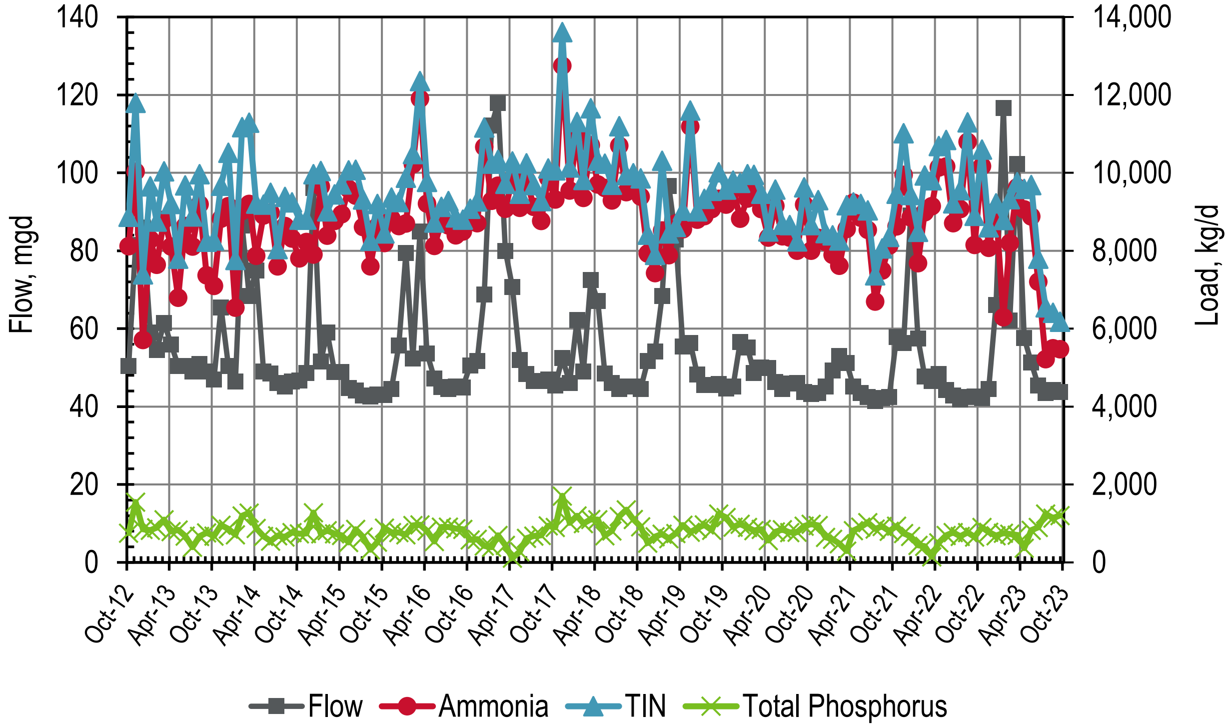

Figure 9-2. Discharge: EBMUD Monthly Flows and Loads

Table 9-2. Discharge: EBMUD Monthly Flows and Loads

Month, Year	Flow	Ammonia *	Nitrate + Nitrite *	TIN *,**	Total P *
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	50.5	8,120	756	8,880	752
Nov-12	81.5	10,000	1,770	11,800	1,550
Dec-12	86.0	5,710	1,690	7,400	854
Jan-13	59.0	8,290	1,370	9,660	829
Feb-13	54.5	7,640	1,120	8,760	891
Mar-13	61.5	8,800	1,240	10,000	1,100
Apr-13	56.0	8,110	1,090	9,210	794
May-13	50.5	6,800	996	7,800	832
Jun-13	50.5	8,640	1,050	9,680	683
Jul-13	49.0	8,120	767	8,880	389
Aug-13	51.0	9,200	771	9,970	675
Sep-13	49.0	7,380	858	8,230	762
Oct-13	47.0	7,100	1,170	8,270	681
Nov-13	65.5	8,820	847	9,670	958
Dec-13	50.5	9,150	1,380	10,500	859
Jan-14	46.5	6,550	1,220	7,770	711
Feb-14	86.5	9,020	2,150	11,200	1,200
Mar-14	68.5	9,200	2,090	11,300	1,270
Apr-14	75.0	7,880	1,340	9,220	874
May-14	49.0	8,910	277	9,190	671
Jun-14	48.5	8,990	509	9,500	551
Jul-14	46.1	7,610	444	8,050	691
Aug-14	45.2	8,640	749	9,390	658
Sep-14	46.5	8,320	927	9,240	771
Oct-14	46.7	7,810	992	8,800	737
Nov-14	48.7	8,230	574	8,800	742
Dec-14	96.2	7,910	2,060	9,970	1,280
Jan-15	51.5	9,660	392	10,100	740
Feb-15	59.1	8,390	623	9,010	816
Mar-15	49.0	8,770	679	9,450	736
Apr-15	48.9	8,940	765	9,710	693
May-15	44.8	9,590	479	10,100	516
Jun-15	44.2	9,420	664	10,100	854
Jul-15	42.9	8,620	708	9,320	658
Aug-15	42.7	7,600	652	8,260	326
Sep-15	43.1	8,630	570	9,200	526

Month, Year	Flow	Ammonia *	Nitrate + Nitrite *	TIN *,**	Total P *
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	43.0	8,200	247	8,450	887
Nov-15	44.6	8,820	543	9,370	772
Dec-15	55.8	8,630	624	9,260	769
Jan-16	79.5	8,700	1,170	9,880	709
Feb-16	52.4	10,200	259	10,500	948
Mar-16	85.0	11,900	457	12,400	966
Apr-16	53.7	9,210	557	9,770	814
May-16	47.3	8,130	595	8,730	535
Jun-16	45.0	8,730	400	9,130	905
Jul-16	44.6	8,650	629	9,280	906
Aug-16	45.2	8,400	458	8,860	866
Sep-16	45.0	8,500	309	8,810	852
Oct-16	50.6	8,740	340	9,080	583
Nov-16	51.8	8,720	554	9,270	600
Dec-16	68.8	10,700	494	11,200	422
Jan-17	112	9,290	953	10,200	393
Feb-17	118	9,670	669	10,300	695
Mar-17	80.0	9,080	640	9,720	438
Apr-17	70.7	9,840	463	10,300	112
May-17	52.1	9,110	357	9,470	277
Jun-17	48.4	9,820	423	10,200	622
Jul-17	46.6	9,140	555	9,690	677
Aug-17	46.5	8,770	511	9,280	698
Sep-17	47.0	9,870	243	10,100	945
Oct-17	45.4	9,320	742	10,100	898
Nov-17	52.5	12,800	867	13,600	1,710
Dec-17	46.2	9,550	593	10,100	1,020
Jan-18	62.3	11,000	303	11,300	1,200
Feb-18	49.0	9,360	458	9,820	1,000
Mar-18	72.5	10,700	945	11,700	1,110
Apr-18	67.1	9,700	606	10,300	1,100
May-18	48.5	9,620	622	10,200	686
Jun-18	46.0	9,290	409	9,700	809
Jul-18	44.5	10,700	499	11,200	1,180
Aug-18	45.2	9,510	394	9,950	1,350
Sep-18	45.3	9,750	435	9,990	1,110
Oct-18	44.5	9,400	467	9,860	915

Month, Year	Flow	Ammonia *	Nitrate + Nitrite *	TIN *,**	Total P *
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	51.7	7,930	484	8,420	500
Dec-18	54.2	7,430	468	7,900	663
Jan-19	68.4	8,520	1,030	10,300	731
Feb-19	96.6	7,890	552	8,450	610
Mar-19	82.9	8,710	614	8,610	749
Apr-19	55.5	8,560	477	9,030	959
May-19	56.4	11,200	406	11,600	780
Jun-19	48.3	8,810	380	9,010	874
Jul-19	45.5	8,890	440	9,330	965
Aug-19	45.5	9,070	467	9,540	830
Sep-19	45.9	9,340	413	10,000	1,240
Oct-19	44.7	9,190	387	9,570	1,160
Nov-19	45.3	9,580	357	9,810	908
Dec-19	56.6	8,830	409	9,740	982
Jan-20	55.2	9,350	568	9,970	898
Feb-20	48.7	9,580	373	9,950	816
Mar-20	50.1	9,080	394	9,470	852
Apr-20	49.9	8,350	369	8,500	563
May-20	46.4	9,150	418	9,570	783
Jun-20	44.5	8,370	298	8,670	843
Jul-20	46.0	8,350	317	8,660	768
Aug-20	46.0	8,010	348	8,240	775
Sep-20	43.8	9,190	459	9,630	932
Oct-20	43.3	8,010	657	8,660	980
Nov-20	43.6	8,330	671	9,300	952
Dec-20	45.2	8,230	823	8,460	646
Jan-21	49.3	7,900	501	8,400	599
Feb-21	53.1	7,620	647	8,270	482
Mar-21	51.3	8,560	566	9,180	295
Apr-21	45.3	9,240	396	9,250	818
May-21	43.5	8,850	353	9,210	906
Jun-21	42.5	8,540	505	9,040	1,030
Jul-21	41.5	6,700	676	7,370	862
Aug-21	42.2	7,500	569	8,070	928
Sep-21	42.5	8,140	301	8,360	806
Oct-21	58.0	8,630	431	9,470	937
Nov-21	56.3	9,950	633	11,000	745

Month, Year	Flow	Ammonia *	Nitrate + Nitrite *	TIN *,**	Total P *
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	89.1	8,860	453	9,440	672
Jan-22	57.5	7,690	1,110	8,490	439
Feb-22	47.8	8,990	768	9,940	419
Mar-22	46.6	9,140	541	9,810	149
Apr-22	48.3	10,100	551	10,700	507
May-22	44.3	10,200	318	10,900	696
Jun-22	42.9	8,710	507	9,220	771
Jul-22	41.8	9,070	483	9,560	670
Aug-22	42.5	10,800	500	11,300	766
Sep-22	42.7	8,150	720	8,900	652
Oct-22	42.2	10,200	430	10,600	901
Nov-22	44.5	8,080	525	8,600	774
Dec-22	66.2	9,030	830	9,220	683
Jan-23	117	6,300	1,860	8,800	753
Feb-23	62.2	8,200	1,290	9,330	732
Mar-23	102	9,630	610	9,770	705
Apr-23	57.7	9,070	530	9,590	368
May-23	51.3	8,880	467	9,690	826
Jun-23	45.4	7,210	594	7,800	899
Jul-23	43.5	5,220	1,330	6,550	1,240
Aug-23	44.2	5,500	914	6,410	1,140
Sep-23	43.8	5,480	763	6,180	1,200
Dry Season Average	**45.9**	**8,610**	**549**	**9,170**	**803**
Dry Season Trend * **	**Down**	**None**	**None**	**None**	**Up**
Wet Season Average	**60.8**	**8,860**	**774**	**9,640**	**793**
Average Annual	**54.6**	**8,760**	**680**	**9,440**	**797**

* Numbers in this table are slightly different compared to those reported in the CIWQS, due to rounding of conversion factors used.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

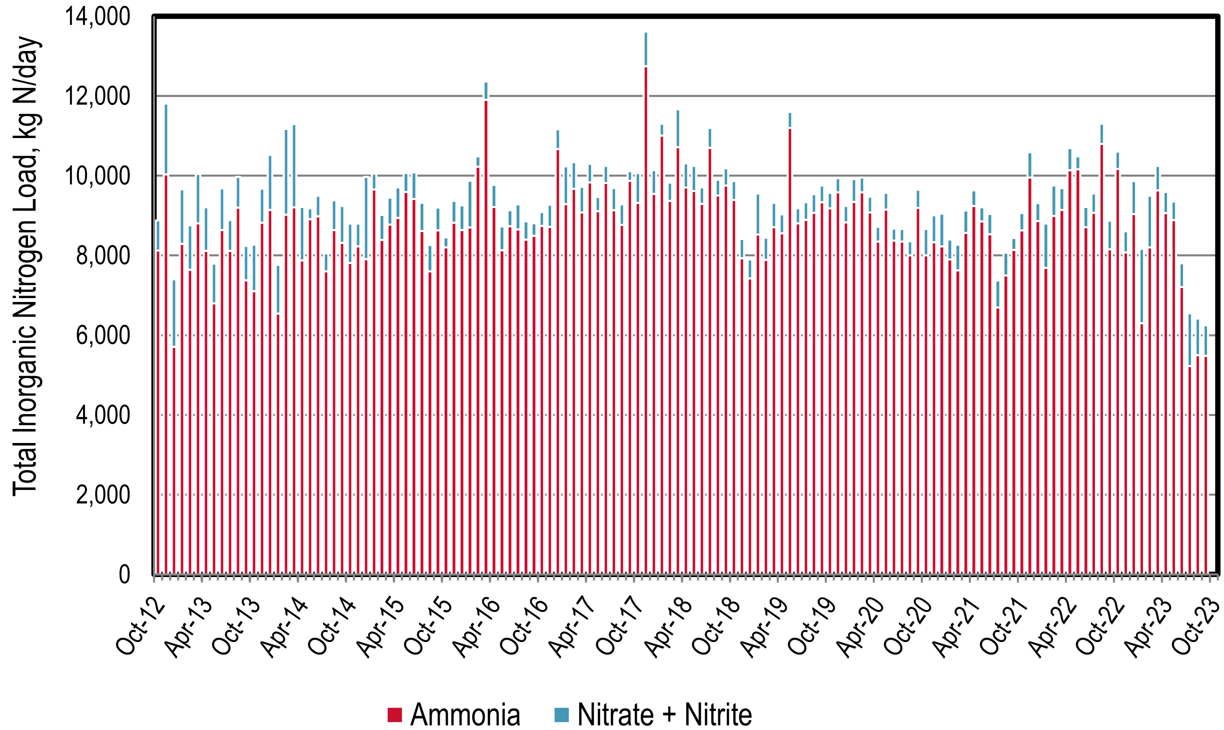

Figure 9-3. Discharge: EBMUD Monthly Nitrogen Loads

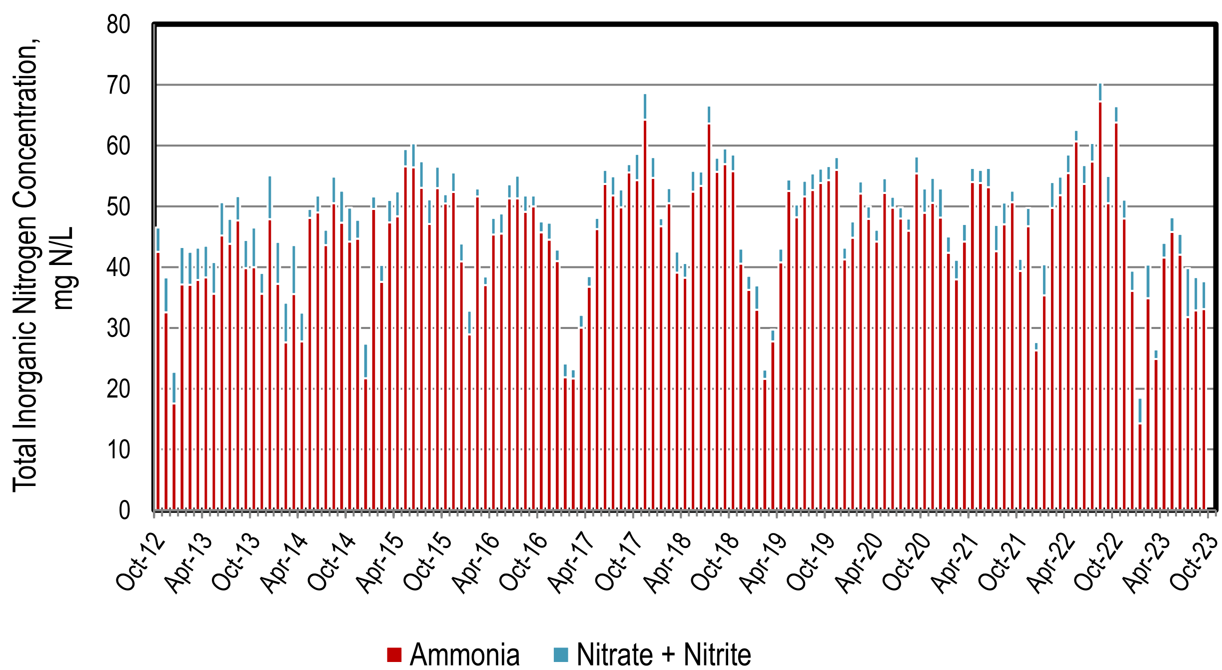

Figure 9-4. Discharge: EBMUD Monthly Nitrogen Concentrations

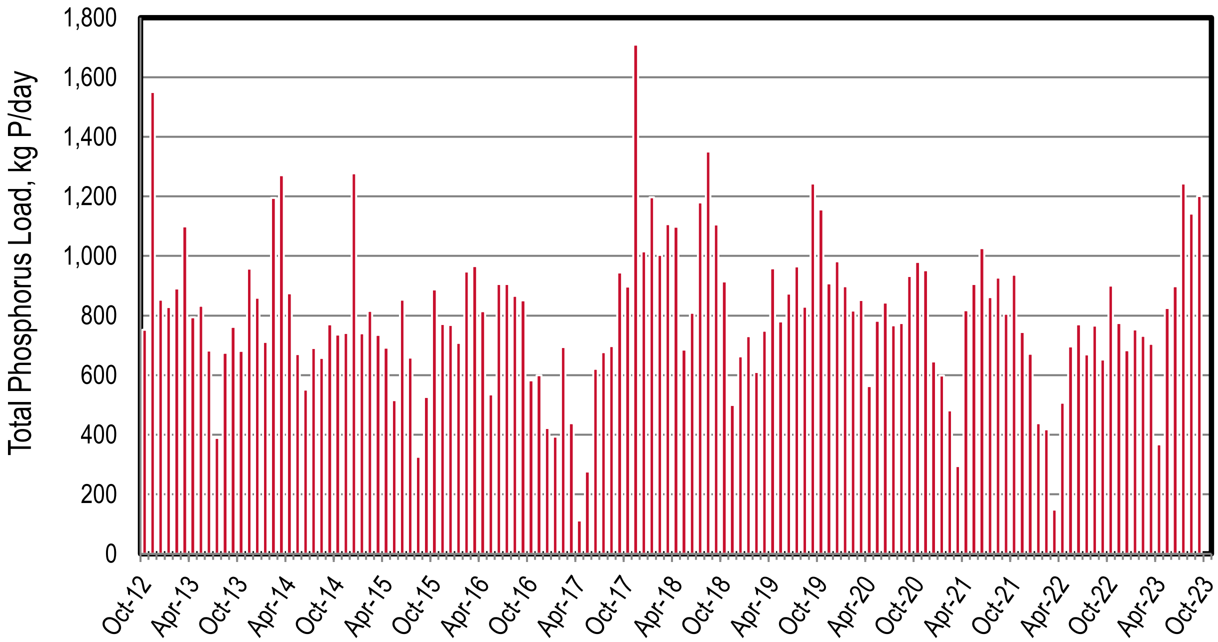

Figure 9-5. Discharge: EBMUD Monthly Phosphorus Loads

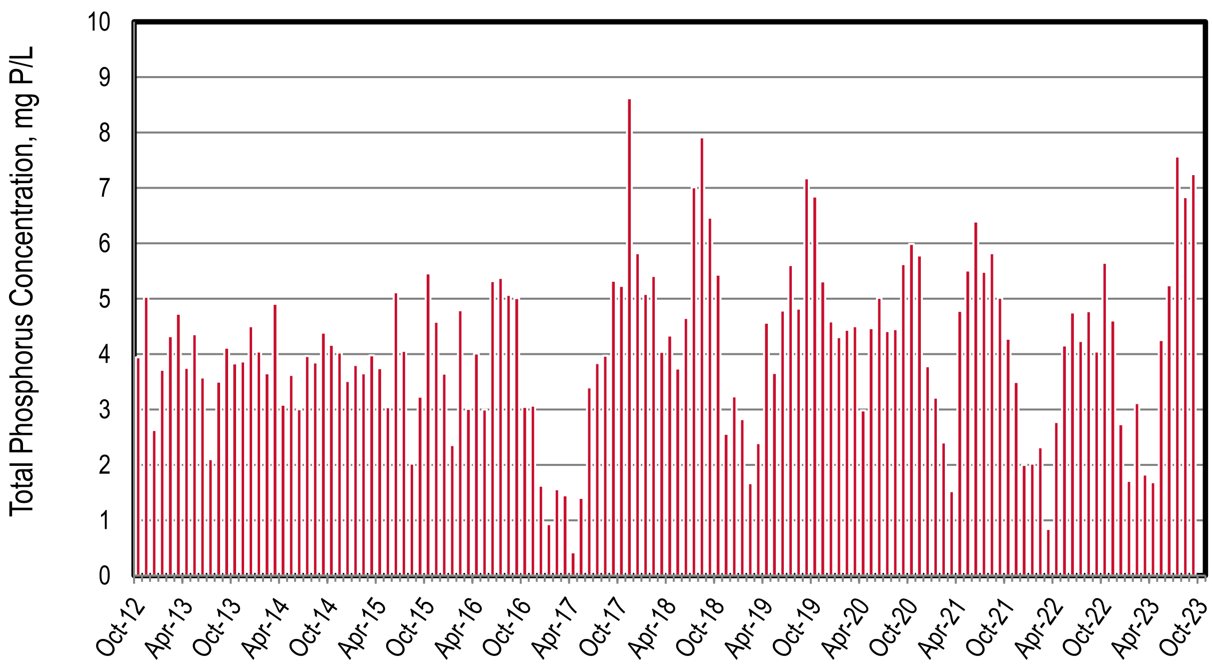

Figure 9-6. Discharge: EBMUD Monthly Phosphorus Concentrations

Recycled Water

Table 9-3. Recycled Water: EBMUD Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application ***	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	162 (0.14)	--	813 (0.73)	--	--	--	975 (0.87)
2020	--	185 (0.17)	--	648 (0.58)	--	--	--	833 (0.74)
2021	--	193 (0.17)	--	652 (0.58)	--	--	--	845 (0.75)
2022	--	198 (0.18)	--	0 (0)	--	--	--	198 (0.18)
Average	--	185 (0.17)	--	528 (0.47)	--	--	--	713 (0.64)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** The listed EBMUD volume and/or load represents the portion of industrial application that is diverted from the Bay. Approximately 4 to 10 times more volume and/or load is used for industrial applications, but they are not diverted from the Bay and thus not included with this dataset.**

Table 9-4. Recycled Water: EBMUD Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application ***	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	22	--	115	--	--	--	137
2020	--	31	--	107	--	--	--	137
2021	--	28	--	95	--	--	--	123
2022	--	35	--	0	--	--	--	35
Average	--	29	--	79	--	--	--	108

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** The listed EBMUD volume and/or load represents the portion of industrial application that is diverted from the Bay. Approximately 4 to 10 times more volume and/or load is used for industrial applications, but they are not diverted from the Bay and thus not included with this dataset.**

Table 9-5. Recycled Water: EBMUD Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application ***	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	23	--	121	--	--	--	145
2020	--	33	--	112	--	--	--	143
2021	--	30	--	101	--	--	--	131
2022	--	37	--	0	--	--	--	37
Average	--	31	--	84	--	--	--	114

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** The listed EBMUD volume and/or load represents the portion of industrial application that is diverted from the Bay. Approximately 4 to 10 times more volume and/or load is used for industrial applications, but they are not diverted from the Bay and thus not included with this dataset.**

Table 9-6. Recycled Water: EBMUD Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application ***	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	2	--	11	--	--	--	14
2020	--	3	--	10	--	--	--	13
2021	--	3	--	9	--	--	--	11
2022	--	2	--	0	--	--	--	2
Average	--	3	--	8	--	--	--	10

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** The listed EBMUD volume and/or load represents the portion of industrial application that is diverted from the Bay. Approximately 4 to 10 times more volume and/or load is used for industrial applications, but they are not diverted from the Bay and thus not included with this dataset.**

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10 Fairfield-Suisun Sewer District (FSSD)

FSSD discharges to waterways in the Suisun Marsh that flow more than 13 miles before reaching Suisun Bay. FSSD serves approximately 40,300 service connections. The plant has a permitted ADWF capacity of 23.7 mgd. This past dry season average discharge flow was approximately 13.6 mgd. The plant fully nitrifies and partially denitrifies using activated sludge.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent
  - Note: limited to sampling since July 2019; quarterly sampling required at a minimum. Based on the limited dataset in Table 10-1, there is an upward dry season trend for flows and no emerging dry season trends for the nutrient parameters.
  - The flow reduction across the plant is ≤10 percent. This reduction is attributed to a blend of water bound with biosolids, evaporation, and recycled water.
  - Nitrogen load reduction values across the plant ranges from approximately 55 to 85 percent. This load reduction is attributed primarily to a combination of biological assimilation and nutrient load reduction in the activated sludge system. Note: secondary process optimization during the 2023 dry season resulted in higher than average nitrogen and phosphorus load reductions.
  - Phosphorus load reduction across the plant ranges from approximately 25 to 85 percent. This reduction is primarily attributed to a combination of chemical removal, biological assimilation, and biological phosphorus removal in the activated sludge system. Refer to the aforementioned process optimization during the 2023 dry season.
- Discharge
  - Nitrogen loads typically increase with flow during wet weather events, whereas the phosphorus loads are relatively flat year-round.
  - NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant reliably nitrifies year-round. The 2023 dry season optimization efforts were evident based on the relatively low June 2023 levels.
  - Total phosphorus concentrations are wide ranging from approximately 0.9 to 6.8 mg P/L. The 2023 dry season optimization efforts were evident based on the relatively low June 2023 levels.
  - Based on Table 10-2 statistics for the entire dry season dataset, flow appears to be trending upwards, whereas the other nutrient parameters have no emerging trends.
- Recycled Water
  - Based on Table 10-3, the plant has averaged 0.78 mgd of recycled water over the 2019-2022 calendar years. Recycled water uses include commercial, industrial, and agricultural uses. Note: the listed volume/flows in Table 10-3 does not include in-plant/utility flow volumes. Furthermore, the listed average does not include water that is discharged to the duck clubs adjacent to the plant which provides marsh enhancement. Such duck club discharges are included in the plant’s effluent flows.

- Based on Table 10-4 through Table 10-6 respectively, the plant has averaged the diversion of <1 kg ammonia-N/d, 61 kg TIN-N/d and 11 kg P/d away from the Bay through recycled water over the 2019-2022 calendar years.

Influent

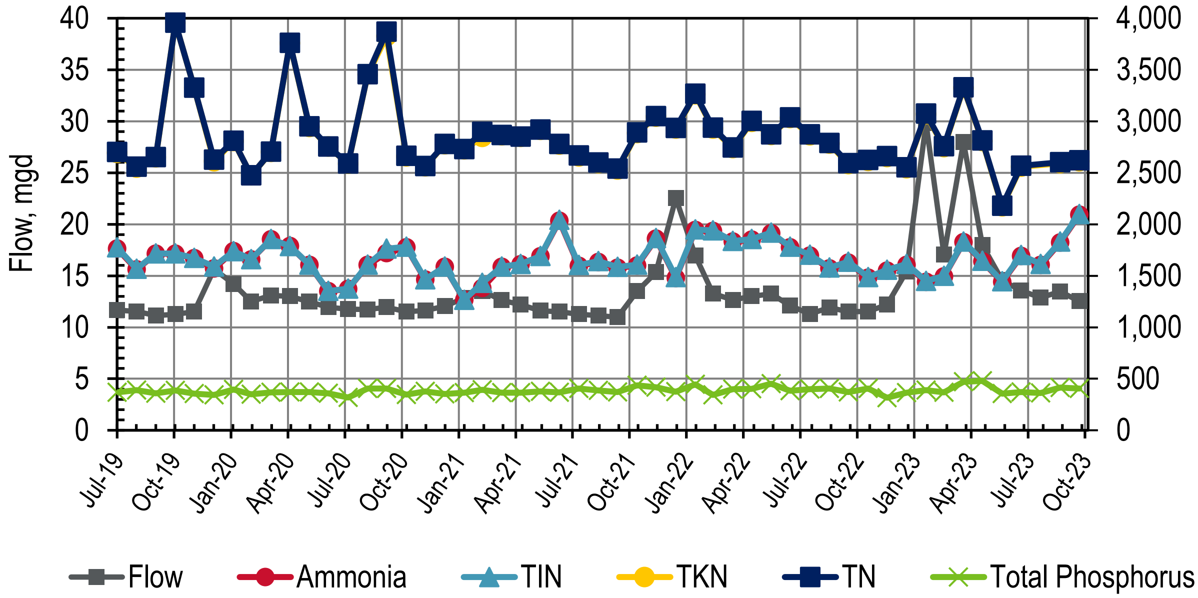

Figure 10-1. Influent: FSSD Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N loads and thus are not visible.

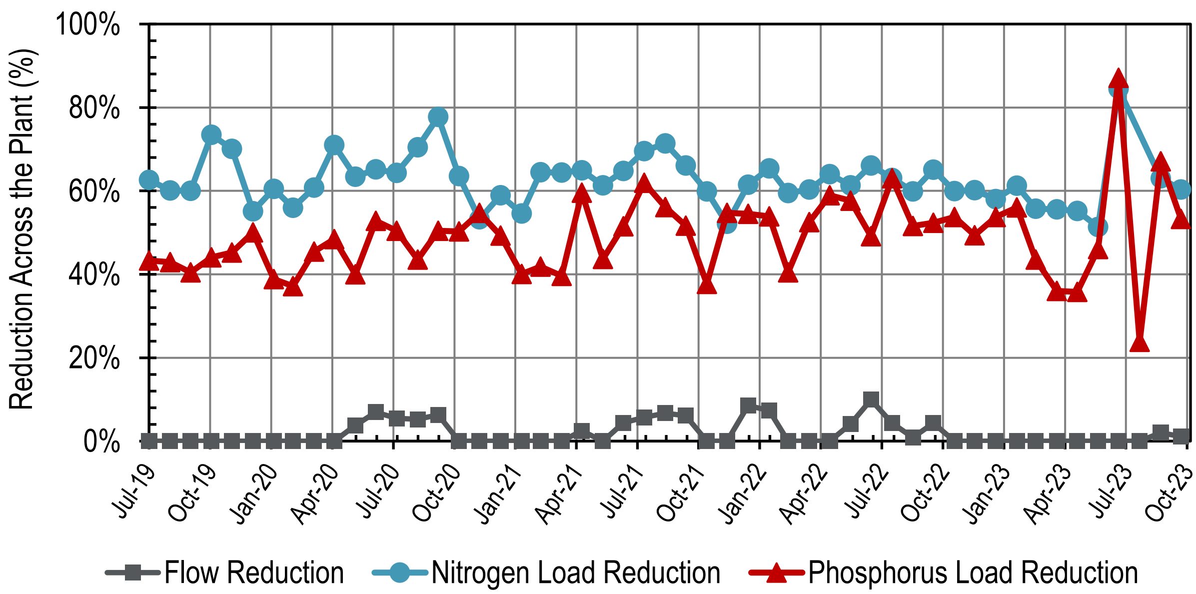

Figure 10-2. Influent: FSSD Monthly Reductions Across the Plant

Note: Influent TKN (instead of Total N) was compared against Discharge TIN for calculating nitrogen load reduction as insufficient Total N data was available. The difference is anticipated to be negligible as the historical TKN and Total N data are comparable (referred to Figure 10-1).

Table 10-1. Influent: FSSD Monthly Flows and Loads

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	11.7	1,760	10.2	1,770	2,690	2,700	368
Aug-19	11.5	1,560	8.34	1,570	2,550	2,560	389
Sep-19	11.1	1,710	3.00	1,720	2,650	2,650	359
Oct-19	11.2	1,710	1.74	1,720	3,950	3,960	388
Nov-19	11.5	1,670	2.62	1,670	3,320	3,330	356
Dec-19	15.7	1,570	17.2	1,590	2,610	2,630	344
Jan-20	14.2	1,740	2.40	1,740	2,810	2,810	396
Feb-20	12.5	1,660	2.15	1,660	2,470	2,470	350
Mar-20	13.1	1,850	2.57	1,860	2,700	2,700	367
Apr-20	13.0	1,790	2.63	1,790	3,760	3,760	372
May-20	12.5	1,600	4.90	1,610	2,940	2,950	370
Jun-20	11.9	1,350	2.11	1,350	2,750	2,750	358
Jul-20	11.7	1,370	1.73	1,370	2,590	2,590	319
Aug-20	11.7	1,600	2.67	1,610	3,450	3,460	404
Sep-20	12.0	1,720	44.2	1,760	3,820	3,870	405
Oct-20	11.5	1,780	4.43	1,780	2,660	2,660	346
Nov-20	11.6	1,460	3.45	1,460	2,560	2,560	378
Dec-20	12.0	1,590	2.58	1,590	2,780	2,780	351
Jan-21	12.8	1,260	2.35	1,270	2,730	2,730	364
Feb-21	13.5	1,380	49.6	1,430	2,850	2,900	394
Mar-21	12.6	1,590	1.97	1,590	2,860	2,870	366
Apr-21	12.2	1,610	3.49	1,610	2,850	2,850	366
May-21	11.6	1,690	2.54	1,690	2,920	2,920	378
Jun-21	11.5	2,030	7.91	2,040	2,770	2,780	367
Jul-21	11.2	1,600	7.78	1,600	2,660	--	404
Aug-21	11.1	1,630	7.78	1,640	2,590	--	385
Sep-21	11.0	1,580	7.78	1,590	2,530	--	372
Oct-21	13.5	1,600	7.78	1,610	2,880	--	437
Nov-21	15.3	1,860	7.78	1,870	3,040	--	418
Dec-21	22.5	1,480	7.78	1,490	2,930	--	374
Jan-22	16.9	1,940	7.78	1,950	3,260	--	447
Feb-22	13.3	1,930	7.78	1,940	2,930	--	344
Mar-22	12.7	1,830	7.78	1,840	2,740	--	400
Apr-22	13.0	1,850	7.78	1,860	2,990	--	402
May-22	13.2	1,910	7.78	1,920	2,860	--	451
Jun-22	12.1	1,770	7.78	1,780	3,030	--	383

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	11.3	1,690	7.78	1,700	2,860	--	400
Aug-22	11.9	1,570	7.78	1,580	2,780	--	405
Sep-22	11.5	1,630	7.78	1,630	2,580	--	371
Oct-22	11.5	1,480	7.78	1,490	2,610	2,620	406
Nov-22	12.2	1,550	7.78	1,560	2,650	2,660	316
Dec-22	15.4	1,610	7.78	1,610	2,540	2,550	365
Jan-23	29.8	1,440	7.78	1,450	3,070	3,070	389
Feb-23	17.0	1,490	7.78	1,500	2,750	2,760	369
Mar-23	28.0	1,820	7.78	1,830	3,320	3,330	472
Apr-23	18.0	1,640	7.78	1,650	2,810	2,810	479
May-23	14.6	1,440	7.78	1,450	2,170	2,180	356
Jun-23	13.6	1,690	7.78	1,700	2,560	2,570	371
Jul-23	12.9	1,610	7.78	1,610	--	--	362
Aug-23	13.5	1,820	7.78	1,830	2,590	2,600	416
Sep-23	12.5	2,090	7.78	2,100	2,610	2,620	404
Dry Season Average	**12.1**	**1,670**	**8.20**	**1,680**	**2,770**	**2,780**	**383**
Dry Season Trend ***	**Up**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**14.9**	**1,650**	**7.43**	**1,660**	**2,910**	**2,920**	**384**
Average Annual	**13.6**	**1,660**	**7.78**	**1,670**	**2,850**	**2,860**	**383**

* Fairfield-Suisun Sewer District typically samples more than the required influent quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

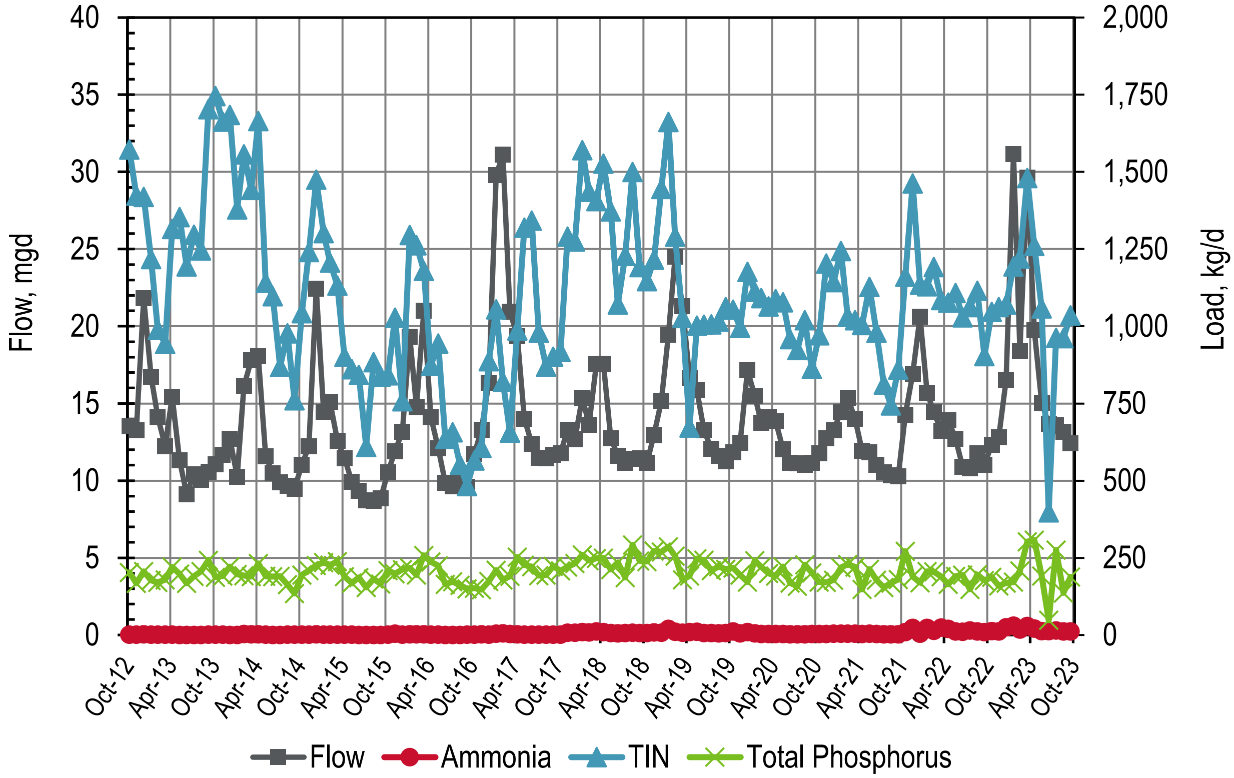

Figure 10-3. Discharge: FSSD Monthly Flows and Loads

Table 10-2. Discharge: FSSD Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	13.5	1.26	1,570	1,570	203
Nov-12	13.3	1.81	1,420	1,420	168
Dec-12	21.8	2.74	1,420	1,420	206
Jan-13	16.7	1.90	1,220	1,220	177
Feb-13	14.1	1.60	987	989	171
Mar-13	12.2	1.95	941	943	179
Apr-13	15.4	1.46	1,310	1,320	221
May-13	11.3	0.855	1,350	1,350	198
Jun-13	9.15	0.691	1,190	1,190	168
Jul-13	10.4	0.787	1,300	1,300	190
Aug-13	10.1	0.940	1,240	1,250	206
Sep-13	10.6	1.42	1,700	1,700	243
Oct-13	11.1	1.25	1,740	1,750	187
Nov-13	11.7	1.50	1,660	1,660	192
Dec-13	12.7	0.962	1,680	1,690	221
Jan-14	10.3	0.775	1,380	1,380	197
Feb-14	16.1	3.57	1,550	1,560	193
Mar-14	17.8	2.89	1,440	1,440	189
Apr-14	18.1	2.82	1,660	1,670	232
May-14	11.6	1.75	1,140	1,140	191
Jun-14	10.5	0.982	1,100	1,100	189
Jul-14	9.88	1.12	868	869	190
Aug-14	9.67	1.18	977	978	163
Sep-14	9.50	1.32	759	761	135
Oct-14	11.0	1.83	1,040	1,040	195
Nov-14	12.2	2.00	1,240	1,240	209
Dec-14	22.4	3.12	1,470	1,480	225
Jan-15	14.5	2.18	1,300	1,300	235
Feb-15	15.1	1.78	1,210	1,210	227
Mar-15	12.6	1.45	1,130	1,130	238
Apr-15	11.5	1.34	901	902	190
May-15	9.95	1.18	860	861	169
Jun-15	9.35	1.07	842	843	187
Jul-15	8.75	0.924	608	609	154
Aug-15	8.70	1.03	883	884	183
Sep-15	8.85	0.896	836	837	166

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	10.6	1.17	840	842	209
Nov-15	11.9	4.73	1,020	1,030	198
Dec-15	13.2	1.36	756	757	213
Jan-16	19.3	2.38	1,290	1,300	217
Feb-16	14.8	2.69	1,260	1,260	194
Mar-16	21.0	2.77	1,180	1,180	258
Apr-16	14.1	1.58	871	873	238
May-16	12.1	1.99	942	944	225
Jun-16	9.86	1.01	634	635	164
Jul-16	9.65	1.04	657	658	173
Aug-16	9.88	0.910	552	553	161
Sep-16	9.60	1.33	482	483	150
Oct-16	11.7	1.76	565	566	152
Nov-16	13.3	2.52	604	607	147
Dec-16	16.4	2.15	885	887	174
Jan-17	29.8	4.77	1,050	1,060	210
Feb-17	31.1	5.60	815	821	179
Mar-17	20.9	3.24	653	656	190
Apr-17	19.4	2.83	984	987	252
May-17	14.0	1.96	1,320	1,320	227
Jun-17	12.4	2.10	1,340	1,340	221
Jul-17	11.5	1.58	979	980	192
Aug-17	11.4	1.73	868	870	195
Sep-17	11.7	1.84	900	902	223
Oct-17	11.8	1.94	916	918	208
Nov-17	13.3	7.91	1,280	1,290	221
Dec-17	12.7	7.81	1,270	1,280	232
Jan-18	15.4	9.74	1,560	1,570	260
Feb-18	13.6	8.61	1,430	1,440	241
Mar-18	17.6	12.0	1,390	1,410	249
Apr-18	17.6	9.75	1,520	1,530	249
May-18	12.8	7.29	1,370	1,370	212
Jun-18	11.6	5.97	1,070	1,070	235
Jul-18	11.2	6.74	1,040	1,230	186
Aug-18	11.4	7.57	1,490	1,500	293
Sep-18	11.4	6.56	1,190	1,190	240
Oct-18	11.2	6.63	1,140	1,150	238

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	13.0	9.32	1,210	1,220	272
Dec-18	15.2	8.32	1,440	1,450	269
Jan-19	19.4	19.9	1,640	1,660	286
Feb-19	24.5	10.6	1,280	1,290	256
Mar-19	21.3	7.67	1,020	1,030	179
Apr-19	16.7	9.60	663	672	191
May-19	15.9	11.4	991	1,000	248
Jun-19	13.3	6.98	998	1,010	242
Jul-19	12.1	6.36	1,000	1,010	209
Aug-19	11.6	5.73	1,010	1,020	222
Sep-19	11.3	6.57	1,060	1,060	214
Oct-19	11.8	12.0	1,040	1,050	217
Nov-19	12.5	6.04	989	995	195
Dec-19	17.2	9.73	1,170	1,180	172
Jan-20	15.5	5.95	1,110	1,110	242
Feb-20	13.8	3.98	1,090	1,090	220
Mar-20	14.1	4.18	1,060	1,060	200
Apr-20	13.8	4.22	1,080	1,090	192
May-20	12.0	3.52	1,070	1,080	222
Jun-20	11.1	2.96	956	959	169
Jul-20	11.1	3.01	920	923	158
Aug-20	11.1	3.15	1,020	1,020	228
Sep-20	11.2	3.24	859	862	201
Oct-20	11.8	3.51	968	971	172
Nov-20	12.8	3.55	1,200	1,200	171
Dec-20	13.3	4.66	1,140	1,140	178
Jan-21	14.4	4.40	1,240	1,240	218
Feb-21	15.4	4.93	1,030	1,030	229
Mar-21	14.0	4.50	1,020	1,020	221
Apr-21	11.9	3.34	1,000	1,000	148
May-21	11.8	5.16	1,120	1,130	213
Jun-21	11.0	3.27	976	980	178
Jul-21	10.6	2.97	809	812	154
Aug-21	10.4	2.74	741	744	169
Sep-21	10.3	3.19	857	860	180
Oct-21	14.3	9.49	1,150	1,160	272
Nov-21	16.9	23.4	1,440	1,460	189

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	20.6	5.23	1,130	1,130	170
Jan-22	15.7	23.0	1,110	1,130	206
Feb-22	14.5	14.6	1,180	1,190	205
Mar-22	13.2	24.0	1,060	1,090	190
Apr-22	13.9	20.1	1,060	1,080	165
May-22	12.7	12.3	1,100	1,110	191
Jun-22	10.9	11.3	1,020	1,030	195
Jul-22	10.8	14.7	1,050	1,060	148
Aug-22	11.8	11.7	1,100	1,120	196
Sep-22	11.0	10.4	894	904	177
Oct-22	12.3	13.4	1,030	1,050	188
Nov-22	12.8	12.0	1,050	1,060	160
Dec-22	16.6	25.3	1,050	1,070	169
Jan-23	31.1	31.2	1,160	1,190	171
Feb-23	18.4	17.8	1,200	1,220	208
Mar-23	29.6	29.3	1,450	1,480	302
Apr-23	19.7	21.8	1,240	1,260	308
May-23	15.0	13.5	1,050	1,060	192
Jun-23	13.7	13.6	384	398	48.0
Jul-22	13.6	14.7	949	963	276
Aug-23	13.2	11.8	951	962	137
Sep-23	12.4	11.7	1,020	1,040	189
Dry Season Average	**11.2**	**4.76**	**989**	**997**	**192**
Dry Season Trend **	**Up**		**None**	**None**	**None**
Wet Season Average	**15.8**	**7.21**	**1,170**	**1,180**	**209**
Average Annual	**13.9**	**6.19**	**1,100**	**1,100**	**202**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Ammonia was not considered in the trending as the plant reliably fully nitrifies and the majority of samples are non-detects.

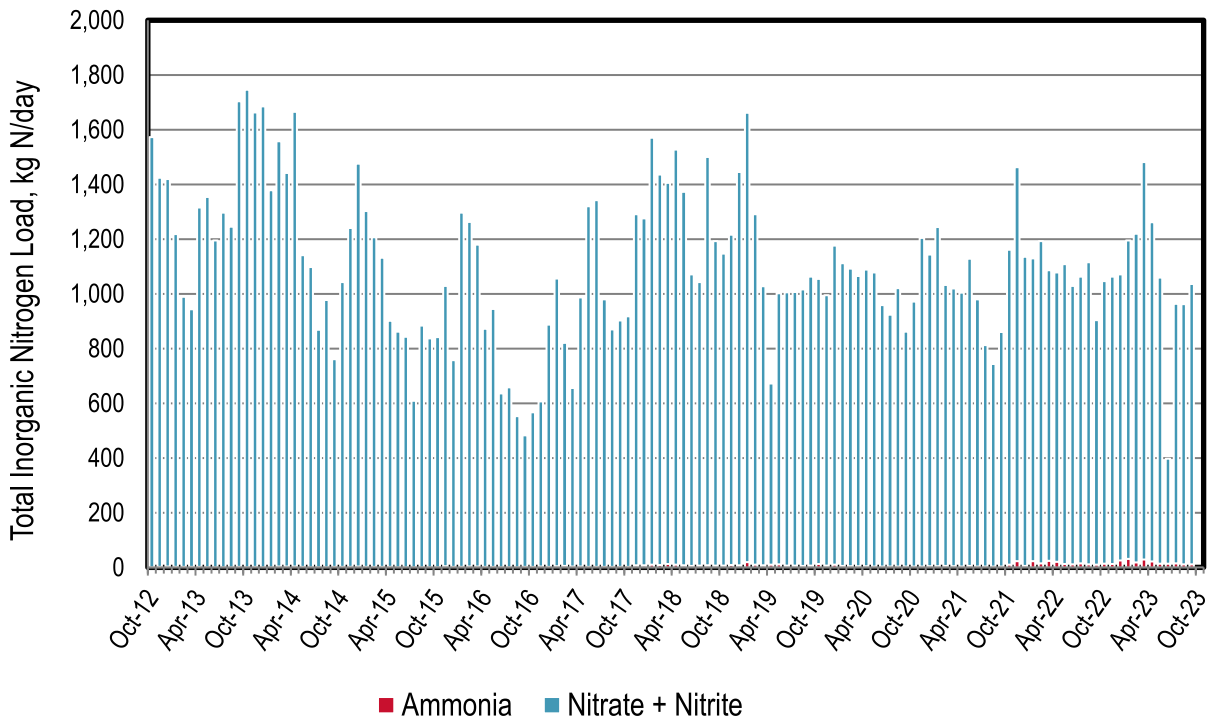

Figure 10-4. Discharge: FSSD Monthly Nitrogen Loads

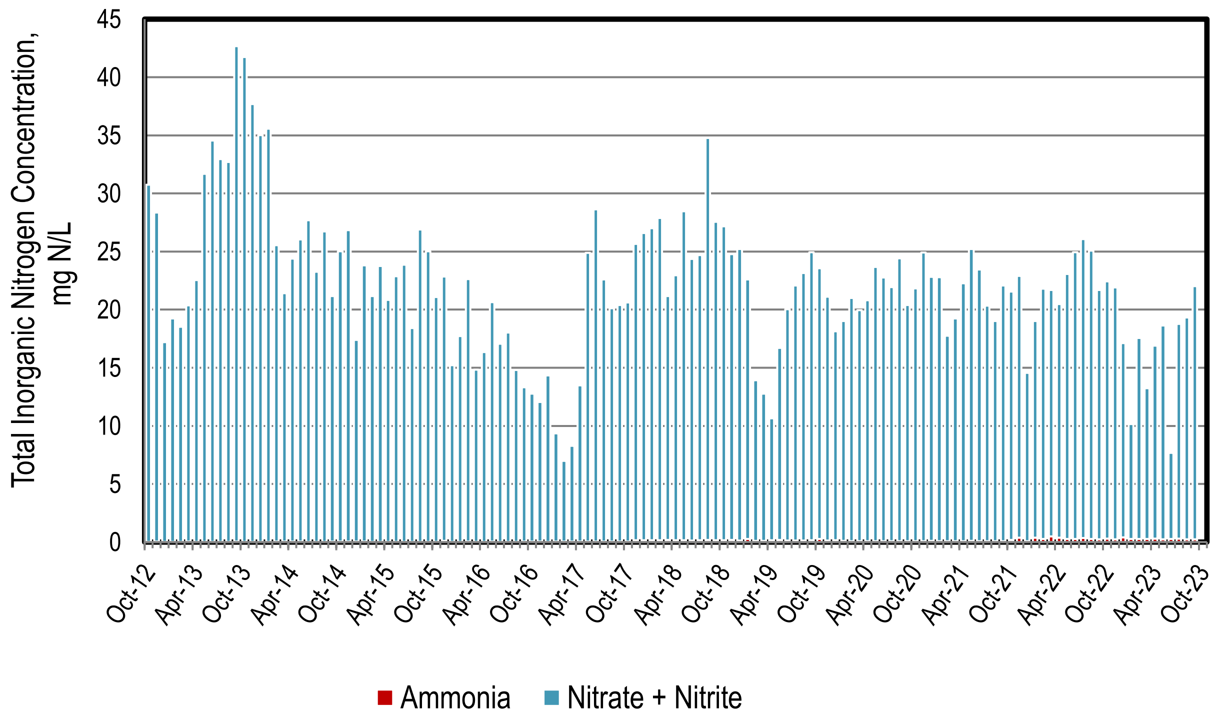

Figure 10-5. Discharge: FSSD Monthly Nitrogen Concentrations

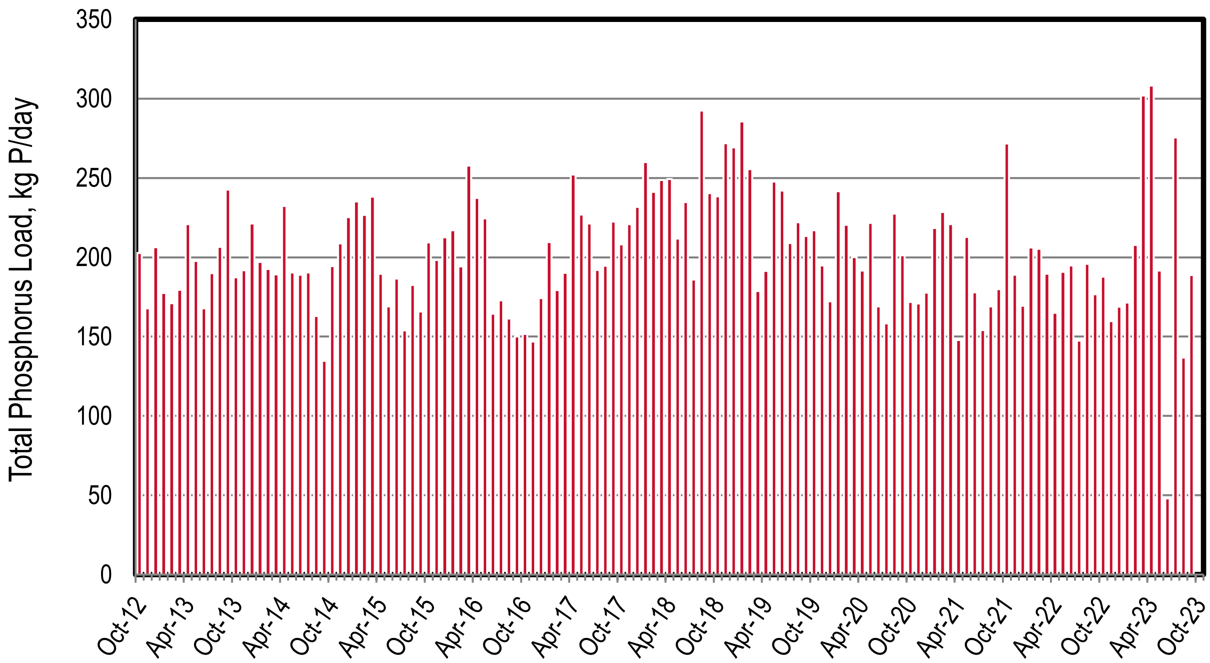

Figure 10-6. Discharge: FSSD Monthly Phosphorus Loads

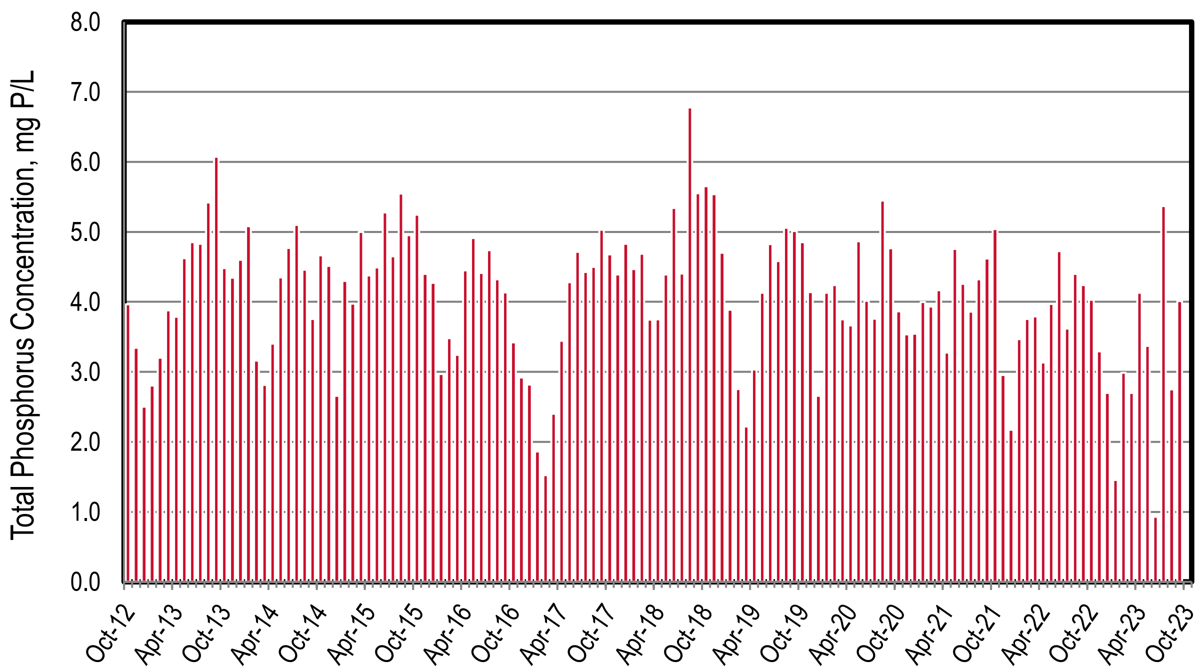

Figure 10-7. Discharge: FSSD Monthly Phosphorus Concentrations

Recycled Water

Table 10-3. Recycled Water: FSSD Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	--	--	19 (0.02)	730 (0.65)	--	--	749 (0.67)
2020	--	--	13 (0.01)	28 (0.02)	989 (0.88)	--	--	1,030 (0.92)
2021	--	--	38 (0.03)	32 (0.03)	925 (0.83)	--	--	995 (0.89)
2022	--	--	7 (0.01)	36 (0.03)	647 (0.58)	--	--	690 (0.62)
Average	--	--	15 (0.01)	29 (0.03)	823 (0.74)	--	--	866 (0.78)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 10-4. Recycled Water: FSSD Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	--	<1	<1	<1	--	--	<1
2020	--	--	<1	<1	<1	--	--	<1
2021	--	--	<1	<1	<1	--	--	<1
2022	--	--	<1	<1	<1	--	--	<1
Average	--	--	<1	<1	<1	--	--	<1

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 10-5. Recycled Water: FSSD Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	--	<1	1	45	--	--	46
2020	--	--	<1	2	73	--	--	76
2021	--	--	2	2	65	--	--	69
2022	--	--	<1	2	48	--	--	51
Average	--	--	1	2	58	--	--	61

* Assumes 100% of the recycled load is diverted for all recycled water applications

** **Calendar year as opposed to California's water year (October 1 through September 30)**

Table 10-6. Recycled Water: FSSD Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	--	<1	<1	9	--	--	9
2020	--	--	<1	<1	14	--	--	14
2021	--	--	<1	<1	12	--	--	13
2022	--	--	<1	<1	8	--	--	9
Average	--	--	<1	<1	11	--	--	11

* Assumes 100% of the recycled load is diverted for all recycled water applications

** **Calendar year as opposed to California's water year (October 1 through September 30)**

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11 Las Gallinas Valley Sanitary District

Las Gallinas discharges to Miller Creek that is connected to San Pablo Bay. The plant has approximately 15,800 service connections; it has a permitted capacity of 2.92 mgd ADWF and a peak wet weather secondary treatment capacity of up to 8.0 mgd. The average discharge flow this past dry season was 0 mgd as Las Gallinas did not discharge to San Pablo Bay during the dry season. The plant achieves secondary treatment using a hybrid fixed film activated sludge process, which also achieves nitrification and partial denitrification. Discharge to Miller Creek is prohibited June 1 through October 31. However, when conditions permit, the non-discharge period may be voluntarily extended beyond October 31, as was the case in 2022/2023.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge:
  - TIN loads are relatively consistent over the years shown except for 20221/2022 and 2022/2023 when the TIN loads were relatively lower than previous years. This is due to LGVSD extending the period of non-discharge and also a result of the new secondary treatment process that achieves nitrification and partial denitrification as noted above.
  - Wet weather ammonia loads have gradually increased since nutrient sampling began in 2012 under Section 13267 Letter Data. Average monthly ammonia loads were the highest in March 2023, which was driven by a blending event on March 3, 2023.
  - NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. A portion of ammonia bleeds through during the colder months.
  - Total phosphorus concentrations range from 0.2 to 6.0 mg P/L. This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L.
  - Based on Table 11-1 statistics for the entire dry season dataset, there are no emerging dry season trends as Las Gallinas does not typically discharge during the dry season.
- Recycled Water:
  - Based on Table 11-2, the plant averages 0.64 mgd of recycled water. Recycled water uses included landscape irrigation and agricultural irrigation.
  - Based on Table 11-3 through Table 11-5, the plant diverted on average 6 kg ammonia-N/d, 39 kg TIN-N/d, and 12 kg P/d away from the Bay in 2022 through recycled water.

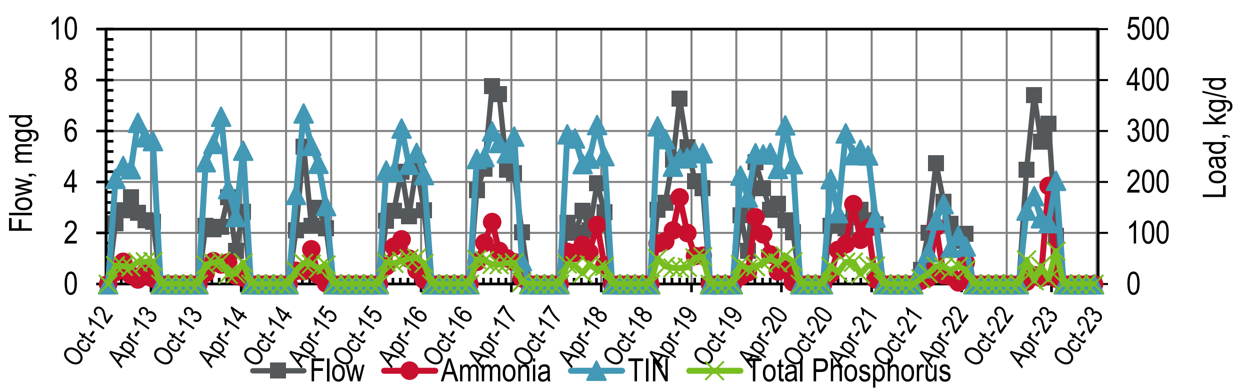

Figure 11-1. Discharge: Las Gallinas Monthly Flows and Loads

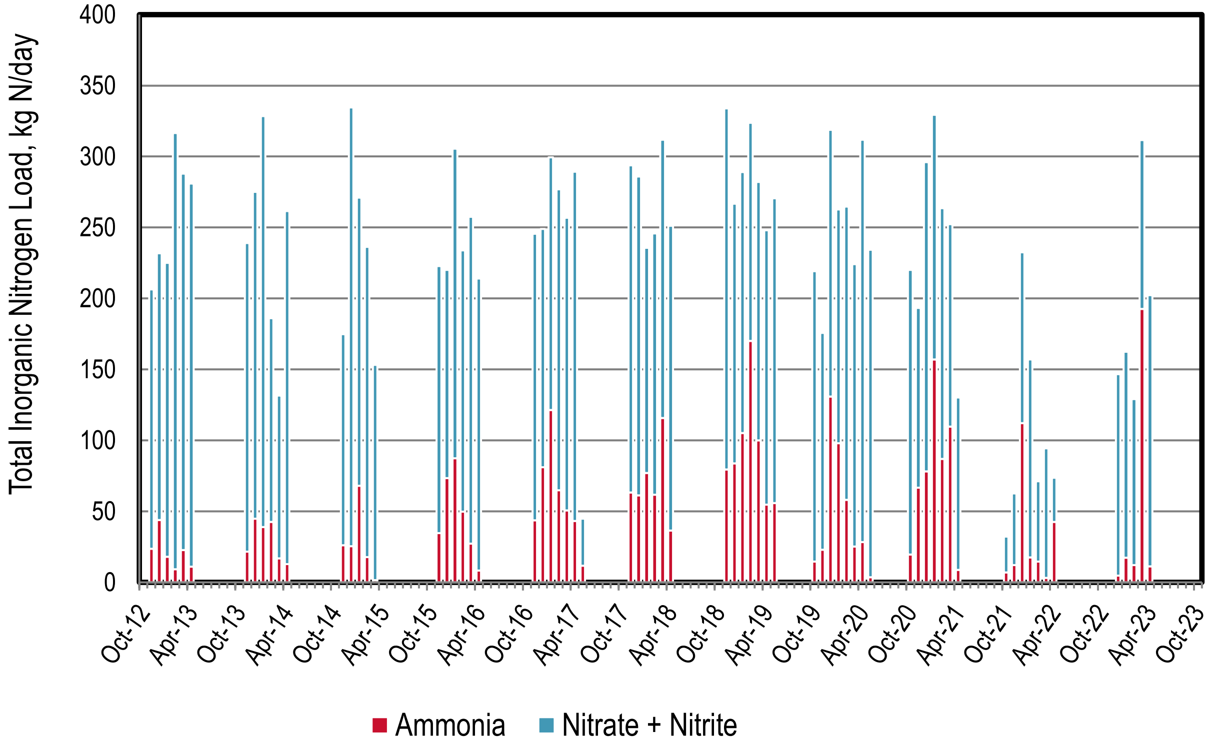

Figure 11-2. Discharge: Las Gallinas Monthly Nitrogen Loads

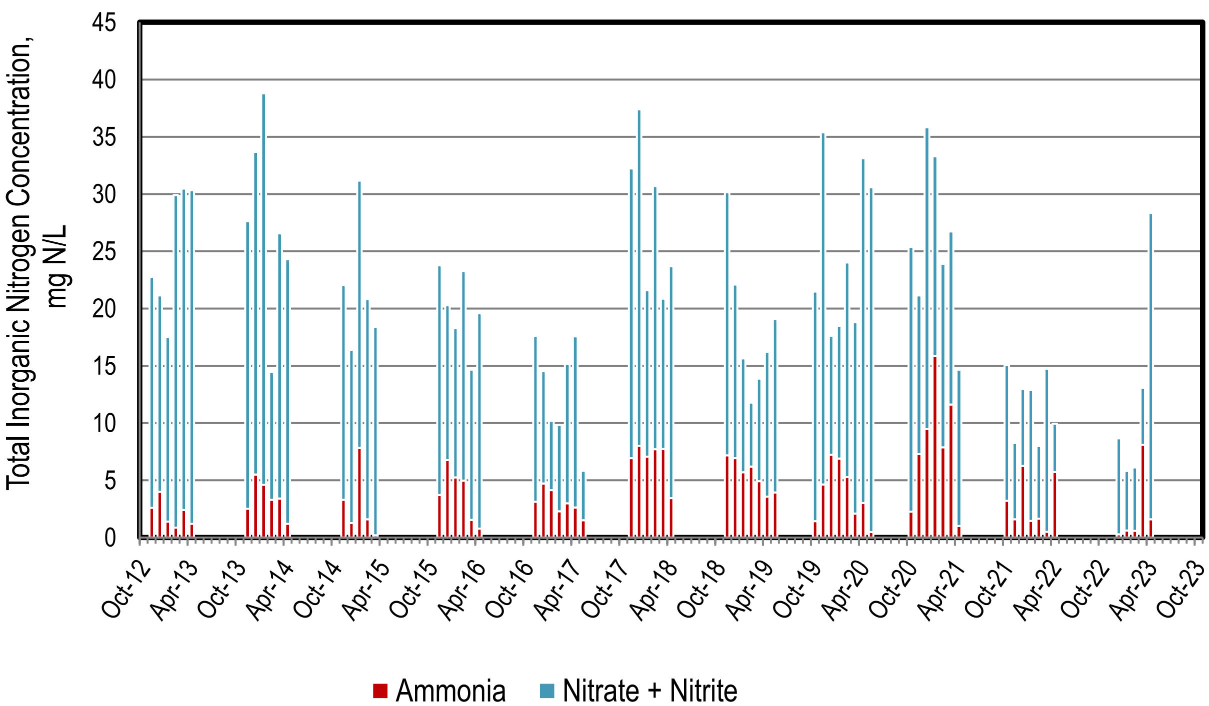

Figure 11-3. Discharge: Las Gallinas Monthly Nitrogen Concentrations

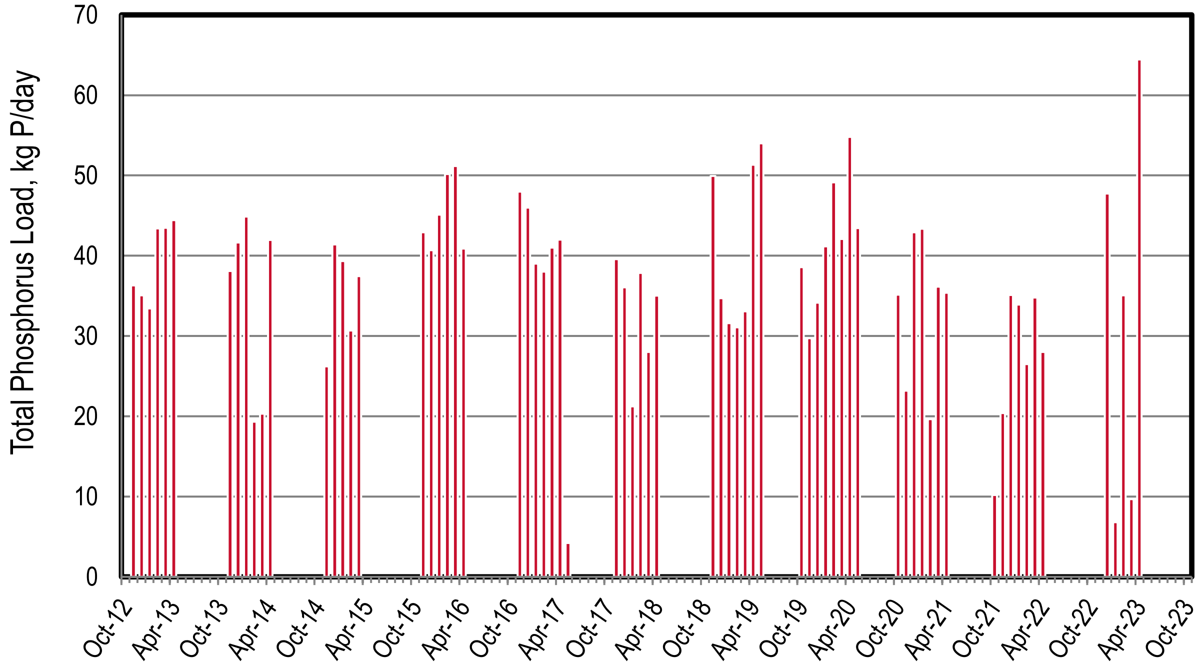

Figure 11-4. Discharge: Las Gallinas Monthly Phosphorus Loads

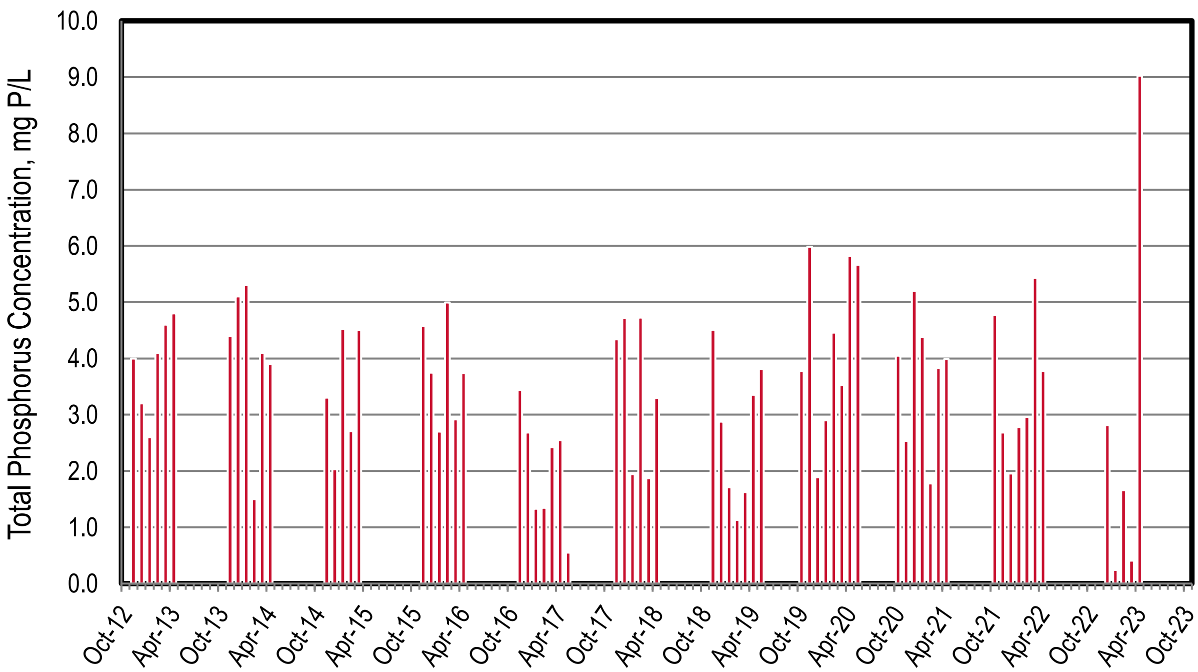

Figure 11-5. Discharge: Las Gallinas Monthly Phosphorus Concentrations

Table 11-1. Discharge: Las Gallinas Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0	0	0	0	0
Nov-12	2.40	23.6	183	206	36.3
Dec-12	2.90	43.8	188	232	35.1
Jan-13	3.40	18.0	207	225	33.4
Feb-13	2.80	9.21	307	316	43.4
Mar-13	2.50	22.7	265	288	43.5
Apr-13	2.45	11.1	270	281	44.5
May-13	0	0	0	0	0
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	0	0	0	0	0
Nov-13	2.29	21.6	217	239	38.1
Dec-13	2.16	44.9	230	275	41.6
Jan-14	2.24	38.9	289	328	44.9
Feb-14	3.41	42.5	144	186	19.3
Mar-14	1.31	16.8	115	132	20.3
Apr-14	2.85	12.9	249	262	42.0
May-14	0	0	0	0	0
Jun-14	0	0	0	0	0
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	0	0	0	0	0
Nov-14	2.10	26.2	149	175	26.2
Dec-14	5.40	25.4	309	335	41.4
Jan-15	2.30	68.1	203	271	39.4
Feb-15	3.00	17.9	218	236	30.7
Mar-15	2.20	1.60	152	153	37.5
Apr-15	0	0	0	0	0
May-15	0	0	0	0	0
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0	0	0	0	0
Nov-15	2.48	34.8	188	223	42.9
Dec-15	2.87	73.3	147	220	40.7
Jan-16	4.42	87.4	218	305	45.1
Feb-16	2.66	49.8	184	234	50.2
Mar-16	4.65	27.2	230	257	51.2
Apr-16	2.89	8.42	206	214	40.9
May-16	0	0	0	0	0
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16	0	0	0	0	0
Nov-16	3.69	43.6	202	246	48.0
Dec-16	4.54	81.0	168	249	46.0
Jan-17	7.77	121	178	299	39.0
Feb-17	7.45	64.9	212	277	38.0
Mar-17	4.48	50.8	206	257	41.0
Apr-17	4.36	43.3	246	289	42.0
May-17	2.04	11.6	33.3	44.9	4.22
Jun-17	0	0	0	0	0
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	0	0	0	0	0
Oct-17	0	0	0	0	0
Nov-17	2.41	63.2	231	294	39.6
Dec-17	2.02	61.2	225	286	36.0
Jan-18	2.89	77.1	159	236	21.2
Feb-18	2.12	61.7	184	246	37.8
Mar-18	3.96	116	196	312	28.0
Apr-18	2.81	36.5	215	251	35.0
May-18	0	0	0	0	0
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	0	0	0	0	0
Oct-18	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	2.93	79.5	254	310	49.9
Dec-18	3.19	83.7	183	284	34.7
Jan-19	4.89	105	184	230	31.6
Feb-19	7.27	170	154	247	31.1
Mar-19	5.38	100	182	248	33.1
Apr-19	4.05	54.8	193	258	51.3
May-19	3.75	55.9	215	257	54.0
Jun-19	0	0	0	0	0
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	2.70	14.6	205	213	38.6
Nov-19	1.31	23.0	153	170	29.7
Dec-19	4.79	131	188	257	34.2
Jan-20	3.76	97.9	165	254	41.2
Feb-20	2.92	58.1	207	257	49.2
Mar-20	3.16	25.1	199	226	42.1
Apr-20	2.49	28.4	283	312	54.8
May-20	2.03	3.61	231	236	43.4
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	0	0	0	0	0
Oct-20	2.29	19.6	200	206	35.1
Nov-20	2.42	66.7	127	139	23.2
Dec-20	2.19	78.3	218	296	42.9
Jan-21	2.62	157	172	253	43.4
Feb-21	2.92	87.0	177	264	19.6
Mar-21	2.50	110	143	252	36.2
Apr-21	2.35	8.85	121	130	35.4
May-21	0	0	0	0	0
Jun-21	0	0	0	0	0
Jul-21	0	0	0	0	0
Aug-21	0	0	0	0	0
Sep-21	0	0	0	0	0
Oct-21	0.565	6.88	25.3	31.3	10.2
Nov-21	2.01	12.1	50.6	62.7	20.4

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	4.75	112	120	126	35.1
Jan-22	3.23	17.6	139	157	33.9
Feb-22	2.36	14.6	56.7	71.3	26.5
Mar-22	1.69	3.23	91.1	94.3	34.8
Apr-22	1.96	42.6	31.1	73.7	28.0
May-22	0	0	0	0	0
Jun-22	0	0	0	0	0
Jul-22	0	0	0	0	0
Aug-22	0	0	0	0	0
Sep-22	0	0	0	0	0
Oct-22	0	0	0	0	0
Nov-22	0	0	0	0	0
Dec-22	4.49	4.69	142	145	47.8
Jan-23	7.41	17.4	145	172	6.80
Feb-23	5.59	12.2	117	129	35.1
Mar-23	6.30	193	119	120	9.69
Apr-23	1.89	11.3	191	202	64.4
May-23	0	0	0	0	0
Jun-23	0	0	0	0	0
Jul-23	0	0	0	0	0
Aug-23	0	0	0	0	0
Sep-23	0	0	0	0	0
Dry Season Average	**0.142**	**1.29**	**8.70**	**9.77**	**1.85**
Dry Season Trend **	**--*****	**--*****	**--*****	**--*****	**--*****
Wet Season Average	**2.89**	**45.4**	**159**	**195**	**31.8**
Average Annual	**1.74**	**27.0**	**96.2**	**118**	**19.3**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** The dry season average is significantly lower than the wet season due to only having one month with a dry season discharge (May 2017).

*** No dry season trending analysis was performed on Las Gallinas as discharge is prohibited from June through October.

Recycled Water

Table 11-2. Recycled Water: Las Gallinas Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	150 (0.13)	--	--	318 (0.28)	--	--	468 (0.41)
2020	--	101 (0.09)	--	--	275 (0.25)	--	--	376 (0.34)
2021	--	648 (0.58)	--	--	234 (0.21)	--	--	882 (0.79)
2022	--	882 (0.79)	--	--	245 (0.22)	--	--	1,127 (1.01)
Average	--	445 (0.39)	--	--	268 (0.24)	--	--	713 (0.64)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 11-3. Recycled Water: Las Gallinas Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	2	--	--	5	--	--	8
2020	--	2	--	--	4	--	--	6
2021	--	16	--	--	6	--	--	20=2
2022	--	5	--	--	1	--	--	6
Average	--	6	--	--	4	--	--	11

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 11-4. Recycled Water: Las Gallinas Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	7	--	--	15	--	--	23
2020	--	8	--	--	23	--	--	31
2021	--	37	--	--	13	--	--	50
2022	--	31	--	--	9	--	--	39
Average	--	21	--	--	15	--	--	36

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 11-5. Recycled Water: Las Gallinas Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	1	--	--	2	--	--	4
2020	--	1	--	--	4	--	--	5
2021	--	7	--	--	2	--	--	9
2022	--	10	--	--	3	--	--	12
Average	--	5	--	--	3	--	--	8

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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12 City of Millbrae

Millbrae discharges to the South Bay. The plant has approximately 6,500 service connections and it has a permitted capacity of 3.0 mgd ADWF. The average dry season flow this past year was approximately 1.44 mgd. The plant performs secondary treatment using an activated sludge process.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge
  - Nutrient loads typically increase with flow during wet weather events. However, the loads typically stay elevated after the flows decline back to typical values.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
  - Total phosphorus concentrations range from 0.5 to 5.4 mg P/L. The plant has an anaerobic selector which is thought to be the removal mechanism for months with relatively low values.
  - Based on Table 12-1 statistics for the entire dry season dataset, all the monitored parameters show no trending.
- Recycled Water: No recycled water was produced or distributed this past year.

