



Monterey Bay Sanctuary Citizen Watershed Monitoring Network
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2014-2015 MRSWMP Monitoring Final Report

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Introduction

The Monterey Regional Storm Water Management Program's (MRSWMP) water quality monitoring program is modeled after the Monterey Bay National Marine Sanctuary's (MBNMS) Dry Run/First Flush monitoring, for which volunteers collect water samples which are analyzed for common urban pollutants. This monitoring program design promotes volunteer participation, stewardship and environmental education while providing important data regarding the quality of water flowing into the Monterey Bay National Marine Sanctuary.

The 2014-2015 MRSWMP monitoring program collected water samples prior to the first major rainstorm of the year (Dry Run) and during the first major rainstorm of the winter season (First Flush). Samples collected during dry weather, prior to the first major rainstorm (Dry Run), can be used for source tracking of pollutants of concern and can give an indication of urban water uses (car washing, pressure washing, irrigation or illicit discharges), or groundwater base flow. In some cases dry weather flows can be more concentrated than those of wet weather flows. Due to an increased concentration and continual flow for weeks or even months, dry weather flows may contribute more to impaired or impacted water quality and loading of receiving water than wet weather flows. Water samples collected during the first major storm of the winter season (First Flush) provide information on the concentration of the contaminants in storm water after months of dry weather accumulation of pollutants on land in urban areas. All runoff from the Monterey region eventually flows into the Monterey Bay National Marine Sanctuary except in Pacific Grove where some dry weather flows are diverted to the sanitary sewer. It is hoped that this data provided by the MRSWMP water quality monitoring program will provide managers with the information needed to implement best management practices focused on improving water quality.

This monitoring program is designed to meet E.8.ii requirements under the Phase II Stormwater Permit of the MRSWMP, satisfying public involvement and participation elements of the permit. This monitoring program does not fulfill the E.13 requirements pertaining to ASBS Monitoring, TMDL Monitoring, or 303(d) Monitoring, or Receiving Water Monitoring, which are completed by permittees on their own or through regional programs. For additional information regarding the Central Coast ASBS Regional Monitoring Program, please visit: <http://ccasbsrmp.stanford.edu/>

Methods

The same protocols and laboratory analyses are used for all of the MRSWMP water quality monitoring events. Volunteers take field measurements (water temperature, pH, electrical conductivity, and transparency) and collect water samples for lab analysis of nutrients (nitrate, orthophosphate, and urea), bacteria (*Escherichia coli* and enterococcus), metals (copper, lead and zinc) and total suspended solids, ammonia, color, MBAS detergents, fluoride, hardness (as CaCO₃), potassium and turbidity. Hardness results have been collected since 2003, but never reported until last year. They are measured to determine the toxicity of metals, i.e. as hardness decreases in concentration the toxicity of total metals increases.

All results (lab and field) in this study are compared to receiving water standards established for particular beneficial uses in a stream, lake, or the ocean (see Table 1). These receiving water quality standards are not meant for end of pipe monitoring, such as for this MRSWMP water quality monitoring program. However, lacking any standards for end-of-pipe monitoring these receiving water standards are used for comparison. MBAS detergents and metal results are compared to the Central Coast Basin Plan Water Quality Objectives (WQO) for the protection of marine aquatic life. Because there are no numerical water quality objectives in the Basin Plan for total coliform, *E. coli*, nitrate, orthophosphate, and total suspended solids (TSS), those

results are compared with the US EPA and Central Coast Ambient Monitoring Program's (CCAMP) Action Levels. The EPA objectives are for the protection of human health while CCAMP's Action Levels are benchmarks that are set for receiving water concentrations at which pollutants may impact cold-water fish. Action Levels typically represent existing regulatory standards, levels derived from the literature or other agency references, or levels that are elevated relative to the data distribution for that parameter on the Central Coast. It is important to reiterate that both Basin Plan water quality objectives and CCAMP Action Levels are established for receiving waters and not for end of pipe discharges such as is collected for the MRSWMP monitoring. However the SWRCB NPDES MS4 General Permit does provide end of pipe water quality standards or Action Levels for the new set of analytes required: ammonia, color, fluoride, hardness, potassium and turbidity. For turbidity the SWRCB NPDES MS4 Action Levels have been supplanted by CCAMP Action Levels that are more protective of water quality. No Action Level was provided in the SWRCB NPDES MS4 General Permit for fluoride.

A grab sample is collected and the results are reported as concentration, which is also how the water quality objectives are defined. However, this does not give an indication of the load or total amount of pollutants being discharged. To calculate load, flow must be measured. Flow is estimated by volunteers at the time of sampling and is listed for each site that has flow (Table 2).

Dry Run monitoring entails collecting a single grab sample from each site with flowing water. Those sites that did not have water flowing during any event were visited and "no flow" was documented on a field data sheet. During the First Flush, grab samples were collected 30 minutes apart for two time series, and results were averaged. Samples for urea were only collected during the first time series and are therefore not an average but a single sample result for each event.

Table 1: Receiving Water Quality Objectives (Urea and fluoride do not have a water quality objectives)

Parameter (reporting units)	Water Quality Objectives	Source of Objective
Ammonia	Not to exceed 50 mg/L	SWRCB NPDES MS4 General Permit
Color	Not to exceed 500	SWRCB NPDES MS4 General Permit
Copper (ppb)	Not to exceed 30	Basin Plan Objective
<i>E. coli</i> (MPN/100ml)	Not to exceed 235 ¹	EPA Ambient Water Quality Criteria
Enterococcus (MPN/100ml)	Not to exceed 104	EPA Ambient Water Quality Criteria
Hardness as CaCO ₃ (mg/L)	Not less than 10 or greater than 2,000	SWRCB NPDES MS4 General Permit
Lead (ppb)	Not to exceed 30	Basin Plan Objective
MBAS Detergents (mg/L)	Not to exceed 0.2	Basin Plan Objective
Nitrate as N (mg/L)	Not to exceed 2.25 ²	Central Coast Ambient Monitoring Program (CCAMP)
Orthophosphate as P (mg/L)	Not to exceed 0.12 ³	Central Coast Ambient Monitoring Program (CCAMP)
pH	Not < 6.5 or > 8.5	General Basin Plan Objective
Potassium (mg/L)	Not to exceed 20	SWRCB NPDES MS4 General Permit
Total Suspended Solids (TSS) (ppm)	Not to exceed 500 ⁴	Central Coast Ambient Monitoring Program (CCAMP)
Transparency (cm)	Not less than 25	Central Coast Ambient Monitoring Program (CCAMP)
Turbidity	Not to exceed 25 NTU	Central Coast Ambient Monitoring Program (CCAMP)
Water Temperature (°C)	Not more than 21 ⁵	Central Coast Ambient Monitoring Program (CCAMP)
Zinc (ppb)	Not to exceed 200	Basin Plan Objective

¹ Environmental Protection Agency, Updated WQO.

² Central Coast Ambient Monitoring Program, Pajaro River Watershed Characterization Report 1998, rev 2003.

³ Williamson, The Establishment of Nutrient Objectives, Sources, Impacts and Best Management Practices for the Pajaro River and Llagas Creek, 1994.

⁴ Central Coast Ambient Monitoring Program, Salinas River Watershed Characterization Report 1999, rev. 2000.

⁵ Moyle, P. 1976. Inland Fisheries of California. University of California Press.

Results

Two monitoring events took place during the 2014-2015 MRSWMP permit year:

- The Dry Run was conducted on September 13th, 2014. With the help of 20 volunteers, all sites were visited for the Dry Run but only 4 of the 9 sites had enough water flowing to be sampled.
- The first significant storm of the rainy season hit the Monterey Peninsula on October 25th, 2013. This rain event was a southerly storm that covered only the most exposed of the MRSWMP sites on the Monterey Peninsula and in Pajaro. A total of 6 volunteers assisted with the collection of field data and samples at 3 sites: Crossroads (Monterey County), Pico (Pacific Grove), Pajaro (Monterey County). The next storm that produced enough rain to create another flush occurred almost a week later on October 31st, 2014. This storm had enough energy for sample collection at the remaining sites: Bay Street (Seaside), Twins (Monterey), San Carlos (Monterey), Steinbeck (Monterey) and Lovers (Pacific Grove).

All sites visited for each event have instantaneous flow estimates calculated and listed in Table 2. First Flush instantaneous flow estimates are an average of two time series samples while the other events are from a single sample. Bay Street (Seaside) and Lovers (Pacific Grove) are not possible to estimate flow due to the pipe inaccessibility. Pajaro (Monterey County) and Crossroads (Monterey County) do not have flow estimates due to a flap gate at the end of the outfall that impedes natural flow (Table 2).

Table 2: Sites monitored for the 2014-2015 MRSWMP Program. Flow is given in gallons per minute (gpm). NA= data not available due to issues with pipe and/or accessibility, NF= no flow, NS= not sampled.

Sites	Dry Run	First Flush
Pajaro (Monterey County)	NF	NA
Bay Street (Seaside)	NF	NA
Twins (Monterey)	2.16	1600
San Carlos Beach (Monterey)	NF	139
Steinbeck (Monterey)	0.08	350
Greenwood Park (Pacific Grove)	1.18	450
Lover's (Pacific Grove)	NF	NA
Pico (Pacific Grove)	0.78	561
Crossroads (Monterey County)	NF	NA

Table 3. The range of results for each of the 2014-2015 MRSWMP sampling events. First Flush range results are not averaged.

Parameter	Units	Dry Run	First Flush
Ammonia	mg/L	0.03 – 0.21	ND – 11
Color	color units	20 - 30	100 - 500
Conductivity	µS	750 – 4,600	100 - 810
Copper- total	µg/L	ND - 11	30 - 374
<i>Escherichia coli (E. coli)</i>	MPN/ 100 ml	402 – 6,152	2,590 – 199,000
Enterococcus	MPN/ 100 ml	83 – 4,962	435 – 155,000
Fluoride	mg/L	ND – 0.4	ND – 0.4
Hardness	mg/L	161 - 910	17 - 149
Lead- total	µg/L	ND	ND - 45
MBAS Detergents	mg/L	ND – 0.27	0.37 – 1.30
Nitrate as N	mg-N/L	0.3 – 2.4	0.3 – 1.2
Orthophosphate as P	mg-P/L	ND – 0.2	0.2 – 2.8
pH	pH units	6.75 – 7.50	6.25 – 7.50
Potassium	mg/L	4.2 – 18.0	2.4 – 11.2
Total Suspended Solids	mg/L	ND	12 - 173
Transparency	cm	> 120	4.6 – 112.0
Turbidity	NTU	1 - 7	11 - 150
Urea	µg/L	10 - 45	270 – 4,490
Water temperature	°C	16.7 – 19.6	16.5 – 19.7
Zinc- total	µg/L	39 - 313	129 - 941

Nitrate as N

Nitrogen is an element needed for plant growth. Primary sources of nitrate include runoff from fertilized lawns, agricultural and pasture lands, construction sites and septic and sewer system leachate. The CCAMP Action Level for nitrate as N ($\text{NO}_3\text{-N}$) is 2.25 mg-N/L. The minimum detection limit (MDL) is 0.1 mg-N/L. Figure 2 represents all MRSWMP data since 2006, collected during both dry and wet weather. All results are listed in Appendix 2.

For the **Dry Run**, only one of the monitored sites was above the Action Level for nitrate as N, that site was Pico (Pacific Grove) with a result of 2.4 mg-N/L.

During the **First Flush**, none of the sites monitored were above the Action Level for nitrate as N.

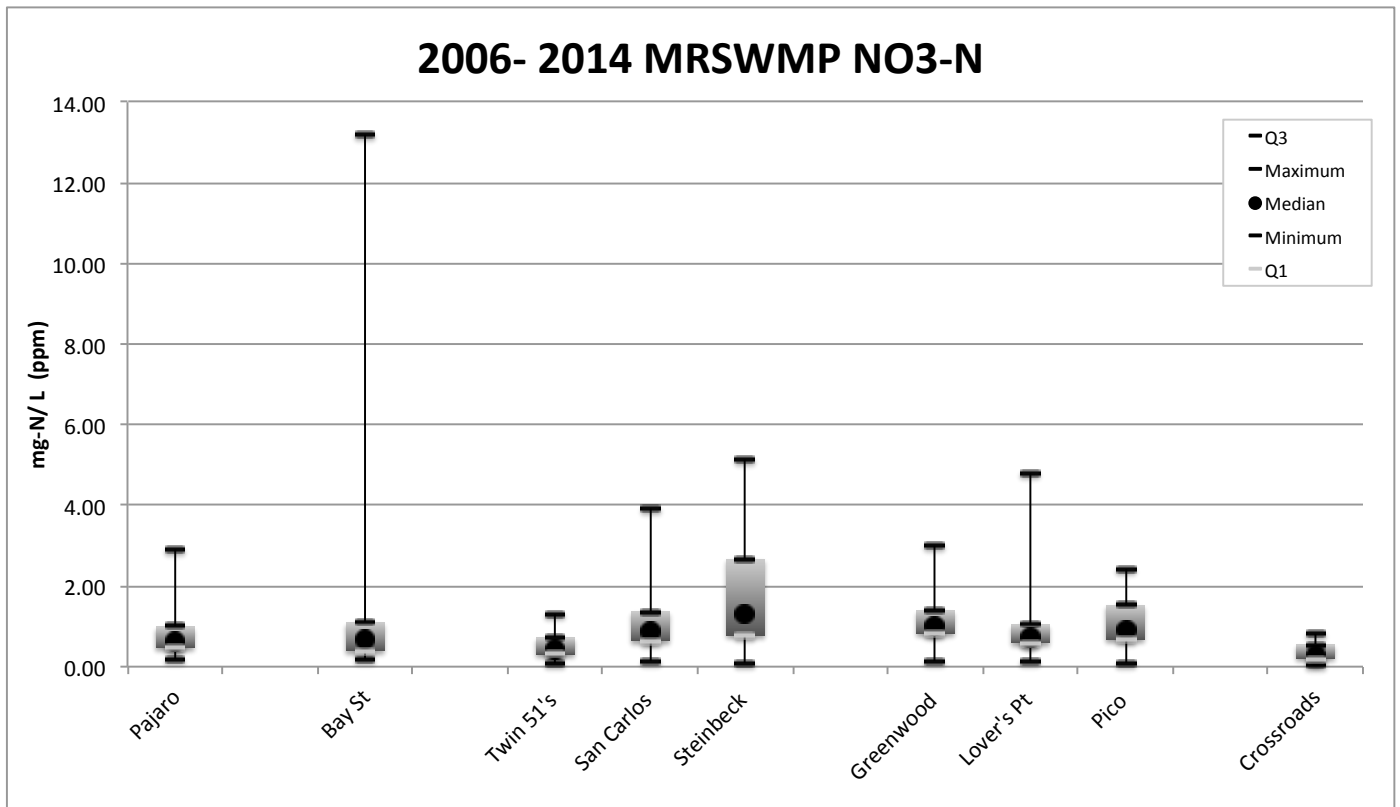


Figure 2. 2006-2014 MRSWMP average nitrate as N ($\text{NO}_3\text{-N}$) results. Sites are listed north to south.

