Bay Area Clean Water Agencies
Nutrient Reduction Study

Group Annual Report

Nutrient Watershed Permit Annual Report

2015

November 12, 2015

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1 Introduction

On April 9, 2014 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. R2-2014-0014. The Nutrient Watershed Permit became effective on July 1, 2014 and 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 monitoring programs, support load response modeling, and conduct treatment plant optimization and upgrade studies for nutrient removal.

One of the key requirements of the Nutrient Watershed Permit is the reporting and analysis of 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 Nutrient Watershed Permit for the participating agencies for the period between July 1, 2012 and June 30, 2015. This report includes the following sections:

- **Section 2 – Background.** This section includes relevant background information on the requirements of the Nutrient Watershed 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 – Results.** This section presents the data for each discharger as well as the annual and seasonal averages for the Effluent Flow, Ammonia, Total Kjeldahl Nitrogen, Nitrate plus Nitrate, Total Nitrogen, Orthophosphate, 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 – Discussion.** The section includes a discussion of the data presented in Section 4.
- **Section 6 – 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 thirty-three dischargers.

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2 Background

The Nutrient Watershed 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

<table>
<tr><th>Discharger Name
(Abbreviation)</th><th>POTW Facility Name</th><th>Minor / Major[(a)]</th></tr>
<tr><td>American Canyon, City of (American Canyon)</td><td>Wastewater Treatment and Reclamation Facility</td><td>Major</td></tr>
<tr><td>Benicia, City of (Benicia)</td><td>Benicia Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td>Burlingame, City of (Burlingame)</td><td>Burlingame Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td>Central Contra Costa Sanitary District (CCCSD)</td><td>Central Contra Costa Sanitary District Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td>Central Marin Sanitation Agency (CMSA)</td><td>Central Marin Sanitation Agency Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td>Crockett Community Services District (Port Costa)</td><td>Port Costa Wastewater Treatment Plant</td><td>Minor</td></tr>
<tr><td>Delta Diablo (Delta Diablo)</td><td>Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td rowspan="8">East Bay Dischargers Authority (EBDA) (City of Hayward, City of San Leandro, Oro Loma Sanitary District, Castro Valley Sanitary District, Union Sanitary District, Livermore-Amador Valley Water Management Agency, Dublin San Ramon Services District, and City of Livermore)</td><td>EBDA Common Outfall</td><td rowspan="8">Major</td></tr>
<tr><td>Hayward Water Pollution Control Facility</td></tr>
<tr><td>San Leandro Water Pollution Control Plant</td></tr>
<tr><td>Oro Loma/Castro Valley Sanitary Districts Water Pollution Control Plant</td></tr>
<tr><td>Raymond A. Boege Alvarado Wastewater Treatment Plant</td></tr>
<tr><td>Livermore-Amador Valley Water Management Agency Export and Storage Facilities</td></tr>
<tr><td>Dublin San Ramon Services District Wastewater Treatment Plant</td></tr>
<tr><td>City of Livermore Water Reclamation Plant</td></tr>
<tr><td>East Bay Municipal Utility District (EBMUD)</td><td>East Bay Municipal Utility District, Special District No. 1 Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td>Fairfield-Suisun Sewer District (FSSD)</td><td>Fairfield-Suisun Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td>Las Gallinas Valley Sanitary District (Las Gallinas)</td><td>Las Gallinas Valley Sanitary District Sewage Treatment Plant</td><td>Major</td></tr>
<tr><td>Marin County (Paradise Cove), Sanitary District No. 5 of</td><td>Paradise Cove Treatment Plant</td><td>Minor</td></tr>
<tr><td>Marin County (Tiburon), Sanitary District No. 5 of</td><td>Wastewater Treatment Plant</td><td>Minor</td></tr>
<tr><td>Millbrae, City of (Millbrae)</td><td>Water Pollution Control Plant</td><td>Major</td></tr>
<tr><td>Mt. View Sanitary District (Mt View)</td><td>Mt View Sanitary District Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td>Napa Sanitation District (Napa)</td><td>Soscol Water Recycling Facility</td><td>Major</td></tr>
<tr><td>Novato Sanitary District (Novato)</td><td>Novato Sanitary District Wastewater Treatment Plant</td><td>Major</td></tr>
<tr><td>Palo Alto, City of (Palo Alto)</td><td>Palo Alto Regional Water Quality Control Plant</td><td>Major</td></tr>
<tr><td>Petaluma, City of (Petaluma)</td><td>Ellis Creek Water Recycling Facility</td><td>Major</td></tr>
<tr><td>Pinole, City of (Pinole)</td><td>Pinole-Hercules Water Pollution Control Plant</td><td>Major</td></tr>
</table>

Discharger Name (Abbreviation)	POTW Facility Name	Minor / Major[(a)]
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
Sonoma Valley County Sanitary District (Sonoma Valley)	Municipal Wastewater Treatment Plant	Major
Silicon Valley Clean Water (SVCW)	SVCW 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)	Wastewater Treatment Plant	Major
Vallejo Sanitation and Flood Control District (Vallejo)	Vallejo Sanitation and Flood Control District 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

(a) As defined in the Nutrient Watershed Permit.

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

1. Ammonia as Nitrogen
2. Total Kjeldahl Nitrogen
3. Nitrate/Nitrite as Nitrogen
4. Total Phosphorus
5. Soluble Reactive Phosphorus as Phosphorus
6. Total Nitrogen as Nitrogen

Figure 2-1. Location of Dischargers

Major municipal dischargers having a flow greater than 10 million gallons per day (mgd), are required to sample twice per month. Major municipal dischargers having a flow less than 10 mgd, are required to sample once per month. Minor municipal discharges, which are those with a flow less than 1 mgd, are required to monitor twice per year. In addition, dischargers are required to sample only during the portion 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 Nutrient Watershed 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 Nutrient Watershed Permit 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 Nutrient Watershed 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 Section VIII.1 Arithmetic Calculations of Standard Provisions (Attachment G of individual permits) covering July 1 through June 30 of the preceding year. Each individual Discharger shall document its nutrient loads relative to other facilities covered by this Order that discharge to the same subembayment, i.e., Suisun Bay, San Pablo Bay, Central Bay, South Bay, and Lower South Bay.

iii. An analysis of nutrient trends, load variability, and an assessment as to whether or not nutrient mass discharges are increasing or decreasing.

iv. If trend analysis shows a significant change in load, the Discharger shall investigate the cause and shall report its results, or status, or plans for investigation, in the annual report or in subsequent annual reports. This investigation shall include, at a minimum, whether treatment process changes have reduced or increased nutrient discharges, changes in nutrient loads related to water reclamation (increasing or decreasing), and changes in total influent flow resulted to water conservation, population growth, transient work community, new industry, and/or changes in wet weather flows.

[1] Wolfe, Bruce. (2012) Letter: Water Code Section 13267 Technical Report Order Requiring Submittal of Information on Nutrients in Wastewater Discharges. March 2, 2012. http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/amendments/estuarineNNE/Nutrients%2013267%20Order%20-%203-12.pdf

3 Approach

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

3.1 Data Sources

Data was collected from two different sources, including that compiled for the Section 13267 Letter requirements and the subsequent Nutrient Watershed Permit data. The Section 13267 Letter data includes the initial two years (July 2012 through June 2014) and the Nutrient Watershed Permit data includes the most recent year (July 2014 through June 2015 downloaded from CIWQS).

The sampling requirements and frequency differ between the two data sets. The requirements for each are summarized in Table 3-1.

Table 3-1. Comparison of Section 13267 Letter and Nutrient Watershed Permit Requirements

Parameter	Section 13267 Letter	Nutrient Watershed Permit
Major Dischargers and Sampling Frequency	1) Flows ≥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 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	1) Flows >10 mgd permitted capacity must sample twice per month 2) Flows between 1 and 10 mgd permitted capacity must sample once per month
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
Non-Nutrient Sampling Parameters	Flow pH Temperature	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	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

Parameter	Section 13267 Letter	Nutrient Watershed Permit
	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	
Phosphorus Species and Sample Type	1) Total Phosphorus (TP) – Composite Sample 2) Soluble Total Phosphorus (STP; reported as P) – Composite Sample 3) Dissolved Orthophosphate (reported as P) – Composite Sample 4) Total Orthophosphate (reported as P) – Composite Sample	1) Soluble Reactive Phosphorus (SRP, reported as P) – Grab Sample 2) Total Phosphorus (TP) – Composite Sample

(a) https://ciwqs.waterboards.ca.gov/ciwqs/readOnly/CiwqsReportServlet?inCommand=reset&reportName=esmrAnalytical

3.2 Parameters of Interest

A list of the parameters required by both the Section 13267 Letter and the Nutrient Watershed Permit and their respective measurement methodology is presented in Table 3-2. With the exception of soluble reactive phosphorus (SRP), the samples for all other parameters were 24 hour composites. The SRP sample type was a composite for the Section 13267 Letter data and a grab sample for the Nutrient Watershed Permit data.

Table 3-2. List of Parameters, Methodology, and Sample Type Required for both Datasets

Parameter	Measured or Calculated	Sample Type	Method[a,b]	Calculation
Flow	Both (plant specific)	Continuous		$Flow\ (mgd) = \frac{Load\ (\frac{kg}{d})}{Conc\ \left(\frac{mg}{L}\right) * 3.78}$
Total Ammonia	Measured[c]	24-hr Composite	4500-NH3	
TKN	Both (plant specific)[c]	24-hr Composite	4500-N(org)	$TKN = TN - NOx$
NOx	Measured[c]	24-hr Composite	4500-N	
TN	Calculated[c]	24-hr Composite	Calculated	$TN = TKN + NOx$
Ortho-P[d]	Measured[c]	24-hr Composite for Section 13267 Letter data; Grab for Nutrient Watershed Permit	4500-P	
TP	Measured[c]	Composite	4500-P	

a. Standard Methods for the Examination of Water and Wastewater 1998-20th 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.
d. Dissolved orthophosphate if available and total orthophosphate, if dissolved not available.

The phosphorus species are different for the Section 13267 Letter data and the Nutrient Watershed Permit data. The Section 13267 Letter data requires sampling for a suite of phosphorus species (soluble total phosphorus, dissolved orthophosphate and total orthophosphate). In contrast, the Watershed Permit requires soluble reactive phosphorus which is unclear, as a specific method of analysis was not defined. As a result, the phosphorus species reported under the Watershed Permit varies by discharger. The species listed in CIWQS, available for reporting, includes: total phosphate, dissolved orthophosphate, total orthophosphate, and dissolved phosphorus. The majority of agencies reported as dissolved orthophosphate (28 out of the 33 discharging agencies). The remaining dischargers reported total orthophosphate.

In order to provide consistency, the analysis presented in this Group Annual Report is based on dissolved orthophosphate from the Section 13267 Letter dataset and dissolved orthophosphate for the Watershed Permit data, if available, and total orthophosphate otherwise. While this approach is not ideal, it is the best use of the available data. In this Group Annual Report, SRP is referred to as orthophosphate (ortho-P).

3.3 Data Confirmation

Once the datasets were collected and compiled, the dataset for each plant was provided to each participating discharger for review and confirmation. The data presented in this Group Annual Report reflects additions and corrections provided by the participating agencies.

3.4 Seasonality

The seasonal variations in the data were examined by dividing the data in to 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 is attributed to inflow and infiltration (I&I) during such events which can bias the discharge results, especially for small datasets such as this.
- Wastewater treatment facilities are better able to remove nutrient loads (if deemed necessary) during the warmer, dry season when the kinetics of biological treatment are more favorable and there are fewer (if any) peak flow events.
- A Nutrient Management Study 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. In order to provide a consistent basis for the purposes of this Group Annual Report, the seasonal definition presented in the approved Scoping and Evaluation Plan[2] 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 Trend Analysis

The effluent data was evaluated to identify evidence of trends over the past three years. Due to the change in sampling frequency between the Section 13267 Letter and Watershed Permit requirements, there is an inconsistency in the reporting of flows and loads during the wet season. Specifically, the Section 13267 Letter 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 the Watershed Permit. As a result, an artificial bias has been introduced which is expected to overestimate the wet season load. Therefore, the trend analysis was limited to the dry season. The dry season 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.[3] The sample set size was 5 samples per year (n = 15 in total for the 3 years of effluent 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 is the p-value was less than alpha.

[2] Bay Area Clean Water Agencies (2015) Scoping and Evaluation Plan for Potential Nutrient Reduction by Treatment Optimization and Treatment Upgrades. Order No. R2-2014-0014, NPDES Permit No. CA0038873.

[3] 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 Results

This section presents a discussion of the dataset limitations as well as the data results for the following effluent parameters:

1. Flow
2. Total Ammonia (reported as N)
3. Total Kjeldahl Nitrogen
4. Nitrate plus Nitrite (NOx, reported as N))
5. Total Nitrogen (reported as N)
6. Orthophosphate (reported as P)
7. Total Phosphorus

Data are summarized for each discharger, 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 July 1, 2012 and June 30, 2013, 2013/2014 represents the period between July 1, 2013 and June 30, 2014, and 2014/2015 represents the period between July 1, 2014 and June 30, 2015.

In addition, the relative contribution of flow and loads for each discharger is provided for each subembayment.

4.1 Dataset Limitations

There are some limitations in the overall dataset for the period between July 2012 and June 2015. The sampling frequency requirements vary by size of discharger, ranging from once per dry season for minor plants to twice per month for plants larger than 10 mgd. It is further complicated by the earlier Section 13267 Letter requirement to sample twice per wet season during peak wet weather events. This variation in data collection creates inconsistencies in the datasets and presents limitations on statistical analysis for the purposes of trending. Given the relatively small dataset (n = 36 for most dischargers), a few additional samples from wet weather events can artificially exaggerate the average monthly load values during the wet period. In order to have more confidence in the trend analysis, a larger dataset is desired, which will be developed over the course of the Watershed Permit.

As previously described, the trend analysis presented in the following subsections is based on the Dry Season (n = 15 for most dischargers).

4.2 Flows

The annual average and dry season average effluent flows are presented in Table 4-1 and Table 4-2, respectively. The annual average and dry season effluent flows discharged to each subembayment are presented in Table 4-3 and Table 4-3Table 4-4.

Table 4-1. Annual Average Daily Effluent Flows by Discharger (mgd)

Discharger	Subembayment	Permitted Capacity[a]	2012/13	2013/14	2014/15
American Canyon	San Pablo Bay	2.5	1.5	1.4	1.5
Benicia	San Pablo Bay	4.5	2.2	2.1	2.0
Burlingame	South Bay	5.5	3.0	3.0	3.0
CCCSD	Suisun Bay	53.8	37.4	36.2	33.7
CMSA	Central Bay	10	7.7	6.1	7.0
Port Costa	San Pablo Bay	0.033	0.01	0.01	0.01
Delta Diablo	Suisun Bay	19.5	6.9	6.1	7.3
EBDA	South Bay	107.8	62.2	59.6	59.4
EBMUD	Central Bay	120	58.8	57.2	52.2
FSSD	Suisun Bay	23.7	13.6	12.6	12.3
Las Gallinas[b]	San Pablo Bay	2.92	1.4	1.2	1.3
Millbrae	South Bay	3	1.5	1.7	1.4
Mt. View	Suisun Bay	3.2	1.4	1.3	1.3
Napa[b]	San Pablo Bay	15.4	5.0	4.6	5.3
Novato[b]	San Pablo Bay	7	3.2	2.9	3.3
Palo Alto	Lower South Bay	39	21.3	18.9	19.4
Paradise Cove	Central Bay	0.04	0.01	0.01	0.01
Petaluma[b]	San Pablo Bay	6.7	3.7	4.3	3.2
Pinole	San Pablo Bay	4.06	2.6	2.6	2.5
Rodeo	San Pablo Bay	1.14	0.6	0.6	0.6
San Jose	Lower South Bay	167	92.5	85.6	83.0
San Mateo	South Bay	15.7	11.3	10.9	10.4
SASM	Central Bay	3.6	2.2	2.7	2.4
SFO Airport	South Bay	2.2	1.1	1.2	1.1
SFPUC Southeast	South Bay	84.5	56.8	58.6	56.0
SMCSD	Central Bay	1.8	1.5	1.3	1.2
Sonoma Valley[b]	San Pablo Bay	3	1.6	1.3	0.3
South SF	South Bay	13	9.0	8.7	8.6
Sunnyvale	Lower South Bay	29.5	10.3	11.0	10.4
SVCW	South Bay	29	13.2	12.4	12.4
Tiburon	Central Bay	0.98	0.58	0.59	0.54
Treasure Island	Central Bay	2	0.3	0.3	0.3
Vallejo	San Pablo Bay	15.5	10.4	9.1	10.2
West County	Central Bay	28.5	8.5	8.3	7.5
Total Effluent Discharge		**826**	**453**	**434**	**421**

a. Based on ADWF permitted capacity. Data is presented in detail and summarized for each plant in the Appendix.

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-2. Dry Season Average Daily Flows by Discharger (mgd)

Discharger	Subembayment	Permitted Capacity[(a)]	2012/13[(b)]	2013/14[(b)]	2014/15[(b)]
American Canyon	San Pablo Bay	2.5	1.2	1.2	1.2
Benicia	San Pablo Bay	4.5	1.9	2.0	1.8
Burlingame	South Bay	5.5	2.7	2.7	2.7
CCCSD	Suisun Bay	53.8	33.8	34.2	30.2
CMSA	Central Bay	10	5.7	5.5	4.8
Port Costa	San Pablo Bay	0.033	0.006	0.005	0.006
Delta Diablo	Suisun Bay	19.5	6.4	5.7	5.8
EBDA	South Bay	107.8	55.6	53.4	51.9
EBMUD	Central Bay	120	51.4	49.3	45.4
FSSD	Suisun Bay	23.7	11.1	10.6	9.7
Las Gallinas[(c)]	San Pablo Bay	2.92	0.0	0.0	0.0
Millbrae	South Bay	3	1.4	1.5	1.2
Mt. View	Suisun Bay	3.2	1.3	1.2	1.2
Napa[(c)]	San Pablo Bay	15.4	0.0	1.2	0.0
Novato[(c)]	San Pablo Bay	7	0.8	0.7	0.7
Palo Alto	Lower South Bay	39	22.6	19.7	19.5
Paradise Cove	Central Bay	0.04	0.01	0.01	0.01
Petaluma[(c)]	San Pablo Bay	6.7	0.0	0.0	0.0
Pinole	San Pablo Bay	4.06	2.7	2.4	2.2
Rodeo	San Pablo Bay	1.14	0.6	0.6	0.5
San Jose	Lower South Bay	167	86.0	80.2	76.3
San Mateo	South Bay	15.7	10.5	10.4	8.9
SASM	Central Bay	3.6	2.0	1.9	1.8
SFO Airport	South Bay	2.2	1.0	1.1	1.1
SFPUC Southeast	South Bay	84.5	52.9	55.2	54.4
SMCSD	Central Bay	1.8	1.2	1.1	1.1
Sonoma Valley[(c)]	San Pablo Bay	3	0.0	0.0	0.0
South SF	South Bay	13	8.6	8.5	7.9
Sunnyvale	Lower South Bay	29.5	7.9	9.5	8.2
SVCW	South Bay	29	12.5	11.6	11.0
Tiburon	Central Bay	0.98	0.51	0.55	0.54
Treasure Island	Central Bay	2	0.3	0.3	0.3
Vallejo	San Pablo Bay	15.5	8.9	8.7	8.6
West County	Central Bay	28.5	7.0	6.3	5.8
Total Effluent Discharge		**826**	**399**	**387**	**365**

a. Based on ADWF permitted capacity.
b. Data is presented in detail and summarized for each plant in the Appendix. A "-" indicates data was not available, whereas a "0" indicates a value of zero.
c. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-3. Annual Average Daily Discharges by Subembayment, Flow (mgd)

Subembayment	Permitted Capacity[(a)]	2012/13	2013/14	2014/15
Suisun Bay	100	59	56	55
San Pablo Bay	63	32	30	30
Central Bay	167	80	77	71
South Bay	261	158	156	152
Lower South Bay	235	124	115	113
Total Effluent Discharge to Bay	**826**	**453**	**434**	**421**

a. Based on ADWF permitted capacity.

Table 4-4. Dry Season Average Daily Discharges by Subembayment, Flow (mgd)

Subembayment	Permitted Capacity[(a)]	2012/13	2013/14	2014/15	Trend[(b)]
Suisun Bay	100	53	52	47	Decreasing
San Pablo Bay	63	16	17	15	None
Central Bay	167	68	65	60	Decreasing
South Bay	261	145	144	139	Decreasing
Lower South Bay	235	117	109	104	Decreasing
Total Effluent Discharge to Bay	**826**	**399**	**387**	**365**	Decreasing

a. Based on ADWF permitted capacity.
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 15. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

As shown in Table 4-3, the South Bay and Lower South Bay Subembayments account for over half of the total effluent flow discharged to the San Francisco Bay. On a dry season basis (Table 4-4, Figure 4-1), decreasing trends in wastewater discharges appear to be present in the Suisun Bay, Central Bay, South Bay, and the Lower South Bay Subembayments. In addition, the total effluent flow discharged to the Bay appears to be decreasing.

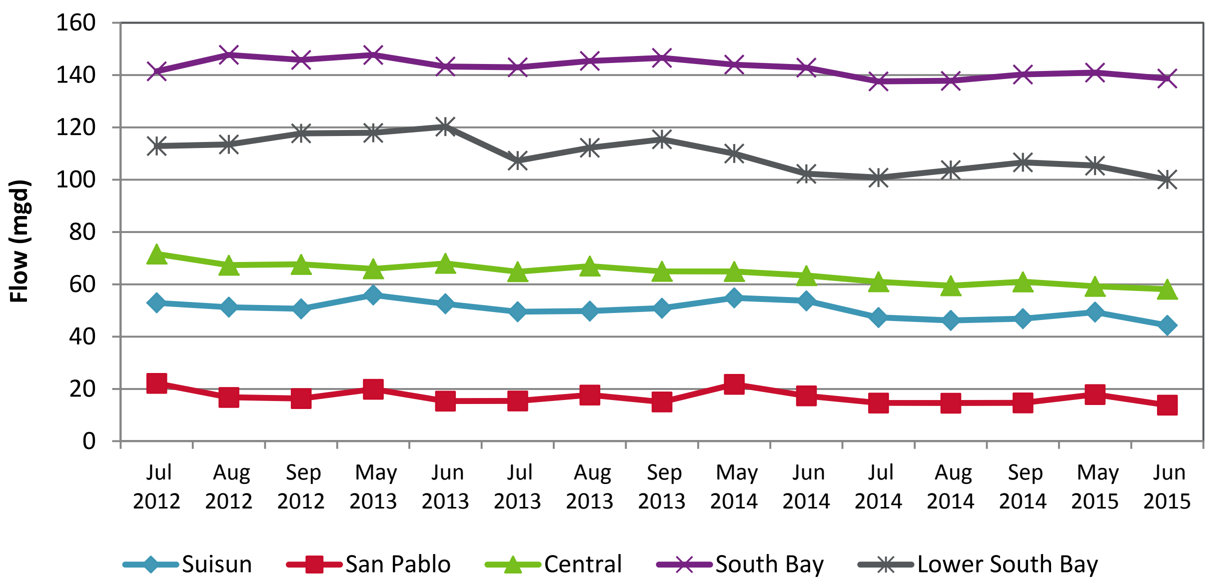

Figure 4-1. Dry Season Average Daily Discharge

4.3 Ammonia

The annual average and dry season average effluent ammonia loads are presented in Table 4-5 and Table 4-6, respectively. The annual average and dry season loadings to each subembayment are presented in Table 4-7 and Table 4-8, respectively.

Table 4-5. Annual Average Daily Discharges by Discharger, Ammonia (kg N/d)

Discharger	Subembayment	2012/13[a]	2013/14[a]	2014/15[a]
American Canyon	San Pablo Bay	2	6	4
Benicia	San Pablo Bay	182	175	199
Burlingame	South Bay	284	274	254
CCCSD	Suisun Bay	3,544	3,545	3,341
CMSA	Central Bay	750	778	623
Port Costa	San Pablo Bay	0.2	0.4	0.3
Delta Diablo	Suisun Bay	769	746	925
EBDA	South Bay	6,714	6,942	7,158
EBMUD	Central Bay	7,890	8,359	8,606
FSSD	Suisun Bay	2	2	2
Las Gallinas[b]	San Pablo Bay	11	15	12
Millbrae	South Bay	226	250	225
Mt. View	Suisun Bay	3	1	2
Napa[b]	San Pablo Bay	44	17	4
Novato[b]	San Pablo Bay	7	10	17
Palo Alto	Lower South Bay	11	13	16
Paradise Cove	Central Bay	0.4	-	0.3
Petaluma[b]	San Pablo Bay	3	7	3
Pinole	San Pablo Bay	218	196	235
Rodeo	San Pablo Bay	5	5	4
San Jose	Lower South Bay	280	201	197
San Mateo	South Bay	1,233	1,331	1,345
SASM	Central Bay	44	48	45
SFO Airport	South Bay	215	223	167
SFPUC Southeast	South Bay	7,194	9,313	8,822
SMCSD	Central Bay	54	42	49
Sonoma Valley[b]	San Pablo Bay	1.5	2.5	0.2
South SF	South Bay	822	818	884
Sunnyvale	Lower South Bay	307	86	165
SVCW	South Bay	1,858	2,001	2,073
Tiburon	Central Bay	41	-	54
Treasure Island	Central Bay	1	2	7
Vallejo	San Pablo Bay	401	567	842
West County	Central Bay	652	653	606
Total		**33,769**	**36,629**	**36,887**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-6. Dry Season Average Daily Discharges by Discharger, Ammonia (kg N/d)

Discharger	Subembayment	2012/13[(a)]	2013/14[(a)]	2014/15[(a)]
American Canyon	San Pablo Bay	1	2	3
Benicia	San Pablo Bay	171	187	173
Burlingame	South Bay	261	264	229
CCCSD	Suisun Bay	3,366	3,467	3,265
CMSA	Central Bay	813	778	666
Port Costa	San Pablo Bay	0.3	0.1	0.1
Delta Diablo	Suisun Bay	739	690	700
EBDA	South Bay	6,028	6,338	6,816
EBMUD	Central Bay	7,592	8,517	8,714
FSSD	Suisun Bay	1	1	1
Las Gallinas[(b)]	San Pablo Bay	0	0	0
Millbrae	South Bay	215	246	205
Mt. View	Suisun Bay	1	1	1
Napa[(b)]	San Pablo Bay	0	0	0
Novato[(b)]	San Pablo Bay	0	2	1
Palo Alto	Lower South Bay	11	14	13
Paradise Cove	Central Bay	0.2	0.0	0.4
Petaluma[(b)]	San Pablo Bay	0	0	0
Pinole	San Pablo Bay	283	188	234
Rodeo	San Pablo Bay	5	3	3
San Jose	Lower South Bay	229	153	182
San Mateo	South Bay	1,323	1,550	1,447
SASM	Central Bay	41	38	40
SFO Airport	South Bay	206	216	227
SFPUC Southeast	South Bay	7,716	8,924	9,388
SMCSD	Central Bay	57	50	43
Sonoma Valley[(b)]	San Pablo Bay	0.0	0.0	0.0
South SF	South Bay	900	801	826
Sunnyvale	Lower South Bay	22	10	16
SVCW	South Bay	1,666	1,942	1,909
Tiburon	Central Bay	38	0	48
Treasure Island	Central Bay	1	2	8
Vallejo	San Pablo Bay	373	513	767
West County	Central Bay	658	644	634
Total		**32,718**	**35,541**	**36,560**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-7. Annual Average Daily Discharges by Subembayment, Ammonia (kg N/d)

Subembayment	2012/13	2013/14	2014/15
Suisun Bay	4,318	4,294	4,270
San Pablo Bay	875	1,001	1,321
Central Bay	9,432	9,882	9,990
South Bay	18,546	21,152	20,928
Lower South Bay	598	300	378
Total	**33,769**	**36,629**	**36,887**

Table 4-8. Dry Season Average Daily Discharges by Subembayment, Ammonia (kg N/d)

Subembayment	2012/13	2013/14	2014/15	Trend[(a)]
Suisun Bay	4,107	4,159	3,967	None
San Pablo Bay	834	895	1,181	Increasing
Central Bay	9,200	10,029	10,154	Increasing
South Bay	18,315	20,281	21,047	Increasing
Lower South Bay	262	177	211	None
Total	**32,718**	**35,541**	**36,560**	Increasing

a. 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 15. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

On a dry season basis, ammonia loads appear to be increasing in the San Pablo Bay, Central Bay, and South Bay Subembayments. For the South Bay, dry season ammonia loads appear to be increasing while effluent discharges were found to be decreasing (per Table 4-4, Figure 4-2).

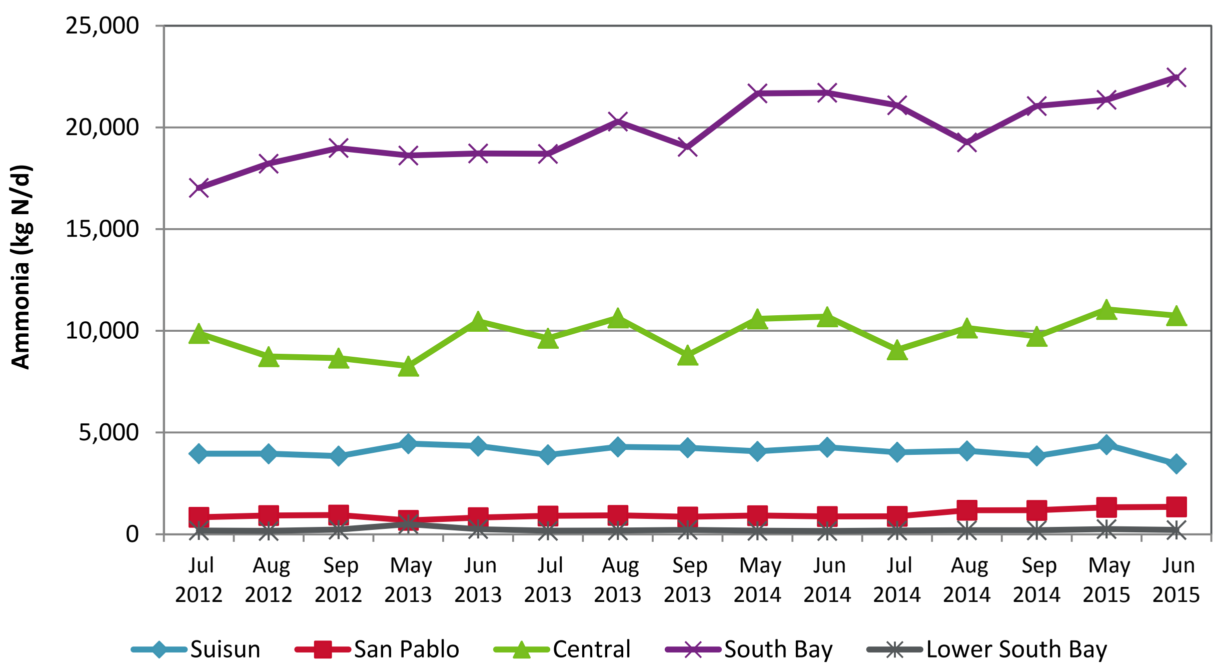

Figure 4-2. Dry Season Average Daily Ammonia Discharge

4.4 Total Kjeldahl Nitrogen (TKN)

The annual average and dry season average effluent TKN loads are presented in Table 4-9 and Table 4-10, respectively. The annual average and dry season effluent loads to each subembayment are presented in Table 4-11 and Table 4-12, respectively.

Table 4-9. Annual Average Daily Discharges by Discharger, TKN (kg N/d)

Discharger	Subembayment	2012/13[a]	2013/14[a]	2014/15[a]
American Canyon	San Pablo Bay	7	4	11
Benicia	San Pablo Bay	179	177	202
Burlingame	South Bay	394	328	310
CCCSD	Suisun Bay	3,910	3,858	3,597
CMSA	Central Bay	793	884	839
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	805	695	1,024
EBDA	South Bay	7,476	7,816	7,765
EBMUD	Central Bay	9,113	9,717	9,579
FSSD	Suisun Bay	31	18	15
Las Gallinas[b]	San Pablo Bay	16	18	17
Millbrae	South Bay	244	286	264
Mt. View	Suisun Bay	6	2	2
Napa[b]	San Pablo Bay	89	51	43
Novato[b]	San Pablo Bay	25	18	30
Palo Alto	Lower South Bay	75	18	152
Paradise Cove	Central Bay	0.5	-	0.3
Petaluma[b]	San Pablo Bay	18	31	29
Pinole	San Pablo Bay	243	215	268
Rodeo	San Pablo Bay	8	8	11
San Jose	Lower South Bay	683	529	504
San Mateo	South Bay	1,363	1,509	1,554
SASM	Central Bay	68	83	70
SFO Airport	South Bay	213	207	146
SFPUC Southeast	South Bay	7,705	9,161	9,860
SMCSD	Central Bay	71	58	66
Sonoma Valley[b]	San Pablo Bay	6.3	6.5	1.3
South SF	South Bay	977	1,013	1,063
Sunnyvale	Lower South Bay	380	170	246
SVCW	South Bay	2,042	2,158	2,066
Tiburon	Central Bay	45	-	66
Treasure Island	Central Bay	4	5	6
Vallejo	San Pablo Bay	492	674	1,019
West County	Central Bay	730	800	755
Total		**38,212**	**40,518**	**41,581**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-10. Dry Season Average Daily Discharges by Discharger, TKN (kg N/d)

Discharger	Subembayment	2012/13[a]	2013/14[a]	2014/15[a]
American Canyon	San Pablo Bay	6	2	9
Benicia	San Pablo Bay	157	191	173
Burlingame	South Bay	313	263	272
CCCSD	Suisun Bay	3,683	3,770	3,546
CMSA	Central Bay	853	891	796
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	794	636	692
EBDA	South Bay	6,795	7,040	7,327
EBMUD	Central Bay	8,678	9,791	9,601
FSSD	Suisun Bay	23	16	13
Las Gallinas[b]	San Pablo Bay	0	0	0
Millbrae	South Bay	240	271	241
Mt. View	Suisun Bay	5	2	1
Napa[b]	San Pablo Bay	0	8	0
Novato[b]	San Pablo Bay	7	2	6
Palo Alto	Lower South Bay	71	18	17
Paradise Cove	Central Bay	0.3	-	0.4
Petaluma[b]	San Pablo Bay	0	0	0
Pinole	San Pablo Bay	312	205	267
Rodeo	San Pablo Bay	8	7	13
San Jose	Lower South Bay	529	436	444
San Mateo	South Bay	1,521	1,735	1,662
SASM	Central Bay	66	65	52
SFO Airport	South Bay	234	182	180
SFPUC Southeast	South Bay	8,031	8,959	9,954
SMCSD	Central Bay	75	63	61
Sonoma Valley[b]	San Pablo Bay	0.0	0.0	0.0
South SF	South Bay	990	1,064	972
Sunnyvale	Lower South Bay	104	122	119
SVCW	South Bay	1,922	2,046	1,884
Tiburon	Central Bay	44	-	57
Treasure Island	Central Bay	4	4	7
Vallejo	San Pablo Bay	483	624	946
West County	Central Bay	742	739	737
Total		**36,690**	**39,152**	**40,049**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-11. Annual Average Daily Discharges by Subembayment, TKN (kg N/d)

Subembayment	2012/13	2013/14	2014/15
Suisun Bay	4,752	4,573	4,638
San Pablo Bay	1,083	1,203	1,631
Central Bay	10,825	11,547	11,382
South Bay	20,414	22,478	23,028
Lower South Bay	1,138	717	902
Total	**38,212**	**40,518**	**41,581**

Table 4-12. Dry Season Average Daily Discharges by Subembayment, TKN (kg N/d)

Subembayment	2012/13	2013/14	2014/15	Trend[(a)]
Suisun Bay	4,505	4,424	4,252	None
San Pablo Bay	973	1,039	1,414	Increasing
Central Bay	10,462	11,553	11,311	None
South Bay	20,046	21,560	22,492	Increasing
Lower South Bay	704	576	580	None
Total	**36,690**	**39,152**	**40,049**	Increasing

a. 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 15. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

On a dry season basis, TKN loads also appear to be increasing in the San Pablo Bay and South Bay Subembayments. For the South Bay, dry season TKN loads were increasing while effluent discharges were found to be decreasing (Table 4-4, Figure 4-3).

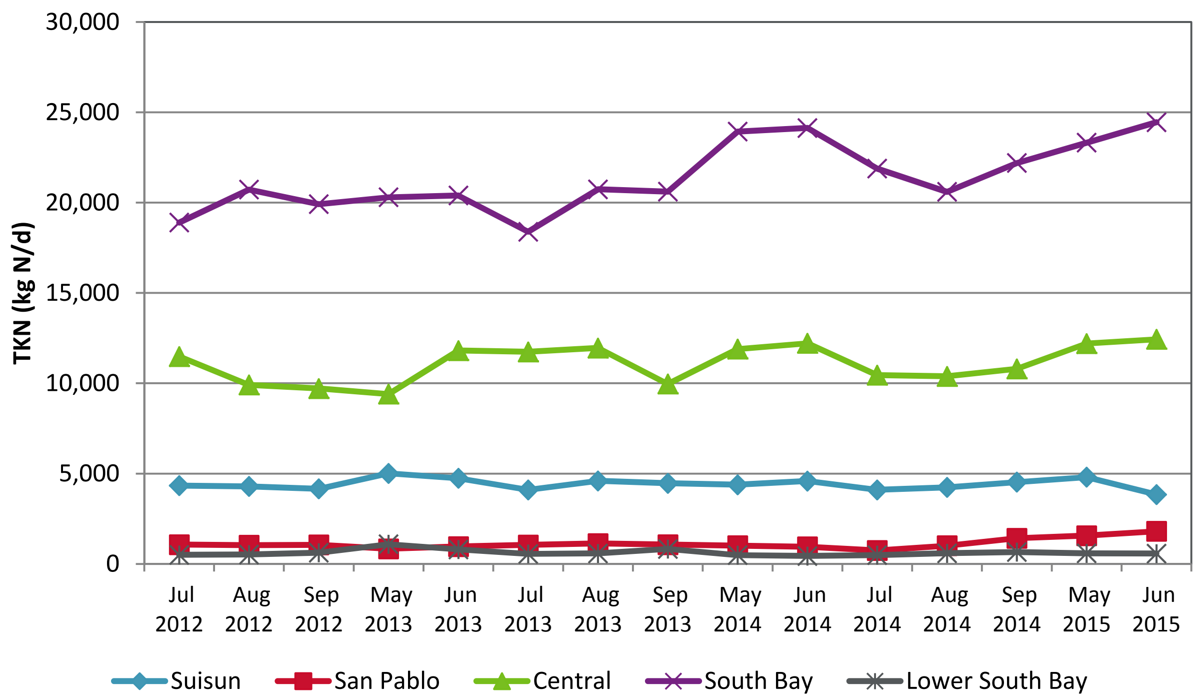

Figure 4-3. Dry Season Average Daily TKN Discharge

4.5 Nitrite plus Nitrate (NOx)

The annual average and dry season average effluent NOx loads are presented in Table 4-13 and Table 4-14, respectively. The annual average and dry season effluent loads to each subembayment are presented in Table 4-15 and Table 4-16, respectively.

Table 4-13. Annual Average Daily Discharges by Discharger, NOx (kg N/d)

Discharger	Subembayment	2012/13[a]	2013/14[a]	2014/15[a]
American Canyon	San Pablo Bay	59	79	53
Benicia	San Pablo Bay	37	40	45
Burlingame	South Bay	64	215	29
CCCSD	Suisun Bay	265	277	421
CMSA	Central Bay	110	80	148
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	907	736	554
EBDA	South Bay	1,044	866	1,011
EBMUD	Central Bay	1,245	1,114	779
FSSD	Suisun Bay	1,278	1,467	1,050
Las Gallinas[b]	San Pablo Bay	118	104	86
Millbrae	South Bay	2	2	2
Mt. View	Suisun Bay	121	131	116
Napa[b]	San Pablo Bay	129	158	163
Novato[b]	San Pablo Bay	137	126	150
Palo Alto	Lower South Bay	2,272	2,132	2,131
Paradise Cove	Central Bay	1.6	-	1.6
Petaluma[b]	San Pablo Bay	22	5	20
Pinole	San Pablo Bay	104	104	44
Rodeo	San Pablo Bay	33	26	27
San Jose	Lower South Bay	4,501	4,475	5,248
San Mateo	South Bay	138	102	64
SASM	Central Bay	162	154	133
SFO Airport	South Bay	23	15	20
SFPUC Southeast	South Bay	554	783	873
SMCSD	Central Bay	72	80	73
Sonoma Valley[b]	San Pablo Bay	27.9	6.8	23.1
South SF	South Bay	199	120	66
Sunnyvale	Lower South Bay	681	584	586
SVCW	South Bay	62	78	57
Tiburon	Central Bay	16	-	4
Treasure Island	Central Bay	9	11	10
Vallejo	San Pablo Bay	343	251	127
West County	Central Bay	120	148	54
Total		**14,857**	**14,470**	**14,169**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-14. Dry Season Average Daily Discharges by Discharger, NOx (kg N/d)

Discharger	Subembayment	2012/13[a]	2013/14[a]	2014/15[a]
American Canyon	San Pablo Bay	41	109	57
Benicia	San Pablo Bay	40	38	48
Burlingame	South Bay	57	159	23
CCCSD	Suisun Bay	168	205	321
CMSA	Central Bay	70	91	79
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	855	716	631
EBDA	South Bay	858	800	698
EBMUD	Central Bay	1,183	636	652
FSSD	Suisun Bay	1,293	1,296	861
Las Gallinas[b]	San Pablo Bay	0	0	0
Millbrae	South Bay	2	3	2
Mt. View	Suisun Bay	108	119	97
Napa[b]	San Pablo Bay	0	50	0
Novato[b]	San Pablo Bay	40	40	36
Palo Alto	Lower South Bay	2,438	2,189	2,256
Paradise Cove	Central Bay	1.8	-	1.2
Petaluma[b]	San Pablo Bay	0	0	0
Pinole	San Pablo Bay	109	126	32
Rodeo	San Pablo Bay	26	24	24
San Jose	Lower South Bay	3,944	3,946	4,753
San Mateo	South Bay	28	6	5
SASM	Central Bay	134	120	125
SFO Airport	South Bay	21	20	19
SFPUC Southeast	South Bay	519	750	881
SMCSD	Central Bay	71	81	80
Sonoma Valley[b]	San Pablo Bay	0.0	0.0	0.0
South SF	South Bay	105	118	78
Sunnyvale	Lower South Bay	565	295	366
SVCW	South Bay	88	67	61
Tiburon	Central Bay	10	-	6
Treasure Island	Central Bay	7	9	10
Vallejo	San Pablo Bay	322	270	152
West County	Central Bay	24	19	12
Total		**13,128**	**12,302**	**12,366**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-15. Annual Average Daily Discharges by Subembayment, NOx (kg N/d)

Subembayment	2012/13	2013/14	2014/15
Suisun Bay	2,571	2,611	2,141
San Pablo Bay	1,010	900	738
Central Bay	1,736	1,587	1,203
South Bay	2,086	2,181	2,122
Lower South Bay	7,454	7,191	7,965
Total	**14,857**	**14,470**	**14,169**

Table 4-16. Dry Season Average Daily Discharges by Subembayment, NOx (kg N/d)

Subembayment	2012/13	2013/14	2014/15	Trend[a]
Suisun Bay	2,424	2,336	1,910	Decreasing
San Pablo Bay	578	657	349	None
Central Bay	1,501	956	965	Decreasing
South Bay	1,678	1,923	1,767	None
Lower South Bay	6,947	6,430	7,375	None
Total	**13,128**	**12,302**	**12,366**	Decreasing

a. 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 15. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.

On a dry season basis, decreasing trends in NOx loads appear in the Suisun Bay and Central Bay Subembayments. In addition, the total effluent NOx to San Francisco Bay appears to be decreasing.

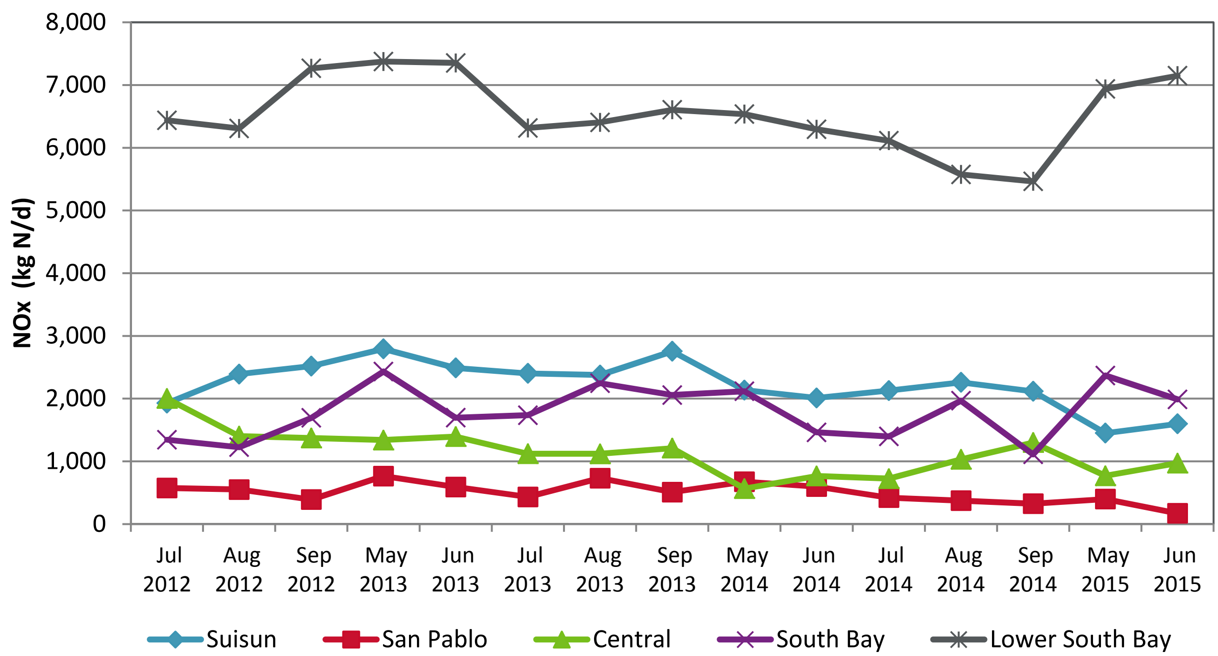

Figure 4-4. Dry Season Average Daily NOx Discharge

4.6 Total Nitrogen (TN)

The annual average and dry season average effluent TN loads are presented in Table 4-17 and Table 4-18, respectively. The annual average and dry season effluent TN loads by subembayment are presented in Table 4-19 and Table 4-20, respectively.

Table 4-17. Annual Average Daily Discharges by Discharger, TN (kg N/d)

Discharger	Subembayment	2012/13[(a)]	2013/14[(a)]	2014/15[(a)]
American Canyon	San Pablo Bay	66	83	64
Benicia	San Pablo Bay	215	218	245
Burlingame	South Bay	458	544	337
CCCSD	Suisun Bay	4,175	4,135	4,002
CMSA	Central Bay	903	964	992
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	1,712	1,431	1,571
EBDA	South Bay	8,483	8,664	8,777
EBMUD	Central Bay	10,356	10,831	10,361
FSSD	Suisun Bay	1,308	1,442	1,083
Las Gallinas[(b)]	San Pablo Bay	135	122	103
Millbrae	South Bay	246	288	266
Mt. View	Suisun Bay	128	133	118
Napa[(b)]	San Pablo Bay	218	209	206
Novato[(b)]	San Pablo Bay	162	144	180
Palo Alto	Lower South Bay	2,347	2,150	2,289
Paradise Cove	Central Bay	2	-	2
Petaluma[(b)]	San Pablo Bay	40	35	51
Pinole	San Pablo Bay	347	319	315
Rodeo	San Pablo Bay	41	33	38
San Jose	Lower South Bay	5,185	5,004	5,752
San Mateo	South Bay	1,501	1,611	1,619
SASM	Central Bay	230	237	203
SFO Airport	South Bay	236	222	166
SFPUC Southeast	South Bay	8,258	9,944	10,733
SMCSD	Central Bay	143	138	140
Sonoma Valley[(b)]	San Pablo Bay	34	13	25
South SF	South Bay	1,176	1,134	1,129
Sunnyvale	Lower South Bay	1,060	754	868
SVCW	South Bay	2,113	2,237	2,123
Tiburon	Central Bay	61	-	70
Treasure Island	Central Bay	13	16	17
Vallejo	San Pablo Bay	836	925	1,145
West County	Central Bay	850	948	808
Total		**53,038**	**54,928**	**55,798**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-18. Dry Season Average Daily Discharges by Discharger, TN (kg N/d)

Discharger	Subembayment	2012/13[(a)]	2013/14[(a)]	2014/15[(a)]
American Canyon	San Pablo Bay	47	111	67
Benicia	San Pablo Bay	196	229	222
Burlingame	South Bay	370	422	295
CCCSD	Suisun Bay	3,851	3,975	3,852
CMSA	Central Bay	922	982	875
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	1,649	1,352	1,308
EBDA	South Bay	7,611	7,796	8,024
EBMUD	Central Bay	9,862	10,428	10,263
FSSD	Suisun Bay	1,315	1,312	919
Las Gallinas[(b)]	San Pablo Bay	0	0	0
Millbrae	South Bay	242	274	243
Mt. View	Suisun Bay	113	121	98
Napa[(b)]	San Pablo Bay	0	57	0
Novato[(b)]	San Pablo Bay	46	42	43
Palo Alto	Lower South Bay	2,510	2,207	2,282
Paradise Cove	Central Bay	2	-	2
Petaluma[(b)]	San Pablo Bay	0	0	0
Pinole	San Pablo Bay	421	331	304
Rodeo	San Pablo Bay	34	31	37
San Jose	Lower South Bay	4,473	4,382	5,196
San Mateo	South Bay	1,549	1,741	1,667
SASM	Central Bay	200	185	176
SFO Airport	South Bay	255	202	199
SFPUC Southeast	South Bay	8,550	9,709	10,835
SMCSD	Central Bay	146	144	143
Sonoma Valley[(b)]	San Pablo Bay	0	0	0
South SF	South Bay	1,096	1,182	1,050
Sunnyvale	Lower South Bay	669	417	566
SVCW	South Bay	2,033	2,113	1,946
Tiburon	Central Bay	54	-	64
Treasure Island	Central Bay	11	13	17
Vallejo	San Pablo Bay	805	895	1,098
West County	Central Bay	766	758	749
Total		**49,798**	**51,411**	**52,540**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-19. Annual Average Daily Discharges by Subembayment, TN (kg N/d)

Subembayment	2012/13	2013/14	2014/15
Suisun Bay	7,323	7,141	6,774
San Pablo Bay	2,094	2,101	2,372
Central Bay	12,558	13,134	12,593
South Bay	22,471	24,644	25,150
Lower South Bay	8,592	7,908	8,909
Total	**53,038**	**54,928**	**55,798**

Table 4-20. Dry Season Average Daily Discharges by Subembayment, TN (kg N/d)

Subembayment	2012/13	2013/14	2014/15	Trend[a]
Suisun Bay	6,928	6,760	6,177	None
San Pablo Bay	1,549	1,696	1,771	None
Central Bay	11,963	12,510	12,289	None
South Bay	21,706	23,439	24,259	Increasing
Lower South Bay	7,652	7,006	8,044	None
Total	**49,798**	**51,411**	**52,540**	Increasing

a. 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 15. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

The dry season TN loads discharged to the Bay do not appear to exhibit a discernible trend (Table 4-20, Figure 4-5), with the exception of South Bay, where TN loads appear to have increased over the past 3 years. Since the South Bay makes up nearly fifty percent of the total effluent TN load to the Bay, the overall Bay is exhibiting an increase in effluent TN loads.

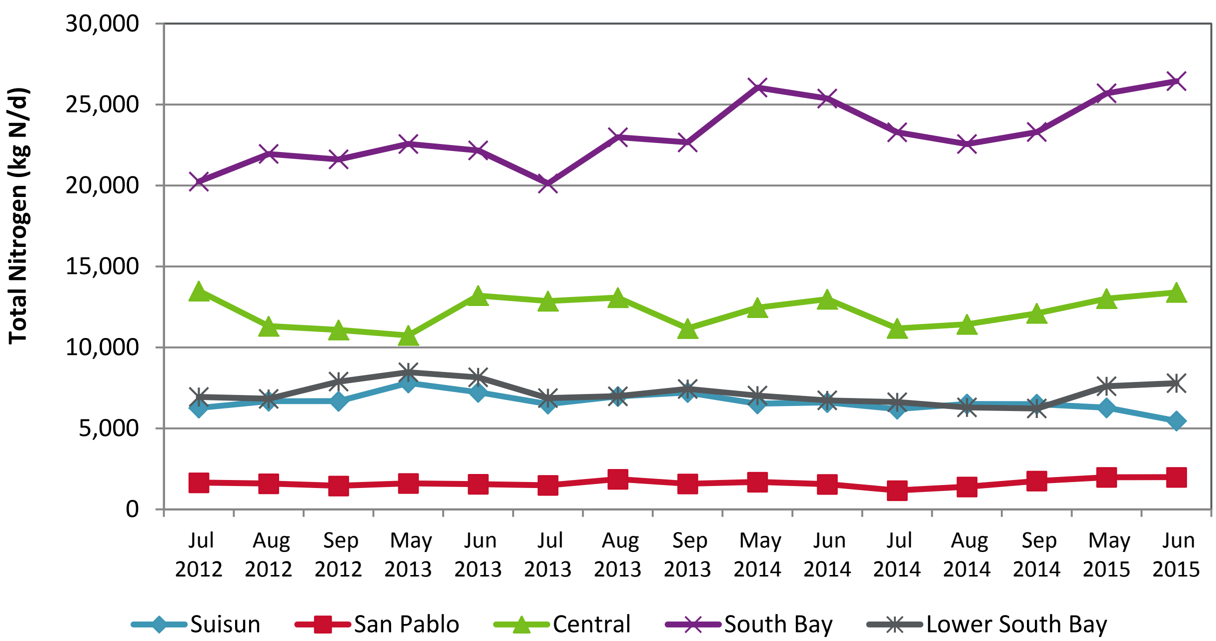

Figure 4-5. Dry Season Average Daily TN Discharge

4.7 Ortho-Phosphate (Ortho-P)

The annual average and dry season average effluent ortho-P loads are presented in Table 4-21 and Table 4-22, respectively. The annual average and dry season effluent ortho-P loads discharge to each subembayment are presented in Table 4-23 and Table 4-24, respectively.

Table 4-21. Annual Average Daily Discharges by Discharger, Ortho-P (kg P/d)

Discharger	Subembayment	2012/13[a]	2013/14[a]	2014/15[a]
American Canyon	San Pablo Bay	23	34	25
Benicia	San Pablo Bay	22	25	21
Burlingame	South Bay	162	110	18
CCCSD	Suisun Bay	80	47	58
CMSA	Central Bay	138	109	84
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	32	27	18
EBDA	South Bay	597	629	422
EBMUD	Central Bay	944	805	501
FSSD	Suisun Bay	224	321	185
Las Gallinas[b]	San Pablo Bay	18	26	15
Millbrae	South Bay	21	18	6
Mt. View	Suisun Bay	17	15	15
Napa[b]	San Pablo Bay	24	8	8
Novato[b]	San Pablo Bay	26	14	18
Palo Alto	Lower South Bay	439	463	347
Paradise Cove	Central Bay	0.3	-	0.3
Petaluma[b]	San Pablo Bay	28	31	24
Pinole	San Pablo Bay	48	30	12
Rodeo	San Pablo Bay	15	10	7
San Jose	Lower South Bay	374	276	280
San Mateo	South Bay	159	219	134
SASM	Central Bay	72	92	36
SFO Airport	South Bay	14	21	6
SFPUC Southeast	South Bay	340	313	197
SMCSD	Central Bay	38	37	15
Sonoma Valley[b]	San Pablo Bay	16	10	3
South SF	South Bay	189	219	110
Sunnyvale	Lower South Bay	200	172	215
SVCW	South Bay	259	316	164
Tiburon	Central Bay	9	-	7
Treasure Island	Central Bay	4	4	4
Vallejo	San Pablo Bay	106	108	87
West County	Central Bay	82	86	32
Total		**4,720**	**4,595**	**3,074**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-22. Dry Season Average Daily Discharges by Discharger, Ortho-P (kg P/d)

Discharger	Subembayment	2012/13[(a)]	2013/14[(a)]	2014/15[(a)]
American Canyon	San Pablo Bay	24	62	23
Benicia	San Pablo Bay	20	24	18
Burlingame	South Bay	160	96	20
CCCSD	Suisun Bay	90	61	49
CMSA	Central Bay	126	111	85
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	30	33	12
EBDA	South Bay	503	559	450
EBMUD	Central Bay	692	601	435
FSSD	Suisun Bay	246	335	163
Las Gallinas[(b)]	San Pablo Bay	0	0	0
Millbrae	South Bay	23	21	8
Mt. View	Suisun Bay	17	16	18
Napa[(b)]	San Pablo Bay	0	1	0
Novato[(b)]	San Pablo Bay	2	1	0
Palo Alto	Lower South Bay	494	490	385
Paradise Cove	Central Bay	0.4	-	0.2
Petaluma[(b)]	San Pablo Bay	0	0	0
Pinole	San Pablo Bay	52	38	12
Rodeo	San Pablo Bay	16	7	9
San Jose	Lower South Bay	121	215	214
San Mateo	South Bay	130	230	122
SASM	Central Bay	73	89	37
SFO Airport	South Bay	15	27	8
SFPUC Southeast	South Bay	387	400	212
SMCSD	Central Bay	48	50	18
Sonoma Valley[(b)]	San Pablo Bay	0	0	0
South SF	South Bay	218	217	112
Sunnyvale	Lower South Bay	202	133	208
SVCW	South Bay	323	381	168
Tiburon	Central Bay	7	-	7
Treasure Island	Central Bay	4	4	5
Vallejo	San Pablo Bay	108	104	104
West County	Central Bay	83	61	29
Total		**4,214**	**4,367**	**2,931**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-23. Annual Average Daily Discharges by Subembayment, Ortho-P (kg P/d)

Subembayment	2012/13	2013/14	2014/15
Suisun Bay	353	410	276
San Pablo Bay	326	296	220
Central Bay	1,287	1,133	679
South Bay	1,741	1,845	1,057
Lower South Bay	1,013	911	842
Total	**4,720**	**4,595**	**3,074**

Table 4-24. Dry Season Average Daily Discharges by Subembayment, Ortho-P (kg P/d)

Subembayment	2012/13	2013/14	2014/15	Trend[a]
Suisun Bay	383	445	242	None
San Pablo Bay	222	237	166	None
Central Bay	1,033	916	616	Decreasing
South Bay	1,759	1,931	1,100	Decreasing
Lower South Bay	817	838	807	None
Total	**4,214**	**4,367**	**2,931**	Decreasing

a. 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 15. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

The dry season ortho-P loads discharged to the Bay generally appear to exhibit a decreasing trend; however, Suisun, San Pablo, and the Lower South Bay Subembayments do not appear to be exhibit a statistically relevant trend.

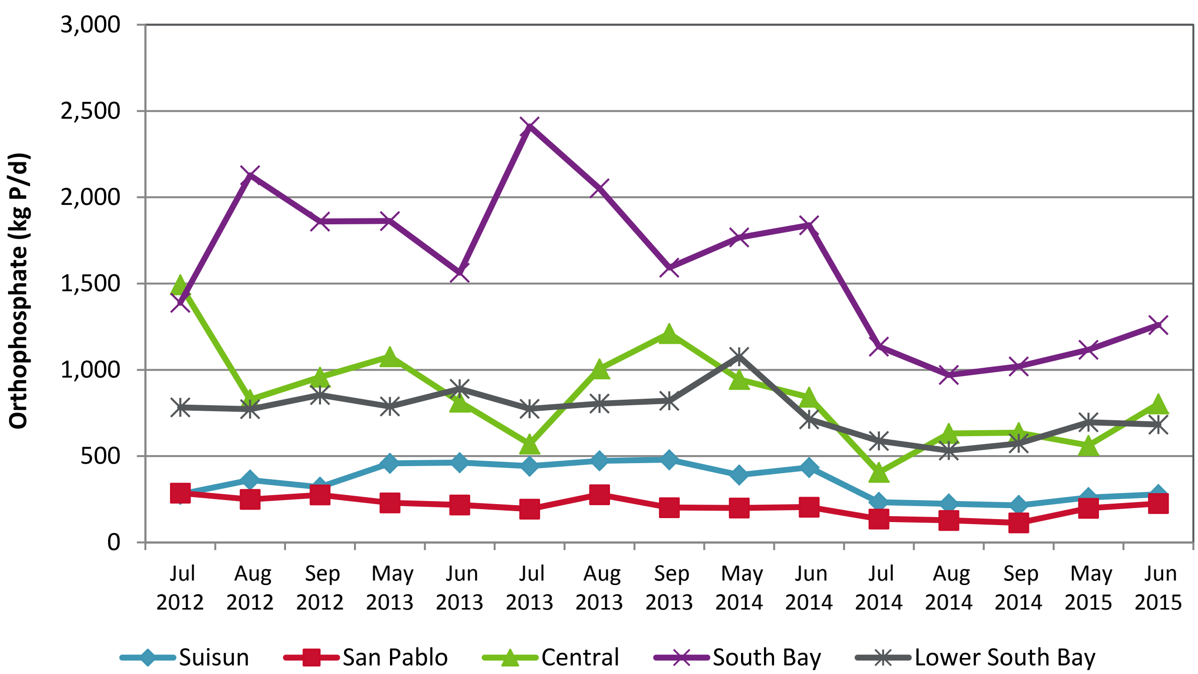

Figure 4-6. Dry Season Average Daily Ortho-P Discharge

4.8 Total Phosphorus (TP)

The annual average and dry season average effluent TP loads are presented in Table 4-25 and Table 4-26, respectively. The annual average and dry season effluent TP load discharged by subembayment is presented in Table 4-27 and Table 4-28, respectively.

Table 4-25. Annual Average Daily Discharges by Discharger, TP (kg P/d)

Discharger	Subembayment	2012/13[a]	2013/14[a]	2014/15[a]
American Canyon	San Pablo Bay	26	26	24
Benicia	San Pablo Bay	26	26	28
Burlingame	South Bay	81	140	22
CCCSD	Suisun Bay	139	96	125
CMSA	Central Bay	89	88	93
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	33	28	36
EBDA	South Bay	539	539	517
EBMUD	Central Bay	933	800	769
FSSD	Suisun Bay	195	203	197
Las Gallinas[b]	San Pablo Bay	20	17	15
Millbrae	South Bay	16	16	12
Mt. View	Suisun Bay	18	17	17
Napa[b]	San Pablo Bay	23	14	24
Novato[b]	San Pablo Bay	16	11	21
Palo Alto	Lower South Bay	341	335	361
Paradise Cove	Central Bay	0.3	-	0.3
Petaluma[b]	San Pablo Bay	28	31	25
Pinole	San Pablo Bay	34	19	14
Rodeo	San Pablo Bay	9	7	7
San Jose	Lower South Bay	326	261	306
San Mateo	South Bay	124	128	122
SASM	Central Bay	41	49	42
SFO Airport	South Bay	15	17	9
SFPUC Southeast	South Bay	100	134	172
SMCSD	Central Bay	23	20	17
Sonoma Valley[b]	San Pablo Bay	16	10	3
South SF	South Bay	154	155	169
Sunnyvale	Lower South Bay	214	202	225
SVCW	South Bay	172	177	176
Tiburon	Central Bay	8	-	8
Treasure Island	Central Bay	2	3	3
Vallejo	San Pablo Bay	128	130	121
West County	Central Bay	57	62	41
Total		**3,946**	**3,761**	**3,721**

a. Data is presented in detail and summarized for each plant in the Appendix.

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-26 Dry Season Average Daily Discharges by Discharger, TP (kg P/d)

Discharger	Subembayment	2012/13[a]	2013/14[a]	2014/15[a]
American Canyon	San Pablo Bay	26	47	17
Benicia	San Pablo Bay	27	25	24
Burlingame	South Bay	76	103	23
CCCSD	Suisun Bay	141	110	107
CMSA	Central Bay	92	94	86
Port Costa	San Pablo Bay	-	-	-
Delta Diablo	Suisun Bay	32	28	27
EBDA	South Bay	477	505	519
EBMUD	Central Bay	885	610	698
FSSD	Suisun Bay	202	204	169
Las Gallinas[b]	San Pablo Bay	0	0	0
Millbrae	South Bay	17	19	12
Mt. View	Suisun Bay	18	18	19
Napa[b]	San Pablo Bay	0	4	0
Novato[b]	San Pablo Bay	1	2	1
Palo Alto	Lower South Bay	384	355	400
Paradise Cove	Central Bay	0.3	-	0.2
Petaluma[b]	San Pablo Bay	0	0	0
Pinole	San Pablo Bay	40	23	17
Rodeo	San Pablo Bay	9	6	8
San Jose	Lower South Bay	119	233	229
San Mateo	South Bay	117	137	130
SASM	Central Bay	40	51	44
SFO Airport	South Bay	19	18	8
SFPUC Southeast	South Bay	103	112	183
SMCSD	Central Bay	24	23	19
Sonoma Valley[b]	San Pablo Bay	0	0	0
South SF	South Bay	156	158	158
Sunnyvale	Lower South Bay	214	155	207
SVCW	South Bay	181	173	181
Tiburon	Central Bay	8	-	8
Treasure Island	Central Bay	2	2	3
Vallejo	San Pablo Bay	130	126	127
West County	Central Bay	54	45	32
Total		**3,594**	**3,386**	**3,456**

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

b. No discharge during a portion or all of the dry season months, except with authorization under emergency conditions.

Table 4-27. Annual Average Daily Discharges by Subembayment, TP (kg P/d)

Subembayment	2012/13	2013/14	2014/15
Suisun Bay	385	344	375
San Pablo Bay	326	291	282
Central Bay	1,153	1,022	973
South Bay	1,201	1,306	1,199
Lower South Bay	881	798	892
Total	**3,946**	**3,761**	**3,721**

Table 4-28. Dry Season Average Daily Discharges by Subembayment, TP (kg P/d)

Subembayment	2012/13	2013/14	2014/15	Trend[a]
Suisun Bay	393	360	322	None
San Pablo Bay	233	233	194	None
Central Bay	1,105	825	890	None
South Bay	1,146	1,225	1,214	None
Lower South Bay	717	743	836	Increasing
Total	**3,594**	**3,386**	**3,456**	None

a. 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 15. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

With the exception of the Lower South Bay, the dry season TP loads discharged to the remaining Bay do not exhibit a statistically relevant trend based on the least squares correlation test selected as the basis for trends analysis. A plot of the dry season data used to evaluate the trends is presented in Figure 4-7.

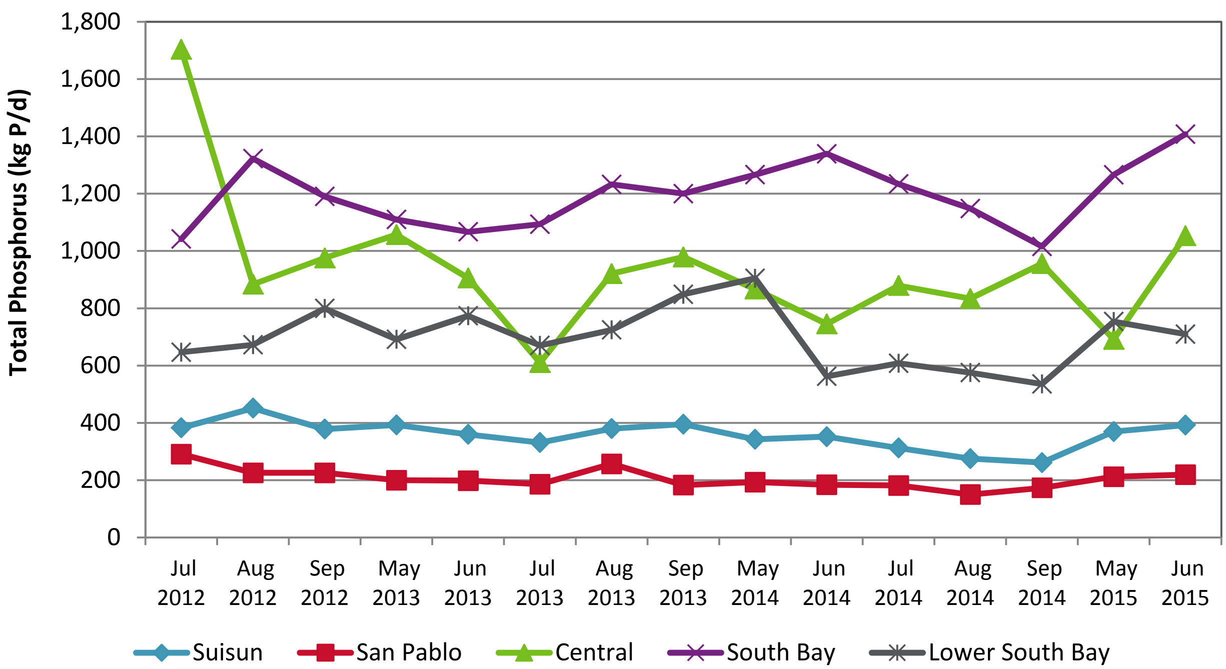

Figure 4-7. Dry Season Average Daily TP Loads

In several instances, the report ortho-P values were greater than TP values, which is clear when comparing values in Table 4-21 and Table 4-25 for specific plants. It is especially pronounced for certain plants, such as the SFPUC Southeast Plant, who has communicated this issue with the Regional Water Board. This issue is attributed to a combination of sampling methodology (composite versus grab) and the analytical methodology for measuring phosphorus, which suffers from matrix issues.[4]

4.9 Subembayment Nutrient Loading

Nutrient effluent loading for select nitrogen and phosphorus species 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 three years.

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, total nitrogen and total phosphorus.

[4] Neal, C.; Neal, M; and Wickham, H. (2000) Phosphate measurement in natural waters: two examples of analytical problems associated with silica interference using phosphomolybdic acid methodologies. Science of the Total Environment, 251-252:511-522. Also Eleuterio, L. and Neethling, J.B., "Low Phosphorus Analytical Measurement Study" WERF Nutrient Removal Challenge Report NUTR1R06F, 2009.

4.9.1 Suisun Bay

The average monthly discharge to Suisun Bay by discharger for flow, ammonia, TN and TP is provided in Figure 4-8, Figure 4-9, Figure 4-10, and Figure 4-11, respectively. Flows to Suisun Bay are dominated by the CCCSD discharge and followed, in terms of magnitude, by FSSD and Delta Diablo. CCCSD also discharges the largest loads of ammonia and total nitrogen. FSSD discharges the largest phosphorus load to Suisun Bay, followed by CCCSD.

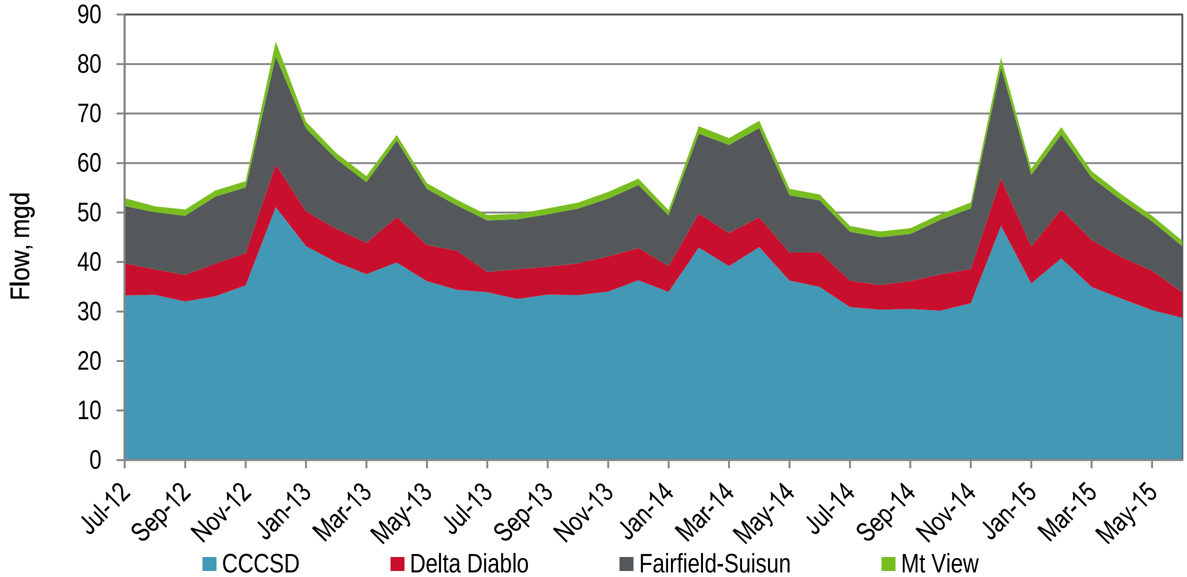

Figure 4-8. Flow Contribution by Discharger to Suisun Bay

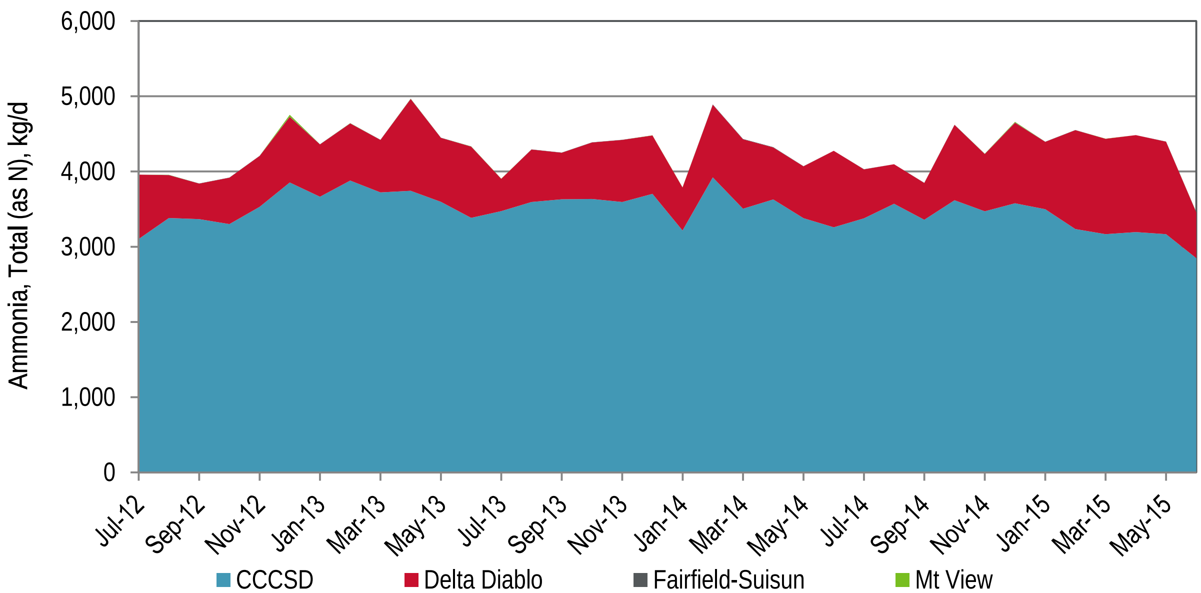

Figure 4-9. Ammonia Load Contribution by Discharger to Suisun Bay

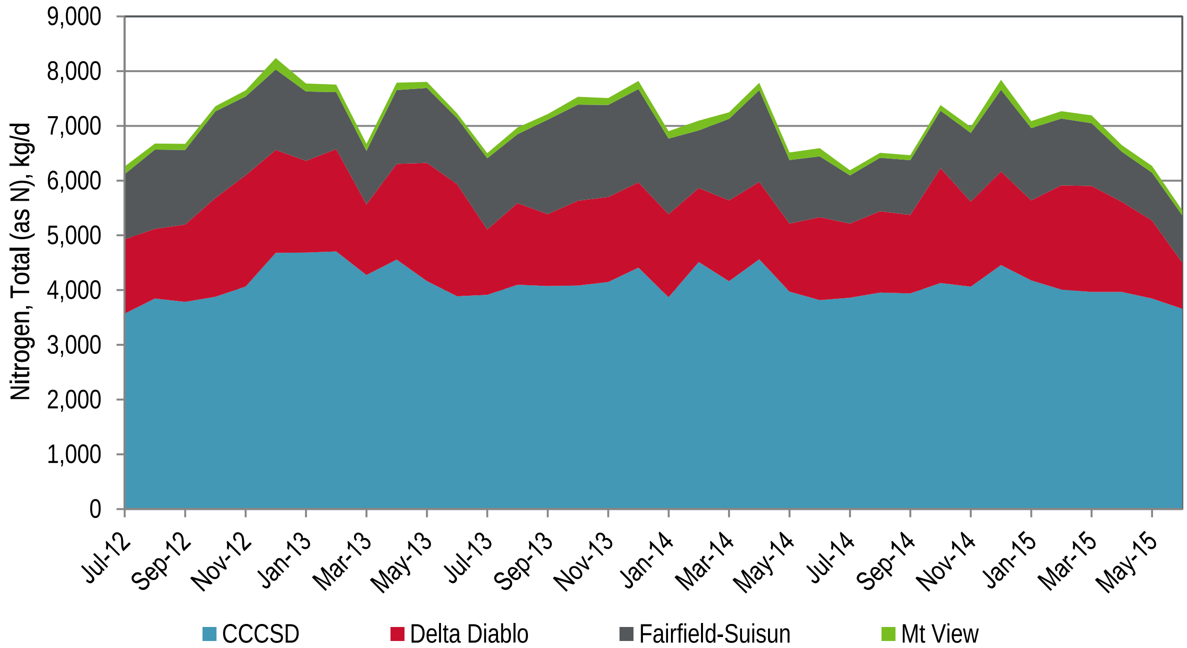

Figure 4-10. Total Nitrogen Load Contribution by Discharger to Suisun Bay

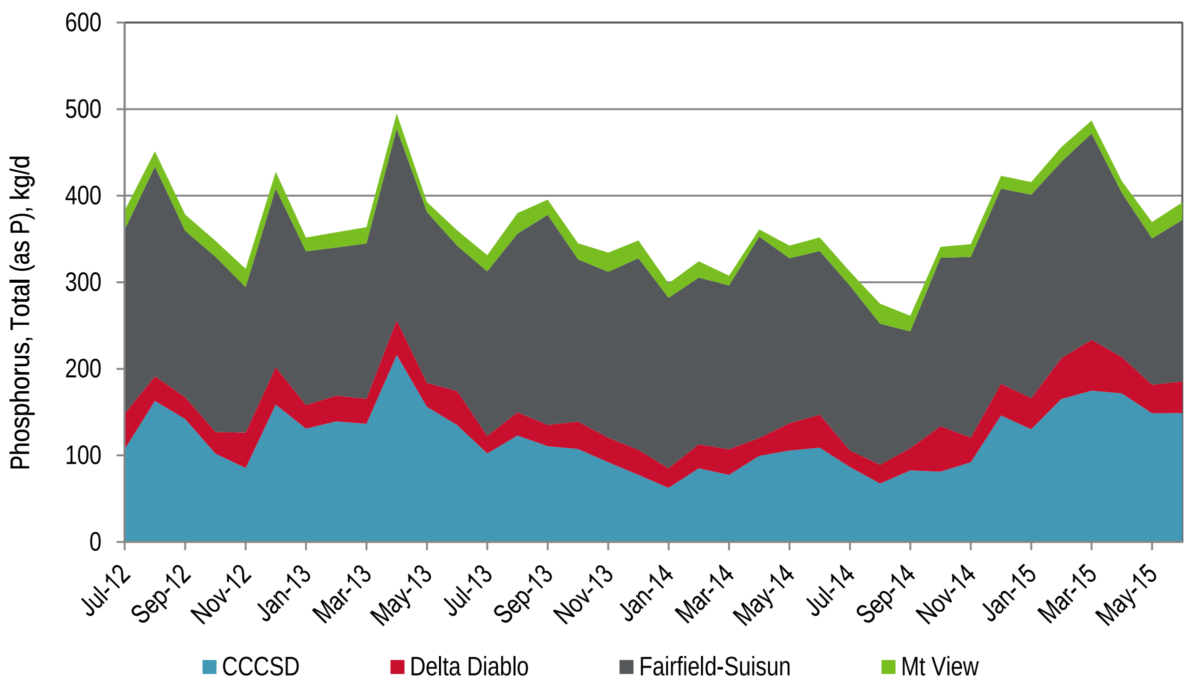

Figure 4-11. Total Phosphorus Load Contribution by Discharger to Suisun Bay

4.9.2 San Pablo Bay

The average monthly discharge to San Pablo Bay by discharger for flow, ammonia, TN and TP is provided in Figure 4-12, Figure 4-13, Figure 4-14, and Figure 4-15, respectively. Figure 4-12 clearly demonstrates the seasonal discharges at Sonoma Valley, Napa, Las Gallinas, and Petaluma. The ammonia load from Vallejo to San Pablo Bay appears to be increasing over the past three years. Similar to flow, total nitrogen and total phosphorus loads to San Pablo Bay appear to exhibit a significant seasonal pattern with higher wintertime loads.

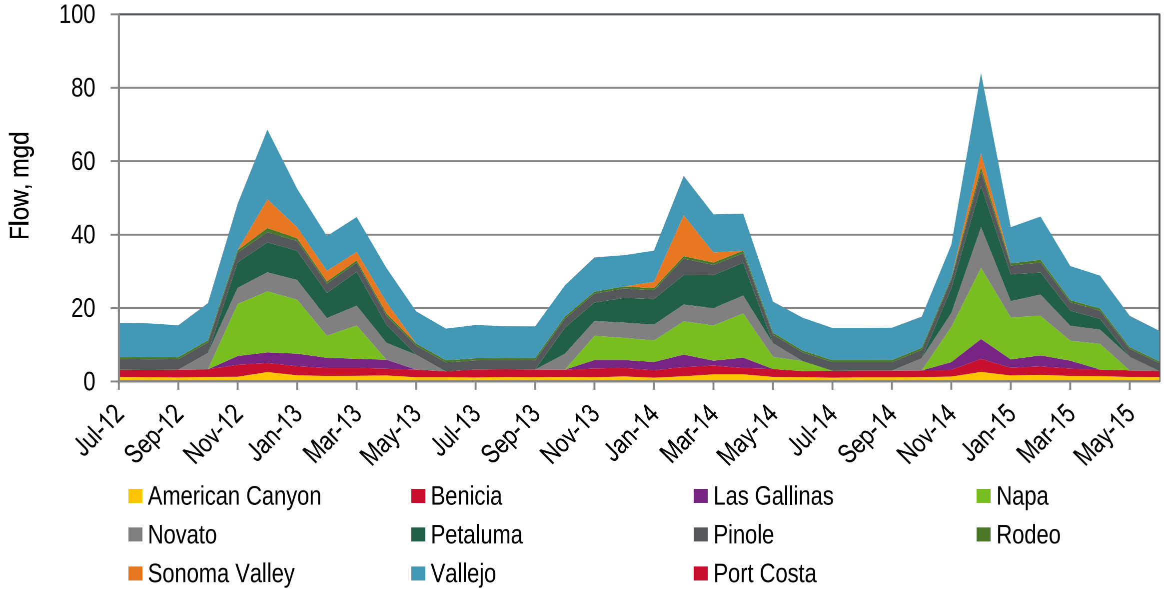

Figure 4-12. Flow Contribution by Discharger to San Pablo Bay

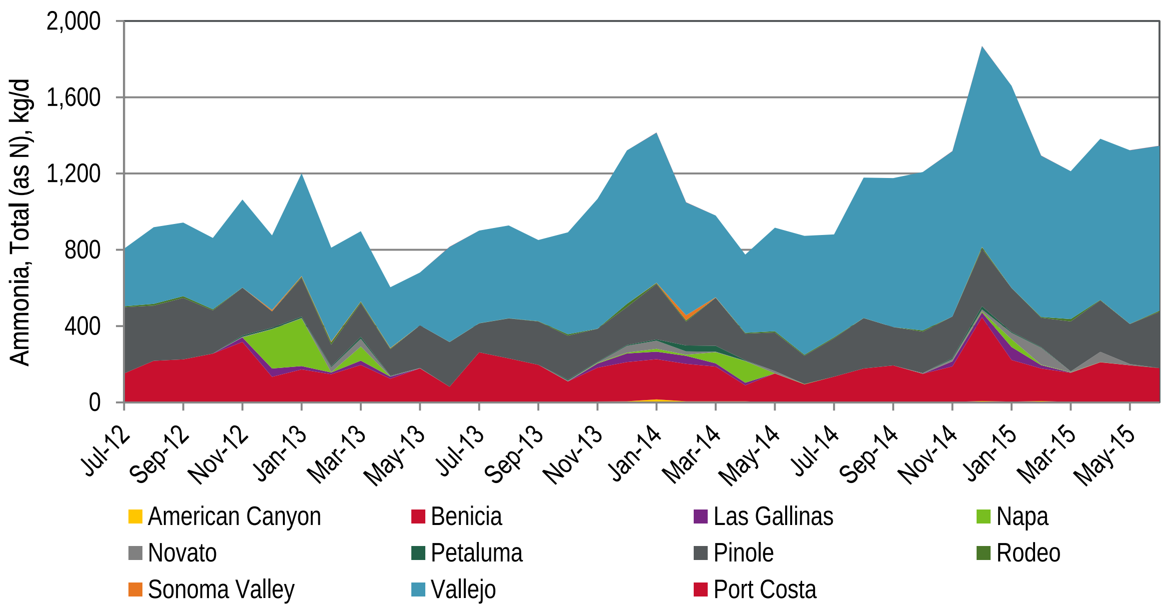

Figure 4-13. Ammonia Load Contribution by Discharger to San Pablo Bay

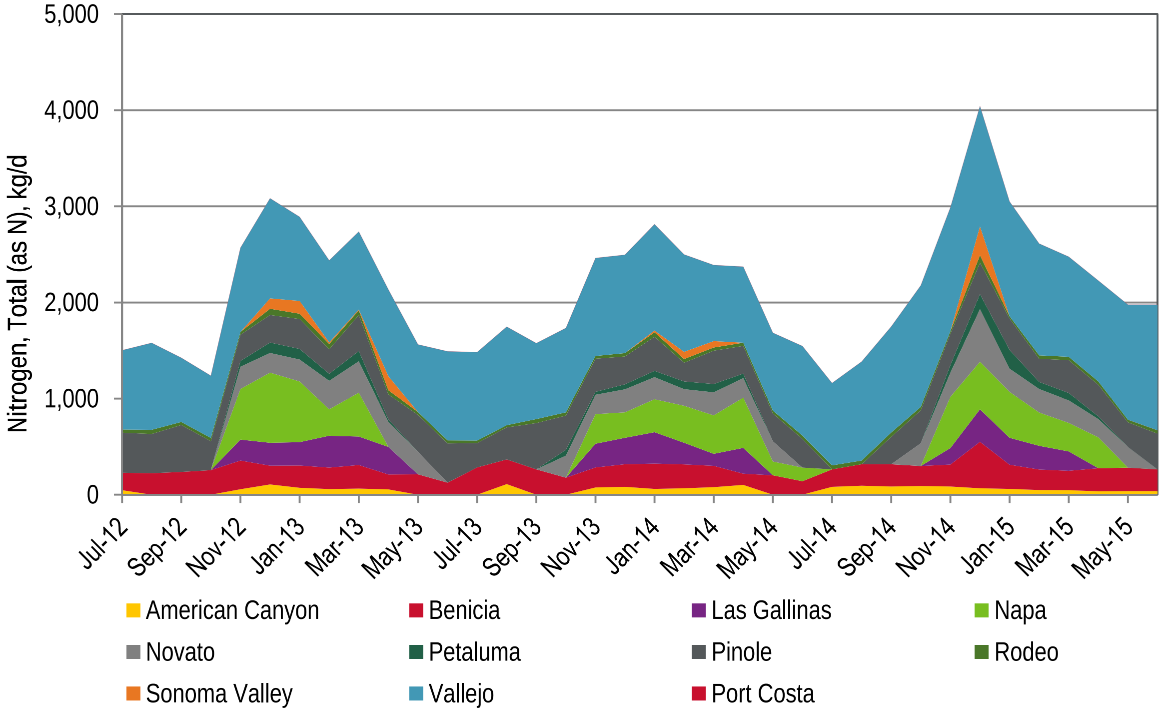

Figure 4-14. Total Nitrogen Load Contribution by Discharger to San Pablo Bay

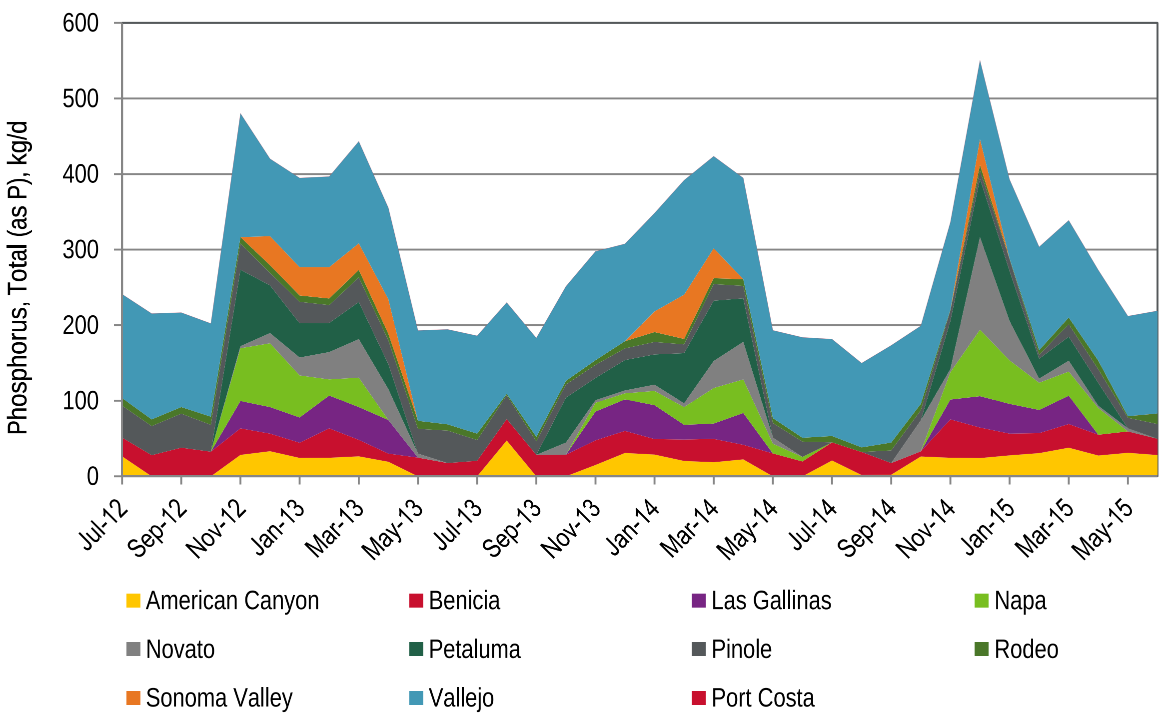

Figure 4-15. Total Phosphorus Load Contribution by Discharger to San Pablo Bay

4.9.3 Central Bay

The average monthly discharge to Central Bay by discharger for flow, ammonia, TN and TP is provided in Figure 4-16, Figure 4-17, Figure 4-18, Figure 4-19, respectively. Effluent flows to the Central Bay are dominated by EBMUD, which also dominates the ammonia, total nitrogen and total phosphorus loads to the Central Bay.