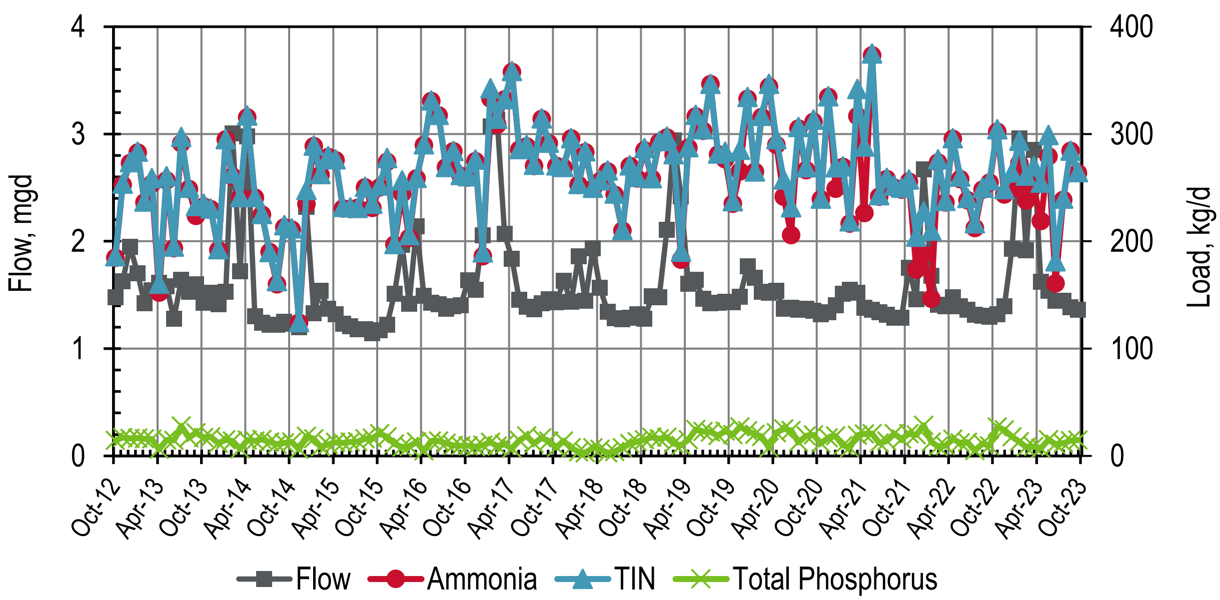

Figure 12-1. Discharge: Millbrae Monthly Flows and Loads

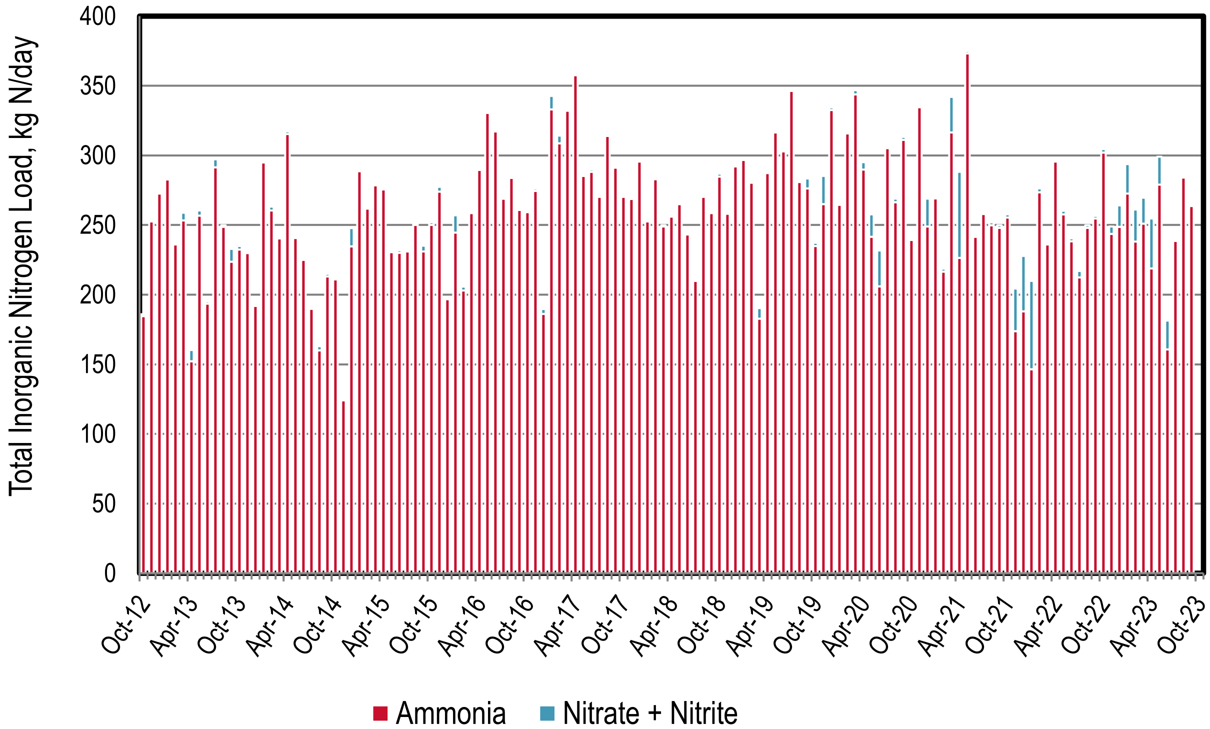

Figure 12-2. Discharge: Millbrae Monthly Nitrogen Loads

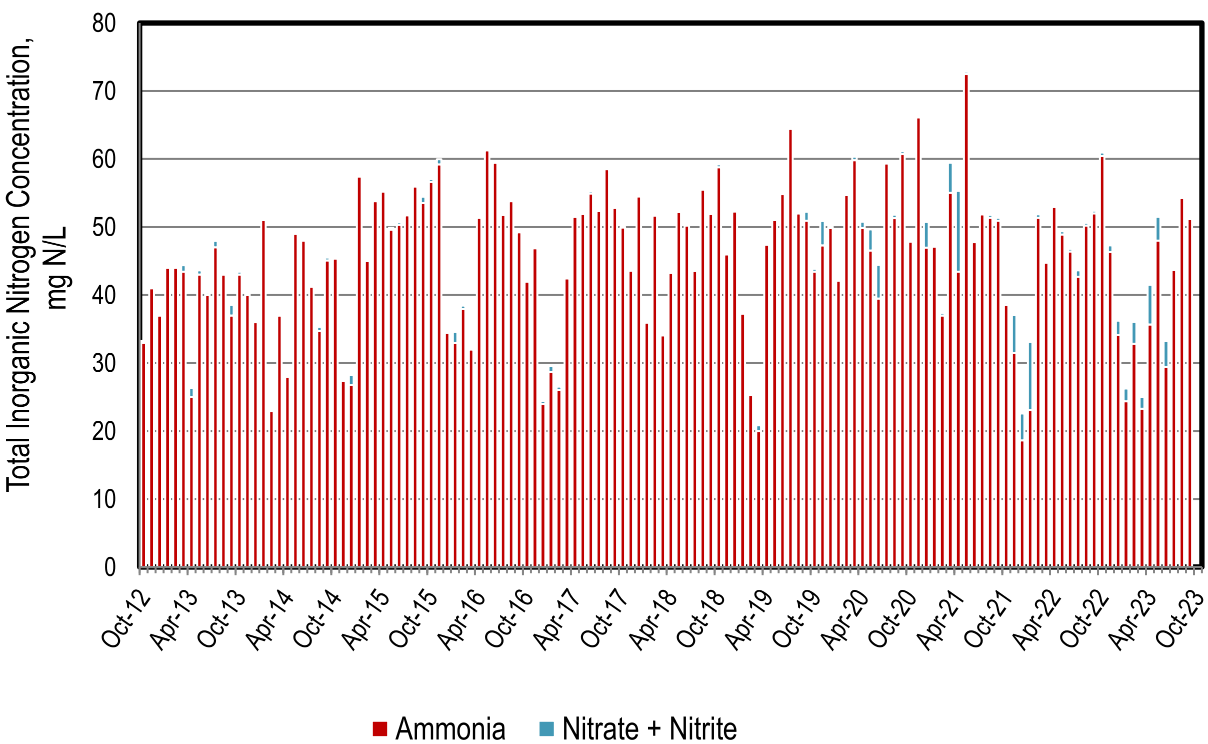

Figure 12-3. Discharge: Millbrae Monthly Nitrogen Concentration

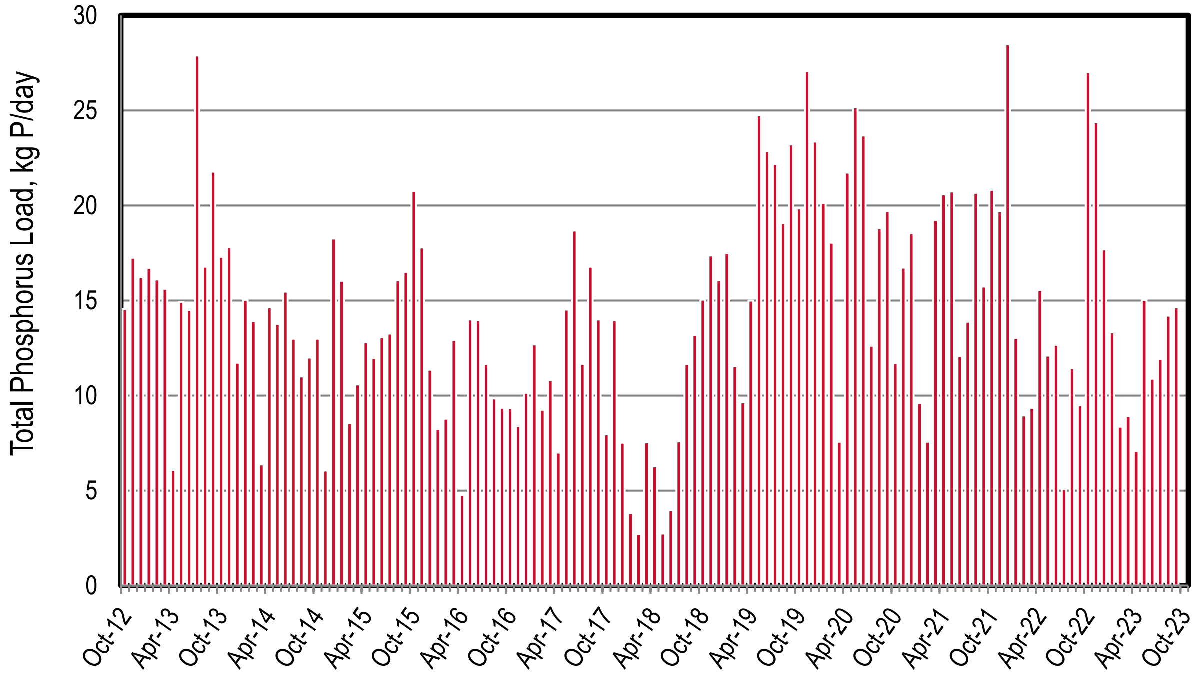

Figure 12-4. Discharge: Millbrae Monthly Phosphorus Loads

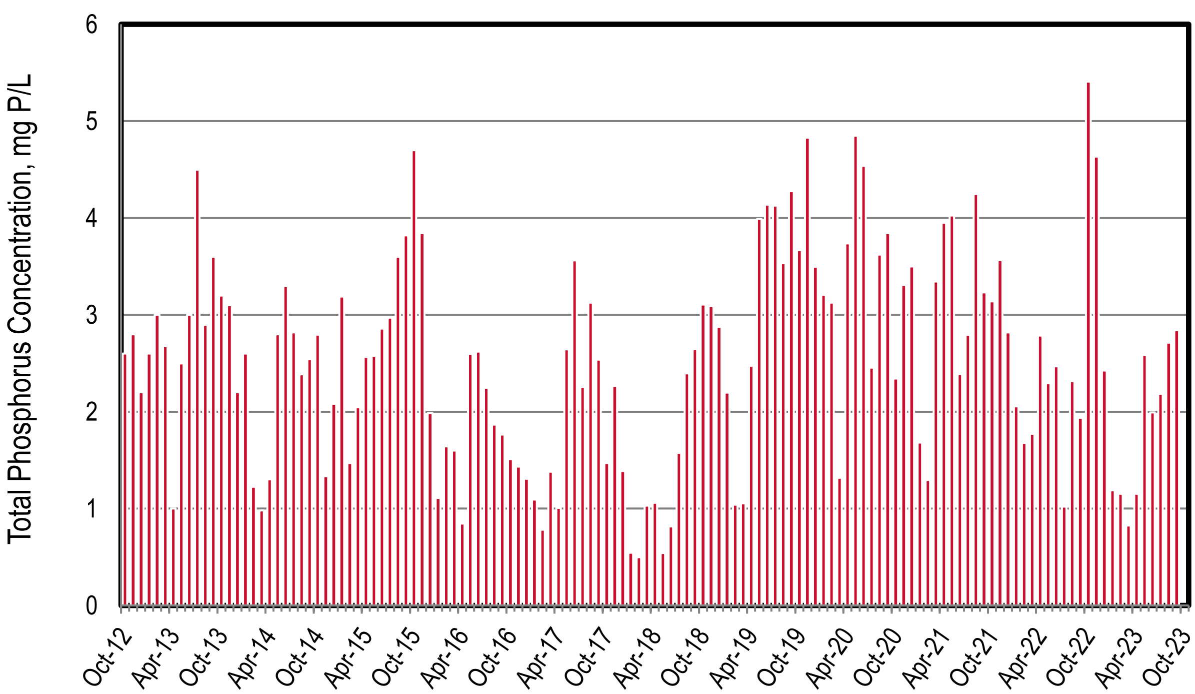

Figure 12-5. Discharge: Millbrae Monthly Phosphorus Concentrations

Table 12-1. Discharge: Millbrae Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.48	185	1.40	186	14.5
Nov-12	1.63	253	1.11	254	17.3
Dec-12	1.95	273	0.855	274	16.2
Jan-13	1.70	283	0.945	284	16.7
Feb-13	1.42	236	0.896	237	16.1
Mar-13	1.54	253	5.46	259	15.6
Apr-13	1.61	152	8.23	160	6.09
May-13	1.58	257	3.72	261	14.9
Jun-13	1.28	194	1.55	195	14.5
Jul-13	1.64	291	5.95	297	27.9
Aug-13	1.53	249	1.15	250	16.8
Sep-13	1.60	224	9.19	233	21.8
Oct-13	1.43	232	2.43	235	17.3
Nov-13	1.52	230	0.718	231	17.8
Dec-13	1.41	192	0.933	193	11.7
Jan-14	1.53	295	0.197	295	15.0
Feb-14	3.01	260	2.96	263	13.9
Mar-14	1.72	241	0.592	241	6.37
Apr-14	2.98	315	1.72	317	14.6
May-14	1.30	241	0.457	241	13.8
Jun-14	1.24	225	0.502	225	15.5
Jul-14	1.22	190	0.0650	190	13.0
Aug-14	1.22	160	3.00	163	11.0
Sep-14	1.25	213	2.00	215	12.0
Oct-14	1.23	211	1.00	212	13.0
Nov-14	1.20	124	0.670	125	6.05
Dec-14	2.32	235	13.0	248	18.3
Jan-15	1.33	289	0.750	289	16.0
Feb-15	1.54	262	0.690	263	8.55
Mar-15	1.37	279	0.780	279	10.6
Apr-15	1.32	276	0.900	276	12.8
May-15	1.23	231	1.33	232	12.0
Jun-15	1.21	230	1.76	232	13.1
Jul-15	1.18	231	0.0856	231	13.3
Aug-15	1.18	250	0.715	251	16.1
Sep-15	1.14	231	4.00	235	16.5

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.17	250	1.91	252	20.8
Nov-15	1.22	274	3.46	277	17.8
Dec-15	1.51	197	0.644	197	11.4
Jan-16	1.96	245	12.4	257	8.24
Feb-16	1.42	203	2.63	206	8.78
Mar-16	2.14	259	0.600	259	12.9
Apr-16	1.49	290	0.738	290	4.77
May-16	1.43	331	0.672	331	14.0
Jun-16	1.41	317	0.753	318	14.0
Jul-16	1.37	269	0.492	269	11.7
Aug-16	1.40	284	0.510	284	9.85
Sep-16	1.40	261	0.935	262	9.35
Oct-16	1.63	259	1.40	261	9.33
Nov-16	1.55	275	1.46	276	8.40
Dec-16	2.05	186	3.55	190	10.2
Jan-17	3.07	333	9.52	343	12.7
Feb-17	3.13	309	5.66	314	9.26
Mar-17	2.07	332	0.440	332	10.8
Apr-17	1.84	358	0.874	359	7.00
May-17	1.45	285	0.778	286	14.5
Jun-17	1.39	288	1.55	290	18.7
Jul-17	1.37	270	0.954	271	11.7
Aug-17	1.42	314	0.595	315	16.8
Sep-17	1.46	291	0.560	292	14.0
Oct-17	1.43	270	0.472	271	7.95
Nov-17	1.63	269	0.349	269	14.0
Dec-17	1.43	296	0.296	296	7.53
Jan-18	1.86	253	0.699	253	3.82
Feb-18	1.45	283	1.07	284	2.72
Mar-18	1.93	249	0.811	250	7.53
Apr-18	1.57	256	0.888	257	6.27
May-18	1.34	265	0.899	266	2.74
Jun-18	1.28	243	1.38	245	3.96
Jul-18	1.28	210	0.581	210	7.59
Aug-18	1.29	270	0.435	271	11.7
Sep-18	1.32	259	1.32	260	13.2
Oct-18	1.28	285	1.99	287	15.0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.49	258	0.751	259	17.4
Dec-18	1.48	292	1.31	294	16.1
Jan-19	2.11	297	0.989	298	17.5
Feb-19	2.94	281	0.611	281	11.6
Mar-19	2.42	183	7.48	190	9.64
Apr-19	1.60	287	0.500	288	15.0
May-19	1.64	316	1.44	318	24.7
Jun-19	1.46	303	1.49	304	22.9
Jul-19	1.42	346	0.417	347	22.2
Aug-19	1.43	281	1.06	282	19.1
Sep-19	1.44	276	7.18	283	23.2
Oct-19	1.43	235	2.25	237	19.8
Nov-19	1.48	265	20.3	285	27.1
Dec-19	1.77	333	1.77	334	23.4
Jan-20	1.66	265	0.57	265	20.1
Feb-20	1.53	316	1.02	317	18.0
Mar-20	1.52	344	2.91	347	7.58
Apr-20	1.54	290	5.40	295	21.7
May-20	1.37	242	16.1	258	25.2
Jun-20	1.38	206	25.7	232	23.7
Jul-20	1.36	305	1.32	306	12.6
Apr-20	1.37	266	2.61	269	18.8
Sep-20	1.36	311	2.23	313	19.7
Oct-20	1.32	239	0.400	240	11.7
Nov-20	1.34	335	0.640	335	16.7
Dec-20	1.40	249	20.0	269	18.6
Jan-21	1.51	269	0.721	270	9.61
Feb-21	1.55	217	2.22	219	7.58
Mar-21	1.52	317	25.5	342	19.2
Apr-21	1.38	226	61.8	288	20.6
May-21	1.36	373	1.61	375	20.7
Jun-21	1.34	242	1.36	243	12.1
Jul-21	1.31	258	1.29	259	13.9
Aug-21	1.29	250	1.97	252	20.7
Sep-21	1.29	248	1.96	250	15.7
Oct-21	1.75	255	2.18	258	20.8
Nov-21	1.46	174	30.7	204	19.7

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	2.67	188	39.8	228	28.5
Jan-22	1.68	146	63.5	210	13.0
Feb-22	1.41	274	2.74	276	8.94
Mar-22	1.40	236	1.38	238	9.35
Apr-22	1.48	296	0.622	296	15.6
May-22	1.40	258	2.47	260	12.1
Jun-22	1.36	238	2.03	240	12.7
Jul-22	1.32	212	4.53	217	5.08
Aug-22	1.31	248	1.81	250	11.4
Sep-22	1.30	255	1.80	257	9.49
Oct-21	1.32	302	2.49	305	27.0
Nov-21	1.39	244	5.09	249	24.4
Dec-21	1.93	249	15.5	264	17.7
Jan-22	2.96	273	21.2	294	13.3
Feb-22	1.92	238	23.2	261	8.36
Mar-22	2.85	251	18.6	270	8.91
Apr-22	1.62	219	36.0	255	7.08
May-22	1.54	279	20.0	299	15.0
Jun-22	1.45	161	20.7	181	10.9
Jul-22	1.44	239	1.09	240	11.9
Aug-22	1.39	284	0.380	284	14.2
Sep-22	1.36	264	0.684	264	14.6
Dry Season Average	**1.37**	**259**	**3.11**	**262**	**14.9**
Dry Season Trend**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**1.73**	**258**	**6.73**	**264**	**13.7**
Average Annual	**1.58**	**258**	**5.22**	**263**	**14.2**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

No recycled water was produced or distributed this past year.

13 Mt. View Sanitary District

Mt. View Sanitary District discharges to Suisun Bay. The plant has approximately 10,500 service connections; it has a permitted capacity of 3.2 mgd ADWF and a peak wet weather design flow of 10.9 mgd. This past dry season average discharge flow was approximately 1.1 mgd. The plant performs nitrification using a series of trickling filters.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge
  - The average monthly flow values for ammonia and TIN in 2021/2022 were the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012. This is attributed to a change in the sampling location as it is now at the Moorhen Marsh effluent, whereby treatment occurs within the Marsh.
  - Nutrient loads typically increase with flow during wet weather events.
  - Wet season nitrogen loads are greater and more variable than the dry season loads.
  - NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. A portion of ammonia bleeds through during the colder months. This increases the ammonia contribution during such months.
  - Total phosphorus concentrations range from 0.6 to 6.2 mg P/L, which suggests occasional P removal as typical effluent TP concentrations at treatment plants is typically 4 to 6 mg P/L.
  - Based on Table 13-1 statistics for the entire dry season dataset, flow, and the nutrient parameters (except ammonia) are trending downwards. Ammonia does not appear to have any emerging trends as the plant already nitrifies. The change in sampling location at the Moorhen Marsh effluent seems to play a role as previously noted.
- Recycled Water: No recycled water was produced or distributed this past year.

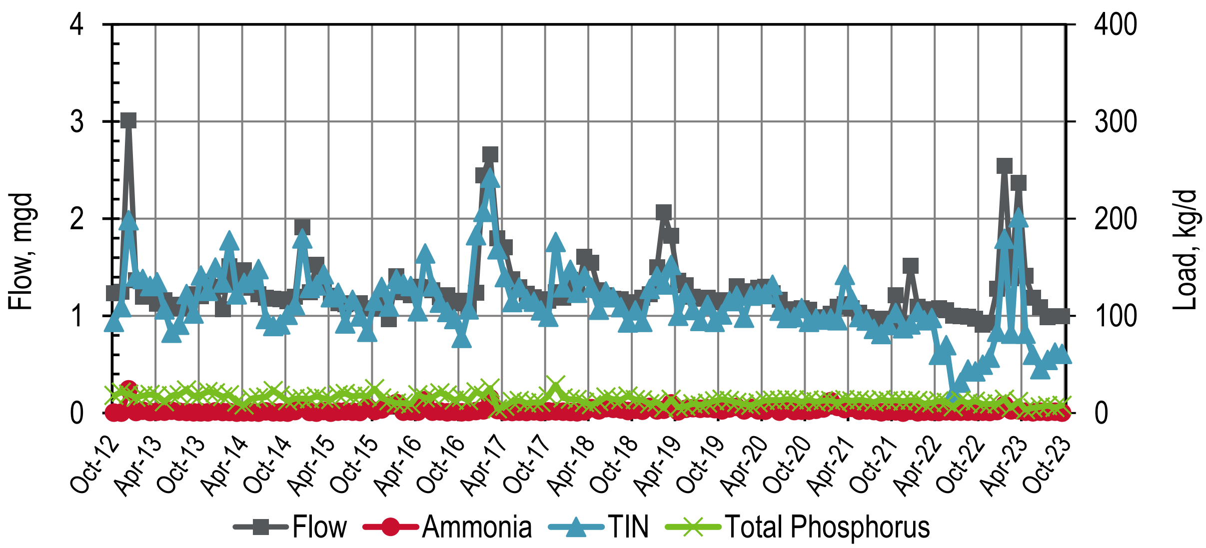

Figure 13-1. Discharge: Mt. View Sanitary District Monthly Flows and Loads

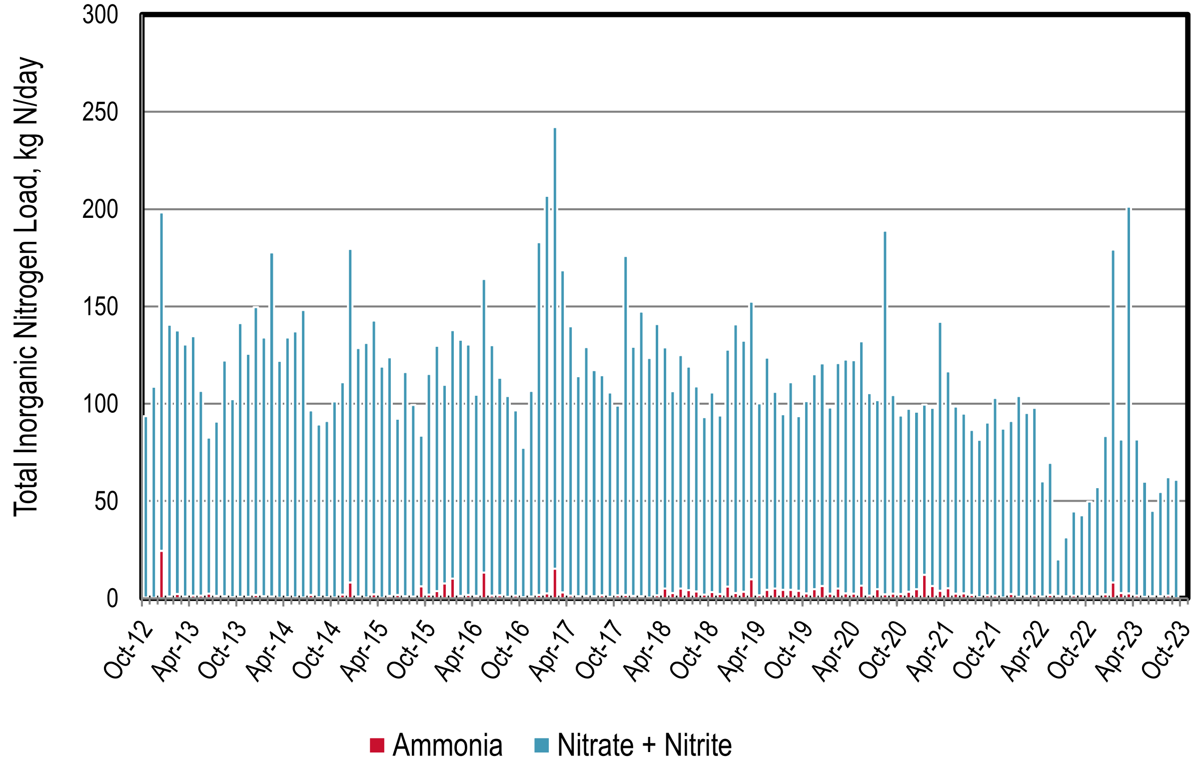

Figure 13-2. Discharge: Mt. View Sanitary District Monthly Nitrogen Loads

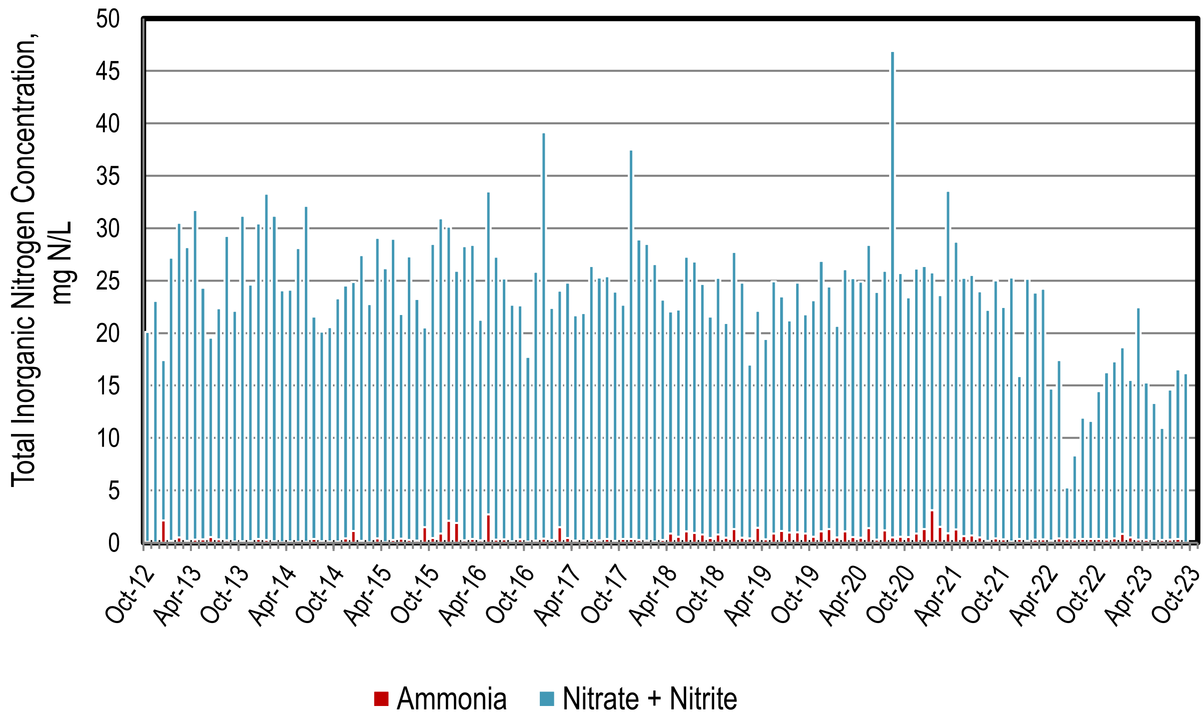

Figure 13-3. Discharge: Mt. View Sanitary District Monthly Nitrogen Concentrations

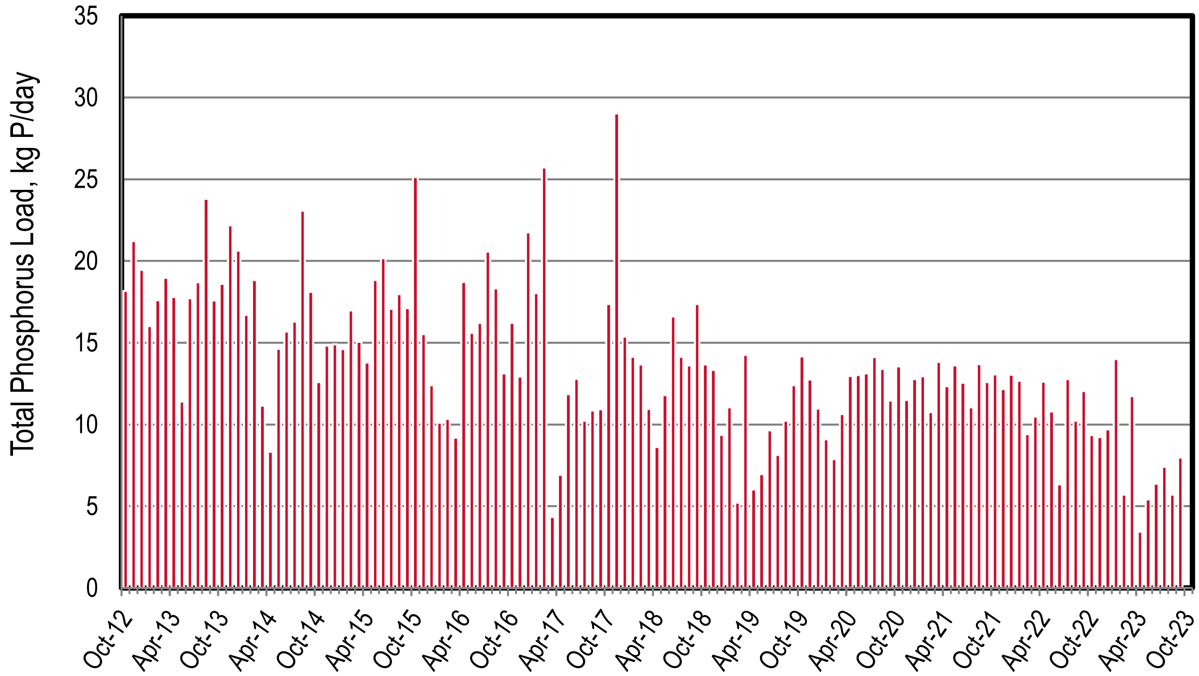

Figure 13-4: Discharge: Mt. View Sanitary District Monthly Phosphorus Loads

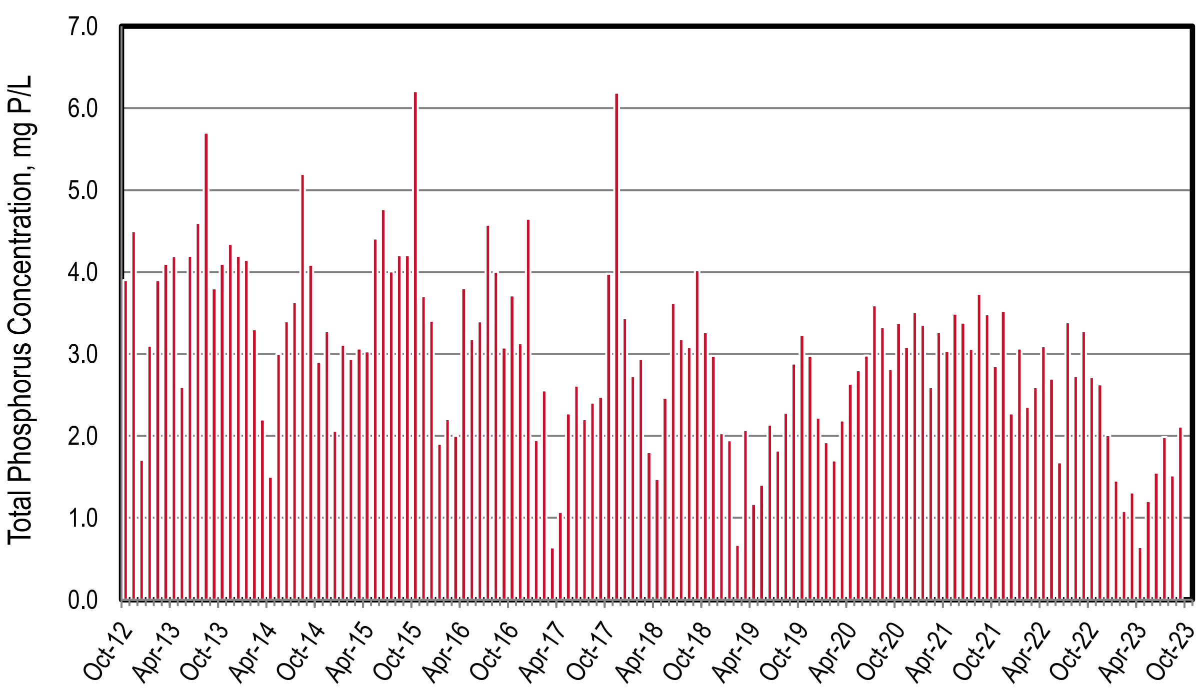

Figure 13-5. Discharge: Mt. View Sanitary District Monthly Phosphorus Concentrations

Table 13-1. Discharge: Mt. View Sanitary District Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.23	0.461	93.2	93.7	18.2
Nov-12	1.25	0.189	109	109	21.2
Dec-12	3.01	24.3	174	198	19.5
Jan-13	1.37	0.982	140	141	16.0
Feb-13	1.19	2.30	135	138	17.6
Mar-13	1.22	0.879	130	130	19.0
Apr-13	1.12	1.34	133	135	17.8
May-13	1.16	1.40	105	107	11.4
Jun-13	1.12	2.32	80.2	82.6	17.7
Jul-13	1.08	1.30	89.6	90.9	18.7
Aug-13	1.11	1.00	121	122	23.8
Sep-13	1.22	0.509	102	102	17.6
Oct-13	1.20	0.680	141	141	18.6
Nov-13	1.35	0.771	125	126	22.2
Dec-13	1.30	1.77	148	150	20.6
Jan-14	1.07	1.03	133	134	16.7
Feb-14	1.51	0.913	177	178	18.8
Mar-14	1.34	0.334	122	122	11.1
Apr-14	1.47	0.611	133	134	8.33
May-14	1.29	0.483	137	137	14.6
Jun-14	1.22	0.457	148	148	15.7
Jul-14	1.19	1.67	94.9	96.6	16.3
Aug-14	1.17	0.620	88.8	89.4	23.1
Sep-14	1.17	0.540	90.6	91.1	18.1
Oct-14	1.15	0.460	101	101	12.6
Nov-14	1.20	1.94	109	111	14.8
Dec-14	1.91	8.07	171	180	14.9
Jan-15	1.24	0.910	128	129	14.6
Feb-15	1.53	0.370	131	131	17.0
Mar-15	1.30	2.01	141	143	15.1
Apr-15	1.20	0.190	119	119	13.8
May-15	1.13	1.19	123	124	18.8
Jun-15	1.12	1.72	90.6	92.3	20.2
Jul-15	1.13	1.15	115	116	17.1
Aug-15	1.13	0.899	98.5	99.4	18.0
Sep-15	1.08	6.11	77.4	83.5	17.1

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.07	1.82	114	115	25.1
Nov-15	1.11	3.74	126	130	15.5
Dec-15	0.963	7.66	102	110	12.4
Jan-16	1.41	10.1	128	138	10.1
Feb-16	1.24	1.18	132	133	10.3
Mar-16	1.22	1.70	129	130	9.20
Apr-16	1.30	1.18	103	105	18.7
May-16	1.30	13.2	151	164	15.6
Jun-16	1.26	1.39	129	130	16.2
Jul-16	1.19	1.52	112	113	20.6
Aug-16	1.21	0.715	103	104	18.3
Sep-16	1.13	1.44	95.2	96.6	13.1
Oct-16	1.15	0.555	76.8	77.3	16.2
Nov-16	1.09	0.861	106	107	12.9
Dec-16	1.24	1.81	181	183	21.7
Jan-17	2.44	2.52	204	207	18.0
Feb-17	2.66	15.1	227	242	25.7
Mar-17	1.80	3.03	166	169	4.35
Apr-17	1.70	1.45	138	140	6.92
May-17	1.38	1.13	113	114	11.8
Jun-17	1.29	1.33	128	129	12.8
Jul-17	1.23	1.07	116	117	10.2
Aug-17	1.19	1.58	113	115	10.8
Sep-17	1.17	0.831	105	106	10.9
Oct-17	1.15	1.61	97.4	99.0	17.4
Nov-17	1.24	1.74	174	176	29.0
Dec-17	1.18	1.24	128	129	15.4
Jan-18	1.37	1.06	146	147	14.1
Feb-18	1.23	0.501	123	124	13.7
Mar-18	1.61	1.64	139	141	10.9
Apr-18	1.55	5.06	124	129	8.62
May-18	1.26	2.69	104	106	11.8
Jun-18	1.21	5.07	120	125	16.6
Jul-18	1.17	4.24	115	119	14.1
Aug-18	1.17	3.51	105	109	13.6
Sep-18	1.14	1.95	91.2	93.1	17.4
Oct-18	1.11	3.29	102	106	13.7

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.19	2.21	91.7	93.9	13.3
Dec-18	1.22	6.09	122	128	9.36
Jan-19	1.50	2.71	138	141	11.0
Feb-19	2.06	3.32	129	132	5.22
Mar-19	1.82	9.81	143	152	14.3
Apr-19	1.36	1.64	98.5	100	6.02
May-19	1.31	4.32	119	124	6.96
Jun-19	1.19	5.05	101	106	9.64
Jul-19	1.18	4.29	90.3	94.6	8.13
Aug-19	1.19	4.44	107	111	10.2
Sep-19	1.14	3.85	89.8	93.7	12.4
Oct-19	1.16	2.58	98.7	101	14.2
Nov-19	1.13	4.68	111	115	12.8
Dec-19	1.31	6.40	114	121	11.0
Jan-20	1.25	2.46	95.5	98.0	9.10
Feb-20	1.22	5.09	116	121	7.87
Mar-20	1.29	2.59	120	123	10.6
Apr-20	1.30	2.35	120	122	13.0
May-20	1.23	6.51	125	132	13.0
Jun-20	1.16	1.36	104	105	13.1
Jul-20	1.04	4.65	97.2	97.7	14.1
Aug-20	1.07	2.09	187	98.7	13.4
Sep-20	1.08	2.39	102	108	11.4
Oct-20	1.06	2.23	91.7	93.9	13.6
Nov-20	0.986	3.31	94.1	97.4	11.5
Dec-20	0.962	4.74	91.2	96.0	12.8
Jan-21	1.02	12.0	87.4	97.2	12.9
Feb-21	1.10	6.36	91.6	95.4	10.8
Mar-21	1.12	3.92	138	142	13.8
Apr-21	1.07	5.18	111	117	12.3
May-21	1.03	2.44	96.1	98.6	13.6
Jun-21	0.983	2.59	92.4	94.9	12.6
Jul-21	0.954	1.80	84.7	86.5	11.0
Aug-21	0.969	0.667	80.7	81.4	13.7
Sep-21	0.956	1.55	88.8	90.4	12.6
Oct-21	1.21	1.49	102	103	13.1
Nov-21	0.912	0.382	86.9	87.2	12.2

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	1.52	2.16	89.0	91.2	13.0
Jan-22	1.09	0.797	103	104	12.7
Feb-22	1.06	1.22	94.1	95.3	9.41
Mar-22	1.07	1.38	96.5	97.8	10.5
Apr-22	1.08	0.868	59.2	60.0	12.6
May-22	1.06	1.68	67.9	69.6	10.8
Jun-22	0.999	1.27	18.6	19.9	6.34
Jul-22	0.997	1.16	30.2	31.3	12.8
Aug-22	0.990	1.34	43.3	44.6	10.2
Sep-22	0.971	1.32	41.4	42.7	12.0
Oct-22	0.909	1.28	48.4	49.7	9.34
Nov-22	0.928	1.09	56.0	57.1	9.22
Dec-22	1.28	2.09	81.4	83.5	9.69
Jan-23	2.54	8.09	171	179	14.0
Feb-23	1.39	2.76	78.9	81.7	5.70
Mar-23	2.37	2.62	199	201	11.7
Apr-23	1.41	1.43	80.1	81.6	3.43
May-23	1.19	0.787	59.0	59.8	5.41
Jun-23	1.09	1.16	43.8	45.0	6.38
Jul-23	0.988	1.07	53.5	54.6	7.41
Aug-23	0.994	1.37	60.8	62.2	5.70
Sep-23	0.997	0.152	60.7	60.9	7.97
Dry Season Average	**1.13**	**2.22**	**96.5**	**97.0**	**13.5**
Dry Season Trend **	**Down**	**None**	**Down**	**Down**	**Down**
Wet Season Average	**1.35**	**3.07**	**121**	**124**	**13.6**
Average Annual	**1.26**	**2.72**	**111**	**113**	**13.6**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

No recycled water was produced or distributed this past year.

14 Napa Sanitation District

Napa Sanitation District discharges to the Napa River that is connected to San Pablo Bay. The plant has a permitted capacity of 15.4 mgd ADWF. The plant performs nitrogen removal using a step-feed activated sludge process with anoxic zones coupled with oxidation ponds which also serves as equalization during peak flow. Discharge is prohibited July 1 through September 30.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent:
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters. Data is absent for a few nutrient species as Napa Sanitation District has not discharged for several quarters since sampling began.
  - The flow reduction across the plant is heavily seasonal based as it ranges from 0 to 100 percent. Periods with 100 percent load reduction is attributed to no discharge as they recycle all their water during such periods.
  - The nitrogen load reduction during discharge periods is greater than 65 percent (except for the relatively wet January 2022). The variability in reduction across the plant is attributed to discharge TIN concentrations that range from 7 to 22 mg N/L.
  - The phosphorus load reduction during discharge periods is wide-ranging. This variability is attributed to occasional phosphorus load reduction across the plant as evidenced by discharge concentration occasionally less than 1 mg P/L. The mechanism for TP load reduction is likely from ferric chloride addition.
- Discharge:
  - Nitrogen and phosphorus loads generally increase with flow during wet weather events.
  - NOx is the majority of the nitrogen discharged as the activated sludge system is operated to nitrify. During the wet season months partially nitrified pond effluent may be clarified then comingled with nitrified activated sludge effluent prior to discharge which may increase the ammonia levels during such months.
  - Based on average monthly values, the plant discharge typically meets Level 2 TIN limits (i.e., 15 mg N/L) developed as part of the first Watershed Permit (R2-2014-0014).
  - The average monthly phosphorus values range from 0.3 to 5.6 mg P/L. This suggests P is occasionally removed as previously noted from likely ferric chloride addition.
  - Based on Table 14-2 statistics for the entire dry season dataset, there are no emerging trends as Napa rarely discharges during the dry season (i.e., May and June 2014).
- Recycled Water:
  - Based on Table 14-3, the plant averaged 2.9 mgd in 2022. Users include Landscape Irrigation, Commercial, Agricultural, and Other Non-Potable Customers.
  - Based on values from Table 5-3 through Table 5-5, the average nutrient loads diverted from the Bay in 2022 due to recycled water is 29 kg Ammonia-N/d, 110 kg TIN-N/d, and 27 kg P/d away.

Influent

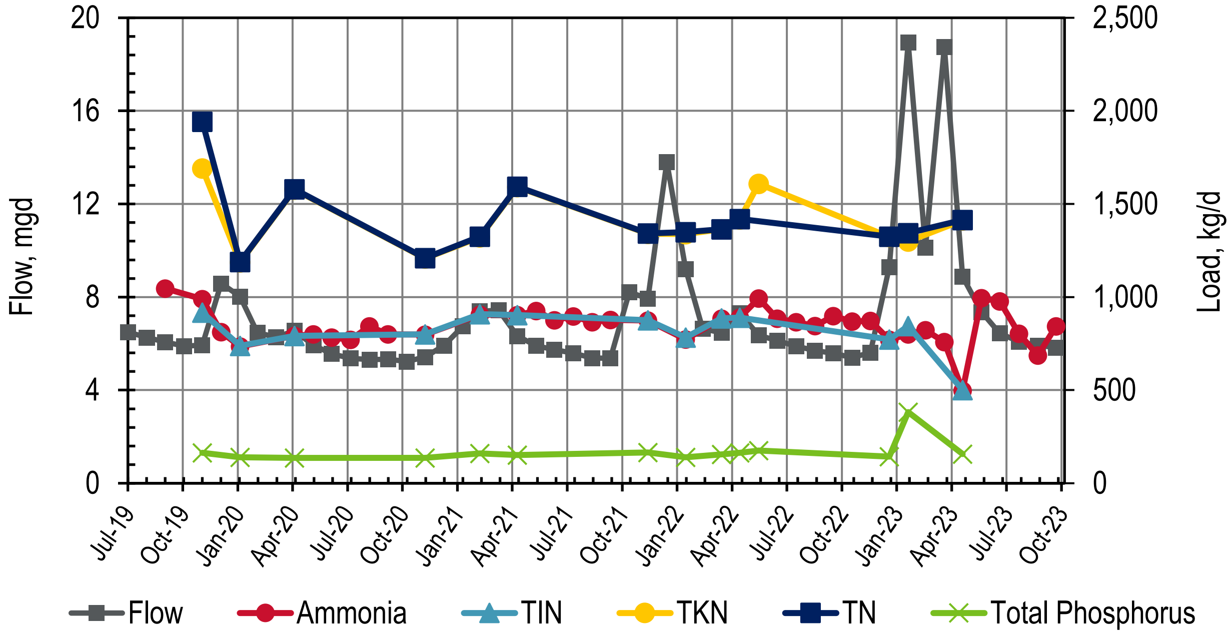

Figure 14-1. Influent: Napa Sanitation District Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N loads and thus are not visible.

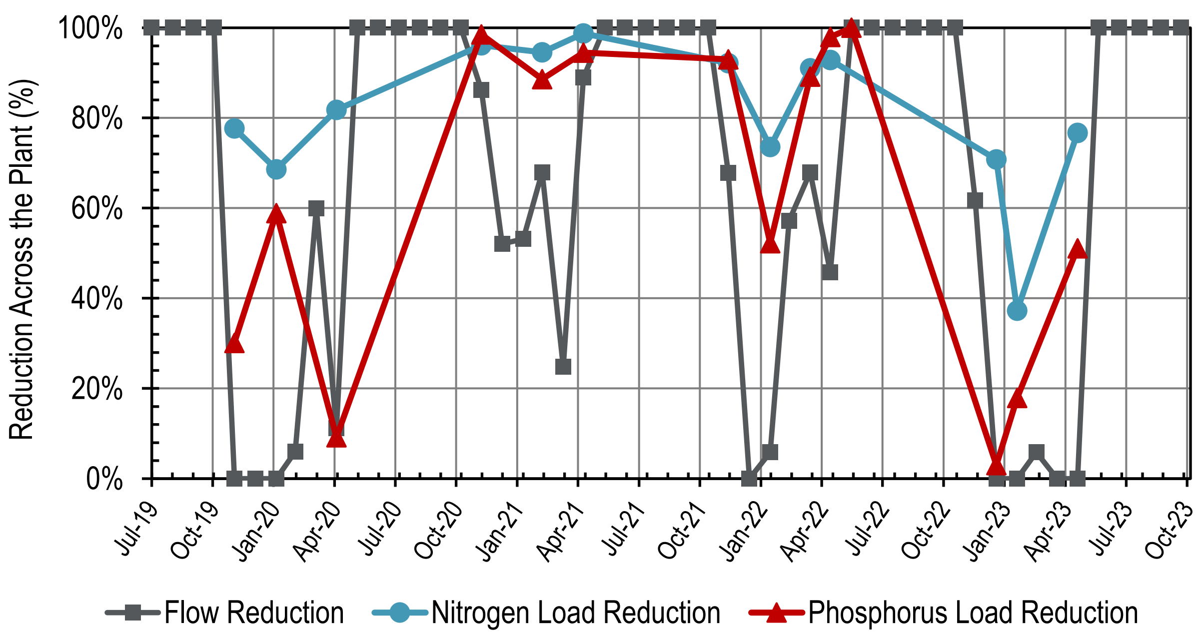

Figure 14-2. Influent: Napa Sanitation District Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 14-1. Influent: Napa Sanitation District Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	TKN	Total N*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	6.50	--	--	--	--	--	--
Aug-19	6.27	--	--	--	--	--	--
Sep-19	6.07	1,050	--	--	--	--	--
Oct-19	5.90	--	--	--	--	--	--
Nov-19	5.94	990	2.93	917	1,690	1,940	163
Dec-19	8.59	813	--	--	--	--	--
Jan-20	8.02	735	2.78	737	1,190	1,190	139
Feb-20	6.47	--	--	--	--	--	--
Mar-20	6.27	--	--	--	--	--	--
Apr-20	6.55	791	1.18	792	1,580	1,580	137
May-20	5.94		--	--	--	--	--
Jun-20	5.56		--	--	--	--	--
Jul-20	5.38	770	--	--	--	--	--
Aug-20	5.31		--	--	--	--	--
Sep-20	5.32		--	--	--	--	--
Oct-20	5.23	--	--	--	--	--	--
Nov-20	5.42	799	0.975	800	1,210	1,210	136
Dec-20	5.92	--	--	--	--	--	--
Jan-21	6.74	--	--	--	--	--	--
Feb-21	7.40	906	3.15	909	1,320	1,320	160
Mar-21	7.43	--	--	--	--	--	--
Apr-21	6.33	904	0.490	904	1,590	1,590	152
May-21	5.91		--	--	--	--	--
Jun-21	5.74		--	--	--	--	--
Jul-21	5.59	897	--	--	--	--	--
Aug-21	5.38		--	--	--	--	--
Sep-21	5.37		--	--	--	--	--
Oct-21	8.22	--	--	--	--	--	--
Nov-21	7.93	874	1.98	876	1,340	1,340	166
Dec-21	13.8	--	--	--	--	--	--
Jan-22	9.19	773	10.2	783	1,340	1,350	139
Feb-22	6.63	--	--	--	--	--	--
Mar-22	6.46	885	0.526	886	1,360	1,360	155
Apr-22	7.30	889	0.649	890	1,420	1,420	163
May-22	6.37	994	--	--	1,610	--	175
Jun-22	6.13		--	--	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	TKN	Total N*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	5.89		--	--	--	--	--
Aug-22	5.70	845	--	--	--	--	--
Sep-22	5.59		--	--	--	--	--
Oct-22	5.40	869	--	--	--	--	--
Nov-22	5.61	872	--	--	--	--	--
Dec-22	9.29	772	1.65	773	1,320	1,320	143
Jan-23	18.9	801	44.7	846	1,300	1,340	382
Feb-23	10.1	822	--	--	--	--	--
Mar-23	18.7	759	--	--	--	--	--
Apr-23	8.88	498	2.60	501	1,410	1,420	156
May-23	7.36	995	--	--	--	--	--
Jun-23	6.44	978	--	--	--	--	--
Jul-23	6.09	803	--	--	--	--	--
Aug-23	5.93	687	--	--	--	--	--
Sep-23	5.84	844	--	--	--	--	--
Dry Season Average	**5.90**	**870**	***	***	***	***	***
**Dry Season Trend **	**None**	*******	***	***	***	***	***
Wet Season Average	**8.17**	**820**	**5.68**	**816**	**1,390**	**1,410**	**169**
Average Annual	**7.14**	**847**	**5.68**	**816**	**1,410**	**1,410**	**169**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Insufficient dry season sampling to perform analysis.

Discharge

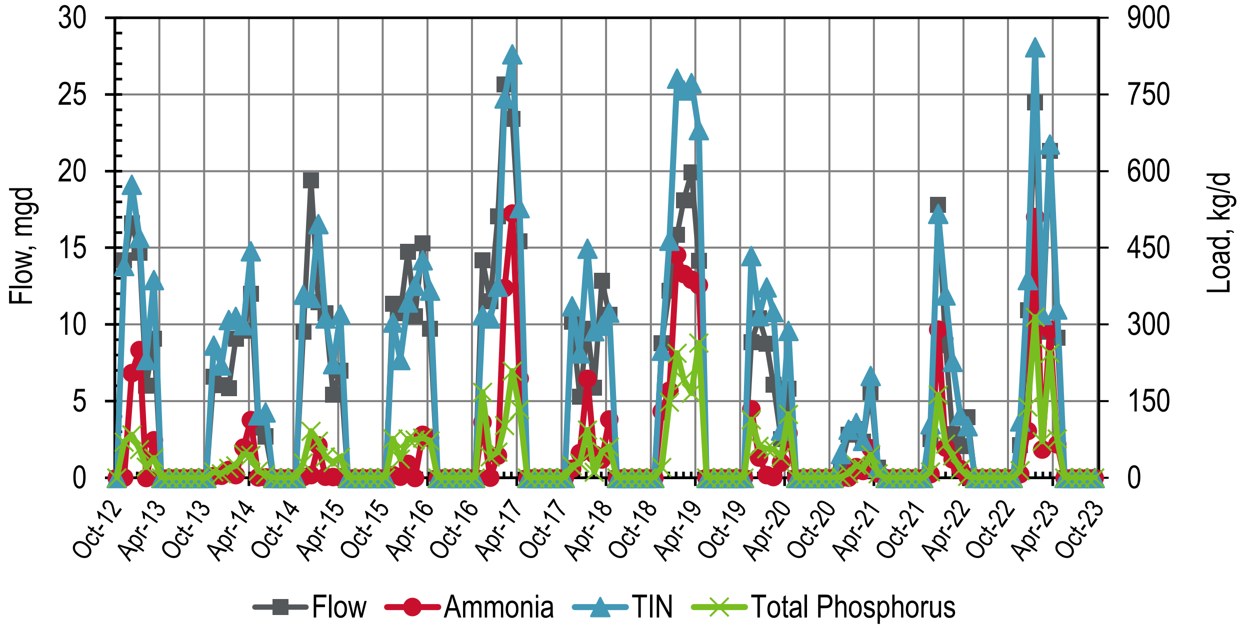

Figure 14-3. Discharge: Napa Sanitation District Monthly Flows and Loads

Table 14-2. Discharge: Napa Sanitation District Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0	0	0	0	0
Nov-12	14.2	0.268	414	415	69.8
Dec-12	16.6	205	369	574	84.4
Jan-13	14.7	250	220	470	55.8
Feb-13	5.99	0.113	231	231	21.5
Mar-13	9.10	73.6	314	387	38.9
Apr-13	0	0	0	0	0
May-13	0	0	0	0	0
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	0	0	0	0	0
Nov-13	6.61	3.77	255	259	11.6
Dec-13	6.08	4.25	216	220	8.04
Jan-14	5.85	15.4	294	309	18.7
Feb-14	9.09	5.49	310	315	23.5
Mar-14	9.60	59.3	239	299	47.0
Apr-14	12.0	113	330	443	44.5
May-14	3.30	0.988	122	122	12.8
Jun-14	2.70	1.09	127	128	6.06
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	0	0	0	0	0
Nov-14	9.53	1.91	356	358	29.3
Dec-14	19.4	5.30	347	352	91.0
Jan-15	11.5	63.8	433	497	71.8
Feb-15	10.8	2.73	309	312	41.1
Mar-15	5.42	1.51	221	223	29.8
Apr-15	7.00	0.900	319	319	40.4
May-15	0	0	0	0	0
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0	0	0	0	0
Nov-15	11.4	5.66	298	304	76.1
Dec-15	10.7	2.26	228	231	37.0
Jan-16	14.8	27.7	315	343	76.5
Feb-16	10.6	0	376	376	74.3
Mar-16	15.3	84.3	342	426	78.3
Apr-16	9.74	78.1	288	366	72.6
May-16	0	0	0	0	0
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16	0	0	0	0	0
Nov-16	14.2	109	210	319	168
Dec-16	11.5	0.778	311	312	41.1
Jan-17	17.1	43.5	330	374	50.3
Feb-17	25.7	372	371	743	103
Mar-17	23.4	517	311	829	209
Apr-17	15.4	194	333	528	134
May-17	0	0	0	0	0
Jun-17	0	0	0	0	0
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	0	0	0	0	0
Oct-17	0	0	0	0	0
Nov-17	10.2	18.1	317	336	23.6
Dec-17	5.29	48.8	195	244	28.8
Jan-18	9.74	194	255	449	93.9
Feb-18	5.88	46.1	241	287	10.9
Mar-18	12.9	36.3	262	298	51.4
Apr-18	10.7	114	209	323	60.7
May-18	0	0	0	0	0
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	0	0	0	0	0
Oct-18	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	8.79	130	119	249	20.7
Dec-18	12.2	171	312	464	148
Jan-19	15.9	436	345	781	244
Feb-19	18.1	399	359	758	191
Mar-19	19.9	388	385	772	166
Apr-19	14.1	377	263	680	264
May-19	0	0	0	0	0
Jun-19	0	0	0	0	0
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	0	0	0	0	0
Nov-19	8.84	134	300	434	114
Dec-19	10.4	39.9	268	317	62.2
Jan-20	8.75	5.78	375	373	57.1
Feb-20	6.30	2.19	334	336	58.0
Mar-20	5.57	66.6	138	205	89.6
Apr-20	7.59	114	261	375	162
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	0	0	0	0	0
Oct-20	0	0	0	0	0
Nov-20	0.745	0.192	46.4	46.6	2.00
Dec-20	2.84	0.712	93.8	94.6	8.57
Jan-21	3.16	20.9	86.3	107	25.0
Feb-21	2.37	13.9	58.3	72.3	18.3
Mar-21	5.59	58.2	142	200	45.6
Apr-21	0.696	8.47	11.3	19.8	8.34
May-21	0	0	0	0	0
Jun-21	0	0	0	0	0
Jul-21	0	0	0	0	0
Aug-21	0	0	0	0	0
Sep-21	0	0	0	0	0
Oct-21	0	0	0	0	0
Nov-21	2.55	7.40	97.4	105	11.6

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	17.8	290	226	517	163
Jan-22	8.65	59.2	298	357	66.4
Feb-22	2.84	36.4	191	227	43.4
Mar-22	2.07	17.4	105	122	16.8
Apr-22	3.96	2.50	98.8	101	3.30
May-22	0	0	0	0	0
Jun-22	0	0	0	0	0
Jul-22	0	0	0	0	0
Aug-22	0	0	0	0	0
Sep-22	0	0	0	0	0
Oct-22	0	0	0	0	0
Nov-22	2.15	7.67	103	111	14.3
Dec-22	10.9	92.2	295	387	139
Jan-23	24.5	511	332	843	314
Feb-23	9.53	55.9	263	319	71.5
Mar-23	21.3	290	362	653	244
Apr-23	9.15	65.7	264	330	76.3
May-23	0	0	0	0	0
Jun-23	0	0	0	0	0
Jul-23	0	0	0	0	0
Aug-23	0	0	0	0	0
Sep-23	0	0	0	0	0
Dry Season Average	**0.109**	**0.0378**	**4.52**	**4.56**	**0.343**
Dry Season Trend	**--****	**--****	**--****	**--****	**--****
Wet Season Average	**8.70**	**83.6**	**218**	**301**	**63.3**
Average Annual	**5.12**	**48.8**	**129**	**178**	**37.1**

* The Total Inorganic Nitrogen value is calculated by adding the "Ammonia" and "Nitrate + Nitrite" values.

** No dry season trending analysis was performed on Napa as there are only two months (May and June 2014) that Napa has discharged since sampling began in 2012.

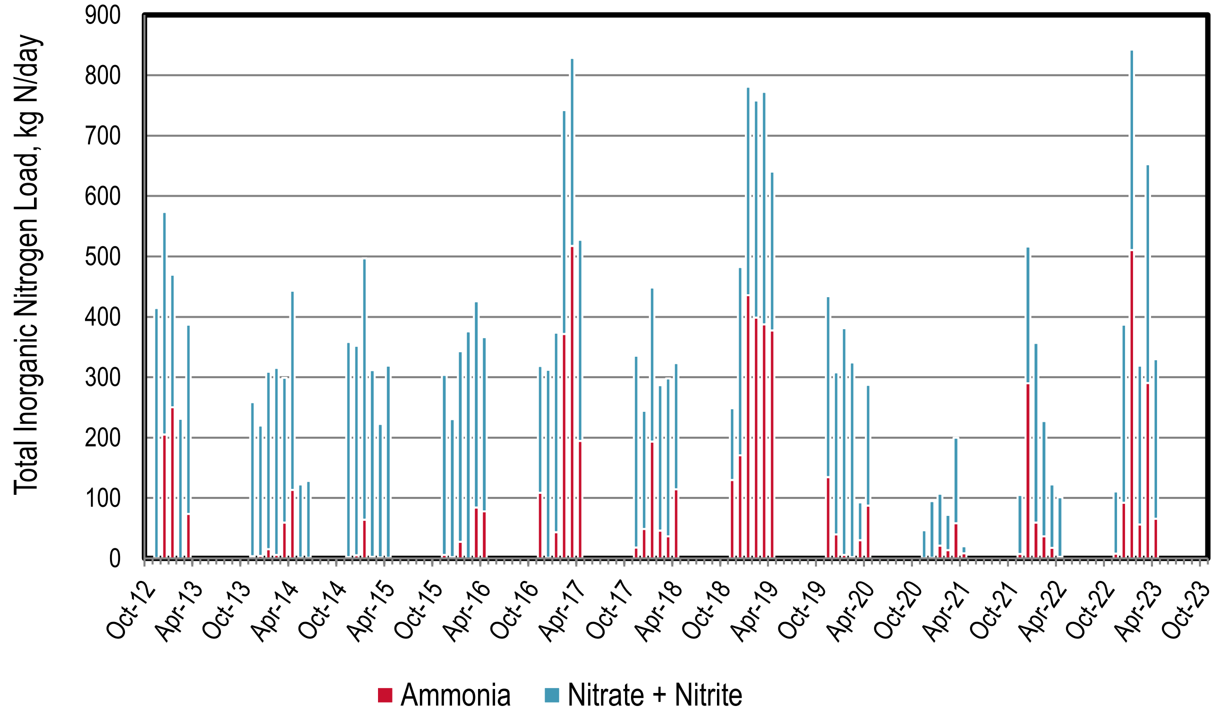

Figure 14-4. Discharge: Napa Sanitation District Monthly Nitrogen Loads

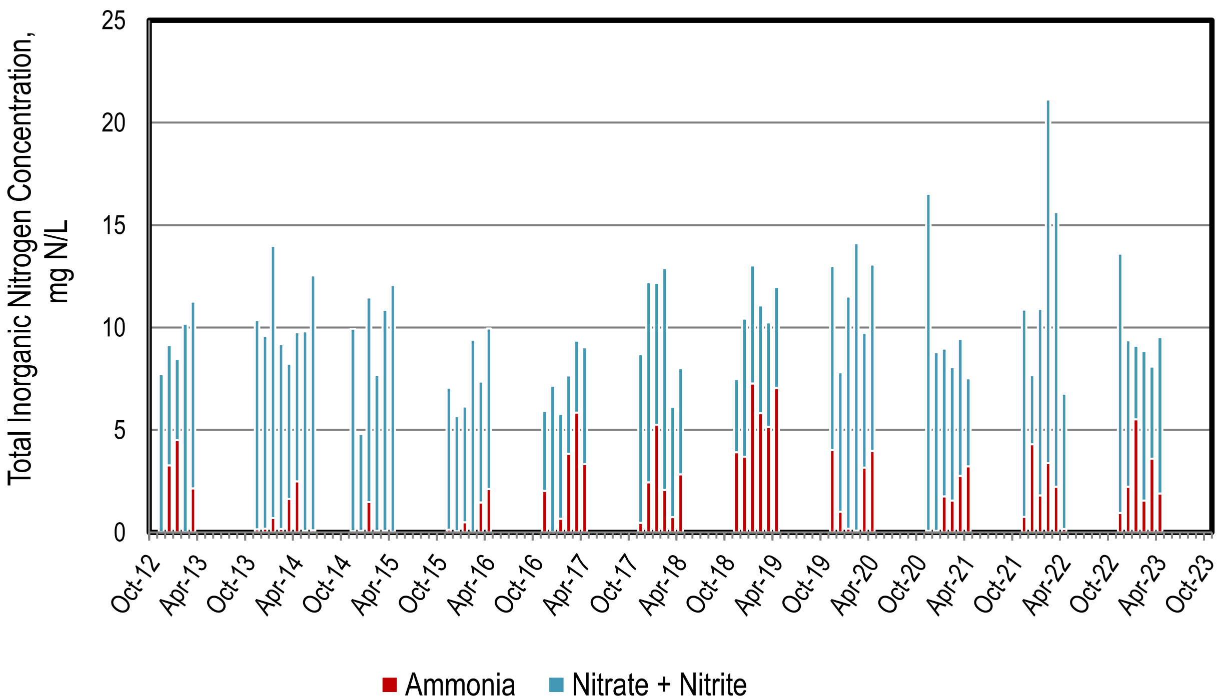

Figure 14-5. Discharge: Napa Sanitation District Monthly Nitrogen Concentrations

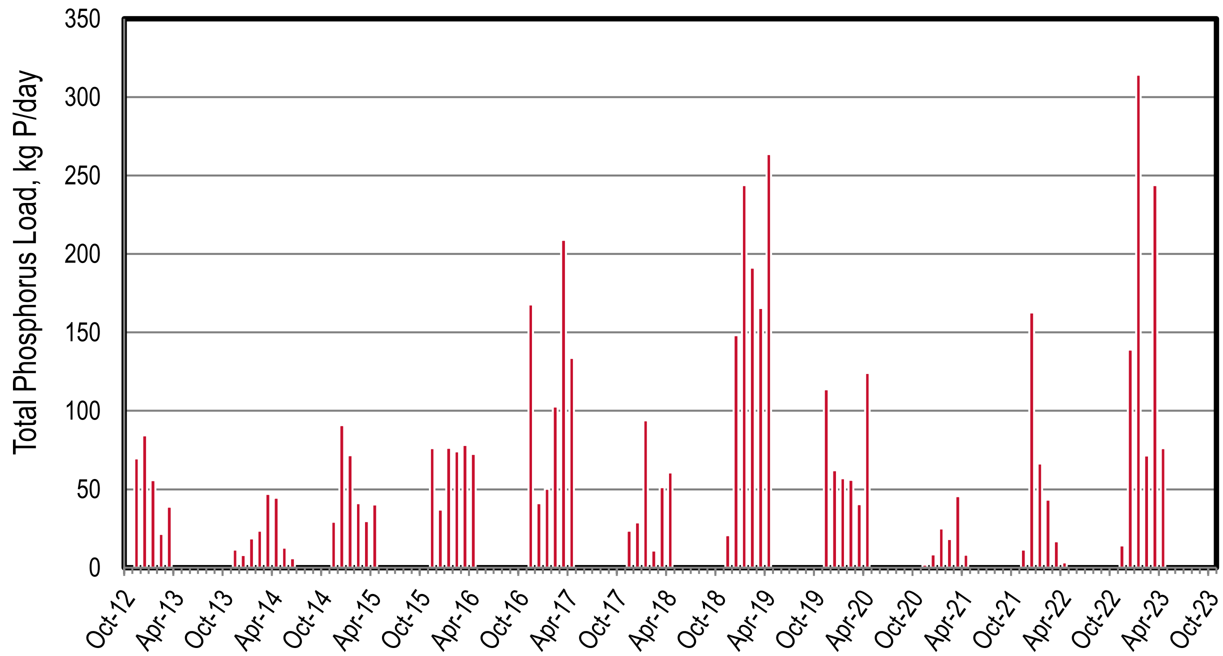

Figure 14-6. Discharge: Napa Sanitation District Monthly Phosphorus Loads

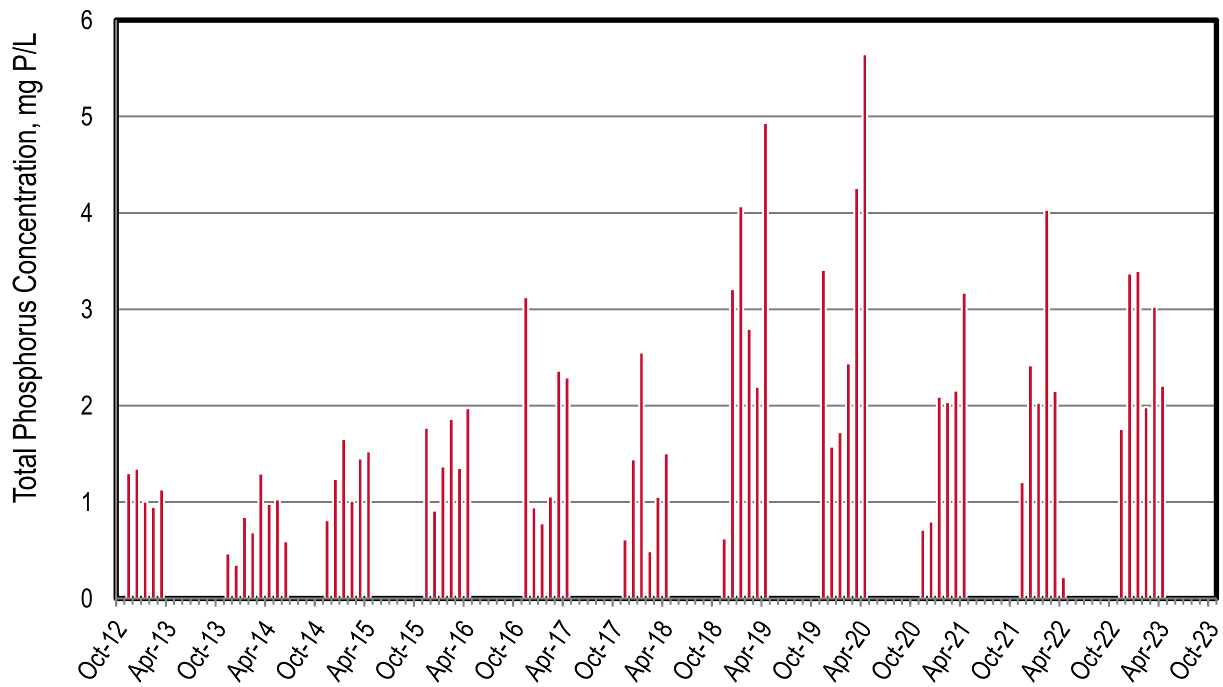

Figure 14-7. Discharge: Napa Sanitation District Monthly Phosphorus Concentrations

Recycled Water

Table 14-3. Recycled Water: Napa Sanitation District Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	1,040 (0.92)	509 (0.45)	--	--	767 (0.68)	--	26 (0.02)	2,340 (2.07)
2020	1,310 (1.17)	595 (0.53)	--	--	1,110 (0.99)	--	70 (0.06)	3,080 (2.75)
2021	1,280 (1.15)	530 (0.47)	--	--	1,760 (1.57)	--	130 (0.12)	3,700 (3.31)
2022	1,290 (1.15)	572 (0.51)	--	--	1,340 (1.19)	--	76 (0.07)	3,280 (2.92)
Average	1,230 (1.10)	552 (0.49)	--	--	1,240 (1.11)	--	76 (0.07)	3,100 (2.76)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 14-4. Recycled Water: Napa Sanitation District Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	19	9	--	--	14	--	<1	42
2020	6	3	--	--	5	--	<1	13
2021	14	6	--	--	20	--	1	41
2022	8	4	--	--	8	--	<1	21
Average	12	5	--	--	12	--	<1	29

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 14-5. Recycled Water: Napa Sanitation District Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	39	19	--	--	29	--	1	89
2020	51	23	--	--	43	--	3	121
2021	37	15	--	--	50	--	4	105
2022	49	22	--	--	51	--	3	125
Average	44	20	--	--	43	--	3	110

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 14-6. Recycled Water: Napa Sanitation District Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	11	5	--	--	8	--	<1	25
2020	13	6	--	--	11	--	1	30
2021	10	4	--	--	13	--	1	28
2022	11	5	--	--	11	--	1	27
Average	11	5	--	--	11	--	1	27

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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15 Novato Sanitary District

Novato discharges to San Pablo Bay. The plant has approximately 28,500 service connections; it has a permitted capacity of 7.0 mgd ADWF and a peak wet weather capacity of 47 mgd. The plant performs nitrogen removal using activated sludge. The District was issued a new NPDES permit (September, 2020) that allows for year-round discharge to San Pablo Bay. The District will be transitioning to year-round discharge over the next several years as it winds down its ranching/irrigation spray field operation.

The following observations are made based upon the figures and tables in the subsequent pages:

- Discharge:
  - Both nitrogen and phosphorus loads typically increase with wet weather flow events.
  - Since sampling began in July 2012, average monthly flow and ammonia loads were the highest in January 2023 and March 2023, respectively.
  - NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. A portion of ammonia bleeds through during the colder months. This increases the ammonia contribution during such months.
  - The plant nearly meets Level 2 TIN concentration limits (i.e., 15 mg N/L) developed under the Scoping and Evaluation Plan with values reliably less than 20 mg N/L.
  - Total phosphorus concentrations range from 0.1 to 6.1 mg P/L. This suggests a portion of P is removed as typical effluent TP concentrations for similar treatment plants are 4 to 6 mg P/L. The removal mechanism might be attributed to a combination of ferric chloride addition to the digester influent and/or biological P removal.
- Recycled Water:
  - Based on Table 1-2, the plant averages 1.3 mgd of recycled water. Recycled water uses included Golf Course, Landscape Irrigation, Agricultural, and Other Non-Potable.
  - Based on Table 5-3 through Table 5-5, the plant diverts on average 14 kg ammonia-N/d, 57 kg TIN-N/d, and 3 kg P/d away from the Bay through recycled water.

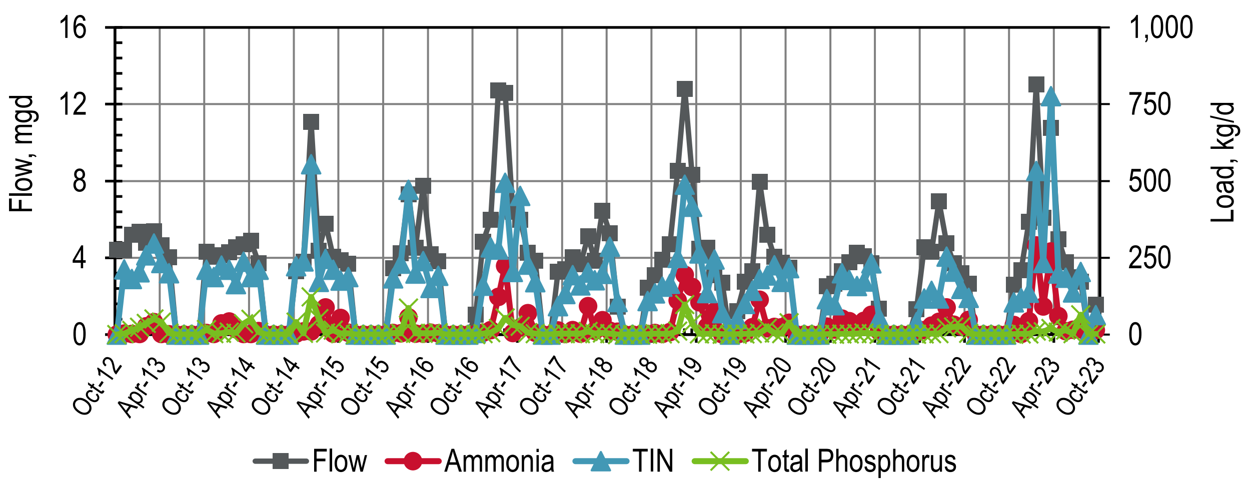

Figure 15-1. Discharge: Novato Monthly Flows and Loads

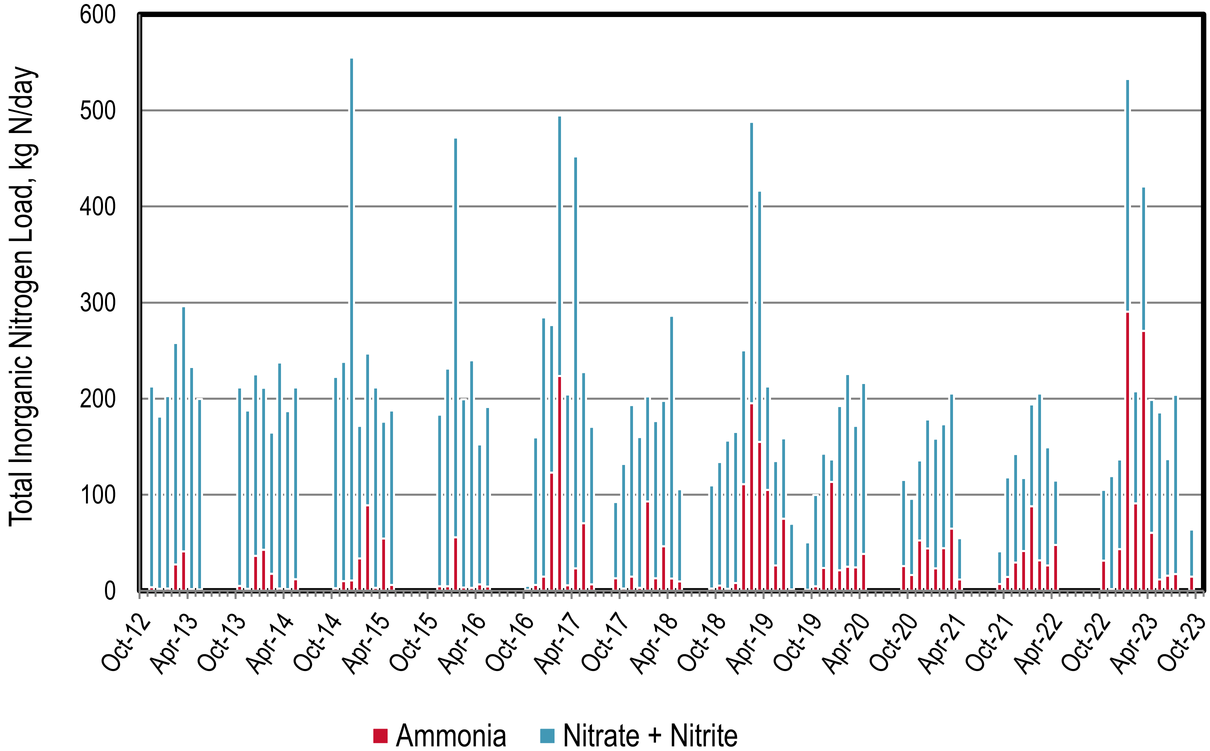

Figure 15-2. Discharge: Novato Monthly Nitrogen Loads

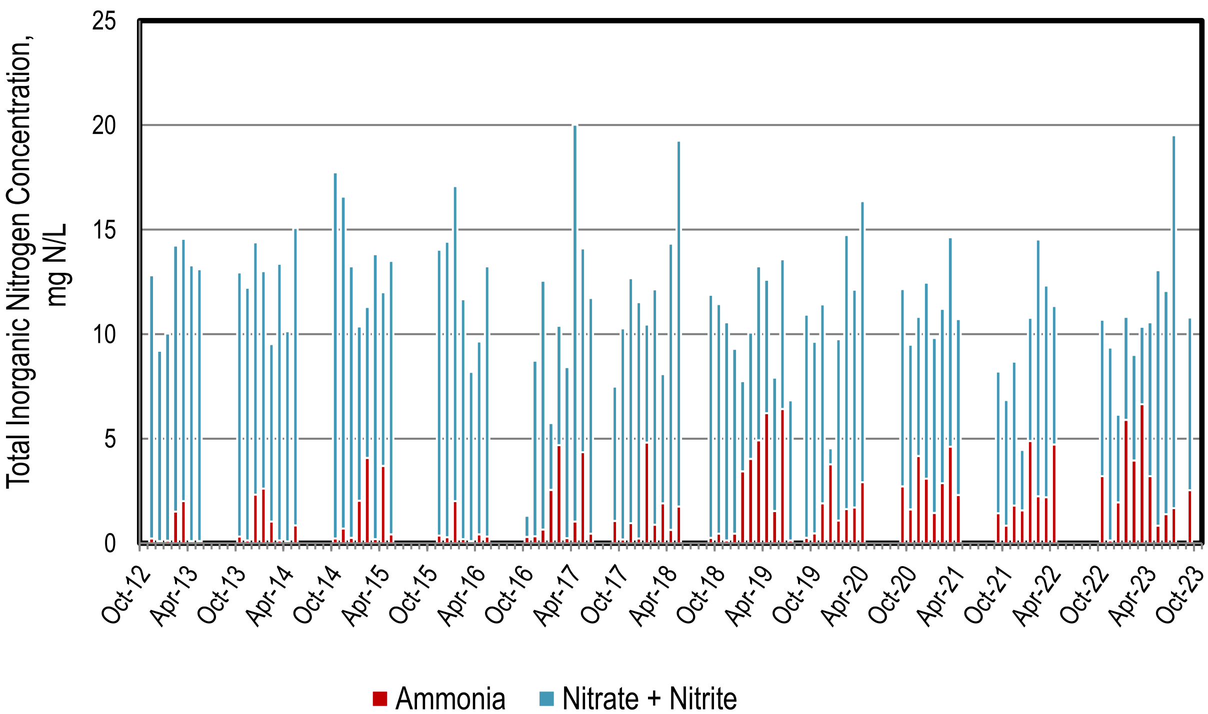

Figure 15-3. Discharge: Novato Monthly Nitrogen Concentrations

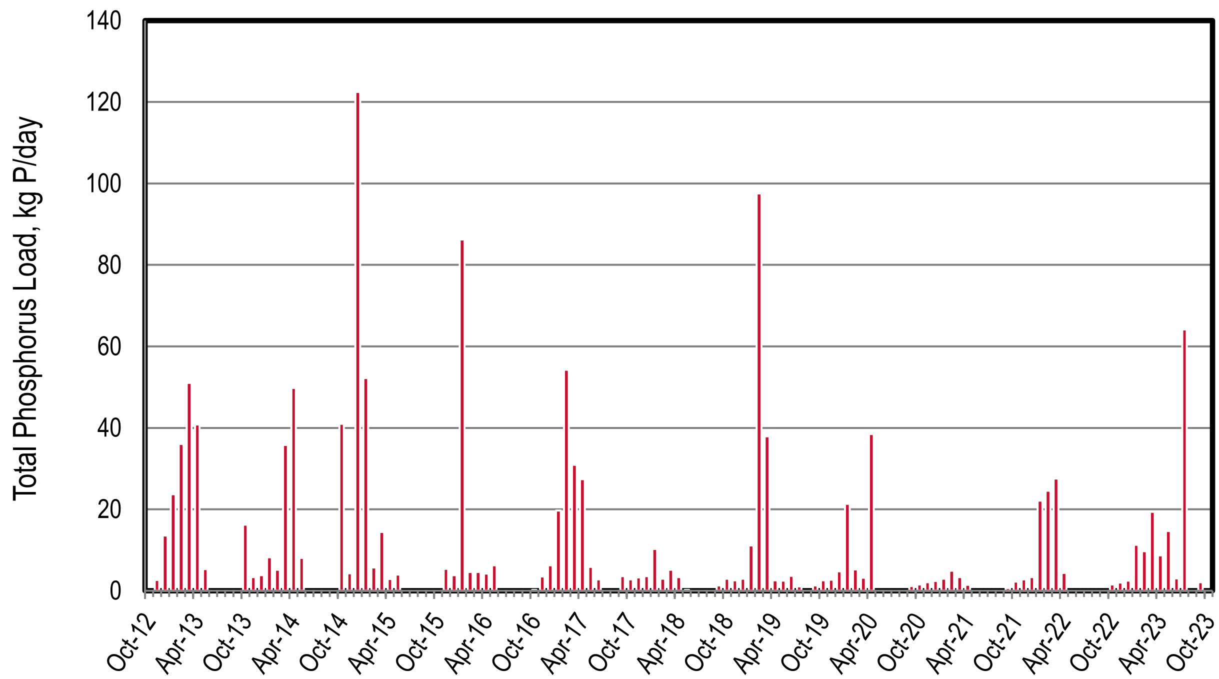

Figure 15-4. Discharge: Novato Monthly Phosphorus Loads

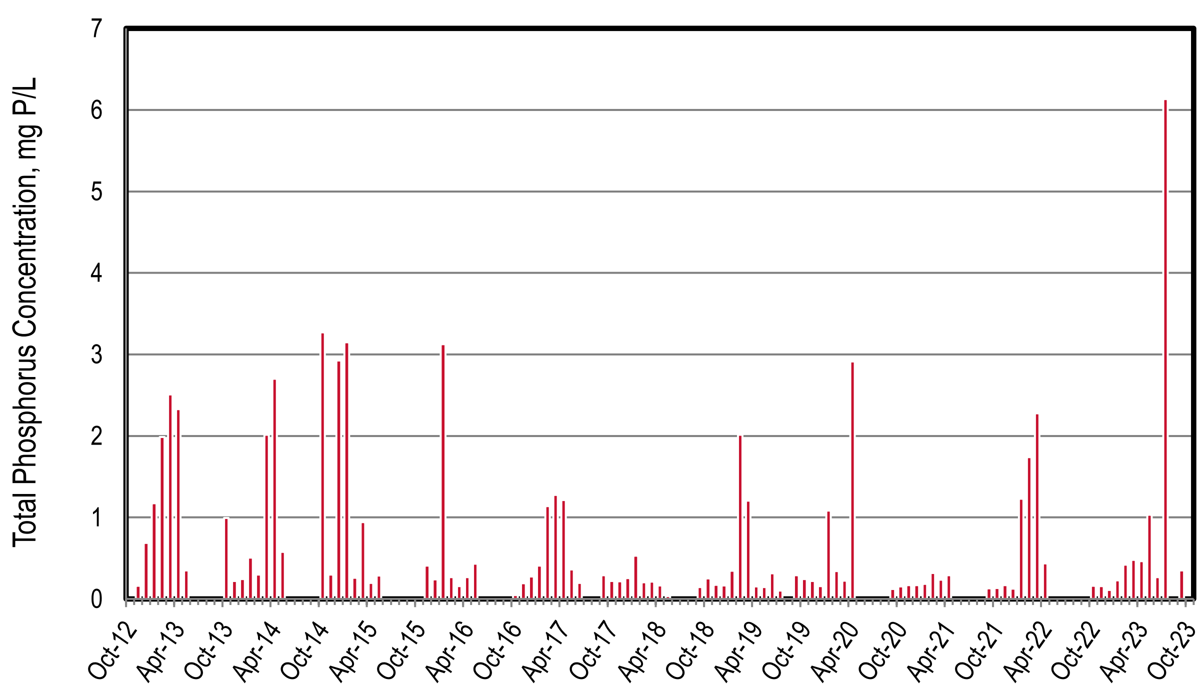

Figure 15-5. Discharge: Novato Monthly Phosphorus Concentrations

Table 15-1. Discharge: Novato Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	4.44	--	--	--	--
Nov-12	4.39	3.63	209	213	2.65
Dec-12	5.21	2.16	179	181	13.6
Jan-13	5.34	2.30	200	203	23.7
Feb-13	4.79	27.3	231	258	36.0
Mar-13	5.39	41.0	255	296	51.1
Apr-13	4.64	1.85	231	233	40.9
May-13	4.03	1.52	198	200	5.32
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	4.33	5.24	207	212	16.3
Nov-13	4.07	2.16	186	188	3.39
Dec-13	4.14	36.4	189	225	3.82
Jan-14	4.30	42.6	169	211	8.23
Feb-14	4.57	17.8	147	165	5.18
Mar-14	4.70	2.52	235	238	35.8
Apr-14	4.88	1.66	185	187	49.8
May-14	3.71	11.9	200	212	8.09
Jun-14	0	0	0	0	0
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	3.32	2.88	220	222	41.0
Nov-14	3.80	10.1	228	238	4.30
Dec-14	11.1	10.6	544	555	123
Jan-15	4.38	33.6	138	172	52.2
Feb-15	5.78	89.0	158	247	5.70
Mar-15	4.05	3.10	208	212	14.4
Apr-15	3.88	54.3	122	176	2.90
May-15	3.68	6.00	182	188	4.00
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0	0	0	0	0
Nov-15	3.46	4.81	179	183	5.36
Dec-15	4.24	4.67	227	231	3.82
Jan-16	7.30	55.8	416	472	86.2
Feb-16	4.52	3.43	196	199	4.57
Mar-16	7.75	3.16	237	240	4.58
Apr-16	4.18	6.68	146	152	4.25
May-16	3.82	4.51	187	191	6.22
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16***	1.05	1.19	4.01	5.20	0.182
Nov-16	4.84	6.01	154	160	3.51
Dec-16	5.99	14.7	270	284	6.22
Jan-17	12.7	123	154	276	19.7
Feb-17	12.6	223	271	495	54.3
Mar-17	6.41	5.74	199	204	30.9
Apr-17	5.97	23.4	429	452	27.4
May-17	4.27	70.3	157	228	5.86
Jun-17	3.85	6.71	164	171	2.83
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	3.27	13.2	79.2	92.5	3.60
Oct-17	3.40	2.38	130	132	2.81
Nov-17	4.03	14.7	179	193	3.27
Dec-17	3.67	3.14	157	160	3.57
Jan-18	5.11	93.0	109	202	10.2
Feb-18	3.85	12.9	164	177	2.98
Mar-18	6.46	46.5	151	198	5.15
Apr-18	5.28	12.7	273	286	3.32
May-18***	1.45	9.61	96.1	106	0.186
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	2.44	2.41	107	110	1.34
Oct-18	3.10	5.28	129	134	2.96

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	3.91	2.06	154	156	2.57
Dec-18	4.71	8.23	157	165	2.93
Jan-19	8.54	111	139	250	11.1
Feb-19	12.8	195	293	488	97.6
Mar-19	8.32	155	262	417	37.9
Apr-19	4.47	105	108	265	2.58
May-19	4.51	26.3	109	135	2.51
Jun-19	3.09	75.1	83.5	245	3.66
Jul-19	2.70	1.35	68.4	69.7	1.03
Aug-19	0	0	0	0	0
Sep-19***	1.22	1.16	49.2	50.4	1.34
Oct-19	2.74	4.85	94.9	99.8	2.52
Nov-19	3.30	23.8	119	143	2.74
Dec-19	7.96	113	23.2	182	4.75
Jan-20	5.21	21.3	171	192	21.3
Feb-20	4.05	25.1	201	226	5.22
Mar-20	3.74	24.3	147	172	3.19
Apr-20	3.50	38.5	178	216	38.5
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	2.51	25.8	89.7	116	1.15
Oct-20	2.67	16.4	79.5	95.8	1.56
Nov-20	3.31	52.3	83.3	200	2.11
Dec-20	3.78	44.2	134	178	2.41
Jan-21	4.27	23.5	135	158	2.98
Feb-21	4.09	44.5	129	173	4.93
Mar-21	3.71	64.7	140	232	3.31
Apr-21***	1.35	11.8	43.0	54.8	1.48
May-21	0	0	0	0	0
Jun-21	0	0	0	0	0
Jul-21	0	0	0	0	0
Aug-21	0	0	0	0	0
Sep-21***	1.32	7.20	33.8	41.0	0.648
Oct-21	4.55	14.5	103	118	2.28
Nov-21	4.33	29.4	113	142	2.78

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	6.94	41.3	75.9	117	3.33
Jan-22	4.76	88.1	106	254	22.1
Feb-22	3.74	31.8	174	205	24.6
Mar-22	3.20	26.6	123	149	27.6
Apr-22***	2.67	47.7	67.0	120	4.39
May-22	0	0	0	0	0
Jun-22	0	0	0	0	0
Jul-22	0	0	0	0	0
Aug-22	0	0	0	0	0
Sep-22	0	0	0	0	0
Oct-22	2.59	31.5	73.4	105	1.57
Nov-22	3.37	1.62	118	119	2.03
Dec-22	5.88	43.5	93.1	137	2.48
Jan-23	13.0	291	242	533	11.3
Feb-23	6.10	91.2	117	233	9.67
Mar-23	10.8	271	150	776	19.4
Apr-23	4.97	60.3	138	199	8.71
May-23	3.76	11.8	174	186	14.7
Jun-23	3.00	15.8	121	137	3.03
Jul-23	2.77	17.5	187	204	64.1
Aug-23	0	0	0	0	0
Sep-23***	1.56	14.9	48.7	63.5	2.06
Dry Season Average	**1.04**	**5.87**	**42.4**	**49.9**	**2.39**
Dry Season Trend	**--****	**--****	**--****	**--****	**--****
Wet Season Average	**5.07**	**42.2**	**170**	**220**	**16.0**
Average Annual	**3.39**	**27.0**	**116**	**149**	**10.3**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** No dry season trending analysis was performed on Novato as the facility typically does not discharge during most dry season months.