Orthophosphate as P

Phosphorus is an essential element for plant growth. Orthophosphate is a form of phosphorus commonly found bound to soil particles, in sewage, fertilizers, and in detergents that contain phosphates. In aquatic systems, orthophosphate is rapidly taken up by algae and aquatic plants. With excessive amounts present, large algal blooms can occur which can lead to degraded water quality conditions toxic to aquatic life. The CCAMP Action Level for orthophosphate as P ($\text{PO}_4\text{-P}$) is 0.12 mg-P/L. The MDL was 0.1 mg-P/L. Figure 3 represents all MRSWMP data both dry and wet weather, collected since 2006. All results are listed in Appendix 2.

For the **Dry Run**, only one of the sites monitored had results above non-detect. That one site was Steinbeck (Monterey) with a result of 0.20 mg-P/L.

During the **First Flush**, all of the sampled sites were above the Action Level. The highest average result was from Steinbeck (Monterey) with a value of 2.8 mg-P/ L.

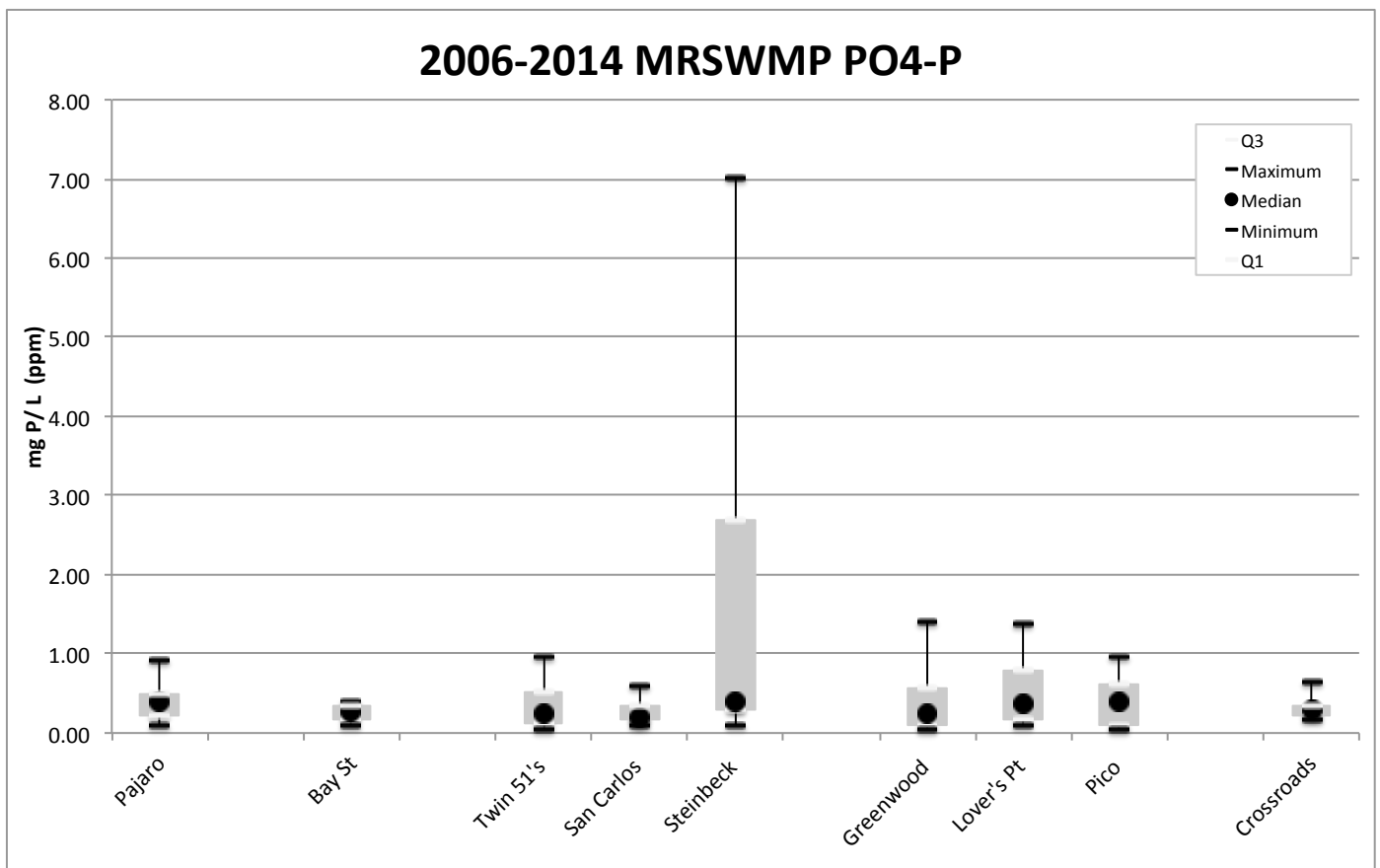


Figure 3. 2006-2014 MRSWMP average orthophosphate as P ($\text{PO}_4\text{-P}$) results. Sites are listed north to south.

Urea

Urea is an organic compound that is often used in agricultural and urban fertilizers. While there is not an established Action Level, urea concentrations are compared against other sites. The MDL for urea was 10 $\mu\text{g/L}$. Figure 4 represents all MRSWMP data both dry and wet weather, collected since 2006. All results are listed in Appendix 2.

For the **Dry Run**, the highest urea result was from Twins (Monterey) with a value of 45 $\mu\text{g/L}$.

During the **First Flush**, urea was only measured during the first time series. The highest result was from Steinbeck (Monterey) with a value of 4490 $\mu\text{g/L}$.

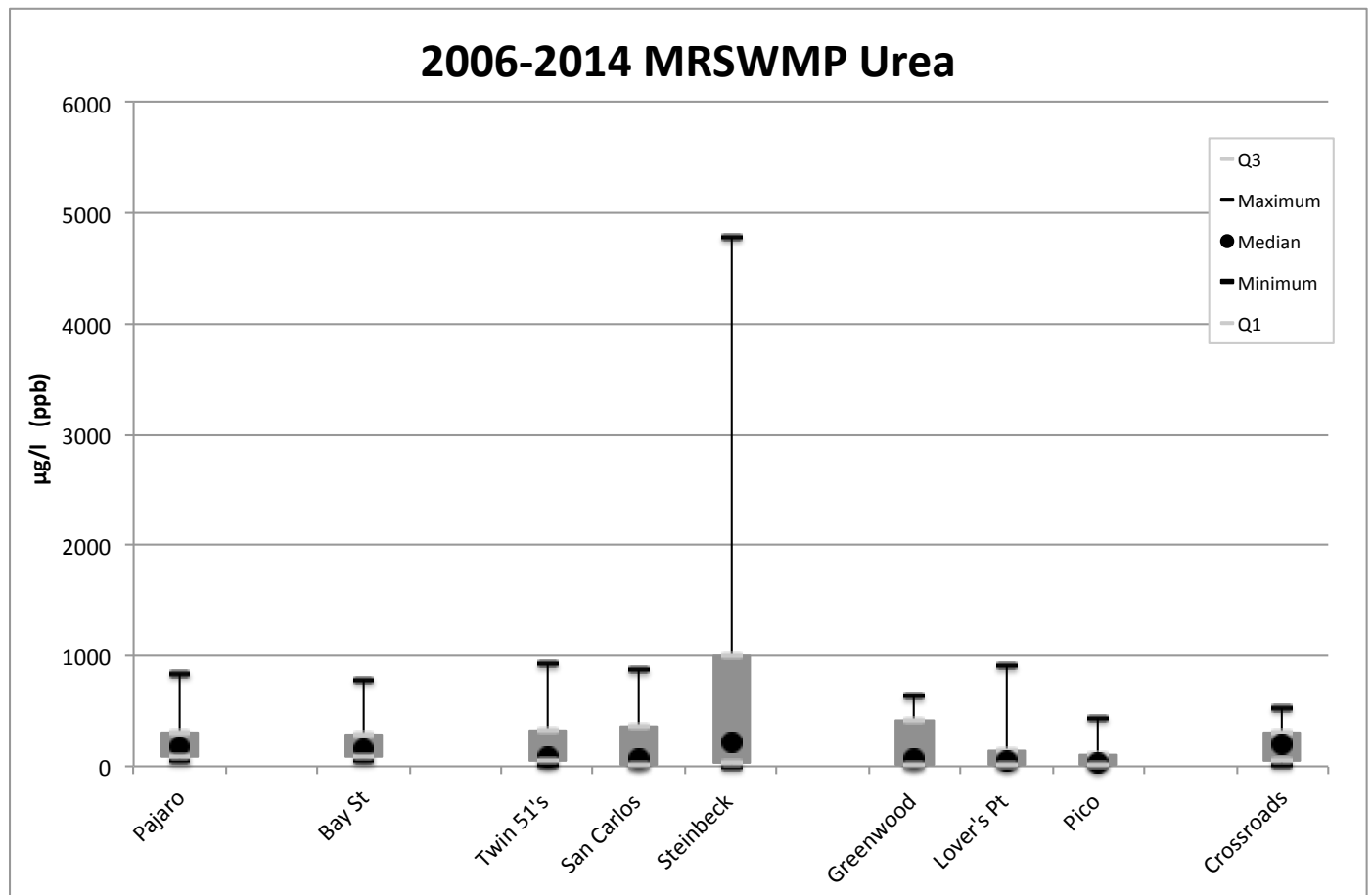


Figure 4. 2006–2014 MRSWMP urea results. Sites are listed from north to south.

Ammonia

This analyte in conjunction with other analytes, will assist in the determination of whether sample water is from a discharge of sewage, industrial or commercial liquid wastes. The Action Level for ammonia as N is 50 mg/L. The MDL was 0.05 mg/L. All results are listed in Appendix 2.

For the **Dry Run** none of the sites were above the Action Level, the highest result was 0.21 mg/L at Greenwood Park (Pacific Grove).

For the **First Flush** none of the sites were above the Action Level. The site with the highest average result was Steinbeck (Monterey) with a result of 10.46 mg/L.

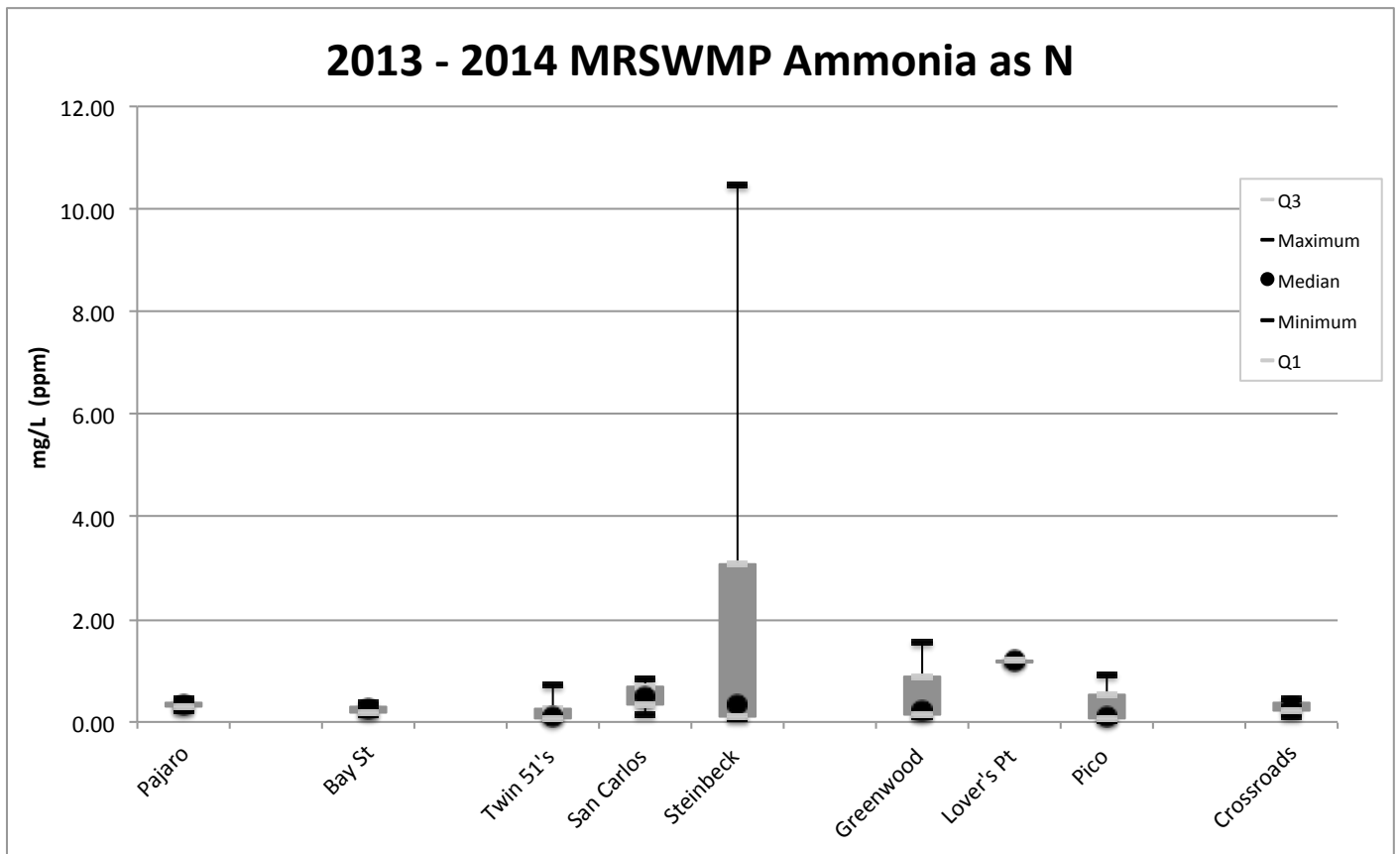


Figure 5. 2013- 2014 MRSWMP average ammonia as N results. Sites are listed north to south.

Fluoride

There is no Action Level, however tap water on the Monterey Peninsula contains from 0.25 - 0.60 mg/L of fluoride from natural sources. California American Water, the local water provider for Peninsula cities, does not add fluoride to local tap water. The MDL for Fluoride was 0.1 mg/L. All results are listed in Appendix 2.

For the **Dry Run**, the highest fluoride result was from Twins (Monterey) with a value of 0.4 mg/L. One site sampled for the Dry Run had a non-detect for fluoride, that site was Pico (Pacific Grove).

During the **First Flush**, three sites (33%) had matching results for the highest result of 0.3 mg/L. The three sites were: Twins (Monterey), Steinbeck (Monterey), Pico (Pacific Grove).