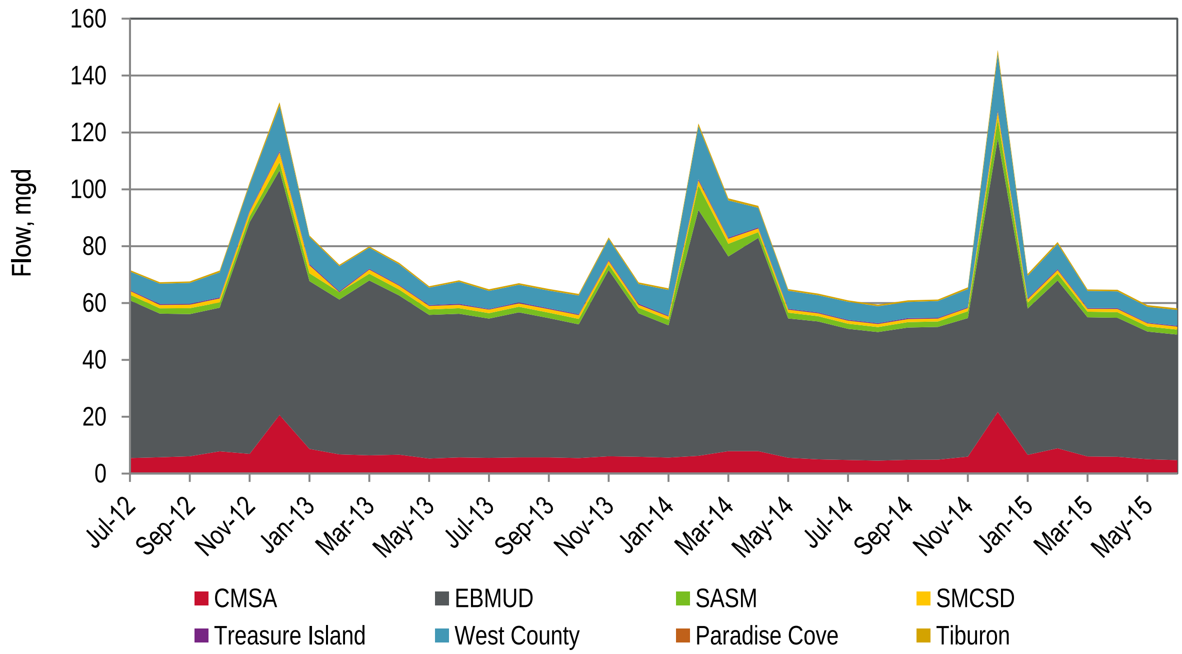

Figure 4-16. Flow Contribution by Discharger to Central Bay

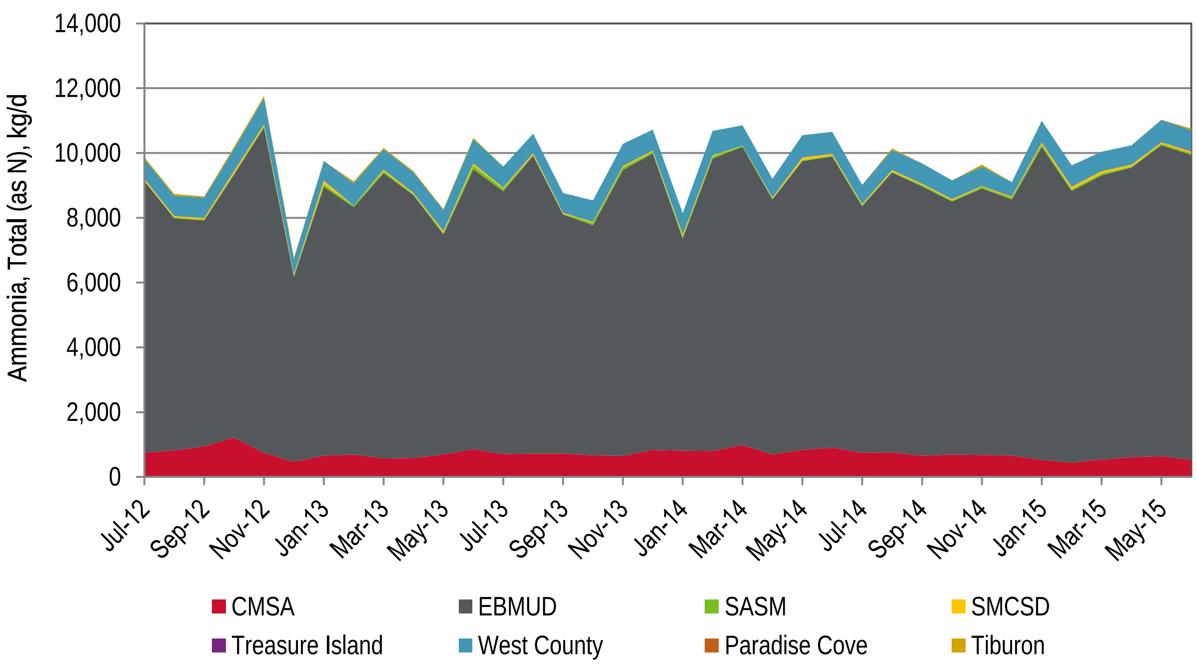

Figure 4-17. Ammonia Load Contribution by Discharger to Central Bay

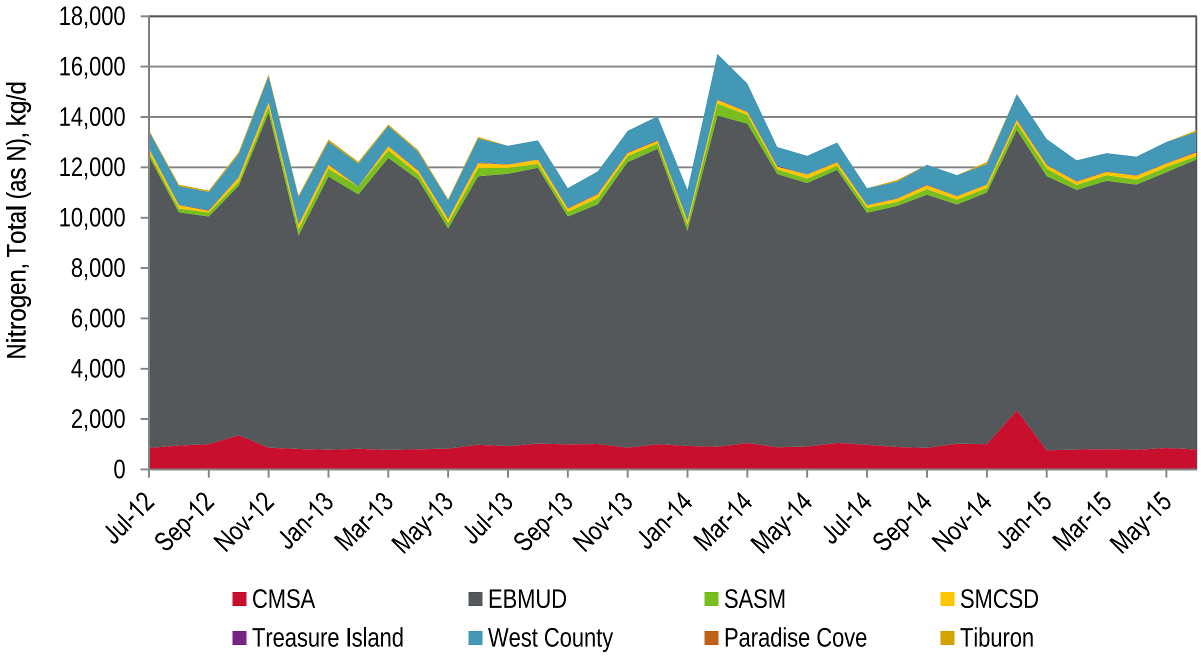

Figure 4-18. Total Nitrogen Load Contribution by Discharger to Central Bay

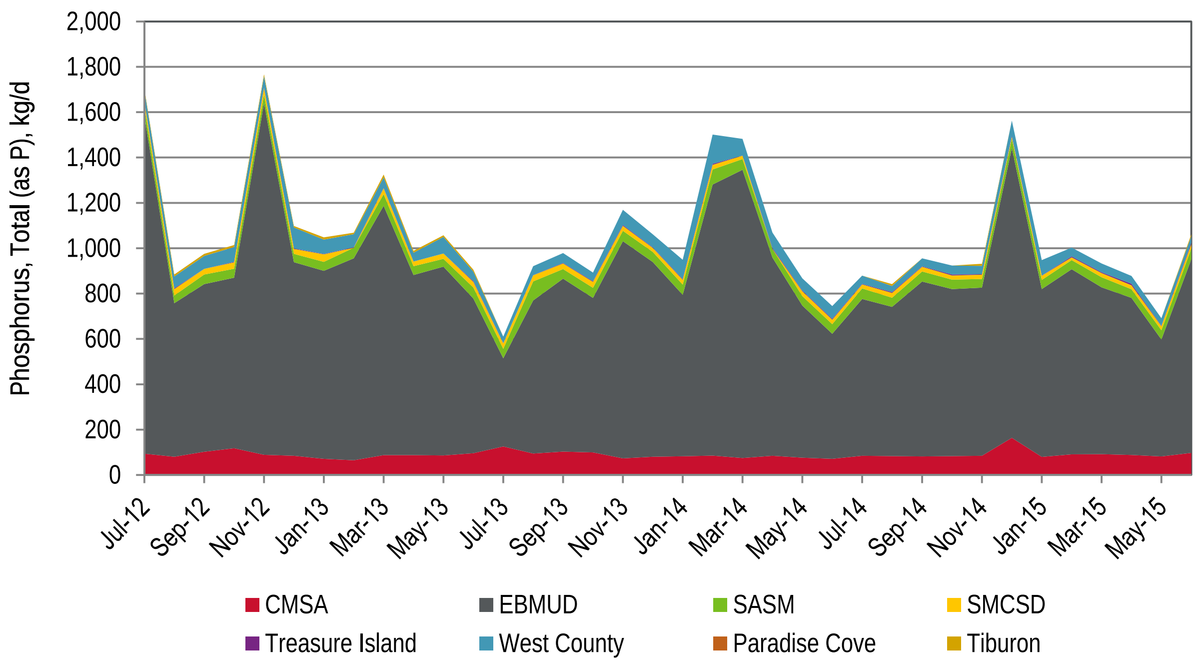

Figure 4-19. Total Phosphorus Load Contribution by Discharger to Central Bay

4.9.4 South Bay

The average monthly discharge to the South Bay by discharger for flow, ammonia, TN and TP is provided in Figure 4-20, Figure 4-21, Figure 4-22, and Figure 4-23, respectively. In the South Bay, the largest wastewater discharges are from the SFPUC Southeast Plant and EBDA. Ammonia and total nitrogen loads to the South Bay are also largest from the SFPUC Southeast Plant and EBDA. The total phosphorus discharges to the South Bay are more evenly distributed between EBDA, San Mateo, and SVCW. SFPUC's total phosphorus loads are a lower proportion of the total compared to flow, ammonia, and total nitrogen.

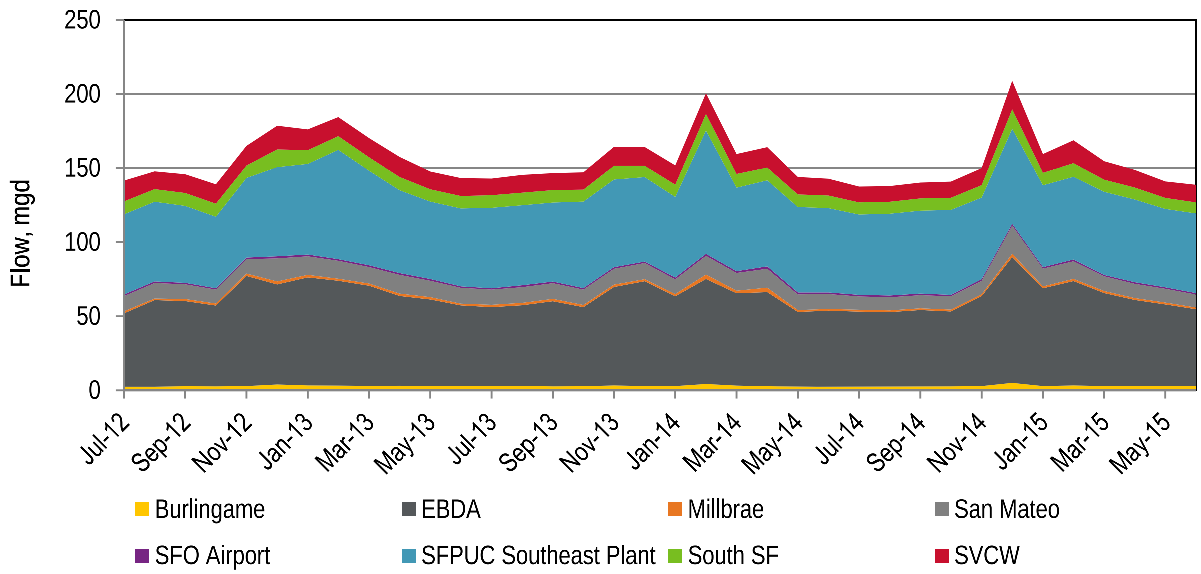

Figure 4-20. Flow Contribution by Discharger to South Bay

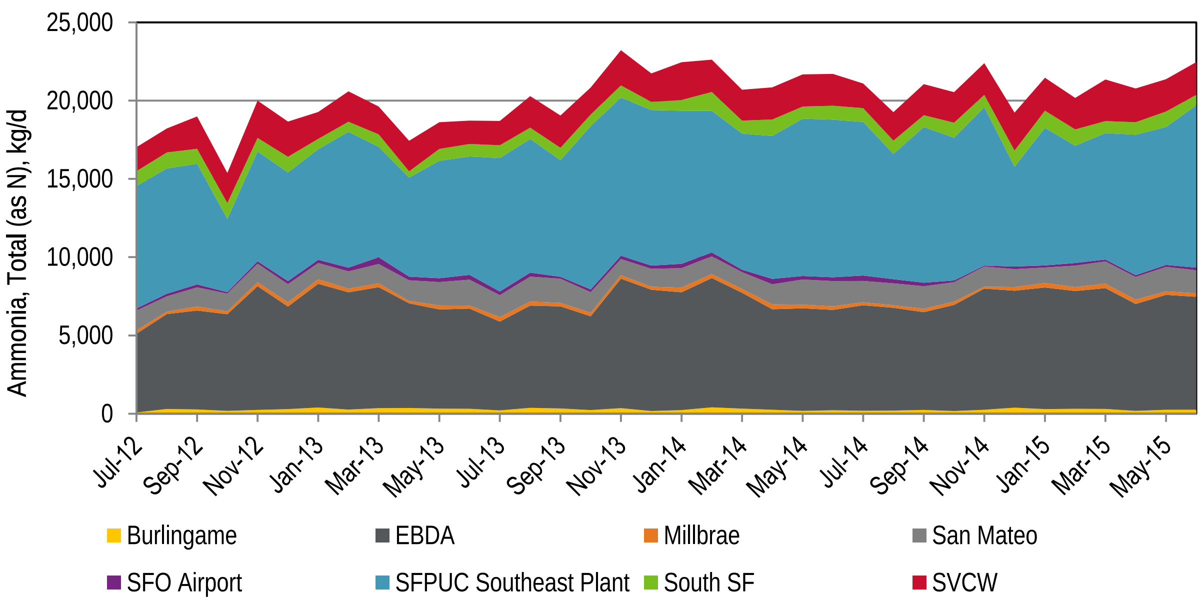

Figure 4-21. Ammonia Load Contribution by Discharger to South Bay

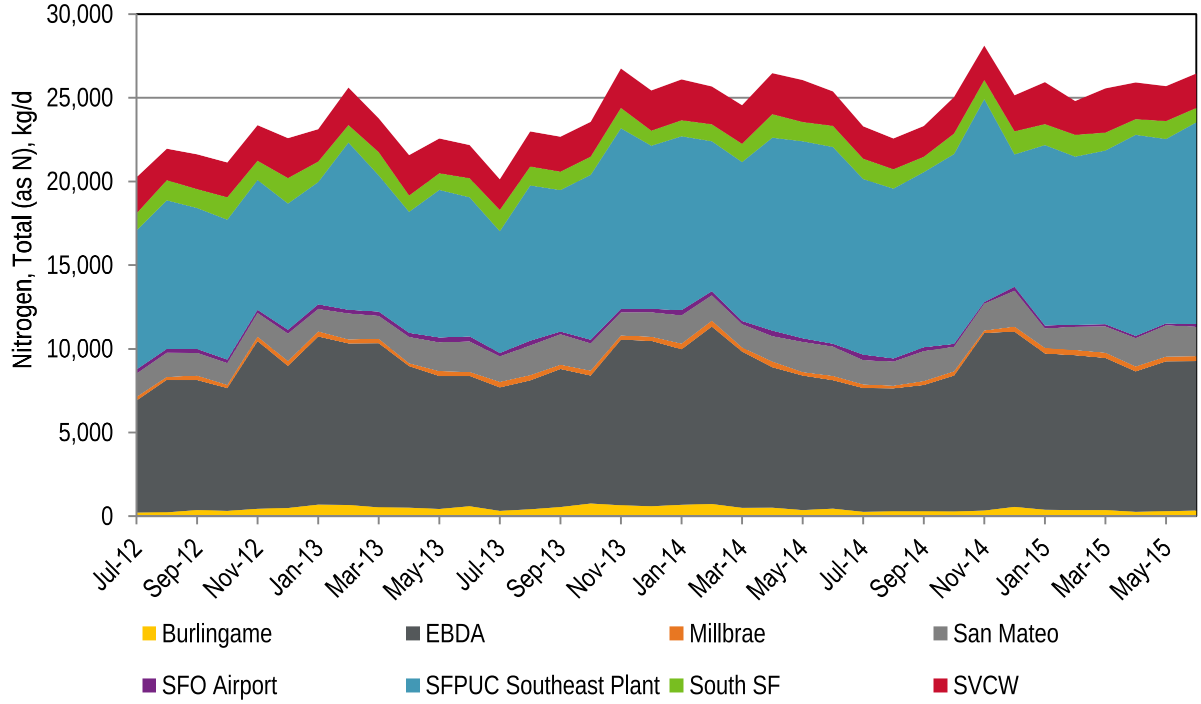

Figure 4-22. Total Nitrogen Load Contribution by Discharger to South Bay

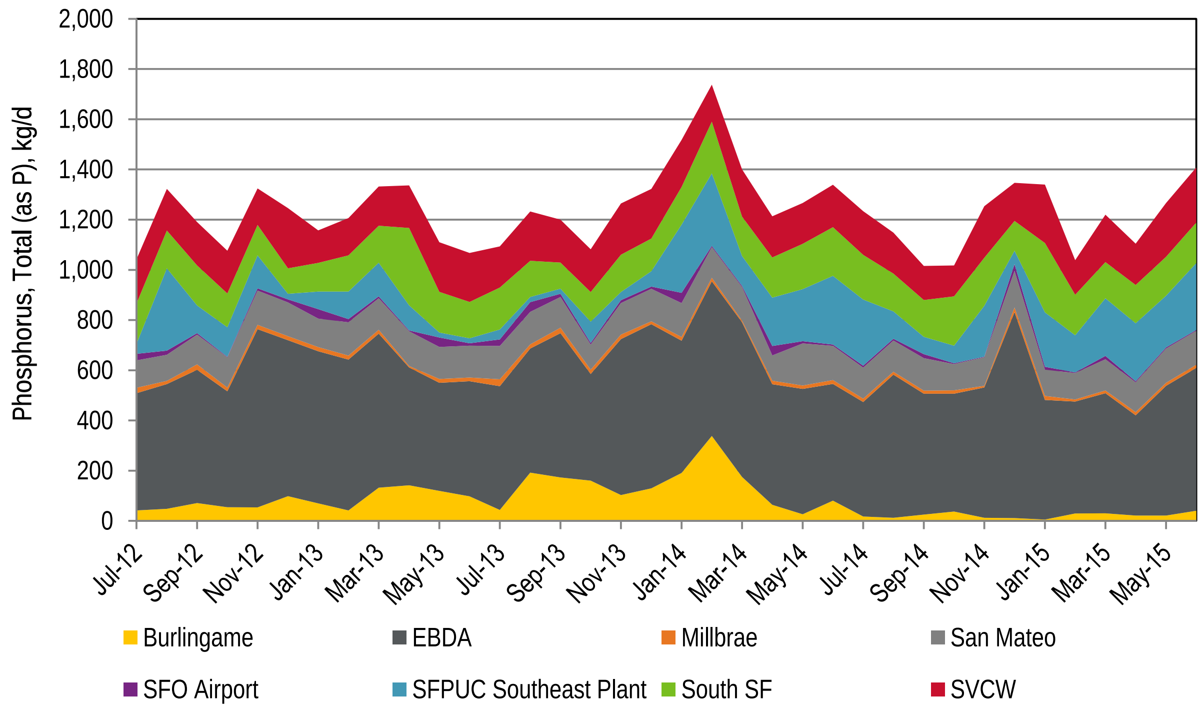

Figure 4-23. Total Phosphorus Load Contribution by Discharger to South Bay

4.9.5 Lower South Bay

The average monthly discharge to Lower South Bay by discharger for flow, ammonia, TN and TP is provided in Figure 4-24, Figure 4-25, Figure 4-26, and Figure 4-27, respectively. Lower South Bay wastewater flows are dominated by San Jose. San Jose also discharges the largest total nitrogen load. Sunnyvale's ammonia loads exhibit a significant seasonal pattern.

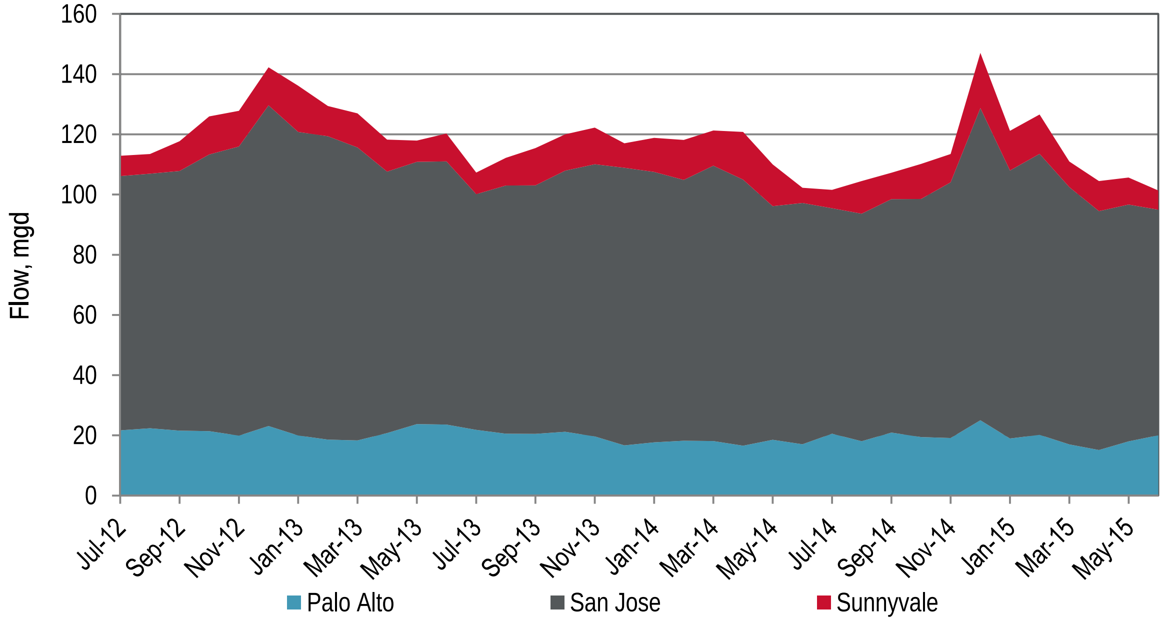

Figure 4-24. Flow Contribution by Discharger to Lower South Bay

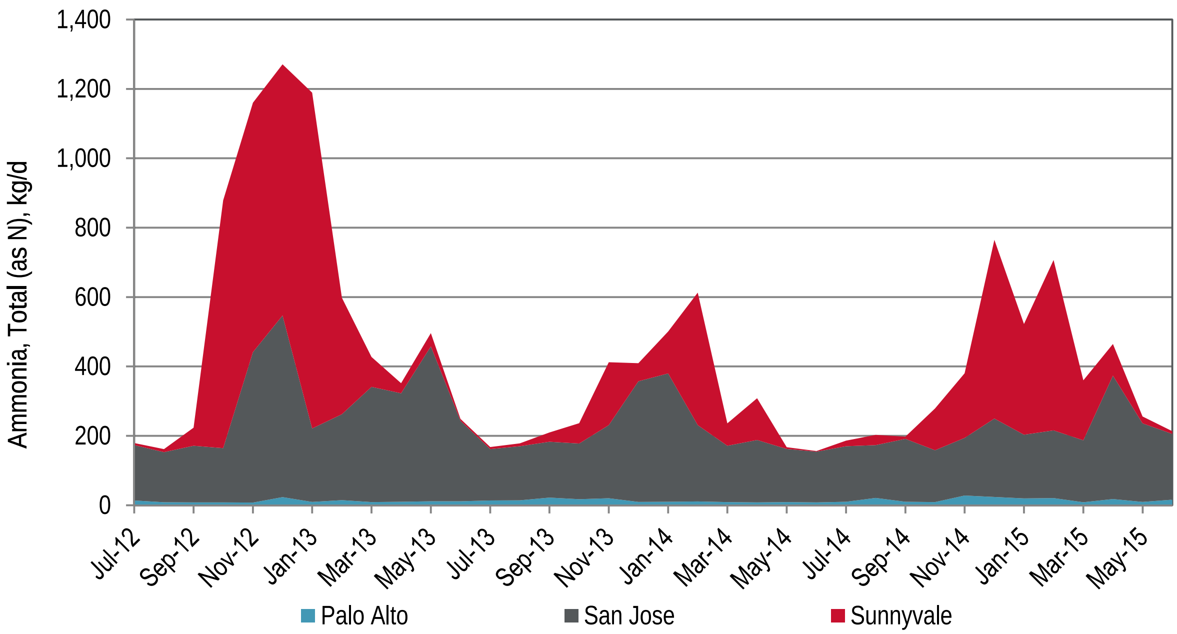

Figure 4-25. Ammonia Load Contribution by Discharger to Lower South Bay

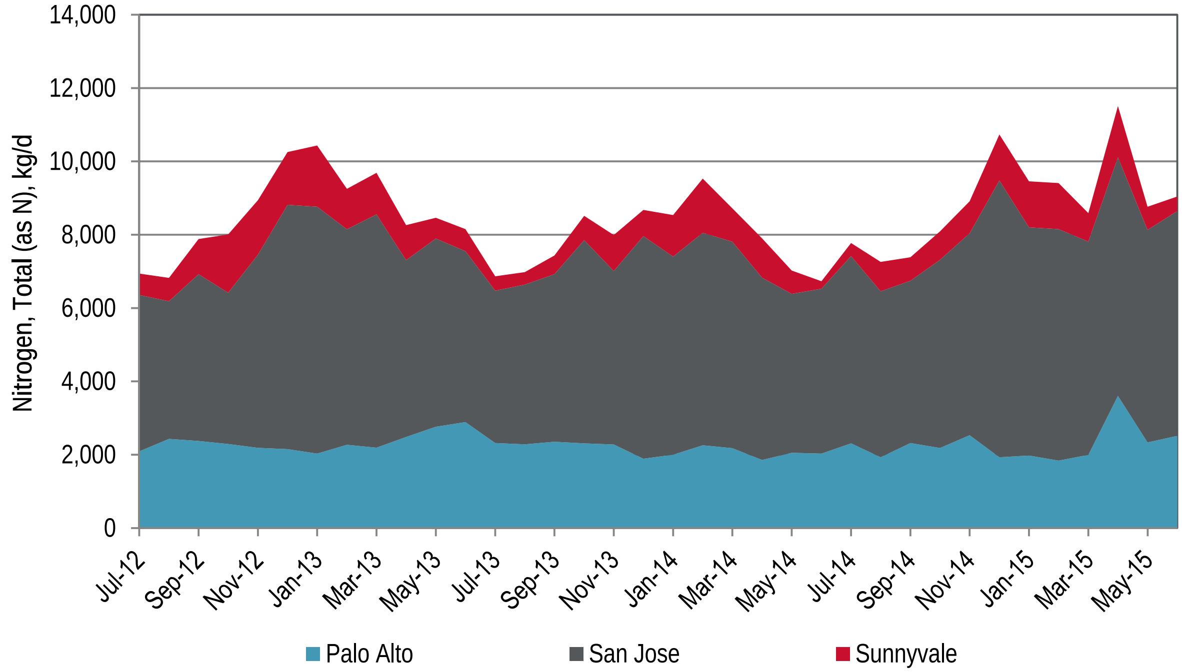

Figure 4-26. Total Nitrogen Load Contribution by Discharger to Lower South Bay

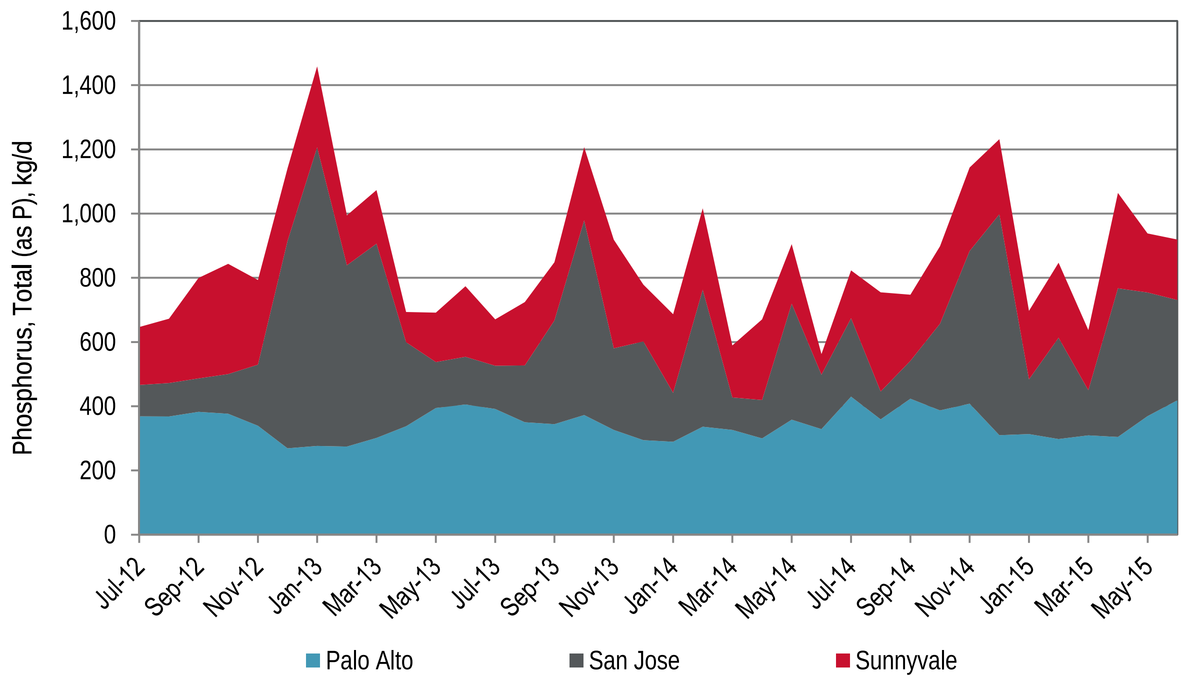

Figure 4-27. Total Phosphorus Load Contribution by Discharger to Lower South Bay

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5 Discussion

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

5.1 Flow Analysis

Although the total ADWF permitted capacity of the POTW dischargers in the San Francisco Bay is 826 mgd, the total average annual discharge ranged from 421 mgd to just over 450 mgd for the three year period. The South Bay and Lower South Bay Subembayments contribute the highest flows, making up over 60 percent of the total flow discharged to the Bay. The largest overall discharger is San Jose, followed by SFPUC Southeast, EBDA, and EBMUD.

The average annual and dry season flows for all Subembayments are either flat or trending downward. This is attributed to a combination of water conservation, the drought, and increased diversion for recycled water. San Pablo Bay has the largest portion of recycled water diversion during the dry season, when several plants actually divert all flow and have a zero dry season discharge.

In general, nutrient loads tend to track closely with the flows. For example, during peak wet weather events, both the flow and loads typically increase. However, the limited dataset makes it difficult to have confidence that this relation is strong. In other words, it is unknown whether the trend would be as evident with a larger dataset where the impacts from an initial scouring event in the collection system due to wet weather (similar to the “first flush” stormwater collection systems) would be reduced and dilution increased. Additional data is needed to further understand the correlation between flow and loads during peak wet weather events.

5.2 Ammonia Analysis

The total average annual ammonia discharge ranged from approximately 33,770 kg N/d to nearly 36,890 kg N/d for the three year period. The Central Bay and South Bay Subembayments contribute the highest ammonia loads, making up over 80 percent of the total ammonia discharged to the Bay. The largest overall contributor of ammonia is the SFPUC Southeast Plant, followed by EBMUD and EBDA.

With the exception of the Lower South Bay and Suisun Bay Subembayments, the dry season ammonia loads appear to be increasing. Additional data is needed to determine a statistically relevant trend for the Lower South Bay and Suisun Bay. It is noted that the Sunnyvale plant had a spike in the first year (2012/13) which is attributed to pond dredging.

Despite having the second highest flow contribution, the Lower South Bay ammonia loads are about an order of magnitude lower than any other Subembayment, making up less than one percent of the total ammonia load to the Bay. This is because the three dischargers to the Lower South Bay are required to fully nitrify at their plants due to their shallow water discharges. Ammonia removal addresses ammonia related toxicity; however, a portion of the nitrogen is still present as nitrate in the effluent.

Seasonal variations in ammonia loads were also examined. The seasonal loading difference is most pronounced for the Lower South Bay and San Pablo Bay. The Lower South Bay has the most significant seasonal load reduction as evidenced by about a 50 percent reduction from the wet to the dry season. Similar to the seasonal variation in flow, these seasonal load variations are attributed to seasonal diversion of recycled water and, in addition, seasonal nitrification. Recycling water has the potential to divert loads from the Bay when used for consumptive purposes (e.g., irrigation).

Agencies with nitrifying trickling filters, including for example Sunnyvale, have variable wet weather ammonia concentrations which are attributed to temperature variations that impact the nitrification process. As a result, these plants appear to have difficultly maintaining a consistent effluent ammonia load during winter months.

5.3 TKN Analysis

The total average annual TKN discharge ranged from approximately 38,200 kg N/d to nearly 41,600 kg N/d for the three year period. TKN loads exhibit similar patterns to ammonia, except the seasonal difference is not as pronounced.

5.4 NOx Analysis

The total average annual NOx discharge ranged from approximately 14,170 kg N/d to nearly 14,860 kg N/d for the three year period and illustrated an overall downward trend. The Lower South Bay contributes the highest NOx load, making up roughly half of the total NOx load discharged to the Bay. The largest overall contributor of NOx is San Jose, averaging over 4,700 kg N/d for the three year period.

Among the nitrogen species, NOx has the smallest range in values amongst the Subembayments, ranging from approximately 740 kg N/d up to 8,000 kg N/d. The Lower South Bay has the highest loads, regardless of season. This is attributed to nitrification of ammonia, in which a portion of the ammonia is converted and discharged as NOx. The overwhelming majority of NOx is nitrate. The remaining nitrogen is either assimilated or denitrified to nitrogen gas.

The seasonal variation of NOx from the wet to the dry season is most pronounced for San Pablo Bay, Central Bay, and South Bay. There are also occasional spikes of NOx in the dry season from agencies that have intermittent nitrification, specifically for under-loaded trickling filter plants.

5.5 Total Nitrogen Analysis

The total average annual TN discharge ranged from 53,000 kg N/d to 55,800 kg N/d for the three year period. The Central Bay and South Bay Subembayments contribute the highest total nitrogen loads, making up over 65 percent of the total nitrogen discharged to the Bay. The largest overall contributor of TN is EBMUD, followed by SFPUC Southeast and EBDA. There appears to be an upward trend in the total nitrogen loads, which is largely attributed to increasing loads in the South Bay.

The seasonal difference in Total N loading is most pronounced for San Pablo Bay and the Lower South Bay. San Pablo Bay has the most significant seasonal load reduction as evidenced by a 35 percent reduction from the wet to the dry season. Similar to TKN and ammonia, this is attributed to a combination of more effective nitrification/denitrification during the warm season and seasonal use of recycled water, which diverts loads.

5.6 Orthophosphate Analysis

The total average annual ortho-P discharge ranged from approximately 3,100 kg P/d to 4,700 kg P/d for the three year period and demonstrated an overall downward trend. The South Bay contributed the highest ortho-P load. The largest overall contributor of ortho-P is EBMUD, followed by EBDA and Palo Alto.

The San Pablo Bay, Central Bay, and Lower South Bay Subembayments show a 20 to approximately 35 percent reduction in ortho-P from the wet to dry season. In contrast, the South Bay and Suisun Subembayments show no significant changes from the wet to the dry season. This is attributed to a combination of recycled water during the dry season, seasonal biological phosphorus removal, and seasonal filtration.

5.7 Total Phosphorus Analysis

The total average annual TP discharge ranged from approximately 3,720 kg P/d to nearly 3,950 kg P/d for the three year period and similarly demonstrated an overall downward trend. The South Bay contributed the highest TP load. The largest overall contributor of TP is EBMUD, followed by EBDA and Palo Alto.

The seasonal TP load reductions are similar to ortho-P, whereby the San Pablo Bay, Central Bay, and Lower South Bay Subembayments show a significant reduction in TP load from the wet to the dry season. In contrast, the South Bay and Suisun Subembayments do not appear to have a significant variation in TP loading between the wet and dry season.

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6 Summary

Table 6-1 presents an overall summary of the total flows and nutrient loads discharged to the San Francisco Bay between July 2012 and June 2015. Similarly, Table 6-2 presents a summary of the constituent concentrations for the same period.

Table 6-1. Summary of Total Flow and Load Discharges to the Bay

Constituent	2012/13[(a)]	2013/14[(a)]	2014/15[(a)]	Trend[(b)]	3 Year Average
Flow, mgd	453	434	421	Decreasing	436
Ammonia, kg N/d	33,769	36,629	36,887	Increasing	35,762
TKN, kg N/d	38,212	40,518	41,581	Increasing	40,104
NOx, kg N/d	14,857	14,470	14,169	Decreasing	14,499
TN, kg N/d	53,038	54,928	55,798	Increasing	54,588
Orthophosphate, kg P/d	4,720	4,595	3,074	Decreasing	4,130
TP, kg P/d	3,946	3,761	3,721	None	3,809

a. 2012/13 represents the period between July 1, 2012 and June 30, 2013; 2013/14 represents the period between July 1, 2013 and June 30, 2014; 2014/15 represents the period between July 1, 2014 and June 30, 2015.

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 15. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

Table 6-2. Summary of Total Flow and Constituent Concentrations Discharged to the Bay

Constituent	2012/13[(a)]	2013/14[(a)]	2014/15[(a)]	Trend[(b)]	3 Year Average
Flow, mgd	453	434	421	Decreasing	436
Ammonia, mg N/L	20	22	23	Increasing	22
TKN, mg N/L	22	25	26	Increasing	24
NOx, mg N/L	8.7	8.8	8.9	None	8.8
TN, mg N/L	31	33	35	Increasing	33
Orthophosphate, mg P/L	2.8	2.8	1.9	Decreasing	2.5
TP, mg P/L	2.3	2.3	2.3	None	2.3

a. 2012/13 represents the period between July 1, 2012 and June 30, 2013; 2013/14 represents the period between July 1, 2013 and June 30, 2014; 2014/15 represents the period between July 1, 2014 and June 30, 2015.

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 15. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.

While the total effluent flow discharged to the San Francisco Bay has decreased over the past three years, the ammonia, TKN, and TN loads have increased. Similarly, and as expected, the ammonia, TKN and TN concentrations have also increased. Although the NOx load has decreased over the three year period, the concentration has remained relatively consistent. The ortho-P load, as well as the ortho-P concentration, has decreased. Because the nitrogen load is increasing and the ortho-P load is going down, the N:P ratio of discharges into the Bay is changing.

The analysis did not evaluate influent flows and loadings to each discharger over the three-year period. Most dischargers have seen that while flows are declining from a combination of water conservation and the drought, the loads have increased (i.e., higher strength). Future analyses should include an analysis of the influent flows and loadings to better understand how each discharger is performing with respect to load reduction.

Changes in the data collection procedures during the three year period created some uncertainty about the resulting trends. The data collection requirements were different in the first two years, under the 13267 Letter requirements, which disproportionately emphasized the importance of wet weather loading and potentially skewed the resulting trends. As a result, trends were evaluated for only the Dry Season, which limited the number of data points for use in the trend analysis (most agencies had 15). Future data will increase the size of the sample set and improve the level of confidence in the trends.

In addition to the wet weather sampling, there were observed issues with the reporting of soluble reactive phosphorus (SRP). Such that some agencies reported SRP as ortho-P while other agencies used other entries for the Nutrient Watershed Permit (data in CIWQS). It is recommended that the different options for reporting soluble reactive phosphorus be clarified for future reporting. Limit entries for reactive phosphorus (Method 4500-P) to two options: soluble or total. Report values as “total reactive P” (TRP) or “soluble reactive P” (SRP). Soluble measurements require a filtration step through 0.45 um filter. The TRP and SRP values will be similar, with the SRP excluding any measurements of particulate reactive phosphorus (such as chemically precipitated ortho-P).

As expected, the largest dischargers dominate the nutrient loading. Generally, three to four large dischargers contribute more than 70 percent of the nutrient loads. The loading of ammonia and NOx is severely impacted by plants that nitrify, wherein they become the lowest ammonia contributors and the major NOx contributors.

Seasonal variations are pronounced. Dry season loads are generally lower than wet season loads. This is attributed to two factors. First, the higher flows and sampling procedures amplify the wet season discharges. Secondly, during the dry season, water reuse diverts much of the nutrient load away from the Bay. In some instances, agencies have achieved zero discharge during the summer months. It is recommended that in future years, agencies report the flow diverted for recycled water use as well as any return streams (e.g., cooling tower blow down, advanced purification concentrate, e.g.,) such that the total quantity of recycled water can be clearly quantified, as well as the associated nutrient loads being diverted from the San Francisco Bay.

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Appendix

Discharge Evaluation for Individual Dischargers

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Contents

Tables

Figures

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 mgd. It has a current ADWF flow of about 1.2 mgd. The plant is a nitrifying MBR plant.

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

- There are 10 missing monthly average nutrient load samples per nutrient, which may be attributed to seasonal discharge restrictions.
- Based on the table with the average monthly values, there does not appear to be any emerging dry season trends for flow or loads.
- NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant nitrifies.
- Total phosphorus concentrations range from less than 2 mg P/L to over 6 mg P/L.
- The distribution of phosphorus species is predominantly ortho-P.

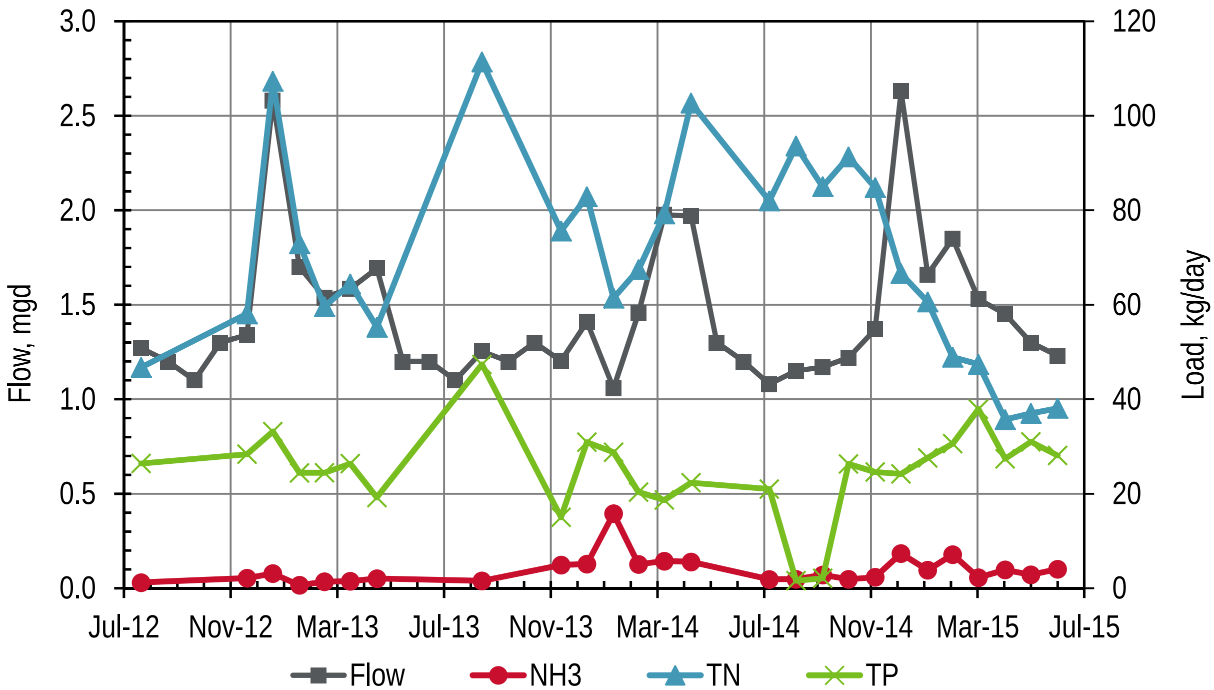

Figure 1-1. American Canyon Monthly Flows and Loads

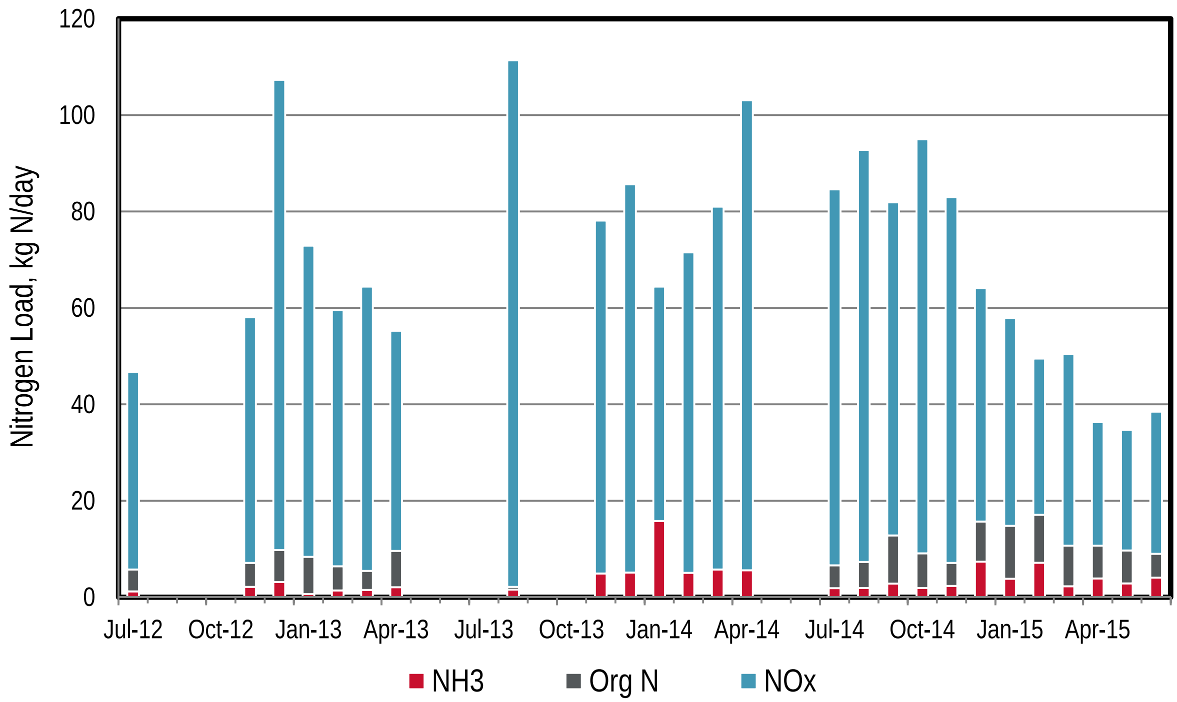

Figure 1-2. American Canyon Monthly Nitrogen Loads

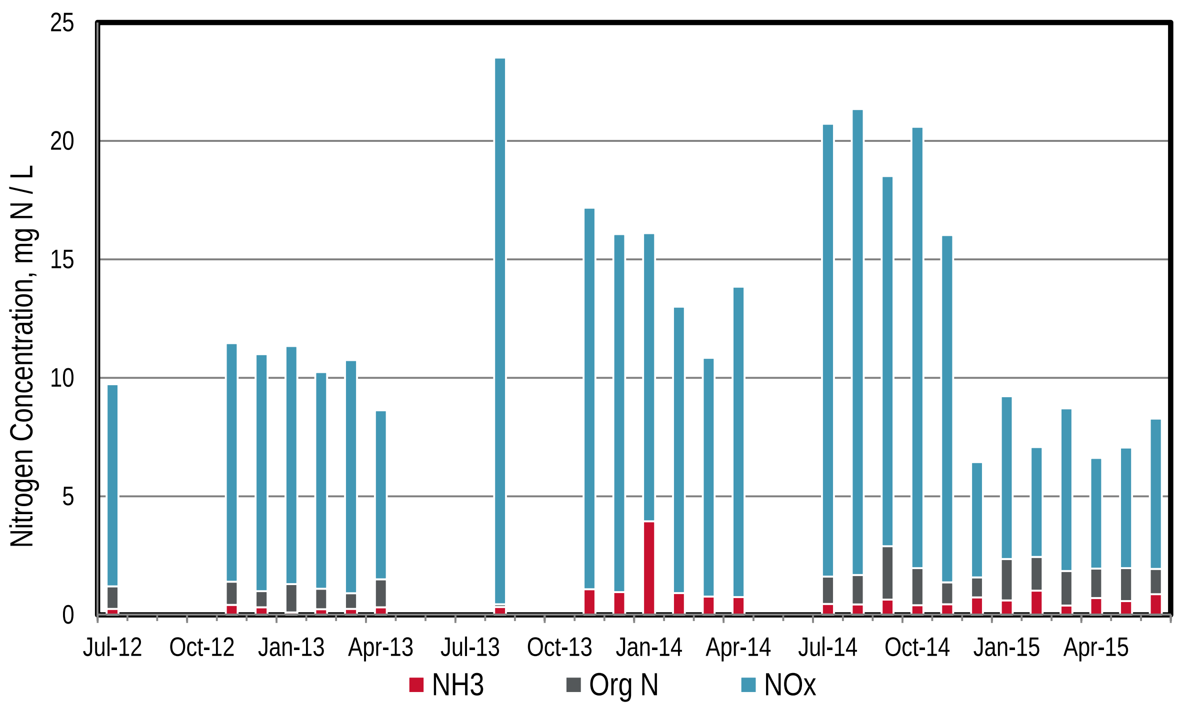

Figure 1-3. American Canyon Monthly Nitrogen Concentrations

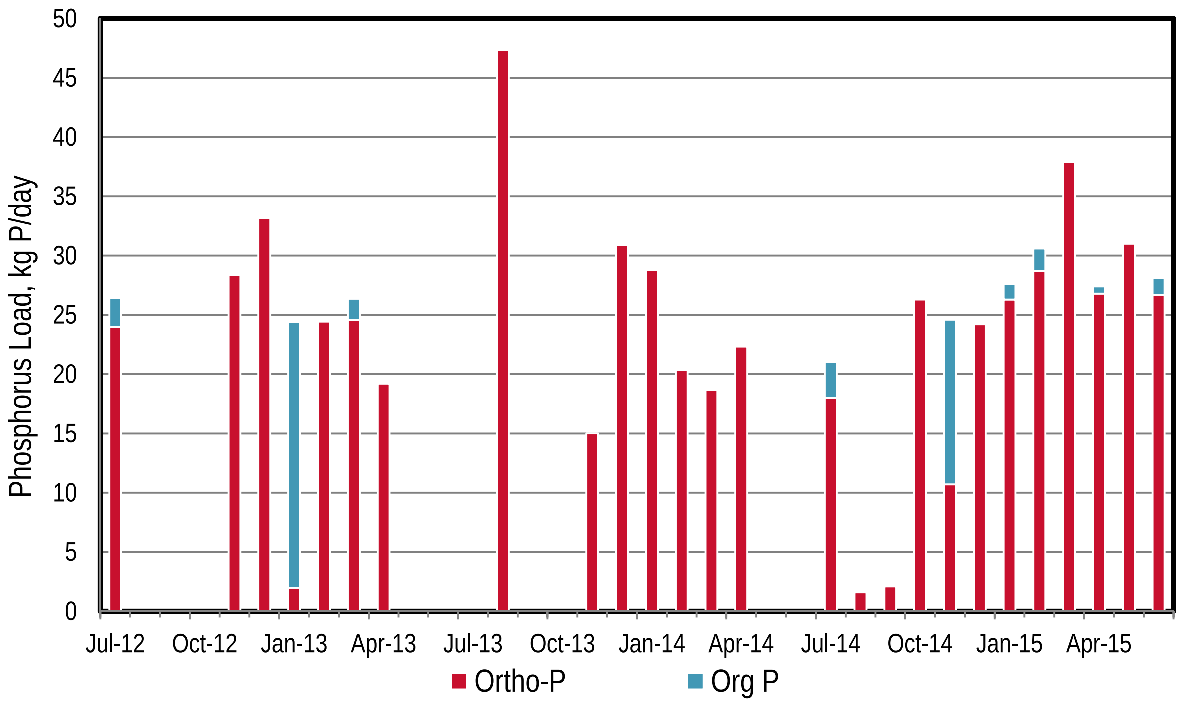

Figure 1-4. American Canyon Monthly Phosphorus Loads

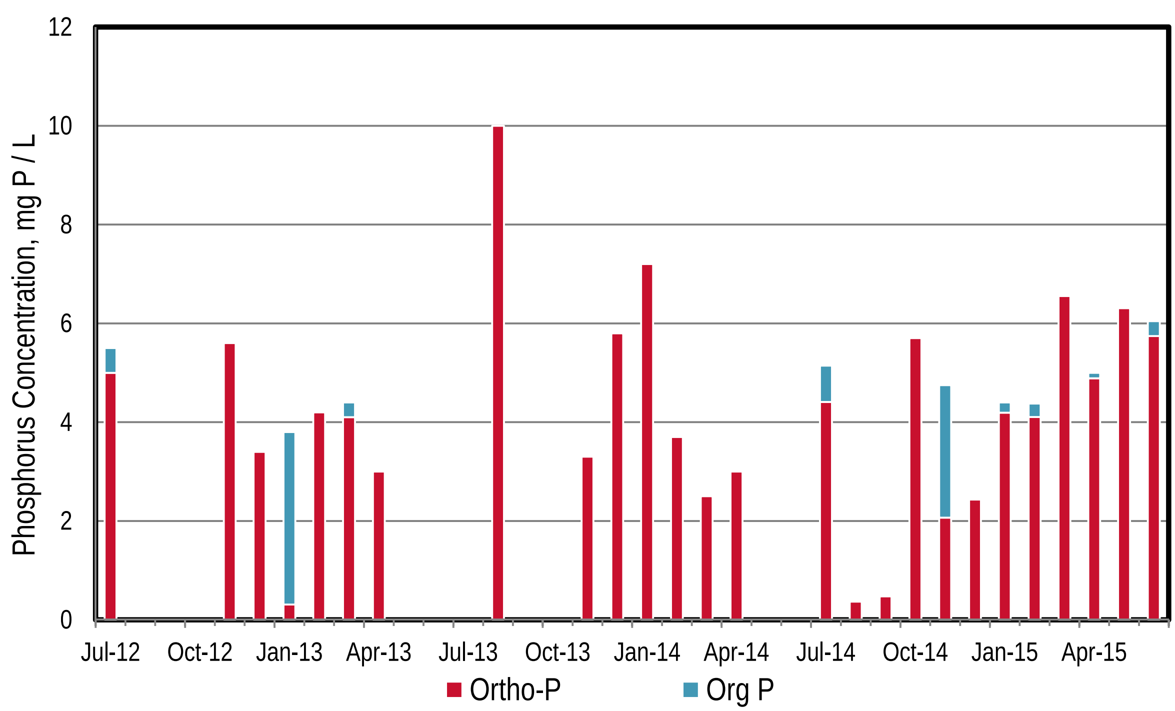

Figure 1-5. American Canyon Monthly Phosphorus Concentrations

Table 1-1. American Canyon Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	1.3	1	6	41	47	24	26
Aug 2012	1.2	--	--	--	--	--	--
Sep 2012	1.1	--	--	--	--	--	--
Oct 2012	1.3	--	--	--	--	--	--
Nov 2012	1.3	2	7	51	58	31	28
Dec 2012	2.6	3	10	98	107	37	33
Jan 2013	1.7	1	8	65	73	2	24
Feb 2013	1.5	1	6	53	60	24	24
Mar 2013	1.6	1	5	59	64	25	26
Apr 2013	1.7	2	10	46	55	20	19
May 2013	1.2	--	--	--	--	--	--
Jun 2013	1.2	--	--	--	--	--	--
Jul 2013	1.1	--	--	--	--	--	--
Aug 2013	1.3	2	2	109	111	62	47
Sep 2013	1.2	--	--	--	--	--	--
Oct 2013	1.3	--	--	--	--	--	--
Nov 2013	1.2	5	2	73	76	18	15
Dec 2013	1.4	5	2	81	83	33	31
Jan 2014	1.1	16	13	49	61	42	29
Feb 2014	1.5	5	1	66	67	35	20
Mar 2014	2.0	6	4	75	79	24	19
Apr 2014	2.0	6	5	98	103	28	22
May 2014	1.3	--	--	--	--	--	--
Jun 2014	1.2	--	--	--	--	--	--
Jul 2014	1.1	2	7	78	82	18	21
Aug 2014	1.2	2	7	86	94	24	2
Sep 2014	1.2	3	13	69	85	18	2
Oct 2014	1.2	2	9	86	91	27	26
Nov 2014	1.4	2	7	76	85	11	25
Dec 2014	2.6	7	16	48	67	27	24
Jan 2015	1.7	4	15	43	61	26	28
Feb 2015	1.9	7	17	32	49	29	31
Mar 2015	1.5	2	11	40	47	38	38
Apr 2015	1.5	4	11	26	36	27	27
May 2015	1.3	3	10	25	37	31	31
Jun 2015	1.2	4	9	30	38	27	28
Dry Season Average	**1.2**	**2.3**	**7.6**	**62**	**71**	**29**	**23**
Dry Season Trend (n=15)	**No**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**
Wet Season Average	**1.6**	**4.3**	**8.4**	**61**	**70**	**26**	**26**
Average Annual	**1.4**	**3.8**	**8.2**	**62**	**70**	**27**	**25**

2 City of Benicia

Benicia discharges to San Pablo Bay, and serves approximately 9,569 service connections. The plant has a permitted ADWF capacity of 4.5 mgd and 18 mgd one-hour peak wet weather design flow capacity. It has a current ADWF flow of about 1.9 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 table in the subsequent pages:

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for flow and ortho-P loads. The ortho-P loads trend is attributed to the change in sampling methodology between the Section 13267 Letter data and the Nutrient Watershed Permit data.
- Nitrogen loads increase with flow during wet weather events.
- Wet season loads are 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.
- Ammonia concentrations vary throughout the year.
- Total phosphorus concentrations from less than 1 mg P/L to over 8 mg P/L.
- The distribution of phosphorus species is predominantly ortho-P; however, it is noted that the ortho-P data reported under the 13267 Letter requirements was greater than TP, as shown in Table 2-1.

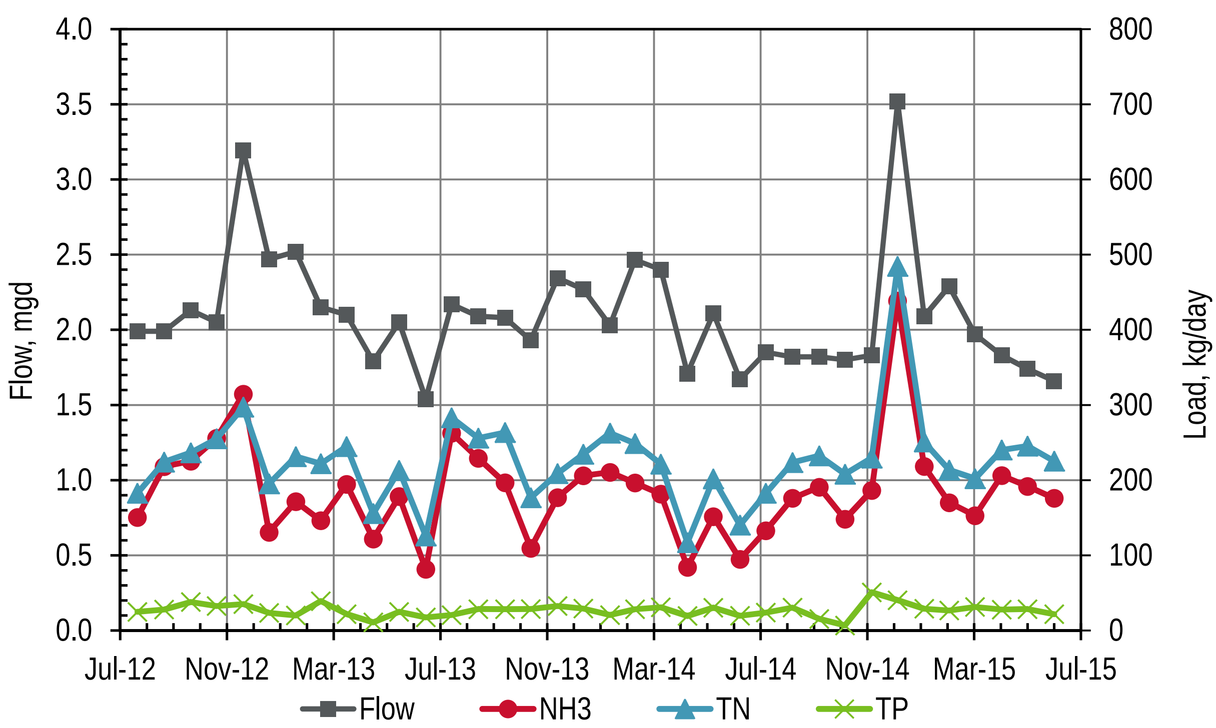

Figure 2-1. Benicia Monthly Flows and Loads

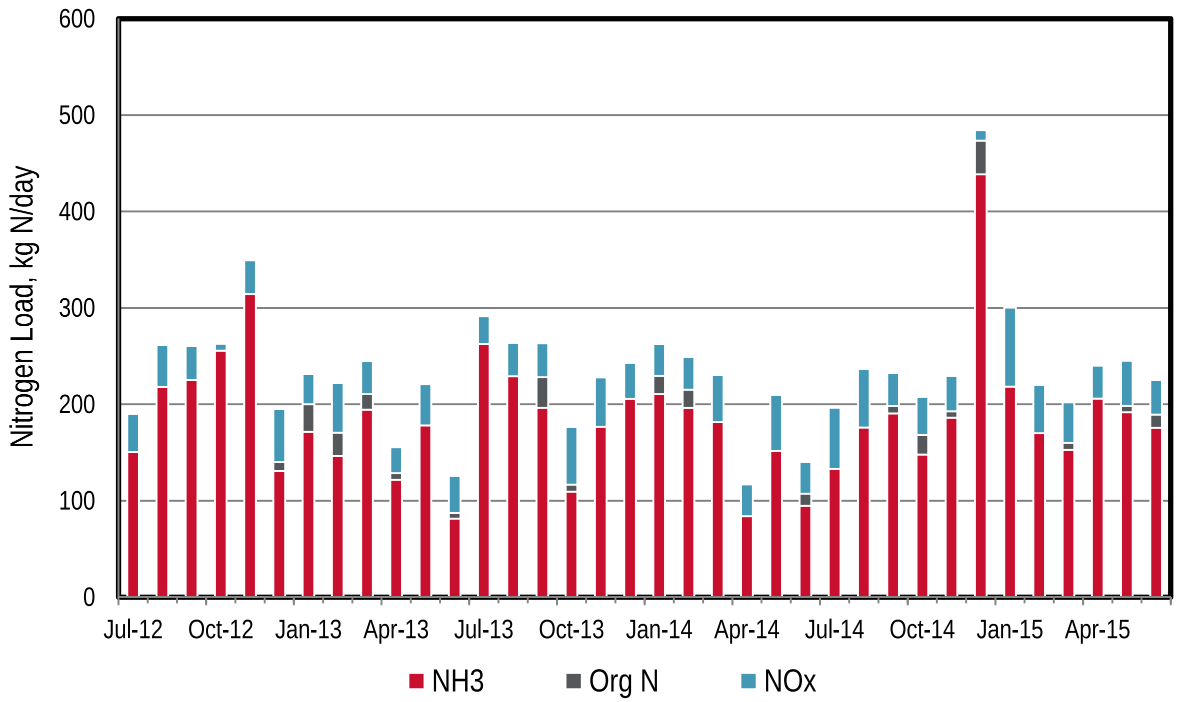

Figure 2-2. Benicia Monthly Nitrogen Loads

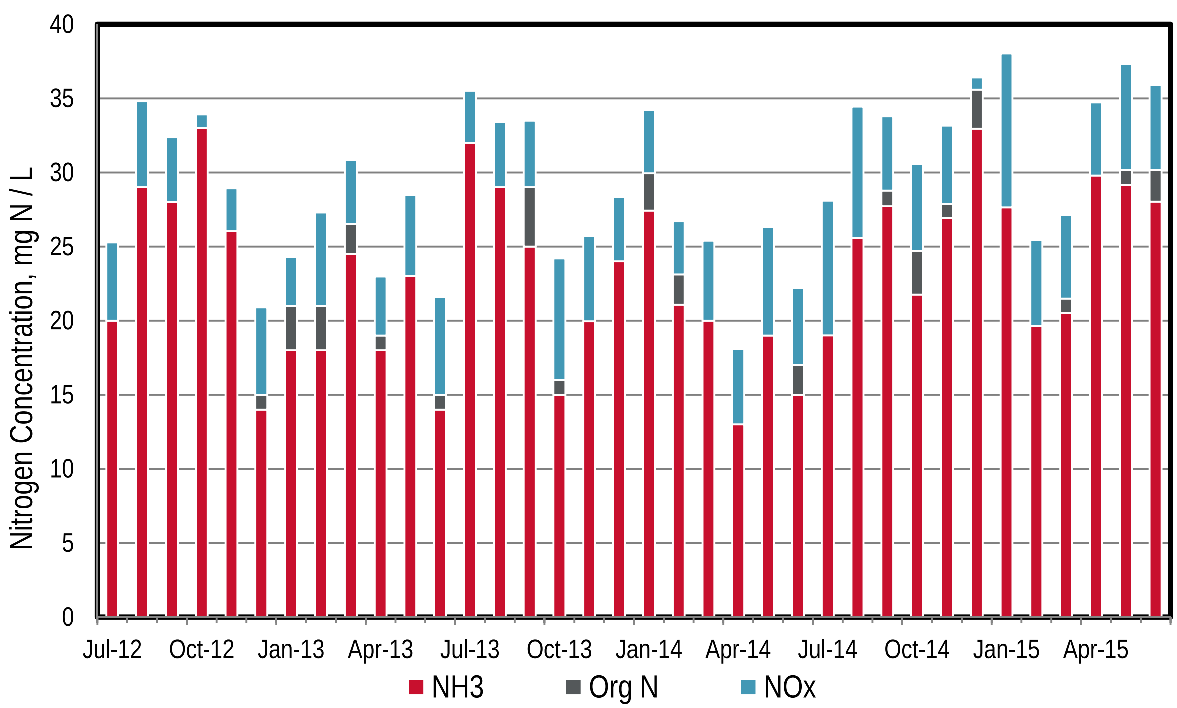

Figure 2-3. Benicia Monthly Nitrogen Concentrations

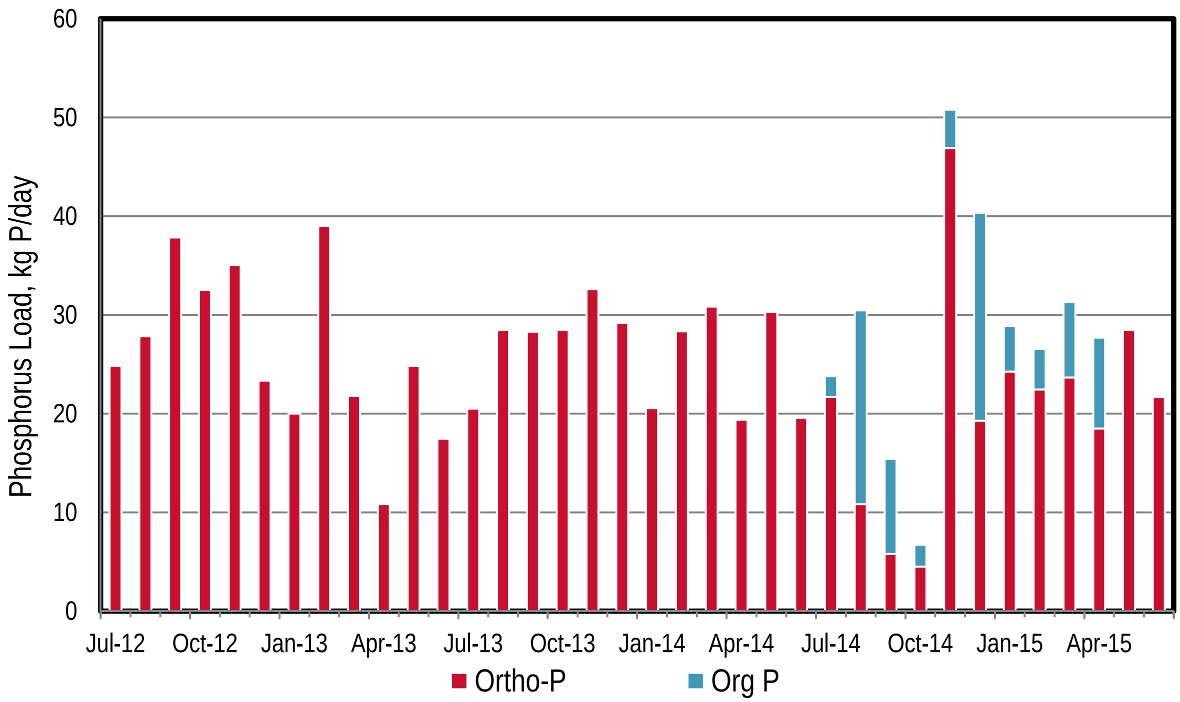

Figure 2-4. Benicia Monthly Phosphorus Loads

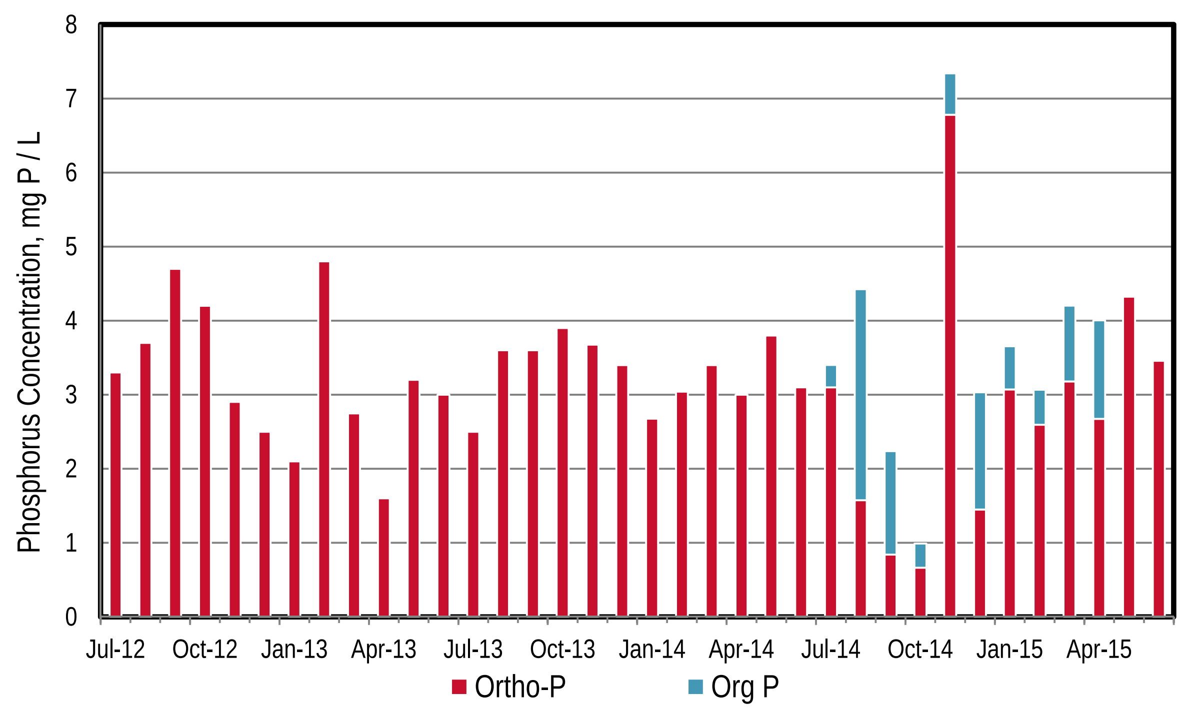

Figure 2-5. Benicia Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 2-1. Benicia Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	2.0	150	143	40	183	36	25
Aug 2012	2.0	218	181	44	224	62	28
Sep 2012	2.1	225	201	35	236	60	38
Oct 2012	2.1	256	248	7	255	43	33
Nov 2012	3.2	314	262	35	297	67	35
Dec 2012	2.5	131	140	55	195	36	23
Jan 2013	2.5	171	200	31	231	30	20
Feb 2013	2.2	146	171	51	222	65	39
Mar 2013	2.1	195	210	34	245	34	22
Apr 2013	1.8	122	129	27	155	24	11
May 2013	2.1	178	170	43	213	70	25
Jun 2013	1.5	81	87	38	126	37	17
Jul 2013	2.2	262	254	29	283	36	21
Aug 2013	2.1	229	221	35	256	40	28
Sep 2013	2.1	197	228	35	263	60	28
Oct 2013	1.9	109	117	60	177	52	28
Nov 2013	2.4	177	158	51	209	64	33
Dec 2013	2.3	206	197	37	235	60	29
Jan 2014	2.0	210	230	33	263	44	21
Feb 2014	2.5	196	215	33	249	43	28
Mar 2014	2.4	181	172	49	221	99	31
Apr 2014	1.7	84	84	33	117	41	19
May 2014	2.1	152	144	58	202	49	30
Jun 2014	1.7	95	107	33	140	49	20
Jul 2014	1.9	133	119	64	183	22	24
Aug 2014	1.8	176	162	61	223	11	30
Sep 2014	1.8	191	198	34	232	6	15
Oct 2014	1.8	148	168	40	208	5	7
Nov 2014	1.8	186	193	37	229	47	51
Dec 2014	3.5	438	474	11	484	19	40
Jan 2015	2.1	218	194	82	251	24	29
Feb 2015	2.3	170	163	50	214	22	27
Mar 2015	2.0	153	160	42	202	24	31
Apr 2015	1.8	206	206	34	240	19	28
May 2015	1.7	192	198	47	245	29	28
Jun 2015	1.7	176	189	36	225	22	22
Dry Season Average	**1.9**	**177**	**174**	**42**	**216**	**39**	**25**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**No**
Wet Season Average	**2.2**	**191**	**195**	**40**	**233**	**41**	**28**
Average Annual	**2.1**	**185**	**186**	**41**	**226**	**40**	**27**

3 City of Burlingame

Burlingame discharges to South Bay, and 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 ADWF flow of about 2.7 mgd. The plant performs secondary treatment using activated sludge.

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

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for ortho-P loads, with a stark drop beginning in July 2015. The ortho-P loads trend is attributed to the change in sampling methodology between the Section 13267 Letter data and the Nutrient Watershed Permit dataset.
- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- Wet season loads are greater and more variable than the dry season loads.
- Ammonia is typically the majority of the nitrogen species discharged, regardless of season. However, from about August 2013 through June 2014, the NOx load and concentration was significantly higher than in the preceding or subsequent year.
- Ammonia concentrations are relatively consistent throughout the year.
- Total phosphorus concentrations were typically above 10 mg P/L in the first two reporting years and then dropped to less than 5 mg P/L in the most recent reporting year.
- The distribution of phosphorus species is predominantly ortho-P.

