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2018 MRSWMP Dry Run & First Flush Monitoring Report

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Introduction

The Monterey Regional Storm Water Management Program's (MRSWMP) water quality monitoring program is modeled after Monterey Bay National Marine Sanctuary's (MBNMS) Dry Run/First Flush monitoring program. Dry Run and First Flush volunteers collect water samples from storm drain outfalls prior to the first major rainstorm of the year (Dry Run) and during the first major rainstorm of the winter season (First Flush). Samples are analyzed for common urban pollutants such as detergents, bacteria, metals, sediments, and nutrients.

Samples collected during dry weather prior to the first major rainstorm provide information about dry weather flows such as pollutant concentrations, amount of groundwater base flow, or contributions from urban sources such as car washing, pressure washing, irrigation or illicit discharges. Dry weather flows are an important component of water quality monitoring since contaminants can be less diluted and therefore more concentrated than those of wet weather flows. Water samples collected during the first major rain storm of the winter season provide information on the concentration of 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 MBNMS except in Pacific Grove where some dry and wet weather flows are diverted to the sanitary sewer. It is hoped that this data collected for the MRSWMP water quality monitoring program provides local cities with the information on where best to implement best management practices focused on improving water quality.

The MRSWMP water quality monitoring program promotes volunteer participation, stewardship, and environmental education while providing important data regarding the quality of water flowing into MBNMS. This monitoring program is designed to meet E.8.ii requirements under the Phase II Storm Water 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, 303(d) Monitoring, or Receiving Water Monitoring, which are completed by permittees individually or through regional programs.

Methods

The same protocols and laboratory analyses are used for all of the MRSWMP water quality monitoring events. New Dry Run and First Flush volunteers attend a classroom training and participate in hands-on practice during the Dry Run: a half day event where volunteers demonstrate their skills, visit outfall sites, and collect water samples if flowing water is found. Volunteers are mobilized for the First Flush when at least 0.10 inches of rain has fallen, there is sheeting water on roadways, and conductivity is at or below 1000 µS. During the Dry Run and First Flush, volunteers take field measurements (water temperature, pH, electrical conductivity, and transparency) and collect water samples for lab analysis of nutrients (nitrate, orthophosphate, ammonia, and urea), bacteria (*Eschericia coli* and enterococcus), metals (copper, lead, and zinc) and total suspended solids, color, Methylene Blue Active Substances (MBAS) detergents, hardness (as CaCO3), potassium, and turbidity. Samples and field equipment are delivered immediately to the monitoring coordinator once sample collection is complete.

Dry Run monitoring entails collecting a single grab sample from each site with flowing water. During the First Flush, two sets of grab samples are collected 30 minutes apart for two time series. In this report, First Flush results reported by *analyte* are averaged between the two time series, and First Flush results reported by *jurisdiction* have individual time series results listed. Samples for urea are only collected during the first time series and are therefore not an average but a single sample result for each event.

During the First Flush, samples are collected from receiving water sites as a comparison to outfall results. Receiving water sample collection consists of collecting water at the point at which outfall flows reach receiving water in this case the ocean, and some mixing has occurred, a location termed point zero. Samples for this receiving water sampling are collected at point zero, as soon as feasible after the outfall samples are collected, in a bucket similar to what is used for outfall monitoring. Receiving water samples are tested for the same analytes as outfall samples.

The City of Pacific Grove operates a dry weather storm drain diversion system where dry weather flows in the storm drain system are diverted into the sanitary sewer. Some of the sites monitored for the MRSWMP monitoring are within the diversion system boundaries: HopkinsMon, HopkinsPG, 8th Street, Greenwood Park, and Lovers. While most diverted sites are monitored at the outfall, Greenwood Park is monitored above the connection point with the diversion system for the Dry Run and both Lovers and Greenwood Park are monitored above the connection point for the First Flush. Water quality data from Greenwood Park and Lovers are still valuable as contaminants are identified in the runoff that did *not* flow to the ocean. When the diversion remains on during the First Flush, sites are still monitored as long as water is flowing from the outfall. This flow is overflow from within the system which could be a combination of flows from a number of adjacent watersheds. For this year's First Flush, the diversion was on. However, the 8th Street outfall diversion was offline due to a summer-time pump change out and remained offline until final inspection which did not occur before the First Flush.

Most results (lab and field) in this study are compared to receiving water standards established for 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, except for the analytes that refer to the MS4 General Permit. However, lacking standards for most end-of-pipe monitoring receiving water standards are used for comparison. MBAS detergents and metal results are compared to the Water Quality Control Plan for the Central Coast Basin (Basin Plan) Water Quality Objectives (WQO) set by the Regional Water Quality Control Board (RWQCB) for the protection of marine or aquatic life. Because there are no numerical water quality objectives in the Basin Plan for *E. coli*, enterococcus, nitrate, orthophosphate, and total suspended solids (TSS), those results are compared with the U.S. Environmental Protection Agency (U.S. EPA) WQOs or Central Coast Ambient Monitoring Program's (CCAMP) Action Levels. The U.S. 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 from data that shows levels are elevated relative to the data distribution for that parameter on the Central Coast. It is important to reiterate that both RWQCB 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. There are no end-of-pipe

objectives for most of the monitored analytes of the MRSWMP monitoring program, however, the State Water Resources Control Board's (SWRCD) National Pollution Discharge and Elimination System (NPDES) MS4 General Permit does provide end-of-pipe water quality Action Levels for: ammonia, color, 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.

Grab sample results are reported as concentration, consistent with how the water quality objectives are defined. However, this does not give an indication of the load of pollutants being discharged. To calculate instantaneous load, instantaneous flow was measured by filling a container of known volume (a bucket), timing how fast the container filled, and estimating how much of the flow was captured while filling the container. Dry Run instantaneous flow calculations are from a single sample, while the First Flush instantaneous flow calculations are an average of two time series samples.

Figure 2. Volunteers gather at Twins (Monterey) for First Flush training on September 22, 2018. Photo: L. Chandler.

Figure 3. Volunteers check First Flush sites for flowing water during the Dry Run at 8th Avenue (Carmel). Photo: A. Gutierrez.

Figure 4. Sudsy water flows at 4th Avenue, (Carmel) during the First Flush 2018. Photo: B. Hoover.

Figure 5. First Flush volunteer grabs a bucket of sudsy sample water at Twins (Monterey). Photo: R. Bunting.

Table 1: Receiving Water Quality Objectives

Parameter (reporting units)	Water Quality Objectives	Source of Objective
Ammonia (mg/L)	Not to exceed 50	SWRCB NPDES MS4 General Permit
Color (color units)	Not to exceed 500	SWRCB NPDES MS4 General Permit
Copper (µg/L)	Not to exceed 30[1]	Water Quality Control Plan for the Central Coast- RWQCB
E. coli (MPN/100ml)	Not to exceed 235 [2]	U.S. EPA Ambient Water Quality Criteria
Enterococcus (MPN/100ml)	Not to exceed 104	U.S. EPA Ambient Water Quality Criteria
Hardness as CaCO3 (mg/L)	Not less than or = to 10 or greater than or = to 2,000	SWRCB NPDES MS4 General Permit
Lead (µg/L)	Not to exceed 30 [1]	Water Quality Control Plan for the Central Coast- RWQCB
MBAS Detergents (mg/L)	Not to exceed 0.2	Water Quality Control Plan for the Central Coast- RWQCB
Nitrate as N (mg/L)	Not to exceed 2.25 [3]	Central Coast Ambient Monitoring Program (CCAMP)
Orthophosphate as P (mg/L)	Not to exceed 0.12 [4]	Central Coast Ambient Monitoring Program (CCAMP)
pH (pH units)	Not < 6.5 or > 8.5	Water Quality Control Plan for the Central Coast- RWQCB
Potassium (mg/L)	Not to exceed 20	SWRCB NPDES MS4 General Permit
Total Suspended Solids (TSS) (mg/L)	Not to exceed 500 [5]	Central Coast Ambient Monitoring Program (CCAMP)
Transparency (cm)	Not less than 25 [6]	Central Coast Ambient Monitoring Program (CCAMP)
Turbidity (NTU)	Not to exceed 25	Central Coast Ambient Monitoring Program (CCAMP)
Zinc (µg/L)	Not to exceed 200 [1]	Water Quality Control Plan for the Central Coast- RWQCB

Note: Urea is not listed because it does not have a Water Quality Objective or Action Level.

[1] Water Quality Control Plan for Central Coast Cold Water objective for hard water
[2] Environmental Protection Agency, Updated WQO.
[3] Central Coast Ambient Monitoring Program, Pajaro River Watershed Characterization Report 1998, rev 2003.
[4] Williamson, The Establishment of Nutrient Objectives, Sources, Impacts and Best Management Practices for the Pajaro River and Llagas Creek, 1994.
[5] Central Coast Ambient Monitoring Program, Salinas River Watershed Characterization Report 1999, rev. 2000.
[6] Based upon equivalent guideline value used for 303(d) Listing Guideline Value (Sigler et al., 1985)

Results

Two monitoring events took place during the 2018 MRSWMP permit year:

- The Dry Run was conducted on September 22nd, 2018 at 15 sites with the help of 19 volunteers. Only 4 of the 15 sites had enough flowing water to be sampled.
- The First Flush was conducted on November 23rd, 2018 with the help of 30 volunteers. All volunteers were mobilized at 11:15 am when the front approached the peninsula from the south and dropped enough rain to warrant sampling. All 15 outfall sites and 2 receiving water sites were sampled on the 23rd.

During the First Flush two receiving water sites, 8th Street (Pacific Grove) and Lovers (Pacific Grove), were sampled on November 23rd. All receiving water results are presented in Appendix 4.

Flow was measured by volunteers at the time of sampling except at the following sites due to end of pipe inaccessibility: Bay Street (Seaside and Sand City) and Lovers (Pacific Grove). Flow was also not measured at Pajaro (Monterey County) and Crossroads (Monterey County) due to flap gates at the end of the outfall that impede natural flow. All other instantaneous flow estimates are listed in Table 2.

Table 2: Instantaneous flow estimates in gallons per minute (gpm). NA= data not available due to issues with pipe and/or accessibility, NR= Not recorded, NF= No flow.

Sites	Dry Run	First Flush
Pajaro (Monterey County)	NF	NA
Bay Street (Seaside and Sand City)	NF	NA
Twins (Monterey)	67	2000
San Carlos Beach (Monterey)	NF	NR
Steinbeck (Monterey)	NF	100
HopkinsMon (Pacific Grove)	NF	28
HopkinsPG (Pacific Grove)	NF	NR
8th Street (Pacific Grove)	0.4	122
Greenwood Park (Pacific Grove)	1.2	107
Lover's (Pacific Grove)	NF	NA
Pico (Pacific Grove)	2.8	234
4th Avenue (Carmel)	NF	121
Ocean Avenue (Carmel)	NF	51
8th Avenue (Carmel)	NF	51
Crossroads (Monterey County)	NF	NA

Table 3. The range of results for field measurements and lab samples. First Flush range of results are not averaged, both time series samples are accounted for.

Parameter	Units	Dry Run	First Flush
Ammonia as N	mg/L	ND – 0.30	0.1 – 6.4
Color	color units	20 – 50	15 – 300
Conductivity	µS	1,340 – 3,900	50 - Or
Copper- total	µg/L	ND	ND – 216
Escherichia coli (E. coli)	MPN/ 100 ml	52 – >24,196	8,803 – >241,960
Enterococcus	MPN/ 100 ml	31 – 15,531	8,474 – 198,630
Hardness	mg/L	179 – 699	28 – 6,240
Lead- total	µg/L	ND	ND – 21
MBAS Detergents	mg/L	0.08 – 0.16	0.15 – 0.99
Nitrate as N	mg-N/L	0.5 – 2.6	0.10 – 1.80
Orthophosphate as P	mg-P/L	ND – 0.20	ND – 2.10
pH	pH units	6.5 – 7.0	6.0 – 8.5
Potassium	mg/L	5.1 – 8.6	2.4 – 366
Total Suspended Solids	mg/L	ND – 7	16 – 216
Transparency	cm	>120	5.0 – 78
Turbidity	NTU	1.4 – 6.3	2.7 – 120
Urea	µg/L	ND – 587	24 – 1,120
Water temperature	°C	14.8 – 18.1	15.5 – 17.8
Zinc- total	µg/L	ND – 74	ND – 284

Analyte descriptions below are listed alphabetically and include box and whisker graphs that show the data divided into dry weather (DR) and wet weather (FF) results by site. Dry weather monitoring events include Dry Runs and any historical Spring Run and Summer Run events. Wet weather monitoring is inclusive of First Flush and historical Second Flush events. Box and whisker graphs show a distribution of the dataset in a convenient format for making comparisons between sites and the range of concentrations over the years. The box represents the range of 50% of the data with the median. The lines above and below the boxes are upper and lower whiskers and represent the remaining upper and lower 25% of the data. The end point of each whisker represents the maximum and minimum result for that analyte at that location and provides an indication of the best- and worst-case results. Each graph includes a marker for the most recent year's results for comparison to historical data as well as a marker for receiving water results which are discussed in Appendix 4. A few analytes have graphs that are split along the y-axis to encompass the entire dataset.

Each analyte description includes a reporting of the Minimum Detection Limit (MDL), the smallest concentration that lab equipment can reliably detect an analyte. MDL is a statistical analysis of the confidence of results. Results below the MDL are reported as non-detect since lab equipment cannot reliably determine where the results lay between zero and the MDL.

Ammonia as N

Ammonia, in conjunction with other analytes can assist in identifying a discharge of sewage as well as industrial or commercial liquid wastes. The SWRCB NPDES MS4 General Permit Action Level for ammonia as N is 50 mg/L; the MDL was 0.1 mg/L for the Dry Run and First Flush. Figure 6 represents all MRSWMP ammonia as N data since 2013. All outfall results are listed in Appendix 2.

- **Dry Run** and **First Flush** results for all outfall sites were below the Action Level in 2018.

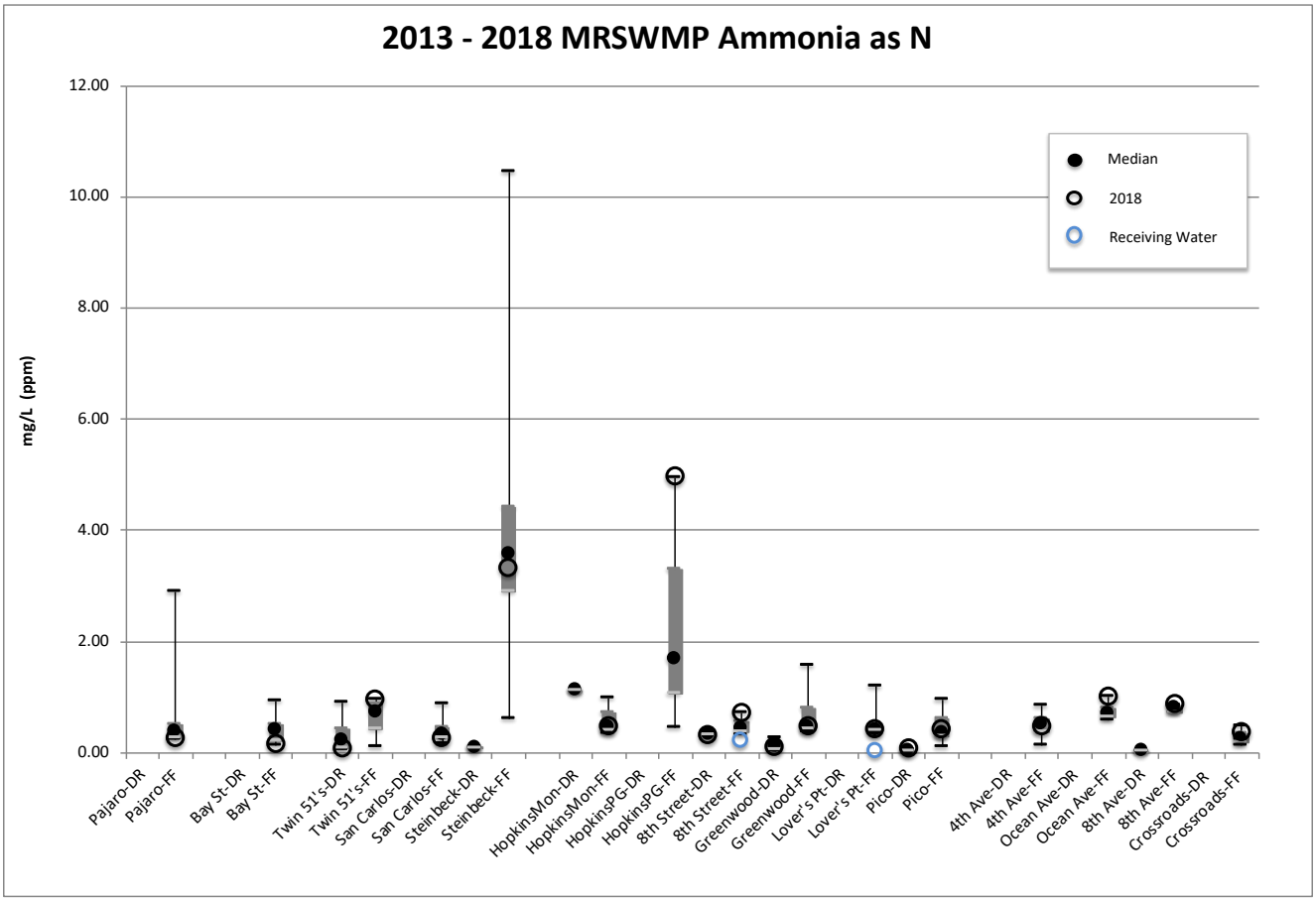

Figure 6. 2013- 2018 MRSWMP ammonia as N results. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Color

Color, in conjunction with other analytes, can assist in identifying a discharge of sewage, wash water, as well as industrial or commercial liquid wastes. The SWRCB NPDES MS4 General Permit Action Level for color is 500 units; the MDL for color was 3 color units for both the Dry Run and First Flush. Figure 7 represents all MRSWMP color data since 2013. All outfall results are listed in Appendix 2.

- **Dry Run** and **First Flush** results for all outfall sites were below the Action Level in 2018.