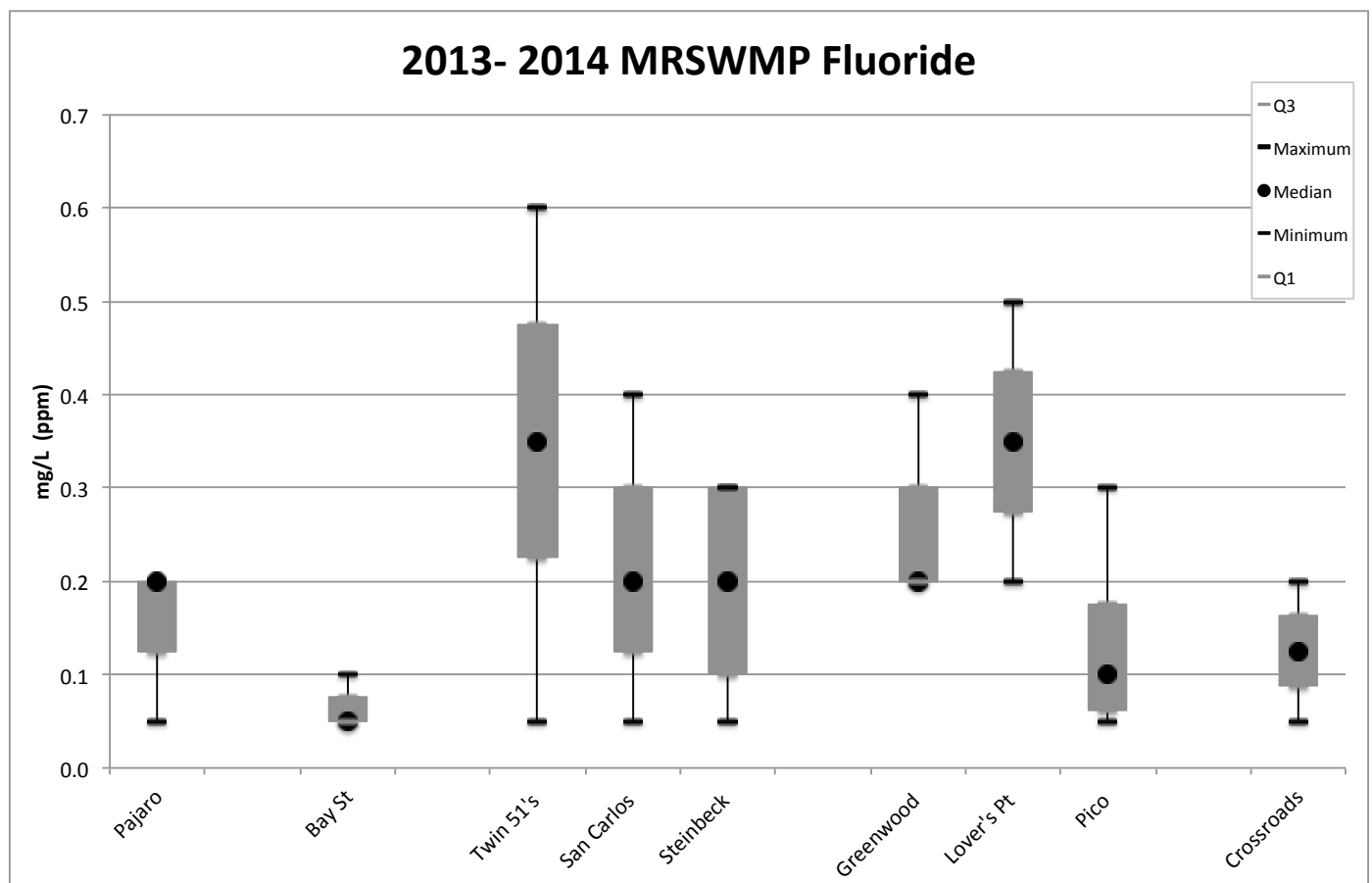


Figure 6. 2013- 2014 MRSWMP average fluoride results. Sites are listed from north to south.

Escherichia coli (*E. coli*)

Escherichia coli (*E. coli*), and enterococcus are types of indicator bacteria found in warm blooded animals. While they do not cause disease in humans, they are pollutants of concern because they indicate the potential presence of pathogens that do cause disease in humans and wildlife. The U.S. Environmental Protection Agency Ambient Water Quality Objective for *E. coli* is 235 MPN/100 ml. Figure 7 represents all MRSWMP data both dry and wet weather, collected since 2006. All results are listed in Appendix 2.

For the **Dry Run** all four of the sites monitored (100%) were above the Water Quality Objective (WQO) for *E. coli*. The highest *E. coli* result was 6,152 MPN/100 ml from both Twins (Monterey) and Greenwood Park (Pacific Grove).

During the **First Flush**, all of the sites were above the Water Quality Objective. The highest average result was from San Carlos (Monterey) with a value of 138,000 MPN/ 100 ml.

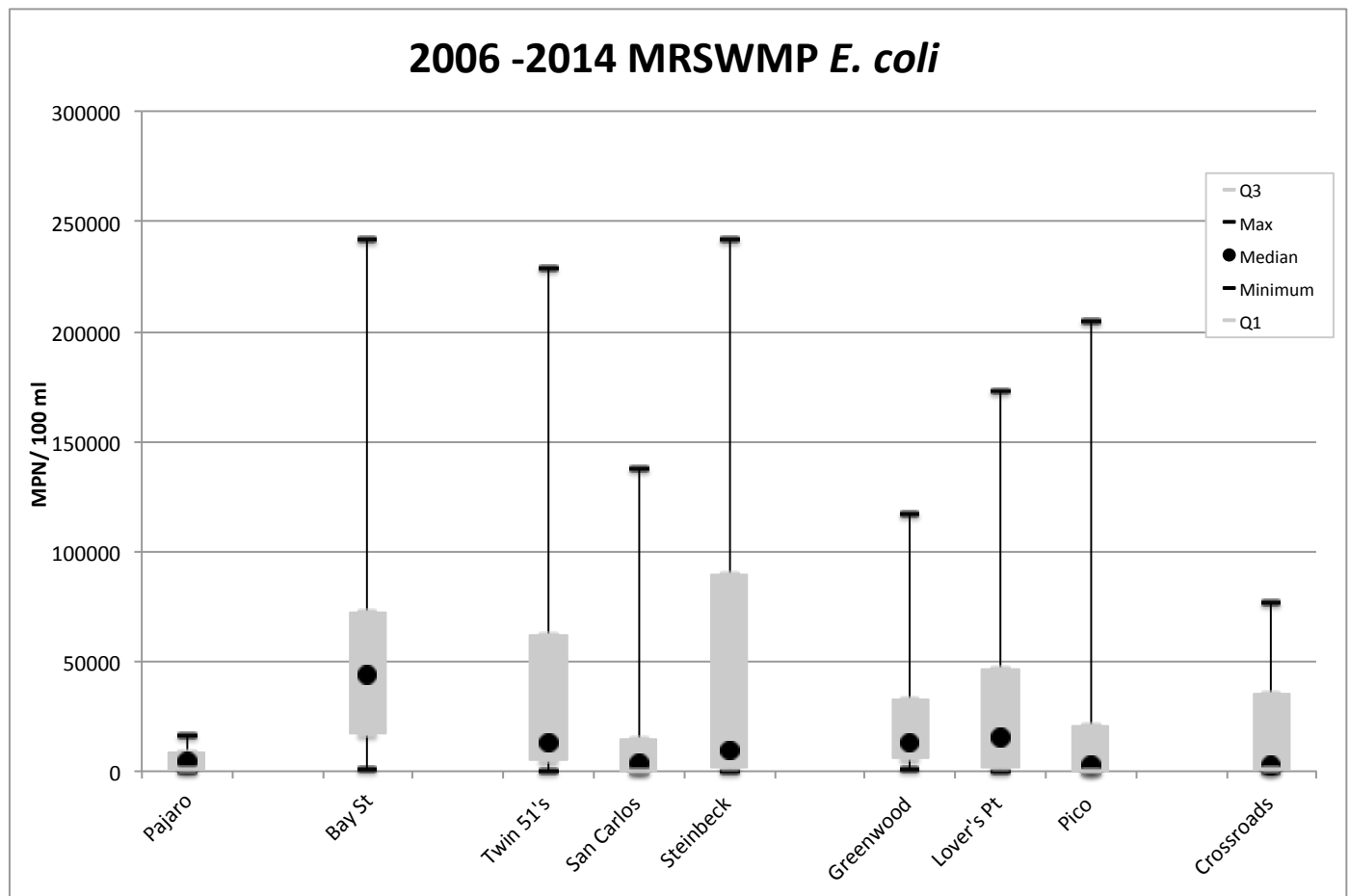


Figure 7. 2006-2014 MRSWMP average *E. coli* results. Sites are listed north to south.

Enterococcus

The EPA's Ambient Water Quality Criteria for enterococcus is 104 MPN/100 ml. Figure 8 represents all MRSWMP data both dry and wet weather, collected since 2006. All results are listed in Appendix 2.

For the **Dry Run** three of the four sites (75%) exceeded the WQO. The highest enterococcus result was 4,962 MPN/ 100 ml at Steinbeck (Monterey). The one site not above the WQO was Pico (Pacific Grove) with a result of 83 MPN/ 100ml.

During the **First Flush** all sites were above the WQO. The highest average result was 126,500 at Bay Street (Seaside).

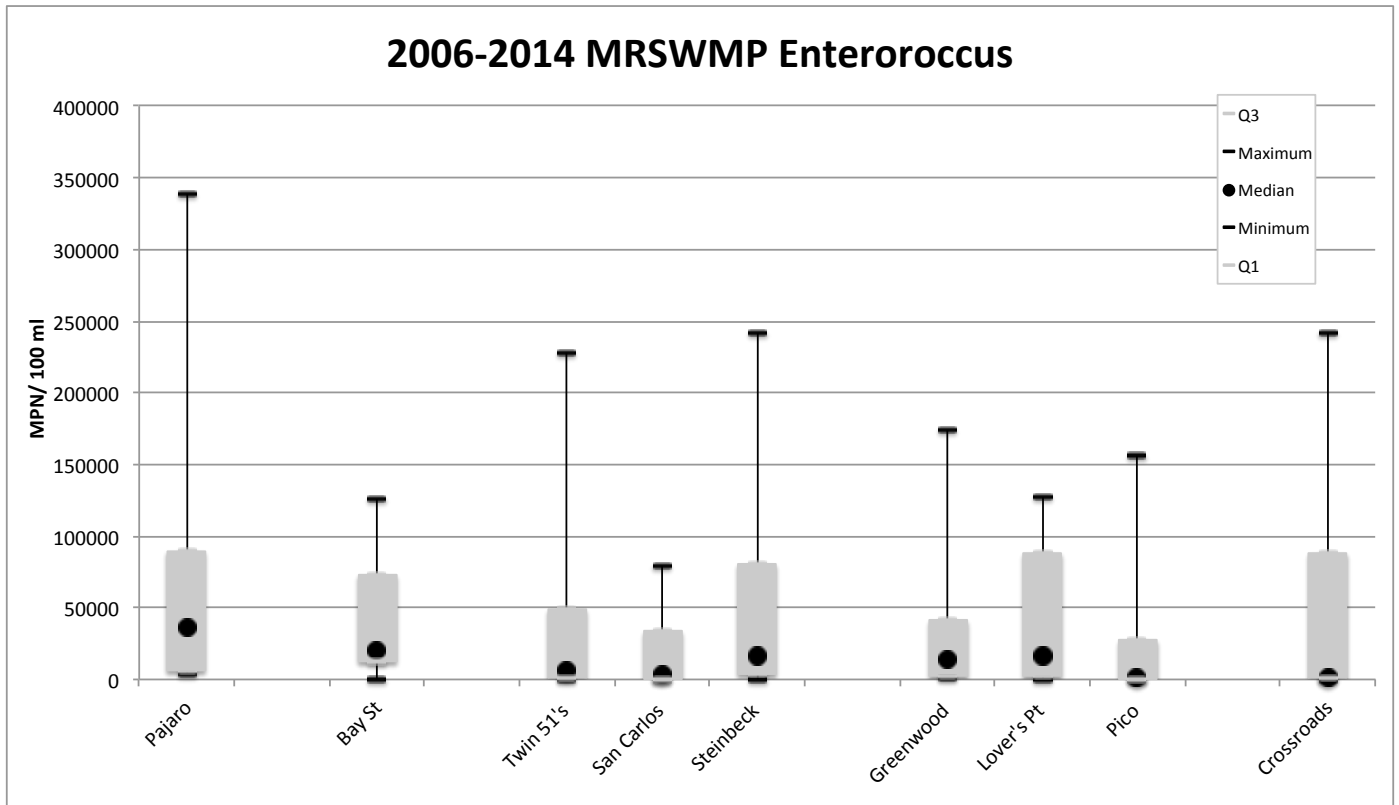


Figure 8. 2006-2014 MRSWMP average enterococcus results. Sites are listed north to south.

Zinc

The Basin Plan water quality objective for Zn is 200 µg/L. The MDL for zinc is 10 µg/L. Figure 9 represents all MRSWMP data both dry and wet weather, collected since 2006. All results are listed in Appendix 2.

For the **Dry Run**, Twins (Monterey) was the only site to exceed the WQO with a result of 313 µg/L.

For **First Flush**, eight of the sites monitored (89%) were above the WQO. Only Pico (Pacific Grove) did not exceed the WQO for either time series samples. The highest average result was from Steinbeck (Monterey) with a value of 764 µg/L.

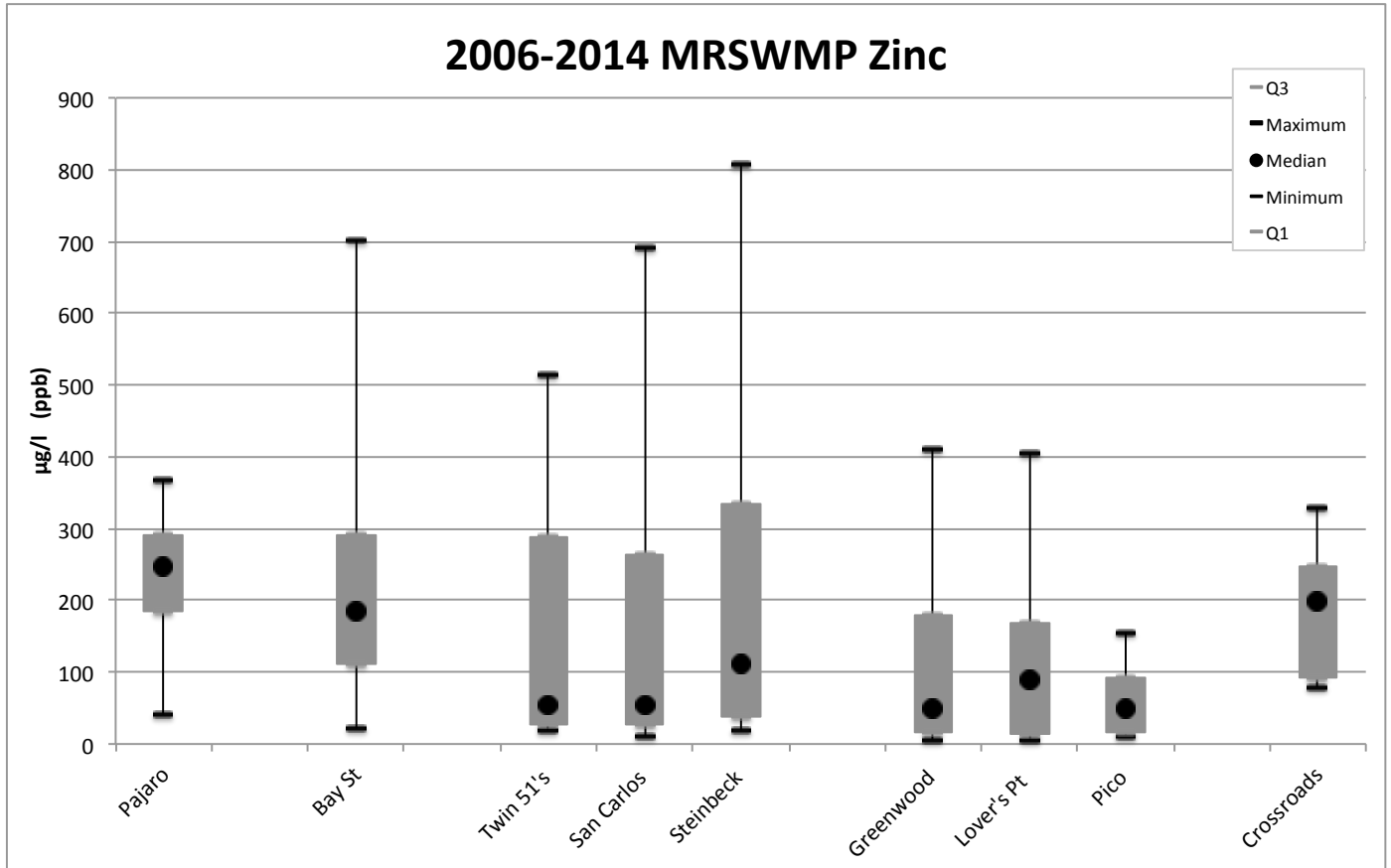


Figure 9. 2006-2014 MRSWMP average zinc results. Sites are listed from north to south.