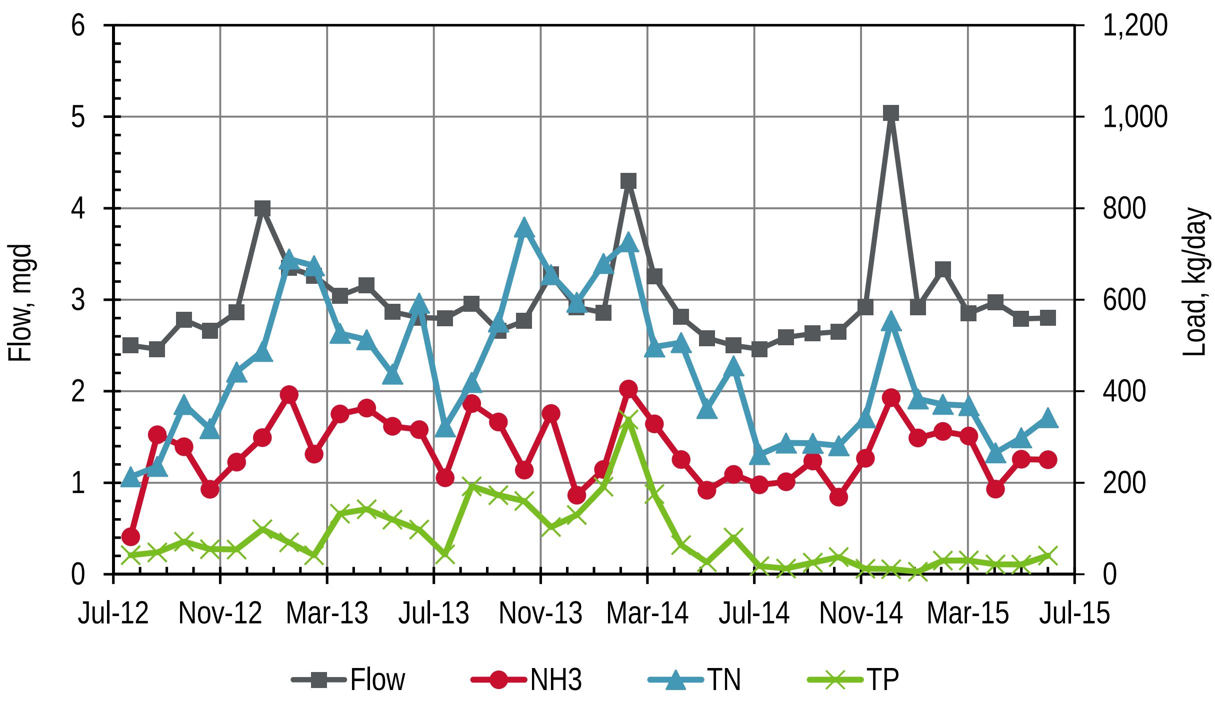

Figure 3-1. Burlingame Monthly Flows and Loads

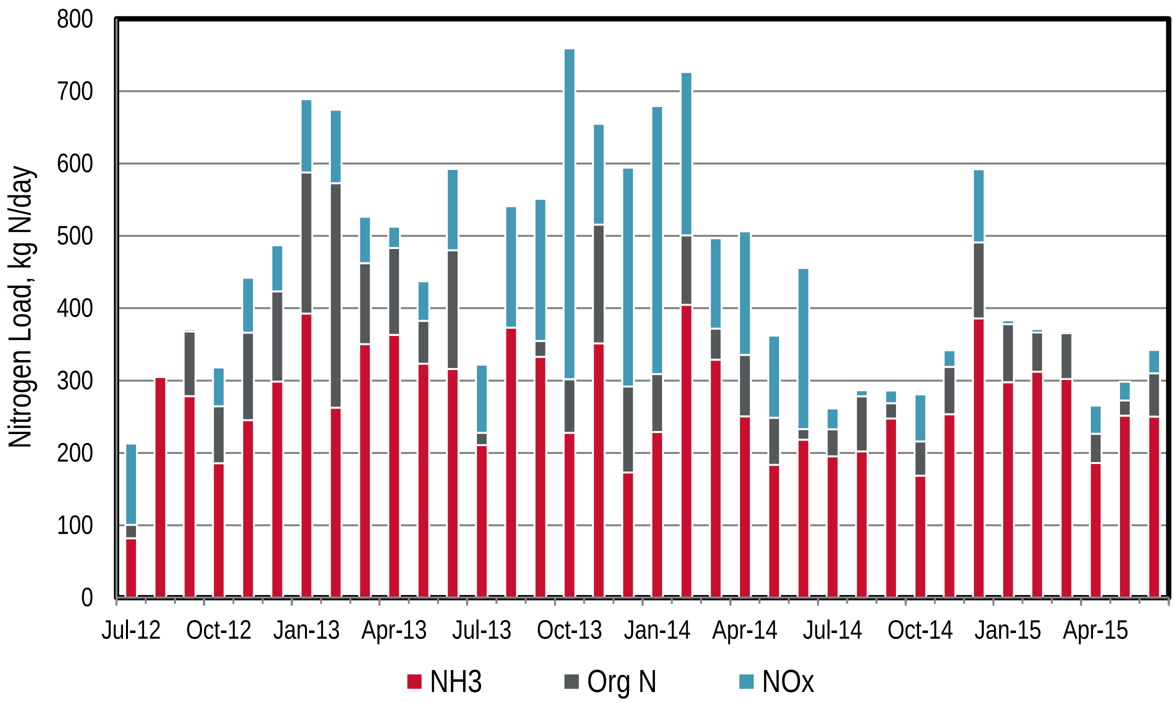

Figure 3-2. Burlingame Monthly Nitrogen Loads

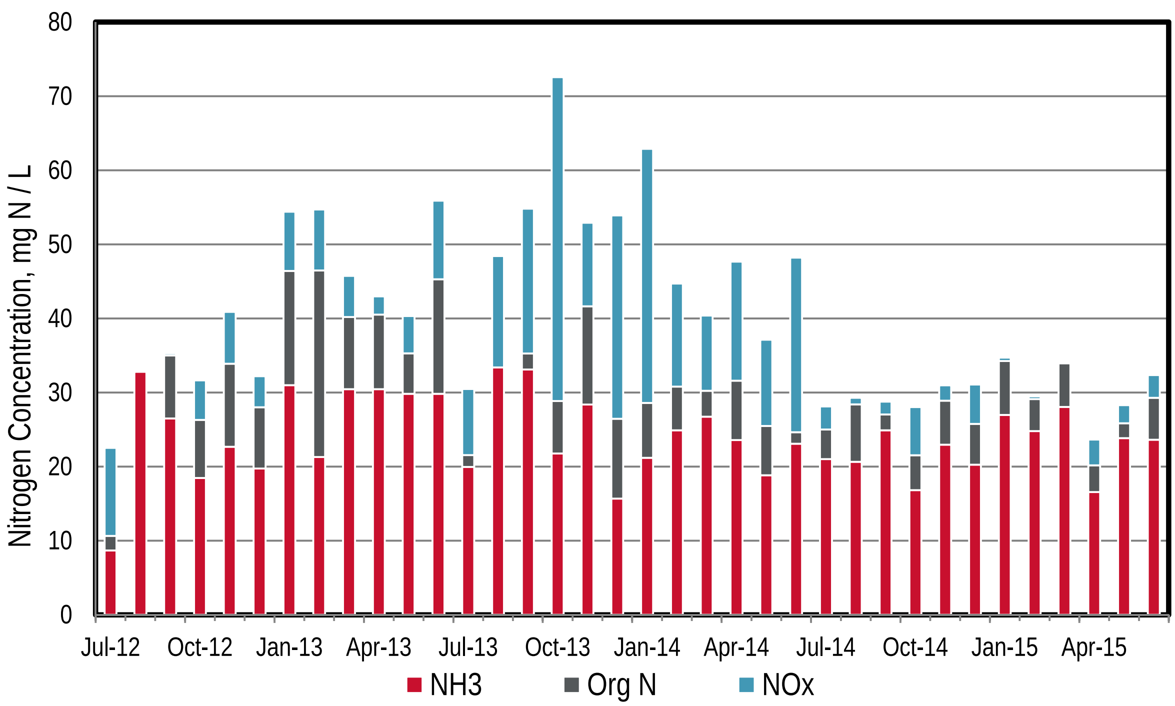

Figure 3-3. Burlingame Monthly Nitrogen Concentrations

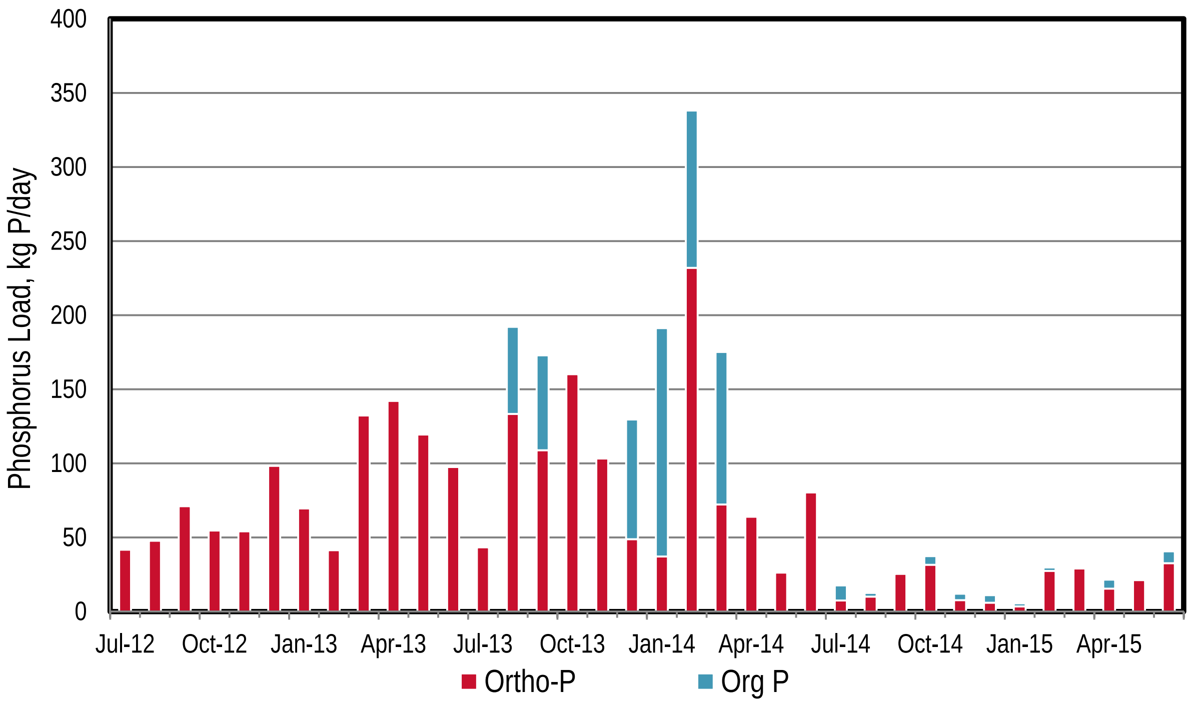

Figure 3-4. Burlingame Monthly Phosphorus Loads

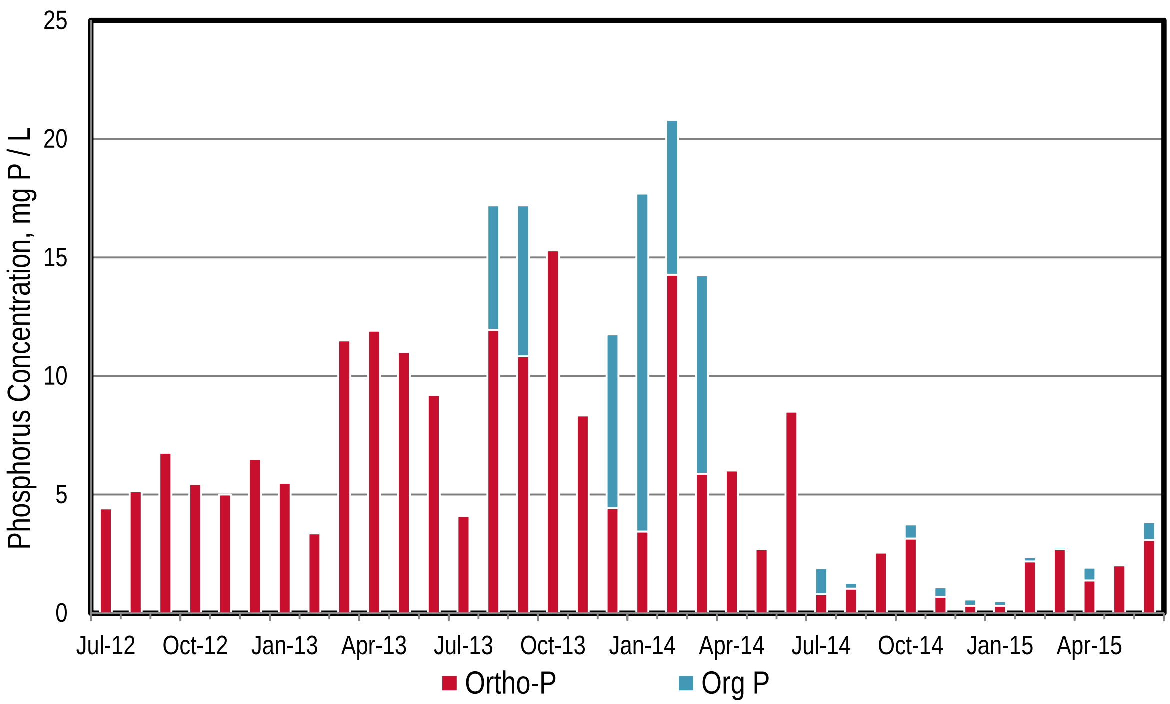

Figure 3-5. Burlingame Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 3-1. Burlingame Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	2.5	82	101	112	213	127	42
Aug 2012	2.5	305	235	1	236	158	48
Sep 2012	2.8	279	368	3	371	111	71
Oct 2012	2.7	186	265	54	318	122	55
Nov 2012	2.9	245	366	76	442	122	54
Dec 2012	4.0	299	423	64	487	238	98
Jan 2013	3.4	393	588	101	689	185	70
Feb 2013	3.3	263	573	101	674	167	41
Mar 2013	3.0	350	462	64	526	142	132
Apr 2013	3.2	363	483	29	513	170	142
May 2013	2.9	323	383	55	437	222	119
Jun 2013	2.8	316	480	112	593	185	98
Jul 2013	2.8	211	228	94	322	60	43
Aug 2013	3.0	373	251	168	419	133	192
Sep 2013	2.7	333	355	197	551	109	173
Oct 2013	2.8	228	302	457	759	212	160
Nov 2013	3.3	351	516	139	655	111	103
Dec 2013	2.9	173	292	303	594	49	130
Jan 2014	2.9	229	309	370	679	37	191
Feb 2014	4.3	405	501	226	727	232	338
Mar 2014	3.3	329	372	125	497	72	175
Apr 2014	2.8	251	336	171	506	125	64
May 2014	2.6	184	249	114	362	46	26
Jun 2014	2.5	218	233	223	456	131	80
Jul 2014	2.5	195	233	29	262	7	18
Aug 2014	2.6	202	278	9	287	10	13
Sep 2014	2.6	248	269	17	286	27	25
Oct 2014	2.7	169	216	65	281	32	37
Nov 2014	2.9	254	319	23	342	8	12
Dec 2014	5.0	386	491	101	554	6	11
Jan 2015	2.9	298	378	5	383	3	6
Feb 2015	3.3	312	366	5	371	27	30
Mar 2015	2.9	302	366	3	368	29	30
Apr 2015	3.0	186	227	39	266	15	22
May 2015	2.8	251	273	26	298	22	21
Jun 2015	2.8	250	310	32	342	33	41
Dry Season Average	**2.7**	**251**	**283**	**79**	**362**	**92**	**67**
Dry Season Trend (n=15)	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**
Wet Season Average	**3.2**	**284**	**388**	**120**	**506**	**100**	**91**
Average Annual	**3.0**	**271**	**344**	**103**	**446**	**97**	**81**

4 Central Contra Costa Sanitary District (CCCSD)

CCCSD discharges to Suisun Bay, and serves about 115,100 service connections. The plant has a permitted ADWF capacity of 53.8 mgd and a peak wet weather influent design flow of 250 mgd. It has a current ADWF flow of about 33 mgd. The plant performs secondary treatment using activated sludge.

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

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for flow, and NOx and Ortho-P loads.
- Ammonia, TKN and TN loads increase with flow during wet weather events.
- Wet season loads are 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 fully nitrify.
- Ammonia concentrations are greatest during the dry season and it becomes more pronounced towards the end of the dry season.
- Total phosphorus concentrations are generally less than 1.5 mg P/L, which is lower than typical effluent concentrations of 4 to 6 mg P/L. This indicates the plant is reliably removing phosphorus.

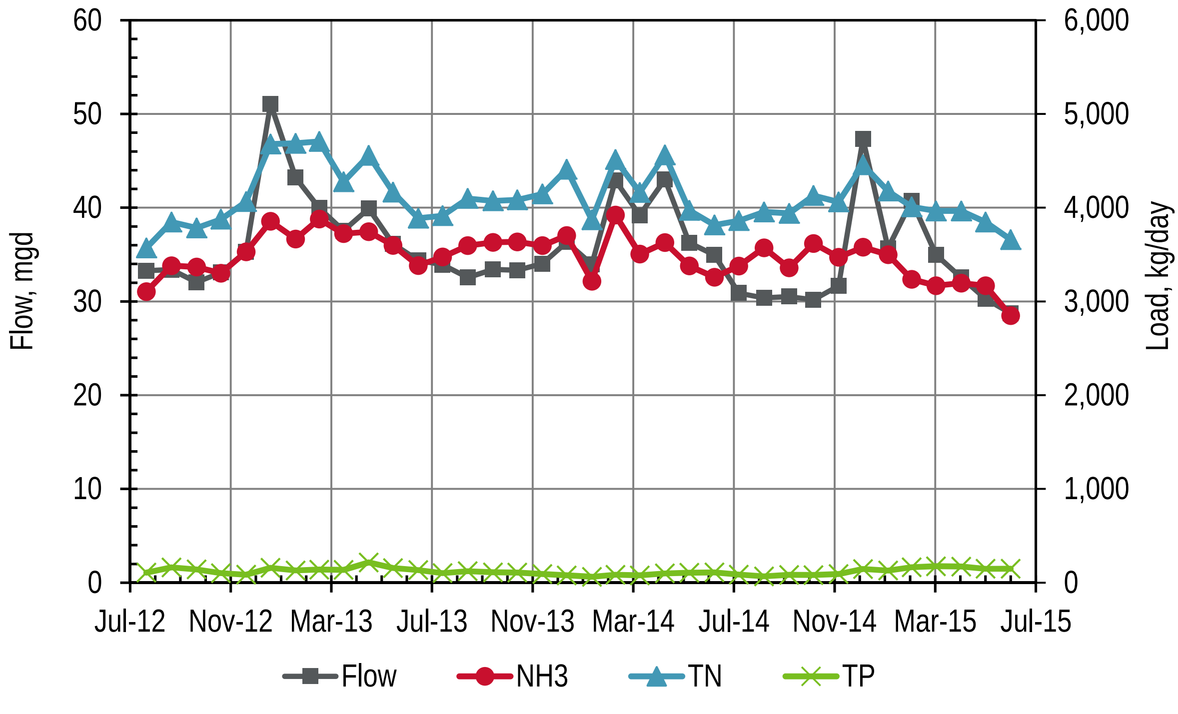

Figure 4-1. CCCSD Monthly Flows and Loads

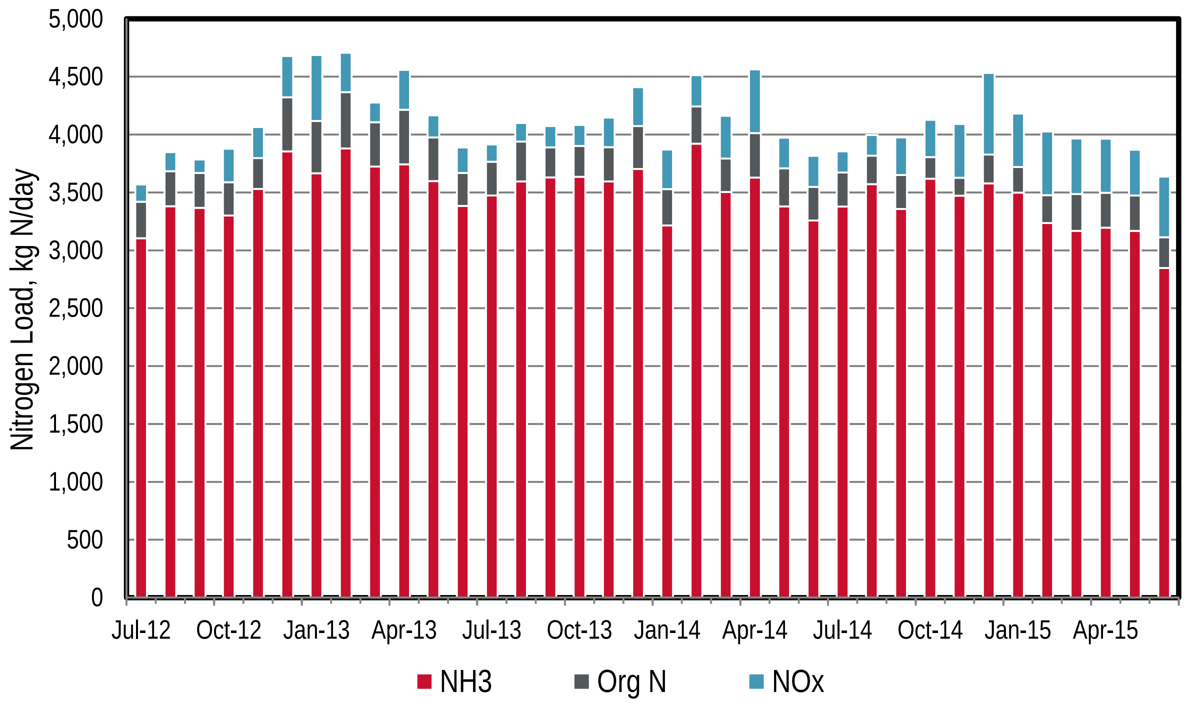

Figure 4-2. CCCSD Monthly Nitrogen Loads

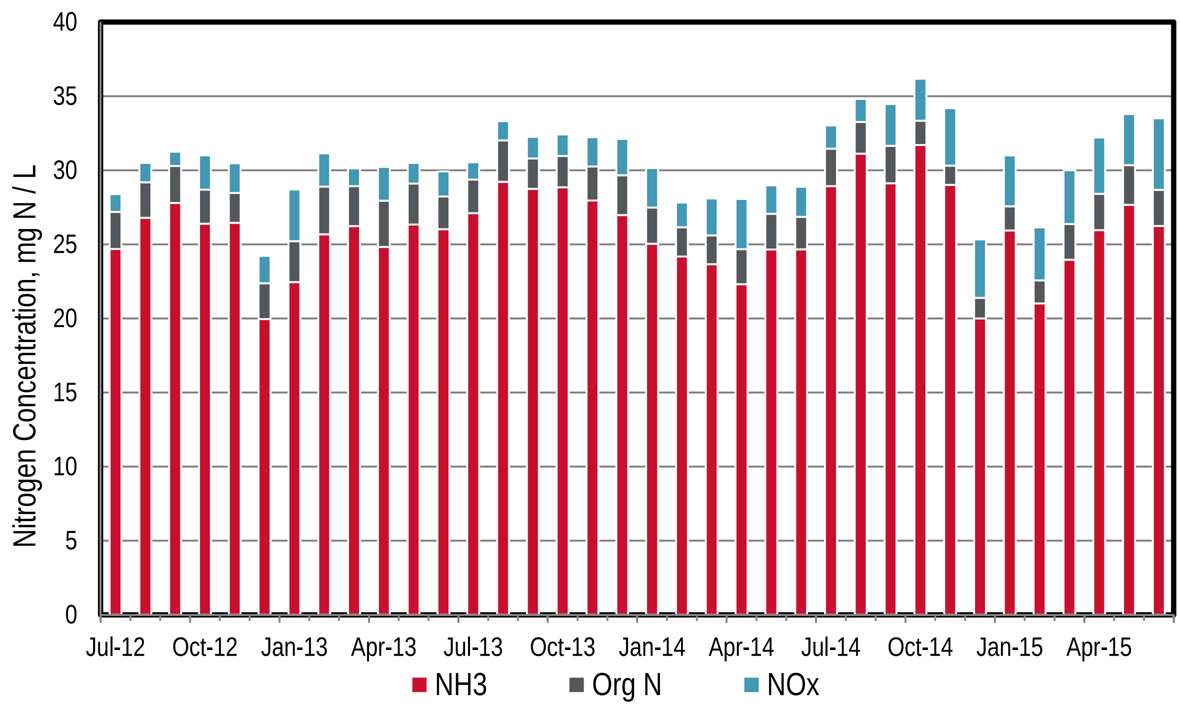

Figure 4-3. CCCSD Monthly Nitrogen Concentrations

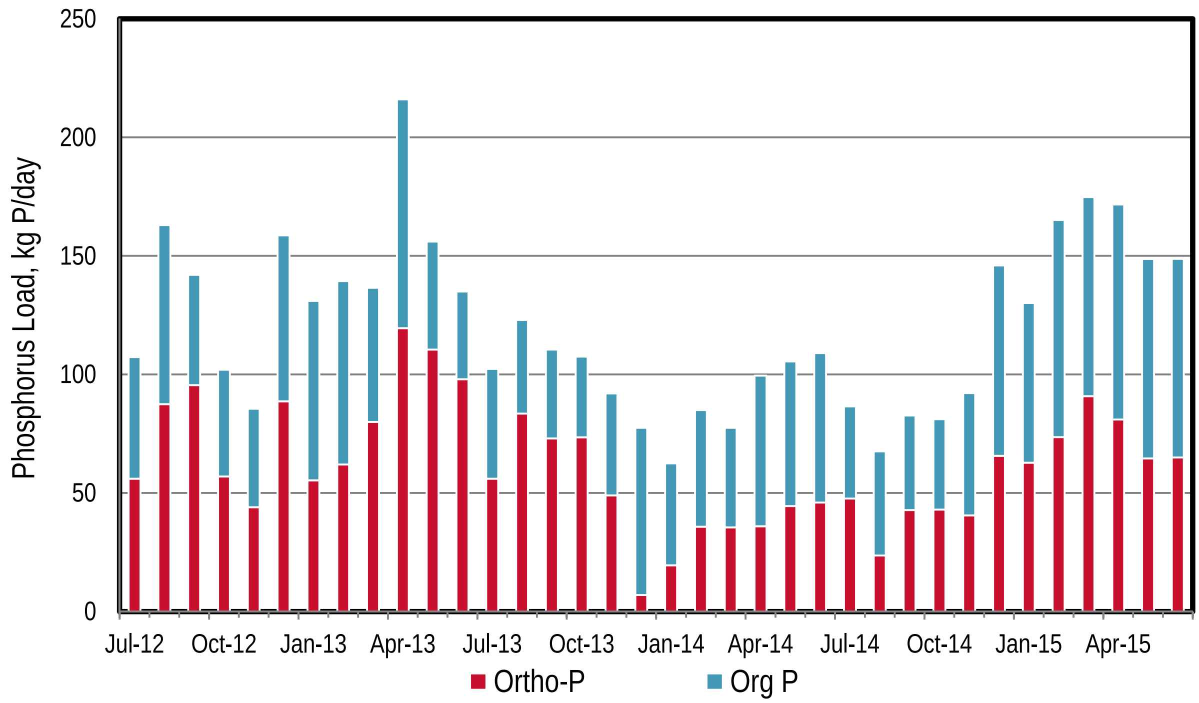

Figure 4-4. CCCSD Monthly Phosphorus Loads

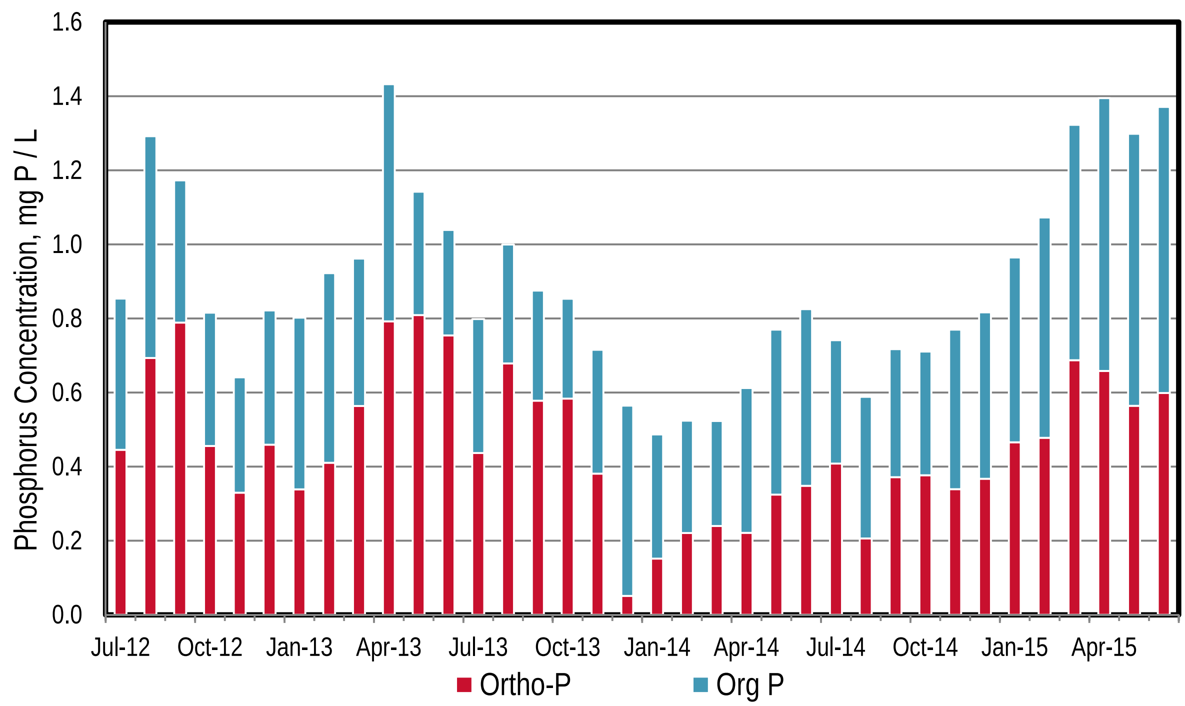

Figure 4-5. CCCSD Monthly Phosphorus Concentrations

Table 4-1. CCCSD Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	33	3104	3420	150	3570	56	107
Aug 2012	33	3381	3683	165	3847	88	163
Sep 2012	32	3367	3669	116	3784	96	142
Oct 2012	33	3301	3588	290	3877	57	102
Nov 2012	35	3530	3797	269	4065	44	86
Dec 2012	51	3855	4322	357	4678	89	159
Jan 2013	43	3666	4117	569	4686	55	131
Feb 2013	40	3879	4366	340	4706	62	139
Mar 2013	38	3723	4106	170	4276	80	137
Apr 2013	40	3744	4214	344	4558	120	216
May 2013	36	3598	3975	191	4165	111	156
Jun 2013	34	3383	3669	220	3888	98	135
Jul 2013	34	3474	3765	149	3914	56	102
Aug 2013	33	3596	3940	160	4099	84	123
Sep 2013	33	3630	3890	184	4073	73	111
Oct 2013	33	3636	3902	182	4083	74	108
Nov 2013	34	3596	3892	255	4146	49	92
Dec 2013	36	3704	4074	336	4410	7	78
Jan 2014	34	3216	3529	342	3871	20	63
Feb 2014	43	3922	4243	270	4513	36	85
Mar 2014	39	3505	3793	370	4163	36	78
Apr 2014	43	3628	4013	550	4563	36	100
May 2014	36	3379	3709	264	3972	45	106
Jun 2014	35	3259	3548	268	3816	46	109
Jul 2014	31	3378	3673	182	3861	48	87
Aug 2014	30	3572	3818	178	3954	24	68
Sep 2014	31	3358	3650	325	3939	43	83
Oct 2014	30	3618	3805	323	4129	43	81
Nov 2014	32	3472	3627	465	4061	41	92
Dec 2014	47	3578	3827	705	4458	66	146
Jan 2015	36	3499	3719	463	4177	63	130
Feb 2015	41	3236	3476	550	4009	74	165
Mar 2015	35	3168	3486	479	3964	91	175
Apr 2015	33	3195	3497	467	3965	81	172
May 2015	30	3168	3474	395	3847	65	149
Jun 2015	29	2848	3113	524	3659	65	149
Dry Season Average	**32.7**	**3,366**	**3,666**	**231**	**3,892**	**66**	**119**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**Yes**	**No**	**Yes**	**No**
Wet Season Average	**37.9**	**3,556**	**3,876**	**385**	**4,255**	**58**	**121**
Average Annual	**35.8**	**3,477**	**3,788**	**321**	**4,104**	**62**	**120**

5 Central Marin Sanitation Agency (CMSA)

CMSA discharges to the Central Bay Subembayment, and serves about 52,200 service connections. The plant has a permitted ADWF capacity of 10.0 mgd. It has a current ADWF flow of about 5.3 mgd. The plant performs secondary treatment using a trickling filter and activated sludge process.

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

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for flow, and ammonia and ortho-P loads. The ortho-P loads trend is attributed to the change in sampling methodology between the Section 13267 Letter data and the Nutrient Watershed Permit dataset.
- Both nitrogen and phosphorus loads 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 was not designed to nitrify (some nitrification does occur in the secondary process, most likely in the biotowers).
- Ammonia concentrations increase during the dry weather season as flows decrease and temperatures increase.
- Total phosphorus concentrations range from 2 mg P/L to over 6 mg P/L.
- The distribution of phosphorus species predominantly ortho-P.

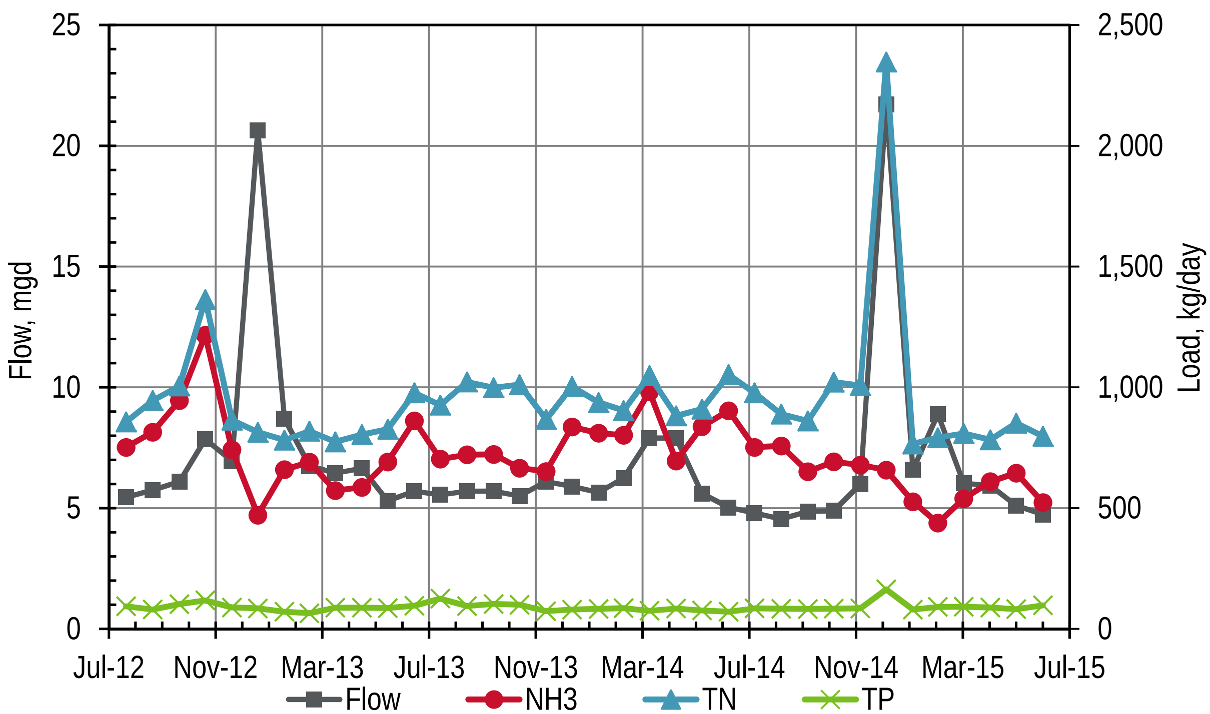

Figure 5-1. CMSA Monthly Flows and Loads

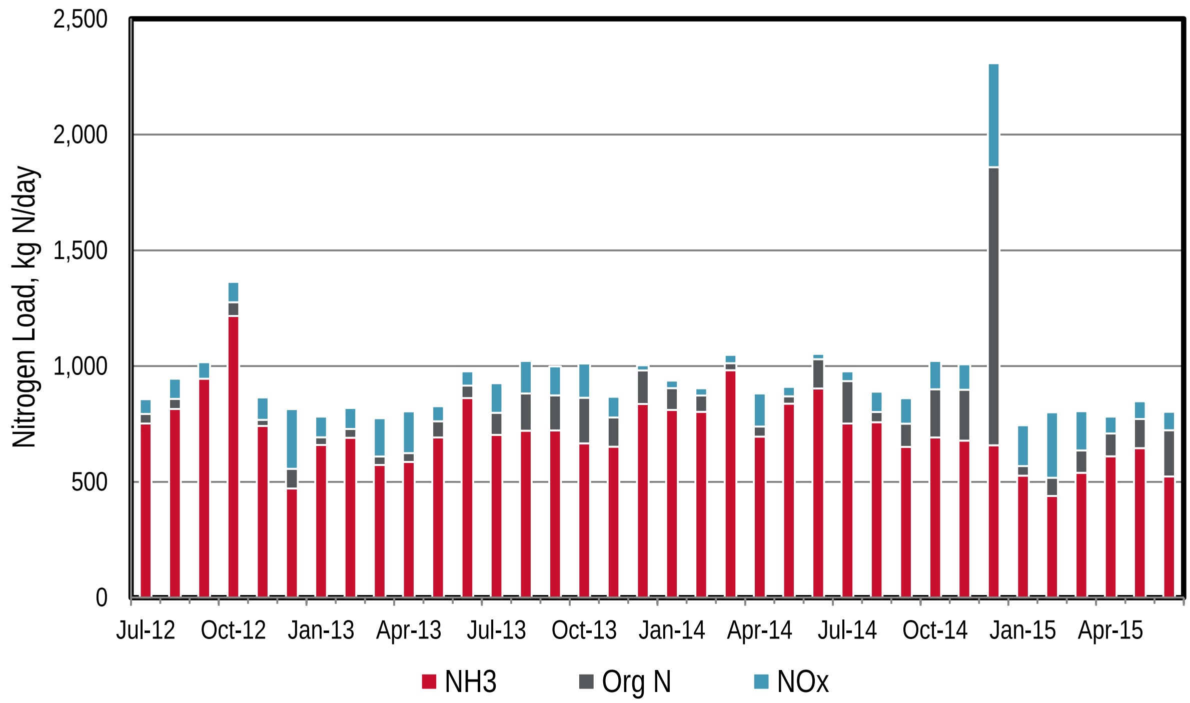

Figure 5-2. CMSA Monthly Nitrogen Loads

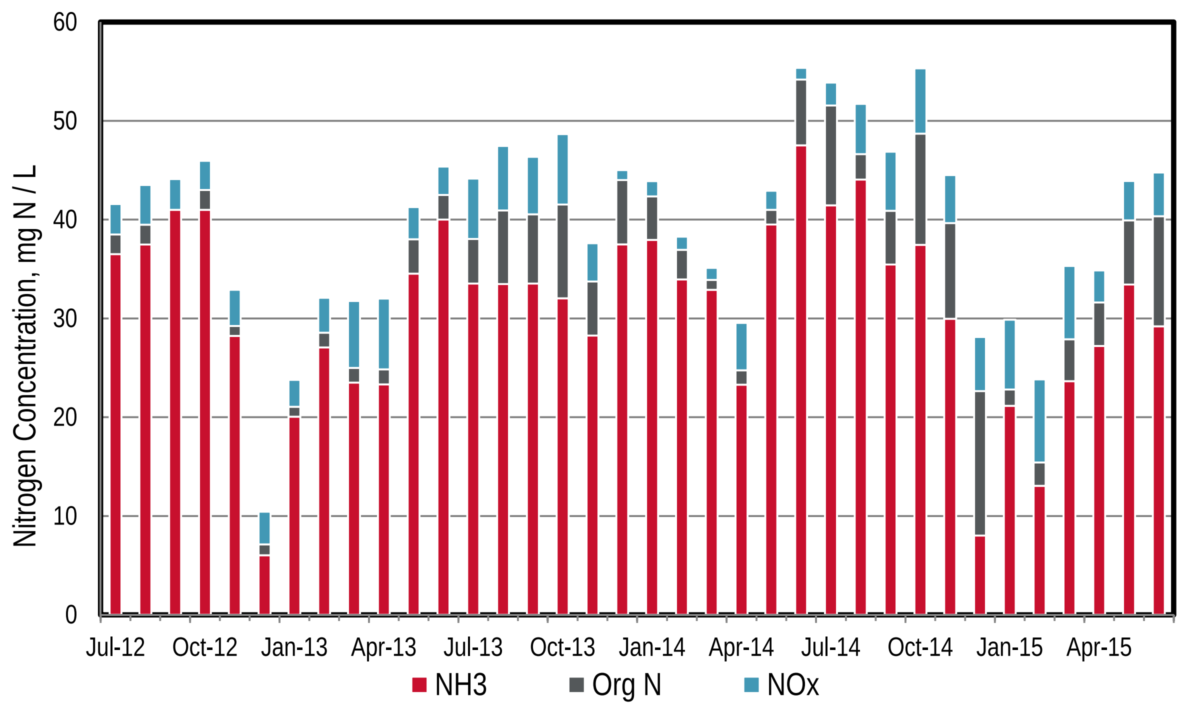

Figure 5-3. CMSA Monthly Nitrogen Concentrations

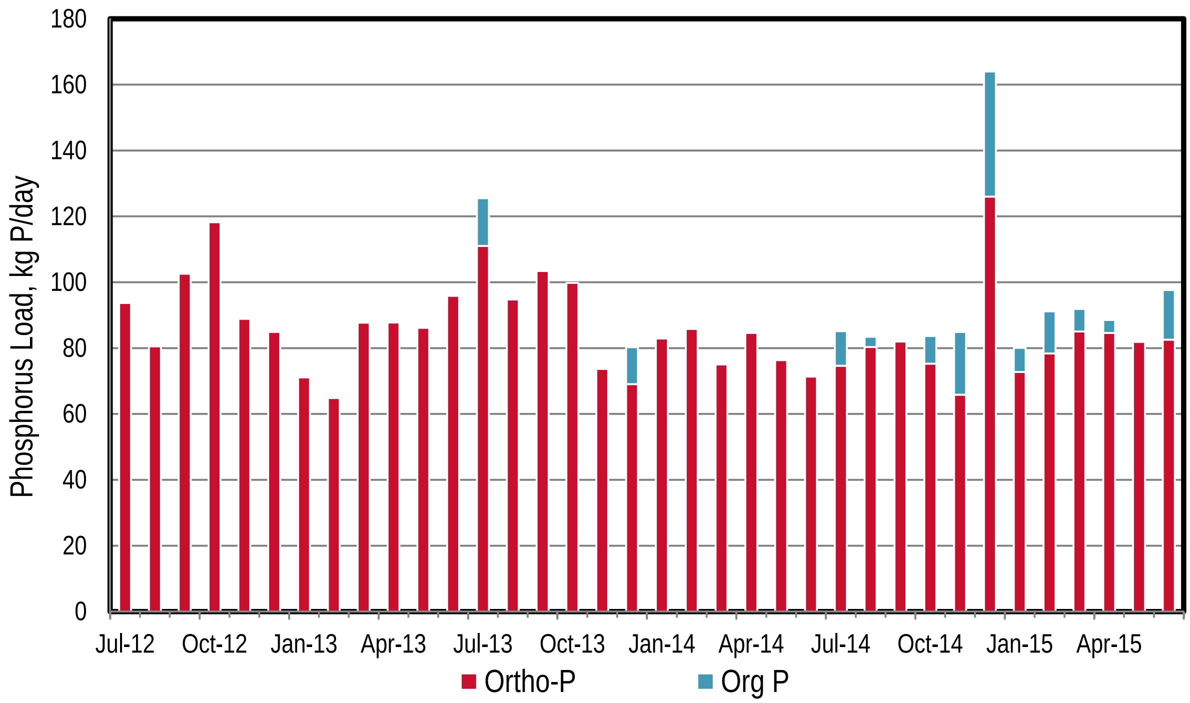

Figure 5-4. CMSA Monthly Phosphorus Loads

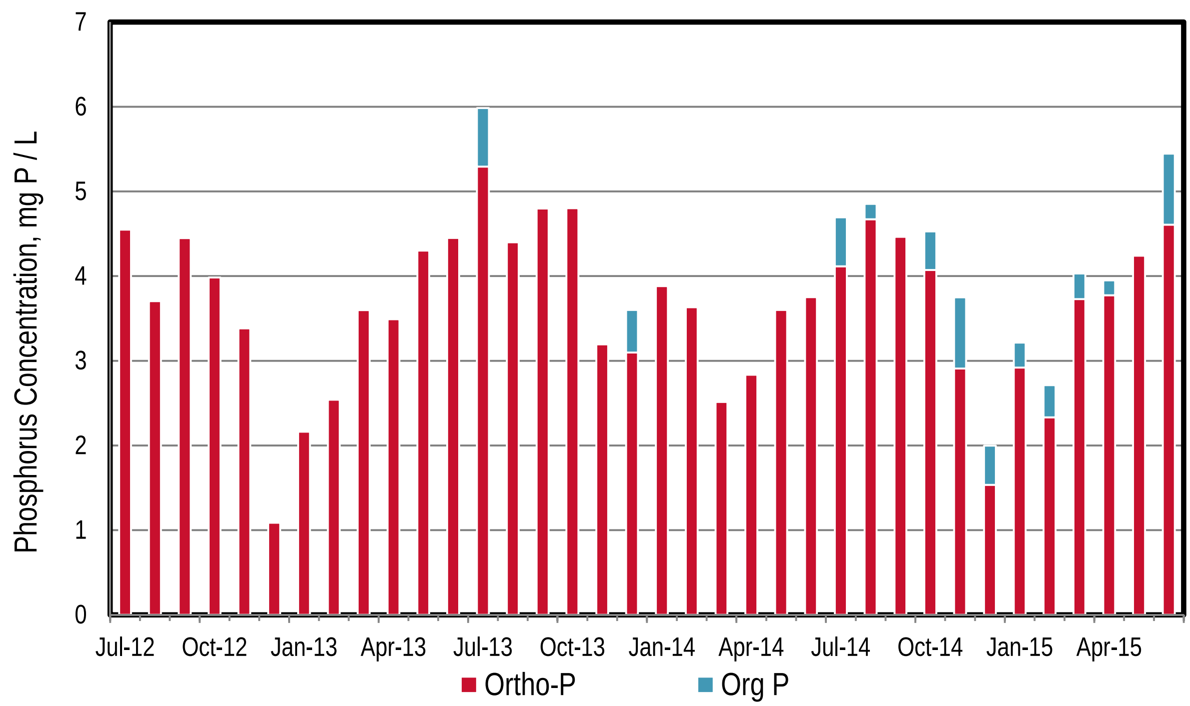

Figure 5-5. CMSA Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 5-1. CMSA Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	5	752	793	63	857	125	94
Aug 2012	6	815	858	87	946	103	81
Sep 2012	6	945	934	72	1006	142	103
Oct 2012	8	1217	1276	88	1363	178	118
Nov 2012	7	742	768	96	864	102	89
Dec 2012	21	471	556	258	814	322	85
Jan 2013	9	660	692	89	782	86	71
Feb 2013	7	691	729	90	819	89	65
Mar 2013	6	573	610	165	775	128	88
Apr 2013	7	586	624	180	805	128	88
May 2013	5	692	762	65	827	125	86
Jun 2013	6	862	916	62	977	132	96
Jul 2013	6	703	798	128	926	111	126
Aug 2013	6	721	882	140	1022	125	95
Sep 2013	6	722	874	125	999	137	103
Oct 2013	6	666	863	148	1011	148	100
Nov 2013	6	652	778	89	867	116	74
Dec 2013	6	836	981	22	1004	69	80
Jan 2014	6	810	905	33	937	105	83
Feb 2014	6	802	873	31	904	99	86
Mar 2014	8	982	1012	36	1049	99	75
Apr 2014	8	695	739	143	882	113	85
May 2014	6	838	869	41	910	108	76
Jun 2014	5	903	1030	23	1053	72	71
Jul 2014	5	752	935	42	977	75	85
Aug 2014	5	757	802	88	889	80	83
Sep 2014	5	651	751	110	861	82	82
Oct 2014	5	692	900	122	1022	75	84
Nov 2014	6	678	898	110	1008	66	85
Dec 2014	22	658	1859	449	2347	126	164
Jan 2015	7	527	568	176	766	73	80
Feb 2015	9	439	518	283	792	78	91
Mar 2015	6	539	636	169	809	85	92
Apr 2015	6	610	709	72	783	85	89
May 2015	5	645	771	77	852	106	82
Jun 2015	5	524	723	80	798	83	98
Dry Season Average	**5.3**	**752**	**847**	**80**	**927**	**107**	**91**
Dry Season Trend (n=15)	**Yes**	**Yes**	**No**	**No**	**No**	**Yes**	**No**
Wet Season Average	**8.1**	**692**	**833**	**136**	**972**	**113**	**89**
Average Annual	**6.9**	**717**	**839**	**113**	**953**	**110**	**90**

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. It has a current ADWF flow of about 0.011 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:

- The dataset is limited to flow and occasional monthly ammonia samples. Based on the average monthly values in the table below, there do not appear to be any emerging dry season trends for flow or ammonia.
- Both flow and ammonia increase with flow during wet weather events.

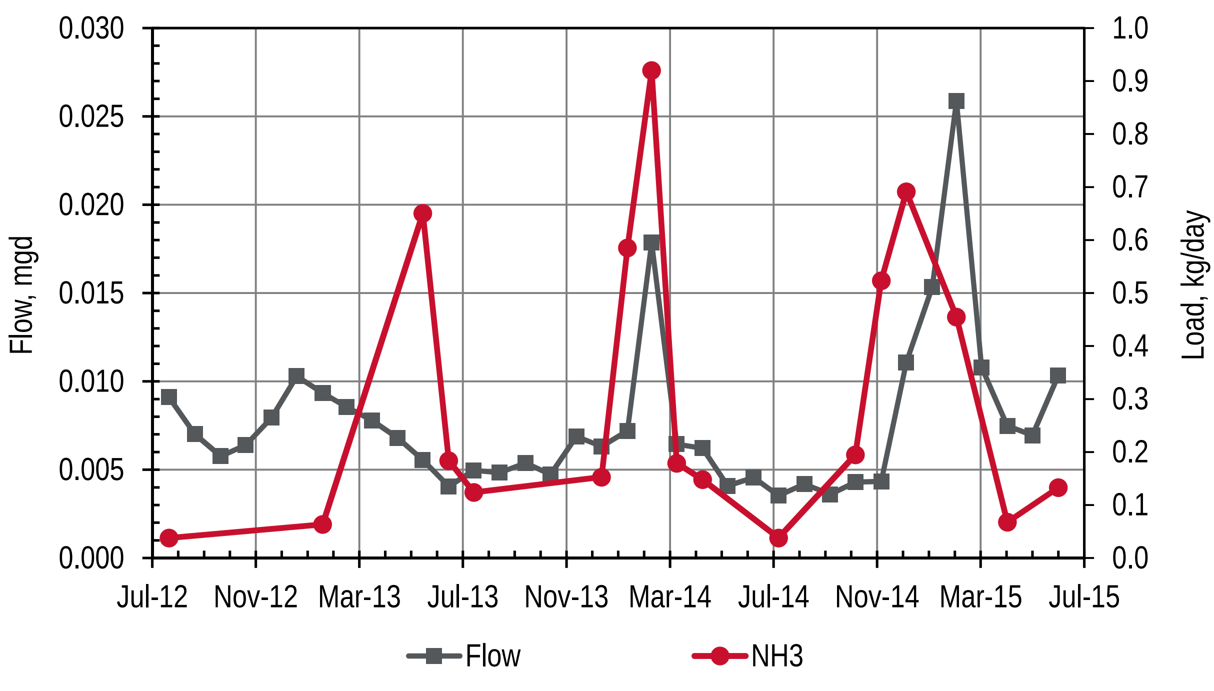

Figure 6-1. Port Costa Monthly Flows and Loads

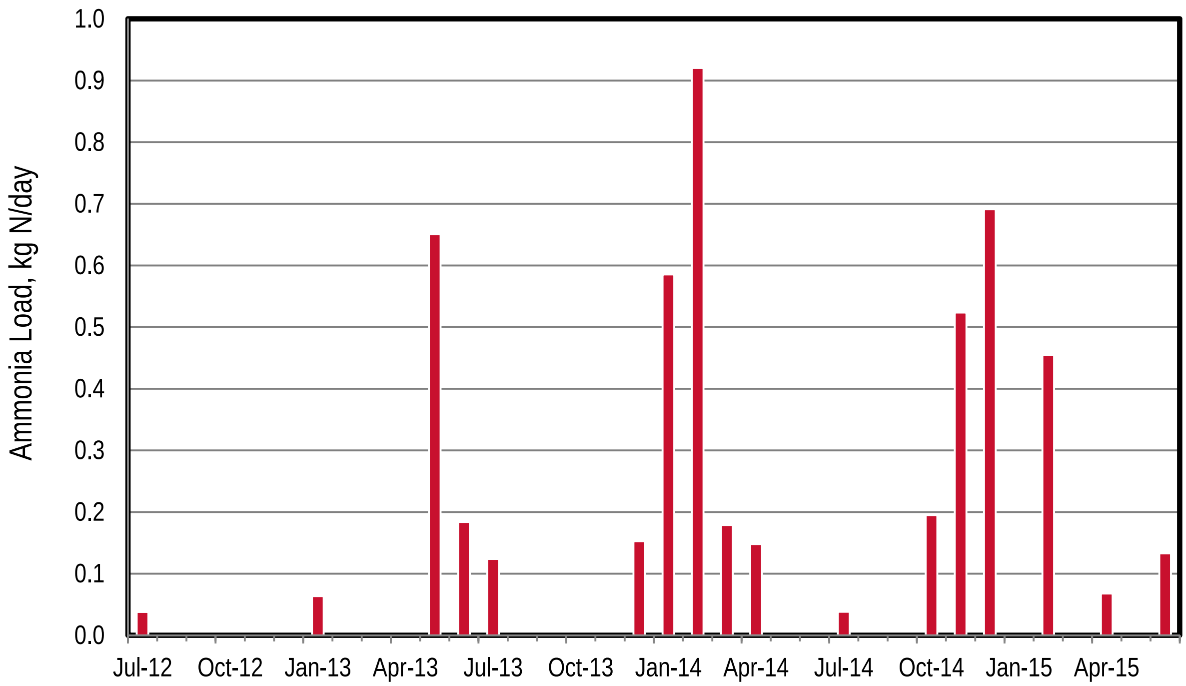

Figure 6-2. Port Costa Monthly Ammonia Loads

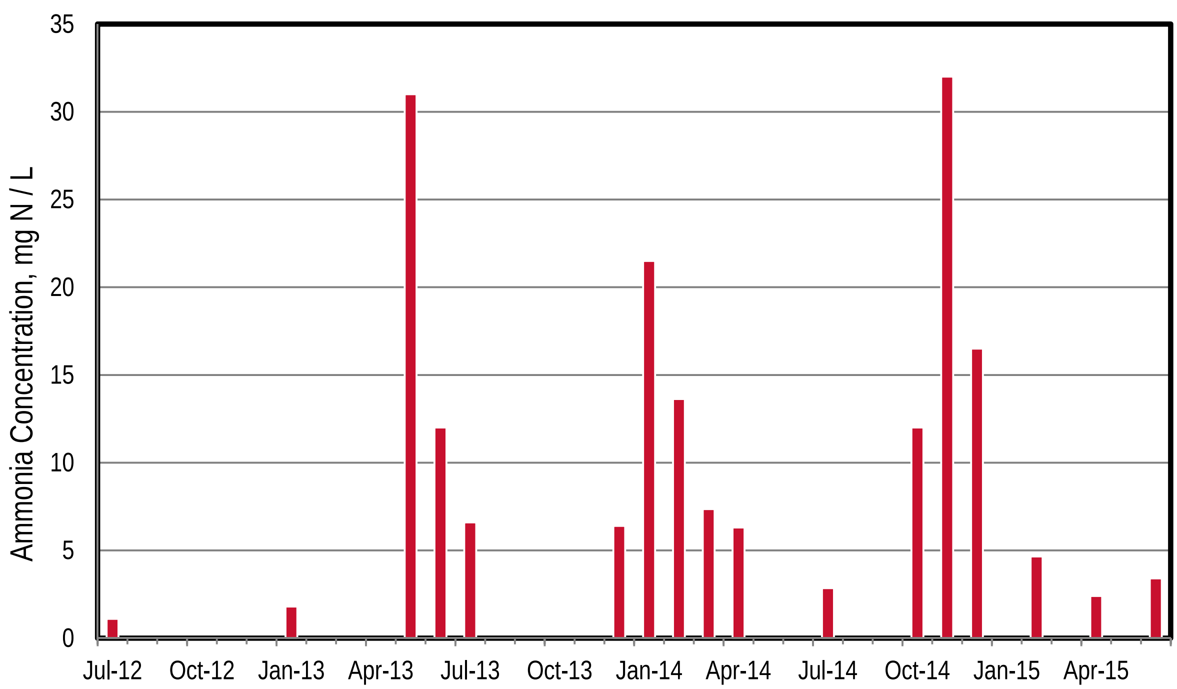

Figure 6-3. Port Costa Monthly Ammonia Concentrations

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Table 6-1. Port Costa Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.009	0.04	--	--	--	--	--
Aug 2012	0.007	--	--	--	--	--	--
Sep 2012	0.006	--	--	--	--	--	--
Oct 2012	0.006	--	--	--	--	--	--
Nov 2012	0.008	--	--	--	--	--	--
Dec 2012	0.010	--	--	--	--	--	--
Jan 2013	0.009	0.06	--	--	--	--	--
Feb 2013	0.009	--	--	--	--	--	--
Mar 2013	0.008	--	--	--	--	--	--
Apr 2013	0.007	--	--	--	--	--	--
May 2013	0.006	0.65	--	--	--	--	--
Jun 2013	0.004	0.18	--	--	--	--	--
Jul 2013	0.005	0.12	--	--	--	--	--
Aug 2013	0.005	--	--	--	--	--	--
Sep 2013	0.005	--	--	--	--	--	--
Oct 2013	0.005	--	--	--	--	--	--
Nov 2013	0.007	--	--	--	--	--	--
Dec 2013	0.006	0.15	--	--	--	--	--
Jan 2014	0.007	0.59	--	--	--	--	--
Feb 2014	0.018	0.92	--	--	--	--	--
Mar 2014	0.006	0.18	--	--	--	--	--
Apr 2014	0.006	0.15	--	--	--	--	--
May 2014	0.004	--	--	--	--	--	--
Jun 2014	0.005	--	--	--	--	--	--
Jul 2014	0.004	0.04	--	--	--	--	--
Aug 2014	0.004	--	--	--	--	--	--
Sep 2014	0.004	--	--	--	--	--	--
Oct 2014	0.004	0.19	--	--	--	--	--
Nov 2014	0.004	0.52	--	--	--	--	--
Dec 2014	0.011	0.69	--	--	--	--	--
Jan 2015	0.015	--	--	--	--	--	--
Feb 2015	0.026	0.45	--	--	--	--	--
Mar 2015	0.011	--	--	--	--	--	--
Apr 2015	0.007	0.07	--	--	--	--	--
May 2015	0.007	--	--	--	--	--	--
Jun 2015	0.010	0.13	--	--	--	--	--
Dry Season Average	**0.006**	**0.19**					
Dry Season Trend (n=15)	**No**	**Insufficient Data**	**--**	**--**	**--**	**--**	**--**
Wet Season Average	**0.01**	**0.36**	**--**	**--**	**--**	**--**	**--**
Average Annual	**0.01**	**0.30**	**--**	**--**	**--**	**--**	**--**

7 Delta Diablo

Delta Diablo discharges to New York Slough (part of the Suisun Bay) and serves about 57,700 service connections throughout Antioch, Pittsburg and Bay Point. The plant has a permitted ADWF capacity of 19.5 mgd. It has a current ADWF flow of about 6.0 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 to the tertiary treatment prior to being distributed 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 are made based upon the figures and table in the subsequent pages:

- Both flows and loads appear to be relatively consistent; no dry season trends appear to be emerging.
- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- Wet season loads are more variable than the dry season loads.
- The variability of the distribution of the nitrogen species in the effluent is due to the power plant cooling towers going in and out of nitrification.
- Ammonia concentrations are lowest during the dry season, with a low of 23 mg N/L. TN concentrations are variable, ranging from 43 mg/L to over 80 mg/L within the dry season.
- For several of the samples, the ortho-P was greater than the total phosphorus. The distribution of phosphorus species tends to favor ortho-P, which is common.
- Total phosphorus concentrations are generally less than 2 mg P/L, which is lower than typical effluent concentrations of 4 to 6 mg P/L. This indicates the plant is removing phosphorus.

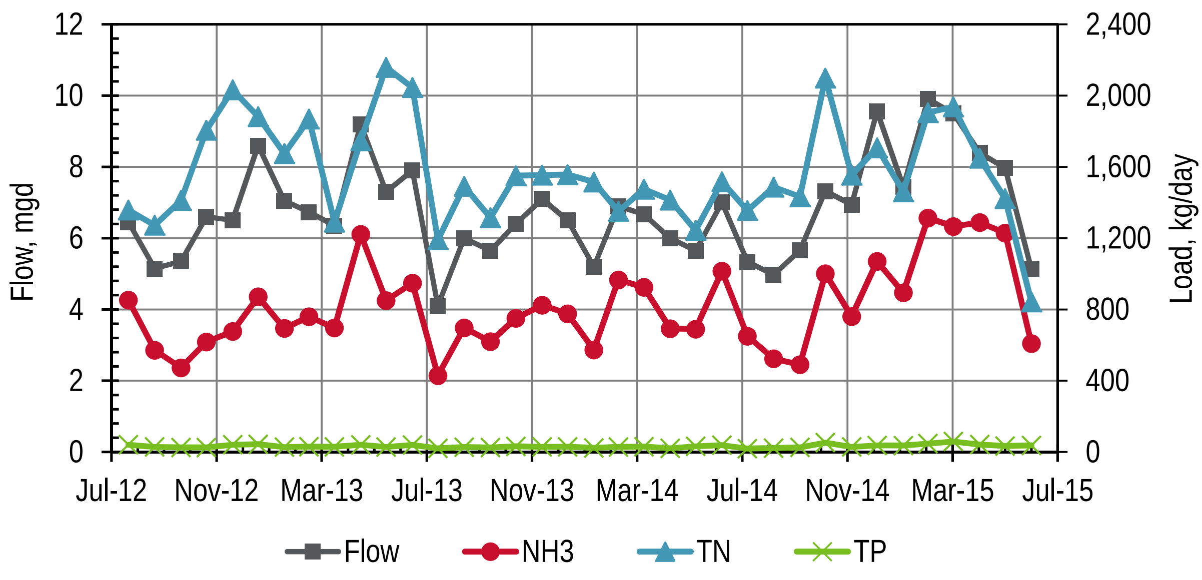

Figure 7-1. Delta Diablo Monthly Flows and Loads

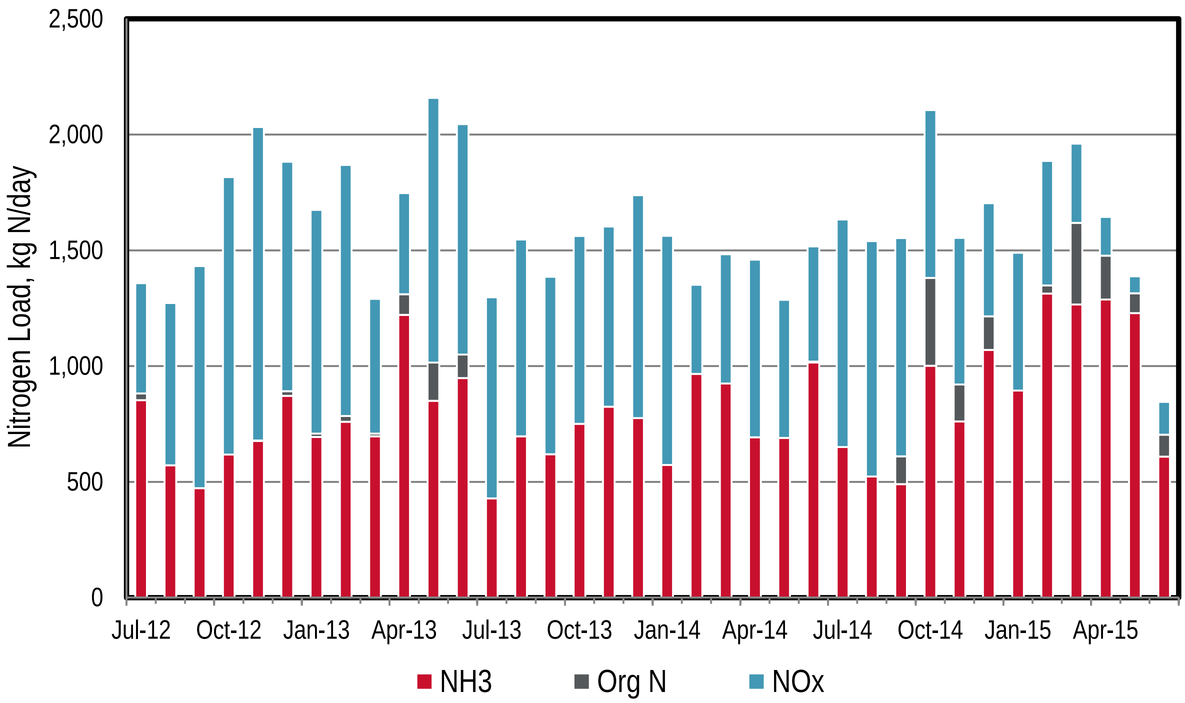

Figure 7-2. Delta Diablo Monthly Nitrogen Loads

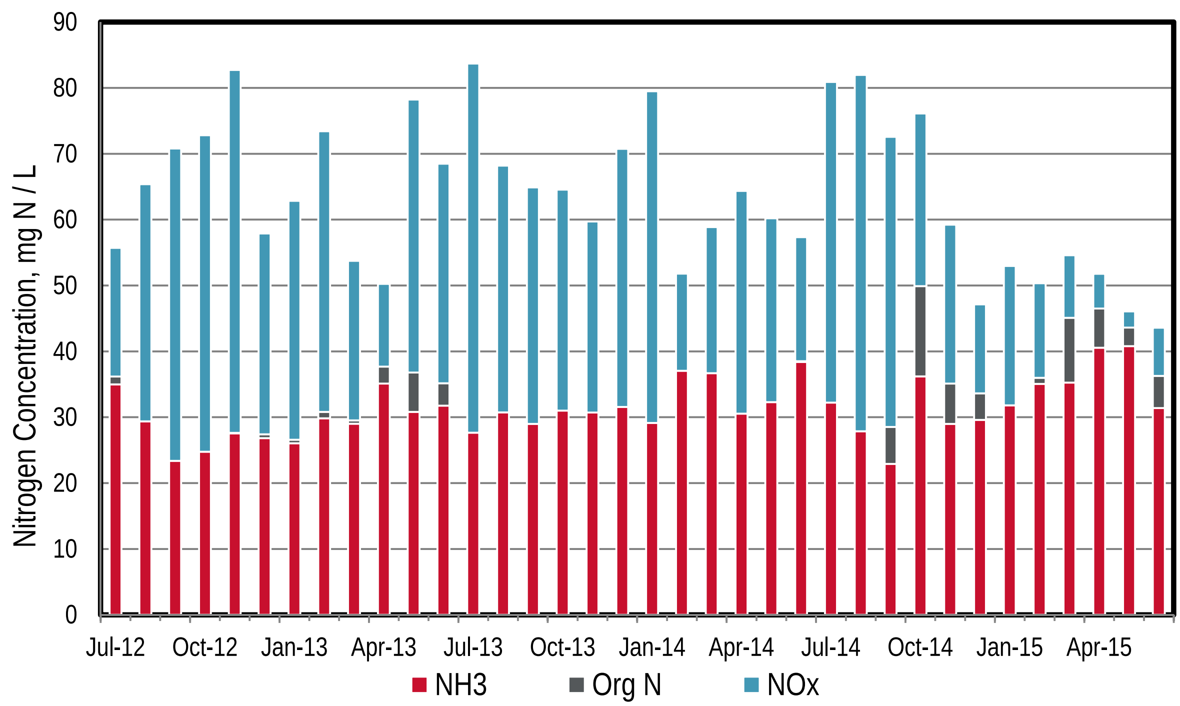

Figure 7-3. Delta Diablo Monthly Nitrogen Concentrations

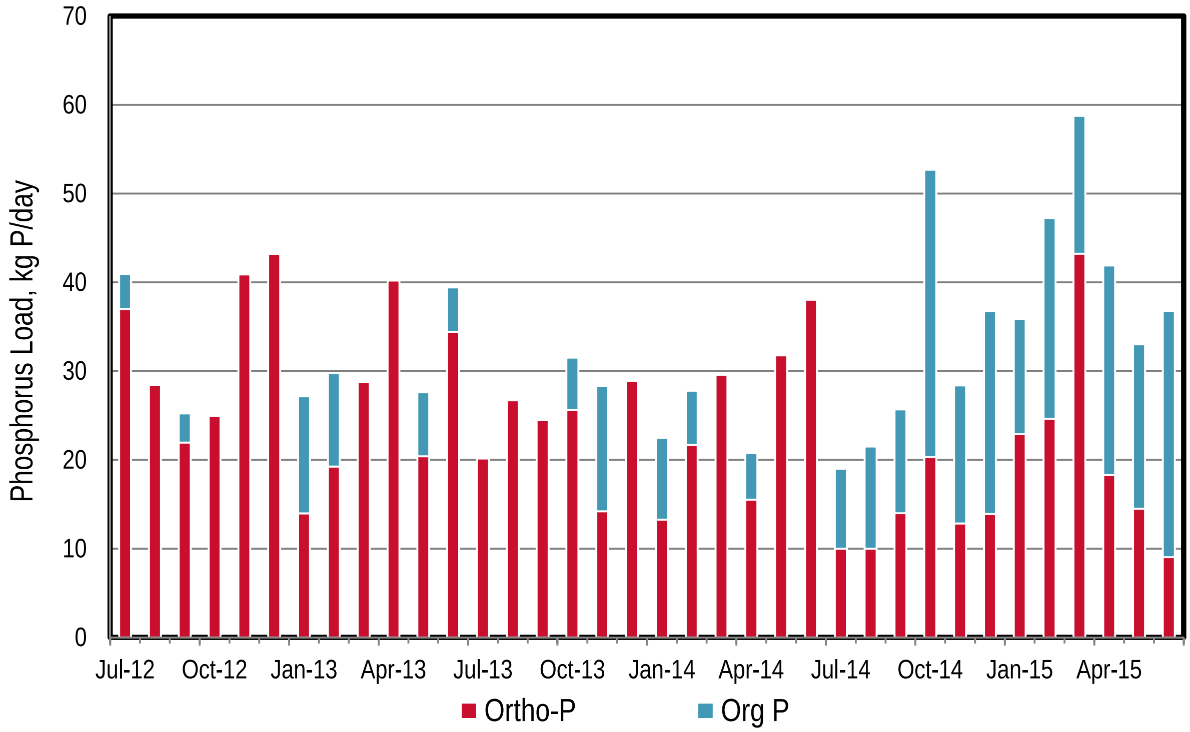

Figure 7-4. Delta Diablo Monthly Phosphorus Loads

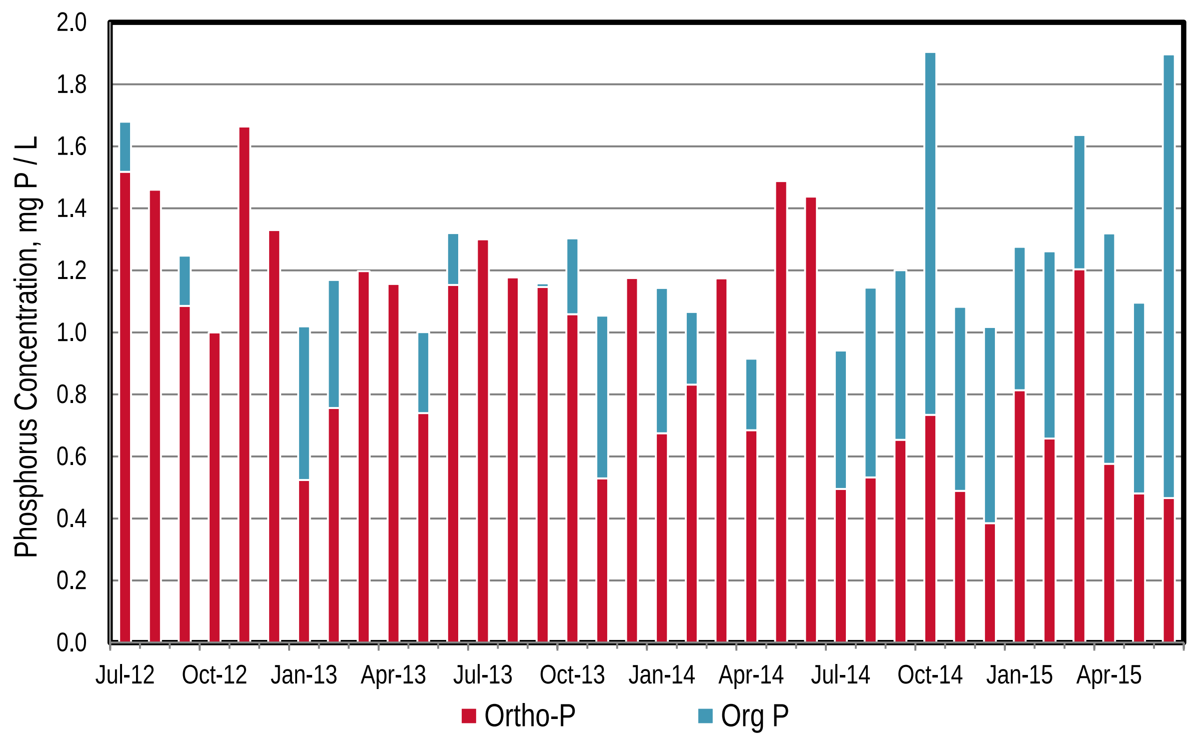

Figure 7-5. Delta Diablo Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 7-1. Delta Diablo Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	6	853	882	476	1358	37	41
Aug 2012	5	572	572	701	1273	43	28
Sep 2012	5	473	452	959	1412	22	25
Oct 2012	7	618	607	1199	1805	29	25
Nov 2012	7	677	679	1354	2033	44	41
Dec 2012	9	872	891	991	1882	43	43
Jan 2013	7	694	708	967	1675	14	27
Feb 2013	7	760	784	1084	1868	19	30
Mar 2013	6	697	708	582	1290	36	29
Apr 2013	9	1221	1310	437	1747	43	40
May 2013	7	850	1015	1143	2159	20	28
Jun 2013	8	948	1050	995	2045	34	39
Jul 2013	4	429	323	868	1191	22	20
Aug 2013	6	697	641	850	1491	31	27
Sep 2013	6	619	548	767	1315	24	25
Oct 2013	6	750	739	812	1550	26	32
Nov 2013	7	824	775	778	1553	14	28
Dec 2013	7	776	594	963	1557	30	29
Jan 2014	5	573	525	990	1515	13	22
Feb 2014	7	966	966	385	1351	22	28
Mar 2014	7	925	916	559	1475	39	30
Apr 2014	6	693	647	767	1414	16	21
May 2014	6	690	648	596	1244	40	32
Jun 2014	7	1015	1019	498	1517	48	38
Jul 2014	5	651	414	982	1355	10	19
Aug 2014	5	524	418	1016	1487	10	22
Sep 2014	6	490	611	942	1433	14	26
Oct 2014	7	1001	1381	725	2098	20	53
Nov 2014	7	761	921	633	1554	13	28
Dec 2014	10	1070	1215	488	1707	14	37
Jan 2015	7	894	865	595	1461	23	36
Feb 2015	10	1313	1348	538	1905	25	47
Mar 2015	10	1266	1619	341	1937	43	59
Apr 2015	8	1288	1477	167	1649	18	42
May 2015	8	1229	1314	74	1422	14	33
Jun 2015	5	609	704	142	842	9	37
Dry Season Average	**6.0**	**710**	**707**	**734**	**1436**	**25**	**29**
Dry Season Trend (n=15)	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**7.4**	**888**	**937**	**731**	**1668**	**26**	**35**
Average Annual	**6.8**	**814**	**841**	**732**	**1571**	**26**	**32**

8 East Bay Dischargers Authority (EBDA)

EBDA discharges to the South Bay. The EBDA permitted ADWF capacity of 107.8 mgd and a peak wet weather capacity of 189.1 mgd. It has a current ADWF flow of about 54 mgd. The EBDA plants have various types of secondary treatment.

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

- The flows reduce 10 to 20 mgd from the wet to the dry season due to a combination of recycled water demand during the dry season and a lack of I&I.
- Based on the average monthly values table, there appears to be an upward dry season trend for nitrogen species loads. The increase in concentrations over time supports this trend as the dry season flows are relatively flat.
- Both nitrogen and phosphorus loads increase with flow during wet weather events. The increase in loads during a wet weather event is less pronounced with months where there are back to back months with storms, such as December 2014 and January 2015. This is attributed to a lack of scouring in the collection system during the latter month.
- Wet season loads are 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 the EBDA plants were not designed to nitrify.
- Total phosphorus concentrations are relatively flat and range from 1.5 mg P/L to 3.0 mg P/L. Such values are lower than typical effluent concentrations of 4 to 6 mg P/L. This was expected as a portion of the EBDA plants perform either biological P removal using an anaerobic selector or chemical removal at the headworks, primaries, or filters.
- The distribution of phosphorus species predominantly ortho-P.

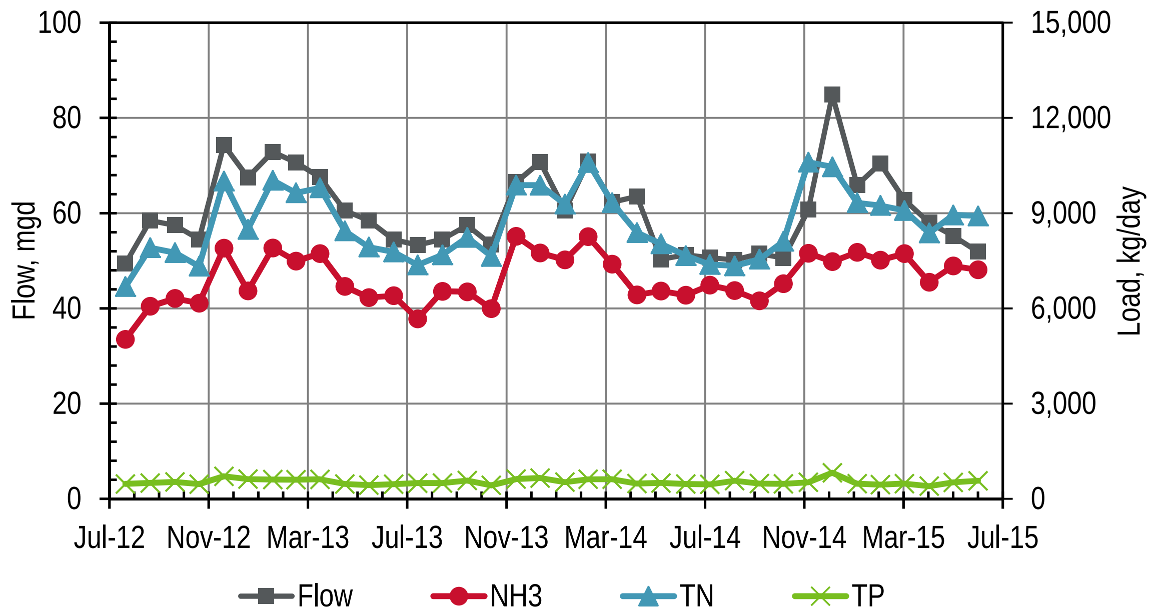

Figure 8-1. EBDA Monthly Flows and Loads

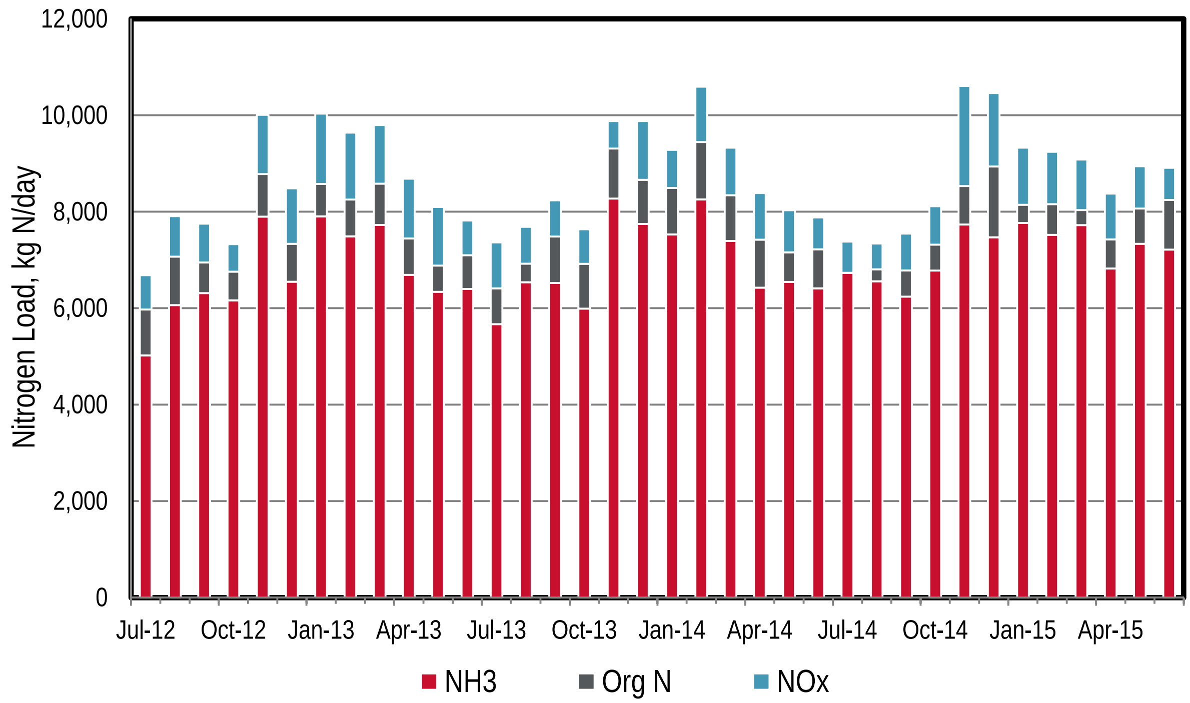

Figure 8-2. EBDA Monthly Nitrogen Loads

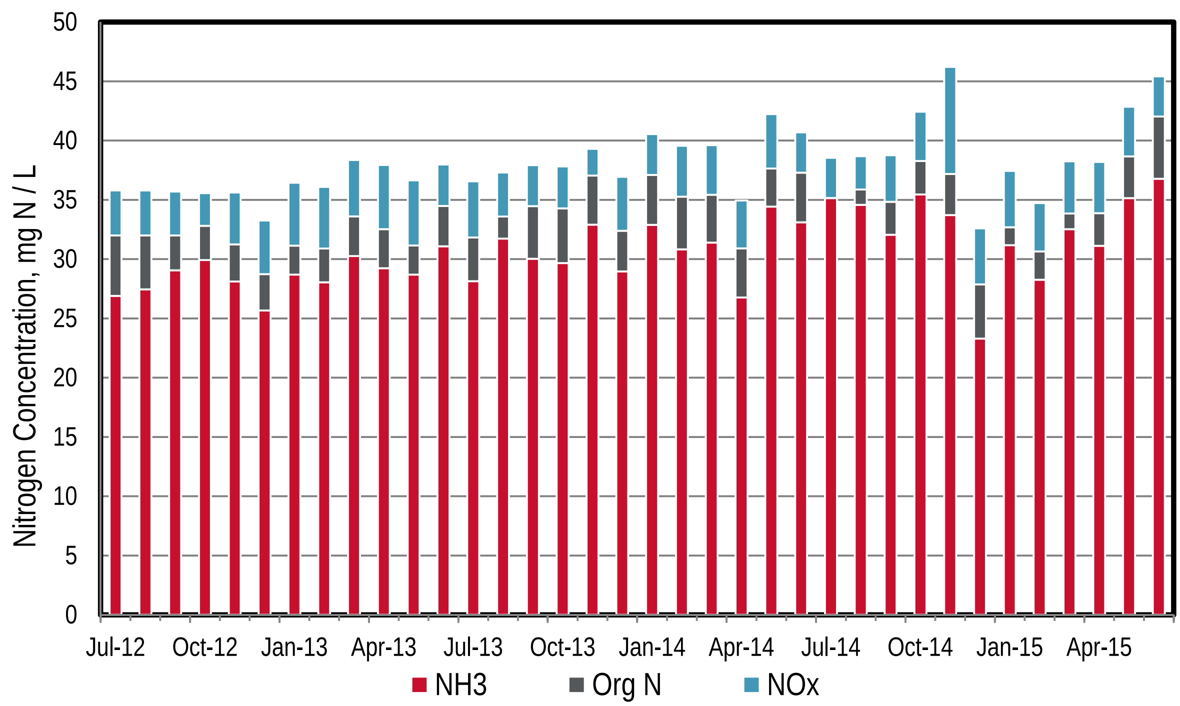

Figure 8-3. EBDA Monthly Nitrogen Concentrations

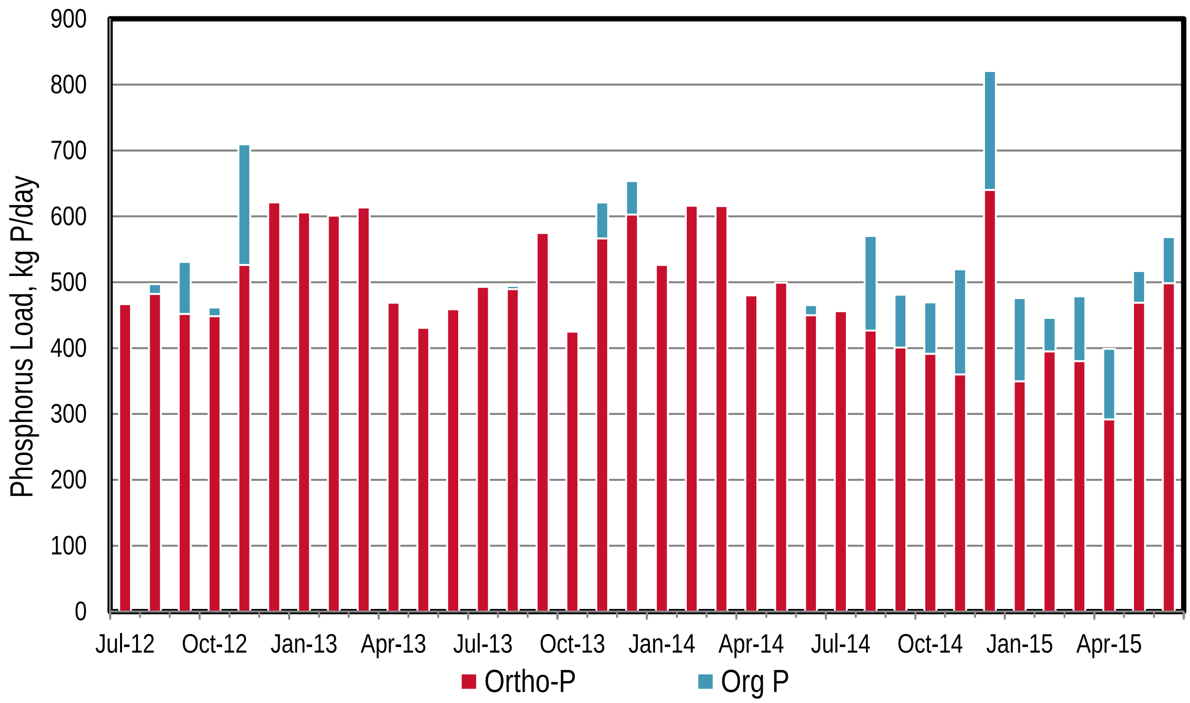

Figure 8-4. EBDA Monthly Phosphorus Loads

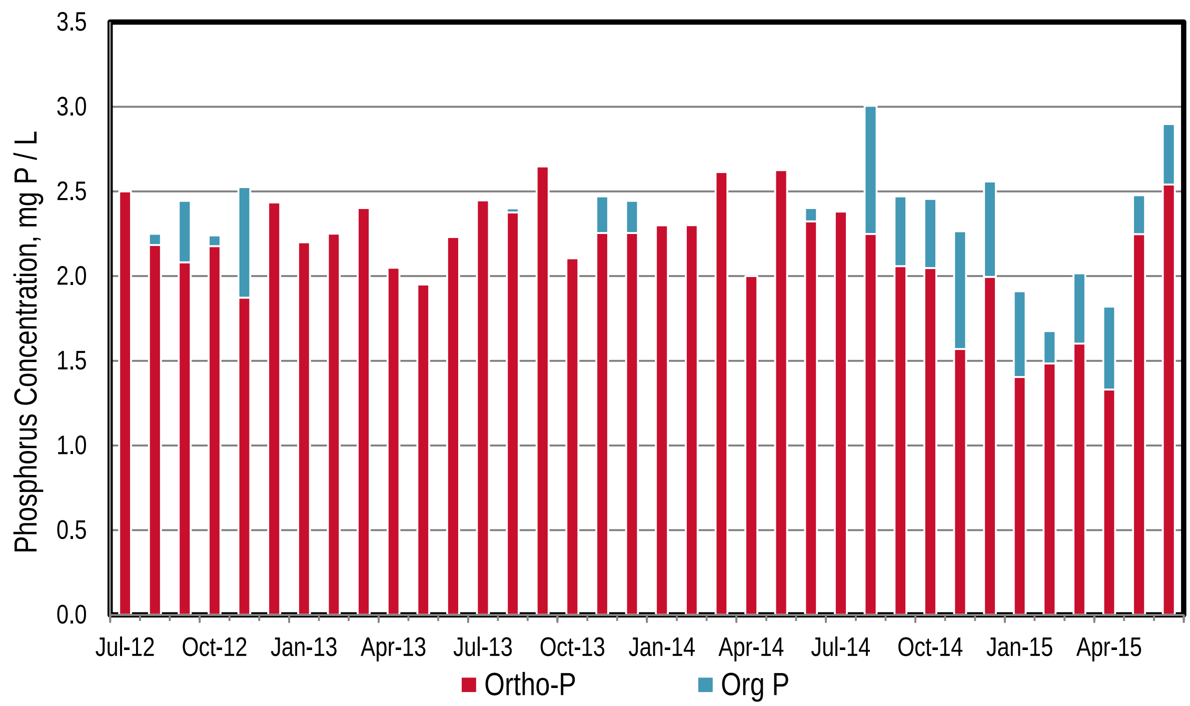

Figure 8-5. EBDA Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 8-1. EBDA Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	49	5,023	5,975	710	6,685	476	467
Aug 2012	58	6,065	7,070	840	7,910	482	497
Sep 2012	57	6,311	6,949	804	7,754	452	531
Oct 2012	55	6,164	6,759	568	7,327	448	462
Nov 2012	74	7,898	8,781	1,228	10,009	526	710
Dec 2012	68	6,550	7,333	1,152	8,485	813	621
Jan 2013	73	7,904	8,577	1,459	10,036	778	606
Feb 2013	71	7,491	8,252	1,388	9,640	802	601
Mar 2013	68	7,727	8,583	1,212	9,795	714	613
Apr 2013	61	6,691	7,446	1,237	8,442	568	469
May 2013	58	6,341	6,882	1,215	7,932	530	431
Jun 2013	54	6,399	7,099	719	7,777	573	459
Jul 2013	53	5,670	6,413	953	7,366	627	493
Aug 2013	55	6,538	6,922	763	7,685	490	494
Sep 2013	57	6,523	7,487	750	8,236	677	575
Oct 2013	53	5,990	6,920	715	7,635	686	425
Nov 2013	67	8,272	9,313	567	9,880	567	621
Dec 2013	71	7,745	8,661	1,217	9,878	603	654
Jan 2014	61	7,530	8,492	789	9,282	644	526
Feb 2014	71	8,258	9,446	1,148	10,593	751	616
Mar 2014	62	7,395	8,344	986	9,329	883	616
Apr 2014	64	6,425	7,420	966	8,387	624	480
May 2014	50	6,546	7,158	873	8,031	550	499
Jun 2014	51	6,413	7,221	660	7,661	450	465
Jul 2014	51	6,731	6,733	649	7,382	456	456
Aug 2014	50	6,560	6,806	534	7,340	427	570
Sep 2014	52	6,239	6,783	765	7,547	401	481
Oct 2014	51	6,780	7,318	795	8,113	392	470
Nov 2014	61	7,736	8,531	2,074	10,605	360	520
Dec 2014	85	7,472	8,939	1,519	10,458	640	821
Jan 2015	66	7,766	8,143	1,184	9,327	350	476
Feb 2015	70	7,520	8,158	1,083	9,241	395	446
Mar 2015	63	7,723	8,036	1,046	9,082	380	479
Apr 2015	58	6,824	7,427	948	8,375	292	399
May 2015	55	7,335	8,068	874	8,942	469	517
Jun 2015	52	7,215	8,245	667	8,911	499	569
Dry Season Average	**53.6**	**6,394**	**7,054**	**785**	**7,811**	**504**	**500**
Dry Season Trend (n=15)	**No**	**Yes**	**Yes**	**No**	**Yes**	**No**	**No**
Wet Season Average	**65.2**	**7,327**	**8,137**	**1,109**	**9,234**	**582**	**554**
Average Annual	**60.4**	**6,938**	**7,686**	**974**	**8,641**	**549**	**531**

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 ADWF flow of about 49 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 table in the subsequent pages:

- Based on the average monthly values table below, there appears to be a downward dry season trend for flows and NOx loads. This decrease in flows is attributed to a combination of recycled water and water conservation.
- There appears to be an upward dry season trend for ammonia loads.
- The July 2012 (i.e., first nutrient sampling event) has the largest dry season loads for NOx, TN, ortho-P, and TP.
- Wet season loads are greater and more variable than the dry season loads.
- The effluent TN concentrations are relatively strong with occasional exceedance of 60 mg N/L.
- Nitrogen and phosphorus loads increase with flow during wet weather events.
- Ammonia is the majority of the nitrogen species discharged, regardless of season since EBMUD does not nitrify.
- Ortho-P is the predominant phosphorus species.
- The phosphorus loads appear to be random with occasional spikes during the winter months.
- The wide ranging phosphorus loads are likely due to a combination of 1) accepting nutrient containing organic wastes for renewable energy production and 2) biological and/or chemical P removal.