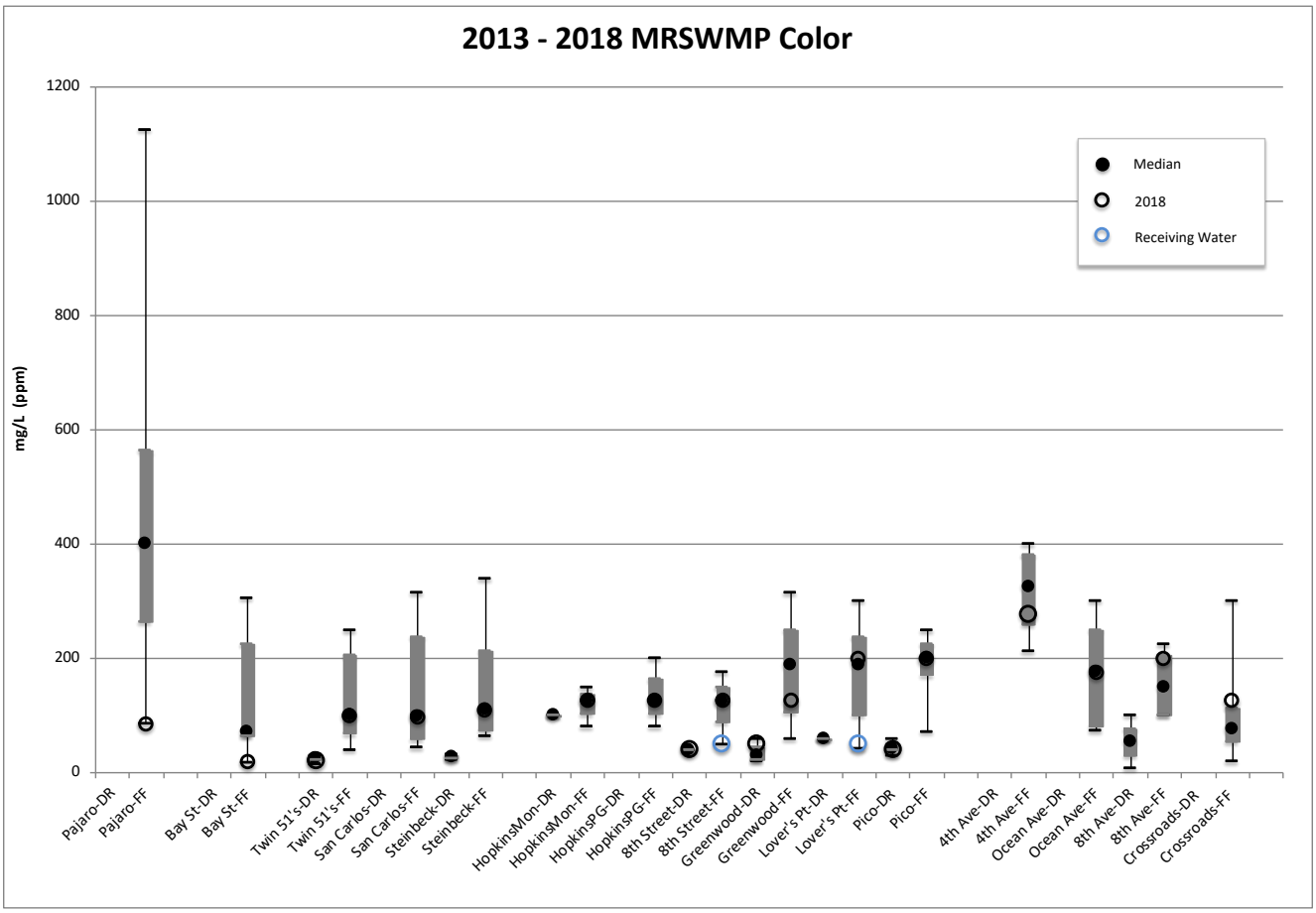

Figure 7. 2013 - 2018 MRSWMP color results. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Copper

Copper is toxic to marine organisms and can cause reduced reproduction, developmental deformities, reduced photosynthesis, and mortality. Copper and other heavy metal toxicity can be mitigated by the presence of sediment, hardness, or other binding compounds that may reduce the metal's bioavailability. Copper is present in some brake pads, pesticides, wood preservatives, roofing materials, and architectural structures such as gutters and downspouts.

The Basin Plan WQO established for total copper is 30 µg/L; the MDL for copper was 10 µg/L for both the Dry Run and First Flush. Figure 8 represents all MRSWMP copper data since 2006. All outfall results are listed in Appendix 2.

- **Dry Run** results**:** Copper concentrations for all outfall sites were below the WQO in 2018.

- **First Flush** results: Eleven of the outfall sites monitored (73%) were above the WQO in 2018. The highest average result of 163 µg/L was from 4th Avenue (Carmel).

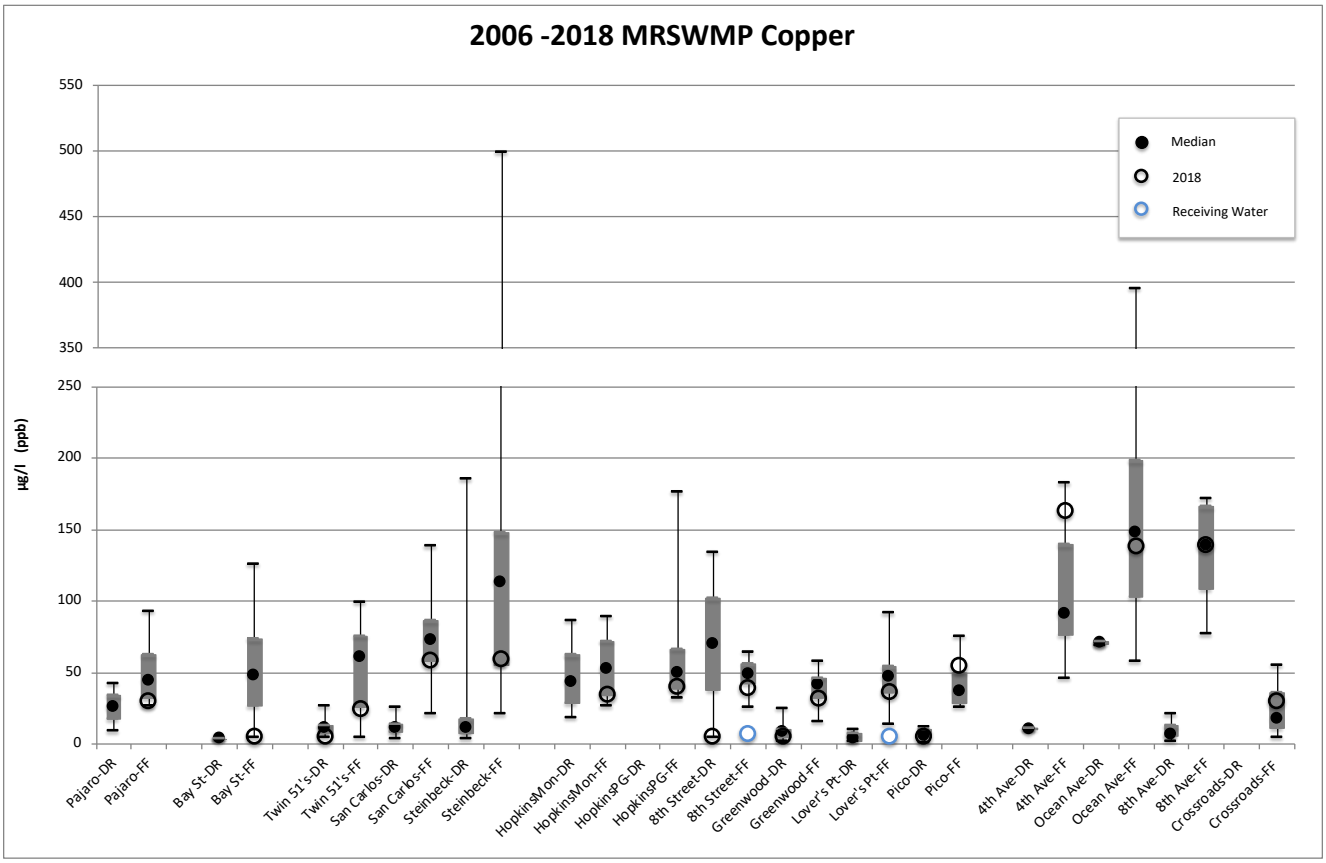

Figure 8. 2006-2018 MRSWMP total copper results. To better illustrate results, the scale on the graph is split between 250 and 350 µg/L. As a result, First Flush 2017 results from Steinbeck (Monterey) of 499 µg/L, and First Flush 2010 results from Ocean Avenue (Carmel) of 395 µg/L are in the upper portion of the graph. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between zero and the MDL. Sites are listed north to south.

Escherichia coli (E. coli)

Escherichia coli (*E. coli*) is a type of indicator bacteria found in warm-blooded animals. While *E. coli* does not cause disease in humans, it is a pollutant of concern because its' presence indicates the potential presence of pathogens that do cause disease in humans and wildlife.

The U.S. EPA Ambient Water Quality Criteria for *E. coli* is 235 MPN/100 ml. The MDL for *E. coli* was 1 MPN/ 100 ml for the Dry Run and First Flush. Figure 9 represents all MRSWMP *E. coli* data since 2006. All outfall results are listed in Appendix 2.

- **Dry Run** results: All but one outfall site was above the WQO for *E. coli* in 2018. The highest *E. coli* result of >24,196 MPN/100 ml was from 8th Street (Pacific Grove). Pico (Pacific Grove) had the only result below the WQO at 52 MPN/ 100 ml.

- **First Flush** results: All of the outfall sites were above the WQO in 2018. The highest average result of 191,660 MPN/ 100 ml was from Pico (Pacific Grove).

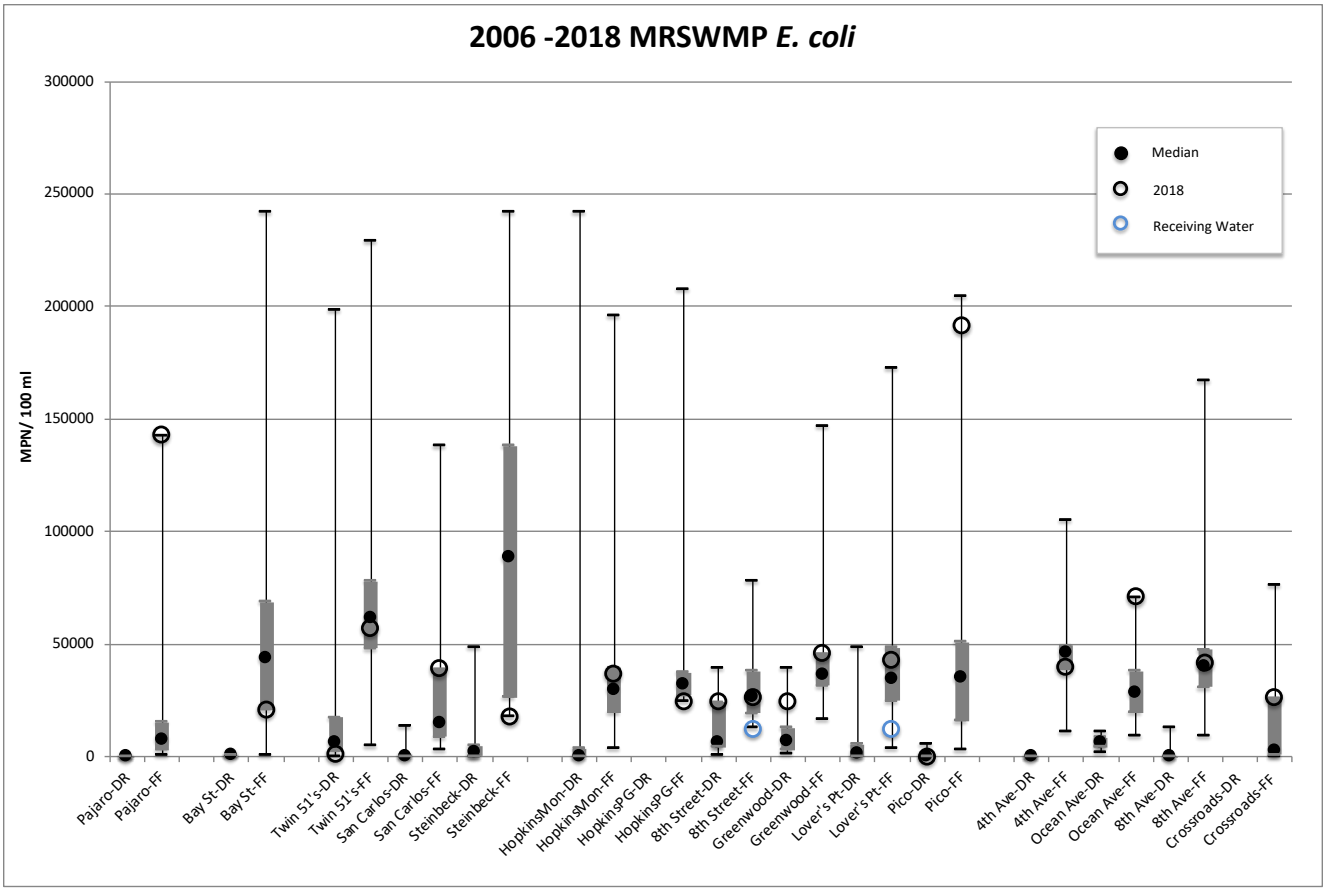

Figure 9. 2006-2018 MRSWMP *E. coli* results. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Enterococcus

Enterococcus is another type of indicator bacteria found in warm blooded animals. As described above, it does not cause disease in humans, but it is a pollutant of concern because its' presence indicates the potential presence of pathogens that do cause disease in humans and wildlife.

The U.S. EPA Ambient Water Quality Criteria for enterococcus is 104 MPN/100 ml. The MDL for enterococcus was 1 MPN/ 100ml for the Dry Run and First Flush. Figure 10 represents all MRSWMP enterococcus data since 2006. All outfall results are listed in Appendix 2.

- **Dry Run** results: All but one of the outfall sites monitored was above the WQO for enterococcus in 2018. The highest enterococcus result of 15,531 MPN/ 100 ml was from 8th Street (Pacific Grove). Pico (Pacific Grove) had the only result below the WQO at 31 MPN/ 100 ml.

- **First Flush** results: All outfall sites exceeded the WQO in 2018. The highest average result of 169,995 MPN/100 ml was from Pico (Pacific Grove).

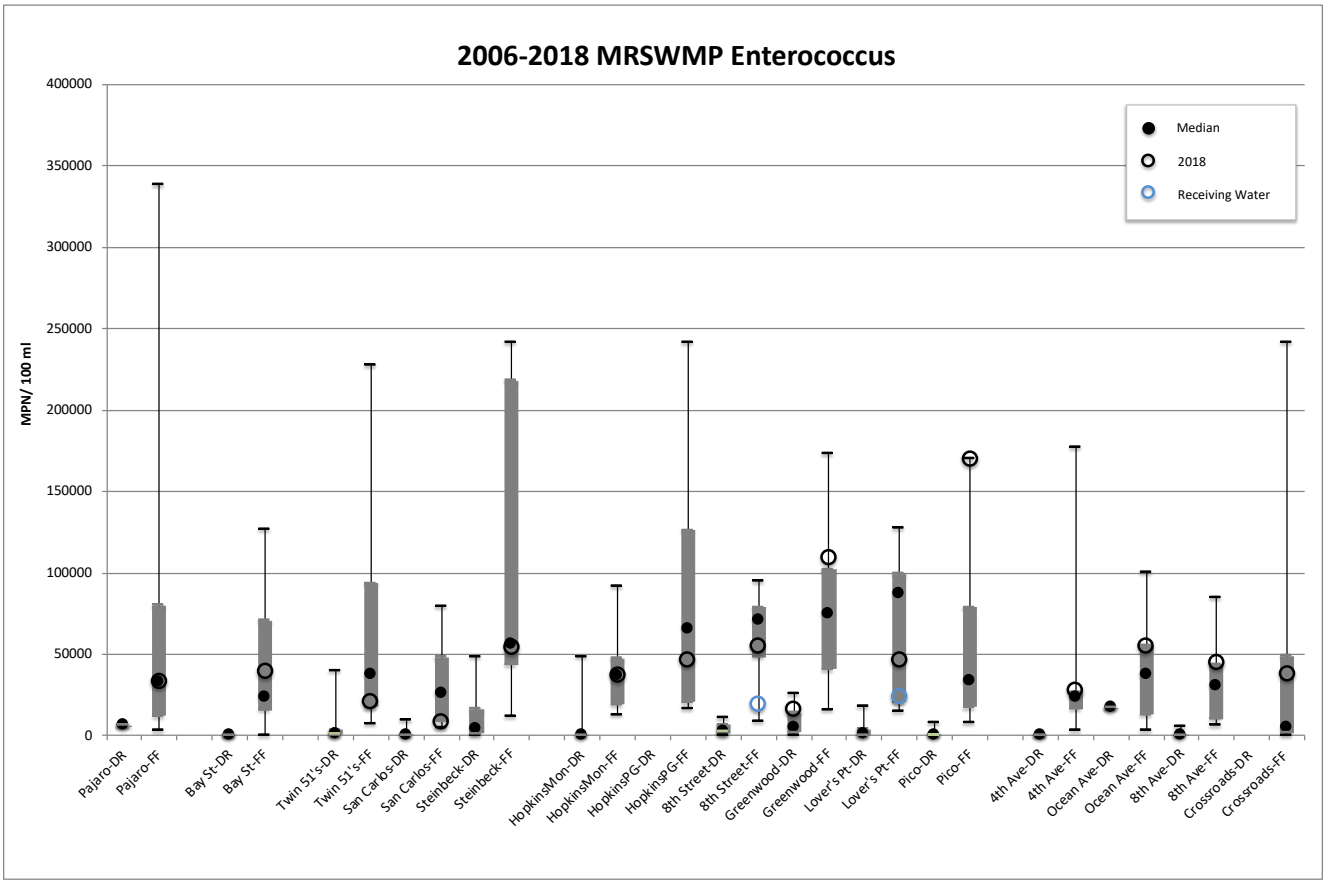

Figure 10. 2006-2018 MRSWMP enterococcus results. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Hardness (as CaCO3)

Hardness (as CaCO3) in conjunction with other analytes, can assist in identifying a discharge of sewage, wash water, tap water, as well as industrial or commercial liquid wastes. Additionally, when hardness increases, the amount of dissolved metals biologically available to aquatic and marine life decreases resulting in a decrease in the toxicity of the metal.

The SWRCB NPDES MS4 General Permit Action Level for hardness is not less than or equal to 10 mg/L or greater than or equal to 2,000 mg/L; the MDL for hardness (as CaCO3) was 10 mg/L for both the Dry Run and First Flush. Figure 11 represents all MRSWMP hardness data since 2013. All outfall results are listed in Appendix 2.

- **Dry Run** results: All outfall sites were within the acceptable range in 2018.

- **First Flush** results: For 2018 only one outfall site, Bay Street (Seaside and Sand City), was above the Action Level with a result of 5970 mg/L.

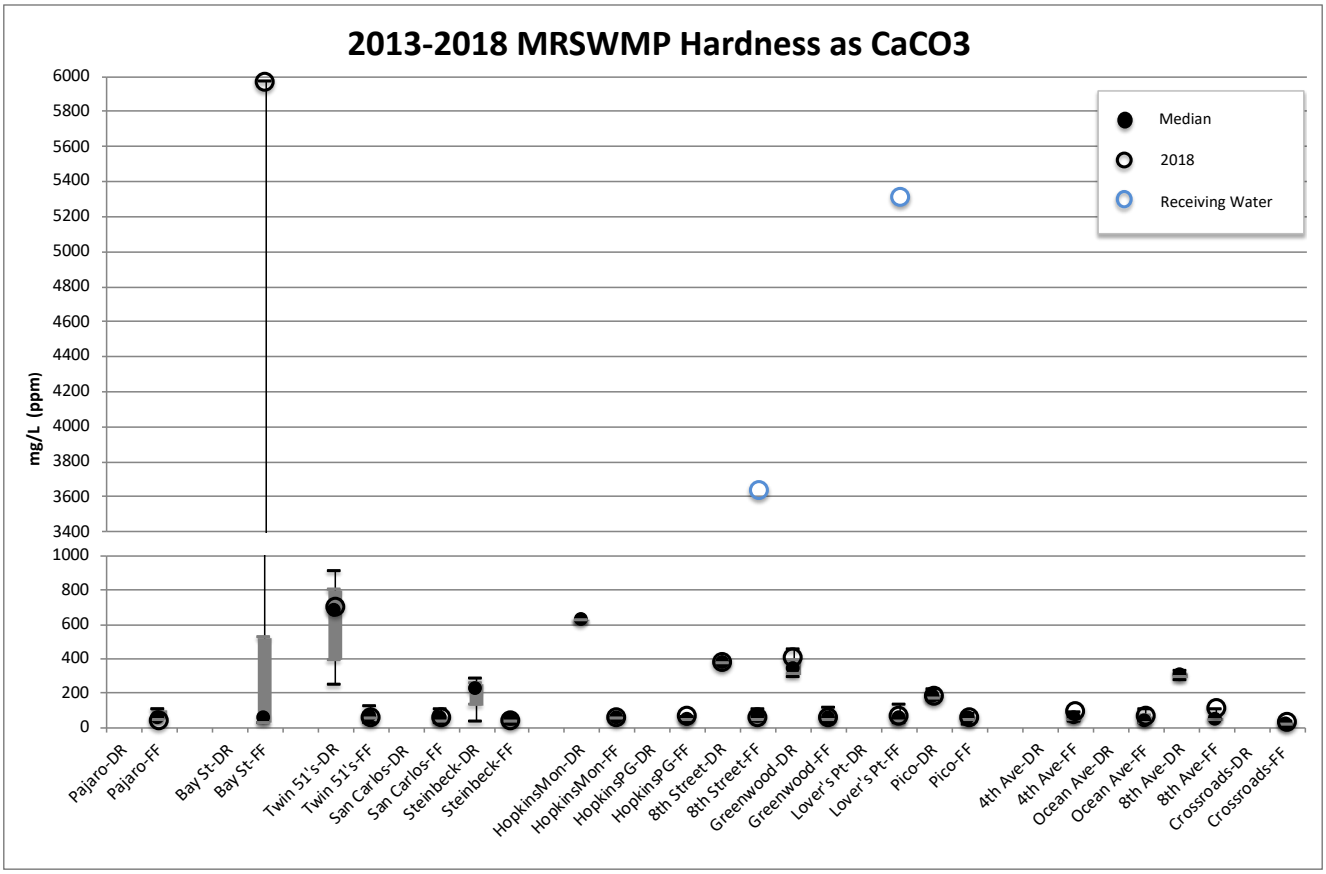

Figure 11. 2013 - 2018 MRSWMP hardness (as CaCO3) results. To better illustrate results, the scale on the graph is split between 1000 and 3400 mg/L. As a result, First Flush 2018 results from Bay Street (Seaside and Sand City) of 5970 mg/L, 8th Street (Pacific Grove) Receiving Water of 3630 mg/L, and Lovers (Pacific Grove) Receiving Water of 5310 mg/L, are in the top portion of the graph. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Lead

Lead is toxic to marine organisms causing reduced reproduction, developmental deformities, reduced photosynthesis, and mortality. Lead and other heavy metal toxicity can be mitigated by the presence of sediment, hardness, or other binding compounds that may reduce the metal's bioavailability. Lead is present in some types of paint, water distribution systems, auto emissions, and can be passed through the food web via uptake by plants that are grown in lead contaminated soils.