*** Lower than typical monthly averages due to discharge to the Bay only occurring during a portion of the month.

Recycled Water

Table 15-2. Recycled Water: Novato Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	215 (0.19)	200 (0.18)	--	--	401 (0.36)	--	57 (0.05)	873 (0.78)
2020	--	640 (0.57)	--	--	902 (0.81)	--	99 (0.09)	1,640 (1.46)
2021	385 (0.34)	196 (0.18)	--	8 (0.01)	1,010 (0.90)	--	49 (0.04)	1,650 (1.47)
2022	350 (0.31)	202 (0.18)	--	10 (0.01)	1,200 (1.07)	--	46 (0.04)	1,810 (1.61)
Average	317 (0.28)	310 (0.28)	--	9 (0.01)	878 (0.78)	--	63 (0.06)	1,490 (1.33)

*	Assumes 100% of the recycled flow is diverted from the Bay

****	Calendar year as opposed to California's water year (October 1 through September 30)**

Table 15-3. Recycled Water: Novato Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	3	2	--	--	5	--	1	11
2020	--	5	--	--	7	--	1	13
2021	3	1	--	<1	7	--	<1	11
2022	3	2	--	<1	11	--	<1	17
Average	3	3	--	<1	7	--	1	14

*	Assumes 100% of the recycled load is diverted from the Bay

****	Calendar year as opposed to California's water year (October 1 through September 30)**

Table 15-4. Recycled Water: Novato Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	7	7	--	--	14	--	2	31
2020	--	28	--	--	39	--	4	71
2021	12	6	--	<1	31	--	1	50
2022	13	7	--	<1	45	--	2	67
Average	11	12	--	<1	32	--	2	57

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 15-5. Recycled Water: Novato Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	1	1	--	--	1	--	<1	2
2020	--	2	--	--	2	--	<1	4
2021	<1	<1	--	<1	1	--	<1	1
2022	1	1	--	<1	3	--	<1	5
Average	1	1	--	<1	2	--	<1	3

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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16 City of Palo Alto

Palo Alto discharges to the Lower South Bay. The plant serves an estimated population of 217,000 and it has a permitted ADWF capacity of 39 mgd and a peak wet weather capacity of 80 mgd. This past dry season average discharge flow was approximately 18.4 mgd. The plant performs ammonia and limited nitrogen removal using a combination of trickling filters and activated sludge.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
  - Based on the limited average monthly values in Table 16-1, there is an upward emerging dry season trend for ammonia, TIN, and TP (other parameters have no emerging trends).
  - The flow reduction across the plant ranges was up to 26 percent in 2019. Since September 2019, the flow reduction was limited but it increased up to 19 percent in 2022. The primary flow reduction are from a blend of new recycled water demands and flow management during wet weather events.
  - The nitrogen load reduction values across the plant ranges from approximately 25 to 60 percent. This load reduction is attributed primarily to a combination of biological assimilation and biological load reduction in the trickling filter/activated sludge system, as well as recycled water.
  - The phosphorus load reduction across the plant is up to 27 percent. Such a reduction is attributed to biological assimilation within the plant, as well as recycled water.
- Discharge
  - The average monthly dry season flow values in 2023 reverted back to levels typical of the last relatively wet year in 2018. This was anticipated given how wet the 2022/2023 season was.
  - Based on Table 16-2 statistics for the entire dry season dataset, all the monitored parameters are trending downwards. The plant fully nitrifies and removes ammonia so no statistics were applied to ammonia (values reliably <0.3 mg N/L).
  - NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant reliably nitrifies year-round.
  - TP discharge concentrations range from 2.7 to 5.9 mg P/L. Such values suggests occasional removal beyond biological assimilation.
- Recycled Water:
  - Based on Table 1-2, the plant averages 0.67 mgd of Recycled Water. Recycled water uses include golf course irrigation, landscape irrigation, and other non-potable uses.
  - Based on Table 5-3 through Table 5-5, the average load diverted from the Bay from recycled water is <1 kg ammonia-N/d, 78 kg TIN-N/d, and 12 kg P/d

Influent

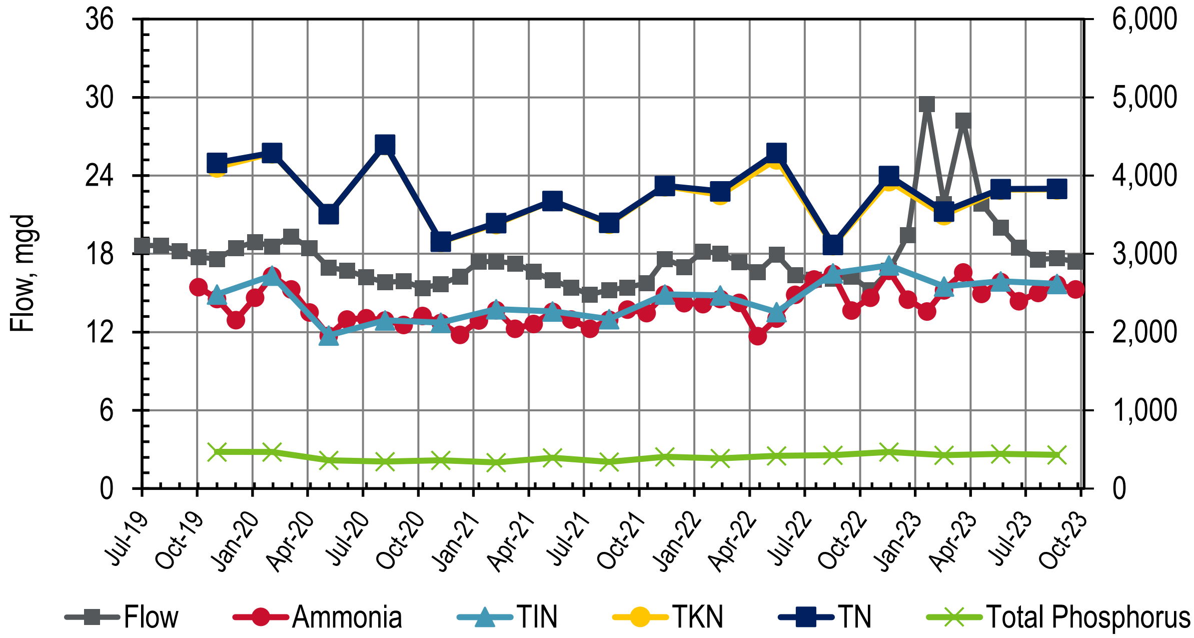

Figure 16-1. Influent: Palo Alto Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

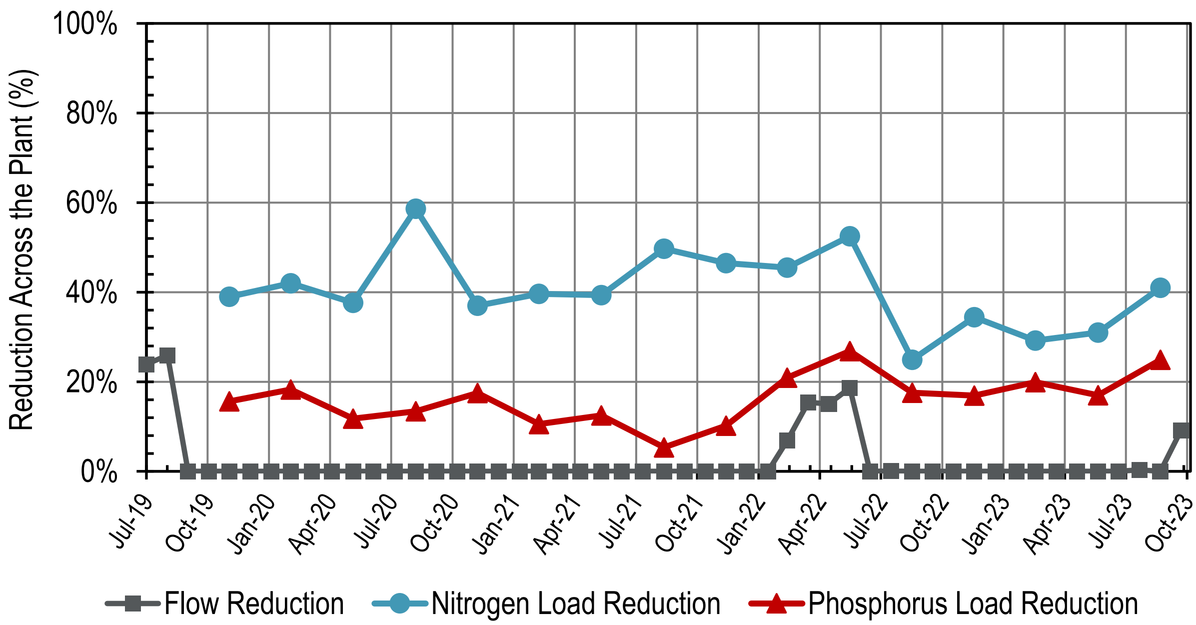

Figure 16-2. Influent: Palo Alto Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 16-1. Influent: Palo Alto Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	18.7	--	--	--	--	--	--
Aug-19	18.6	--	--	--	--	--	--
Sep-19	18.2	--	--	--	--	--	--
Oct-19	17.8	2,580	--	--	--	--	--
Nov-19	17.6	2,420	57.2	2,480	4,110	4,160	469
Dec-19	18.5	2,160	--	--	--	--	--
Jan-20	18.9	2,440	--	--	--	--	--
Feb-20	18.6	2,720	2.81	2,720	4,290	4,290	467
Mar-20	19.3	2,550	--	--	--	--	--
Apr-20	18.4	2,250	--	--	--	--	--
May-20	16.9	1,960	2.60	1,960	3,510	3,510	360
Jun-20	16.7	2,160	--	--	--	--	--
Jul-20	16.2	2,180	--	--	--	--	--
Aug-20	15.8	2,150	2.77	2,150	4,390	4,400	343
Sep-20	15.9	2,090	--	--	--	--	--
Oct-20	15.4	2,210	--	--	--	--	--
Nov-20	15.7	2,120	2.38	2,120	3,150	3,160	361
Dec-20	16.3	1,970	--	--	--	--	--
Jan-21	17.4	2,150	--	--	--	--	--
Feb-21	17.4	2,280	12.6	2,290	3,380	3,390	334
Mar-21	17.3	2,040	--	--	--	--	--
Apr-21	16.6	2,100	--	--	--	--	--
May-21	16.0	2,260	2.53	2,260	3,670	3,680	394
Jun-21	15.4	2,160	--	--	--	--	--
Jul-21	14.9	2,040	--	--	--	--	--
Aug-21	15.2	2,160	10.7	2,170	3,390	3,400	342
Sep-21	15.4	2,290	--	--	--	--	--
Oct-21	15.7	2,250	--	--	--	--	--
Nov-21	17.6	2,480	2.67	2,480	3,870	3,870	405
Dec-21	17.0	2,370	--	--	--	--	--
Jan-22	18.2	2,360	--	--	--	--	--
Feb-22	18.0	2,420	45.7	2,470	3,750	3,800	387
Mar-22	17.4	2,370	--	--	--	--	--
Apr-22	16.6	1,950	--	--	--	--	--
May-22	17.9	2,170	81.5	2,250	4,210	4,290	418
Jun-22	16.4	2,480	--	--	--	--	--
Jul-22	16.0	2,670	--	--	--	--	--
Aug-22	16.1	2,740	6.71	2,750	3,110	3,120	426

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Sep-22	16.3	2,280	--	--	--	--	--
Oct-22	15.2	2,440	--	--	--	--	--
Nov-22	16.7	2,790	66.4	2,850	3,930	3,990	469
Dec-22	19.5	2,420	--	--	--	--	--
Jan-23	29.5	2,270	--	--	--	--	--
Feb-23	21.8	2,540	46.3	2,580	3,500	3,540	426
Mar-23	28.2	2,760	--	--	--	--	--
Apr-23	21.9	2,490	--	--	--	--	--
May-23	20.0	2,640	7.64	2,650	3,820	3,830	442
Jun-23	18.5	2,390	--	--	--	--	--
Jul-23	17.6	2,500	--	--	--	--	--
Aug-23	17.7	2,610	7.38	2,620	3,820	3,830	433
Sep-23	17.4	2,550	--	--	--	--	--
Dry Season Average	**16.9**	**2,320**	**15.2**	**2,350**	**3,740**	**3,760**	**395**
Dry Season Trend * **	**None**	**Up**	**None**	**Up**	**None**	**None**	**Up**
Wet Season Average	**18.5**	**2,350**	**29.5**	**2,500**	**3,750**	**3,780**	**415**
Average Annual	**17.8**	**2,340**	**22.4**	**2,430**	**3,740**	**3,770**	**405**

* Palo Alto typically samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads (except for ammonia).

Discharge

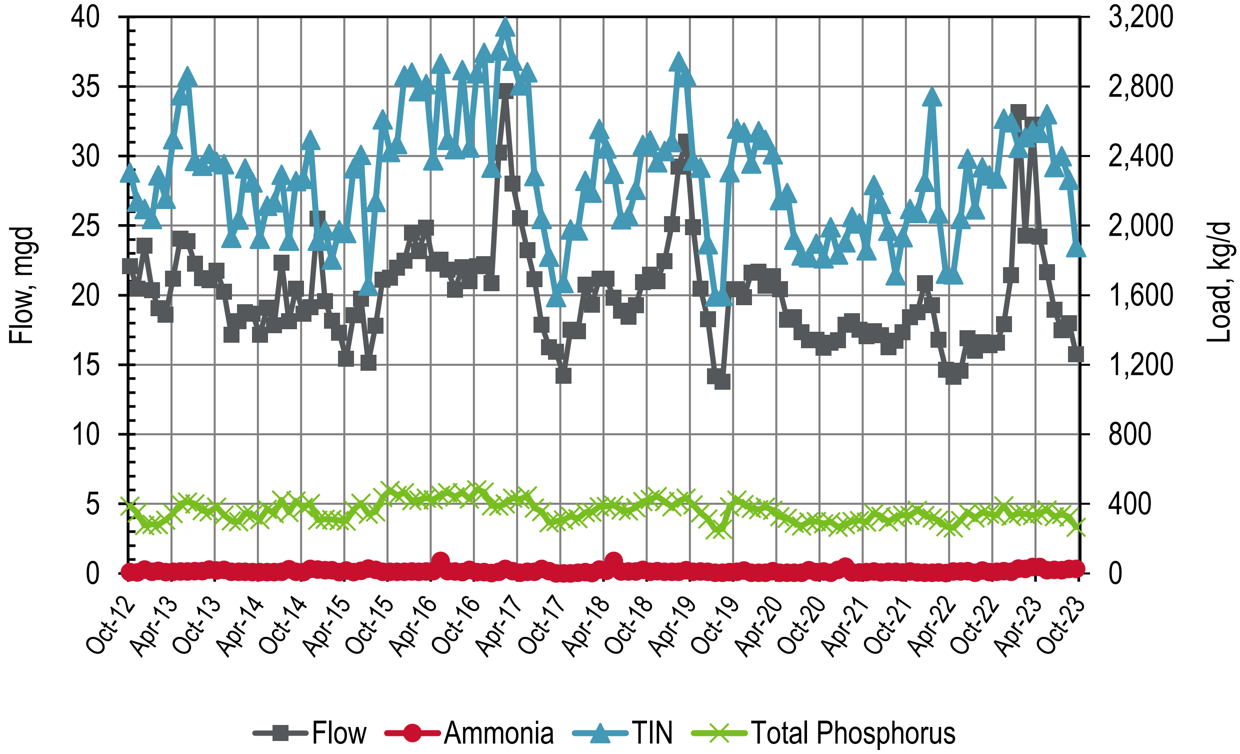

Figure 16-3. Discharge: Palo Alto Monthly Flows and Loads

Table 16-2. Discharge: Palo Alto Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	22.1	8.36	2,300	2,310	389
Nov-12	20.5	7.75	2,130	2,140	349
Dec-12	23.6	23.9	2,070	2,100	275
Jan-13	20.4	9.88	2,030	2,040	283
Feb-13	19.1	15.3	2,280	2,290	282
Mar-13	18.6	9.16	2,150	2,160	306
Apr-13	21.2	10.4	2,490	2,500	345
May-13	24.1	11.8	2,740	2,750	401
Jun-13	23.9	11.8	2,850	2,860	411
Jul-13	22.3	14.3	2,360	2,370	400
Aug-13	21.2	14.9	2,330	2,340	362
Sep-13	21.1	22.8	2,390	2,410	355
Oct-13	21.8	17.7	2,350	2,370	383
Nov-13	20.2	21.0	2,330	2,350	336
Dec-13	17.2	10.0	1,920	1,930	304
Jan-14	18.1	10.4	2,030	2,040	298
Feb-14	18.8	11.4	2,320	2,330	347
Mar-14	18.7	9.42	2,240	2,250	337
Apr-14	17.2	8.45	1,920	1,920	311
May-14	19.1	9.40	2,110	2,120	370
Jun-14	17.8	8.78	2,130	2,140	345
Jul-14	22.4	11.0	2,280	2,290	423
Aug-14	18.1	26.2	1,890	1,910	351
Sep-14	20.5	10.1	2,250	2,260	417
Oct-14	18.7	8.94	2,260	2,270	380
Nov-14	19.2	27.7	2,470	2,490	403
Dec-14	25.5	23.8	1,890	1,910	307
Jan-15	19.6	19.3	1,960	1,980	312
Feb-15	18.2	20.4	1,790	1,810	311
Mar-15	17.3	8.52	1,970	1,970	306
Apr-15	15.5	17.5	1,940	1,960	301
May-15	18.6	9.47	2,320	2,330	367
Jun-15	19.8	15.6	2,390	2,410	404
Jul-15	15.2	29.6	1,630	1,660	341
Aug-15	17.8	21.6	2,120	2,140	355
Sep-15	21.1	10.4	2,600	2,610	438

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	21.3	10.5	2,410	2,420	477
Nov-15	22.0	10.8	2,460	2,470	449
Dec-15	22.5	11.1	2,850	2,860	465
Jan-16	24.5	12.1	2,870	2,880	419
Feb-16	23.2	11.4	2,760	2,770	423
Mar-16	24.9	12.9	2,800	2,810	434
Apr-16	22.3	13.9	2,360	2,380	425
May-16	22.6	73.4	2,860	2,930	450
Jun-16	21.8	13.6	2,480	2,490	465
Jul-16	20.4	12.1	2,430	2,440	441
Aug-16	22.0	8.89	2,890	2,890	465
Sep-16	21.0	21.1	2,430	2,450	429
Oct-16	22.1	9.67	2,870	2,880	482
Nov-16	22.2	8.12	2,990	3,000	470
Dec-16	20.9	3.86	2,330	2,330	390
Jan-17	30.2	11.5	3,000	3,010	388
Feb-17	34.7	27.0	3,120	3,150	402
Mar-17	28.0	13.6	2,930	2,950	435
Apr-17	25.6	4.20	2,800	2,810	427
May-17	23.2	11.0	2,870	2,880	447
Jun-17	21.2	10.6	2,280	2,290	376
Jul-17	17.9	27.7	2,010	2,040	356
Aug-17	16.3	14.9	1,810	1,820	292
Sep-17	15.9	2.14	1,590	1,590	300
Oct-17	14.2	2.02	1,670	1,670	309
Nov-17	17.5	2.13	1,980	1,980	329
Dec-17	17.4	4.22	1,970	1,970	316
Jan-18	20.8	8.38	2,250	2,260	352
Feb-18	19.3	3.91	2,190	2,190	353
Mar-18	21.2	22.8	2,530	2,560	384
Apr-18	21.2	15.6	2,430	2,440	387
May-18	19.8	72.7	2,230	2,300	393
Jun-18	18.9	12.4	2,030	2,040	366
Jul-18	18.5	12.4	2,040	2,060	360
Aug-18	19.3	12.1	2,200	2,210	379
Sep-18	20.9	21.0	2,440	2,460	414
Oct-18	21.5	10.3	2,480	2,490	427

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	21.0	14.0	2,350	2,360	443
Dec-18	22.4	10.1	2,420	2,430	414
Jan-19	25.1	10.2	2,470	2,480	384
Feb-19	29.2	10.4	2,930	2,940	416
Mar-19	31.0	19.7	2,840	2,860	435
Apr-19	24.9	10.8	2,360	2,370	395
May-19	20.5	11.6	2,320	2,330	349
Jun-19	18.3	11.4	1,880	1,890	313
Jul-19	14.2	5.75	1,590	1,590	252
Aug-19	13.8	4.40	1,590	1,600	256
Sep-19	20.4	8.35	2,300	2,310	384
Oct-20	20.5	9.73	2,550	2,560	424
Nov-19	19.8	17.8	2,520	2,540	396
Dec-19	21.6	6.03	2,350	2,360	375
Jan-20	21.7	5.88	2,540	2,540	367
Feb-20	20.7	5.76	2,490	2,490	382
Mar-20	21.4	14.7	2,400	2,410	363
Apr-20	20.4	5.37	2,140	2,150	327
May-20	18.2	4.78	2,180	2,190	318
Jun-20	18.4	4.80	1,910	1,920	290
Jul-20	17.3	4.41	1,820	1,830	274
Aug-20	16.8	19.6	1,800	1,820	297
Sep-20	16.8	7.98	1,890	1,900	301
Oct-20	16.2	13.0	1,800	1,810	288
Nov-20	16.6	4.35	1,990	1,990	298
Dec-20	16.8	22.3	1,810	1,830	267
Jan-21	17.9	39.3	1,870	1,910	281
Feb-21	18.2	6.06	2,040	2,050	299
Mar-21	17.5	6.36	2,010	2,010	304
Apr-21	17.0	8.77	1,850	1,860	296
May-21	17.4	11.7	2,220	2,230	345
Jun-21	17.1	6.75	2,120	2,130	329
Jul-21	16.3	10.7	1,960	1,970	298
Aug-21	16.8	11.3	1,700	1,710	324
Sep-21	17.4	6.50	1,930	1,940	337
Oct-21	18.4	12.0	2,080	2,100	334
Nov-21	18.8	6.27	2,070	2,070	364

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	20.9	5.55	2,250	2,250	334
Jan-22	19.3	5.04	2,740	2,740	319
Feb-22	16.8	6.44	2,060	2,070	306
Mar-22	14.7	3.77	1,720	1,730	271
Apr-22	14.1	12.4	1,710	1,720	263
May-22	14.6	11.8	2,030	2,040	306
Jun-22	16.9	15.1	2,370	2,380	352
Jul-22	16.0	4.97	2,090	2,090	319
Aug-22	16.6	17.2	2,320	2,340	351
Sep-22	16.4	8.69	2,280	2,290	342
Oct-22	16.6	11.3	2,260	2,270	335
Nov-22	17.9	13.8	2,600	2,620	390
Dec-22	21.4	10.6	2,580	2,590	329
Jan-23	33.2	28.7	2,420	2,450	345
Feb-23	24.3	28.0	2,480	2,510	341
Mar-23	32.3	37.9	2,510	2,550	335
Apr-23	24.2	37.8	2,500	2,530	346
May-23	21.7	19.0	2,620	2,640	367
Jun-23	19.0	22.0	2,320	2,340	326
Jul-23	17.5	19.3	2,380	2,400	339
Aug-23	18.0	27.0	2,240	2,260	325
Sep-23	15.8	26.9	1,850	1,880	266
Dry Season Average	**18.8**	**15.6**	**2,190**	**2,210**	**357**
**Dry Season Trend ** **	**Down**	**--*** **	**Down**	**Down**	**Down**
Wet Season Average	**21.1**	**12.9**	**2,320**	**2,330**	**358**
Average Annual	**20.1**	**14.0**	**2,270**	**2,280**	**358**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Ammonia not considered in the dry season trending as the plant has ammonia discharge limits and it reliably nitrifies.

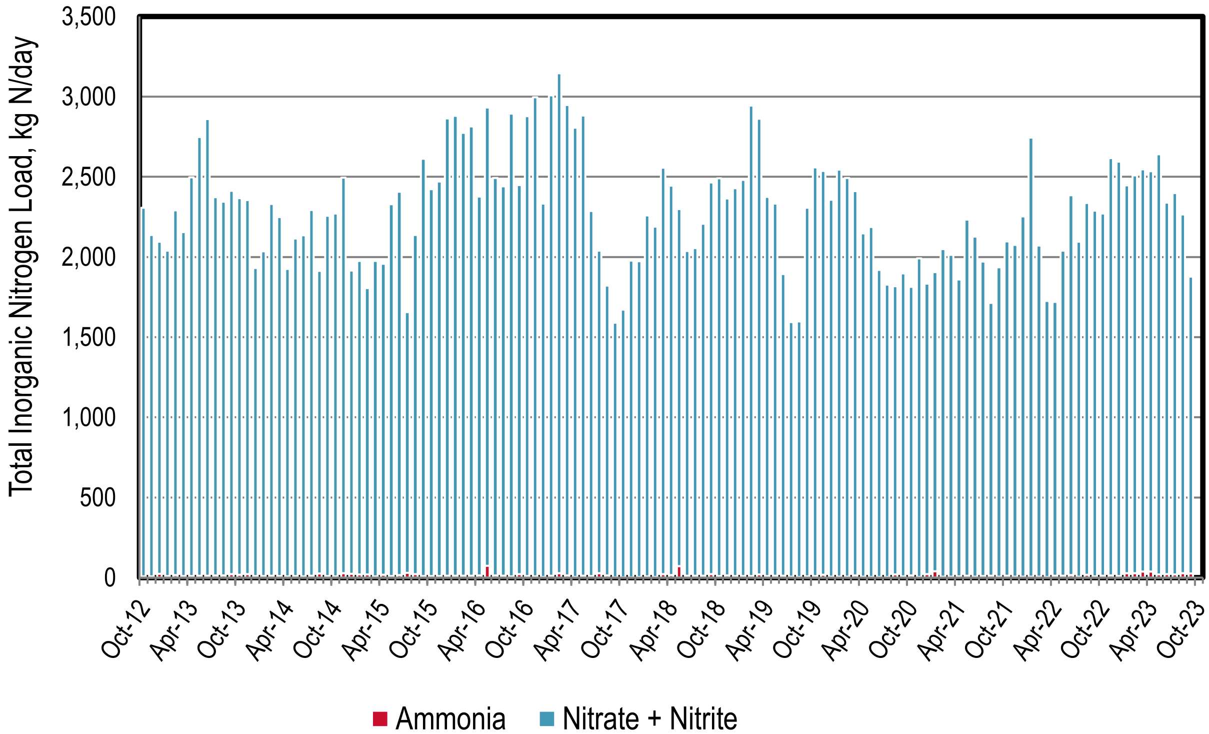

Figure 16-4. Discharge: Palo Alto Monthly Nitrogen Loads

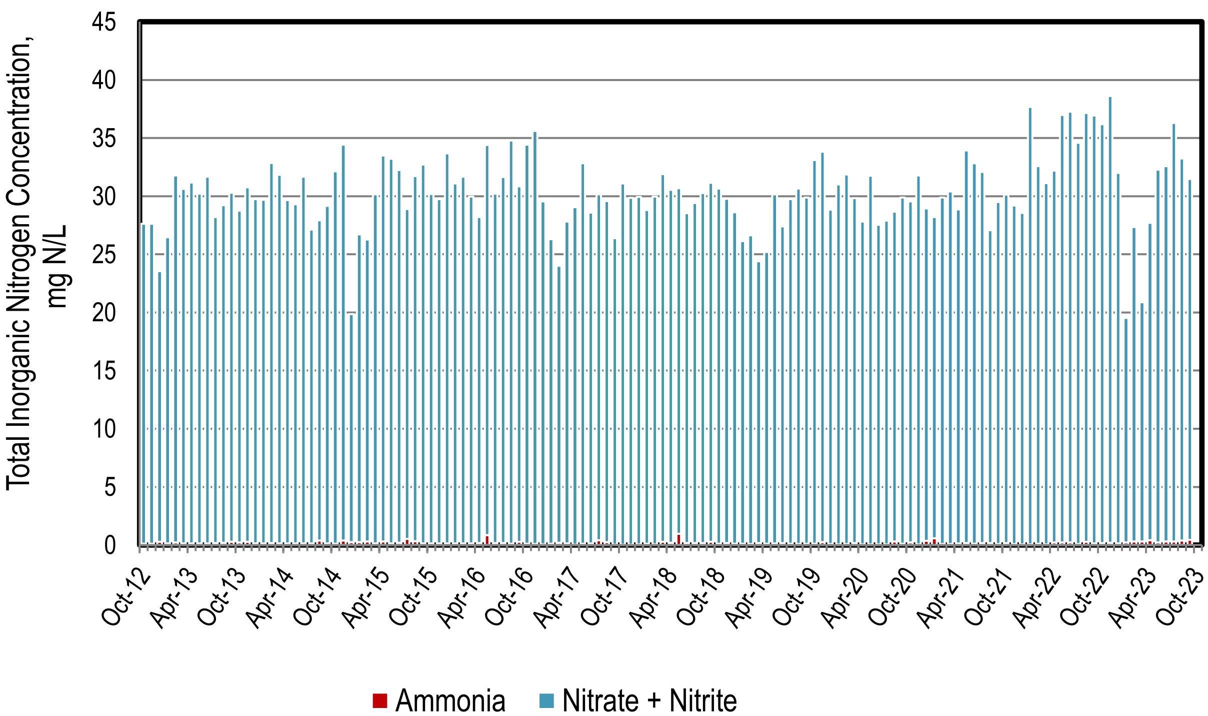

Figure 16-5. Discharge: Palo Alto Monthly Nitrogen Concentrations

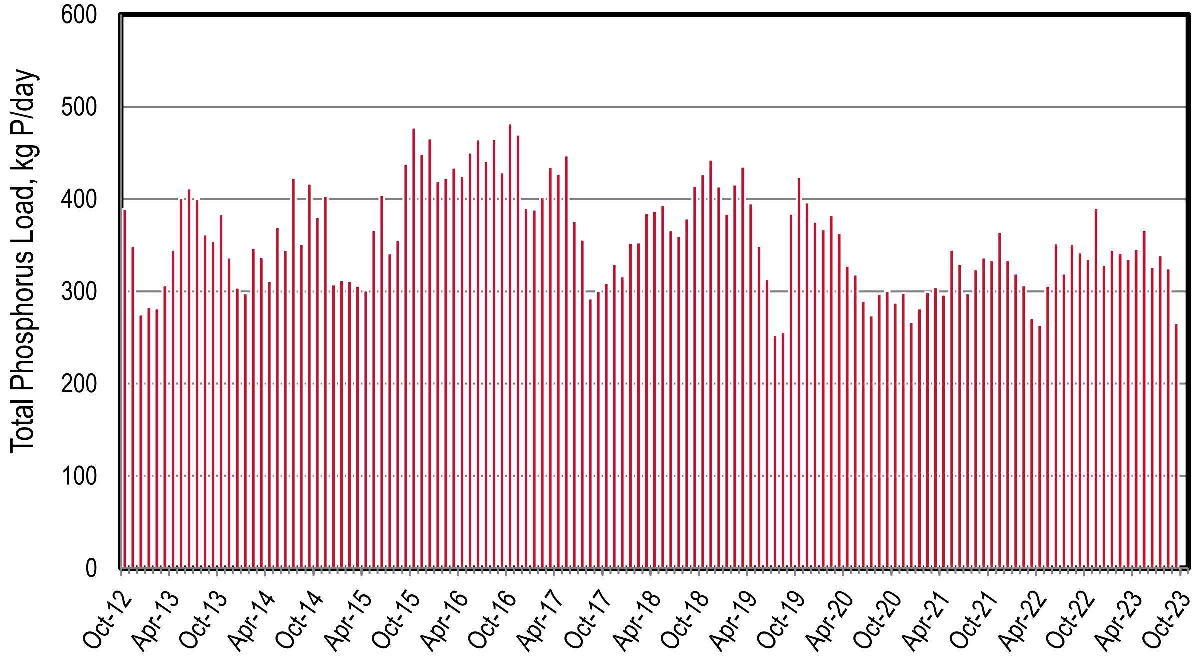

Figure 16-6. Discharge: Palo Alto Monthly Phosphorus Loads

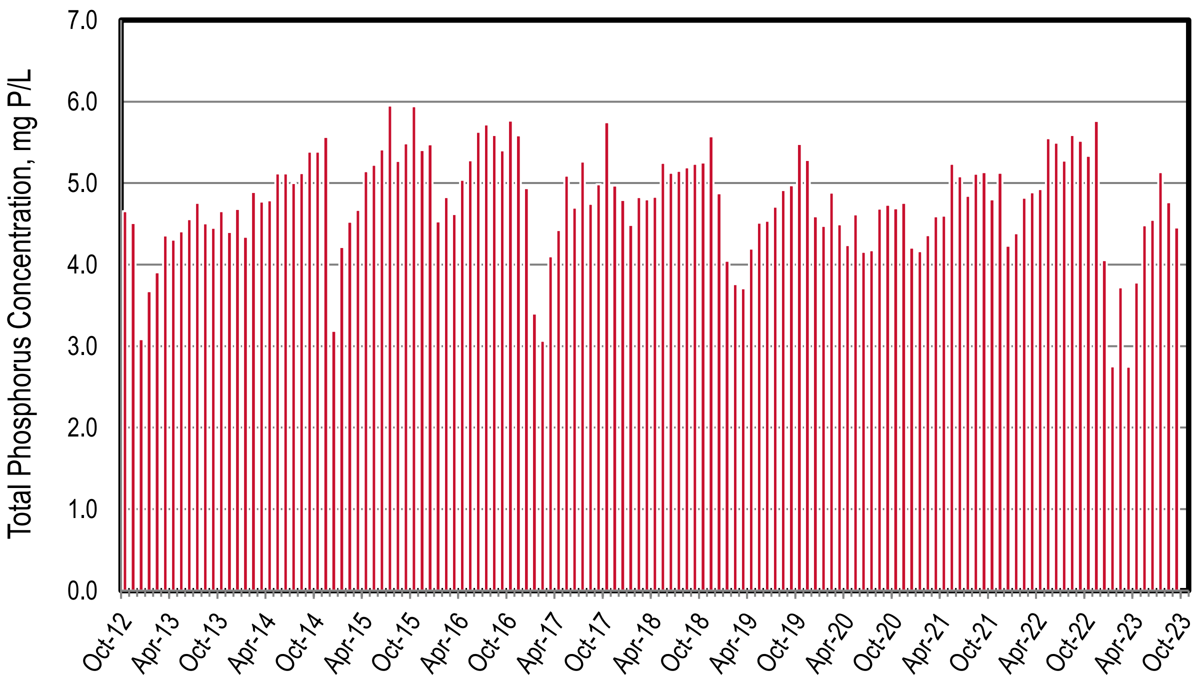

Figure 16-7. Discharge: Palo Alto Monthly Phosphorus Concentrations

Recycled Water

Table 16-3. Recycled Water: Palo Alto Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	332 (0.30)	307 (0.27)	--	--	--	--	62 (0.06)	701 (0.63)
2020	356 (0.32)	300 (0.27)	--	--	--	--	76 (0.07)	732 (0.66)
2021	313 (0.28)	369 (0.33)	--	--	--	--	13 (0.01)	695 (0.62)
2022	434 (0.39)	320 (0.29)	--	--	--	--	75 (0.07)	829 (0.75)
Average	359 (0.32)	324 (0.29)	--	--	--	--	56 (0.05)	739 (0.67)

* Assumes 100% of the recycled flow is diverted from the Bay

** **Calendar year as opposed to California's water year (October 1 through September 30)**

Table 16-4. Recycled Water: Palo Alto Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	<1	<1	--	--	--	--	<1	<1
2020	<1	<1	--	--	--	--	<1	<1
2021	<1	<1	--	--	--	--	<1	<1
2022	<1	<1	--	--	--	--	<1	<1
Average	<1	<1	--	--	--	--	<1	<1

* Assumes 100% of the recycled load is diverted from the Bay

** **Calendar year as opposed to California's water year (October 1 through September 30)**

Table 16-5. Recycled Water: Palo Alto Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	32	30	--	--	--	--	6	68
2020	36	30	--	--	--	--	8	74
2021	32	38	--	--	--	--	1	71
2022	51	38	--	--	--	--	9	98
Average	38	34	--	--	--	--	6	78

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 16-6. Recycled Water: Palo Alto Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	5	5	--	--	--	--	1	11
2020	5	5	--	--	--	--	1	11
2021	5	6	--	--	--	--	<1	11
2022	7	5	--	--	--	--	1	14
Average	6	5	--	--	--	--	1	12

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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17 Sanitary District No. 5 of Marin County - Paradise Cove Treatment Plant

The Paradise Cove Treatment Plant discharges to the Central Bay. The service area has approximately 65 service connections. The plant has a permitted ADWF capacity of 0.040 mgd and it has currents dry season flows of approximately 0.012 mgd. The plant performs secondary treatment using an activated sludge treatment process.

The plant is classified as a minor discharger (<1 mgd permitted capacity) and thus not required to sample as frequently as the major dischargers (>1 mgd permitted capacity). The minor dischargers are required to sample twice per year under the Nutrient Watershed Permit. As a result, there are several months of nutrient data gaps.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge
  - Flow values are provided over the entire study period. The remaining nutrient species only have monthly sampling for the first year of sampling, followed by occasional sampling thereafter.
  - The plant occasionally nitrifies as evidenced by ammonia values of less than 0.2 mg N/L.
  - During months of nitrification, NOx is the majority of the nitrogen species discharged. During months of no nitrification, ammonia is the majority of discharged nitrogen species.
  - Total phosphorus concentrations are wide ranging from approximately 2.2 to 16 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L.
  - Based on Table 17-1 statistics for the entire dry season dataset, flow and ammonia do not appear to have any emerging trends.
- Recycled Water: No recycled water was produced or distributed this past year.

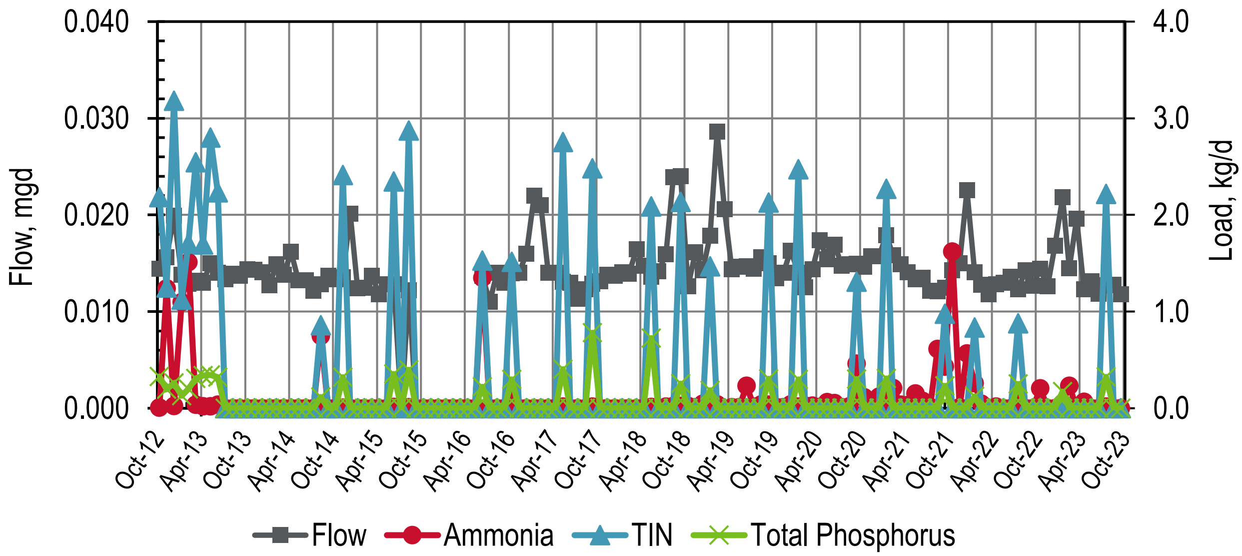

Figure 17-1. Discharge: Paradise Cove Monthly Flows and Loads

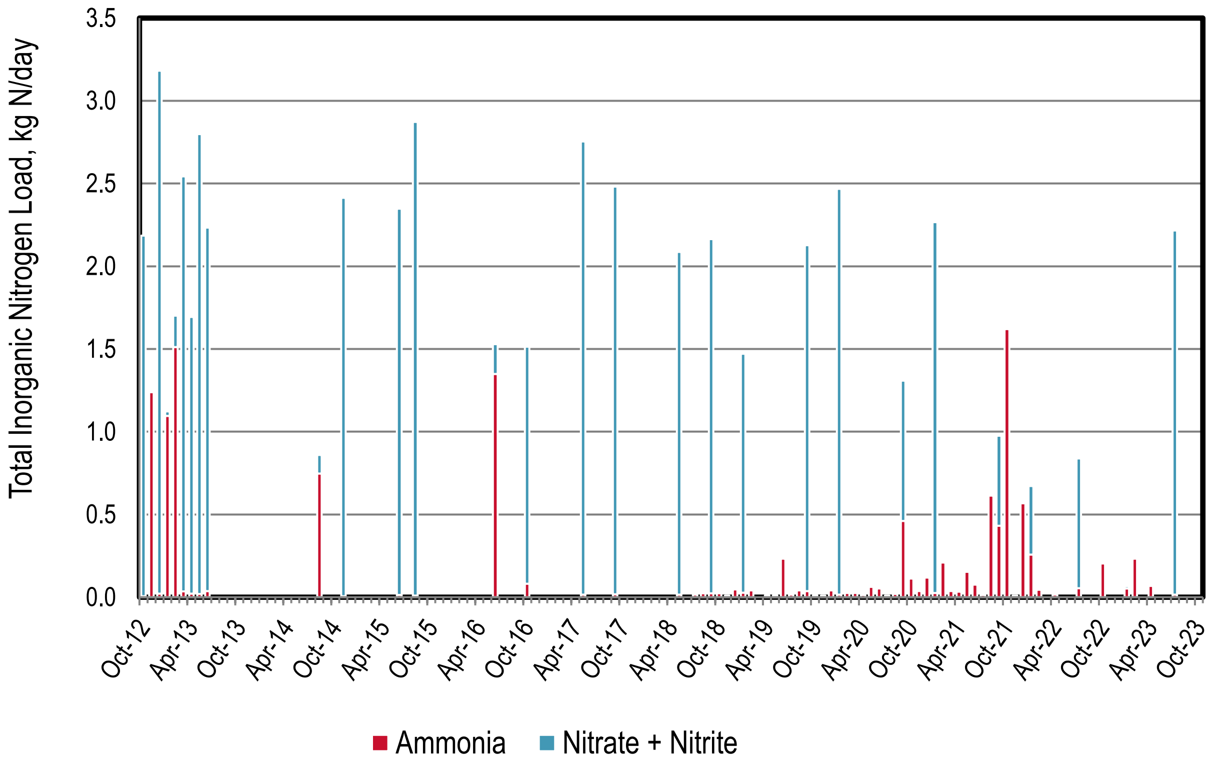

Figure 17-2. Discharge: Paradise Cove Monthly Nitrogen Loads

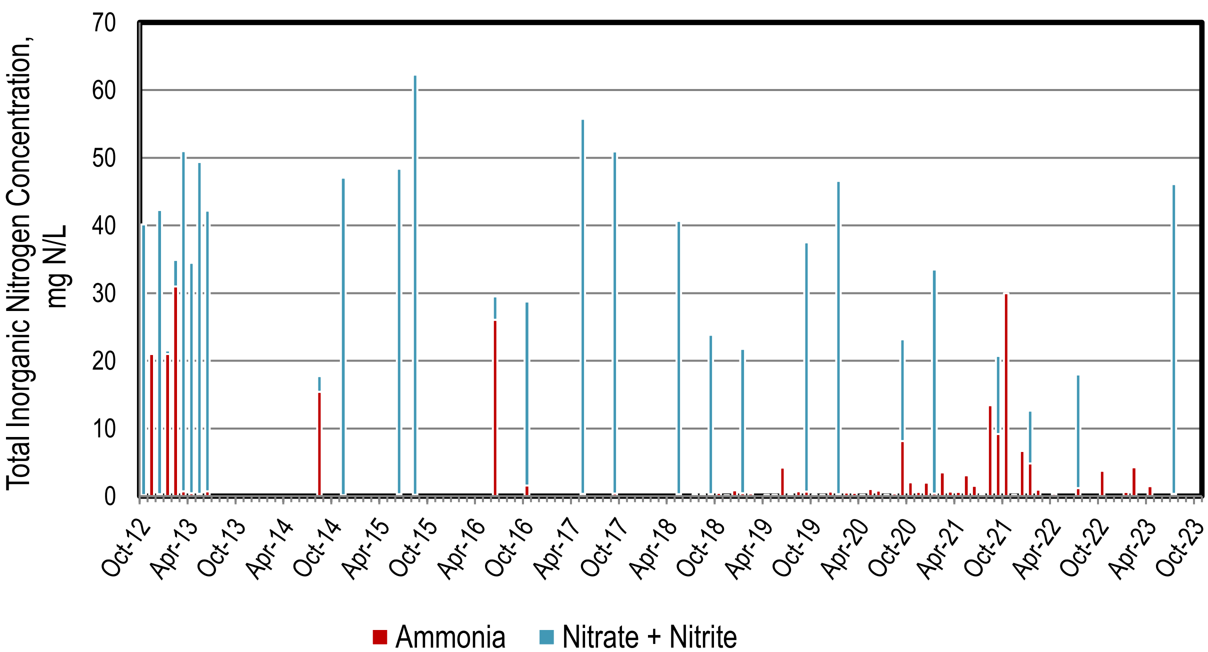

Figure 17-3. Discharge: Paradise Cove Monthly Nitrogen Concentrations

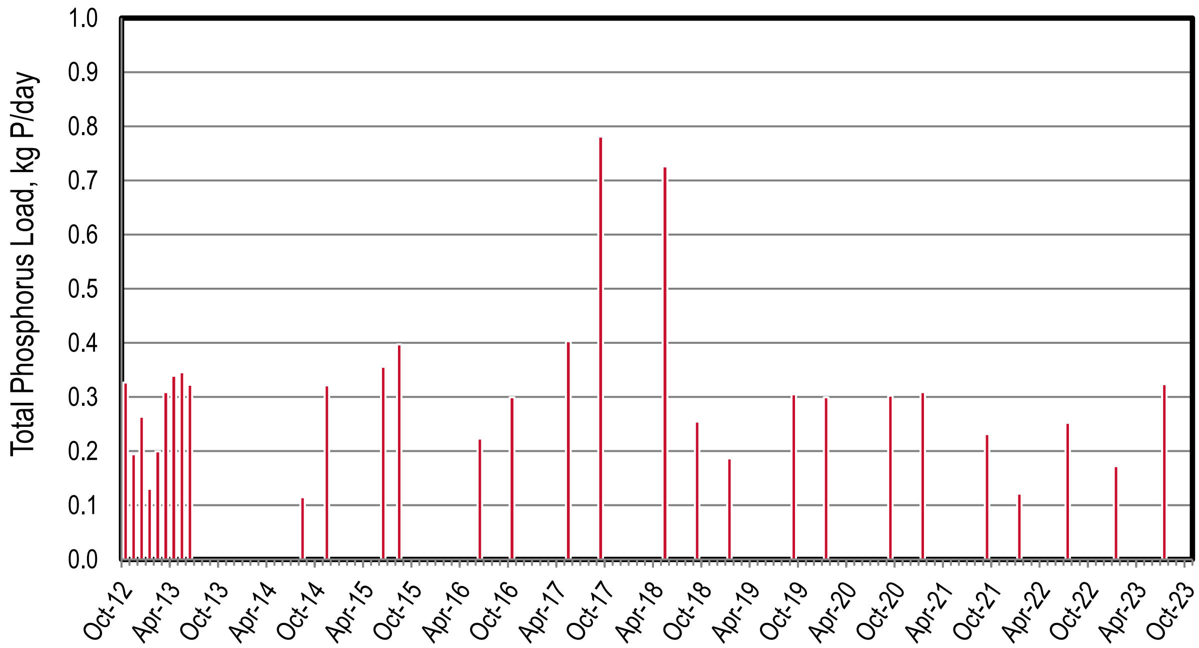

Figure 17-4. Discharge: Paradise Cove Monthly Phosphorus Loads

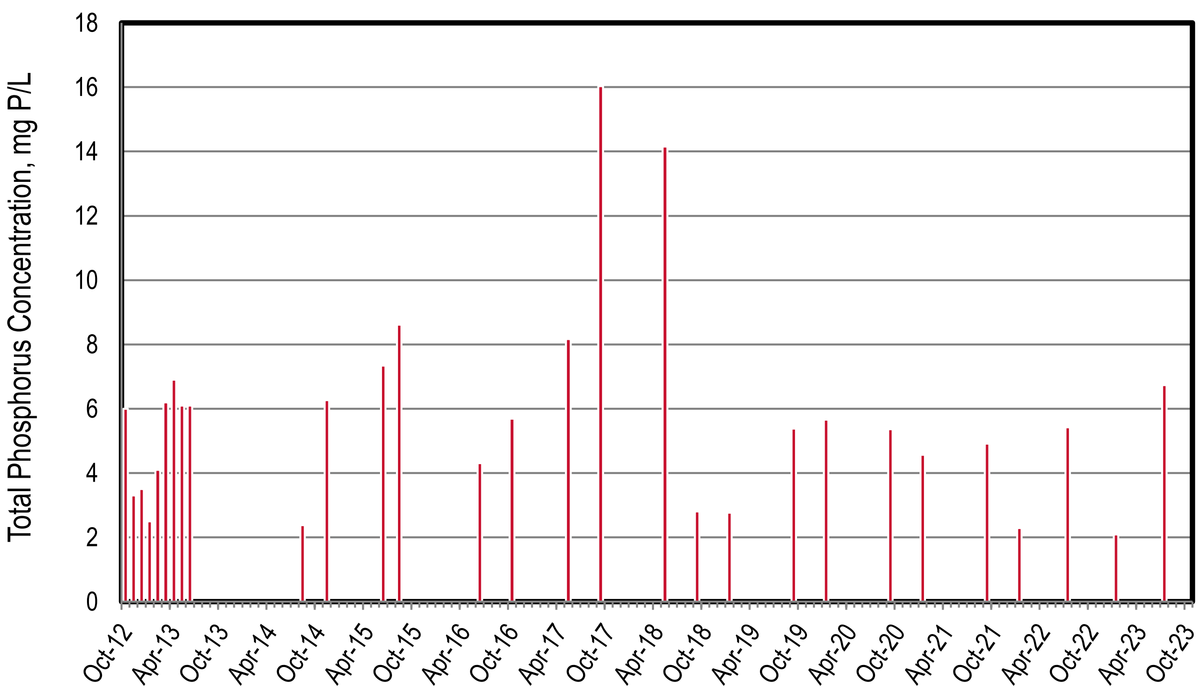

Figure 17-5. Discharge: Paradise Cove Monthly Phosphorus Concentrations

Table 17-1. Discharge: Paradise Cove Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.0144	0.00708	2.18	2.19	0.327
Nov-12	0.0156	1.24	0.0113	1.25	0.195
Dec-12	0.0199	0.0218	3.16	3.18	0.263
Jan-13	0.0138	1.10	0.0282	1.12	0.130
Feb-13	0.0129	1.51	0.191	1.70	0.200
Mar-13	0.0132	0.0349	2.51	2.54	0.309
Apr-13	0.0130	0.0216	1.67	1.69	0.339
May-13	0.0150	0.0198	2.78	2.80	0.346
Jun-13	0.0140	0.0370	2.20	2.23	0.323
Jul-13	0.0133	--	--	--	--
Aug-13	0.0139	--	--	--	--
Sep-13	0.0137	--	--	--	--
Oct-13	0.0144	--	--	--	--
Nov-13	0.0143	--	--	--	--
Dec-13	0.0141	--	--	--	--
Jan-14	0.0127	--	--	--	--
Feb-14	0.0149	--	--	--	--
Mar-14	0.0138	--	--	--	--
Apr-14	0.0162	--	--	--	--
May-14	0.0132	--	--	--	--
Jun-14	0.0132	--	--	--	--
Jul-14	0.0121	--	--	--	--
Aug-14	0.0128	0.748	0.112	0.860	0.115
Sep-14	0.0137	--	--	--	--
Oct-14	0.0133	--	--	--	--
Nov-14	0.0136	0.00689	2.41	2.41	0.321
Dec-14	0.0202	--	--	--	--
Jan-15	0.0124	--	--	--	--
Feb-15	0.0124	--	--	--	--
Mar-15	0.0137	--	--	--	--
Apr-15	0.0118	--	--	--	--
May-15	0.0128	--	--	--	--
Jun-15	0.0128	0.0146	2.33	2.35	0.356
Jul-15	--	--	--	--	--
Aug-15	0.0122	0.00924	2.86	2.87	0.397
Sep-15	--	--	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	--	--	--	--	--
Nov-15	--	--	--	--	--
Dec-15	--	--	--	--	--
Jan-16	--	--	--	--	--
Feb-16	--	--	--	--	--
Mar-16	--	--	--	--	--
Apr-16	--	--	--	--	--
May-16	--	--	--	--	--
Jun-16	0.0137	1.35	0.180	1.53	0.223
Jul-16	0.0110	--	--	--	--
Aug-16	0.0140	--	--	--	--
Sep-16	0.0130	--	--	--	--
Oct-16	0.0139	0.0818	1.43	1.51	0.300
Nov-16	0.0140	--	--	--	--
Dec-16	0.0160	--	--	--	--
Jan-17	0.0220	--	--	--	--
Feb-17	0.0210	--	--	--	--
Mar-17	0.0140	--	--	--	--
Apr-17	0.0140	--	--	--	--
May-17	0.0131	0.0165	2.74	2.75	0.403
Jun-17	0.0130	--	--	--	--
Jul-17	0.0113	--	--	--	--
Aug-17	0.0123	--	--	--	--
Sep-17	0.0129	0.0174	2.46	2.48	0.781
Oct-17	0.0131	--	--	--	--
Nov-17	0.0138	--	--	--	--
Dec-17	0.0137	--	--	--	--
Jan-18	0.0141	--	--	--	--
Feb-18	0.0139	--	--	--	--
Mar-18	0.0164	--	--	--	--
Apr-18	0.0147	--	--	--	--
May-18	0.0136	0.0149	2.07	2.09	0.726
Jun-18	0.0142	--	--	--	--
Jul-18	0.0159	0.0159	--	--	--
Aug-18	0.0239	0.0239	--	--	--
Sep-18	0.0240	0.0240	2.14	2.13	0.255
Oct-18	0.0126	0.0229	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0.0162	0.0102	--	--	--
Dec-18	0.0142	0.0469	--	--	--
Jan-19	0.0179	0.0277	1.44	1.47	0.187
Feb-19	0.0286	0.0401	--	--	--
Mar-19	0.0206	--	--	--	--
Apr-19	0.0144	0.0114	--	--	--
May-19	0.0147	0.0113	--	--	--
Jun-19	0.0147	0.233	--	--	--
Jul-19	0.0144	0.0158	--	--	--
Aug-19	0.0156	0.0413	--	--	--
Sep-19	0.0150	0.0368	2.09	2.13	0.305
Oct-19	0.0135	0.0120	--	--	--
Nov-19	0.0140	0.0101	--	--	--
Dec-19	0.0163	0.0407	--	--	--
Jan-20	0.0140	0.0158	2.45	2.47	0.300
Feb-20	0.0125	0.0256	--	--	--
Mar-20	0.0144	0.0254	--	--	--
Apr-20	0.0174	0.0130	--	--	--
May-20	0.0154	0.0616	--	--	--
Jun-20	0.0169	0.0531	--	--	--
Jul-20	0.0147	0.0106	--	--	--
Aug-20	0.0149	0.0204	--	--	--
Sep-20	0.0151	0.460	0.848	1.31	0.303
Oct-20	0.0147	0.113	--	--	--
Nov-20	0.0157	0.0366	--	--	--
Dec-20	0.0157	0.119	--	--	--
Jan-21	0.0179	0.0263	2.24	2.27	0.309
Feb-21	0.0158	0.209	--	--	--
Mar-21	0.0149	0.0363	--	--	--
Apr-21	0.0141	0.0336	--	--	--
May-21	0.0133	0.154	--	--	--
Jun-21	0.0135	0.0763	--	--	--
Jul-21	0.0122	0.0132	--	--	--
Aug-21	0.0121	0.613	--	--	--
Sep-21	0.0125	0.431	0.545	0.977	0.232
Oct-21	0.0143	1.62	--	--	--
Nov-21	0.0150	0.00954	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	0.0225	0.568	--	--	--
Jan-22	0.0141	0.258	0.415	0.836	0.122
Feb-22	0.0128	0.0454	--	--	--
Mar-22	0.0118	--	--	--	--
Apr-22	0.0128	0.0151	--	--	--
May-22	0.0130	--	--	--	--
Jun-22	0.0136	--	--	--	--
Jul-22	0.0123	0.0541	0.783	0.877	0.252
Aug-22	0.0143	--	--	--	--
Sep-22	0.0127	--	--	--	--
Oct-22	0.0144	0.204	--	--	--
Nov-22	0.0126	--	--	--	--
Dec-22	0.0168	--	--	--	--
Jan-23	0.0218	0.0516	0.0143	0.0660	0.172
Feb-23	0.0145	0.233	--	--	--
Mar-23	0.0196	--	--	--	--
Apr-23	0.0123	0.0673	--	--	--
May-23	0.0131	--	--	--	--
Jun-23	0.0119	--	--	--	--
Jul-23	0.0127	0.0155	2.20	2.22	0.324
Aug-23	0.0128	--	--	--	--
Sep-23	0.0118	--	--	--	--
Dry Season Average	**0.0139**	**0.158**	**1.76**	**1.97**	**0.356**
Dry Season Trend **	**None**	**None**	*****	*****	*****
Wet Season Average	**0.0152**	**0.204**	**1.44**	**1.77**	**0.248**
Average Annual	**0.0147**	**0.185**	**1.60**	**1.87**	**0.304**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** No statistical dry season trending analysis was performed on nutrient species (except ammonia) due to the limited number of samples required for minor dischargers.

Recycled Water

No recycled water was produced or distributed this past year.

18 City of Petaluma

Petaluma discharges to Petaluma River that is connected to San Pablo Bay. The plant has approximately 25,300 service connections and it has a permitted capacity of 6.7 mgd ADWF. The plant performs nitrogen and phosphorus removal using oxidation ditches coupled with treatment wetlands and oxidation ponds. The oxidation ponds also serve as equalization during peak wet weather flow. Effluent flow that is not discharged to the Petaluma River is diverted to recycled water whenever possible. Discharge to Petaluma River is prohibited May 1 through October 20, except when the Facility inflow exceeds the recycled water distribution and storage system capacity.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge:
  - Nutrient loads typically increase with flow during wet weather events.
  - NOx and organic nitrogen are the majority of the nitrogen species discharged as would be expected since this plant nitrifies. The plant also reduces their overall TIN and NOx loads due to enhanced denitrification.
  - The plant meets Level 3 TIN concentration limits (i.e., 6 mg N/L) developed under the Bay Area Clean Water Agencies Scoping and Evaluation Plan for the whole dataset.
  - Total phosphorus concentrations range from 0.5 to 3.8 mg P/L, which suggests P removal. Removal is attributed to biological P removal in the oxidation ditch.
- Recycled Water:
  - Based on Table 1-2, the plant averaged 1.8 mgd of recycled water over the 2022 calendar year. Recycled water uses included golf course irrigation, landscape irrigation, agricultural irrigation, and other non-potable uses within the plant such as process water.
  - Based on Table 1-3. Recycled Water: American Canyon Yearly Recycled Water Ammonia Load Diverted from the Bay through Table 1-5. Recycled Water: American Canyon Yearly Recycled Water Total Phosphorus Load Diverted from the Bay, the plant averaged the diversion of 2 kg Ammonia-N/d, 5 kg TIN-N/d, and 14 kg P/d away from the San Francisco Bay via recycled water in 2022.

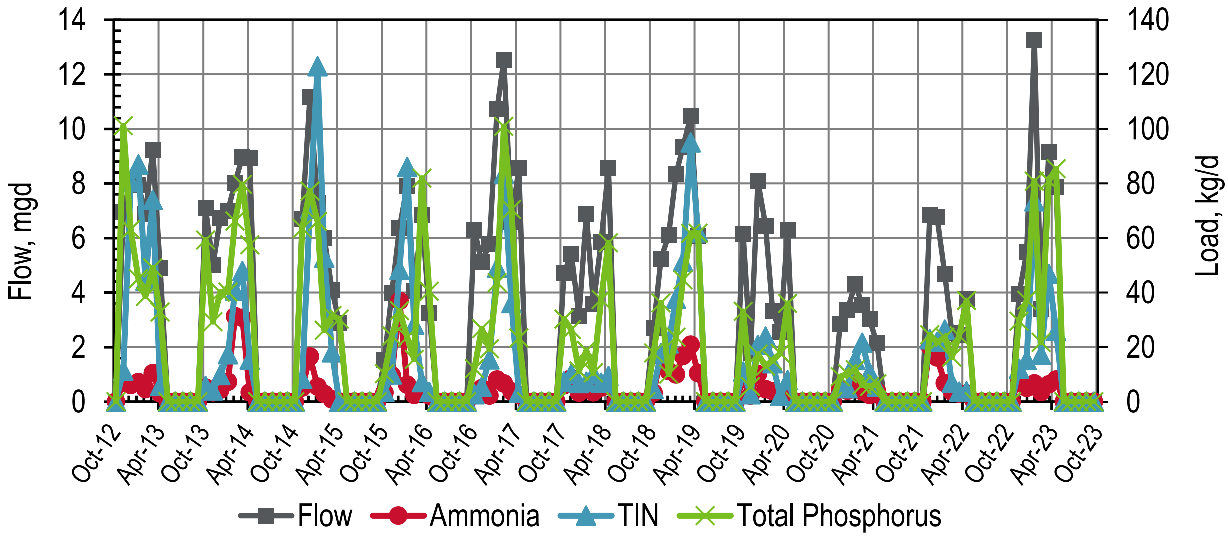

Figure 18-1. Discharge: Petaluma Monthly Flows and Loads

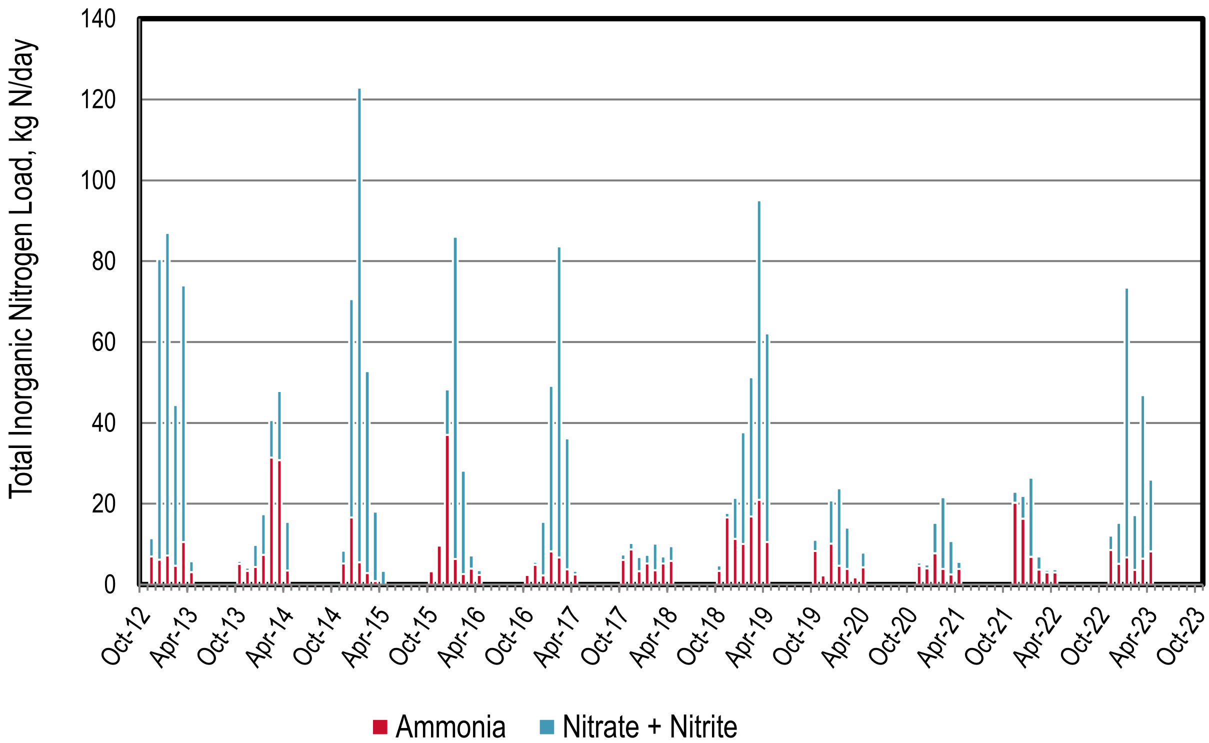

Figure 18-2. Discharge: Petaluma Monthly Nitrogen Loads

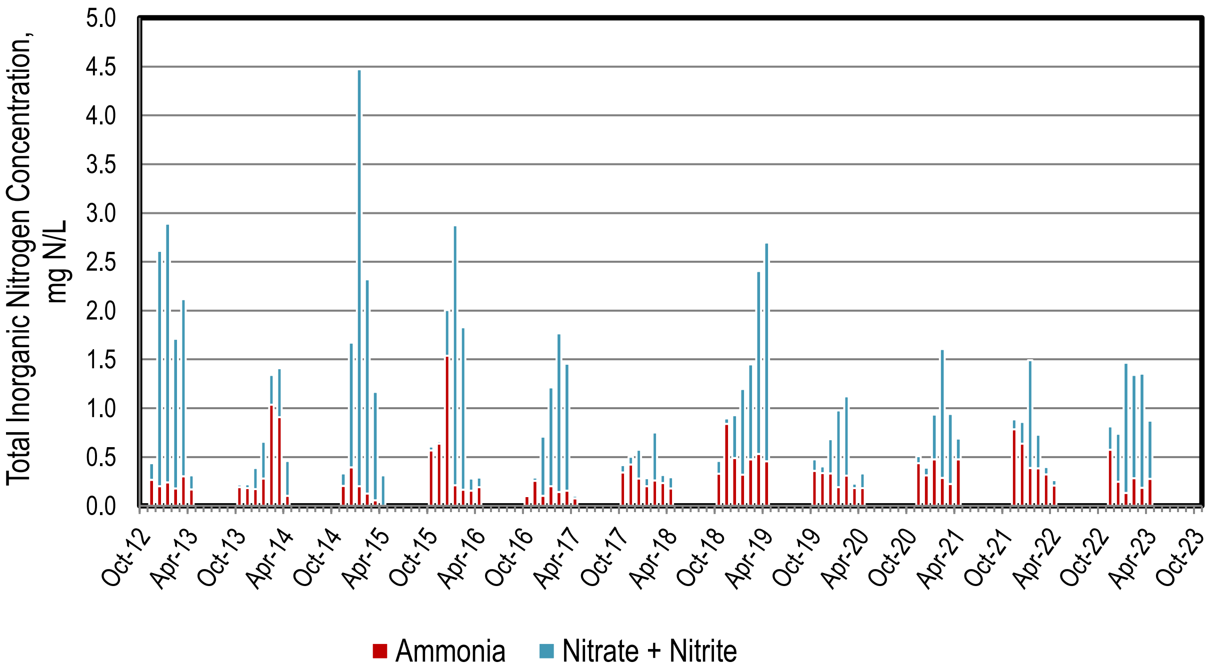

Figure 18-3. Discharge: Petaluma Monthly Nitrogen Concentrations

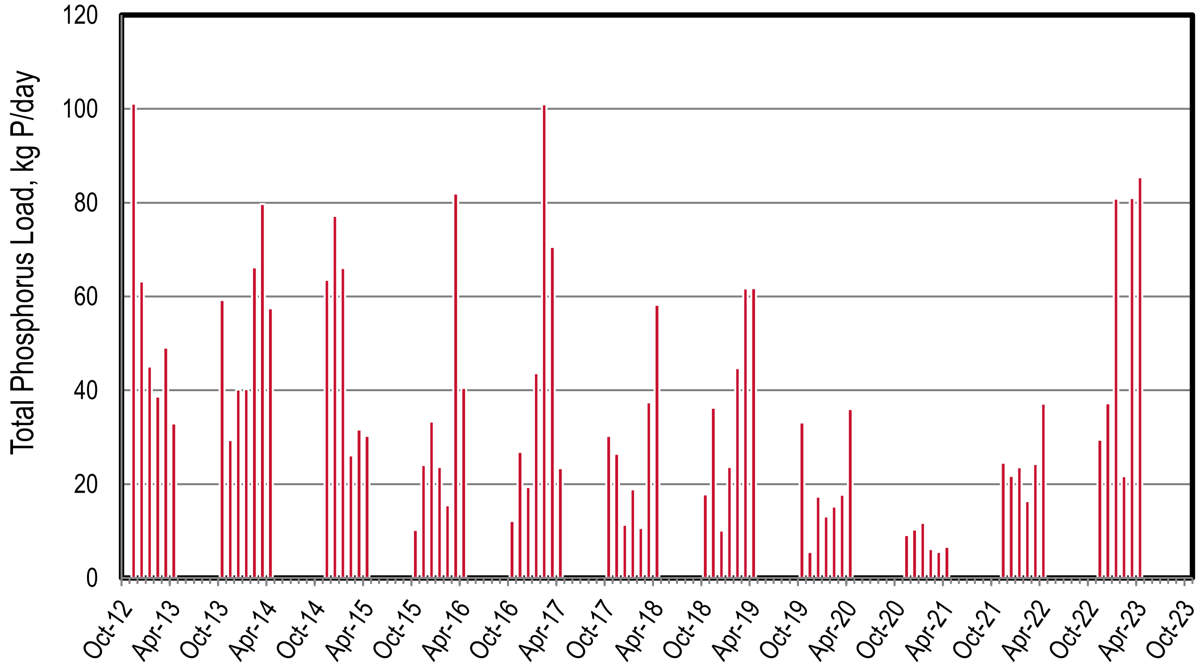

Figure 18-4. Discharge: Petaluma Monthly Phosphorus Loads

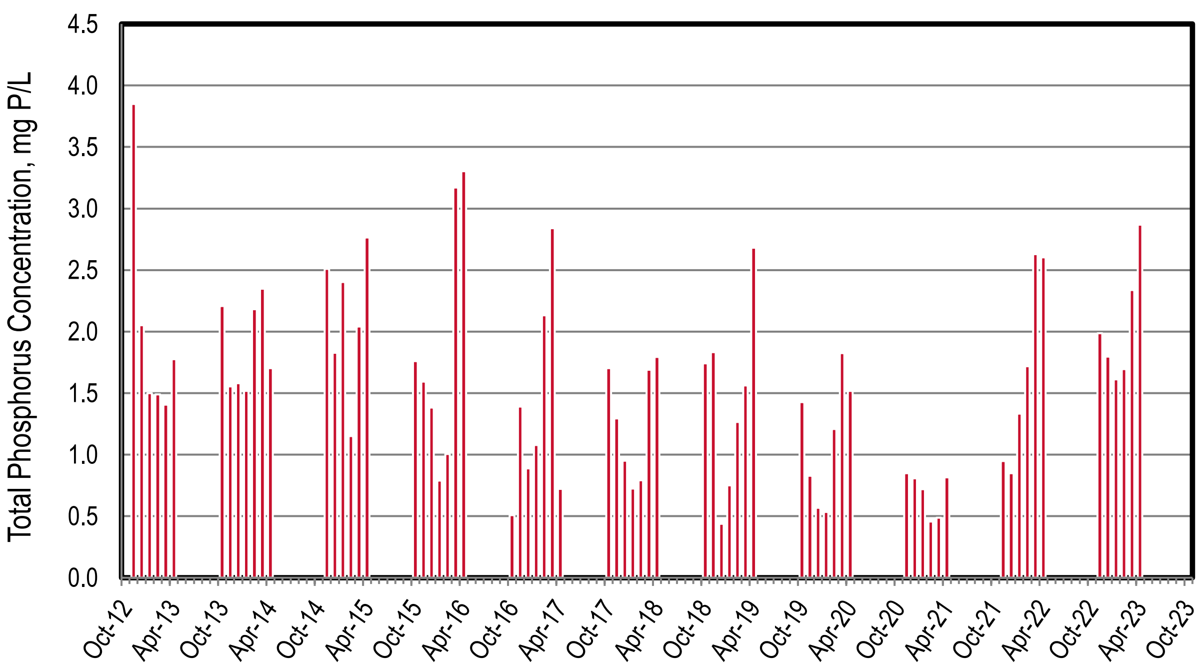

Figure 18-5. Discharge: Petaluma Monthly Phosphorus Concentrations

Table 18-1. Discharge: Petaluma Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0	0	0	0	0
Nov-12	6.95	6.98	4.47	11.4	101
Dec-12	8.15	6.16	74.4	80.5	63.2
Jan-13	7.96	7.23	79.7	87.0	45.1
Feb-13	6.87	4.65	39.7	44.4	38.7
Mar-13	9.24	10.5	63.5	74.0	49.1
Apr-13	4.91	3.11	2.68	5.79	32.9
May-13	0	0	0	0	0
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	7.11	5.16	0.691	5.85	59.3
Nov-13	5.01	3.42	0.760	4.18	29.4
Dec-13	6.72	4.36	5.46	9.82	40.2
Jan-14	7.01	7.37	10.0	17.4	40.2
Feb-14	8.03	31.4	9.31	40.7	66.2
Mar-14	8.98	30.8	17.1	47.9	79.7
Apr-14	8.94	3.50	12.0	15.5	57.5
May-14	0	0	0	0	0
Jun-14	0	0	0	0	0
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	0	0	0	0	0
Nov-14	6.70	5.20	3.18	8.37	63.5
Dec-14	11.2	16.6	54.0	70.6	77.2
Jan-15	7.27	5.51	117	123	66.1
Feb-15	6.02	2.85	49.9	52.8	26.2
Mar-15	4.10	0.870	17.2	18.1	31.6
Apr-15	2.90		3.41		30.3
May-15	0	0	0	0	0
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Sep-15	0	0	0	0	0
Oct-15	1.54	3.31	0.234	3.54	10.3
Nov-15	4.00	9.62	0.344	9.97	24.1
Dec-15	6.37	37.0	11.3	48.3	33.3
Jan-16	7.92	6.32	79.7	86.0	23.6
Feb-16	4.07	2.56	25.6	28.2	15.5
Mar-16	6.84	3.97	3.23	7.20	81.9
Apr-16	3.24	2.33	1.20	3.54	40.5
May-16	0	0	0	0	0
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16	6.31	2.35	0.406	2.76	12.1
Nov-16	5.10	4.92	0.686	5.61	26.8
Dec-16	5.77	2.26	13.2	15.5	19.4
Jan-17	10.7	8.19	40.9	49.1	43.7
Feb-17	12.5	6.73	76.9	83.6	101
Mar-17	6.57	3.82	32.4	36.2	70.6
Apr-17	8.58	2.51	0.841	3.35	23.4
May-17	0	0	0	0	0
Jun-17	0	0	0	0	0
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	0	0	0	0	0
Oct-17	4.70	6.05	1.39	7.44	30.3
Nov-17	5.41	8.67	1.62	10.3	26.4
Dec-17	3.15	3.33	3.48	6.81	11.3
Jan-18	6.89	5.21	2.17	7.37	18.9
Feb-18	3.57	3.51	6.62	10.1	10.7
Mar-18	5.86	5.20	1.79	6.98	37.4
Apr-18	8.58	5.82	3.63	9.45	58.2
May-18	0	0	0	0	0
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-18	2.71	3.36	1.36	4.72	17.8
Nov-18	5.23	16.6	1.12	17.7	36.2
Dec-18	6.10	11.3	10.1	21.4	10.1
Jan-19	8.34	10.0	27.7	37.7	23.7
Feb-19	9.36	16.9	34.4	51.3	44.7
Mar-19	10.5	21.0	74.1	95.0	61.7
Apr-19	6.10	10.5	51.6	62.1	61.8
May-19	0	0	0	0	0
Jun-19	0	0	0	0	0
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	6.15	8.29	2.76	11.1	33.2
Nov-19	1.78	2.26	0.466	2.72	5.56
Dec-19	8.08	10.1	10.7	20.8	17.4
Jan-20	6.46	4.67	19.1	23.8	13.1
Feb-20	3.32	3.87	10.2	14.1	15.2
Mar-20	2.57	1.77	0.438	2.21	17.7
Apr-20	6.27	4.28	3.60	7.88	36.0
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	0	0	0	0	0
Oct-20	0	0	0	0	0
Nov-20	2.85	4.69	0.791	5.49	9.14
Dec-20	3.37	3.99	0.991	4.98	10.3
Jan-21	4.32	7.75	7.53	15.3	11.7
Feb-21	3.56	3.83	17.8	21.6	6.16
Mar-21	3.02	2.54	8.23	10.8	5.57
Apr-21	2.14	3.86	1.72	5.58	6.61
May-21	0	0	0	0	0
Jun-21	0	0	0	0	0
Jul-21	0	0	0	0	0
Aug-21	0	0	0	0	0
Sep-21	0	0	0	0	0
Oct-21	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-21	6.84	20.3	2.63	22.9	24.5
Dec-21	6.77	16.3	5.65	21.9	21.7
Jan-22	4.68	6.87	19.5	26.4	23.6
Feb-22	2.53	3.67	3.28	6.95	16.4
Mar-22	2.44	2.99	0.672	3.66	24.3
Apr-22	3.78	2.97	0.804	3.77	37.2
May-22	0	0	0	0	0
Jun-22	0	0	0	0	0
Jul-22	0	0	0	0	0
Aug-22	0	0	0	0	0
Sep-22	0	0	0	0	0
Oct-22	0	0	0	0	0
Nov-22	3.93	8.55	3.54	12.1	29.5
Dec-22	5.48	5.10	10.2	15.3	37.3
Jan-23	13.3	6.68	66.8	73.5	80.9
Feb-23	3.39	3.62	13.6	17.2	21.7
Mar-23	9.17	6.41	40.5	46.9	81.0
Apr-23	7.88	8.20	17.8	26.0	85.4
May-23	0	0	0	0	0
Jun-23	0	0	0	0	0
Jul-23	0	0	0	0	0
Aug-23	0	0	0	0	0
Sep-23	0	0	0	0	0
Dry Season Average	**0**	**0**	**0**	**0**	**0**
Dry Season Trend**	**--****	**--****	**--****	**--****	**--****
Wet Season Average	**5.64**	**7.01**	**17.4**	**24.6**	**34.3**
Average Annual	**3.29**	**4.07**	**10.2**	**14.3**	**20.0**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** No dry season trending analysis was performed on Petaluma as the facility does not discharge during dry season months.

Recycled Water

Table 18-2. Recycled Water: Petaluma Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet/yr (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	510 (0.46)	195 (0.17)	--	--	512 (0.46)	--	14 (0.01)	1,230 (1.1)
2020	467 (0.42)	228 (0.20)	--	--	992 (0.89)	--	147 (0.13)	1,830 (1.6)
2021	580 (0.52)	215 (0.19)	--	--	1,150 (1.0)	--	466 (0.42)	2,410 (2.2)
2022	473 (0.42)	199 (0.18)	--	--	928 (0.83)	--	458 (0.41)	2,060 (1.84)
Average	508 (0.46)	209 (0.19)	--	--	896 (0.80)	--	271 (0.24)	1,880 (1.69)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 18-3. Recycled Water: Petaluma Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	1	<1	--	--	1	--	1	2
2020	1	<1	--	--	1	--	<1	1
2021	1	<1	--	--	2	--	1	4
2022	1	<1	--	--	1	--	1	2
Average	1	<1	--	--	1	--	1	3

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 18-4. Recycled Water: Petaluma Yearly Recycled Water TIN Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	3	1	--	--	3	--	<1	6
2020	1	<1	--	--	2	--	<1	4
2021	2	1	--	--	4	--	2	8
2022	1	1	--	--	2	--	1	5
Average	2	1	--	--	3	--	1	6

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 18-5. Recycled Water: Petaluma Yearly Recycled Water Total Phosphorus Load Diverted from the Bay

Year**	Average TP Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	2	1	--	--	2	--	<1	5
2020	2	1	--	--	4	--	1	7
2021	1	1	--	--	3	--	1	6
2022	3	1	--	--	6	--	3	14
Average	2	1	--	--	4	--	1	8

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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19 City of Pinole

The Pinole-Hercules Water Pollution Control Plant discharges to San Pablo Bay. The plant has approximately 11,215 service connections; it has a permitted capacity of 4.06 mgd ADWF and a peak wet weather capacity of 20.0 mgd. The average dry season discharge flow this past year was approximately 2.46 mgd.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge:
  - The City of Pinole completed a $45 Mil plant upgrade project that included the ability to remove ammonia and TIN loads during the dry season (commissioned in 2019 in conventional cBOD mode). While the system was upgraded to provide ammonia and TIN load reduction, the plant experiences multiple process upsets when the aeration basin is operated in biological nutrient removal mode. The plant is currently working with the design engineer on a plan on transitioning in and out biological nutrient removal mode and whether the plant can operate in this mode year-round or limited to the dry season. Additional upgrades maybe necessary to operate in biological nutrient removal mode.
  - The average monthly ammonia, TIN, and total phosphorus loads for 2022/2023 are the second highest since nutrient sampling was initiated under Section 13267 Letter Data in 2012 (highest was in 2021/2022). As noted, the plant is still developing a plan for transitioning to ammonia/TIN load reduction mode during the dry season.
  - Nitrogen and phosphorus loads do not track with the flows as seen at most other plants.
  - Total phosphorus concentrations range from 0.5 to 6.0 mg P/L which suggests occasional removal.
  - Based on Table 19-1 statistics for the entire dry season dataset, flow, ammonia, and TIN loads do not appear to have any emerging trends. The dry season nitrate + nitrite loads for the entire dataset is trending downwards, whereas the TP loads are trending upwards. It is anticipated that ammonia and TIN loads will be reduced in the future once the plan is developed for transitioning to ammonia/TIN load reduction in the dry season.
- Recycled Water: No recycled water was produced or distributed this past year.