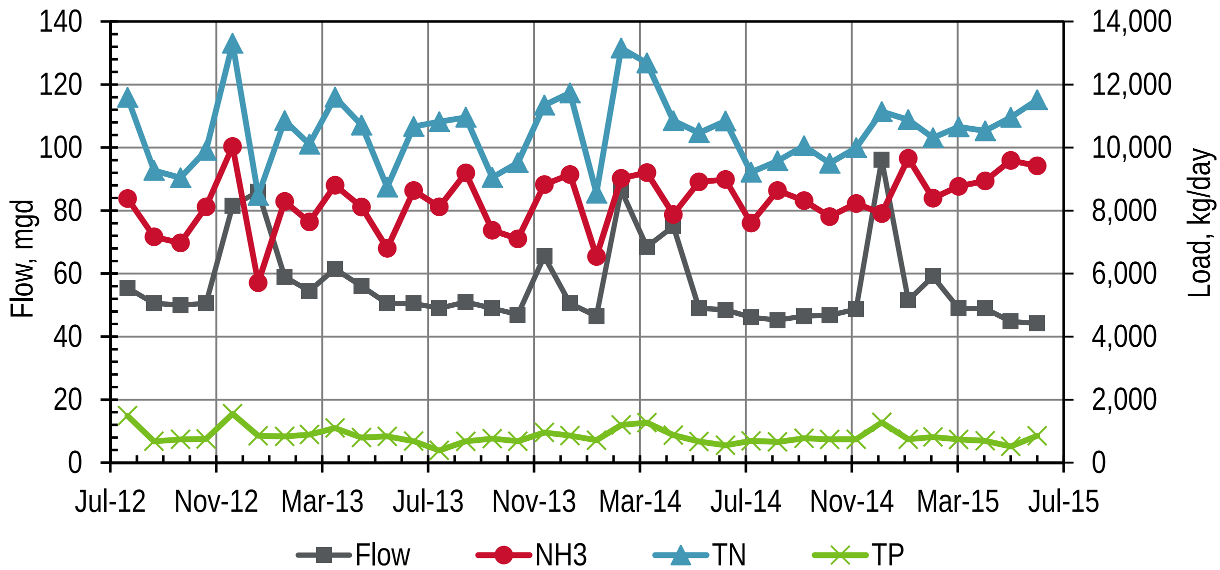

Figure 9-1. EBMUD Monthly Flows and Loads

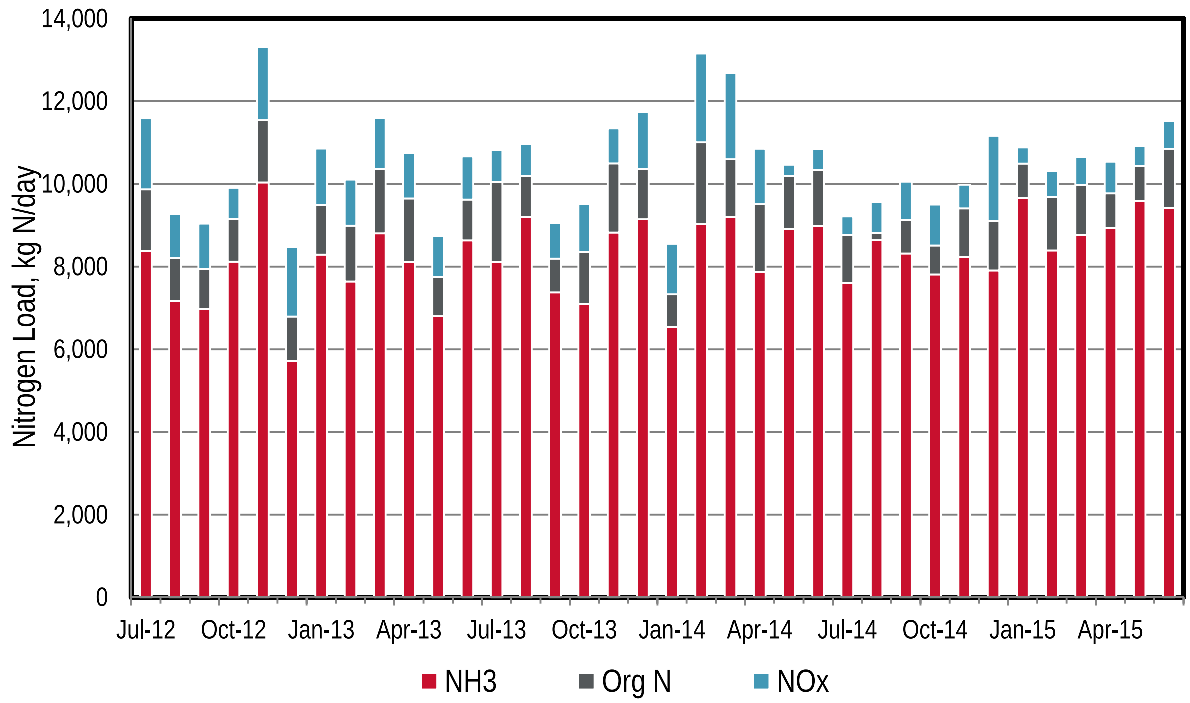

Figure 9-2. EBMUD Monthly Nitrogen Loads

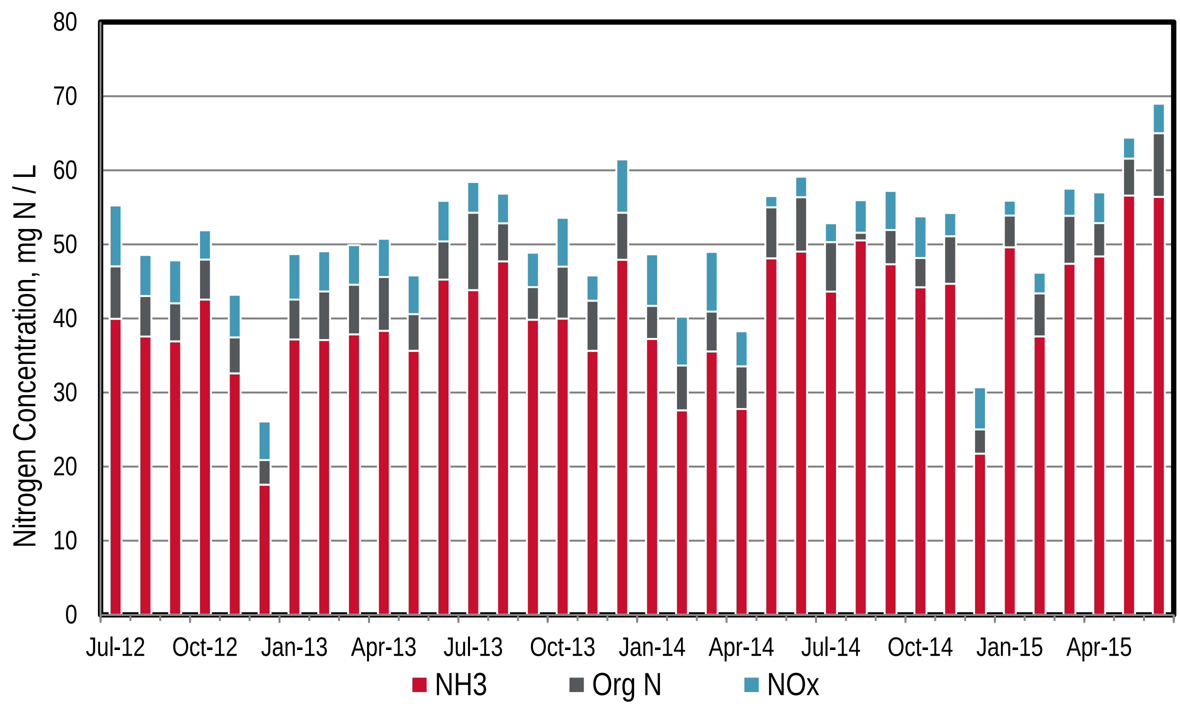

Figure 9-3. EBMUD Monthly Nitrogen Concentrations

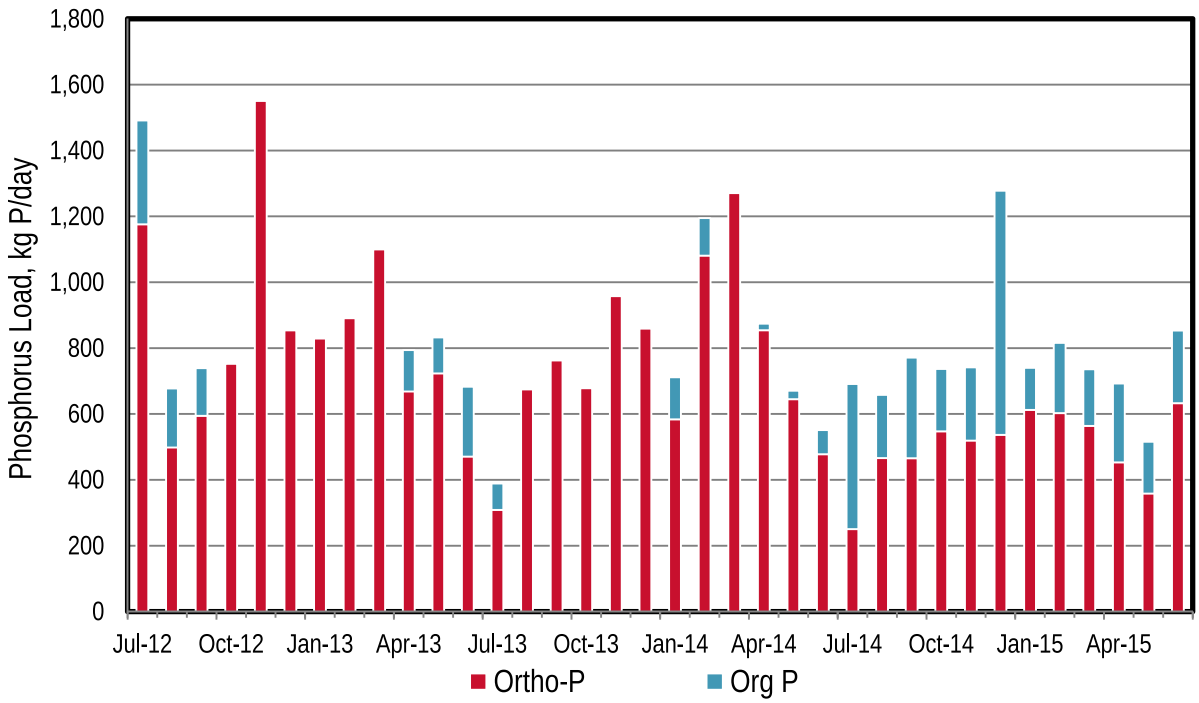

Figure 9-4. EBMUD Monthly Phosphorus Loads

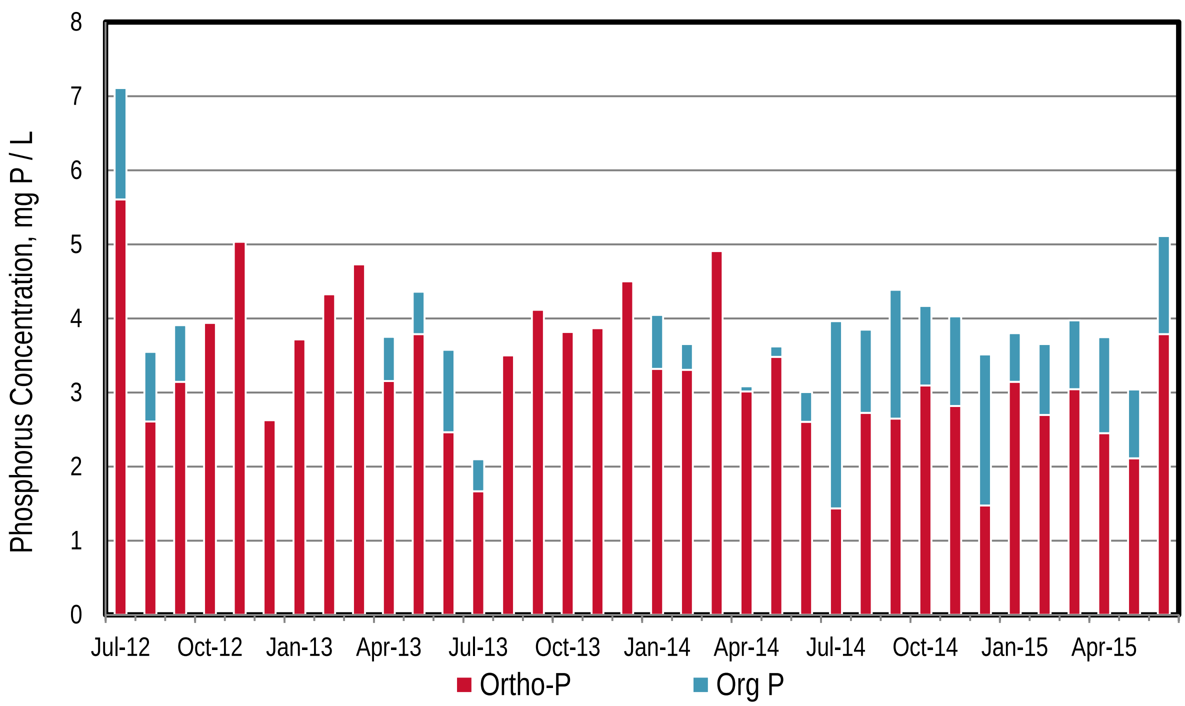

Figure 9-5. EBMUD Monthly Phosphorus Concentrations

Table 9-1. EBMUD Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	56	8,383	9,870	1,719	11,589	1,176	1,491
Aug 2012	51	7,168	8,210	1,060	9,270	498	677
Sep 2012	50	6,975	7,946	1,095	9,041	594	739
Oct 2012	51	8,121	9,151	756	9,907	903	752
Nov 2012	82	10,037	11,540	1,767	13,307	1,631	1,551
Dec 2012	86	5,711	6,791	1,690	8,480	1,435	854
Jan 2013	59	8,291	9,487	1,367	10,855	908	829
Feb 2013	55	7,641	8,991	1,115	10,107	1,048	891
Mar 2013	62	8,803	10,359	1,238	11,597	1,277	1,100
Apr 2013	56	8,115	9,649	1,094	10,711	668	794
May 2013	51	6,801	7,746	996	8,743	723	832
Jun 2013	51	8,635	9,621	1,045	10,666	471	683
Jul 2013	49	8,116	10,052	767	10,819	309	389
Aug 2013	51	9,196	10,188	771	10,960	695	675
Sep 2013	49	7,375	8,194	858	9,051	878	762
Oct 2013	47	7,103	8,351	1,167	9,518	679	681
Nov 2013	66	8,824	10,497	847	11,344	1,075	958
Dec 2013	51	9,146	10,359	1,375	11,734	931	859
Jan 2014	47	6,545	7,332	1,220	8,552	584	711
Feb 2014	87	9,024	11,005	2,150	13,155	1,081	1,195
Mar 2014	69	9,205	10,595	2,090	12,685	1,458	1,271
Apr 2014	75	7,876	9,510	1,341	10,850	854	874
May 2014	49	8,910	10,190	277	10,467	645	671
Jun 2014	49	8,986	10,333	509	10,842	477	551
Jul 2014	46	7,605	8,771	444	9,215	251	691
Aug 2014	45	8,639	8,818	749	9,575	466	658
Sep 2014	47	8,316	9,128	927	10,055	466	771
Oct 2014	47	7,810	8,511	992	9,502	547	737
Nov 2014	49	8,227	9,408	574	9,992	519	742
Dec 2014	96	7,907	9,104	2,061	11,140	537	1,278
Jan 2015	52	9,659	10,491	392	10,883	613	740
Feb 2015	59	8,392	9,687	623	10,310	603	816
Mar 2015	49	8,770	9,968	679	10,656	564	736
Apr 2015	49	8,941	9,774	765	10,530	453	693
May 2015	45	9,591	10,437	479	10,956	358	516
Jun 2015	44	9,419	10,853	664	11,516	633	854
Dry Season Average	**49**	**8,274**	**9,357**	**824**	**10,184**	**576**	**731**
Dry Season Trend (n=15)	**Yes**	**Yes**	**No**	**Yes**	**No**	**No**	**No**
Wet Season Average	**61**	**8,293**	**9,550**	**1,205**	**10,753**	**875**	**908**
Average Annual	**56**	**8,285**	**9,470**	**1,046**	**10,516**	**750**	**834**

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 and a peak wet weather capacity of 52.9 mgd. The current ADWF flow is about 10 mgd. The plant nitrifies using a combination of trickling filters and conventional activated sludge.

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

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for flow, NOx, TN and total phosphorus loads during the dry season.
- Nitrogen loads typically increase with flow during wet weather events, whereas the phosphorus loads are relatively flat year round.
- Nitrogen wet season loads are typically greater and more variable than the dry season loads (with the exception of a TN spike in September 2013).
- NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant reliably nitrifies year round.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations are wide ranging from about 2 to 6 mg P/L. Typical effluent TP concentrations are 4 to 6 mg P/L

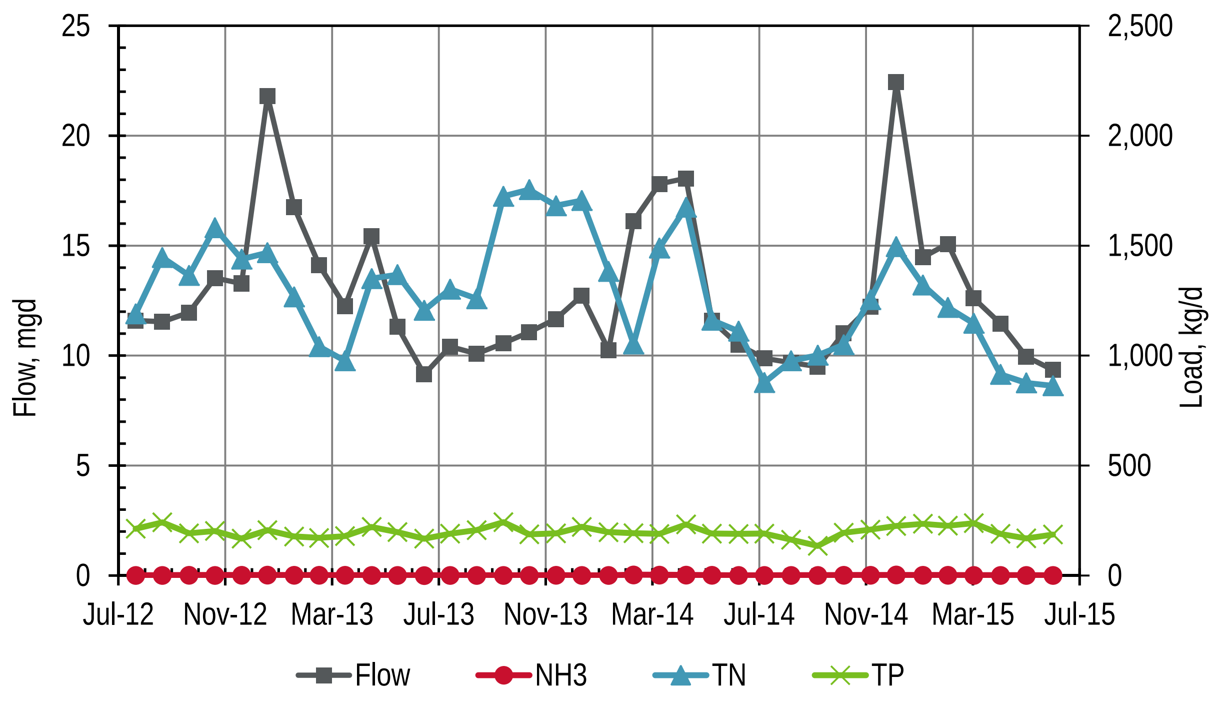

Figure 10-1. Fairfield-Suisun Monthly Flows and Loads

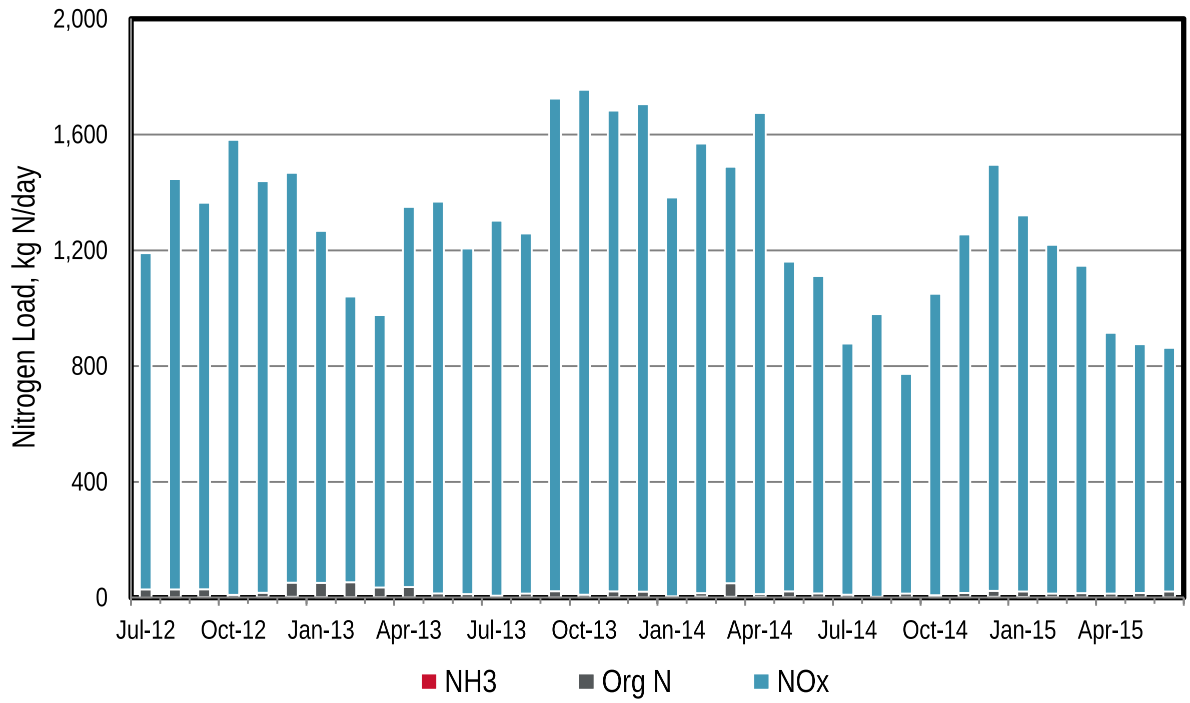

Figure 10-2. Fairfield-Suisun Monthly Nitrogen Loads

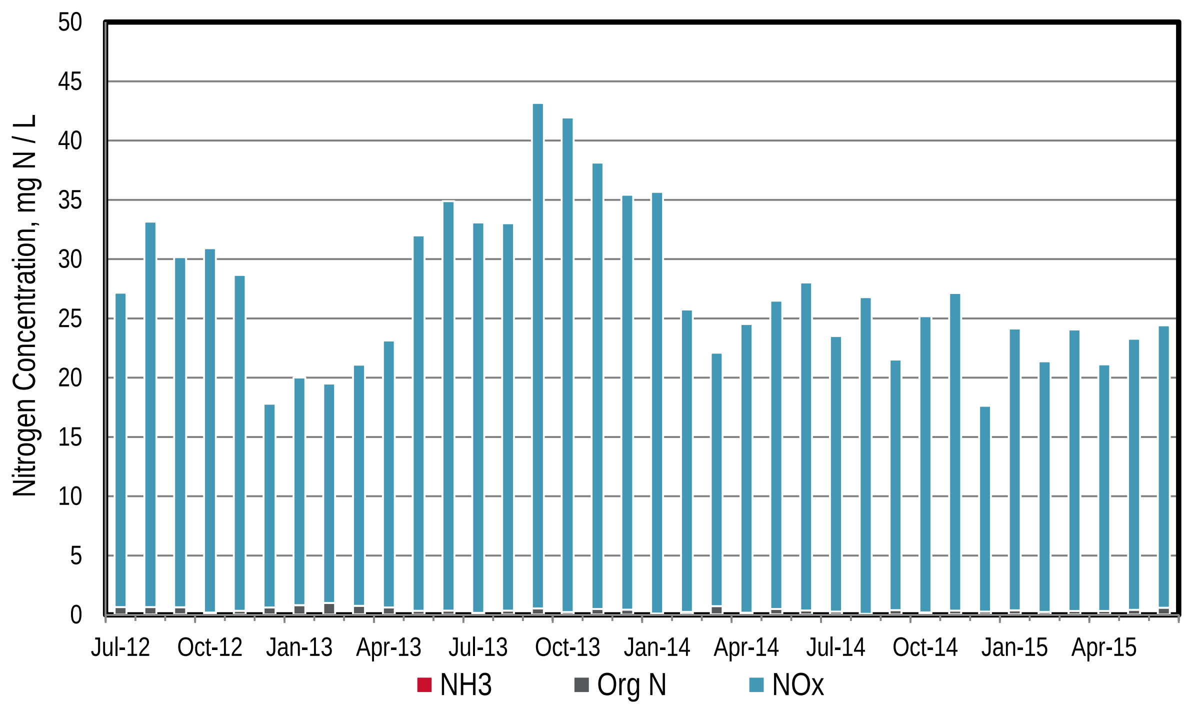

Figure 10-3. Fairfield-Suisun Monthly Nitrogen Concentrations

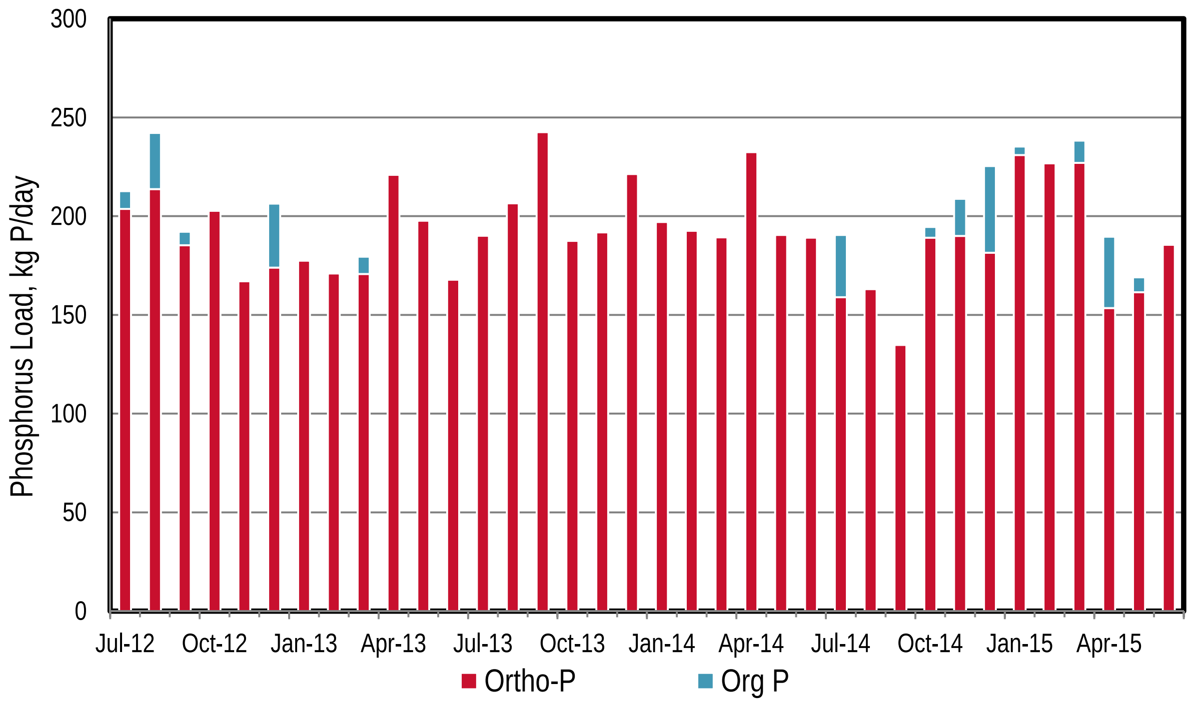

Figure 10-4. Fairfield-Suisun Monthly Phosphorus Loads

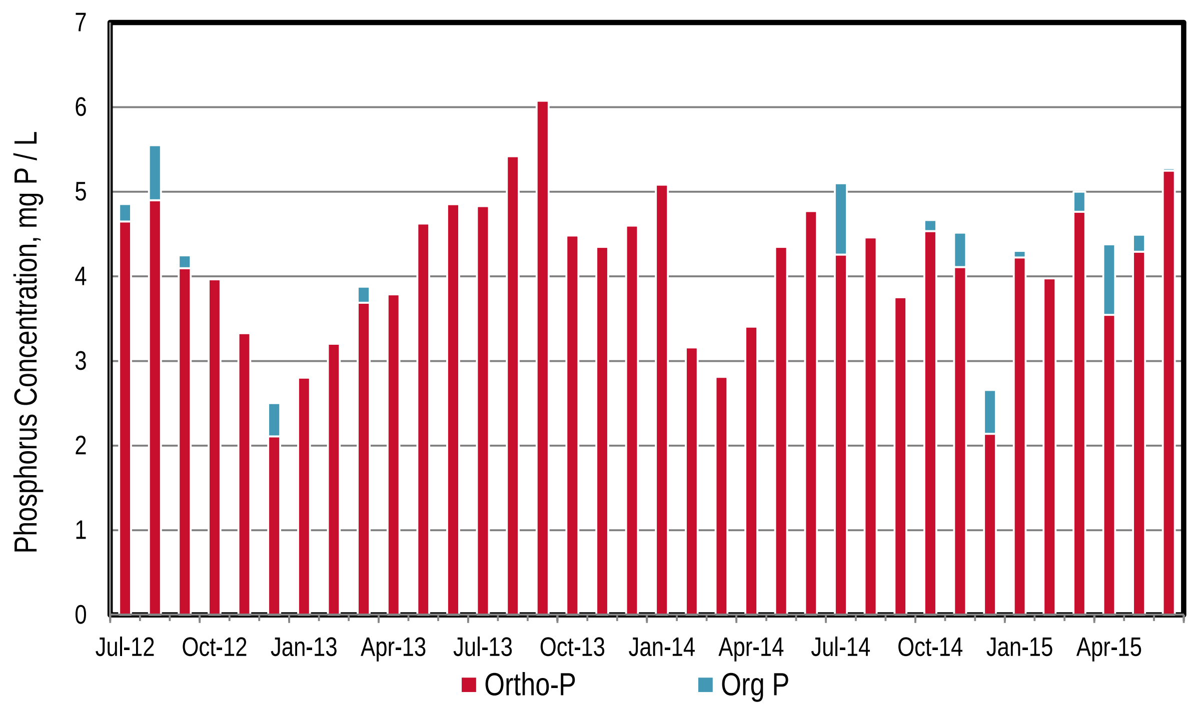

Figure 10-5. Fairfield-Suisun Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 10-1. Fairfield-Suisun Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	12	1	29	1,162	1,190	204	213
Aug 2012	12	1	28	1,418	1,447	214	242
Sep 2012	12	2	29	1,336	1,365	185	192
Oct 2012	14	1	10	1,572	1,582	213	203
Nov 2012	13	2	17	1,422	1,439	167	168
Dec 2012	22	3	51	1,417	1,468	174	206
Jan 2013	17	2	51	1,216	1,267	179	177
Feb 2013	14	2	53	987	1,041	192	171
Mar 2013	12	2	35	941	977	171	179
Apr 2013	15	1	36	1,314	1,350	356	221
May 2013	11	1	15	1,354	1,368	315	198
Jun 2013	9	1	12	1,194	1,206	313	168
Jul 2013	10	1	7	1,296	1,302	349	190
Aug 2013	10	1	14	1,245	1,259	340	206
Sep 2013	11	1	22	1,703	1,724	366	243
Oct 2013	11	1	10	1,745	1,755	355	187
Nov 2013	12	1	22	1,661	1,682	309	192
Dec 2013	13	1	21	1,684	1,705	318	221
Jan 2014	10	1	5	1,378	1,383	323	197
Feb 2014	16	4	15	1,554	1,053	292	193
Mar 2014	18	3	50	1,439	1,489	307	189
Apr 2014	18	3	12	1,662	1,675	275	232
May 2014	12	2	21	1,139	1,161	292	191
Jun 2014	10	1	14	1,097	1,111	325	189
Jul 2014	10	1	10	868	878	159	190
Aug 2014	10	1	3	977	977	168	163
Sep 2014	10	1	14	759	1,002	142	135
Oct 2014	11	2	8	1,041	1,050	189	195
Nov 2014	12	2	16	1,239	1,255	190	209
Dec 2014	22	3	24	1,472	1,496	182	225
Jan 2015	14	2	21	1,300	1,321	231	235
Feb 2015	15	2	14	1,205	1,219	235	227
Mar 2015	13	1	16	1,131	1,147	227	238
Apr 2015	11	1	14	901	915	154	190
May 2015	10	1	16	860	876	162	169
Jun 2015	9	1	21	842	863	186	187
Dry Season Average	**10**	**1**	**17**	**1,150**	**1,182**	**248**	**192**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**Yes**	**Yes**	**No**	**Yes**
Wet Season Average	**14**	**2**	**24**	**1,347**	**1,346**	**240**	**203**
Average Annual	**13**	**2**	**21**	**1,265**	**1,278**	**243**	**198**

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 8.0 mgd. The plant performs nitrification using a series of trickling filters. Discharge to Miller Creek is prohibited June 1 through October 31.

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

- Based on the average monthly values table, there are no emerging dry season trends as Las Gallinas does not typically discharge during the dry season.
- Wet season trends analyzed (data not shown) and there are no emerging trends.
- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- 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.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 1.5 to 5.3 mg P/L, This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L.

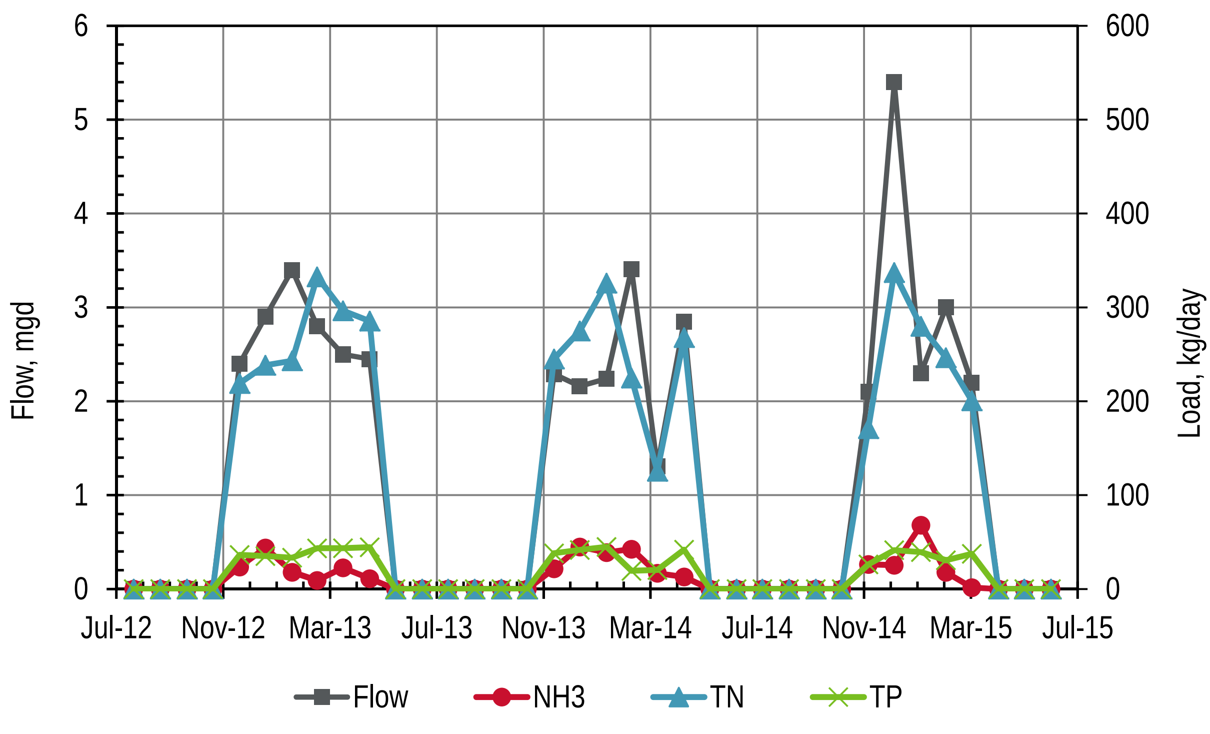

Figure 11-1. Las Gallinas Monthly Flows and Loads

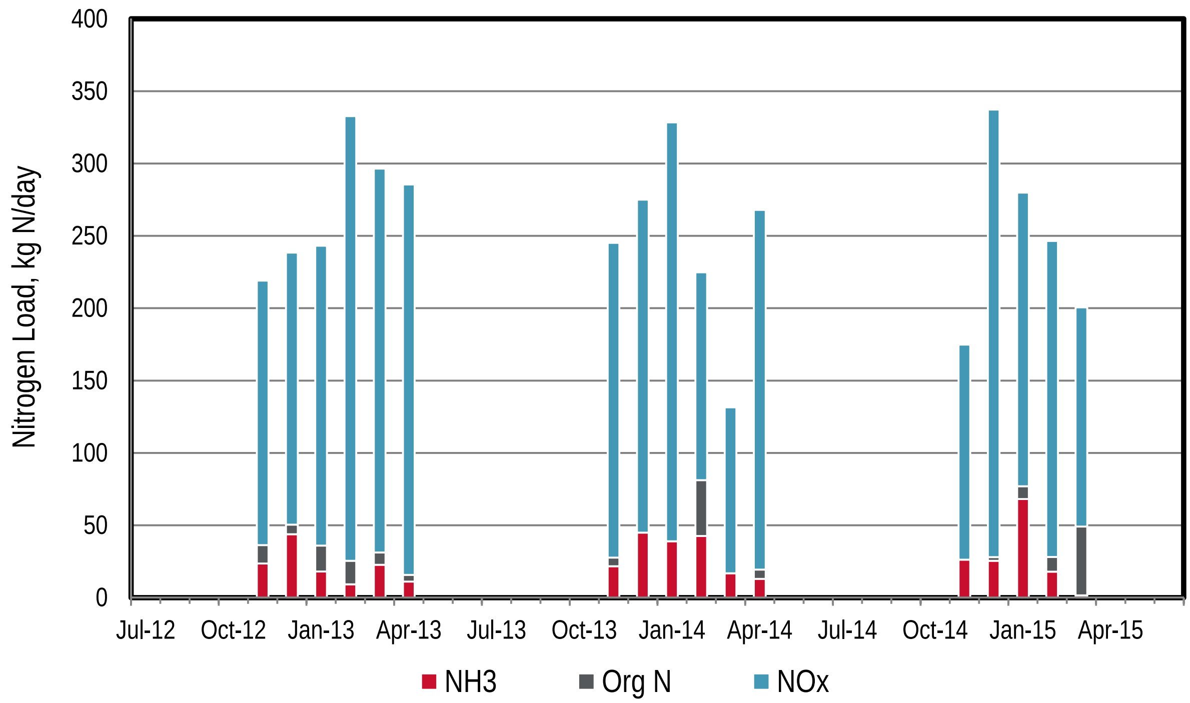

Figure 11-2. Las Gallinas Monthly Nitrogen Loads

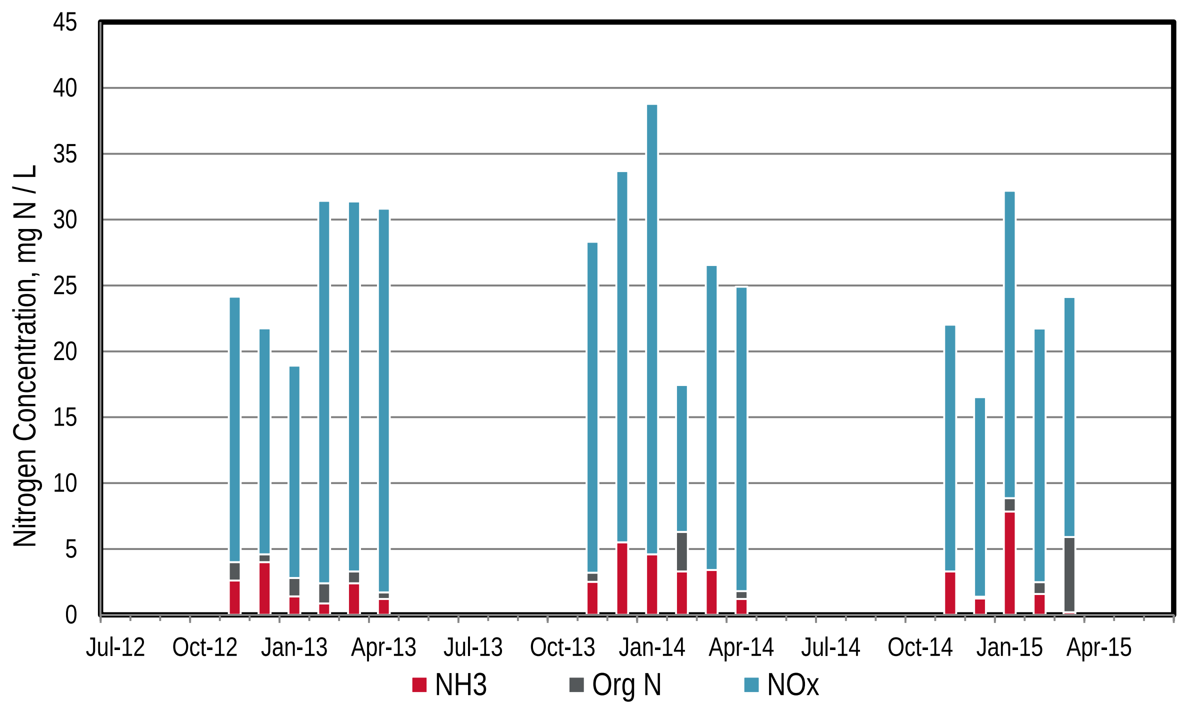

Figure 11-3. Las Gallinas Monthly Nitrogen Concentrations

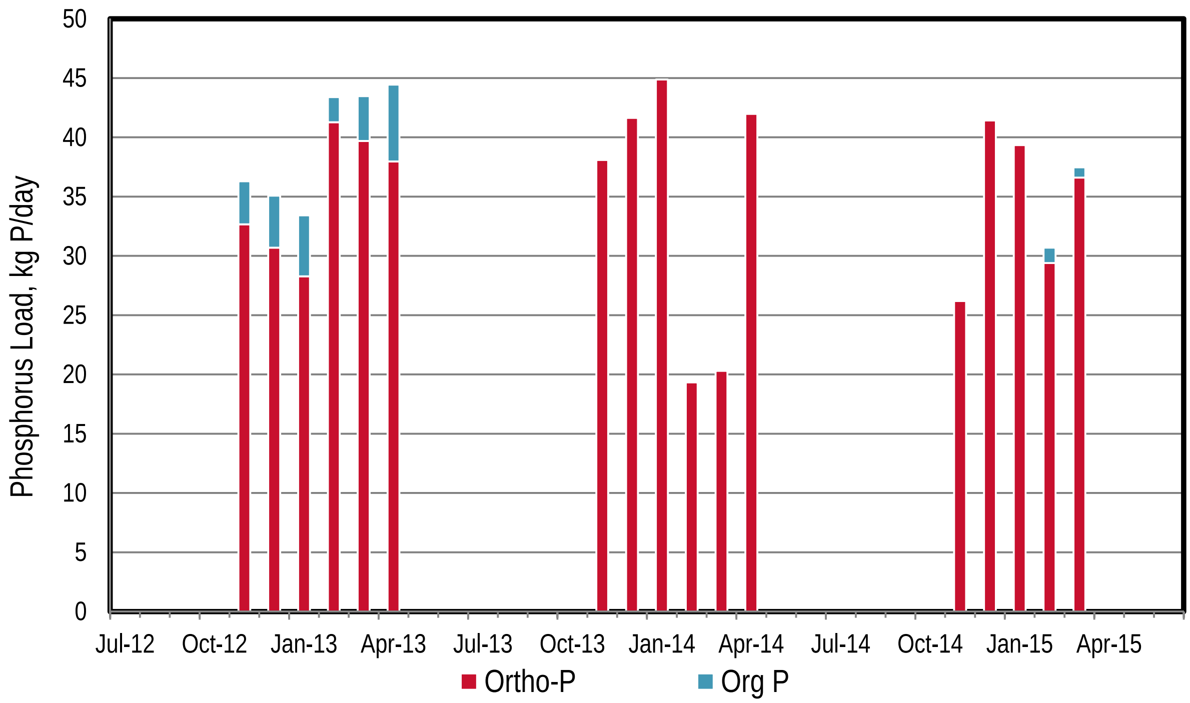

Figure 11-4. Las Gallinas Monthly Phosphorus Loads

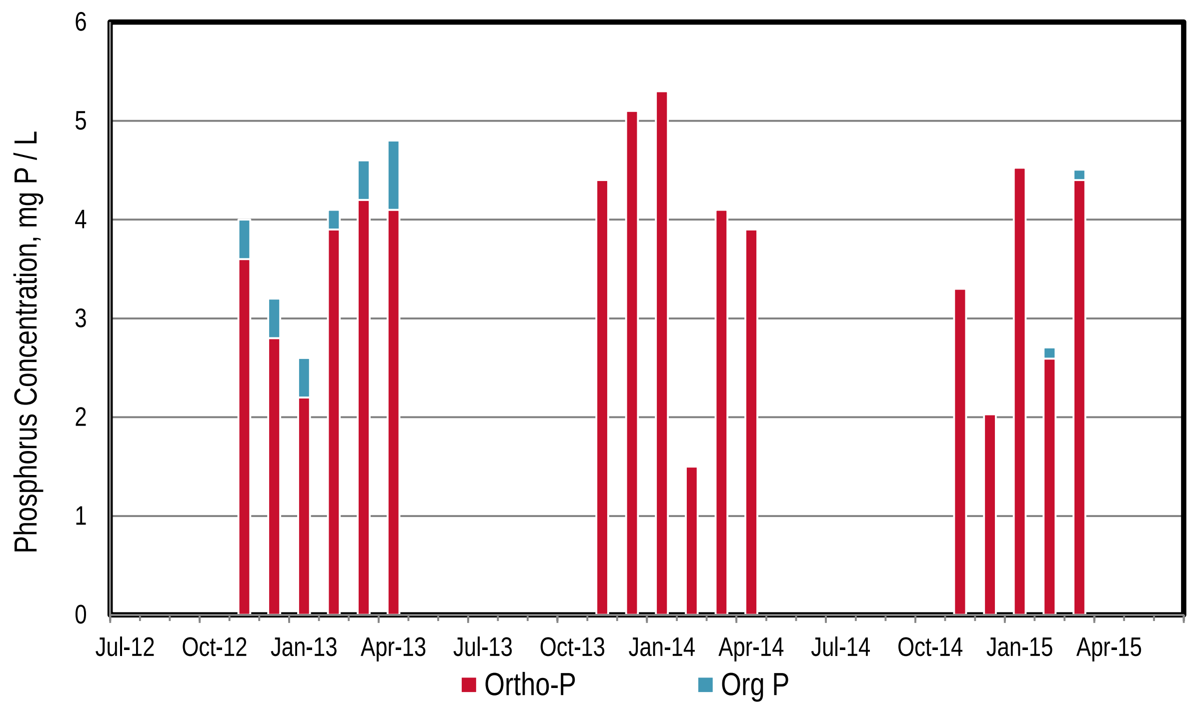

Figure 11-5. Las Gallinas Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 11-1. Las Gallinas Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.0	0	0	0	0	0	0
Aug 2012	0.0	0	0	0	0	0	0
Sep 2012	0.0	0	0	0	0	0	0
Oct 2012	0.0	0	0	0	0	0	0
Nov 2012	2.4	24	36	183	219	33	36
Dec 2012	2.9	44	50	188	238	31	35
Jan 2013	3.4	18	36	207	243	28	33
Feb 2013	2.8	9	25	307	333	41	43
Mar 2013	2.5	23	31	265	296	40	43
Apr 2013	2.5	11	16	270	286	38	44
May 2013	0.0	0	0	0	0	0	0
Jun 2013	0.0	0	0	0	0	0	0
Jul 2013	0.0	0	0	0	0	0	0
Aug 2013	0.0	0	0	0	0	0	0
Sep 2013	0.0	0	0	0	0	0	0
Oct 2013	0.0	0	0	0	0	0	0
Nov 2013	2.3	22	28	217	245	57	38
Dec 2013	2.2	45	45	230	275	52	42
Jan 2014	2.2	39	36	289	326	71	45
Feb 2014	3.4	43	81	144	225	27	19
Mar 2014	1.3	17	11	115	126	49	20
Apr 2014	2.8	13	19	249	268	62	42
May 2014	0.0	0	0	0	0	0	0
Jun 2014	0.0	0	0	0	0	0	0
Jul 2014	0.0	0	0	0	0	0	0
Aug 2014	0.0	0	0	0	0	0	0
Sep 2014	0.0	0	0	0	0	0	0
Oct 2014	0.0	0	0	0	0	0	0
Nov 2014	2.1	26	22	149	171	26	26
Dec 2014	5.4	25	28	309	337	43	41
Jan 2015	2.3	68	77	203	280	40	39
Feb 2015	3.0	18	28	218	247	29	31
Mar 2015	2.2	2	49	152	201	37	37
Apr 2015	0.0	0	0	0	0	0	0
May 2015	0.0	0	0	0	0	0	0
Jun 2015	0.0	0	0	0	0	0	0
Dry Season Average	**0.0**	**0**	**0**	**0**	**0**	**0**	**0**
Dry Season Trend (n=15)	**No discharge**	**No discharge**	**No discharge**	**No discharge**	**No discharge**	**No discharge**	**No discharge**
Wet Season Average	**2.2**	**21**	**30**	**176**	**205**	**33**	**29**
Average Annual	**1.3**	**12**	**17**	**103**	**120**	**20**	**17**

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 current plant flows are 1.3 mgd ADWF. 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:

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for phosphorus loads.
- Both nitrogen and phosphorus loads 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.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 1.0 to 4.5 mg P/L, This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is through to be the anaerobic selector in the activated sludge process.

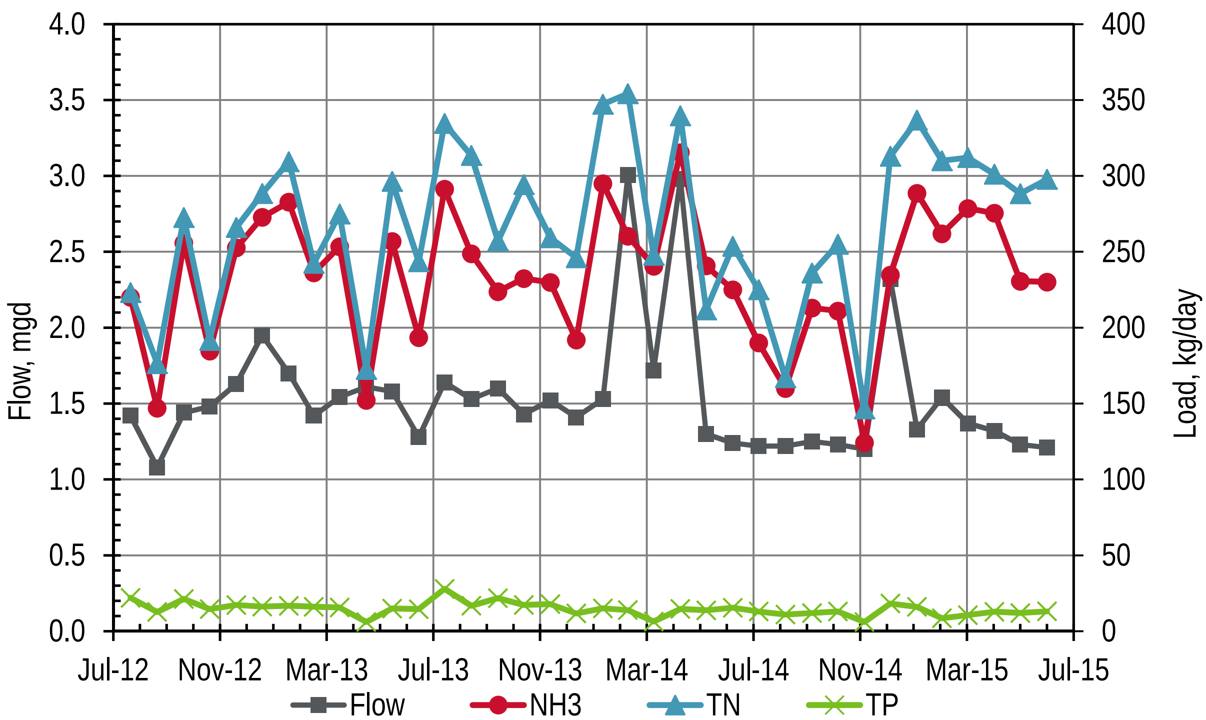

Figure 12-1. Millbrae Monthly Flows and Loads

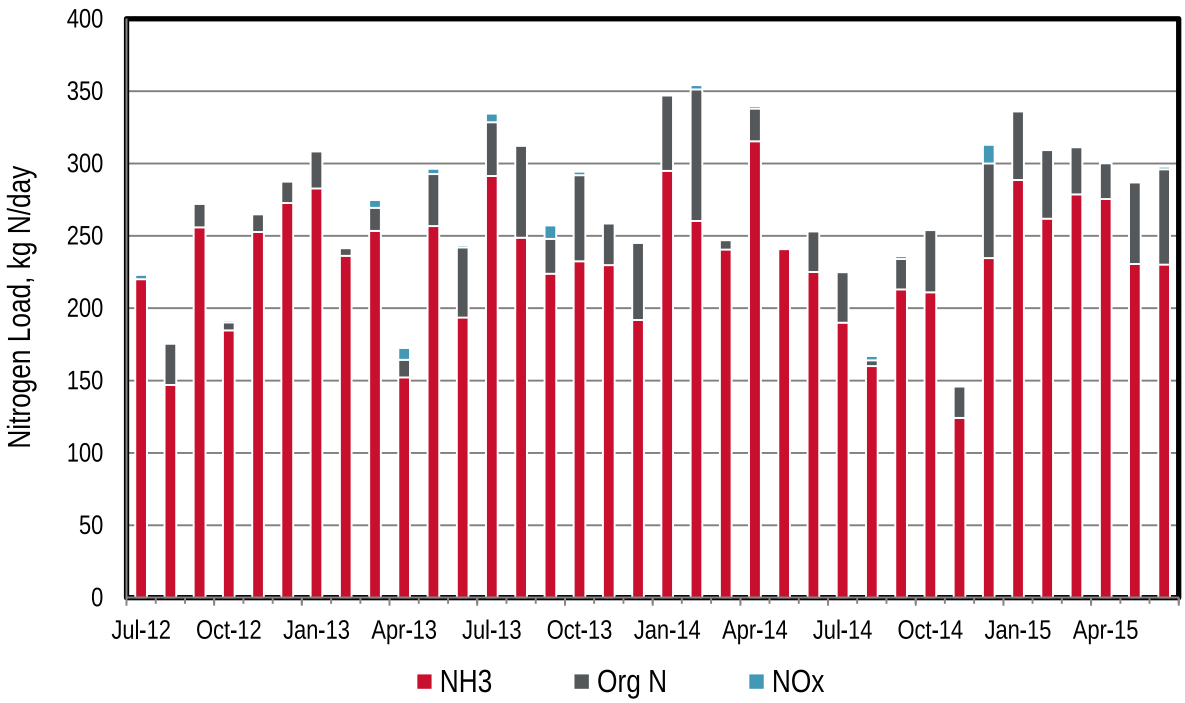

Figure 12-2. Millbrae Monthly Nitrogen Loads

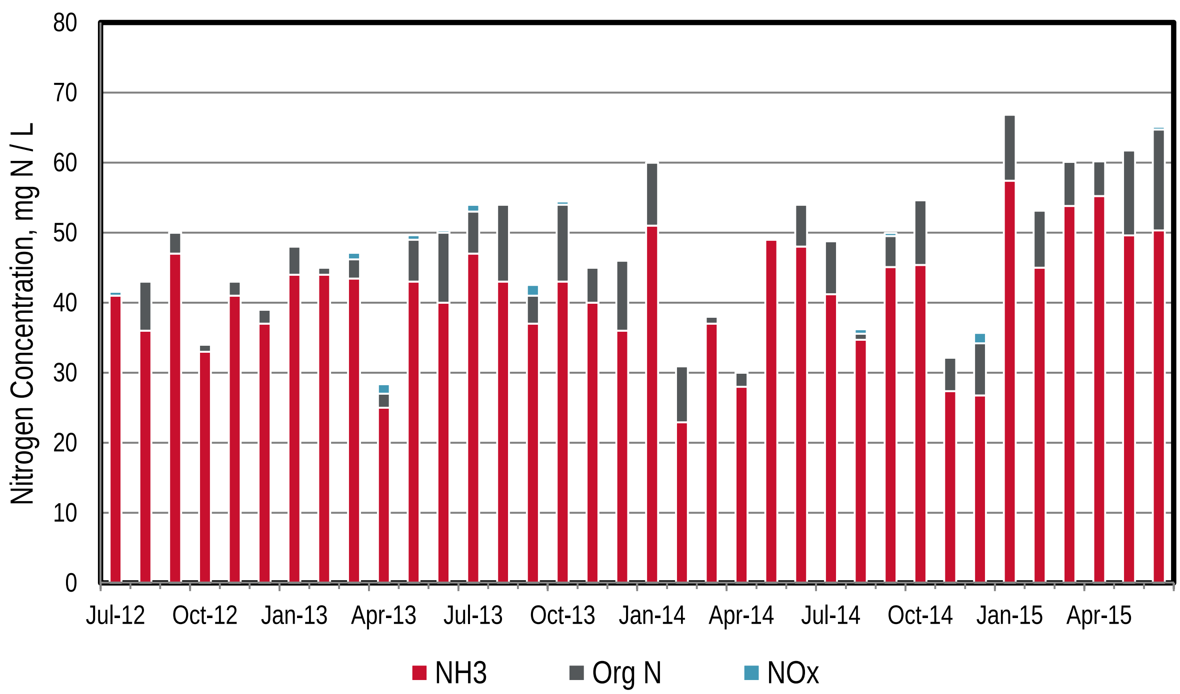

Figure 12-3. Millbrae Monthly Nitrogen Concentrations

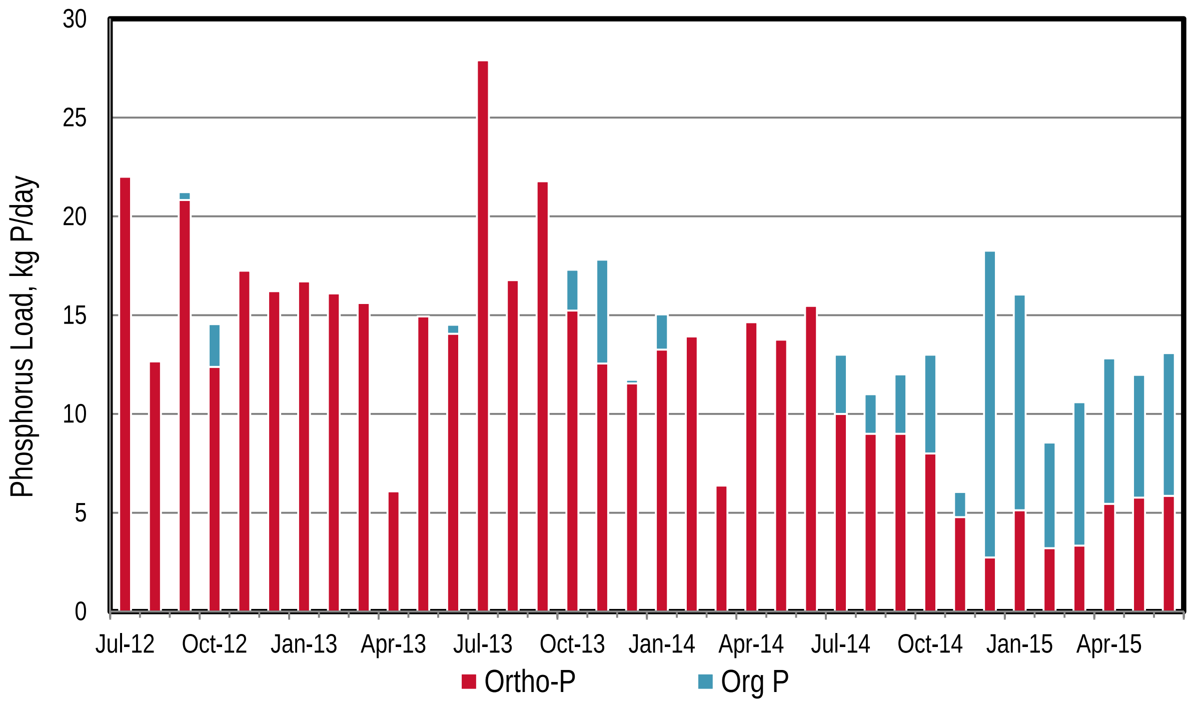

Figure 12-4. Millbrae Monthly Phosphorus Loads

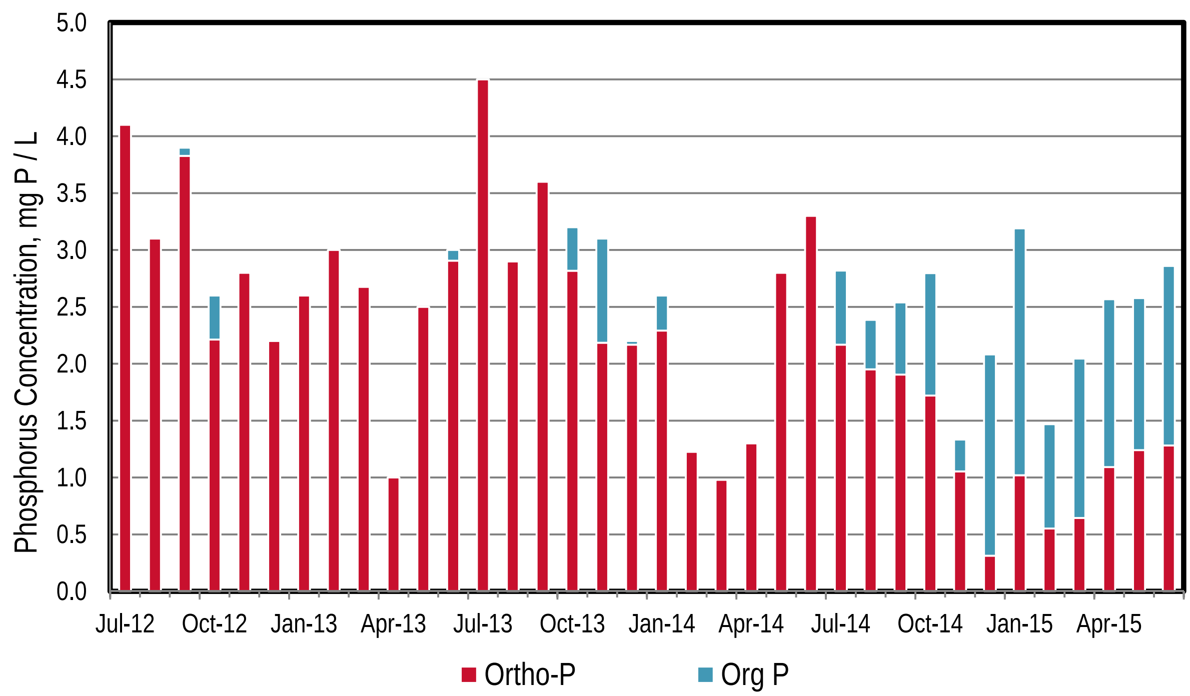

Figure 12-5. Millbrae Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 12-1. Millbrae Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	1.4	220	220	3	223	23	22
Aug 2012	1.1	147	176	1	176	38	13
Sep 2012	1.4	256	272	0	273	21	21
Oct 2012	1.5	185	190	1	192	12	15
Nov 2012	1.6	253	265	1	266	39	17
Dec 2012	2.0	273	287	1	288	24	16
Jan 2013	1.7	283	308	1	309	17	17
Feb 2013	1.4	236	242	1	242	20	16
Mar 2013	1.5	253	269	5	275	22	16
Apr 2013	1.6	152	164	8	173	8	6
May 2013	1.6	257	293	4	296	20	15
Jun 2013	1.3	194	242	2	243	14	15
Jul 2013	1.6	291	329	6	335	32	28
Aug 2013	1.5	249	312	1	313	18	17
Sep 2013	1.6	224	248	9	257	22	22
Oct 2013	1.4	232	292	2	294	15	17
Nov 2013	1.5	230	259	1	259	13	18
Dec 2013	1.4	192	245	1	246	12	12
Jan 2014	1.5	295	347	0	347	13	15
Feb 2014	3.0	260	351	3	354	17	14
Mar 2014	1.7	241	247	1	248	8	6
Apr 2014	3.0	315	338	2	340	36	15
May 2014	1.3	241	211	0	212	18	14
Jun 2014	1.2	225	253	1	254	16	15
Jul 2014	1.2	190	225	0	225	10	13
Aug 2014	1.2	160	164	3	167	9	11
Sep 2014	1.3	213	234	2	236	9	12
Oct 2014	1.2	211	254	1	255	8	13
Nov 2014	1.2	124	146	1	146	5	6
Dec 2014	2.3	235	300	13	313	3	18
Jan 2015	1.3	289	336	1	337	5	16
Feb 2015	1.5	262	309	1	310	3	9
Mar 2015	1.4	279	311	1	312	3	11
Apr 2015	1.3	276	300	1	301	5	13
May 2015	1.2	231	287	1	288	6	12
Jun 2015	1.2	230	296	2	298	6	13
Dry Season Average	**1.3**	**222**	**251**	**2**	**253**	**17**	**16**
Dry Season Trend (n=15)	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**
Wet Season Average	**1.7**	**242**	**274**	**2**	**277**	**14**	**14**
Average Annual	**1.5**	**233**	**265**	**2**	**267**	**15**	**15**

13 Mt. View Sanitary District

Mt. View 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 capacity of 8.5 mgd. The current flow is 1.2 mgd ADWF. 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:

- Based on the average monthly values table below, there do not appear to be any emerging dry season trends.
- Both nitrogen and phosphorus loads 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.
- Phosphorus loads do not show a seasonal trend.
- Ortho-P values are occasionally greater than TP values. For such instances, ortho-P values were set equal to TP for the plots.
- Total phosphorus concentrations range from 1.5 to 5.7 mg P/L, which suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L.

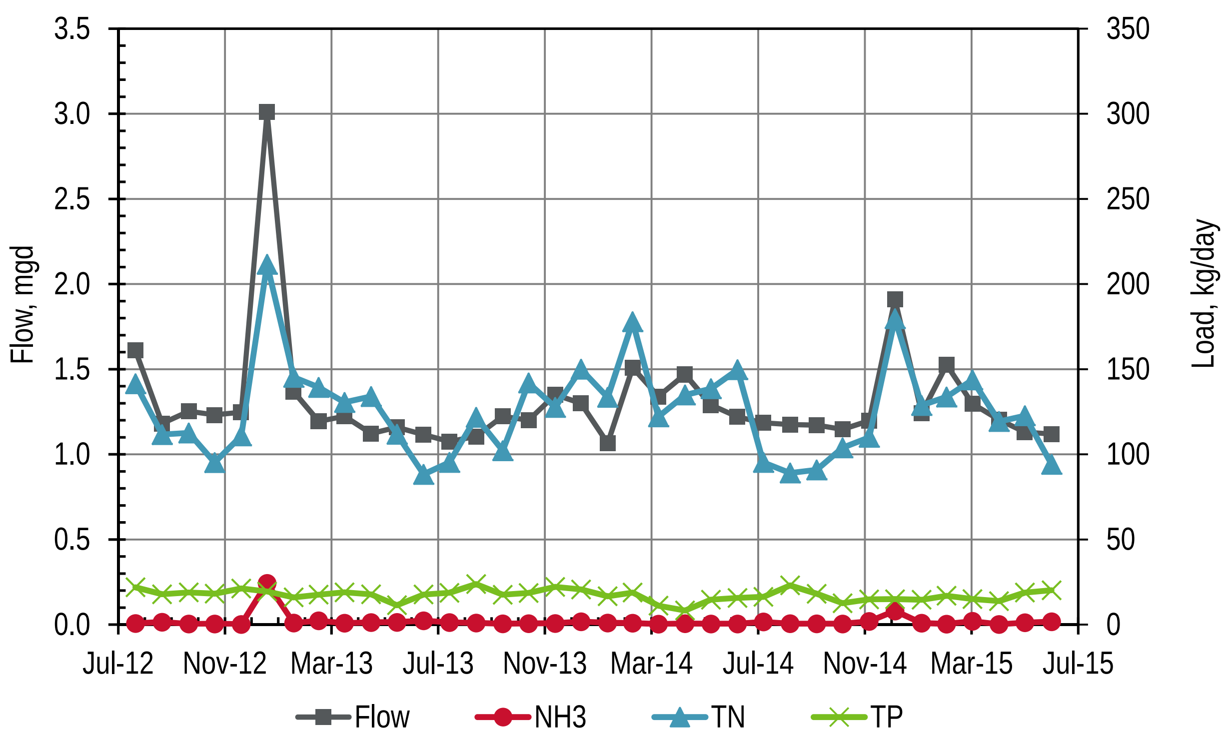

Figure 13-1. Mt. View Monthly Flows and Loads

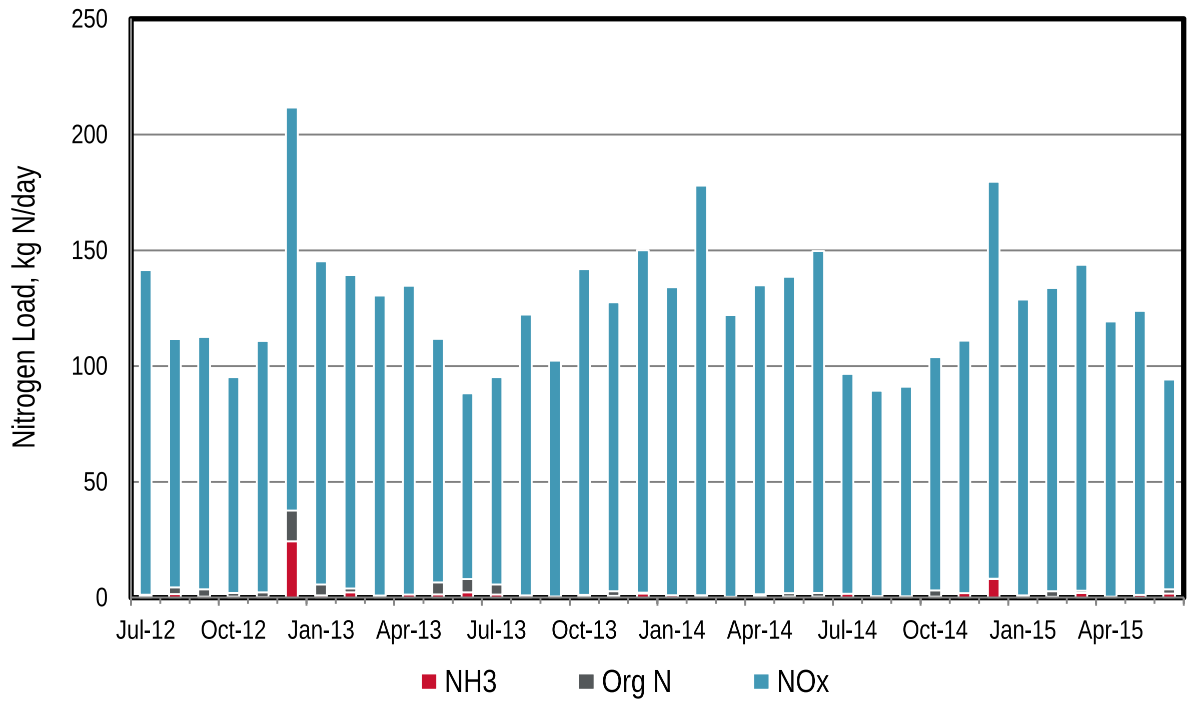

Figure 13-2. Mt. View Monthly Nitrogen Loads

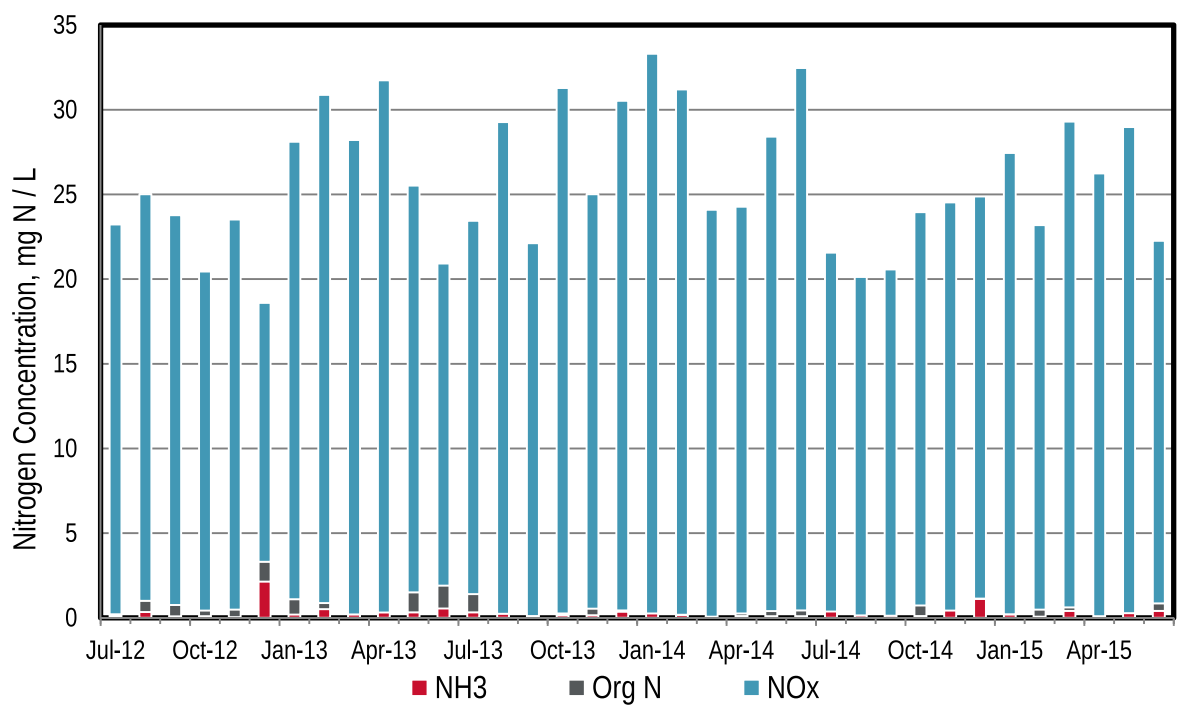

Figure 13-3. Mt. View Monthly Nitrogen Concentrations

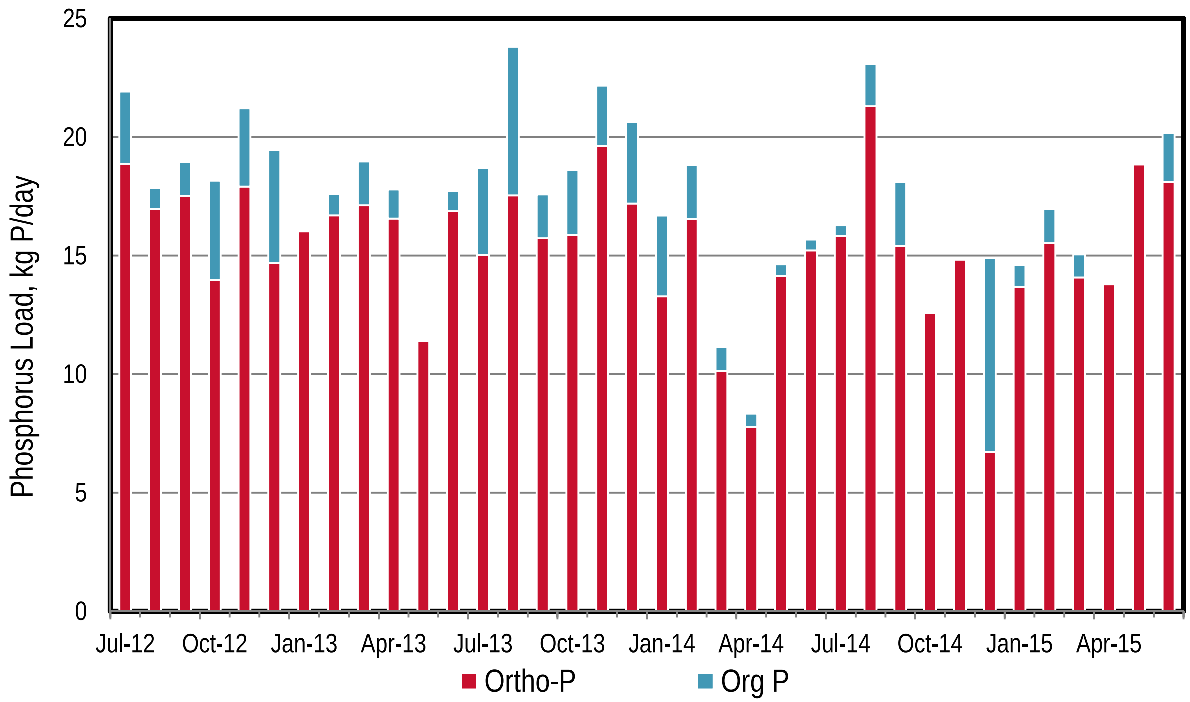

Figure 13-4. Mt. View Monthly Phosphorus Loads

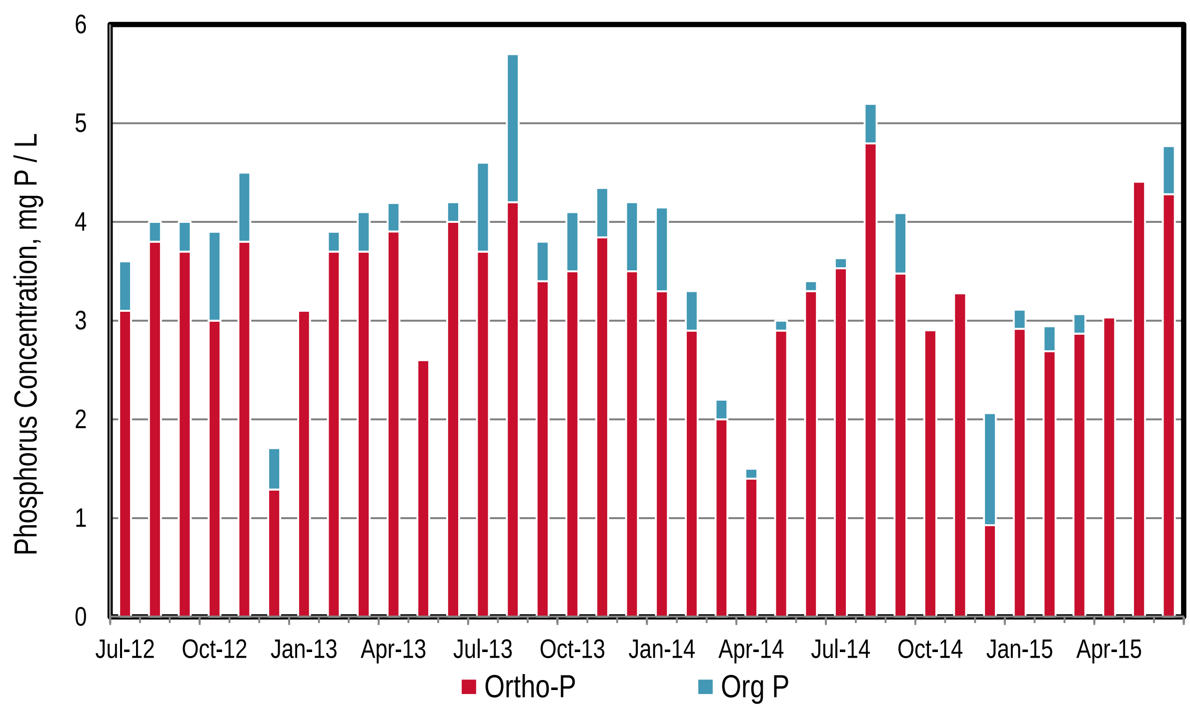

Figure 13-5. Mt. View Monthly Phosphorus Concentrations

Table 13-1. Mt. View Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	1.6	1	1	140	141	19	22
Aug 2012	1.2	2	4	107	112	17	18
Sep 2012	1.3	0	4	109	113	18	19
Oct 2012	1.2	0	2	93	95	14	18
Nov 2012	1.2	0	2	109	111	18	21
Dec 2012	3.0	24	38	174	212	15	19
Jan 2013	1.4	1	6	140	145	19	16
Feb 2013	1.2	2	4	135	139	17	18
Mar 2013	1.2	1	1	130	131	17	19
Apr 2013	1.1	1	1	133	134	17	18
May 2013	1.2	1	7	105	112	12	11
Jun 2013	1.1	2	8	80	88	17	18
Jul 2013	1.1	1	6	90	95	15	19
Aug 2013	1.1	1	1	121	122	18	24
Sep 2013	1.2	1	0	102	102	16	18
Oct 2013	1.2	1	1	141	142	16	19
Nov 2013	1.4	1	3	125	128	20	22
Dec 2013	1.3	2	2	148	150	17	21
Jan 2014	1.1	1	0	133	133	13	17
Feb 2014	1.5	1	1	177	178	17	19
Mar 2014	1.3	0	0	122	122	10	11
Apr 2014	1.5	1	1	133	135	8	8
May 2014	1.3	0	2	137	139	14	15
Jun 2014	1.2	0	2	148	150	15	16
Jul 2014	1.2	2	0	95	95	16	16
Aug 2014	1.2	1	0	89	89	21	23
Sep 2014	1.2	1	0	91	91	15	18
Oct 2014	1.1	0	3	101	104	13	13
Nov 2014	1.2	2	1	109	110	17	15
Dec 2014	1.9	8	8	171	180	7	15
Jan 2015	1.2	1	1	128	129	14	15
Feb 2015	1.5	0	3	131	134	16	17
Mar 2015	1.3	2	3	141	144	14	15
Apr 2015	1.2	0	0	119	119	14	14
May 2015	1.1	1	0	123	123	20	19
Jun 2015	1.1	2	4	91	94	18	20
Dry Season Average	**1.2**	**1**	**3**	**108**	**111**	**17**	**18**
Dry Season Trend (n=15)	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**1.4**	**2**	**4**	**133**	**137**	**15**	**17**
Average Annual	**1.3**	**2**	**3**	**123**	**126**	**16**	**17**

14 Napa Sanitation District

Napa 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 prohibited May 1 through October 31, except with authorization under emergency conditions.

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

- There are no emerging dry season trends as Napa does not discharge during the dry season, except with authorization in emergency.
- Wet season trends analyzed (data not shown) and there are no emerging trends.
- Both 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 colder 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.
- The plant meets Level 2 total nitrogen concentration limits (i.e., 15 mg N/L) developed under the Scoping and Evaluation Plan for all but one month (value of 15.6 mg N/L).
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 0.3 to 1.6 mg P/L, This suggests a portion of P is removed as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is most likely from ferric chloride addition.