The Basin Plan WQO established for total lead is 30 µg/L; the MDL for lead was 1 µg/L for both the Dry Run and First Flush. Figure 12 represents all MRSWMP lead data since 2006. All outfall results are listed in Appendix 2.

- **Dry Run** results: All outfall lead results were below the WQO in 2018. Non-detects were reported for all four sampled outfall sites.

- **First Flush** results: All outfall lead results were below the WQO in 2018. Two sites had non-detects for both time series samples: Bay Street (Seaside and Sand City) and Crossroads (Monterey County).

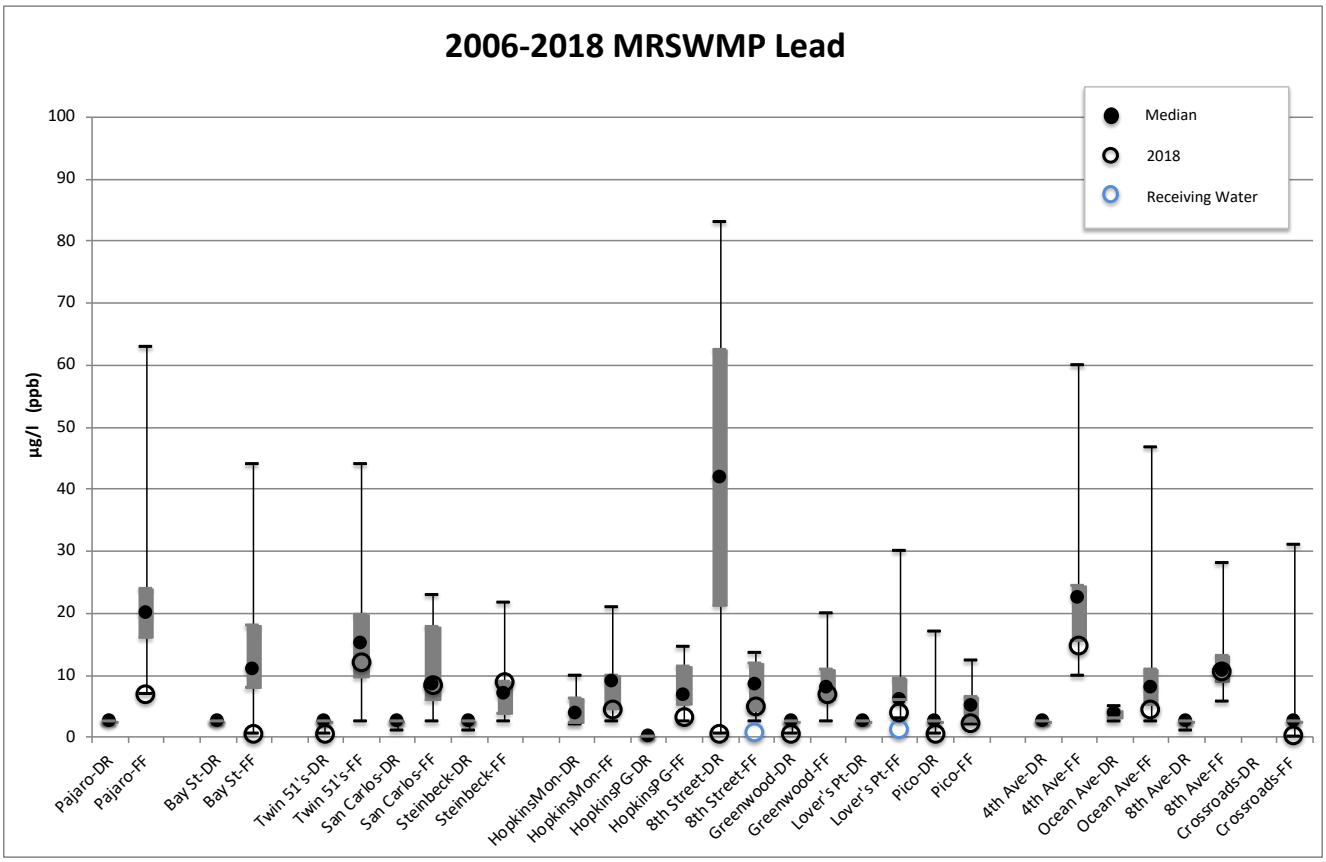

Figure 12. 2006-2018 MRSWMP lead results. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

MBAS Detergents

MBAS detergents in sample water can indicate a discharge from sewage or wash water, and in conjunction with other analytes, can assist in identifying a discharge of industrial or commercial liquid wastes.

The Basin Plan's WQO established for MBAS detergents is 0.2 mg/L; the MDL for MBAS detergents was 0.1 for the Dry Run and First Flush. Figure 13 represents all MRSWMP MBAS detergent data since 2013. All outfall results are listed in Appendix 2.

- **Dry Run** results: MBAS concentrations were below the WQO for all outfall sites in 2018.

- **First Flush** results: Results from all but one of the outfall sites (93%) were above the WQO in 2018. The highest average result of 0.92 mg/L was from 8th Avenue (Carmel). Bay Street (Seaside and Sand City) had the only result below the WQO at 0.17 mg/L.

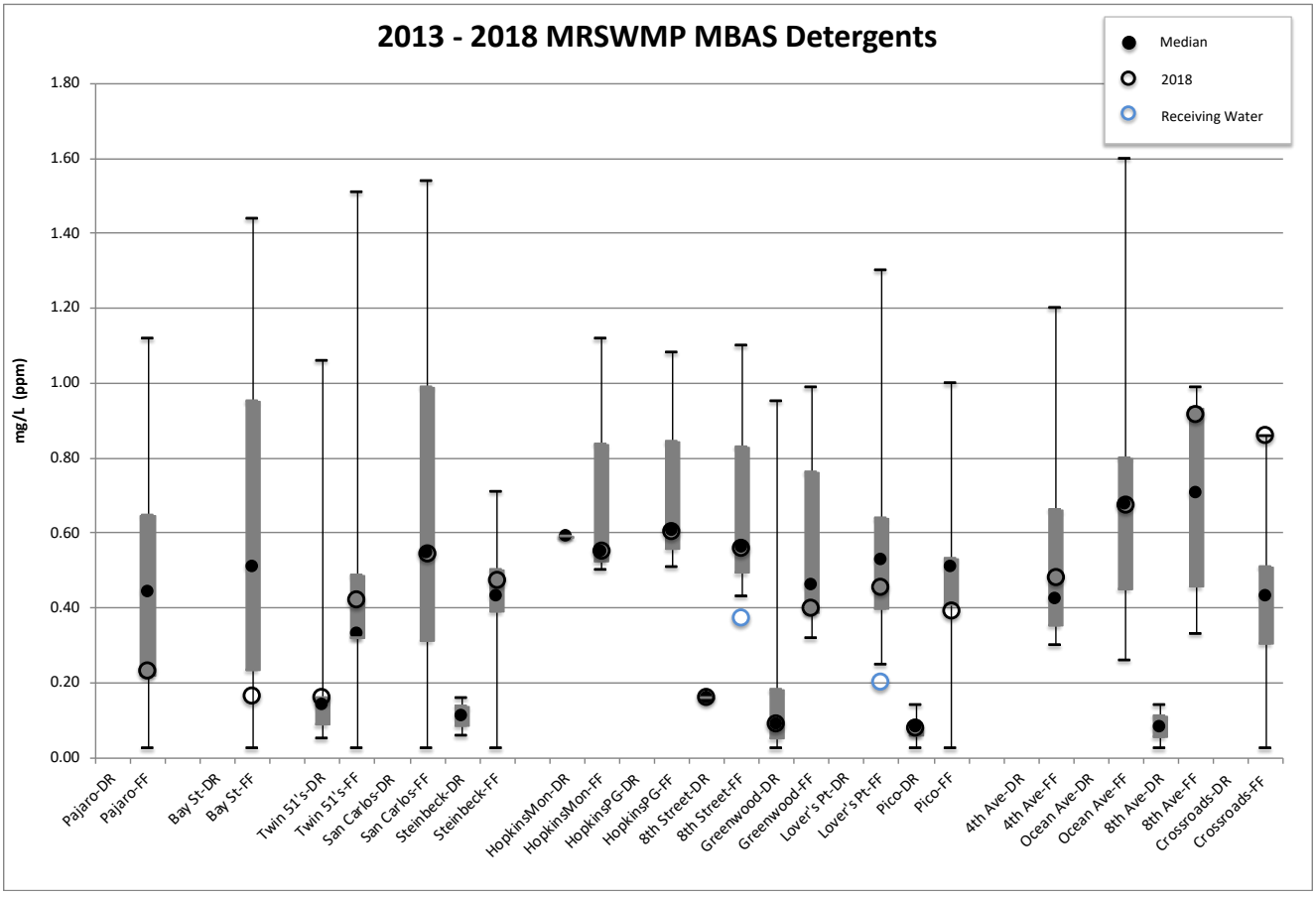

Figure 13. 2013 - 2018 MRSWMP MBAS detergent results. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Nitrate as N

Nitrogen is an element needed for plant growth. Primary sources of nitrate in runoff include overwatering of fertilized lawns, agricultural and pasture lands, construction sites, and septic or sewer system leachate. Nitrate in runoff can lead to excessive nitrate in groundwater or increased growth of algal blooms that degrade water quality as algae die off and consume oxygen in their decomposition.

The CCAMP Action Level for nitrate as N (NO_3-N) is 2.25 mg-N/L. The MDL was 0.1 mg-N/L for the Dry Run and First Flush. Figure 14 represents all MRSWMP nitrate as N data since 2006. All outfall results are listed in Appendix 2.

- **Dry Run** results: Results were below the Action Level at all but one outfall site in 2018: 8th Street (Pacific Grove) with a result of 2.6 mg/L.

- **First Flush** results: Results from all outfall sites were below the Action Level in 2018.

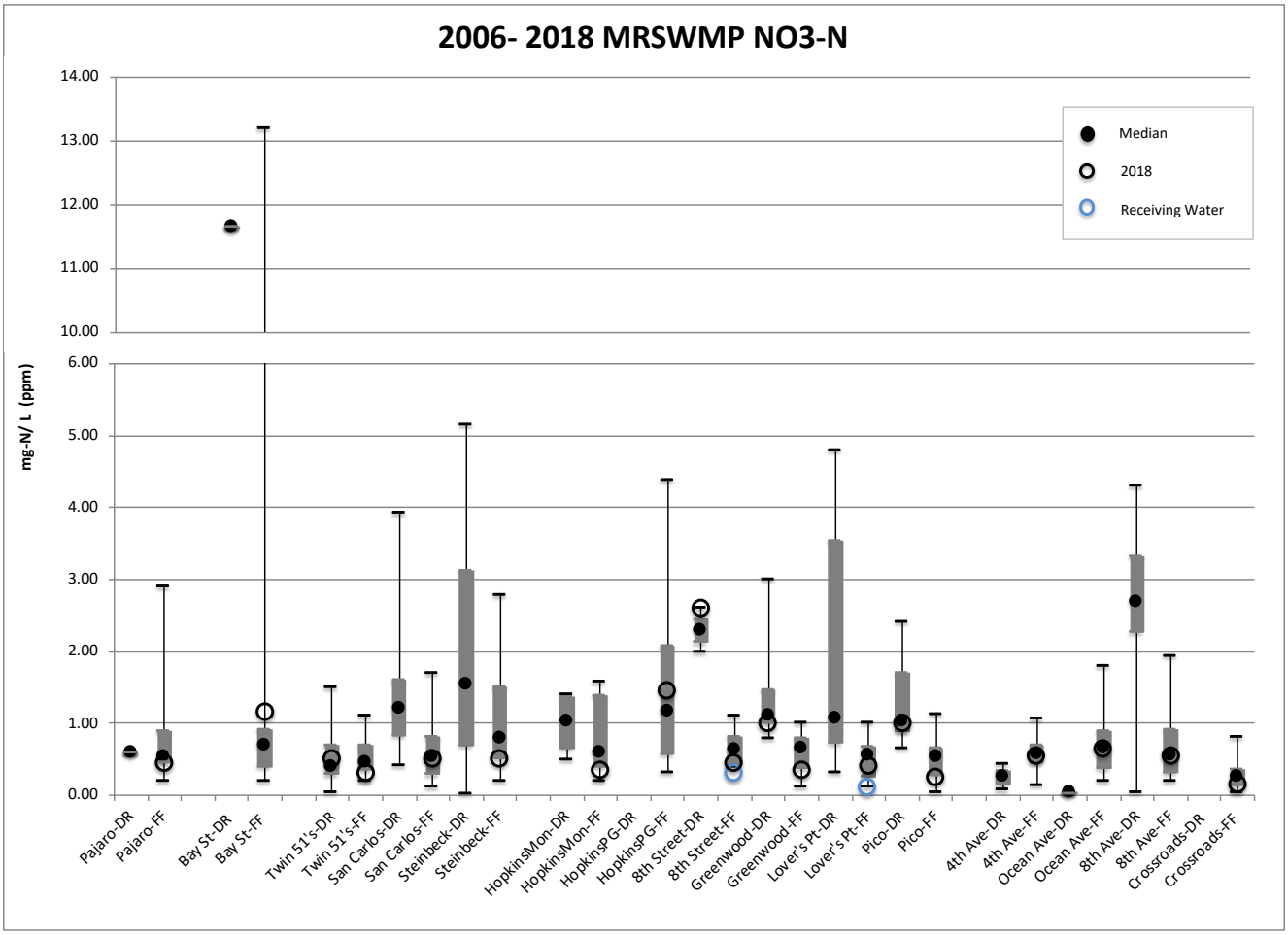

Figure 14. 2006-2018 MRSWMP nitrate as N (NO3-N) results. To better illustrate results, the scale on the graph is split between 6.00 and 10.00 mg-N/L. As a result, two results from Bay Street (Seaside and Sand City), one from First Flush 2006 of 13.2 mg/L, and Spring Run 2011 of 11.64 mg/L, are in the upper portion of the graph. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. 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. When excessive amounts are present, large algal blooms can occur which can lead to degraded water quality conditions toxic to marine or aquatic life.

The CCAMP Action Level for orthophosphate as P (PO_4-P) is 0.12 mg-P/L. The MDL was 0.1 mg-P/L for the Dry Run and First Flush. Figure 15 represents all MRSWMP orthophosphate as P data since 2006. All outfall results are listed in Appendix 2.

- **Dry Run** results: In 2018 just one of the outfall sites had results above the Action Level. The highest result of 0.20 was from 8th Street (Pacific Grove).

- **First Flush** results: All results were above the Action Level in 2018. The highest average result of 1.50 mg-P/ L was from Steinbeck (Monterey).

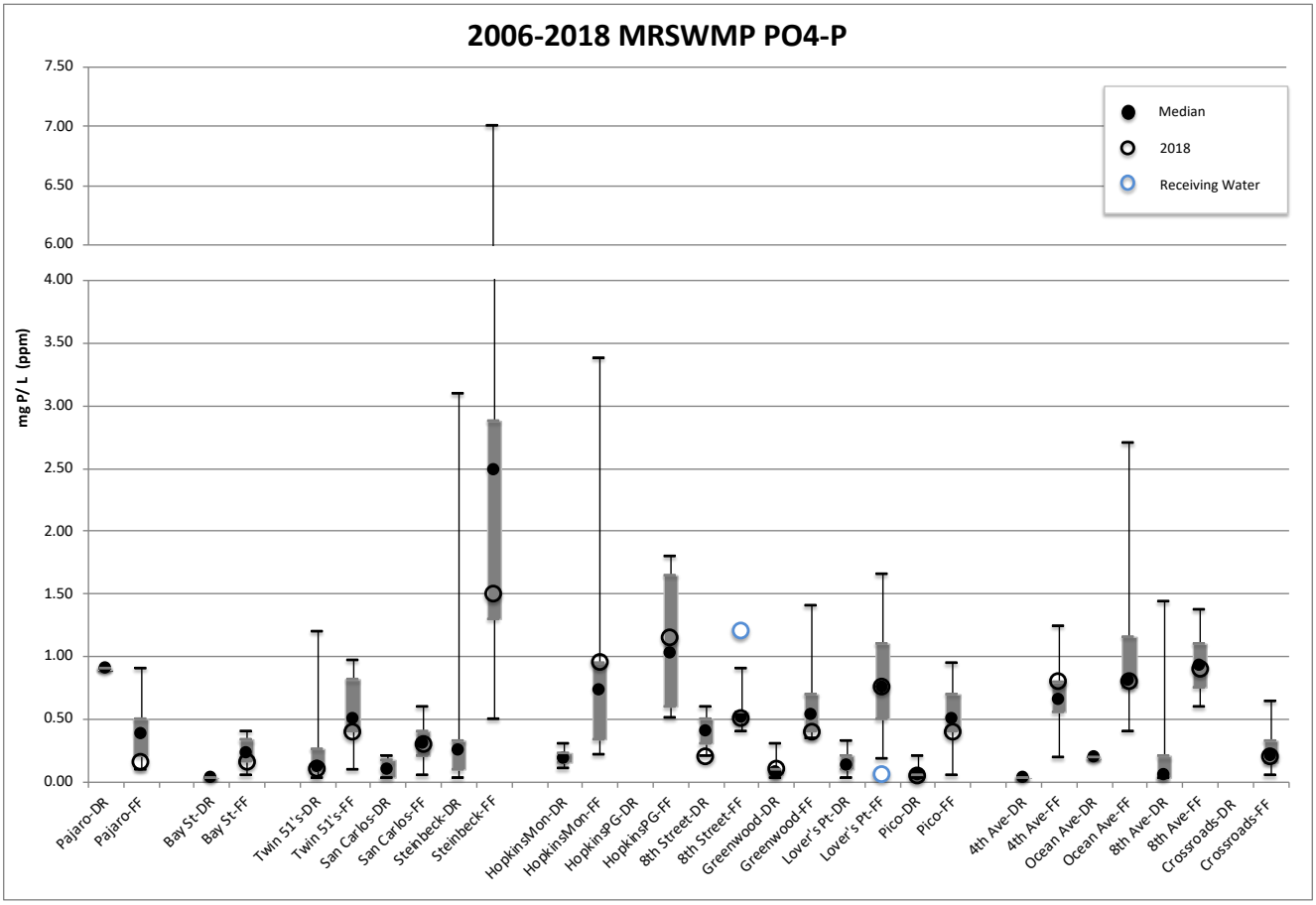

Figure 15. 2006-2018 MRSWMP orthophosphate as P (PO4-P) results. To better illustrate results, the scale on the graph is split between 4.00 and 6.00 mg-P/L. As a result, the First Flush 2010 result of 7.01 mg/L from Steinbeck (Monterey) is in the upper portion of the chart. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Potassium

Potassium, in conjunction with other analytes, can assist in identifying a discharge of sewage, industrial, or commercial liquid wastes.