Copper

The Basin Plan water quality objective established for copper is 30 $\mu\text{g/L}$. The MDL for copper is 4 $\mu\text{g/L}$. Figure 10 represents all MRSWMP data both dry and wet weather, collected since 2006. All results are listed in Appendix 2.

For the **Dry Run**, copper concentrations were all below the WQO; two sites had non-detects Pico and Greenwood Park (Pacific Grove).

During the **First Flush**, all of the sites monitored (100%) were above the WQO. The highest average result was from Steinbeck (Monterey) with a value of 248 $\mu\text{g/L}$.

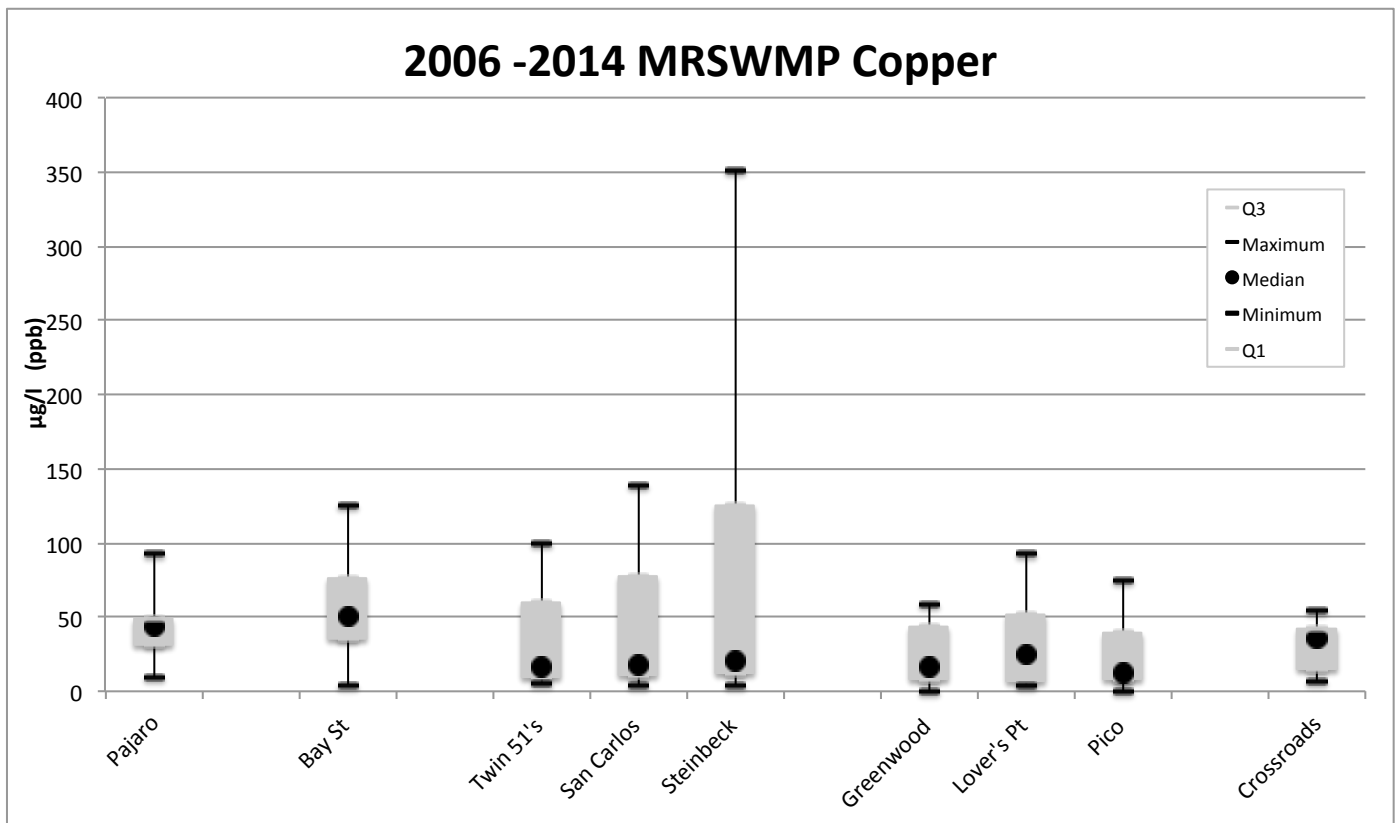


Figure 10. 2006-2014 MRSWMP average total copper results. Sites are listed from north to south.

Lead

The Basin Plan water quality objective established for lead is 30 µg/l. The MDL for lead is 5 µg/L. Figure 11 represents all MRSWMP data both dry and wet weather, collected since 2006. All results are listed in Appendix 2.

For the **Dry Run**, lead results for all sites were non-detect.

For **First Flush**, one of the sites (11%) monitored was above the WQO. The highest average result was in Bay Street (Seaside) with a value of 44 µg/L.

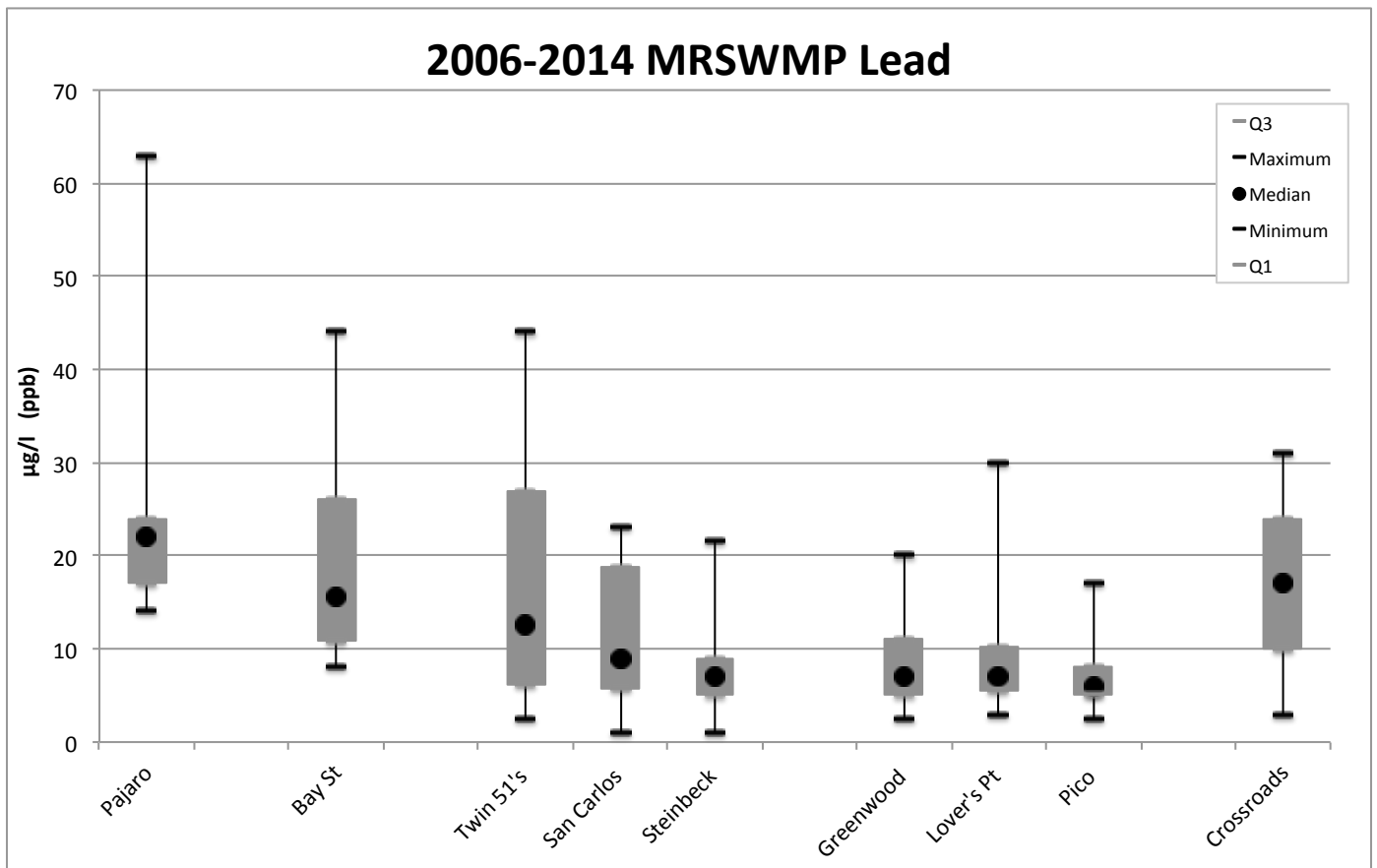


Figure 11. 2006-2014 MRSWMP average lead results. Sites are listed from north to south.

Total Suspended Solids

Total suspended solids (TSS) are measured due to the affinity some pollutants have for solids carried in the runoff. In addition, high amounts of sediment are harmful to fish populations because they can destroy habitat, suffocate eggs in fresh water systems, limit the food supply, clog gills or impair an organism's vision when feeding. High TSS can also mitigate metal toxicity. The Action Level for TSS is 500 mg/L, with an MDL of 2 mg/L. Figure 12 represents all MRSWMP data both dry and wet weather, collected since 2006. All results are listed in Appendix 2.

For the **Dry Run**, all sites were below the Action Level. Three sites had non-detects: Twins, Steinbeck (Monterey) and Pico (Pacific Grove).

For the **First Flush**, all sites were below the Action Level.

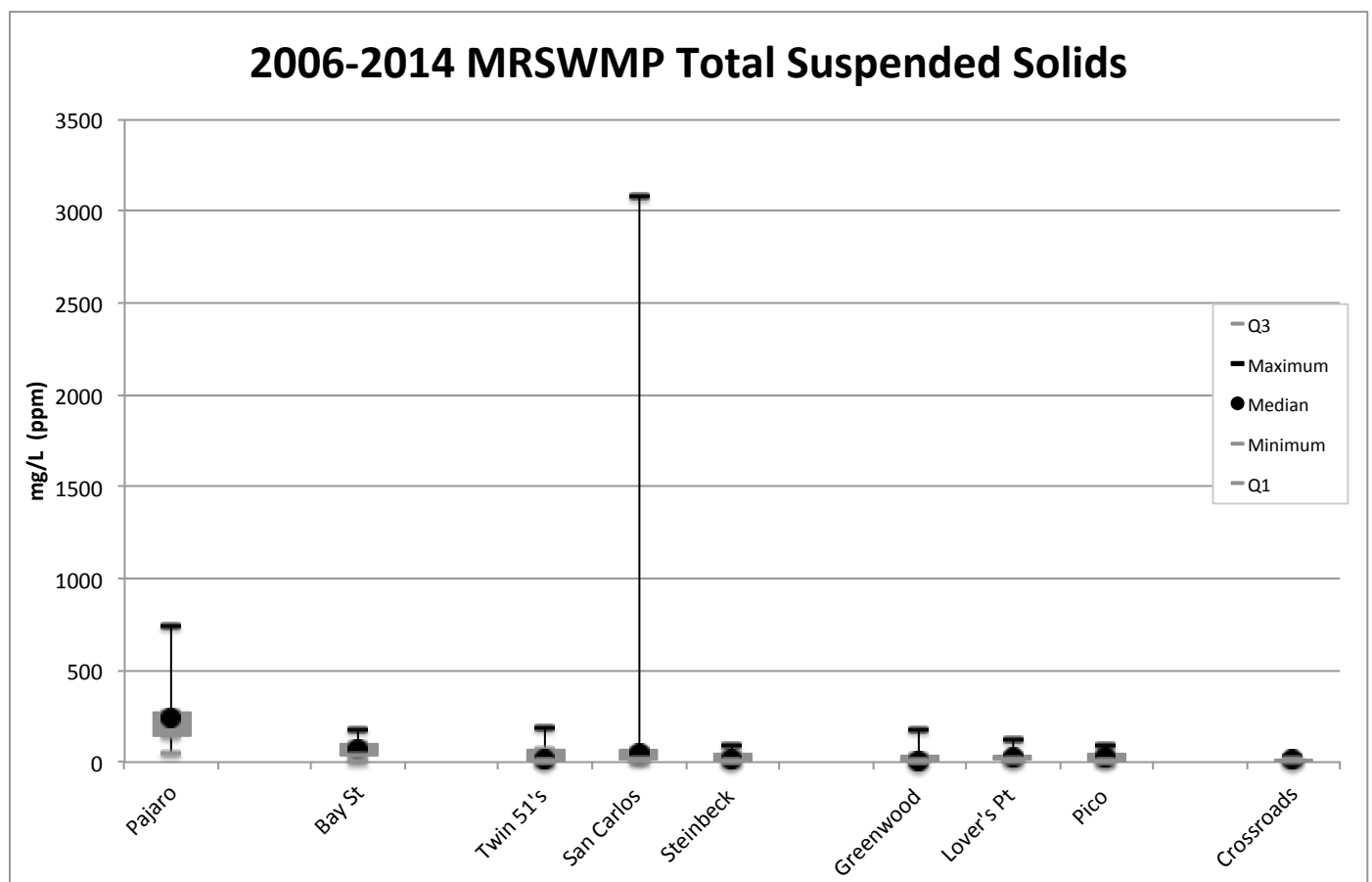


Figure 12. 2006-2014 MRSWMP average TSS results. Sites are listed from north to south.

Turbidity

Turbidity measures the transparency of water while TSS measures the weight of the solids in the water that contribute to less transparency. Both are useful measurements for water clarity but are approaching the issue from different angles.