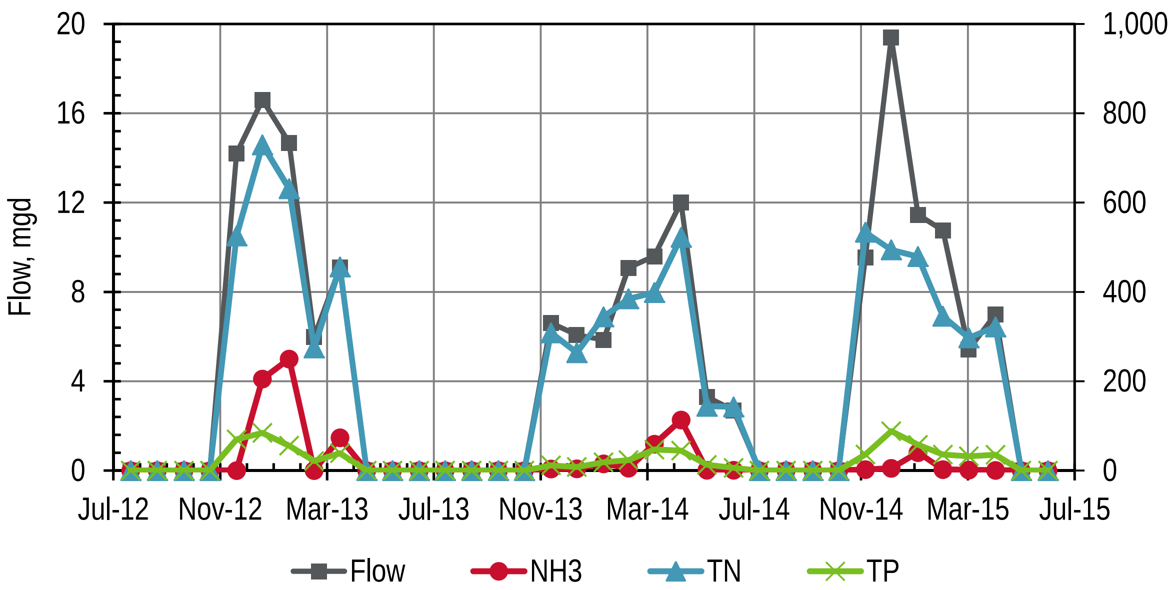

Figure 14-1. Napa Monthly Flows and Loads

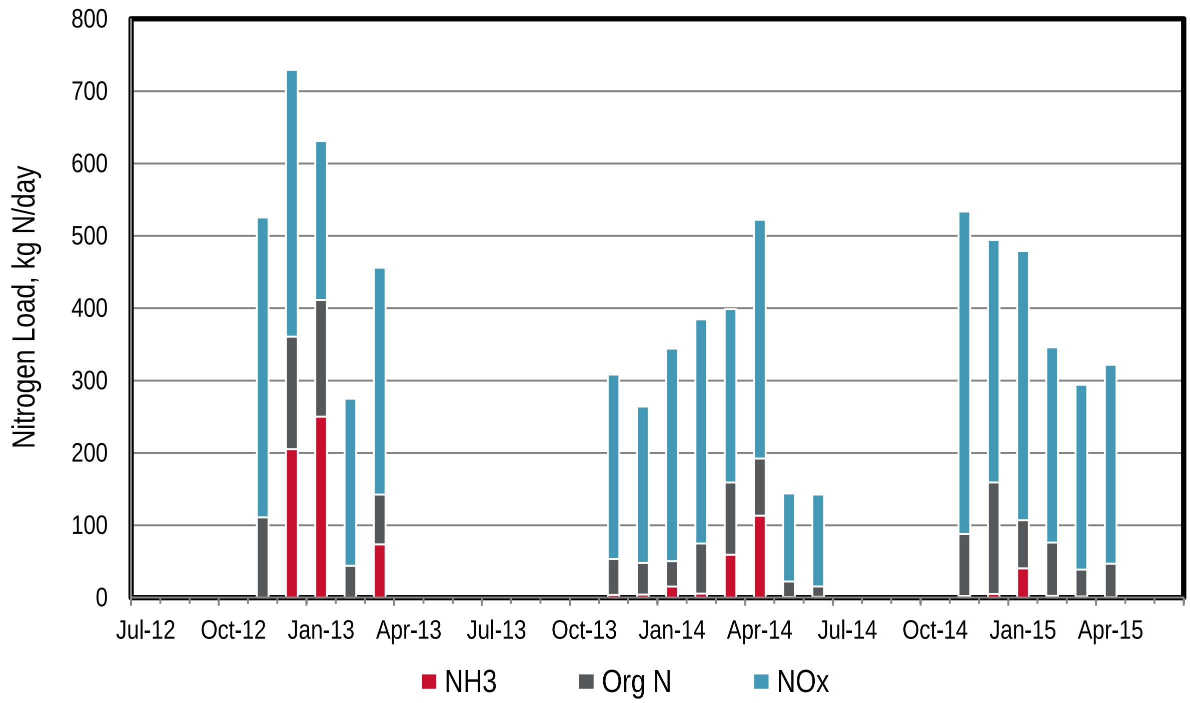

Figure 14-2. Napa Monthly Nitrogen Loads

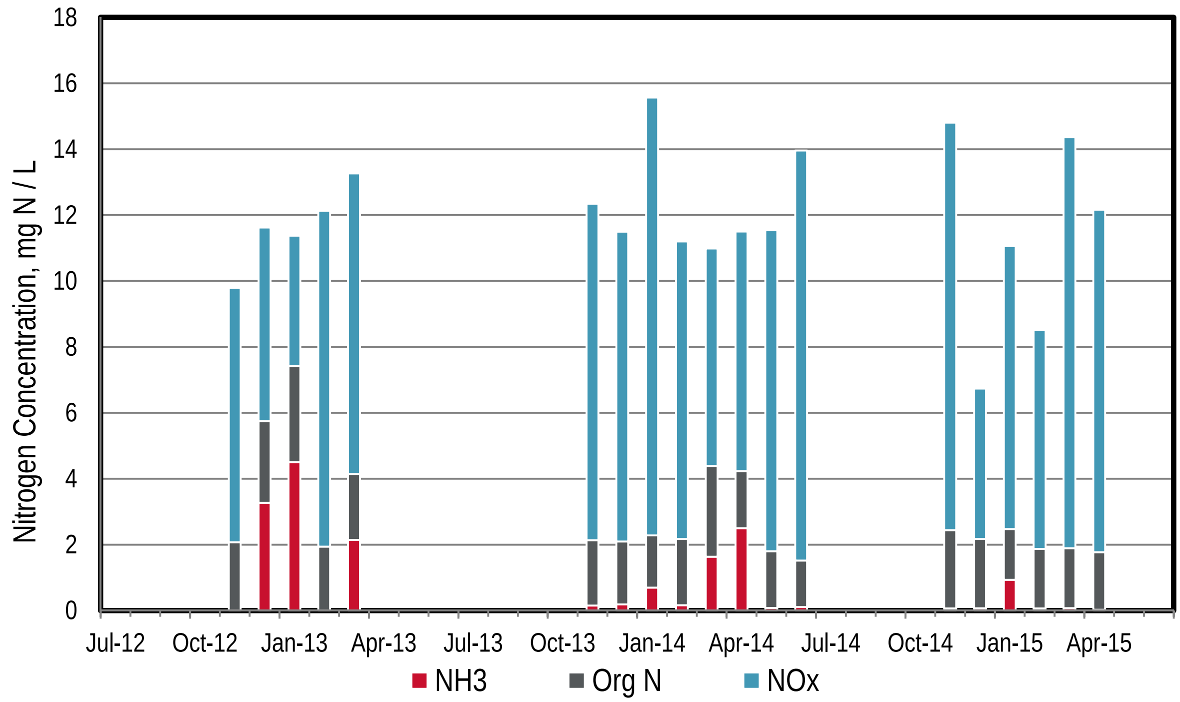

Figure 14-3. Napa Monthly Nitrogen Concentrations

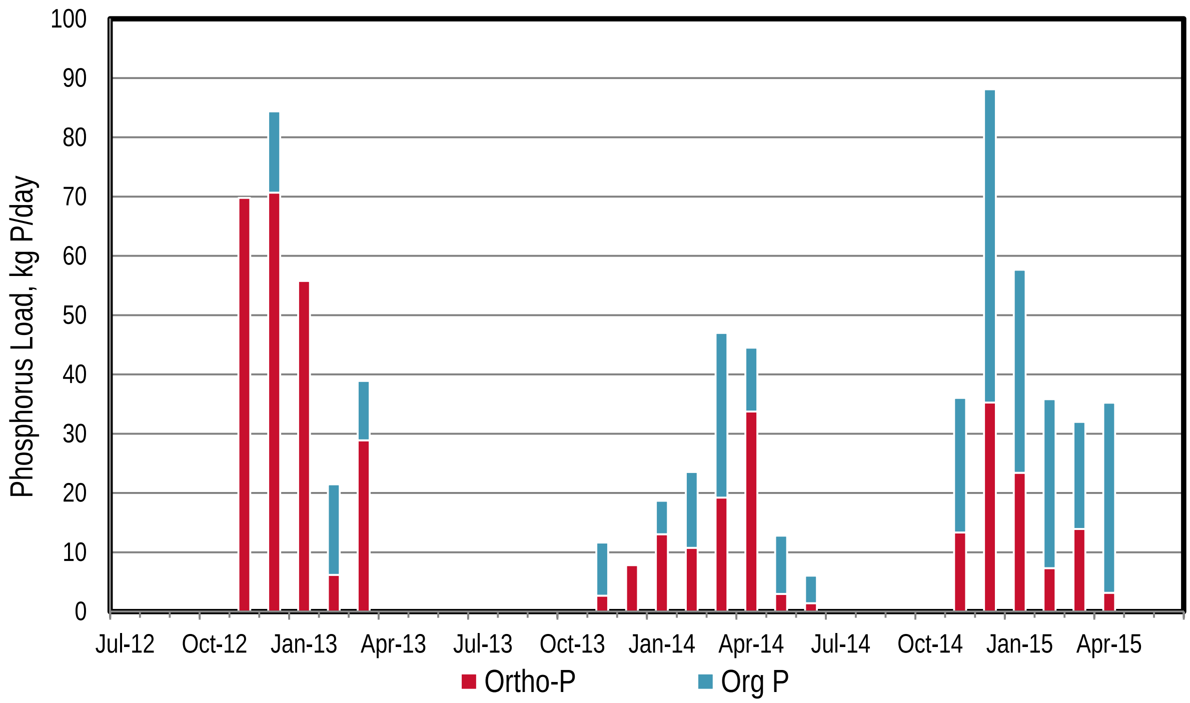

Figure 14-4. Napa Monthly Phosphorus Loads

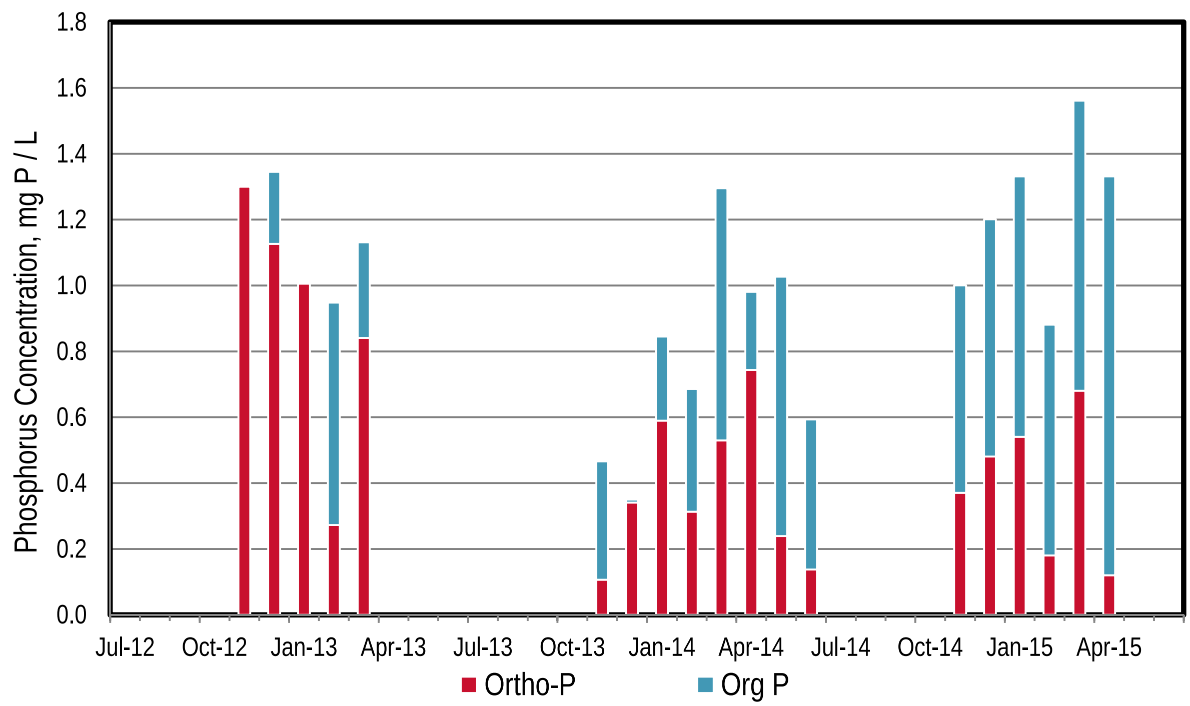

Figure 14-5. Napa Monthly Phosphorus Concentrations

Table 14-1. Napa Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.0	0	0	0	0	0	0
Aug 2012	0.0	0	0	0	0	0	0
Sep 2012	0.0	0	0	0	0	0	0
Oct 2012	0.0	0	0	0	0	0	0
Nov 2012	14.2	0	111	414	525	72	70
Dec 2012	16.6	205	361	369	729	71	84
Jan 2013	14.7	250	411	220	631	111	56
Feb 2013	6.0	0	44	231	275	6	21
Mar 2013	9.1	74	142	314	456	29	39
Apr 2013	0.0	0	0	0	0	0	0
May 2013	0.0	0	0	0	0	0	0
Jun 2013	0.0	0	0	0	0	0	0
Jul 2013	0.0	0	0	0	0	0	0
Aug 2013	0.0	0	0	0	0	0	0
Sep 2013	0.0	0	0	0	0	0	0
Oct 2013	0.0	0	0	0	0	0	0
Nov 2013	6.6	4	53	255	308	3	12
Dec 2013	6.1	4	48	216	264	8	8
Jan 2014	5.9	15	50	294	344	13	19
Feb 2014	9.1	5	75	310	385	11	24
Mar 2014	9.6	59	159	239	399	19	47
Apr 2014	12.0	113	192	330	522	34	45
May 2014	3.3	1	22	122	144	3	13
Jun 2014	2.7	1	15	127	142	1	6
Jul 2014	0.0	0	0	0	0	0	0
Aug 2014	0.0	0	0	0	0	0	0
Sep 2014	0.0	0	0	0	0	0	0
Oct 2014	0.0	0	0	0	0	0	0
Nov 2014	9.5	2	88	446	534	13	36
Dec 2014	19.4	5	159	335	494	35	88
Jan 2015	11.5	41	107	372	479	23	58
Feb 2015	10.8	3	76	270	346	7	36
Mar 2015	5.4	1	39	255	297	14	32
Apr 2015	7.0	1	47	275	322	3	35
May 2015	0.0	0	0	0	0	0	0
Jun 2015	0.0	0	0	0	0	0	0
Dry Season Average	0.4	0.1	2.5	16.6	19.1	0.3	1.3
Dry Season Trend (n=15)	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	8.3	37	103	245	348	23	34
Average Annual	5.0	22	61	150	211	13	20

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. Discharge is prohibited June 1 through August 31, except when effluent volume exceeds reclamation water demand. The discharge will increase to year-round once Novato begins discharging to a new wetland adjacent to San Pablo Bay.

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

- There are no emerging dry season trends as Novato does not typically discharge during the dry season.
- Wet season trends analyzed (data not shown) and there are no emerging trends.
- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- 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 total nitrogen concentration limits (i.e., 15 mg N/L) developed under the Scoping and Evaluation Plan with values reliably less than 20 mg N/L.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 0.2 to 3.2 mg P/L, This suggests a portion of P is removed as typical effluent TP concentrations 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.

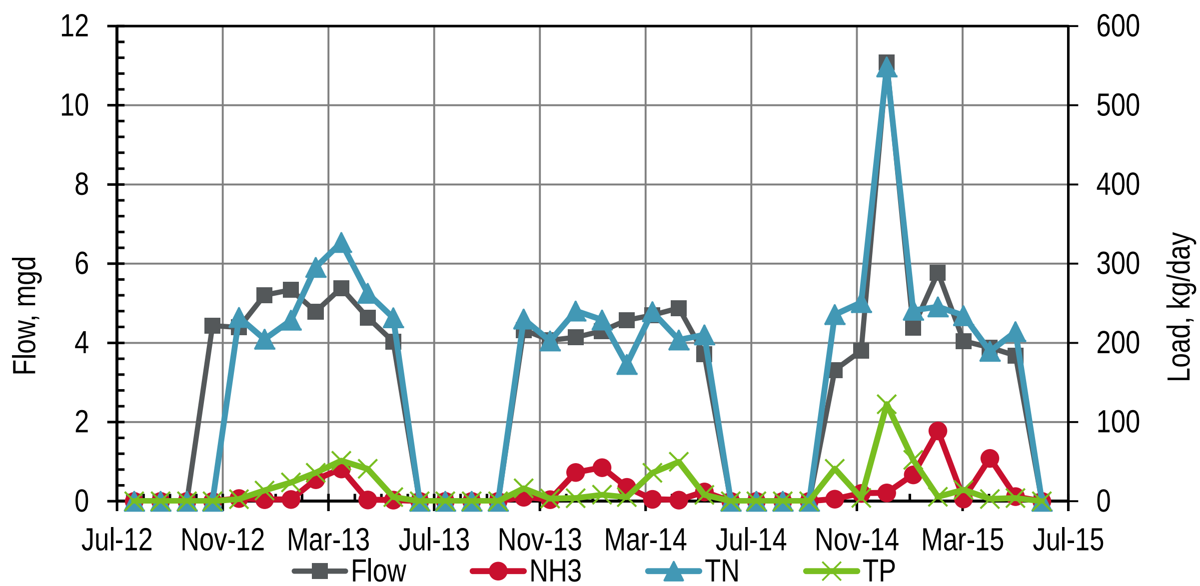

Figure 15-1. Novato Monthly Flows and Loads

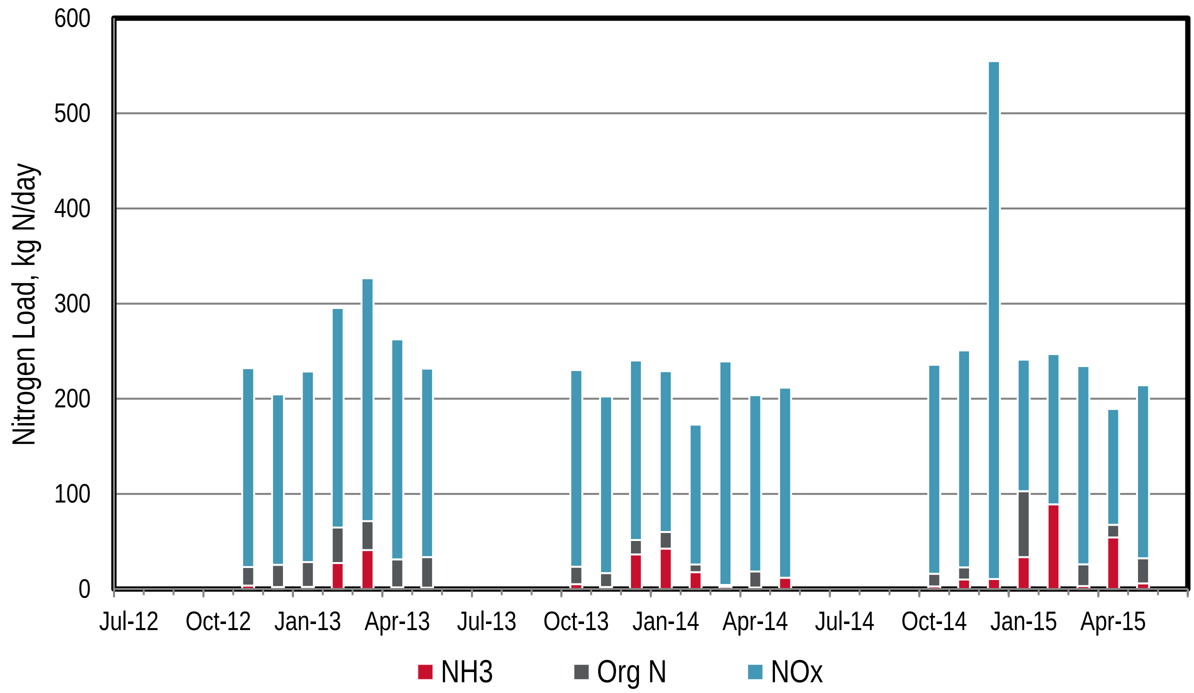

Figure 15-2. Novato Monthly Nitrogen Loads

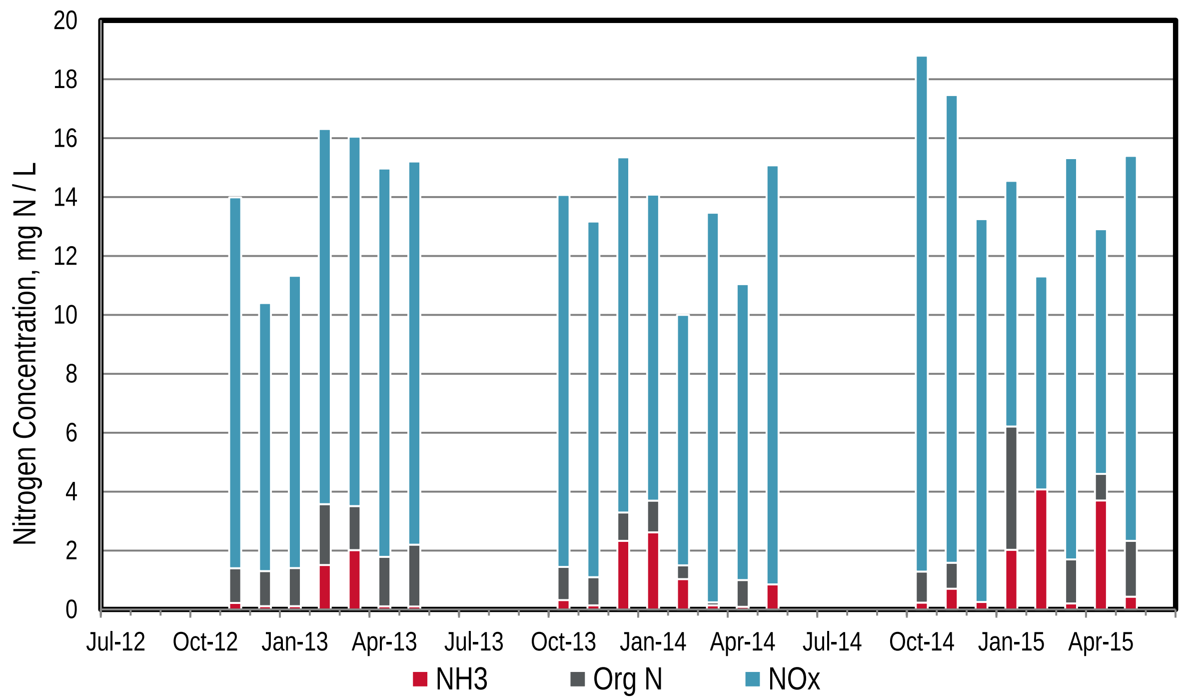

Figure 15-3. Novato Monthly Nitrogen Concentrations

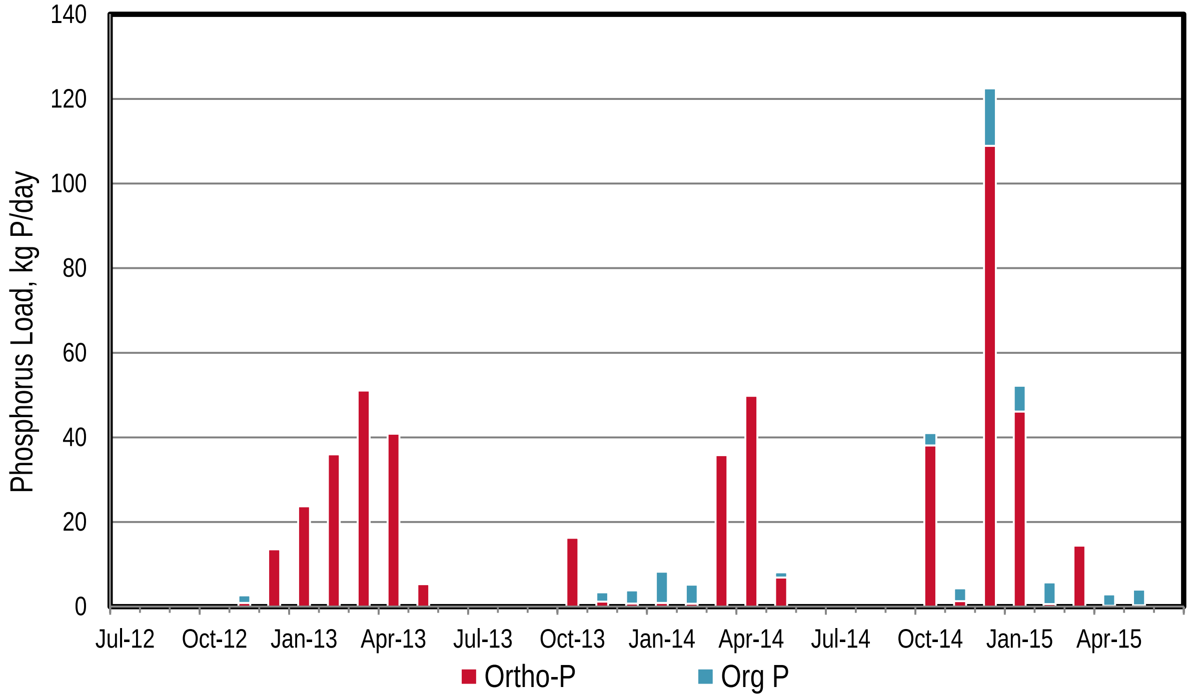

Figure 15-4. Novato Monthly Phosphorus Loads

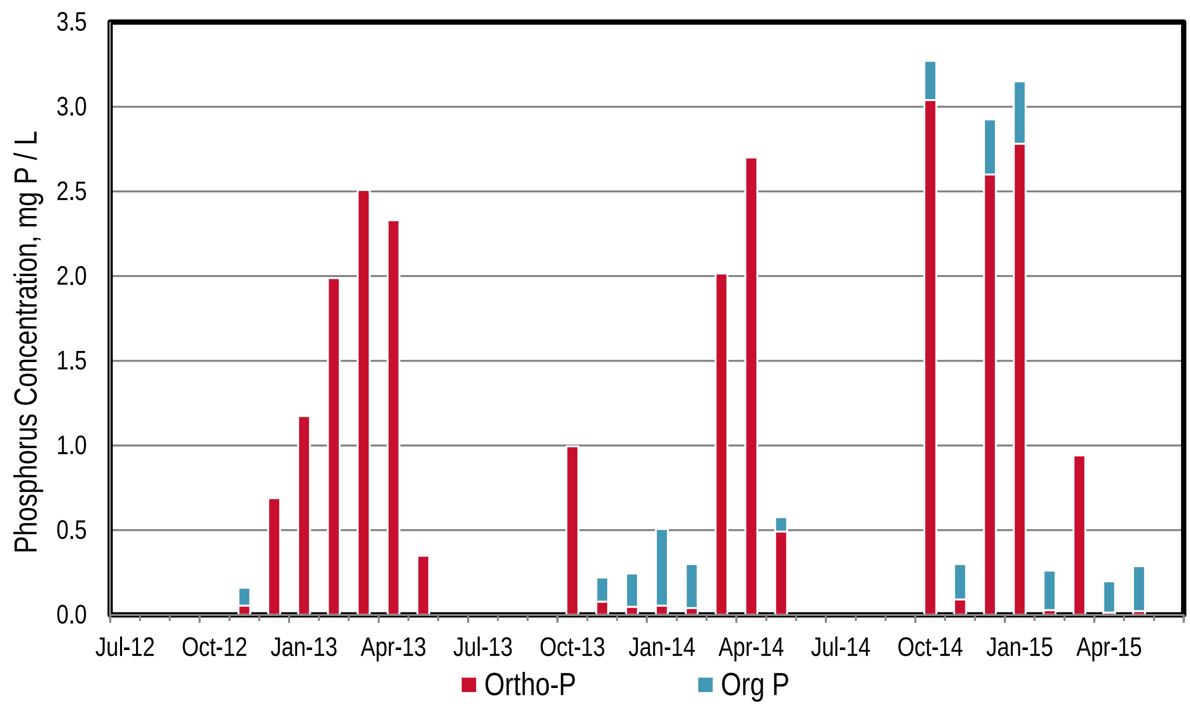

Figure 15-5. Novato Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 15-1. Novato Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.0	0	0	0	0	0	0
Aug 2012	0.0	0	0	0	0	0	0
Sep 2012	0.0	0	0	0	0	0	0
Oct 2012	4.4	--	--	--	--	--	--
Nov 2012	4.4	4	23	209	232	1	3
Dec 2012	5.2	2	26	179	205	35	14
Jan 2013	5.3	2	28	200	229	35	24
Feb 2013	4.8	27	65	231	295	58	36
Mar 2013	5.4	41	71	255	327	86	51
Apr 2013	4.6	2	31	231	263	64	41
May 2013	4.0	2	34	198	232	9	5
Jun 2013	0.0	0	0	0	0	0	0
Jul 2013	0.0	0	0	0	0	0	0
Aug 2013	0.0	0	0	0	0	0	0
Sep 2013	0.0	0	0	0	0	0	0
Oct 2013	4.3	5	24	207	230	22	16
Nov 2013	4.1	2	17	186	202	1	3
Dec 2013	4.1	36	52	189	240	1	4
Jan 2014	4.3	43	60	169	229	1	8
Feb 2014	4.6	18	26	147	173	1	5
Mar 2014	4.7	3	4	235	239	58	36
Apr 2014	4.9	2	18	185	204	82	50
May 2014	3.7	12	10	200	210	7	8
Jun 2014	0.0	0	0	0	0	0	0
Jul 2014	0.0	0	0	0	0	0	0
Aug 2014	0.0	0	0	0	0	0	0
Sep 2014	0.0	0	0	0	0	0	0
Oct 2014	3.3	3	16	220	236	38	41
Nov 2014	3.8	10	23	228	251	1	4
Dec 2014	11.1	11	4	544	548	109	123
Jan 2015	4.4	34	103	138	241	46	52
Feb 2015	5.8	89	88	158	246	1	6
Mar 2015	4.0	3	26	208	234	19	14
Apr 2015	3.9	54	68	122	189	0	3
May 2015	3.7	6	32	182	214	0	4
Jun 2015	0.0	0	0	0	0	0	0
Dry Season Average	**0.8**	1.3	5.1	39	44	1.1	1.2
Dry Season Trend (n=15)	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**4.8**	19	37	202	239	31	25
Average Annual	**3.1**	**12**	**24**	**138**	**162**	**19**	**16**

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. The current ADWDF flow is about 21 mgd. The plant performs ammonia and 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:

- Based on the table with the average monthly values, there appears to be an emerging dry season dry season downward trend for flow and TKN.
- The plant reliably fully nitrifies as evidenced by ammonia values of all less than 0.4 mg N/L.
- There is an increase trend in ammonia in the plant influent (data not shown) that is expected to continue as population and economy grows and shifts away from industrial and towards business office growth.
- NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant reliably nitrifies year round.
- TN loads in general increase with flows.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- TKN and TN have a sudden spike in April 2015, which was validated by contract laboratory. The basis for this is unclear.
- Phosphorus loads are greatest during the dry season.
- Total phosphorus concentrations range from 3.1 to 5.6 mg P/L. This is within the range of typical effluent TP concentrations (4 to 6 mg P/L).

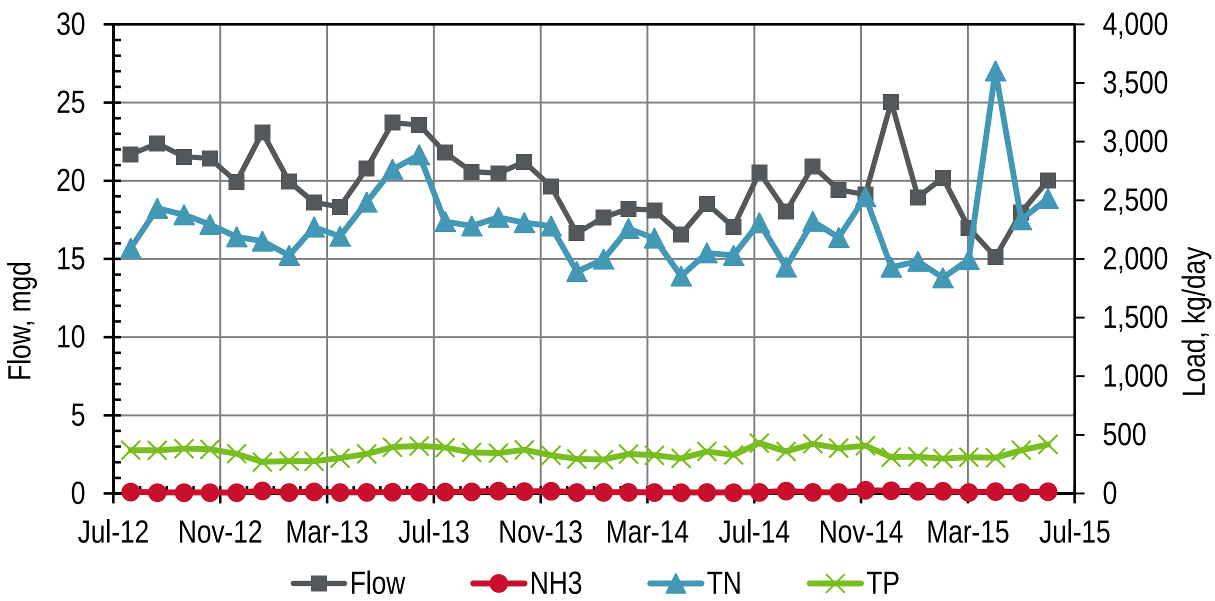

Figure 16-1. Palo Alto Monthly Flows and Loads

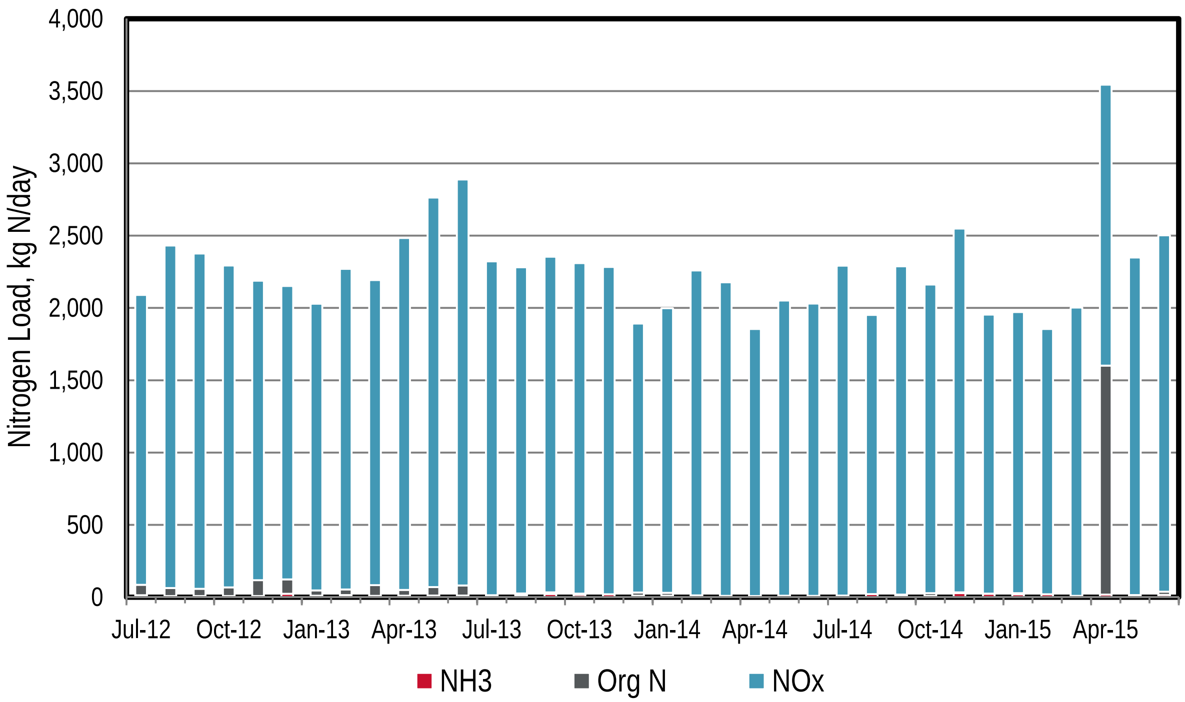

Figure 16-2. Palo Alto Monthly Nitrogen Loads

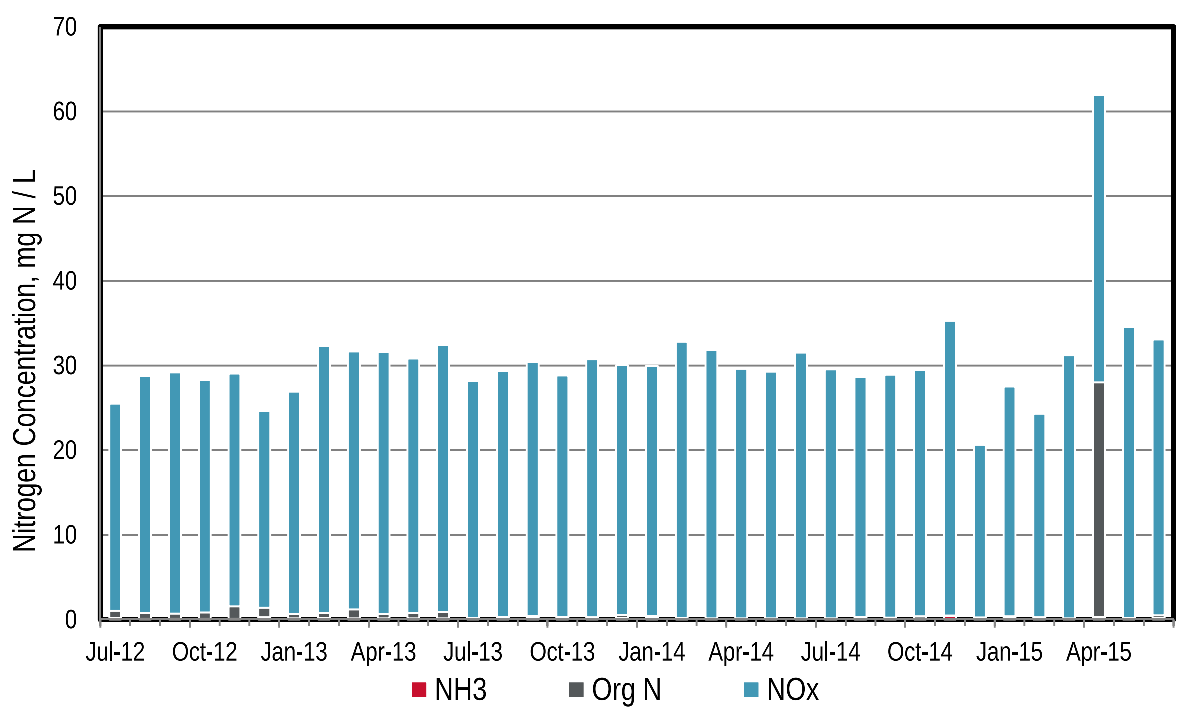

Figure 16-3. Palo Alto Monthly Nitrogen Concentrations

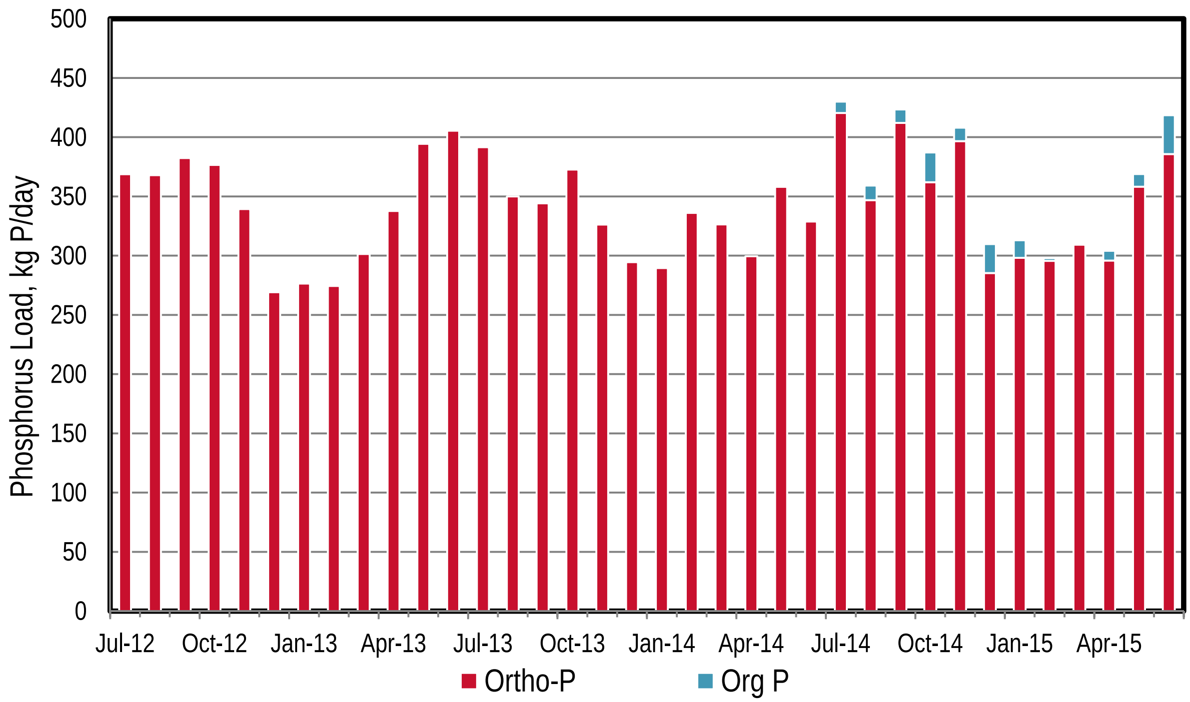

Figure 16-4. Palo Alto Monthly Phosphorus Loads

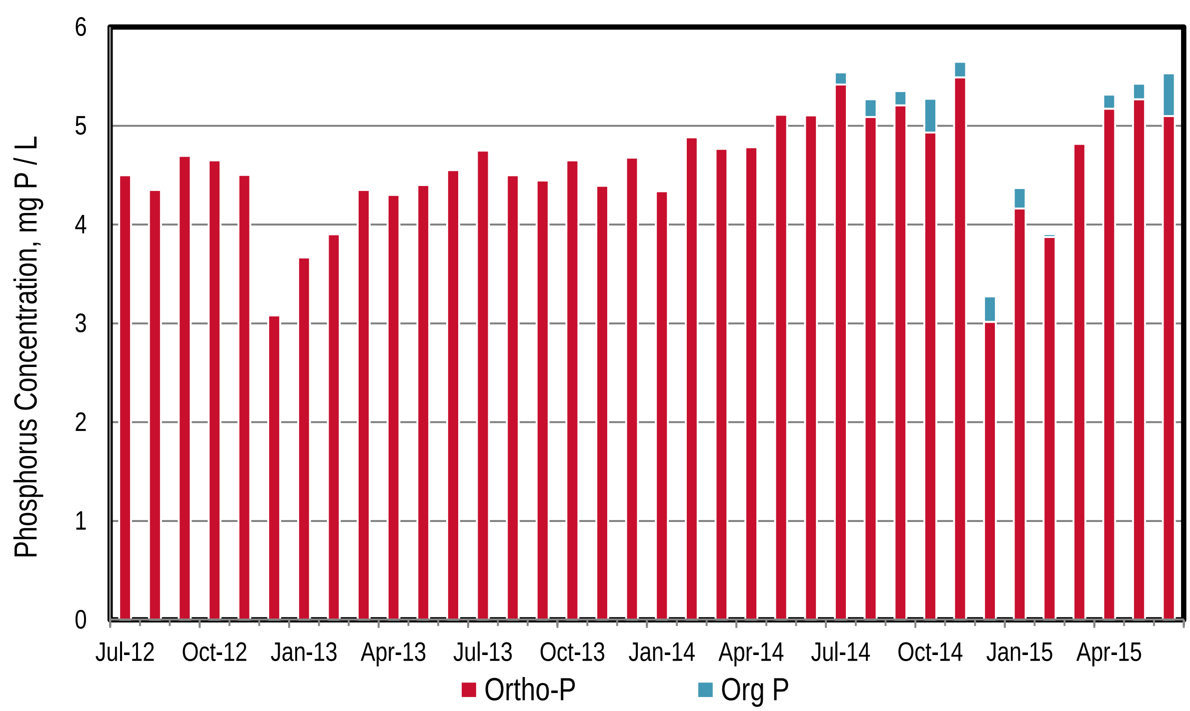

Figure 16-5. Palo Alto Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 16-1. Palo Alto Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	22	14	85	2,005	2,090	494	369
Aug 2012	22	8	64	2,367	2,431	499	368
Sep 2012	22	8	58	2,319	2,376	472	382
Oct 2012	21	8	67	2,226	2,293	514	377
Nov 2012	20	8	117	2,071	2,188	410	339
Dec 2012	23	23	122	2,029	2,151	334	269
Jan 2013	20	10	47	1,982	2,029	351	276
Feb 2013	19	15	53	2,217	2,271	391	274
Mar 2013	18	9	83	2,110	2,193	382	301
Apr 2013	21	10	50	2,434	2,484	413	338
May 2013	24	12	70	2,693	2,763	473	394
Jun 2013	24	12	81	2,807	2,888	532	405
Jul 2013	22	14	10	2,308	2,319	473	392
Aug 2013	21	14	26	2,255	2,281	460	350
Sep 2013	20	22	34	2,320	2,354	517	344
Oct 2013	21	17	25	2,285	2,309	517	373
Nov 2013	20	20	18	2,263	2,281	413	326
Dec 2013	17	10	32	1,860	1,892	426	294
Jan 2014	18	10	30	1,969	1,998	393	290
Feb 2014	18	11	12	2,247	2,259	452	336
Mar 2014	18	9	8	2,169	2,177	467	326
Apr 2014	17	8	8	1,846	1,854	436	300
May 2014	19	9	10	2,041	2,051	498	358
Jun 2014	17	8	9	2,021	2,030	500	329
Jul 2014	21	10	11	2,282	2,309	421	430
Aug 2014	18	21	5	1,931	1,931	347	359
Sep 2014	21	10	18	2,270	2,320	412	423
Oct 2014	19	9	28	2,134	2,183	362	387
Nov 2014	19	28	34	2,515	2,530	397	408
Dec 2014	25	24	25	1,929	1,929	285	310
Jan 2015	19	20	27	1,944	1,980	298	313
Feb 2015	20	21	17	1,834	1,839	296	298
Mar 2015	17	9	5	1,994	1,994	310	309
Apr 2015	15	18	1,601	1,943	3,603	296	304
May 2015	18	10	15	2,334	2,335	358	369
Jun 2015	20	16	38	2,465	2,515	386	419
Dry Season Average	**20**	**13**	**35**	**2,295**	**2,333**	**456**	**379**
Dry Season Trend (n=15)	**Yes**	**No**	**Yes**	**No**	**No**	**No**	**No**
Wet Season Average	**19**	**14**	**115**	**2,095**	**2,211**	**388**	**321**
Average Annual	**20**	**13**	**82**	**2,178**	**2,262**	**416**	**346**

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 0.020 mgd and it has currents flows of about 0.013 mgd ADWF. 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, in particular from July 2013 through July 2014.

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

- 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.
- There are no emerging dry season flow trends for the provided data (limited to flow).
- The plant occasionally nitrifies as evidenced by 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 the nitrogen species discharged.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations are wide ranging from about 2.2 to 7.3 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L.

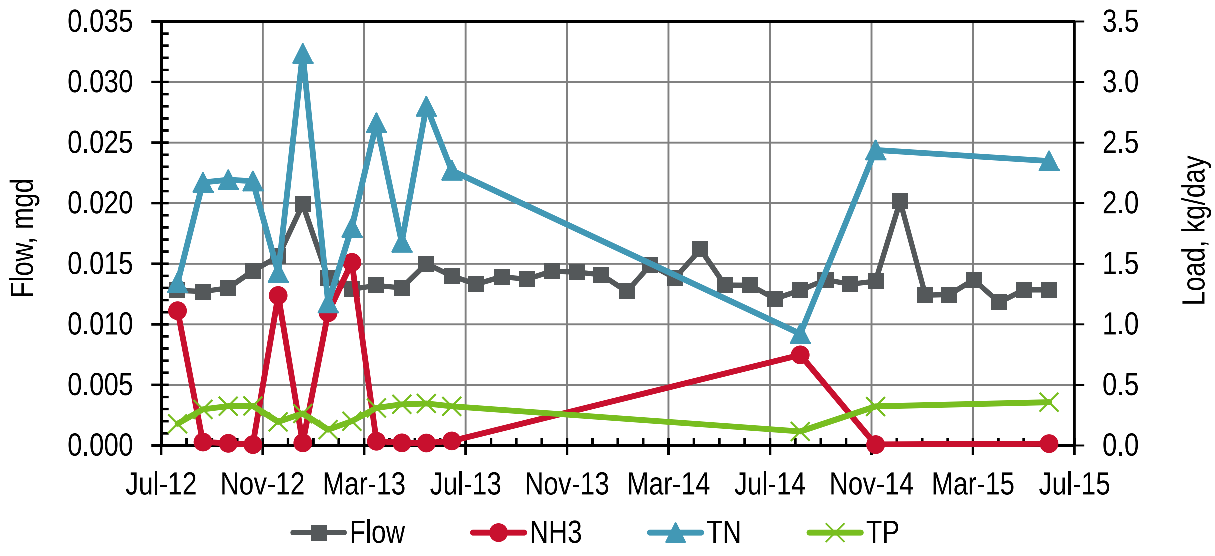

Figure 17-1. Paradise Cove Monthly Flows and Loads

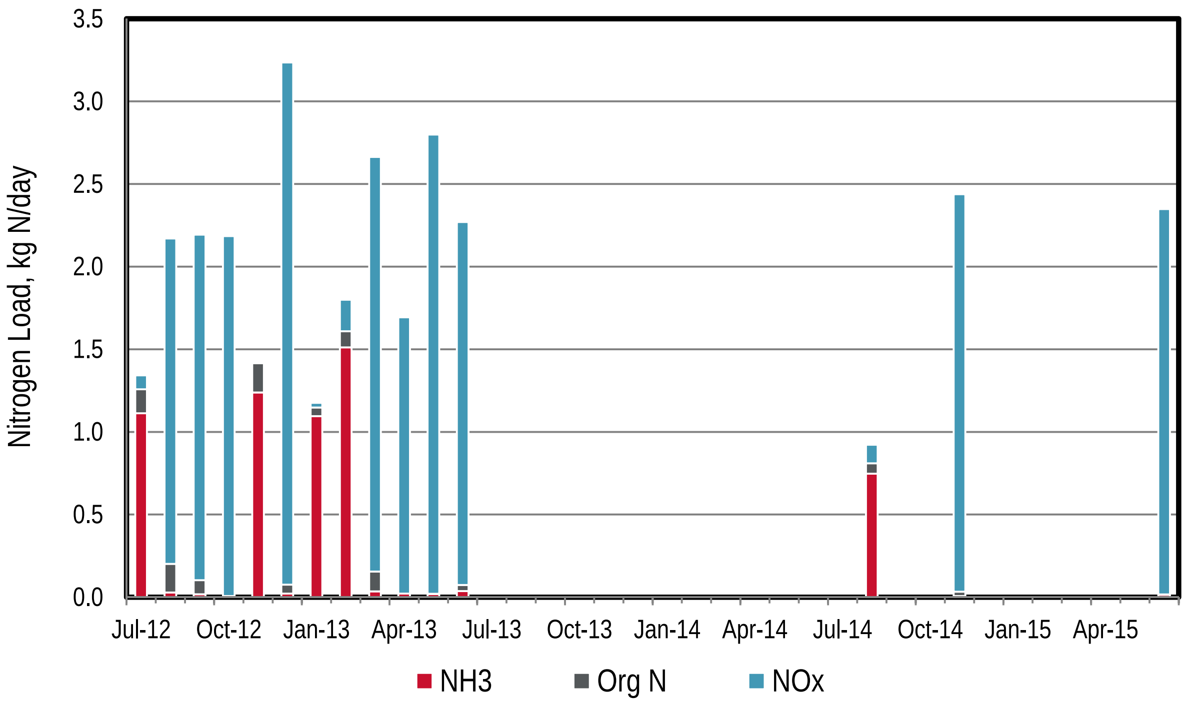

Figure 17-2. Paradise Cove Monthly Nitrogen Loads

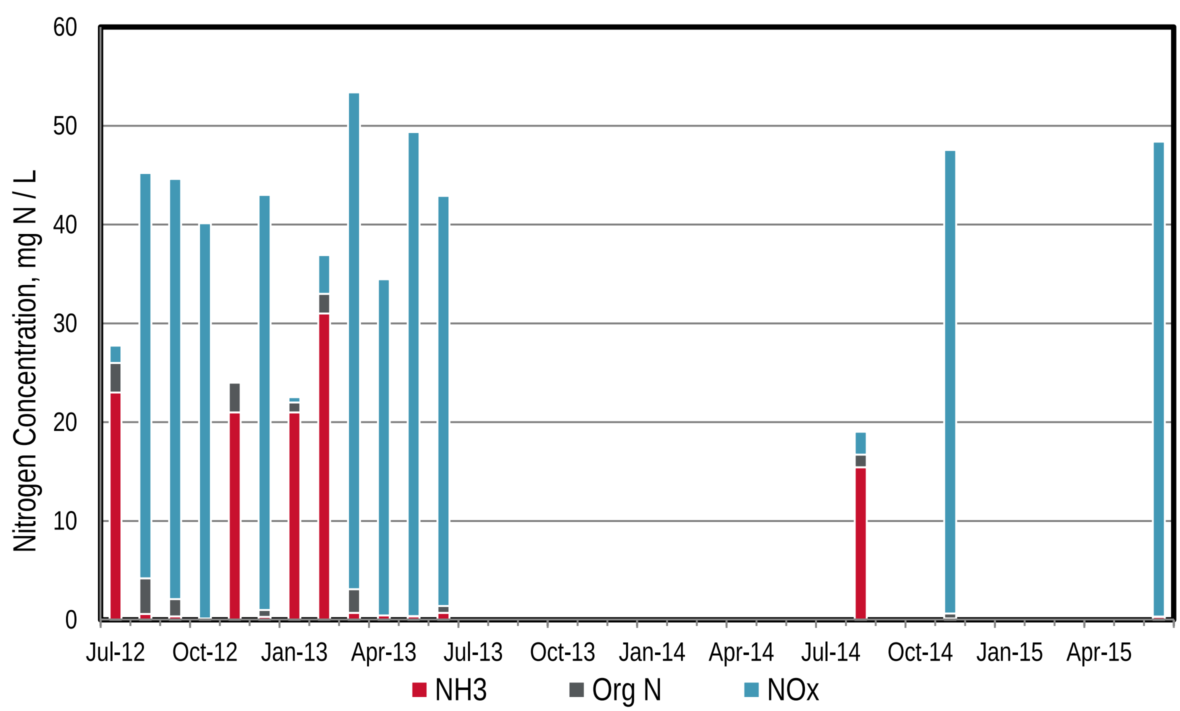

Figure 17-3. Paradise Cove Monthly Nitrogen Concentrations

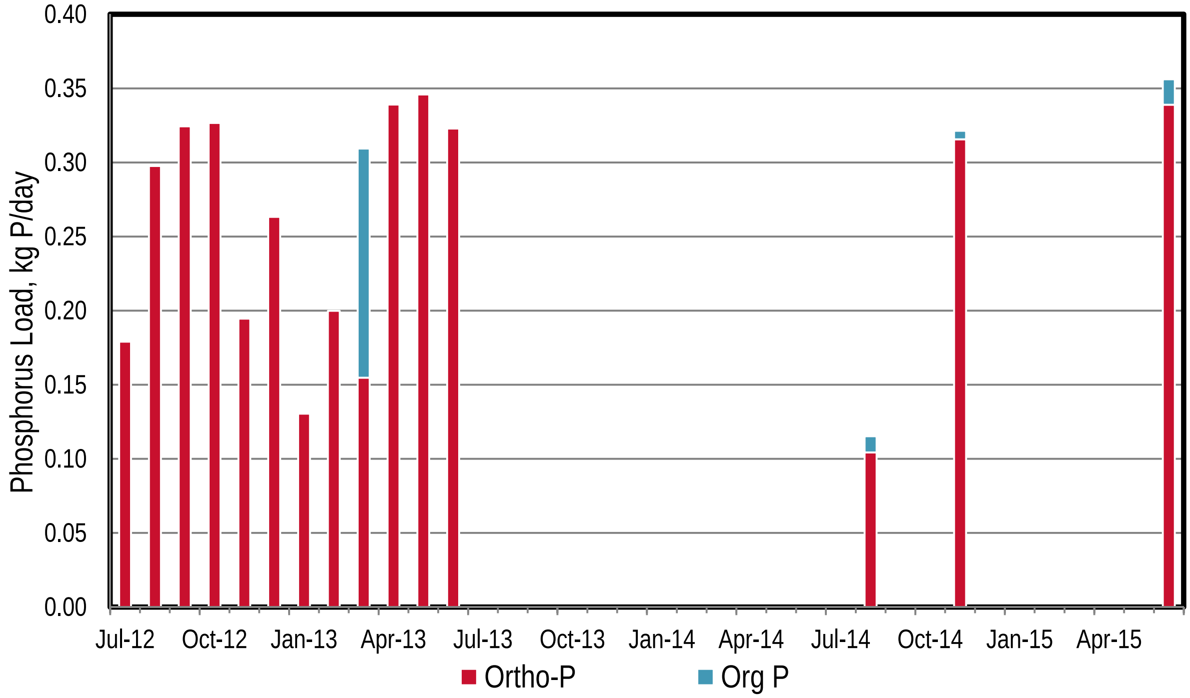

Figure 17-4. Paradise Cove Monthly Phosphorus Loads

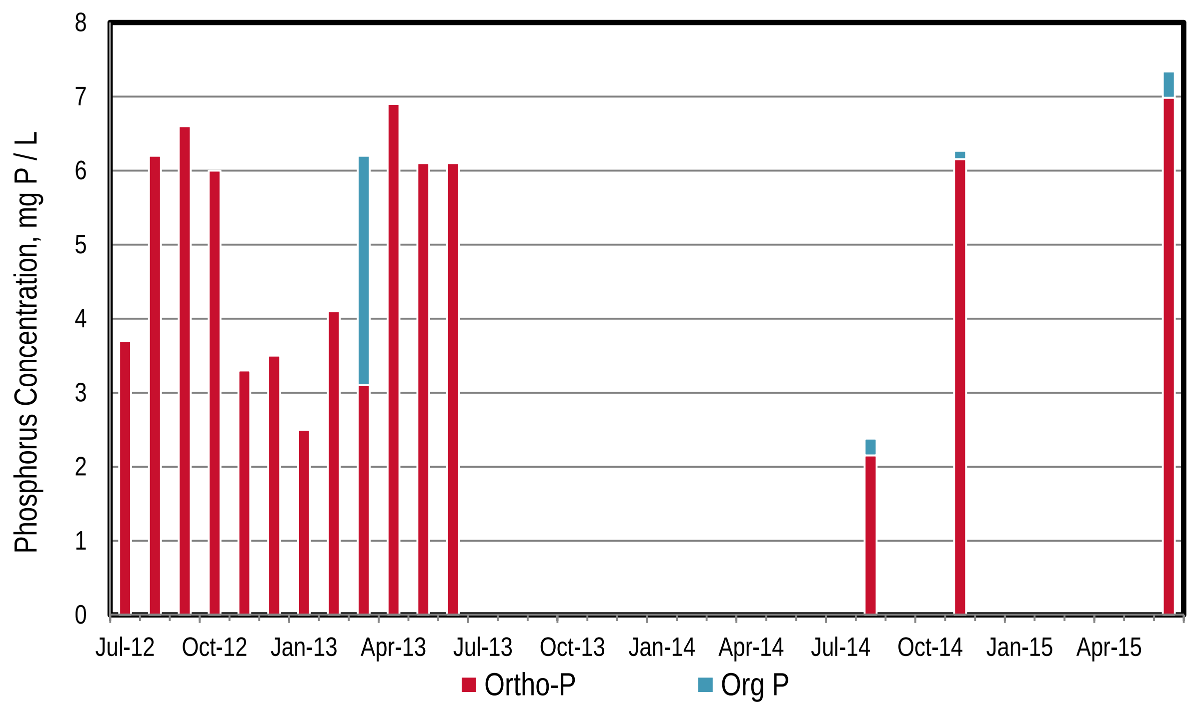

Figure 17-5. Paradise Cove Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 17-1. Paradise Cove Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.013	1.11	1.26	0.08	1.34	0.24	0.18
Aug 2012	0.013	0.03	0.20	1.97	2.17	0.38	0.30
Sep 2012	0.013	0.02	0.10	2.09	2.19	0.38	0.32
Oct 2012	0.014	0.01	0.00	2.18	2.18	0.40	0.33
Nov 2012	0.016	1.24	1.42	0.01	1.43	0.24	0.19
Dec 2012	0.020	0.02	0.08	3.16	3.23	0.53	0.26
Jan 2013	0.014	1.10	1.15	0.03	1.18	0.20	0.13
Feb 2013	0.013	1.51	1.61	0.19	1.80	0.23	0.20
Mar 2013	0.013	0.03	0.15	2.51	2.66	0.15	0.31
Apr 2013	0.013	0.02	0.00	1.67	1.68	0.54	0.34
May 2013	0.015	0.02	0.02	2.78	2.80	0.46	0.35
Jun 2013	0.014	0.04	0.07	2.20	2.27	0.44	0.32
Jul 2013	0.013	--	--	--	--	--	--
Aug 2013	0.014	--	--	--	--	--	--
Sep 2013	0.014	--	--	--	--	--	--
Oct 2013	0.014	--	--	--	--	--	--
Nov 2013	0.014	--	--	--	--	--	--
Dec 2013	0.014	--	--	--	--	--	--
Jan 2014	0.013	--	--	--	--	--	--
Feb 2014	0.015	--	--	--	--	--	--
Mar 2014	0.014	--	--	--	--	--	--
Apr 2014	0.016	--	--	--	--	--	--
May 2014	0.013	--	--	--	--	--	--
Jun 2014	0.013	--	--	--	--	--	--
Jul 2014	0.012	--	--	--	--	--	--
Aug 2014	0.013	0.75	0.81	0.11	0.92	0.10	0.12
Sep 2014	0.014	--	--	--	--	--	--
Oct 2014	0.013	--	--	--	--	--	--
Nov 2014	0.014	0.01	0.03	2.41	2.44	0.32	0.32
Dec 2014	0.020	--	--	--	--	--	--
Jan 2015	0.012	--	--	--	--	--	--
Feb 2015	0.012	--	--	--	--	--	--
Mar 2015	0.014	--	--	--	--	--	--
Apr 2015	0.012	--	--	--	--	--	--
May 2015	0.013	--	--	--	--	--	--
Jun 2015	0.013	0.01	0.02	2.33	2.35	0.34	0.36
Dry Season Average	**0.013**	**0.28**	**0.35**	**1.65**	**2.01**	**0.33**	**0.28**
Dry Season Trend (n=15)	**No**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**
Wet Season Average	**0.014**	**0.49**	**0.56**	**1.52**	**2.07**	**0.33**	**0.26**
Average Annual	**0.014**	**0.39**	**0.46**	**1.58**	**2.04**	**0.33**	**0.27**

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 an oxidation ditch and filters coupled with oxidation ponds which also serves as equalization during peak flow. All of the flows are 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:

- Based on the average monthly values table, there are no emerging dry season trends as Petaluma does not discharge during the dry season.
- Wet season trends analyzed (data not shown) and there are no emerging trends.
- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- 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 meets Level 3 total nitrogen concentration limits (i.e., 6 mg N/L) developed under the Scoping and Evaluation Plan for all but two months.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 1.4 to 3.8 mg P/L, This suggests a portion of P is removed as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is attributed to biological P removal in the oxidation ditch.

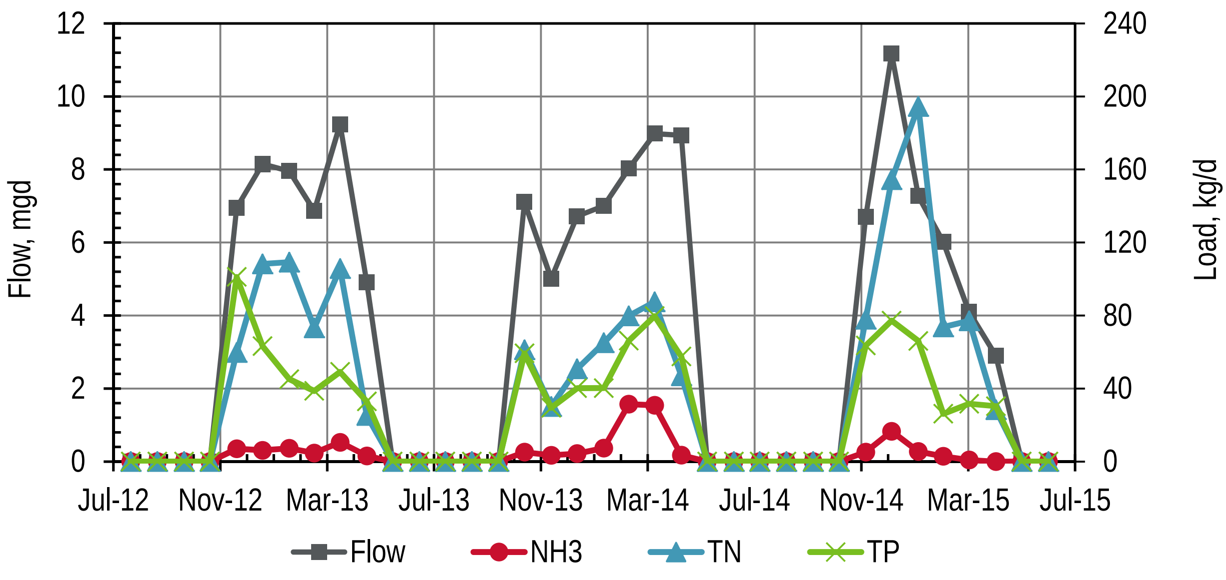

Figure 18-1. Petaluma Monthly Flows and Loads

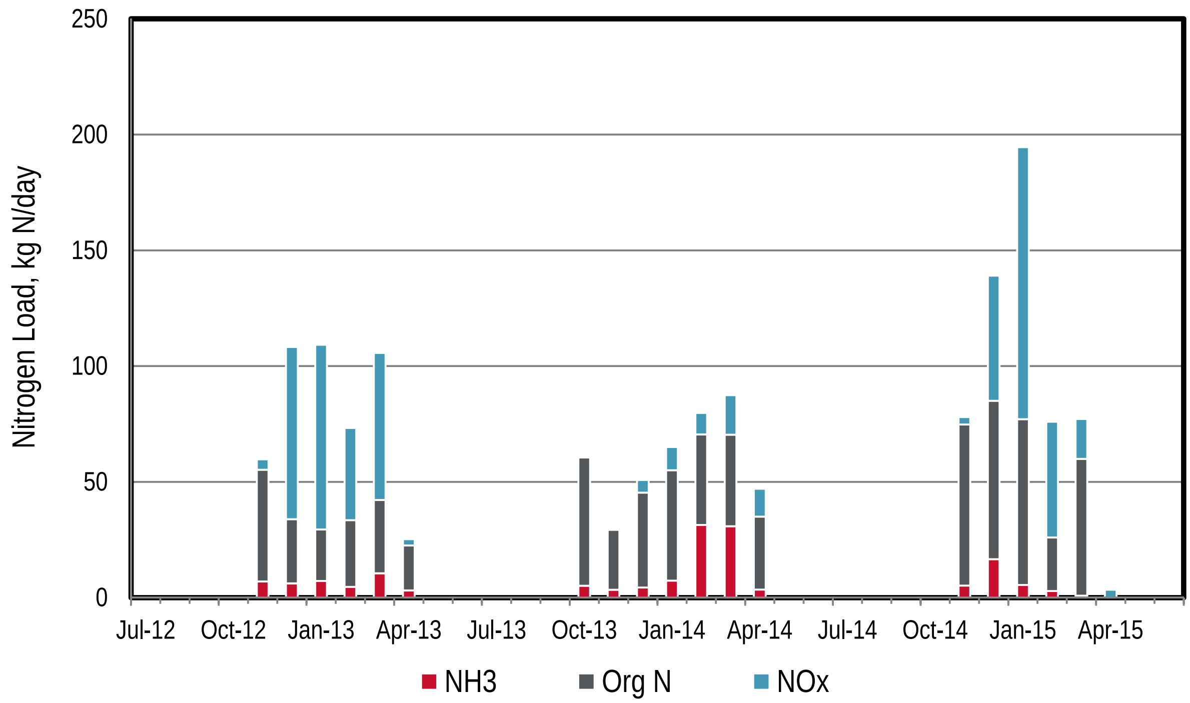

Figure 18-2. Petaluma Monthly Nitrogen Loads

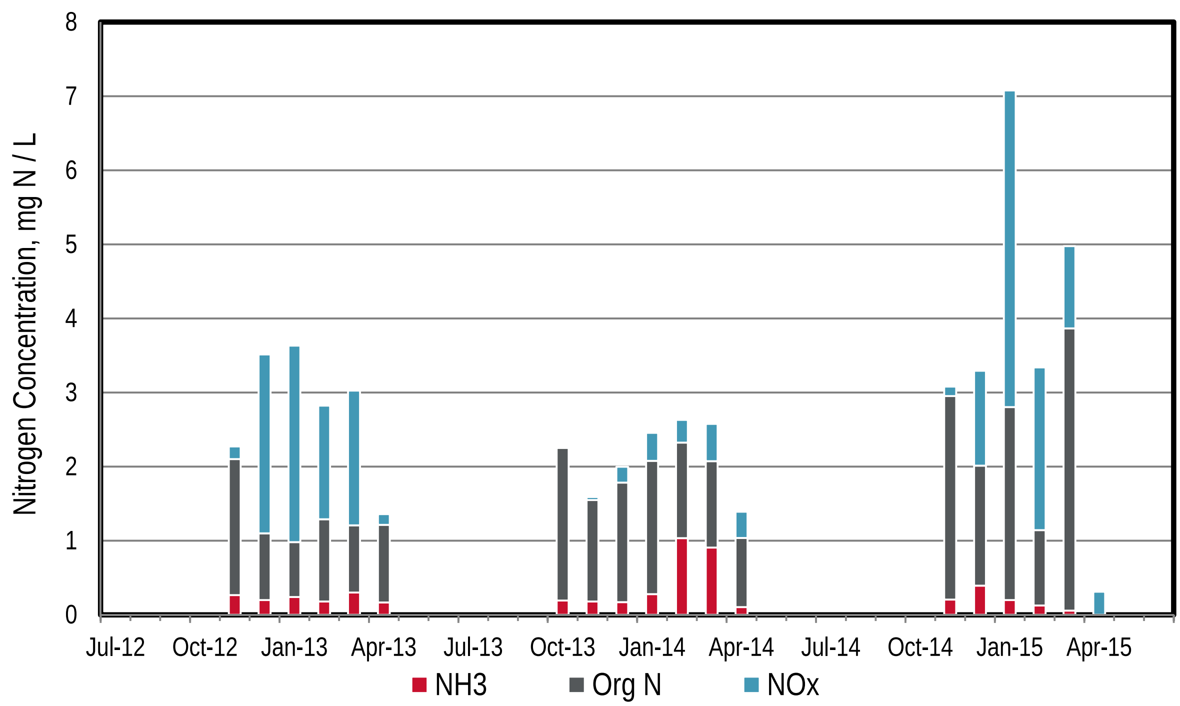

Figure 18-3. Petaluma Monthly Nitrogen Concentrations

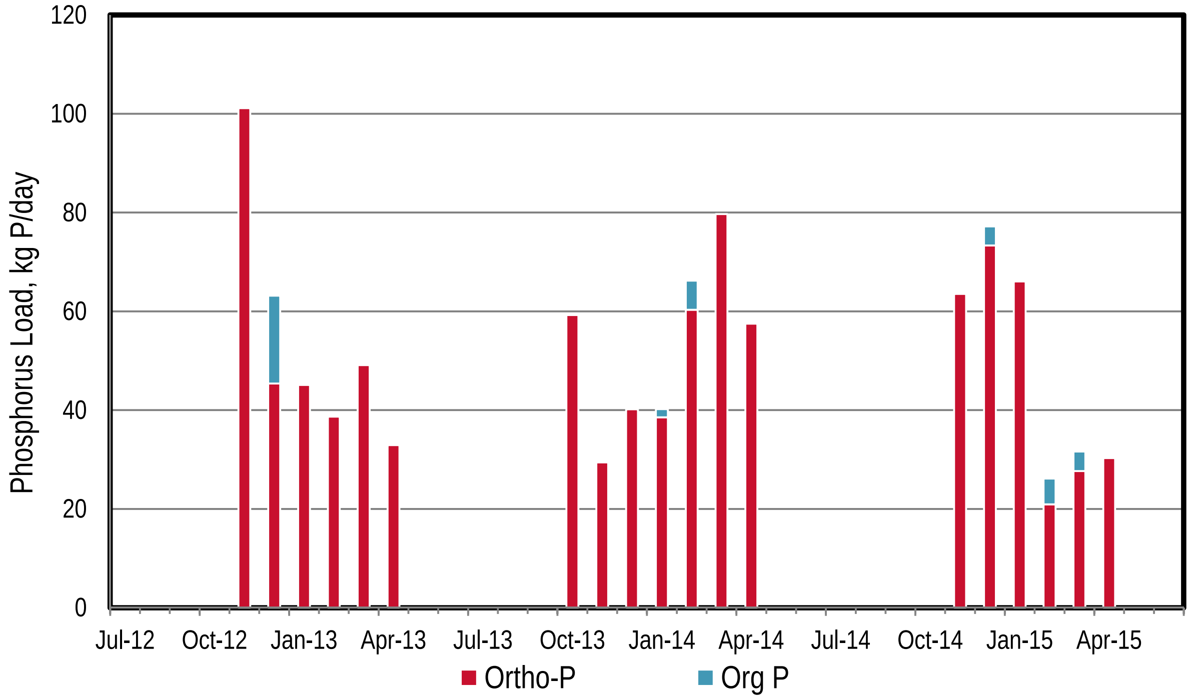

Figure 18-4. Petaluma Monthly Phosphorus Loads

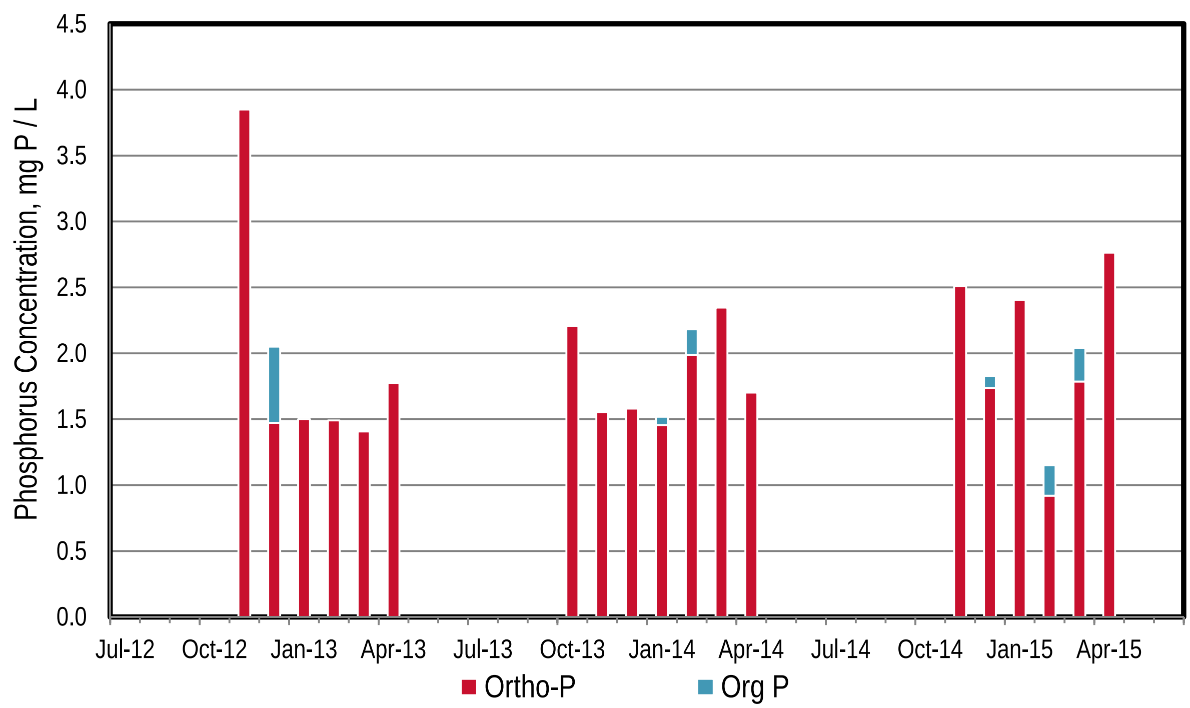

Figure 18-5. Petaluma Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 18-1. Petaluma Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0	0	0	0	0	0	0
Aug 2012	0	0	0	0	0	0	0
Sep 2012	0	0	0	0	0	0	0
Oct 2012	0	0	0	0	0	0	0
Nov 2012	7	7	55	4	60	106	101
Dec 2012	8	6	34	74	108	45	63
Jan 2013	8	7	29	80	109	45	45
Feb 2013	7	5	33	40	73	45	39
Mar 2013	9	11	42	63	106	51	49
Apr 2013	5	3	23	3	25	38	33
May 2013	0	0	0	0	0	0	0
Jun 2013	0	0	0	0	0	0	0
Jul 2013	0	0	0	0	0	0	0
Aug 2013	0	0	0	0	0	0	0
Sep 2013	0	0	0	0	0	0	0
Oct 2013	7	5	61	1	61	61	59
Nov 2013	5	3	29	1	30	30	29
Dec 2013	7	4	45	5	51	45	40
Jan 2014	7	7	55	10	65	39	40
Feb 2014	8	31	70	9	80	60	66
Mar 2014	9	31	70	17	87	81	80
Apr 2014	9	4	35	12	47	63	57
May 2014	0	0	0	0	0	0	0
Jun 2014	0	0	0	0	0	0	0
Jul 2014	0	0	0	0	0	0	0
Aug 2014	0	0	0	0	0	0	0
Sep 2014	0	0	0	0	0	0	0
Oct 2014	0	0	0	0	0	0	0
Nov 2014	7	5	75	3	78	66	64
Dec 2014	11	17	85	54	154	73	77
Jan 2015	7	6	77	117	195	66	66
Feb 2015	6	3	26	50	74	21	26
Mar 2015	4	1	60	17	77	28	32
Apr 2015	3	ND	25	3	28	30	30
May 2015	0	0	0	0	0	0	0
Jun 2015	0	0	0	0	0	0	0
Dry Season Average	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Dry Season Trend (n=15)	**No Discharge**	**No Discharge**	**No Discharge**	**No Discharge**	**No Discharge**	**No Discharge**	**No Discharge**
Wet Season Average	**6**	**7**	**44**	**27**	**72**	**47**	**47**
Average Annual	**4**	**4**	**26**	**16**	**42**	**28**	**28**

19 City of Pinole

Pinole 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 current flow averages about 2.5 mgd ADWF.

For each Agency, include tables and graphs. Write bulleted list for observations regarding:

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for flow, total nitrogen loads, and the phosphate loads.
- Nitrogen and phosphorus loads do not track with the flows as seen at the majority of the other plants.
- Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not fully nitrify. A portion of the ammonia load is partially nitrified to NOx.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations from 0.5 to 4.6 mg P/L.