The SWRCB NPDES MS4 General Permit Action Level for potassium is 20 mg/L; the MDL was 0.5 mg/L for the Dry Run and First Flush. Figure 16 represents all MRSWMP potassium data since 2013. All outfall results are listed in Appendix 2.

- **Dry Run** results: All sites were below the Action Level in 2018.
- **First Flush** results: In 2018 all sites were below the Action Level except for one site. Bay Street (Seaside and Sand City) had the only site above the Action Level with an average result of 351 mg/L.

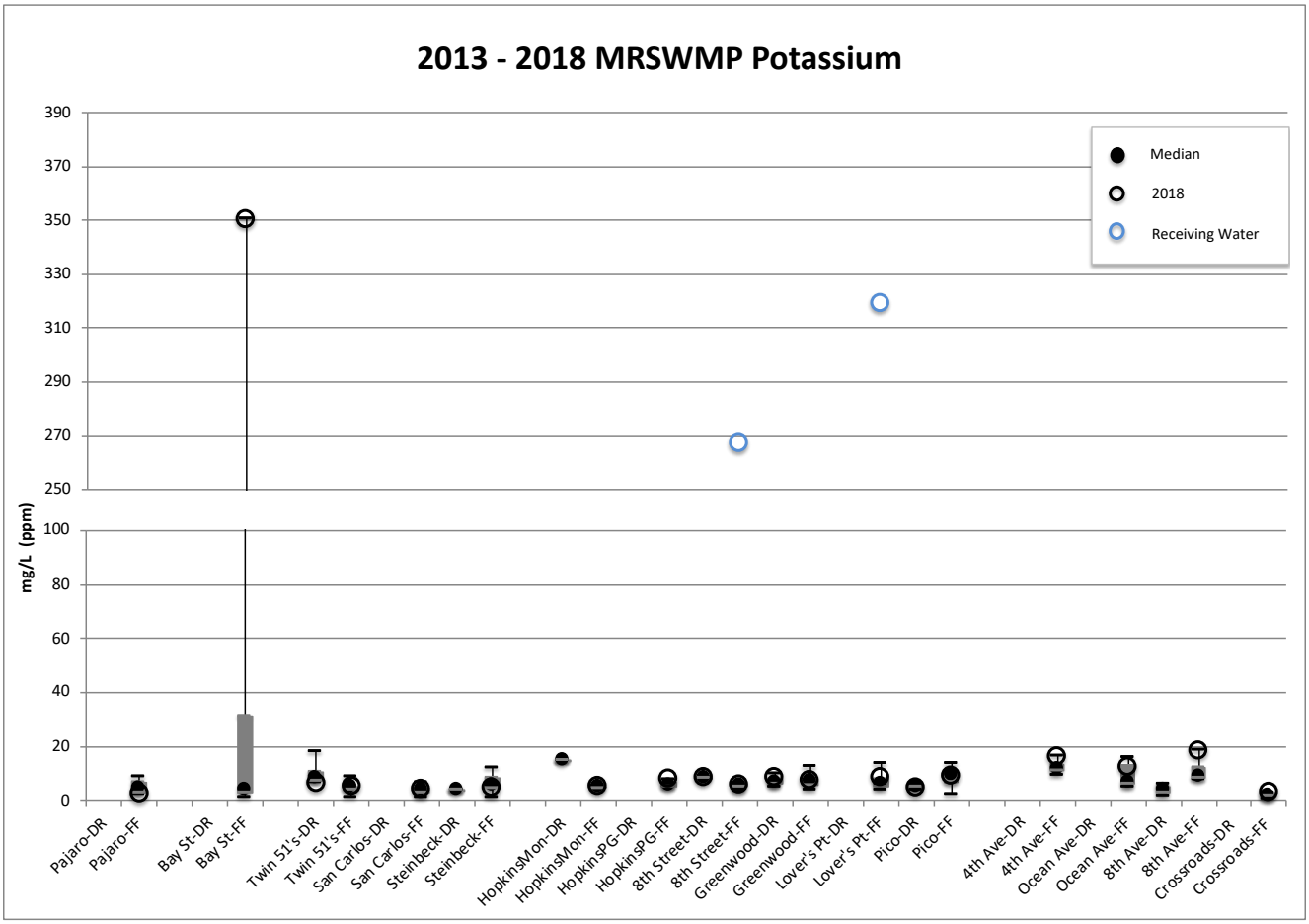

Figure 16. 2013 - 2018 MRSWMP potassium results. To better illustrate results, the scale on the graph is split between 100 and 250 mg/L. As a result, First Flush 2018 result from Bay Street (Seaside and Sand City) of 351 mg/L, 8th Street (Pacific Grove) Receiving Water of 267 mg/L, and Lovers (Pacific Grove) Receiving Water of 319 mg/L are all in the top portion of the graph. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Total Suspended Solids

Total suspended solids (TSS) are measured because high amounts of sediment can destroy habitat, suffocate eggs in fresh water systems, limit the food supply, clog gills or impair an organism's vision when feeding.

The CCAMP Action Level for TSS is 500 mg/L; the MDL was 2 mg/L for both the Dry Run and First Flush. Figure 17 represents all MRSWMP TSS data since 2006. All outfall results are listed in Appendix 2.

- **Dry Run** results: In 2018 all sites were below the Action Level and one site, Pico (Pacific Grove), had a non-detect.

- **First Flush** results: All sites were below the Action Level in 2018.

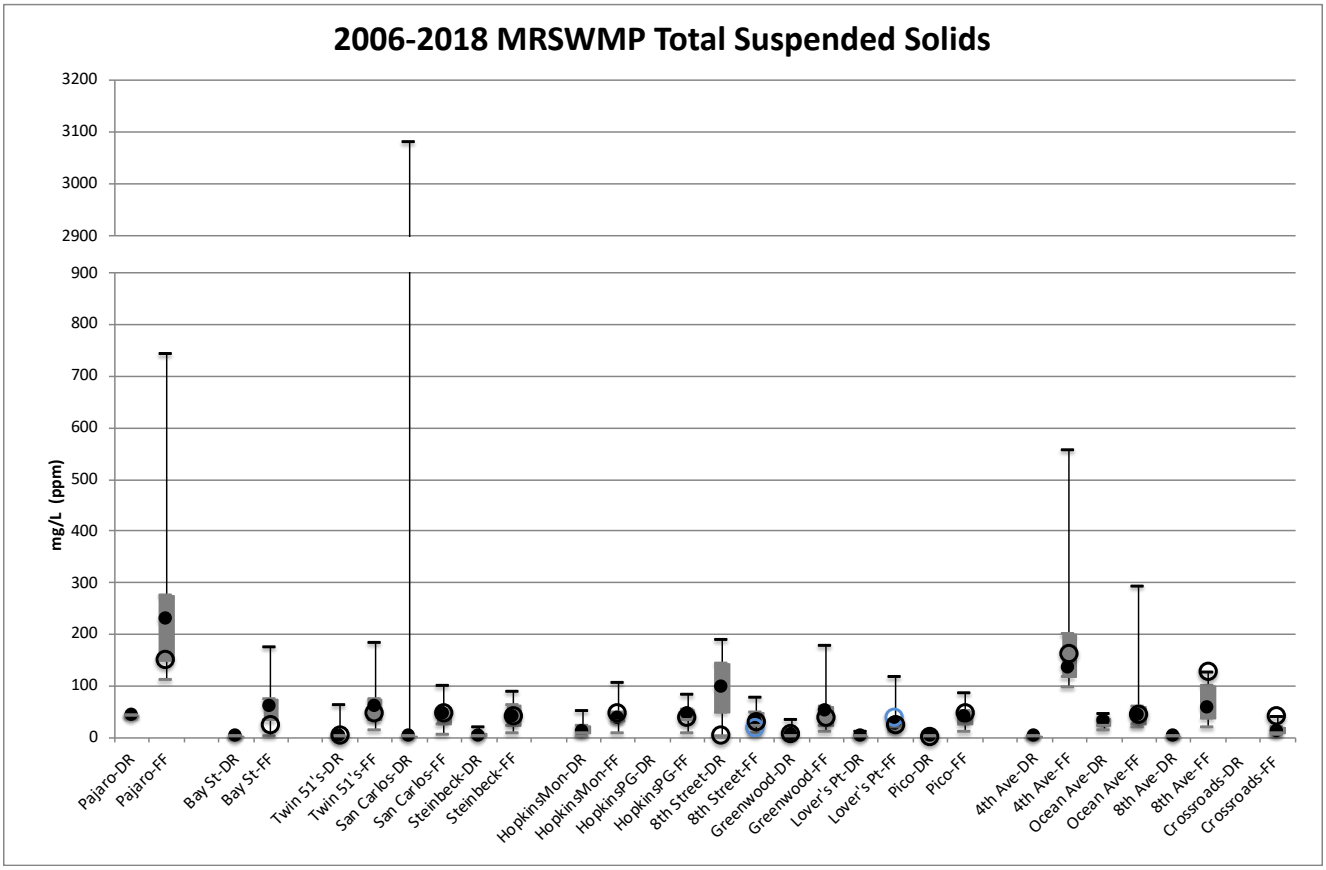

Figure 17. 2006-2018 MRSWMP TSS results. To better illustrate results, the scale on the graph is split between 900 and 2900 mg/L. As a result, the Dry Run 2007 result of 3080 mg/L from San Carlos (Monterey) is in the top portion of the graph. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed 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 have different methodologies for analysis.

The Action Level for turbidity provided by the State Board in the General Permit is not greater than 1000 NTU. As a comparison CCAMP lists turbidity to be not greater than 25 NTU; the CCAMP Action Level will be used for this set of data as it is more protective of water quality. The MDL for the Dry Run and First Flush was 0.1 NTU. Figure 18 represents all MRSWMP turbidity data since 2013. All outfall results are listed in Appendix 2.

- **Dry Run** results: All sites were below the Action Level in 2018.
- **First Flush** results: Twelve of the monitored sites (80%) were above the Action Level in 2018. The highest average result of 118 NTU was from Pajaro (Monterey County).

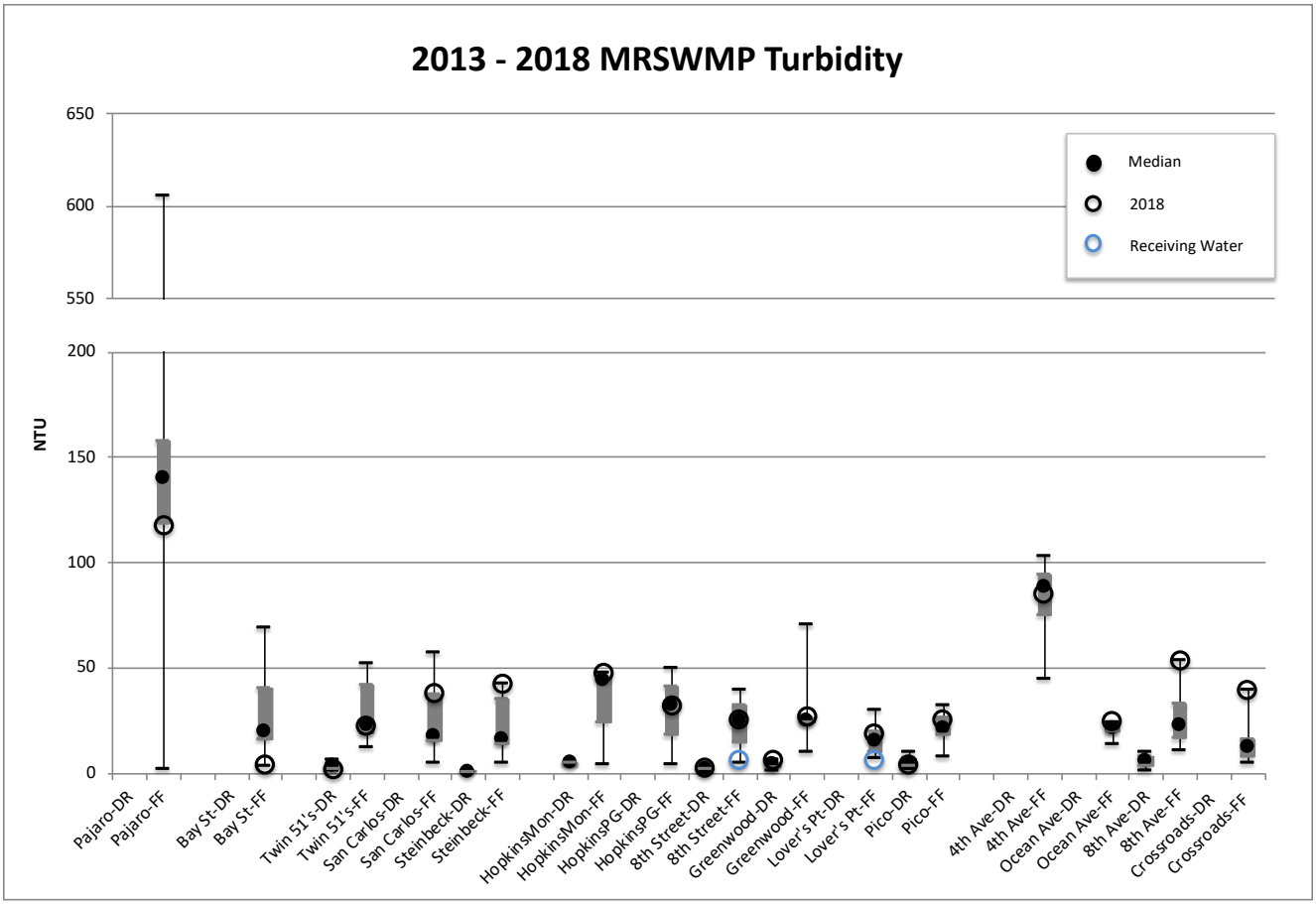

Figure 18. 2013- 2018 MRSWMP turbidity results. To better illustrate results, the scale on the graph is split between 200 and 550 NTU. As a result, the First Flush 2017 result of 606 NTU from Pajaro (Monterey County) is in the top portion of the graph. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. 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 or WQO, urea concentrations are compared between sites. The MDL for urea was 10 µg/L for the Dry Run and First Flush. Figure 19 represents all MRSWMP urea data since 2006. During the First Flush urea was collected during the first time series only; results shown in Figure 19 are not averaged. All outfall results are listed in Appendix 2.

- **Dry Run** results: In 2018 the highest urea result of 587 µg/L was from 8th Street (Pacific Grove). One site, Pico (Pacific Grove), had a non-detect.

- **First Flush** results: In 2018 the highest result of 1120 µg/L was from HopkinsMon (Monterey).

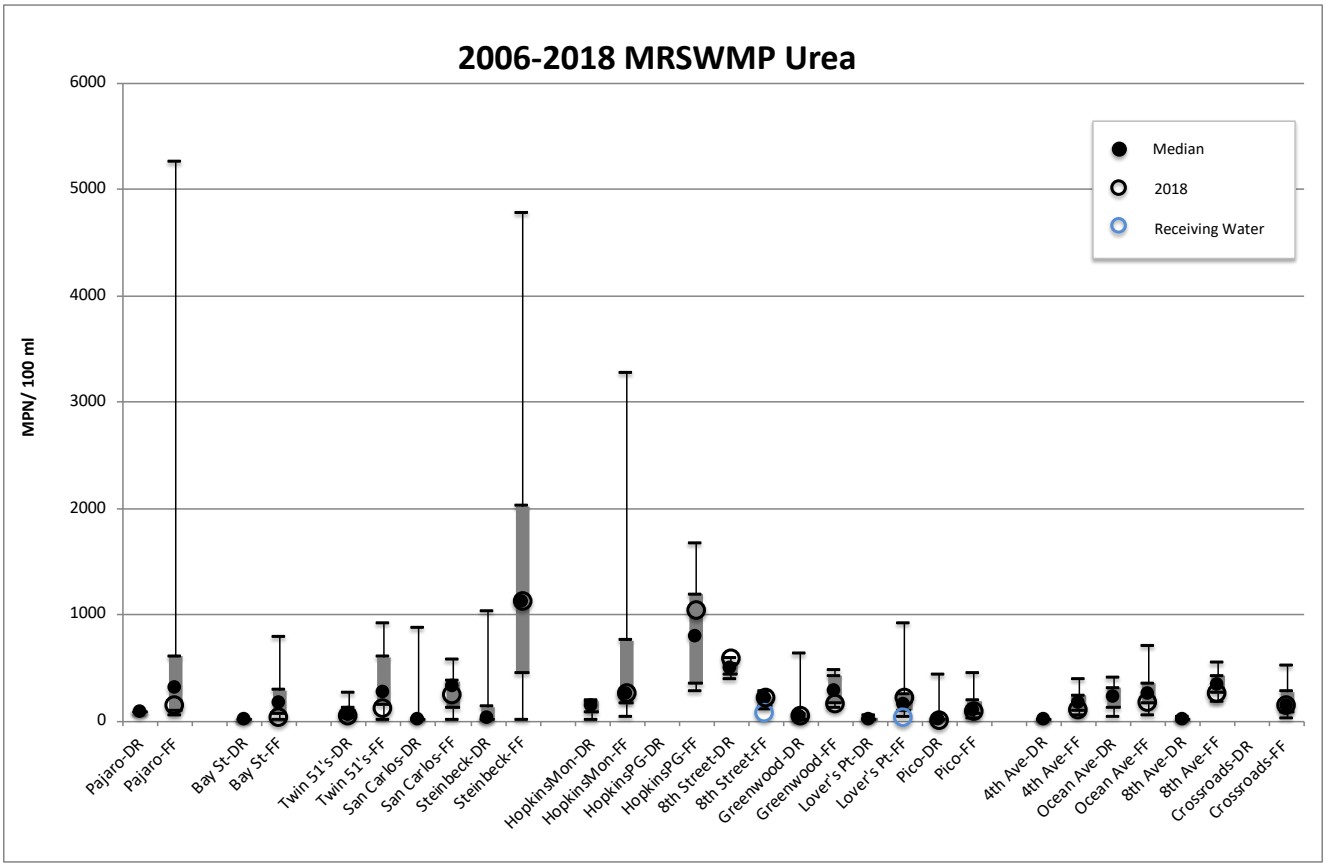

Figure 19. 2006–2018 MRSWMP urea results. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Zinc

Zinc is toxic to marine organisms causing reduced reproduction, developmental deformities and mortality. Zinc and other heavy metal toxicity can be mitigated by the presence of sediment or other binding compounds that may reduce the metal's bioavailability. Zinc sources in urban runoff include tires, paint, and outdoor zinc surfaces such as galvanized surfaces.

The Basin Plan WQO for total zinc is 200 µg/L. The zinc MDL was 10 µg/L for both the Dry Run and First Flush. Figure 20 represents all MRSWMP zinc data since 2006. All outfall results are listed in Appendix 2.

- **Dry Run** results: No sites were above the WQO in 2018. Three outfall sites had non-detects: Pico (Pacific Grove), Greenwood Park (Pacific Grove), and 8th Street (Pacific Grove).

- **First Flush** results: Four sites (27%) were above the WQO in 2018. The highest average result of 275 µg/L was from HopkinsPG (Pacific Grove).