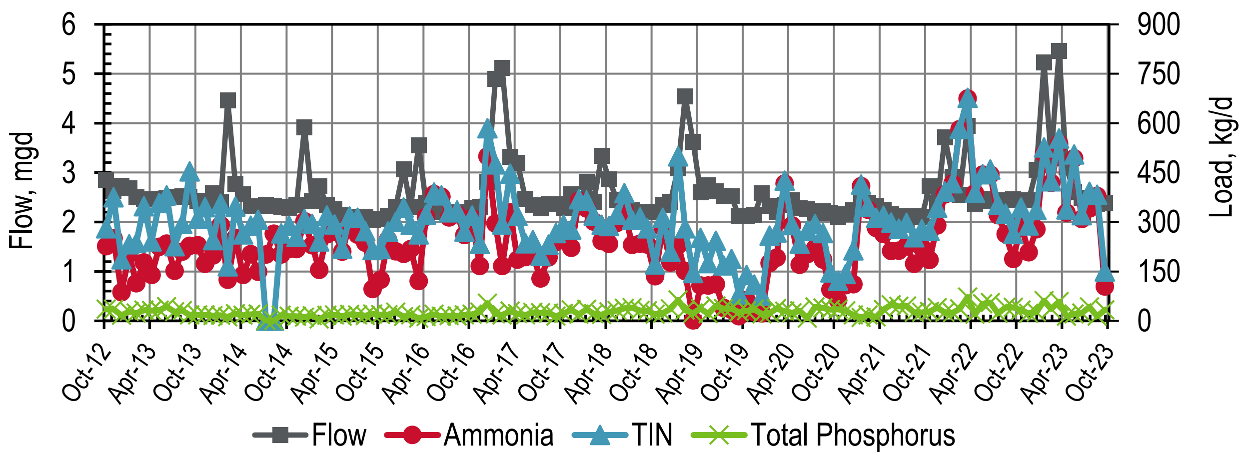

Figure 19-1. Discharge: Pinole Monthly Flows and Loads

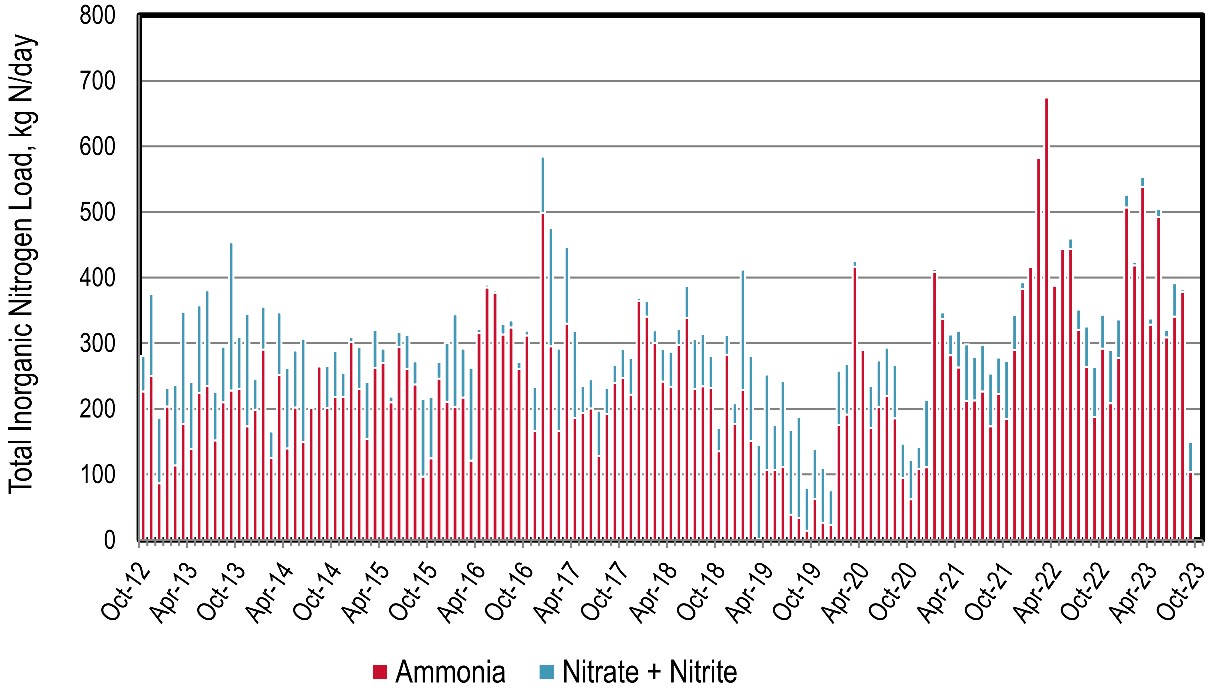

Figure 19-2. Discharge: Pinole Monthly Nitrogen Loads

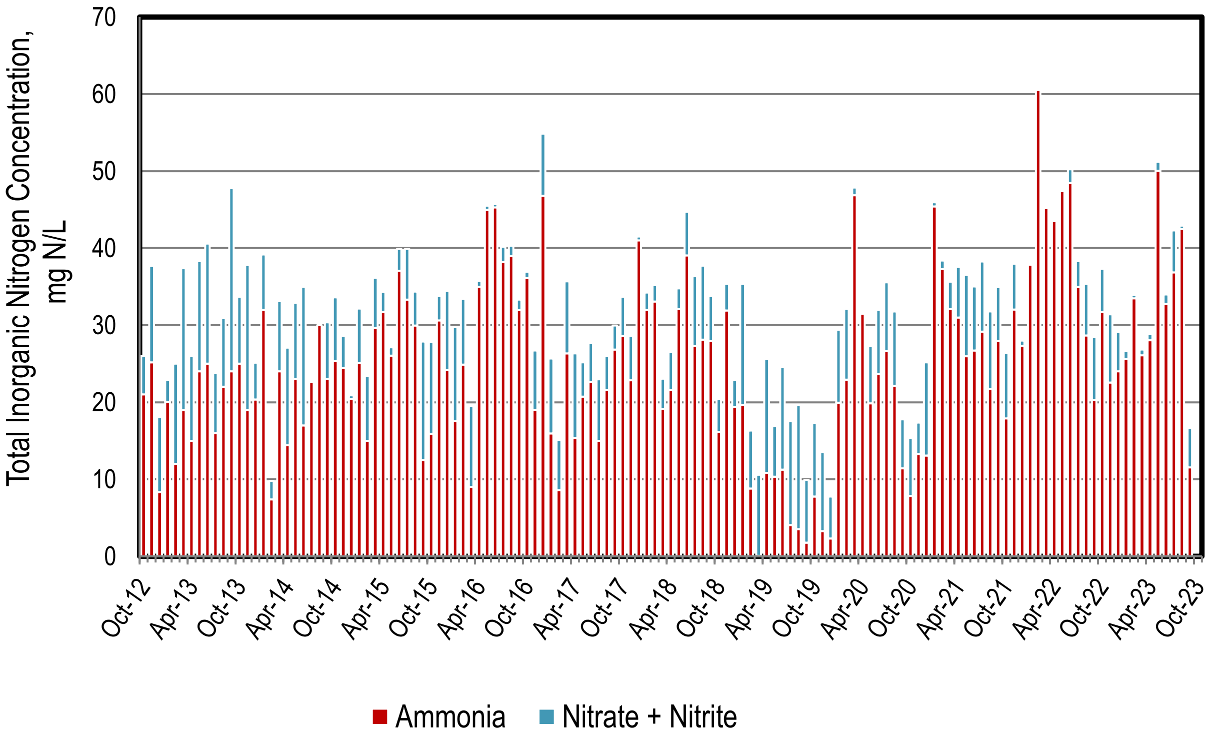

Figure 19-3. Discharge: Pinole Monthly Nitrogen Concentrations

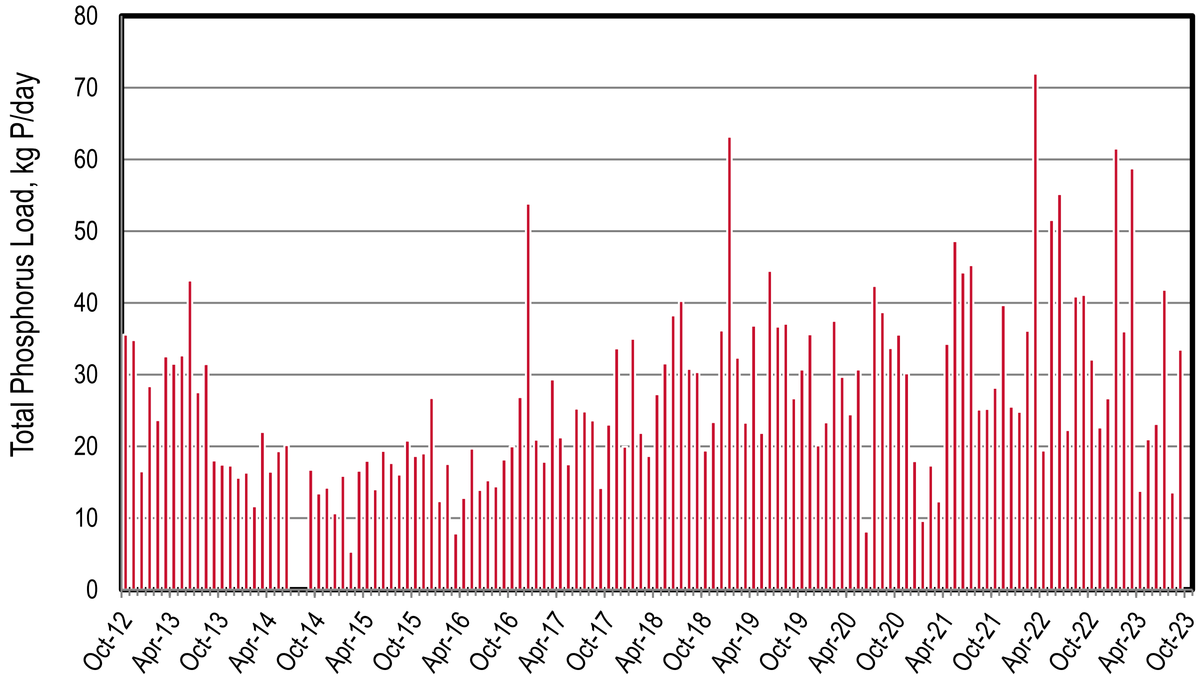

Figure 19-4. Discharge: Pinole Monthly Phosphorus Loads

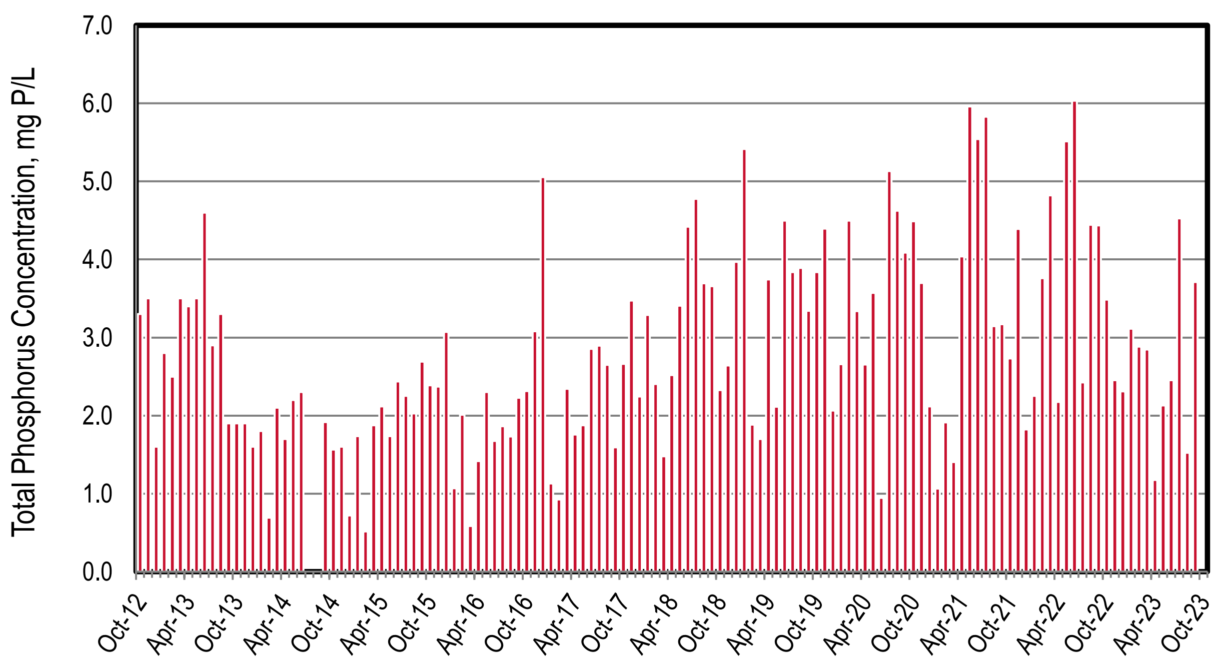

Figure 19-5. Discharge: Pinole Monthly Phosphorus Concentrations

Table 19-1. Discharge: Pinole Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	2.85	226	54.0	280	35.6
Nov-12	2.63	250	124	374	34.8
Dec-12	2.73	86.2	100	186	16.5
Jan-13	2.68	203	28.4	232	28.4
Feb-13	2.50	113	123	236	23.6
Mar-13	2.46	177	171	348	32.5
Apr-13	2.45	139	102	241	31.5
May-13	2.47	224	134	358	32.7
Jun-13	2.48	234	146	381	43.1
Jul-13	2.51	152	74.0	226	27.5
Aug-13	2.52	210	84.8	294	31.4
Sep-13	2.51	228	226	454	18.0
Oct-13	2.43	230	79.9	310	17.5
Nov-13	2.41	173	171	344	17.3
Dec-13	2.58	198	46.8	245	15.6
Jan-14	2.40	290	65.3	356	16.3
Feb-14	4.46	125	40.5	165	11.6
Mar-14	2.77	251	95.3	347	22.0
Apr-14	2.56	139	123	262	16.5
May-14	2.32	202	86.8	289	19.3
Jun-14	2.32	149	158	307	20.2
Jul-14	2.35	201	**	**	**
Aug-14	2.33	264	**	**	**
Sep-14	2.31	201	64.5	265	16.7
Oct-14	2.27	218	70.4	288	13.4
Nov-14	2.35	218	36.8	254	14.2
Dec-14	3.91	302	7.06	309	10.6
Jan-15	2.42	230	64.5	294	15.9
Feb-15	2.72	154	86.2	240	5.28
Mar-15	2.34	262	57.7	320	16.6
Apr-15	2.25	270	22.1	292	18.0
May-15	2.13	210	8.55	218	14.0
Jun-15	2.10	294	22.5	317	19.4
Jul-15	2.07	261	51.4	312	17.7
Aug-15	2.09	237	35.2	272	16.0
Sep-15	2.04	96.4	119	215	20.8

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	2.07	124	93.2	217	18.6
Nov-15	2.12	246	25.4	271	19.0
Dec-15	2.30	211	89.1	300	26.7
Jan-16	3.06	203	141	344	12.3
Feb-16	2.31	217	74.4	292	17.5
Mar-16	3.55	121	141	262	7.84
Apr-16	2.38	315	6.65	322	12.8
May-16	2.26	385	4.56	389	19.7
Jun-16	2.20	377	3.36	380	13.9
Jul-16	2.17	313	16.1	329	15.3
Aug-16	2.20	324	10.8	334	14.4
Sep-16	2.15	260	11.0	271	18.1
Oct-16	2.28	312	7.51	319	20.0
Nov-16	2.31	166	67.1	233	26.9
Dec-16	2.82	498	85.7	584	53.8
Jan-17	4.89	295	180	475	20.9
Feb-17	5.11	166	126	292	17.8
Mar-17	3.31	330	117	447	29.3
Apr-17	3.20	186	133	318	21.2
May-17	2.46	193	41.4	235	17.5
Jun-17	2.34	200	44.4	245	25.2
Jul-17	2.27	128	68.5	197	24.8
Aug-17	2.35	192	39.3	232	23.6
Sep-17	2.35	239	27.4	266	14.2
Oct-17	2.29	247	44.3	291	23.0
Nov-17	2.56	221	55.8	277	33.6
Dec-17	2.35	364	4.51	369	19.9
Jan-18	2.81	340	23.6	364	35.0
Feb-18	2.40	301	19.1	320	21.9
Mar-18	3.34	242	49.4	291	18.7
Apr-18	2.86	233	53.5	287	27.2
May-18	2.45	297	25.0	322	31.5
Jun-18	2.29	338	48.9	387	38.3
Jul-18	2.23	230	76.4	306	40.2
Aug-18	2.20	234	80.0	314	30.8
Sep-18	2.19	232	48.7	280	30.3
Oct-18	2.21	135	35.5	170	19.4

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	2.34	282	30.6	313	23.4
Dec-18	2.41	176	31.9	208	36.1
Jan-19	3.08	229	183	499	63.1
Feb-19	4.54	151	129	280	32.4
Mar-19	3.62	0.765	144	145	23.3
Apr-19	2.60	107	145	252	36.8
May-19	2.74	107	68.0	175	21.9
Jun-19	2.62	111	131	243	44.5
Jul-19	2.53	38.7	129	168	36.7
Aug-19	2.52	33.5	154	187	37.1
Sep-19	2.11	14.1	65.2	79.3	26.7
Oct-19	2.12	62.2	76.3	138	30.7
Nov-19	2.14	26.5	83.3	110	35.6
Dec-19	2.58	22.6	52.8	75.5	20.1
Jan-20	2.32	175	83.3	258	23.3
Feb-20	2.20	191	76.5	268	37.5
Mar-20	2.35	417	8.78	425	29.7
Apr-20	2.43	289	1.09	291	24.4
May-20	2.27	170	63.9	234	30.7
Jun-20	2.26	202	71.2	274	8.09
Jul-20	2.18	220	73.7	293	42.3
Aug-20	2.21	185	80.6	266	38.7
Sep-20	2.18	94.1	52.5	147	33.7
Oct-20	2.10	62.1	59.6	122	35.6
Nov-20	2.16	108	33.3	142	30.2
Dec-20	2.24	111	102	213	17.9
Jan-21	2.38	408	4.61	413	9.56
Feb-21	2.39	337	10.0	347	17.3
Mar-21	2.32	281	31.6	313	12.3
Apr-21	2.25	263	55.8	319	34.3
May-21	2.16	212	86.2	298	48.6
Jun-21	2.11	213	66.3	279	44.2
Jul-21	2.05	226	70.8	297	45.2
Aug-21	2.11	173	80.5	254	25.1
Sep-21	2.10	222	55.6	278	25.2
Oct-21	2.73	184	88.1	272	28.2
Nov-21	2.39	289	53.7	343	39.7

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	3.71	383	9.36	392	25.5
Jan-22	2.91	417	1.19	418	24.8
Feb-22	2.54	582	0.973	583	36.1
Mar-22	3.95	674	2.40	677	71.9
Apr-22	2.36	388	0.959	389	19.4
May-22	2.47	443	1.36	445	51.6
Jun-22	2.42	443	16.3	460	55.2
Jul-22	2.43	320	31.1	351	22.2
Aug-22	2.43	263	61.8	325	40.9
Sep-22	2.45	188	75.9	264	41.1
Oct-22	2.44	292	51.6	343	32.1
Nov-22	2.44	208	81.4	289	22.6
Dec-22	3.05	277	59.0	336	26.7
Jan-23	5.23	507	19.9	526	61.5
Feb-23	3.30	418	5.23	424	36.0
Mar-23	5.46	538	15.4	553	58.7
Apr-23	3.10	328	9.38	338	13.8
May-23	2.61	493	11.5	504	21.0
Jun-23	2.49	309	11.9	321	23.1
Jul-23	2.44	340	50.6	391	41.8
Aug-23	2.36	378	4.21	383	13.6
Sep-23	2.38	104	45.9	150	33.4
Dry Season Average	**2.32**	**229**	**62.5**	**292**	**28.4**
Dry Season Trend * **	**None**	**None**	**Down**	**None**	**Up**
Wet Season Average	**2.79**	**246**	**64.7**	**311**	**25.8**
Average Annual	**2.59**	**239**	**63.8**	**303**	**26.9**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** No samples taken this month.
*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

No recycled water was produced or distributed this past year.

20 Rodeo Sanitary District

Rodeo discharges to San Pablo Bay. The plant services approximately 8,900 people and it has a permitted capacity of 1.14 mgd ADWF. This past dry season average discharge flow was approximately 0.55 mgd. The plant performs nitrification and phosphorus removal using an activated sludge process.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge:
  - The annual average monthly ammonia and TIN loads and concentrations the last couple years are the highest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012. This increase is attributed to a combination of struggles in maintaining the biology that performs ammonia removal during precipitation events coupled with maintaining an ammonia residual to form chloramines as a strategy to reduce chlorine demand.
  - Total inorganic nitrogen loads generally increase with flow during wet weather events.
  - NOx is typically the majority of the nitrogen species discharged as would be expected since this plant nitrifies (with the exception of the latter half of the 2019/2020 and 2020/2021 seasons). A portion of ammonia occasionally bleeds through year round.
  - Total phosphorus concentrations are wide ranging from 0.3 to 12.7 mg P/L. This suggests occasional P removal for periods with values less than 1 mg P/L. The removal mechanism is thought to be the anaerobic selector in the activated sludge process.
  - Based on Table 20-1 statistics for the entire dry season dataset, Ammonia and TIN loads appear to be trending upwards. This is attributed to biological washout and maintaining an ammonia residual. All other monitored parameters do not have any emerging trends. Rodeo has seen an increase in influent flows/loads since the start of the pandemic.
- Recycled Water: No recycled water was produced or distributed this past year.

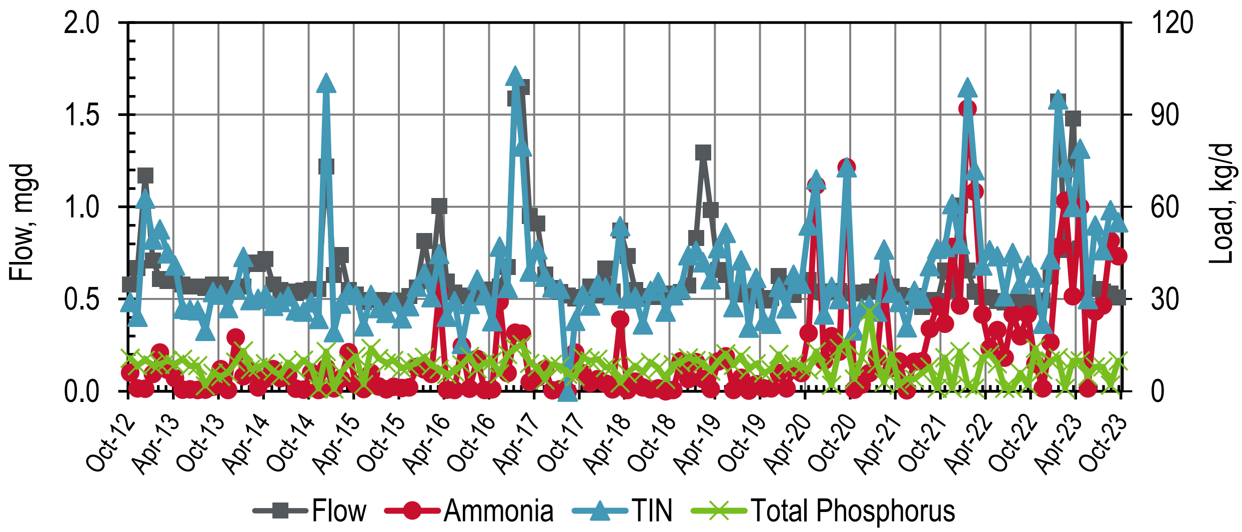

Figure 20-1. Discharge: Rodeo Monthly Flows and Loads

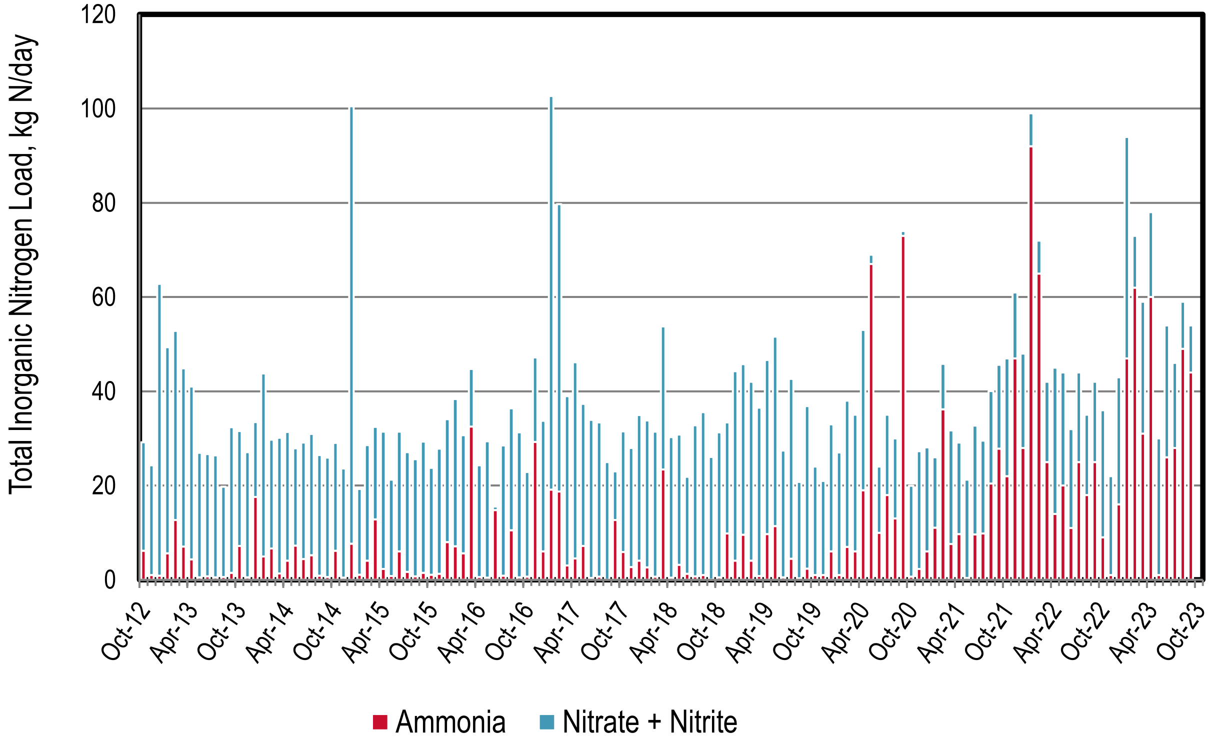

Figure 20-2. Discharge: Rodeo Monthly Nitrogen Loads

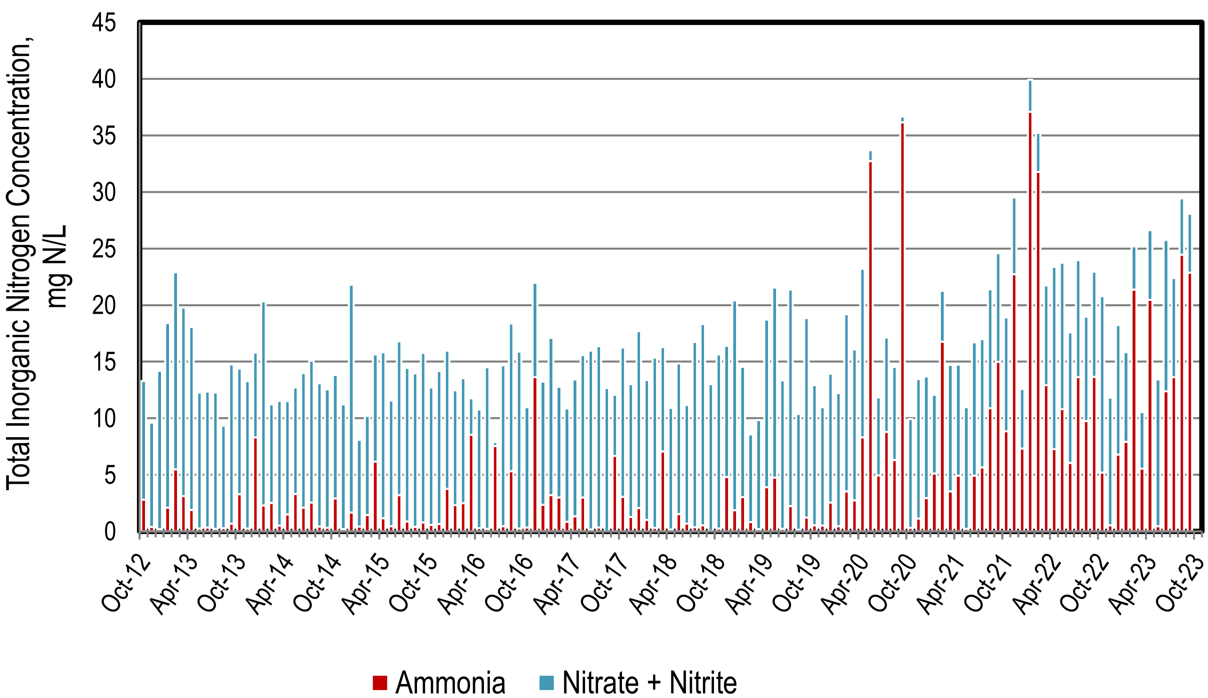

Figure 20-3. Discharge: Rodeo Monthly Nitrogen Concentrations

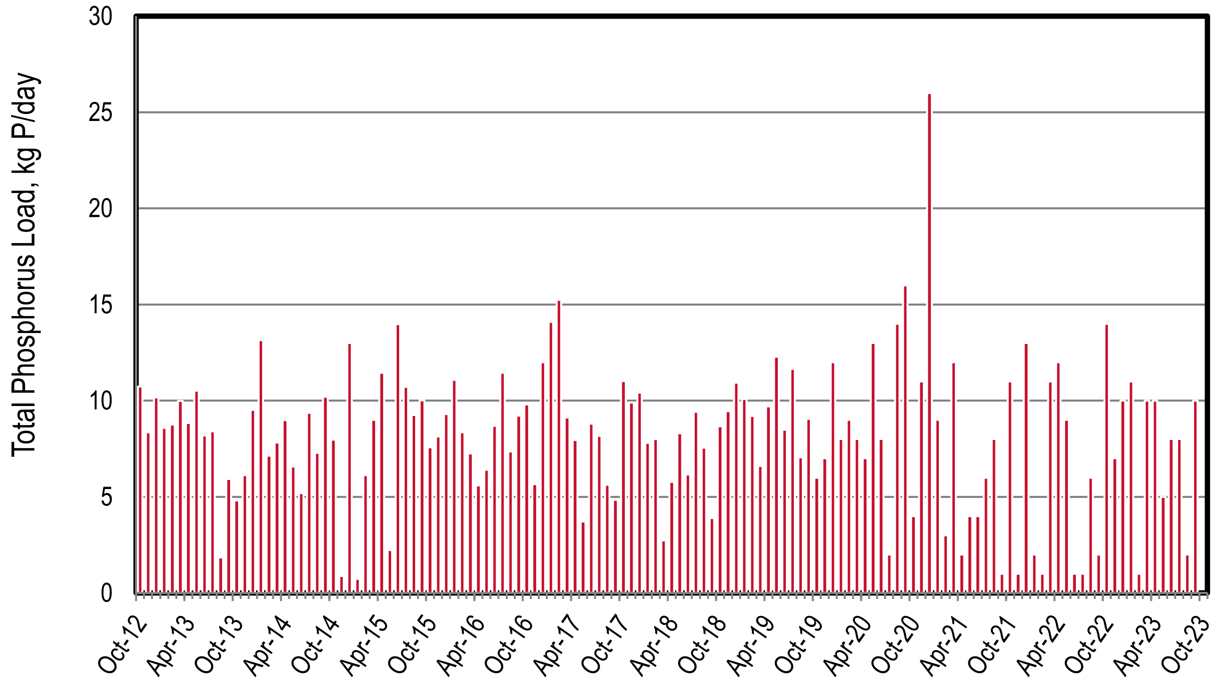

Figure 20-4. Discharge: Rodeo Monthly Phosphorus Loads

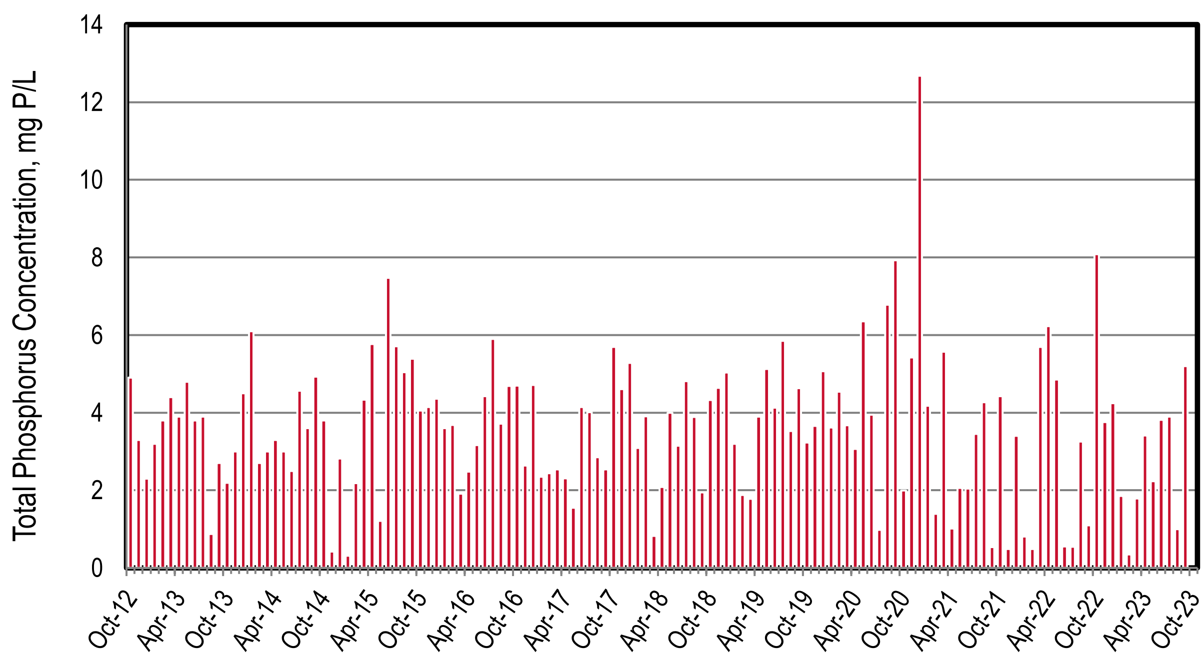

Figure 20-5. Discharge: Rodeo Monthly Phosphorus Concentrations

Table 20-1. Discharge: Rodeo Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.580	6.14	23.0	29.2	10.7
Nov-12	0.670	1.01	23.3	24.3	8.36
Dec-12	1.17	0.885	61.9	62.8	10.2
Jan-13	0.710	5.64	43.7	49.4	8.59
Feb-13	0.610	12.7	40.1	52.8	8.76
Mar-13	0.600	7.03	37.9	44.9	9.98
Apr-13	0.600	4.31	36.7	41.0	8.85
May-13	0.580	0.548	26.4	26.9	10.5
Jun-13	0.570	0.733	25.9	26.7	8.19
Jul-13	0.570	0.517	25.9	26.4	8.40
Aug-13	0.560	0.614	19.1	19.7	1.84
Sep-13	0.580	1.49	30.9	32.4	5.92
Oct-13	0.580	7.21	24.3	31.6	4.81
Nov-13	0.540	0.510	26.6	27.1	6.12
Dec-13	0.560	17.6	15.9	33.4	9.53
Jan-14	0.570	4.96	38.8	43.8	13.1
Feb-14	0.700	6.65	23.1	29.7	7.14
Mar-14	0.690	1.36	28.8	30.1	7.82
Apr-14	0.720	4.08	27.3	31.4	8.98
May-14	0.580	7.23	20.7	27.9	6.58
Jun-14	0.550	4.37	24.7	29.1	5.20
Jul-14	0.543	5.20	25.8	31.0	9.37
Aug-14	0.535	0.846	25.6	26.4	7.28
Sep-14	0.547	0.625	25.3	26.0	10.2
Oct-14	0.555	6.13	22.9	29.0	7.97
Nov-14	0.556	0.444	23.2	23.6	0.888
Dec-14	1.22	7.68	92.8	100	13.0
Jan-15	0.631	1.04	18.2	19.3	0.739
Feb-15	0.741	4.08	24.5	28.6	6.12
Mar-15	0.549	12.8	19.7	32.5	9.00
Apr-15	0.525	2.29	29.1	31.4	11.4
May-15	0.485	0.816	20.4	21.2	2.23
Jun-15	0.495	6.00	25.4	31.4	14.0
Jul-15	0.496	1.67	25.4	27.1	10.7
Aug-15	0.485	0.712	24.9	25.6	9.25
Sep-15	0.491	1.48	27.8	29.3	10.0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.494	1.06	22.7	23.8	7.57
Nov-15	0.519	1.31	26.5	27.8	8.14
Dec-15	0.565	8.01	26.1	34.1	9.31
Jan-16	0.815	7.11	31.3	38.4	11.1
Feb-16	0.600	5.64	25.1	30.7	8.36
Mar-16	1.01	32.5	12.2	44.7	7.26
Apr-16	0.597	0.625	23.7	24.3	5.60
May-16	0.536	0.475	28.9	29.4	6.41
Jun-16	0.520	14.8	0.692	15.5	8.69
Jul-16	0.514	0.869	27.7	28.5	11.5
Aug-16	0.524	10.5	25.8	36.4	7.35
Sep-16	0.520	0.527	30.7	31.3	9.22
Oct-16	0.552	0.685	22.2	22.9	9.81
Nov-16	0.568	29.2	17.9	47.2	5.65
Dec-16	0.674	6.00	27.7	33.7	12.0
Jan-17	1.59	19.1	83.6	103	14.1
Feb-17	1.65	18.8	61.0	79.7	15.2
Mar-17	0.950	3.04	35.9	39.0	9.12
Apr-17	0.910	4.54	41.6	46.2	7.95
May-17	0.634	7.19	30.2	37.4	3.71
Jun-17	0.562	0.377	33.6	33.9	8.81
Jul-17	0.539	0.675	32.7	33.4	8.18
Aug-17	0.522	--***	25.0	--***	5.62
Sep-17	0.504	12.7	10.3	23.0	4.84
Oct-17	0.512	5.91	25.6	31.5	11.0
Nov-17	0.569	2.72	25.2	28.0	9.90
Dec-17	0.522	4.05	30.9	34.9	10.4
Jan-18	0.668	2.60	31.2	33.8	7.80
Feb-18	0.542	0.636	30.8	31.4	8.00
Mar-18	0.874	23.4	30.4	53.8	2.73
Apr-18	0.733	0.456	29.8	30.2	5.78
May-18	0.549	3.16	27.7	30.8	8.30
Jun-18	0.518	1.31	20.5	21.8	6.16
Jul-18	0.518	0.702	32.1	32.8	9.43
Aug-18	0.514	1.04	34.5	35.6	7.55
Sep-18	0.530	0.0742	26.0	26.0	3.89
Oct-18	0.530	0.501	30.8	31.3	8.67

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0.539	9.81	23.6	33.4	9.45
Dec-18	0.574	4.03	40.3	44.3	10.9
Jan-19	0.833	9.57	36.2	45.8	10.1
Feb-19	1.30	4.03	38.0	42.0	9.21
Mar-19	0.983	0.770	35.8	36.5	6.60
Apr-19	0.659	9.70	36.9	46.6	9.70
May-19	0.633	11.4	40.2	51.6	12.3
Jun-19	0.544	0.497	26.9	27.4	8.49
Jul-19	0.527	4.45	38.2	42.6	11.7
Aug-19	0.529	0.297	20.4	20.7	7.06
Sep-19	0.517	2.37	34.5	36.9	9.06
Oct-19	0.492	1.00	23.0	23.0	6.00
Nov-19	0.506	1.00	20.0	22.0	7.00
Dec-19	0.626	6.00	27.0	34.0	12.0
Jan-20	0.585	1.00	26.0	27.0	8.00
Feb-20	0.524	7.00	31.0	38.0	9.00
Mar-20	0.575	6.00	29.0	35.0	8.00
Apr-20	0.604	19.0	34.0	54.0	7.00
May-20	0.541	67.0	2.00	69.0	13.0
Jun-20	0.536	10.0	14.0	25.0	8.00
Jul-20	0.541	18.0	17.0	34.0	2.00
Aug-20	0.546	13.0	17.0	30.0	14.0
Sep-20	0.534	73.0	1.00	73.0	16.0
Oct-20	0.531	0.630	19.3	19.9	4.00
Nov-20	0.537	2.29	25.0	27.1	11.0
Dec-20	0.543	6.02	22.1	28.1	26.0
Jan-21	0.569	11.0	15.0	26.0	9.00
Feb-21	0.570	36.2	9.65	46.2	3.00
Mar-21	0.570	7.62	24.1	32.1	12.0
Apr-21	0.523	9.70	19.4	29.1	2.00
May-21	0.514	0.417	20.9	20.9	4.00
Jun-21	0.518	9.63	23.1	32.8	4.00
Jul-21	0.460	9.84	19.7	30.3	6.00
Aug-21	0.495	20.4	19.7	40.8	8.00
Sep-21	0.491	27.8	17.8	46.4	1.00
Oct-21	0.657	22.0	25.0	47.0	11.0
Nov-21	0.547	47.0	14.0	61.0	1.00

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	1.01	28.0	20.0	48.0	13.0
Jan-22	0.656	92.0	7.00	99.0	2.00
Feb-22	0.541	65.0	7.00	72.0	1.00
Mar-22	0.511	25.0	17.0	41.0	11.0
Apr-22	0.509	14.0	31.0	46.0	12.0
May-22	0.490	20.0	24.0	44.0	9.00
Jun-22	0.482	11.0	21.0	31.0	1.00
Jul-22	0.486	25.0	19.0	45.0	1.00
Aug-22	0.488	18.0	17.0	35.0	6.00
Sep-22	0.484	25.0	17.0	41.0	2.00
Oct-22	0.458	9.00	27.0	37.0	14.0
Nov-22	0.493	1.00	21.0	22.0	7.00
Dec-22	0.624	16.0	27.0	43.0	10.0
Jan-23	1.57	47.0	47.0	95.0	11.0
Feb-23	0.767	62.0	11.0	73.0	1.00
Mar-23	1.48	31.0	28.0	60.0	10.0
Apr-23	0.775	60.0	18.0	79.0	10.0
May-23	0.591	1.00	29.0	30.0	5.00
Jun-23	0.555	26.0	28.0	54.0	8.00
Jul-23	0.543	28.0	18.0	46.0	8.00
Aug-23	0.530	49.0	10.0	59.0	2.00
Sep-23	0.509	44.0	10.0	55.0	10.0
Dry Season Average	**0.530**	**11.2**	**23.0**	**34.2**	**7.38**
Dry Season Trend **	**Down**	**Up**	**None**	**Up**	**None**
Wet Season Average	**0.698**	**12.5**	**28.7**	**41.3**	**8.59**
Average Annual	**0.628**	**12.0**	**26.3**	**38.3**	**8.09**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Missing data due to Caltest missing request for ammonia analysis. (See letter below).

Recycled Water

No recycled water was produced or distributed this past year.

NELAP/ORELAP Certification 4036

Caltest
ANALYTICAL LABORATORY
ENVIRONMENTAL ANALYSES

ELAP Certification 1664

September 29, 2017

Andrew Alva
Rodeo Sanitary District
800 San Pablo Ave
Rodeo, CA 94572

RECEIVED
OCT 03 2017
BY: S8B

RE: Missed Ammonia Analysis

Dear Andrew Alva,

On August 14, 2017, Caltest received two water samples from Rodeo Sanitary District. One of the samples had TKN, NH3, Total Phosphate, and Nitrate/Nitrite analyses clearly requested on the accompanying Chain of Custody form. Unfortunately, the request for NH3 analysis was missed by Caltest and was not performed on the sample received. This request was not noticed until the client brought it to my attention on September 27, 2017, by then the sample was beyond the method prescribed 28 day holding time.

I apologize for this error; missed analysis requests are quite an anomaly here at Caltest and are something we take very seriously. I've alerted our staff of this unfortunate event to decrease the likelihood of this error occurring again.

Please feel free to contact me if you have any questions or need any further assistance.

Thank you,

Sincerely,
Caltest Analytical Laboratory

Sandralyn Luna
Project Manager
Caltest Analytical Laboratory

1885 North Kelly Road • Napa, California 94558
(707) 258-4000 • Fax: (707) 226-1001 • e-mail: info@caltestlabs.com

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21 San Jose-Santa Clara Regional Wastewater Facility

The San Jose-Santa Clara Regional Wastewater Facility discharges to the Lower South Bay. It serves an estimated population of 1.5 million with approximately 17,000 commercial and industrial connections. The plant has a permitted ADWF capacity of 167 mgd and a peak wet weather capacity of 261 mgd. This past year's dry season discharge flows were approximately 80 mgd. The process includes advanced treatment with a Biological Nutrient Removal system for N and P removal.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent
  - Note: limited to data since July 2019.
  - The flow reduction across the plant is seasonal and it ranges from approximately 5 to 26 percent. This reduction is attributed to recycled water, water bound with biosolids, evaporation, etc.
  - The nitrogen species and phosphorus load reductions across the plant ranges from approximately 70 to 98 percent. This load reduction is attributed primarily to nutrient load reduction in the activated sludge system and load diversion from recycled water.
  - Based on the limited average monthly values in Table 21-1, there is no trend for influent flows. Trending was not performed on nutrients as the plant added a new autosampler in 2023 which has had plugging challenges. This issue has since been resolved.
- Discharge
  - The average dry season flows increased 16 mgd from 2022 to 2023. This increase is attributed to the relatively wet winter this past year.
  - The dry season ammonia, nitrite plus nitrate, and TIN loads were the third lowest since sampling began in 2012. The TIN loads did increase approximately 1,000 kg N/d. Despite this increase, the average dry season TIN discharge concentration was 11 mg N/L. Maintaining such low TIN levels is attributed to optimization of the BNR system, which was piloted in 2019 and 2020 and implemented at full scale beginning in 2021.
  - Wet season loads are greater and generally more variable than the dry season loads.
  - Based on Table 21-2 statistics for the entire dry season dataset, nutrient parameters are all trending downwards, whereas dry season flow has no trend. Reduced nutrient levels is largely attributed to plant optimization which began several few years back.
  - NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since the plant fully nitrifies year-round and discharges very little ammonia.
  - Since April 2017, the facility has enhanced the total phosphorus load reduction capabilities as evidenced by total phosphorus concentrations typically below 1 mg P/L.
- Recycled Water
  - Based on Table 1-2, the plant has averaged 11 mgd of recycled water from 2019 through 2022. Recycled water uses included golf course irrigation, landscape irrigation, industrial application, agricultural irrigation, and other non-potable uses.

- Based on Table 5-3 through Table 5-5, the plant has diverted on average 22 kg ammonia-N/d, 577 kg TIN-N/d, and 25 kg P/d from the Bay through reuse from 2019 through 2022. Note: these values are for year-round values and not limited to the dry season when the facility has the highest non-potable recycled water demand.

Influent

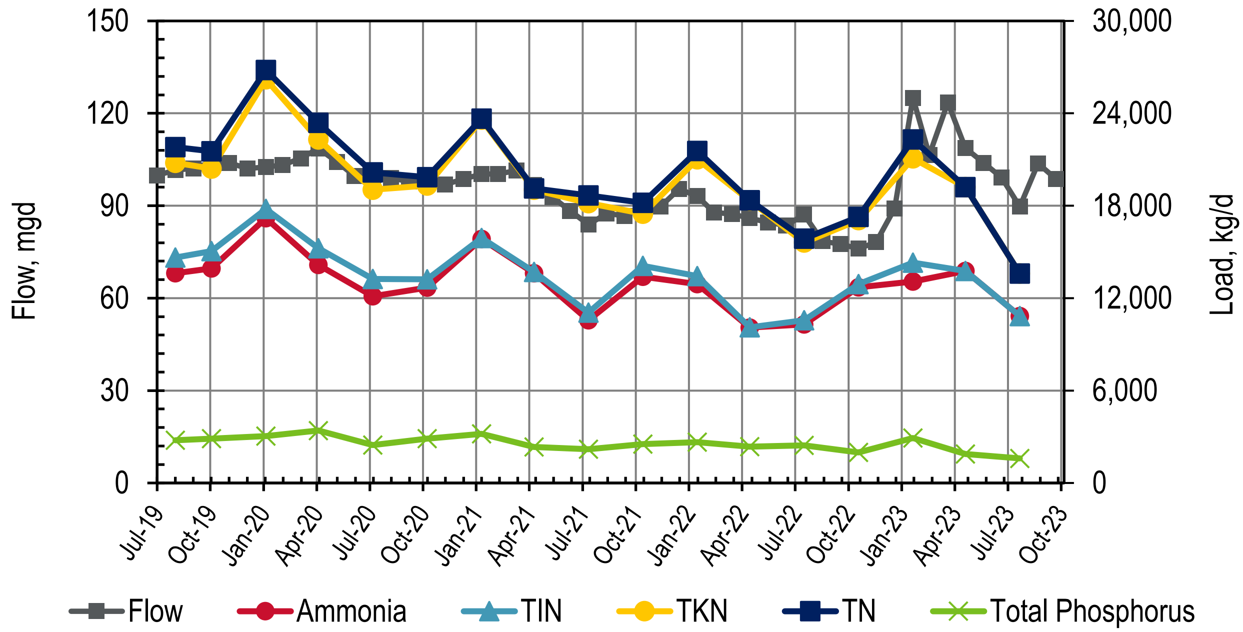

Figure 21-1. Influent: San Jose Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N loads and thus are challenging to see.

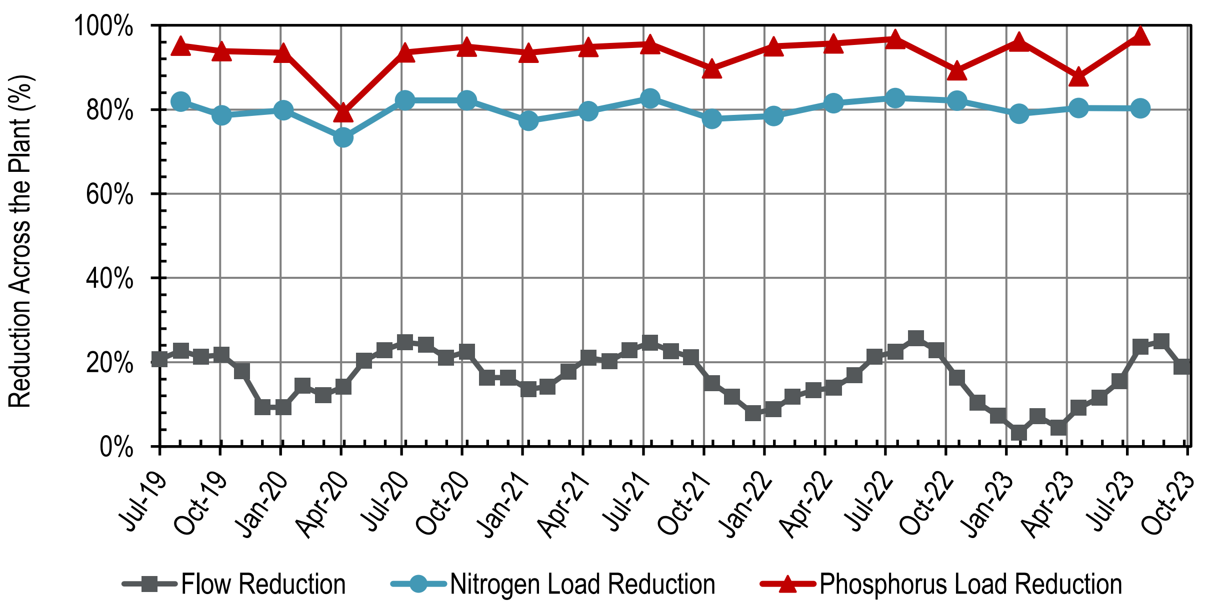

Figure 21-2. Influent: San Jose Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 21-1. Influent: San Jose Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	TKN	Total N *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	99.9	--	--	--	--	--	--
Aug-19	102	13,600	1,020	14,600	20,800	21,800	2,770
Sep-19	102	--	--	--	--	--	--
Oct-19	104	13,900	1,130	15,100	20,400	21,500	2,870
Nov-19	104	--	--	--	--	--	--
Dec-19	102	--	--	--	--	--	--
Jan-20	103	17,200	594	17,800	26,200	26,800	3,040
Feb-20	103	--	--	--	--	--	--
Mar-20	105	--	--	--	--	--	--
Apr-20	109	14,200	1,070	15,200	22,300	23,400	3,410
May-20	104	--	--	--	--	--	--
Jun-20	99.6	--	--	--	--	--	--
Jul-20	98.4	12,100	1,130	13,200	19,000	20,200	2,460
Aug-20	99.0	--	--	--	--	--	--
Sep-20	97.8	--	--	--	--	--	--
Oct-20	97.3	12,700	546	13,200	19,300	19,900	2,870
Nov-20	96.9	--	--	--	--	--	--
Dec-20	98.7	--	--	--	--	--	--
Jan-21	100	15,800	74.9	15,900	23,600	23,700	3,190
Feb-21	100	--	--	--	--	--	--
Mar-21	101	--	--	--	--	--	--
Apr-21	96.8	13,600	71.9	13,700	19,100	19,100	2,340
May-21	92.8	--	--	--	--	--	--
Jun-21	88.4	--	--	--	--	--	--
Jul-21	83.9	10,600	501	11,100	18,200	18,700	2,200
Aug-21	87.5	--	--	--	--	--	--
Sep-21	86.7	--	--	--	--	--	--
Oct-21	89.8	13,400	700	14,100	17,500	18,200	2,530
Nov-21	89.7	--	--	--	--	--	--
Dec-21	95.4	--	--	--	--	--	--
Jan-22	93.1	12,900	526	13,400	21,000	21,600	2,650
Feb-22	87.8	--	--	--	--	--	--
Mar-22	87.3	--	--	--	--	--	--
Apr-22	86.0	10,100	14.1	10,100	18,300	18,400	2,360
May-22	84.6	--	--	--	--	--	--
Jun-22	83.6	--	--	--	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	TKN	Total N *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	87.1	10,300	261	10,600	15,600	15,900	2,440
Aug-22	78.4	--	--	--	--	--	--
Sep-22	77.5	--	--	--	--	--	--
Oct-22	76.1	12,700	203	12,900	17,100	17,300	1,980
Nov-22	78.2	--	--	--	--	--	--
Dec-22	89.2	--	--	--	--	--	--
Jan-23	125	13,100	1,230	14,300	21,100	22,300	2,920
Feb-23	106	--	--	--	--	--	--
Mar-23	123	--	--	--	--	--	--
Apr-23	109	13,800	12.9 **	13,800	19,200	19,200	1,870
May-23	104	--	--	--	--	--	--
Jun-23	99.2	--	--	--	--	--	--
Jul-23	89.7	10,800	3.33 **	10,800	13,600	13,600	1,600
Aug-23	104	--	--	--	--	--	--
Sep-23	98.8	--	--	--	--	--	--
Dry Season Average	**93.4**	**11,500**	**584**	**12,100**	**17,400**	**18,000**	**2,290**
Dry Season Trend * **	**None**	**** **	**** **	**** **	**** **	**** **	**** **
Wet Season Average	**98.5**	**13,600**	**514**	**14,100**	**20,400**	**20,900**	**2,670**
Average Annual	**96.2**	**13,000**	**535**	**13,500**	**19,500**	**20,100**	**2,560**

* The Total Inorganic Nitrogen value is calculated by adding the "Ammonia" and "Nitrate + Nitrite" values. The Total Nitrogen value is calculated by adding "TKN" and "Nitrate + Nitrite".

** "Nitrate + Nitrite" values that were non-detect. The listed values are equal to 50 percent of the method detection limit.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

**** Statistical analyses not performed on the influent nutrient parameters due to a sampler plugging issue that occurred following construction of their new headworks.

Discharge

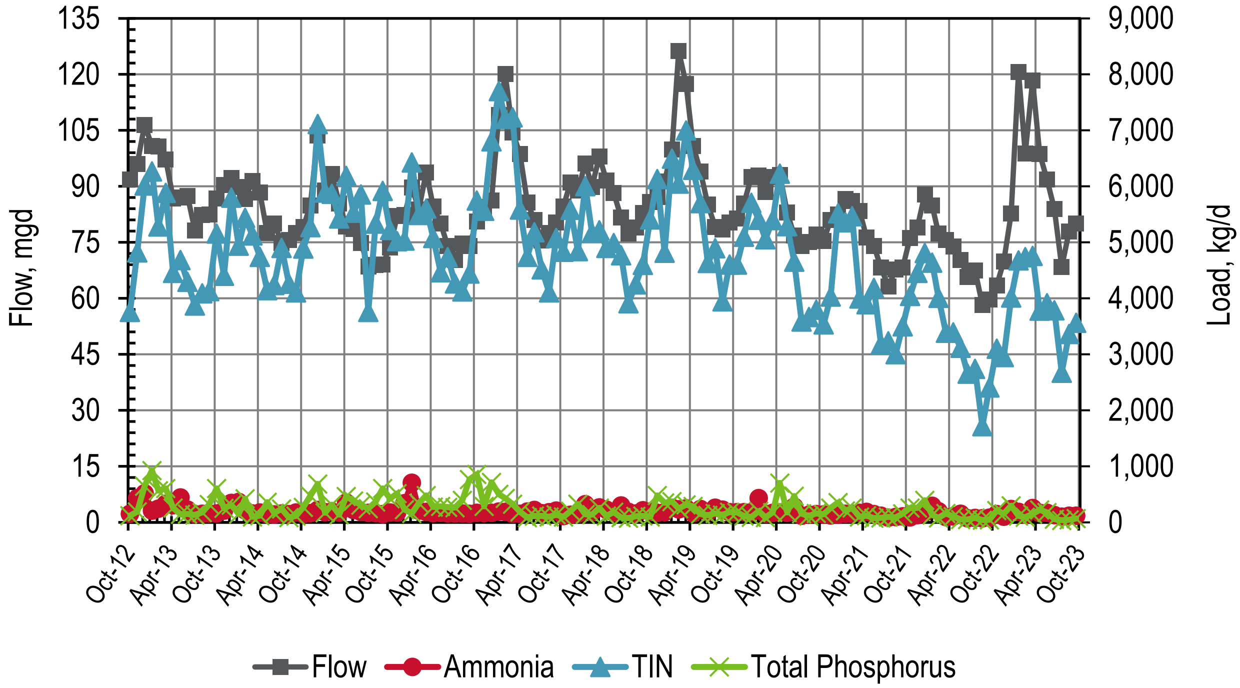

Figure 21-3. Discharge: San Jose Monthly Flows and Loads

Table 21-2. Discharge: San Jose Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	91.9	157	3,600	3,760	124
Nov-12	96.0	433	4,390	4,830	190
Dec-12	107	523	5,490	6,020	646
Jan-13	101	211	6,060	6,270	930
Feb-13	101	247	5,040	5,290	565
Mar-13	97.3	332	5,560	5,890	605
Apr-13	86.9	313	4,150	4,460	261
May-13	87.2	446	4,240	4,690	143
Jun-13	87.5	232	4,070	4,300	149
Jul-13	78.3	148	3,730	3,870	134
Aug-13	82.4	156	3,940	4,090	177
Sep-13	82.6	161	3,970	4,140	323
Oct-13	86.8	161	5,000	5,160	606
Nov-13	90.4	211	4,190	4,410	254
Dec-13	92.3	347	5,450	5,800	307
Jan-14	89.9	370	4,580	4,950	152
Feb-14	86.7	220	5,220	5,440	426
Mar-14	91.5	162	4,960	5,120	101
Apr-14	88.4	180	4,560	4,740	120
May-14	77.6	153	4,000	4,150	361
Jun-14	80.2	146	4,100	4,240	169
Jul-14	74.9	160	4,740	4,900	244
Aug-14	75.6	152	4,110	4,270	86.8
Sep-14	77.5	181	3,930	4,110	118
Oct-14	79.1	149	4,750	4,900	270
Nov-14	84.9	166	5,110	5,270	475
Dec-14	104	226	6,890	7,120	688
Jan-15	89.0	184	5,710	5,890	171
Feb-15	93.3	195	5,680	5,870	315
Mar-15	85.5	178	5,250	5,430	141
Apr-15	79.4	356	5,830	6,190	463
May-15	78.7	227	5,310	5,530	385
Jun-15	74.9	190	5,670	5,860	312
Jul-15	68.6	175	3,580	3,760	246
Aug-15	69.0	167	5,170	5,340	370
Sep-15	69.2	151	5,770	5,920	608

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	73.8	178	5,050	5,220	423
Nov-15	82.1	177	4,850	5,030	518
Dec-15	82.4	343	4,690	5,030	231
Jan-16	89.8	710	5,720	6,430	160
Feb-16	83.8	212	5,280	5,490	346
Mar-16	93.8	190	5,420	5,610	483
Apr-16	84.7	166	4,910	5,080	273
May-16	80.1	170	4,300	4,470	287
Jun-16	74.1	163	4,570	4,740	272
Jul-16	70.3	161	4,110	4,270	265
Aug-16	74.7	159	3,970	4,130	394
Sep-16	74.1	156	4,290	4,450	766
Oct-16	80.7	171	5,580	5,750	857
Nov-16	84.6	169	5,400	5,570	287
Dec-16	86.2	172	6,640	6,810	716
Jan-17	109	196	7,510	7,710	502
Feb-17	120	190	7,020	7,210	432
Mar-17	105	157	7,080	7,240	327
Apr-17	98.7	159	5,430	5,590	187
May-17	85.7	198	4,550	4,750	89.9
Jun-17	81.1	222	4,960	5,190	117
Jul-17	75.5	168	4,360	4,520	114
Aug-17	77.6	185	3,930	4,110	97.8
Sep-17	80.5	214	4,870	5,080	137
Oct-17	84.8	117	4,720	4,840	101
Nov-17	91.1	138	5,440	5,580	201
Dec-17	88.9	154	4,690	4,850	326
Jan-18	96.2	327	5,680	6,010	144
Feb-18	90.0	185	4,990	5,170	139
Mar-18	98.0	269	4,950	5,220	260
Apr-18	91.7	229	4,670	4,900	117
May-18	88.2	177	4,810	4,990	182
Jun-18	81.7	305	4,470	4,770	85.3
Jul-18	77.4	189	3,720	3,910	75.8
Aug-18	79.1	162	4,090	4,250	108
Sep-18	82.9	220	4,380	4,600	114
Oct-18	85.8	195	5,220	5,410	98.7

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	87.2	171	5,960	6,130	480
Dec-18	91.3	186	4,630	4,820	352
Jan-19	100.0	265	6,240	6,500	372
Feb-19	126	234	5,820	6,050	247
Mar-19	117	255	6,750	7,000	317
Apr-19	101	168	6,130	6,300	288
May-19	94.0	244	5,460	5,710	148
Jun-19	85.2	185	4,450	4,640	129
Jul-19	79.2	267	4,630	4,900	162
Aug-19	78.5	227	3,720	3,950	134
Sep-19	80.4	186	4,420	4,610	185
Oct-19	81.5	185	4,420	4,610	176
Nov-19	85.4	186	4,920	5,110	118
Dec-19	92.6	185	5,530	5,710	95.7
Jan-20	93.0	436	4,970	5,410	199
Feb-20	88.4	159	4,900	5,060	84.9
Mar-20	92.5	171	5,230	5,400	179
Apr-20	93.2	178	6,050	6,230	704
May-20	83.1	171	5,120	5,290	176
Jun-20	76.8	279	4,380	4,660	469
Jul-20	74.1	121	3,470	3,590	158
Aug-20	75.1	140	3,530	3,670	115
Sep-20	77.2	150	3,650	3,800	164
Oct-20	75.4	145	3,400	3,540	146
Nov-20	81.0	129	3,900	4,030	256
Dec-20	82.5	137	5,390	5,520	355
Jan-21	86.7	155	5,200	5,360	209
Feb-21	86.1	156	5,320	5,470	256
Mar-21	83.5	174	3,830	4,000	97.8
Apr-21	76.4	192	3,710	3,900	121
May-21	74.0	152	4,040	4,190	78.1
Jun-21	68.2	124	3,060	3,190	83.2
Jul-21	63.2	89.4	3,150	3,240	97.8
Aug-21	67.7	101	2,900	3,000	88.6
Sep-21	68.3	112	3,400	3,510	155
Oct-21	76.3	92.8	3,950	4,040	258
Nov-21	79.1	131	4,330	4,460	260

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	87.9	177	4,640	4,820	396
Jan-22	84.9	299	4,340	4,640	132
Feb-22	77.4	201	3,810	4,010	82.9
Mar-22	75.7	97.0	3,290	3,390	164
Apr-22	74.0	107	3,290	3,400	102
May-22	70.3	154	2,970	3,120	54.8
Jun-22	65.8	77.2	2,580	2,660	50.5
Jul-22	67.6	79.0	2,670	2,740	79.3
Aug-22	58.3	73.5	1,650	1,720	44.2
Sep-22	59.8	88.5	2,330	2,410	47.0
Oct-22	63.6	152	2,950	3,100	211
Nov-22	70.0	103	2,850	2,960	154
Dec-22	82.7	242	3,770	4,020	301
Jan-23	121	191	4,490	4,680	113
Feb-23	98.8	139	4,600	4,740	93.4
Mar-23	118	257	4,510	4,760	150
Apr-23	98.8	170	3,610	3,780	227
May-23	91.9	172	3,740	3,910	181
Jun-23	83.9	132	3,660	3,790	58.0
Jul-23	68.4	107	2,570	2,680	38.7
Aug-23	77.9	121	3,240	3,370	49.2
Sep-23	80.1	124	3,440	3,560	68.3
Dry Season Average	**76.7**	**170**	**4,000**	**4,170**	**181**
Dry Season Trend **	**None**	**Down**	**Down**	**Down**	**Down**
Wet Season Average	**90.3**	**212**	**5,000**	**5,210**	**294**
Average Annual	**84.6**	**195**	**4,580**	**4,780**	**247**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

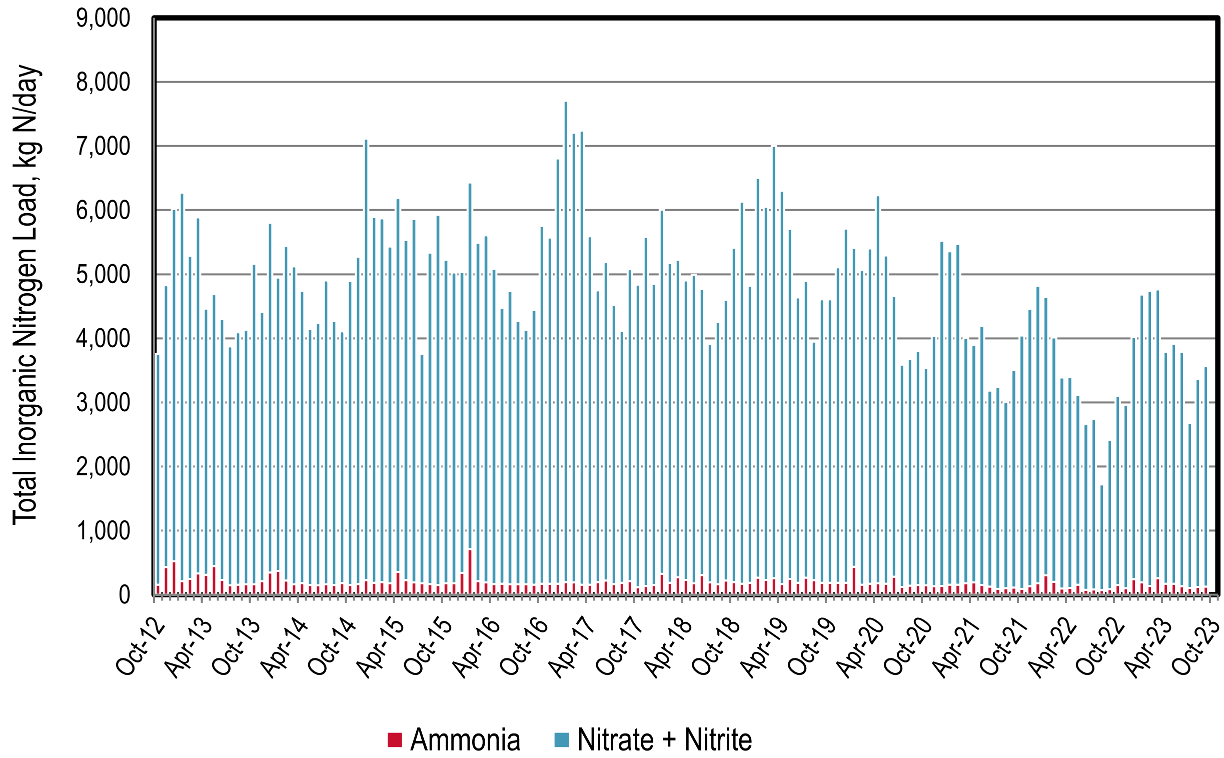

Figure 21-4. Discharge: San Jose Monthly Nitrogen Loads

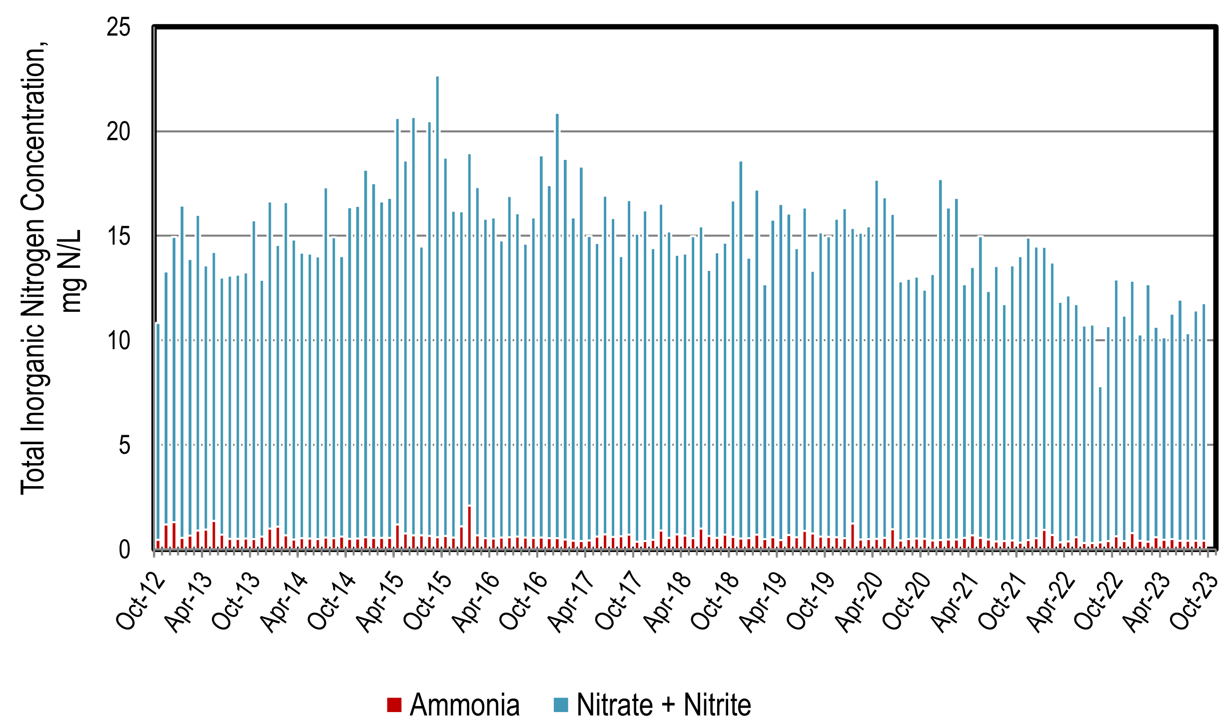

Figure 21-5. Discharge: San Jose Monthly Nitrogen Concentrations

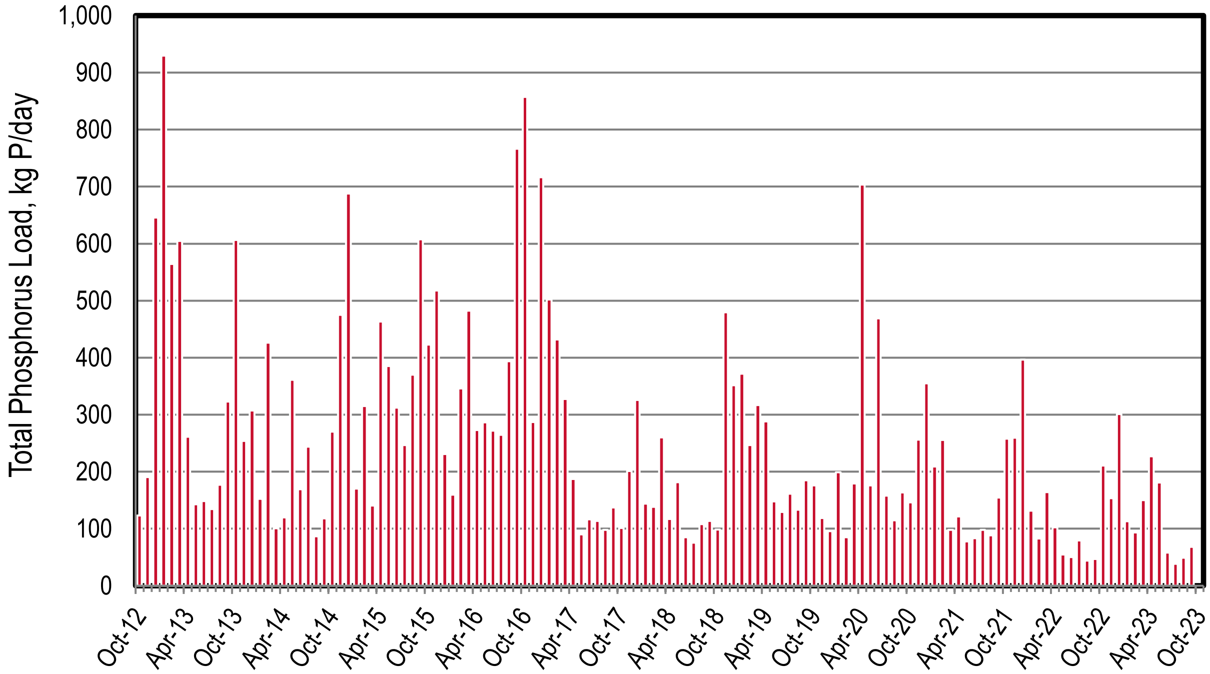

Figure 21-6. Discharge: San Jose Monthly Phosphorus Loads

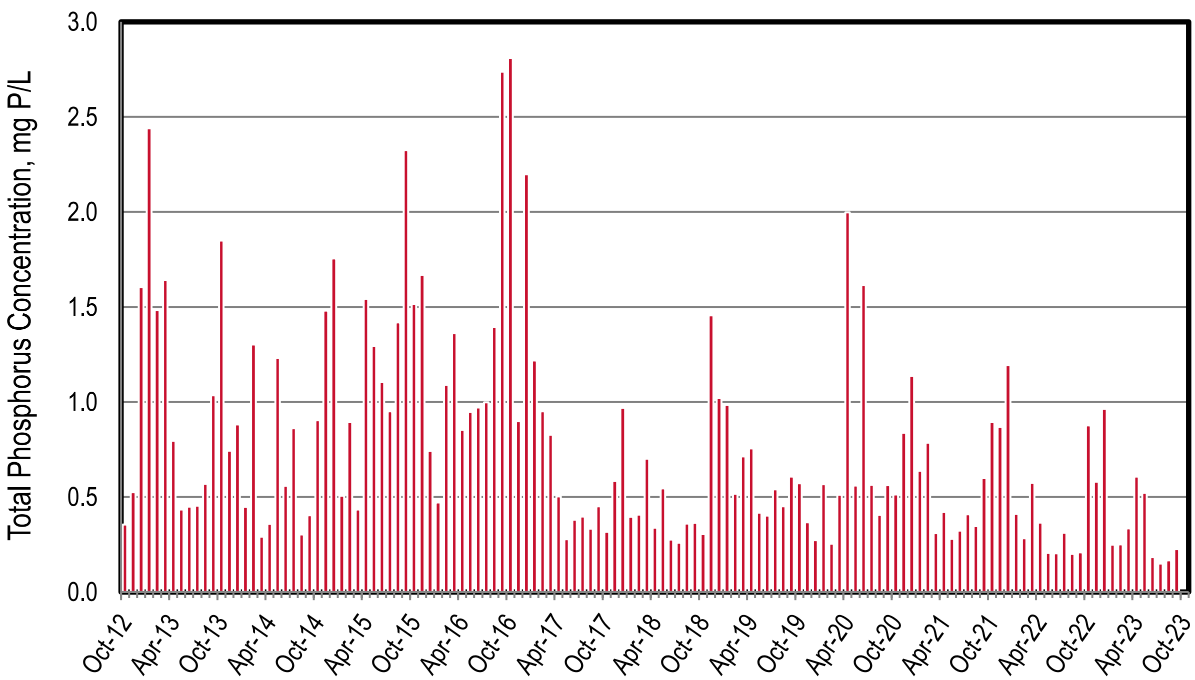

Figure 21-7. Discharge: San Jose Monthly Phosphorus Concentrations

Recycled Water

Table 21-3. Recycled Water: San Jose-Santa Clara Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	1,100 (0.98)	6,320 (5.64)	--	4,220 (3.77)	1 (<0.01)	--	39 (0.03)	11,680 (10.4)
2020	938 (0.84)	7,130 (6.37)	--	4,270 (3.82)	2 (<0.01)	--	59 (0.05)	12,400 (11.1)
2021	823 (0.73)	6,990 (6.24)	--	4,320 (3.86)	2 (<0.01)	--	38 (0.03)	12,170 (10.9)
2022	936 (0.84)	6,830 (6.10)	--	4,500 (4.01)	2 (<0.01)	--	8 (0.01)	12,280 (11.0)
Average	949 (0.85)	6,820 (6.09)	--	4,330 (3.87)	2 (<0.01)	--	36 (0.03)	12,130 (10.8)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 21-4. Recycled Water: San Jose-Santa Clara Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	2	13	--	9	<1	--	<1	24
2020	2	14	--	8	<1	--	<1	25
2021	1	11	--	7	<1	--	<1	20
2022	2	12	--	8	<1	--	<1	22
Average	2	13	--	8	<1	--	<1	22

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 21-5. Recycled Water: San Jose-Santa Clara Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	57	327	--	219	<1	--	2	605
2020	48	361	--	216	<1	--	3	627
2021	39	334	--	207	<1	--	2	582
2022	38	274	--	180	<1	--	<1	492
Average	45	324	--	206	<1	--	2	577

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 21-6. Recycled Water: San Jose-Santa Clara Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	2	12	--	8	<1	--	<1	22
2020	3	19	--	12	<1	--	<1	34
2021	2	14	--	9	<1	--	<1	25
2022	1	10	--	7	<1	--	<1	18
Average	2	14	--	9	<1	--	<1	25

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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22 City of San Mateo

San Mateo discharges to the South Bay and it has approximately 41,434 service connections. The plant has a permitted ADWF capacity of 15.7 mgd and a peak wet weather capacity of 60 mgd. This past dry season average discharge flow was approximately 9.5 mgd. The plant performs secondary treatment using activated sludge. Note: the plant has on-going construction for upgrades that will result in nutrient reduction (emphasis on ammonia and TIN load reduction)

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent and Reduction Across the Plant
  - Note: limited to data since July 2019; quarterly data is required but more provided for various parameters.
  - Based on Table 22-1's statistical analysis for the entire dry season dataset, there are no apparent trends for all of the parameters.
  - The flow reduction across the plant is upwards of 17 percent. The reduction is attributed to biosolids, evaporation associated with the process, and/or flow management during wet weather events.
  - The nitrogen load reduction across the plant is upwards of approximately 54 percent. This load reduction is attributed to a combination of biological assimilation, biosolids management, and/or biological load reduction in the activated sludge system. Note: the elevated nitrate plus nitrite values in 01/2023 is likely from rainfall contributions.
  - The phosphorus load reduction across the plant is upwards of approximately 57 percent. This load reduction is attributed to a combination of biological assimilation, biosolids management, and/or chemical precipitation associated with chemical addition in the collection system, headworks, and/or during solids thickening.
- Discharge
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not fully nitrify. Note: the plant does occasionally nitrify as evidenced by nitrite plus nitrate discharge concentrations greater than influent concentrations. A portion of this produced nitrite plus nitrate is removed.
  - Nitrogen species concentrations are typically highest during the dry season.
  - Total phosphorus concentrations range from 0.5 to 5.0 mg P/L across the entire dataset (1.1 to 5.0 mg P/L for the 2022/2023 dataset). A portion of P is removed as influent concentrations are 5.3 mg P/L or greater for all sampling events. The removal mechanism is most likely from ferric addition at solids thickening.
  - Based on Table 22-2 statistics for the entire dry season dataset, nitrite plus nitrate loads over the entire dataset is trending upwards, whereas the dry season ammonia is trending downwards. Such trending would be expected as the plant does occasionally nitrify as previously noted. The flow and TP loads over the entire dataset do not appear to have any emerging trends.
- Recycled Water: No recycled water was produced or distributed this past year.

Influent

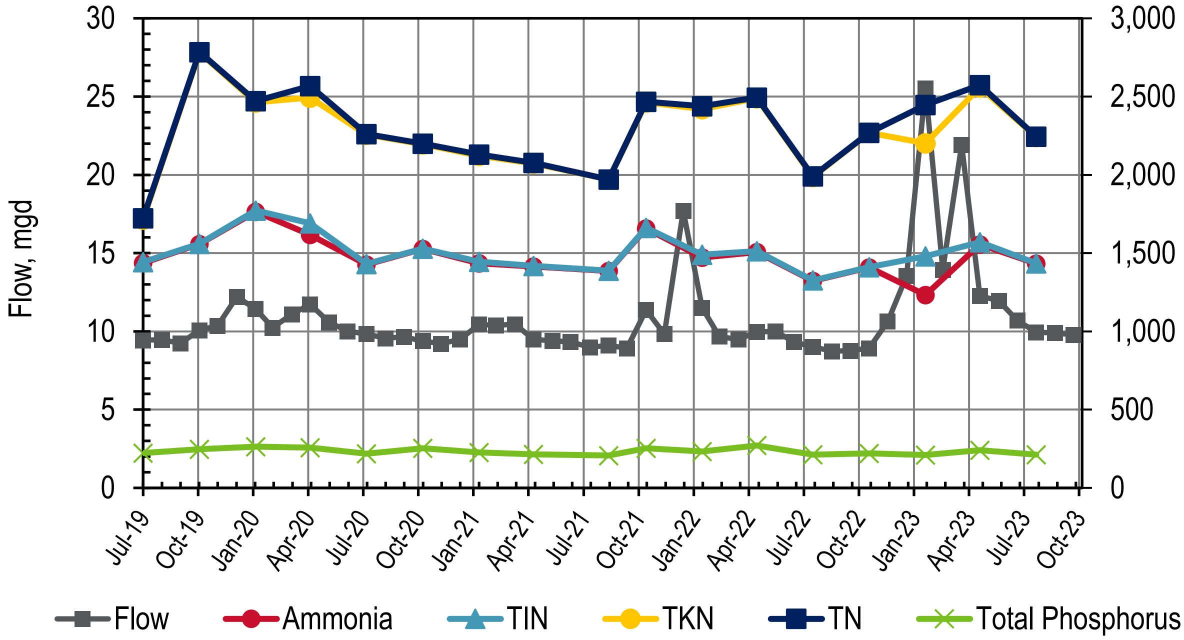

Figure 22-1. Influent: San Mateo Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

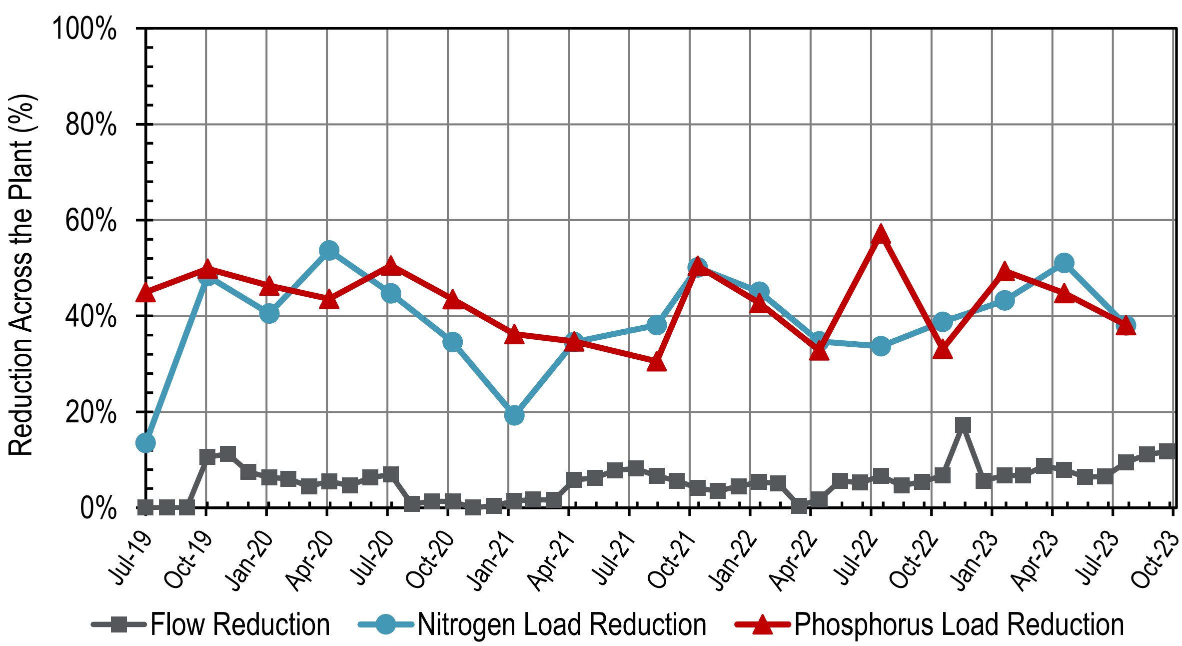

Figure 22-2. Influent: San Mateo Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 22-1. Influent: San Mateo Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	9.44	1,440	7.98	1,440	1,720	1,720	223
Aug-19	9.47	--	--	--	--	--	--
Sep-19	9.24	--	--	--	--	--	--
Oct-19	10.1	1,560	3.86	1,560	2,780	2,790	247
Nov-19	10.4	--	--	--	--	--	--
Dec-19	12.2	--	--	--	--	--	--
Jan-20	11.4	1,760	7.80	1,770	2,460	2,470	263
Feb-20	10.2	--	--	--	--	--	--
Mar-20	11.1	--	--	--	--	--	--
Apr-20	11.7	1,620	72.6	1,690	2,490	2,570	257
May-20	10.6	--	--	--	--	--	--
Jun-20	10.0	--	--	--	--	--	--
Jul-20	9.84	1,430	5.10	1,430	2,260	2,260	218
Aug-20	9.56	--	--	--	--	--	--
Sep-20	9.65	--	--	--	--	--	--
Oct-20	9.39	1,530	3.72	1,530	2,200	2,200	253
Nov-20	9.22	--	--	--	--	--	--
Dec-20	9.49	--	--	--	--	--	--
Jan-21	10.5	1,440	8.34	1,440	2,120	2,130	227
Feb-21	10.4	--	--	--	--	--	--
Mar-21	10.5	--	--	--	--	--	--
Apr-21	9.48	1,410	4.64	1,420	2,070	2,080	214
May-21	9.41	--	--	--	--	--	--
Jun-21	9.32	--	--	--	--	--	--
Jul-21	8.99	--	--	--	--	--	--
Aug-21	9.10	1,390	1.73	1,390	1,970	1,970	207
Sep-21	8.94	--	--	--	--	--	--
Oct-21	11.4	1,660	3.91	1,660	2,460	2,470	254
Nov-21	9.83	--	--	--	--	--	--
Dec-21	17.7	--	--	--	--	--	--
Jan-22	11.5	1,470	17.8	1,490	2,420	2,440	232
Feb-22	9.66	--	--	--	--	--	--
Mar-22	9.48	--	--	--	--	--	--
Apr-22	9.97	1,510	5.24	1,510	2,490	2,490	271
May-22	9.99	--	--	--	--	--	--
Jun-22	9.33	--	--	--	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	9.02	1,320	3.43	1,330	1,990	1,990	212
Aug-22	8.73	--	--	--	--	--	--
Sep-22	8.76	--	--	--	--	--	--
Oct-22	8.93	1,410	1.72	1,410	2,270	2,270	220
Nov-22	10.6	--	--	--	--	--	--
Dec-22	13.6	--	--	--	--	--	--
Jan-23	25.5	1,230	247	1,480	2,200	2,450	211
Feb-23	13.9	--	--	--	--	--	--
Mar-23	21.9	--	--	--	--	--	--
Apr-23	12.3	1,560	14.6	1,570	2,560	2,570	241
May-23	12.0	--	--	--	--	--	--
Jun-23	10.7	--	--	--	--	--	--
Jul-23	9.96	1,430	1.84	1,440	2,240	2,240	213
Aug-23	9.90	--	--	--	--	--	--
Sep-23	9.78	--	--	--	--	--	--
Dry Season Average	**9.64**	**1,400**	**4.01**	**1,400**	**2,030**	**2,040**	**215**
Dry Season Trend **	**None**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**11.9**	**1,510**	**32.6**	**1,550**	**2,380**	**2,410**	**241**
Average Annual	**10.9**	**1,480**	**24.2**	**1,500**	**2,280**	**2,300**	**233**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads.

