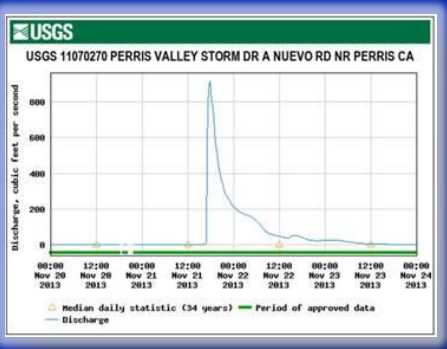
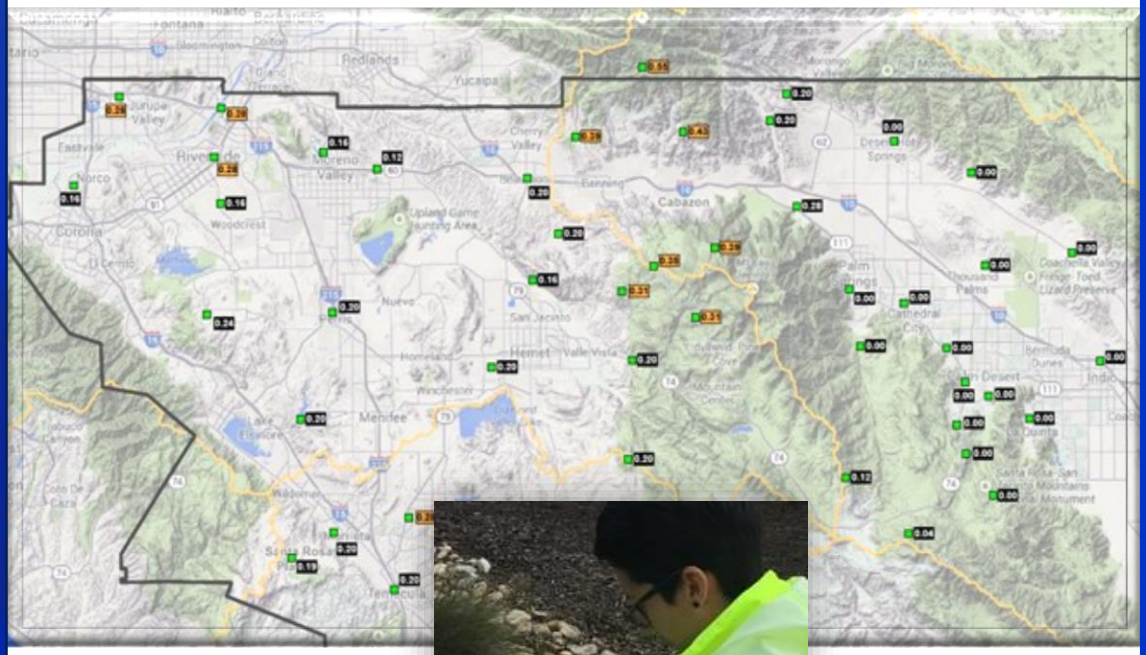
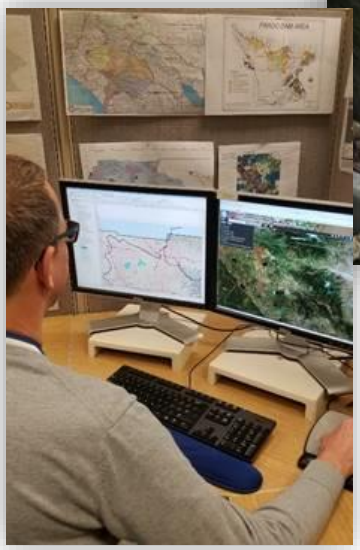