The Action Level for turbidity provided by the State Board in the General Permit is not greater than 1000 NTU. As a comparison the Central Coast Regional Water Quality Control Board (CCRWQCB) lists turbidity as not greater than 25 NTU. The CCRWQCB Action Level will be used for this set of data. The MDL for the Dry Run was 0.05 NTU and 0.10 NTU for the First Flush. All results are listed in Appendix 2.

For the **Dry Run**, all sites were below the Action Level.

For the **First Flush**, four of the monitored sites (44%) were above the Action Level with the highest concentration at Pajaro (Monterey County) with a result of 140 NTU.

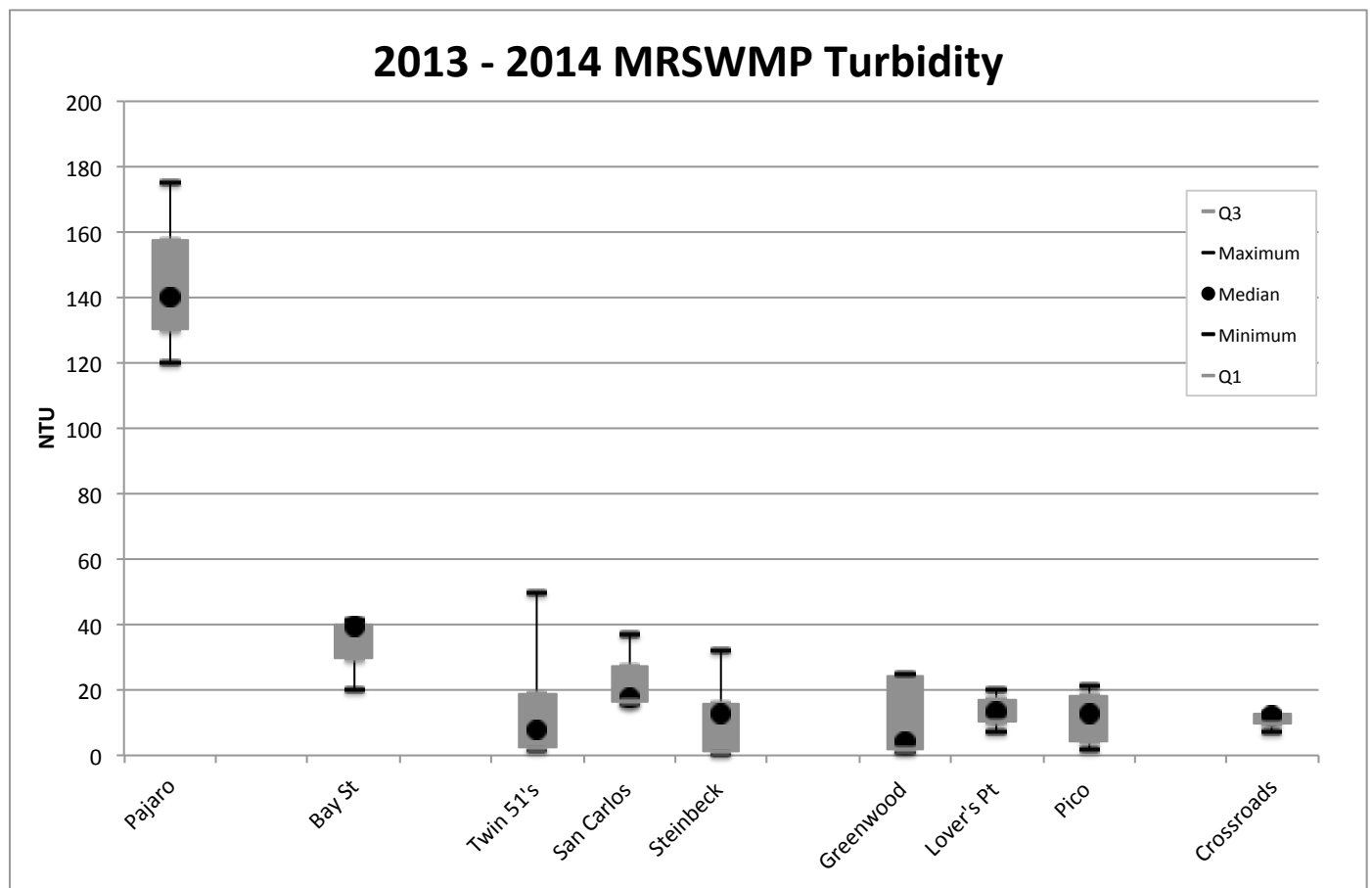


Figure 13. 2013- 2014 MRSWMP average turbidity results. Sites are listed from north to south.

Potassium

Potassium, in conjunction with other analytes, will assist in the determination of whether sample water is from a discharge of sewage, industrial or commercial liquid wastes. The Action Level for potassium is 20 mg/L. The MDL was 0.5 mg/L. All results are listed in Appendix 2.

For the **Dry Run** and **First Flush**, all sites were below the Action Level.

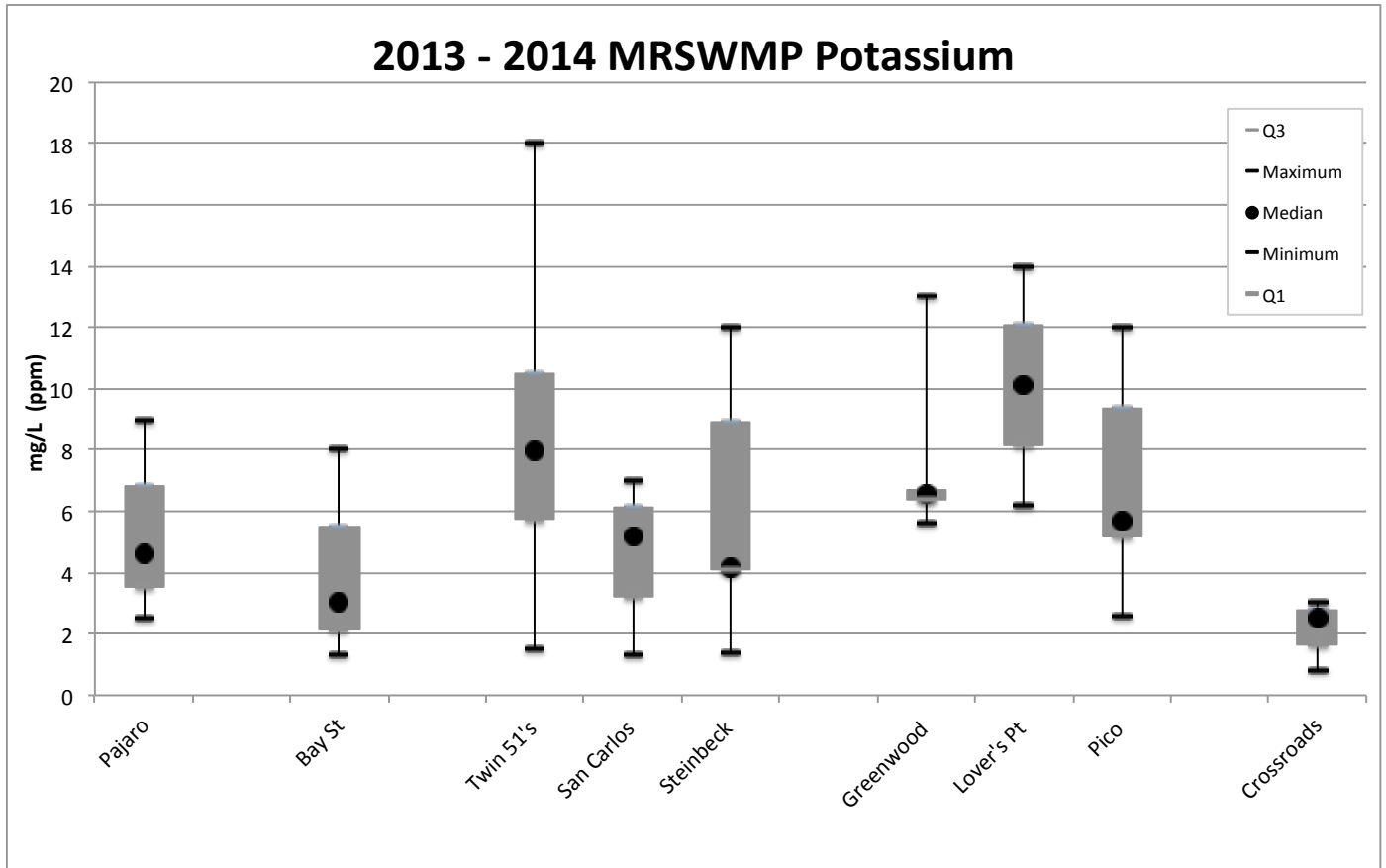


Figure 14. 2013 - 2014 MRSWMP average potassium results. Sites are listed from north to south.

Color

Color, in conjunction with other analytes, will assist in the determination of whether sample water is from a discharge of sewage, wash water or industrial or commercial liquid wastes. The Action Level for color is 500 units. All results are listed in Appendix 2.

For the **Dry Run** and **First Flush**, all sites were below the Action Level.

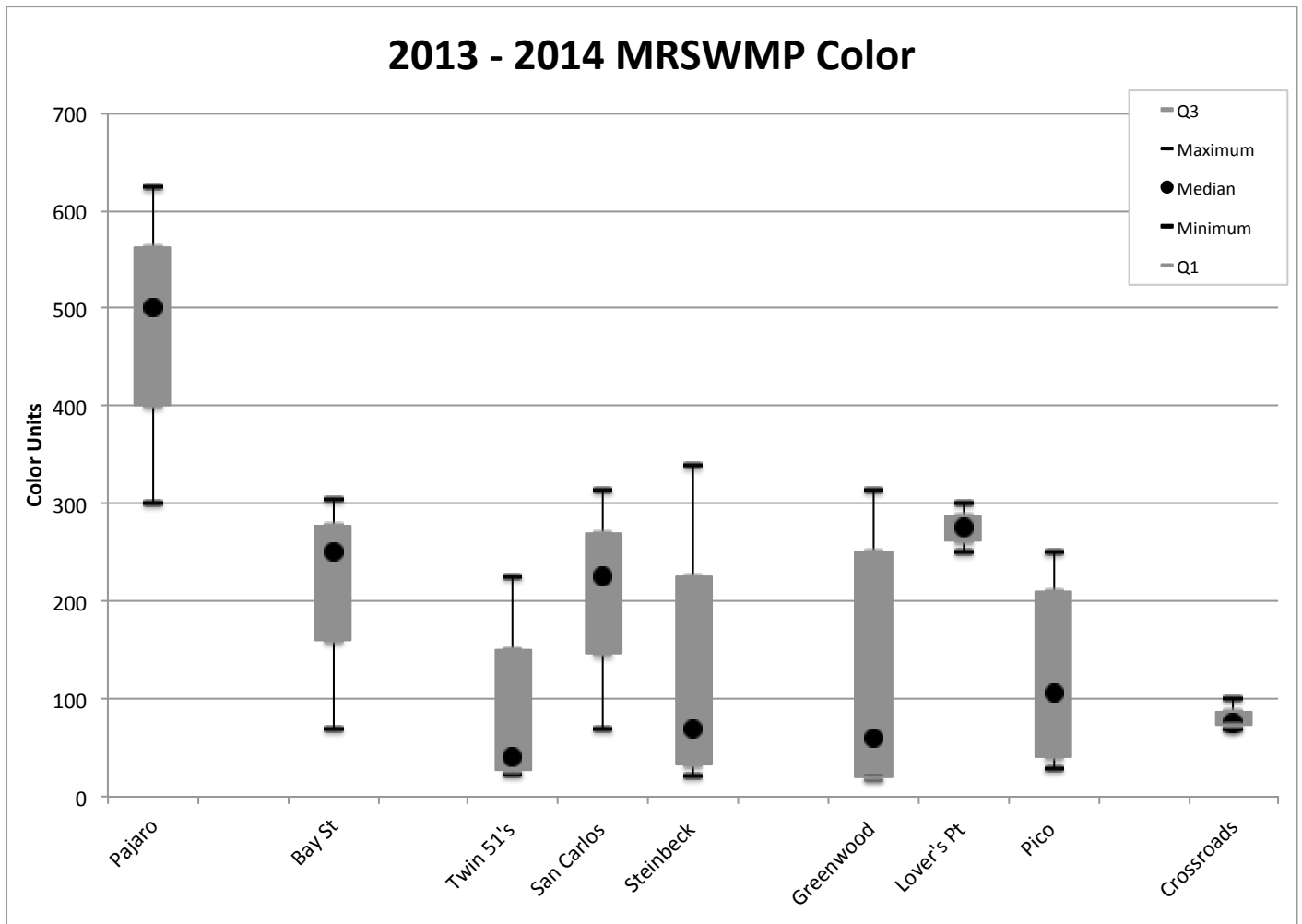


Figure 15. 2013 - 2014 MRSWMP average color results. Sites are listed from north to south.

Hardness (as CaCO₃)

Hardness (as CaCO₃) in conjunction with other analytes, will assist in the determination of whether a sample is from a discharge of sewage, wash water, tap water or industrial or commercial liquid wastes. Additionally, when hardness increases the amount of dissolved metals biologically available to aquatic and marine life decreases, indicating a decrease in the toxicity of the metal. The Action Level for hardness is not less than 10 mg/L or greater than 2,000 mg/L. The MDL for hardness (as CaCO₃) was 10 mg/L. All results are listed in Appendix 2.

For both the **Dry Run** and **First Flush**, all sites were within the acceptable range.