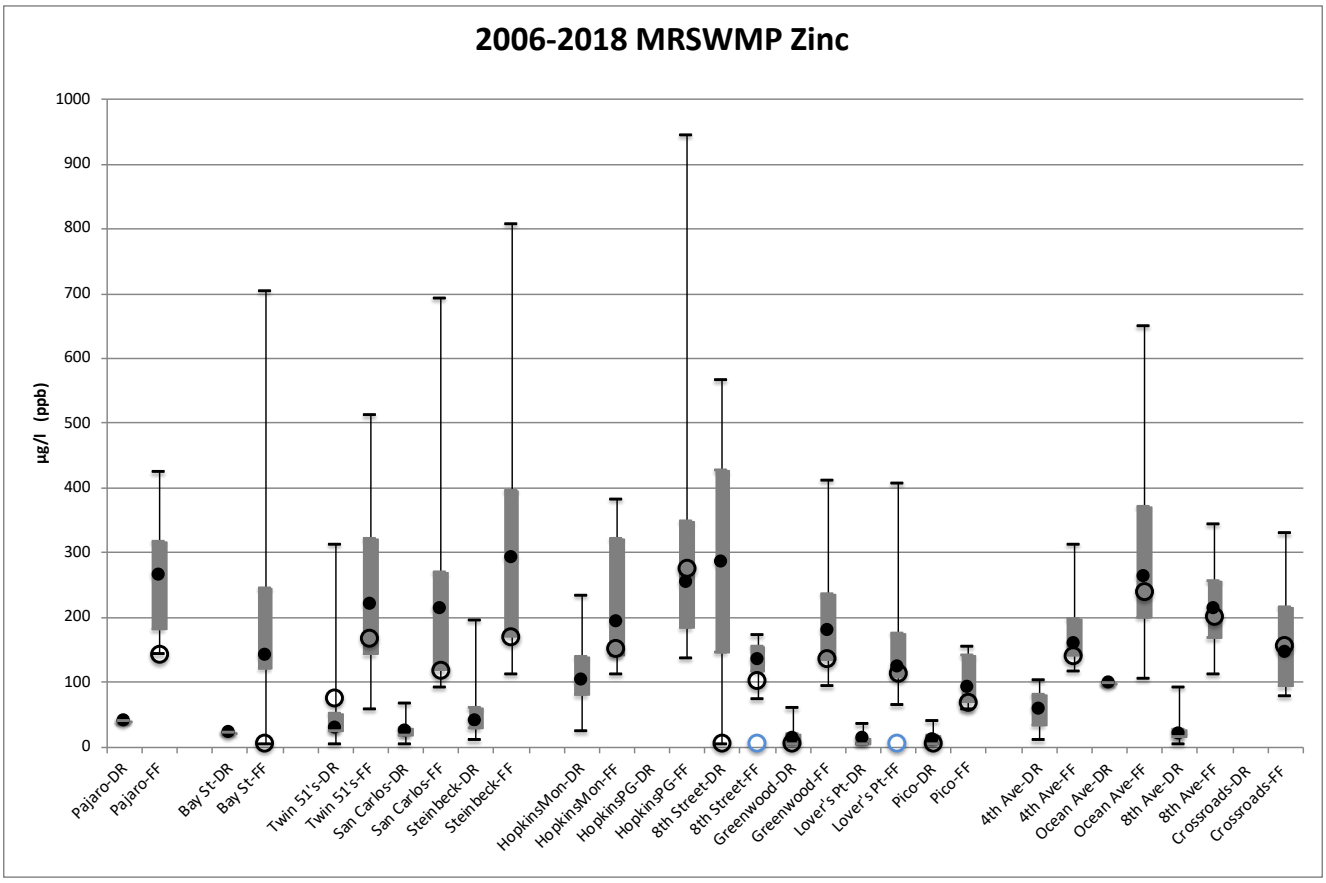

Figure 20. 2006-2018 MRSWMP zinc results. Non-detects were given the value of half the Minimum Detection Limit (MDL) but their true value lies between the zero and the MDL. Sites are listed north to south.

Results by Jurisdiction

The following section is broken out by city or county for this permit year.

Carmel

For the 2018-2019 permit year, three sites were monitored in Carmel: 4th Avenue, Ocean Avenue and 8th Avenue. There was no flow at any of the three sites for the Dry Run.

For the First Flush:

- *E. coli* and enterococcus exceeded the U.S. EPA WQO in all samples at all sites.
- Copper exceeded the Basin Plan WQO in all samples at all sites. The 2018 MRSWMP highest copper single sample results and overall average were from 4th Avenue with results of 110 µg/L, 216 µg/L respectively and an average of 163 µg/L.
- MBAS surfactants exceeded the Basin Plan WQO in all samples at all sites. The 8th Avenue site had the highest overall average for the 2018 MRSWMP monitoring with a result of 0.92 mg/L.
- Orthophosphate exceeded the CCAMP Action Level in all samples at all sites.
- Potassium exceeded the SWRCB General Permit WQO in only one sample: the second sample at 8th Avenue with a result of 20.9 mg/L.
- Turbidity exceeded the Action Level for both samples at 4th Avenue and one sample at each of Ocean Avenue and 8th Avenue.
- Zinc exceeded the Basin Plan WQO in the first time series samples at Ocean and 8th Avenues.
- Ammonia, color, hardness, lead, nitrate as N, total suspended solids, and turbidity were all below WQOs and Action Levels for both time series samples at all sites.

All 2018 outfall results can be found in Appendix 2 and by jurisdiction in Appendix 3.

Monterey

For the 2018-2019 permit year, three sites were monitored: Twins, San Carlos, and Steinbeck. Twins was the only Monterey site that had flowing water during the Dry Run.

For the Dry Run (Twins Only):

- *E. coli* and enterococcus results were above the U.S. EPA WQOs at Twins.
- No other Action Levels or WQOs were exceeded during the Dry Run for any other analytes.

During the First Flush:

- *E. coli* and enterococcus exceeded the U.S. EPA WQO in all samples at all Monterey sites.
- Copper exceeded the Basin Plan WQO in all samples from San Carlos and Steinbeck. There were no exceedences at Twins.
- MBAS detergents exceeded the Basin Plan WQO in all samples at all Monterey sites.
- Orthophosphate exceeded the CCAMP Action Level in all samples at all Monterey sites. Steinbeck had the highest average of all 2018 MRSWMP sites with a result of 1.50 mg-P/L.
- Turbidity exceeded the CCAMP Action Level in all samples from San Carlos and one sample each from Twins and Steinbeck.

- Zinc exceeded the RWQCB Basin Plan WQO for all samples from Steinbeck. There were no exceedances at Twins or San Carlos.
- Ammonia, color, hardness, lead, nitrate as N, potassium, and total suspended solids were all below WQOs and Action Levels for both time series samples at all sites.

All 2018 outfall results can be found in Appendix 2 and by jurisdiction in Appendix 3.

Monterey County

For the 2018-2019 permit year, two sites were monitored: Pajaro and Crossroads. There was no flow at either site during the Dry Run.

During the First Flush:

- *E. coli* and enterococcus exceeded the U.S. EPA WQO in all samples at both Monterey County sites.
- Copper exceeded the Basin Plan WQO for one sample at each site, but not in overall averages.
- MBAS surfactants exceeded the RWQCB Basin Plan WQO in one sample at Pajaro and both samples from Crossroads.
- Orthophosphate exceeded the CCAMP Action Level in one sample at Pajaro and both samples from Crossroads.
- Turbidity exceeded the CCAMP Action Level for all samples at both sites. Pajaro had the highest individual results and the highest average of all 2018 MRSWMP samples.
- Ammonia, color, hardness, lead, nitrate as N, potassium, total suspended solids, and zinc results did not exceed WQOs or Action Levels for any samples during the First Flush.

All 2018 outfall results can be found in Appendix 2 and by jurisdiction in Appendix 3.

Pacific Grove

For the 2018-2019 permit year, six sites were monitored: HopkinsMon, HopkinsPG, 8th Street, Greenwood Park, Lovers, and Pico. Hopkins Mon, Hopkins PG, 8th Street, Greenwood Park, and Lovers are included in a dry weather diversion that diverts dry weather urban runoff typically from April to October to Monterey One Water for treatment. In recent years, the diversion has been left on for early season rain events. For the 2018 Dry Run and First Flush, the diversion remained in operation but for reasons already explained, samples were collected at the following sites; 8th Street, Greenwood Park, and Pico (outside of the diversion area)during the Dry Run. All sites were sampled during the First Flush, but for the sites connected to the diversion, the water that was sampled was overflowing the diversion system and with the majority of runoff treated at M1W.

For the Dry Run (8th Street, Greenwood Park, and Pico):

- *E. coli* was above the U.S. EPA WQO at two sites: 8th Street and Greenwood Park. The highest *E. coli* result for all MRSWMP 2018 sites of >24,196 MPN/100 ml was from 8th Street.
- Enterococcus was above the U.S. EPA WQO at two sites: 8th Street and Greenwood Park. The highest result for all MRSWMP 2018 sites of 15,531 MPN/100 ml was from Greenwood Park.
- Nitrate exceeded the Action Level in only one site; 8th Street, with a result of 2.6 mg/L.

- Orthophosphate exceeded the Action Level at only one site; 8th Street, with a result of 0.20 mg/L.

During the First Flush:

- Each site had at least one sample in which copper results exceeded the RWQCB Basin Plan WQO.
- *E. coli* exceeded the U.S. EPA WQO in all samples at all sites. Pico had the highest average result for all 2018 MRSWMP sites at 191,660 MPN/100 ml. Pico also had the lowest *E.coli* result during the Dry Run.
- Enterococcus exceeded the U.S. EPA WQO in all samples at all sites. Pico had the highest average result for all 2018 MRSWMP sites at 169,995 MPN/100 ml. Pico also had the lowest enterococcus result during the Dry Run.
- MBAS surfactants exceeded the RWQCB Basin Plan WQO for all samples at all sites.
- Orthophosphate exceeded the CCAMP Action Level in all samples at all sites.
- Average turbidity results exceeded the CCAMP Action Level for all sites, except Lovers. Most sites exceeded the action level for just one sample, however HopkinsMon exceeded the Action Level for both samples.
- Zinc exceeded the RWQCB Basin Plan WQO only at HopkinsPG and was the highest of all 2018 MRSWMP sites in sample results (284 µg/L and 265 µg/L), and overall average (275 µg/L).
- Ammonia, color, hardness, lead, nitrate as N, potassium, and total suspended solids were all below WQOs and Action Levels for both time series samples at all sites.

All 2018 outfall results can be found in Appendix 2 and by jurisdiction in Appendix 3.

Seaside and Sand City

For the 2018-2019 permit year, Bay Street was the only site monitored, and as in past years, this site had no flow for the Dry Run monitoring event.

During the First Flush:

- *E. coli* and enterococcus exceeded the U.S. EPA WQO for all samples.
- Hardness exceeded the WQO for both samples (5700 mg/L and 6240 mg/L) as well as overall average at 5970 mg/L.
- Copper, lead, and zinc were all non-detects for both samples.
- Orthophosphate exceeded the CCAMP Action Level in only the first time series sample.
- Potassium exceeded the NPDES MS4 Permit WQO. Bay Street had the highest individual sample results (335 mg/L and 366 mg/L) as well as the highest average for all 2018 MRSWMP sites (351 mg/L).
- Ammonia, color, copper, hardness, lead, MBAS surfactants, nitrate as N, total suspended solids, turbidity, and zinc results did not exceed any WQOs or Action Levels for any samples.

All 2018 outfall 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 that discharge into the ocean. The outfall sites monitored as part of the MRSWMP program are sites that provide a good representation of water quality throughout a jurisdiction and in some cases have been monitored for many years. For 2018- 2019 permit year, fifteen outfall sites were monitored for the Dry Run and the First Flush in six jurisdictions: Monterey County, Seaside/Sand City, Monterey, Pacific Grove and Carmel-by-the-Sea.

In past years, approximately half of the MRSWMP outfall sites did not flow during the dry weather months. This year, four (27%) of the fifteen storm drains outfalls had flow for the Dry Run: Twins (Monterey), 8th Street (Pacific Grove), Greenwood Park (Pacific Grove), and Pico (Pacific Grove). Dry weather data can be an indicator of the effectiveness of storm water programs. More dry sites during the Dry Run and reduction of concentrations of pollutants in the runoff are indicators of a successful program. Dry weather monitoring also allows for tracking potential sources of contamination in discharges. While wet weather samples do indicate the worst-case scenario of high pollutant concentrations discharging into the ocean after months of accumulating on the land, it is important to identify how sub-watersheds compare to each other and if they should be prioritized for follow up investigation during dry weather months.

The First Flush event provides an understanding of the types of pollutants flowing into Monterey Bay National Marine Sanctuary after months of dry weather during which contaminants accumulate on streets, roofs, and parking lots. 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

Jurisdiction	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 & Sand City	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	PGSD-09	HopkinsMon	40.7	45% residential 30% commercial 25% public /other	PG-41	
Pacific Grove	PGSD-08	HopkinsPG			PG-40	
Pacific Grove	PGSD-01	8th Street	35	100% residential	PG-32	
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	240	54% residential 1% commercial 20% other	PG-22	54"
Pacific Grove	PGSD-04	Pico	17.56	60% residential 40% public	PG-03	40"
Carmel	CASD-01	4th Avenue	128.0	86% residential 7% comm/ res 7% public/ other	C-1	36"x60" box culvert
Carmel	CASD-02	Ocean Avenue	115.2	22% commercial 71% residential 7% comm/ res	C-2	24"
Carmel	CAS-03	8th Avenue	44.8	58% residential 27% comm/ res 13% commercial 1% public/ other	C-3	24"
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. Shaded boxes indicate that the General Permit Action Level of 50 mg/L was exceeded; NA= Not Analyzed; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP monitoring for this analyte.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013
Pajaro	0.25	NF	0.51	NF	2.90	NF	0.31	NF	0.44	NF	NF	0.23	NA	NF
Bay St	0.15	NF	0.93	NF	0.39	NF	0.53	NF	0.37	NF	NF	0.13	NA	NF
Twin 51's	0.95	ND	0.92	0.9	0.32	0.44	0.69	0.34	0.72	0.07	0.06	0.10	NA	NA
San Carlos	0.25	NF	0.47	NF	0.26	NF	0.35	NF	0.86	NF	NF	0.14	NA	NF
Steinbeck	3.30	NF	4.63	NF	2.76	NF	3.79	NF	10.46	0.09	0.08	0.61	NA	NF
HopkinsMon	0.45	NF	0.98	1.1	0.33	NF	--	--	--	--	--	--	--	--
HopkinsPG	4.95	NF	0.45	NF	1.66	NF	--	--	--	--	--	--	--	--
8th Street	0.70	0.30	0.41	NF	0.32	NF	--	--	--	--	--	--	--	--
Greenwood	0.45	0.10	0.41	ND	0.36	0.26	0.78	ND	1.57	0.21	0.11	NS	NA	NA
Lover's	0.40	NF	0.39	NF	0.33	NF	0.49	NF	1.18	NF	NF	NS	NA	NF
Pico	0.40	ND	0.29	ND	0.29	ND	0.68	ND	0.94	ND	ND	0.11	NA	NA
4th Avenue	0.45	NF	0.13	NF	0.84	NF	0.53	NF	--	--	NF	NS	NS	NF
Ocean	1.00	NF	0.65	NF	0.73	NF	0.59	NF	--	--	NF	NS	NA	NF
8th Avenue	0.85	NF	0.71	ND	0.84	NF	0.73	NF	--	--	NF	NS	NS	NA
Crossroads	0.35	NF	0.29	NF	0.18	NF	0.18	NF	0.46	NF	NF	0.12	NA	NF

Color

Comparison of color results for MRSWMP monitoring, reported in Color Units. Shaded boxes indicate that the General Permit action level of 500 color units was exceeded. ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP monitoring of this analyte.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	SuR 2014	SF 2014	FF 2013	DR 2013
Pajaro	85	NF	1125	NF	255	NF	400	NF	300	NF	500	625	NF
Bay St	18	NF	200	NF	60	NF	65	NF	305	NF	70	250	NF
Twin 51's	100	20	250	19	40	24	85	30	185	30	50	225	24
San Carlos	98	NF	250	NF	44	NF	50	NF	315	NF	70	225	NF
Steinbeck	110	NF	200	NF	75	NF	63	NF	340	33	70	225	NF
HopkinsMon	125	NF	150	32	80	NF	--	--	--	--	--	--	--
HopkinsPG	125	NF	200	NF	80	NF	--	--	--	--	--	--	--
8th Street	125	40	175	NF	50	NF	--	--	--	--	--	--	--
Greenwood	125	50	250	10	60	30	100	25	315	20	NS	250	60
Lover's	200	NF	175	NF	42	NF	75	NF	250	NF	NS	300	NF
Pico	200	40	225	8	70	60	175	50	225	40	167	250	44
4th Avenue	275	NF	375	NF	213	NF	400	NF	--	NF	NS	NS	NF
Ocean	175	NF	250	NF	80	NF	73	NF	--	NF	NS	300	NF
8th Avenue	200	NF	225	14	100	NF	100	NF	--	NF	NS	NS	7
Crossroads	125	NF	300	NF	40	NF	20	NF	100	NF	70	75	NF

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; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP monitoring. The table is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	30	NF	79	NF	62	NF	27	NF	32	NF	NF	42	51	NF	NF	32	44	NF
Bay St	ND	NF	81	NF	28	NF	26	NF	106	NF	NF	21	88	NF	NF	48	28	NF
Twin 51's	24	ND	65	19	22	13	27	27	76	11	ND	ND	75	16	13	16	46	10
San Carlos	58	NF	72	NF	21	NF	25	NF	121	NF	NF	24	86	NF	12	--	--	NF
Steinbeck	59	NF	499	NF	52	NF	39	NF	248	4	ND	21	113	NF	12	37	147	6
HopkinsMon	34	NF	52	32	27	NF	--	--	--	--	--	--	--	--	25	NS	NS	NS
HopkinsPG	40	NF	52	NF	32	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NS
8th Street	39	ND	43	NF	26	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	32	ND	41	10	16	4	22	8	58	ND	ND	NS	52	6	ND	NS	24	ND
Lover's	36	NF	47	NF	19	NF	24	NF	68	NF	NF	NS	92	NF	NF	NS	36	NF
Pico	55	ND	27	8	29	5	30	ND	61	ND	ND	28	75	6	7	26	28	ND
4th Avenue	163	NF	46	NF	86	NF	73	NF	--	--	NF	NS	NS	NF	NF	NS	86	NF
Ocean	138	NF	111	NF	95	NF	58	NF	--	--	NF	NS	248	NF	NF	NS	87	NF
8th Avenue	139	NF	77	14	108	NF	86	NF	--	--	NF	NS	NS	6	14	NS	NS	NF
Crossroads	30	NF	15	NF	17	NF	10	NF	35	NF	NF	ND	18	NF	NF	7	40	NF

Copper continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	28	NF	NF	NF	73	NF	NF	NF	44	9	93	NF	--	--	--	--
Bay St	NF	NF	52	NF	NF	4	65	NF	NF	NF	126	NF	42	NF	50	NF	ND	NF
Twin 51's	16	8	52	9	5	11	99	12	20	6	78	11	69	7	60	5	92	ND
San Carlos	14	13	65	8	4	8	124	26	10	7	77	16	84	18	73	11	139	ND
Steinbeck	31	20	77	9	8	18	352	15	12	10	148	6	126	185	83	17	125	ND
HopkinsMon	22	NS	27	NF	9	16	72	18	24	25	79	86	49	54	57	NF	89	NF
HopkinsPG	NF	NS	35	NF	NF	NF	176	NF	NF	NF	77	NF	63	NF	47	NF	--	--
8th Street	NF	11	NF	NF	17	13	64	134	NF	NF	59	NF	49	NF	55	NF	49	NF
Greenwood	8	12	38	10	17	13	56	5	9	25	44	6	44	17	46	3	41	ND
Lover's	NF	9	40	NF	4	10	14	5	5	7	54	ND	51	4	48	ND	57	NF
Pico	10	11	43	6	ND	10	62	7	11	9	45	5	37	12	44	ND	33	ND
4th Avenue	NF	NF	96	11	NF	10	101	NF	NF	NF	183	NF	53	NF	152	NF	--	--
Ocean	72	NF	165	NF	NF	NF	395	NF	69	NF	184	NF	148	NF	212	NF	--	--
8th Avenue	7	21	114	6	4	8	172	5	7	5	166	ND	170	6	148	14	--	--
Crossroads	NF	NF	11	NF	NF	NF	55	NF	NF	NF	44	NF	--	--	--	--	--	--