Discharge

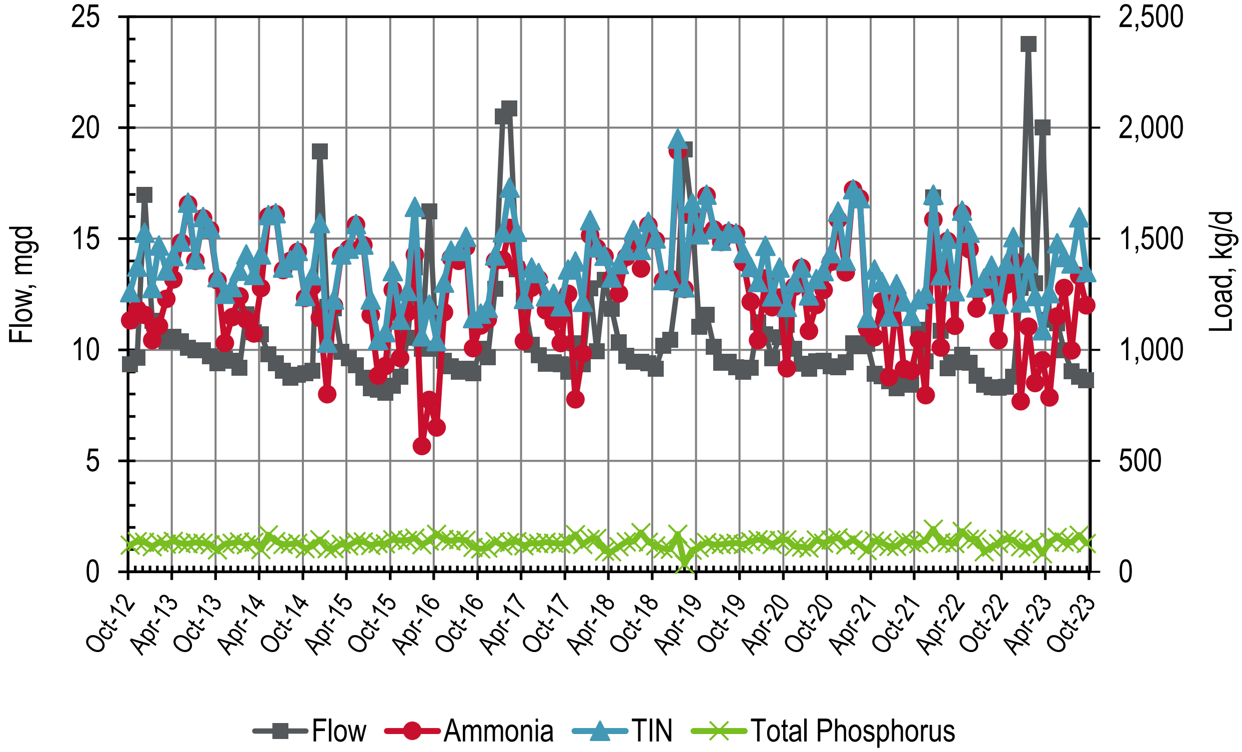

Figure 22-3. Discharge: San Mateo Monthly Flows and Loads

Table 22-2. Discharge: San Mateo Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	9.37	1,130	126	1,260	121
Nov-12	9.65	1,180	192	1,380	137
Dec-12	17.0	1,160	371	1,530	134
Jan-13	11.3	1,040	235	1,280	114
Feb-13	10.5	1,110	362	1,470	132
Mar-13	10.4	1,230	127	1,360	125
Apr-13	10.6	1,320	104	1,420	138
May-13	10.4	1,480	4.45	1,490	128
Jun-13	10.1	1,660	6.85	1,660	127
Jul-13	10.0	1,400	6.42	1,410	132
Aug-13	10.0	1,590	5.84	1,600	129
Sep-13	9.70	1,540	7.72	1,550	122
Oct-13	9.40	1,310	14.1	1,330	100
Nov-13	9.60	1,030	221	1,250	125
Dec-13	9.50	1,150	135	1,280	129
Jan-14	9.20	1,240	115	1,360	135
Feb-14	11.6	1,140	294	1,430	122
Mar-14	10.8	1,070	263	1,340	134
Apr-14	10.7	1,280	151	1,430	100
May-14	9.80	1,600	5.87	1,610	168
Jun-14	9.40	1,610	3.53	1,620	137
Jul-14	9.05	1,360	12.1	1,370	124
Aug-14	8.76	1,400	2.57	1,400	125
Sep-14	8.89	1,440	4.97	1,450	130
Oct-14	8.95	1,230	7.47	1,240	105
Nov-14	9.07	1,290	50.8	1,340	115
Dec-14	18.9	1,150	425	1,570	146
Jan-15	12.0	800	233	1,030	105
Feb-15	11.9	1,200	26.7	1,230	105
Mar-15	9.93	1,430	3.91	1,430	125
Apr-15	9.62	1,450	1.75	1,460	119
May-15	9.30	1,560	1.95	1,570	137
Jun-15	8.75	1,470	2.84	1,470	135
Jul-15	8.28	1,160	71.4	1,230	119
Aug-15	8.21	885	161	1,050	128
Sep-15	8.07	927	153	1,080	126

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	8.38	1,270	84.2	1,350	145
Nov-15	8.80	963	173	1,140	142
Dec-15	10.5	1,170	95.8	1,270	142
Jan-16	13.7	1,430	217	1,650	153
Feb-16	10.1	567	495	1,060	123
Mar-16	16.2	775	430	1,200	140
Apr-16	10.0	651	389	1,040	170
May-16	9.51	1,170	134	1,300	146
Jun-16	9.27	1,410	33.1	1,450	139
Jul-16	9.01	1,400	44.4	1,450	146
Aug-16	9.16	1,460	46.7	1,510	143
Sep-16	8.96	1,010	136	1,140	111
Oct-16	10.1	1,110	53.9	1,160	103
Nov-16	9.67	1,140	51.6	1,190	108
Dec-16	12.7	1,400	24.5	1,430	137
Jan-17	20.5	1,410	124	1,530	118
Feb-17	20.9	1,550	182	1,730	133
Mar-17	13.6	1,370	162	1,530	137
Apr-17	12.2	1,040	190	1,230	118
May-17	10.2	1,280	90.0	1,370	129
Jun-17	9.76	1,320	27.1	1,350	128
Jul-17	9.38	1,180	63.4	1,240	134
Aug-17	9.45	1,130	124	1,250	130
Sep-17	9.34	1,030	166	1,200	126
Oct-17	9.02	1,250	109	1,360	132
Nov-17	10.3	778	621	1,400	168
Dec-17	9.34	983	233	1,220	123
Jan-18	12.8	1,520	67.5	1,580	147
Feb-18	9.93	1,460	2.59	1,460	151
Mar-18	13.2	1,420	3.92	1,420	93.4
Apr-18	11.8	1,320	5.13	1,330	90.0
May-18	10.4	1,250	132	1,390	113
Jun-18	9.73	1,420	29.2	1,450	135
Jul-18	9.46	1,490	47.2	1,540	137
Aug-18	9.46	1,370	82.6	1,450	177
Sep-18	9.40	1,560	15.5	1,580	134
Oct-18	9.16	1,490	9.07	1,500	118

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	10.2	1,310	2.58	1,310	105
Dec-18	10.4	1,320	2.88	1,320	103
Jan-19	13.0	1,900	54.5	1,950	170
Feb-19	19.0	1,280	6.80	1,280	34.0
Mar-19	16.0	1,610	49.0	1,660	97.3
Apr-19	11.0	1,520	2.96	1,520	110
May-19	11.6	1,700	3.84	1,700	132
Jun-19	10.1	1,540	4.55	1,550	122
Jul-19	9.44	1,490	6.55	1,490	123
Aug-19	9.47	1,530	5.47	1,530	128
Sep-19	9.24	1,520	3.76	1,530	129
Oct-19	9.01	1,400	42.5	1,440	124
Nov-19	9.20	1,220	158	1,370	137
Dec-19	11.3	1,040	261	1,310	145
Jan-20	10.7	1,320	147	1,470	141
Feb-20	9.63	1,190	48.4	1,240	123
Mar-20	10.6	1,240	135	1,370	143
Apr-20	11.1	917	277	1,190	145
May-20	10.1	1,290	19.2	1,300	114
Jun-20	9.38	1,370	1.43	1,370	113
Jul-20	9.16	1,090	160	1,250	108
Aug-20	9.49	1,200	118	1,320	143
Sep-20	9.53	1,270	85.6	1,360	129
Oct-20	9.27	1,400	38.2	1,440	143
Nov-20	9.23	1,590	36.9	1,620	154
Dec-20	9.45	1,350	52.0	1,400	123
Jan-21	10.3	1,720	1.49	1,720	145
Feb-21	10.2	1,680	1.78	1,680	122
Mar-21	10.3	1,100	50.2	1,150	97.1
Apr-21	8.93	1,060	306	1,360	140
May-21	8.82	1,220	87.9	1,310	131
Jun-21	8.59	878	273	1,150	116
Jul-21	8.26	1,230	63.8	1,300	115
Aug-21	8.50	914	304	1,220	144
Sep-21	8.44	906	247	1,150	133
Oct-21	10.9	1,040	184	1,230	126
Nov-21	9.49	797	458	1,250	141

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	16.9	1,590	112	1,700	193
Jan-22	10.9	1,010	325	1,340	133
Feb-22	9.17	1,490	9.14	1,500	132
Mar-22	9.44	1,110	157	1,260	127
Apr-22	9.80	1,610	12.7	1,630	182
May-22	9.43	1,450	74.3	1,530	147
Jun-22	8.84	1,190	95.2	1,280	149
Jul-22	8.42	1,280	42.4	1,320	90.9
Aug-22	8.33	1,340	39.9	1,380	113
Sep-22	8.29	1,040	163	1,210	128
Oct-22	8.33	1,290	94.2	1,390	147
Nov-22	8.79	1,400	109	1,510	143
Dec-22	12.8	769	445	1,210	114
Jan-23	23.8	1,110	286	1,390	107
Feb-23	13.0	851	392	1,240	132
Mar-23	20.0	953	135	1,090	82.2
Apr-23	11.3	786	469	1,260	133
May-23	11.2	1,150	331	1,480	156
Jun-23	10.00	1,280	139	1,420	136
Jul-23	9.02	999	391	1,390	132
Aug-23	8.80	1,330	264	1,600	166
Sep-23	8.64	1,200	149	1,350	129
Dry Season Average	**9.31**	**1,310**	**85.4**	**1,390**	**131**
Dry Season Trend **	**None**	**Down**	**Up**	**None**	**None**
Wet Season Average	**11.5**	**1,220**	**156**	**1,380**	**128**
Average Annual	**10.6**	**1,260**	**127**	**1,390**	**129**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

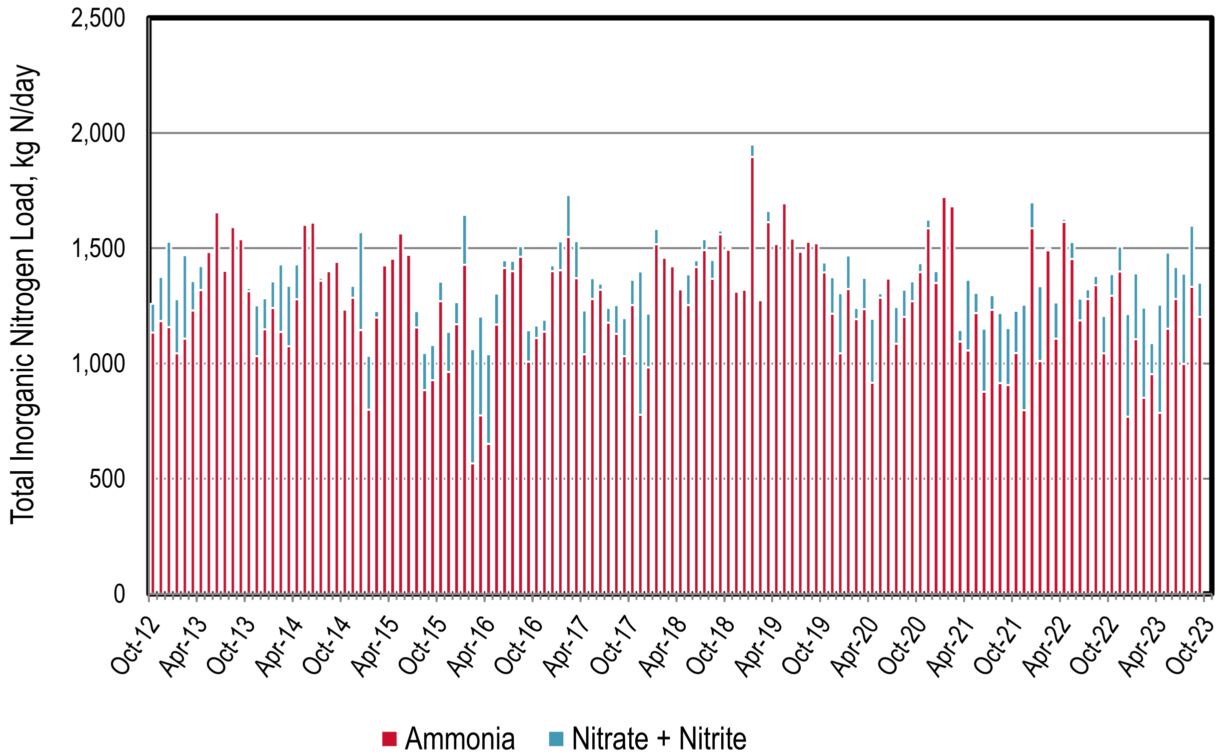

Figure 22-4. Discharge: San Mateo Monthly Nitrogen Loads

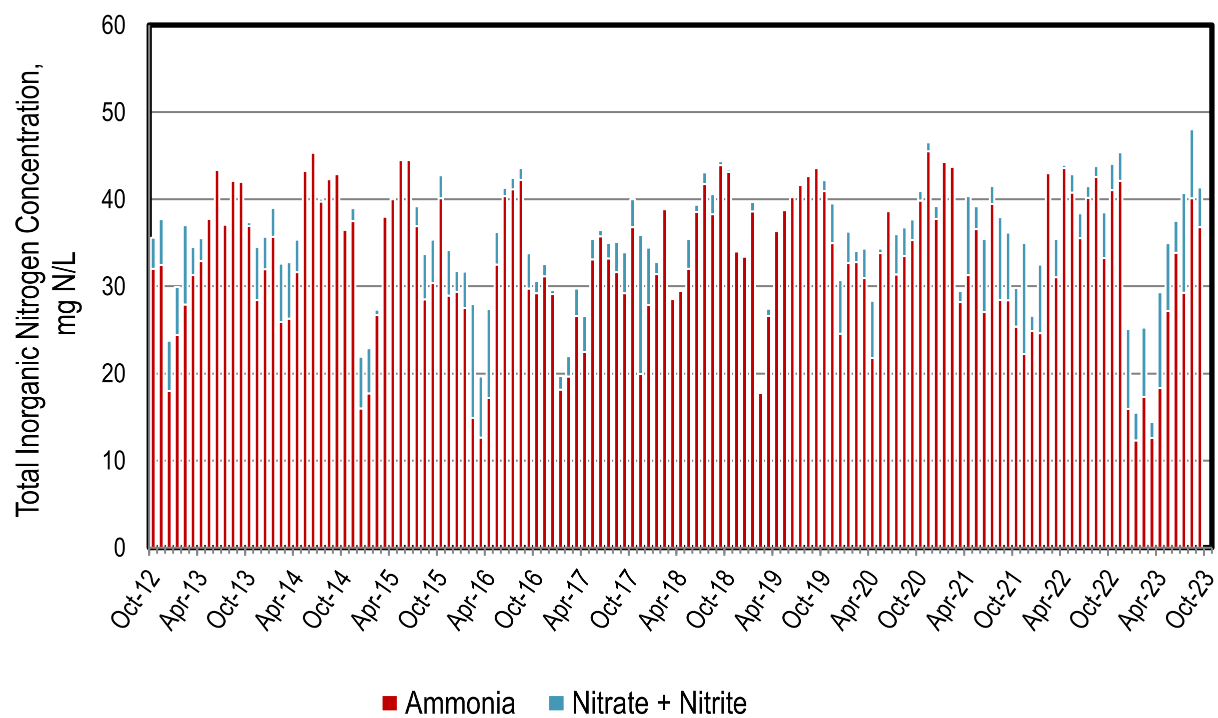

Figure 22-5. Discharge: San Mateo Monthly Nitrogen Concentrations

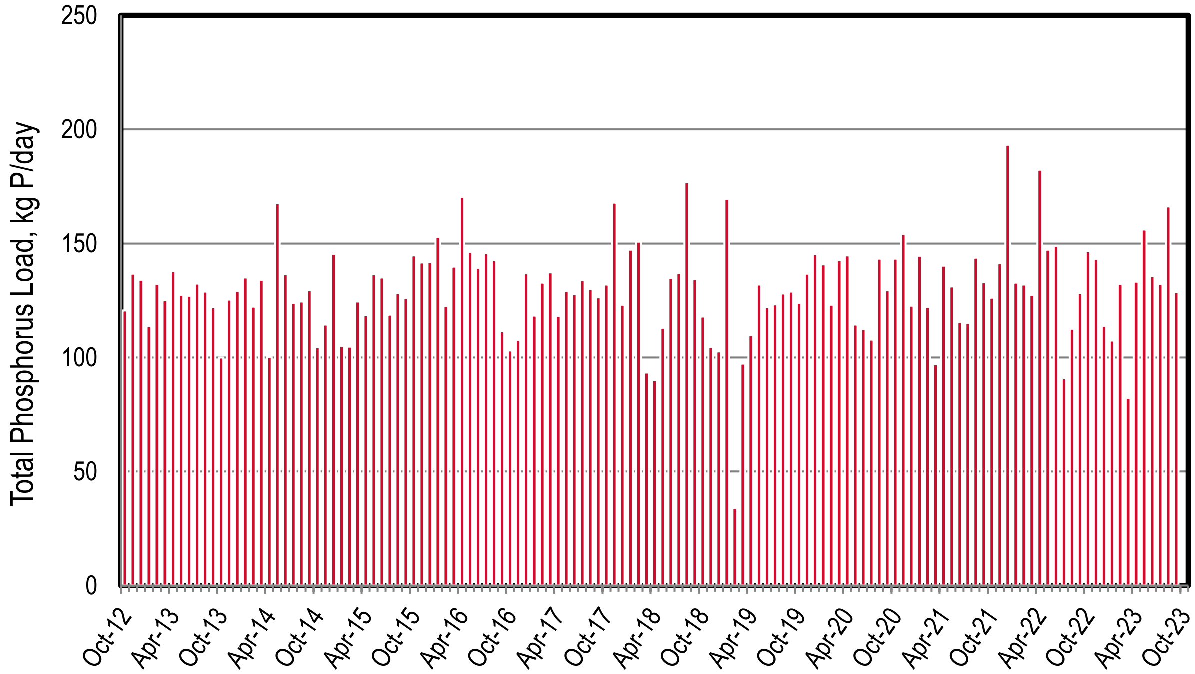

Figure 22-6-Discharge: San Mateo Monthly Phosphorus Loads

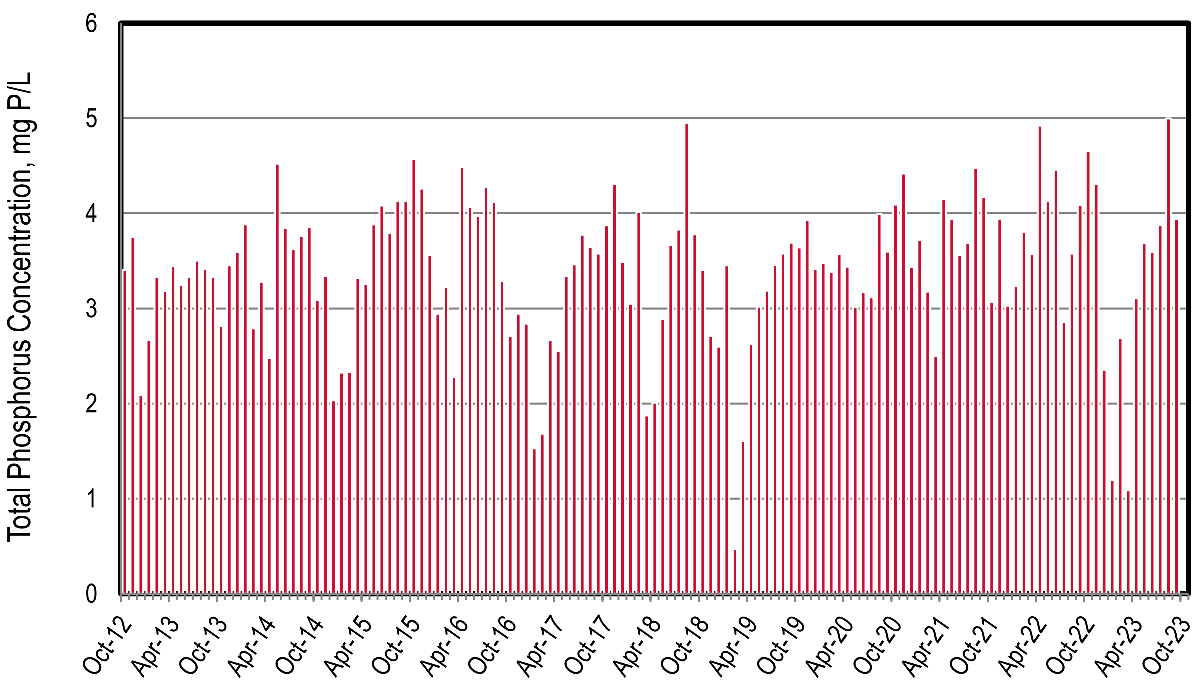

Figure 22-7. Discharge: San Mateo Monthly Phosphorus Concentrations

Recycled Water

No recycled water was produced or distributed this past year.

23 Sewerage Agency of Southern Marin (SASM)

SASM discharges to the Central Bay. The plant has approximately 14,800 service connections and it has a permitted capacity of 3.6 mgd ADWF. This past dry season average discharge flow was approximately 1.94 mgd. The existing plant performs nitrification using trickling filters.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge
  - Total ammonia concentrations range from less than 1 to 29 mg N/L. Up until year 2018, the values were reliably less than 15 mg N/L. Significant plant improvements in 2018/2019 has resulted in ammonia bleed through which is in the process of being addressed. The 2023 dry season data showed improvements compared to 2022.
  - TIN concentrations range from 7 to 50 mg N/L. NOx represented the majority of nitrogen species until the ammonia bleed through that began in 2018/2019 as previously stated. Similar to ammonia, the 2023 dry season TIN data showed improvements compared to 2022 data.
  - Total phosphorus concentrations range from 1.1 to 11 mg P/L (<7 mg P/L since November 2018). The most recent year of data suggests a decline in TP loads.
  - Based on Table 21-1 statistics for the entire dry season dataset, dry season Ammonia and TIN loads over the entire dataset were trending upwards, while TP loads are trending downwards. The upward trends and the downward nitrate plus nitrite trend are attributed to the 2018/2019 plant upgrades as previously noted. The additional capital improvements in 2022 resulted in reversal of the upward trend for Ammonia and downward trend for TIN loads at the end of 2023.
- Recycled Water
  - Based on Table 8-3, the plant averaged 0.01 mgd of recycled water over the 2022 calendar year. The primary recycled water use is landscape irrigation.
  - Based on Table 8-4 through Table 8-6, in 2022 the plant averaged the diversion of <1 kg ammonia-N/d, 2 kg TIN-N/d, and <1 kg P/d from the Bay through recycled water.

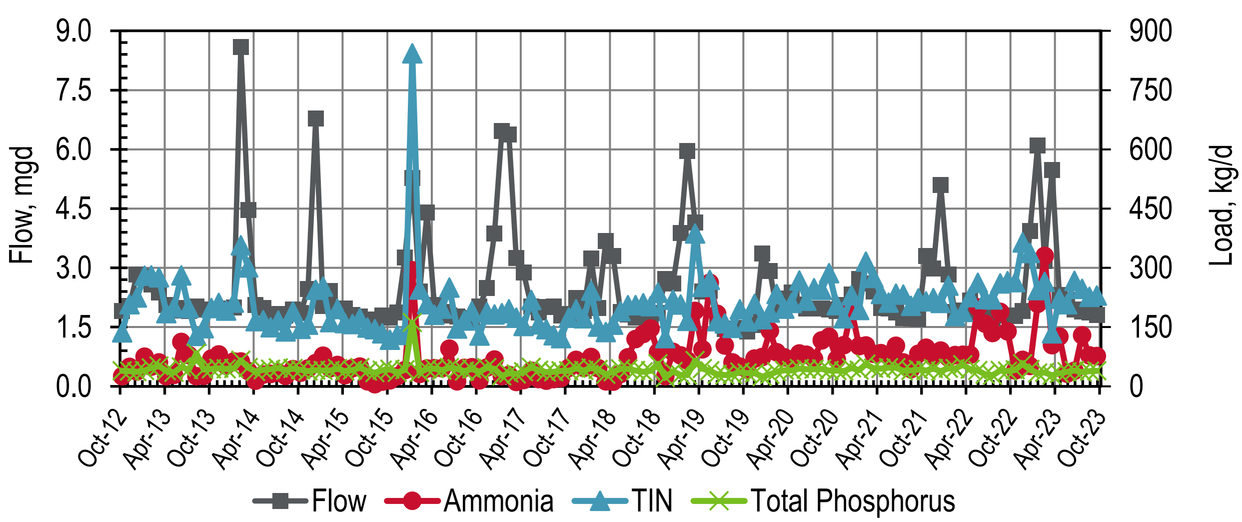

Figure 23-1. Discharge: SASM Monthly Flows and Loads

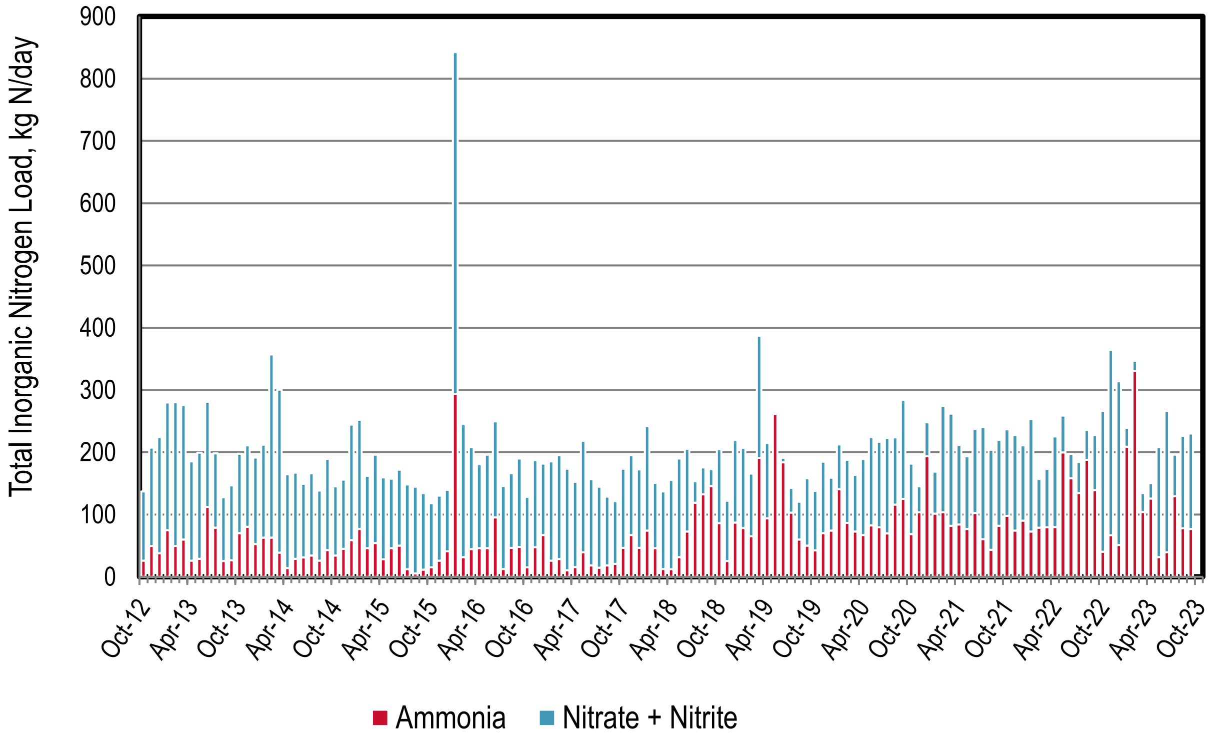

Figure 23-2. Discharge: SASM Monthly Nitrogen Loads

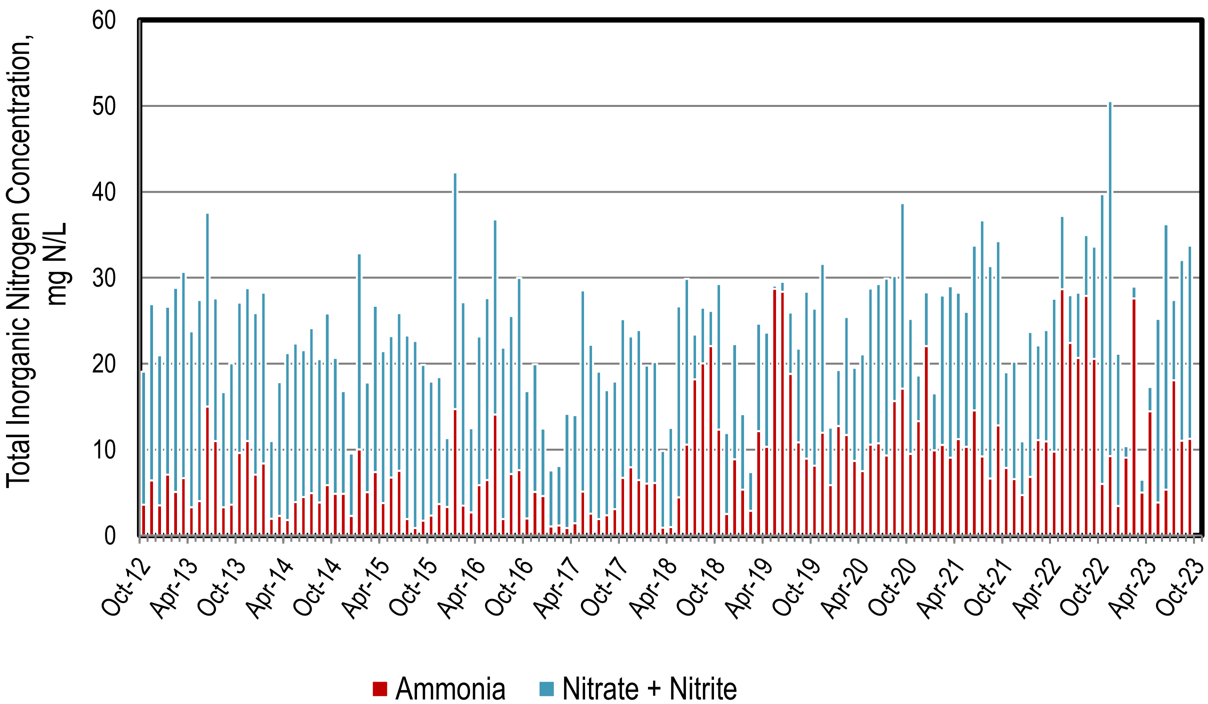

Figure 23-3. Discharge: SASM Monthly Nitrogen Concentrations

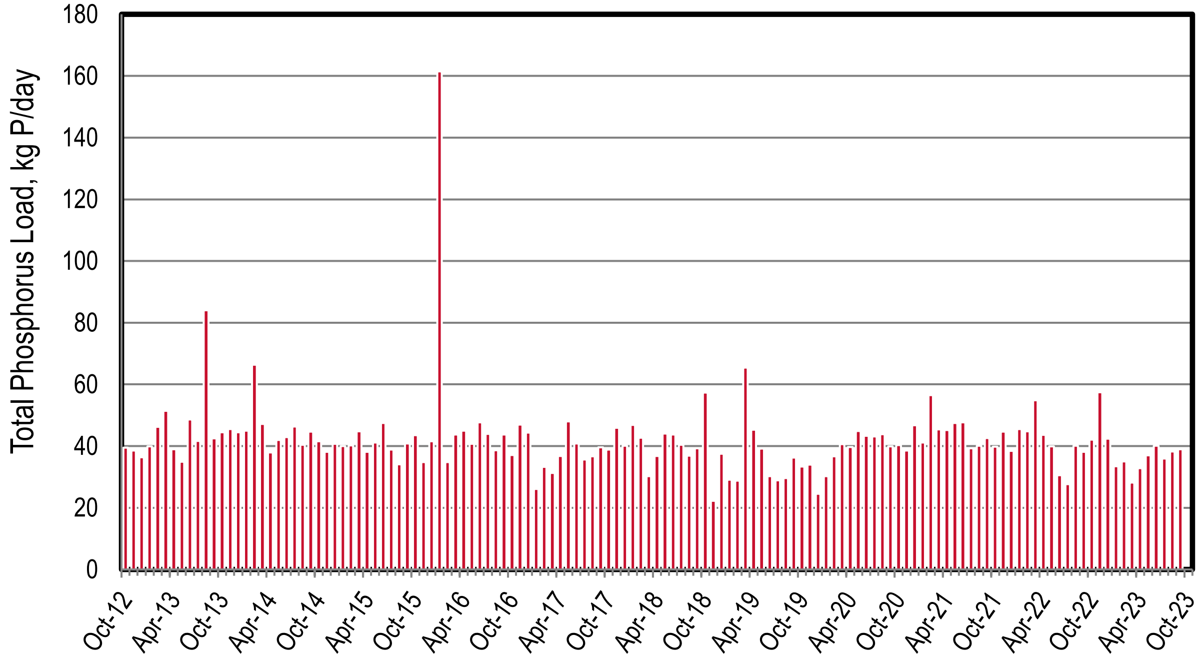

Figure 23-4. Discharge: SASM Monthly Phosphorus Loads

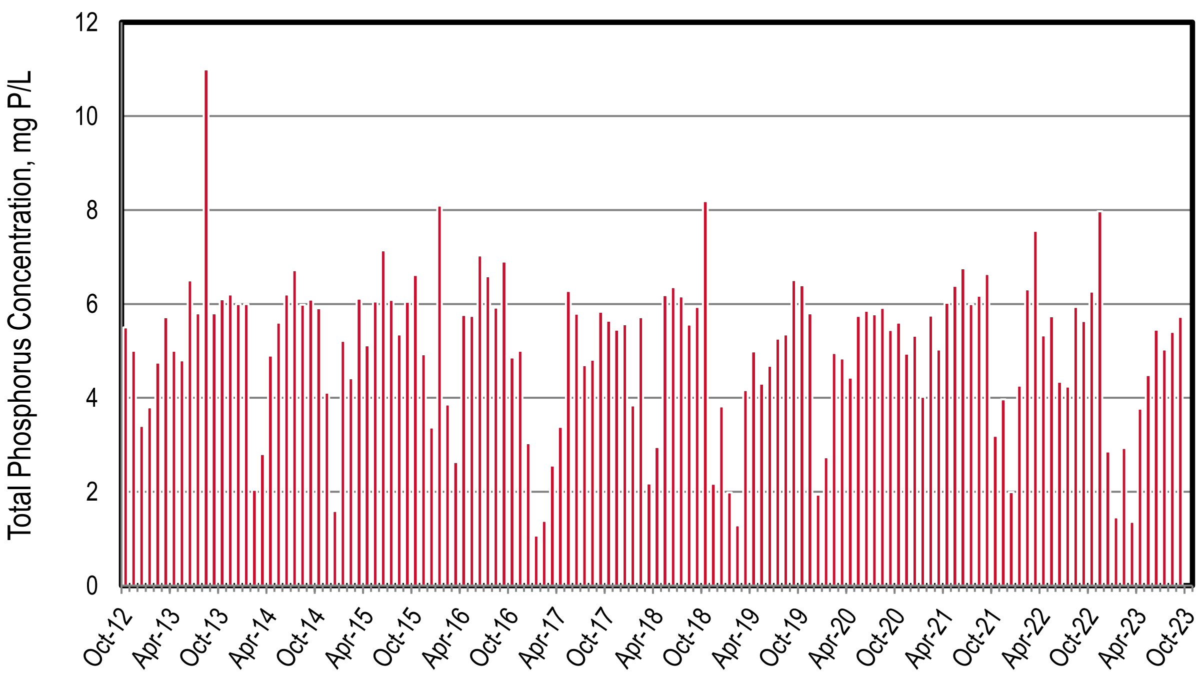

Figure 23-5. Discharge: SASM Monthly Phosphorus Concentrations

Table 23-1. Discharge: SASM Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.90	25.8	111	137	39.4
Nov-12	2.04	49.3	158	208	38.5
Dec-12	2.83	37.5	187	224	36.4
Jan-13	2.78	74.6	205	280	39.9
Feb-13	2.58	49.5	231	280	46.3
Mar-13	2.38	60.0	216	276	51.4
Apr-13	2.06	25.7	159	185	39.0
May-13	1.93	29.1	170	199	34.9
Jun-13	1.98	112	169	281	48.6
Jul-13	1.90	79.0	119	198	41.7
Aug-13	2.02	25.2	102	128	84.0
Sep-13	1.94	26.4	120	147	42.5
Oct-13	1.93	70.0	128	198	44.5
Nov-13	1.94	80.7	130	211	45.5
Dec-13	1.96	52.6	139	192	44.5
Jan-14	1.99	63.0	149	212	45.0
Feb-14	8.59	63.1	294	357	66.3
Mar-14	4.46	38.8	262	301	47.2
Apr-14	2.05	13.9	151	165	38.0
May-14	1.98	29.2	138	167	42.0
Jun-14	1.83	31.1	118	149	42.9
Jul-14	1.82	34.0	132	166	46.3
Aug-14	1.79	26.0	113	139	40.5
Sep-14	1.94	43.0	146	189	44.6
Oct-14	1.86	34.0	111	145	41.6
Nov-14	2.46	45.0	111	156	38.1
Dec-14	6.78	59.0	185	244	40.8
Jan-15	2.03	77.0	175	252	40.0
Feb-15	2.41	46.0	116	162	40.2
Mar-15	1.94	54.0	142	196	44.8
Apr-15	1.97	28.0	132	160	38.2
May-15	1.80	46.0	112	158	41.2
Jun-15	1.76	50.0	122	172	47.5
Jul-15	1.69	12.3	136	149	38.8
Aug-15	1.69	5.50	139	145	34.1
Sep-15	1.79	11.6	123	134	40.9

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.74	15.4	102	118	43.5
Nov-15	1.87	25.8	104	130	34.8
Dec-15	3.26	40.8	98.6	139	41.5
Jan-16	5.28	294	549	843	161
Feb-16	2.39	31.5	214	245	34.9
Mar-16	4.40	44.5	163	208	43.8
Apr-16	2.06	45.7	135	181	45.0
May-16	1.88	45.8	150	196	40.8
Jun-16	1.80	95.5	154	250	47.7
Jul-16	1.76	12.7	133	146	44.0
Aug-16	1.73	46.6	120	167	38.6
Sep-16	1.68	48.3	142	190	43.8
Oct-16	2.02	15.1	113	128	37.1
Nov-16	2.49	47.7	140	187	47.0
Dec-16	3.86	67.3	114	182	44.4
Jan-17	6.46	25.7	159	185	26.1
Feb-17	6.38	28.5	166	195	33.3
Mar-17	3.24	10.7	163	174	31.3
Apr-17	2.88	15.4	137	152	36.8
May-17	2.02	39.1	179	218	48.0
Jun-17	1.87	18.0	139	157	40.9
Jul-17	2.01	14.4	130	145	35.6
Aug-17	2.02	18.0	111	129	36.7
Sep-17	1.79	20.9	101	122	39.6
Oct-17	1.82	46.2	127	174	38.9
Nov-17	2.23	67.0	128	195	46.0
Dec-17	1.91	46.5	126	172	40.2
Jan-18	3.23	74.0	168	242	46.9
Feb-18	1.98	45.7	105	151	42.7
Mar-18	3.68	12.5	125	137	30.2
Apr-18	3.29	12.0	144	156	36.7
May-18	1.88	31.5	158	190	44.1
Jun-18	1.82	72.9	132	205	43.7
Jul-18	1.74	119	34.3	206	40.4
Aug-18	1.75	133	42.9	210	36.8
Sep-18	1.75	146	27.1	203	39.3
Oct-18	1.85	86.3	119	237	57.3

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	2.71	25.6	96.6	122	22.3
Dec-18	2.60	87.2	132	219	37.5
Jan-19	3.88	78.2	129	207	29.1
Feb-19	5.95	64.9	101	166	28.8
Mar-19	4.15	191	196	387	65.4
Apr-19	2.40	93.6	121	252	45.3
May-19	2.41	262	3.29	269	39.2
Jun-19	1.71	184	7.27	165	30.3
Jul-19	1.45	103	39.2	159	28.9
Aug-19	1.46	60.1	60.4	148	29.6
Sep-19	1.47	49.9	108	195	36.3
Oct-19	1.38	42.4	95.4	164	33.4
Nov-19	1.55	70.0	115	209	34.0
Dec-19	3.35	74.3	84.8	170	24.6
Jan-20	2.92	140	71.9	187	30.2
Feb-20	1.96	86.5	101	234	36.6
Mar-20	2.22	72.9	91.0	196	40.6
Apr-20	2.37	67.2	121	211	39.7
May-20	2.07	82.7	142	268	44.9
Jun-20	1.96	79.5	137	217	43.4
Jul-20	1.97	69.4	153	248	43.1
Aug-20	1.96	116	108	245	43.9
Sep-20	1.94	125	158	286	39.9
Oct-20	1.91	68.4	113	205	40.3
Nov-20	2.06	104	41.4	172	38.5
Dec-20	2.32	193	54.8	230	46.8
Jan-21	2.71	102	67.4	193	41.2
Feb-21	2.60	104	171	315	56.5
Mar-21	2.39	81.9	180	274	45.4
Apr-21	1.98	84.0	128	233	45.2
May-21	1.97	76.6	117	212	47.5
Jun-21	1.87	103	135	235	47.7
Jul-21	1.73	60.3	180	232	39.3
Aug-21	1.72	43.2	160	204	40.1
Sep-21	1.70	82.1	138	223	42.6
Oct-21	3.30	98.0	139	215	39.8
Nov-21	2.98	74.0	154	223	44.7

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	5.09	90.4	121	211	38.4
Jan-22	2.83	72.8	180	255	45.5
Feb-22	1.88	78.8	78.3	178	44.8
Mar-22	1.92	79.5	94.0	188	54.8
Apr-22	2.16	79.9	145	225	43.6
May-22	1.84	200	59.2	262	40.0
Jun-22	1.87	158	39.1	221	30.6
Jul-22	1.72	135	49.6	220	27.6
Aug-22	1.79	188	47.7	261	40.1
Sep-22	1.79	139	88.6	266	38.2
Oct-22	1.78	40.3	227	263	42.1
Nov-22	1.91	66.7	297	364	57.4
Dec-22	3.93	51.2	263	338	42.4
Jan-23	6.10	209	30.4	243	33.5
Feb-23	3.17	330	16.3	264	35.1
Mar-23	5.48	104	30.3	134	28.1
Apr-23	2.30	126	24.6	222	32.9
May-23	2.18	31.7	176	208	37.0
Jun-23	1.95	39.4	227	266	40.1
Jul-23	1.89	129	66.7	247	36.0
Aug-23	1.87	77.9	149	226	38.2
Sep-23	1.80	76.6	153	230	39.0
Dry Season Average	**1.84**	**74.4**	**117**	**199**	**41.0**
Dry Season Trend **	**None**	**Up**	**None**	**Up**	**Down**
Wet Season Average	**2.93**	**71.1**	**142**	**217**	**42.5**
Average Annual	**2.48**	**72.5**	**131**	**210**	**41.8**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

Table 23-2. Recycled Water: SASM Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	28 (0.02)	--	--	--	--	1 (<0.01)	29 (0.02)
2020	--	17 (0.02)	--	--	--	--	1 (<0.01)	18 (0.02)
2021	--	14 (0.01)	--	--	--	--	1 (<0.01)	15 (0.01)
2022	--	21 (0.02)	--	--	--	--	1 (<0.01)	23 (0.01)
Average	--	20 (0.02)	--	--	--	--	1 (<0.01)	21 (0.02)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 23-3. Recycled Water: SASM Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	1	--	--	--	--	<1	1
2020	--	1	--	--	--	--	<1	1
2021	--	<1	--	--	--	--	<1	<1
2022	--	1	--	--	--	--	<1	1
Average	--	1	--	--	--	--	<1	1

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 23-4. Recycled Water: SASM Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	2	--	--	--	--	<1	2
2020	--	2	--	--	--	--	<1	2
2021	--	1	--	--	--	--	<1	1
2022	--	2	--	--	--	--	<1	2
Average	--	2	--	--	--	--	<1	2

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 23-5. Recycled Water: SASM Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	--	--	--	<1	<1
2020	--	<1	--	--	--	--	<1	<1
2021	--	<1	--	--	--	--	<1	<1
2022	--	<1	--	--	--	--	<1	<1
Average	--	<1	--	--	--	--	<1	<1

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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24 San Francisco International Airport – MLTP (SFO)

SFO discharges to the South Bay. The plant has a permitted capacity of 3.4 mgd ADWF. The average dry season flow this past year was approximately 0.99 mgd. The process includes two separate treatment processes. Domestic water from the airport facilities are collected through the sanitary sewer collection system and treated with a sequential batch reactor (SBR). Industrial wastewater and storm run-off is treated in the industrial plant, which includes a trickling filter.

The following observations are made based upon the figures and tables in the subsequent pages:

- Discharge
  - The facility made numerous process changes over the last few years (completed in 2018) to accomplish total inorganic nitrogen load reductions (emphasis on the dry season). For example, the average ammonia concentrations this past year were greater than last year's due to construction of a new headworks. The new headworks is online, and the ammonia removal rate is increasing.
  - Phosphorus loads generally increase with flow during wet weather events.
  - Total phosphorus concentrations range from <1 to 26.9 mg P/L. This wide range is attributed to a combination of highly variable industrial waste and recent construction.
  - Based on Table 24-1 statistics for the entire dry season dataset, flow, ammonia, nitrite plus nitrate, and TIN loads are trending downwards.
- Recycled Water
  - Based on Table 1-2, recycled water flows were <0.01 mgd on average in the 2022 calendar year. The only recycled water use is for landscape irrigation.
  - Based on Table 24-3 through Table 24-5, <1 kg ammonia-N/d, <1 kg TIN-N/d, and <1 Total P kg-P/d were diverted from the Bay on average in the 2022 calendar year.

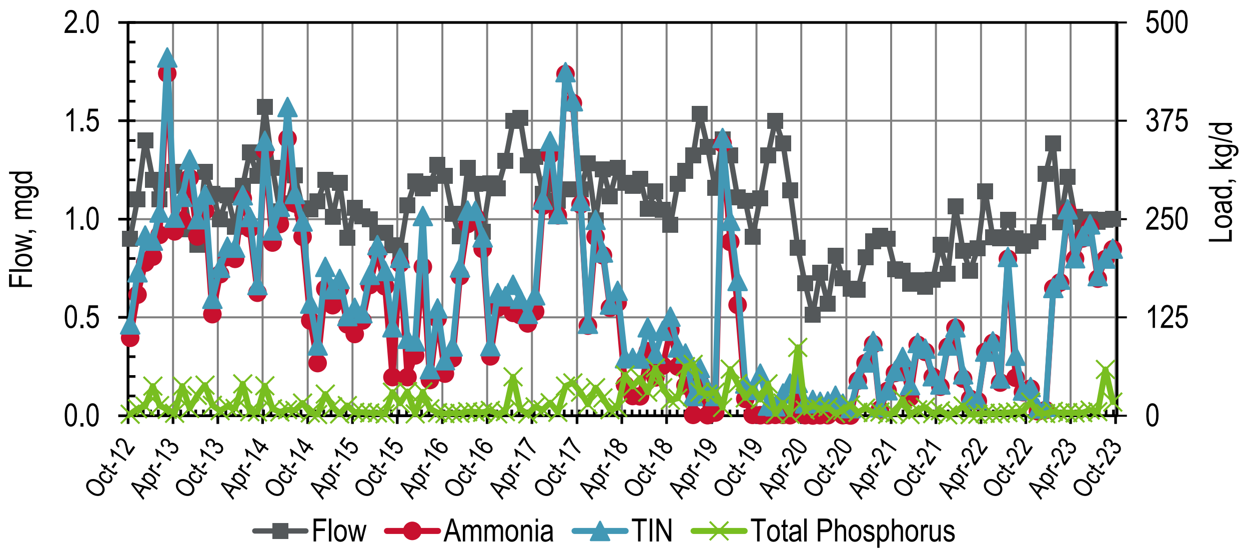

Figure 24-1. Discharge: SFO Airport Monthly Flows and Loads

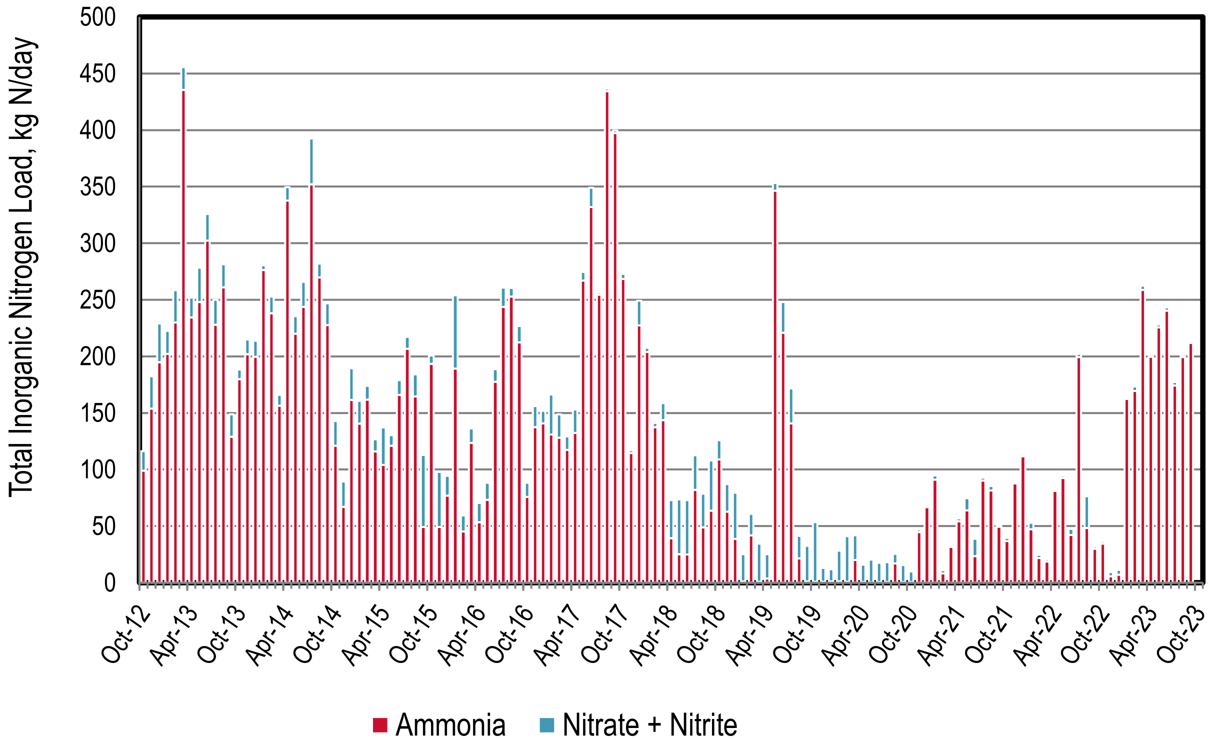

Figure 24-2. Discharge: SFO Airport Monthly Nitrogen Loads

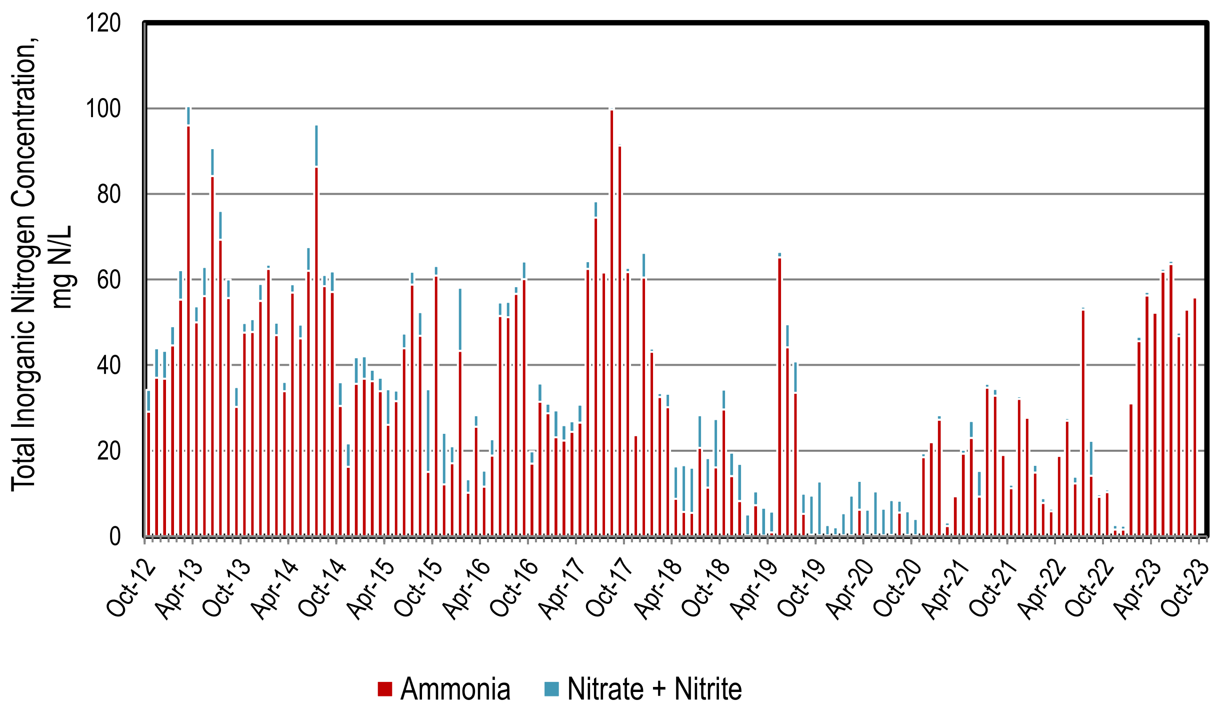

Figure 24-3. Discharge: SFO Airport Monthly Nitrogen Concentrations

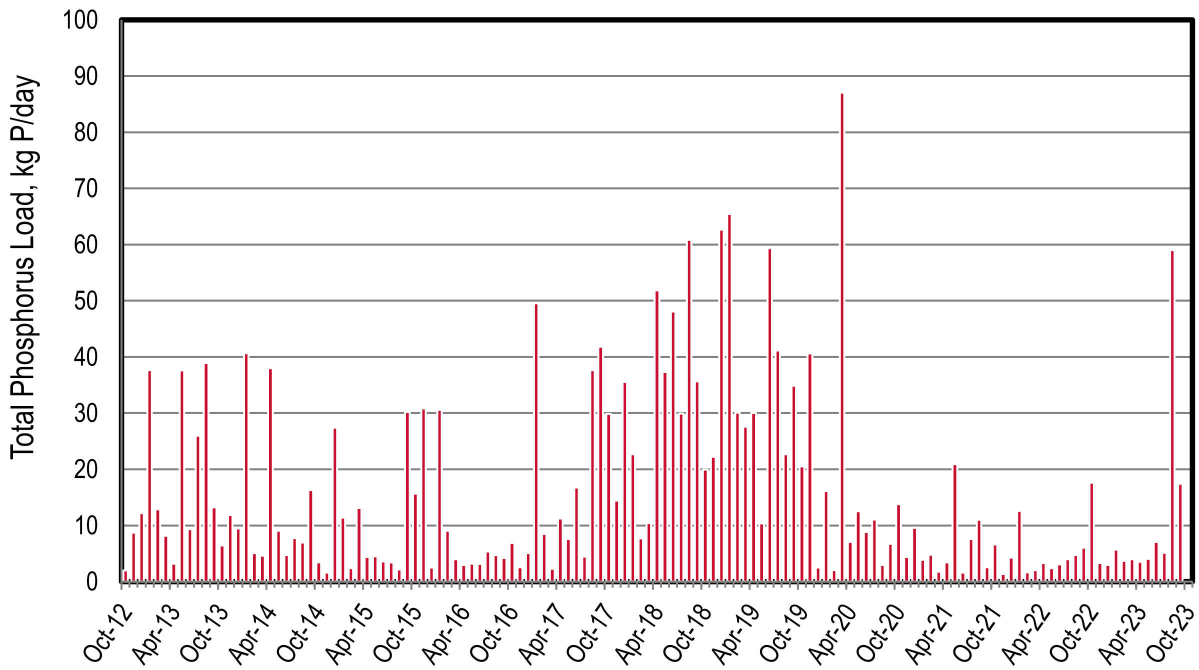

Figure 24-4. Discharge: SFO Airport Monthly Phosphorus Loads

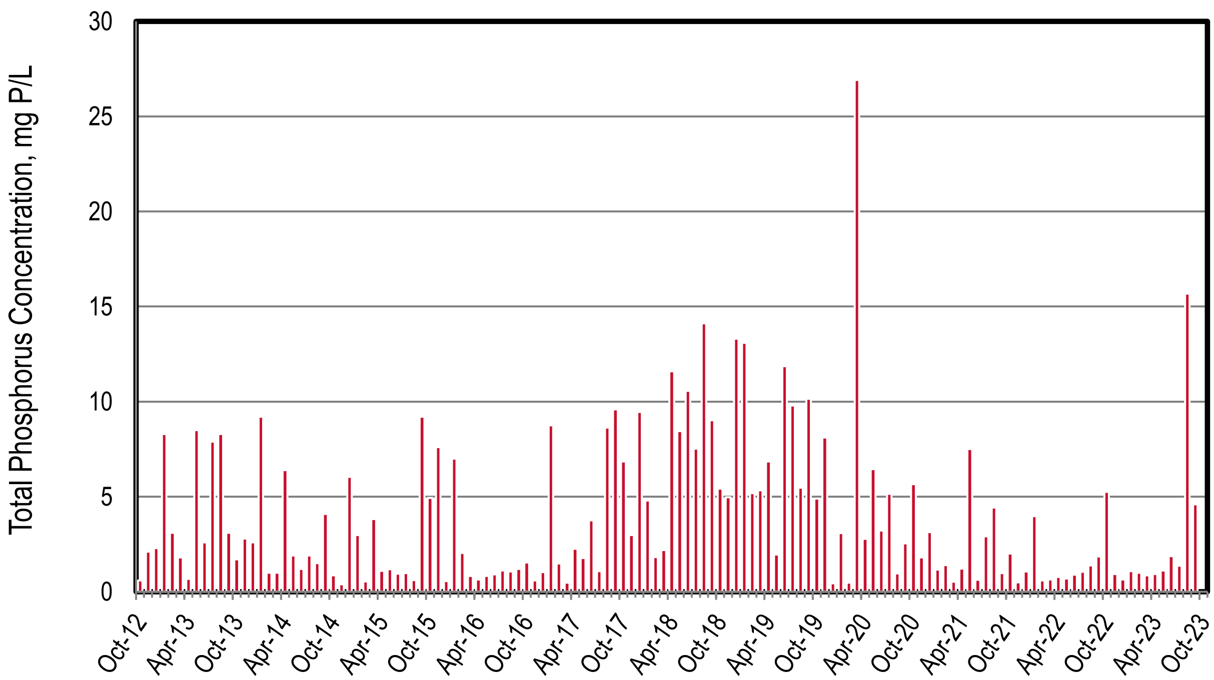

Figure 24-5. Discharge: SFO Airport Monthly Phosphorus Concentrations

Table 24-1. Discharge: SFO Airport Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.900	99.0	17.3	116	2.01
Nov-12	1.10	154	28.7	183	8.73
Dec-12	1.40	195	34.3	229	12.2
Jan-13	1.20	202	20.4	223	37.6
Feb-13	1.10	230	28.6	259	12.9
Mar-13	1.20	435	20.2	456	8.16
Apr-13	1.24	234	17.5	252	3.19
May-13	1.17	248	30.1	278	37.6
Jun-13	0.950	302	23.4	326	9.34
Jul-13	0.870	228	22.0	250	26.0
Aug-13	1.24	261	20.2	281	38.9
Sep-13	1.13	129	19.9	149	13.2
Oct-13	1.00	180	8.32	188	6.43
Nov-13	1.12	202	12.9	215	11.9
Dec-13	0.960	200	14.3	214	9.43
Jan-14	1.17	276	4.16	281	40.7
Feb-14	1.34	238	14.7	253	5.07
Mar-14	1.22	156	9.78	166	4.61
Apr-14	1.57	338	11.9	350	38.0
May-14	1.26	220	15.5	236	9.05
Jun-14	1.04	244	22.0	266	4.72
Jul-14	1.08	352	40.3	393	7.74
Aug-14	1.22	270	12.1	282	6.96
Sep-14	1.06	228	19.3	247	16.3
Oct-14	1.05	121	21.9	143	3.40
Nov-14	1.09	67.0	22.3	89.3	1.60
Dec-14	1.20	162	28.0	190	27.4
Jan-15	1.01	141	20.1	161	11.4
Feb-15	1.18	162	12.0	174	2.40
Mar-15	0.906	116	10.8	127	13.1
Apr-15	1.06	104	33.2	137	4.40
May-15	1.01	121	9.52	131	4.50
Jun-15	1.00	166	13.2	179	3.60
Jul-15	0.930	207	10.5	217	3.45
Aug-15	0.930	165	19.6	184	2.17
Sep-15	0.868	49.3	63.4	113	30.2

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.841	194	7.19	201	15.7
Nov-15	1.07	49.1	48.7	97.9	30.8
Dec-15	1.19	77.0	17.5	94.5	2.51
Jan-16	1.16	189	64.7	254	30.6
Feb-16	1.18	45.4	14.0	59.4	9.08
Mar-16	1.28	124	12.8	136	4.00
Apr-16	1.22	53.4	17.1	70.5	2.96
May-16	1.03	73.2	15.0	88.2	3.19
Jun-16	0.913	178	11.0	189	3.14
Jul-16	1.26	244	17.2	261	5.34
Aug-16	1.18	253	7.79	261	4.72
Sep-16	0.934	212	14.5	227	4.22
Oct-16	1.18	75.7	12.7	88.4	6.88
Nov-16	1.16	137	18.7	156	2.57
Dec-16	1.30	141	11.1	152	5.09
Jan-17	1.50	131	35.5	166	49.6
Feb-17	1.51	128	20.7	149	8.49
Mar-17	1.27	117	12.1	129	2.31
Apr-17	1.32	132	20.8	153	11.2
May-17	1.13	267	7.76	275	7.57
Jun-17	1.18	332	17.0	349	16.8
Jul-17	1.09	255	1.99	257	4.47
Aug-17	1.15	434	2.30	437	37.6
Sep-17	1.15	397	2.26	400	41.8
Oct-17	1.15	268	4.41	273	29.8
Nov-17	1.28	115	2.37	117	14.4
Dec-17	0.995	227	21.6	249	35.6
Jan-18	1.25	204	3.47	208	22.7
Feb-18	1.12	137	3.82	141	7.72
Mar-18	1.26	144	14.9	159	10.4
Apr-18	1.18	39.2	33.7	72.9	51.9
May-18	1.17	25.2	48.3	73.6	37.3
Jun-18	1.20	24.8	48.1	72.9	48.1
Jul-18	1.05	82.2	30.4	113	29.9
Aug-18	1.14	48.8	29.9	78.8	60.9
Sep-18	1.05	63.6	44.5	108	35.6
Oct-18	0.972	109	17.0	126	19.9

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.18	62.7	24.4	87.1	22.2
Dec-18	1.25	38.7	40.7	79.4	62.7
Jan-19	1.32	1.13	24.1	25.2	65.4
Feb-19	1.54	42.0	18.7	60.7	30.1
Mar-19	1.37	0.866	33.6	34.4	27.6
Apr-19	1.16	3.83	21.3	25.1	30.0
May-19	1.41	346	6.74	353	10.4
Jun-19	1.32	221	27.1	248	59.3
Jul-19	1.11	141	30.7	172	41.2
Aug-19	1.09	21.6	19.6	41.2	22.6
Sep-19	0.910	1.18	31.5	32.7	34.9
Oct-19	1.11	0.842	52.6	53.5	20.5
Nov-19	1.33	0.878	12.1	13.0	40.6
Dec-19	1.50	1.28	10.7	12.0	2.50
Jan-20	1.38	1.15	27.0	28.2	16.1
Feb-20	1.15	0.946	40.2	41.2	2.03
Mar-20	0.855	20.0	21.8	41.8	87.1
Apr-20	0.672	0.674	15.2	15.8	7.07
May-20	0.514	0.431	19.8	20.3	12.5
Jun-20	0.728	0.553	17.1	17.7	8.84
Jul-20	0.568	0.568	17.6	18.2	11.1
Aug-20	0.813	17.0	8.61	25.6	2.95
Sep-20	0.701	0.674	14.8	15.5	6.74
Oct-20	0.645	0.530	9.27	9.80	13.8
Nov-20	0.641	44.8	2.08	46.8	4.37
Dec-20	0.806	66.9	0.956	67.9	9.56
Jan-21	0.887	91.1	3.73	94.9	3.90
Feb-21	0.915	8.22	2.81	11.0	4.81
Mar-21	0.899	31.7	0.625	32.4	1.80
Apr-21	0.745	54.3	2.64	57.0	3.41
May-21	0.736	63.9	10.9	74.8	20.9
Jun-21	0.671	23.5	15.2	38.8	1.60
Jul-21	0.688	90.2	2.51	92.7	7.57
Aug-21	0.655	81.4	3.97	85.4	11.0
Sep-21	0.692	49.6	0.785	50.4	2.58
Oct-21	0.870	36.8	2.86	39.6	6.60
Nov-21	0.722	87.7	1.68	89.3	1.34

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	1.07	112	0.894	112	4.29
Jan-22	0.838	47.1	5.81	52.9	12.6
Feb-22	0.737	21.7	3.01	24.7	1.65
Mar-22	0.852	18.7	1.93	20.7	2.07
Apr-22	1.14	81.1	0.483	81.6	3.32
May-22	0.906	92.4	2.12	94.6	2.37
Jun-22	0.904	42.1	5.49	47.6	3.05
Jul-22	0.996	199	2.63	202	3.97
Aug-22	0.905	48.3	28.0	76.3	4.72
Sep-22	0.864	29.9	2.08	32.0	6.06
Oct-22	0.887	34.5	2.10	36.6	17.6
Nov-22	0.933	5.62	3.67	9.29	3.30
Dec-22	1.23	7.15	4.24	11.4	2.96
Jan-23	1.38	162	0.118	162	5.68
Feb-23	0.984	169	3.80	173	3.71
Mar-23	1.22	259	3.67	262	3.97
Apr-23	1.01	200	0.648	200	3.53
May-23	0.966	226	2.59	228	4.05
Jun-23	1.00	240	2.98	243	7.10
Jul-23	0.986	174	3.28	177	5.11
Aug-23	0.996	199	0.689	200	59.0
Sep-23	1.00	212	0.824	213	17.4
Dry Season Average	**0.991**	**156**	**16.7**	**173**	**16.8**
Dry Season Trend **	**Down**	**Down**	**Down**	**Down**	**None**
Wet Season Average	**1.11**	**111**	**15.7**	**127**	**15.2**
Average Annual	**1.06**	**130**	**16.1**	**146**	**15.8**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

Table 24-2. Recycled Water: SFO Airport Yearly Recycled Water Volume Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1 (<0.01)	--	--	--	--	<1 (<0.01)	<1 (<0.01)
2020	--	<1 (<0.01)	--	--	--	--	--	<1 (<0.01)
2021	--	<1 (<0.01)	--	--	--	--	--	<1 (<0.01)
2022	--	<1 (<0.01)	--	--	--	--	--	<1 (<0.01)
Average	--	<1 (<0.01)	--	--	--	--	<1 (<0.01)	<1 (<0.01)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 24-3. Recycled Water: SFO Airport Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	--	--	--	--	<1
2020	--	<1	--	--	--	--	--	<1
2021	--	<1	--	--	--	--	--	<1
2022	--	<1	--	--	--	--	--	<1
Average	--	<1	--	--	--	--	--	<1

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 24-4. Recycled Water: SFO Airport Yearly Recycled Water TIN Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	--	--	--	--	<1
2020	--	<1	--	--	--	--	--	<1
2021	--	<1	--	--	--	--	--	<1
2022	--	<1	--	--	--	--	--	<1
Average	--	<1	--	--	--	--	--	<1

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 24-5. Recycled Water: SFO Airport Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	--	--	--	--	<1
2020	--	<1	--	--	--	--	--	<1
2021	--	<1	--	--	--	--	--	<1
2022	--	<1	--	--	--	--	--	<1
Average	--	<1	--	--	--	--	--	<1

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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25 SFPUC Southeast Plant

SFPUC has a combined collection system, discharges to the South Bay, and serves approximately 450,000 service connections. The plant has a permitted ADWF capacity of 85.4 mgd and a peak wet weather capacity of 250 mgd (150 mgd secondary, 100 mgd primary). The average dry season flow this past year was approximately 44.4 mgd. The plant performs secondary treatment using a high purity oxygen system.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent
  - Note: observations are limited to data since July 2019 (quarterly sampling required).
  - Average monthly influent flows peaked in January of 2023 due to several wet weather events that month.
  - Influent average monthly nitrogen loads were greatest in July 2021. The values during this month are in question as i) ammonia values are greater than the reported TKN which should not be the case as TKN = ammonia plus organic nitrogen and ii) the corresponding ammonia concentration for this month is nearly double the average value. A correction to this was made by assuming TKN = ammonia only for July 2021.
  - No significant flow and load reductions across the plant are expected because the facility does not recycle water. Note: calculating flow and load reductions across the plant cannot be easily quantified because the permit has separate permit-designated monitoring locations for dry and wet weather effluent, and a single monitoring location for influent.
  - Based on a statistical analysis performed for the entire dry season dataset since 2019 (see Table 25-1), there are no apparent trends for any of the evaluated parameters.
- Discharge
  - Ammonia and TIN loads do not always increase with elevated flows typically associated with rain events during the wet season.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This is expected because this plant does not nitrify.
  - Based on the average dry season monthly loads since 2012 in Table 25-2, there appears to be a dry season downward trend for all parameters monitored aside from total phosphorus which has no trend.
- Recycled Water: No recycled water was produced or distributed this year.

Influent

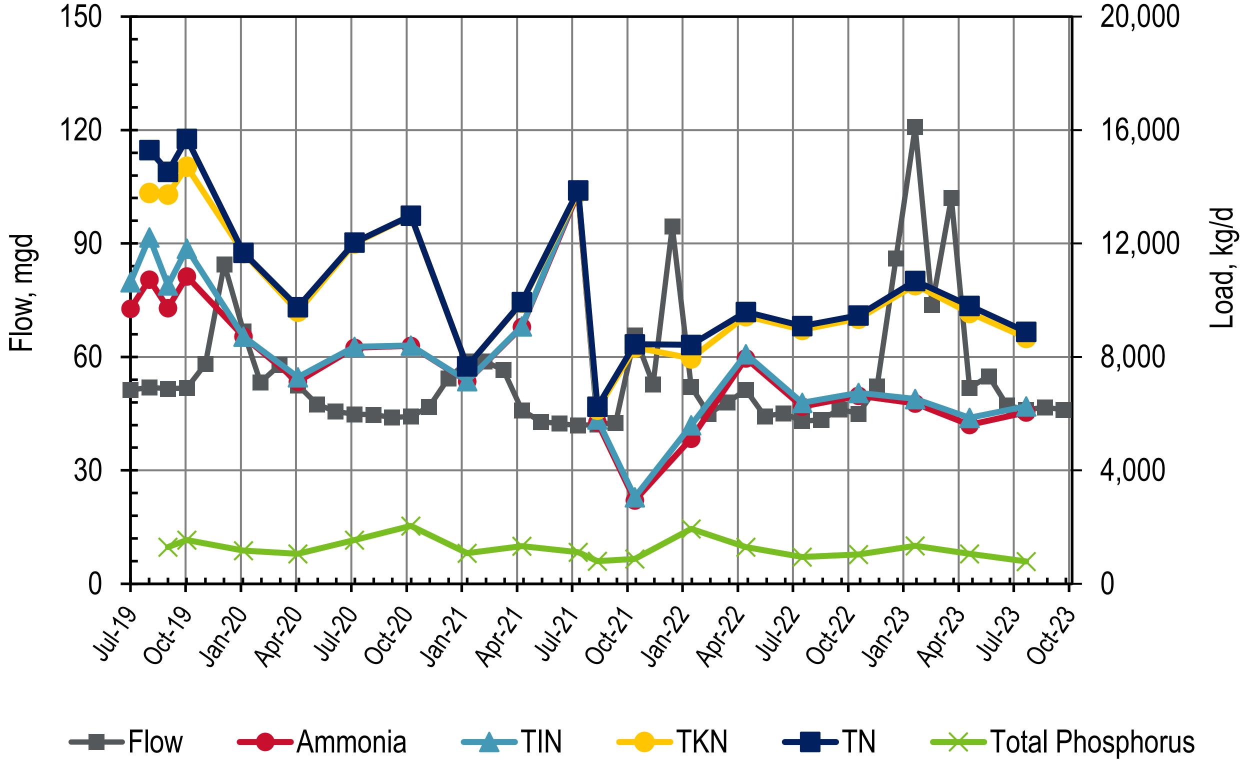

Figure 25-1. Influent: SFPUC Southeast Monthly Flows and Loads

Table 25-1. Influent: SFPUC Southeast Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	TKN	Total N *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	51.3	9,700	940	10,600	--	--	--
Aug-19	51.9	10,700	1,500	12,200	13,800	15,300	--
Sep-19	51.6	9,730	797	10,500	13,700	14,500	1,300
Oct-19	51.8	10,800	986	11,800	14,700	15,700	1,550
Nov-19	58.1	--	--	--	--	--	--
Dec-19	84.5	--	--	--	--	--	--
Jan-20	66.8	8,720	8.74	8,730	11,700	11,700	1,170
Feb-20	53.3	--	--	--	--	--	--
Mar-20	57.9	--	--	--	--	--	--
Apr-20	52.6	7,130	158	7,290	9,600	9,750	1,060
May-20	47.5	--	--	--	--	--	--
Jun-20	45.6	--	--	--	--	--	--
Jul-20	44.8	8,330	28.0	8,350	12,000	12,000	1,550
Aug-20	44.8	--	--	--	--	--	--
Sep-20	44.0	--	--	--	--	--	--
Oct-20	44.2	8,400	7.66	8,400	13,000	13,000	2,040
Nov-20	46.8	--	--	--	--	--	--
Dec-20	54.3	--	--	--	--	--	--
Jan-21	58.8	7,140	8.10	7,150	7,670	7,670	1,080
Feb-21	58.8	--	--	--	--	--	--
Mar-21	56.6	--	--	--	--	--	--
Apr-21	46.0	9,060	15.7	9,080	9,920	9,940	1,330
May-21	42.9	--	--	--	--	--	--
Jun-21	42.4	--	--	--	--	--	--
Jul-21	41.8	13,800	75.8	13,900	13,800**	13,900**	1,120
Aug-21	42.3	5,700	101	5,800	6,150	6,250	804
Sep-21	42.6	--	--	--	--	--	--
Oct-21	65.7	2,940	114	3,060	8,330	8,450	874
Nov-21	52.8	--	--	--	--	--	--
Dec-21	94.5	--	--	--	--	--	--
Jan-22	52.1	5,120	477	5,600	7,950	8,430	1,940
Feb-22	45.0	--	--	--	--	--	--
Mar-22	48.0	--	--	--	--	--	--
Apr-22	51.3	7,950	146	8,100	9,450	9,590	1,290
May-22	44.4	--	--	--	--	--	--
Jun-22	45.1	--	--	--	--	--	--
Jul-22	43.1	6,250	134	6,390	8,960	9,090	947

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	TKN	Total N *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Aug-22	43.3	--	--	--	--	--	--
Sep-22	46.2	--	--	--	--	--	--
Oct-22	45.0	6,630	107	6,740	9,350	9,460	1,040
Nov-22	52.2	--	--	--	--	--	--
Dec-22	86.0	--	--	--	--	--	--
Jan-23	121	6,360	154	6,520	10,500	10,700	1,340
Feb-23	73.8	--	--	--	--	--	--
Mar-23	102	--	--	--	--	--	--
Apr-23	51.9	5,610	249	5,860	9,550	9,800	1,060
May-23	54.9	--	--	--	--	--	--
Jun-23	47.2	--	--	--	--	--	--
Jul-23	46.0	6,040	217	6,260	8,680	8,890	790
Aug-23	46.7	--	--	--	--	--	--
Sep-23	46.0	--	--	--	--	--	--
Dry Season Average	**45.9**	**8,780**	**474**	**9,260**	**11,000**	**11,400**	**1,080**
Dry Season Trend * **	**None**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**61.8**	**7,160**	**203**	**7,360**	**10,100**	**10,30**	**1,320**
Average Annual	**54.7**	**7,810**	**311**	**8,120**	**10,500**	**10,700**	**1,240**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

** The Total Kjeldahl Nitrogen value for July 2021 has been assumed equal to the “Ammonia” value as the reported Total Kjeldahl Nitrogen value for July 2021 was less than the “Ammonia” value.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

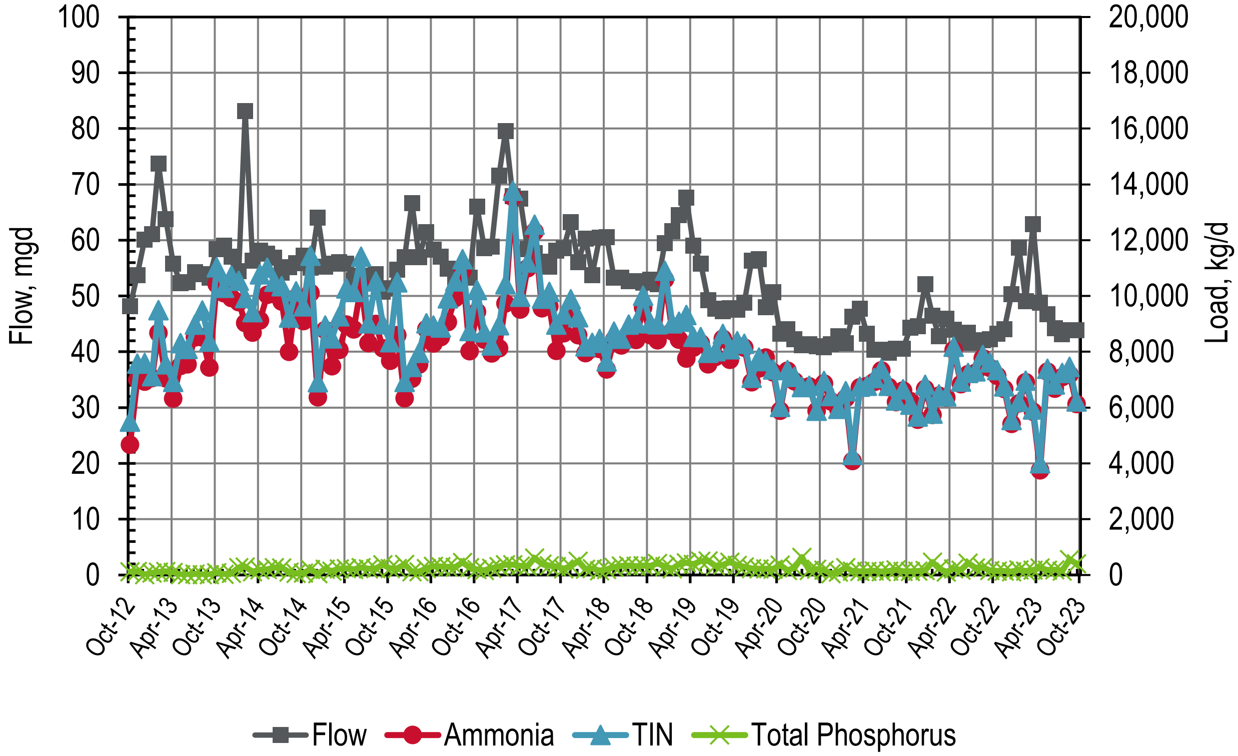

Figure 25-2. Discharge: SFPUC Southeast Monthly Flows and Loads

Table 25-2. Discharge: SFPUC Southeast Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	48.2	4,670	832	5,510	118
Nov-12	53.8	7,010	570	7,580	131
Dec-12	60.2	6,940	663	7,600	22.7
Jan-13	61.1	7,070	65.0	7,130	69.9
Feb-13	73.8	8,680	810	9,490	110
Mar-13	63.8	7,050	506	7,560	134
Apr-13	55.9	6,330	600	6,930	100
May-13	52.3	7,500	813	8,310	19.8
Jun-13	52.6	7,560	550	8,110	19.9
Jul-13	54.3	8,530	451	8,980	39.9
Aug-13	54.0	8,530	956	9,480	20.4
Sep-13	53.4	7,450	920	8,370	20.2
Oct-13	58.4	10,400	600	11,000	84.9
Nov-13	59.1	10,100	194	10,300	32.2
Dec-13	57.1	9,930	804	10,700	61.1
Jan-14	54.5	9,780	769	10,600	272
Feb-14	83.2	9,040	895	9,940	289
Mar-14	56.4	8,700	726	9,420	119
Apr-14	58.2	9,130	1,650	10,800	192
May-14	57.7	10,100	973	11,000	207
Jun-14	56.9	10,100	452	10,500	274
Jul-14	54.2	9,810	549	10,400	263
Aug-14	55.2	8,010	1,230	9,240	109
Sep-14	55.9	9,940	235	10,200	69.0
Oct-14	57.3	9,110	528	9,640	70.0
Nov-14	55.1	10,100	1,330	11,400	203
Dec-14	64.1	6,370	544	6,920	53.0
Jan-15	55.3	8,780	168	8,950	217
Feb-15	55.8	7,490	997	8,490	148
Mar-15	56.1	8,070	1,210	9,280	230
Apr-15	55.8	8,980	1,300	10,300	231
May-15	52.9	8,810	1,340	10,200	206
Jun-15	53.7	10,400	1,050	11,400	266
Jul-15	52.6	8,310	714	9,030	226
Aug-15	53.9	9,000	1,520	10,500	239
Sep-15	50.8	8,140	856	8,990	377

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	51.4	7,690	668	8,360	234
Nov-15	54.8	8,600	1,900	10,500	230
Dec-15	56.9	6,340	591	6,930	384
Jan-16	66.7	7,040	425	7,460	120
Feb-16	57.0	7,540	427	7,970	122
Mar-16	61.5	8,810	217	9,030	232
Apr-16	58.3	8,310	643	8,950	315
May-16	57.1	8,530	344	8,870	309
Jun-16	55.0	9,070	856	9,930	295
Jul-16	53.1	9,930	591	10,500	284
Aug-16	54.6	10,900	388	11,300	450
Sep-16	53.3	8,030	723	8,750	273
Oct-16	66.1	9,440	777	10,200	204
Nov-16	58.6	8,440	263	8,710	169
Dec-16	58.9	7,950	287	8,240	246
Jan-17	71.6	8,130	828	8,960	310
Feb-17	79.6	9,740	686	10,400	377
Mar-17	67.9	13,500	236	13,800	370
Apr-17	67.5	9,520	458	9,980	328
May-17	58.4	11,000	213	11,200	314
Jun-17	57.7	12,300	253	12,600	619
Jul-17	56.1	9,570	349	9,920	396
Aug-17	55.3	9,630	524	10,200	338
Sep-17	58.2	8,040	938	8,980	308
Oct-17	58.6	8,670	680	9,350	221
Nov-17	63.3	9,390	495	9,890	317
Dec-17	56.1	8,600	641	9,240	498
Jan-18	60.4	7,960	239	8,200	209
Feb-18	53.8	8,120	211	8,330	239
Mar-18	60.4	8,110	359	8,470	160
Apr-18	60.6	7,380	284	7,660	200
May-18	53.3	8,430	291	8,730	276
Jun-18	53.3	8,240	235	8,470	327
Jul-18	52.7	8,630	346	8,980	338
Aug-18	52.7	8,440	607	9,040	321
Sep-18	52.4	9,590	423	10,000	344
Oct-18	53.0	8,610	419	9,030	333

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	52.1	8,420	579	9,000	419
Dec-18	59.5	10,600	317	10,900	308
Jan-19	61.7	8,740	290	9,030	228
Feb-19	64.5	8,440	636	9,080	386
Mar-19	67.7	7,760	825	9,320	448
Apr-19	59.1	8,150	388	8,540	382
May-19	55.9	8,310	222	8,530	498
Jun-19	49.3	7,560	357	7,970	510
Jul-19	47.8	7,830	207	8,030	324
Aug-19	47.3	8,480	167	8,650	366
Sep-19	47.8	7,720	384	8,100	464
Oct-19	47.5	8,230	160	8,390	348
Nov-19	48.8	8,160	140	8,300	297
Dec-19	56.3	6,910	159	7,070	239
Jan-20	56.7	7,410	393	7,800	230
Feb-20	48.0	7,800	211	7,670	219
Mar-20	50.7	7,270	12.9	7,380	214
Apr-20	43.3	5,890	138	6,030	367
May-20	44.1	7,330	20.6	7,350	166
Jun-20	42.3	6,950	171	7,120	253
Jul-20	41.2	6,730	19.1	6,750	643
Aug-20	41.3	6,760	28.9	6,790	163
Sep-20	41.0	5,890	6.83	5,900	209
Oct-20	40.9	6,870	100	6,970	177
Nov-20	41.4	6,230	197	6,420	55.4
Dec-20	42.8	5,940	201	5,960	111
Jan-21	41.6	6,350	252	6,600	267
Feb-21	46.3	4,090	223	4,310	139
Mar-21	47.8	6,730	21.7	6,750	130
Apr-21	43.3	6,770	10.3	6,780	130
May-21	40.4	6,930	137	7,070	159
Jun-21	40.5	7,340	49.2	7,390	117
Jul-21	39.8	6,750	44.7	6,790	146
Aug-21	40.6	6,200	58.0	6,260	193
Sep-21	40.6	6,620	45.8	6,670	132
Oct-21	44.3	6,240	97.6	6,110	132
Nov-21	44.6	5,570	116	5,690	140

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	52.1	6,670	149	6,820	169
Jan-22	46.5	5,740	51.0	5,790	461
Feb-22	42.8	6,440	47.4	6,480	236
Mar-22	45.9	6,360	48.0	6,410	115
Apr-22	44.0	8,080	117	8,190	226
May-22	41.6	6,840	90.1	6,930	177
Jun-22	43.4	7,200	49.0	7,250	428
Jul-22	41.7	7,250	57.5	7,310	263
Aug-22	42.1	7,770	117	7,890	266
Sep-22	42.3	7,430	198	7,620	165
Oct-22	43.3	7,140	209	7,350	142
Nov-22	44.0	6,680	81.5	6,760	148
Dec-22	50.4	5,420	140	5,560	117
Jan-23	58.8	6,150	57.8	6,210	192
Feb-23	49.1	6,920	55.9	6,970	147
Mar-23	62.9	5,860	84.8	5,940	176
Apr-23	48.8	3,760	252	4,020	255
May-23	46.8	7,300	104	7,400	180
Jun-23	44.2	6,690	140	6,830	193
Jul-23	43.2	7,100	155	7,250	144
Aug-23	43.9	7,200	268	7,460	560
Sep-23	43.9	6,140	90.7	6,230	408
Dry Season Average	**49.6**	**8,200**	**416**	**8,610**	**267**
Dry Season Trend **	**Down**	**Down**	**Down**	**Down**	**None**
Wet Season Average	**55.6**	**7,730**	**445**	**8,180**	**214**
Average Annual	**53.1**	**7,930**	**433**	**8,360**	**236**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

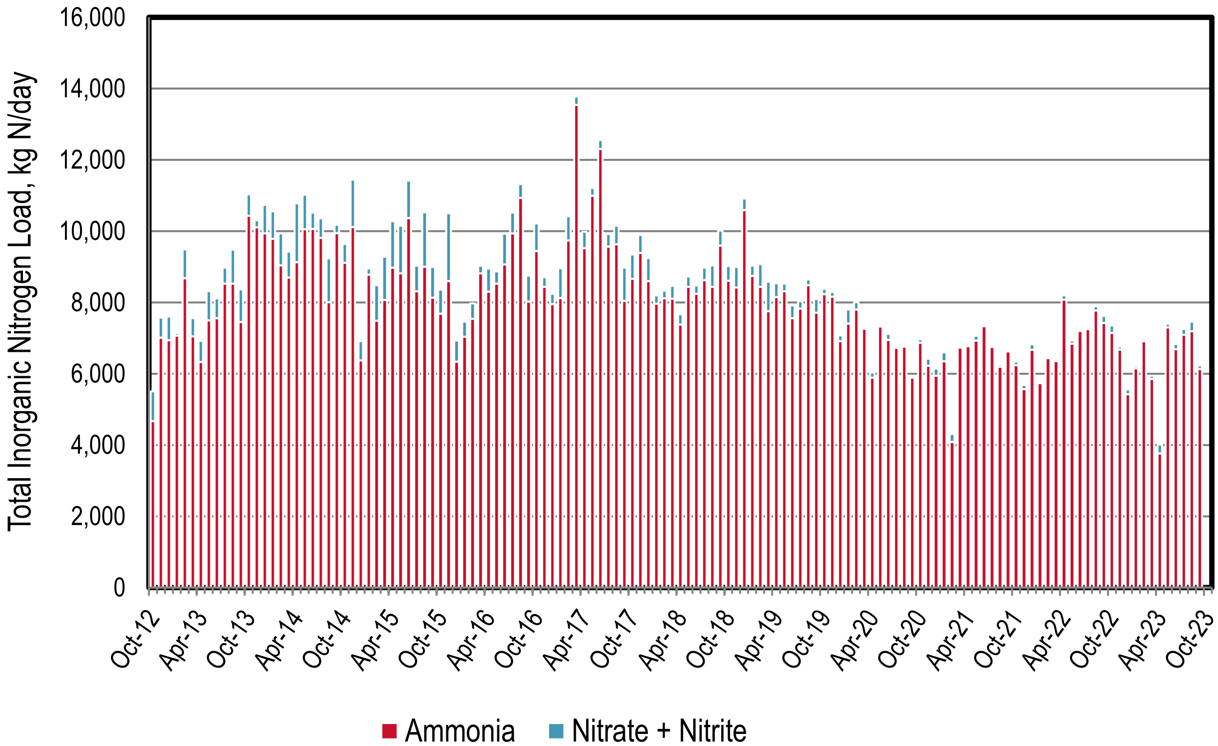

Figure 25-3. Discharge: SFPUC Southeast Monthly Nitrogen Loads

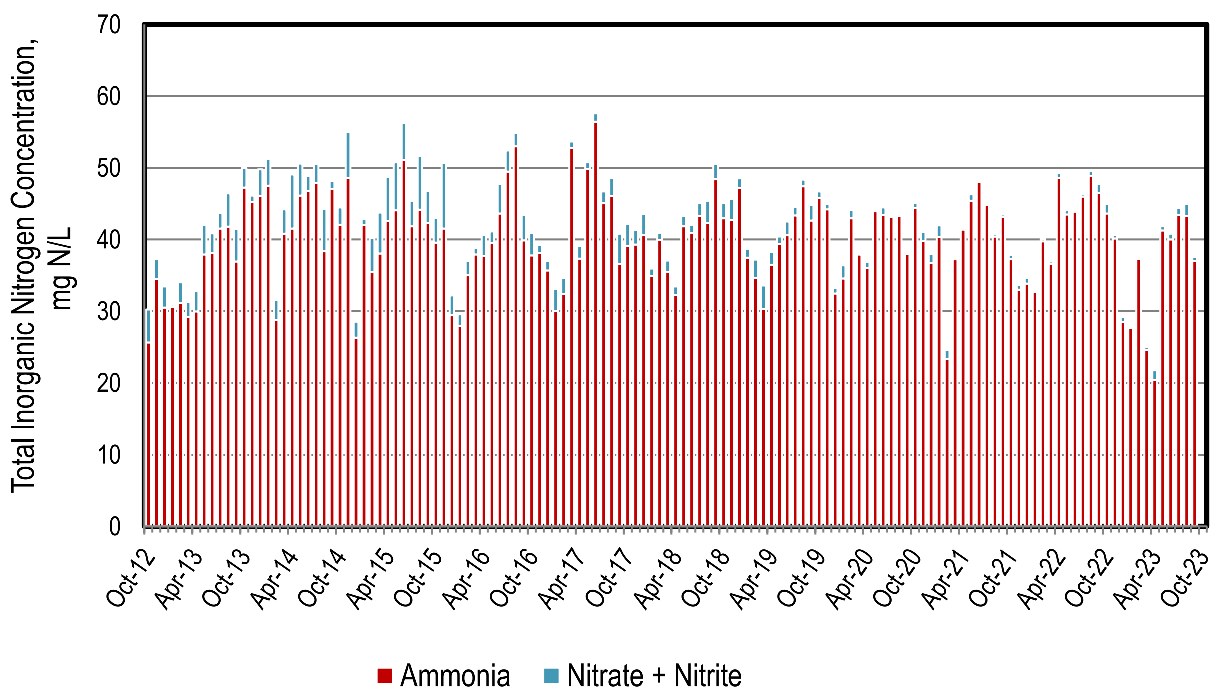

Figure 25-4. Discharge: SFPUC Southeast Monthly Nitrogen Concentrations

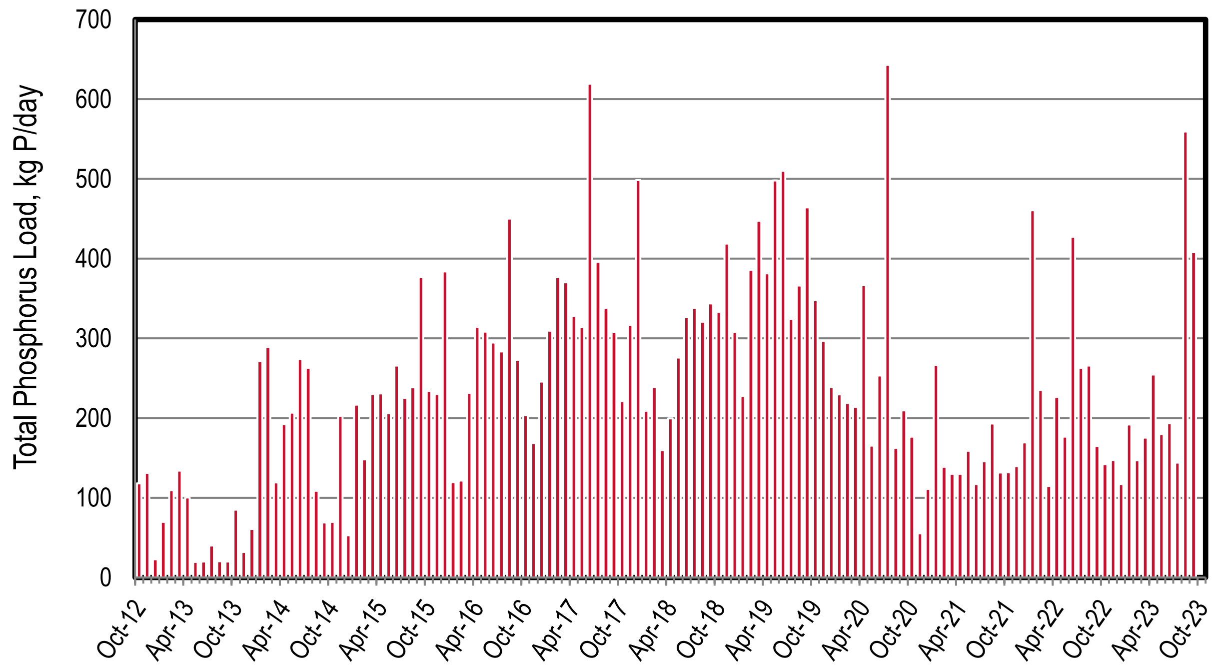

Figure 25-5. Discharge: SFPUC Southeast Monthly Phosphorus Loads

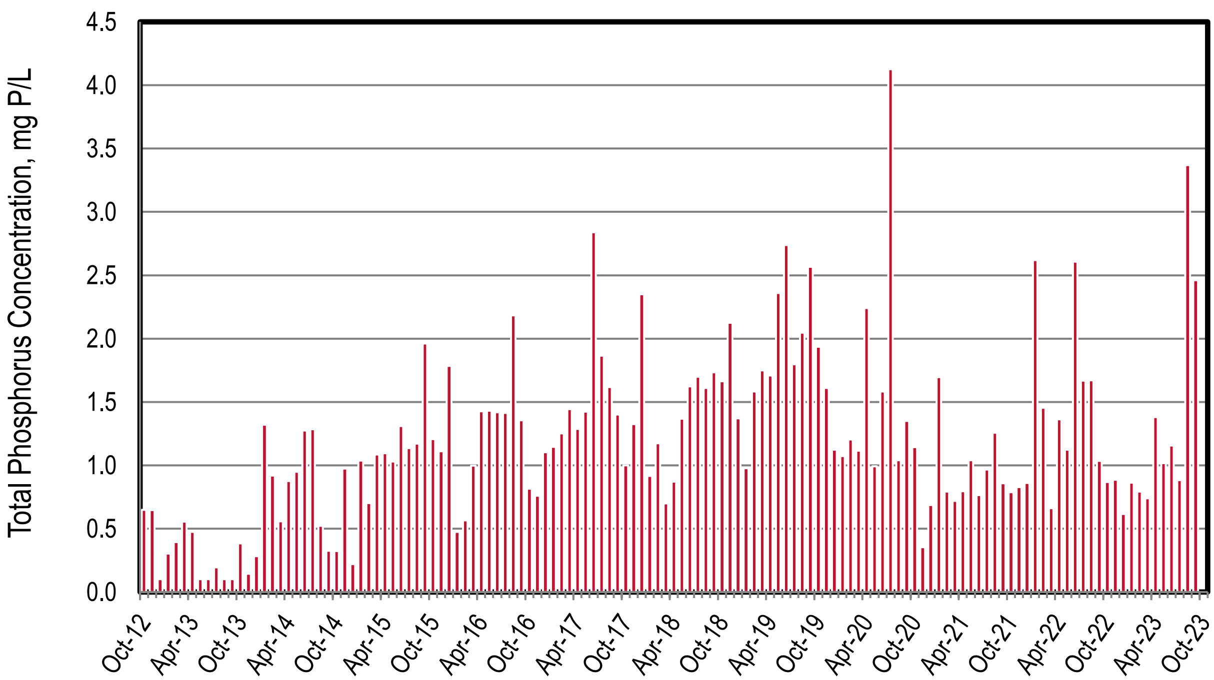

Figure 25-6. Discharge: SFPUC Southeast Monthly Phosphorus Concentrations

Recycled Water

No recycled water was produced or distributed this past year.