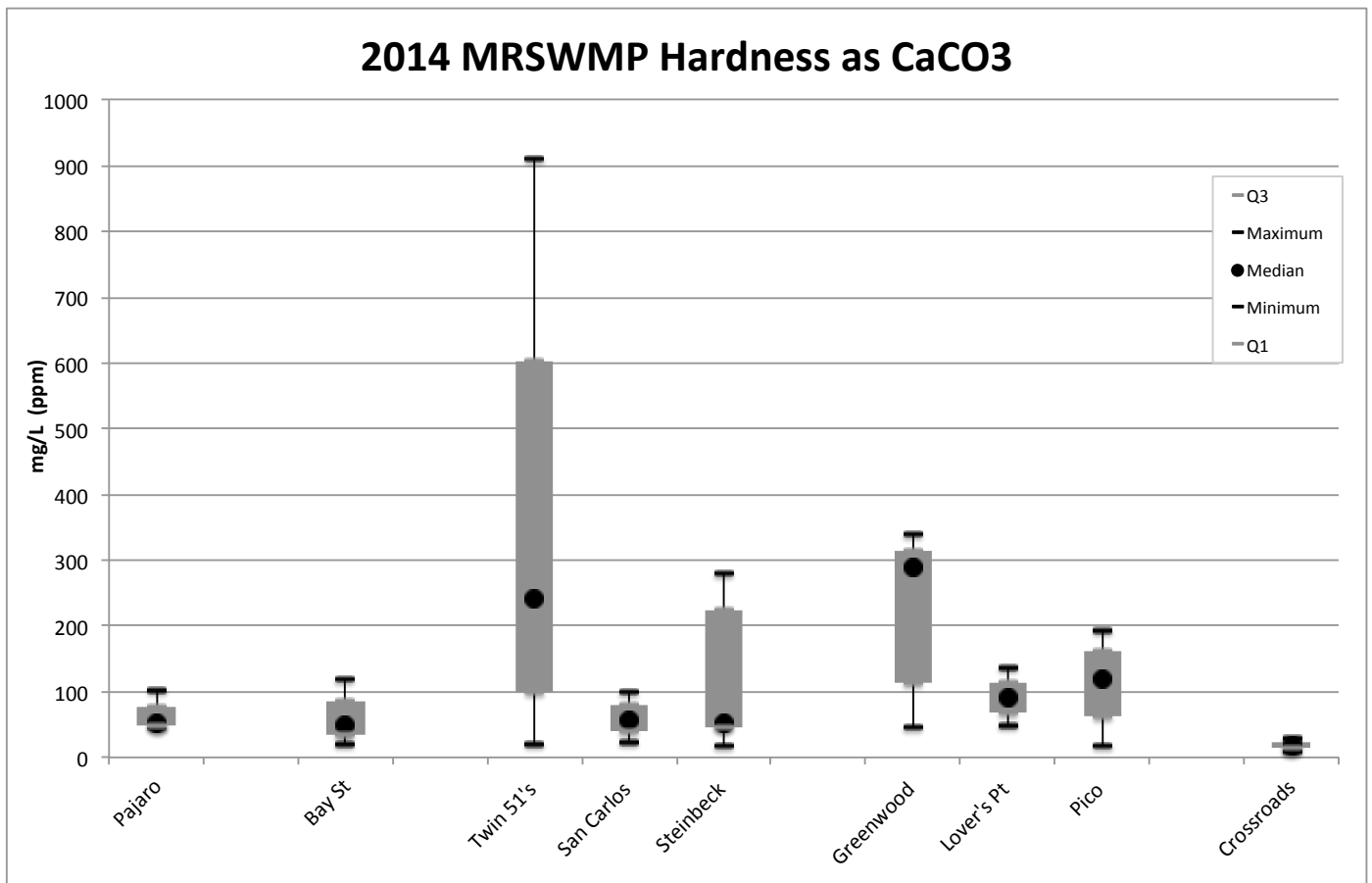


Figure 16. 2013 - 2014 MRSWMP average hardness (as CaCO₃) results. Sites are listed from north to south.

MBAS Detergents

MBAS detergents in sample water can determine if a discharge is from sewage or wash water, and if used in conjunction with other analytes can detect a discharge of industrial or commercial liquid wastes. There is no Water Quality Objective (WQO) for MBAS detergents given in the NPDES MS4 General Permit, however as a comparison, the Basin Plan's general objectives state that MBAS substances should not be greater than 0.2 mg/L. The Basin Plan's WQO's will be used for comparison here. The MDL for MBAS detergents was 0.5 mg/L. All results are listed in Appendix 2.

For the **Dry Run**, one site, Greenwood Park (Pacific Grove) (25%) was above the WQO, with a result of 0.27 mg/L.

For the **First Flush**, all of the sites monitored (100%) were above the WQO. The highest result was from Lovers (Pacific Grove) with a concentration of 1.30 mg/L.

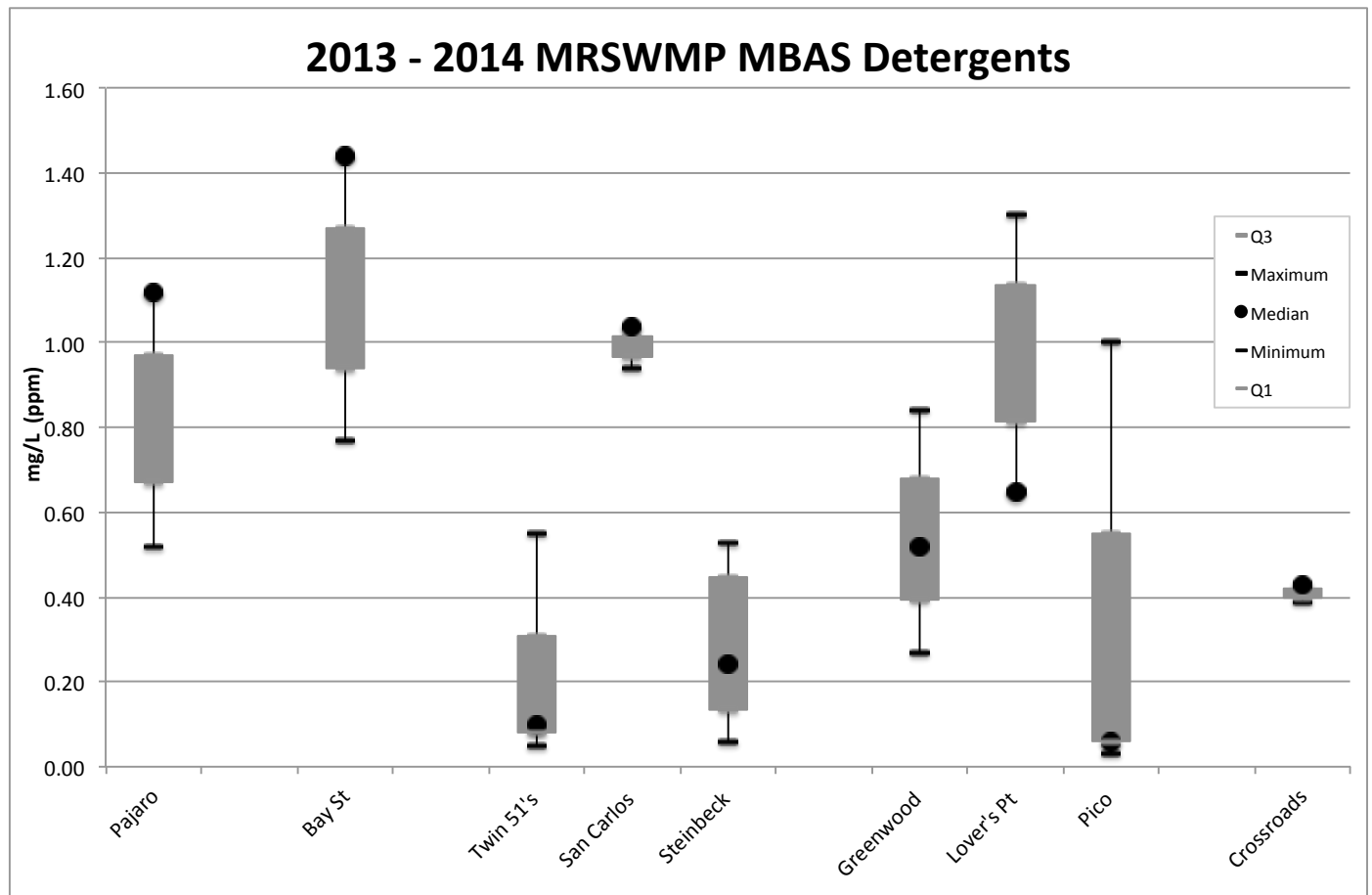


Figure 17. 2013 - 2014 MRSWMP average MBAS detergent results. Sites are listed from north to south.

Results by Jurisdiction

The following section is broken out by city or county for this permit year. Appendix 3 includes table results of the Dry Run (DR) and First Flush time series (FF-A and FF-B).

Monterey County

At Pajaro and Crossroads, there was no flow at either site during the Dry Run monitoring event.

During the First Flush, results from Pajaro and Crossroads were above the WQOs for: *E. coli*, enterococcus, zinc, and orthophosphate. Pajaro had an exceedance for turbidity and copper in the second time series for First Flush. Ammonia, color, hardness, lead, nitrate as N, potassium and total suspended solids results did not exceed the WQO's or Action Levels for any samples during all of the monitored events..

All results can be found in Appendix 2 and by jurisdiction in Appendix 3.

Seaside

Bay Street was the only Seaside site monitored and had no flow for the Dry Run monitoring event.

During the First Flush, results from both time series samples were above the WQO and Action Levels for copper, *E. coli*, enterococcus, lead, MBAS detergents, orthophosphate, turbidity and zinc. Bay Street had the single highest enterococcus result of any time series with a result of 155,000 MPN/ 100 ml during the first time series. Ammonia, color, hardness, nitrate as N, potassium and total suspended solids results did not exceed the WQO's or Action Levels for any samples during all of the monitored events.

All results can be found in Appendix 2 and by jurisdiction in Appendix 3.

Monterey

For the 2014-2015 permit year, three sites were monitored: Twins, San Carlos and Steinbeck.

Two of the three Monterey sites had flow during the Dry Run: Twins and Steinbeck. Dry Run results at Twins were above the WQOs for *E. coli*, enterococcus and zinc only. Twins had one of the highest enterococcus results for any monitored site for the Dry Run with a result of 6,152 MPN/ 100 ml.

First Flush results at all Monterey sites were above the WQOs for: copper, *E. coli*, enterococcus, MBAS detergents, orthophosphate, and zinc. San Carlos had an additional exceedance for turbidity during both time series samples. Steinbeck had an exceedance of turbidity during the first time series sample. San Carlos had the highest *E. coli* result for any time series during the First Flush, 199,000 MPN/ 100 ml.

All results can be found in Appendix 2 and by jurisdiction in Appendix 3.

Pacific Grove

For 2014-2015 permit year, three sites were monitored: Greenwood Park, Lovers and Pico. The Areas of Special Biological Significance (ASBS) monitoring program continued monitoring this permit year but monitored during storms other than the First Flush.

Due to the operation of the dry weather diversion, only two of the three Pacific Grove sites had water flowing for the Dry Run: Greenwood Park and Pico. For the Dry Run both sites were over the WQO for *E. coli*. Greenwood Park had an additional exceedances for MBAS surfactants while Pico had an exceedance for nitrate an N during the Dry Run.

During the First Flush, average results at Pacific Grove sites were above the WQOs for: copper, *E. coli*, enterococcus, MBAS detergents, orthophosphate and zinc (Greenwood Park and Lovers only).

All results can be found in Appendix 2 and by jurisdiction in Appendix 3.

Conclusion

Since 2006, the MRSWMP program has utilized the MBNMS' Dry Run and First Flush programs to ascertain what concentrations of pollutants are found in both dry and wet weather flows through storm drains discharging into the ocean. The sites monitored as part of the MRSWMP program are sites that can provide a good representation of water quality throughout a jurisdiction and in some cases have been monitored for many years. For 2014- 2015 permit year, Carmel decided to not participate in MRSWMP monitoring so only nine sites were monitored for Dry Run and the First Flush in four jurisdictions: Monterey County, Monterey, Seaside and Pacific Grove.

In past years, approximately half of the MRSWMP sites did not flow during the dry weather months. This year, 44% of the storm drains had flow for the Dry Run which all exceeded the WQO for *E.coli*. All sites except Pico (Pacific Grove) also exceeded for enterococcus. Other analytes exceeded the WQO at only one site during the Dry Run: MBAS detergents, orthophosphate as P, nitrate as N and zinc. Dry weather data is an indicator of the effectiveness of storm water programs and allows an opportunity for additional tracking to potential sources of contamination in the discharges. It is our recommendation for all jurisdictions to pay close attention to the dry weather results to determine if there are concentrations of pollutants that can be traced to their sources.

First Flush average results from all sites exceeded the WQO's for *E. coli* and enterococcus, however they were lower concentration than in previous years. Additionally, average results from all sites exceeded the WQO or Action Levels for MBAS detergents, copper, and orthophosphate during the First Flush. While wet weather sampling does indicate worst-case scenario of high pollutant concentrations discharging into the ocean after months of accumulating on the land, it is still important to identify how sub-watersheds compare to each other and if they should be prioritized for follow up investigation. For example, due to the overall exceedances of MBAS detergents during the First Flush at all sites, a regional approach might be conducted to address this issue. Metals continue to exceed WQO's for wet weather events especially copper and zinc and might warrant looking at ways to control sediment or particles from entering the storm drain or receiving water. Ammonia, color, MBAS detergents, fluoride, hardness (as CaCO₃), potassium and turbidity were added to the list of analytes during the last permit year. Of these newer analytes MBAS detergents and turbidity consistently exceeded Action Levels during rain events. MBAS detergents was the only newer analyte to exceed the Action Level during dry weather and that was at only one site.

The First Flush event provides an understanding of the types of pollutants flowing into the ocean after months of dry weather during which contaminants build up on streets, roofs and parking lots. The results are valuable for a better understanding of potential impacts to the marine environment, however they do not always easily correlate to management activities. By coupling First Flush with the Dry Run and source tracking within each watershed, a better understanding of each watershed's specific characteristics and problem areas can be achieved, providing needed information for decision making and effective storm water programs.

Appendix 1: MRSWMP Monitoring sites- listed from north to south

City	Site ID	Site Name	Drainage Area (acres)	Primary Land Use	MRSWMP Outfall #	Pipe ID (Inches)
Monterey County	PASD-01	Pajaro	30	70% residential 30% commercial	MC-1	
Seaside	SSD-02	Bay Street	1200	80% residential 10% commercial 10% public/other	SC-1	90
Monterey	MSD-03	Twin 51's	291	63% residential 15% commercial 22% public/ other	M-15	51" (x2)
Monterey	MSD-04	San Carlos	22	12% commercial 38% residential 50% public/ other	M-7	24"
Monterey	MSD-05	Steinbeck	37	66% commercial 12% residential 22% public/ other	M-3	36"
Pacific Grove	CENTR-31	Greenwood Park	238.3	71% residential 25% public/Other 5% commercial	PG-28	36"
Pacific Grove	PGSD-03	Lover's Point	4.0	78% public 22% residential	PG-21	24"/12"
Pacific Grove	PGSD-04	Pico	2.7	60% residential 40% public	PG-20	2 – 12"
Monterey County	CVSD-01	Crossroads	21	100% commercial		

Appendix 2: Results by Analyte (listed alphabetically)

Ammonia as N

Comparison of ammonia results for MRSWMP monitoring and reported in mg/L. Ammonia as N was monitored for the first time during the 2013 - 2014 permit year at MRSWMP sites. Shaded boxes indicate that the General Permit Action Level of 50 mg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; -- = Not included in MRSWMP.

Site Name	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	NF	NA	0.23	NF	NF	0.44
Bay St	NF	NA	0.13	NF	NF	0.37
Twin 51's	NA	NA	0.10	0.06	0.07	0.72
San Carlos	NF	NA	0.14	NF	NF	0.86
Steinbeck	NF	NA	0.61	0.08	0.09	10.46
Greenwood	NA	NA	NS	0.11	0.21	1.57
Lover's	NF	NA	NS	NF	NF	1.18
Pico	NA	NA	0.11	ND	ND	0.94
Crossroads	NF	NA	0.12	NF	NF	0.46

Color

Comparison of color results for MRSWMP monitoring, reported in Color Units. Color was monitored for the first time during the 2013- 2014 permit year at MRSWMP sites. Shaded boxes indicate that the General Permit action level of 500 color units was exceeded. NA= Not Analyzed; ND= Non-detect; NF= No Flow; -- = Not included in MRSWMP.