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 monitoring. The table is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	142739	NF	15112	NF	20660	NF	4693	NF	7617	NF	NF	860	3163	NF	NF	618	8766	NF
Bay St	20679	NF	72839	NF	21026	NF	38969	NF	94500	NF	NF	6488	148335	NF	NF	241960	43518	NF
Twin 51's	56879	1223	9267	1610	42755	141361	53713	198629	60200	6152	3106	9208	67265	4978	2878	4962	72294	296
San Carlos	39043	NF	10148	NF	8044	NF	13973	NF	138000	NF	NF	4106	3475	NF	5206	NS	NS	NF
Steinbeck	17915	NF	20999	NF	27860	NF	25024	NF	65300	3836	196	21870	88662	NF	34658	241960	130847	2500
HopkinsMon	36806	NF	25589	242000	12246	NF	--	--	--	--	--	--	--	--	3316	NS	NS	NS
HopkinsPG	24422	NF	29093	NF	36606	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NS
8th Street	26491	>24196	33673	NF	12885	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	45590	24196	146841	2920	19105	1153	41922	28272	36590	6152	5510	NS	19585	39726	1980	NS	35076	31062
Lover's	42692	NF	8712	NF	14634	NF	28761	NF	60200	NF	NF	NS	30745	NF	NF	NS	42288	NF
Pico	191660	52	7121	880	35076	30	25572	<20	42603	402	2092	4884	58030	244	40	3214	37769	1720
4th Avenue	40029	NF	49134	NF	38799	NF	46181	NF	--	--	NF	NS	NS	NF	NF	NS	45645	NF
Ocean	70778	NF	27508	NF	23084	NF	32817	NF	--	--	NF	NS	16250	NF	NF	NS	28322	NF
8th Avenue	41370	NF	9462	13200	15252	NF	43788	NF	--	--	NF	NS	NS	<20	82	NS	NS	NF
Crossroads	26180	NF	743	NF	2020	NF	14265	NF	94500	NF	NF	703	1095	NF	NF	296	76395	NF

E. coli continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	16075	NF	NF	NF	2050	NF	NF	NF	4681	40	15186	NF	--	--	--	--
Bay St	NF	NF	44059	NF	NF	672	64900	NF	NF	NF	34162	NF	20277	NF	46464	NF	856	NF
Twin 51's	2289	17329	65081	7746	6152	19608	61300	13340	48384	12263	229170	296	83819	6150	165301	25993	185536	50
San Carlos	20	20	41525	20	40	20	40400	13734	244	149	8770	8212	17484	40	16304	218	14749	798
Steinbeck	653	218	241960	6511	194	126	145400	1974	398	220	90824	4494	112738	48400	40925	9768	158848	2602
HopkinsMon	169	NS	39726	NF	20	3912	29650	104	20	3912	19735	48392	3741	312	82782	NF	196179	NF
HopkinsPG	NF	NS	207625	NF	NF	NF	40300	NF	NF	NF	25994	NF	27742	NF	27742	NF	--	--
8th Street	NF	456	NF	NF	NF	456	20976	39726	4283	6511	77979	NF	26485	NF	14636	NF	50978	--
Greenwood	6511	1253	116644	6896	12976	10950	32700	1814	8212	2966	44059	1976	31528	13000	16767	11588	73322	20529
Lover's	NF	5510	48391	NF	6152	220	3807	82	82	3870	34659	170	24916	1390	60214	48384	172534	NF
Pico	20	40	32860	2802	80	61	15050	410	40	148	17063	104	204626	3840	155639	5818	43926	606
4th Avenue	NF	NF	105013	<20	NF	126	22400	NF	NF	NF	73916	NF	11413	NF	49590	NF	--	--
Ocean	1918	NF	41525	NF	NF	NF	9950	NF	10950	NF	34658	NF	9214	NF	43374	NF	--	--
8th Avenue	<20	20	167021	12263	104	20	38450	520	20	20	NA	80	36119	126	59067	82	--	--
Crossroads	NF	NF	44059	NF	NF	NF	25950	NF	NF	NF	NA	NF	--	--	--	--	--	--

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 monitoring. The table is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	33127		55711	NF	25545	NF	12311	NF	20013	NF	NF	7541	3163	NF	NF	6260	92342	NF
Bay St	39564		70697	NF	18458	NF	17265	NF	126500	NF	NF	17329	23415	NF	NF	12229	82392	NF
Twin 51's	20948	697	13590	74	14298	1470	25867	7746	37150	1417	1760	8164	21000	22398	942	6896	79326	492
San Carlos	8786		10884	NF	7921	NF	18471	NF	79650	NF	NF	8164	4825	NF	374	NS	NS	NF
Steinbeck	54175		43561	NF	13667	NF	56518	NF	54200	4962	270	34480	88662	NF	48392	43517	241957	1587
HopkinsMon	37138		14088	300	19241	NF	--	--	--	--	--	--	--	--	12976	NS	NS	NS
HopkinsPG	46308		21426	NF	18168	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NS
8th St	54750	2755	76523	NF	8704	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	109490	15531	102024	11200	16001	40	40794	20925	41950	4374	2290	NS	20880	8704	1226	NS	81461	14540
Lover's	46662		17090	NF	18572	NF	119844	NF	20768	NF	NF	NS	127750	NF	NF	NS	95634	NF
Pico	169995	31	7980	328	13415	416	29926	<20	23118	83	3978	15650	9005	322	746	7308	70697	583
4th Avenue	27521		24825	NF	7039	NF	22801	NF	--	--	NF	NS	NS	NF	NF	NS	14554	NF
Ocean	55079		13744	NF	11051	NF	14901	NF	--	--	NF	NS	9665	NF	NF	NS	55607	NF
8th Avenue	44622		11072	5480	7607	NF	25451	NF	--	--	NF	NS	NS	104	974	NS	NS	NF
Crossroads	37762		4892	NF	2607	NF	8083	NF	1530	NF	NF	1434	1095	NF	NF	559	241960	NF

Enterococcus continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	80189	NF	NF	NF	339000	NF	NF	NF	51797	6339	100612	NF	--	--	--	--
Bay St	NF	NF	47396	NF	NF	20	70700	NF	NF	NF	90327	NF	13650	NF	13435	NF	341	--
Twin 51's	431	1587	67477	346	5819	2306	108150	970	498	2669	111501	125	139002	8700	57609	39726	227516	--
San Carlos	20	313	48391	346	40	146	34450	4196	9768	1918	38751	531	67560	62	25993	20	63487	--
Steinbeck	16328	4494	241957	16328	2184	393	12100	3232	976	1249	241960	16328	193983	48400	112902	14540	241960	--
HopkinsMon	242	NS	63725	NF	747	700	38000	148	172	917	47619	48291	31828	292	91787	NF	--	--
HopkinsPG	NF	NS	241957	NF	NF	NF	116000	NF	NF	NF	157330	NF	84778	NF	16523	NF	--	--
8th St	NF	218	NF	NF	12976	242	85350	10950	NF	NF	95062	NF	75211	NF	29202	NF	66298	--
Greenwood	25993	1024	173291	8703	13733	1625	75150	1918	2792	1188	111501	3571	76803	5820	29372	17382	62567	--
Lover's	NF	1352	116644	NF	3571	521	15372	82	104	10950	88435	104	87231	4130	39739	18416	99442	--
Pico	40	61	101332	126	20	20	33550	1210	512	220	33310	583	155638	8210	81652	1760	43965	--
4th Avenue	NF	NF	176971	20	NF	20	21650	NF	NF	NF	40438	NF	25567	NF	3328	NF	--	--
Ocean	17329	NF	41125	NF	NF	NF	33900	NF	81640	NF	48392	NF	100120	NF	3381	NF	--	--
8th Avenue	20	20	84547	4564	82	187	43700	100	40	40	NA	220	36000	942	6168	436	--	--
Crossroads	NF	NF	116723	NF	NF	NF	60200	NF	NF	NF	NA	NF	--	--	--	--	--	--

Hardness

Comparison of hardness results for MRSWMP monitoring reported in mg/L. Shaded boxes indicate that the General Permit Action Level of less than or equal to 10 mg/L or greater than or equal to 2000 mg/L was exceeded; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP monitoring.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013
Pajaro	40	NF	103	NF	101	NF	41	NF	45	NF	NF	50	102	NF
Bay St	5970	NF	922	NF	23	NF	28	NF	48	NF	NF	21	120	NF
Twin 51's	57	699	55	429	39	905	53	248	93	910	682	19	119	360
San Carlos	53	NF	64	NF	32	NF	34	NF	57	NF	NF	23	100	NF
Steinbeck	39	NF	64	NF	33	NF	29	NF	47	224	281	17	52	NF
HopkinsMon	53	NF	54	626	51	NF	--	--	--	--	--	--	--	--
HopkinsPG	63	NF	43	NF	42	NF	--	--	--	--	--	--	--	--
8th Street	57	373	102	NF	31	NF	--	--	--	--	--	--	--	--
Greenwood	55	400	46	456	23	376	35	298	45	314	289	NS	114	341
Lover's	66	NF	57	NF	31	NF	20	NF	48	NF	NF	NS	135	NF
Pico	51	179	39	223	36	179	62	161	60	161	192	18	75	163
4th Avenue	90	NF	36	NF	58	NF	44	NF	--	--	NF	NS	NS	NF
Ocean	68	NF	36	NF	25	NF	25	NF	--	--	NF	NS	105	NF
8th Avenue	106	NF	38	326	40	NF	40	NF	--	--	NF	NS	NS	277
Crossroads	29	NF	14	NF	20	NF	9	NF	18	NF	NF	9	28	NF

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. The table below is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	7	NF	32	NF	14	NF	16	NF	14	NF	NF	24	16	NF	NF	22	20	NF
Bay St	ND	NF	11	NF	8	NF	7	NF	44	NF	NF	10	20	NF	NF	9	8	NF
Twin 51's	12	0.3	15	ND	15	ND	15	ND	12	ND	ND	ND	31	ND	ND	ND	23	ND
San Carlos	8	NF	8	NF	ND	NF	5	NF	23	NF	NF	10	8	NF	ND	NS	NS	NF
Steinbeck	9	NF	5	NF	ND	NF	ND	NF	15	ND	ND	8	ND	NF	ND	ND	7	ND
HopkinsMon	5	NF	8	2	ND	NF	--	--	--	--	--	--	--	--	ND	NS	NS	NA
HopkinsPG	3	NF	6	NF	ND	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
8th St	5	0.5	9	NF	ND	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	7	ND	15	ND	ND	ND	9	ND	11	ND	ND	NS	8	ND	ND	NS	4	ND
Lover's	4	NF	6	NF	4	NF	6	NF	11	NF	NF	NS	6	NF	NF	NS	6	NF
Pico	2	0.2	6	ND	ND	ND	5	ND	ND	ND	17	8	6	ND	ND	ND	ND	ND
4th Avenue	15	NF	10	NF	24	NF	32	NF	--	--	NF	NS	NS	NF	NF	NS	23	NF
Ocean	5	NF	6	NF	ND	NF	11	NF	--	--	NF	NS	9	NF	NF	NS	11	NF
8th Avenue	11	NF	9	1	9	NF	28	NF	--	--	NF	NS	NS	ND	ND	NS	NS	NF
Crossroads	ND	NF	1	NF	ND	NF	ND	NF	ND	NF	NF	31	ND	NF	NF	ND	ND	NF

Lead Continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	17	NF	NF	NF	34	NF	NF	NF	24	ND	63	NF	--	--	--	--
Bay St	NF	NF	16	NF	NF	ND	28	NF	NF	NF	33	NF	14	NF	15	NF	ND	NF
Twin 51's	ND	ND	ND	ND	ND	ND	44	ND	ND	ND	8	ND	17	5	36	5	13	ND
San Carlos	ND	ND	22	ND	ND	ND	22	1	ND	ND	6	ND	6	5	18	5	11	ND
Steinbeck	ND	ND	13	ND	ND	ND	9	1	ND	ND	7	ND	6	5	22	5	7	ND
HopkinsMon	ND	NS	14	NF	ND	ND	9	ND	ND	ND	21	10	7	5	9	NF	10	NF
HopkinsPG	NF	NS	13	NF	NF	NF	11	NF	NF	NF	7	NF	ND	NF	15	NF	--	--
8th St	NF	ND	NF	NF	6	ND	8	83	NF	NF	14	NF	ND	NF	12	NF	12	NF
Greenwood	ND	ND	20	ND	ND	ND	11	ND	ND	ND	6	ND	6	5	18	5	8	ND
Lover's	NF	ND	30	NF	ND	ND	3	ND	ND	ND	10	ND	7	5	16	5	9	NF
Pico	ND	ND	7	ND	ND	ND	6	ND	ND	ND	ND	ND	8	5	12	5	5	ND
4th Avenue	NF	NF	60	ND	NF	ND	22	NF	NF	NF	25	NF	15	NF	18	NF	--	--
Ocean	ND	NF	26	NF	NF	NF	8	NF	5	NF	ND	NF	6	NF	47	NF	--	--
8th Avenue	ND	ND	19	ND	ND	ND	11	ND	ND	ND	9	ND	6	5	13	5	--	--
Crossroads	NF	NF	ND	NF	NF	NF	ND	NF	NF	NF	ND	--	--	--	--	--	--	--

MBAS Detergents

Comparison of MBAS surfactant results for MRSWMP monitoring reported in mg/L. Shaded boxes indicate that the Basin Plan Water Quality Objective of 0.2 mg/L was exceeded; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP monitoring.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013
Pajaro	0.23	NF	0.44	NF	0.77	NF	0.21	NF	0.52	NF	NF	ND	1.12	NF
Bay St	0.17	NF	1.13	NF	0.51	NF	0.30	NF	0.77	NF	NF	ND	1.44	NF
Twin 51's	0.42	0.16	1.51	0.16	0.33	0.14	0.33	1.06	0.55	0.08	0.1	ND	0.31	0.05
San Carlos	0.55	NF	1.54	NF	0.33	NF	0.29	NF	0.94	NF	NF	ND	1.04	NF
Steinbeck	0.48	NF	0.71	NF	0.43	NF	0.36	NF	0.53	0.16	0.06	ND	0.42	NF
HopkinsMon	0.55	NF	1.12	0.59	0.50	NF	--	--	--	--	--	--	--	--
HopkinsPG	0.61	NF	1.08	NF	0.51	NF	--	--	--	--	--	--	--	--
8th Street	0.56	0.16	1.10	NF	0.43	NF	--	--	--	--	--	--	--	--
Greenwood	0.40	0.09	0.99	0.09	0.38	0.08	0.32	0.95	0.84	0.27	ND	NS	0.52	ND
Lover's	0.46	NF	0.60	NF	0.38	NF	0.25	NF	1.30	NF	NF	NS	0.65	NF
Pico	0.39	0.08	0.51	0.08	0.43	0.08	0.51	0.14	1.00	ND	0.06	ND	0.55	0.06
4th Avenue	0.48	NF	1.20	NF	0.37	NF	0.30	NF	--	--	NF	NS	NS	NF
Ocean	0.68	NF	0.80	NF	0.45	NF	0.26	NF	--	--	NF	NS	1.6	NF
8th Avenue	0.92	NF	0.99	0.14	0.50	NF	0.33	NF	--	--	NF	NS	NS	ND
Crossroads	0.86	NF	0.47	NF	0.55	NF	0.22	NF	0.39	NF	NF	ND	0.43	NF

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; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP monitoring. The table below is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	0.45	NF	0.53	NF	0.9	NF	0.35	NF	0.5	NF	NF	0.2	1.2	NF	NF	0.6	0.47	NF
Bay St	1.15	NF	0.83	NF	0.3	NF	0.45	NF	0.4	NF	NF	0.2	1.4	NF	NF	1.0	0.74	NF
Twin 51's	0.30	0.5	0.66	0.5	0.3	0.40	0.45	1.5	0.7	0.3	0.3	0.2	0.7	0.8	ND	0.2	0.44	0.73
San Carlos	0.50	NF	0.53	NF	0.3	NF	0.30	NF	0.6	NF	NF	0.2	0.9	NF	1.6	NS	NS	NF
Steinbeck	0.50	NF	2.78	NF	0.5	1.10	0.55	NF	1.1	0.4	1.7	0.2	1.3	NF	3.6	0.6	2.67	0.78
HopkinsMon	0.35	NF	0.59	0.5	0.4	NF	--	--	--	--	--	--	--	--	1.2	NS	NS	NS
HopkinsPG	1.45	NF	0.53	NF	0.9	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
8th St	0.45	2.6	0.41	NF	0.4	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	0.35	1.0	0.37	1.1	0.2	NF	0.45	1.4	0.7	0.9	0.8	NS	1.0	1.0	1.4	NS	0.79	2.09
Lover's	0.40	NF	0.47	NF	0.2	NF	0.25	NF	0.7	NF	NF	NS	1.0	NF	NF	NS	0.59	NF
Pico	0.25	1.0	0.39	0.9	0.2	0.90	0.35	0.9	0.7	2.4	1.9	ND	0.6	2.2	1.7	0.3	1.13	1.91
4th Avenue	0.55	NF	0.15	NF	0.5	NF	0.60	NF	--	--	NF	NS	NS	NF	NF	NS	0.43	NF
Ocean	0.65	NF	0.66	NF	0.3	NF	0.45	NF	--	--	NF	NS	1.8	NF	NF	NS	0.51	NF
8th Avenue	0.55	NF	0.72	ND	0.3	NF	0.55	NF	--	--	NF	NS	NS	2.2	2.5	NS	NS	NF
Crossroads	0.15	NF	0.30	NF	0.2	NF	0.20	NF	0.3	NF	NF	ND	0.5	NF	NF	0.05	0.59	NF

Nitrate as N continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	0.39	NF	NF	NF	1.12	NF	NF	NF	0.60	0.60	2.90	NF	--	--	--	--
Bay St	NF	NF	0.22	NF	NF	11.64	0.7	NF	NF	NF	0.40	NF	0.60	NF	0.69	NF	13.20	NF
Twin 51's	0.39	0.1	0.46	0.7	0.47	0.39	1.1	0.98	1.30	0.20	0.40	0.40	0.90	0.60	0.99	0.32	0.45	0.16
San Carlos	0.8	1.43	0.12	0.83	0.41	1.18	0.81	2.84	1.20	0.64	0.50	1.20	0.87	1.20	0.64	2.17	1.69	3.92
Steinbeck	2.45	2.97	0.28	ND	2.92	4.81	1.96	1.39	1.20	5.15	0.70	ND	1.10	0.10	0.79	1.07	1.72	4.71
HopkinsMon	1.29	NS	0.20	NF	1.25	1.76	1.5	1.35	1.30	1.80	0.50	1.40	0.87	0.70	1.59	NF	1.39	NF
HopkinsPG	NF	NS	0.31	NF	NF	NF	4.38	NF	NF	NF	2.70	NF	1.87	NF	0.60	NF	--	--
8th St	NF	0.95	NF	NF	1.83	1.05	0.87	1.99	NF	NF	0.80	NF	1.10	NF	0.48	NF	0.79	NF
Greenwood	1.01	1.07	0.13	1.54	1.05	0.93	0.9	1.47	1.30	1.35	0.60	1.10	0.97	1.90	0.66	3.00	0.78	2.17
Lover's	NF	1.06	0.12	NF	0.31	0.73	0.12	3.54	2.30	0.74	0.60	4.80	0.87	4.80	0.56	0.86	0.68	NF
Pico	1.55	1.09	0.1	1.12	0.65	0.92	0.81	0.82	0.90	0.76	0.60	1.00	0.83	1.50	0.54	2.04	0.61	1.03
4th Avenue	NF	NF	0.33	0.08	NF	0.43	1.07	NF	NF	NF	0.60	NF	0.77	NF	0.73	NF	--	--
Ocean	ND	NF	0.20	NF	NF	NF	1.58	NF	0.03	NF	0.20	NF	1.07	NF	0.71	NF	--	--
8th Avenue	4.31	3.36	0.31	3.19	2.73	2.64	1.94	2.92	3.60	3.63	0.20	2.60	1.40	0.10	0.91	2.17	--	--
Crossroads	NF	NF	0.11	NF	NF	NF	0.81	NF	NF	NF	0.30	NF	--	--	--	--	--	--