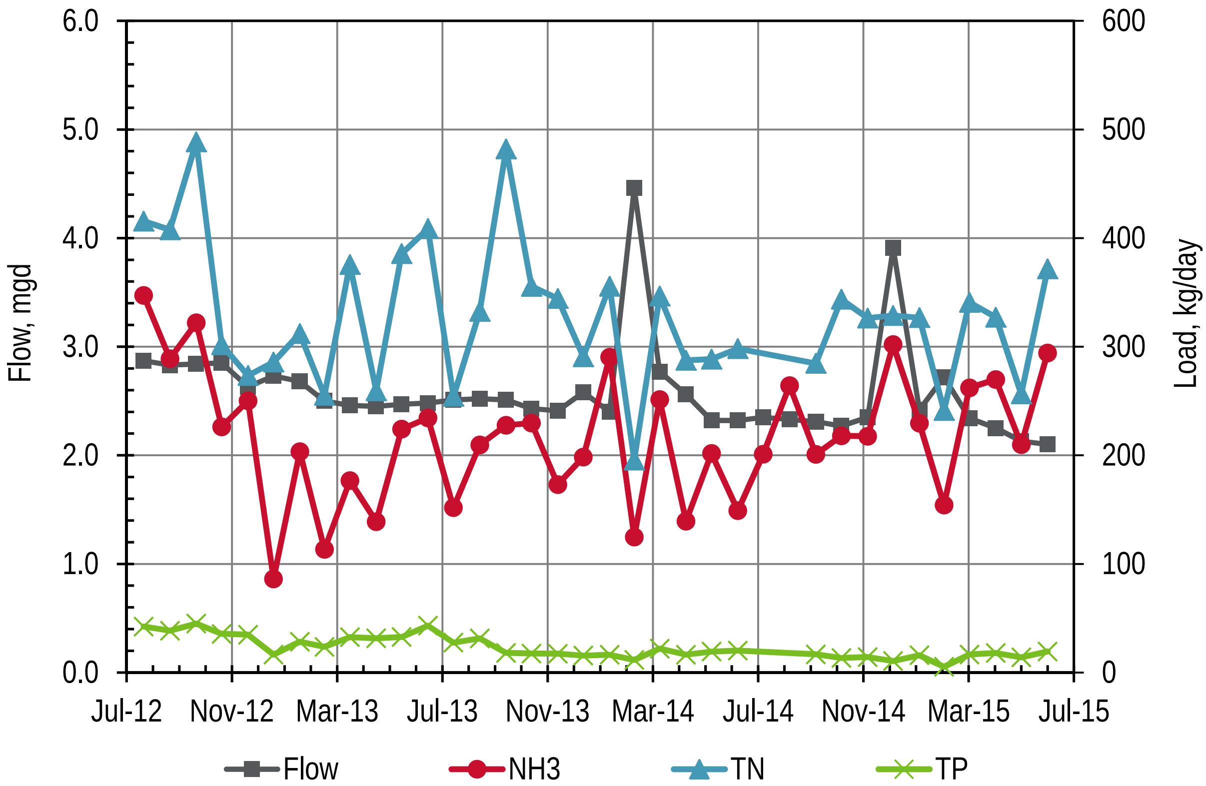

Figure 19-1. Pinole Monthly Flows and Loads

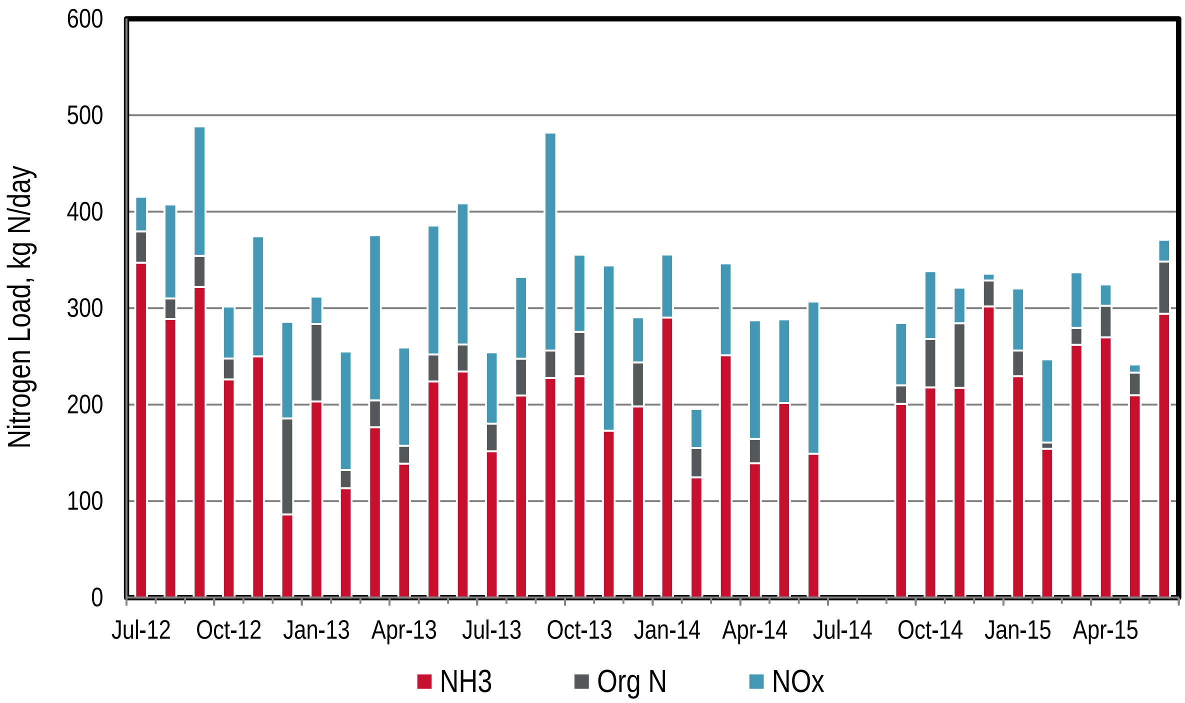

Figure 19-2. Pinole Monthly Nitrogen Loads

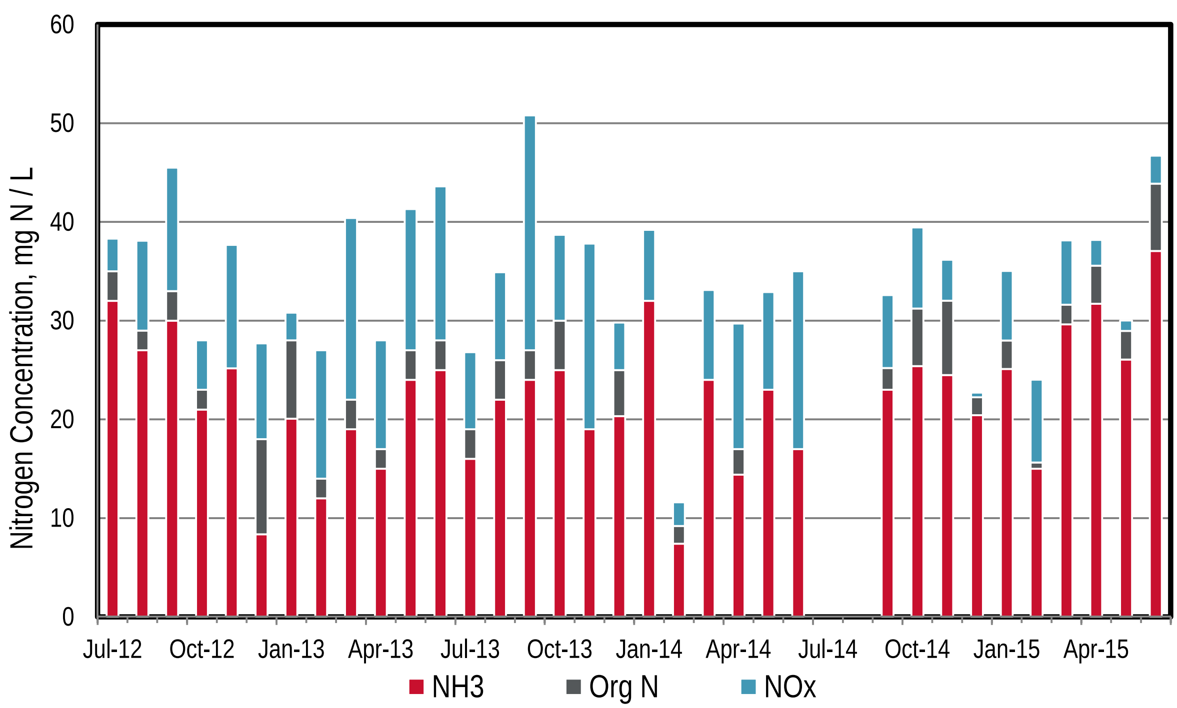

Figure 19-3. Pinole Monthly Nitrogen Concentrations

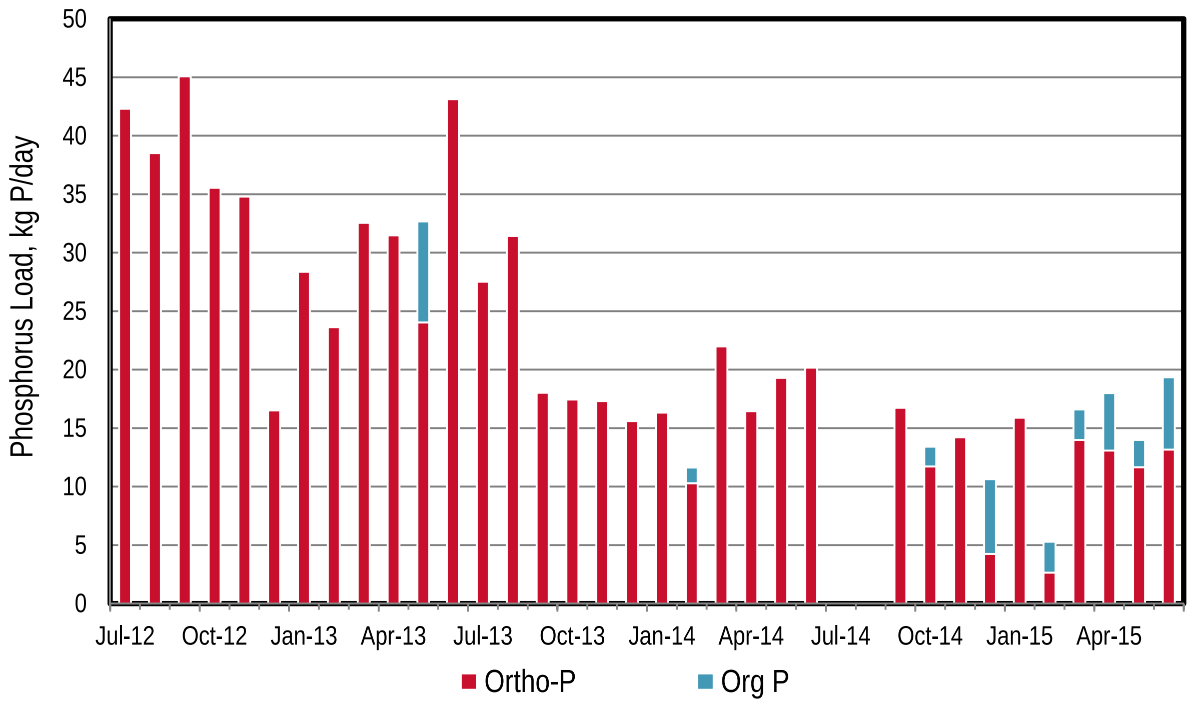

Figure 19-4. Pinole Monthly Phosphorus Loads

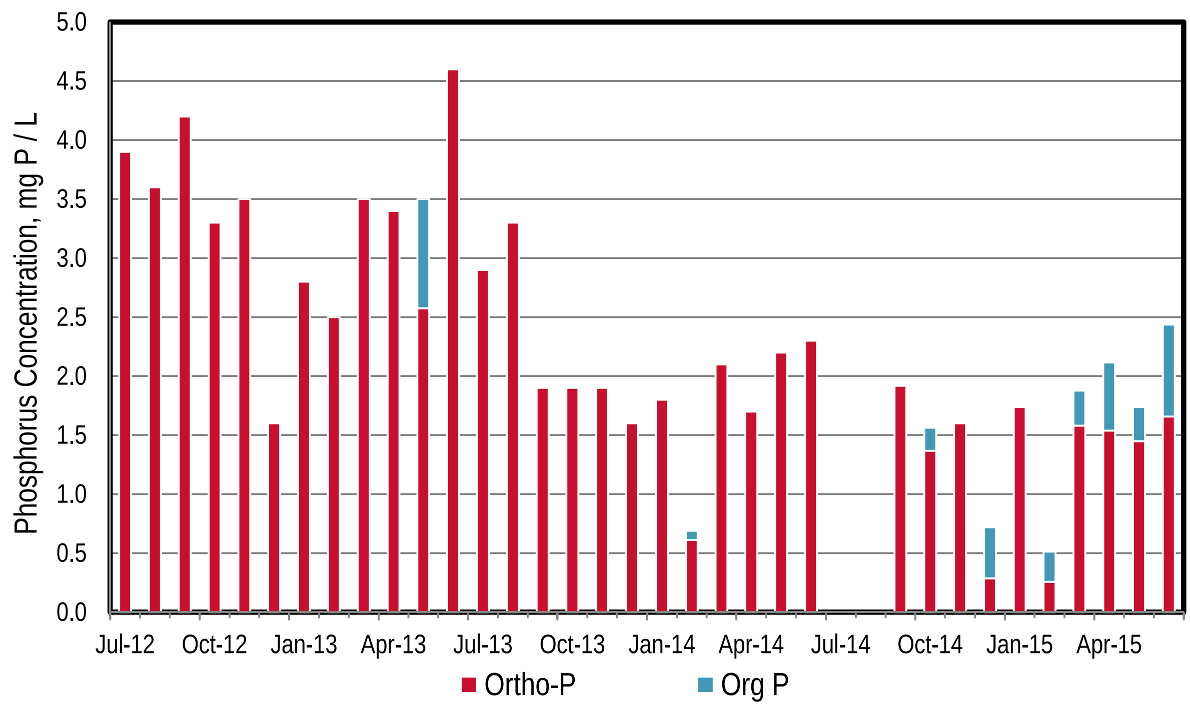

Figure 19-5. Pinole Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 19-1. Pinole Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	2.9	347	380	36	416	62	42
Aug 2012	2.8	289	310	97	408	49	39
Sep 2012	2.8	322	354	134	488	66	45
Oct 2012	2.9	226	248	54	302	50	36
Nov 2012	2.6	250	149	124	273	52	35
Dec 2012	2.7	86	186	100	286	37	17
Jan 2013	2.7	203	284	28	312	32	28
Feb 2013	2.5	113	132	123	255	34	24
Mar 2013	2.5	177	205	171	376	50	33
Apr 2013	2.5	139	157	102	259	60	31
May 2013	2.5	224	252	134	386	24	33
Jun 2013	2.5	234	262	146	409	59	43
Jul 2013	2.5	152	180	74	254	40	28
Aug 2013	2.5	210	248	85	332	45	31
Sep 2013	2.5	228	256	226	482	40	18
Oct 2013	2.4	230	276	80	355	29	17
Nov 2013	2.4	173	173	171	344	32	17
Dec 2013	2.6	198	244	47	291	25	16
Jan 2014	2.4	290	290	65	356	25	16
Feb 2014	4.5	125	155	40	196	10	12
Mar 2014	2.8	251	251	95	347	31	22
Apr 2014	2.6	139	165	123	287	21	16
May 2014	2.3	202	202	87	289	31	19
Jun 2014	2.3	149	140	158	298	35	20
Jul 2014	2.4	201	--	--	--	--	--
Aug 2014	2.3	264	--	--	--	--	--
Sep 2014	2.3	201	220	64	285	--	17
Oct 2014	2.3	218	268	70	344	12	13
Nov 2014	2.4	218	284	37	326	18	14
Dec 2014	3.9	302	329	7	329	4	11
Jan 2015	2.4	230	256	64	327	16	16
Feb 2015	2.7	154	161	86	241	3	5
Mar 2015	2.3	262	280	58	341	14	17
Apr 2015	2.3	270	303	22	327	13	18
May 2015	2.1	210	233	9	256	12	14
Jun 2015	2.1	294	348	22	372	13	19
Dry Season Average	**2.5**	**235**	**226**	**85**	**312**	**32**	**25**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**
Wet Season Average	**2.7**	**203**	**228**	**79**	**308**	**27**	**20**
Average Annual	**2.6**	**216**	**241**	**86**	**328**	**32**	**23**

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. The current plant flows are about 0.60 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:

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for flows.
- Total nitrogen loads increase with flow during wet weather events.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. A portion of ammonia occasionally bleeds through year round.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 0.3 to 7.5 mg P/L, This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is through to be the anaerobic selector in the activated sludge process.

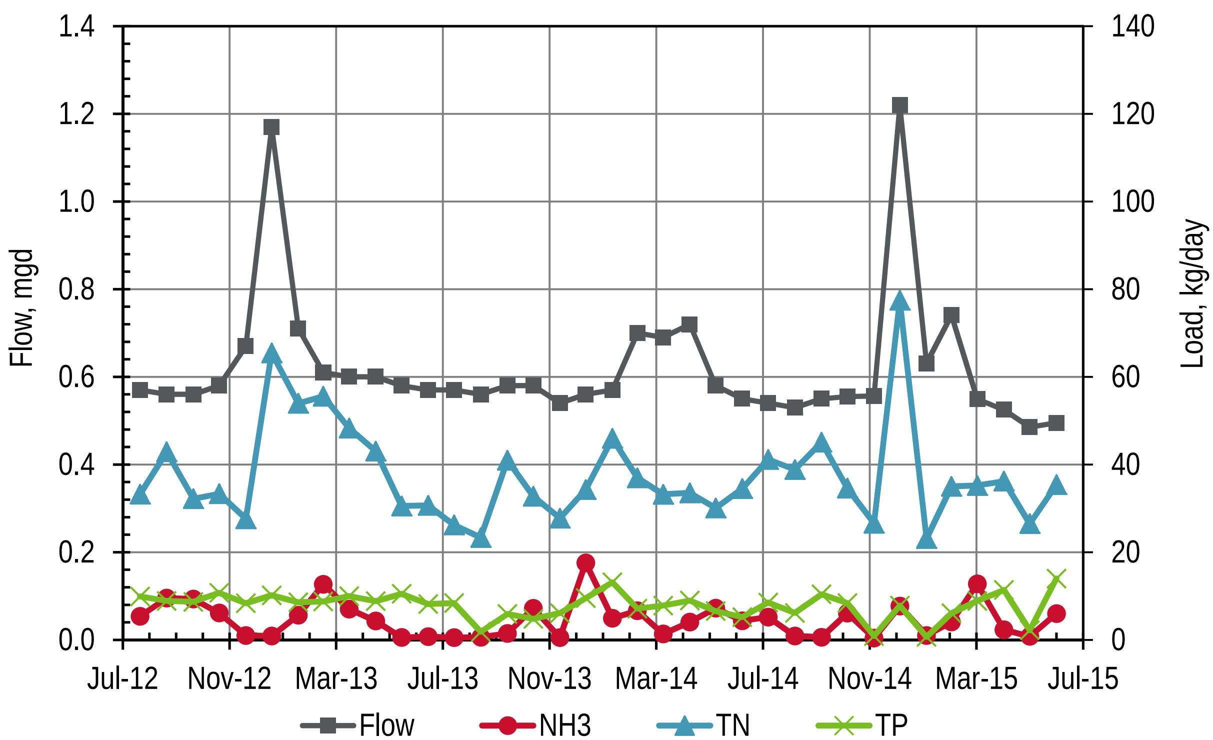

Figure 20-1. Rodeo Monthly Flows and Loads

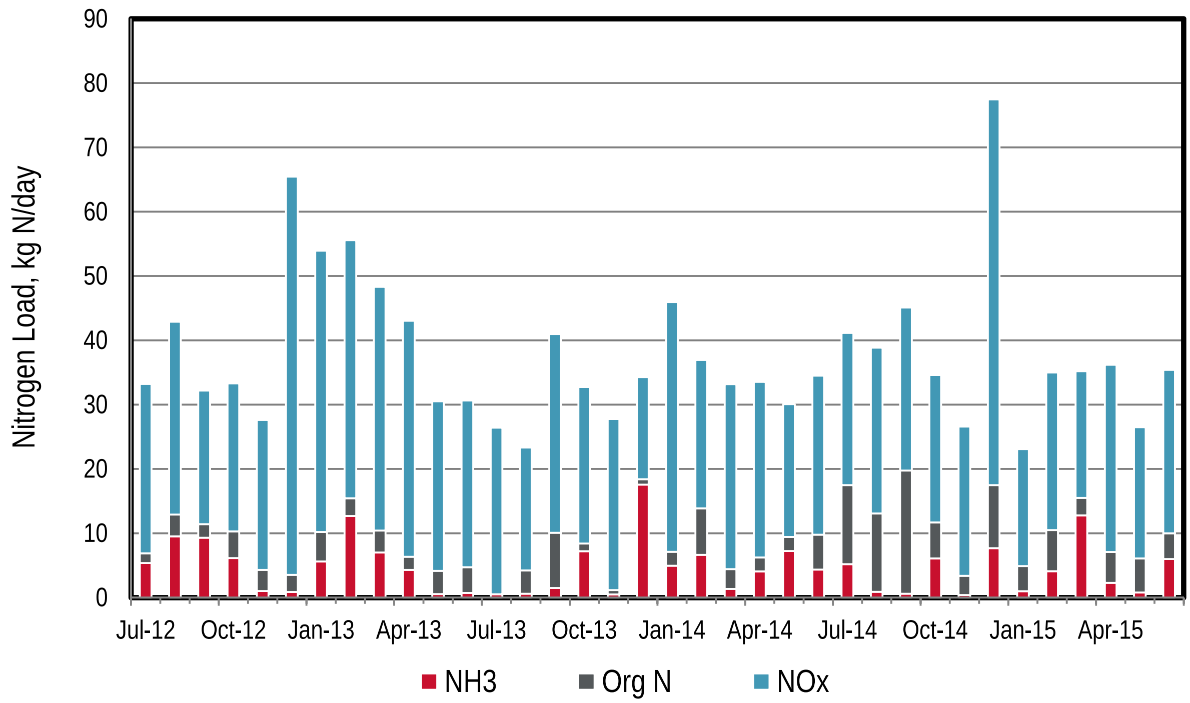

Figure 20-2. Rodeo Monthly Nitrogen Loads

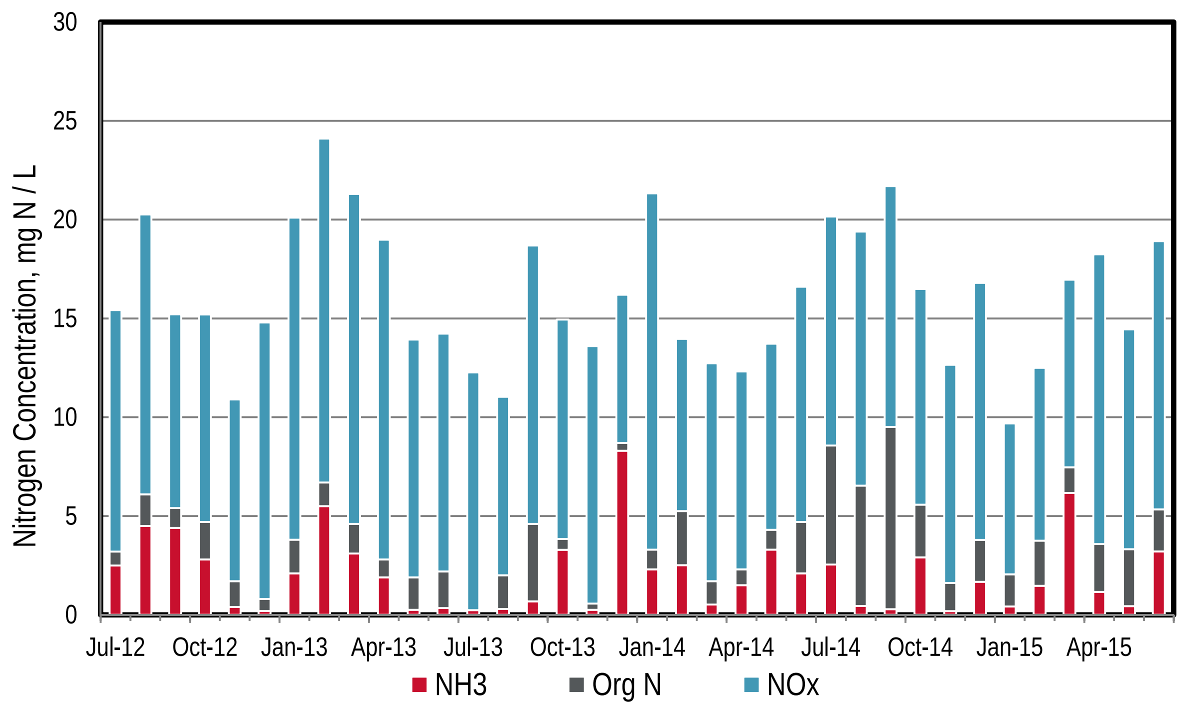

Figure 20-3. Rodeo Monthly Nitrogen Concentrations

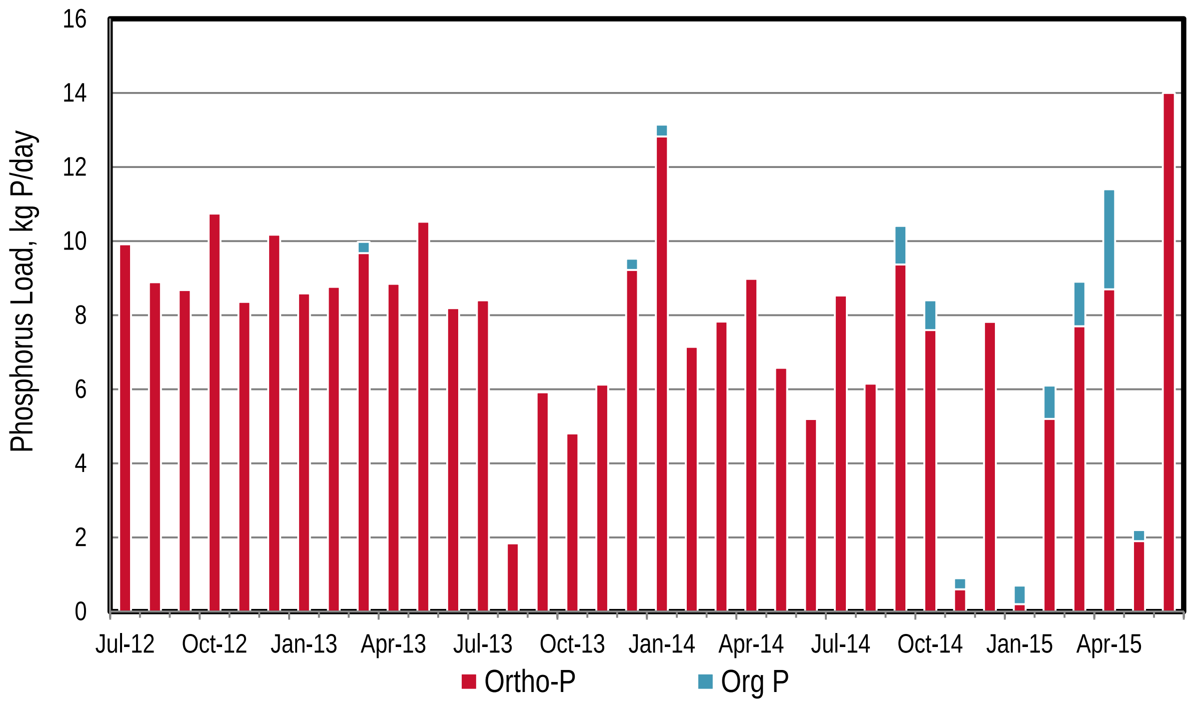

Figure 20-4. Rodeo Monthly Phosphorus Loads

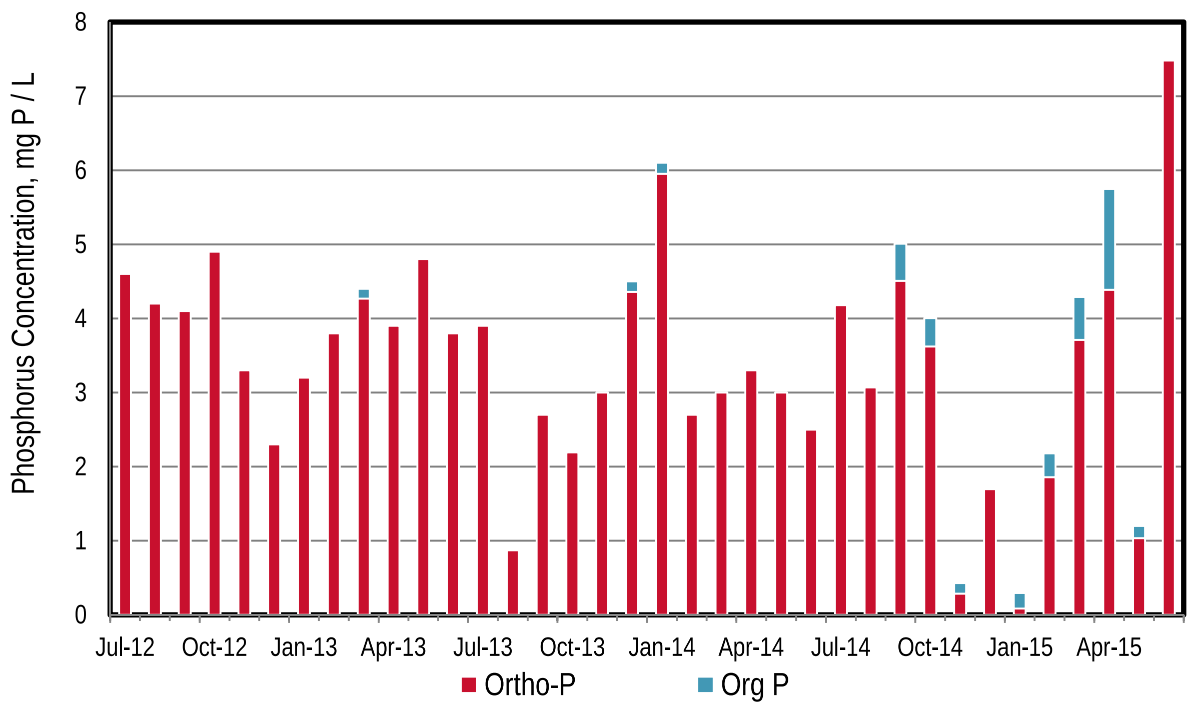

Figure 20-5. Rodeo Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 20-1. Rodeo Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.6	5	7	26	33	19	10
Aug 2012	0.6	10	13	30	43	20	9
Sep 2012	0.6	9	11	21	32	22	9
Oct 2012	0.6	6	10	23	33	14	11
Nov 2012	0.7	1	4	23	28	13	8
Dec 2012	1.2	1	4	62	65	32	10
Jan 2013	0.7	6	10	44	54	10	9
Feb 2013	0.6	13	15	40	56	9	9
Mar 2013	0.6	7	10	38	48	10	10
Apr 2013	0.6	4	6	37	43	10	9
May 2013	0.6	1	4	26	31	13	11
Jun 2013	0.6	1	5	26	31	9	8
Jul 2013	0.6	1	0	26	26	10	8
Aug 2013	0.6	1	4	19	23	2	2
Sep 2013	0.6	1	10	31	41	8	6
Oct 2013	0.6	7	8	24	33	5	5
Nov 2013	0.5	1	1	27	28	7	6
Dec 2013	0.6	18	18	16	34	9	10
Jan 2014	0.6	5	7	39	46	13	13
Feb 2014	0.7	7	14	23	37	16	7
Mar 2014	0.7	1	4	29	33	14	8
Apr 2014	0.7	4	6	27	34	18	9
May 2014	0.6	7	9	21	30	8	7
Jun 2014	0.6	4	10	25	35	5	5
Jul 2014	0.5	5	17	24	41	9	9
Aug 2014	0.5	1	13	26	39	7	6
Sep 2014	0.6	1	20	25	45	9	10
Oct 2014	0.6	6	12	23	35	8	8
Nov 2014	0.6	0	3	23	27	1	1
Dec 2014	1.2	8	18	60	77	13	8
Jan 2015	0.6	1	5	18	23	0	1
Feb 2015	0.7	4	11	25	35	5	6
Mar 2015	0.5	13	16	20	35	8	9
Apr 2015	0.5	2	7	29	36	9	11
May 2015	0.5	1	6	20	27	2	2
Jun 2015	0.5	6	10	25	35	20	14
Dry Season Average	**0.6**	**4**	**9**	**25**	**34**	**11**	**8**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**0.7**	**5**	**9**	**31**	**40**	**11**	**8**
Average Annual	**0.6**	**5**	**9**	**28**	**38**	**11**	**8**

21 San Jose-Santa Clara Regional Wastewater Facility

The San Jose-Santa Clara Regional Wastewater Facility discharges to the Lower South Bay, and serves an estimated population of 1.4 million with about 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. The current flows are about 80 mgd ADWF. The process includes advanced treatment with a BNR activated sludge system for N and P removal.

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

- The flows reduce 10 to 20 mgd from the wet to the dry season due to a combination of recycled water demand and a lack of I&I during the dry season.
- Based on the average monthly values table below, there appears to be a downward trend in flows during the dry season for the reasons stated above.
- There appears to be an upward trend for NOx, TN, ortho-P, and TP loads. The increase in concentrations over time supports this trend as the dry season flows are relatively flat.
- Both nitrogen (except ammonia) and phosphorus loads increase with flow during wet weather events.
- Wet season loads are greater and more variable than the dry season loads.
- NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since the plant nitrifies.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots.
- Total phosphorus loads are variable in the wet season compared to the dry season.
- Total phosphorus concentrations are reliably below 1 mg P/L during the dry season with occasional excursions above 2 mg P/L during the wet season.

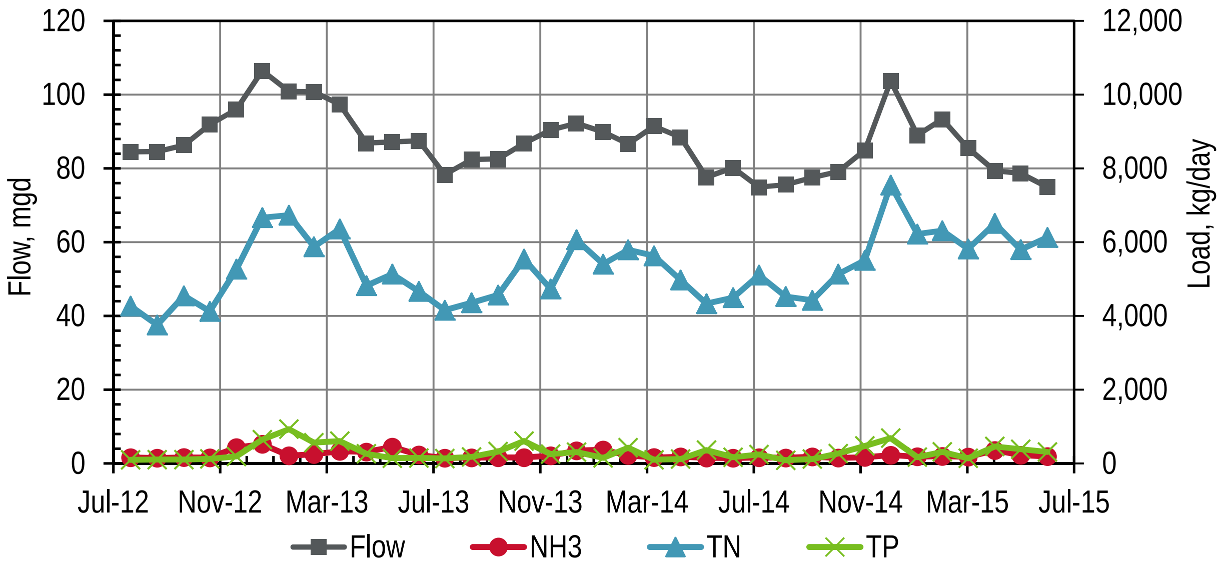

Figure 21-1. San Jose Monthly Flows and Loads

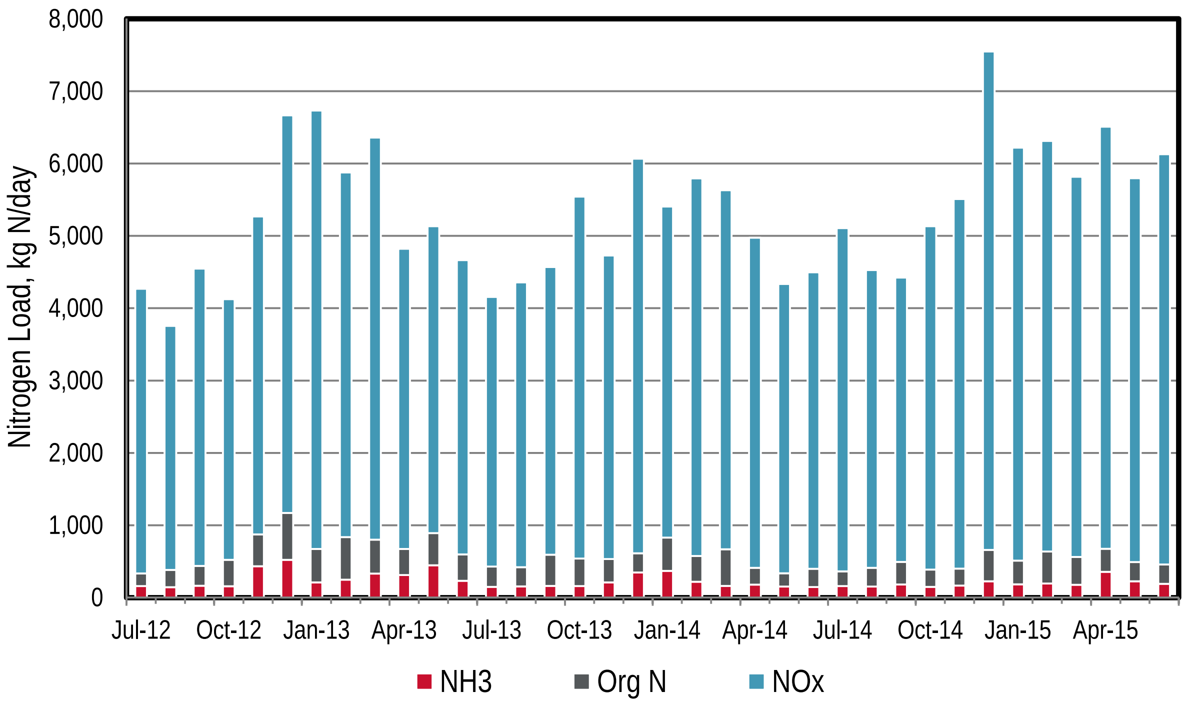

Figure 21-2. San Jose Monthly Nitrogen Loads

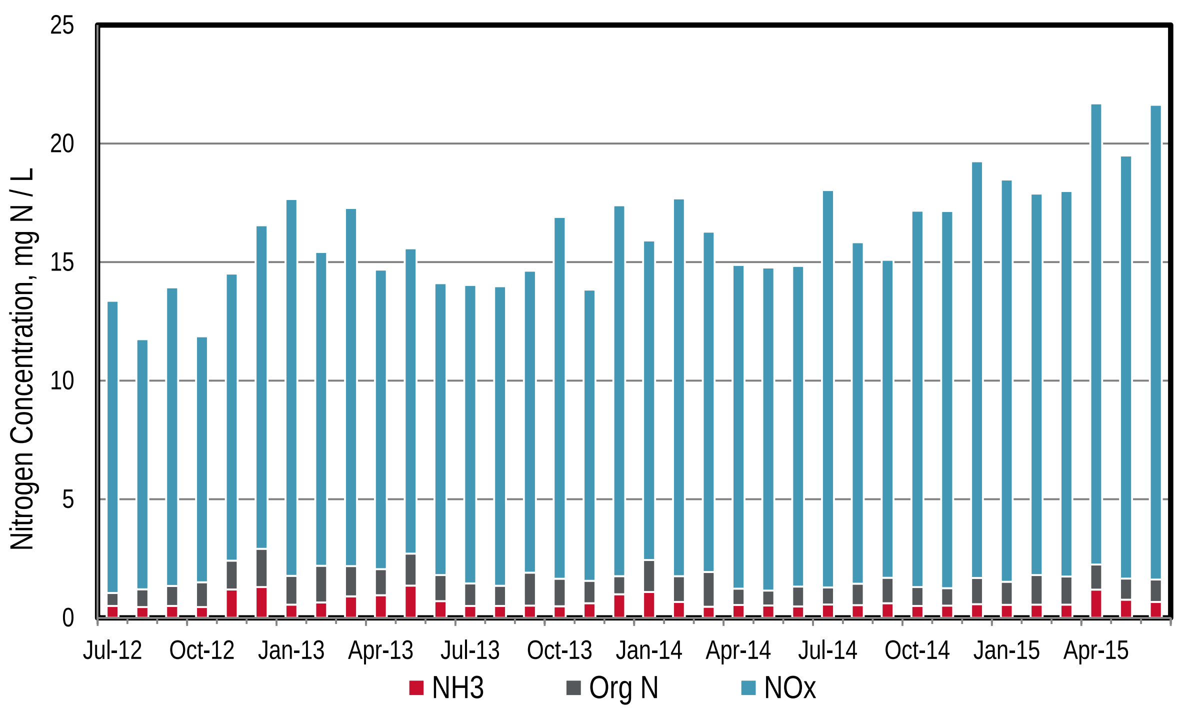

Figure 21-3. San Jose Monthly Nitrogen Concentrations

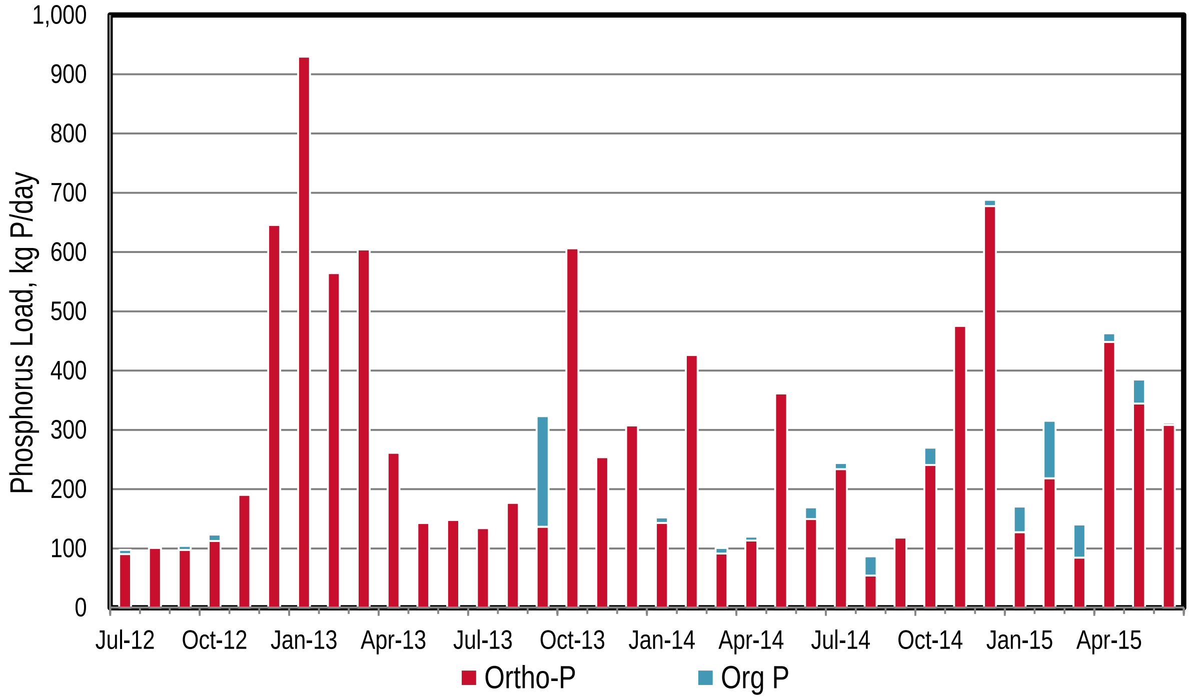

Figure 21-4. San Jose Monthly Phosphorus Loads

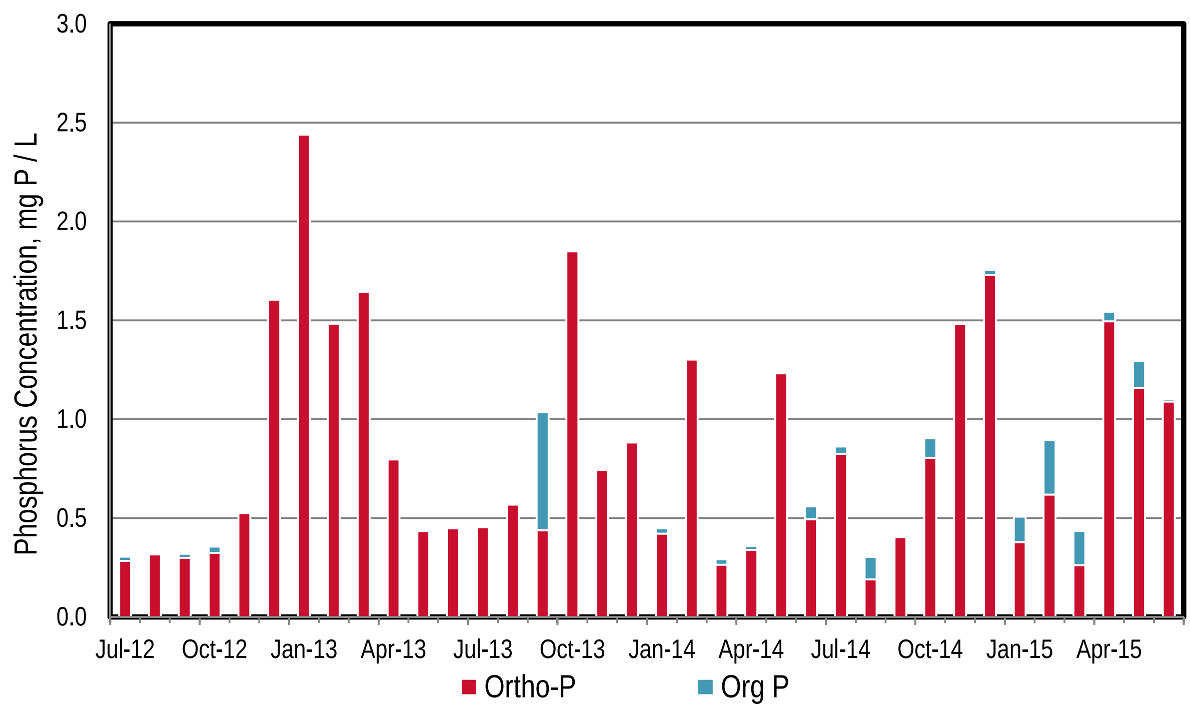

Figure 21-5. San Jose Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 21-1. San Jose Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	84	160	335	3,932	4,267	90	97
Aug 2012	85	144	384	3,372	3,755	101	104
Sep 2012	86	163	439	4,107	4,546	98	104
Oct 2012	92	157	521	3,604	4,125	113	124
Nov 2012	96	433	874	4,393	5,267	203	190
Dec 2012	107	523	1,171	5,494	6,665	672	646
Jan 2013	101	211	674	6,059	6,732	1,102	930
Feb 2013	101	247	836	5,040	5,876	746	565
Mar 2013	97	332	802	5,557	6,359	746	605
Apr 2013	87	313	674	4,148	4,822	304	261
May 2013	87	446	892	4,242	5,134	167	143
Jun 2013	87	232	596	4,068	4,665	148	149
Jul 2013	78	148	429	3,726	4,156	159	134
Aug 2013	82	156	421	3,936	4,357	217	177
Sep 2013	83	161	594	3,975	4,569	137	323
Oct 2013	87	161	541	5,002	5,543	766	606
Nov 2013	90	211	534	4,195	4,729	254	254
Dec 2013	92	347	612	5,455	6,067	349	307
Jan 2014	90	370	829	4,576	5,405	143	152
Feb 2014	87	220	575	5,219	5,794	521	426
Mar 2014	91	162	667	4,963	5,630	91	101
Apr 2014	88	180	411	4,562	4,973	113	120
May 2014	78	153	338	3,997	4,334	411	361
Jun 2014	80	146	399	4,098	4,496	150	169
Jul 2014	75	160	363	4,743	5,107	234	244
Aug 2014	76	152	412	4,115	4,526	54	87
Sep 2014	78	181	494	3,929	4,424	129	118
Oct 2014	79	149	387	4,746	5,133	241	270
Nov 2014	85	166	401	5,108	5,508	496	475
Dec 2014	104	226	658	6,890	7,549	678	688
Jan 2015	89	184	512	5,708	6,219	127	171
Feb 2015	93	195	636	5,675	6,312	218	315
Mar 2015	85	178	563	5,253	5,816	85	141
Apr 2015	79	356	675	5,832	6,508	448	463
May 2015	79	227	491	5,306	5,797	344	385
Jun 2015	75	190	458	5,670	6,128	309	312
Dry Season Average	**81**	**188**	**470**	**4,214**	**4,684**	**183**	**194**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Wet Season Average	**91**	**253**	**645**	**5,118**	**5,763**	**401**	**372**
Average Annual	**87**	**226**	**572**	**4,742**	**5,314**	**310**	**298**

22 City of San Mateo

San Mateo discharges to the South Bay and it has approximately 37,823 service connections. The plant has a permitted ADWF capacity of 15.7 mgd and a peak wet weather capacity of 60 mgd, with blending allowable above 40 mgd. The current flows are about 9.9 mgd ADWF. The plant performs secondary treatment using activated sludge, followed by filtration for advanced treatment.

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

- Based on the average monthly values table below, there appears to be a downward trend for flows in the dry season. This is attributed to a combination of weather (drought) and water conservation.
- There appears to be an upward trend for all the nutrient species (except ortho-P) in the dry season.
- Nitrogen loads and concentrations are typically highest during the dry season.
- Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
- Phosphorus loads have remained relatively flat over the years, whereas total phosphorus concentrations appear to be random with little or no seasonal trends.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 2.0 to 4.2 mg P/L, This suggests a portion of P is removed as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is most likely from ferrous chloride addition to solids thickening.

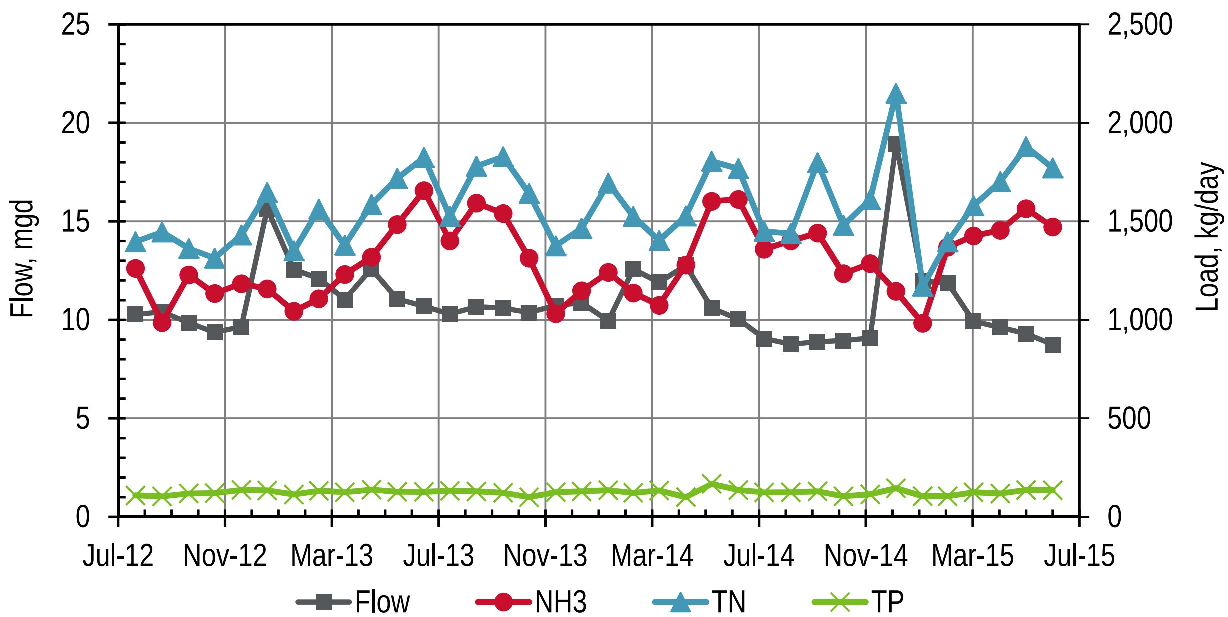

Figure 22-1. San Mateo Monthly Flows and Loads

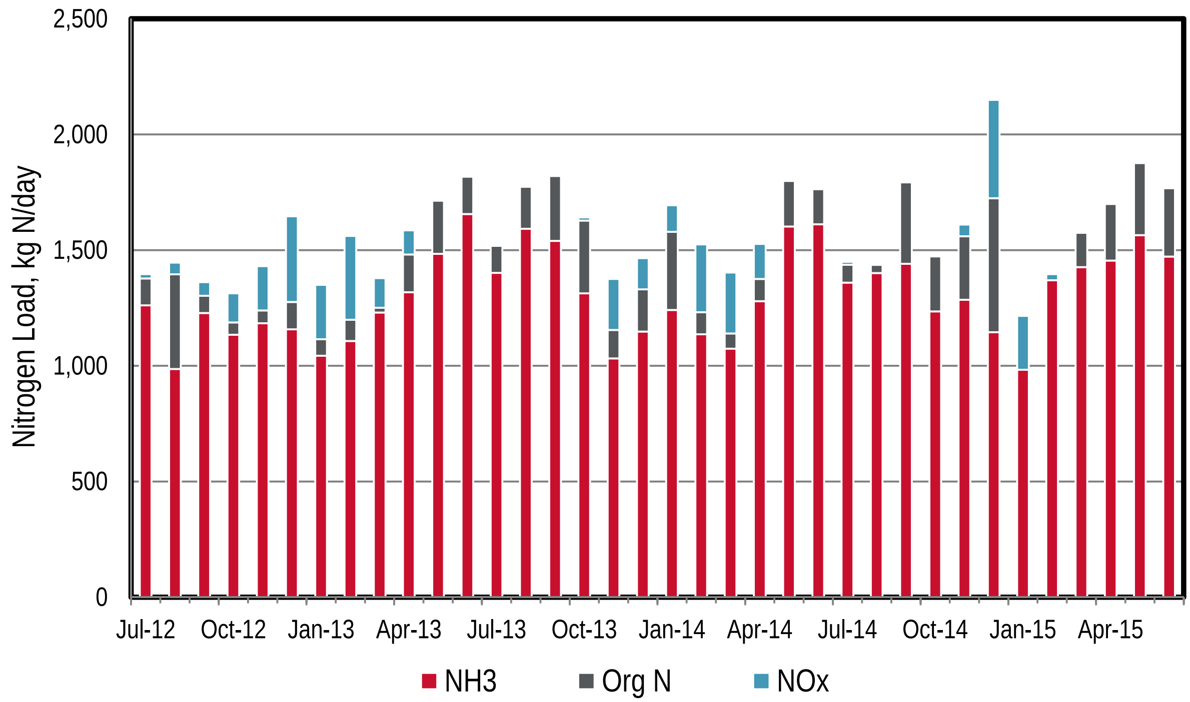

Figure 22-2. San Mateo Monthly Nitrogen Loads

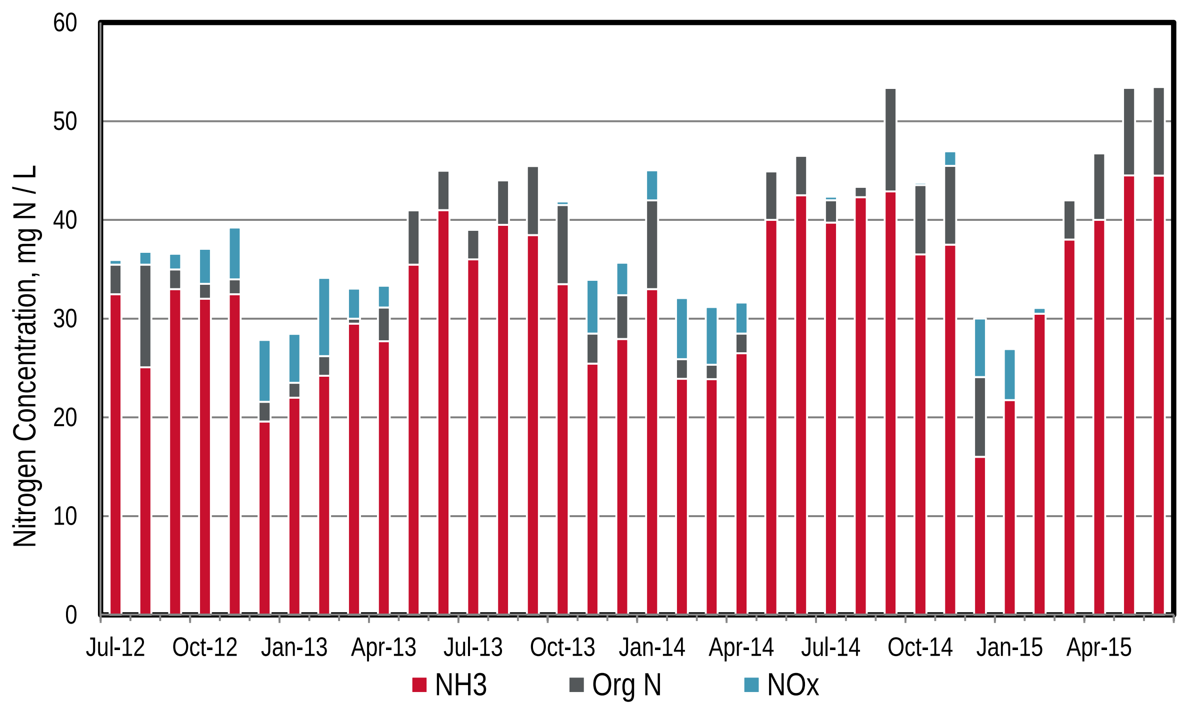

Figure 22-3. San Mateo Monthly Nitrogen Concentrations

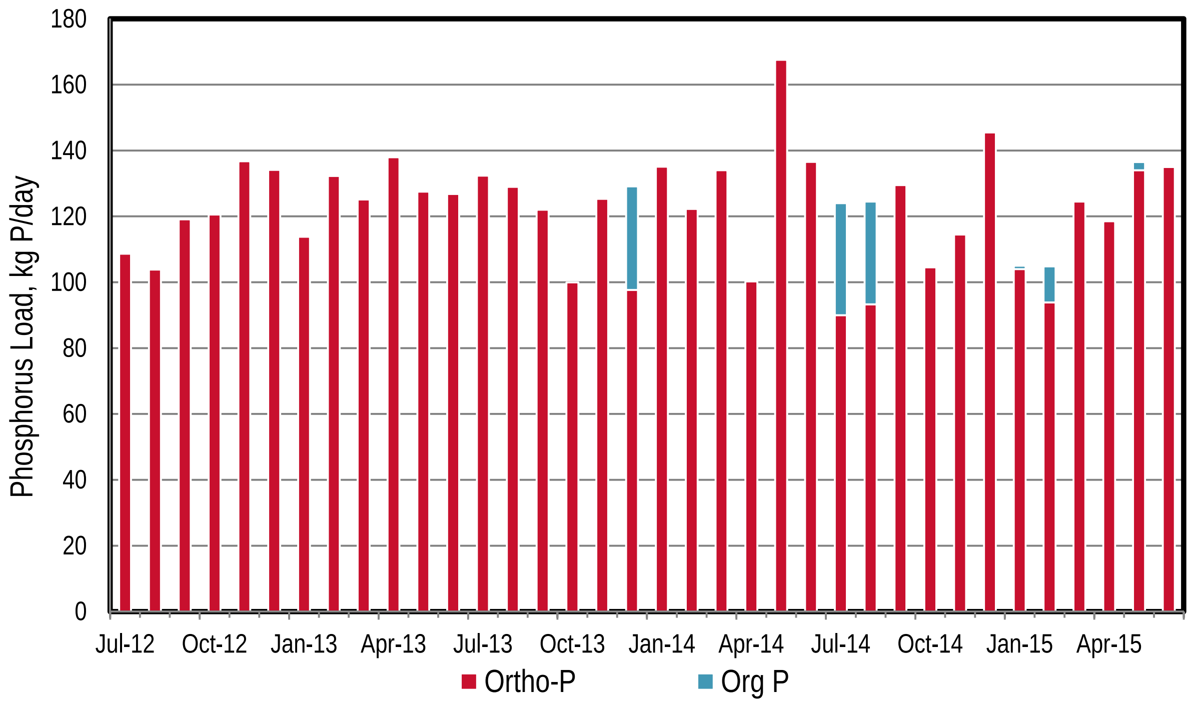

Figure 22-4. San Mateo Monthly Phosphorus Loads

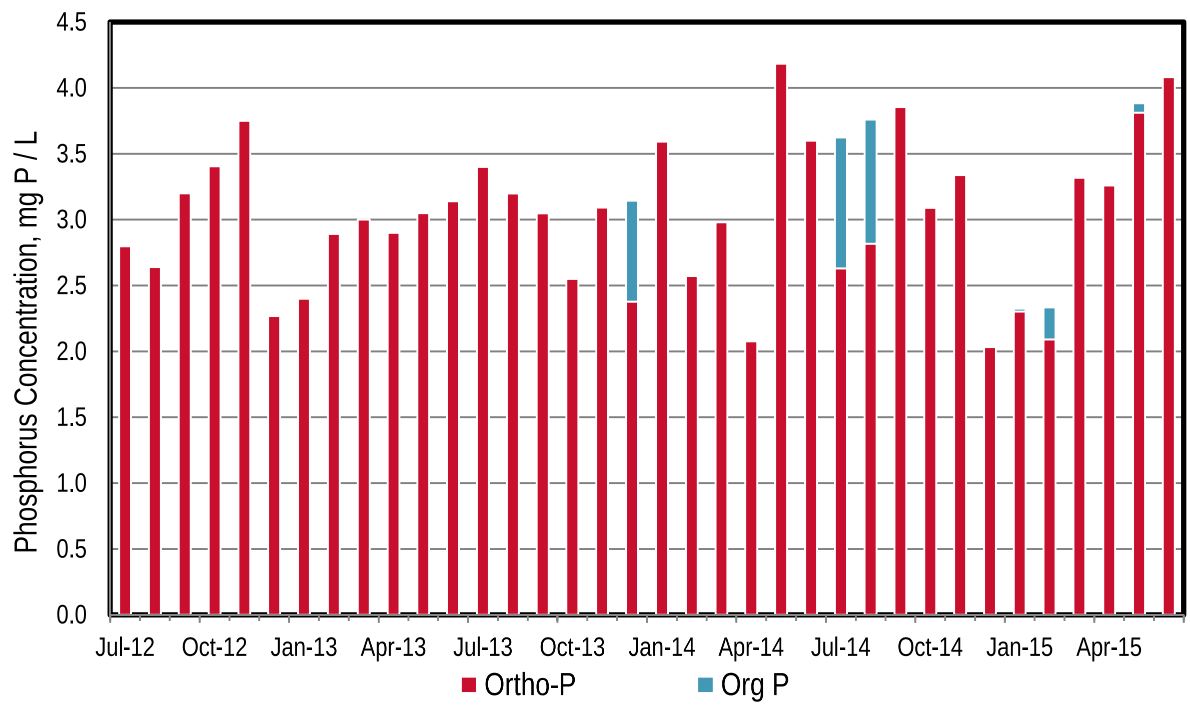

Figure 22-5. San Mateo Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 22-1. San Mateo Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	10.3	1,262	1,378	18	1,396	113	109
Aug 2012	10.4	986	1,395	51	1,446	127	104
Sep 2012	9.8	1,228	1,303	59	1,362	140	119
Oct 2012	9.4	1,134	1,187	126	1,313	207	121
Nov 2012	9.6	1,184	1,239	192	1,430	158	137
Dec 2012	15.6	1,158	1,276	371	1,646	141	134
Jan 2013	12.6	1,044	1,115	235	1,350	149	114
Feb 2013	12.1	1,107	1,199	362	1,561	220	132
Mar 2013	11.0	1,230	1,251	127	1,378	245	125
Apr 2013	12.6	1,318	1,481	104	1,585	140	138
May 2013	11.1	1,484	1,714	4	1,718	142	128
Jun 2013	10.7	1,656	1,818	7	1,824	127	127
Jul 2013	10.3	1,402	1,518	6	1,525	221	132
Aug 2013	10.7	1,593	1,774	6	1,780	193	129
Sep 2013	10.6	1,540	1,820	8	1,828	205	122
Oct 2013	10.4	1,313	1,627	14	1,641	219	100
Nov 2013	10.7	1,032	1,155	221	1,376	250	125
Dec 2013	10.9	1,148	1,330	135	1,465	98	129
Jan 2014	10.0	1,241	1,579	115	1,694	263	135
Feb 2014	12.6	1,136	1,231	294	1,525	131	122
Mar 2014	11.9	1,074	1,140	263	1,403	203	134
Apr 2014	12.8	1,279	1,376	151	1,527	319	100
May 2014	10.6	1,602	1,799	6	1,805	273	168
Jun 2014	10.0	1,612	1,764	4	1,767	257	137
Jul 2014	9.1	1,359	1,437	12	1,449	90	124
Aug 2014	8.8	1,401	1,436	3	1,439	93	125
Sep 2014	8.9	1,441	1,793	5	1,798	150	130
Oct 2014	8.9	1,235	1,473	7	1,480	177	105
Nov 2014	9.1	1,286	1,560	51	1,611	143	115
Dec 2014	18.9	1,145	1,725	425	2,150	156	146
Jan 2015	12.0	983	938	233	1,171	104	105
Feb 2015	11.9	1,370	1,369	27	1,396	94	105
Mar 2015	9.9	1,426	1,575	4	1,579	136	125
Apr 2015	9.6	1,455	1,700	2	1,702	183	119
May 2015	9.3	1,564	1,877	2	1,879	134	137
Jun 2015	8.8	1,472	1,768	3	1,771	146	135
Dry Season Average	**9.9**	**1,440**	**1,640**	**13**	**1,652**	**161**	**128**
Dry Season Trend (n=15)	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**
Wet Season Average	**11.5**	**1,205**	**1,358**	**165**	**1,523**	**178**	**122**
Average Annual	**10.9**	**1,303**	**1,475**	**101**	**1,577**	**171**	**125**

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. The current plant flow is 1.9 mgd. The plant performs nitrification using under-loaded trickling filters.

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

- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for flows.
- Nitrogen and phosphorus loads increase with flow during wet weather events.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. However, a portion of ammonia occasionally bleeds through year round. The ammonia bleed through is attributed to cold weather and over loading the trickling filters for nitrification.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 1.6 to 11 mg P/L, This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is thought to be metal salt addition in the collection system.

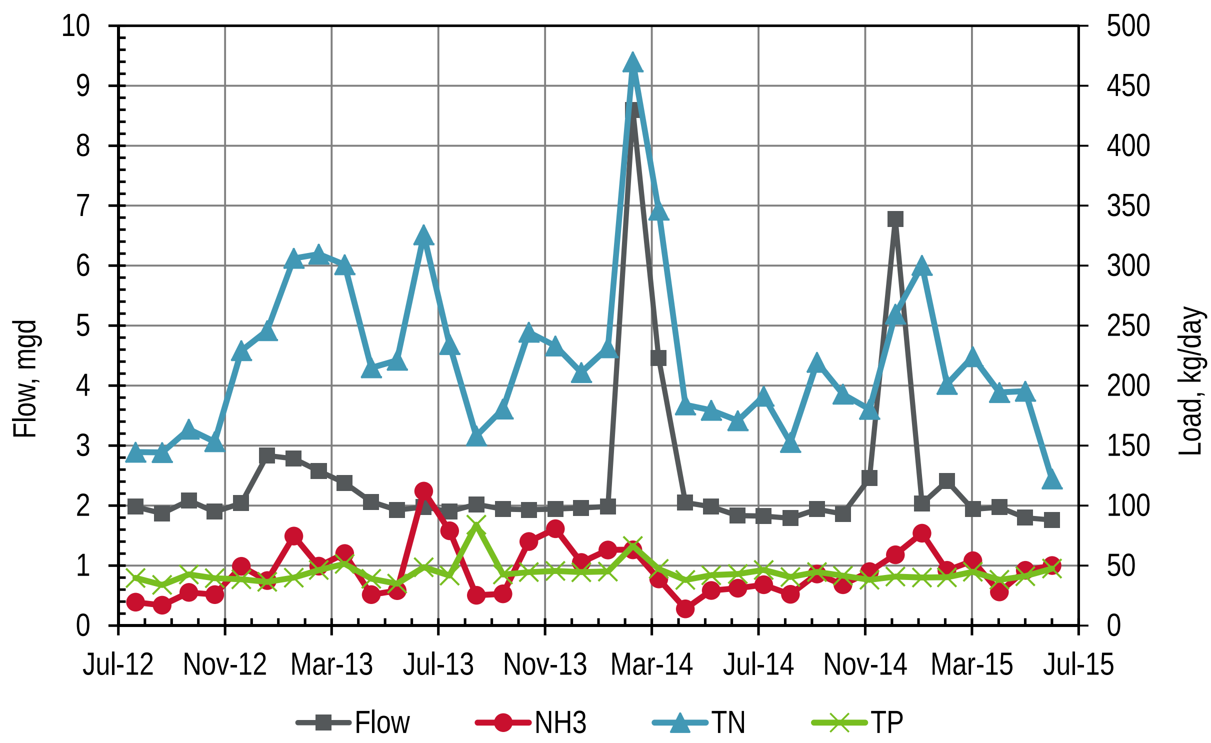

Figure 23-1. SASM Monthly Flows and Loads

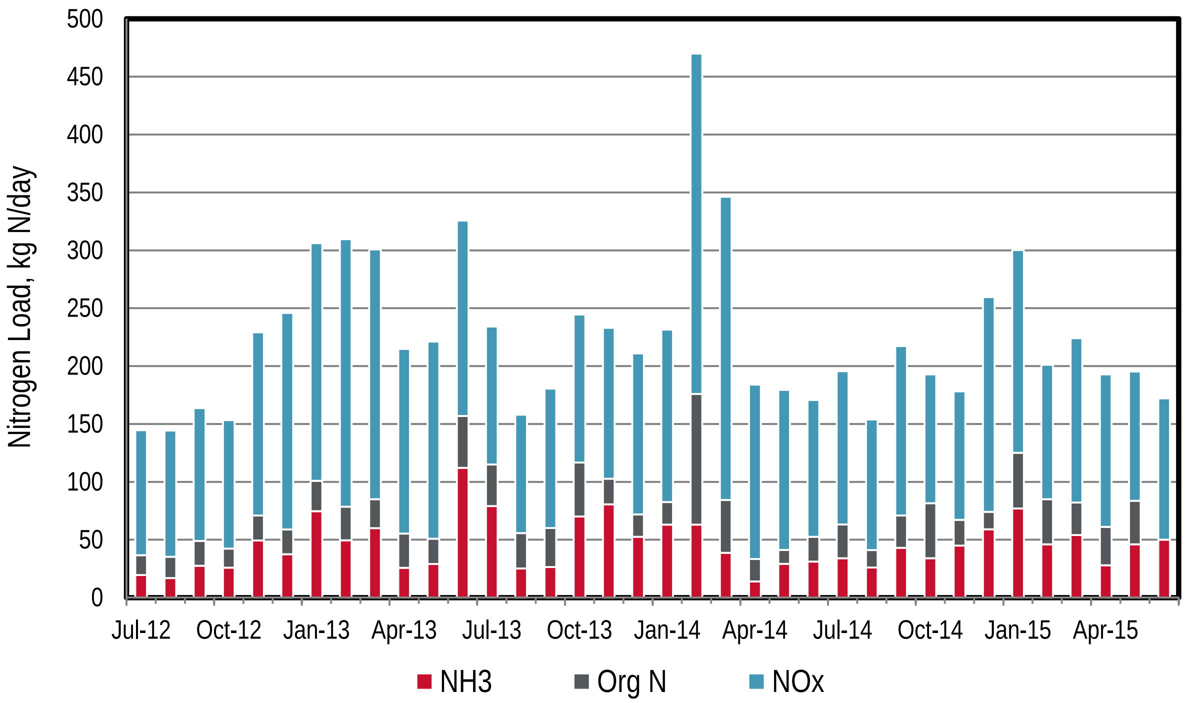

Figure 23-2. SASM Monthly Nitrogen Loads

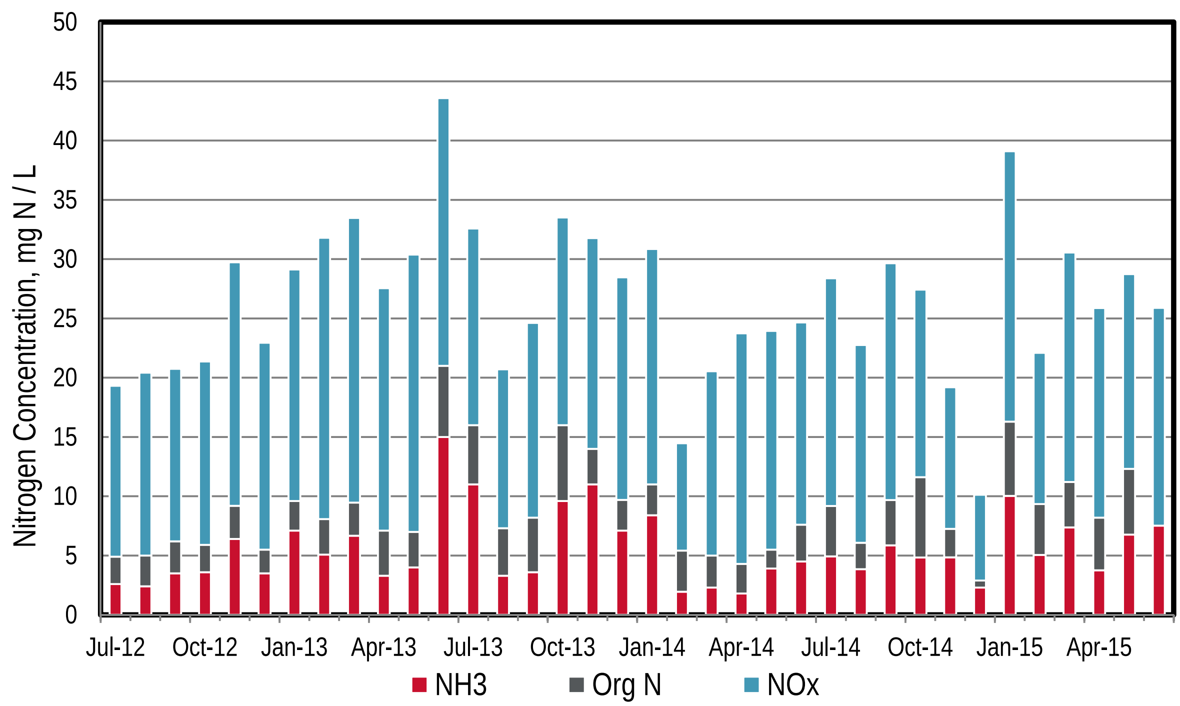

Figure 23-3. SASM Monthly Nitrogen Concentrations

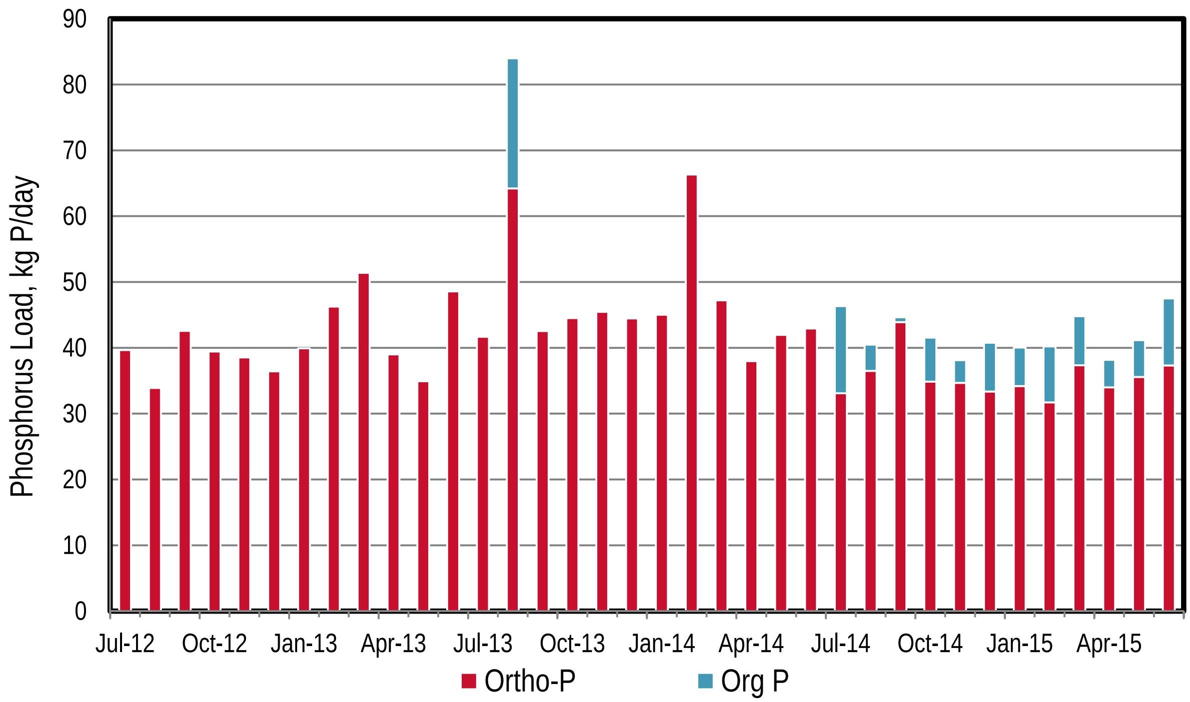

Figure 23-4. SASM Monthly Phosphorus Loads

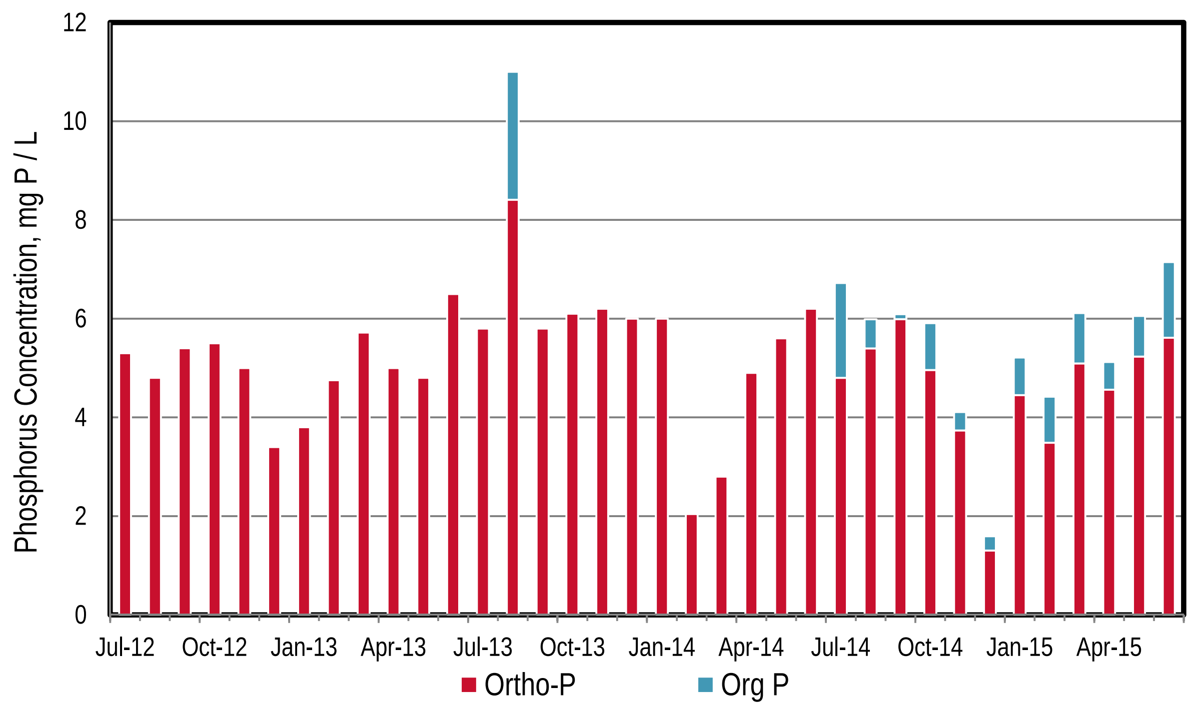

Figure 23-5. SASM Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 23-1. SASM Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	2.0	19	37	108	145	56	40
Aug 2012	1.9	17	35	109	144	69	34
Sep 2012	2.1	28	49	115	164	70	43
Oct 2012	1.9	26	42	111	153	80	39
Nov 2012	2.0	49	71	158	229	67	39
Dec 2012	2.8	37	59	187	246	55	36
Jan 2013	2.8	75	101	205	306	58	40
Feb 2013	2.6	49	79	231	310	91	46
Mar 2013	2.4	60	85	216	301	78	51
Apr 2013	2.1	26	55	159	215	71	39
May 2013	1.9	29	51	170	221	80	35
Jun 2013	2.0	112	157	169	326	90	49
Jul 2013	1.9	79	115	119	234	66	42
Aug 2013	2.0	25	56	102	158	64	84
Sep 2013	1.9	26	60	120	181	74	43
Oct 2013	1.9	70	117	128	245	78	45
Nov 2013	1.9	81	103	130	233	79	45
Dec 2013	2.0	53	72	139	211	79	44
Jan 2014	2.0	63	83	149	232	98	45
Feb 2014	8.6	63	176	294	470	128	66
Mar 2014	4.5	39	84	262	346	120	47
Apr 2014	2.1	14	33	151	184	72	38
May 2014	2.0	29	41	138	179	78	42
Jun 2014	1.8	31	53	118	171	164	43
Jul 2014	1.8	34	63	132	191	33	46
Aug 2014	1.8	26	41	113	153	36	40
Sep 2014	1.9	43	71	146	219	44	45
Oct 2014	1.9	34	82	111	193	35	42
Nov 2014	2.5	45	67	111	180	35	38
Dec 2014	6.8	59	74	185	260	33	41
Jan 2015	2.0	77	125	175	300	34	40
Feb 2015	2.4	46	85	116	201	32	40
Mar 2015	1.9	54	82	142	224	37	45
Apr 2015	2.0	28	61	132	194	34	38
May 2015	1.8	46	84	112	195	36	41
Jun 2015	1.8	50	0	122	122	37	48
Dry Season Average	**1.9**	**40**	**61**	**126**	**187**	**66**	**45**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**2.8**	**50**	**83**	**166**	**249**	**66**	**43**
Average Annual	**2.4**	**46**	**74**	**150**	**223**	**66**	**44**

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 current flow is about 1.1 mgd ADWF. 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 table in the subsequent pages:

- Based on the average monthly values table below, there do not appear to have any emerging trends during the dry season.
- Nitrogen 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 this plant does not nitrify.
- Total nitrogen concentrations occasionally reach upwards of 100 mg N/L, which is higher than most of the other plants.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 0.3 to 9.2 mg P/L, This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L.
- Total phosphorus concentrations occasionally exceed 9 mg N/L, which is higher than most of the other plants.

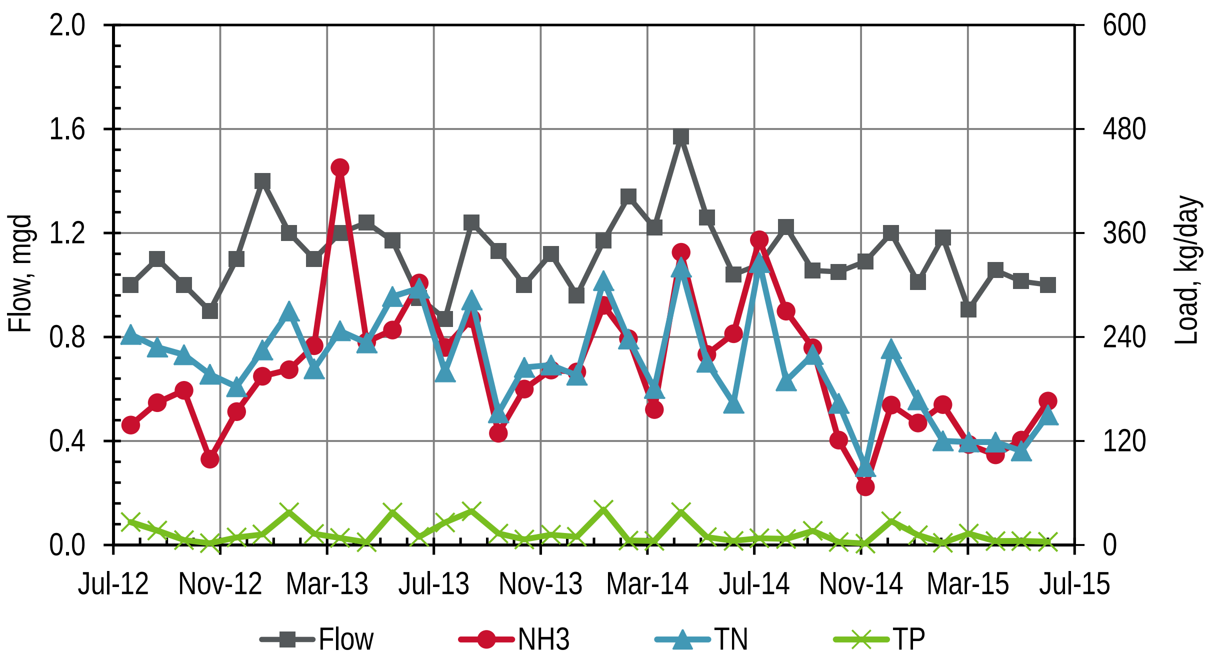

Figure 24-1. SFO Airport Monthly Flows and Loads

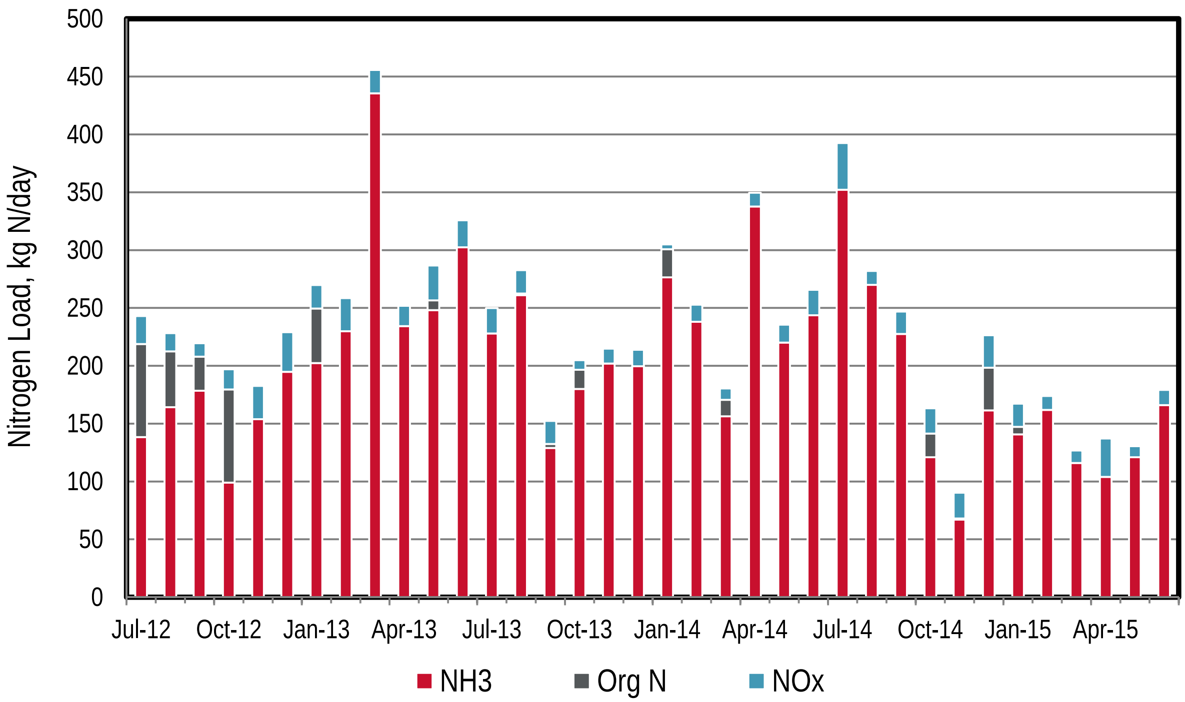

Figure 24-2. SFO Airport Monthly Nitrogen Loads

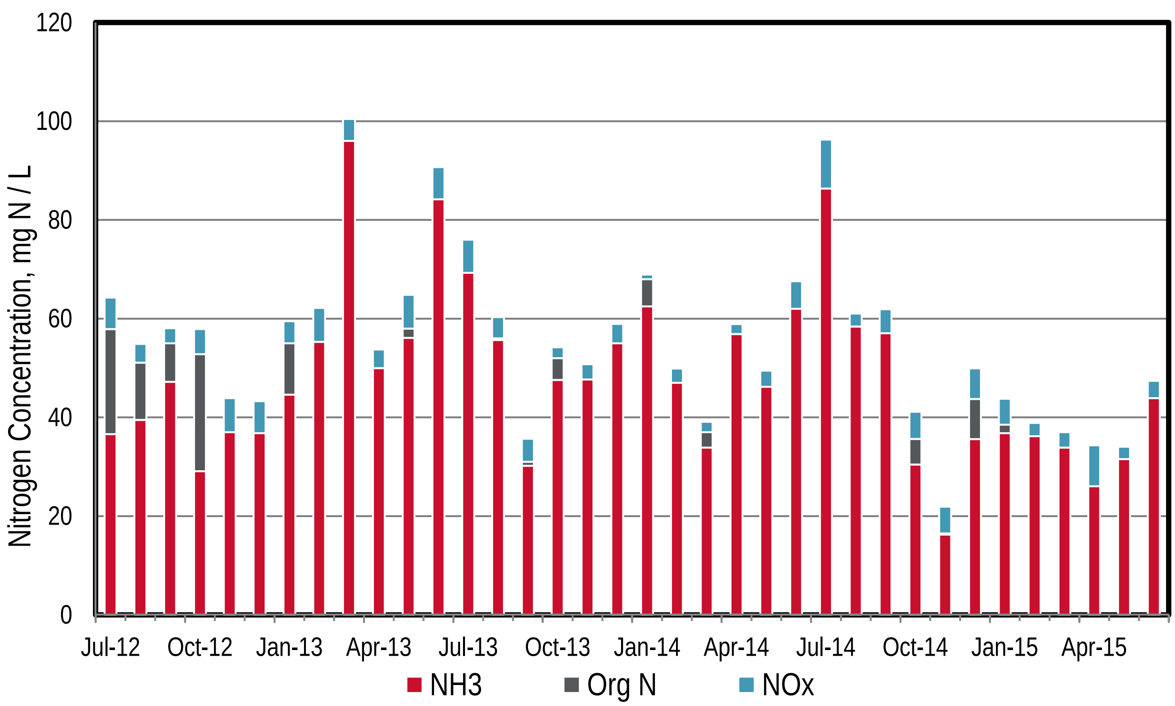

Figure 24-3. SFO Airport Monthly Nitrogen Concentrations

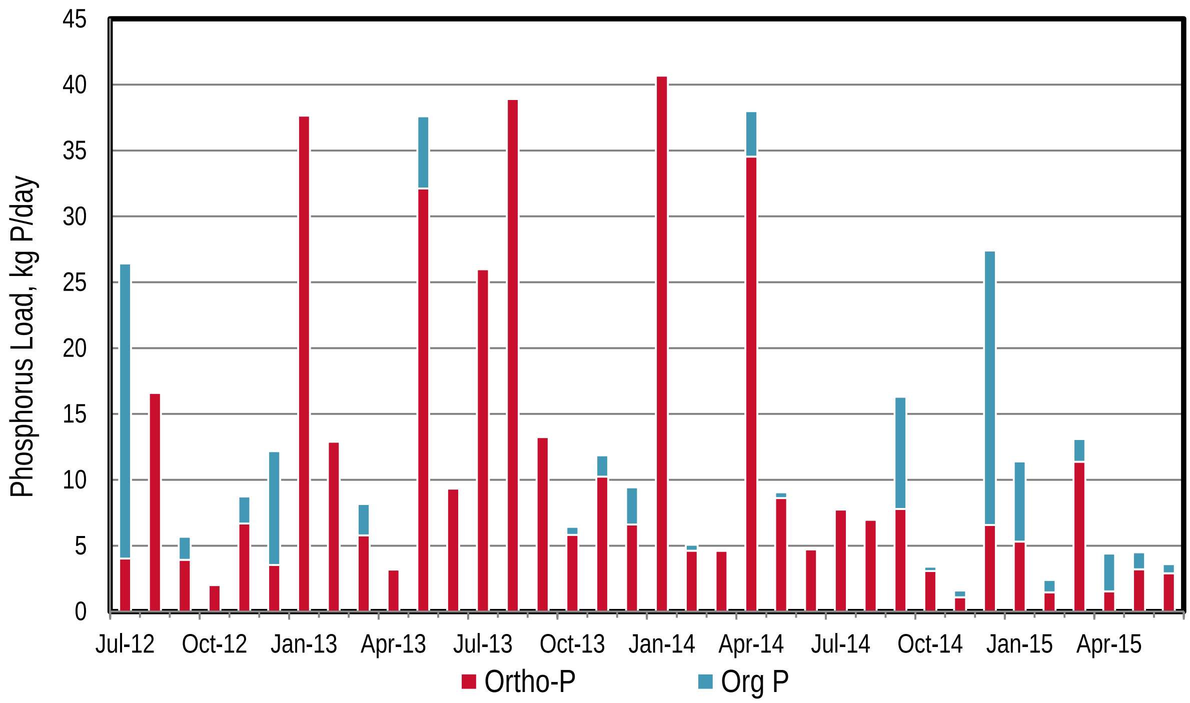

Figure 24-4. SFO Airport Monthly Phosphorus Loads

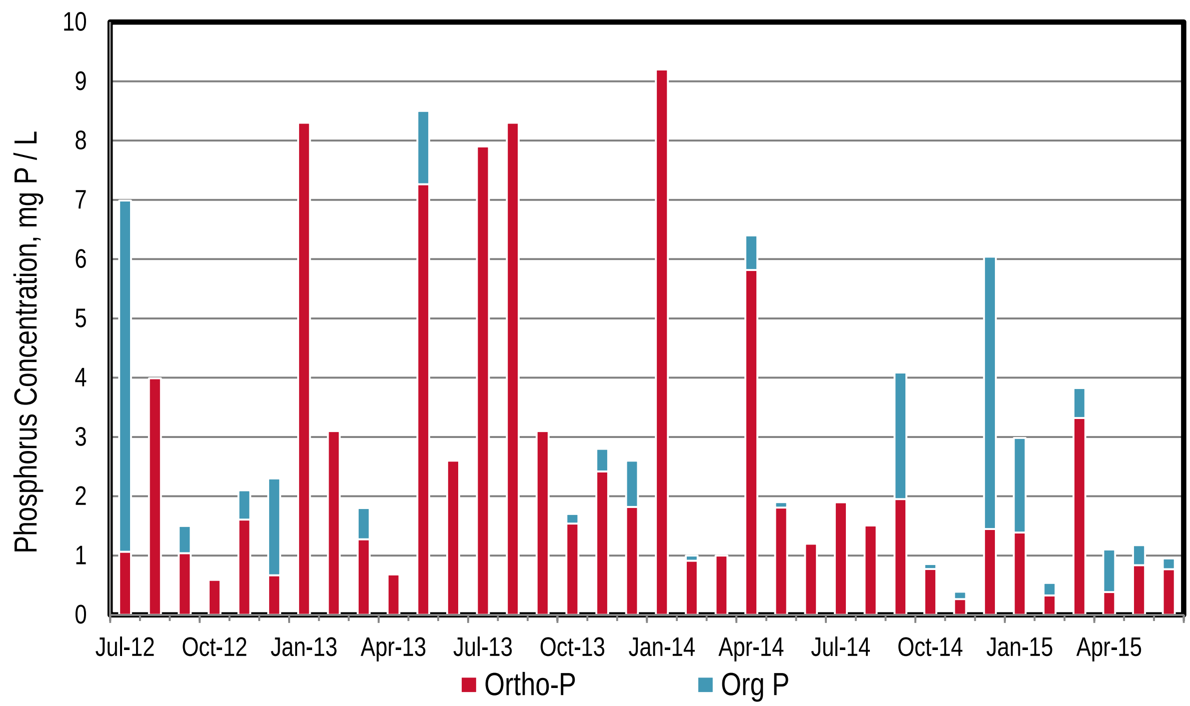

Figure 24-5. SFO Airport Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 24-1. SFO Airport Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	1.0	138	219	24	243	4	26
Aug 2012	1.1	164	212	16	228	25	17
Sep 2012	1.0	178	208	12	219	4	6
Oct 2012	0.9	99	180	17	197	8	2
Nov 2012	1.1	154	154	29	183	7	9
Dec 2012	1.4	195	191	34	225	4	12
Jan 2013	1.2	202	249	20	270	43	38
Feb 2013	1.1	230	175	29	203	25	13
Mar 2013	1.2	435	227	20	247	6	8
Apr 2013	1.2	234	216	18	233	4	3
May 2013	1.2	248	257	30	287	32	38
Jun 2013	1.0	302	273	23	296	12	9
Jul 2013	0.9	228	178	22	200	48	26
Aug 2013	1.2	261	262	20	283	57	39
Sep 2013	1.1	129	132	20	152	17	13
Oct 2013	1.0	180	197	8	205	6	6
Nov 2013	1.1	202	195	13	208	10	12
Dec 2013	1.0	200	181	14	196	7	9
Jan 2014	1.2	276	301	4	305	41	41
Feb 2014	1.3	238	223	15	238	5	5
Mar 2014	1.2	156	171	10	180	6	5
Apr 2014	1.6	338	309	12	321	35	38
May 2014	1.3	220	195	16	211	9	9
Jun 2014	1.0	244	142	22	163	6	5
Jul 2014	1.1	352	285	40	326	13	8
Aug 2014	1.2	270	177	12	189	11	7
Sep 2014	1.1	228	200	19	220	8	16
Oct 2014	1.1	121	141	22	163	3	3
Nov 2014	1.1	67	68	22	90	1	2
Dec 2014	1.2	162	198	28	226	7	27
Jan 2015	1.0	141	147	20	167	5	11
Feb 2015	1.2	162	108	12	120	1	2
Mar 2015	0.9	116	108	11	119	11	13
Apr 2015	1.1	104	85	33	119	2	4
May 2015	1.0	121	99	10	108	3	5
Jun 2015	1.0	166	137	13	150	3	4
Dry Season Average	**1.1**	**217**	**198**	**20**	**218**	**17**	**15**
Dry Season Trend (n=15)	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**1.1**	**191**	**182**	**19**	**201**	**11**	**13**
Average Annual	**1.1**	**202**	**189**	**19**	**208**	**14**	**14**

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 plant currently flows at about 54 mgd ADWF and performs secondary treatment using a high purity oxygen system. The following observations are made based upon the figures and table in the subsequent pages:

- Based on the table with the average monthly values, there appears to be an emerging dry season upward trend for all the nitrogen species during the dry season (n=15).
- The flows appear to be increasing in the dry season, but this is not statistically significant according to the regression analysis.
- Nitrogen loads do not always increase with flows during wet weather events.
- Phosphorus loads are more variable during the wet season.
- With the exception of a few excursions, nitrogen loads appear to be increasing over time, regardless of season.
- Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Although the reported TP concentrations range from 0.1 to 1.6 mg P/L, due to the issues with the analytical method used by SFPUC, it is difficult to have confidence in any emerging trends. SFPUC is now collecting data using mass spectrometry to improve the reliability of the reported phosphorus data.