Site Name	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	NF	625	500	NF	NF	300
Bay St	NF	250	70	NF	NF	305
Twin 51's	24	225	50	30	25	185
San Carlos	NF	225	70	NF	NF	315
Steinbeck	NF	225	70	33	22	340
Greenwood	60	250	NS	20	20	315
Lover's	NF	300	NS	NF	NF	250
Pico	44	250	167	40	30	225
Crossroads	NF	75	70	NF	NF	100

Copper

Comparison of total copper results for MRSWMP monitoring reported in µg/L. Shaded boxes indicate that the Basin Plan Objective of 30 µg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	93	9	44	NF	NF	NF	73	NF	NF	NF	28	NF	NF	NF	44	32	NF	NF	51	42	NF	NF	32
Bay St	NF	ND	NF	50	NF	42	NF	126	NF	NF	NF	65	4	NF	NF	52	NF	NF	NF	28	48	NF	NF	88	21	NF	NF	106
Twin 51's	ND	92	5	60	7	69	11	78	6	20	12	99	11	5	9	52	8	16	10	46	16	13	16	75	ND	ND	11	76
San Carlos	ND	139	11	73	18	84	16	77	7	10	26	124	8	4	8	65	13	14	NF	--	--	12	NF	86	24	NF	NF	121
Steinbeck	ND	125	17	83	185	126	6	148	10	12	15	352	18	8	9	77	20	31	6	147	37	12	NF	113	21	ND	4	248
Greenwood	ND	41	3	46	17	44	6	44	25	9	5	56	13	17	10	38	12	8	ND	24	NS	ND	6	52	NS	ND	ND	58
Lover's	NF	57	ND	48	4	51	ND	54	7	5	5	14	10	4	NF	40	9	NF	NF	36	NS	NF	NF	92	NS	NF	NF	68
Pico	ND	33	ND	44	12	37	5	45	9	11	7	62	10	ND	6	43	11	10	ND	28	26	7	6	75	28	ND	ND	61
Crossroads	--	--	--	--	--	--	NF	44	NF	NF	NF	55	NF	NF	NF	11	NF	NF	NF	40	7	NF	NF	18	ND	NF	NF	35

E. coli

Comparison of *E. coli* results for MRSWMP monitoring reported in MPN/ 100 ml. Shaded boxes indicate that the EPA Water Quality Objective of 235 MPN/ 100 ml was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	15186	40	4681	NF	NF	NF	2050	NF	NF	NF	16075	NF	NF	NF	8766	618	NF	NF	3163	860	NF	NF	7617
Bay St	NF	856	NF	46464	NF	20277	NF	34162	NF	NF	NF	64900	672	NF	NF	44059	NF	NF	NF	43518	241960	NF	NF	148335	6488	NF	NF	94500
Twin 51's	50	185536	25993	165301	6150	83819	296	229170	12263	48384	13340	61300	19608	6152	7746	65081	17329	2289	296	72294	4962	2878	4978	67265	9208	3106	6152	60200
San Carlos	798	14749	218	16304	40	17484	8212	8770	149	244	13734	40400	20	40	20	41525	20	20	NF	NS	NS	5206	NF	3475	4106	NF	NF	138000
Steinbeck	2602	158848	9768	40925	48400	112738	4494	90824	220	398	1974	145400	126	194	6511	241960	218	653	2500	130847	241960	34658	NF	88662	21870	196	3836	65300
Greenwood	20529	73322	11588	16767	13000	31528	1976	44059	2966	8212	1814	32700	10950	12976	6896	116644	1253	6511	31062	35076	NS	1980	39726	19585	NS	5510	6152	36590
Lover's	NF	172534	48384	60214	1390	24916	170	34659	3870	82	82	3807	220	6152	NF	48391	5510	NF	NF	42288	NS	NF	NF	30745	NS	NF	NF	60200
Pico	606	43926	5818	155639	3840	204626	104	17063	148	40	410	15050	61	80	2802	32860	40	20	1720	37769	3214	40	244	58030	4884	2092	402	42603
Crossroads	--	--	--	--	--	--	NF	NA	NF	NF	NF	25950	NF	NF	NF	44059	NF	NF	NF	76395	296	NF	NF	1095	703	NF	NF	94500

Enterococcus

Comparison of enterococcus results for MRSWMP monitoring reported in MPN/ 100 ml. Shaded boxes indicate that the EPA Water Quality Objective of 104 MPN/ 100 ml was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	100612	6339	51797	NF	NF	NF	339000	NF	NF	NF	80189	NF	NF	NF	92342	6260	NF	NF	3163	7541	NF	NF	20013
Bay St	--	341	NF	13435	NF	13650	NF	90327	NF	NF	NF	70700	20	NF	NF	47396	NF	NF	NF	82392	12229	NF	NF	23415	17329	NF	NF	126500
Twin 51's	--	227516	39726	57609	8700	139002	125	111501	2669	498	970	108150	2306	5819	346	67477	1587	431	492	79326	6896	942	22398	21000	8164	1760	1417	37150
San Carlos	--	63487	20	25993	62	67560	531	38751	1918	9768	4196	34450	146	40	346	48391	313	20	NF	NS	NS	374	NF	4825	8164	NF	NF	79650
Steinbeck	--	241960	14540	112902	48400	193983	16328	241960	1249	976	3232	12100	393	2184	16328	241957	4494	16328	1587	241957	43517	48392	NF	88662	34480	270	4962	54200
Greenwood	--	62567	17382	29372	5820	76803	3571	111501	1188	2792	1918	75150	1625	13733	8703	173291	1024	25993	14540	81461	NS	1226	8704	20880	NS	2290	4374	41950
Lover's	--	99442	18416	39739	4130	87231	104	88435	10950	104	82	15372	521	3571	NF	116644	1352	NF	NF	95634	NS	NF	NF	127750	NS	NF	NF	20768
Pico	--	43965	1760	81652	8210	155638	583	33310	220	512	1210	33550	20	20	126	101332	61	40	583	70697	7308	746	322	9005	15650	3978	83	23118
Crossroads	--	--	--	--	--	--	NF	NA	NF	NF	NF	60200	NF	NF	NF	116723	NF	NF	NF	241960	559	NF	NF	1095	1434	NF	NF	1530

Fluoride

Comparison of fluoride results for MRSWMP monitoring reported in mg/L. Fluoride was monitored for the first time during the 2013- 2014 permit year at MRSWMP sites. There is no water quality objective for fluoride; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	NF	0.2	ND	NF	NF	0.2
Bay St	NF	ND	ND	NF	NF	0.1
Twin 51's	0.5	0.2	ND	0.6	0.4	0.3
San Carlos	NF	0.4	ND	NF	NF	0.2
Steinbeck	NF	0.1	ND	0.3	0.2	0.3
Greenwood	0.2	0.4	NS	0.3	0.2	0.2
Lover's	NF	0.5	NS	NF	NF	0.2
Pico	0.1	0.2	ND	0.1	ND	0.3
Crossroads	NF	ND	ND	NF	NF	0.2

Hardness

Comparison of hardness results for MRSWMP monitoring reported in mg/L. Hardness was monitored and reported for the first time during the 2013- 2014 permit year at MRSWMP sites. Shaded boxes indicate that the General Permit Action Level of not less than 10 or greater than 2000 mg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	NF	102	50	NF	NF	45
Bay St	NF	120	21	NF	NF	48
Twin 51's	360	119	19	682	910	93
San Carlos	NF	100	23	NF	NF	57
Steinbeck	NF	52	17	281	224	47
Greenwood	341	114	NS	289	314	45
Lover's	NF	135	NS	NF	NF	48
Pico	163	75	18	192	161	60
Crossroads	NF	28	9	NF	NF	18

Lead

Comparison of total lead results for MRSWMP monitoring reported in µg/L. Shaded boxes indicate that the Basin Plan Objective of 30 µg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	63	ND	24	NF	NF	NF	34	NF	NF	NF	17	NF	NF	NF	20	22	NF	NF	16	24	NF	NF	14
Bay St	NF	ND	NF	15	NF	14	NF	33	NF	NF	NF	28	ND	NF	NF	16	NF	NF	NF	8	9	NF	NF	20	10	NF	NF	44
Twin 51's	ND	13	5	36	5	17	ND	8	ND	ND	ND	44	ND	ND	ND	ND	ND	ND	ND	23	ND	ND	ND	31	ND	ND	ND	12
San Carlos	ND	11	5	18	5	6	ND	6	ND	ND	1	22	ND	ND	ND	22	ND	ND	NF	NS	NS	ND	NF	8	10	NF	NF	23
Steinbeck	ND	7	5	22	5	6	ND	7	ND	ND	1	9	ND	ND	ND	13	ND	ND	ND	7	ND	ND	NF	ND	8	ND	ND	15
Greenwood	ND	8	5	18	5	6	ND	6	ND	ND	ND	11	ND	ND	ND	20	ND	ND	ND	4	NS	ND	ND	8	NS	ND	ND	11
Lover's	NF	9	5	16	5	7	ND	10	ND	ND	ND	3	ND	ND	NF	30	ND	NF	NF	6	NS	NF	NF	6	NS	NF	NF	11
Pico	ND	5	5	12	5	8	ND	ND	ND	ND	ND	6	ND	ND	ND	7	ND	ND	ND	ND	ND	ND	ND	6	8	17	ND	ND
Crossroads	--	--	--	--	--	--	--	ND	NF	NF	NF	ND	NF	NF	NF	ND	NF	NF	NF	ND	ND	NF	NF	ND	31	NF	NF	ND

MBAS Detergents

Comparison of MBAS Detergent results for MRSWMP monitoring reported in mg/L. MBAS detergents were monitored for the first time during the 2013- 2014 permit year at MRSWMP sites. Shaded boxes indicate that the Basin Plan Water Quality Objective of 0.2 mg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	NF	1.12	ND	NF	NF	0.52
Bay St	NF	1.44	ND	NF	NF	0.77
Twin 51's	0.05	0.31	ND	0.1	0.08	0.55
San Carlos	NF	1.04	ND	NF	NF	0.94
Steinbeck	NF	0.42	ND	0.06	0.16	0.53
Greenwood	ND	0.52	NS	ND	0.27	0.84
Lover's	NF	0.65	NS	NF	NF	1.30
Pico	0.06	0.55	ND	0.06	ND	1.00
Crossroads	NF	0.43	ND	NF	NF	0.39

Nitrate as N

Comparison of nitrate as N (NO₃-N) results for 2006-2014 MRSWMP monitoring reported in mg-N/ L. Shaded boxes indicate that the Basin Plan Objective of 2.25 mg-N/ L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	2.90	0.60	0.60	NF	NF	NF	1.12	NF	NF	NF	0.39	NF	NF	NF	0.47	0.6	NF	NF	1.2	0.2	NF	NF	0.5
Bay St	NF	13.20	NF	0.69	NF	0.60	NF	0.40	NF	NF	NF	0.7	11.64	NF	NF	0.22	NF	NF	NF	0.74	1.0	NF	NF	1.4	0.2	NF	NF	0.4
Twin 51's	0.16	0.45	0.32	0.99	0.60	0.90	0.40	0.40	0.20	1.30	0.98	1.1	0.39	0.47	0.7	0.46	0.1	0.39	0.73	0.44	0.2	ND	0.8	0.7	0.2	0.3	0.3	0.7
San Carlos	3.92	1.69	2.17	0.64	1.20	0.87	1.20	0.50	0.64	1.20	2.84	0.81	1.18	0.41	0.83	0.12	1.43	0.8	NF	NS	NS	1.6	NF	0.9	0.2	NF	NF	0.6
Steinbeck	4.71	1.72	1.07	0.79	0.10	1.10	ND	0.70	5.15	1.20	1.39	1.96	4.81	2.92	ND	0.28	2.97	2.45	0.78	2.67	0.6	3.6	NF	1.3	0.2	1.7	0.4	1.1
Greenwood	2.17	0.78	3.00	0.66	1.90	0.97	1.10	0.60	1.35	1.30	1.47	0.9	0.93	1.05	1.54	0.13	1.07	1.01	2.09	0.79	NS	1.4	1.0	1.0	NS	0.8	0.9	0.7
Lover's	NF	0.68	0.86	0.56	4.80	0.87	4.80	0.60	0.74	2.30	3.54	0.12	0.73	0.31	NF	0.12	1.06	NF	NF	0.59	NS	NF	NF	1.0	NS	NF	NF	0.7
Pico	1.03	0.61	2.04	0.54	1.50	0.83	1.00	0.60	0.76	0.90	0.82	0.81	0.92	0.65	1.12	0.1	1.09	1.55	1.91	1.13	0.3	1.7	2.2	0.6	ND	1.9	2.4	0.7
Crossroads	--	--	--	--	--	--	NF	0.30	NF	NF	NF	0.81	NF	NF	NF	0.11	NF	NF	NF	0.59	0.05	NF	NF	0.5	ND	NF	NF	0.3

Orthophosphate as P

Comparison of orthophosphate as P results for MRSWMP monitoring reported as mg-P/ L. Shaded boxes indicate that the Basin Plan Objective of 0.12 mg-P/ L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	0.50	0.90	0.31	NF	NF	NF	0.38	NF	NF	NF	0.17	NF	NF	NF	0.46	0.1	NF	NF	0.70	0.20	NF	NF	0.4
Bay St	NF	0.32	NF	0.09	NF	0.40	NF	0.31	NF	NF	NF	0.34	ND	NF	NF	0.17	NF	NF	NF	0.23	ND	NF	NF	0.40	0.10	NF	NF	0.2
Twin 51's	0.35	0.56	ND	0.72	0.20	0.97	0.30	0.92	0.25	0.20	ND	0.94	0.11	NF	0.09	0.52	0.11	0.13	0.11	0.31	0.10	0.20	ND	0.40	0.20	ND	ND	0.5
San Carlos	ND	0.46	ND	0.38	0.20	0.60	0.20	0.18	0.19	0.10	0.17	0.33	0.15	ND	ND	0.19	0.10	ND	NF	NS	NS	ND	NF	0.40	ND	NF	NF	0.3
Steinbeck	0.38	3.01	0.09	2.69	3.10	3.77	0.30	2.48	0.35	0.30	0.32	7.01	0.10	ND	ND	0.98	0.15	0.31	0.14	1.82	0.50	0.40	NF	4.20	0.50	0.10	0.2	2.8
Greenwood	ND	0.53	0.07	0.65	0.20	1.40	0.10	0.51	0.18	0.20	0.08	0.68	0.10	ND	ND	0.35	0.10	ND	0.13	0.37	NS	0.30	ND	0.70	NS	ND	ND	0.8
Lover's	NF	1.38	ND	0.93	0.20	1.30	0.10	0.70	0.32	0.20	0.12	0.18	0.18	ND	NF	0.41	0.13	NF	NF	0.63	NS	NF	NF	1.10	NS	NF	NF	0.8
Pico	ND	0.44	ND	0.73	0.20	0.70	0.10	0.40	0.13	0.05	ND	0.58	ND	ND	ND	0.37	0.10	ND	ND	0.41	ND	ND	ND	0.90	0.10	ND	ND	1.0
Crossroads	--	--	--	--	--	--	NF	0.31	NF	NF	NF	0.64	NF	NF	NF	0.16	NF	NF	NF	0.37	ND	NF	NF	0.20	ND	NF	NF	0.3