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; ND= Non-detect; NF= No Flow; NS= Not Sampled; -- = Not included in MRSWMP monitoring. The table below is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	0.15	NF	0.62	NF	0.9	NF	0.2	NF	0.4	NF	NF	0.20	0.70	NF	NF	0.10	0.46	NF
Bay St	0.15	NF	0.27	NF	0.4	NF	0.2	NF	0.2	NF	NF	0.10	0.40	NF	NF	ND	0.23	NF
Twin 51's	0.40	0.10	0.90	0.32	0.4	0.3	0.4	1.2	0.5	ND	ND	0.20	0.40	ND	0.20	0.10	0.31	0.11
San Carlos	0.30	NF	0.49	NF	0.3	NF	0.2	NF	0.3	NF	NF	ND	0.40	NF	ND	NS	NS	NF
Steinbeck	1.50	NF	2.54	NF	1.2	NF	1.4	NF	2.8	0.2	0.10	0.50	4.20	NF	0.40	0.50	1.82	0.14
HopkinsMon	0.95	NF	0.74	0.16	0.3	NF	--	--	--	--	--	--	--	--	ND	NS	NS	NS
HopkinsPG	1.15	NF	0.61	NF	0.9	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NS
8th St	0.50	0.20	0.55	NF	0.4	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	0.40	0.10	0.48	ND	0.4	ND	0.7	ND	0.8	ND	ND	NS	0.70	ND	0.30	NS	0.37	0.13
Lover's	0.75	NF	1.66	NF	0.5	NF	0.3	NF	0.8	NF	NF	NS	1.10	NF	NF	NS	0.63	NF
Pico	0.40	ND	0.64	ND	0.5	ND	0.7	ND	1.0	ND	ND	0.10	0.90	ND	ND	ND	0.41	ND
4th Avenue	0.80	NF	0.60	NF	1.0	NF	0.6	NF	--	--	NF	NS	NS	NF	NF	NS	0.19	NF
Ocean	0.80	NF	1.15	NF	0.7	NF	0.4	NF	--	--	NF	NS	2.00	NF	NF	NS	0.67	NF
8th Avenue	0.90	NF	1.23	0.20	1.1	NF	0.6	NF	--	--	NF	NS	NS	ND	ND	NS	NS	NF
Crossroads	0.20	NF	0.38	NF	0.2	NF	0.1	NF	0.3	NF	NF	ND	0.20	NF	NF	ND	0.37	NF

Orthophosphate as P continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	0.17	NF	NF	NF	0.38	NF	NF	NF	0.31	0.90	0.50	NF	--	--	--	--
Bay St	NF	NF	0.17	NF	NF	ND	0.34	NF	NF	NF	0.31	NF	0.40	NF	0.09	NF	0.32	NF
Twin 51's	0.13	0.11	0.52	0.09	NF	0.11	0.94	ND	0.20	0.25	0.92	0.30	0.97	0.20	0.72	ND	0.56	0.35
San Carlos	ND	0.10	0.19	ND	ND	0.15	0.33	0.17	0.10	0.19	0.18	0.20	0.60	0.20	0.38	ND	0.46	ND
Steinbeck	0.31	0.15	0.98	ND	ND	0.10	7.01	0.32	0.30	0.35	2.48	0.30	3.77	3.10	2.69	0.09	3.01	0.38
HopkinsMon	ND	NS	0.22	NF	ND	ND	0.60	0.11	0.10	0.18	0.34	0.30	0.73	0.20	3.38	NF	2.37	NF
HopkinsPG	NF	NS	0.54	NF	NF	NF	1.79	NF	NF	NF	1.60	NF	1.80	NF	0.51	NF	--	--
8th St	NF	0.21	NF	NF	ND	0.12	0.46	0.60	NF	NF	0.56	NF	0.90	NF	0.52	NF	0.49	NF
Greenwood	ND	0.10	0.35	ND	ND	0.10	0.68	0.08	0.20	0.18	0.51	0.10	1.40	0.20	0.65	0.07	0.53	ND
Lover's	NF	0.13	0.41	NF	ND	0.18	0.18	0.12	0.20	0.32	0.70	0.10	1.30	0.20	0.93	ND	1.38	NF
Pico	ND	0.10	0.37	ND	ND	ND	0.58	ND	0.05	0.13	0.40	0.10	0.70	0.20	0.73	ND	0.44	ND
4th Avenue	NF	NF	0.32	ND	NF	ND	0.54	NF	NF	NF	0.78	NF	0.70	NF	1.24	NF	--	--
Ocean	0.19	NF	0.77	NF	NF	NF	1.18	NF	2.70	NF	0.81	NF	0.93	NF	0.77	NF	--	--
8th Avenue	ND	0.10	0.65	ND	1.44	ND	0.92	ND	ND	0.24	0.75	0.20	1.37	0.20	0.99	ND	--	--
Crossroads	NF	NF	0.16	NF	NF	NF	0.64	NF	NF	NF	0.31	NF	--	--	--	--	--	--

Potassium

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

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013
Pajaro	2.60	NF	5.0	NF	8.5	NF	3.8	NF	4.6	NF	NF	2.5	9	NF
Bay St	350.50	NF	55.0	NF	2.8	NF	4.0	NF	3.0	NF	NF	1.3	8	NF
Twin 51's	5.30	6.7	5.0	10	3.5	8.3	5.2	8	5.4	18.0	11	1.5	9	6.9
San Carlos	4.05	NF	4.0	NF	2.5	NF	3.0	NF	5.2	NF	NF	1.3	7	NF
Steinbeck	5.05	NF	8.0	NF	4.1	NF	5.5	NF	8.9	4.2	4.1	1.4	12	NF
HopkinsMon	5.40	NF	5.0	15	4.4	NF	--	--	--	--	--	--	--	--
HopkinsPG	8.10	NF	5.0	NF	5.4	NF	--	--	--	--	--	--	--	--
8th Street	5.90	8.6	6.0	NF	3.8	NF	--	--	--	--	--	--	--	--
Greenwood	7.75	8.4	5.0	10	4.0	7.3	7.5	5.1	6.6	6.7	5.6	NS	13	6.4
Lover's	8.75	NF	6.0	NF	4.5	NF	4.2	NF	6.2	NF	NF	NS	14	NF
Pico	9.40	5.1	6.0	6	7.4	4.6	14.0	5.2	10.5	5.9	5.5	2.6	12	5.1
4th Ave.	16.35	NF	12.0	NF	11.3	NF	9.5	NF	--	--	NF	NS	NS	NF
Ocean Ave.	12.55	NF	7.0	NF	6.3	NF	5.1	NF	--	--	NF	NS	16	NF
8th Ave	18.55	NF	8.0	6	10.0	NF	8.2	NF	--	--	NF	NS	NS	1.6
Crossroads	3.00	NF	2.0	NF	1.9	NF	1.5	NF	2.5	NF	NF	0.8	3	NF

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 monitoring. The table below is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	150	NF	652	NF	111	NF	191	NF	152	NF	NF	244	132	NF	NF	276	140	NF
Bay St	23	NF	82	NF	32	NF	35	NF	173	NF	NF	33	66	NF	NF	63	33	NF
Twin 51's	47	2	96	4	28	2	59	3	73	ND	ND	14	69	3	6	19	74	ND
San Carlos	48	NF	54	NF	6	NF	25	NF	91	NF	NF	44	13	NF	3	NS	NS	NF
Steinbeck	42	NF	38	NF	7	NF	24	NF	84	ND	ND	34	21	NF	4	8	30	7
HopkinsMon	48	NF	46	10	7	NF	--	--	--	--	--	--	--	--	35	NS	NS	NS
HopkinsPG	37	NF	48	NF	9	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NS
8th St	29	3	71	NF	7	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	37	7	178	2	12	2	50	6	59	3	8	NS	36	4	3	NS	17	2
Lover's	24	NF	29	NF	20	NF	20	NF	33	NF	NF	NS	11	NF	NF	NS	21	NF
Pico	47	ND	41	ND	14	ND	61	ND	27	ND	ND	68	32	ND	2	12	10	ND
4th Ave.	162	NF	129	NF	96	NF	312	NF	--	--	NF	NS	NS	NF	NF	NS	139	NF
Ocean Ave.	45	NF	22	NF	18	NF	62	NF	--	--	NF	NS	20	NF	NF	NS	57	NF
8th Ave	127	NF	26	4	36	NF	101	NF	--	--	NF	NS	NS	ND	ND	NS	NS	NF
Crossroads	41	NF	6	NF	6	NF	20	NF	12	NF	NF	20	7	NF	NF	5	11	NF

Total Suspended Solids (TSS) continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	230	NF	NF	NF	348	NF	NF	NF	270	42	743	NF	--	--	--	--
Bay St	NF	NF	59	NF	NF	ND	173	NF	NF	NF	123	NF	66	NF	38	NF	3	NF
Twin 51's	ND	ND	15	ND	ND	ND	183	61	5	ND	44	6	74	5	137	3	41	2
San Carlos	ND	ND	100	ND	ND	ND	69	3	ND	ND	22	ND	32	5	47	3080	46	ND
Steinbeck	18	2	88	ND	ND	ND	56	6	ND	ND	68	8	49	8	66	4	14	12
HopkinsMon	ND	NS	57	NF	8	ND	30	ND	8	7	106	51	34	12	36	NF	29	NF
HopkinsPG	NF	NS	75	NF	NF	NF	82	NF	NF	NF	45	NF	25	NF	43	NF	--	--
8th St	NF	2	NF	NF	20	ND	26	188	NF	NF	31	NF	15	NF	75	NF	39	
Greenwood	ND	4	174	ND	ND	7	50	5	6	0	60	0	19	14	71	3	23	33
Lover's	NF	ND	118	NF	9	12	20	3	ND	ND	52	ND	25	1.9	35	5	24	NF
Pico	ND	ND	57	ND	ND	ND	36	ND	6	ND	20	ND	45	ND	86	5	40	ND
4th Ave.	NF	NF	557	ND	NF	ND	212	NF	NF	NF	121	NF	116	NF	103	NF	--	--
Ocean Ave.	14	NF	292	NF	NF	NF	42	NF	45	NF	28	NF	34	NF	59	NF	--	--
8th Ave	ND	ND	99	ND	ND	ND	36	3	ND	ND	57	ND	20	5	89	4	--	--
Crossroads	NF	NF	11	NF	NF	NF	15	NF	NF	NF	21	NF	--	--	--	--	--	--

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 monitoring.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013
Pajaro	118	NF	606	NF	2.3	NF	140.0	NF	140.0	NF	NF	120.0	175.0	NF
Bay St	4	NF	69	NF	12.3	NF	19.0	NF	41.0	NF	NF	20.0	40.0	NF
Twin 51's	23	1.4	52	3.8	16.5	6.1	33.0	3.4	21.0	2.0	1.6	12.0	50.0	3.8
San Carlos	38	NF	57	NF	5.2	NF	14.0	NF	37.0	NF	NF	16.0	17.3	NF
Steinbeck	43	NF	39	NF	5.0	NF	14.0	NF	32.0	0.7	0.7	16.0	13.0	NF
HopkinsMon	48	NF	44	5.3	4.4	NF	--	--	--	--	--	--	--	--
HopkinsPG	32	NF	50	NF	3.9	NF	--	--	--	--	--	--	--	--
8th St	25	2.1	40	NF	4.6	NF	--	--	--	--	--	--	--	--
Greenwood	27	6.3	71	4.7	10.1	4.5	25.0	5.0	25.0	4.0	2.1	NS	24.0	1.5
Lover's	19	NF	30	NF	12.3	NF	10.0	NF	20.0	NF	NF	NS	7.1	NF
Pico	25	4.2	28	6.7	7.9	10.0	32.0	3.3	21.0	7.2	2.1	18.0	18.0	3.0
4th Ave.	85	NF	91	NF	44.5	NF	103.0	NF	--	--	NF	NS	NS	NF
Ocean Ave.	25	NF	20	NF	21.5	NF	14.0	NF	--	--	NF	NS	24.0	NF
8th Ave	54	NF	19	10.0	11.0	NF	26.0	NF	--	--	NF	NS	NS	1.1
Crossroads	40	NF	19	NF	4.7	NF	9.0	NF	12.0	NF	NF	13.0	7.0	NF

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 monitoring. The table below is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	140	NF	434	NF	5260	NF	827	NF	313	NF	NF	49	838	NF	NF	98	312	NF
Bay St	26	NF	ND	NF	205	NF	304	NF	298	NF	NF	57	787	NF	NF	349	158	NF
Twin 51's	117	49	ND	139	186	102	266	254	598	45	22	45	595	131	93	55	193	32
San Carlos	247	NF	ND	NF	145	NF	118	NF	434	NF	NF	68	572	NF	ND	NS	NS	NF
Steinbeck	1120	NF	ND	NF	1120	NF	914	NF	4490	24	27	228	2075	NF	938	405	478	29
HopkinsMon	249	NF	754	95	168	NF	--	--	--	--	--	--	--	--	ND	NS	NS	NS
HopkinsPG	1040	NF	278	NF	740	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NS
8th St	207	587	280	NF	102	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	154	37	177	124	143	92	180	ND	378	43	17	NS	446	11	56	NS	423	11
Lover's	206	NF	249	NF	135	NF	150	NF	914	NF	NF	NS	450	NF	NF	NS	98	NF
Pico	83	ND	140	15	89	ND	451	ND	292	10	435	34	225	ND	42	63	63	ND
4th Ave.	94	NF	109	NF	239	NF	122	NF	--	--	NF	NS	NS	NF	NF	NS	293	NF
Ocean Ave.	169	NF	436	NF	289	NF	187	NF	--	--	NF	NS	699	NF	NF	NS	156	NF
8th Ave	258	NF	269	32	212	NF	173	NF	--	--	NF	NS	NS	ND	ND	NS	NS	NF
Crossroads	149	NF	150	NF	129	NF	80	NF	271	NF	NF	56	114	NF	NF	20	289	NF

Urea continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	44	NF	NF	NF	609	NF	NF	NF	241	74	98	NF	--	--	--	--
Bay St	NF	NF	143	NF	NF	ND	284	NF	NF	NF	62	NF	108	NF	205	NF	60	NF
Twin 51's	87	61	179	35	53	16	520	21	16	258	920	250	753	45	560	116	724	53
San Carlos	ND	5	73	ND	10	ND	326	878	15	10	331	ND	336	15	440	35	370	13
Steinbeck	127	5	393	30	42	ND	2234	11	10	213	1547	11	740	1	1965	1028	4777	152
HopkinsMon	ND	NS	55	NF	30	ND	160	ND	ND	36	456	193	38	173	2495	NF	3263	NF
HopkinsPG	NF	NS	378	NF	NF	NF	1628	NF	NF	NF	1671	NF	840	NF	275	NF	--	--
8th St	NF	1861	NF	NF	83	ND	192	389	NF	NF	141	NF	267	NF	210	NF	139	NF
Greenwood	11	5	168	12	44	70	280	5	636	31	120	14	470	71	455	428	348	485
Lover's	NF	57	97	NF	12	ND	54	5	ND	13	118	20	41	57	320	23	217	NF
Pico	ND	5	25	ND	10	20	96	5	24	13	35	15	104	69	240	10	150	ND
4th Ave.	NF	NF	46	ND	NF	ND	225	NF		NF	393	NF	84	NF	195	NF	--	--
Ocean Ave.	31	NF	47	NF	NF	NF	417	NF	400	NF	105	NF	250	NF	280	NF	--	--
8th Ave	ND	5	547	ND	10	ND	426	ND	ND	ND	419	ND	331	10	345	10	--	--
Crossroads	NF	NF	52	NF	NF	NF	519	NF	NF	NF	321	NF	--	--	--	--	--	--

Zinc

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; -- = Not included in MRSWMP monitoring. The table below is broken into two sections to facilitate printing.

Site Name	FF 2018	DR 2018	FF 2017	DR 2017	FF 2016	DR 2016	FF 2015	DR 2015	FF 2014	DR 2014	SuR 2014	SF 2014	FF 2013	DR 2013	SuR 2013	SF 2013	FF 2012	DR 2012
Pajaro	143	NF	424	NF	317	NF	167	NF	231	NF	NF	264	297	NF	NF	182	198	NF
Bay St	ND	NF	136	NF	138	NF	141	NF	703	NF	NF	119	402	NF	NF	187	94	NF
Twin 51's	99	74	220	17	93	56	167	114	513	313	48	58	504	93	46	70	147	28
San Carlos	150	NF	157	NF	92	NF	118	NF	692	NF	NF	96	269	NF	36	NS	NS	NF
Steinbeck	222	NF	249	NF	149	NF	170	NF	764	53	25	112	293	NF	43	158	392	38
HopkinsMon	152	NF	142	106	112	NF	--	--	--	--	--	--	--	--	60	NS	NS	NS
HopkinsPG	275	NF	136	NF	189	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NS
8th St	101	ND	121	NF	74	NF	--	--	--	--	--	--	--	--	NF	NS	NS	NF
Greenwood	135	ND	180	13	93	ND	129	ND	410	60	48	NS	263	20	14	NS	102	ND
Lover's Pt	112	NF	107	NF	80	NF	87	NF	406	NF	NF	NS	204	NF	NF	NS	114	NF
Pico	68	ND	92	ND	68	23	150	ND	144	39	ND	63	129	37	ND	70	58	21
4th Avenue	141	NF	198	NF	133	NF	148	NF	--	--	NF	NS	NS	NF	NF	NS	145	NF
Ocean	238	NF	194	NF	144	NF	106	NF	--	--	NF	NS	395	NF	NF	NS	203	NF
8th Avenue	201	NF	111	71	125	NF	169	NF	--	--	NF	NS	NS	24	92	NS	NS	NF
Crossroads	156	NF	130	NF	134	NF	78	NF	229	NF	NF	81	185	NF	NF	79	211	NF

Zinc continued

Site Name	SuR 2012	SpR 2012	FF 2011	DR 2011	SuR 2011	SpR 2011	FF 2010	DR 2010	SuR 2010	SpR 2010	FF 2009	DR 2009	FF 2008	DR 2008	FF 2007	DR 2007	FF 2006	DR 2006
Pajaro	NF	NF	170	NF	NF	NF	351	NF	NF	NF	273	41	368	NF	--	--	--	--
Bay St	NF	NF	219	NF	NF	22	272	NF	NF	NF	345	NF	124	NF	185	NF	33	NF
Twin 51's	ND	40	142	20	25	25	385	46	52	20	313	29	273	28	330	25	295	ND
San Carlos	ND	43	264	17	29	67	351	28	28	25	213	19	157	18	269	10	342	ND
Steinbeck	21	60	258	19	31	62	808	31	29	40	400	196	347	110	384	130	411	ND
HopkinsMon	ND	NS	138	NF	36	24	322	24	22	35	341	234	194	99	382	NF	307	NF
HopkinsPG	NF	NS	166	NF	NF	NF	945	NF	NF	NF	477	NF	305	NF	231	NF	--	--
8th St	NF	22	NF	NF	88	15	156	567	NF	NF	147	NF	121	NF	173	NF	153	
Greenwood	ND	21	300	ND	16	12	232	5	ND	14	167	ND	156	35	236	11	180	27
Lover's Pt	NF	14	182	NF	16	36	65	5	ND	14	166	ND	123	10	175	13	158	NF
Pico	ND	12	86	ND	11	34	139	17	16	11	87	ND	96	12	154	10	142	ND
4th Avenue	NF	NF	312	11	NF	104	195	NF	NF	NF	226	NF	116	NF	170	NF	--	--
Ocean	98	NF	354	NF	NF	NF	650	NF	439	NF	288	NF	225	NF	361	NF	--	--
8th Avenue	ND	26	214	20	19	ND	344	15	14	17	256	19	237	20	303	61	--	--
Crossroads	NF	NF	97	NF	NF	NF	330	NF	NF	NF	303	NF	--	--	--	--	--	--

Appendix 3: Results by Jurisdiction (listed alphabetically)

Carmel 2018 MRSWMP monitoring results.