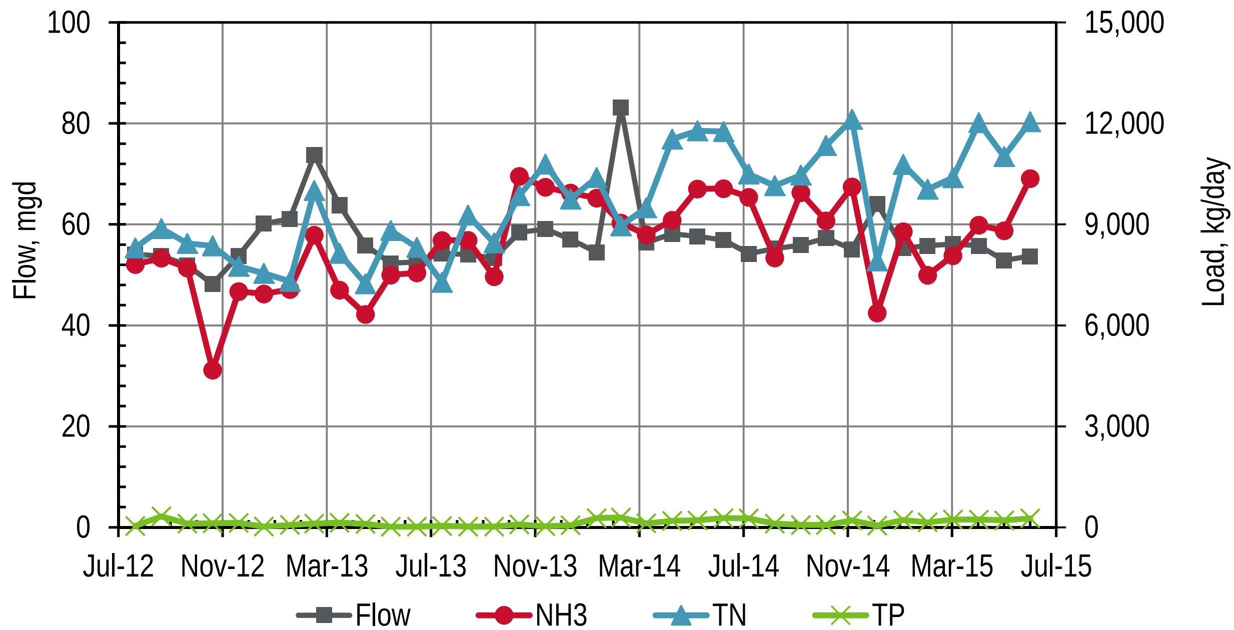

Figure 25-1. SFPUC Southeast Monthly Flows and Loads

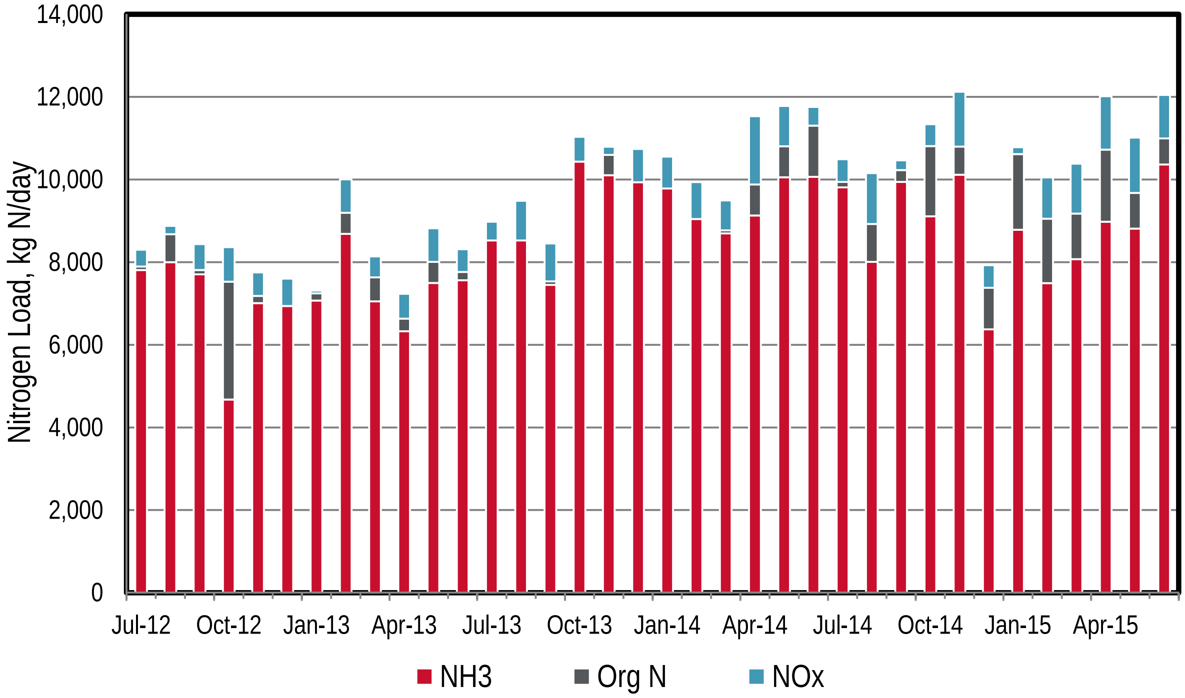

Figure 25-2. SFPUC Southeast Monthly Nitrogen Loads

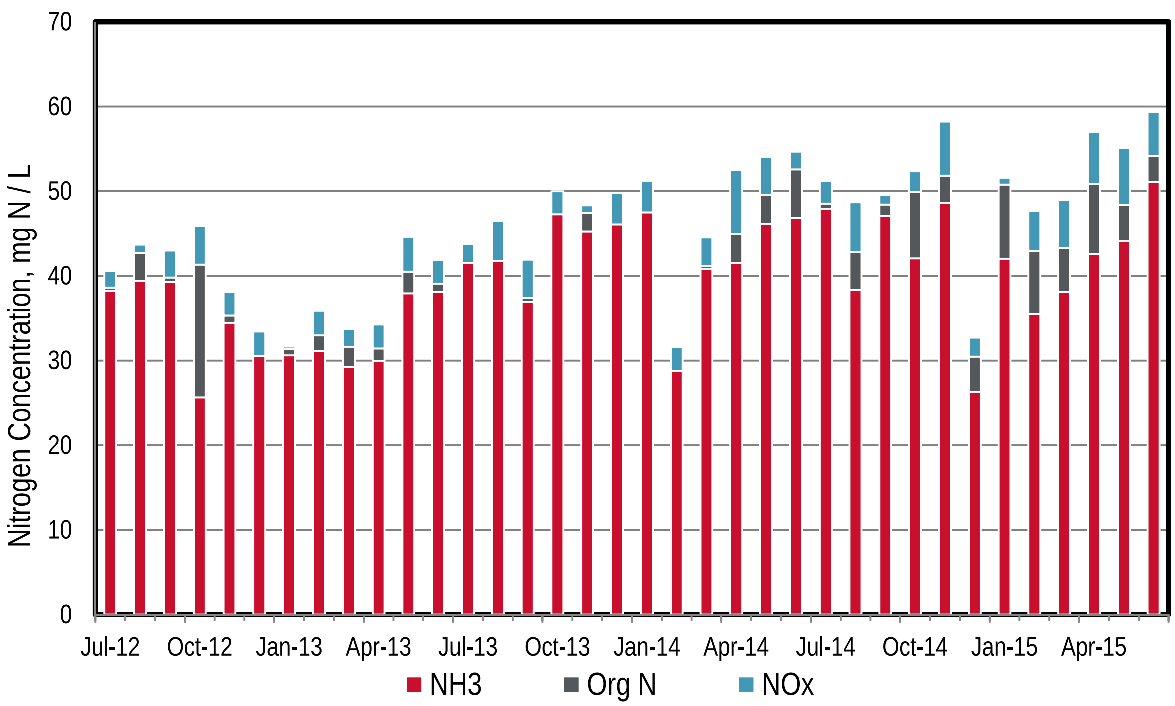

Figure 25-3. SFPUC Southeast Monthly Nitrogen Concentrations

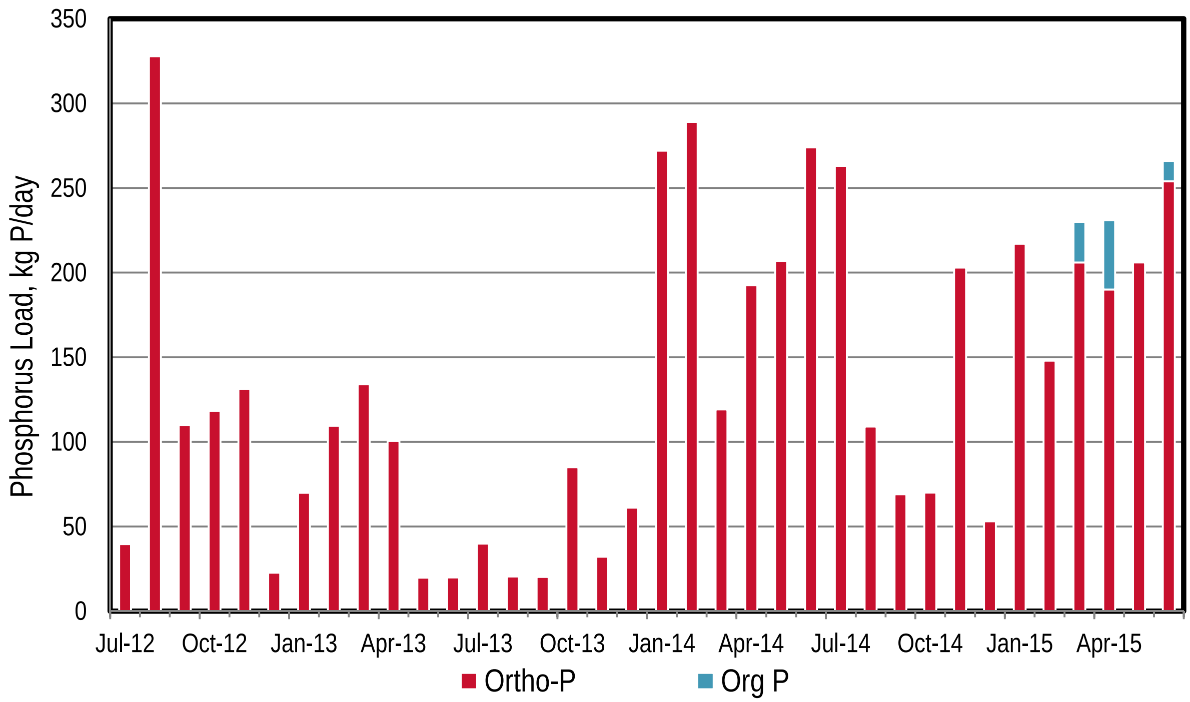

Figure 25-4. SFPUC Southeast Monthly Phosphorus Loads

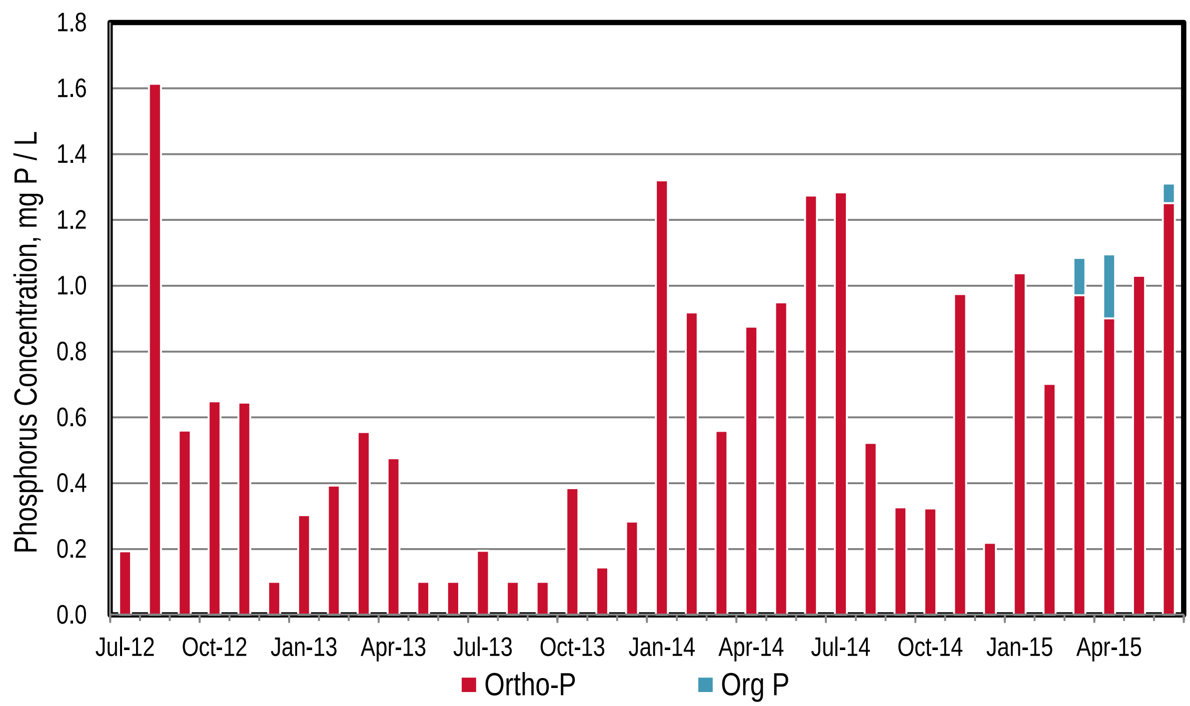

Figure 25-5. SFPUC Southeast Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 25-1. SFPUC Southeast Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	54	7,812	7,897	406	8,302	231	40
Aug 2012	54	7,999	8,677	201	8,878	831	328
Sep 2012	52	7,707	7,808	627	8,436	304	110
Oct 2012	48	4,674	7,529	832	8,362	295	118
Nov 2012	54	7,009	7,182	570	7,752	560	131
Dec 2012	60	6,939	6,882	663	7,545	173	23
Jan 2013	61	7,070	7,244	65	7,309	244	70
Feb 2013	74	8,683	9,196	810	10,006	324	110
Mar 2013	64	7,050	7,633	506	8,139	308	134
Apr 2013	56	6,327	6,635	600	7,235	234	100
May 2013	52	7,498	8,008	813	8,820	356	20
Jun 2013	53	7,563	7,764	550	8,314	215	20
Jul 2013	54	8,526	6,828	451	7,279	688	40
Aug 2013	54	8,528	8,321	956	9,277	288	20
Sep 2013	53	7,449	7,534	920	8,453	200	20
Oct 2013	58	10,433	9,255	600	9,855	131	85
Nov 2013	59	10,107	10,598	194	10,793	132	32
Dec 2013	57	9,935	8,947	804	9,752	147	61
Jan 2014	55	9,785	9,622	769	10,391	359	272
Feb 2014	83	9,043	8,064	895	8,959	446	289
Mar 2014	56	8,698	8,769	726	9,494	228	119
Apr 2014	58	9,129	9,882	1,653	11,535	307	192
May 2014	58	10,053	10,806	973	11,779	349	207
Jun 2014	57	10,067	11,306	452	11,758	478	274
Jul 2014	54	9,809	9,943	549	10,496	287	263
Aug 2014	55	8,006	8,926	1,230	10,149	161	109
Sep 2014	56	9,944	10,229	235	10,462	152	69
Oct 2014	57	9,109	10,811	528	11,343	159	70
Nov 2014	55	10,118	10,796	1,328	12,121	203	203
Dec 2014	64	6,373	7,381	544	7,915	119	53
Jan 2015	55	8,784	10,614	168	10,782	222	217
Feb 2015	56	7,491	9,052	997	10,044	205	148
Mar 2015	56	8,073	9,177	1,207	10,388	206	230
Apr 2015	56	8,980	10,723	1,295	12,022	190	231
May 2015	53	8,814	9,675	1,339	11,017	206	206
Jun 2015	54	10,365	10,995	1,052	12,052	254	266
Dry Season Average	54	**8,676**	**8,981**	**717**	**9,698**	**333**	**133**
Dry Season Trend (n=15)	No	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**
Wet Season Average	59	**8,277**	**8,857**	**750**	**9,607**	**247**	**138**
Average Annual	57	**8,443**	**8,909**	**736**	**9,645**	**283**	**136**

26 Sausalito-Marin City Sanitary District (SMCSD)

SMCSD discharges to the Central Bay. The plant has approximately 6,500 service connections and permitted capacity of 1.8 mgd ADWF. The current flows are about 1.2 mgd ADWF. The plant performs partial nitrification using a trickling filter.

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

- Based on the table with the average monthly values, there appears to be an emerging downward trend for flows and phosphorus loads during the dry season.
- Nitrogen and phosphorus loads do not appear to track with flows during wet weather events.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. A portion of ammonia bleeds through year round due to the trickling filters inability to reliably remove all the ammonia.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 0.8 to 6.1 mg P/L, This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is most likely from metal salt addition at the front of the plant with removal in the primary clarifiers.

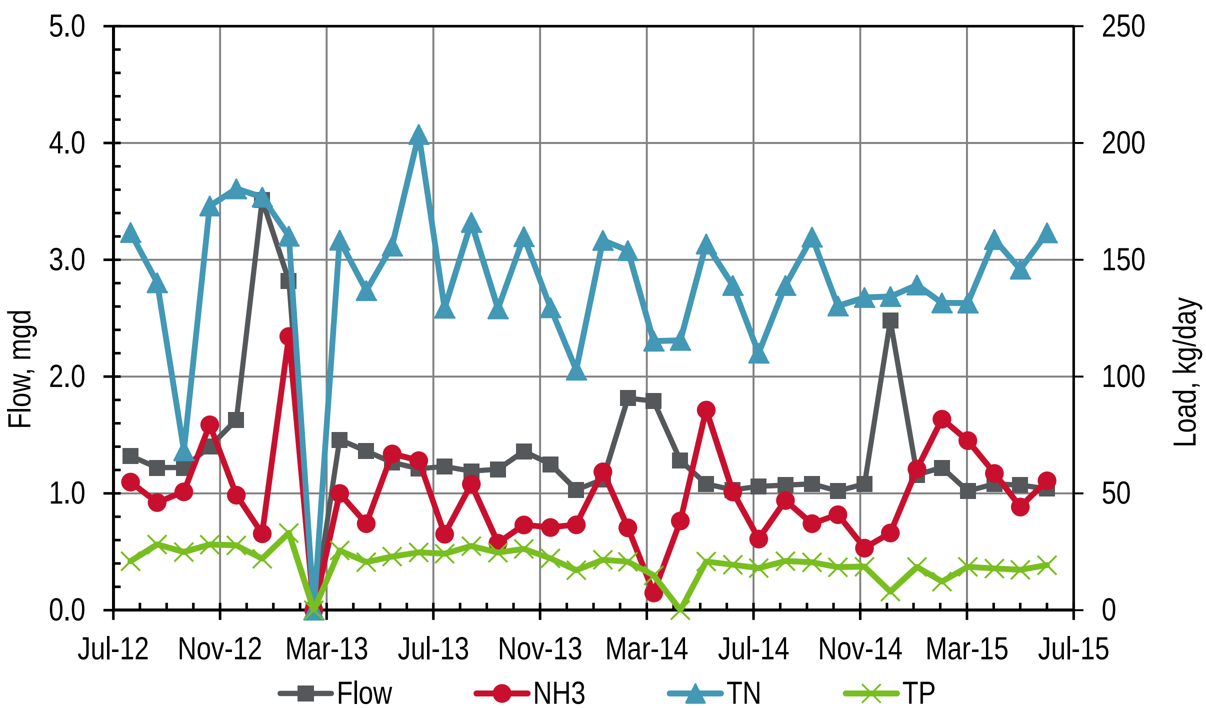

Figure 26-1. SMCSD Monthly Flows and Loads

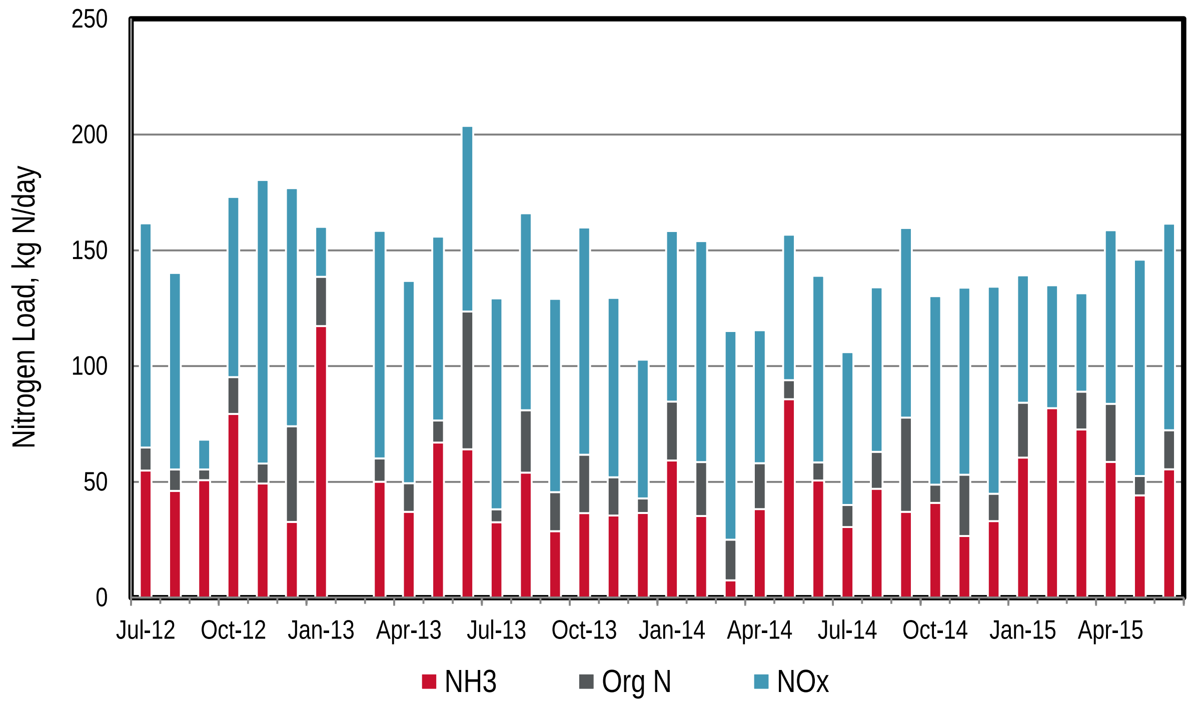

Figure 26-2. SMCSD Monthly Nitrogen Loads

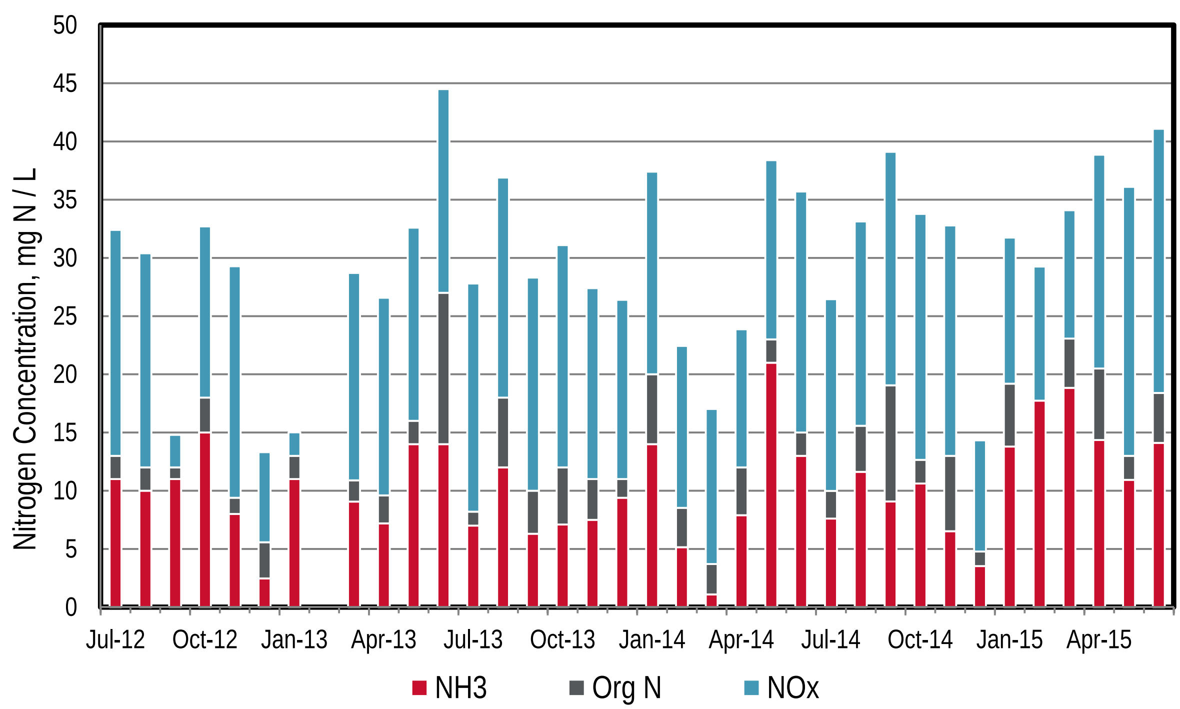

Figure 26-3. SMCSD Monthly Nitrogen Concentrations

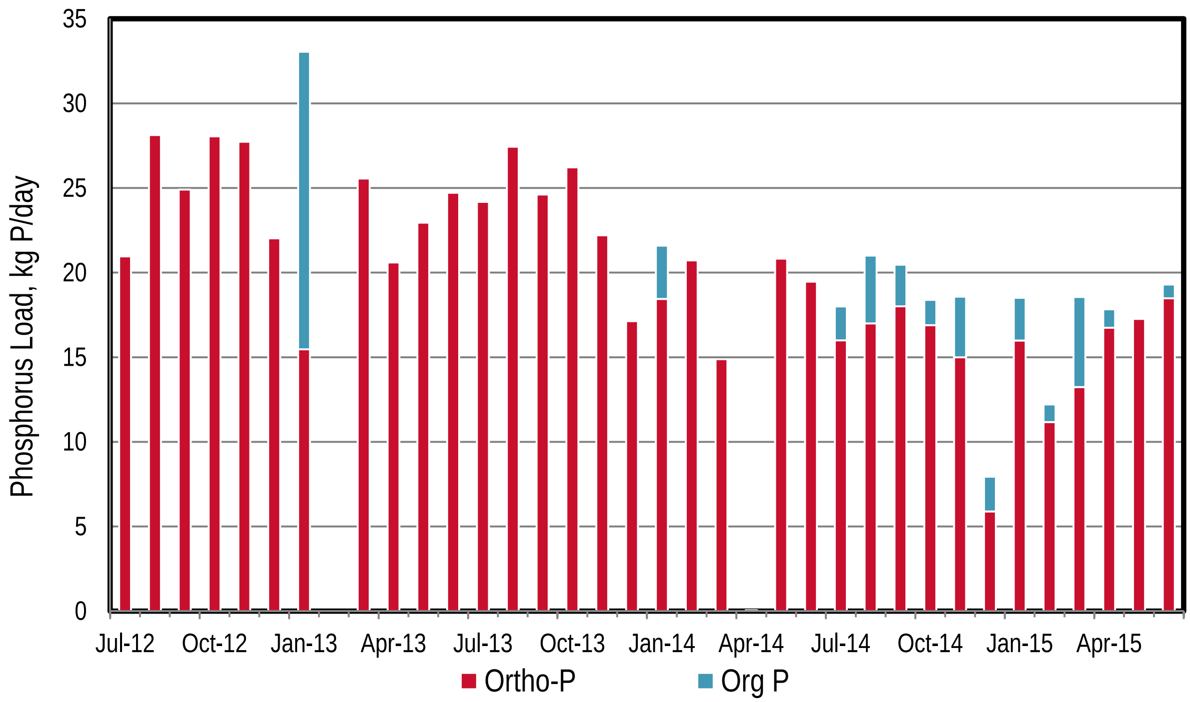

Figure 26-4. SMCSD Monthly Phosphorus Loads

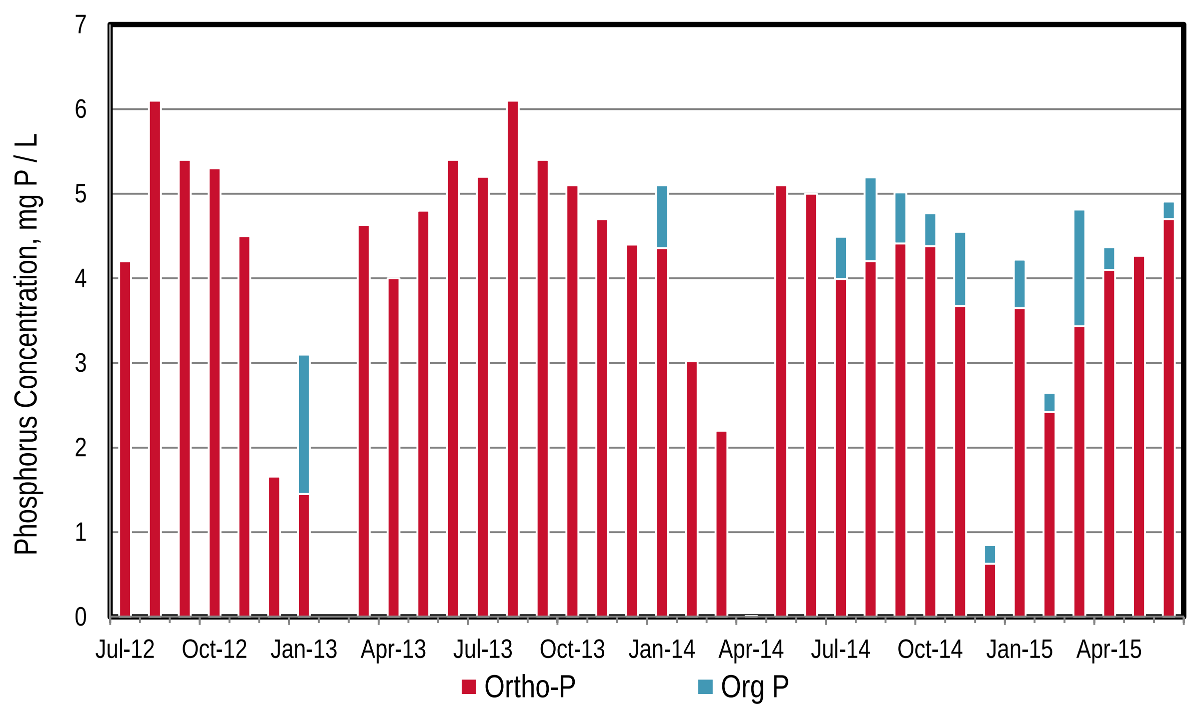

Figure 26-5. SMCSD Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 26-1. SMCSD Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	1.3	55	65	97	162	36	21
Aug 2012	1.2	46	55	85	140	63	28
Sep 2012	1.2	51	55	13	68	40	25
Oct 2012	1.4	79	95	78	173	42	28
Nov 2012	1.6	49	58	122	180	63	28
Dec 2012	3.5	33	74	103	177	30	22
Jan 2013	2.8	117	139	22	160	15	33
Feb 2013	0.0	0	0	0	0	0	0
Mar 2013	1.5	50	60	98	158	39	26
Apr 2013	1.4	37	49	87	137	29	21
May 2013	1.3	67	77	79	156	36	23
Jun 2013	1.2	64	124	80	204	67	25
Jul 2013	1.2	33	38	91	129	55	24
Aug 2013	1.2	54	81	85	166	56	27
Sep 2013	1.2	29	46	83	129	69	25
Oct 2013	1.4	36	62	98	160	35	26
Nov 2013	1.3	35	52	77	129	35	22
Dec 2013	1.0	37	43	60	103	32	17
Jan 2014	1.1	59	85	74	158	18	22
Feb 2014	1.8	35	59	95	154	29	21
Mar 2014	1.8	7	25	90	115	16	15
Apr 2014	1.3	38	58	57	115	25	0
May 2014	1.1	86	94	63	157	37	21
Jun 2014	1.0	51	58	81	139	33	19
Jul 2014	1.1	31	40	66	110	16	18
Aug 2014	1.1	47	63	71	139	17	21
Sep 2014	1.1	37	78	82	160	18	20
Oct 2014	1.0	41	49	81	130	17	18
Nov 2014	1.1	27	53	81	134	15	19
Dec 2014	2.5	33	45	89	134	6	8
Jan 2015	1.2	60	84	55	139	16	19
Feb 2015	1.2	82	78	53	132	11	12
Mar 2015	1.0	73	89	43	131	13	19
Apr 2015	1.1	59	84	75	159	17	18
May 2015	1.1	44	53	93	146	19	17
Jun 2015	1.0	55	72	89	162	18	19
Dry Season Average	**1.2**	**50**	**67**	**77**	**144**	**39**	**22**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**Yes**
Wet Season Average	**1.5**	**47**	**64**	**73**	**137**	**24**	**19**
Average Annual	**1.3**	**48**	**65**	**75**	**140**	**30**	**20**

27 Sonoma Valley County Sanitation District

Sonoma Valley discharges Schell Slough that is connected to San Pablo Bay. The plant has approximately 17,200 service connections and a permitted capacity of 3 mgd ADWF. The plant has a wet weather discharge to Schell Slough capacity of 11 mgd. Discharge to Schell Slough is prohibited May 1 through October 31. 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:

- There are no emerging dry season trends as Sonoma Valley is prohibited from discharging to Schell Slough during the dry season.
- Wet season trends analyzed (data not shown) and there are no emerging trends.
- There are only 9 out of 36 months in which they discharged to Schell Slough. The water was all recycled during the other months.
- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant fully nitrifies. The highest average monthly effluent ammonia concentration was 0.6 mg N/L.
- The plant meets Level 2 total nitrogen concentration limits (i.e., 15 mg N/L) developed under the Scoping and Evaluation Plan for all but one month.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 1.3 to 4.3 mg P/L, which suggests a portion of P is removed as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is unclear at this stage.

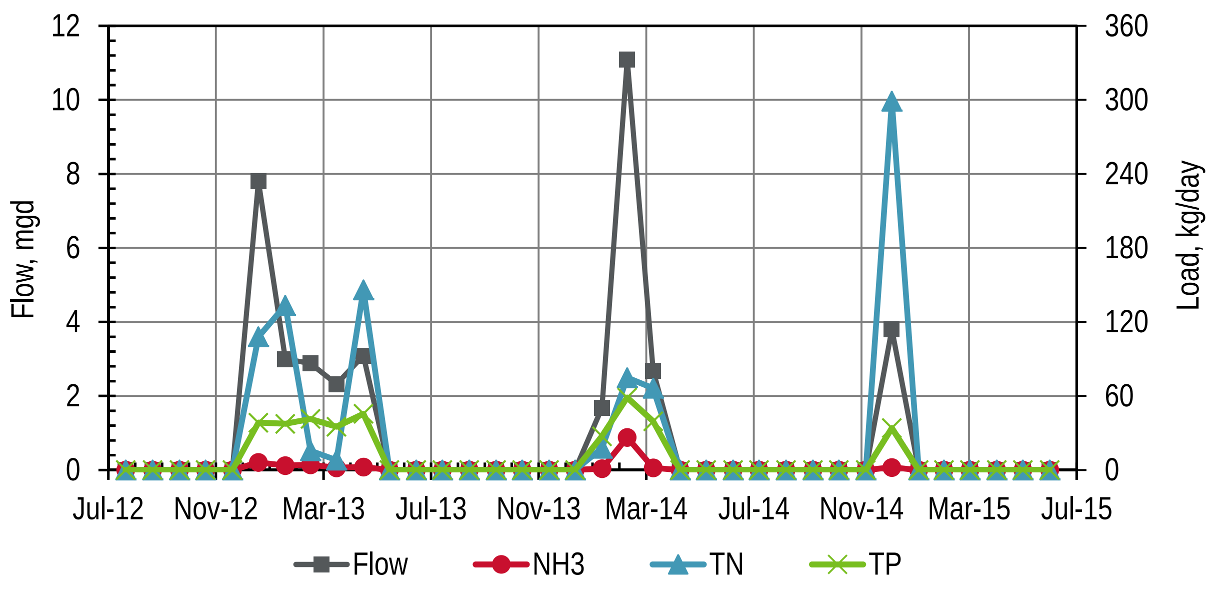

Figure 27-1. Sonoma Valley Monthly Flows and Loads

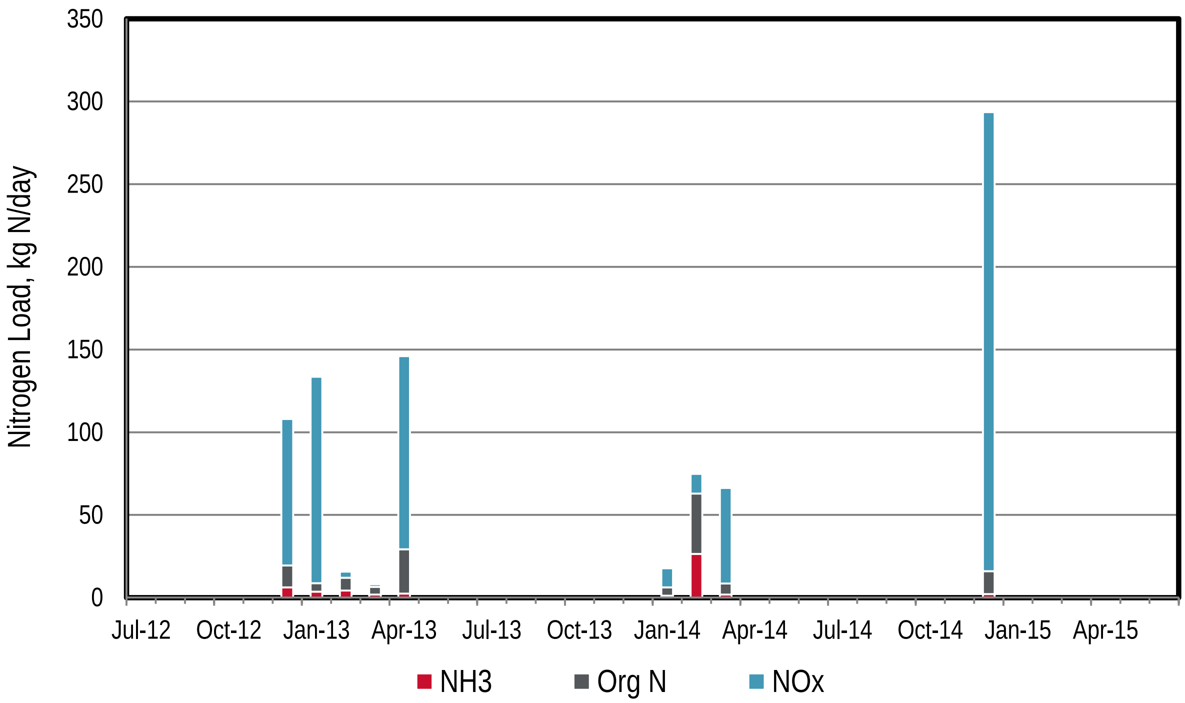

Figure 27-2. Sonoma Valley Monthly Nitrogen Loads

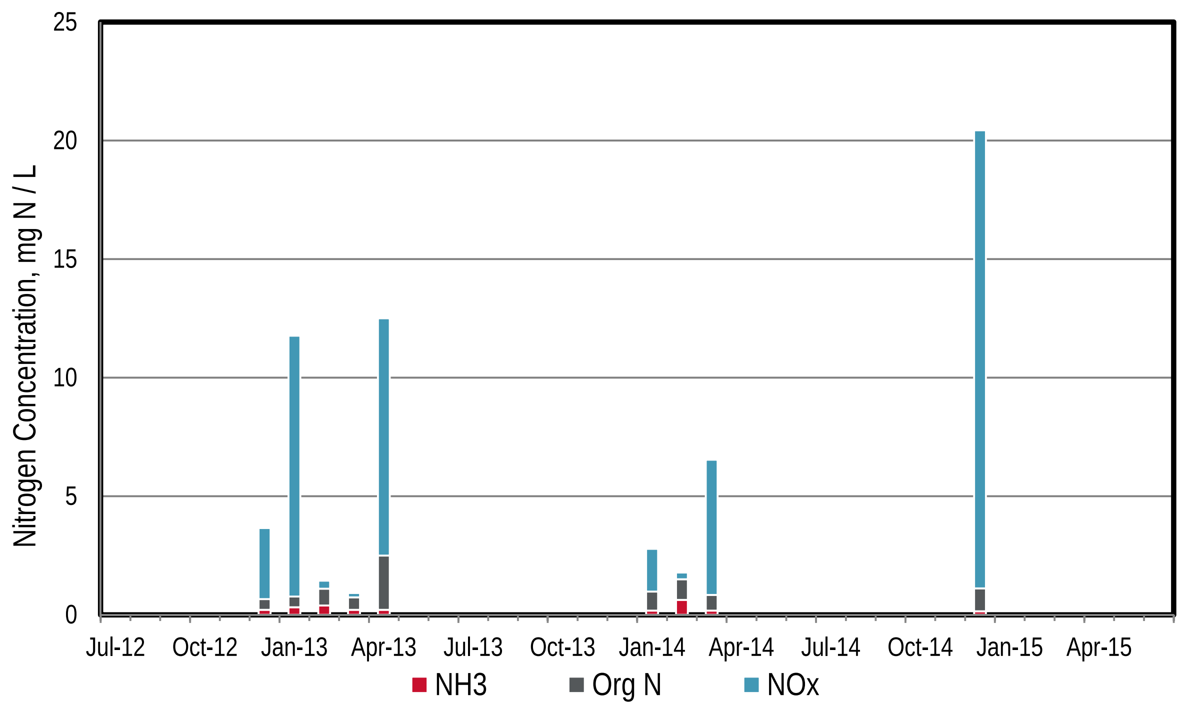

Figure 27-3. Sonoma Valley Monthly Nitrogen Concentrations

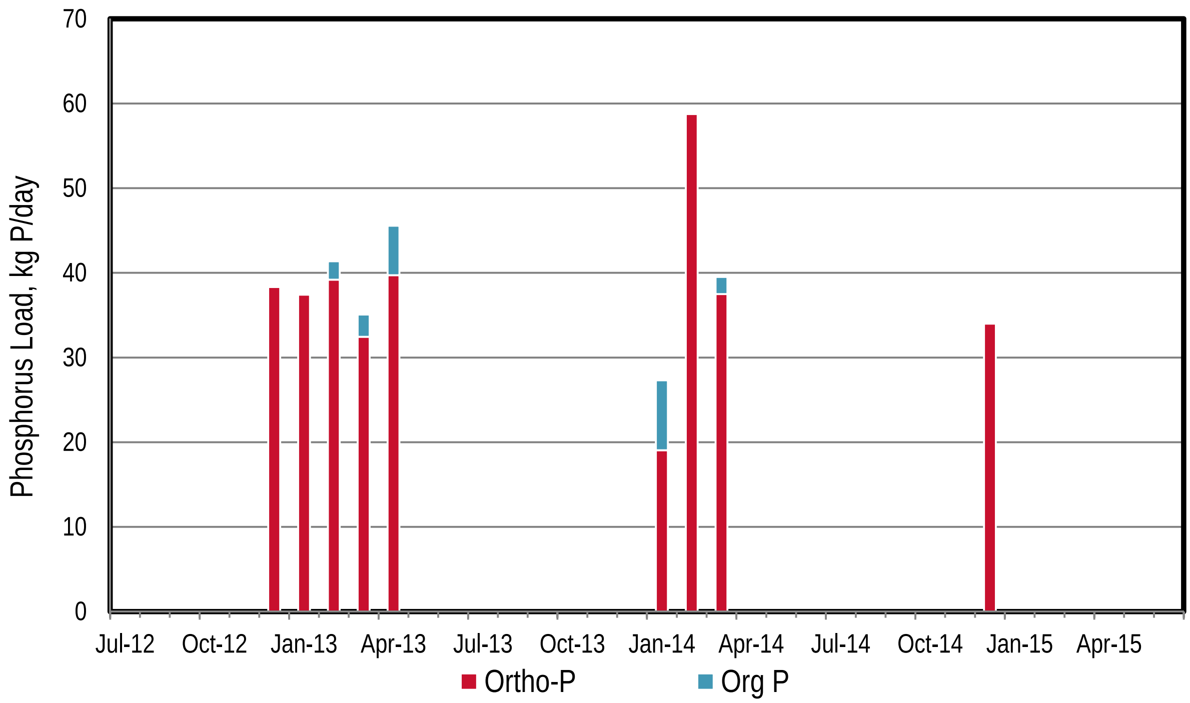

Figure 27-4. Sonoma Valley Monthly Phosphorus Loads

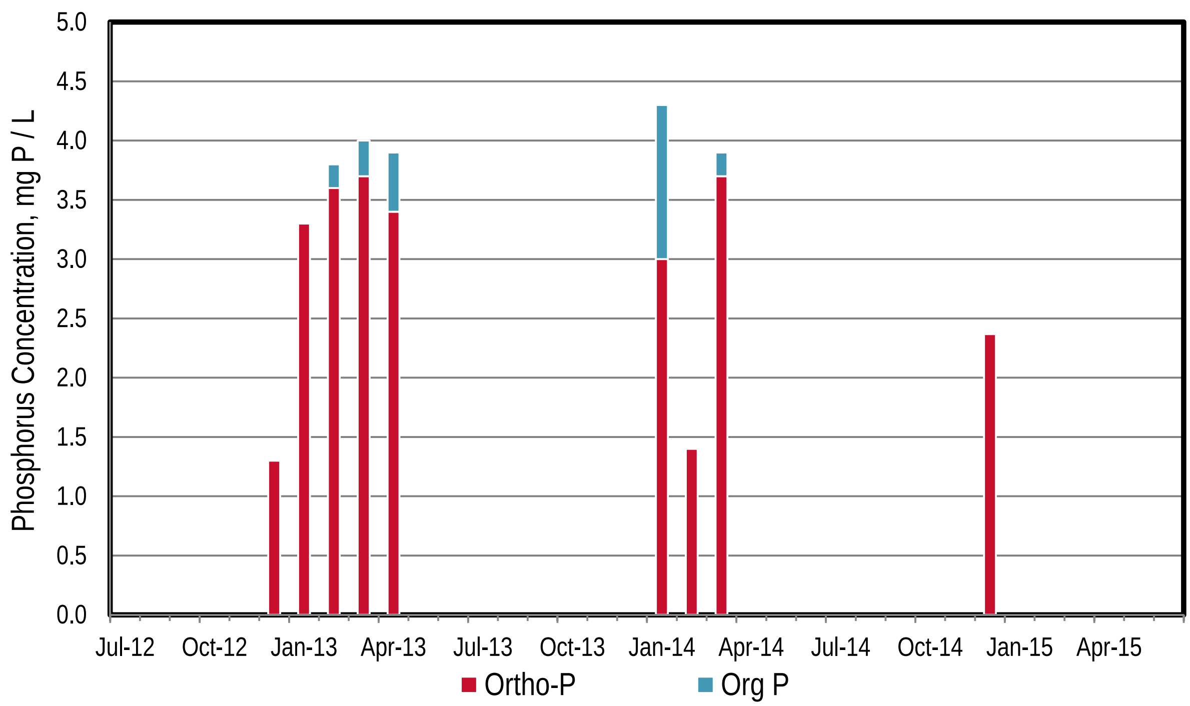

Figure 27-5. Sonoma Valley Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 27-1. Sonoma Valley Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.0	0	0	0	0	0	0
Aug 2012	0.0	0	0	0	0	0	0
Sep 2012	0.0	0	0	0	0	0	0
Oct 2012	0.0	0	0	0	0	0	0
Nov 2012	0.0	0	0	0	0	0	0
Dec 2012	7.8	6	19	88	108	41	38
Jan 2013	3.0	4	9	125	133	39	37
Feb 2013	2.9	4	12	4	16	39	41
Mar 2013	2.3	2	6	2	8	32	35
Apr 2013	3.1	2	29	117	146	40	46
May 2013	0.0	0	0	0	0	0	0
Jun 2013	0.0	0	0	0	0	0	0
Jul 2013	0.0	0	0	0	0	0	0
Aug 2013	0.0	0	0	0	0	0	0
Sep 2013	0.0	0	0	0	0	0	0
Oct 2013	0.0	0	0	0	0	0	0
Nov 2013	0.0	0	0	0	0	0	0
Dec 2013	0.0	0	0	0	0	0	0
Jan 2014	1.7	1	6	11	18	19	27
Feb 2014	11.1	26	63	12	75	63	59
Mar 2014	2.7	2	9	58	66	37	40
Apr 2014	0.0	0	0	0	0	0	0
May 2014	0.0	0	0	0	0	0	0
Jun 2014	0.0	0	0	0	0	0	0
Jul 2014	0.0	0	0	0	0	0	0
Aug 2014	0.0	0	0	0	0	0	0
Sep 2014	0.0	0	0	0	0	0	0
Oct 2014	0.0	0	0	0	0	0	0
Nov 2014	0.0	0	0	0	0	0	0
Dec 2014	3.8	2	16	278	299	36	34
Jan 2015	0.0	0	0	0	0	0	0
Feb 2015	0.0	0	0	0	0	0	0
Mar 2015	0.0	0	0	0	0	0	0
Apr 2015	0.0	0	0	0	0	0	0
May 2015	0.0	0	0	0	0	0	0
Jun 2015	0.0	0	0	0	0	0	0
Dry Season Average	**0.0**	**0**	**0**	**0**	**0**	**0**	**0**
Dry Season Trend (n=15)	**No discharge**	**No discharge**	**No discharge**	**No discharge**	**No discharge**	**No discharge**	**No discharge**
Wet Season Average	**1.8**	**2**	**8**	**33**	**41**	**17**	**17**
Average Annual	**1.1**	**1**	**5**	**19**	**24**	**10**	**10**

28 South San Francisco-San Bruno

South SF-San Bruno discharges to the South Bay. The plant has a permitted capacity of 13 mgd ADWF and a peak wet weather capacity of 30 mgd, with blending above 30 mgd allowable. The current flow is about 8.3 mgd ADWF. The process includes a conventional activated sludge system.

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

- Based on the average monthly values table below, there appears to be a downward trend for flows in the dry season. This is attributed to a combination of recycled water and water conservation.
- Nitrogen and phosphorus 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 they do not nitrify.
- Nitrogen and phosphorus concentrations have a seasonal shift for the first couple years of data where the summer has the largest concentrations. Over the last year, this seasonality shift has disappeared and the concentrations are random.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations range from 2.1 to 9 mg P/L, which suggests a portion of P might be removed as typical effluent TP concentrations are 4 to 6 mg P/L. The majority of the samples fall within the typical effluent TP concentrations though so the occasional lower concentrations might be sampling artifacts.

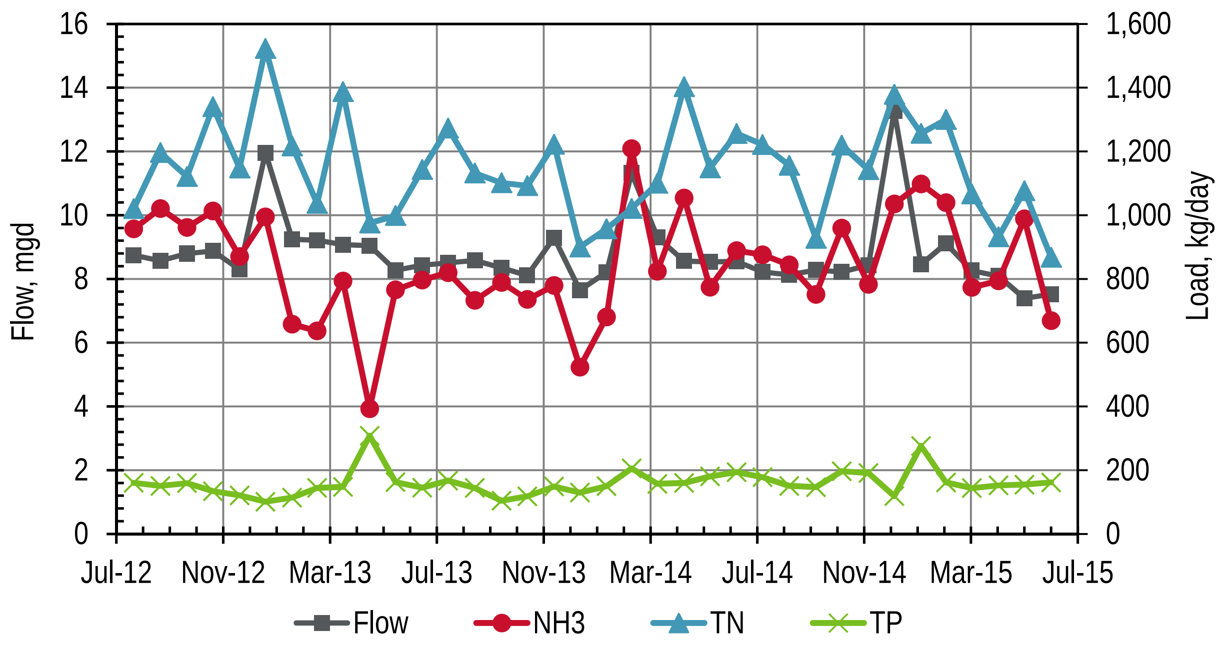

Figure 28-1. South SF-San Bruno Monthly Flows and Loads

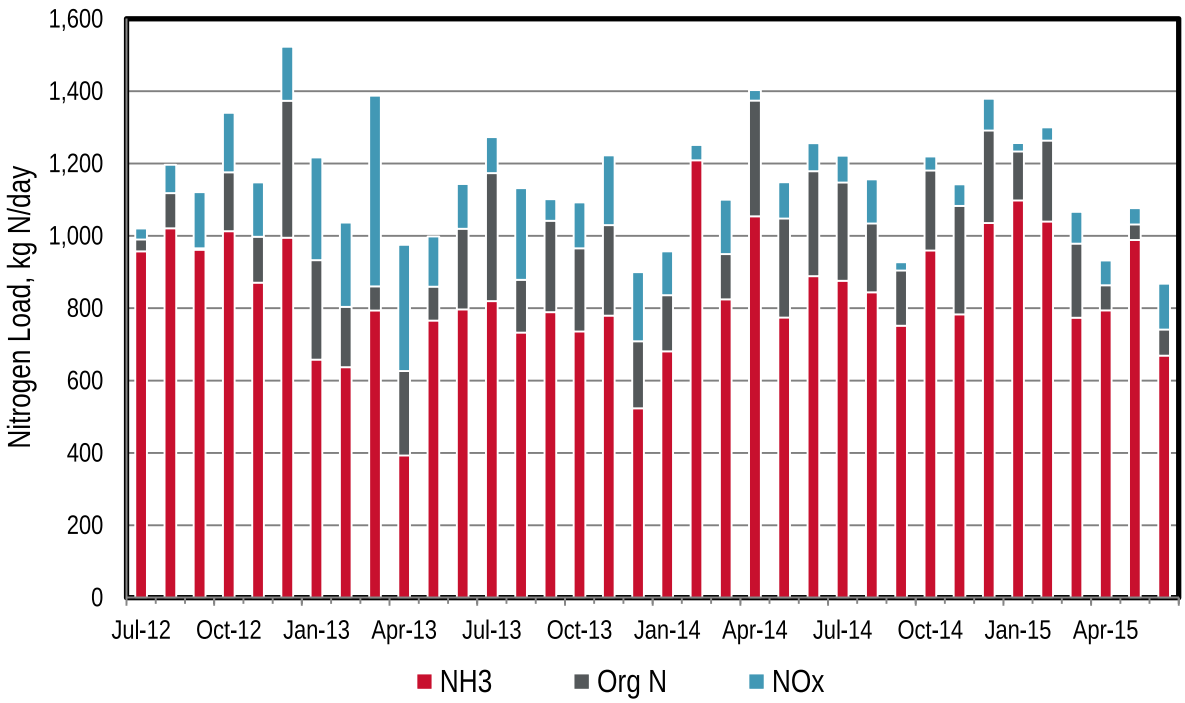

Figure 28-2. South SF-San Bruno Monthly Nitrogen Loads

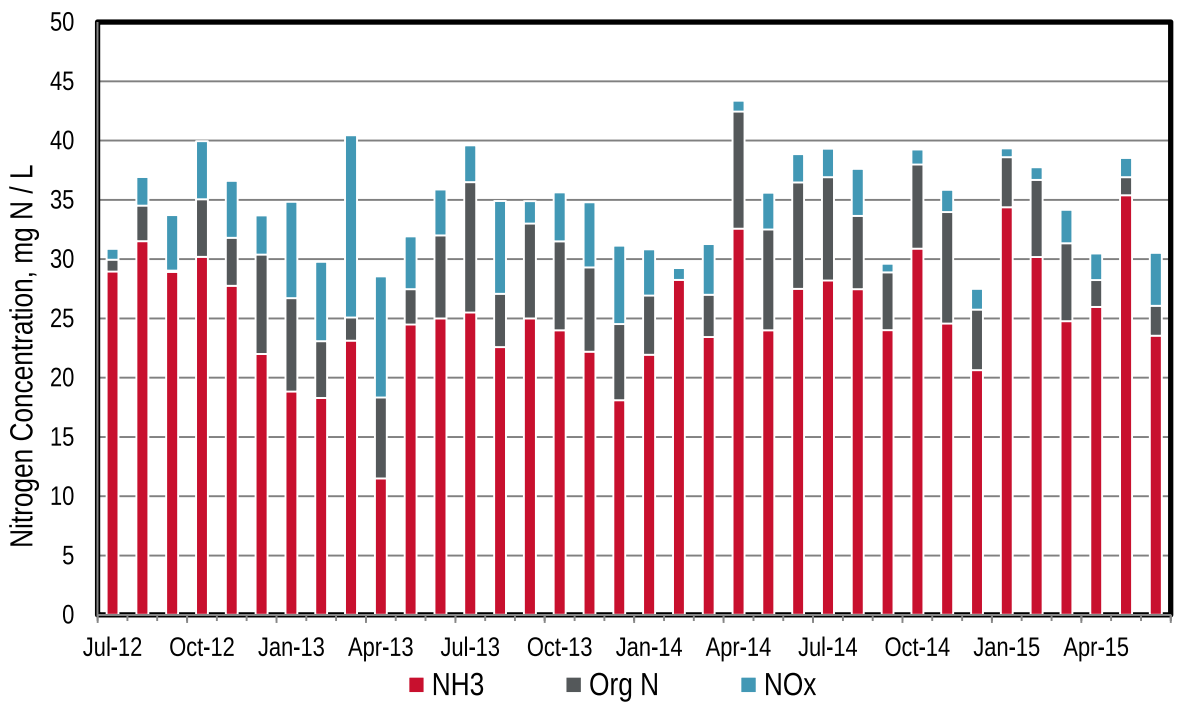

Figure 28-3. South SF-San Bruno Monthly Nitrogen Concentrations

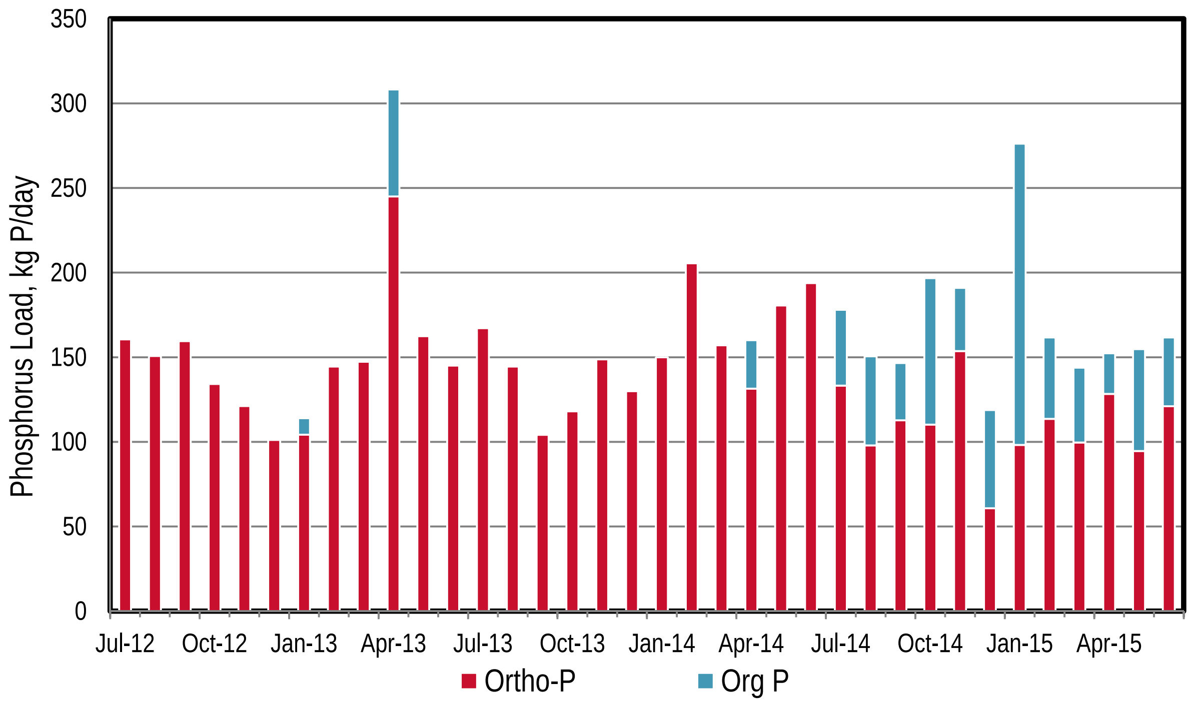

Figure 28-4. South SF-San Bruno Monthly Phosphorus Loads

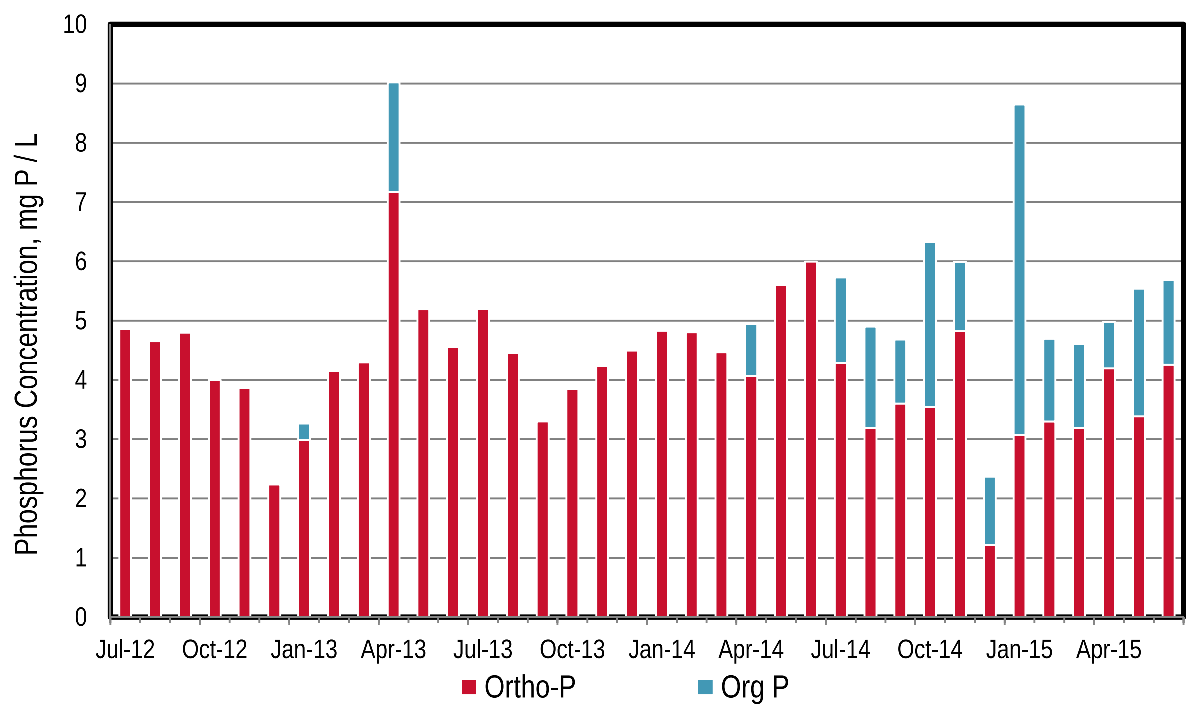

Figure 28-5. South SF-San Bruno Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 28-1. South SF-San Bruno Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	8.7	957	990	30	1,020	182	161
Aug 2012	8.6	1,021	1,118	78	1,196	161	151
Sep 2012	8.8	962	965	156	1,121	264	159
Oct 2012	8.9	1,013	1,176	164	1,340	148	134
Nov 2012	8.3	870	997	151	1,148	161	121
Dec 2012	12.0	995	1,373	149	1,523	128	101
Jan 2013	9.2	658	933	284	1,217	104	114
Feb 2013	9.2	637	804	233	1,037	205	144
Mar 2013	9.1	793	860	527	1,387	183	147
Apr 2013	9.0	393	626	349	975	245	308
May 2013	8.3	766	859	139	998	297	162
Jun 2013	8.4	797	1,020	124	1,143	188	145
Jul 2013	8.5	820	1,173	100	1,273	194	167
Aug 2013	8.6	733	878	254	1,132	163	144
Sep 2013	8.4	789	1,042	60	1,101	150	104
Oct 2013	8.1	736	966	127	1,092	196	118
Nov 2013	9.3	779	1,030	193	1,223	255	149
Dec 2013	7.6	523	709	191	900	211	130
Jan 2014	8.2	681	836	121	957	226	150
Feb 2014	11.3	1,209	978	43	1,021	273	206
Mar 2014	9.3	824	950	150	1,100	254	157
Apr 2014	8.6	1,054	1,374	29	1,403	131	160
May 2014	8.5	774	1,048	100	1,148	275	181
Jun 2014	8.6	889	1,179	77	1,256	304	194
Jul 2014	8.2	876	1,147	74	1,222	133	178
Aug 2014	8.1	844	1,034	122	1,156	98	151
Sep 2014	8.3	752	904	23	927	113	147
Oct 2014	8.2	960	1,180	39	1,220	110	197
Nov 2014	8.4	783	1,083	60	1,143	154	191
Dec 2014	13.3	1,036	1,291	88	1,379	61	119
Jan 2015	8.5	1,098	1,233	23	1,257	98	276
Feb 2015	9.1	1,040	1,263	37	1,300	114	162
Mar 2015	8.3	774	979	88	1,067	100	144
Apr 2015	8.1	794	863	69	932	128	152
May 2015	7.4	989	1,031	45	1,077	95	155
Jun 2015	7.5	669	741	127	868	121	162
Dry Season Average	**8.3**	**842**	**1,009**	**101**	**1,109**	**183**	**157**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**9.1**	**840**	**1,024**	**148**	**1,172**	**166**	**161**
Average Annual	**8.8**	**841**	**1,018**	**128**	**1,146**	**173**	**159**

29 City of Sunnyvale

Sunnyvale discharges to the tributary of the Lower South Bay. It has about 28,300 service connections with a permitted 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 for the upcoming design. The current flows are about 8.6 mgd ADWF. The plant nitrifies using a oxidation ponds followed by nitrifying trickling filters and has filtration.

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

- Based on the average monthly values table below, there do not appear to be any emerging dry season trends for any of the parameters considered. Seasonal flow variation is attributed to rainfall and evaporation from the oxidation ponds and recycled water in the summer.
- Nitrogen and phosphorus loads typically increase with flow during wet weather events.
- The trickling filters struggle to reliably nitrify during colder months as evidenced by occasional ammonia spikes. This is a common phenomenon for nitrifying trickling filters exacerbated by occasionally very cold temperatures from the oxidation ponds.
- The ammonia load excursion during the first year is attributed to dredging the oxidation ponds.
- Nitrogen wet season loads are typically greater and more variable than the dry season loads (with the exception of a TN spike in September 2013).
- The plant has seasonal denitrification as evidenced by occasional TN values around 10 mg N/L.
- 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).
- Total phosphorus concentrations are wide ranging from about 2.3 to 8.4 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L.

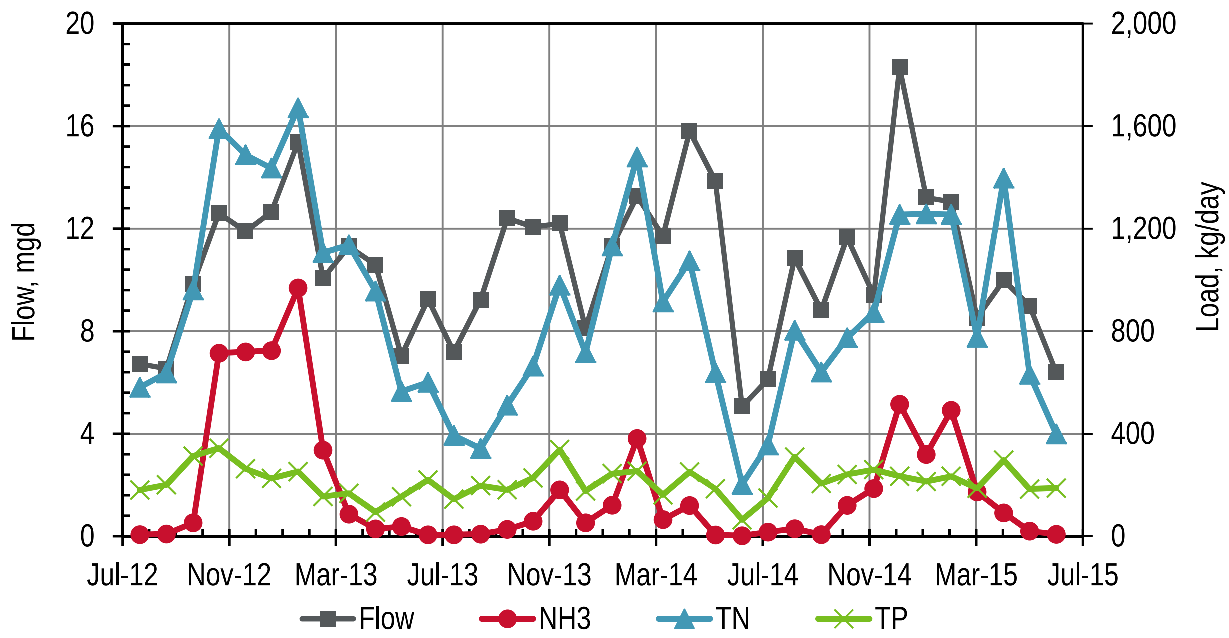

Figure 29-1. Sunnyvale Monthly Flows and Loads

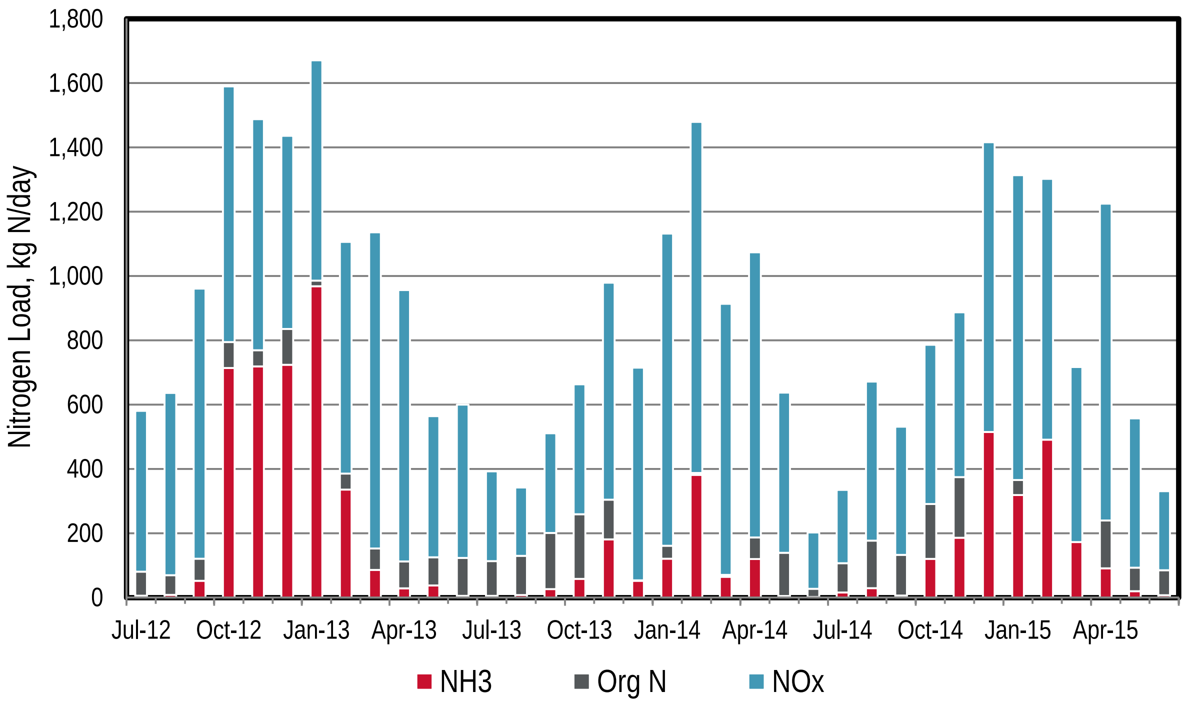

Figure 29-2. Sunnyvale Monthly Nitrogen Loads

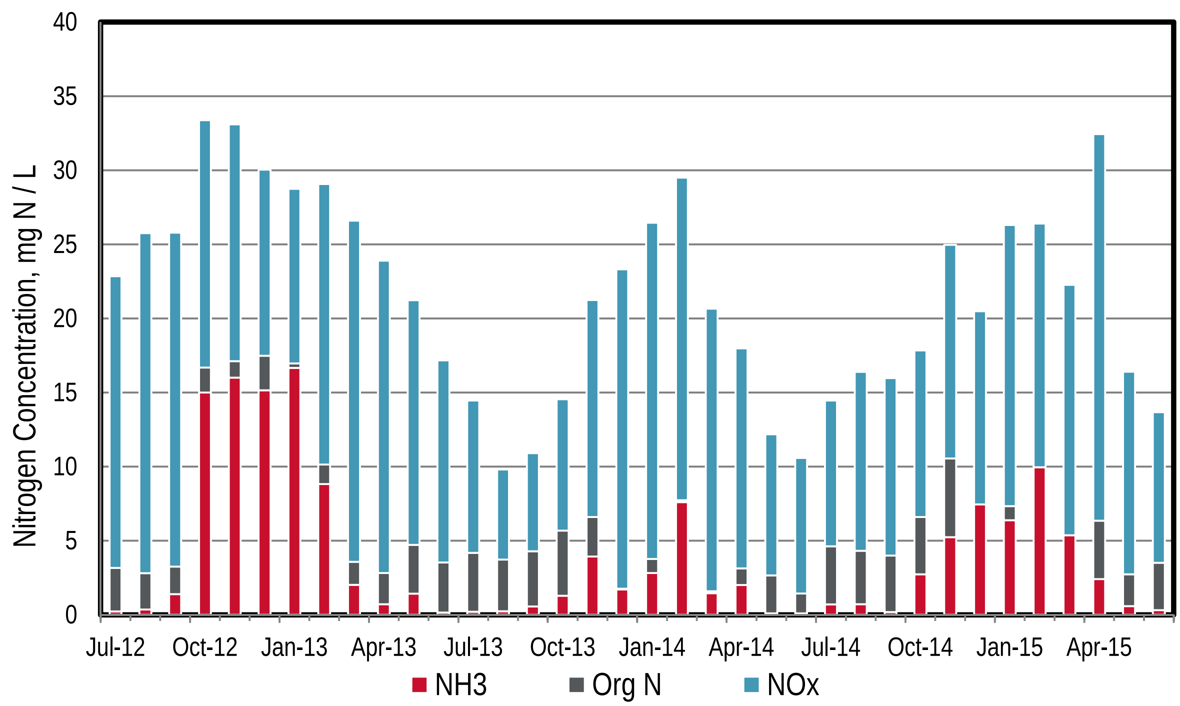

Figure 29-3. Sunnyvale Monthly Nitrogen Concentrations

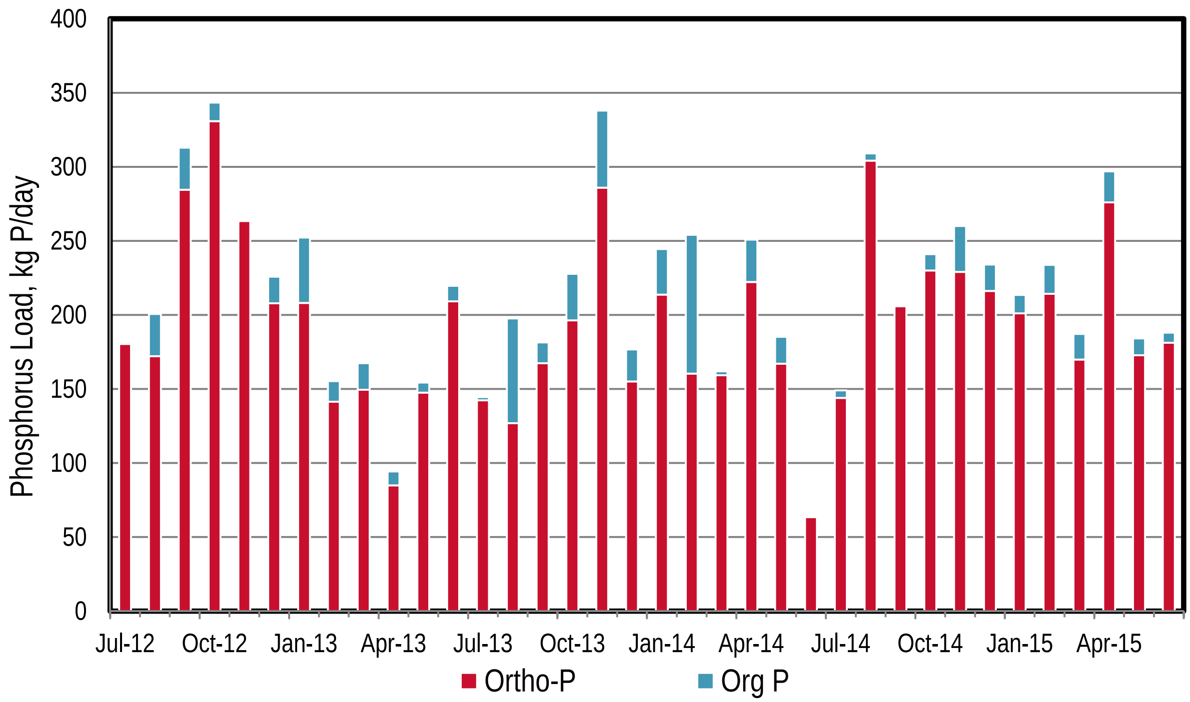

Figure 29-4. Sunnyvale Monthly Phosphorus Loads

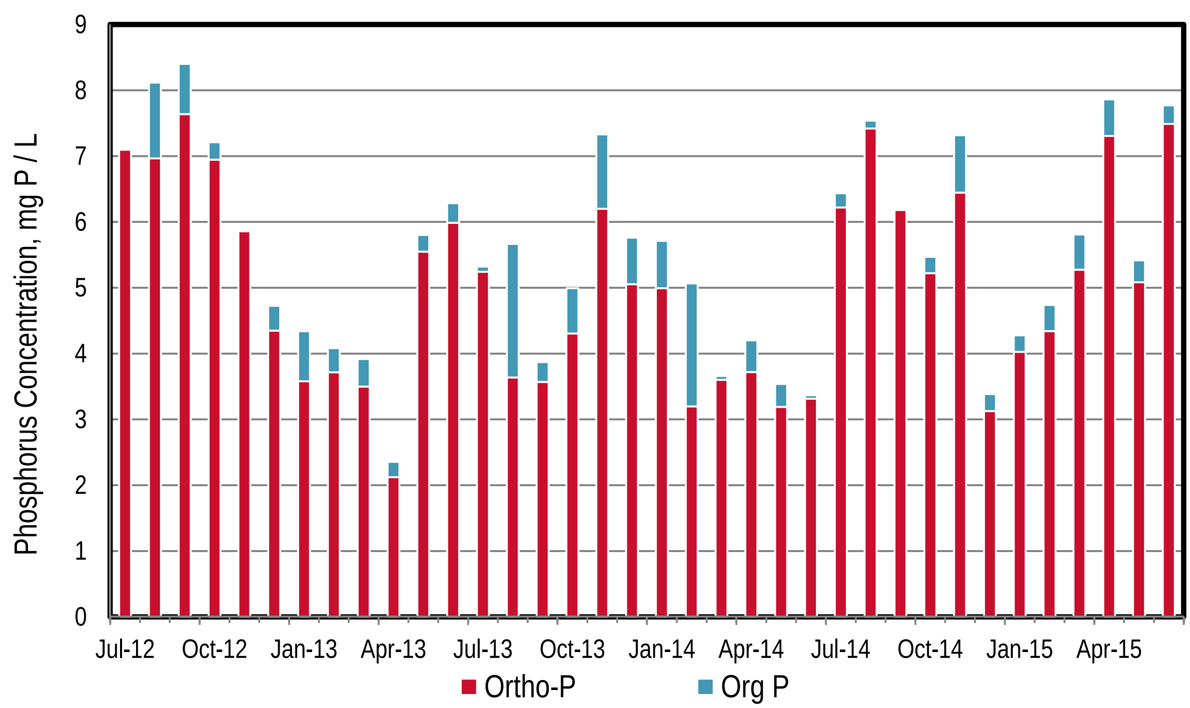

Figure 29-5. Sunnyvale Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 29-1. Sunnyvale Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	7	6	81	500	581	197	180
Aug 2012	7	9	70	567	637	172	201
Sep 2012	10	52	121	840	961	285	313
Oct 2012	13	714	795	795	1,590	331	343
Nov 2012	12	719	769	718	1,488	269	263
Dec 2012	13	724	835	600	1,436	208	226
Jan 2013	15	968	986	685	1,671	208	252
Feb 2013	10	336	386	720	1,106	141	155
Mar 2013	11	86	153	983	1,136	149	167
Apr 2013	11	29	113	844	956	85	94
May 2013	7	38	125	439	565	148	154
Jun 2013	9	6	123	477	600	209	220
Jul 2013	7	6	113	279	393	142	145
Aug 2013	9	8	130	212	342	127	198
Sep 2013	12	27	201	310	511	167	181
Oct 2013	12	58	259	404	663	196	228
Nov 2013	12	181	304	675	979	286	338
Dec 2013	8	52	54	661	715	155	177
Jan 2014	11	121	161	971	1,132	214	244
Feb 2014	13	382	388	1,092	1,479	160	254
Mar 2014	12	65	71	843	914	159	162
Apr 2014	16	120	187	887	1,074	222	251
May 2014	14	5	139	498	638	167	185
Jun 2014	5	2	28	175	202	63	64
Jul 2014	6	16	107	228	356	144	149
Aug 2014	11	29	177	495	803	304	309
Sep 2014	9	6	133	399	641	239	206
Oct 2014	12	120	291	495	774	230	241
Nov 2014	9	186	375	512	873	229	260
Dec 2014	18	515	477	901	1,255	216	234
Jan 2015	13	319	366	948	1,257	201	214
Feb 2015	13	491	481	811	1,255	214	234
Mar 2015	9	173	127	544	776	170	187
Apr 2015	10	91	240	985	1,397	276	297
May 2015	9	20	93	465	632	173	184
Jun 2015	6	8	85	246	399	181	188
Dry Season Average	**9**	**16**	**115**	**409**	**551**	**181**	**192**
Dry Season Trend (n=15)	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**12**	**307**	**372**	**765**	**1,139**	**206**	**230**
Average Annual	**11**	**186**	**265**	**617**	**894**	**196**	**214**

30 Silicon Valley Clean Water (SVCW)

SVCW discharges to the South Bay. The plant services a population of about 200,000 and has a permitted ADWF capacity of 29 mgd. The current flows are about 11.7 mgd ADWF. The plant performs secondary treatment using a trickling filter complemented with an activated sludge system.