Potassium

Comparison of potassium results for MRSWMP monitoring reported as mg/L. Potassium was monitored for the first time at MRSWMP sites in 2014. Shaded boxes indicate that the General Permit Action Level of 20 mg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	NF	9	2.5	NF	NF	4.6
Bay St	NF	8	1.3	NF	NF	3.0
Twin 51's	6.9	9	1.5	11	18.0	5.4
San Carlos	NF	7	1.3	NF	NF	5.2
Steinbeck	NF	12	1.4	4.1	4.2	8.9
Greenwood	6.4	13	NS	5.6	6.7	6.6
Lover's	NF	14	NS	NF	NF	6.2
Pico	5.1	12	2.6	5.5	5.9	10.5
Crossroads	NF	3	0.8	NF	NF	2.5

Total Suspended Solids (TSS)

Comparison of Total Suspended Solids (TSS) results for MRSWMP monitoring reported in mg/L. Shaded boxes indicate that the CCAMP Action Level of 500 mg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	743	42	270	NF	NF	NF	348	NF	NF	NF	230	NF	NF	NF	140	276	NF	NF	132	244	NF	NF	152
Bay St	NF	3	NF	38	NF	66	NF	123	NF	NF	NF	173	ND	NF	NF	59	NF	NF	NF	33	63	NF	NF	66	33	NF	NF	173
Twin 51's	2	41	3	137	5	74	6	44	ND	5	61	183	ND	ND	ND	15	ND	ND	ND	74	19	6	3	69	14	ND	ND	73
San Carlos	ND	46	3080	47	5	32	ND	22	ND	ND	3	69	ND	ND	ND	100	ND	ND	NF	NS	NS	3	NF	13	44	NF	NF	91
Steinbeck	12	14	4	66	8	49	8	68	ND	ND	6	56	ND	ND	ND	88	2	18	7	30	8	4	NF	21	34	ND	ND	84
Greenwood	33	23	3	71	14	19	0	60	0	6	5	50	7	ND	ND	174	4	ND	2	17	NS	3	4	36	NS	8	3	59
Lover's	NF	24	5	35	1.9	25	ND	52	ND	ND	3	20	12	9	NF	118	ND	NF	NF	21	NS	NF	NF	11	NS	NF	NF	33
Pico	ND	40	5	86	ND	45	ND	20	ND	6	ND	36	ND	ND	ND	57	ND	ND	ND	10	12	2	ND	32	68	ND	ND	27
Crossroads	--	--	--	--	--	--	NF	21	NF	NF	NF	15	NF	NF	NF	11	NF	NF	NF	11	5	NF	NF	7	20	NF	NF	12

Turbidity

Comparison of turbidity results for MRSWMP monitoring reported in NTU. Shaded boxes indicate that the CCRWQCB Action Level of 25 NTU was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	NF	175	120	NF	NF	140
Bay St	NF	40	20	NF	NF	41
Twin 51's	3.8	50	12	1.6	2.0	21
San Carlos	NF	17.3	16	NF	NF	37
Steinbeck	NF	13	16	0.7	0.7	32
Greenwood	1.5	24	NS	2.1	4.0	25
Lover's	NF	7.1	NS	NF	NF	20
Pico	3	18	18	2.1	7.2	21
Crossroads	NF	7	13	NF	NF	12

Urea

Comparison of urea results for MRSWMP monitoring reported in µg/L. There is no water quality objective and First Flush results are from a single sample during the first time series; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	98	74	241	NF	NF	NF	609	NF	NF	NF	44	NF	NF	NF	312	98	NF	NF	838	49	NF	NF	313
Bay St	NF	60	NF	205	NF	108	NF	62	NF	NF	NF	284	ND	NF	NF	143	NF	NF	NF	158	349	NF	NF	787	57	NF	NF	298
Twin 51's	53	724	116	560	45	753	250	920	258	16	21	520	16	53	35	179	61	87	32	193	55	93	131	595	45	22	45	598
San Carlos	13	370	35	440	15	336	ND	331	10	15	878	326	ND	10	ND	73	5	ND	NF	NS	NS	ND	NF	572	68	NF	NF	434
Steinbeck	152	4777	1028	1965	1	740	11	1547	213	10	11	2234	ND	42	30	393	5	127	29	478	405	938	NF	2075	228	27	24	4490
Greenwood	485	348	428	455	71	470	14	120	31	636	5	280	70	44	12	168	5	11	11	423	NS	56	11	446	NS	17	43	378
Lover's	NF	217	23	320	57	41	20	118	13	ND	5	54	ND	12	NF	97	57	NF	NF	98	NS	NF	NF	450	NS	NF	NF	914
Pico	ND	150	10	240	69	104	15	35	13	24	5	96	20	10	ND	25	5	ND	ND	63	63	42	ND	225	34	435	10	292
Crossroads	--	--	--	--	--	--	NF	321	NF	NF	NF	519	NF	NF	NF	52	NF	NF	NF	289	20	NF	NF	114	56	NF	NF	271

Table 11. Comparison of total zinc results for MRSWMP monitoring reported in µg/L. Shaded boxes indicate that the Basin Plan Objective of 200 µg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = No longer sampled for MRSWMP.

Site Name	DR 2006	FF 2006	DR 2007	FF 2007	DR 2008	FF 2008	DR 2009	FF 2009	SpR 2010	SuR 2010	DR 2010	FF 2010	SpR 2011	SuR 2011	DR 2011	FF 2011	SpR 2012	SuR 2012	DR 2012	FF 2012	SF 2013	SuR 2013	DR 2013	FF 2013	SF 2014	SuR 2014	DR 2014	FF 2014
Pajaro	--	--	--	--	NF	368	41	273	NF	NF	NF	351	NF	NF	NF	170	NF	NF	NF	198	182	NF	NF	297	264	NF	NF	231
Bay St	NF	33	NF	185	NF	124	NF	345	NF	NF	NF	272	22	NF	NF	219	NF	NF	NF	94	187	NF	NF	402	119	NF	NF	703
Twin 51's	ND	295	25	330	28	273	29	313	20	52	46	385	25	25	20	142	40	ND	28	147	70	46	93	504	58	48	313	513
San Carlos	ND	342	10	269	18	157	19	213	25	28	28	351	67	29	17	264	43	ND	NF	NS	NS	36	NF	269	96	NF	NF	692
Steinbeck	ND	411	130	384	110	347	196	400	40	29	31	808	62	31	19	258	60	21	38	392	158	43	NF	293	112	25	53	764
Greenwood	27	180	11	236	35	156	ND	167	14	ND	5	232	12	16	ND	300	21	ND	ND	102	NS	14	20	263	NS	48	60	410
Lover's Pt	NF	158	13	175	10	123	ND	166	14	ND	5	65	36	16	NF	182	14	NF	NF	114	NS	NF	NF	204	NS	NF	NF	406
Pico	ND	142	10	154	12	96	ND	87	11	16	17	139	34	11	ND	86	12	ND	21	58	70	ND	37	129	63	ND	39	144
Crossroads	--	--	--	--	--	--	NF	303	NF	NF	NF	330	NF	NF	NF	97	NF	NF	NF	211	79	NF	NF	185	81	NF	NF	229

Appendix 3: Results by Jurisdiction (listed alphabetically)

Monterey MRSWMP monitoring results.

Table results include the Dry Run (DR), First Flush time series (FF-A and FF-B). Shaded boxes indicate that a Water Quality Objective (WQO) or Action Level was exceeded. ND= Non-detect; NF= No Flow; -- = Not included in MRSWMP.

Analytes	WQO or Action Level	Twins			San Carlos			Steinbeck		
		DR	FF- A	FF - B	DR	FF- A	FF - B	DR	FF- A	FF - B
Ammonia (mg/L)	50 mg/L	0.07	0.49	0.94	NF	1.22	0.49	0.09	9.91	11.00
Color (Color Units)	500 color units	25	120	250	NF	250	380	22	500	180
Copper (ug/L)	30 ug/L	11	62	89	NF	124	117	4	372	122
<i>E. coli</i> (MPN/ 100 ml)	235 MPN/ 100 ml	6152	51700	68700	NF	199000	77000	3836	57900	72700
Enterococcus (MPN/ 100 ml)	104 MPN/ 100 ml	1417	43500	30800	NF	61300	98000	4962	43500	64900
Fluoride (mg/L)	None currently	0.4	0.4	0.2	NF	0.2	0.1	0.2	0.3	0.2
Hardness mg/L	<10 and >2000 mg/L	910	149	37	NF	62	51	224	58	35
Lead (ug/L)	30 ug/L	ND	9	14	NF	18	27	ND	16	13
MBAS Surfactants	0.2 mg/L	0.08	0.50	0.59	NF	1.20	0.67	0.16	0.68	0.37
NO3-N (mg-N/ L)	2.25 mg-N/ L	0.3	0.8	0.6	NF	0.7	0.4	0.4	1.2	0.9
PO4-P (mg-P/ L)	0.12 mg-P/ L	ND	0.4	0.6	NF	0.3	0.2	0.2	2.8	2.7
Potassium (mg/L)	20 mg/ L	18	6.3	4.5	NF	5.8	4.5	4.2	10.0	7.7
TSS (mg/L)	500 mg/L	ND	44	102	NF	69	112	ND	106	62
Turbidity (NTU)	25 NTU	2.0	18.0	23.0	NF	36.0	38.0	0.7	40.0	23.0
Urea (ug/L)	None currently	45	598	--	NF	434	--	24	4490	--
Zinc (ug/L)	200 ug/L	313	439	587	NF	680	703	53	941	587

Monterey County MRSWMP monitoring results.

Table results include the Dry Run (DR) and First Flush time series (First Flush-A and First Flush-B). Shaded boxes indicate that a Water Quality Objective (WQO) or Action Level was exceeded. ND= Non-detect; NF= No Flow, -- = Not included in MRSWMP.

Analytes	WQO or Action Level	Pajaro			Crossroads		
		Dry Run	First Flush-A	First Flush - B	Dry Run	First Flush - A	First Flush - B
Ammonia (mg/L)	50 mg/L	NF	0.40	0.47	NF	0.47	0.44
Color (Color Units)	500 color units	NF	300	300	NF	100	100
Copper (ug/L)	30 ug/L	NF	30	34	NF	37	32
<i>E. coli</i> (MPN/ 100 ml)	235 MPN/ 100 ml	NF	6170	9063	NF	2590	3051
Enterococcus (MPN/ 100 ml)	104 MPN/ 100 ml	NF	21426	18600	NF	1211	1849
Fluoride (mg/L)	None currently	NF	0.1	0.2	NF	0.2	0.2
Hardness mg/L	<10 and >2000 mg/L	NF	43	46	NF	19	17
Lead (ug/L)	30 ug/L	NF	14	14	NF	ND	ND
MBAS Surfactants (mg/L)	0.2 mg/L	NF	0.59	0.45	NF	0.40	0.37
NO3-N (mg-N/ L)	2.25 mg-N/ L	NF	0.5	0.5	NF	0.3	0.3
PO4-P (mg-P/ L)	0.12 mg-P/ L	NF	0.4	0.4	NF	0.3	0.3
Potassium (mg/L)	20 mg/ L	NF	4.3	4.8	NF	2.6	2.4
TSS (mg/L)	500 mg/L	NF	163	140	NF	12	12
Turbidity (NTU)	25 NTU	NF	130	150	NF	13	11
Urea (ug/L)	None currently	NF	313	--	NF	271	--
Zinc (ug/L)	200 ug/L	NF	229	233	NF	241	216

Pacific Grove MRSWMP monitoring results.

Table results include the Dry Run (DR), First Flush time series (FF-A and FF-B). Shaded boxes indicate that a Water Quality Objective (WQO) or Action Level was exceeded. ND= Non-detect; NF= No Flow; -- = Not included in MRSWMP.

Analytes	WQO or Action Level	Greenwood Park			Lovers			Pico		
		DR	FF- A	FF - B	DR	FF- A	FF - B	DR	FF- A	FF - B
Ammonia (mg/L)	50 mg/L	0.21	1.06	2.07	NF	1.22	1.13	ND	1.02	0.86
Color (Color Units)	500 color units	20	250	380	NF	250	250	30	250	250
Copper (ug/L)	30 ug/L	ND	50	66	NF	67	69	ND	60	62
<i>E. coli</i> (MPN/ 100 ml)	235 MPN/ 100 ml	6152	38700	34480	NF	68700	51700	402	43604	41602
Enterococcus (MPN/ 100 ml)	104 MPN/ 100 ml	4374	29100	54800	NF	41100	435	83	24809	21426
Fluoride (mg/L)	None currently	0.2	0.2	0.2	NF	0.2	0.2	ND	0.3	0.2
Hardness mg/L	<10 and >2000 mg/L	314	44	46	NF	46	49	161	62	57
Lead (ug/L)	30 ug/L	ND	10	11	NF	9	13	ND	ND	ND
MBAS Surfactants	0.2 mg/L	0.27	0.67	1.00	NF	1.30	1.30	ND	1.00	1.00
NO3-N (mg-N/ L)	2.25 mg-N/ L	0.9	0.7	0.7	NF	0.7	0.6	2.4	0.7	0.6
PO4-P (mg-P/ L)	0.12 mg-P/ L	ND	0.6	1.0	NF	0.8	0.7	ND	0.9	1.0
Potassium (mg/L)	20 mg/ L	6.7	6.7	6.4	NF	6.3	6.1	5.9	11.2	9.7
TSS (mg/L)	500 mg/L	3	59	58	NF	22	44	ND	35	19
Turbidity (NTU)	25 NTU	4	22	27	NF	20	20	7	25	17
Urea (ug/L)	None currently	43	378	--	NF	914	--	10	292	--
Zinc (ug/L)	200 ug/L	60	384	435	NF	360	451	39	159	129

Seaside MRSWMP monitoring results.

Table results include the Dry Run (DR), First Flush time series (FF-A and FF-B). Shaded boxes indicate that a Water Quality Objective (WQO) or Action Level was exceeded. ND= Non-detect; NF= No Flow; -- = Not included in MRSWMP.

Analytes	WQO or Action Level	Bay Street		
		Dry Run	First Flush-A	First Flush - B
Ammonia (mg/L)	50 mg/L	NF	0.71	ND
Color (Color Units)	500 color units	NF	360	250
Copper (ug/L)	30 ug/L	NF	117	95
<i>E. coli</i> (MPN/ 100 ml)	235 MPN/ 100 ml	NF	112000	77000
Enterococcus (MPN/ 100 ml)	104 MPN/ 100 ml	NF	155000	98000
Fluoride (mg/L)	None currently	NF	0.1	ND
Hardness mg/L	<10 and >2000 mg/L	NF	63	32
Lead (ug/L)	30 ug/L	NF	45	42
MBAS Surfactants (mg/L)	0.2 mg/L	NF	1.00	0.53
NO3-N (mg-N/ L)	2.25 mg-N/ L	NF	0.5	0.3
PO4-P (mg-P/ L)	0.12 mg-P/ L	NF	0.2	0.2
Potassium (mg/L)	20 mg/ L	NF	3.5	2.4
TSS (mg/L)	500 mg/L	NF	214	131
Turbidity (NTU)	25 NTU	NF	50	31
Urea (ug/L)	None currently	NF	298	--
Zinc (ug/L)	200 ug/L	NF	785	621