26 Sausalito-Marin City Sanitary District (SMCSD)

SMCSD discharges to the San Francisco Bay. The plant has approximately 6,500 service connections and permitted capacity of 1.8 mgd ADWF. The average dry season discharge flow this past year was approximately 0.96 mgd. The plant performs partial nitrification using a trickling filter.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge:
  - The average monthly dry season flow values for 2021/2022 were the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - The plant was under construction from June 2017 to June 2020 with upgrades to improve treatment capacity and performance. During a portion of this period, as required to complete improvements, the plant used one of two sedimentation tanks and fixed film reactors which compromised treatment performance.
  - Nutrient loads do not appear to track with flows during wet weather events.
  - Historically, NOx has represented the majority of the nitrogen species discharged as would be expected since this plant nitrifies. Over the last couple years, the distribution between ammonia and NOx has been more evenly split.
  - Total phosphorus concentrations range from 0.8 to 6.5 mg P/L. This suggests occasional P removal as typical concentrations at treatment plants is approximately 4 to 6 mg P/L. The removal mechanism is most likely from metal salt addition at the headworks.
  - Based on Table 26-1 statistics for the entire dry season dataset, there appears to be an emerging downward trend for flow, nitrate plus nitrate, and total phosphorus loads. There appears to be no emerging upward trend for ammonia and TIN loads. Note: the statistical analysis excluded data while the plant was under construction.
- Recycled Water: No recycled water was produced or distributed this past year. All treatment plant processes utilize reclaimed utility water.

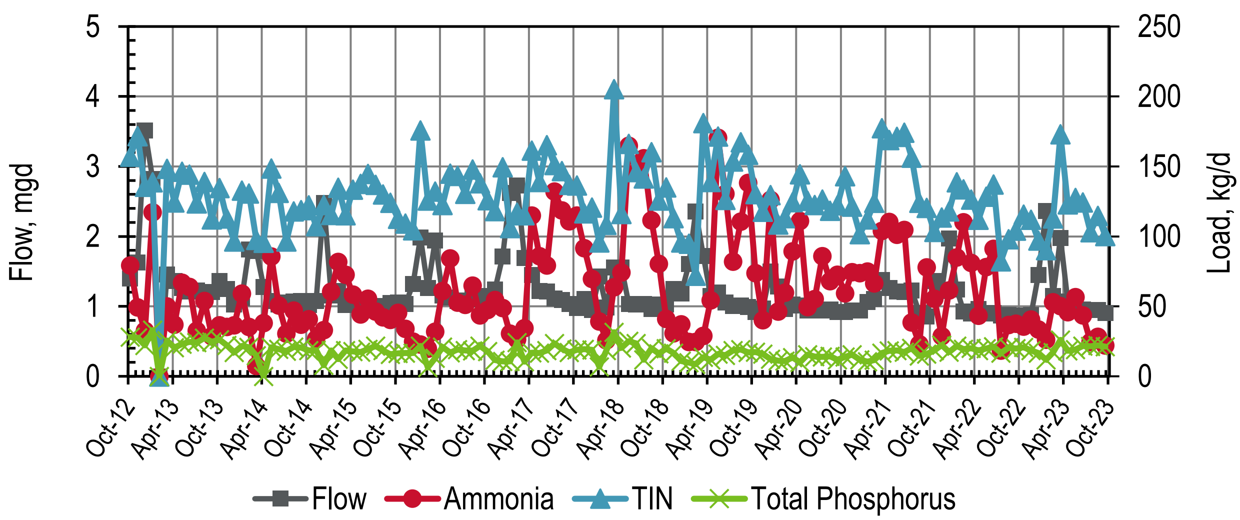

Figure 26-1. Discharge: SMCSD Monthly Flows and Loads

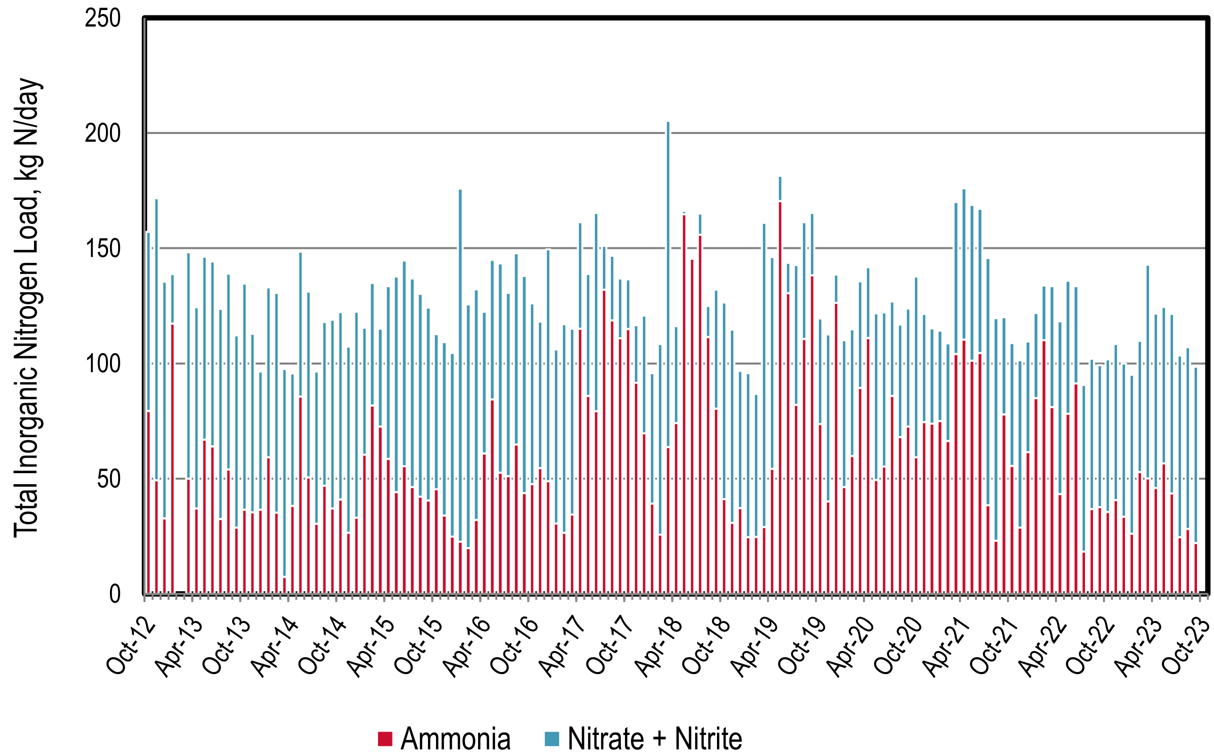

Figure 26-2. Discharge: SMCSD Monthly Nitrogen Loads

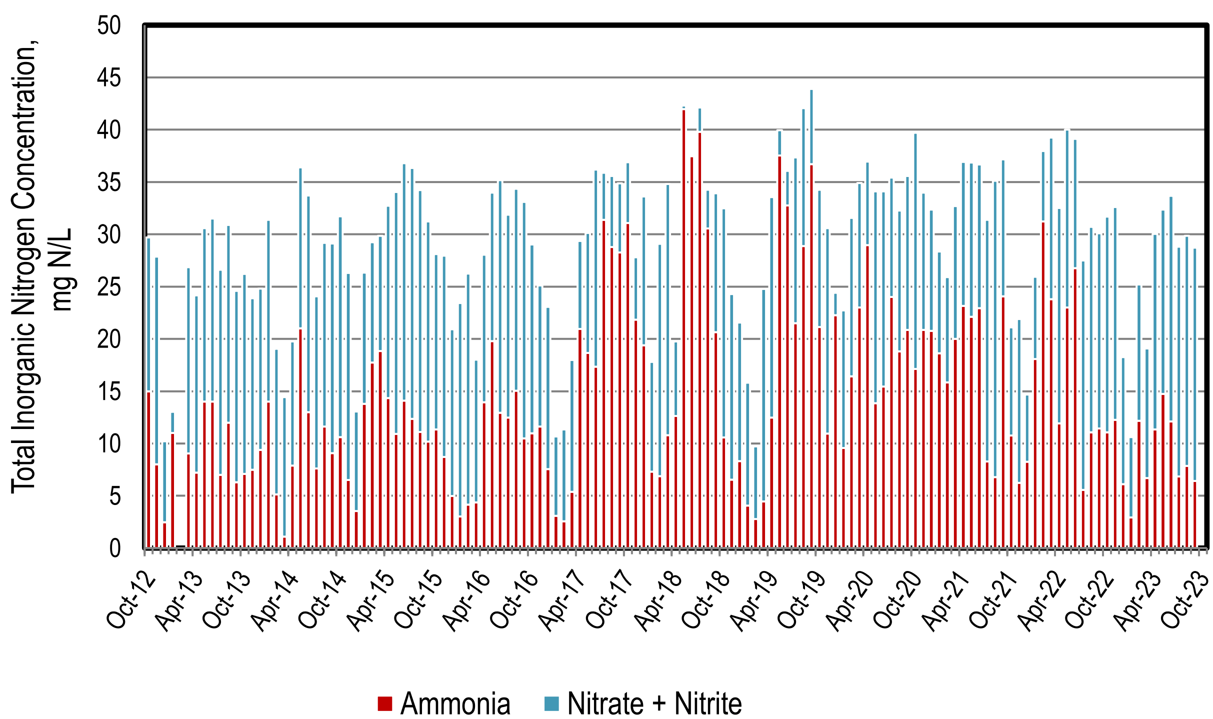

Figure 26-3. Discharge: SMCSD Monthly Nitrogen Concentrations

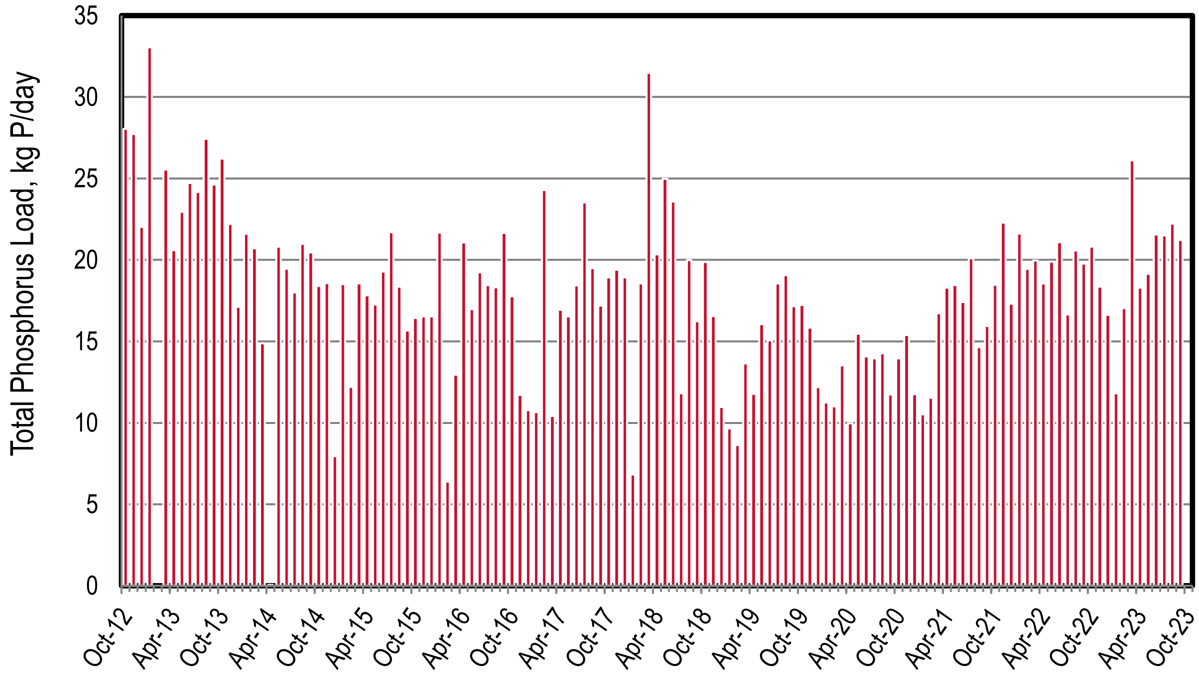

Figure 26-4. Discharge: SMCSD Monthly Phosphorus Loads

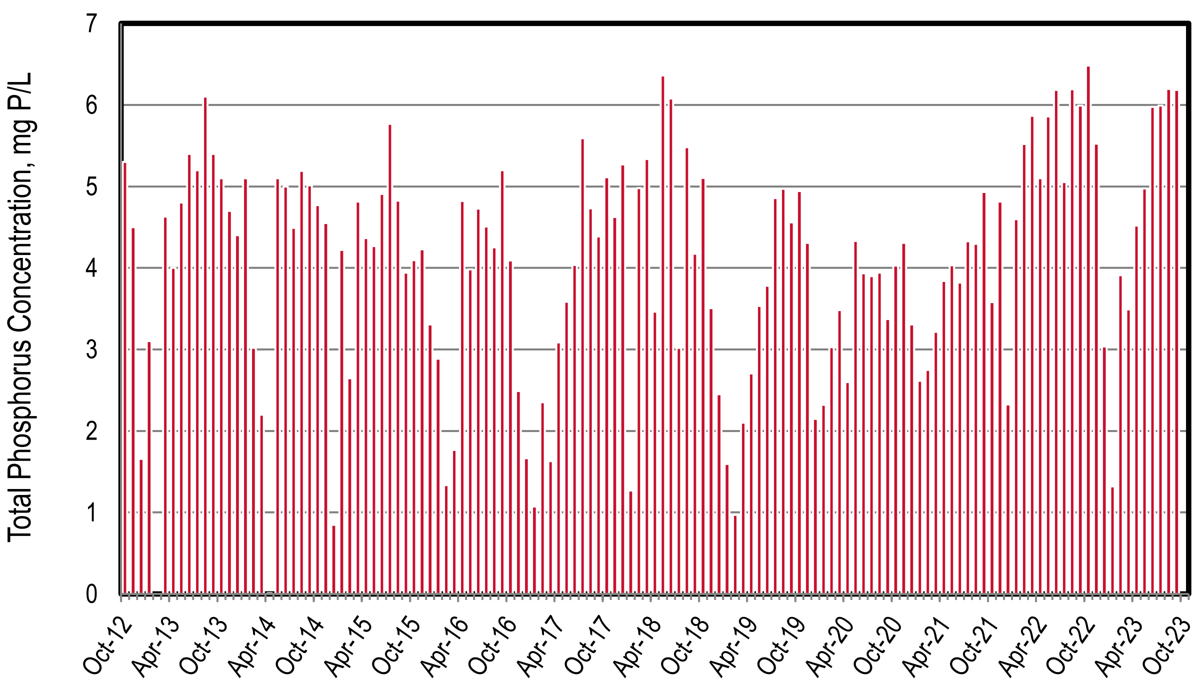

Figure 26-5. Discharge: SMCSD Monthly Phosphorus Concentrations

Table 26-1. Discharge: SMCSD Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.40	79.4	77.8	157	28.0
Nov-12	1.63	49.3	122	172	27.7
Dec-12	3.52	32.7	103	136	22.0
Jan-13	2.82	117	21.5	139	33.0
Feb-13	--	--	--	--	--
Mar-13	1.46	50.0	98.3	148	25.6
Apr-13	1.36	37.1	87.4	124	20.6
May-13	1.27	66.9	79.4	146	23.0
Jun-13	1.21	64.1	80.1	144	24.7
Jul-13	1.23	32.5	91.1	124	24.2
Aug-13	1.19	54.0	85.0	139	27.4
Sep-13	1.21	28.7	83.4	112	24.6
Oct-13	1.36	36.5	98.2	135	26.2
Nov-13	1.25	35.4	77.5	113	22.2
Dec-13	1.03	36.6	60.0	96.6	17.1
Jan-14	1.12	59.3	73.7	133	21.6
Feb-14	1.82	35.3	95.4	131	20.7
Mar-14	1.79	7.44	90.1	97.6	14.9
Apr-14	1.28	38.2	57.4	95.7	0.0484
May-14	1.08	85.7	62.9	149	20.8
Jun-14	1.03	50.6	80.6	131	19.5
Jul-14	1.06	30.5	66.0	96.5	18.0
Aug-14	1.07	47.0	71.0	118	21.0
Sep-14	1.08	37.1	81.9	119	20.5
Oct-14	1.02	40.9	81.4	122	18.4
Nov-14	1.08	26.6	80.8	107	18.6
Dec-14	2.48	33.1	89.4	123	7.94
Jan-15	1.16	60.5	55.0	115	18.5
Feb-15	1.22	81.8	53.1	135	12.2
Mar-15	1.02	72.6	42.5	115	18.6
Apr-15	1.08	58.6	75.0	134	17.8
May-15	1.07	44.2	93.5	138	17.3
Jun-15	1.04	55.5	89.2	145	19.3
Jul-15	0.996	46.5	90.4	137	21.7
Aug-15	1.01	42.2	87.9	130	18.4
Sep-15	1.05	40.5	83.7	124	15.7

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.06	45.5	67.3	113	16.4
Nov-15	1.03	34.0	75.3	109	16.5
Dec-15	1.32	24.8	79.7	105	16.5
Jan-16	1.99	22.7	153	176	21.7
Feb-16	1.27	19.9	106	126	6.40
Mar-16	1.94	32.1	100	132	13.0
Apr-16	1.16	60.9	61.6	123	21.1
May-16	1.13	84.4	60.5	145	17.0
Jun-16	1.08	52.7	90.7	143	19.2
Jul-16	1.08	51.1	79.4	131	18.5
Aug-16	1.14	64.8	83.1	148	18.3
Sep-16	1.10	43.7	94.3	138	21.7
Oct-16	1.15	47.6	78.4	126	17.8
Nov-16	1.24	54.6	63.5	118	11.7
Dec-16	1.71	48.9	101	150	10.8
Jan-17	2.63	30.5	75.5	106	10.7
Feb-17	2.73	26.5	90.5	117	24.3
Mar-17	1.69	34.4	80.7	115	10.4
Apr-17	1.45	115	46.3	161	16.9
May-17	1.22	86.0	52.9	139	16.5
Jun-17	1.21	79.3	86.1	165	18.4
Jul-17	1.11	132	19.0	151	23.5
Aug-17	1.09	119	28.0	147	19.5
Sep-17	1.04	111	26.0	137	17.2
Oct-17	0.979	115	21.5	137	18.9
Nov-17	1.11	91.6	24.9	117	19.4
Dec-17	0.951	69.7	51.1	121	18.9
Jan-18	1.42	39.2	56.6	95.9	6.83
Feb-18	0.986	25.7	82.7	108	18.5
Mar-18	1.56	63.7	142	205	31.5
Apr-18	1.55	74.2	42.0	116	20.4
May-18	1.04	165	1.29	166	25.0
Jun-18	1.03	146	0.669	146	23.6
Jul-18	1.04	156	9.16	142	11.8
Aug-18	0.965	111	13.5	160	20.0
Sep-18	1.03	80.3	51.7	126	16.2
Oct-18	1.03	41.1	85.3	135	19.9

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.25	30.8	83.9	113	16.6
Dec-18	1.19	37.2	59.5	95.8	11.0
Jan-19	1.60	24.5	71.2	94.9	9.66
Feb-19	2.36	24.7	62.0	72.0	8.64
Mar-19	1.72	29.1	132	181	13.7
Apr-19	1.15	54.3	91.9	139	11.8
May-19	1.20	170	11.0	172	16.1
Jun-19	1.05	131	13.2	126	15.1
Jul-19	1.01	82.1	60.6	154	18.5
Aug-19	1.01	111	50.6	167	19.1
Sep-19	0.997	138	27.0	159	17.2
Oct-19	0.923	73.8	45.8	130	17.2
Nov-19	0.973	40.2	72.3	118	15.8
Dec-19	1.50	126	12.2	130	12.2
Jan-20	1.28	46.4	63.7	109	11.2
Feb-20	0.963	59.8	55.1	113	11.0
Mar-20	1.03	89.4	46.3	125	13.5
Apr-20	1.01	111	30.6	144	9.96
May-20	0.945	49.5	72.3	125	15.5
Jun-20	0.947	55.2	66.9	122	14.1
Jul-20	0.947	86.0	40.9	126	14.0
Aug-20	0.958	68.1	48.8	118	14.3
Sep-20	0.921	72.6	51.2	122	11.7
Oct-20	0.917	59.3	78.3	143	14.0
Nov-20	0.945	74.5	46.9	121	15.4
Dec-20	0.942	73.9	41.3	102	11.8
Jan-21	1.07	75.0	39.3	112	10.5
Feb-21	1.11	66.4	42.3	124	11.5
Mar-21	1.38	104	65.9	178	16.7
Apr-21	1.26	110	65.7	169	18.3
May-21	1.21	101	67.6	171	18.5
Jun-21	1.21	105	62.5	174	17.4
Jul-21	1.23	38.5	107	156	20.1
Aug-21	0.902	23.1	96.6	124	14.7
Sep-21	0.855	77.8	42.3	120	15.9
Oct-21	1.36	55.6	53.2	103	18.5
Nov-21	1.22	28.8	72.5	114	22.3

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	1.97	61.6	47.9	118	17.3
Jan-22	1.24	84.9	37.0	139	21.6
Feb-22	0.933	110	23.7	134	19.5
Mar-22	0.901	81.0	52.6	127	20.0
Apr-22	0.962	43.4	74.9	112	18.6
May-22	0.899	78.1	57.8	128	19.9
Jun-22	0.903	91.3	42.2	137	21.1
Jul-22	0.871	18.4	72.3	82.3	16.7
Aug-22	0.879	36.8	65.3	98.0	20.6
Sep-22	0.873	37.7	61.6	104	19.8
Oct-22	0.850	35.6	66.2	116	20.8
Nov-22	0.879	40.7	67.6	112	18.4
Dec-22	1.45	33.5	66.5	97.1	16.6
Jan-23	2.37	26.2	68.9	90.3	11.8
Feb-23	1.15	53.0	56.8	113	17.0
Mar-23	1.98	50.2	92.7	173	26.1
Apr-23	1.07	46.0	75.6	123	18.3
May-23	1.02	56.7	67.8	128	19.1
Jun-23	0.954	43.7	77.8	124	21.6
Jul-23	0.950	24.5	78.9	103	21.5
Aug-23	0.949	28.2	78.9	115	22.2
Sep-23	0.908	22.1	76.5	100	21.2
Dry Season Average	**1.05**	**71.9**	**62.2**	**134**	**19.1**
Dry Season Trend **,***	**Down**	**Up**	**Down**	**None**	**Down**
Wet Season Average	**1.37**	**54.1**	**68.7**	**124**	**16.7**
Average Annual	**1.24**	**61.5**	**66.0**	**128**	**17.7**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** The plant was under construction from June 2017 to June 2020 with upgrades to improve treatment capacity and performance. During a portion of this period, as required to complete improvements, the plant has been using one of two sedimentation tanks and fixed film reactors which has compromised the overall treatment performance. As a result, corresponding data from June 2017 to July 2018 was excluded from the statistical analysis as it is not reflective of plant treatment capacity and performance.

Recycled Water

- No recycled water was produced or distributed this past year. All treatment plant processes utilize reclaimed utility water.

27 Sonoma Valley County Sanitation District

Sonoma Valley County Sanitation District (District) discharges to Schell Slough, Ringstrom Bay, and various restoration management units which are connected to San Pablo Bay. The District's treatment plant has approximately 17,200 service connections and a permitted discharge capacity of 3.0 mgd ADWF. The plant has a wet weather treatment capacity of 16 mgd. The plant performs nitrogen removal using an activated sludge process.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge
  - Between 4/2019 and 11/2021, the District did not discharge. Relatively large wet weather events (e.g., New Year's 2022/2023) result in the need to discharge to the Bay.
  - There are no emerging dry season trends as Sonoma Valley is prohibited from discharging to Schell Slough during the dry season. There is one exception in May 2017, where discharge was for 3 days due to the relatively wet month. Sonoma Valley is only allowed to discharge if flows entering the plant >6 mgd or storage is 50% or more full.
  - There are only 27 out of 132 months in which they discharged to Schell Slough. The water was all recycled during the other months.
  - The plant meets Level 2 total inorganic nitrogen levels (i.e., 15 mg N/L) developed under the Scoping and Evaluation Plan for the 1st Watershed Permit (R2-2014-0014) for all but five months. Such levels typically occur during relatively high levels of precipitation.
- Recycled Water
  - Based on Table 1-2, the plant averaged 1.47 mgd of recycled water in the 2022 calendar year. Uses included landscape and agricultural irrigation, as well as other non-potable uses including construction site dust control, sewer flushing, and wetland restoration.
  - Based on Table 27-3 through Table 27-5, the plant averaged the diversion of <1 kg Ammonia-N/d, 7 kg TIN-N/d, and 14 kg P/d away from the San Francisco Bay through recycled water in 2022.

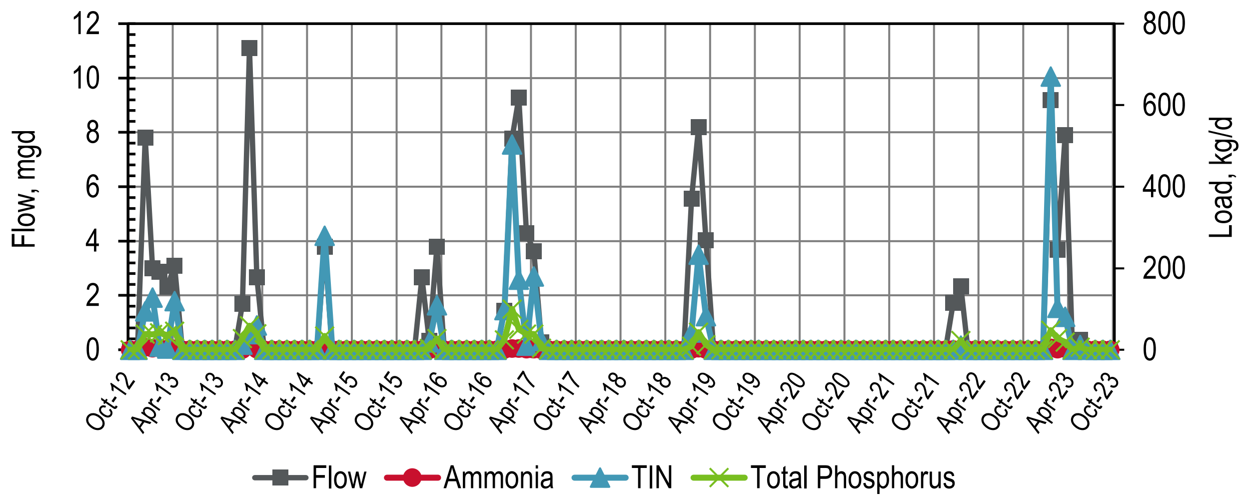

Figure 27-1. Discharge: Sonoma Valley Monthly Flows and Loads

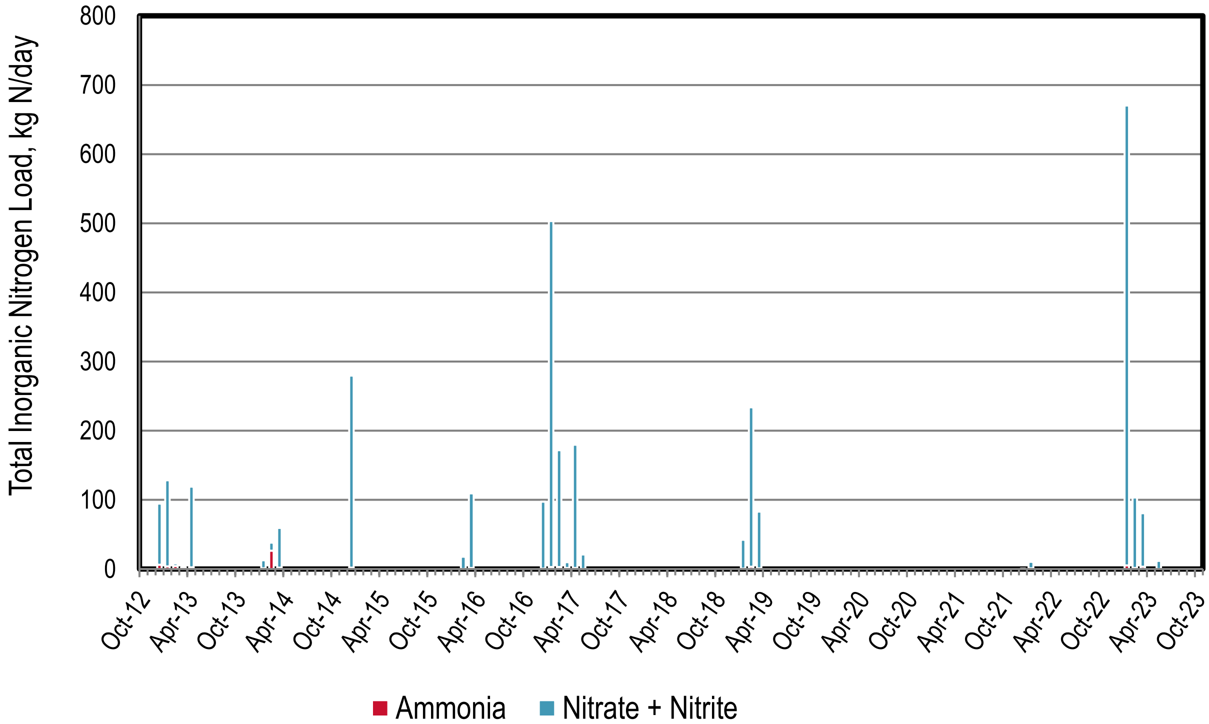

Figure 27-2. Discharge: Sonoma Valley Monthly Nitrogen Loads

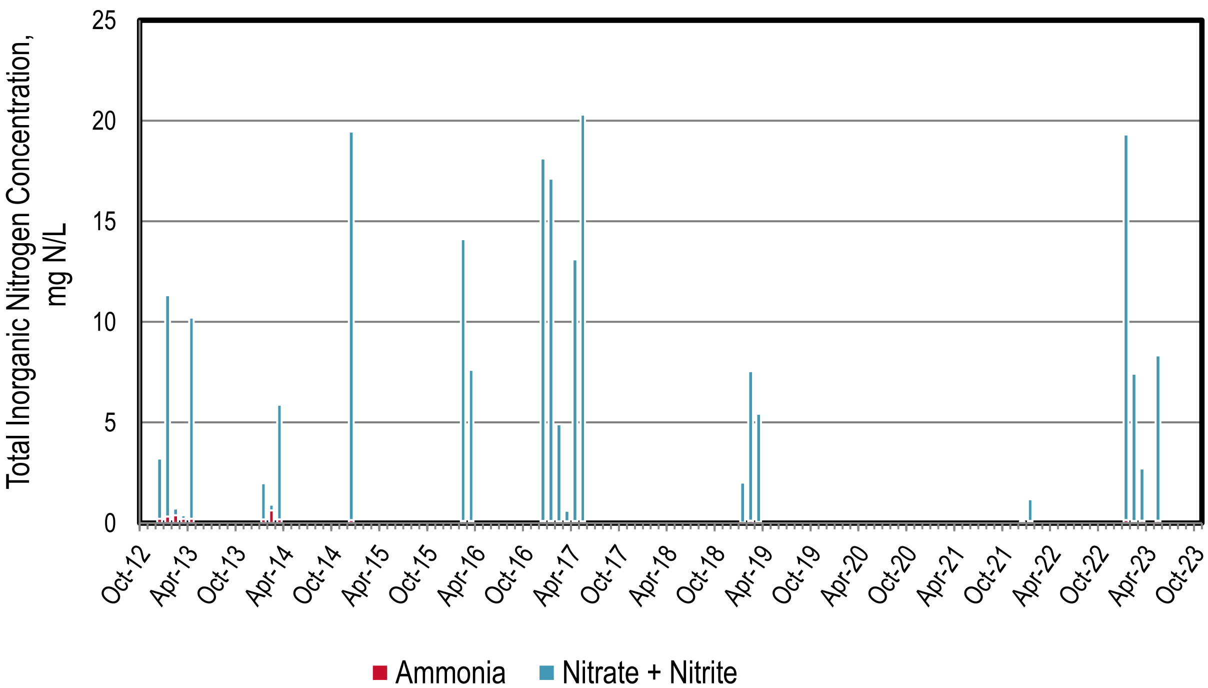

Figure 27-3. Discharge: Sonoma Valley Monthly Nitrogen Concentrations

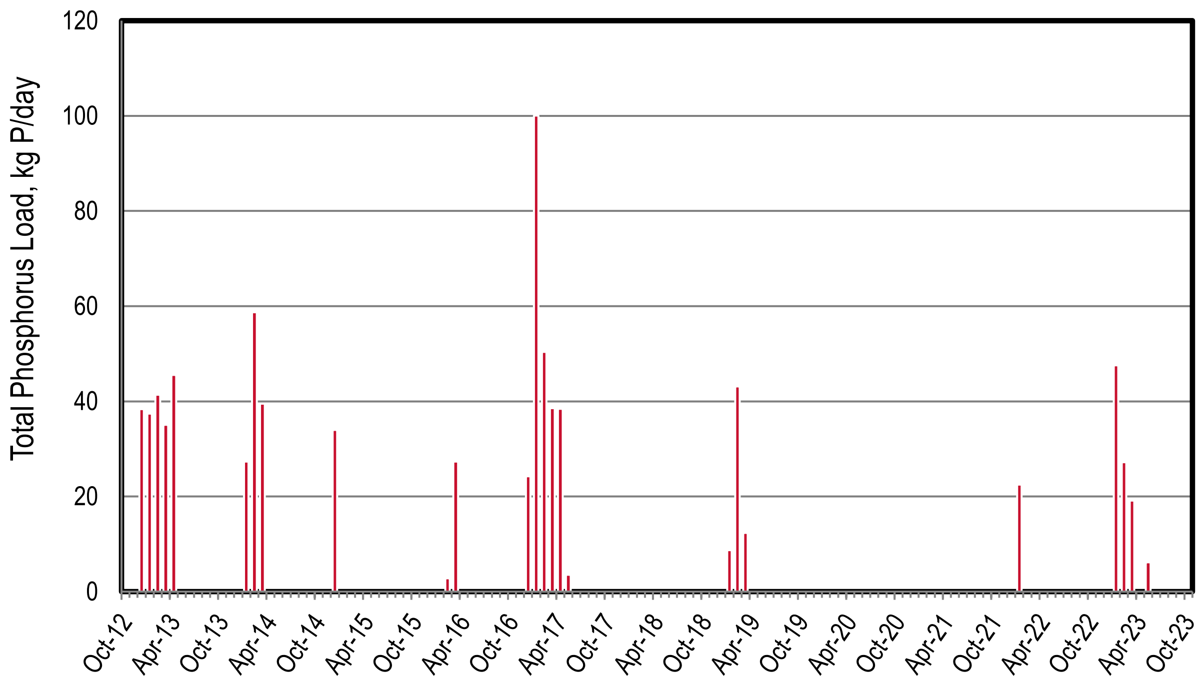

Figure 27-4. Discharge: Sonoma Valley Monthly Phosphorus Loads

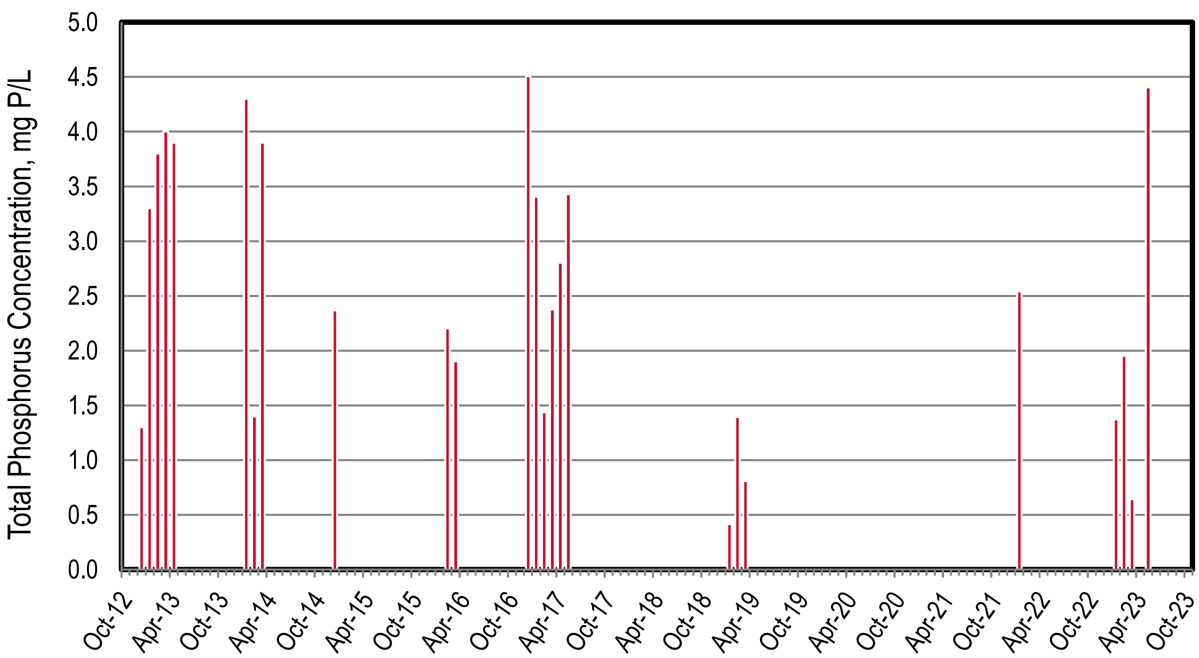

Figure 27-5. Discharge: Sonoma Valley Monthly Phosphorus Concentrations

Table 27-1. Discharge: Sonoma Valley Monthly Flows and Loads

Month, Year	Average Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0	0	0	0	0
Nov-12	0	0	0	0	0
Dec-12	7.80	6.19	88.5	94.7	38.3
Jan-13	3.00	3.63	125	128	37.4
Feb-13	2.88	4.25	3.67	7.92	41.4
Mar-13	2.32	1.84	1.55	3.39	35.1
Apr-13	3.09	2.45	117	119	45.6
May-13	0	0	0	0	0
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	0	0	0	0	0
Nov-13	0	0	0	0	0
Dec-13	0	0	0	0	0
Jan-14	1.68	1.14	11.5	12.6	27.3
Feb-14	11.1	26.4	11.9	38.3	58.7
Mar-14	2.68	1.82	57.8	59.6	39.5
Apr-14	0	0	0	0	0
May-14	0	0	0	0	0
Jun-14	0	0	0	0	0
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	0	0	0	0	0
Nov-14	0	0	0	0	0
Dec-14	3.80	2.14	278	280	34.0
Jan-15	0	0	0	0	0
Feb-15	0	0	0	0	0
Mar-15	0	0	0	0	0
Apr-15	0	0	0	0	0
May-15	0	0	0	0	0
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0

Month, Year	Average Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0	0	0	0	0
Nov-15	0	0	0	0	0
Dec-15	0	0	0	0	0
Jan-16	2.67	--	--	--	--
Feb-16	0.335	0.127	17.8	17.9	2.79
Mar-16	3.80	1.44	108	109	27.3
Apr-16	0	0	0	0	0
May-16	0	0	0	0	0
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16	0	0	0	0	0
Nov-16	0	0	0	0	0
Dec-16	1.42	0.539	96.9	97.5	24.2
Jan-17	7.78	2.94	500	503	100
Feb-17	9.27	2.96	169	172	50.4
Mar-17	4.29	1.54	8.48	10.0	38.6
Apr-17	3.62	1.37	178	180	38.4
May-17	0.275	0.0912	21.0	21.1	3.56
Jun-17	0	0	0	0	0
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	0	0	0	0	0
Oct-17	0	0	0	0	0
Nov-17	0	0	0	0	0
Dec-17	0	0	0	0	0
Jan-18	0	0	0	0	0
Feb-18	0	0	0	0	0
Mar-18	0	0	0	0	0
Apr-18	0	0	0	0	0
May-18	0	0	0	0	0
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	0	0	0	0	0
Oct-18	0	0	0	0	0

Month, Year	Average Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0	0	0	0	0
Dec-18	0	0	0	0	0
Jan-19	5.55	0.458	41.7	42.1	8.70
Feb-19	8.19	3.60	230	234	43.1
Mar-19	4.03	0.881	82.0	82.9	12.3
Apr-19	0	0	0	0	0
May-19	0	0	0	0	0
Jun-19	0	0	0	0	0
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	0	0	0	0	0
Nov-19	0	0	0	0	0
Dec-19	0	0	0	0	0
Jan-20	0	0	0	0	0
Feb-20	0	0	0	0	0
Mar-20	0	0	0	0	0
Apr-20	0	0	0	0	0
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	0	0	0	0	0
Oct-20	0	0	0	0	0
Nov-20	0	0	0	0	0
Dec-20	0	0	0	0	0
Jan-21	0	0	0	0	0
Feb-21	0	0	0	0	0
Mar-21	0	0	0	0	0
Apr-21	0	0	0	0	0
May-21	0	0	0	0	0
Jun-21	0	0	0	0	0
Jul-21	0	0	0	0	0
Aug-21	0	0	0	0	0
Sep-21	0	0	0	0	0
Oct-21	0	0	0	0	0
Nov-21	0	0	0	0	0

Month, Year	Average Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	1.73	0.582	0	0	0
Jan-22	2.34	0.977	9.47	10.5	22.5
Feb-22	0	0	0	0	0
Mar-22	0	0	0	0	0
Apr-22	0	0	0	0	0
May-22	0	0	0	0	0
Jun-22	0	0	0	0	0
Jul-22	0	0	0	0	0
Aug-22	0	0	0	0	0
Sep-22	0	0	0	0	0
Oct-22	0	0	0	0	0
Nov-22	0	0	0	0	0
Dec-22	0	0	0	0	0
Jan-23	9.18	5.12	665	670	47.6
Feb-23	3.68	1.36	102	103	27.2
Mar-23	7.89	3.42	77.5	80.9	19.1
Apr-23	0	0	0	0	0
May-23	0.371	0.168	11.5	11.7	6.17
Jun-23	0	0	0	0	0
Jul-23	0	0	0	0	0
Aug-23	0	0	0	0	0
Sep-23	0	0	0	0	0
Dry Season Average	**0.0117**	**0.00472**	**0.591**	**0.595**	**0.177**
Dry Season Trend **	**--****	**--****	**--****	**--****	**--****
Wet Season Average	**1.48**	**1.00**	**38.7**	**39.7**	**10.6**
Average Annual	**0.870**	**0.587**	**22.8**	**23.4**	**6.28**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** No dry season trending analysis was performed on Sonoma Valley as the facility has only discharged once during the dry season since sampling began in 2012.

Recycled Water

Table 27-2. Recycled Water: Sonoma Valley County Sanitation District Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	6 (0.01)	--	--	801 (0.72)	--	2 (<0.01)	809 (0.72)
2020	--	7 (0.01)	--	--	1,440 (1.28)	--	4 (<0.01)	1,450 (1.29)
2021	--	33 (0.03)	--	--	1,380 (1.23)	--	560 (0.50)	1,970 (1.76)
2022	--	28 (0.02)	--	--	1,320 (1.18)	--	298 (0.27)	1,650 (1.47)
Average	--	18 (0.02)	--	--	1,240 (1.10)	--	216 (0.19)	1,470 (1.31)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 27-3. Recycled Water: Sonoma Valley County Sanitation District Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	--	<1	--	<1	<1
2020***	--***	--***	--***	--***	--***	--***	--***	--***
2021	--	<1	--	--	<1	--	<1	1
2022	--	<1	--	--	1	--	<1	1
Average	--	<1	--	--	<1	--	<1	1

*** Assumes 100% of the recycled load is diverted from the Bay**

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** No bay discharge during this calendar year (i.e., all the effluent used for recycled water applications)**

Table 27-4. Recycled Water: Sonoma Valley County Sanitation District Yearly Recycled Water TIN Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	--	14	--	<1	19
2020***	--***	--***	--***	--***	--***	--***	--***	--***
2021****	--****	--****	--****	--****	--****	--****	--****	--****
2022	--	<1	--	--	5	--	1	7
Average	--	<1	--	--	10	--	<1	11

*** Assumes 100% of the recycled load is diverted from the Bay**

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** No bay discharge during this calendar year (i.e., all the effluent used for recycled water applications)**

**** **No TIN effluent samples during this calendar year as there was limited discharge to the Bay**

Table 27-5. Recycled Water: Sonoma Valley County Sanitation District Yearly Recycled Water Total Phosphorus Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	<1	--	--	3	--	<1	9
2020***	--***	--***	--***	--***	--***	--***	--***	--***
2021****	--****	--****	--****	--****	--****	--****	--****	--****
2022	--	<1	--	--	11	--	3	14
Average	--	<1	--	--	7	--	1	8

*** Assumes 100% of the recycled load is diverted from the Bay**

**** Calendar year as opposed to California's water year (October 1 through September 30)**

***** No bay discharge during this calendar year (i.e., all the effluent used for recycled water applications)**

**** **No Total P effluent samples during this calendar year as there was limited discharge to the Bay**

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28 South San Francisco-San Bruno

South SF-San Bruno discharges to Lower San Francisco Bay (referred to as South Bay in the Group Annual Report). The plant has a permitted capacity of 13 mgd ADWF and a peak wet weather capacity of 30 mgd (blending allowable above 30 mgd). The average dry season discharge flow this past year was 7.6 mgd. The process includes a conventional activated sludge system.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent
  - Note: limited to data since July 2019; quarterly data is required but more is provided for various parameters.
  - The flow reduction across the plant is negligible.
  - The nitrogen load reduction values across the plant ranges from approximately 5 to 60 percent. This load reduction is attributed primarily to a combination of biosolids management, biological assimilation, and/or occasional load reduction in the activated sludge system.
  - The phosphorus load reduction across the plant ranges from approximately 20 to 95 percent. Such a load reduction is attributed to a combination of biological assimilation for growth, chemical precipitation, biosolids management, and biological removal.
  - Based on Table 28-1’s statistical analysis for the entire dry season dataset, ammonia, TIN, TKN, and TN loads have an emerging upwards trend (flow, nitrite plus nitrate and phosphorus have no trends).
- Discharge
  - TIN loads generally increase with flow during wet weather events.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since the plant does not reliably nitrify year-round.
  - Ammonia loads are occasionally greater than TIN loads, and TIN monthly loads occasionally differ from the sum of ammonia and NOx monthly loads. This is attributed to sampling frequency as ammonia is sampled daily and other nitrogen species bimonthly.
  - Total phosphorus concentrations range from 0.2 to 9 mg P/L. The plant has reliably produced discharge of less than 3 mg P/L the past two dry seasons. This has resulted in considerable total P load reduction across the plant as noted.
  - Based on Table 28-2 statistics for the entire dry season dataset, Ammonia and TIN loads appear to be trending upwards. In contrast, flow, nitrite plus nitrate loads, and total P loads appear to be trending downwards.
- Recycled Water: No recycled water was produced or distributed this past year.

Influent

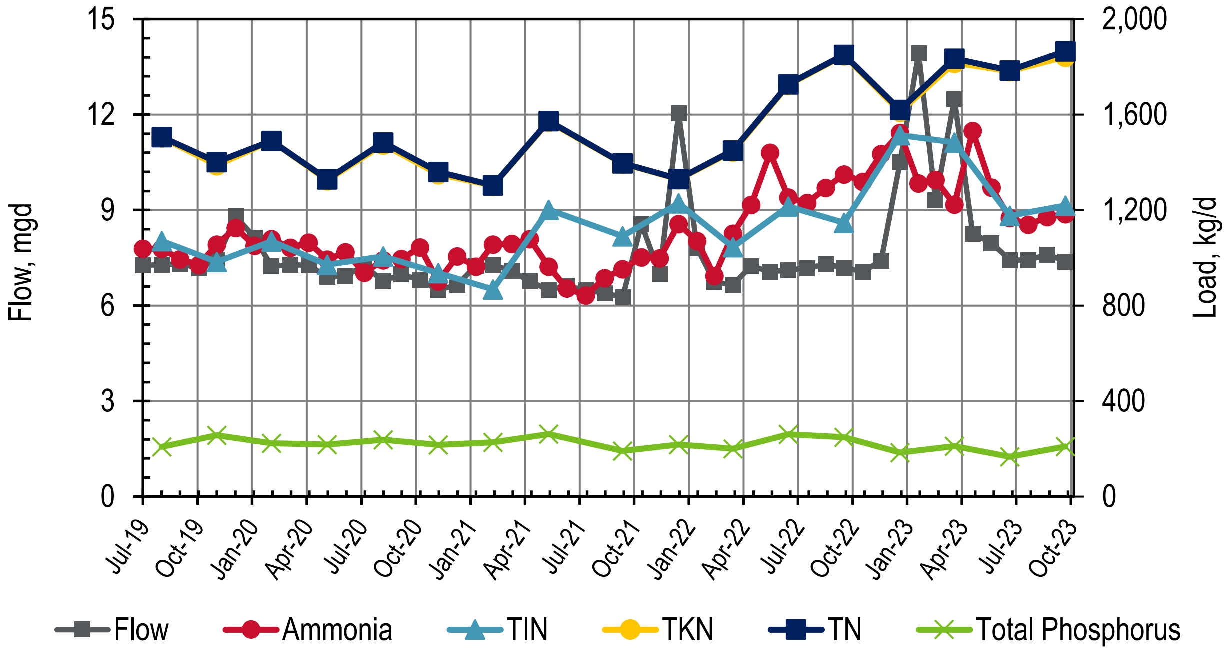

Figure 28-1. Influent: South SF-San Bruno Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

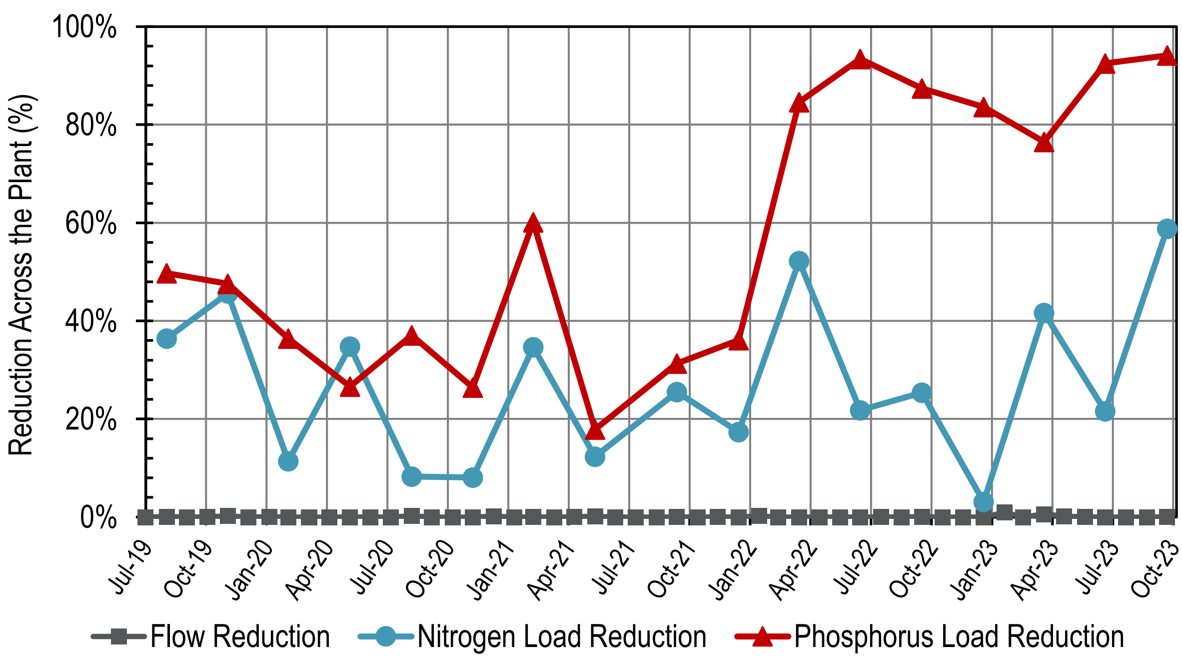

Figure 28-2. Influent: South SF-San Bruno Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 28-1. Influent: South SF-San Bruno Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN **	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	7.27	1,040	--	--	--	--	--
Aug-19	7.29	1,040	1.11	1,070	1,500	1,510	209
Sep-19	7.32	994	--	--	--	--	--
Oct-19	7.17	971	--	--	--	--	--
Nov-19	7.43	1,060	13.3	984	1,390	1,400	257
Dec-19	8.80	1,120	--	--	--	--	--
Jan-20	8.14	1,050	--	--	--	--	--
Feb-20	7.23	1,080	1.10	1,070	1,490	1,490	223
Mar-20	7.28	1,040	--	--	--	--	--
Apr-20	7.26	1,060	--	--	--	--	--
May-20	6.91	992	4.41	972	1,320	1,330	218
Jun-20	6.93	1,020	--	--	--	--	--
Jul-20	7.26	938	--	--	--	--	--
Aug-20	6.76	990	7.09	1,010	1,480	1,480	238
Sep-20	6.98	995	--	--	--	--	--
Oct-20	6.80	1,040	--	--	--	--	--
Nov-20	6.49	901	8.92	936	1,350	1,360	216
Dec-20	6.65	1,010	--	--	--	--	--
Jan-21	7.25	964	--	--	--	--	--
Feb-21	7.29	1,060	1.09	868	1,300	1,300	228
Mar-21	7.08	1,060	--	--	--	--	--
Apr-21	6.76	1,080	--	--	--	--	--
May-21	6.49	963	2.88	1,200	1,570	1,570	262
Jun-21	6.62	872	--	--	--	--	--
Jul-21	6.48	842	--	--	--	--	--
Aug-21	6.39	915	--	--	--	--	--
Sep-21	6.26	952	2.03	1,090	1,390	1,400	191
Oct-21	8.56	1,000	--	--	--	--	--
Nov-21	7.00	998	--	--	--	--	--
Dec-21	12.0	1,140	1.36	1,230	1,330	1,330	218
Jan-22	7.81	1,070	--	--	--	--	--
Feb-22	6.73	925	--	--	--	--	--
Mar-22	6.66	1,100	4.31	1,040	1,450	1,450	200
Apr-22	7.25	1,220	--	--	--	--	--
May-22	7.06	1,440	--	--	--	--	--
Jun-22	7.11	1,250	1.83	1,220	1,720	1,730	261

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN **	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	7.18	1,230	--	--	--	--	--
Aug-22	7.30	1,290	--	--	--	--	--
Sep-22	7.20	1,350	2.04	1,150	1,850	1,850	249
Oct-22	7.07	1,320	--	--	--	--	--
Nov-22	7.42	1,430	--	--	--	--	--
Dec-22	10.5	1,520	8.92	1,510	1,610	1,620	184
Jan-23	13.9	1,310	--	--	--	--	--
Feb-23	9.30	1,330	--	--	--	--	--
Mar-23	12.5	1,220	17.3	1,480	1,820	1,830	211
Apr-23	8.26	1,530	--	--	--	--	--
May-23	7.97	1,290	--	--	--	--	--
Jun-23	7.43	1,170	2.77	1,180	1,780	1,780	167
Jul-23	7.43	1,140	--	--	--	--	--
Aug-23	7.60	1,170	--	--	--	--	--
Sep-23	7.38	1,180	22.8	1,220	1,840	1,870	209
Dry Season Average	**7.07**	**1,090**	**5.22**	**1,120**	**1,610**	**1,610**	**223**
Dry Season Trend	**None**	**Up**	**None**	**Up**	**Up**	**Up**	**None**
Wet Season Average	**8.09**	**1,130**	**7.04**	**1,140**	**1,470**	**1,470**	**217**
Average Annual	**7.63**	**1,110**	**6.08**	**1,130**	**1,540**	**1,550**	**220**

* South SF-San Bruno typically samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the "Ammonia" and "Nitrate + Nitrite" values. The Total Nitrogen value is calculated by adding "TKN" and "Nitrate + Nitrite".

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

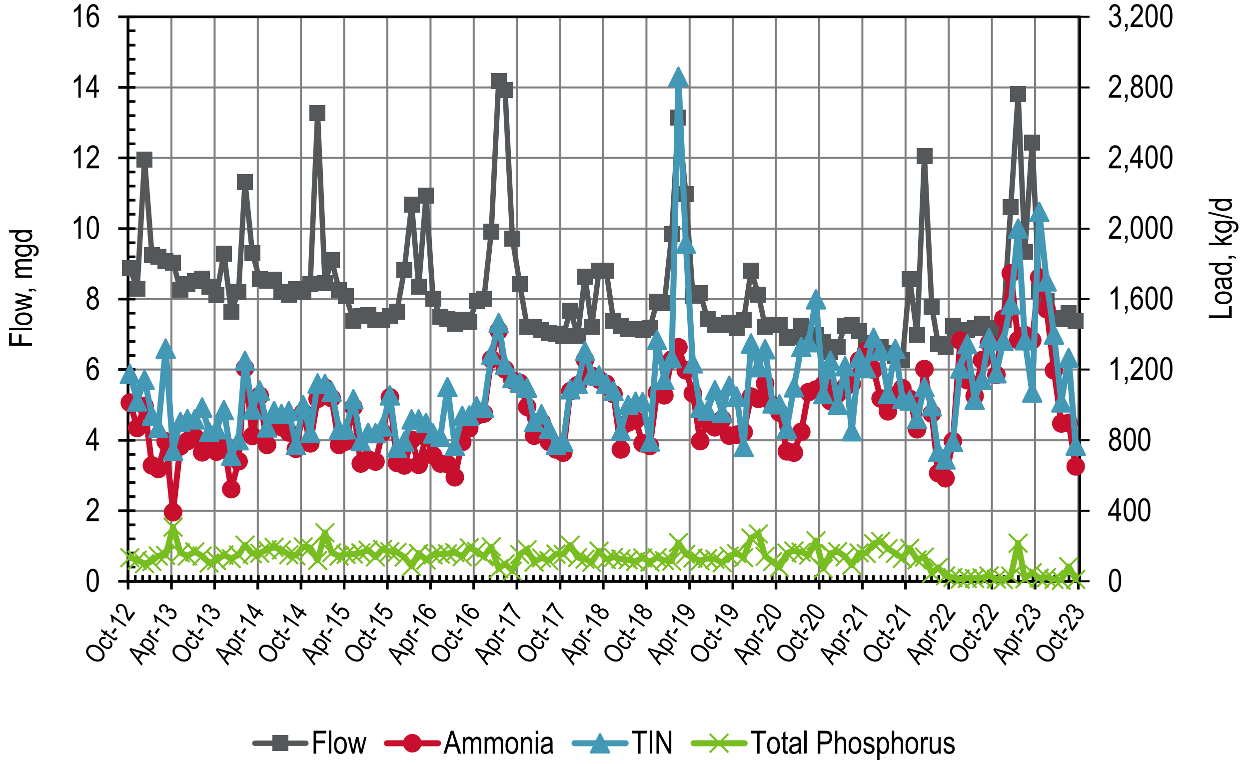

Figure 28-3. Discharge: South SF-San Bruno Monthly Flows and Loads

Table 28-2. Discharge: South SF-San Bruno Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	8.88	1,010	164	1,180	134
Nov-12	8.30	870	151	1,020	121
Dec-12	12.0	995	149	1,140	101
Jan-13	9.24	658	284	942	114
Feb-13	9.21	637	233	870	144
Mar-13	9.08	793	527	1,320	147
Apr-13	9.04	393	349	742	308
May-13	8.28	766	139	905	162
Jun-13	8.43	797	124	920	145
Jul-13	8.51	820	99.6	919	167
Aug-13	8.58	733	254	986	144
Sep-13	8.35	789	59.9	849	104
Oct-13	8.11	736	127	862	118
Nov-13	9.29	779	193	972	149
Dec-13	7.65	523	191	714	130
Jan-14	8.21	681	121	802	150
Feb-14	11.3	1,210	42.7	1,250	206
Mar-14	9.31	824	150	975	157
Apr-14	8.56	1,050	29.4	1,080	160
May-14	8.53	774	100	874	181
Jun-14	8.55	889	77.4	966	194
Jul-14	8.22	876	74.4	950	178
Aug-14	8.13	844	122	966	151
Sep-14	8.28	752	22.8	774	147
Oct-14	8.22	960	39.2	999	197
Nov-14	8.43	783	59.7	843	191
Dec-14	13.3	1,040	87.7	1,120	119
Jan-15	8.45	1,100	23.5	1,120	276
Feb-15	9.11	1,040	36.8	1,080	162
Mar-15	8.26	774	88.0	861	144
Apr-15	8.09	794	68.5	863	152
May-15	7.39	989	45.2	1,030	155
Jun-15	7.52	669	127	796	162
Jul-15	7.54	693	150	843	178
Aug-15	7.41	680	161	842	138
Sep-15	7.42	845	34.1	879	182

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	7.52	1,050	10.9	1,060	169
Nov-15	7.64	673	86.8	759	164
Dec-15	8.83	657	137	794	138
Jan-16	10.7	803	115	919	85.0
Feb-16	8.35	661	258	919	159
Mar-16	10.9	817	82.8	899	122
Apr-16	8.02	714	125	839	152
May-16	7.51	668	153	822	155
Jun-16	7.44	665	438	1,100	158
Jul-16	7.31	590	178	768	164
Aug-16	7.42	791	149	940	140
Sep-16	7.35	868	73.0	940	191
Oct-16	7.95	940	53.3	993	171
Nov-16	8.01	951	34.1	986	140
Dec-16	9.92	1,260	25.5	1,290	197
Jan-17	14.2	1,420	44.9	1,470	70.8
Feb-17	13.9	1,200	24.9	1,230	101
Mar-17	9.73	1,140	11.9	1,150	58.9
Apr-17	8.43	1,130	2.79	1,130	152
May-17	7.22	990	108	1,100	181
Jun-17	7.21	826	78.7	904	110
Jul-17	7.12	904	44.6	949	134
Aug-17	7.06	793	72.4	865	119
Sep-17	7.02	748	28.4	776	154
Oct-17	6.96	730	62.2	792	154
Nov-17	7.68	1,080	10.9	1,090	205
Dec-17	6.96	1,110	10.1	1,120	135
Jan-18	8.64	1,260	48.2	1,310	125
Feb-18	7.23	1,170	3.93	1,170	108
Mar-18	8.81	1,140	23.5	1,170	172
Apr-18	8.82	1,120	3.25	1,120	125
May-18	7.39	1,060	17.7	1,080	138
Jun-18	7.24	749	105	855	129
Jul-18	7.15	901	51.9	1,000	122
Aug-18	7.15	913	31.7	1,020	113
Sep-18	7.12	783	39.0	1,020	134
Oct-18	7.19	769	45.7	794	110

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	7.92	1,070	30.6	1,370	135
Dec-18	7.88	1,060	20.7	1,140	119
Jan-19	9.84	1,260	20.0	1,270	116
Feb-19	13.1	1,330	17.4	2,860	220
Mar-19	11.0	1,200	18.0	1,920	153
Apr-19	8.10	1,070	23.3	1,240	133
May-19	8.17	795	66.4	987	116
Jun-19	7.44	909	26.8	969	129
Jul-19	7.27	873	61.1	1,080	126
Aug-19	7.28	919	24.5	957	105
Sep-19	7.34	826	38.3	1,110	144
Oct-19	7.17	832	57.7	1,050	159
Nov-19	7.41	846	84.4	762	135
Dec-19	8.81	1,050	63.9	1,350	245
Jan-20	8.13	1,040	23.4	1,220	269
Feb-20	7.23	1,120	11.8	1,320	142
Mar-20	7.28	1,000	13.9	1,010	112
Apr-20	7.26	957	77.0	1,000	79.3
May-20	6.91	738	86.7	867	160
Jun-20	6.94	730	104	1,100	173
Jul-20	7.26	848	170	1,330	165
Aug-20	6.75	1,070	26.2	1,360	150
Sep-20	6.99	1,090	12.3	1,600	230
Oct-20	6.80	1,120	8.23	1,060	70.9
Nov-20	6.50	1,020	4.31	1,250	159
Dec-20	6.64	1,060	14.7	1,000	169
Jan-21	7.26	1,100	3.65	1,220	140
Feb-21	7.28	1,120	3.49	852	90.9
Mar-21	7.09	1,250	5.67	1,270	162
Apr-21	6.76	1,310	11.5	1,210	159
May-21	6.48	1,200	19.6	1,380	215
Jun-21	6.64	1,040	18.9	1,310	228
Jul-21	6.48	965	27.3	1,060	185
Aug-21	6.39	1,050	21.9	1,320	159
Sep-21	6.26	1,090	22.3	1,040	131
Oct-21	8.57	1,030	27.9	1,030	187
Nov-21	6.99	864	34.6	922	122

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	12.1	1,200	76.1	1,100	139
Jan-22	7.79	952	27.9	993	46.3
Feb-22	6.73	614	70.0	733	78.1
Mar-22	6.66	585	167	693	30.8
Apr-22	7.25	796	38.0	792	21.8
May-22	7.07	1,370	52.7	1,210	14.3
Jun-22	7.12	1,140	30.7	1,350	17.2
Jul-22	7.18	1,050	112	1,030	17.8
Aug-22	7.30	1,260	29.1	1,140	20.4
Sep-22	7.19	1,350	2.78	1,380	31.4
Oct-22	7.07	1,170	55.0	1,180	13.5
Nov-22	7.42	1,490	6.34	1,360	9.85
Dec-22	10.6	1,750	11.1	1,570	30.2
Jan-23	13.8	1,370	18.9	2,000	217
Feb-23	9.35	1,400	63.8	1,370	15.6
Mar-23	12.4	1,370	4.11	1,070	49.6
Apr-23	8.25	1,720	3.11	2,100	19.0
May-23	7.96	1,540	5.98	1,700	22.6
Jun-23	7.48	1,200	40.6	1,400	12.5
Jul-23	7.43	895	97.7	1,010	6.90
Aug-23	7.61	899	84.2	1,270	83.4
Sep-23	7.38	653	147	769	12.3
Dry Season Average	**7.42**	**903**	**81.6**	**1,040**	**131**
Dry Season Trend**	**Down**	**Up**	**Down**	**Up**	**Down**
Wet Season Average	**8.74**	**1,010**	**70.8**	**1,120**	**134**
Average Annual	**8.19**	**964**	**75.3**	**1,090**	**133**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

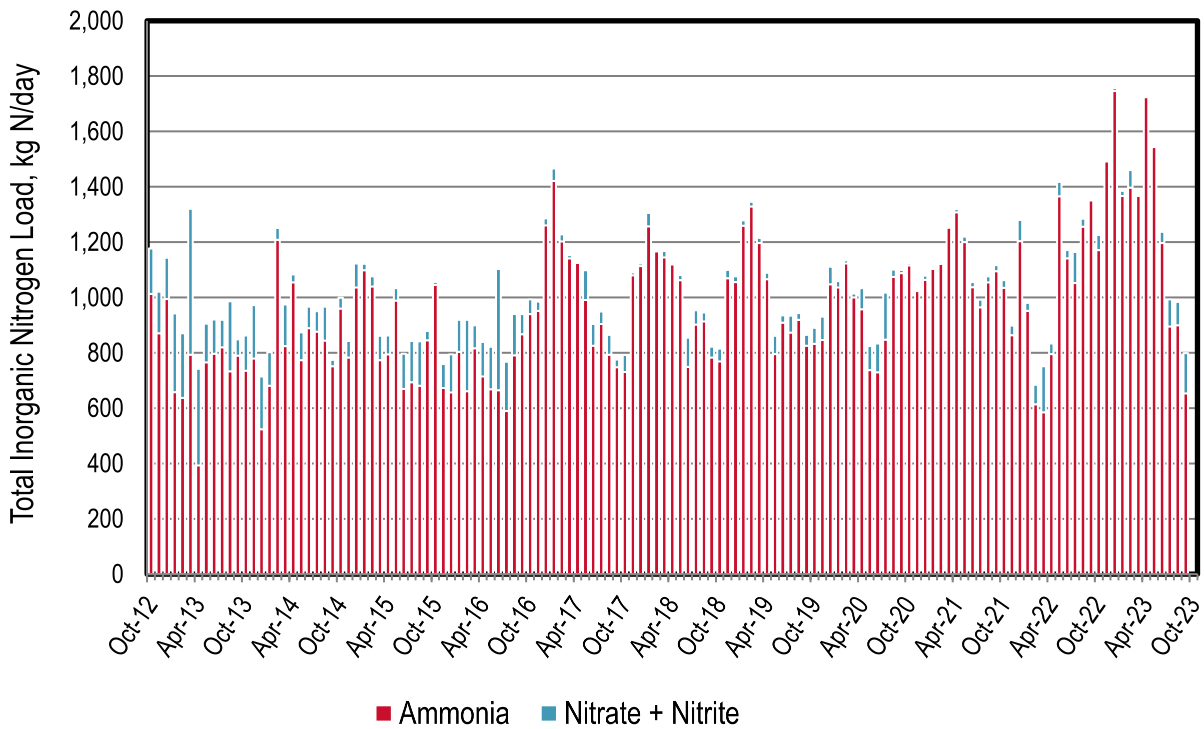

Figure 28-4. Discharge: South SF-San Bruno Monthly Nitrogen Loads

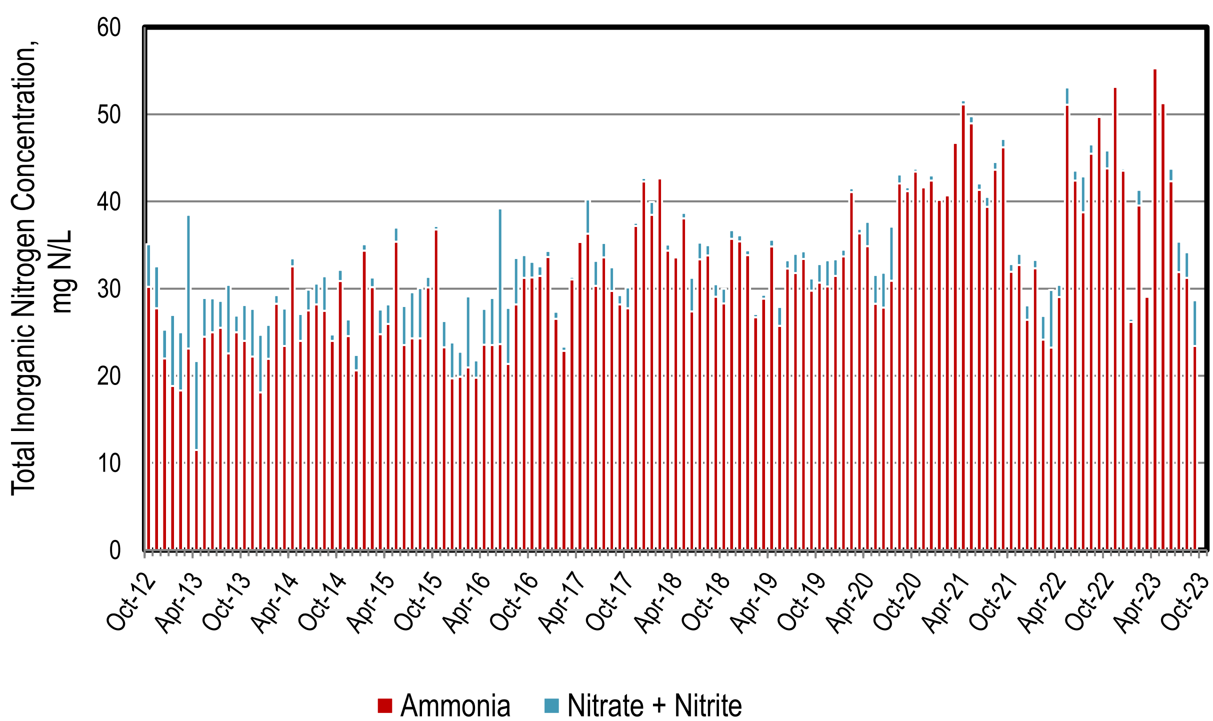

Figure 28-5. Discharge: South SF-San Bruno Monthly Nitrogen Concentrations

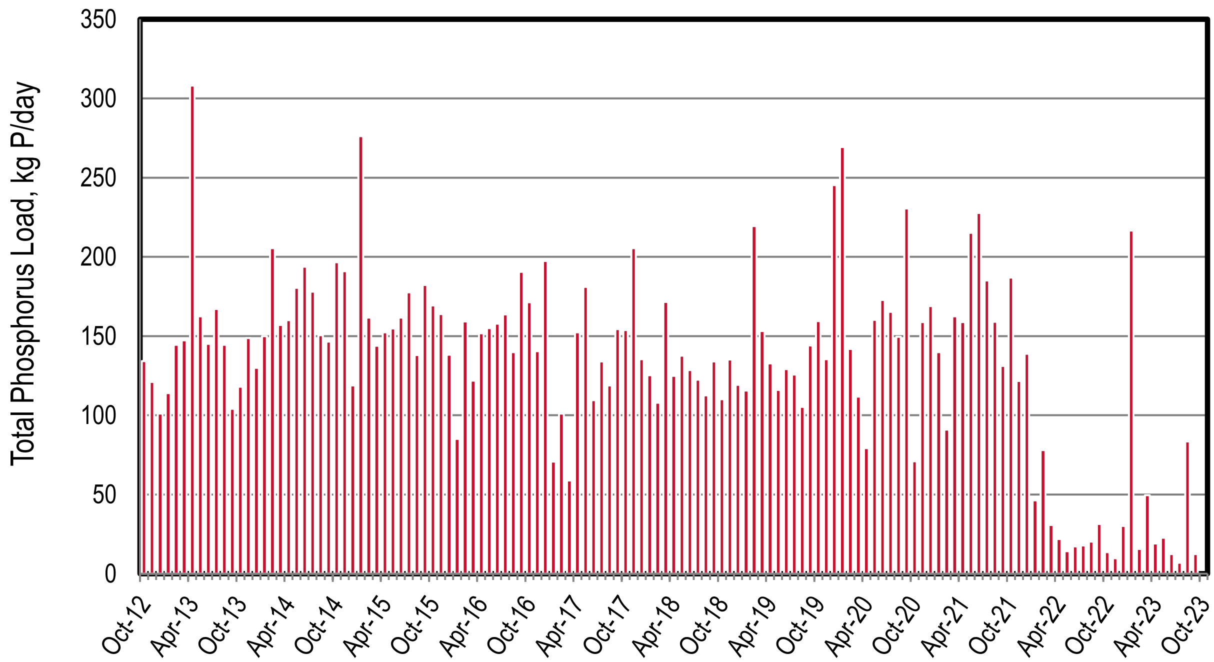

Figure 28-6. Discharge: South SF-San Bruno Monthly Phosphorus Loads

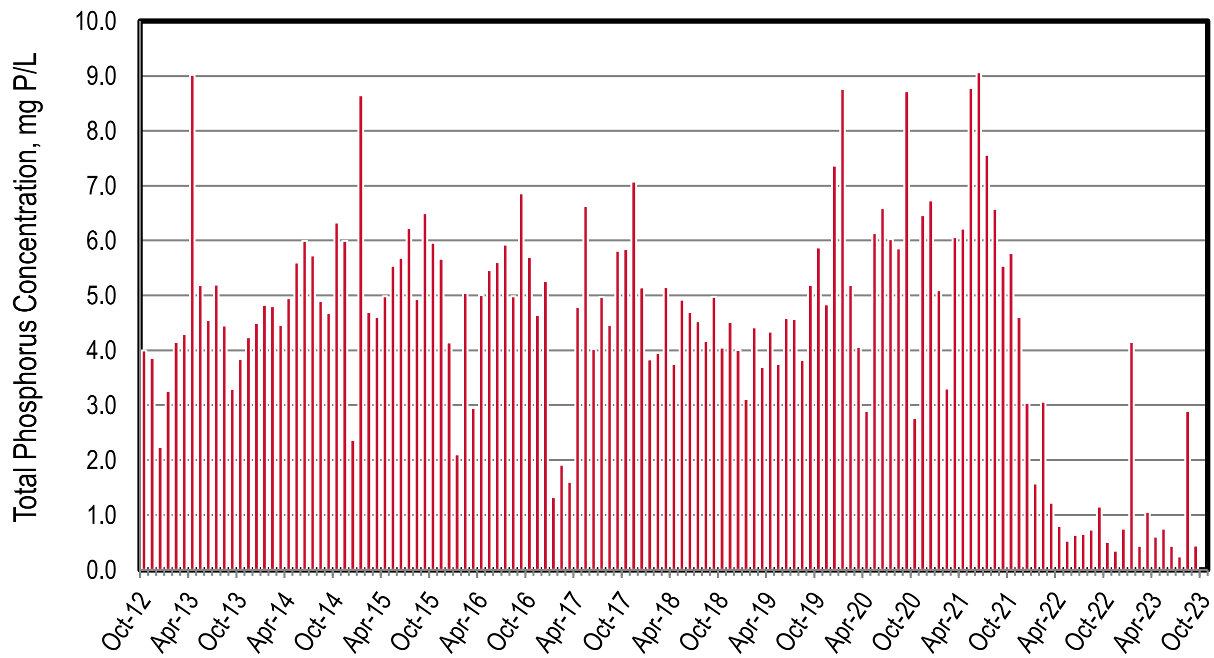

Figure 28-7. Discharge: South SF-San Bruno Monthly Phosphorus Concentrations

Recycled Water

No recycled water was produced or distributed this past year.

29 City of Sunnyvale

Sunnyvale discharges to a tributary of the Lower South Bay. It has approximately 28,300 service connections with a permitted average dry weather flow (ADWF) capacity of 29.5 mgd and a peak wet weather flow capacity of 40 mgd. The permitted ADWF capacity will be reduced to 19.5 mgd as part of the ongoing plant upgrades design. This past dry season average discharge flow was approximately 9.78 mgd. This value excludes effluent that is diverted to Sunnyvale's recycling water network. The plant currently nitrifies using oxidation ponds followed by nitrifying trickling filters and filtration. Significant denitrification occurs in the oxidation ponds primarily during the dry season.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent/Reduction across the Plant
  - Note: limited to data since July 2019; quarterly data is required but more data is provided for various parameters.
  - Based on the limited average monthly values in Table 29-1, flows have a downward dry season trend whereas all the nutrient parameters have no emerging dry season trend.
  - The flow reduction across the plant is upwards of approximately 50 percent. The periods with high flow reduction in 2020 were due to emergency repairs on a major conveyance pipeline from the oxidation ponds that resulted in a reduction of discharge flows. The reduction is attributed to a combination of the emergency repairs in 2020, recycled water production and storage, and/or evaporation from the oxidation ponds.
  - The nitrogen load reduction values across the plant is seasonal with values from 0 to 95 percent. This load reduction is attributed primarily to biological assimilation, biosolids management, load reduction in the ponds, and load diversion with recycled water.
  - The phosphorus load reduction across the plant is less seasonal than nitrogen with values from 0 to 75 percent. This load reduction is attributed primarily to biological assimilation, biosolids management, chemical precipitation, and load diversion associated with recycled water.
- Discharge
  - Nitrogen species and total phosphorus loads typically increase with flow during wet weather events and are typically greater and more variable than the dry season loads.
  - The trickling filters typically experience a decline in performance during colder months as evidenced by occasional ammonia spikes. This is a common phenomenon for nitrifying trickling filters exacerbated by occasional cold temperatures in the oxidation ponds.
  - The plant has seasonal denitrification as evidenced by ADWF TIN values that typically range from 10 to 20 mg N/L as compared with the 40 to 60 mg TN-N/L measured in the influent. Denitrification occurs in the oxidation ponds during the summer months.
  - NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant nitrifies year-round (except for colder months, when only a portion of ammonia bleeds through the trickling filters as noted).
  - Total P concentrations are wide ranging (from approximately 1.8 to >12 mg P/L.)

- Based on Table 29-2 statistics for the entire dry season dataset, nitrate + nitrite and TIN loads have an emerging upwards trend, whereas all other parameters have no trends.

- Recycled Water
  - Based on Table 1-2, the plant averaged 0.10 mgd of recycled water in 2022. Uses include golf course irrigation, landscape irrigation, and industrial application. Recycled Water production has been hindered by water quality from the oxidation ponds. This is expected to improve once the new activated sludge system comes online.
  - Based on Table 29-4 through Table 29-6, the plant diverted on average 2 kg ammonia-N/day, 8 kg TIN-N/day, and 2 kg P/day from the Bay in the 2022 calendar year.