SECTION 11

SANTA ANA REGION FINAL MONITORING ANNUAL REPORT MONITORING YEAR 2018-2019





RIVERSIDE COUNTY
WATERSHED PROTECTION

November 2019

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EXECUTIVE SUMMARY

During the 2018-2019 monitoring year, the Santa Ana Region (SAR) Monitoring Program was implemented in accordance with the requirements of the 2010 municipal separate storm sewer system (MS4) Permit. All wet and dry weather monitoring components of the MS4 outfall monitoring program, receiving water monitoring program, and bioassessment monitoring program were completed except at Perris Valley Channel at Nuevo Road, where the toxicity tests could not be ordered in time for the under-forecasted wet weather event on October 13, 2018. In addition, illicit connection/illegal discharge inspections were conducted, and appropriate illicit discharge detection and elimination procedures were implemented. Only one reported incident occurred that may have impacted water quality results in the SAR during the 2018-2019 monitoring year. Total maximum daily load (TMDL) monitoring was conducted by task force groups.

Summary of 2018-2019 Monitoring Results and Integrated Assessment

An assessment of 2018-2019 SAR water quality results was considered in the context of all historical wet weather and dry weather monitoring data collected for each station to date. The SAR is an ephemeral watershed, in which large and/or high intensity precipitation is needed to generate flow in receiving waters. SAR receiving waters are typically dry or ponded, except where permitted discharges, such as publicly owned treatment works effluent, generate localized flows. Water quality sampling was contingent upon the presence of sufficient flow for sample collection. If a site was dry or flow was insufficient for sample collection, dry weather events were classified as visited, not sampled (VNS). Water quality sampling results were compared to Basin Plan water quality objectives (WQOs), California Toxics Rule WQOs, and standards from the Statewide Bacteria Provisions – statistical threshold values (STVs) or TMDL numeric targets were used for *E. coli*, as applicable.[1] Sample results from MS4 outfall stations were compared to these criteria for comparison purposes only, not compliance, as WQOs and CTR WQOs are only applicable to receiving waters (State Board, 2005).

Wet Weather Monitoring Results

Rainfall totals during the 2018-2019 monitoring year were above normal, unlike six of eight monitoring years during 2010 MS4 Permit implementation with below-average rainfall. Significant wet weather findings regarding water quality status and trends include the following:

- Parameters that were most often above receiving water WQOs were consistent with historical results in the SAR and included the bacterial indicator *E. coli* and dissolved copper. *E. coli* and dissolved copper concentrations were above WQOs during at least one wet weather event at six of seven MS4 outfall stations (all except Corona Storm Drain NPDES – Line K below Harrison and Sheridan Streets [Corona Outfall]). Historical exceedance frequencies for *E. coli* range from 91 to 100% where the REC-1 beneficial use applies. Historical exceedance frequencies for dissolved copper range from 40% to 95%.
- At receiving water stations, *E. coli* exceeded the STV at Perris Valley Channel at Nuevo Road (historical exceedance frequency of 33%, though high flow suspension of REC-1 has been applied to some historical results at this station). Dissolved copper was above the WQO at Temescal Channel at Main (historical exceedance frequency of 46%).

[1] The 2018 approved Statewide Bacteria Provisions was used for many stations where prior Basin Plan WQOs are superseded. Results were also compared to USEPA MSGP Benchmarks as required by the 2010 MS4 Permit and are provided in an attachment.

- pH, a historical pollutant of concern for Temescal Reach 1a and Prado Basin Surface Water Management Zone (PBMZ), was outside of the Basin Plan WQO range during only one event at the North Norco Channel at Country Club Lane (North Norco Outfall) MS4 outfall station (historical exceedance frequency of 43%).
- The only statistically significant increasing trend observed for parameters measured above WQOs was *E. coli* at Perris Line J at Sunset Avenue Storm Drain Channel below Murrieta Road (Perris Line J Outfall). Significant decreasing trends for parameters measured above WQOs included dissolved zinc at Corona Outfall, dissolved copper at University Wash Channel – Market Street and Bowling Green Drive (University Wash Outfall), and pH at North Norco Outfall (a decreasing trend at this station indicates that pH values are moving toward the WQO range).