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

- Based on the table with the average monthly values, there appears to be an emerging downward trend for flows in the dry season, and there is an emerging upward trend for ammonia loads during the dry season.
- Nitrogen and phosphorus loads typically increase with flow during wet weather events.
- Nitrogen wet season loads are typically greater and more variable than the dry season loads. The plant is subjected to lower loads in the dry season and the warmer temperature lends itself to nitrifying a portion of the ammonia load.
- Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations are wide ranging from about 2.1 to 5.1 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L

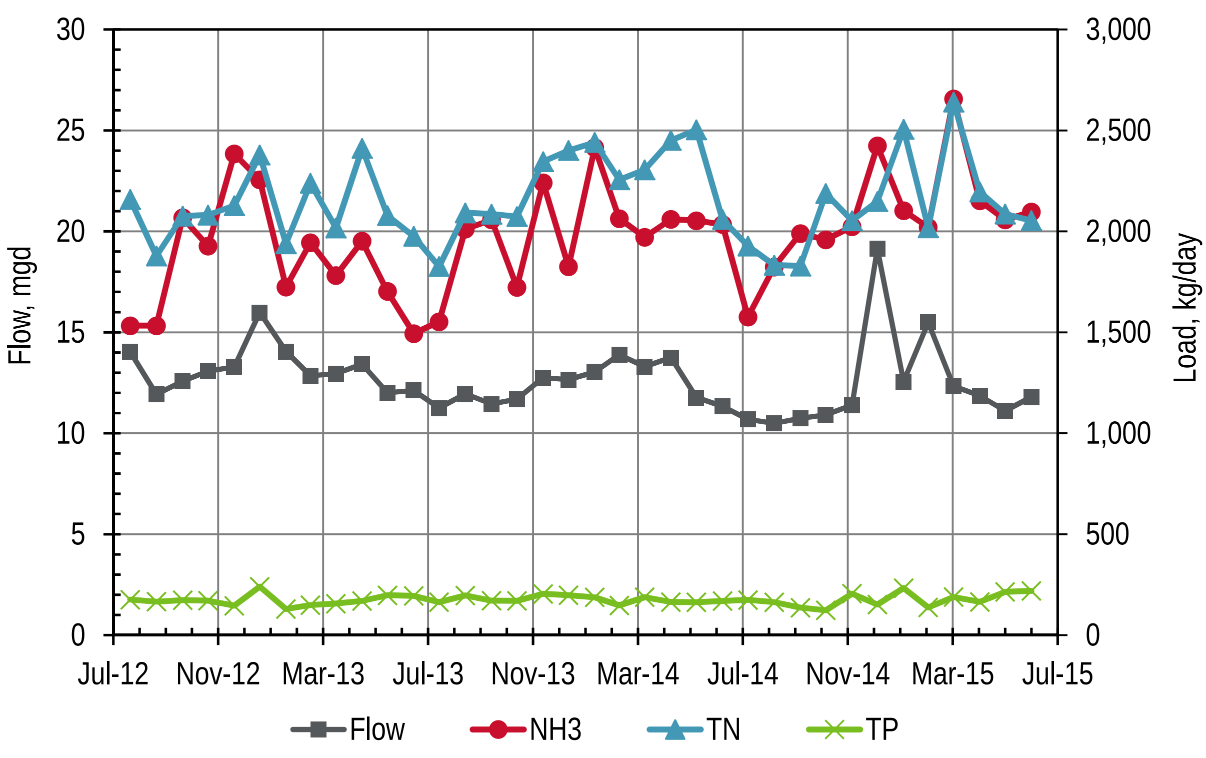

Figure 30-1. SVCW Monthly Flows and Loads

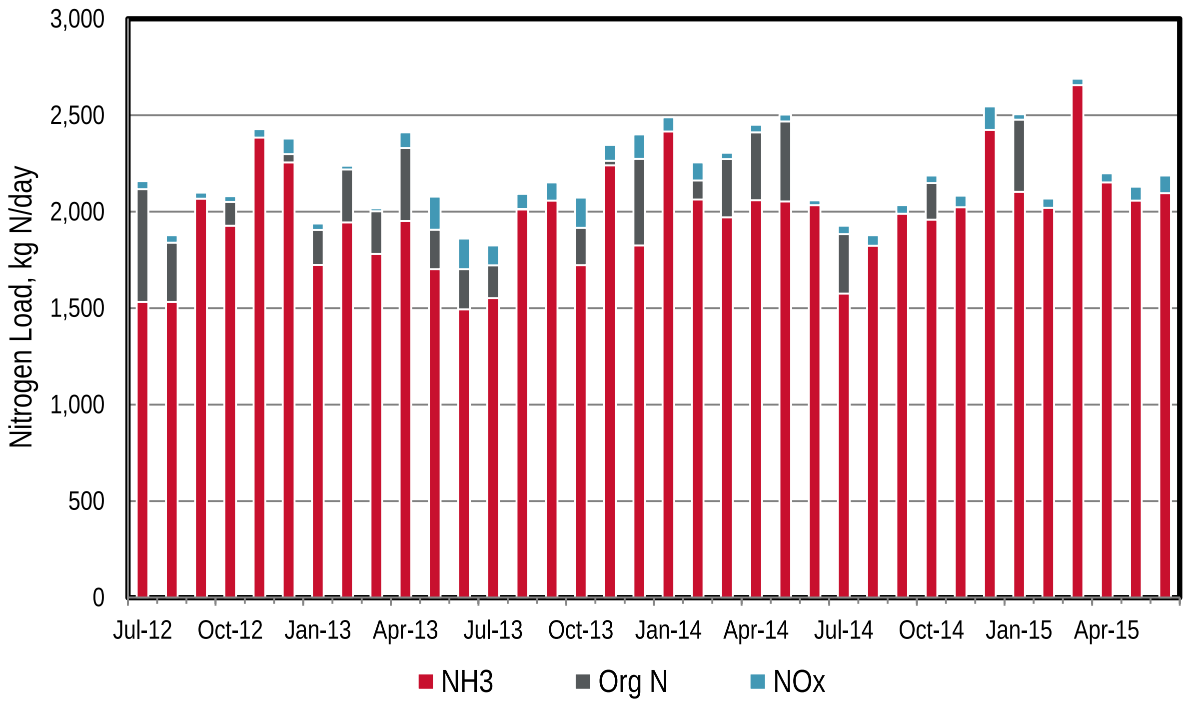

Figure 30-2. SVCW Monthly Nitrogen Loads

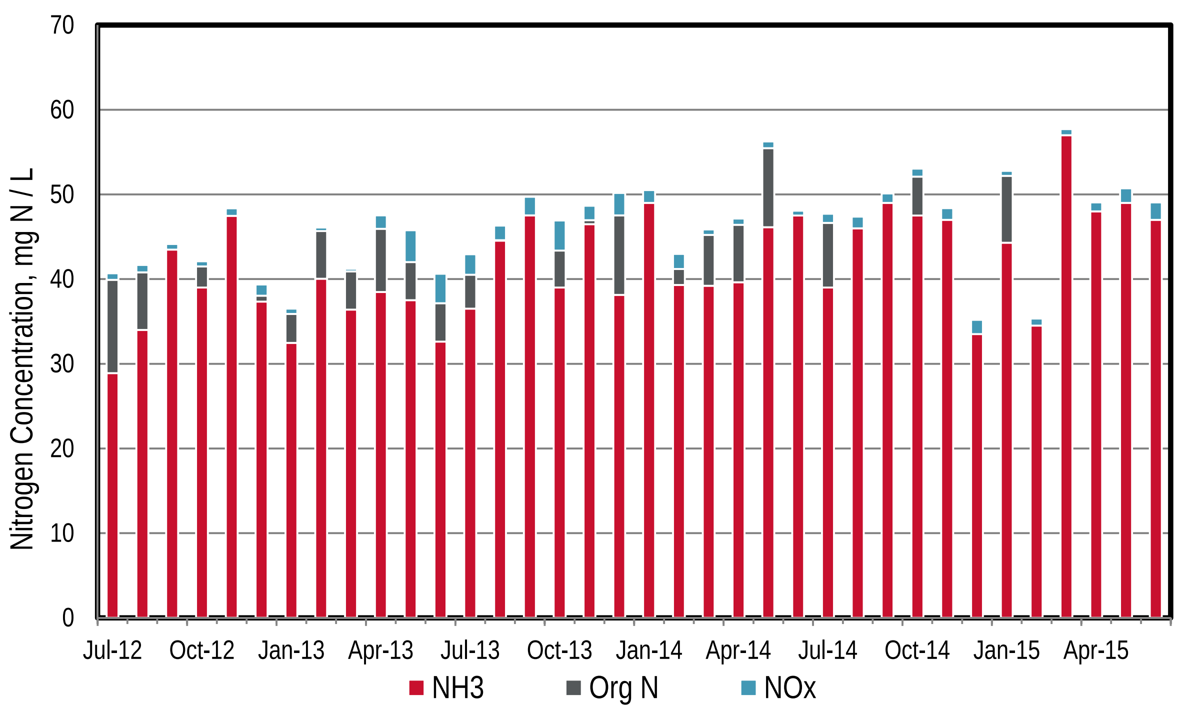

Figure 30-3. SVCW Monthly Nitrogen Concentrations

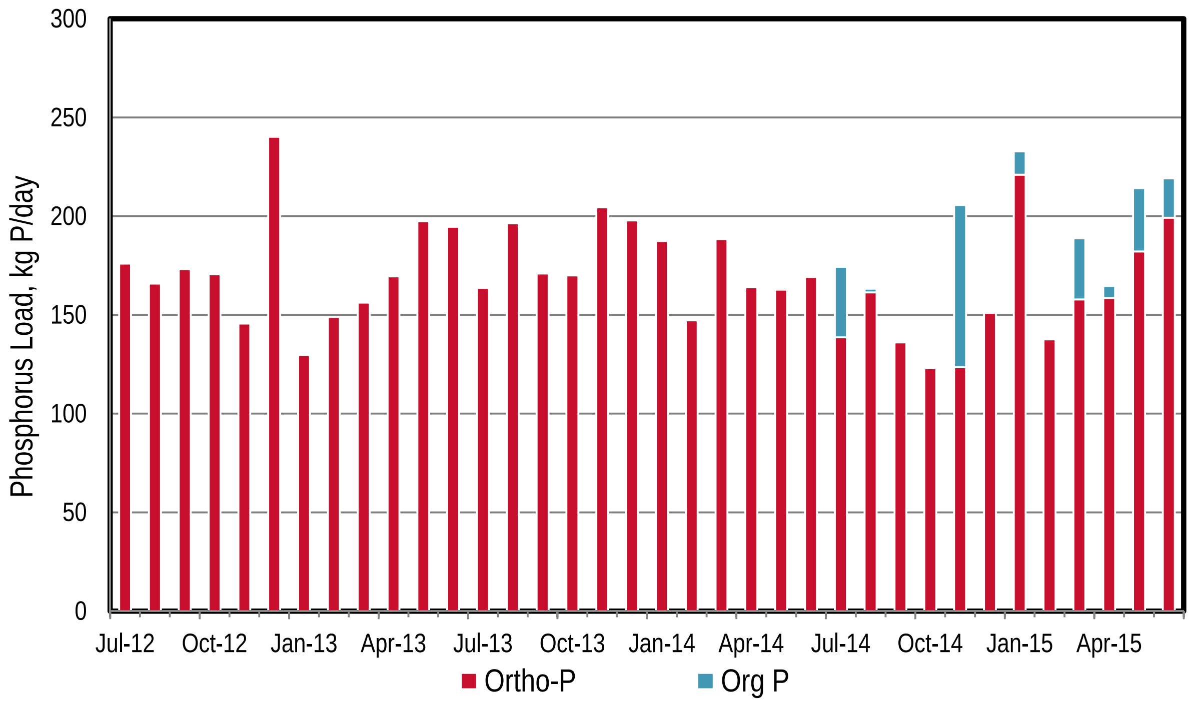

Figure 30-4. SVCW Monthly Phosphorus Loads

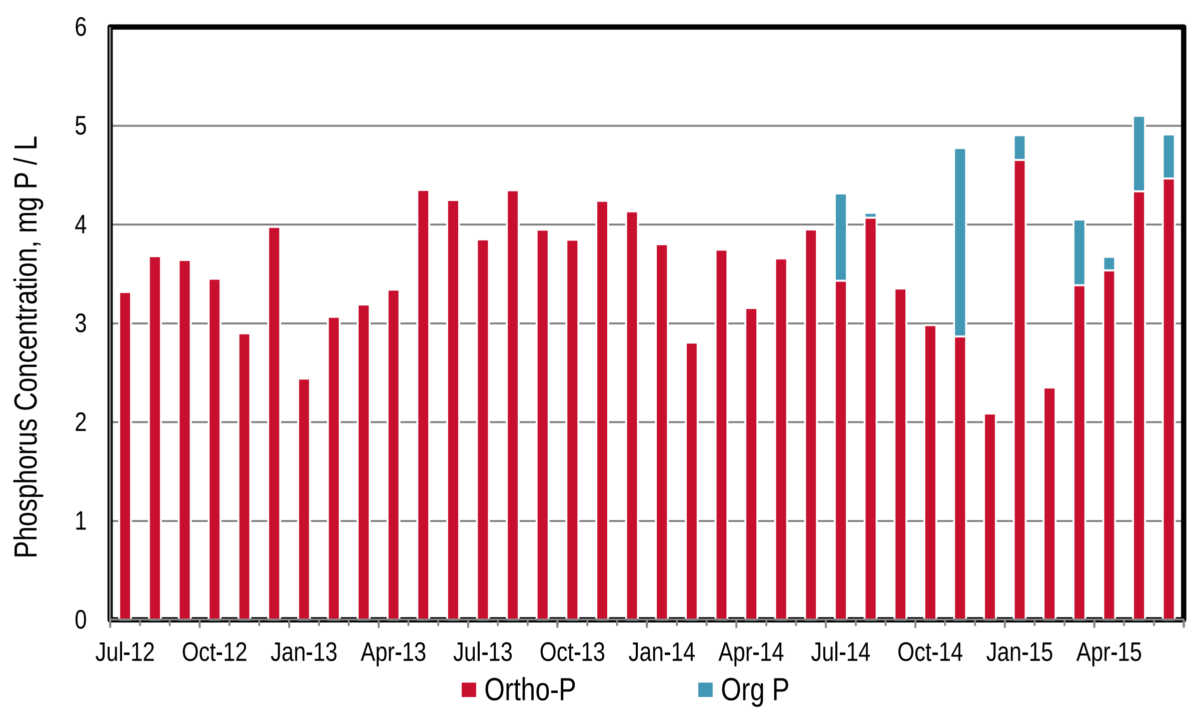

Figure 30-5. SVCW Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 30-1. SVCW Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	14	1,533	2,118	41	2,159	233	176
Aug 2012	12	1,533	1,839	39	1,878	305	166
Sep 2012	13	2,068	2,045	31	2,076	564	173
Oct 2012	13	1,927	2,051	30	2,081	288	171
Nov 2012	13	2,384	2,083	44	2,128	193	146
Dec 2012	16	2,256	2,299	80	2,379	257	240
Jan 2013	14	1,724	1,905	33	1,939	161	130
Feb 2013	13	1,945	2,219	19	2,238	181	149
Mar 2013	13	1,782	2,003	15	2,017	181	156
Apr 2013	13	1,952	2,330	81	2,411	233	170
May 2013	12	1,703	1,907	171	2,078	263	197
Jun 2013	12	1,494	1,702	159	1,976	250	195
Jul 2013	11	1,553	1,723	103	1,826	541	164
Aug 2013	12	2,012	2,014	78	2,092	709	196
Sep 2013	11	2,057	1,991	95	2,086	212	171
Oct 2013	12	1,723	1,916	157	2,073	286	170
Nov 2013	13	2,241	2,264	82	2,346	312	204
Dec 2013	13	1,825	2,274	127	2,401	256	198
Jan 2014	13	2,415	2,366	74	2,440	280	187
Feb 2014	14	2,063	2,162	94	2,256	261	147
Mar 2014	13	1,971	2,273	32	2,305	274	188
Apr 2014	14	2,060	2,412	39	2,451	212	164
May 2014	12	2,053	2,468	35	2,504	248	163
Jun 2014	11	2,034	2,034	24	2,059	196	169
Jul 2014	11	1,576	1,884	43	1,928	139	174
Aug 2014	10	1,824	1,778	54	1,833	161	163
Sep 2014	11	1,989	1,783	45	1,829	161	136
Oct 2014	11	1,959	2,149	39	2,188	168	123
Nov 2014	11	2,024	1,994	59	2,053	124	206
Dec 2014	19	2,424	2,026	122	2,148	151	152
Jan 2015	13	2,103	2,478	28	2,506	221	233
Feb 2015	15	2,020	1,969	49	2,018	144	138
Mar 2015	12	2,657	2,608	33	2,641	158	189
Apr 2015	12	2,152	2,148	48	2,196	159	165
May 2015	11	2,058	2,014	72	2,086	182	214
Jun 2015	12	2,096	1,962	92	2,054	199	219
Dry Season Average	**12**	**1,839**	**1,951**	**72**	**2,031**	**291**	**178**
Dry Season Trend (n=15)	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**13**	**2,077**	**2,187**	**61**	**2,248**	**214**	**173**
Average Annual	**13**	**1,977**	**2,089**	**66**	**2,158**	**246**	**175**

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. It has currents flows of about 0.53 mgd ADWF. 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, in particular from July 2013 through July 2014.

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

- 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.
- Based on the table with the average monthly values, there appears to be an emerging upward trend for flows in the dry season.
- With the exception of January 2013, ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
- During months of nitrification, NOx is the majority of the nitrogen species discharged. During months of no nitrification, ammonia is the majority of the nitrogen species discharged.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations are wide ranging from about 1.4 to 6.5 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L.

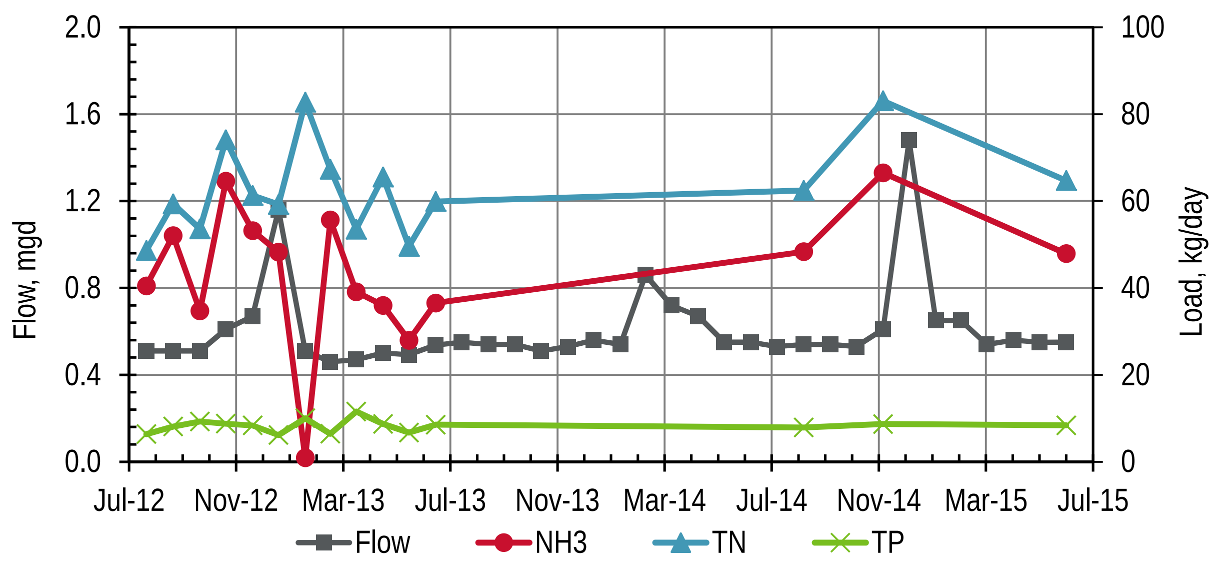

Figure 31-1. Tiburon Monthly Flows and Loads

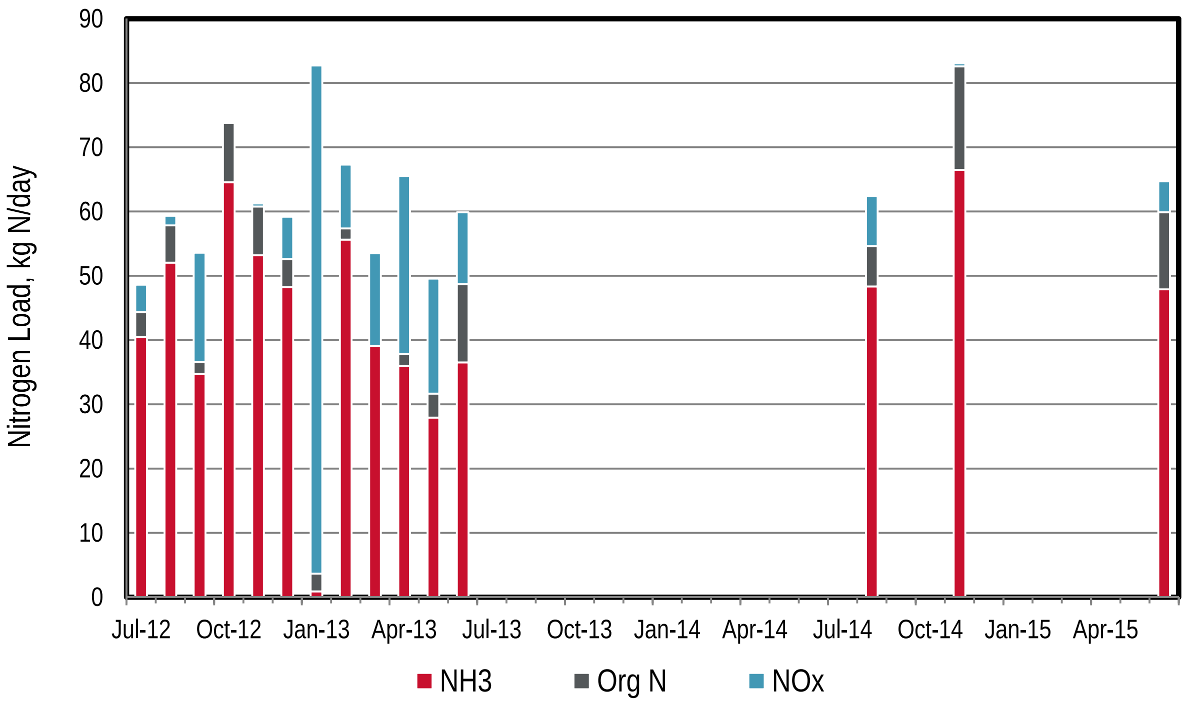

Figure 31-2. Tiburon Monthly Nitrogen Loads

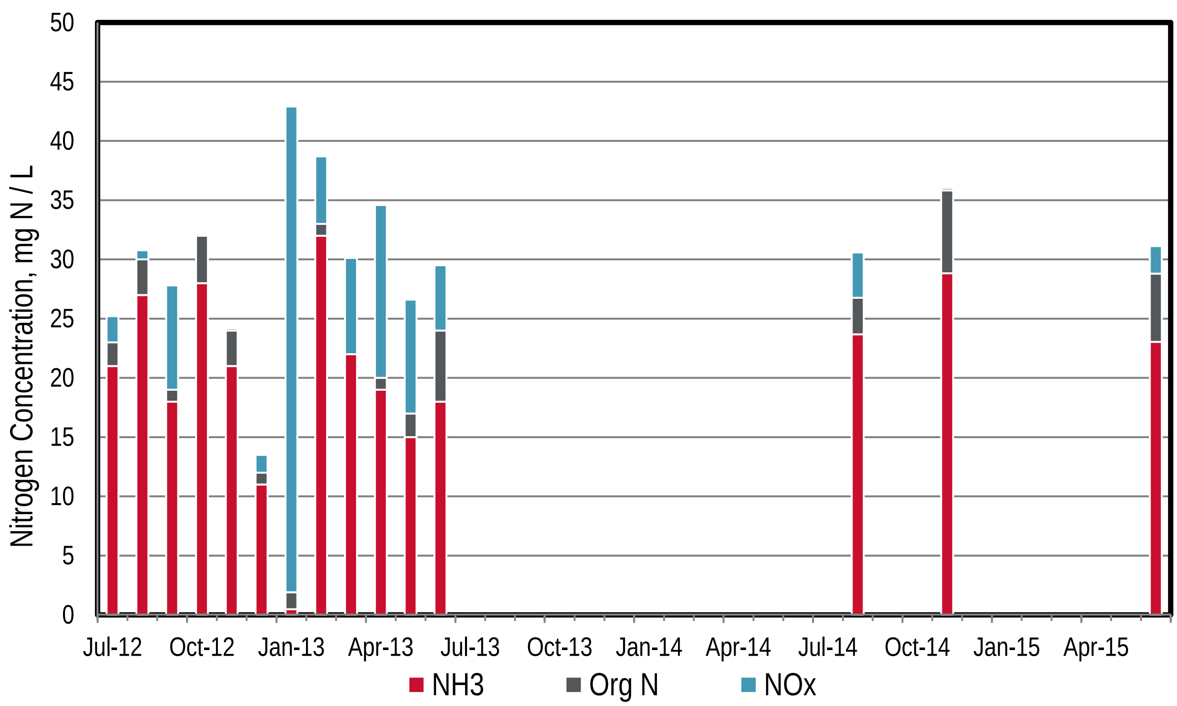

Figure 31-3. Tiburon Monthly Nitrogen Concentrations

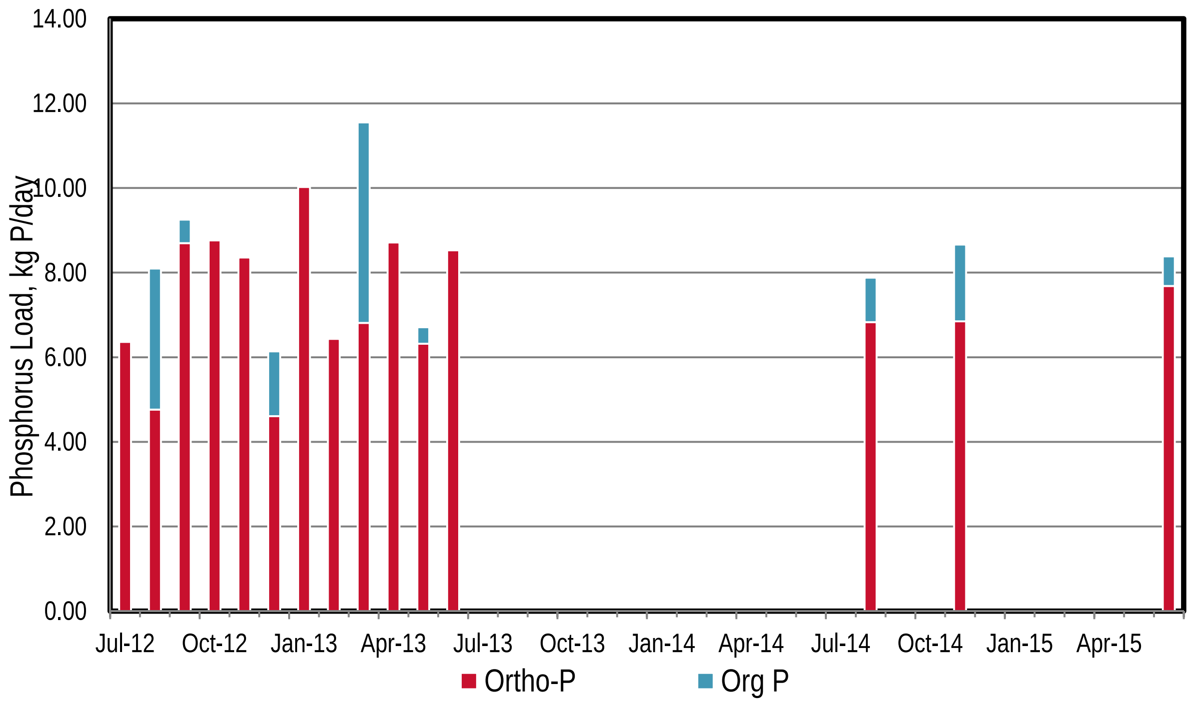

Figure 31-4. Tiburon Monthly Phosphorus Loads

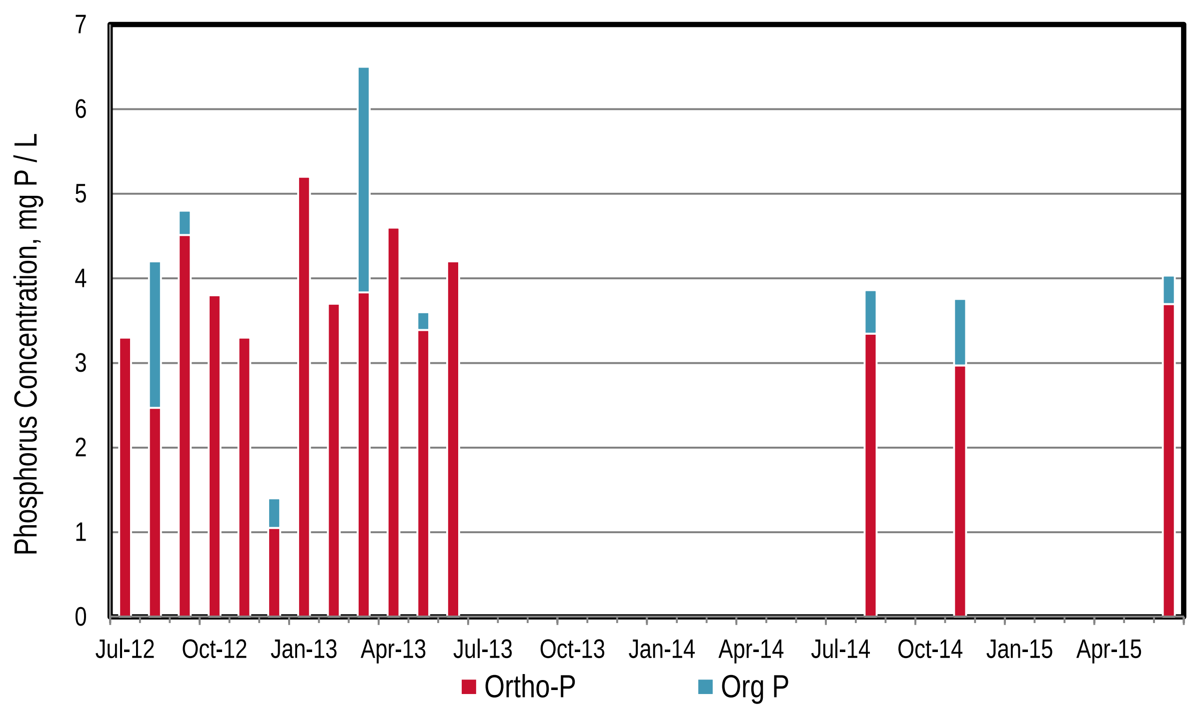

Figure 31-5. Tiburon Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 31-1. Tiburon Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.51	40	44	4	49	7.1	6.4
Aug 2012	0.51	52	58	2	59	4.8	8.1
Sep 2012	0.51	35	37	17	54	8.7	9.3
Oct 2012	0.61	65	74	0	74	13.7	8.8
Nov 2012	0.67	53	61	0	61	10.9	8.4
Dec 2012	1.16	48	53	7	59	4.6	6.1
Jan 2013	0.51	1	4	79	83	13.3	10.0
Feb 2013	0.46	56	57	10	67	8.1	6.4
Mar 2013	0.47	39	39	14	54	6.8	11.5
Apr 2013	0.50	36	38	28	66	11.5	8.7
May 2013	0.49	28	32	18	50	6.3	6.7
Jun 2013	0.54	37	49	11	60	9.8	8.5
Jul 2013	0.55	--	--	--	--	--	--
Aug 2013	0.54	--	--	--	--	--	--
Sep 2013	0.54	--	--	--	--	--	--
Oct 2013	0.51	--	--	--	--	--	--
Nov 2013	0.53	--	--	--	--	--	--
Dec 2013	0.56	--	--	--	--	--	--
Jan 2014	0.54	--	--	--	--	--	--
Feb 2014	0.86	--	--	--	--	--	--
Mar 2014	0.72	--	--	--	--	--	--
Apr 2014	0.67	--	--	--	--	--	--
May 2014	0.55	--	--	--	--	--	--
Jun 2014	0.55	--	--	--	--	--	--
Jul 2014	0.53	--	--	--	--	--	--
Aug 2014	0.54	48	55	8	62	7	8
Sep 2014	0.54	--	--	--	--	--	--
Oct 2014	0.53	--	--	--	--	--	--
Nov 2014	0.61	66	83	0	83	7	9
Dec 2014	1.48	--	--	--	--	--	--
Jan 2015	0.65	--	--	--	--	--	--
Feb 2015	0.65	--	--	--	--	--	--
Mar 2015	0.54	--	--	--	--	--	--
Apr 2015	0.56	--	--	--	--	--	--
May 2015	0.55	--	--	--	--	--	--
Jun 2015	0.55	48	60	5	65	8	8
Dry Season Average	**0.53**	**41**	**48**	**9**	**57**	**7**	**8**
Dry Season Trend (n=15)	**Yes**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**	**Insufficient Data**
Wet Season Average	**0.66**	**46**	**51**	**17**	**68**	**9**	**9**
Average Annual	**0.61**	**43**	**49**	**14**	**63**	**8**	**8**

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. The current plant flow is about 0.3 mgd ADWF. The plant currently nitrifies using trickling filters.

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

- Based on the average monthly values table below, there appears to be an upward trend for ammonia loads in the dry season.
- Nitrogen loads typically increase with flow during wet weather events.
- The plant fully nitrified through April 2014, after which the extent of ammonia bleed through appears to increase over time. This is attributed to the trickling filters capacity exceeded for nitrification.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. The ammonia to NOx split is getting close to 50:50 due to the trickling filters inability to fully nitrify since about April 2014.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Phosphorus loads are random whereby the plant occasionally removes phosphorus. The phosphorus concentrations range from 0.1 to 5.4 mg P/L, which is occasionally lower than typical effluent TP concentrations of 4 to 6 mg P/L.

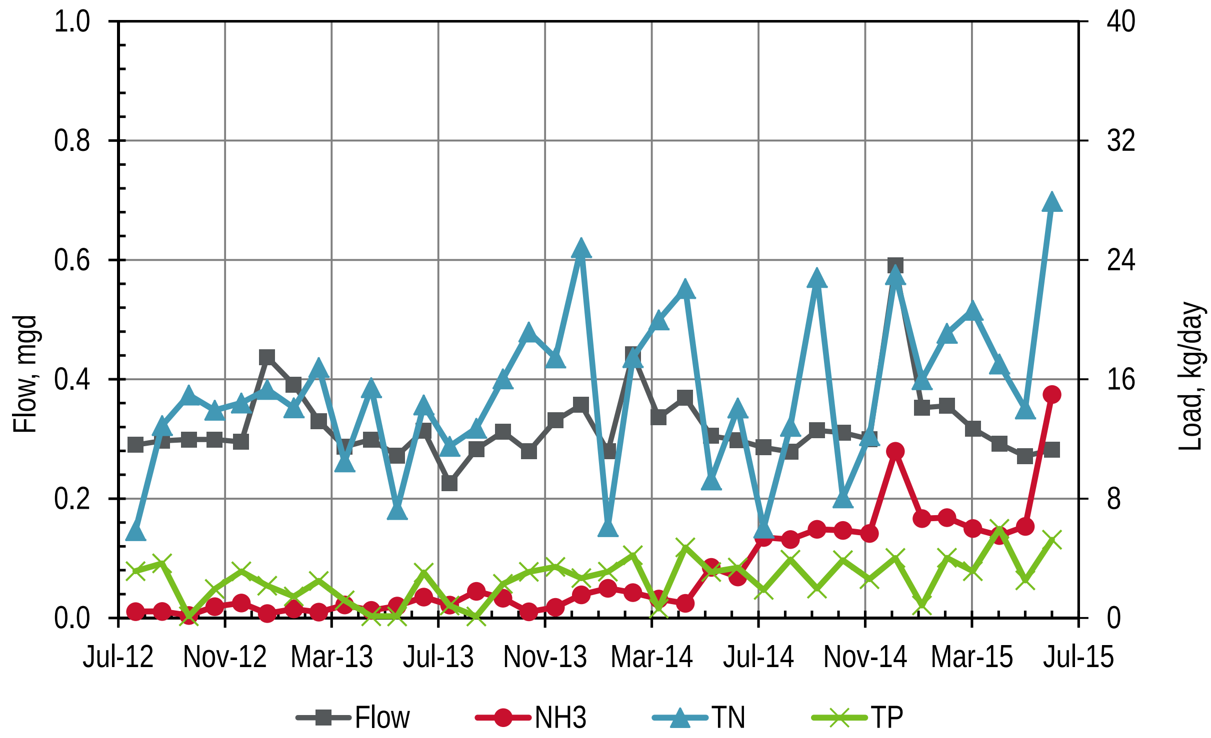

Figure 32-1. Treasure Island Monthly Flows and Loads

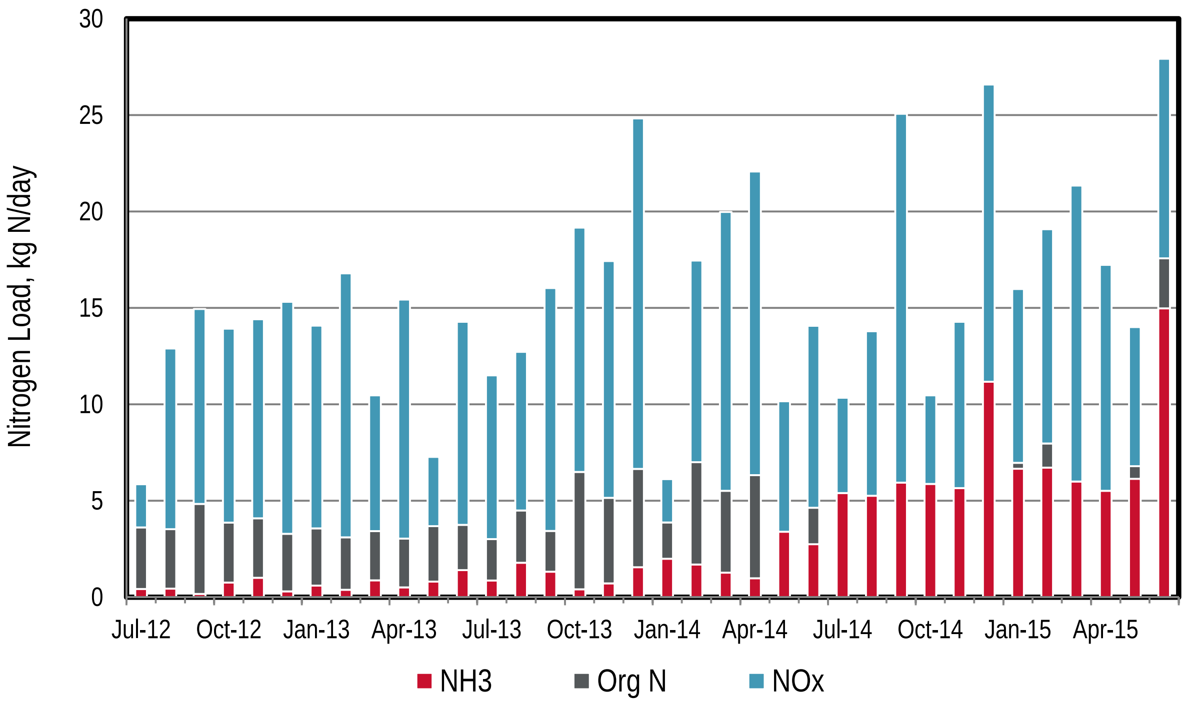

Figure 32-2. Treasure Island Monthly Nitrogen Loads

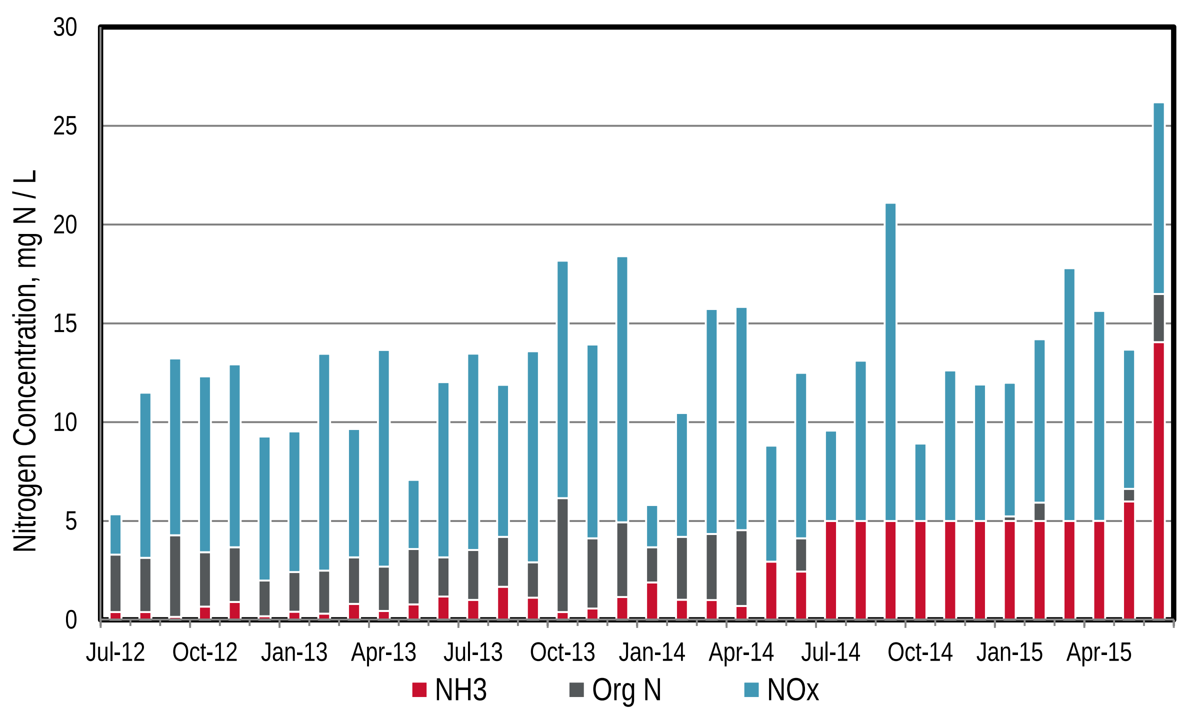

Figure 32-3. Treasure Island Monthly Nitrogen Concentrations

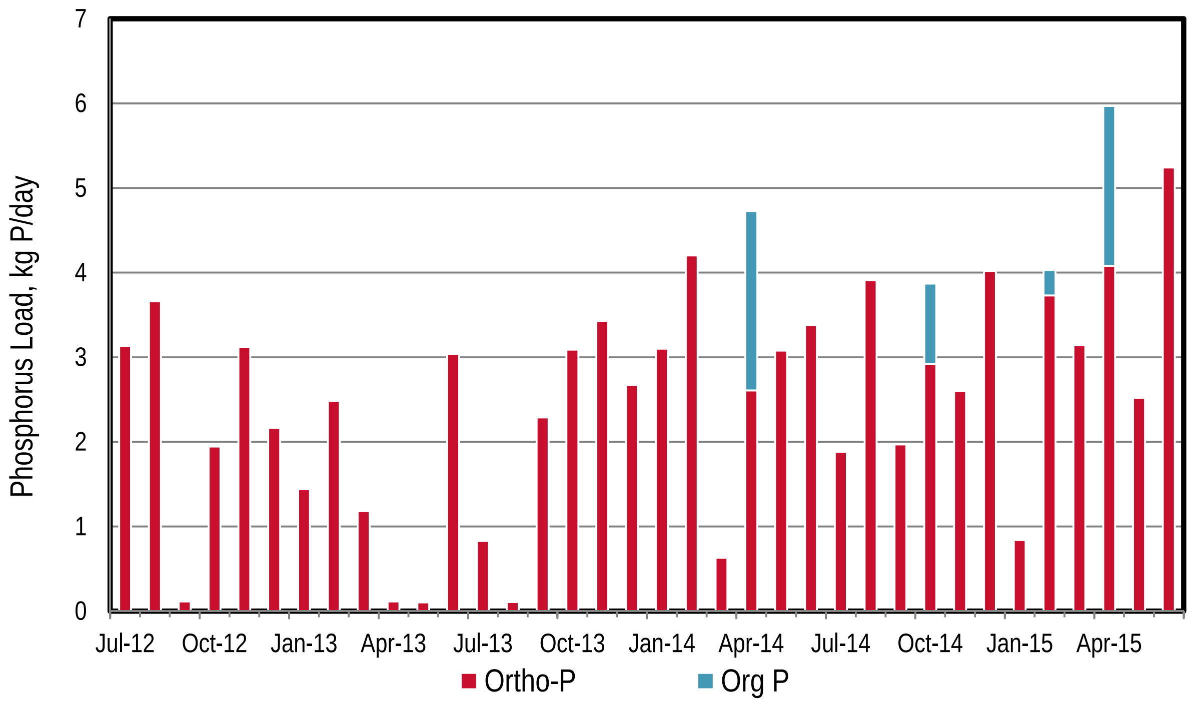

Figure 32-4. Treasure Island Monthly Phosphorus Loads

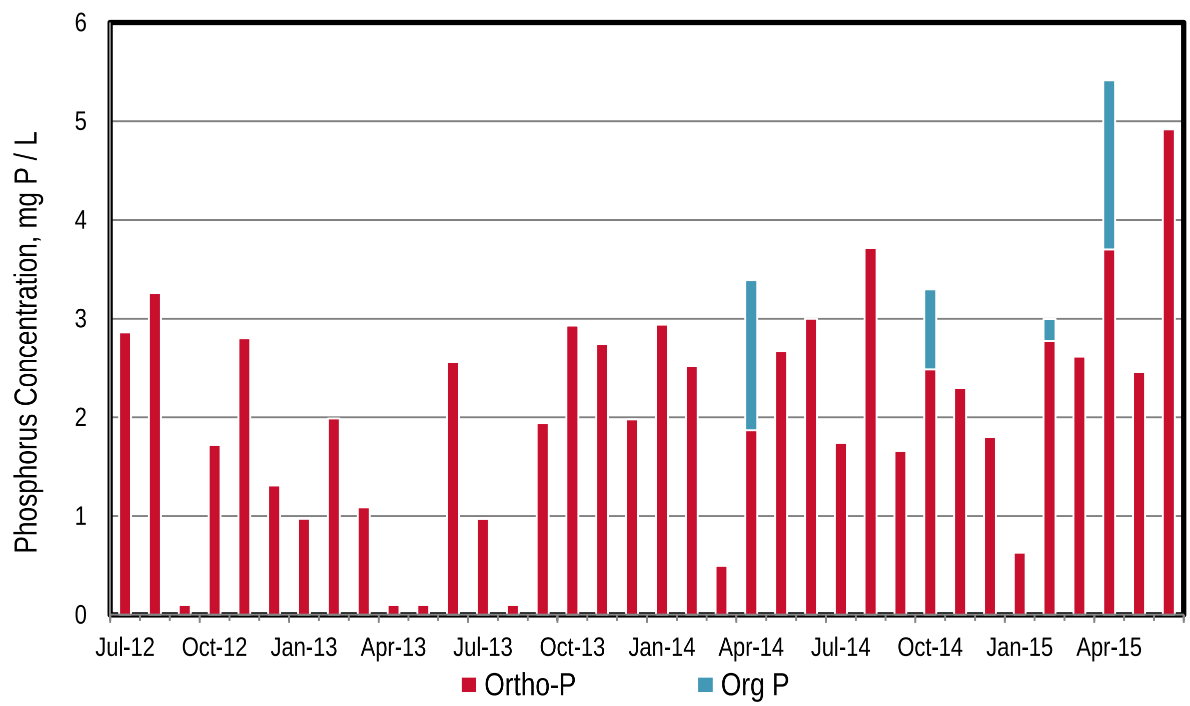

Figure 32-5. Treasure Island Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 32-1. Treasure Island Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	0.29	0.4	3.6	2.2	5.9	4.0	3.1
Aug 2012	0.30	0.4	3.5	9.4	12.9	4.1	3.7
Sep 2012	0.30	0.2	4.8	10.1	14.9	3.2	0.1
Oct 2012	0.30	0.8	3.9	10.1	13.9	3.5	1.9
Nov 2012	0.30	1.0	4.1	10.3	14.4	3.5	3.1
Dec 2012	0.44	0.3	3.3	12.0	15.3	3.4	2.2
Jan 2013	0.39	0.6	3.6	10.5	14.1	3.3	1.4
Feb 2013	0.33	0.4	3.1	13.7	16.8	3.7	2.5
Mar 2013	0.29	0.9	3.4	7.0	10.5	3.3	1.2
Apr 2013	0.30	0.5	3.0	12.4	15.4	3.7	0.1
May 2013	0.27	0.8	3.7	3.6	7.3	3.5	0.1
Jun 2013	0.31	1.4	3.8	10.5	14.3	3.7	3.0
Jul 2013	0.23	0.9	3.0	8.5	11.5	0.9	0.8
Aug 2013	0.28	1.8	4.5	8.2	12.7	4.2	0.1
Sep 2013	0.31	1.3	3.4	12.6	16.0	5.1	2.3
Oct 2013	0.28	0.4	6.5	12.7	19.2	3.7	3.1
Nov 2013	0.33	0.7	5.2	12.3	17.4	4.0	3.4
Dec 2013	0.36	1.6	6.7	18.2	24.8	4.0	2.7
Jan 2014	0.28	2.0	3.9	2.3	6.1	3.1	3.1
Feb 2014	0.44	1.7	7.0	10.5	17.5	5.1	4.2
Mar 2014	0.34	1.3	5.5	14.5	20.0	3.7	0.6
Apr 2014	0.37	1.0	6.3	15.7	22.1	2.6	4.7
May 2014	0.31	3.4	2.5	6.8	9.3	4.0	3.1
Jun 2014	0.30	2.7	4.6	9.4	14.1	4.1	3.4
Jul 2014	0.29	5.4	1.1	4.9	6.0	3.9	1.9
Aug 2014	0.28	5.3	4.3	8.5	12.8	4.4	3.9
Sep 2014	0.31	5.9	3.7	19.1	22.8	4.6	2.0
Oct 2014	0.31	5.9	3.5	4.6	8.1	2.9	3.9
Nov 2014	0.30	5.7	3.6	8.6	12.2	4.0	2.6
Dec 2014	0.59	11.2	7.6	15.4	23.0	5.6	4.0
Jan 2015	0.35	6.7	7.0	9.0	16.0	3.1	0.8
Feb 2015	0.36	6.7	8.0	11.1	19.1	3.7	4.0
Mar 2015	0.32	6.0	5.3	15.4	20.6	3.6	3.1
Apr 2015	0.29	5.5	5.3	11.7	17.0	4.1	6.0
May 2015	0.27	6.1	6.8	7.2	14.0	4.2	2.5
Jun 2015	0.28	15.0	17.6	10.3	27.9	5.5	5.2
Dry Season Average	**0.29**	**3.4**	**4.7**	**8.8**	**13.5**	**4.0**	**2.4**
Dry Season Trend (n=15)	**No**	**Yes**	**No**	**No**	**No**	**No**	**No**
Wet Season Average	**0.35**	**2.9**	**5.0**	**11.3**	**16.4**	**3.7**	**2.8**
Average Annual	**0.32**	**3.1**	**4.9**	**10.3**	**15.2**	**3.8**	**2.6**

33 Vallejo Sanitation and Flood Control 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 current flows are about 8.8 mgd ADWF. The plant performs secondary treatment using a trickling filter/solids contact process.

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

- Based on the average monthly values table below, there appears to be a downward trend for flows in the dry season. This is attributed to a combination of water conservation and the drought.
- There appears to be an upward trend for all nitrogen species in the dry season.
- Nitrogen loads appear to steadily increase over time per calendar year, followed by a sudden drop and a repeat steady increase.
- Ammonia and NOx had about a 50:50 split in TN species during the first couple years of data. Over the last year, ammonia makes up the majority of the nitrogen species. It appears that the plant performed partial nitrification up until the influent loads exceeded any nitrification capacity over the last year.
- Phosphorus loads have remained relatively flat over the years.
- The distribution of phosphorus species is predominantly ortho-P.
- The phosphorus concentrations range from 1.3 to 4.3 mg P/L, which is lower than typical effluent TP concentrations of 4 to 6 mg P/L.

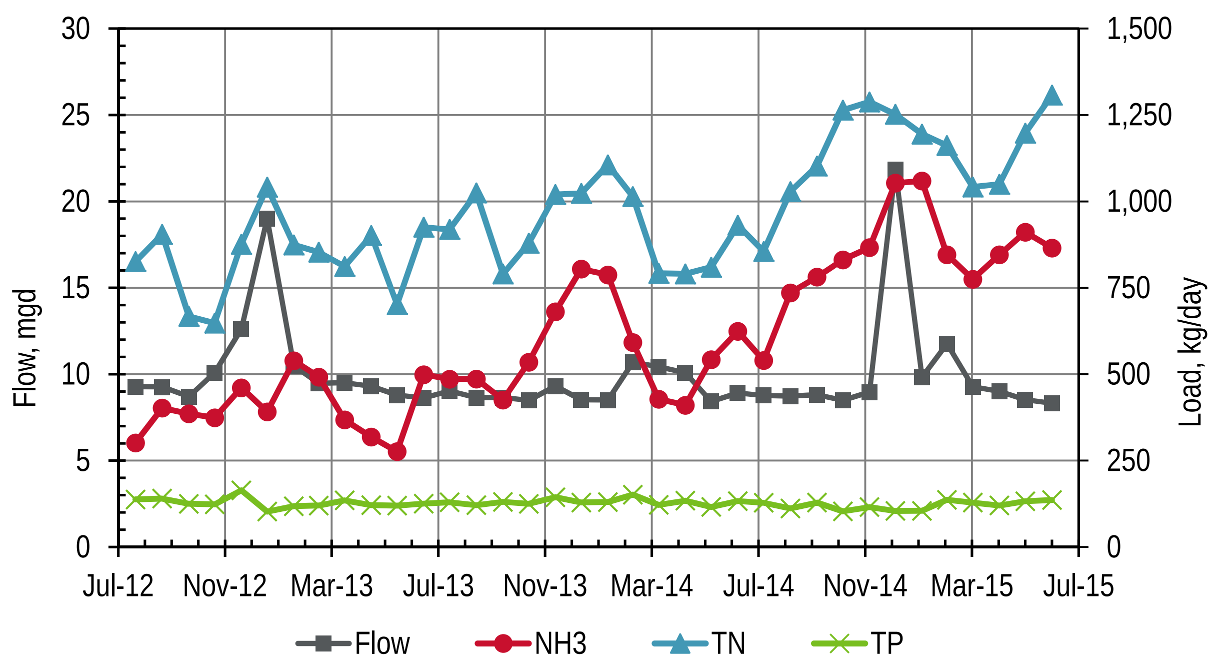

Figure 33-1. Vallejo Monthly Flows and Loads

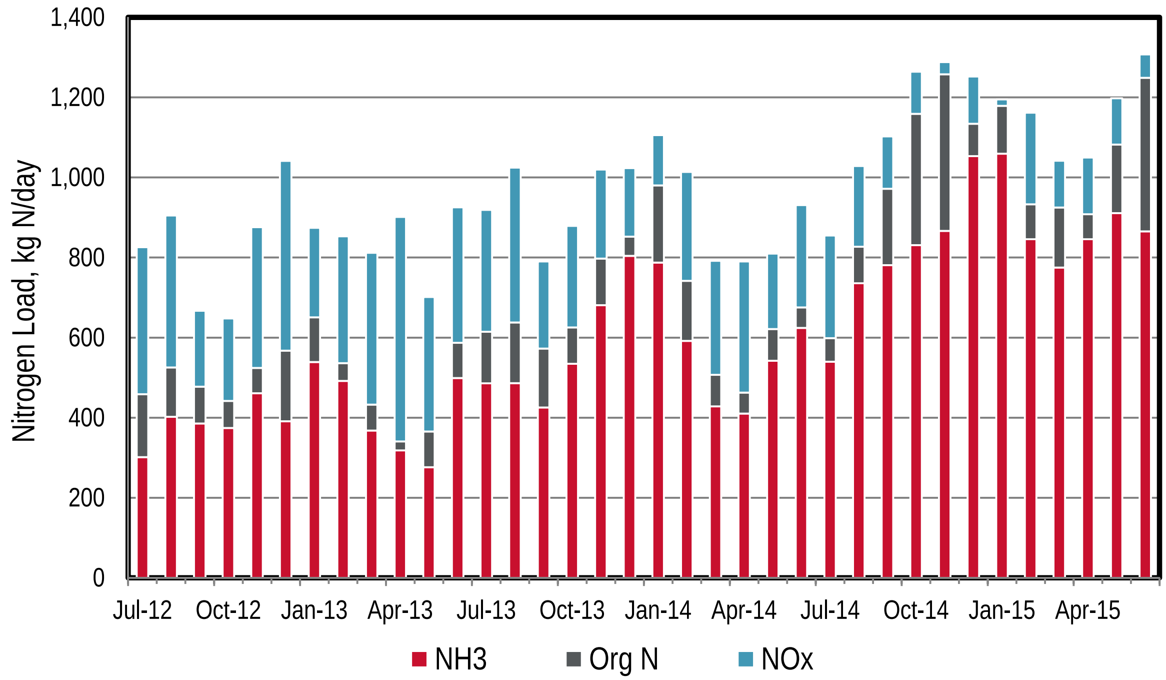

Figure 33-2. Vallejo Monthly Nitrogen Loads

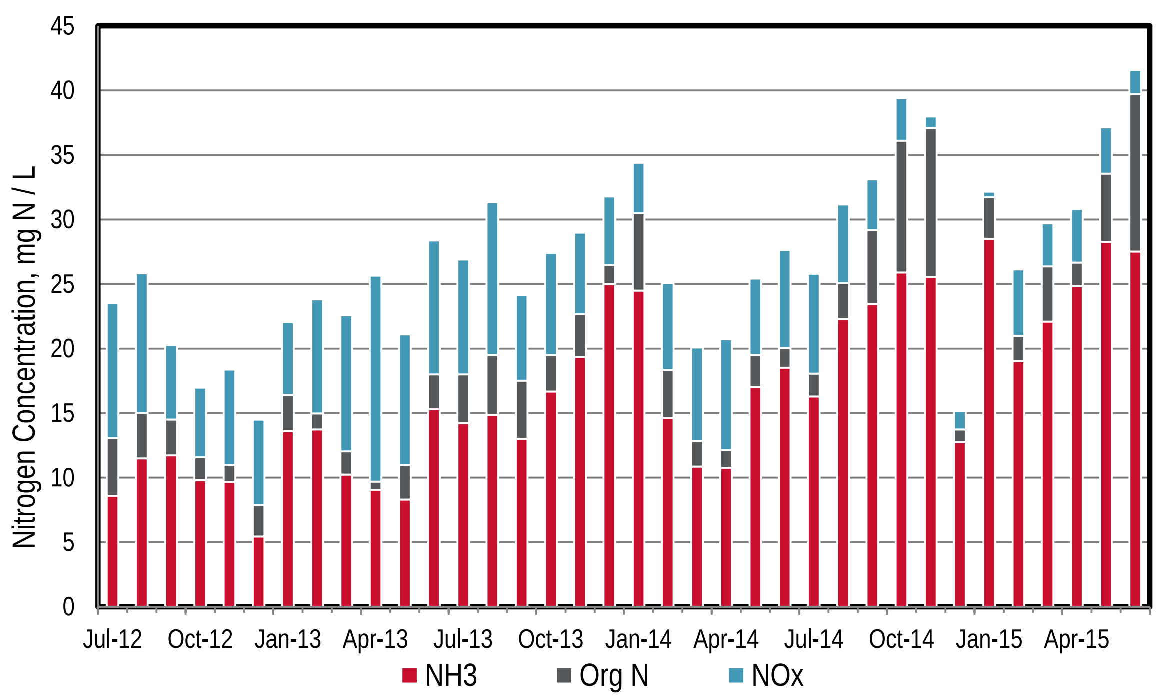

Figure 33-3. Vallejo Monthly Nitrogen Concentrations

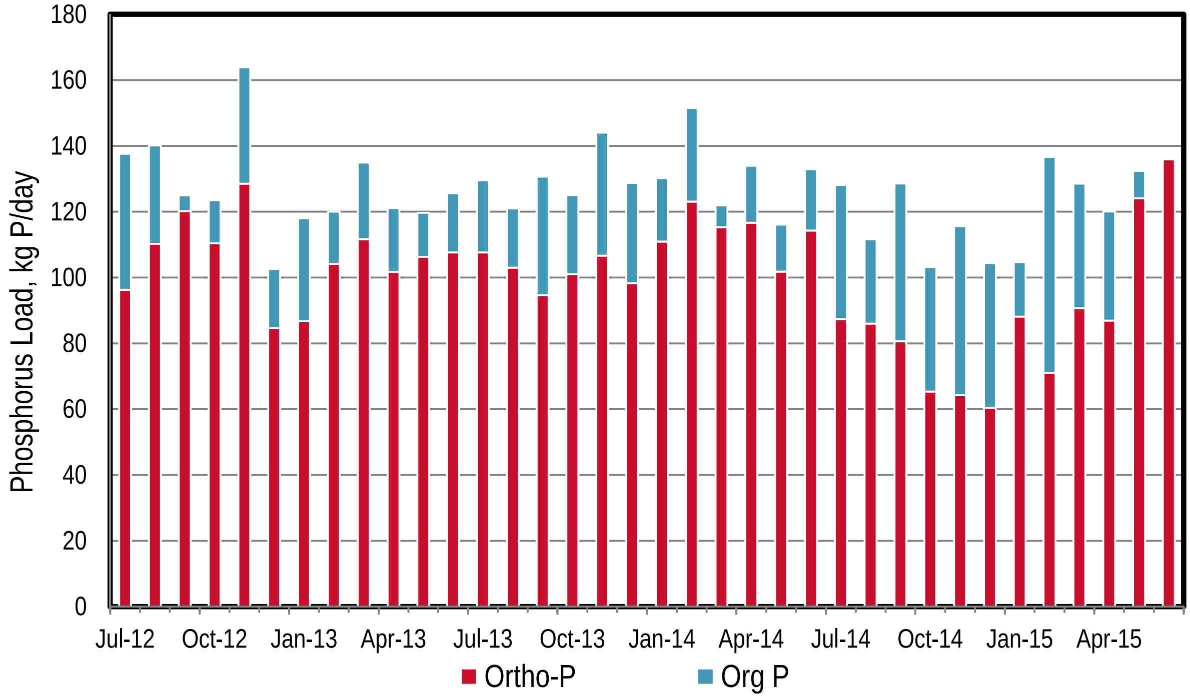

Figure 33-4. Vallejo Monthly Phosphorus Loads

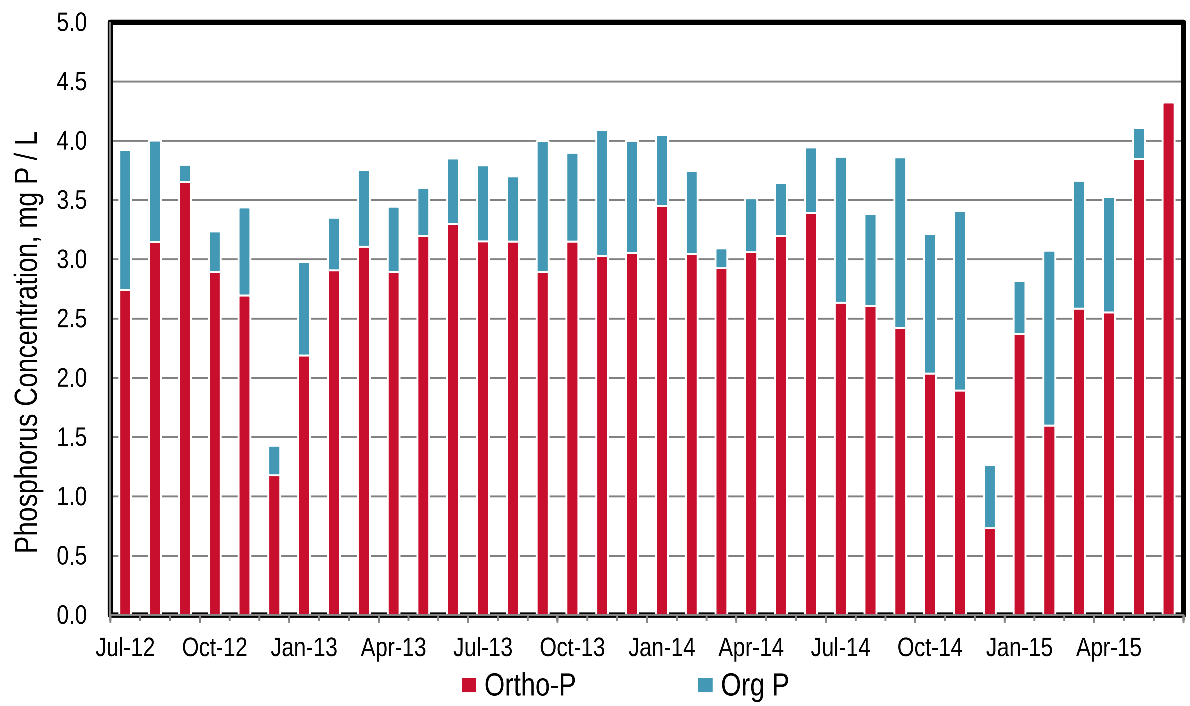

Figure 33-5. Vallejo Monthly Phosphorus Concentrations

Table 33-1. Vallejo Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	9.3	302	459	367	826	96	138
Aug 2012	9.3	402	526	379	905	110	140
Sep 2012	8.7	386	477	190	667	120	125
Oct 2012	10.1	374	442	206	648	110	123
Nov 2012	12.6	461	524	352	876	129	164
Dec 2012	19.0	391	567	474	1,041	85	103
Jan 2013	10.5	539	651	224	874	87	118
Feb 2013	9.5	492	536	317	853	104	120
Mar 2013	9.5	368	432	379	812	112	135
Apr 2013	9.3	318	341	561	901	102	121
May 2013	8.8	276	366	336	701	106	120
Jun 2013	8.6	499	587	338	925	108	126
Jul 2013	9.0	486	615	304	919	108	130
Aug 2013	8.7	486	638	387	1,025	103	121
Sep 2013	8.7	426	573	218	790	95	131
Oct 2013	8.5	535	625	253	879	101	125
Nov 2013	9.3	681	797	222	1,020	107	144
Dec 2013	8.5	804	852	171	1,023	98	129
Jan 2014	8.5	788	980	126	1,106	111	130
Feb 2014	10.7	592	742	272	1,014	123	152
Mar 2014	10.4	428	507	285	792	115	122
Apr 2014	10.1	410	463	327	790	117	134
May 2014	8.4	542	621	188	810	102	116
Jun 2014	8.9	624	675	256	931	114	133
Jul 2014	8.8	540	599	256	855	87	128
Aug 2014	8.7	736	827	201	1,028	86	112
Sep 2014	8.8	781	972	131	1,103	81	129
Oct 2014	8.5	831	1,159	105	1,264	65	103
Nov 2014	9.0	867	1,258	30	1,288	64	116
Dec 2014	21.8	1,053	1,134	118	1,252	60	104
Jan 2015	9.8	1,059	1,179	16	1,195	88	105
Feb 2015	11.8	846	933	229	1,162	71	137
Mar 2015	9.3	775	925	117	1,042	91	129
Apr 2015	9.0	846	908	142	1,050	87	120
May 2015	8.5	911	1,082	115	1,198	124	132
Jun 2015	8.3	865	1,249	59	1,307	143	136
Dry Season Average	**8.8**	**551**	**684**	**248**	**933**	**106**	**128**
Dry Season Trend (n=15)	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**
Wet Season Average	**10.7**	**641**	**760**	**235**	**994**	**97**	**125**
Average Annual	**9.9**	**603**	**728**	**240**	**969**	**100**	**126**

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 (21.5 mgd for West County and 20.0 mgd for the City of Richmond). The Richmond plant has wet weather capacity greater than 20 mgd though only 20 mgd for full secondary treatment. The current discharge flows are about 6.4 mgd ADWF. The Richmond plant performs secondary treatment using activated sludge, whereas the West County plant nitrifies using a roughly filter, followed by an activated sludge process.

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

- The Richmond Plant represents the majority of the discharge flow and load (data not shown). The West County Plant recycles a majority of their flows year-round.
- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for flow, ortho-P, and total phosphorus loads. This is attributed to a combination of increased P removal at the plant, water conservation and the drought.
- Nitrogen and phosphorus 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 the Richmond Plant represents the majority of the discharge load and they do not nitrify. Additionally, West County sends landfill leachate rich in ammonia from their plant to the City of Richmond plant which contributes to the discharge loading.
- Ortho-P values are routinely greater than TP values. For such instances, ortho-P values were set equal to TP for the plots. The reported ortho-P values were, however, used for the data table.
- Total phosphorus concentrations are range from about 0.9 to 3.2 mg P/L. Such values suggest P removal as typical effluent TP concentrations range from 4 to 6 mg P/L. There are no P removal facilities at the Richmond Plant so additional sampling is recommended to confirm where P removal is occurring.

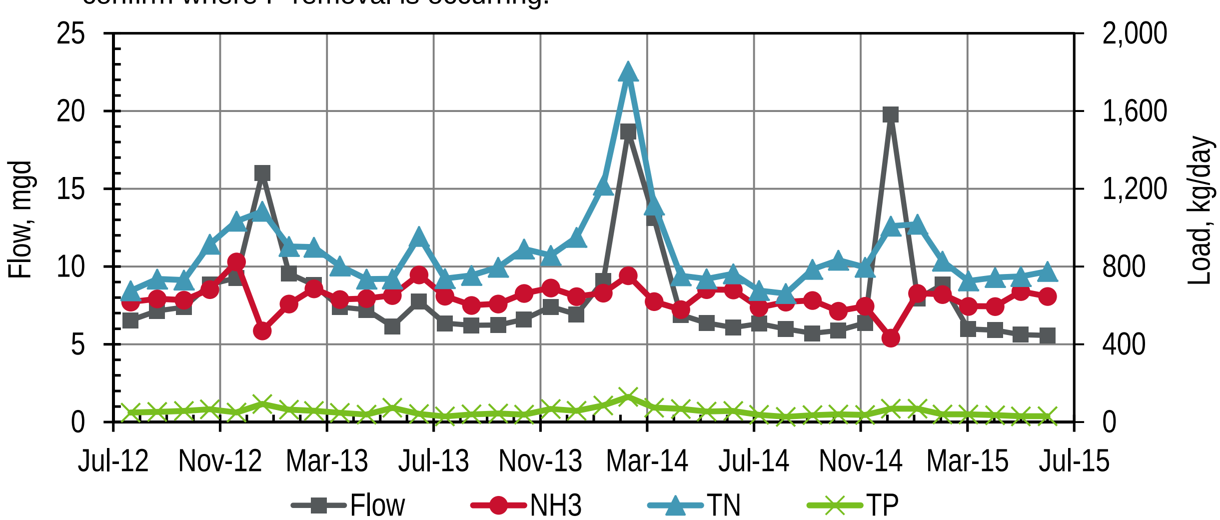

Figure 34-1. West County Monthly Flows and Loads

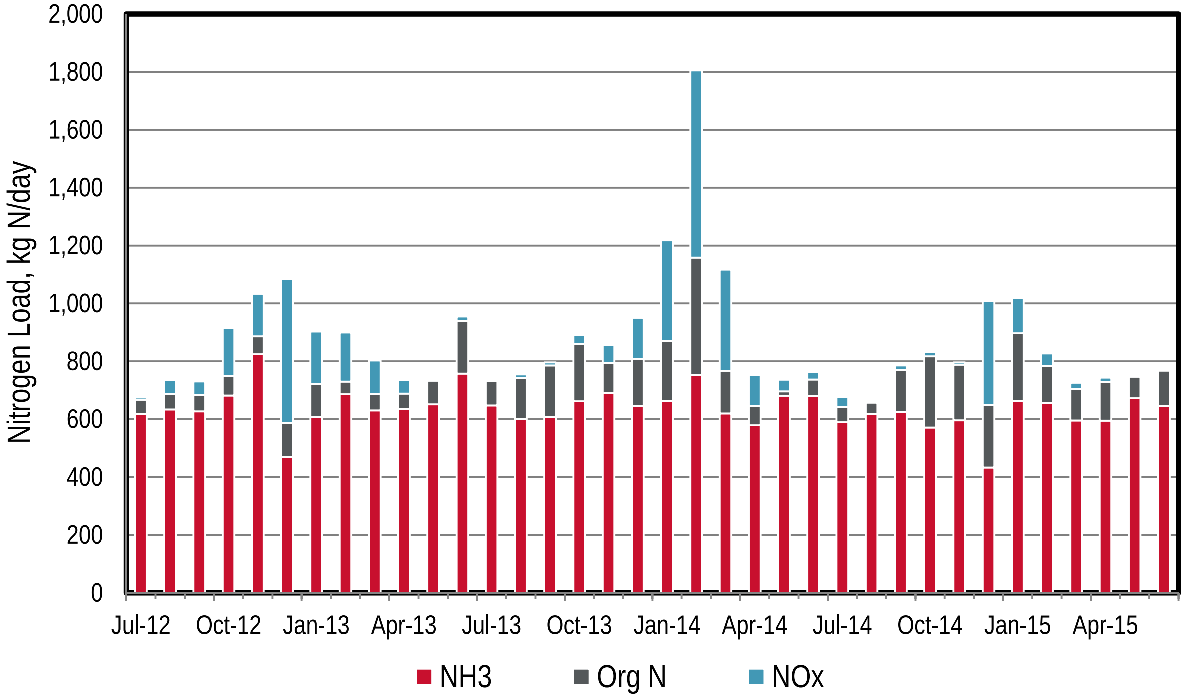

Figure 34-2. West County Monthly Nitrogen Loads

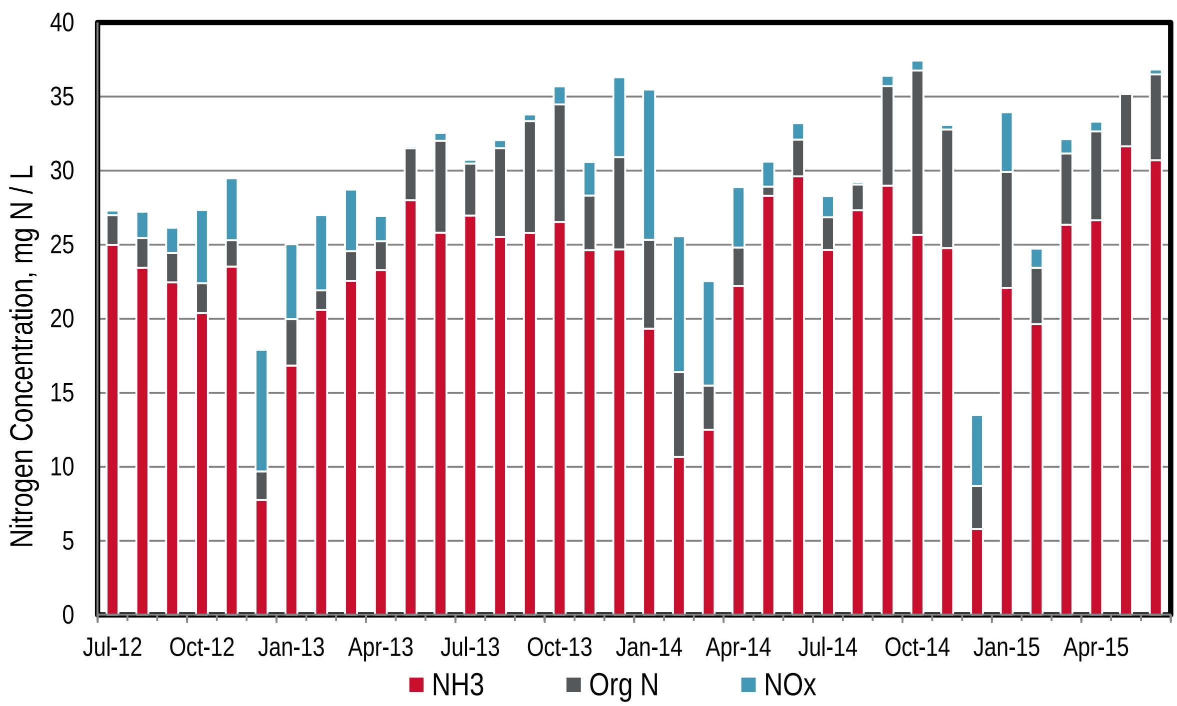

Figure 34-3. West County Monthly Nitrogen Concentrations

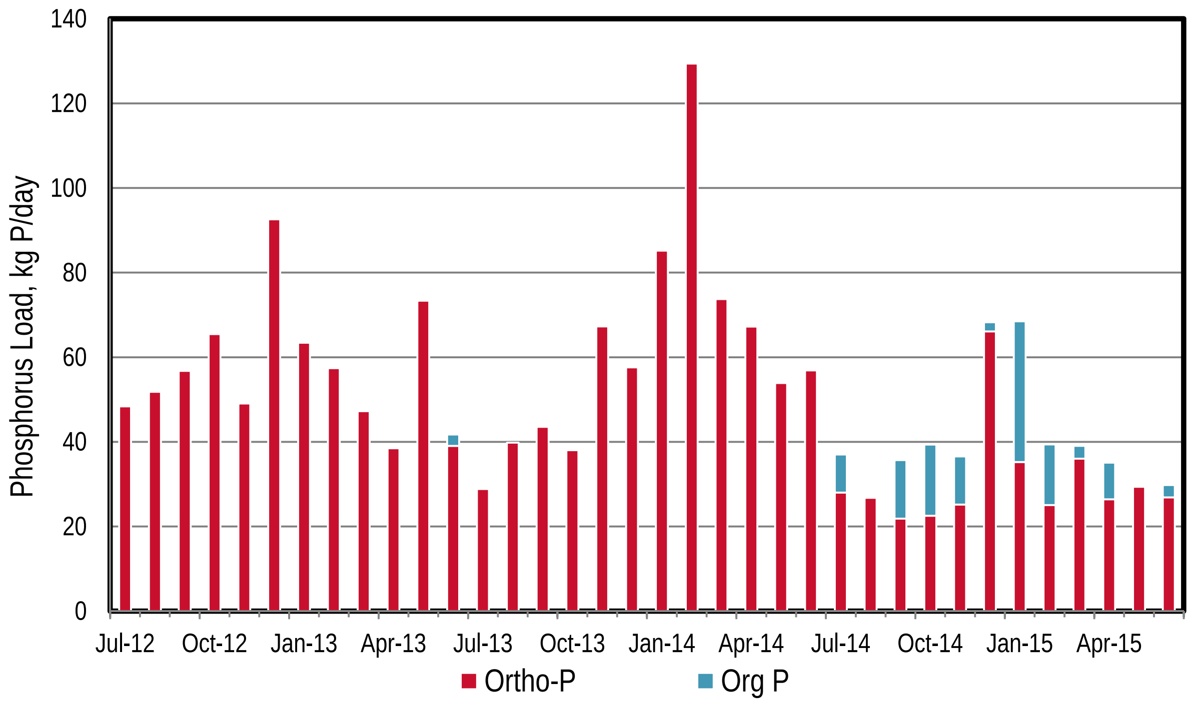

Figure 34-4. West County Monthly Phosphorus Loads

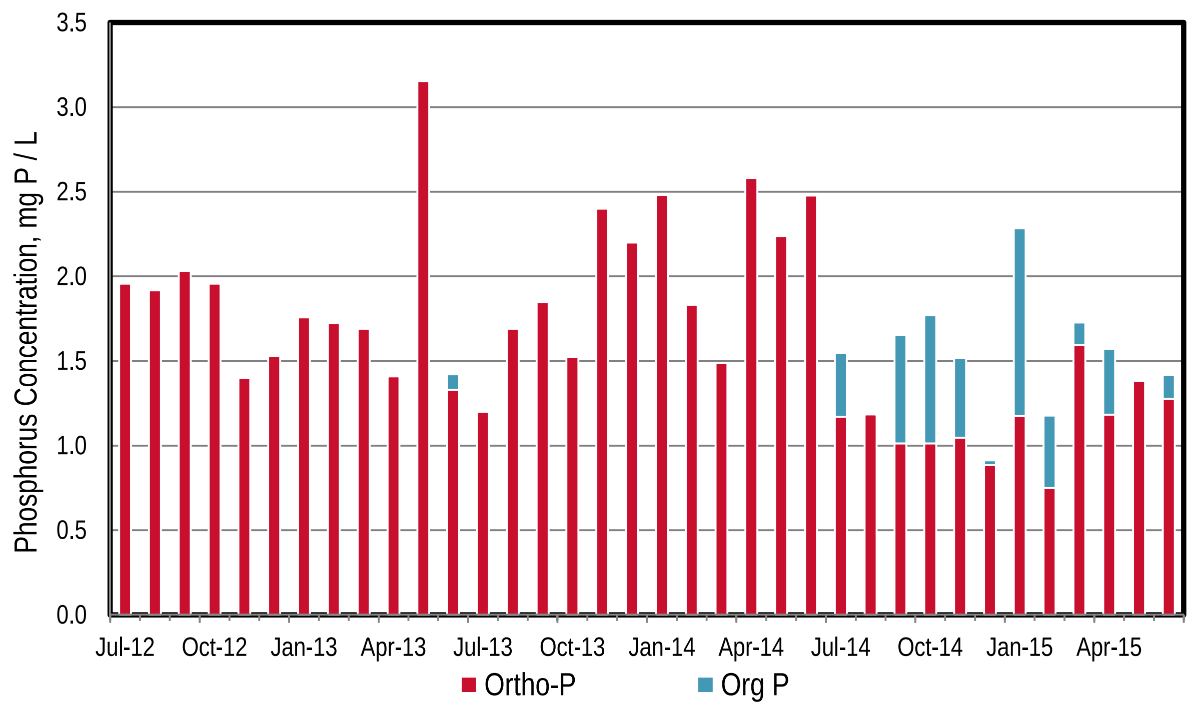

Figure 34-5. West County Monthly Phosphorus Concentrations

In the graphs above, where ortho-P exceeded the TP, ortho-P has been set equal to the TP.

Table 34-1. West County Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	TKN kg N/day	NOx kg N/day	Total N kg N/day	Ortho-P kg P/day	Total P kg P/day
Jul 2012	7	618	667	8	675	88	48
Aug 2012	7	634	688	48	736	85	52
Sep 2012	7	627	683	47	730	99	57
Oct 2012	9	682	749	166	914	96	65
Nov 2012	9	824	887	147	1,033	76	49
Dec 2012	16	470	587	497	1,084	121	93
Jan 2013	10	607	721	182	903	68	63
Feb 2013	9	686	730	169	899	96	57
Mar 2013	7	631	687	116	803	62	47
Apr 2013	7	635	688	47	735	54	38
May 2013	6	652	733	3	736	103	73
Jun 2013	8	758	940	15	955	39	42
Jul 2013	6	648	732	6	738	29	29
Aug 2013	6	601	742	13	754	61	40
Sep 2013	6	608	786	10	796	48	44
Oct 2013	7	662	860	30	890	59	38
Nov 2013	7	690	794	64	857	92	67
Dec 2013	7	646	809	141	950	82	58
Jan 2014	9	664	870	348	1,218	108	85
Feb 2014	19	753	1,158	647	1,805	166	129
Mar 2014	13	620	767	349	1,117	92	74
Apr 2014	7	579	646	106	753	127	67
May 2014	6	681	696	40	737	73	54
Jun 2014	6	680	737	26	763	91	57
Jul 2014	6	590	642	35	677	28	37
Aug 2014	6	618	657	4	661	27	27
Sep 2014	6	626	771	15	786	22	36
Oct 2014	6	571	817	15	832	23	39
Nov 2014	6	596	789	7	796	25	37
Dec 2014	20	433	650	358	1,008	66	68
Jan 2015	8	662	897	121	1,018	35	68
Feb 2015	9	656	784	43	827	25	39
Mar 2015	6	596	704	22	726	36	39
Apr 2015	6	595	729	15	744	26	35
May 2015	6	672	747	1	749	34	29
Jun 2015	6	646	768	7	775	27	30
Dry Season Average	**6**	**645**	**739**	**19**	**758**	**57**	**44**
Dry Season Trend (n=15)	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**Yes**
Wet Season Average	**9**	**631**	**777**	**171**	**948**	**73**	**60**
Average Annual	**8**	**637**	**761**	**107**	**869**	**67**	**53**