Influent

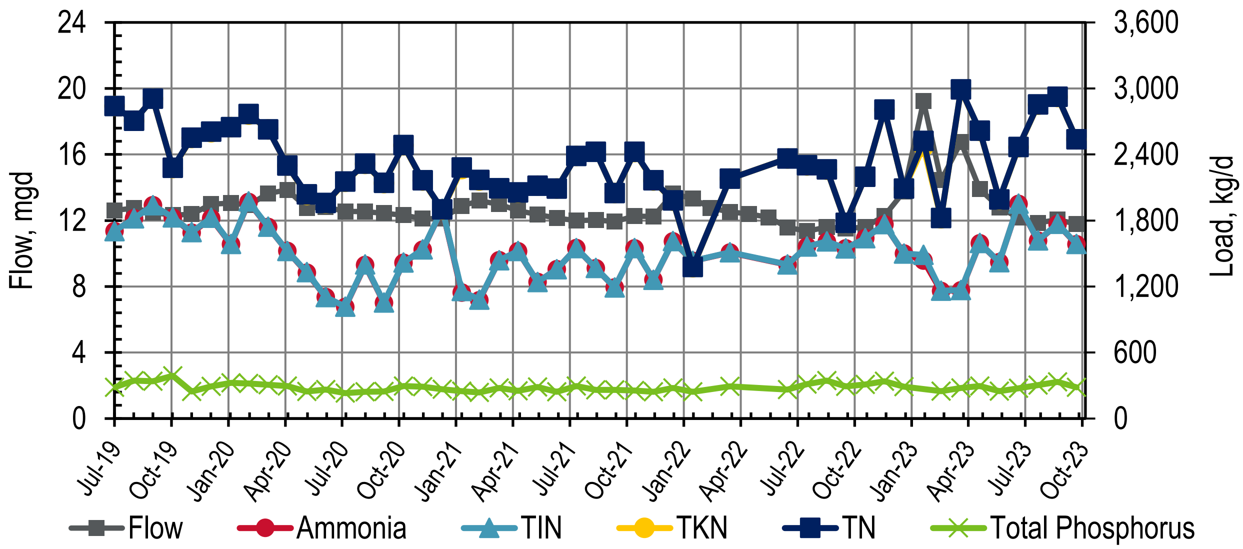

Figure 29-1. Influent: Sunnyvale Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

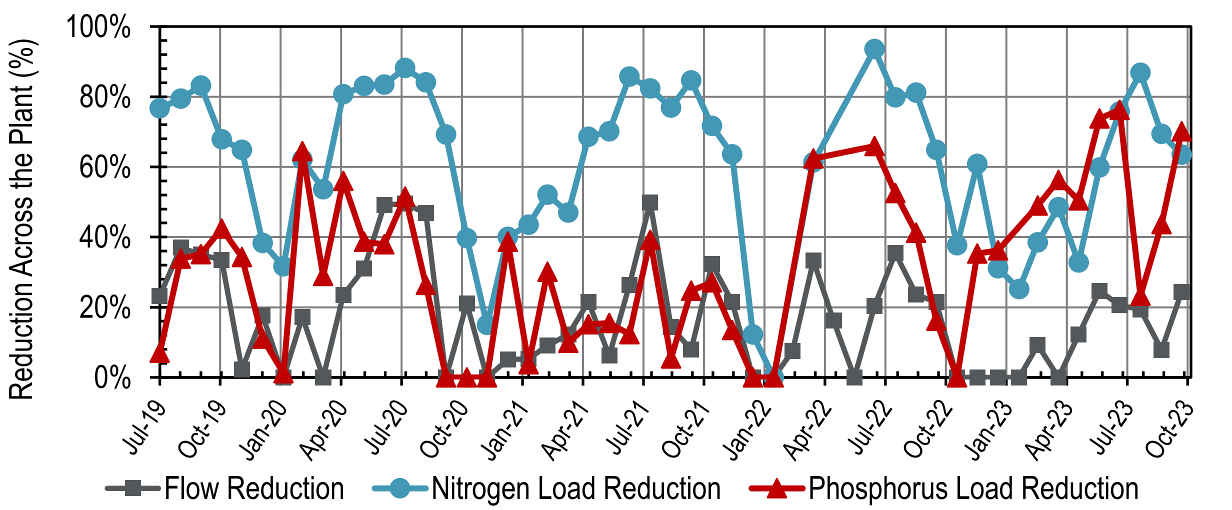

Figure 29-2. Influent: Sunnyvale Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 29-1. Influent: Sunnyvale Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite*	TIN*,**	TKN*	Total N*,**	Total P*
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	12.6	1,700	--	1,700	2,840	2,840	284
Aug-19	12.8	1,820	--	1,820	2,710	2,710	344
Sep-19	12.5	1,940	--	1,940	2,910	2,910	339
Oct-19	12.3	1,830	1.70	1,830	2,280	2,280	389
Nov-19	12.4	1,690	4.22	1,690	2,550	2,550	246
Dec-19	13.0	1,820	4.43	1,830	2,600	2,610	292
Jan-20	13.1	1,580	1.23	1,590	2,650	2,650	324
Feb-20	12.9	1,970	4.96	1,970	2,760	2,770	318
Mar-20	13.6	1,740	0.394	1,740	2,630	2,630	307
Apr-20	13.9	1,520	--	1,520	2,300	2,300	295
May-20	12.8	1,330	4.29	1,330	2,030	2,040	246
Jun-20	12.8	1,100	0.388	1,110	1,960	1,960	263
Jul-20	12.6	1,010	3.29	1,020	2,150	2,150	231
Aug-20	12.5	1,400	3.50	1,400	2,310	2,320	242
Sep-20	12.4	1,050	3.22	1,050	2,140	2,140	246
Oct-20	12.3	1,420	3.54	1,420	2,480	2,480	295
Nov-20	12.1	1,530	2.77	1,540	2,160	2,160	289
Dec-20	12.1	1,900	3.60	1,910	1,900	1,900	267
Jan-21	12.9	1,150	14.8	1,160	2,270	2,280	249
Feb-21	13.2	1,080	5.43	1,080	2,160	2,170	236
Mar-21	13.0	1,440	0.400	1,440	2,090	2,090	277
Apr-21	12.6	1,520	3.19	1,520	2,050	2,050	251
May-21	12.4	1,240	0.568	1,240	2,110	2,120	285
Jun-21	12.2	1,360	0.366	1,360	2,090	2,090	242
Jul-21	12.0	1,550	0.183	1,550	2,390	2,390	294
Aug-21	12.0	1,370	0.462	1,370	2,420	2,420	261
Sep-21	11.9	1,190	0.454	1,190	2,050	2,050	260
Oct-21	12.3	1,550	3.07	1,550	2,420	2,420	254
Nov-21	12.2	1,260	2.79	1,260	2,160	2,170	243
Dec-21	13.6	1,610	2.70	1,610	1,980	1,980	277
Jan-22	13.3	1,430	2.40	1,430	1,370	1,380	243
Feb-22	12.8	--	--	--	--	--	--
Mar-22	12.5	1,510	1.40	1,510	2,180	2,180	292
Apr-22	12.4	--	--	--	--	--	--
May-22	12.2	--	--	--	--	--	--
Jun-22	11.6	1,400	1.54	1,400	2,360	2,360	262

Month, Year	Flow	Ammonia*	Nitrate + Nitrite*	TIN*,**	TKN*	Total N*,**	Total P*
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	11.3	1,560	1.29	1,560	2,300	2,300	312
Aug-22	11.6	1,610	1.58	1,610	2,260	2,260	343
Sep-22	11.5	1,540	1.21	1,550	1,780	1,780	292
Oct-22	11.6	1,640	1.06	1,640	2,200	2,200	310
Nov-22	12.3	1,770	1.71	1,770	2,810	2,810	339
Dec-22	13.7	1,500	1.10	1,500	2,090	2,090	288
Jan-23	19.2	1,440	53.1	1,490	2,470	2,520	--
Feb-23	14.4	1,160	2.27	1,160	1,820	1,820	249
Mar-23	16.8	1,160	3.30	1,170	2,990	2,990	277
Apr-23	13.9	1,590	2.70	1,600	2,610	2,610	296
May-23	12.8	1,420	1.76	1,420	1,990	1,990	250
Jun-23	12.2	1,950	2.79	1,950	2,460	2,470	274
Jul-23	11.9	1,620	1.73	1,620	2,850	2,850	303
Aug-23	12.0	1,770	1.79	1,770	2,920	2,920	332
Sep-23	11.8	1,580	1.60	1,590	2,540	2,540	283
Dry Season Average	**12.2**	**1,480**	**1.68**	**1,480**	**2,340**	**2,350**	**281**
Dry Season Trend * **	**Down**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**13.2**	**1,530**	**5.13**	**1,540**	**2,310**	**2,310**	**284**
Average Annual	**12.8**	**1,510**	**3.64**	**1,510**	**2,320**	**2,330**	**283**

* Sunnyvale typically samples more than the required influent quarterly nutrient sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

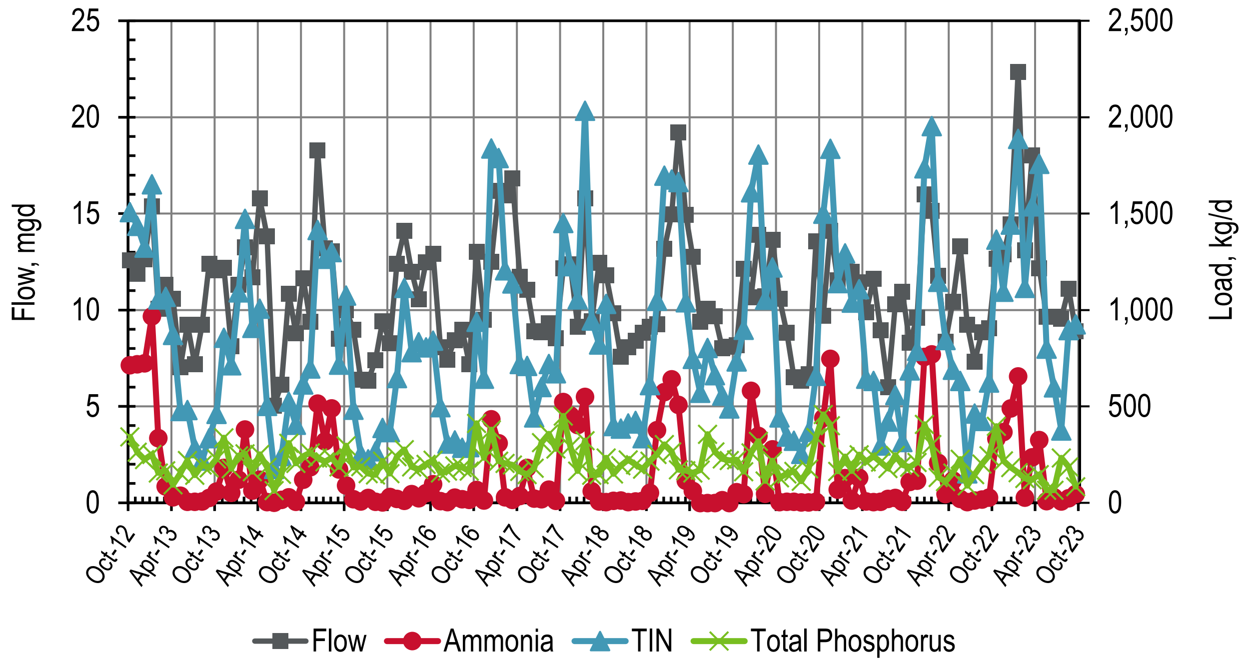

Figure 29-3. Discharge: Sunnyvale Monthly Flows and Loads

Table 29-2. Discharge: Sunnyvale Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	12.6	714	795	1,510	343
Nov-12	11.9	719	718	1,440	263
Dec-12	12.6	724	600	1,320	226
Jan-13	15.4	968	685	1,650	252
Feb-13	10.1	336	720	1,060	155
Mar-13	11.3	86.3	983	1,070	167
Apr-13	10.6	28.8	844	872	94.3
May-13	7.04	37.9	439	477	154
Jun-13	9.25	5.51	477	482	220
Jul-13	7.19	5.62	279	285	145
Aug-13	9.23	8.30	212	220	198
Sep-13	12.4	26.7	310	337	181
Oct-13	12.6	58.5	404	463	228
Nov-13	11.9	181	675	856	338
Dec-13	12.6	52.4	661	714	177
Jan-14	15.4	121	971	1,090	244
Feb-14	10.1	382	1,090	1,470	254
Mar-14	11.3	64.7	843	908	162
Apr-14	10.6	120	887	1,010	251
May-14	7.04	5.24	498	503	185
Jun-14	9.25	1.91	175	177	64.4
Jul-14	6.12	16.2	228	244	149
Aug-14	10.8	29.5	495	524	309
Sep-14	8.81	6.36	399	405	206
Oct-14	11.7	120	495	615	241
Nov-14	9.40	186	512	698	260
Dec-14	18.3	515	901	1,420	234
Jan-15	13.2	319	948	1,270	214
Feb-15	13.1	491	811	1,300	234
Mar-15	8.52	173	544	717	187
Apr-15	9.99	91.1	985	1,080	297
May-15	8.99	19.9	465	485	184
Jun-15	6.40	7.57	246	253	188
Jul-15	6.33	25.5	201	227	152
Aug-15	7.41	6.27	262	268	145
Sep-15	9.43	3.37	386	390	217

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	8.29	30.5	338	368	152
Nov-15	12.4	21.0	627	648	241
Dec-15	14.1	10.9	1,110	1,120	276
Jan-16	12.0	45.8	737	783	188
Feb-16	10.6	23.8	810	834	173
Mar-16	12.5	51.5	756	808	200
Apr-16	12.9	97.9	744	842	222
May-16	8.08	9.09	488	497	155
Jun-16	7.44	4.69	303	308	166
Jul-16	8.45	28.3	296	324	192
Aug-16	8.99	20.0	267	287	183
Sep-16	7.22	16.0	273	289	165
Oct-16	13.0	68.1	872	940	413
Nov-16	9.51	13.2	631	644	233
Dec-16	12.5	434	1,400	1,840	380
Jan-17	16.2	310	1,480	1,790	217
Feb-17	16.0	29.0	1,180	1,210	205
Mar-17	16.8	15.8	1,120	1,140	196
Apr-17	11.7	36.4	685	721	163
May-17	11.1	182	530	711	146
Jun-17	8.91	22.4	421	444	181
Jul-17	8.87	19.7	582	602	312
Aug-17	9.33	69.8	651	721	359
Sep-17	8.55	10.7	663	673	281
Oct-17	12.2	524	928	1,450	451
Nov-17	12.4	453	774	1,230	293
Dec-17	9.15	404	652	1,060	166
Jan-18	15.8	550	1,480	2,030	323
Feb-18	9.43	61.5	885	946	144
Mar-18	12.5	7.03	816	823	147
Apr-18	11.8	4.99	1,030	1,030	233
May-18	9.82	11.0	388	399	151
Jun-18	7.57	13.2	372	385	194
Jul-18	8.07	4.20	408	412	224
Aug-18	8.42	7.67	417	425	199
Sep-18	8.83	11.1	326	337	176
Oct-18	9.12	52.2	559	611	217

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	9.27	377	673	1,050	252
Dec-18	13.2	574	1,120	1,700	303
Jan-19	15.0	641	1,040	1,680	264
Feb-19	19.2	509	1,160	1,660	172
Mar-19	14.9	116	924	1,040	167
Apr-19	12.8	62.1	685	747	155
May-19	9.39	0	571	571	170
Jun-19	10.1	0	804	804	356
Jul-19	9.68	0	663	663	264
Aug-19	8.03	14.9	541	556	228
Sep-19	8.11	0	490	490	220
Oct-19	8.19	55.6	678	733	224
Nov-19	12.1	46.3	852	898	162
Dec-19	10.7	582	1,030	1,610	260
Jan-20	13.9	348	1,460	1,810	320
Feb-20	10.7	47.4	1,010	1,050	113
Mar-20	13.7	278	944	1,220	218
Apr-20	10.6	4.76	438	443	130
May-20	8.81	6.90	338	345	151
Jun-20	6.52	6.84	317	324	163
Jul-20	6.34	2.93	252	255	112
Aug-20	6.67	3.39	366	370	178
Sep-20	13.6	6.86	653	660	340
Oct-20	9.72	441	1,060	1,500	458
Nov-20	14.1	747	1,090	1,840	400
Dec-20	11.5	69.1	1,070	1,140	164
Jan-21	12.2	128	1,170	1,290	240
Feb-21	12.0	12.1	1,030	1,040	165
Mar-21	11.4	131	978	1,110	250
Apr-21	9.88	7.57	638	645	213
May-21	11.6	4.40	629	633	241
Jun-21	8.95	5.63	293	299	212
Jul-21	6.01	20.7	401	422	179
Aug-21	10.3	25.4	534	560	247
Sep-21	11.0	6.17	310	316	196
Oct-21	8.30	110	577	687	185
Nov-21	9.60	115	674	789	210

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	16.0	757	980	1,740	407
Jan-22	15.1	771	1,180	1,950	303
Feb-22	11.8	208	929	1,150	132
Mar-22	8.35	46.4	798	845	110
Apr-22	10.4	117	677	691	155
May-22	13.3	20.3	610	633	227
Jun-22	9.23	5.28	148	153	89.2
Jul-22	7.32	12.1	453	465	148
Aug-22	8.87	18.5	407	426	202
Sep-22	9.05	27.4	598	625	245
Oct-22	12.7	333	1,030	1,370	397
Nov-22	12.9	368	728	1,100	219
Dec-22	14.5	490	953	1,440	184
Jan-23	22.4	657	1,230	1,890	156
Feb-23	13.1	27.5	1,090	1,120	127
Mar-23	18.0	237	1,300	1,540	121
Apr-23	12.2	327	1,430	1,760	147
May-23	9.64	8.89	791	800	65.7
Jun-23	9.66	28.9	570	599	65.2
Jul-23	9.56	7.66	368	376	233
Aug-23	11.1	25.2	871	896	187
Sep-23	8.91	46.2	881	927	84.6
Dry Season Average	**8.90**	**17.1**	**442**	**459**	**192**
Dry Season Trend **	**None**	**None**	**Up**	**Up**	**None**
Wet Season Average	**12.4**	**252**	**887**	**1,140**	**228**
Average Annual	**10.9**	**154**	**702**	**855**	**213**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

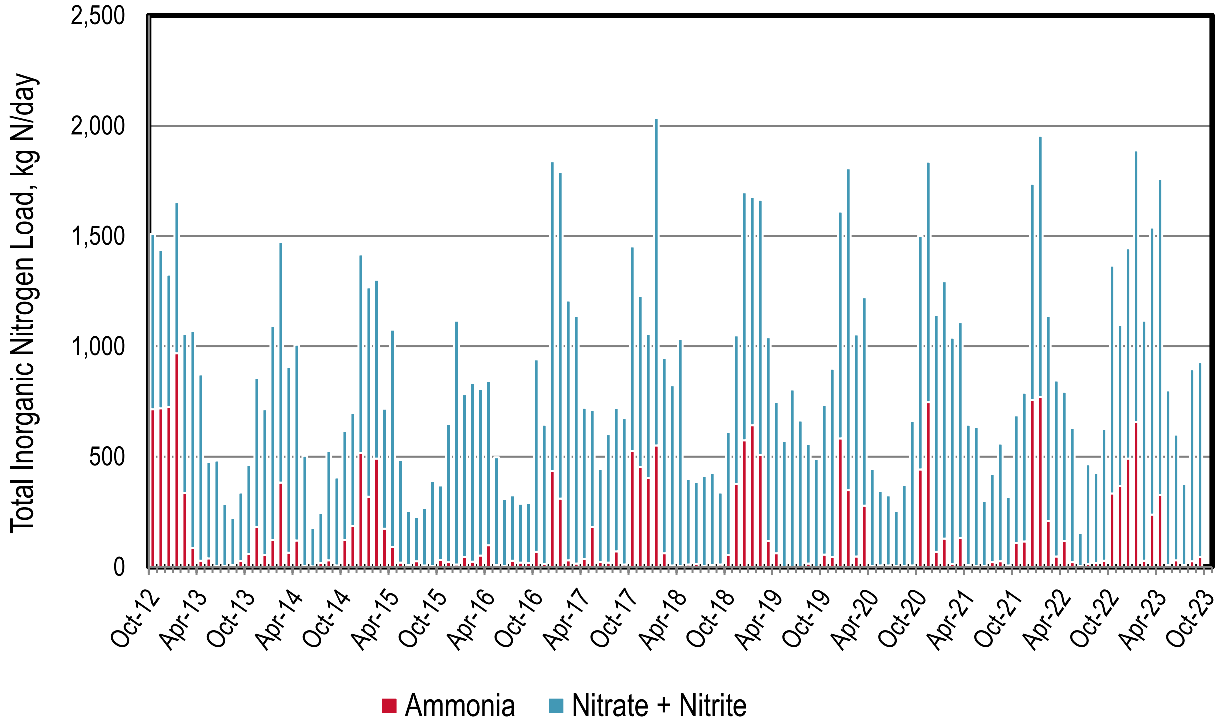

Figure 29-4. Discharge: Sunnyvale Monthly Nitrogen Loads

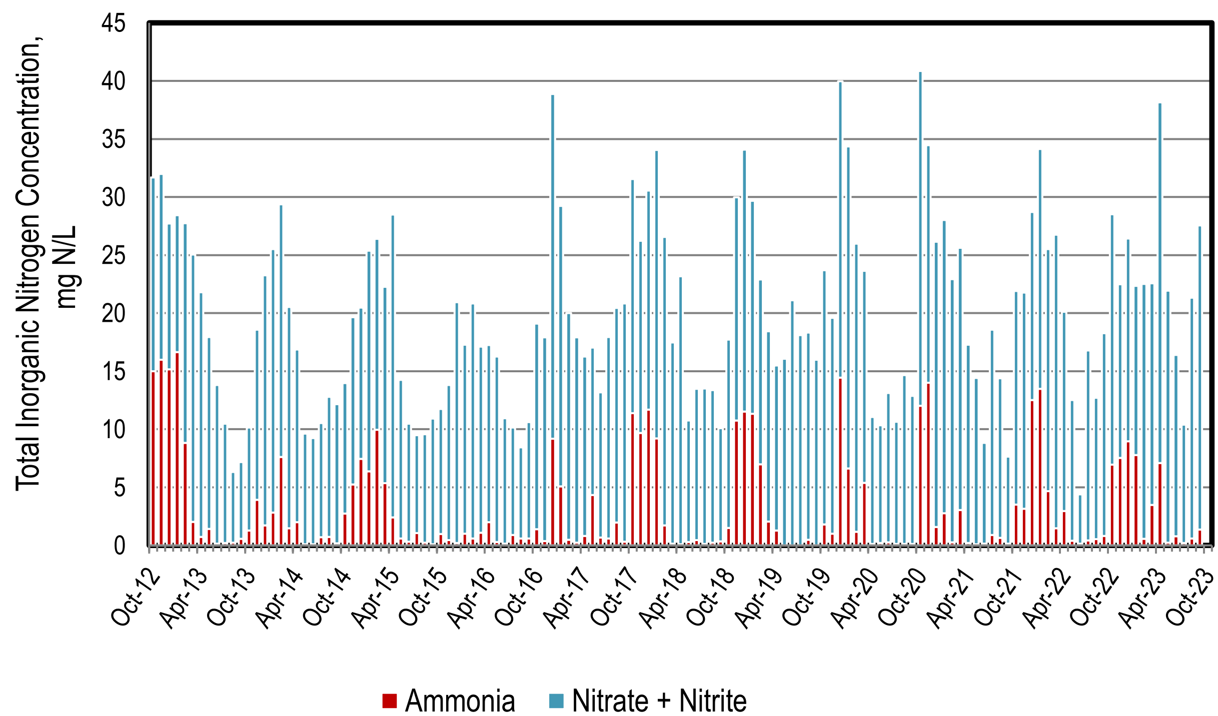

Figure 29-5. Discharge: Sunnyvale Monthly Nitrogen Concentrations

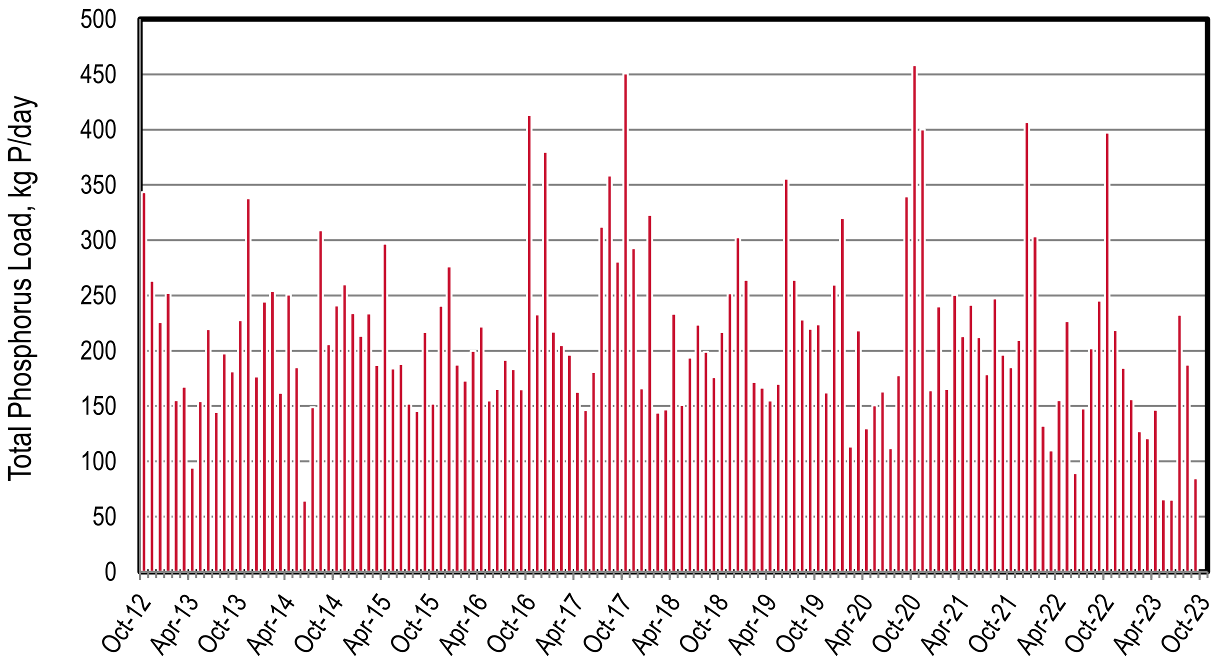

Figure 29-6. Discharge: Sunnyvale Monthly Phosphorus Loads

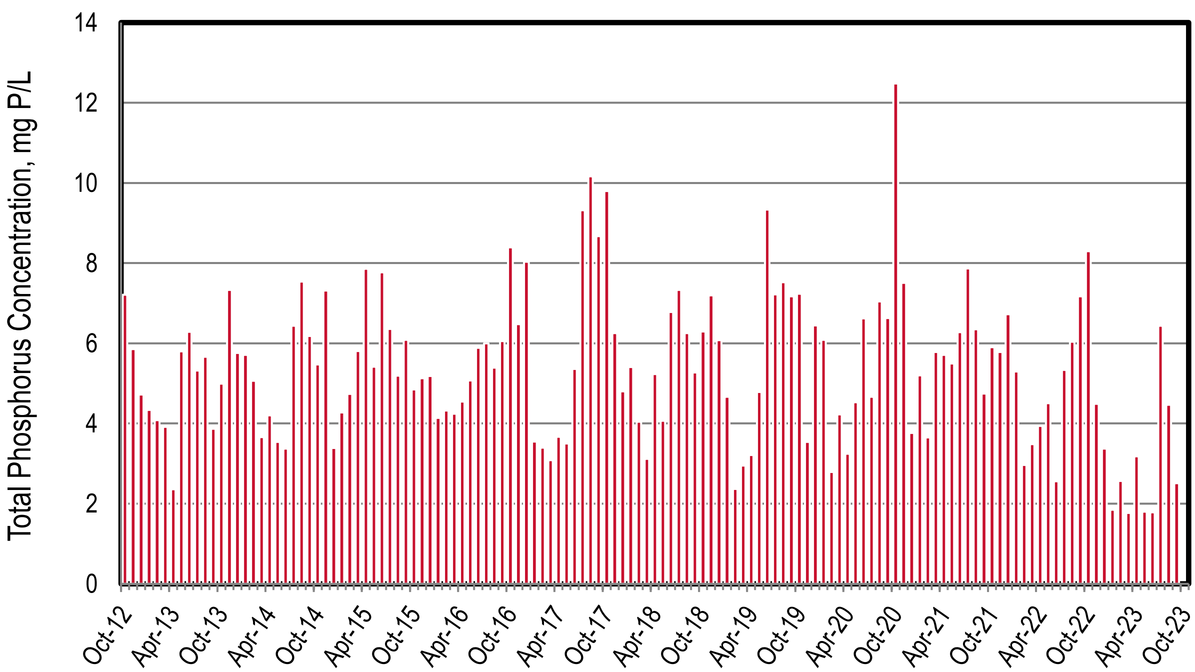

Figure 29-7. Discharge: Sunnyvale Monthly Phosphorus Concentrations

Recycled Water

Table 29-3. Recycled Water: City of Sunnyvale Yearly Recycled Water Flows Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	121 (0.11)	156 (0.14)	--	9 (0.01)	--	--	--	286 (0.26)
2020	111 (0.10)	219 (0.20)	--	10 (0.01)	--	--	--	340 (0.31)
2021	114 (0.10)	209 (0.19)	--	5 (<0.01)	--	--	--	328 (0.29)
2022	40 (0.04)	63 (0.06)	--	2 (<0.01)	--	--	--	105 (0.1)
Average	96 (0.09)	162 (0.15)	--	6 (<0.01)	--	--	--	265 (0.24)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 29-4. Recycled Water: City of Sunnyvale Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	2	2	--	0.1	--	--	--	4
2020	2	3	--	0.1	--	--	--	5
2021	1	2	--	<1	--	--	--	3
2022	1	1	--	<1	--	--	--	2
Average	1	2	--	<1	--	--	--	3

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 29-5. Recycled Water: City of Sunnyvale Yearly Recycled Water TIN Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	9	12	--	1	--	--	--	22
2020	9	17	--	1	--	--	--	27
2021	7	14	--	<1	--	--	--	22
2022	3	5	--	<1	--	--	--	8
Average	7	12	--	<1	--	--	--	20

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 29-6. Recycled Water: City of Sunnyvale Yearly Recycled Water Total Phosphorus Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	2	3	--	<1	--	--	--	5
2020	2	4	--	<1	--	--	--	7
2021	2	4	--	<1	--	--	--	6
2022	1	1	--	<1	--	--	--	2
Average	2	3	--	<1	--	--	--	5

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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30 Silicon Valley Clean Water (SVCW)

SVCW discharges to the South Bay. The plant services a population of approximately 200,000 and has a permitted ADWF capacity of 29 mgd. The average dry season discharge flow this past year was approximately 12.7 mgd. The plant performs tertiary treatment using a trickling filter complemented with an activated sludge system followed by mono-media or dual-media filtration.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent
  - Note: limited to data since July 2019; quarterly data is required but more is provided for various parameters. Based on the limited data, there are no emerging trends for the evaluated parameters.
  - Despite having recycled water customers, the difference between influent and discharge flow to the Bay is typically negligible.
  - The nitrogen load reduction value across the plant is upwards of 30 percent. This load reduction is attributed to biological assimilation and biosolids management.
  - The phosphorus load reduction across the plant is upwards of 50 percent. This load reduction is attributed to chemical precipitation and biological assimilation.
- Discharge
  - Nitrogen species loads typically increases with flow during wet weather events. Furthermore, nitrogen species wet season loads are typically greater and more variable than the dry season loads.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
  - Total phosphorus concentrations are wide ranging, from approximately 1.6 to 5.9 mg P/L.
  - Based on Table 30-2 statistics for the entire dry season dataset, ammonia, TIN, and total phosphorus are trending upwards, while nitrate + nitrite is trending downwards. Flow is trending neither upwards nor downwards across the entire dry season dataset.
- Recycled Water
  - Based on Table 1-2, the plant averaged 0.5 mgd of recycled water from 2019-2022. Uses include landscape irrigation, industrial application, and other non-potable uses such as on-site plumbing.
  - Based on Table 24-3 through Table 24-5, the plant diverted on average 104 kg ammonia-N/day, 106 kg TIN-N/day, and 9 kg P/day away from the Bay from 2019-2022.

Influent

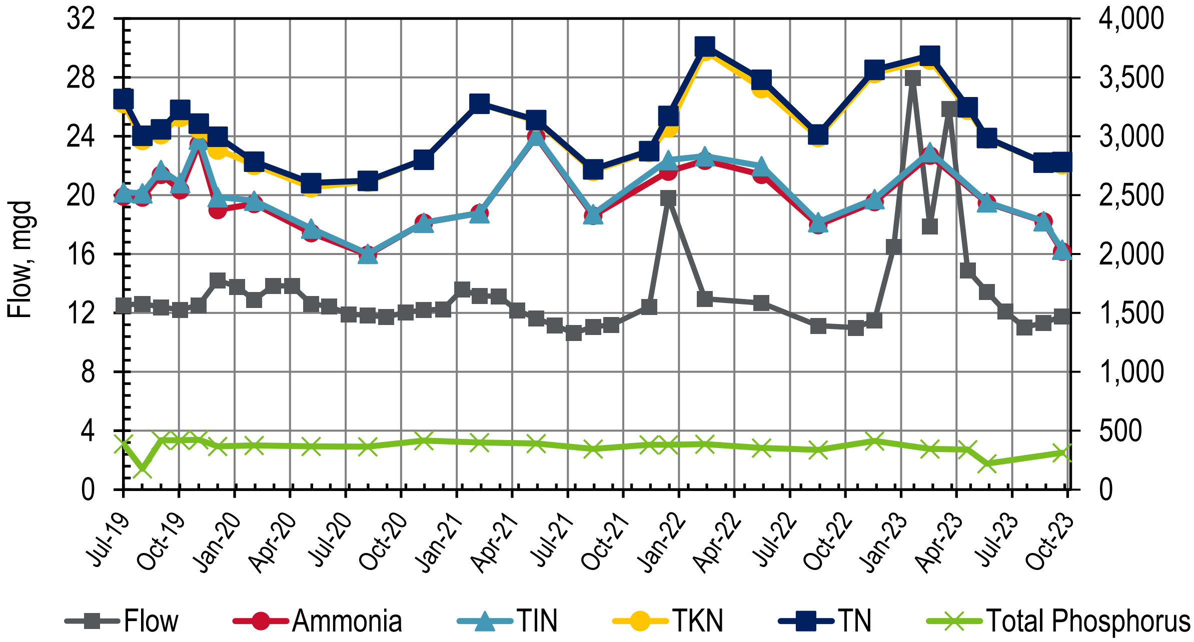

Figure 30-1. Influent: SVCW Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

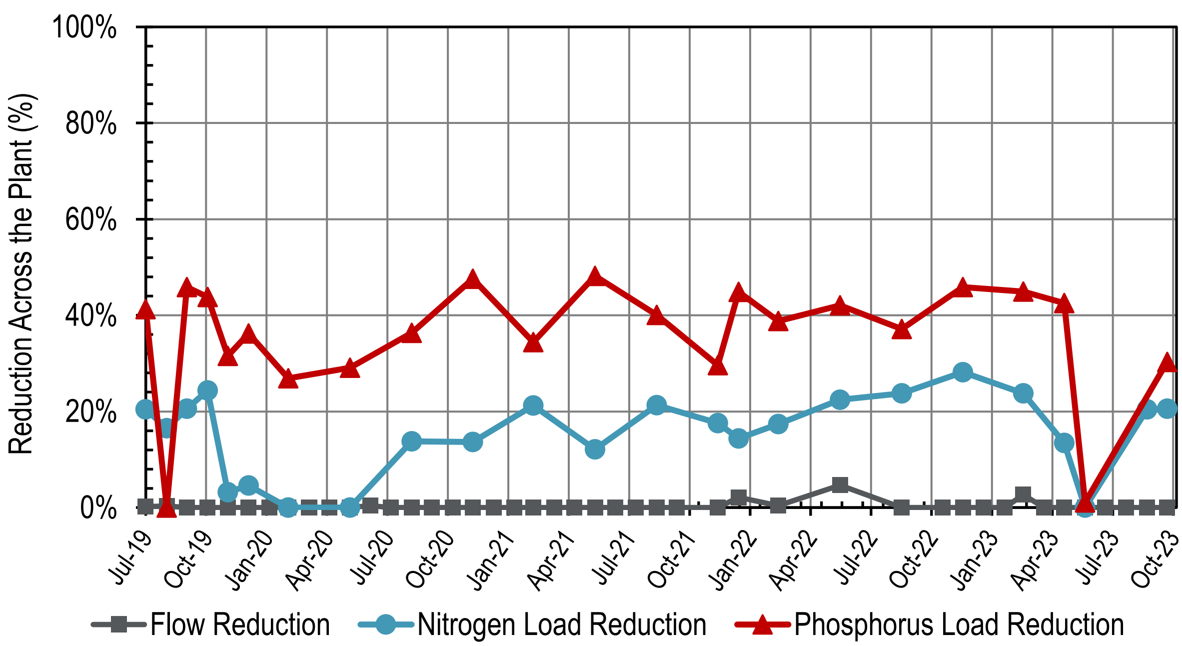

Figure 30-2. Influent: SVCW Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 30-1. Influent: SVCW Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN **	TKN	Total N **	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	12.5	2,490	36.1	2,520	3,280	3,320	390
Aug-19	12.6	2,480	34.7	2,520	2,970	3,010	177
Sep-19	12.4	2,680	40.3	2,720	3,020	3,060	419
Oct-19	12.2	2,540	59.8	2,600	3,170	3,230	420
Nov-19	12.5	2,930	40.9	2,970	3,070	3,110	424
Dec-19	14.2	2,380	109	2,480	2,890	3,000	368
Jan-20	13.8	--	--	--	--	--	--
Feb-20	12.9	2,430	27.4	2,450	2,760	2,790	376
Mar-20	13.9	--	--	--	--	--	--
Apr-20	13.8	--	--	--	--	--	--
May-20	12.6	2,180	37.2	2,220	2,570	2,600	368
Jun-20	12.4	--	--	--	--	--	--
Jul-20	11.9	--	--	--	--	--	--
Aug-20	11.9	2,000	7.80	2,000	2,610	2,620	366
Sep-20	11.7	--	--	--	--	--	--
Oct-20	12.1	--	--	--	--	--	--
Nov-20	12.2	2,270	0	2,270	2,800	2,800	418
Dec-20	12.2	--	--	--	--	--	--
Jan-21	13.6	--	--	--	--	--	--
Feb-21	13.2	2,350	0	2,350	3,280	3,280	401
Mar-21	13.1	--	--	--	--	--	--
Apr-21	12.2	--	--	--	--	--	--
May-21	11.6	3,000	7.74	3,010	3,130	3,140	394
Jun-21	11.1	--	--	--	--	--	--
Jul-21	10.6	--	--	--	--	--	--
Aug-21	11.1	2,330	12.1	2,340	2,710	2,720	347
Sep-21	11.2	--	--	--	--	--	--
Oct-21	--	--	--	--	--	--	--
Nov-21	12.4	--	7.52	--	2,870	2,880	381
Dec-21	19.8	2,700	99.8	2,800	3,080	3,180	383
Jan-22	--	--	--	--	--	--	--
Feb-22	13.0	2,790	37.4	2,830	3,730	3,760	387
Mar-22	--	--	--	--	--	--	--
Apr-22	--	--	--	--	--	--	--
May-22	12.7	2,680	71.1	2,750	3,410	3,480	355
Jun-22	--	--	--	--	--	--	--

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN **	TKN	Total N **	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	--	--	--	--	--	--	--
Aug-22	11.1	2,250	23.7	2,270	2,990	3,020	337
Sep-22	--	--	--	--	--	--	--
Oct-22	11.0	--	--	--	--	--	--
Nov-22	11.5	2,440	25.2	2,470	3,540	3,560	414
Dec-22	16.5	--	--	--	--	--	--
Jan-23	28.0	--	--	--	--	--	--
Feb-23	17.9	2,840	31.3	2,870	3,650	3,680	347
Mar-23	25.9	--	--	--	--	--	--
Apr-23	14.9	--	21.4	--	3,230	3,250	341
May-23	13.4	2,440	5.15	2,440	2,980	2,990	222
Jun-23	12.1	--	--	--	--	--	--
Jul-23	11.0	--	--	--	--	--	--
Aug-23	11.3	2,280	0.421	2,280	2,780	2,780	--
Sep-23	11.8	2,020	18.0	2,040	2,760	2,780	313
Dry Season Average	**11.9**	**2,400**	**24.5**	**2,420**	**2,940**	**2,960**	**335**
Dry Season Trend * **	**None**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**14.7**	**2,570**	**38.3**	**2,610**	**3,170**	**3,210**	**388**
Average Annual	**13.4**	**2,480**	**31.4**	**2,510**	**3,050**	**3,080**	**363**

* SVCW occasionally samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

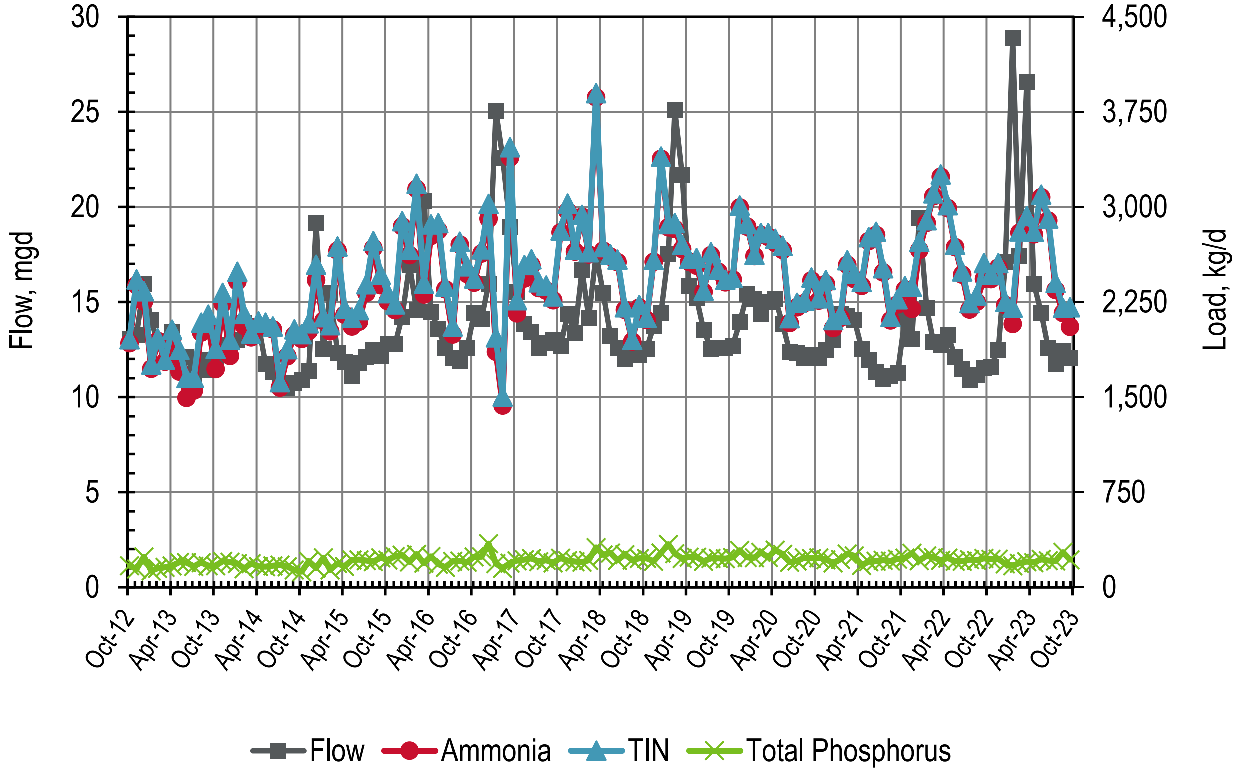

Figure 30-3. Discharge: SVCW Monthly Flows and Loads

Table 30-2. Discharge: SVCW Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	13.1	1,930	30.2	1,960	171
Nov-12	13.3	2,380	44.2	2,430	146
Dec-12	16.0	2,260	80.0	2,340	240
Jan-13	14.1	1,720	33.4	1,760	130
Feb-13	12.9	1,940	19.4	1,960	149
Mar-13	13.0	1,780	14.6	1,800	156
Apr-13	13.4	1,950	81.0	2,030	170
May-13	12.0	1,700	171	1,870	197
Jun-13	12.1	1,490	159	1,650	195
Jul-13	11.3	1,550	103	1,660	164
Aug-13	12.0	2,010	77.7	2,090	196
Sep-13	11.5	2,060	94.7	2,150	171
Oct-13	11.7	1,720	157	1,880	170
Nov-13	12.8	2,240	81.6	2,320	204
Dec-13	12.7	1,820	127	1,950	198
Jan-14	13.0	2,420	74.1	2,490	187
Feb-14	13.9	2,060	94.0	2,160	147
Mar-14	13.3	1,970	32.4	2,000	188
Apr-14	13.8	2,060	38.7	2,100	164
May-14	11.8	2,050	35.4	2,090	163
Jun-14	11.3	2,030	24.4	2,060	169
Jul-14	10.7	1,580	43.4	1,620	174
Aug-14	10.5	1,820	54.2	1,880	163
Sep-14	10.7	1,990	45.4	2,030	136
Oct-14	10.9	1,960	38.9	2,000	123
Nov-14	11.4	2,020	59.4	2,080	206
Dec-14	19.1	2,420	122	2,550	152
Jan-15	12.6	2,100	28.0	2,130	233
Feb-15	15.5	2,020	48.6	2,070	138
Mar-15	12.3	2,660	32.8	2,690	189
Apr-15	11.9	2,150	47.7	2,200	165
May-15	11.1	2,060	71.8	2,130	214
Jun-15	11.8	2,100	91.6	2,190	219
Jul-15	12.1	2,320	67.9	2,390	--
Aug-15	12.5	2,680	57.2	2,730	204
Sep-15	12.2	2,380	81.9	2,470	233

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	12.8	2,260	62.6	2,320	215
Nov-15	12.8	2,190	46.9	2,230	243
Dec-15	14.2	2,850	39.8	2,890	253
Jan-16	16.9	2,620	40.3	2,660	200
Feb-16	14.6	3,140	42.5	3,190	260
Mar-16	20.3	2,310	87.8	2,400	189
Apr-16	14.5	2,770	89.3	2,860	243
May-16	13.6	2,820	57.8	2,870	182
Jun-16	12.6	2,350	23.6	2,370	158
Jul-16	12.1	2,000	61.0	2,060	206
Aug-16	11.9	2,700	23.1	2,730	209
Sep-16	12.6	2,470	60.9	2,530	199
Oct-16	14.4	2,400	32.6	2,440	239
Nov-16	14.1	2,630	32.1	2,670	242
Dec-16	15.9	2,910	115	3,020	344
Jan-17	25.1	1,860	115	1,970	187
Feb-17	22.6	1,430	72.1	1,510	149
Mar-17	19.0	3,390	80.6	3,470	190
Apr-17	15.5	2,160	103	2,270	209
May-17	13.9	2,440	106	2,540	217
Jun-17	13.4	2,540	49.6	2,590	228
Jul-17	12.6	2,360	46.8	2,410	203
Aug-17	12.8	2,340	41.8	2,380	213
Sep-17	13.0	2,260	31.7	2,300	194
Oct-17	12.7	2,800	15.9	2,820	230
Nov-17	14.4	2,970	62.0	3,030	210
Dec-17	13.4	2,650	16.5	2,670	202
Jan-18	16.7	2,920	14.2	2,940	197
Feb-18	14.2	2,630	16.6	2,640	213
Mar-18**	17.5	3,870	33.7	3,900	315
Apr-18	15.5	2,660	29.2	2,690	256
May-18	13.2	2,610	16.7	2,630	272
Jun-18	12.6	2,570	20.0	2,590	212
Jul-18	12.0	2,190	21.4	2,210	259
Aug-18	12.4	1,940	12.3	1,950	216
Sep-18	12.2	2,210	21.5	2,230	228
Oct-18	12.6	2,110	17.6	2,130	228

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	13.7	2,570	13.8	2,580	205
Dec-18	14.5	3,380	18.8	3,400	271
Jan-19	17.6	2,840	24.4	2,870	338
Feb-19	25.1	2,830	46.9	2,870	265
Mar-19	21.7	2,670	32.9	2,700	228
Apr-19	15.8	2,570	23.7	2,590	238
May-19	15.2	2,540	61.4	2,600	238
Jun-19	13.5	2,330	11.8	2,340	205
Jul-19	12.5	2,620	23.2	2,640	229
Aug-19	12.6	2,490	17.5	2,510	228
Sep-19	12.6	2,410	19.0	2,430	227
Oct-19	12.7	2,430	12.4	2,440	236
Nov-19	13.9	3,000	15.8	3,010	290
Dec-19	15.4	2,840	20.1	2,860	235
Jan-20	15.2	2,610	10.9	2,620	233
Feb-20	14.4	2,780	13.5	2,790	275
Mar-20	15.0	2,770	31.0	2,800	237
Apr-20	15.2	2,720	32.7	2,750	293
May-20	13.8	2,660	34.2	2,690	261
Jun-20	12.4	2,090	37.7	2,120	198
Jul-20	12.3	2,210	36.5	2,250	208
Aug-20	12.1	2,240	19.2	2,260	233
Sep-20	12.2	2,420	23.1	2,440	227
Oct-20	12.1	2,260	19.4	2,280	233
Nov-20	12.5	2,390	29.6	2,420	219
Dec-20	13.0	2,050	63.2	2,110	192
Jan-21	14.4	2,130	26.2	2,150	220
Feb-21	14.3	2,550	35.3	2,580	263
Mar-21	14.1	2,430	44.1	2,480	249
Apr-21	12.6	2,380	30.1	2,410	173
May-21	12.0	2,730	30.7	2,760	204
Jun-21	11.3	2,780	26.2	2,810	204
Jul-21	11.0	2,490	32.3	2,520	212
Aug-21	11.1	2,110	28.9	2,140	208
Sep-21	11.3	2,230	40.7	2,270	223
Oct-21	14.1	2,350	27.4	2,380	231
Nov-21	13.1	2,200	173	2,370	268

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	19.4	2,660	63.1	2,720	211
Jan-22	14.7	2,880	20.0	2,900	249
Feb-22	12.9	3,090	23.6	3,110	237
Mar-22	12.7	3,240	17.5	3,260	213
Apr-22	13.3	2,990	21.9	3,020	230
May-22	12.1	2,680	19.7	2,700	206
Jun-22	11.5	2,470	24.6	2,490	205
Jul-22	10.9	2,190	51.2	2,240	217
Aug-22	11.2	2,250	49.9	2,300	212
Sep-22	11.5	2,430	125	2,560	227
Oct-22	11.6	2,430	33.5	2,470	221
Nov-22	12.5	2,520	34.2	2,560	224
Dec-22	17.1	2,230	24.9	2,250	186
Jan-23	28.9	2,080	129	2,210	170
Feb-23	17.4	2,800	11.8	2,810	191
Mar-23	26.6	2,880	46.7	2,930	202
Apr-23	16.0	2,790	20.9	2,810	196
May-23	14.4	3,080	20.6	3,100	220
Jun-23	12.6	2,890	15.8	2,910	210
Jul-23	11.8	2,350	54.2	2,400	207
Aug-23	12.4	2,160	42.0	2,210	275
Sep-23	12.1	2,060	155	2,210	218
Dry Season Average	**12.2**	**2,300**	**50.4**	**2,350**	**209**
Dry Season Trend * **	**None**	**Up**	**Down**	**Up**	**Up**
Wet Season Average	**15.1**	**2,470**	**47.3**	**2,520**	**215**
Average Annual	**13.9**	**2,400**	**48.6**	**2,450**	**213**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** One of the monthly nutrient sampling events (n=2) occurred during the maximum daily flow for that month. The loads are atypically high for this particular day due to a likely flushing phenomenon in the collection system.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

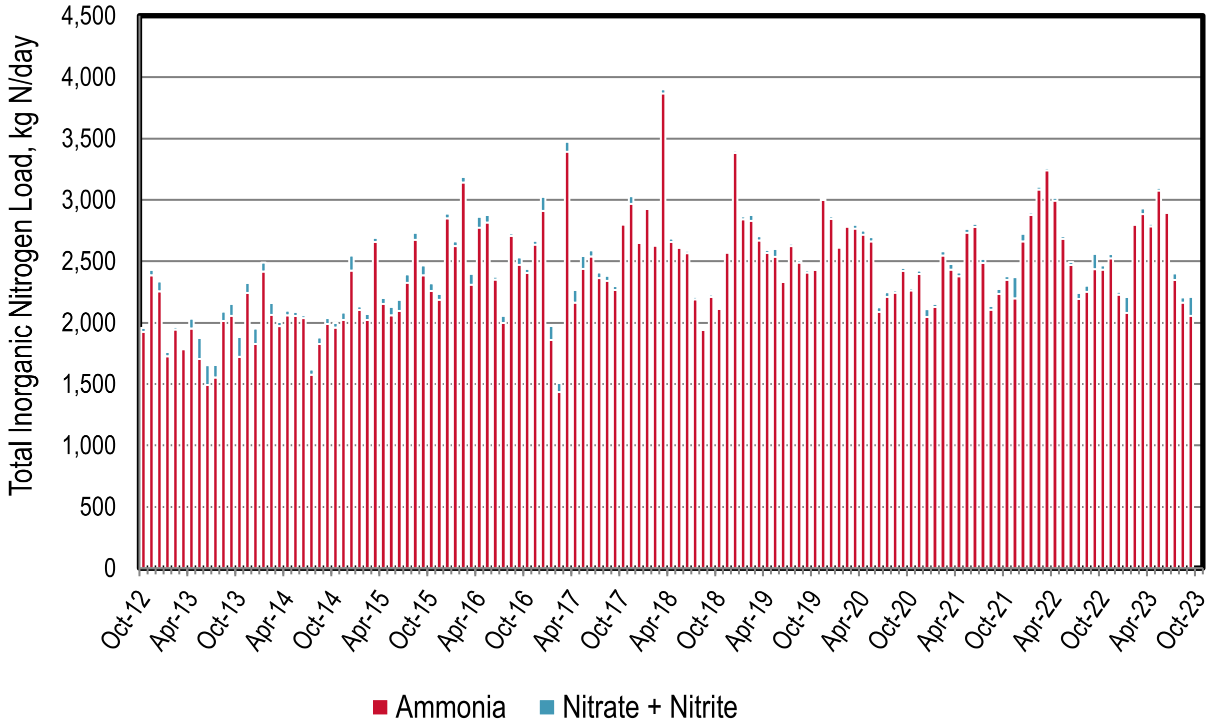

Figure 30-4. Discharge: SVCW Monthly Nitrogen Loads

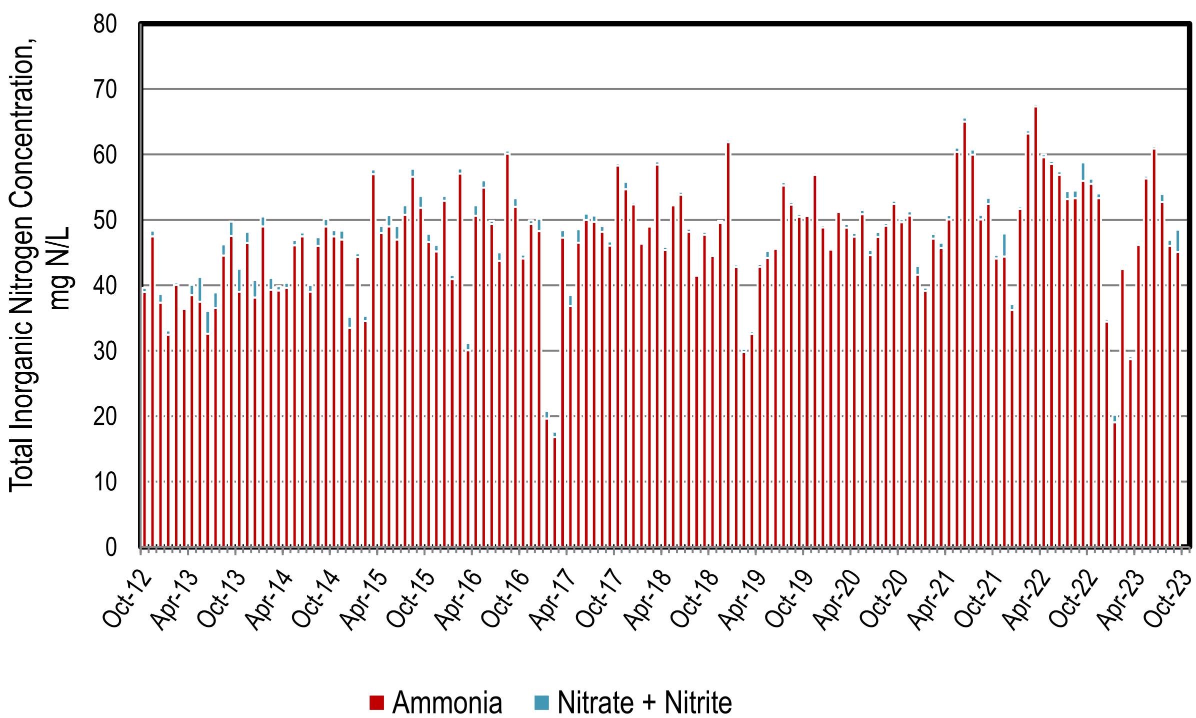

Figure 30-5. Discharge: SVCW Monthly Nitrogen Concentrations

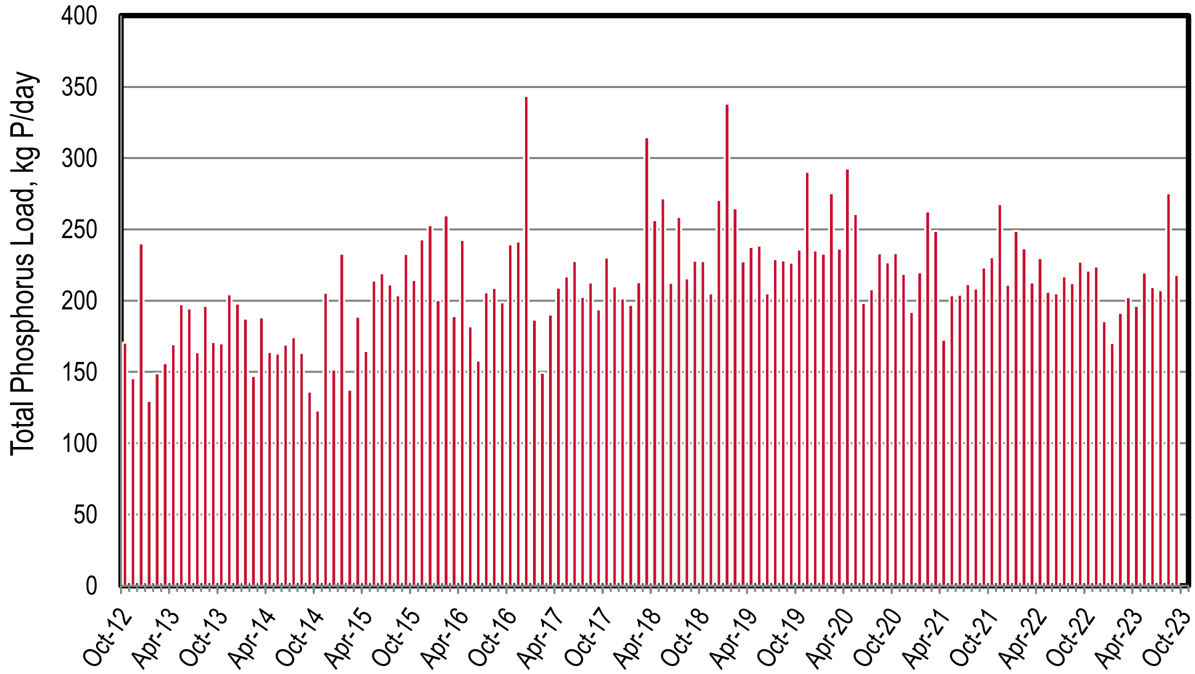

Figure 30-6. Discharge: SVCW Monthly Phosphorus Loads

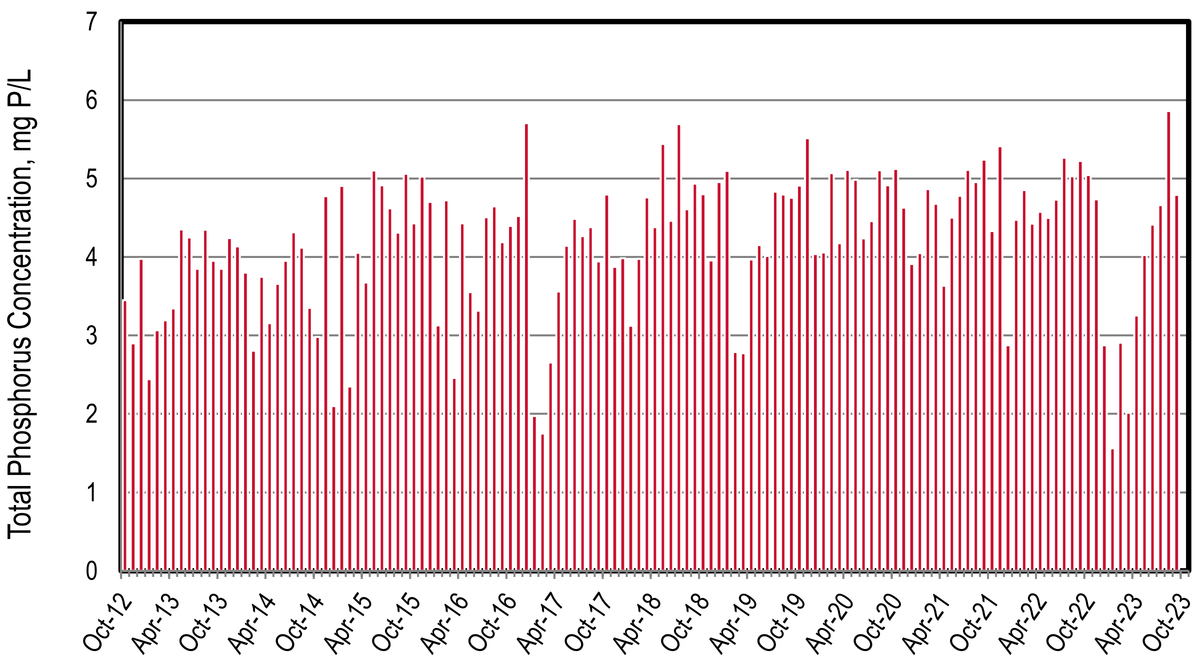

Figure 30-7. Discharge: SVCW Monthly Phosphorus Concentrations

Recycled Water

Table 30-3. Recycled Water: SVCW Yearly Recycled Water Volume Diverted from the Bay

Year**	Flow Diverted*, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	603 (0.54)	--	15 (0.01)	--	--	9 (0.01)	627 (0.56)
2020	--	450 (0.40)	--	7 (0.01)	--	--	2 (<0.01)	460 (0.41)
2021	--	714 (0.64)	--	9 (0.01)	--	--	12 (0.01)	735 (0.66)
2022	--	653 (0.58)	--	18 (0.02)	--	--	10 (0.01)	680 (0.61)
Average	--	605 (0.54)	--	12 (0.01)	--	--	8 (0.01)	626 (0.56)

* Assumes 100% of the recycled flow is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 30-4. Recycled Water: SVCW Yearly Recycled Water Ammonia Load Diverted from the Bay

Year**	Average Ammonia Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	90	--	2	--	--	2	94
2020	--	73	--	2	--	--	<1	75
2021	--	121	--	2	--	--	2	125
2022	--	118	--	4	--	--	2	124
Average	--	101	--	2	--	--	1	104

* Assumes 100% of the recycled load is diverted from the Bay

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 30-5. Recycled Water: SVCW Yearly Recycled Water TIN Load Diverted from the Bay

Year**	Average Total Inorganic Nitrogen Load Diverted*, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	91	--	2	--	--	2	95
2020	--	74	--	2	--	--	<1	75
2021	--	123	--	2	--	--	2	127
2022	--	120	--	4	--	--	2	126
Average	--	102	--	2	--	--	1	106

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

Table 30-6. Recycled Water: SVCW Yearly Recycled Water Total P Load Diverted from the Bay

Year**	Average Total P Load Diverted*, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	8	--	<1	--	--	<1	9
2020	--	7	--	<1	--	--	<1	7
2021	--	11	--	<1	--	--	<1	11
2022	--	10	--	<1	--	--	<1	10
Average	--	9	--	<1	--	--	<1	9

* Assumes 100% of the recycled load is diverted for all recycled water applications

**** Calendar year as opposed to California's water year (October 1 through September 30)**

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31 Sanitary District No. 5 of Marin County – Tiburon Treatment Plant

The Tiburon Treatment Plant discharges to the Central Bay. The service area has a population of approximately 8,400. The plant has a permitted ADWF capacity of 0.98 mgd and a peak wet weather capacity of 2.3 mgd. This past dry season had flows of approximately 0.56 mgd. The plant performs secondary treatment using an activated sludge treatment process.

The plant is classified as a minor discharger (<1 mgd permitted capacity) and thus not required to sample as frequently as the major dischargers (>1 mgd permitted capacity). The minor dischargers are required to sample twice per year under the Nutrient Watershed Permit. As a result, there are several months of nutrient data gaps.

The following observations are made based upon the figures and tables in the subsequent pages:

- Discharge:
  - Flow values are provided over the entire study period. The remaining nutrient species only have monthly sampling for the first year of sampling, followed by occasional sampling thereafter (e.g., ammonia samples are more frequent).
  - Ammonia is the majority of the nitrogen species discharged, regardless of season (except for January 2013, September 2020, January 2022, and July 2023). This would be expected since this plant does not nitrify.
  - Total phosphorus concentrations are wide ranging from approximately 1.4 to 6.5 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L.
  - Based on Table 31-1 statistics for the entire dry season dataset, no parameters appear to be trending.
- Recycled Water: No recycled water was produced or distributed this past year.

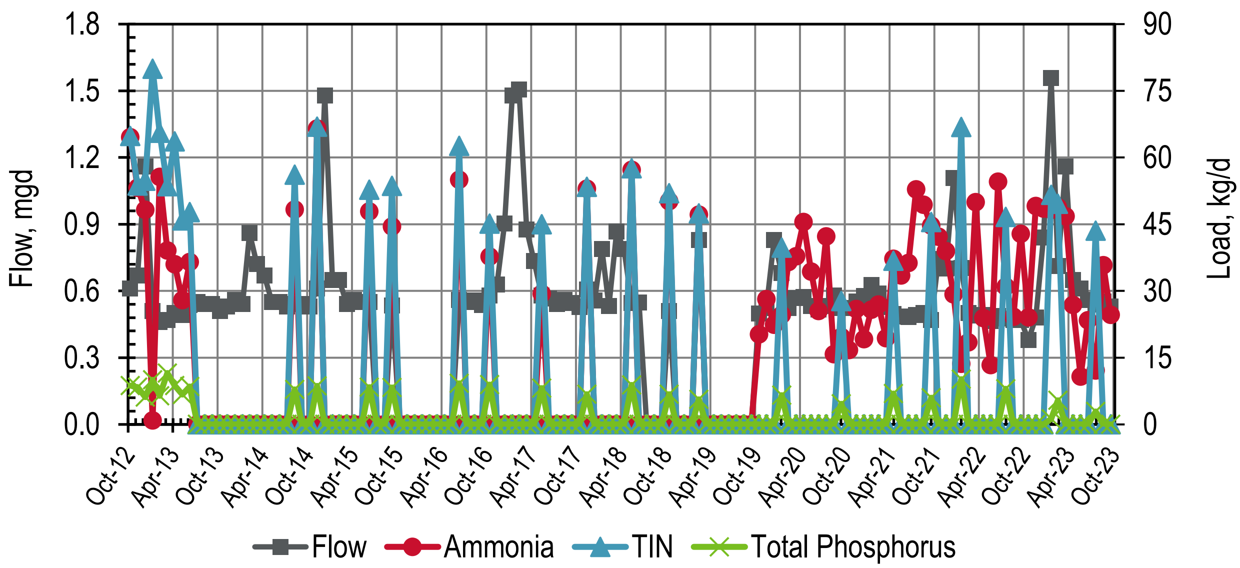

Figure 31-1. Discharge: Tiburon Monthly Flows and Loads

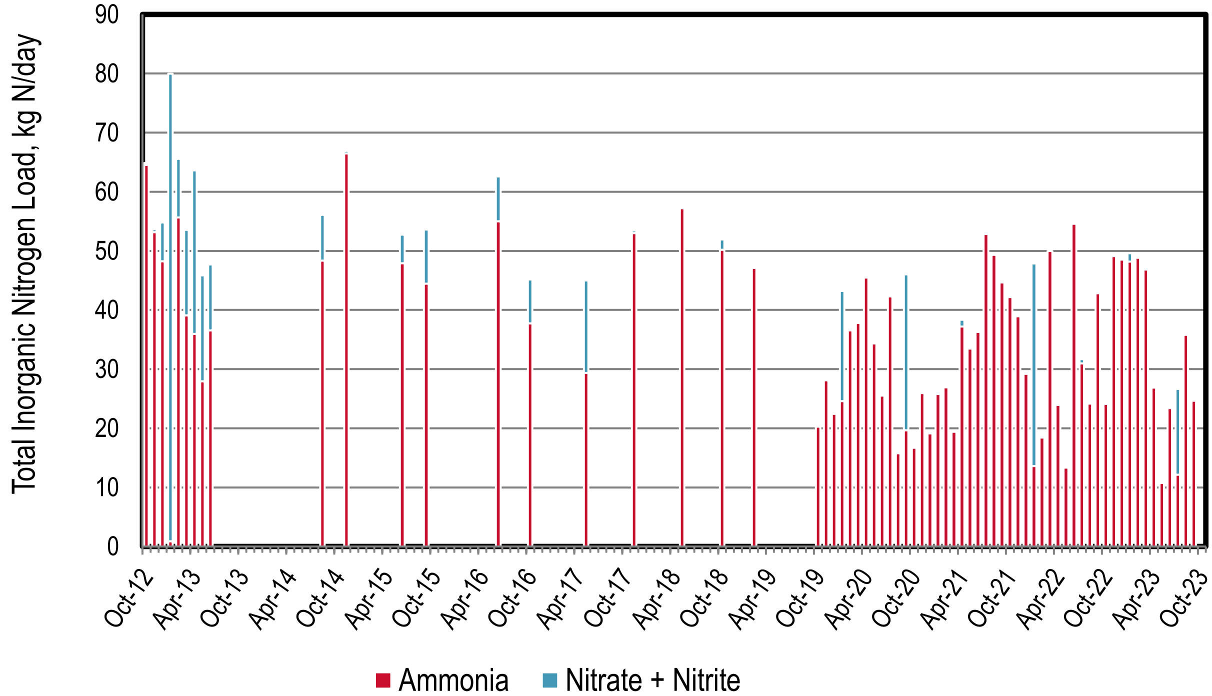

Figure 31-2. Discharge: Tiburon Monthly Nitrogen Loads

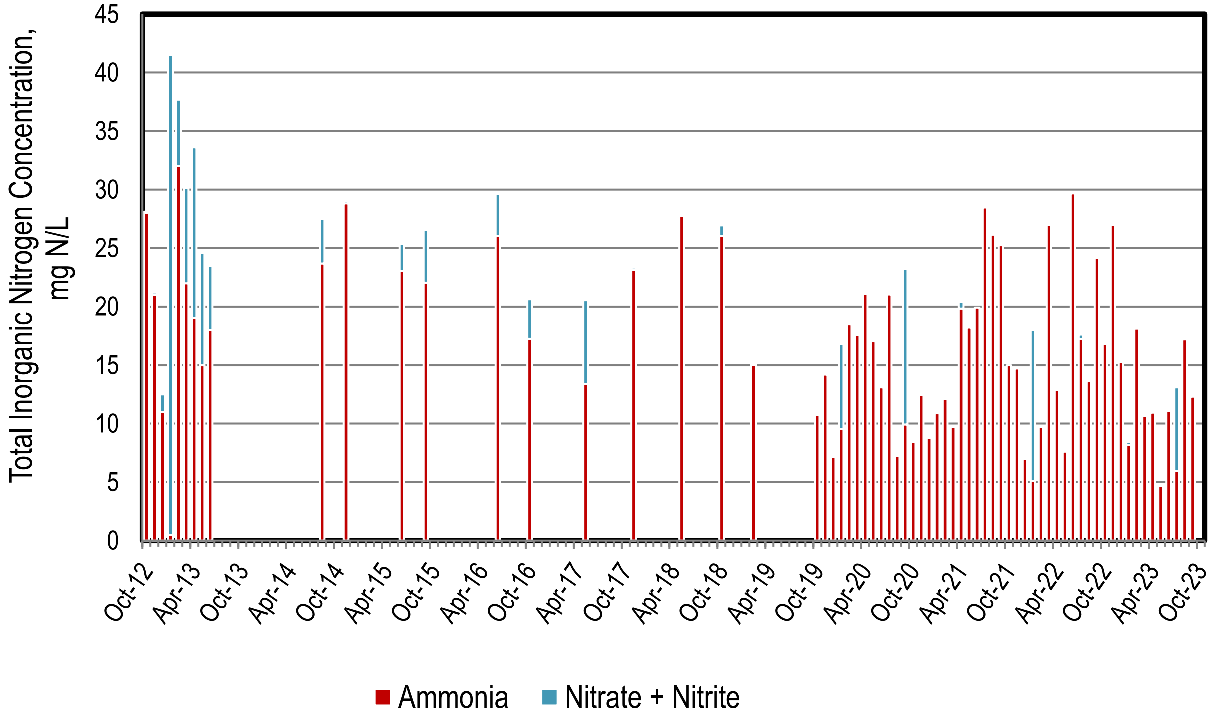

Figure 31-3. Discharge: Tiburon Monthly Nitrogen Concentrations

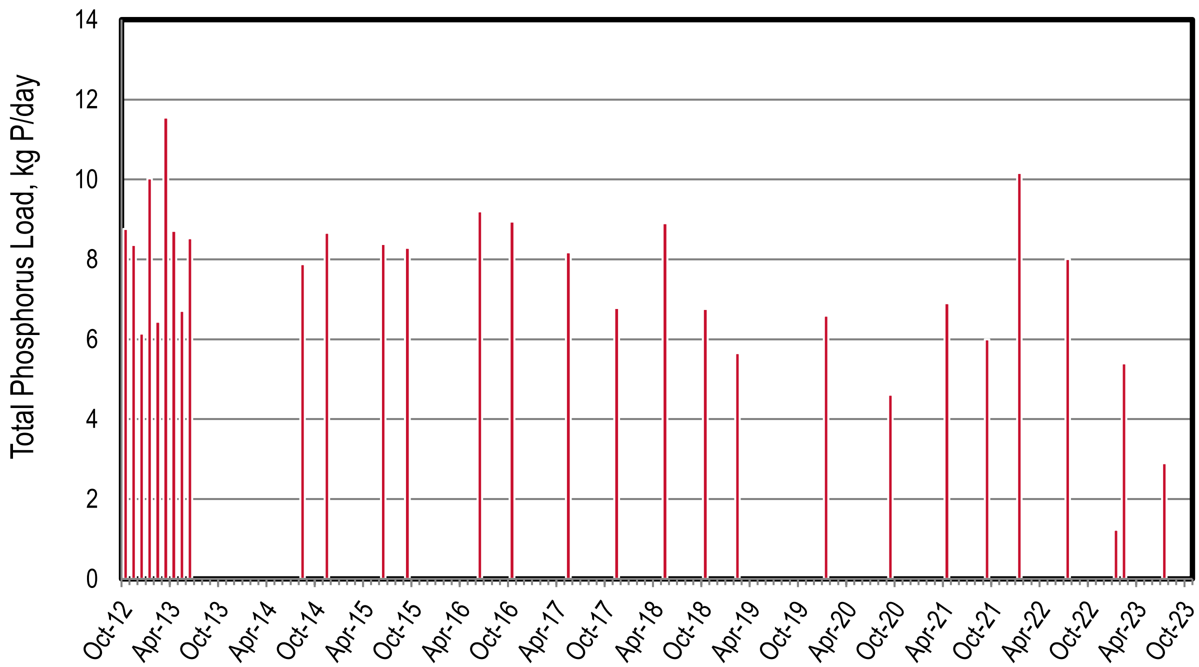

Figure 31-4. Discharge: Tiburon Monthly Phosphorus Loads

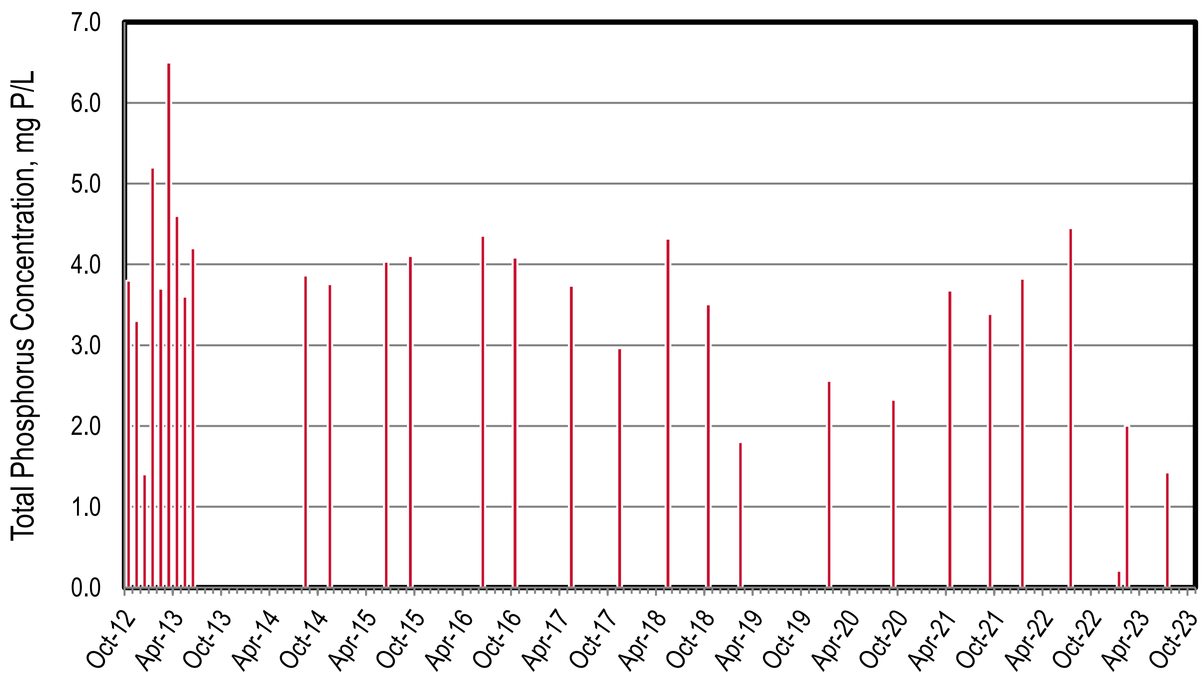

Figure 31-5. Discharge: Tiburon Monthly Phosphorus Concentrations

Table 31-1. Discharge: Tiburon Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.610	64.6	0.284	64.8	8.76
Nov-12	0.670	53.2	0.484	53.7	8.36
Dec-12	1.16	48.2	6.58	54.8	6.14
Jan-13	0.510	0.906	79.1	80.0	10.0
Feb-13	0.460	55.6	9.91	65.6	6.43
Mar-13	0.470	39.1	14.4	53.5	11.5
Apr-13	0.501	36.0	27.6	63.6	8.71
May-13	0.493	28.0	17.9	45.8	6.71
Jun-13	0.537	36.5	11.2	47.7	8.53
Jul-13	0.550	--	--	--	--
Aug-13	0.540	--	--	--	--
Sep-13	0.540	--	--	--	--
Oct-13	0.510	--	--	--	--
Nov-13	0.530	--	--	--	--
Dec-13	0.560	--	--	--	--
Jan-14	0.540	--	--	--	--
Feb-14	0.860	--	--	--	--
Mar-14	0.720	--	--	--	--
Apr-14	0.670	--	--	--	--
May-14	0.550	--	--	--	--
Jun-14	0.550	--	--	--	--
Jul-14	0.530	--	--	--	--
Aug-14	0.540	48.3	7.78	56.1	7.88
Sep-14	0.540	--	--	--	--
Oct-14	0.530	--	--	--	--
Nov-14	0.610	66.5	0.455	66.9	8.66
Dec-14	1.48	--	--	--	--
Jan-15	0.650	--	--	--	--
Feb-15	0.650	--	--	--	--
Mar-15	0.540	--	--	--	--
Apr-15	0.560	--	--	--	--
May-15	0.550	--	--	--	--
Jun-15	0.550	47.9	4.83	52.7	8.38
Jul-15	--	--	--	--	--
Aug-15	--	--	--	--	--
Sep-15	0.534	44.5	9.16	53.6	8.29

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	--	--	--	--	--
Nov-15	--	--	--	--	--
Dec-15	--	--	--	--	--
Jan-16	--	--	--	--	--
Feb-16	--	--	--	--	--
Mar-16	--	--	--	--	--
Apr-16	--	--	--	--	--
May-16	--	--	--	--	--
Jun-16	0.559	55.0	7.60	62.6	9.20
Jul-16	0.550	--	--	--	--
Aug-16	0.557	--	--	--	--
Sep-16	0.536	--	--	--	--
Oct-16	0.579	37.8	7.41	45.2	8.94
Nov-16	0.628	--	--	--	--
Dec-16	0.904	--	--	--	--
Jan-17	1.48	--	--	--	--
Feb-17	1.51	--	--	--	--
Mar-17	0.876	--	--	--	--
Apr-17	0.735	--	--	--	--
May-17	0.579	29.4	15.6	45.0	8.18
Jun-17	0.566	--	--	--	--
Jul-17	0.540	--	--	--	--
Aug-17	0.559	--	--	--	--
Sep-17	0.546	--	--	--	--
Oct-17	0.529	--	--	--	--
Nov-17	0.606	53.0	0.424	53.4	6.78
Dec-17	0.558	--	--	--	--
Jan-18	0.788	--	--	--	--
Feb-18	0.534	--	--	--	--
Mar-18	0.866	--	--	--	--
Apr-18	0.790	--	--	--	--
May-18	0.545	57.2	0.339	57.6	8.90
Jun-18	0.549	--	--	--	--
Jul-18	--	--	--	--	--
Aug-18	--	--	--	--	--
Sep-18	--	--	--	--	--
Oct-18	0.510	50.2	1.76	51.9	6.76

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	--	--	--	--	--
Dec-18	--	--	--	--	--
Jan-19	--	--	--	--	--
Feb-19	0.830	47.1	0.314	47.4	5.65
Mar-19	--	--	--	--	--
Apr-19	--	--	--	--	--
May-19	--	--	--	--	--
Jun-19	--	--	--	--	--
Jul-19	--	--	--	--	--
Aug-19	--	--	--	--	--
Sep-19	--	--	--	--	--
Oct-19	0.499	20.2	--	--	--
Nov-19	0.524	28.1	--	--	--
Dec-19	0.828	22.4	--	--	--
Jan-20	0.681	24.6	18.6	39.7	6.59
Feb-20	0.523	36.5	--	--	--
Mar-20	0.568	37.8	--	--	--
Apr-20	0.571	45.5	--	--	--
May-20	0.533	34.3	--	--	--
Jun-20	0.515	25.5	--	--	--
Jul-20	0.532	42.3	--	--	--
Aug-20	0.578	15.8	--	--	--
Sep-20	0.524	19.7	26.3	27.7	4.61
Oct-20	0.523	16.7	--	--	--
Nov-20	0.551	25.9	--	--	--
Dec-20	0.576	19.1	--	--	--
Jan-21	0.626	25.8	--	--	--
Feb-21	0.588	26.9	--	--	--
Mar-21	0.529	19.4	--	--	--
Apr-21	0.497	37.2	1.09	36.8	6.90
May-21	0.486	33.5	--	--	--
Jun-21	0.482	36.3	--	--	--
Jul-21	0.491	52.9	--	--	--
Aug-21	0.499	49.4	--	--	--
Sep-21	0.468	44.7	0.0727	45.5	6.00
Oct-21	0.745	42.2	--	--	--
Nov-21	0.701	38.9	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	1.11	29.2	--	--	--
Jan-22	0.703	13.6	34.3	66.8	10.2
Feb-22	0.501	18.4	--	--	--
Mar-22	0.490	50.0	--	--	--
Apr-22	0.492	23.9	--	--	--
May-22	0.465	13.3	--	--	--
Jun-22	0.487	54.6	--	--	--
Jul-22	0.476	31.0	0.681	46.7	8.01
Aug-22	0.470	24.2	--	--	--
Sep-22	0.468	42.8	--	--	--
Oct-22	0.379	24.1	--	--	--
Nov-22	0.482	49.1	--	--	--
Dec-22	0.840	48.5	--	--	--
Jan-23	1.56	48.2	1.38	51.6	1.23
Feb-23	0.713	48.8	0.310	49.6	5.40
Mar-23	1.16	46.8	--	--	--
Apr-23	0.650	26.9	--	--	--
May-23	0.610	10.7	--	--	--
Jun-23	0.559	23.4	--	--	--
Jul-23	0.538	12.1	14.5	43.5	2.90
Aug-23	0.551	35.8	--	--	--
Sep-23	0.530	24.7	--	--	--
Dry Season Average	**0.531**	**34.8**	**9.67**	**48.7**	**7.30**
Dry Season Trend,***	**None**	**None**	*****	*****	*****
Wet Season Average	**0.694**	**36.2**	**12.0**	**55.6**	**7.47**
Average Annual	**0.628**	**35.6**	**11.0**	**52.8**	**7.40**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.
*** No statistical dry season trending analysis was performed on nutrient species (except ammonia) due to the limited number of samples required for minor dischargers.

Recycled Water

No recycled water was produced or distributed this past year.

32 Treasure Island

Treasure Island discharges to the Central Bay. The plant has a permitted capacity of 2.0 mgd ADWF and a peak wet weather capacity of 4.4 mgd. It had a dry season flow of approximately 0.32 mgd this past dry season. The plant currently nitrifies using trickling filters.

The following observations are made based upon the figures and table in the subsequent pages:

- Discharge
  - The plant fully nitrified through April 2015 at which time one of the plant's two trickling arm filters became inoperable until March 2016. While the arm was inoperable, the discharge ammonia concentrations increased but have since recovered to discharge concentrations that typically range between 2 to 4 mg N/L.
  - NOx represents the majority of nitrogen species discharged as would be expected since this plant nitrifies (with the exception of the period when the trickling filter arm was inoperable).
  - Since July 2020, the plant has produced a stable and reliable discharge Total P load of approximately 2 to 4 kg P/d (except for an excursion in January 2022 and August 2023).
  - Based on the entire dataset for dry season average monthly values, nitrate + nitrite and TIN are trending upwards while the remaining parameters (Flow, Ammonia, and Total P) are neither trending upwards nor downwards.
- Recycled Water: No recycled water was produced or distributed this year.