Table results include the Dry Run (DR), First Flush time series (FF-A and FF-B) and FF results averaged for the two time series (FF-Avg). 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	4th Avenue				Ocean Avenue				8th Avenue			
		DR	FF- A	FF - B	FF Avg	DR	FF- A	FF - B	FF Avg	DR	FF- A	FF - B	FF Avg
Ammonia (mg/L)	50 mg/L	NF	0.4	0.5	0.5	NF	1.1	0.9	1.0	NF	0.9	0.8	0.9
Color (Color Units)	500 color units	NF	250	300	275	NF	200	150	175	NF	150	250	200
Copper (ug/L)	30 ug/L	NF	110	216	163	NF	160	116	138	NF	138	140	139
E. coli (MPN/ 100 ml)	235 MPN/ 100 ml	NF	36540	43517	40029	NF	43517	98039	70778	NF	61314	21426	41370
Enterococcus (MPN/ 100 ml)	104 MPN/ 100 ml	NF	36540	18501	27521	NF	48844	61314	55079	NF	57943	31301	44622
Hardness mg/L	<10 and >2000 mg/L	NF	90	90	90	NF	81	54	68	NF	92	119	106
Lead (ug/L)	30 ug/L	NF	11.5	18.1	14.8	NF	2.2	6.7	4.5	NF	11.9	9.2	10.6
MBAS Surfactants	0.2 mg/L	NF	0.39	0.57	0.48	NF	0.52	0.83	0.68	NF	0.99	0.84	0.92
NO3-N (mg-N/ L)	2.25 mg-N/ L	NF	0.60	0.50	0.55	NF	0.80	0.50	0.65	NF	0.40	0.70	0.55
PO4-P (mg-P/ L)	0.12 mg-P/ L	NF	0.70	0.90	0.80	NF	0.90	0.70	0.80	NF	0.80	1.00	0.90
Potassium (mg/L)	20 mg/ L	NF	16.1	16.6	16.4	NF	14.4	10.7	12.6	NF	16.2	20.9	18.6
TSS (mg/L)	500 mg/L	NF	117	206	162	NF	33	56	45	NF	216	37	127
Turbidity (NTU)	25 NTU	NF	80	90	86	NF	20	29	25	NF	85	22	54
Urea (ug/L)	None currently	NF	94	--	--	NF	169	--	--	NF	258	--	--
Zinc (ug/L)	200 ug/L	NF	107	174	141	NF	283	193	238	NF	205	197	201

Monterey 2018 MRSWMP monitoring results.

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

	WQO or Action Level	Twins				San Carlos				Steinbeck			
Analytes		DR	FF- A	FF - B	FF Avg	DR	FF- A	FF - B	FF Avg	DR	FF- A	FF - B	FF Avg
Ammonia (mg/L)	50 mg/L	ND	0.40	1.50	0.95	NF	0.30	0.20	0.25	NF	4.90	1.70	3.30
Color (Color Units)	500 color units	20	100	100	100	NF	70	125	98	NF	100	120	110
Copper (ug/L)	30 ug/L	ND	27	21	24	NF	57	59	58	NF	68	50	59
E. coli (MPN/100 ml)	235 MPN/ 100 ml	1223	72699	41058	56879	NF	20142	57943	39043	NF	21872	13958	17915
Enterococcus (MPN/100 ml)	104 MPN/ 100 ml	697	31301	10594	20948	NF	8474	9097	8786	NF	68667	39682	54175
Hardness mg/L	<10 and >2000 mg/L	699	66	48	57	NF	68	38	53	NF	42	35	39
Lead (ug/L)	30 ug/L	ND	20.7	3.2	12.0	NF	3.8	13.0	8.4	NF	3.8	13.7	8.8
MBAS Surfactants	0.2 mg/L	0.16	0.44	0.40	0.42	NF	0.57	0.52	0.55	NF	0.45	0.50	0.48
NO3-N (mg-N/ L)	2.25 mg-N/ L	0.5	0.3	0.3	0.3	NF	0.7	0.3	0.5	NF	0.7	0.3	0.5
PO4-P (mg-P/ L)	0.12 mg-P/ L	0.10	0.2	0.6	0.4	NF	0.4	0.2	0.3	NF	2.1	0.9	1.5
Potassium (mg/L)	20 mg/ L	6.7	5.4	5.0	5.2	NF	4.9	3.2	4.1	NF	6.2	3.9	5.1
TSS (mg/L)	500 mg/L	2	69	24	47	NF	22	73	48	NF	22	61	42
Turbidity (NTU)	25 NTU	1.4	30	15	23	NF	26	50	38	NF	25	60	43
Urea (ug/L)	None currently	49	117	--	--	NF	247	--	--	NF	1120	--	--
Zinc (ug/L)	200 ug/L	74	67	130	99	NF	130	170	150	NF	228	216	222

Monterey County 2018 MRSWMP monitoring results.

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

		Pajaro				Crossroads			
Analytes	**WQO or Action Level**	DR	FF- A	FF- B	FF-Avg	DR	FF- A	FF- B	FF-Avg
Ammonia (mg/L)	50 mg/L	NF	0.2	0.3	0.3	NF	0.4	0.3	0.4
Color (Color Units)	500 color units	NF	100	70	85	NF	150	100	125
Copper (ug/L)	30 ug/L	NF	36	23	30	NF	28	32	30
E. coli (MPN/ 100 ml)	235 MPN/ 100 ml	NF	>241960	43517	142739	NF	24809	27551	26180
Enterococcus (MPN/ 100 ml)	104 MPN/ 100 ml	NF	46111	20142	33127	NF	14209	61314	37762
Hardness mg/L	<10 and >2000 mg/L	NF	47	32	40	NF	28	30	29
Lead (ug/L)	30 ug/L	NF	6	7.9	7.0	NF	0.2	ND	0.2
MBAS Surfactants (mg/L)	0.2 mg/L	NF	0.29	0.17	0.23	NF	0.78	0.94	0.86
NO3-N (mg-N/ L)	2.25 mg-N/ L	NF	0.30	0.60	0.45	NF	0.10	0.20	0.15
PO4-P (mg-P/ L)	0.12 mg-P/ L	NF	0.20	0.10	0.15	NF	0.20	0.20	0.20
Potassium (mg/L)	20 mg/ L	NF	2.8	2.4	2.6	NF	2.9	3.1	3.0
TSS (mg/L)	500 mg/L	NF	128	171	150	NF	47	34	41
Turbidity (NTU)	25 NTU	NF	120	115	118	NF	45	34	40
Urea (ug/L)	None currently	NF	140	--	--	NF	149	--	--
Zinc (ug/L)	200 ug/L	NF	131	155	143	NF	158	153	156

Pacific Grove 2018 MRSWMP Monitoring results.

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

	WQO or Action Level	HopkinsMon				HopkinsPG				8th Street			
Analytes		DR	FF- A	FF - B	FF Ave	DR	FF- A	FF - B	FF Ave	DR	FF- A	FF - B	FF Ave
Ammonia (mg/L)	50 mg/L	NF	0.5	0.4	0.5	NF	6.4	3.5	5.0	0.30	0.6	0.8	0.7
Color (Color Units)	500 color units	NF	100	150	125	NF	150	100	125	40	100	150	125
Copper (ug/L)	30 ug/L	NF	34	34	34	NF	36	44	40	ND	48	29	39
E. coli (MPN/100 ml)	235 MPN/ 100 ml	NF	41058	32554	36806	NF	22818	26025	24422	>24196	34480	18501	26491
Enterococcus (MPN/100 ml)	104 MPN/ 100 ml	NF	30759	43517	37138	NF	61314	31301	46308	2755	54750	54750	54750
Hardness mg/L	<10 and >2000 mg/L	NF	58	48	53	NF	69	56	63	373	73	40	57
Lead (ug/L)	30 ug/L	NF	3.5	5.4	4.5	NF	2.6	3.7	3.2	ND	4.4	5.4	4.9
MBAS Surfactants	0.20 mg/L	NF	0.50	0.60	0.55	NF	0.47	0.74	0.61	0.16	0.52	0.60	0.56
NO3-N (mg-N/ L)	2.25 mg-N/ L	NF	0.40	0.30	0.35	NF	1.80	1.10	1.45	2.6	0.60	0.30	0.45
PO4-P (mg-P/ L)	0.12 mg-P/ L	NF	0.90	1.00	0.95	NF	1.40	0.90	1.15	0.2	0.60	0.40	0.50
Potassium (mg/L)	20 mg/ L	NF	6.1	4.7	5.4	NF	9.7	6.5	8.1	8.6	7.2	4.6	5.9
TSS (mg/L)	500 mg/L	NF	31	64	48	NF	22	51	37	3	28	29	29
Turbidity (NTU)	25 NTU	NF	35	60	48	NF	19	45	32	2.1	29	21	25
Urea (ug/L)	None currently	NF	249	--	--	NF	1040	--	--	587	207	--	--
Zinc (ug/L)	200 ug/L	NF	143	161	152	NF	284	265	275	ND	108	94	101

Pacific Grove 2018 MRSWMP Monitoring results continued

Analytes	WQO or Action Level	Greenwood Park				Lovers				Pico			
		DR	FF- A	FF - B	FF Ave	DR	FF- A	FF - B	FF Ave	DR	FF- A	FF - B	FF Ave
Ammonia (mg/L)	50 mg/L	0.10	0.5	0.5	0.5	NF	0.5	0.3	0.4	ND	0.4	0.4	0.4
Color (Color Units)	500 color units	50	150	100	125	NF	250	150	200	40	200	200	200
Copper (ug/L)	30 ug/L	ND	28	35	32	NF	46	25	36	ND	55	54	55
E. coli (MPN/100 ml)	235 MPN/ 100 ml	24196	61314	29866	45590	NF	48844	36540	42692	52	>241960	141360	191660
Enterococcus (MPN/100 ml)	104 MPN/ 100 ml	15531	173290	45689	109490	NF	51721	41602	46662	31	141360	198630	169995
Hardness mg/L	<10 and >2000 mg/L	400	57	52	55	NF	82	50	66	179	42	60	51
Lead (ug/L)	30 ug/L	ND	964	92.6	528	NF	3.0	4.8	3.9	ND	3.6	0.2	1.9
MBAS Surfactants	0.20 mg/L	0.09	0.30	0.50	0.40	NF	0.42	0.49	0.46	0.08	0.50	0.28	0.39
NO3-N (mg-N/ L)	2.25 mg-N/ L	1.0	0.40	0.30	0.35	NF	0.50	0.30	0.40	1.0	0.20	0.30	0.25
PO4-P (mg-P/ L)	0.12 mg-P/ L	0.10	0.40	0.40	0.40	NF	0.80	0.70	0.75	ND	0.30	0.50	0.40
Potassium (mg/L)	20 mg/ L	8.4	9.0	6.5	7.8	NF	10.7	6.8	8.8	5.1	7.9	10.9	9.4
TSS (mg/L)	500 mg/L	7	25	48	37	NF	16	32	24	ND	68	25	47
Turbidity (NTU)	25 NTU	6.3	20	33	27	NF	15	22	19	4.2	33	17	25
Urea (ug/L)	None currently	37	154	--	--	NF	206	--	--	ND	83	--	--
Zinc (ug/L)	200 ug/L	ND	97	173	135	NF	119	105	112	ND	77	58	68

Seaside and Sand City 2018 MRSWMP Monitoring results.

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

	WQO or Action Level	**Bay Street**			
Analytes		Dry Run	First Flush-A	First Flush-B	FF Average
Ammonia (mg/L)	50 mg/L	NF	0.10	0.20	0.15
Color (Color Units)	500 color units	NF	15	20	18
Copper (ug/L)	30 ug/L	NF	ND	ND	ND
E. coli (MPN/ 100 ml)	235 MPN/ 100 ml	NF	8803	32554	20679
Enterococcus (MPN/ 100 ml)	104 MPN/ 100 ml	NF	10460	68667	39564
Hardness mg/L	<10 and >2000 mg/L	NF	5700	6240	5970
Lead (ug/L)	30 ug/L	NF	ND	ND	ND
MBAS Surfactants (mg/L)	0.2 mg/L	NF	0.18	0.15	0.17
NO3-N (mg-N/ L)	2.25 mg-N/ L	NF	1.50	0.80	1.15
PO4-P (mg-P/ L)	0.12 mg-P/ L	NF	0.20	0.10	0.15
Potassium (mg/L)	20 mg/ L	NF	335	366	351
TSS (mg/L)	500 mg/L	NF	19	26	23
Turbidity (NTU)	25 NTU	NF	2.7	4.3	4.0
Urea (ug/L)	None currently	NF	26	--	--
Zinc (ug/L)	200 ug/L	NF	ND	ND	ND

Appendix 4: Receiving Water Sampling

Appendix 4. Receiving Water Monitoring

Introduction

Collecting receiving water samples and discharge samples can provide a more complete understanding of the fate of common urban pollutants once they flow into the ocean during a major rainstorm. The 2016-2017 MRSWMP monitoring program added the collection and analysis of receiving water samples from two sites in Pacific Grove during the First Flush which was continued into the 2018-2019 program. Specific receiving water sites were selected based upon ease of sample collection and to compliment previous Areas of Special Biological Significance (ASBS) monitoring that was done at the end of pipe and in the receiving water in Pacific Grove. Two receiving water sites, 8th Street and Lovers, were monitored during the First Flush. The dry weather diversion was not operational at 8th Street due to summertime improvements that were still awaiting final inspection. However, the dry weather diversion was operational at Lovers but due to the magnitude of flow at the pumping station all the water within the system could not be diverted, the overflow was flowing from the outfall which made receiving water sampling possible.

Methods

Sample collection protocols were the same as those used for all of the MRSWMP water quality monitoring events. Receiving water samples were collected using a 2-gallon bucket in ankle deep water at the location where the outfall water flowed into the ocean. Receiving water samples are single grab samples. No field measurements were collected. All receiving water samples were analyzed for the same parameters as those for the MRSWMP outfall monitoring: nutrients (nitrate, orthophosphate, ammonia, and urea), bacteria (*Eschericia coli* and enterococcus), metals (copper, lead, and zinc) and total suspended solids, color, Methylene Blue Active Substances (MBAS) detergents, hardness (as CaCO3), potassium, and turbidity.

All results from this receiving water study are compared to actual receiving water standards established for beneficial uses in the ocean. All Water Quality Objectives and Action Levels and their accompanying sources are listed in Table A1. In cases where the Ocean Plan provided more protection of receiving water quality than those water quality objectives used for end of pipe monitoring, the Ocean Plan water quality objectives are used and noted.

Results

Receiving water results are presented for each site along with that site's average First Flush results as a comparison. First Flush average results are from two samples collected 30 minutes apart as compared to a single receiving water grab sample. Receiving water samples were collected by MBNMS and CMSF staff about two hours after the last outfall sample was collected at 8th Street (Pacific Grove) and about one and a half hours after the last sample collected at Lovers (Pacific Grove).

Table A1: Receiving Water Quality Objectives

Parameter (reporting units)	Water Quality Objectives	Source of Objective
Ammonia (mg/L)	Not to exceed 50	SWRCB NPDES MS4 General Permit
Color (color units)	Not to exceed 500	SWRCB NPDES MS4 General Permit
Copper (µg/L)	Not to exceed 30	California Ocean Plan 2015
E. coli (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 CaCO3 (mg/L)	Not less than or = to10 or greater than or = to 2,000	SWRCB NPDES MS4 General Permit
Lead (µg/L)	Not to exceed 20	California Ocean Plan 2015
MBAS Detergents (mg/L)	Not to exceed 0.2	Water Quality Control Plan for the Central Coast
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)
Potassium (mg/L)	Not to exceed 20	SWRCB NPDES MS4 General Permit
Total Suspended Solids (TSS) (mg/L)	Not to exceed 500 [4]	Central Coast Ambient Monitoring Program (CCAMP)
Turbidity (NTU)	Not to exceed 225	California Ocean Plan 2015
Zinc (µg/L)	Not to exceed 200 [1]	California Ocean Plan 2015

Note: Urea is not listed because it does not have a Water Quality Objective or Action Level.

[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.

8th Street Outfall and Receiving Water Monitoring

The 8th Street outfall empties directly on to a small pocket beach that is seasonally used by newborn harbor seal pups and their mothers. The 8th Street outfall has a drainage area of 35 acres that is 100% residential. The 8th Street 2018 First Flush outfall and receiving water results are listed in Table A2.

Table A2. 8th Street outfall and receiving water results for First Flush 2018 samples. Shaded boxes represent an exceedance of a Water Quality Objective or Action Level.

		Outfall Monitoring		Receiving Water Monitoring	
Parameter	**Units**	**FF Average**	**MDL**	**Result**	**MDL**
Ammonia	mg/L	0.70	0.10	0.20	0.10
Color	color units	125	3	50	3
Copper- total	µg/L	39	10	7	10
Escherichia coli (E. coli)	MPN/ 100 ml	26,491	1	12,356	1
Enterococcus	MPN/ 100 ml	54,750	1	19,179	1
Hardness	mg/L	57	10	3630	10
Lead- total	µg/L	5	1	ND	1
MBAS Detergents	mg/L	0.56	0.10	0.37	0.10
Nitrate as N	mg-N/L	0.45	0.10	0.30	0.10
Orthophosphate as P	mg-P/L	0.50	0.10	1.20	0.10
Potassium	mg/L	5.9	0.5	267	0.5
Total Suspended Solids	mg/L	29	2	16	2
Turbidity	NTU	25	0.1	6	0.1
Urea	µg/L	207	10	60	10
Zinc- total	µg/L	101	10	ND	10

Overall, constituent concentrations decreased in seawater except for hardness, orthophosphate, and potassium. Hardness and potassium were above the Action Levels, however the ocean contains quite a bit of calcium carbonate and potassium, so much so that calcium and potassium are within the top six constituents in seawater. Unfortunately, bacteria and detergents were over the Water Quality Objectives (WQO) for receiving water samples.

Lovers Outfall and Receiving Water Monitoring

The Lovers watershed is one of the largest watersheds in Pacific Grove at 240 acres and consists of a mix of residential (54%), commercial (1%), and some public lands or other uses (20%). Lovers 2018 outfall and receiving water results are listed in Table A3.

Table A3. Lovers outfall and receiving water results for First Flush 2018 samples. Shaded boxes represent an exceedance of a Water Quality Objective or Action Level.

		Outfall Monitoring		Receiving Water Monitoring	
Parameter	**Units**	**Result**	**MDL**	**Result**	**MDL**
Ammonia	mg/L	0.40	0.10	ND	0.10
Color	color units	200	3	50	3
Copper- total	µg/L	36	10	ND	10
Escherichia coli (E. coli)	MPN/ 100 ml	42,692	1	12,218	1
Enterococcus	MPN/ 100 ml	46,662	1	23,593	1
Hardness	mg/L	66	10	5310	10
Lead- total	µg/L	4	1	1.2	1.0
MBAS Detergents	mg/L	0.46	0.10	0.20	0.10
Nitrate as N	mg-N/L	0.40	0.10	0.10	0.10
Orthophosphate as P	mg-P/L	0.75	0.10	ND	0.10
Potassium	mg/L	8.8	0.5	319	0.5
Total Suspended Solids	mg/L	24	2	35	2
Turbidity	NTU	19.0	0.1	5.8	0.1
Urea	µg/L	206	10	24	10
Zinc- total	µg/L	112	10	ND	10

As with 8th Street, overall constituent concentrations decreased in seawater except hardness and potassium. Hardness and potassium were above the Action Levels, however the ocean contains quite a bit of calcium carbonate and potassium so much so that calcium and potassium were within the top six constituents in seawater. *E. coli* and enterococcus results were over the Water Quality Objectives (WQO) for both end of pipe and receiving water samples. Metals were exceedingly low with copper and zinc results of non-detects.