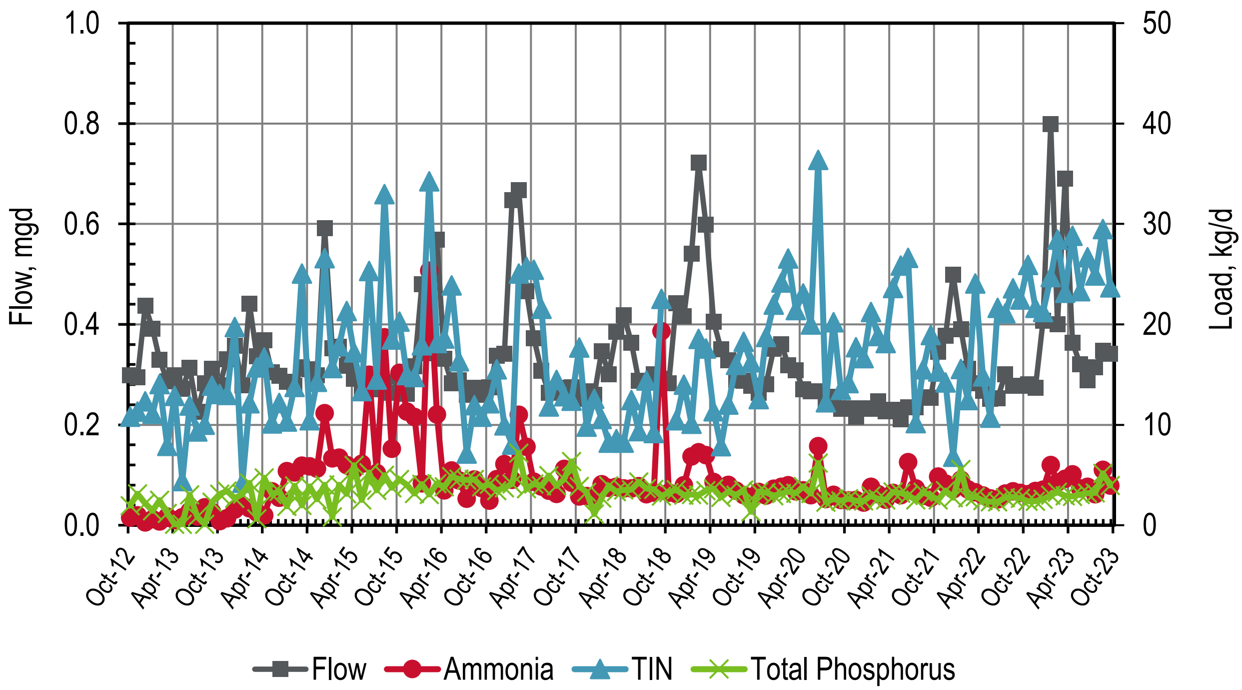

Figure 32-1. Discharge: Treasure Island Monthly Flows and Loads

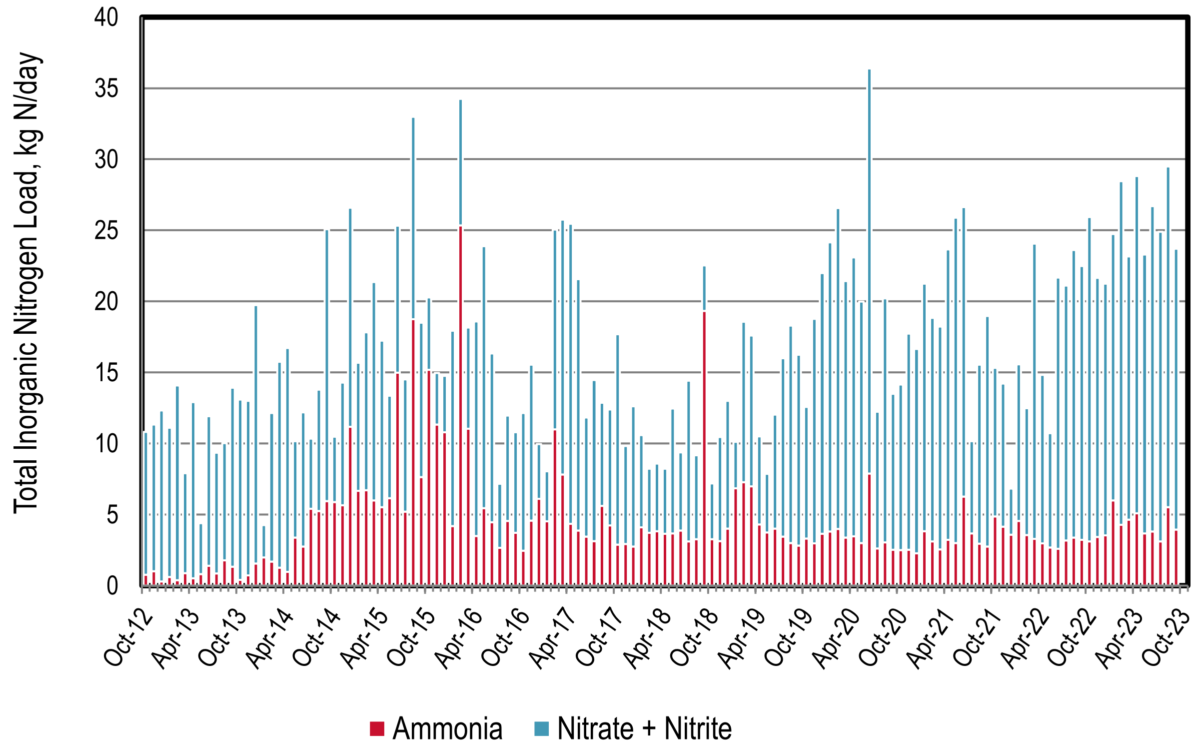

Figure 32-2. Discharge: Treasure Island Monthly Nitrogen Loads

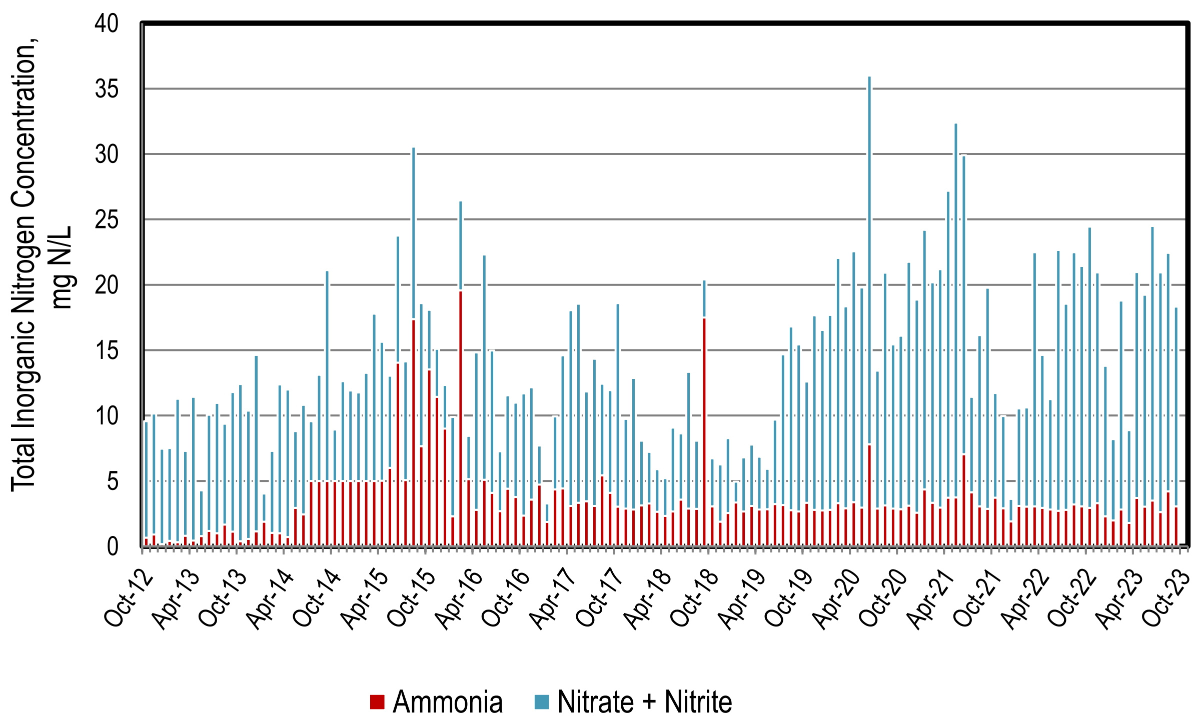

Figure 32-3. Discharge: Treasure Island Monthly Nitrogen Concentrations

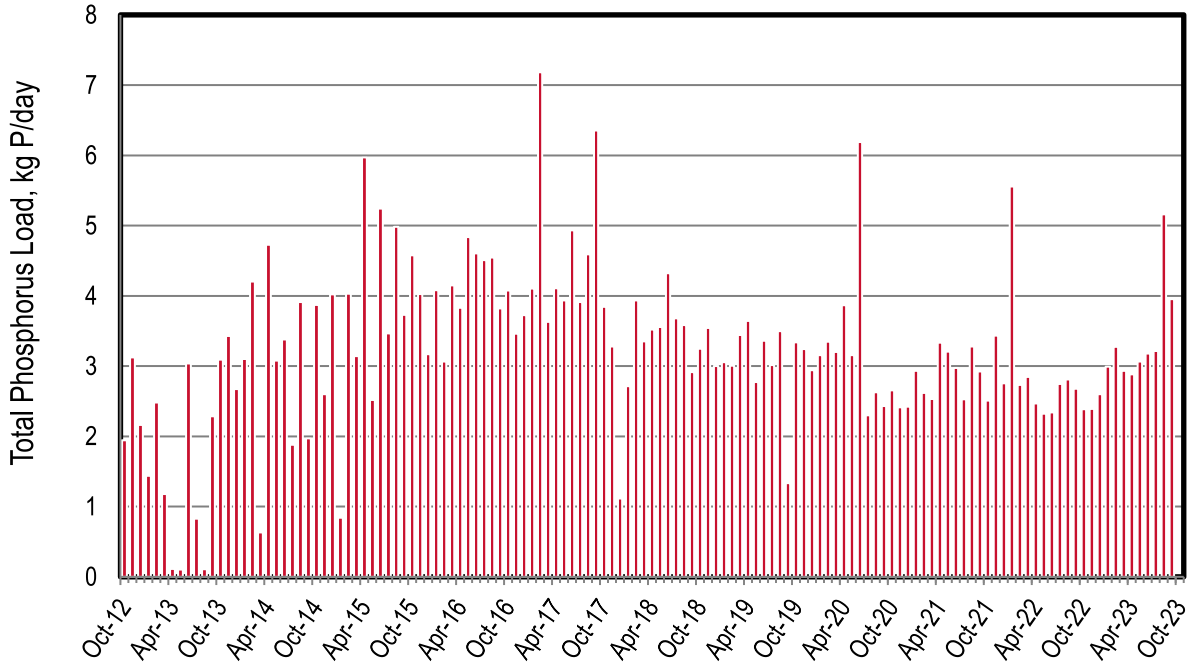

Figure 32-4. Discharge: Treasure Island Monthly Phosphorus Loads

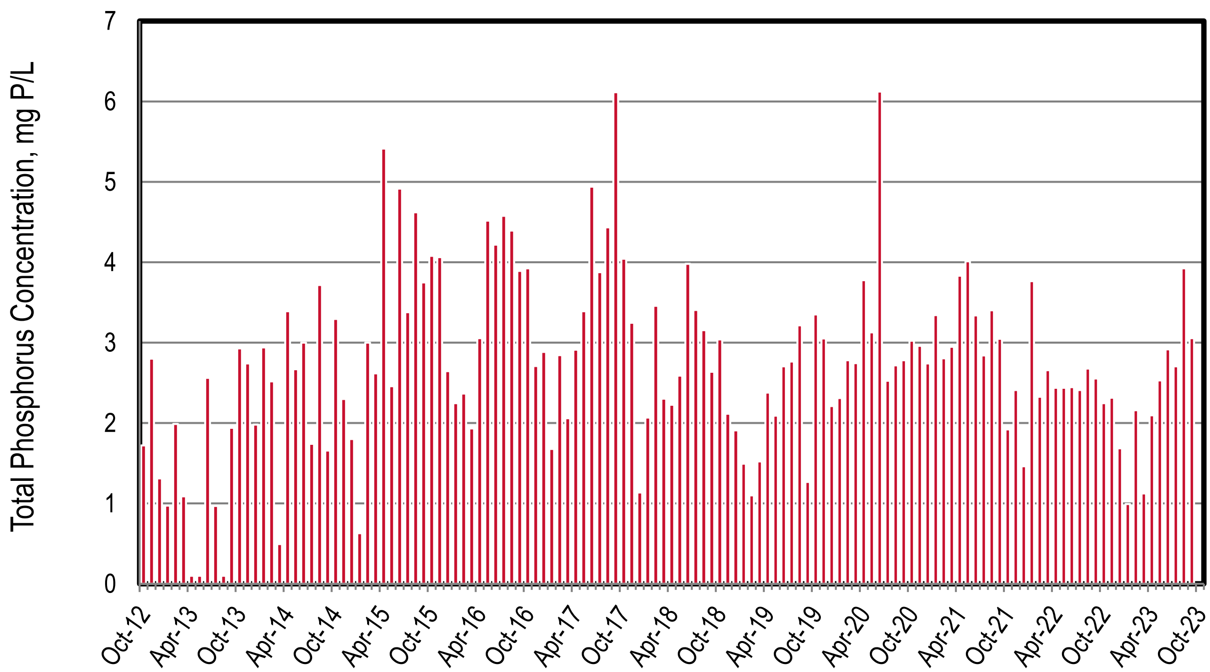

Figure 32-5. Discharge: Treasure Island Monthly Phosphorus Concentrations

Table 32-1. Treasure Island Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.299	0.757	10.1	10.8	1.94
Nov-12	0.295	1.00	10.3	11.3	3.12
Dec-12	0.437	0.297	12.0	12.3	2.16
Jan-13	0.391	0.602	10.5	11.1	1.44
Feb-13	0.330	0.387	13.7	14.1	2.48
Mar-13	0.287	0.872	7.04	7.91	1.18
Apr-13	0.299	0.509	12.4	12.9	0.113
May-13	0.272	0.802	3.59	4.40	0.103
Jun-13	0.314	1.40	10.5	11.9	3.04
Jul-13	0.226	0.863	8.49	9.35	0.829
Aug-13	0.283	1.79	8.23	10.0	0.107
Sep-13	0.312	1.32	12.6	13.9	2.29
Oct-13	0.299	0.411	12.7	13.1	3.09
Nov-13	0.295	0.713	12.3	13.0	3.43
Dec-13	0.437	1.55	18.2	19.7	2.67
Jan-14	0.391	1.99	2.25	4.25	3.10
Feb-14	0.330	1.69	10.5	12.2	4.20
Mar-14	0.287	1.27	14.5	15.7	0.630
Apr-14	0.299	0.976	15.7	16.7	4.73
May-14	0.272	3.39	6.77	10.2	3.08
Jun-14	0.314	2.75	9.43	12.2	3.38
Jul-14	0.286	5.40	4.94	10.3	1.88
Aug-14	0.278	5.26	8.53	13.8	3.91
Sep-14	0.314	5.94	19.1	25.1	1.97
Oct-14	0.311	5.87	4.60	10.5	3.87
Nov-14	0.299	5.66	8.62	14.3	2.60
Dec-14	0.591	11.2	15.4	26.6	4.02
Jan-15	0.352	6.66	9.01	15.7	0.840
Feb-15	0.356	6.72	11.1	17.8	4.03
Mar-15	0.317	6.00	15.4	21.4	3.14
Apr-15	0.292	5.52	11.7	17.2	5.97
May-15	0.271	6.14	7.22	13.4	2.52
Jun-15	0.282	15.0	10.3	25.3	5.24
Jul-15	0.271	5.20	9.30	14.5	3.47
Aug-15	0.285	18.7	14.2	33.0	4.98
Sep-15	0.263	7.63	10.9	18.5	3.73

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.297	15.2	5.09	20.3	4.58
Nov-15	0.262	11.3	3.62	15.0	4.03
Dec-15	0.317	10.8	3.98	14.8	3.17
Jan-16	0.480	4.19	13.7	17.9	4.08
Feb-16	0.343	25.3	8.90	34.2	3.07
Mar-16	0.569	11.0	7.14	18.2	4.15
Apr-16	0.331	3.48	15.1	18.6	3.83
May-16	0.283	5.45	18.4	23.9	4.84
Jun-16	0.289	4.45	11.9	16.3	4.60
Jul-16	0.260	2.65	4.51	7.16	4.51
Aug-16	0.274	4.55	7.42	12.0	4.55
Sep-16	0.260	3.71	7.09	10.8	3.82
Oct-16	0.275	2.45	9.70	12.2	4.07
Nov-16	0.338	4.58	11.0	15.5	3.46
Dec-16	0.342	6.10	3.85	9.95	3.73
Jan-17	0.648	4.52	3.52	8.04	4.10
Feb-17	0.668	11.0	14.1	25.1	7.18
Mar-17	0.466	7.81	17.9	25.7	3.63
Apr-17	0.373	4.34	21.1	25.5	4.11
May-17	0.307	3.87	17.7	21.6	3.94
Jun-17	0.264	3.44	8.38	11.8	4.93
Jul-17	0.267	3.12	11.3	14.5	3.91
Aug-17	0.274	5.61	7.26	12.9	4.59
Sep-17	0.275	4.23	8.17	12.4	6.35
Oct-17	0.252	2.88	14.8	17.7	3.85
Nov-17	0.267	2.92	6.90	9.82	3.28
Dec-17	0.259	2.76	9.85	12.6	1.11
Jan-18	0.347	4.09	6.50	10.6	2.71
Feb-18	0.301	3.72	4.49	8.22	3.94
Mar-18	0.385	3.84	4.75	8.59	3.35
Apr-18	0.418	3.66	4.57	8.23	3.52
May-18	0.364	3.67	8.79	12.5	3.56
Jun-18	0.287	3.88	5.49	9.37	4.32
Jul-18	0.286	3.11	11.3	14.4	3.68
Aug-18	0.301	3.26	5.92	9.18	3.58
Sep-18	0.292	19.3	3.21	22.5	2.91
Oct-18	0.283	3.26	3.92	--	3.25

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0.442	3.13	7.32	10.5	3.54
Dec-18	0.416	--	--	--	--
Jan-19	0.541	6.85	3.27	10.1	3.06
Feb-19	0.723	7.27	11.3	18.6	3.00
Mar-19	0.599	6.98	10.6	17.6	3.45
Apr-19	0.405	4.31	6.19	11.3	3.64
May-19	0.351	3.75	4.12	7.87	2.77
Jun-19	0.329	4.02	8.01	12.0	3.36
Jul-19	0.288	3.45	12.5	16.0	3.01
Aug-19	0.288	3.00	15.3	18.3	3.50
Sep-19	0.278	2.82	13.4	16.2	1.33
Oct-19	0.264	3.32	9.25	12.6	3.34
Nov-19	0.281	2.96	15.8	18.8	3.24
Dec-19	0.352	3.64	18.3	22.0	2.94
Jan-20	0.361	3.82	20.3	24.2	3.15
Feb-20	0.319	3.99	22.6	26.6	3.35
Mar-20	0.309	3.38	18.0	21.4	3.20
Apr-20	0.271	3.46	19.6	23.1	3.87
May-20	0.267	3.00	17.0	20.0	3.16
Jun-20	0.267	7.88	28.5	36.4	6.19
Jul-20	0.241	2.62	9.62	12.2	2.30
Aug-20	0.256	3.03	17.2	20.2	2.63
Sep-20	0.231	2.53	11.0	13.5	2.43
Oct-20	0.233	2.50	11.7	14.2	2.66
Nov-20	0.216	2.53	15.2	17.7	2.41
Dec-20	0.234	2.27	14.4	16.7	2.42
Jan-21	0.232	3.83	17.4	21.2	2.93
Feb-21	0.247	3.10	15.7	18.8	2.62
Mar-21	0.227	2.54	15.7	18.2	2.53
Apr-21	0.230	3.22	20.4	23.6	3.33
May-21	0.211	2.99	22.9	25.9	3.21
Jun-21	0.236	6.27	20.4	26.6	2.97
Jul-21	0.235	3.68	6.48	10.2	2.53
Aug-21	0.255	2.95	12.6	15.5	3.28
Sep-21	0.254	2.75	16.2	19.0	2.92
Oct-21	0.346	4.86	10.4	15.3	2.51
Nov-21	0.377	4.16	10.1	14.2	3.44

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	0.499	3.58	3.24	6.82	2.75
Jan-22	0.391	4.54	11.0	15.6	5.56
Feb-22	0.311	3.57	8.91	12.5	2.73
Mar-22	0.283	3.28	20.8	24.1	2.84
Apr-22	0.268	2.96	11.9	14.8	2.47
May-22	0.252	2.68	8.04	10.7	2.32
Jun-22	0.253	2.60	19.1	21.7	2.34
Jul-22	0.301	3.17	18.0	21.1	2.75
Aug-22	0.278	3.37	20.2	23.6	2.81
Sep-22	0.278	3.21	19.3	22.5	2.68
Oct-22	0.281	3.11	22.8	25.9	2.39
Nov-22	0.274	3.42	18.2	21.6	2.39
Dec-22	0.408	3.54	17.7	21.3	2.60
Jan-23	0.799	5.98	18.8	24.7	2.99
Feb-23	0.401	4.27	24.2	28.5	3.27
Mar-23	0.691	4.63	18.5	23.2	2.93
Apr-23	0.364	5.09	23.7	28.8	2.88
May-23	0.320	3.68	19.6	23.3	3.07
Jun-23	0.289	3.82	22.9	26.7	3.18
Jul-23	0.314	3.11	21.8	24.9	3.21
Aug-23	0.348	5.53	24.0	29.5	5.16
Sep-23	0.342	3.95	19.8	23.7	3.95
Dry Season Average	**0.282**	**4.47**	**12.5**	**17.0**	**3.30**
Dry Season Trend**	**None**	**None**	**Up**	**Up**	**None**
Wet Season Average	**0.364**	**4.47**	**12.1**	**16.8**	**3.17**
Average Annual	**0.330**	**4.47**	**12.3**	**16.9**	**3.23**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Recycled Water

No recycled water was produced or distributed this past year.

33 Vallejo Flood & Wastewater District

Vallejo discharges to San Pablo Bay and it has approximately 37,845 service connections. The plant has a permitted ADWF capacity of 15.5 mgd and a peak wet weather capacity of 60 mgd. The average dry season discharge flows this past year are approximately 7.77 mgd dry season. The plant performs secondary treatment using a trickling filter/solids contact process.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent and Reduction Across the Plant
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters. Based on the limited average monthly values in Table 33-1, ammonia dry season loads are trending downwards, whereas dry season phosphorus loads are trending upwards. All other monitored parameters have no emerging trends.
  - The flow reduction across the plant is negligible.
  - The nitrogen load reduction values across the plant ranges from approximately 30 to 60 percent. This load reduction is attributed primarily to a combination of biological assimilation, biosolids management, and/or biological load reduction in the trickling filter/solids contact process.
  - The phosphorus load reduction across the plant ranges from approximately 15 to 75 percent (sampling from 10/2020 had an abnormally high total P load reduction). The load reduction is attributed to a combination of chemical precipitation, biological assimilation, and/or biosolids management.
- Discharge
  - The average monthly dry season flow values for 2023 increased compared to 2022 (from 7.4 to 7.8 mgd). Such an relatively high increase was expected given how relatively wet this past winter was.
  - During the initial two years of data, TIN was comprised of approximately equal parts Ammonia and NOx. Since the end of 2014, ammonia comprises the majority of the nitrogen species.
  - The phosphorus concentrations range from 1.1 to 5.3 mg P/L. A portion of the total P is removed across the plant as noted.
  - Based on Table 33-1 statistics for the entire dry season dataset, flow, nitrite plus nitrate, and total P loads are trending downwards.. Note: the last several years of ammonia and TIN loads have been relatively flat.
- Recycled Water: No recycled water was produced or distributed this past year.

Influent

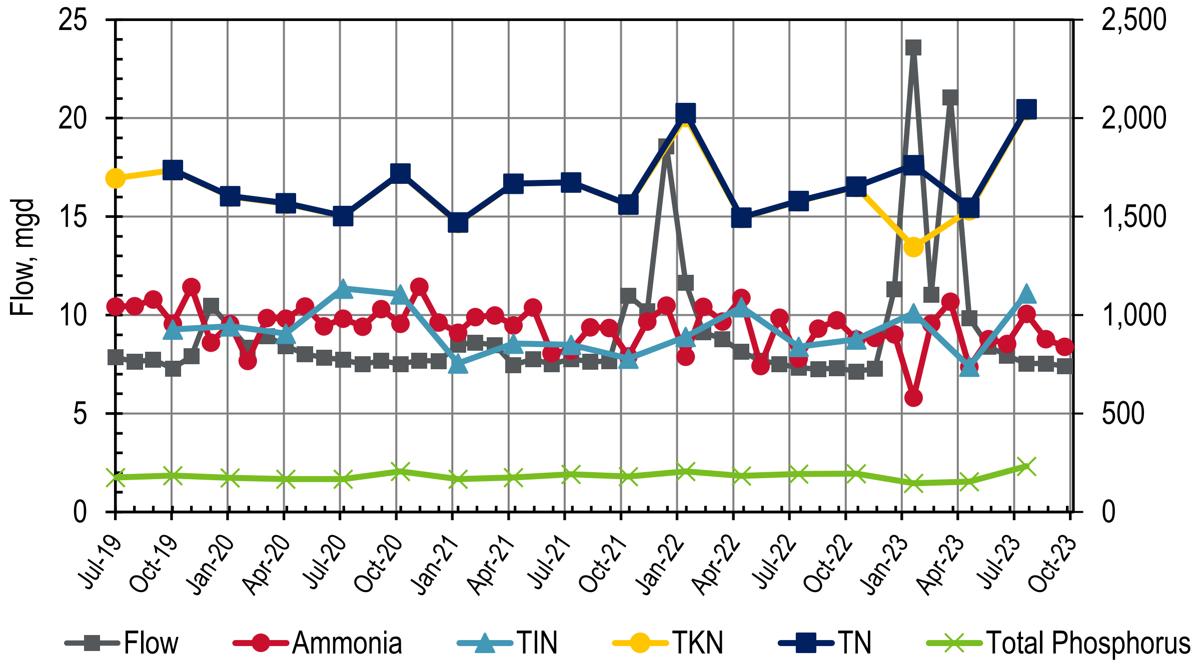

Figure 33-1. Influent: Vallejo Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

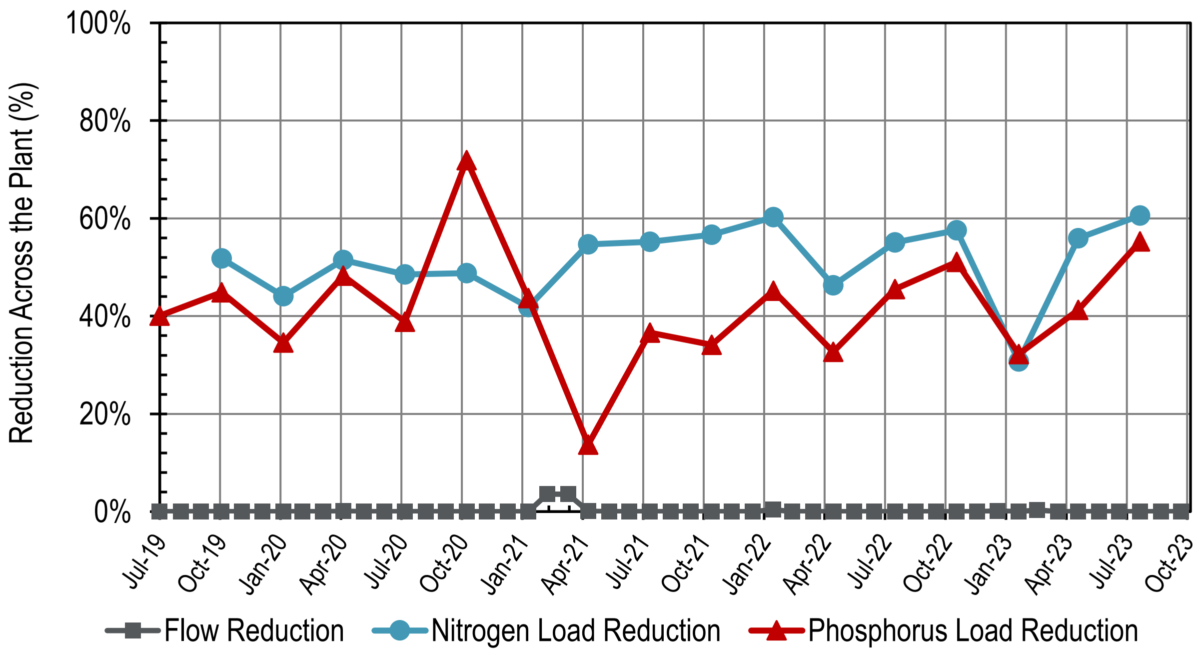

Figure 33-2. Influent: Vallejo Monthly Reductions Across the Plant

Note: Influent Total N was compared against Discharge TIN for calculating nitrogen load reduction.

Table 33-1. Influent: Vallejo Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	7.86	1,040	Non-Detect	**	1,690	**	175
Aug-19	7.63	1,050	--	--	--	--	--
Sep-19	7.72	1,080	--	--	--	--	--
Oct-19	7.29	956	2.14	927	1,740	1,740	185
Nov-19	7.90	1,140	--	--	--	--	--
Dec-19	10.5	861	--	--	--	--	--
Jan-20	9.40	955	1.26	944	1,600	1,600	173
Feb-20	8.34	767	--	--	--	--	--
Mar-20	8.93	986	--	--	--	--	--
Apr-20	8.42	982	3.57	907	1,570	1,570	167
May-20	8.01	1,040	--	--	--	--	--
Jun-20	7.84	943	--	--	--	--	--
Jul-20	7.72	982	1.09	1,140	1,500	1,500	167
Aug-20	7.50	942	--	--	--	--	--
Sep-20	7.67	1,030	--	--	--	--	--
Oct-20	7.52	957	1.75	1,100	1,720	1,720	207
Nov-20	7.69	1,140	--	--	--	--	--
Dec-20	7.67	963	--	--	--	--	--
Jan-21	8.50	910	3.74	755	1,470	1,470	167
Feb-21	8.61	991	--	--	--	--	--
Mar-21	8.47	999	--	--	--	--	--
Apr-21	7.47	947	Non-Detect	856	1,670	1,670	175
May-21	7.75	1,040	--	--	--	--	--
Jun-21	7.51	806	--	--	--	--	--
Jul-21	7.78	822	Non-Detect	849	1,670	1,670	191
Aug-21	7.63	939	--	--	--	--	--
Sep-21	7.66	935	--	--	--	--	--
Oct-21	11.0	791	2.22	779	1,560	1,560	181
Nov-21	10.2	968	--	--	--	--	--
Dec-21	18.6	1,050	--	--	--	--	--
Jan-22	11.6	788	20.1	890	2,010	2,030	206
Feb-22	9.12	1,040	--	--	--	--	--
Mar-22	8.79	968	--	--	--	--	--
Apr-22	8.14	1,090	1.74	1,040	1,490	1,490	183
May-22	7.69	742	--	--	--	--	--
Jun-22	7.51	987	--	--	--	--	--

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-22	7.33	780	1.40	840	1,580	1,580	193
Aug-22	7.26	932	--	--	--	--	--
Sep-22	7.31	975	--	--	--	--	--
Oct-22	7.14	877	1.65	877	1,650	1,650	195
Nov-22	7.28	886	--	--	--	--	--
Dec-22	11.3	902	--	--	--	--	--
Jan-23	23.6	582	415	1,010	1,350	1,760	146
Feb-23	11.0	957	--	--	--	--	--
Mar-23	21.1	1,070	--	--	--	--	--
Apr-23	9.85	738	12.8	738	1,530	1,550	153
May-23	8.42	878	--	--	--	--	--
Jun-23	7.95	854	--	--	--	--	--
Jul-23	7.54	1,010	4.25	1,110	2,040	2,050	232
Aug-23	7.54	877	--	--	--	--	--
Sep-23	7.40	839	--	--	--	--	--
Dry Season Average	**7.66**	**936**	**1.69**	**983**	**1,700**	**1,700**	**192**
Dry Season Trend ***	**None**	**Down**	**None**	**None**	**None**	**None**	**Up**
Wet Season Average	**10.2**	**938**	**38.8**	**902**	**1,610**	**1,650**	**178**
Average Annual	**9.05**	**937**	**29.6**	**923**	**1,640**	**1,660**	**182**

* Vallejo typically samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values for days when sampling occurred. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite” for days when sampling occurred. For instances when ammonia, nitrate + nitrite, or TKN are non-detect, the TIN and Total N values were not calculated. Note: the ammonia sampling is more frequent than the other nitrogen species which can lead to average monthly ammonia values being greater than average monthly TIN values.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads (except for ammonia)

Discharge

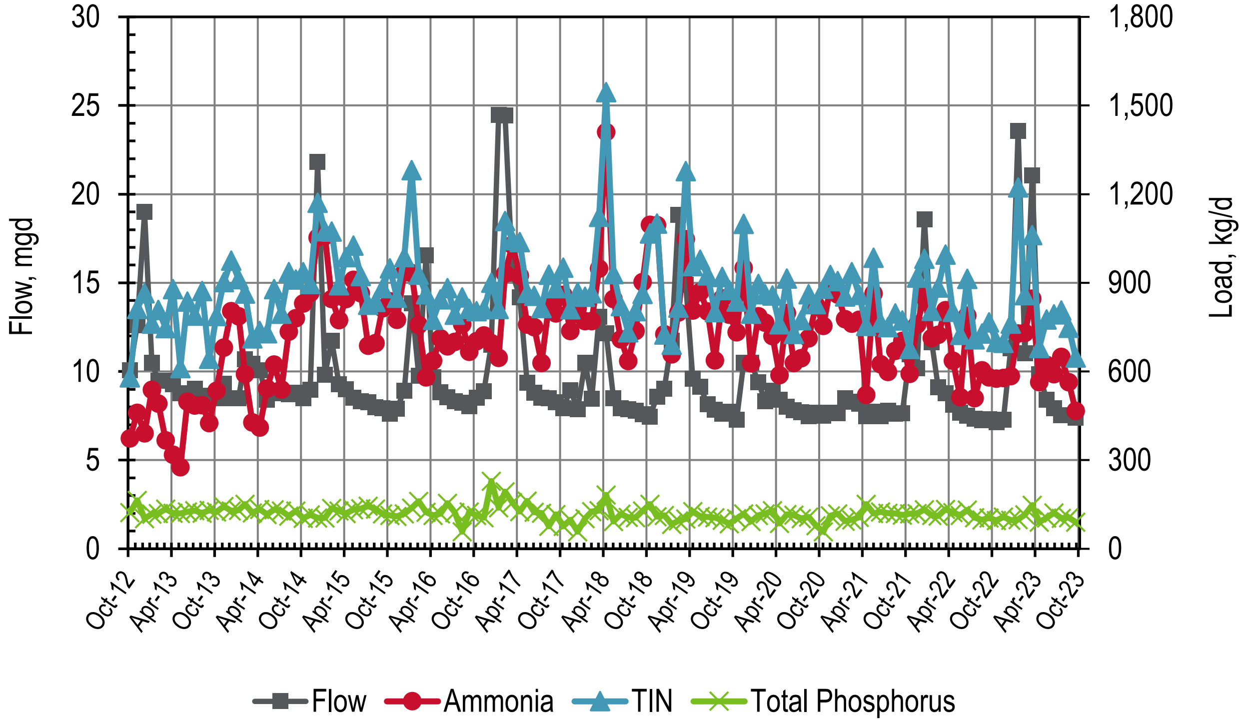

Figure 33-3. Discharge: Vallejo Monthly Flows and Loads

Table 33-2. Discharge: Vallejo Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	10.1	374	206	580	123
Nov-12	12.6	461	352	813	164
Dec-12	19.0	391	474	865	103
Jan-13	10.5	539	224	762	118
Feb-13	9.48	492	317	809	120
Mar-13	9.51	368	379	747	135
Apr-13	9.30	318	561	879	121
May-13	8.80	276	336	612	120
Jun-13	8.63	499	338	837	126
Jul-13	9.04	486	304	790	130
Aug-13	8.65	486	387	873	121
Sep-13	8.65	426	218	643	131
Oct-13	8.49	535	253	788	125
Nov-13	9.31	681	222	903	144
Dec-13	8.52	804	171	975	129
Jan-14	8.51	788	126	913	130
Feb-14	10.7	592	272	864	152
Mar-14	10.4	428	285	713	122
Apr-14	10.1	410	327	738	134
May-14	8.43	542	188	731	116
Jun-14	8.92	624	256	880	133
Jul-14	8.77	540	256	796	128
Aug-14	8.73	736	201	937	112
Sep-14	8.81	781	131	912	129
Oct-14	8.49	831	105	936	103
Nov-14	8.97	867	30.4	897	116
Dec-14	21.8	1,050	118	1,170	104
Jan-15	9.83	1,060	15.9	1,080	105
Feb-15	11.8	846	229	1,070	137
Mar-15	9.28	775	117	892	129
Apr-15	9.01	846	142	987	120
May-15	8.53	911	115	1,030	132
Jun-15	8.32	865	58.6	924	136
Jul-15	8.28	688	138	826	144
Aug-15	7.99	696	140	836	135
Sep-15	7.93	815	68.0	883	119

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	7.65	839	111	950	113
Nov-15	7.92	776	74.3	850	110
Dec-15	8.92	935	52.9	988	118
Jan-16	13.9	934	348	1,280	138
Feb-16	9.77	758	170	928	161
Mar-16	16.6	580	281	862	124
Apr-16	9.69	637	139	776	113
May-16	8.84	713	131	844	119
Jun-16	8.56	686	197	883	155
Jul-16	8.32	701	91.8	793	122
Aug-16	8.23	760	91.1	851	58.4
Sep-16	8.04	667	145	812	126
Oct-16	8.55	703	102	805	114
Nov-16	8.90	722	88.4	811	106
Dec-16	11.5	696	205	901	229
Jan-17	24.5	646	166	812	140
Feb-17	24.4	931	178	1,110	193
Mar-17	15.5	1,030	16.8	1,050	157
Apr-17	14.2	924	114	1,040	126
May-17	9.37	760	107	867	161
Jun-17	8.81	751	106	856	124
Jul-17	8.54	629	187	815	121
Aug-17	8.51	824	104	928	76.0
Sep-17	8.30	797	86.0	883	117
Oct-17	7.95	860	91.7	951	76.5
Nov-17	8.94	737	73.7	811	98.2
Dec-17	7.87	815	53.5	868	58.2
Jan-18	10.5	771	82.3	853	103
Feb-18	8.46	771	94.5	865	126
Mar-18	13.1	948	176	1,120	130
Apr-18	12.2	1,410	136	1,550	182
May-18	8.51	846	83.4	930	92.8
Jun-18	7.94	709	113	822	118
Jul-18	7.87	636	116	734	106
Aug-18	7.78	738	66.6	805	106
Sep-18	7.59	903	54.0	863	129
Oct-18	7.45	1,100	12.7	1,070	151

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	8.60	1,100	6.07	1,100	109
Dec-18	9.05	727	50.6	725	114
Jan-19	11.8	659	106	691	83.1
Feb-19	18.8	800	150	817	94.9
Mar-19	14.9	1,050	230	1,280	101
Apr-19	9.61	807	151	958	127
May-19	9.13	870	109	979	109
Jun-19	8.17	804	122	926	108
Jul-19	7.86	638	163	801	105
Aug-19	7.63	848	72.1	920	97.5
Sep-19	7.72	793	82.6	876	85.3
Oct-19	7.29	733	104	837	102
Nov-19	10.5	951	149	1,100	119
Dec-19	10.5	628	168	796	93.2
Jan-20	9.40	787	110	897	113
Feb-20	8.34	766	95.9	862	118
Mar-20	8.93	721	49.6	857	130
Apr-20	8.42	588	195	761	86.6
May-20	8.01	798	92.6	915	116
Jun-20	7.84	629	124	728	115
Jul-20	7.72	646	153	774	102
Aug-20	7.50	713	76.9	862	107
Sep-20	7.67	825	45.5	828	78.2
Oct-20	7.52	755	58.6	880	58.0
Nov-20	7.69	883	54.7	927	112
Dec-20	7.67	861	45.9	907	119
Jan-21	8.50	778	76.5	855	93.9
Feb-21	8.30	762	174	936	97.6
Mar-21	8.17	775	84.9	860	106
Apr-21	7.47	521	233	755	151
May-21	7.75	864	121	986	120
Jun-21	7.51	625	141	766	125
Jul-21	7.78	599	152	750	121
Aug-21	7.63	671	127	797	119
Sep-21	7.66	704	69.0	773	114
Oct-21	11.0	593	84.0	677	119
Nov-21	10.2	759	159	918	120

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-21	18.6	852	129	982	133
Jan-22	11.6	714	91.9	806	113
Feb-22	9.12	724	161	885	111
Mar-22	8.79	808	187	996	133
Apr-22	8.14	637	166	803	123
May-22	7.69	514	211	725	113
Jun-22	7.51	790	125	914	132
Jul-22	7.33	511	199	709	105
Aug-22	7.26	604	125	729	98.5
Sep-22	7.31	581	186	767	105
Oct-22	7.14	576	124	701	95.6
Nov-22	7.28	579	119	698	108
Dec-22	11.3	585	178	763	96.9
Jan-23	23.6	729	495	1,220	98.8
Feb-23	11.0	732	127	859	116
Mar-23	21.1	847	216	1,060	148
Apr-23	9.85	564	116	681	90.1
May-23	8.42	623	153	776	105
Jun-23	7.95	592	202	794	122
Jul-23	7.54	650	157	806	104
Aug-23	7.54	565	184	749	106
Sep-23	7.40	467	181	648	90.6
Dry Season Average	**8.13**	**680**	**149**	**827**	**115**
Dry Season Trend **	**Down**	**None**	**Down**	**None**	**Down**
Wet Season Average	**11.0**	**744**	**160**	**902**	**120**
Average Annual	**9.78**	**718**	**155**	**871**	**118**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values for days when sampling occurred. Note: the ammonia sampling is typically more frequent than the other nitrogen species which can lead to average monthly ammonia values being greater than average monthly TIN values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

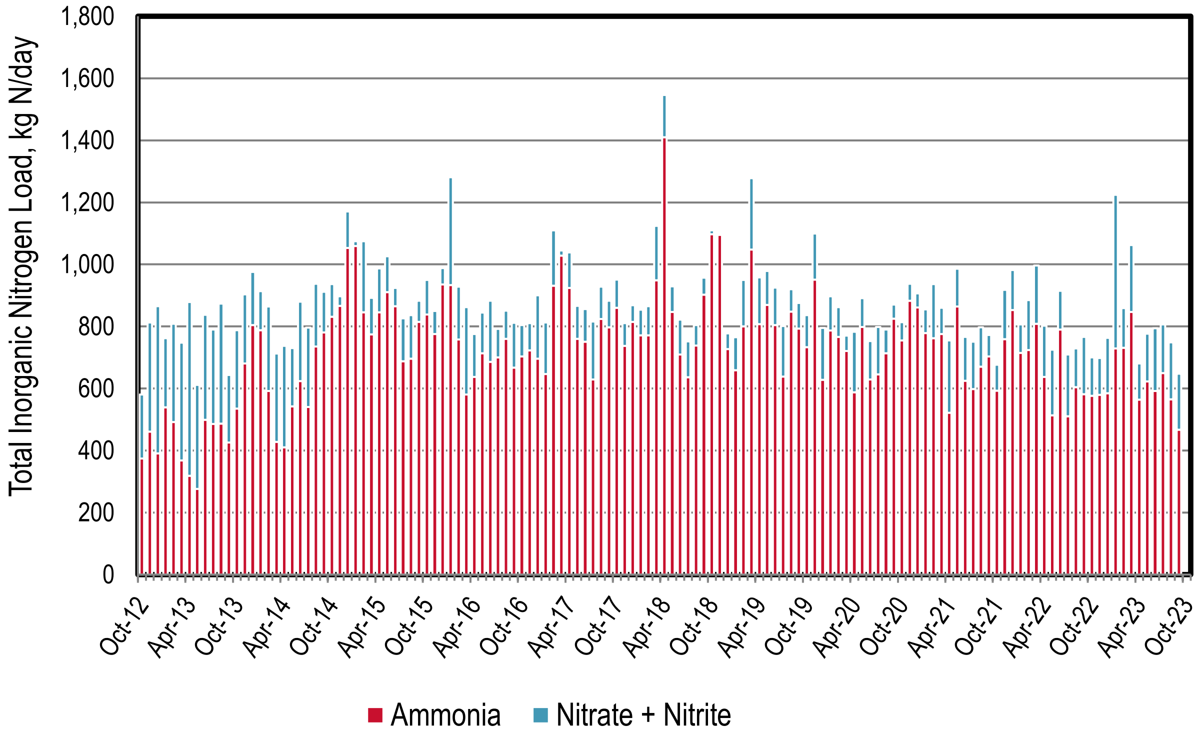

Figure 33-4. Discharge: Vallejo Monthly Nitrogen Loads

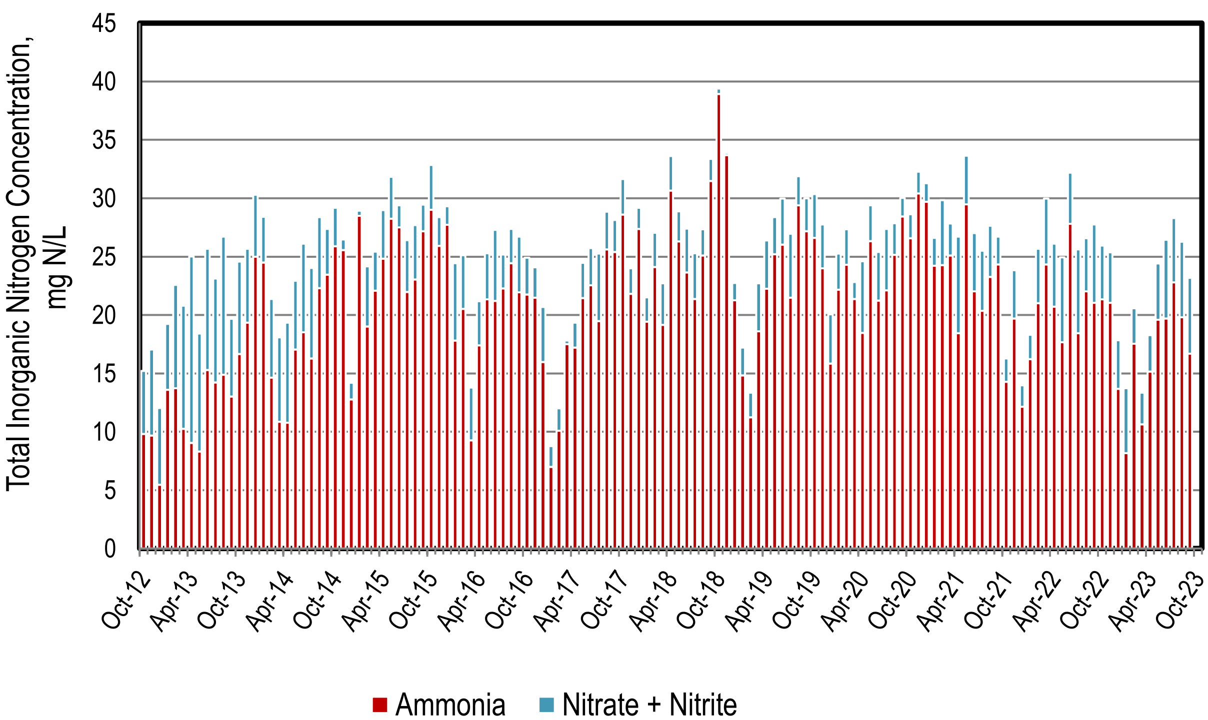

Figure 33-5. Discharge: Vallejo Monthly Nitrogen Concentrations

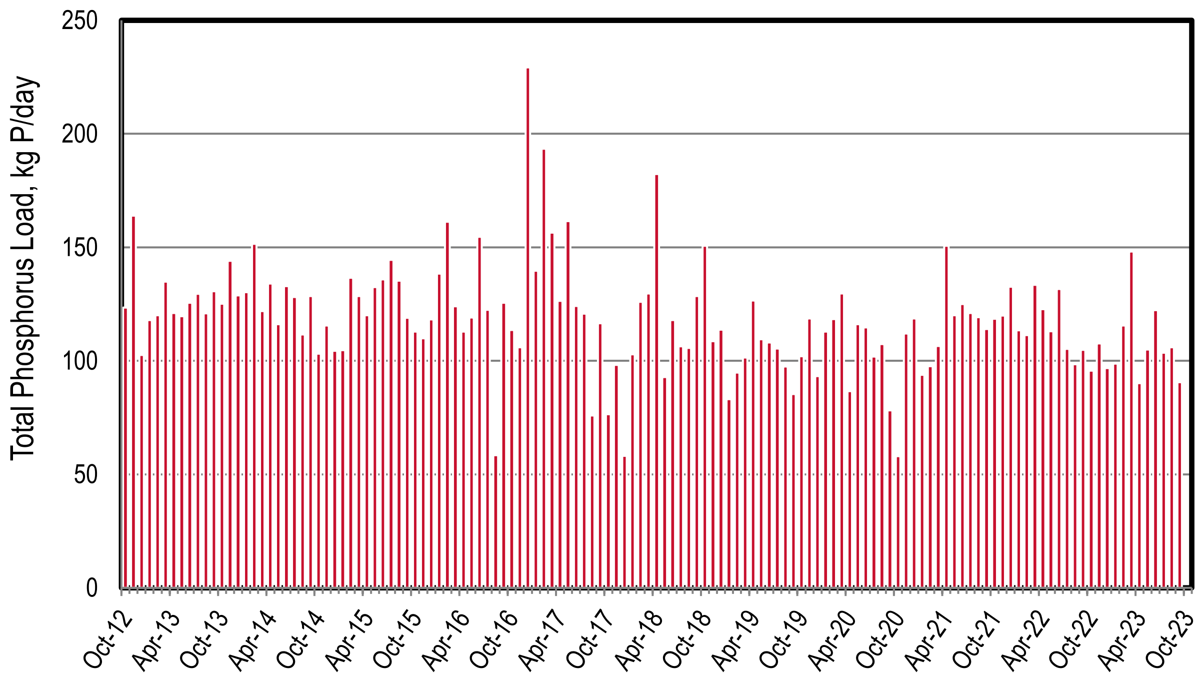

Figure 33-6. Discharge: Vallejo Monthly Phosphorus Loads

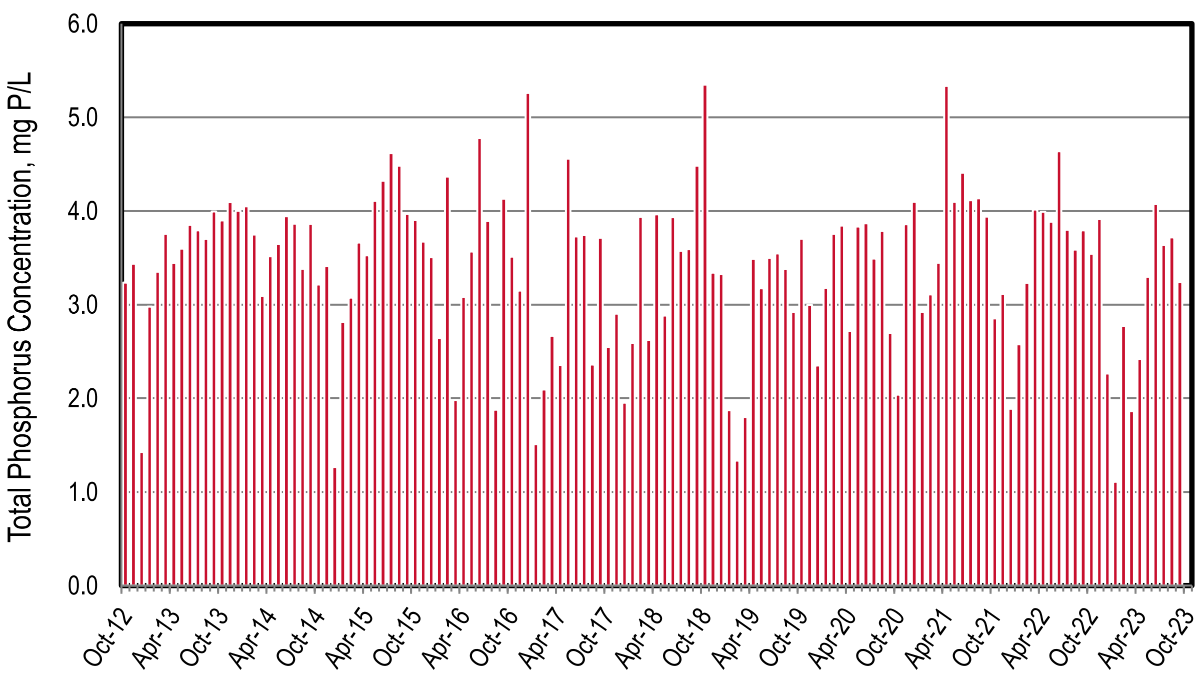

Figure 33-7. Discharge: Vallejo Monthly Phosphorus Concentrations

Recycled Water

No recycled water was produced or distributed this past year.

34 West County Agency Outfall

West County is a common outfall and discharge permit between West County and the City of Richmond which discharges to the Central Bay. They have a combined permitted capacity of 28.5 mgd ADWF (12.5 mgd ADWF for West County and 16.0 mgd ADWF for the City of Richmond) and a combined wet weather capacity of 41 mgd (21 mgd for West County and 20 mgd for the City of Richmond). Note: the Richmond plant has wet weather capacity greater than 20 mgd but is limited to 20 mgd through secondary treatment. The Richmond plant performs secondary treatment, whereas the West County plant recently completed an upgrade of their activated sludge process. It is noteworthy the Richmond plant is ending substantial upgrades including to its secondary process. The major change is conversion from mechanical mixing to fine bubble diffused air. Modifications include an anoxic area where primary effluent enters and is then distributed to the aeration basins. While the design is not intended to remove nutrients per se, there may be some incidental ammonia reduction and time will show to what extent, if any, that benefit is observed. The average dry season discharge flow this past year was approximately 6.11 mgd.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent (combined flows and loads for both treatment plants):
  - Limited to data since July 2019; quarterly required but more occasionally provided.
  - The flow reduction across the plants averages just below 50 percent. The October and December 2021 wet weather events drastically reduced the flow reduction, but it was short-lived as evidenced by a 40 percent reduction in January 2022. The primary contributor to such flow reductions are recycled water projects at the nearby Chevron Refinery which accepts West County treatment plant effluent.
  - The nitrogen and phosphorus load reduction values across the plant are reliably above 70 percent (with the exception of total P in September 2022). This load reduction is attributed to a combination of recycled water to the Chevron Refinery, biological assimilation, biosolids management, and/or biological load reduction at both plants.
  - Based on Table 34-1’s statistical analysis, there are no emerging dry season trends.
- Discharge (combined flows and loads for both treatment plants at the common outfall):
  - The Richmond Plant represents the majority of the discharge flow and loads (data not shown). The West County Plant recycles a large portion of their year-round flows, with some dry weather months above 90%.
  - The average monthly dry season flows for 2022/2023 increased from 2021/2022. This was expected due to the relatively wet year in 2022/2023.
  - Wet season nutrient loads are typically greater and more variable than dry season loads.
  - Ammonia represents the majority of the nitrogen species discharged. This is expected as the Richmond Plant represents most of the discharge load and they do not nitrify.
  - Total phosphorus concentrations vary between 0.6 to 9.3 mg P/L. The three largest values are from the 2022 and 2023 dry seasons. The basis for such values is unclear but there may be a connection to the Covid-19 pandemic. Changes to the influent profile could be a result of the transition in the residential and businesses sectors.

- Based on Table 34-2 statistics for the entire dry season dataset, there are no emerging dry season trends (except total P). The total P loads are trending upwards, primarily due to the recent increase in loads starting at the end of the 2022 dry season.

- Recycled Water:
  - Based on Table 8-3, the plants have averaged 4.9 mgd of Recycled Water from 2019-2022 calendar years. The key user is Industrial (nearby Chevron facility).
  - Based on Table 8-4 through Table 8-6, the plants have averaged the diversion of 3 kg ammonia-N/d, 112 kg TIN-N/d, and 34 kg P/d from the Bay through recycled water from 2019-2022 calendar years.

Influent

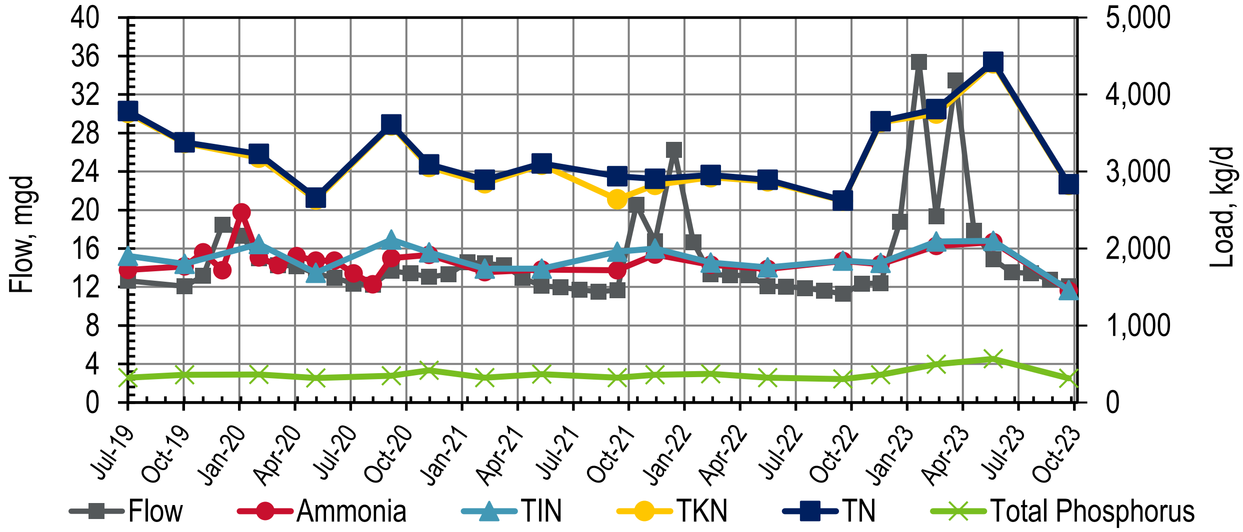

Figure 34-1. Influent: West County Monthly Flows and Loads (for Both Treatment Plants)

Note: the TKN/Total N loads are comparable. The TKN values are located behind the Total N loads.

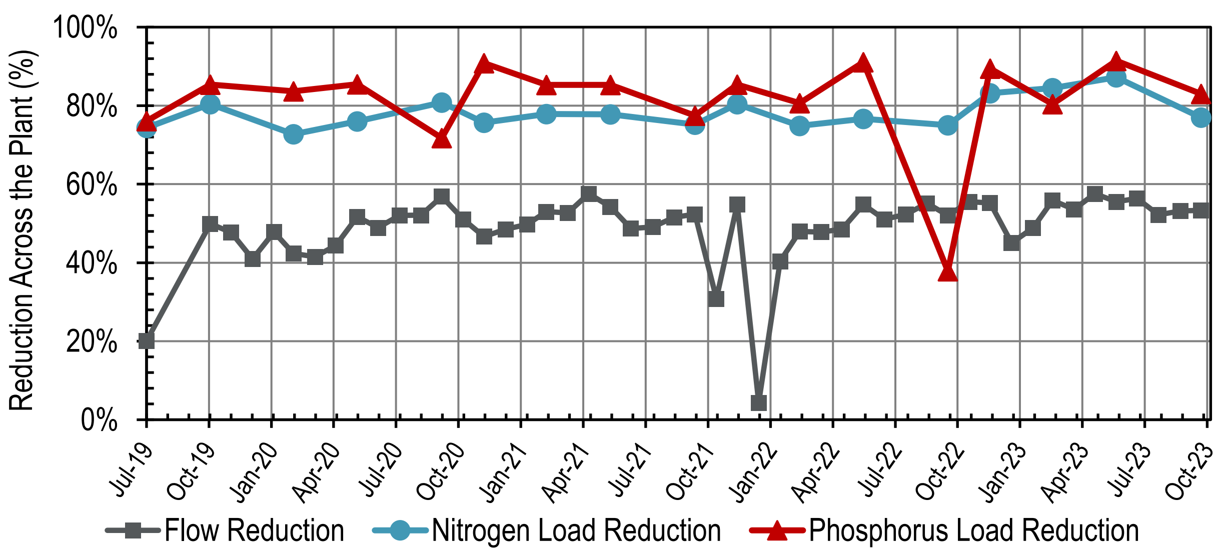

Figure 34-2. Influent: West County Monthly Reductions Across the Plants (for Both Treatment Plants)

Note: Influent Total N was compared against Discharge TIN for calculating nitrogen load reduction.

Table 34-1. Influent: West County Monthly Flows and Loads (for Both Treatment Plants)*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	12.6	1,720	25.2	1,900	3,760	3,790	321
Aug-19	--	--	--	--	--	--	--
Sep-19	--	--	--	--	--	--	--
Oct-19	12.1	1,770	8.27	1,800	3,370	3,380	359
Nov-19	13.1	1,950	--	--	--	--	--
Dec-19	18.5	1,720	--	--	--	--	--
Jan-20	17.3	2,470	--	--	--	--	--
Feb-20	15.0	1,880	50.0	2,060	3,180	3,230	362
Mar-20	14.3	1,780	--	--	--	--	--
Apr-20	14.2	1,900	--	--	--	--	--
May-20	13.4	1,840	22.0	1,690	2,640	2,660	318
Jun-20	13.0	1,840	--	--	--	--	--
Jul-20	12.3	1,680	--	--	--	--	--
Aug-20	12.2	1,530	--	--	--	--	--
Sep-20	13.7	1,880	14.5	2,120	3,600	3,610	347
Oct-20	13.4	--	--	--	--	--	--
Nov-20	13.0	1,920	31.9	1,950	3,060	3,090	416
Dec-20	13.3	--	--	--	--	--	--
Jan-21	14.6	--	--	--	--	--	--
Feb-21	14.4	1,690	44.5	1,740	2,850	2,890	323
Mar-21	14.3	--	--	--	--	--	--
Apr-21	12.9	--	--	--	--	--	--
May-21	12.1	1,720	14.5	1,740	3,090	3,100	368
Jun-21	12.0	--	--	--	--	--	--
Jul-21	11.7	--	--	--	--	--	--
Aug-21	11.5	--	--	--	--	--	--
Sep-21	11.7	1,720	11.9	1,960	2,640	2,940	323
Oct-21	20.5	--	--	--	--	--	--
Nov-21	16.7	1,920	79.2	2,000	2,830	2,900	361
Dec-21	26.2	--	--	--	--	--	--
Jan-22	16.6	--	--	--	--	--	--
Feb-22	13.3	1,790	30.8	1,820	2,930	2,960	374
Mar-22	13.2	--	--	--	--	--	--
Apr-22	13.2	--	--	--	--	--	--
May-22	12.1	1,730	24.0	1,760	2,870	2,890	323

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jun-22	12.0	--	--	--	--	--	--
Jul-22	11.9	--	--	--	--	--	--
Aug-22	11.6	--	--	--	--	--	--
Sep-22	11.3	1,840	4.10	1,840	2,620	2,620	304
Oct-22	12.3	--	--	--	--	--	--
Nov-22	12.4	1,800	15.3	1,810	3,640	3,650	360
Dec-22	18.7	--	--	--	--	--	--
Jan-23	35.4	--	--	--	--	--	--
Feb-23	19.3	2,030	58.6	2,090	3,750	3,810	496
Mar-23	33.4	--	--	--	--	--	--
Apr-23	17.8	--	--	--	--	--	--
May-23	14.9	2,080	19.8	2,100	4,400	4,420	566
Jun-23	13.5	--	--	--	--	--	--
Jul-23	13.4	--	--	--	--	--	--
Aug-23	12.8	--	--	--	--	--	--
Sep-23	12.1	1,450	9.07	1,460	2,820	2,830	316
Dry Season Average	**12.5**	**1,750**	**16.1**	**1,840**	**3,160**	**3,210**	**354**
Dry Season Trend * **	**None**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**16.8**	**1,890**	**39.8**	**1,910**	**3,200**	**3,240**	**381**
Average Annual	**14.9**	**1,830**	**27.3**	**1,870**	**3,180**	**3,220**	**367**

* West County typically samples more than the required influent nutrient quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on the dataset.

Discharge

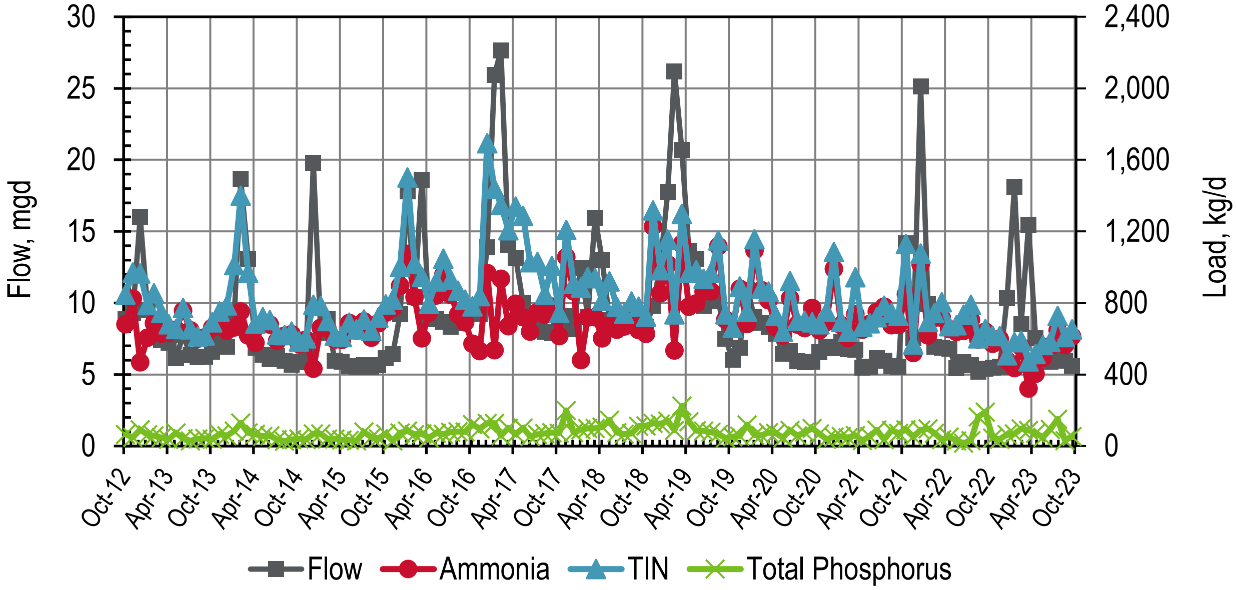

Figure 34-3. Discharge: West County Monthly Flows and Loads (for Both Treatment Plants at the Common Outfall)

Table 34-2. Discharge: West County Monthly Flows and Loads (for Both Treatment Plants at the Common Outfall)

Month, Year	Flow mgd	Ammonia kg N/day	Nitrate + Nitrite kg N/day	TIN* kg N/day	Total P kg P/day
Oct-12	8.85	682	166	848	65.5
Nov-12	9.27	824	147	971	49.0
Dec-12	16.0	470	497	967	92.6
Jan-13	9.55	607	182	789	63.4
Feb-13	8.81	686	169	856	57.4
Mar-13	7.40	631	116	747	47.3
Apr-13	7.22	635	47.0	682	38.5
May-13	6.16	652	3.26	655	73.4
Jun-13	7.77	758	15.3	773	41.7
Jul-13	6.36	648	6.13	654	28.8
Aug-13	6.23	601	12.7	613	39.8
Sep-13	6.24	608	10.4	618	43.6
Oct-13	6.60	662	30.3	692	38.0
Nov-13	7.42	690	63.6	754	67.3
Dec-13	6.93	646	141	787	57.6
Jan-14	9.09	664	348	1,010	85.2
Feb-14	18.7	753	647	1,400	129
Mar-14	13.1	620	349	969	73.7
Apr-14	6.89	579	106	685	67.3
May-14	6.16	681	40.4	722	53.9
Jun-14	7.77	680	25.6	706	56.9
Jul-14	6.33	590	34.5	624	37.0
Aug-14	5.98	618	3.84	622	26.8
Sep-14	5.71	626	15.0	641	35.7
Oct-14	5.88	571	15.0	586	39.4
Nov-14	6.37	596	7.47	604	36.5
Dec-14	19.8	433	358	791	68.3
Jan-15	7.93	662	121	783	68.5
Feb-15	8.85	656	43.2	700	39.4
Mar-15	5.98	596	21.9	617	39.0
Apr-15	5.91	595	14.7	610	35.1
May-15	5.60	689	1.51	691	33.1
Jun-15	5.57	646	6.68	653	29.8
Jul-15	5.66	697	11.6	709	79.9
Aug-15	5.58	606	38.2	645	48.4
Sep-15	5.66	686	32.9	719	41.5

Month, Year	Flow mgd	Ammonia kg N/day	Nitrate + Nitrite kg N/day	TIN* kg N/day	Total P kg P/day
Oct-15	6.15	745	46.5	792	67.9
Nov-15	6.41	772	47.0	819	29.5
Dec-15	9.24	896	108	1,000	73.9
Jan-16	17.8	1,080	427	1,500	84.8
Feb-16	10.4	833	189	1,020	64.3
Mar-16	18.6	602	344	946	68.8
Apr-16	9.06	745	50.2	795	46.2
May-16	8.87	843	77.4	921	71.6
Jun-16	8.71	960	88.0	1,050	66.0
Jul-16	8.35	846	86.0	932	78.2
Aug-16	8.64	736	134	869	81.2
Sep-16	9.12	693	126	819	78.9
Oct-16	9.42	572	210	782	120
Nov-16	9.25	531	308	839	96.7
Dec-16	13.9	968	725	1,690	127
Jan-17	25.9	536	903	1,440	128
Feb-17	27.7	935	414	1,350	58.3
Mar-17	14.1	671	536	1,210	100
Apr-17	13.2	796	544	1,340	67.4
May-17	10.0	721	567	1,290	99.8
Jun-17	8.99	641	388	1,030	54.2
Jul-17	8.32	749	280	1,030	65.6
Aug-17	8.01	736	112	848	70.1
Sep-17	7.91	781	226	1,010	75.0
Oct-17	8.04	616	131	747	72.4
Nov-17	9.12	1,060	151	1,210	199
Dec-17	8.16	867	41.8	908	76.5
Jan-18	12.5	481	406	887	91.3
Feb-18	9.04	720	226	946	99.1
Mar-18	16.0	722	218	939	98.6
Apr-18	13.0	602	211	814	106
May-18	8.83	677	245	922	145
Jun-18	8.57	651	129	780	76.5
Jul-18	8.73	670	71.9	741	66.9
Aug-18	8.65	744	64.3	808	70.7
Sep-18	8.60	649	131	780	111
Oct-18	8.29	629	117	724	114

Month, Year	Flow mgd	Ammonia kg N/day	Nitrate + Nitrite kg N/day	TIN* kg N/day	Total P kg P/day
Nov-18	9.82	1,230	89.8	1,320	127
Dec-18	12.7	855	128	983	124
Jan-19	17.8	1,020	139	1,150	139
Feb-19	26.2	536	201	736	88.1
Mar-19	20.7	1,130	167	1,300	223
Apr-19	13.7	780	190	970	137
May-19	13.1	799	186	984	86.9
Jun-19	9.82	864	71.7	935	85.3
Jul-19	10.1	866	104	969	76.8
Aug-19	10.3	1,120	32.0	1,150	67.3
Sep-19	7.49	709	28.1	737	45.9
Oct-19	6.05	659	3.30	663	52.6
Nov-19	6.87	880	12.9	893	56.7
Dec-19	10.9	684	67.0	751	119
Jan-20	9.03	1,090	61.8	1,160	61.8
Feb-20	8.63	873	17.6	881	59.2
Mar-20	8.35	816	32.2	864	75.2
Apr-20	7.88	666	63.0	729	72.1
May-20	6.46	619	19.8	639	46.2
Jun-20	6.63	827	96.6	923	88.1
Jul-20	5.92	680	20.4	701	57.1
Aug-20	5.86	661	39.7	701	77.1
Sep-20	5.91	773	53.3	693	98.0
Oct-20	6.56	647	34.1	681	67.8
Nov-20	6.95	694	57.3	751	38.2
Dec-20	6.85	991	94.9	1,090	51.1
Jan-21	7.31	677	16.5	694	53.9
Feb-21	6.79	605	34.5	639	47.4
Mar-21	6.76	738	34.8	945	60.0
Apr-21	5.49	651	7.58	667	30.2
May-21	5.54	684	5.38	688	54.2
Jun-21	6.15	751	7.37	721	90.7
Jul-21	5.97	779	13.3	785	36.9
Aug-21	5.59	676	9.12	747	87.7
Sep-21	5.56	678	10.1	729	72.9
Oct-21	14.2	850	24.4	1,130	91.1
Nov-21	7.54	520	48.6	569	52.6

Month, Year	Flow mgd	Ammonia kg N/day	Nitrate + Nitrite kg N/day	TIN* kg N/day	Total P kg P/day
Dec-21	25.1	1,020	60.2	1,080	89.5
Jan-22	9.92	619	74.1	694	96.9
Feb-22	6.93	718	25.7	744	72.3
Mar-22	6.89	717	19.8	806	36.6
Apr-22	6.79	654	16.8	671	51.2
May-22	5.46	640	13.8	676	28.7
Jun-22	5.89	644	10.4	735	16.3
Jul-22	5.66	707	18.5	791	31.8
Aug-22	5.21	596	6.85	602	163
Sep-22	5.41	641	14.1	655	189
Oct-22	5.49	572	45.4	617	44.6
Nov-22	5.56	600	16.7	616	38.0
Dec-22	10.3	479	28.6	507	65.2
Jan-23	18.1	436	144	581	68.7
Feb-23	8.53	554	36.8	591	97.4
Mar-23	15.5	323	151	474	88.7
Apr-23	7.57	405	110	515	71.8
May-23	6.61	494	71.6	565	48.5
Jun-23	5.90	560	24.0	584	92.7
Jul-23	6.42	647	80.1	727	150
Aug-23	5.97	565	44.2	609	31.6
Sep-23	5.64	614	39.0	653	53.7
Dry Season Average	**7.09**	**699**	**72.8**	**774**	**68.3**
Dry Season Trend **	**None**	**None**	**None**	**None**	**Up**
Wet Season Average	**10.7**	**705**	**158**	**870**	**76.6**
Average Annual	**9.21**	**703**	**123**	**830**	**73.1**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

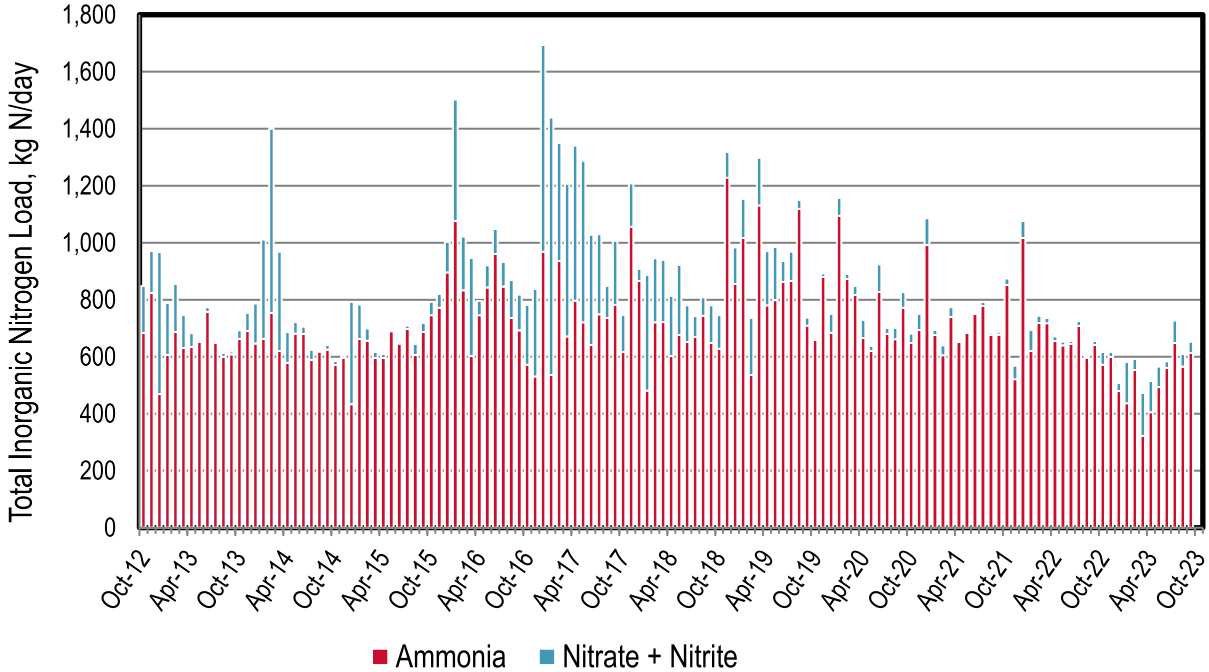

Figure 34-4. Discharge: West County Monthly Nitrogen Loads (for Both Treatment Plants at the Common Outfall)

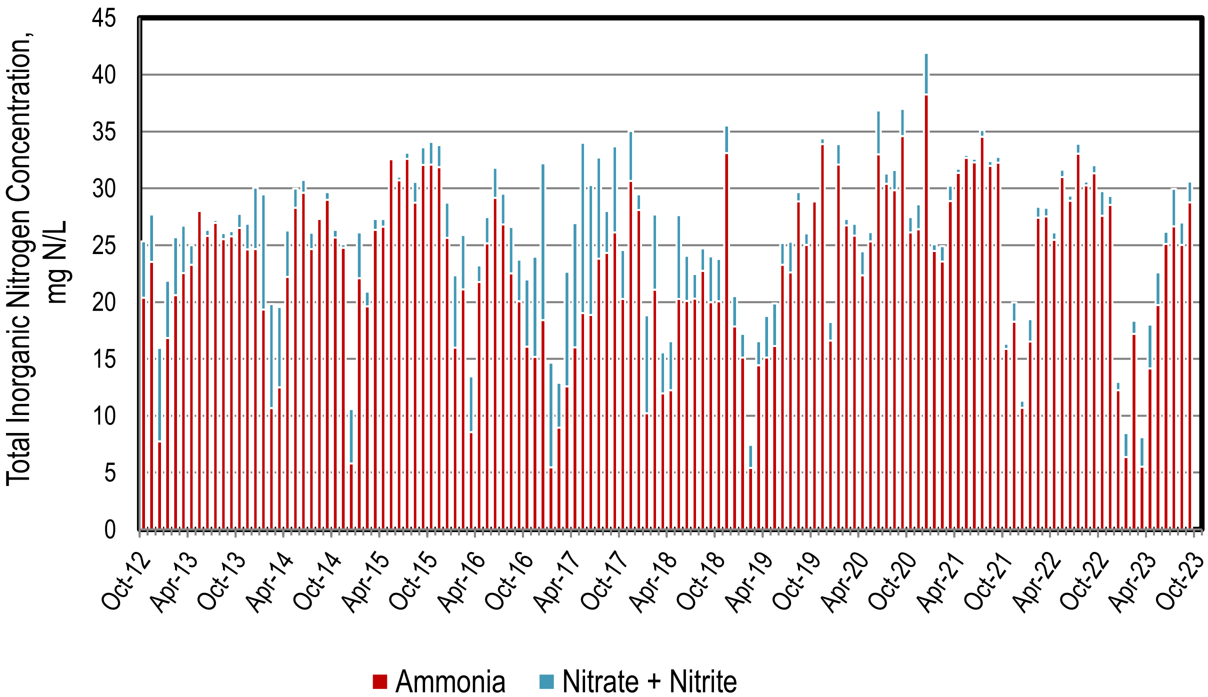

Figure 34-5. Discharge: West County Monthly Nitrogen Concentrations (for Both Treatment Plants at the Common Outfall)

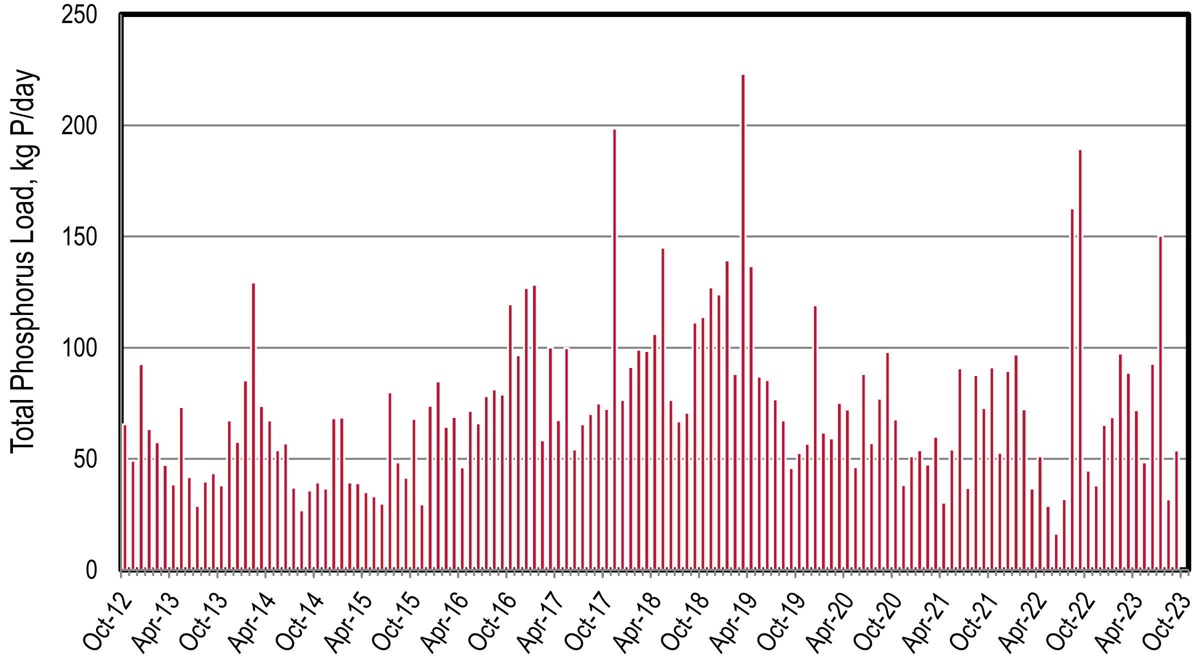

Figure 34-6. Discharge: West County Monthly Phosphorus Loads (for Both Treatment Plants at the Common Outfall)

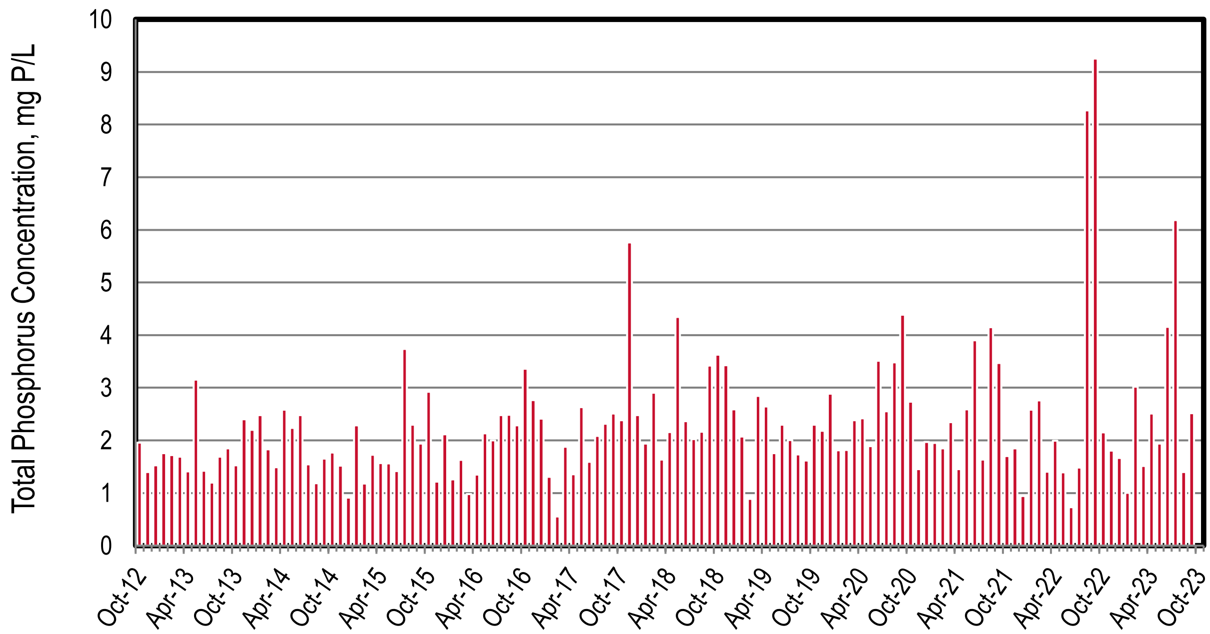

Figure 34-7. Discharge: West County Monthly Phosphorus Concentrations (for Both Treatment Plants at the Common Outfall)

Recycled Water

Table 34-3. Recycled Water: West County Yearly Recycled Water Flows Diverted from the Bay*

Year**	Flow Diverted***, Acre-Feet (mgd)							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	--	--	5,160 (4.6)	--	--	--	5,160 (4.6)
2020	--	--	--	5,670 (5.1)	--	--	--	5,670 (5.1)
2021	--	--	--	5,870 (5.2)	--	--	--	5,870 (5.2)
2022	--	--	--	5,110 (4.6)	--	--	--	5,110 (4.6)
Average	--	--	--	5,450 (4.9)	--	--	--	5,450 (4.9)

***	The loading values are based on water provided to both the RARE Project at the nearby Chevron Refinery and the North Richmond Water Reclamation Plant.**

****	Calendar year as opposed to California's water year (October 1 through September 30)**

*****	Assumes 100% of the recycled load is diverted from the Bay**

Table 34-4. Recycled Water: West County Yearly Recycled Water Ammonia Load Diverted from the Bay*

Year**	Average Ammonia Load Diverted***, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	--	--	2	--	--	--	2
2020	--	--	--	2	--	--	--	2
2021	--	--	--	4	--	--	--	4
2022	--	--	--	3	--	--	--	3
Average	--	--	--	3	--	--	--	3

***	The loading values are based on effluent values from the West County Wastewater District Treatment Plant and its Wastewater Collection System as this represents the feed water to both the RARE Project at the nearby Chevron Refinery and the North Richmond Water Reclamation Plant.**

****	Calendar year as opposed to California's water year (October 1 through September 30)**

*****	Assumes 100% of the recycled load is diverted from the Bay**

Table 34-5. Recycled Water: West County Yearly Recycled Water Total Inorganic Nitrogen Load Diverted from the Bay*

Year**	Average Total Inorganic Nitrogen Load Diverted***, kg N/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	--	--	115	--	--	--	115
2020	--	--	--	123	--	--	--	123
2021	--	--	--	118	--	--	--	118
2022	--	--	--	91	--	--	--	91
Average	--	--	--	112	--	--	--	112

***** **The loading values are based on effluent values from the West County Wastewater District Treatment Plant and its Wastewater Collection System as this represents the feed water to both the RARE Project at the nearby Chevron Refinery and the North Richmond Water Reclamation Plant.**

****** **Calendar year as opposed to California's water year (October 1 through September 30)**

******* **Assumes 100% of the recycled load is diverted from the Bay**

Table 34-6. Recycled Water: West County Yearly Recycled Water Total P Load Diverted from the Bay*

Year**	Average Total P Load Diverted***, kg P/d							
	Golf Course Irrigation	Landscape Irrigation	Commercial Application	Industrial Application	Agricultural Irrigation	Other Potable Uses	Other Non-Potable Uses	Total
2019	--	--	--	29	--	--	--	29
2020	--	--	--	42	--	--	--	42
2021	--	--	--	40	--	--	--	40
2022	--	--	--	23	--	--	--	23
Average	--	--	--	34	--	--	--	34

***** **The loading values are based on effluent values from the West County Wastewater District Treatment Plant and its Wastewater Collection System as this represents the feed water to both the RARE Project at the nearby Chevron Refinery and the North Richmond Water Reclamation Plant.**

****** **Calendar year as opposed to California's water year (October 1 through September 30)**

******* **Assumes 100% of the recycled load is diverted from the Bay**

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