Dry Weather Monitoring Results

Significant dry weather findings include the following:

- Over the period of record, VNS events have become more common. Despite above-average rainfall in this monitoring year, four of the seven MS4 outfall stations and the Perris Valley Channel at Nuevo Road receiving water station were VNS during 2018-2019 dry weather monitoring events.
- Parameters that were most often above WQOs were consistent with historical results in the SAR. *E. coli* was above the WQO where sampled except during the single event at North Norco Outfall. Historically, Magnolia Center NPDES – Storm Drain Outlet at Santa Ana River (Magnolia Center Outfall) and University Wash Outfall have been above the WQO at frequencies of 70% and 58%, respectively.
- At the receiving water stations, dry weather samples were only collected at Santa Ana River at Highgrove, and *E. coli* (historical exceedance frequency of 14%) was below the WQO.
- In contrast to wet weather, dissolved copper was below the WQO at all MS4 outfall and receiving water stations during dry weather.
- The only statistically significant increasing trends observed for parameters measured above WQOs were *E. coli* concentrations at the Magnolia Center Outfall and University Wash Outfall. A significant decreasing trend was identified for dissolved oxygen (DO) at the University Wash Outfall; however, this decrease signifies potential declining water quality.
- pH, a historical pollutant of concern for Temescal Reach 1a and PBMZ, was outside of the Basin Plan WQO range during the single dry weather event at the North Norco Outfall (historical frequency of 92% outside of WQO range). This outfall has historically been dry.
- Nitrogen-Nutrients, another historical pollutant of concern, met WQOs during dry weather at all MS4 outfall and receiving water stations, where applicable, except total nitrogen during the single event at the North Norco Outfall (historical exceedance frequency of 40%). There are both significant increasing and decreasing trends for nutrients in the SAR. DO, a parameter linked to the nutrient cycle, had dry weather field measurements at University Wash Outfall that were below the minimum range of the Basin Plan WQO and are significantly decreasing.

Bioassessment Monitoring Results

The bioassessment component of the receiving water monitoring program was fulfilled through District participation, on behalf of the Permittees, in the Southern California Stormwater Monitoring Coalition Regional Monitoring Program. The SMC program determines the objectives and methods of the study,

including site selection with the SAR, which has a large number of engineered and modified flood control channels.

Bioassessment monitoring was conducted at two condition sites and two long-term trend sites in May and June 2019. At the Strawberry Creek trend site, California Stream Condition Index (CSCI) benthic health scores have typically been in the *possibly altered* to *likely intact* range, but were in the *very likely altered* range for 2018-2019. California Rapid Assessment Method (CRAM) scores have indicated fair to good physical habitat quality but indicated poor quality for 2018-2019. The Cranston Fire that burned near the community of Idyllwild in July 2018 burned a portion of the Strawberry Creek watershed and may have affected the benthic macroinvertebrate community structure. A significant decreasing trend was identified at Strawberry Creek based on 2015-2019 CSCI scores. At the Cucamonga Channel trend site, a fully hardened – engineered channel, CSCI scores have consistently remained in the *very likely altered* to *likely altered* range and CRAM scores have indicated poor physical habitat quality.

Progress of the SAR Monitoring Program

Overall, results from the 2018-2019 monitoring year were consistent with historical results. The SAR Monitoring Program indicates that receiving water conditions are generally protective of beneficial uses within the SAR with some exceptions. Bacterial indicators remain a regional pollutant of concern, and targeted efforts by Permittees through the Middle Santa Ana River (MSAR) TMDL Task Force address urban and agricultural sources of indicator bacteria through implementation of a Regional Board approved Comprehensive Bacteria Reduction Plan (CBRP). Dissolved copper concentrations above receiving water WQOs were frequently observed at MS4 outfall stations with low hardness values during wet weather, but only one receiving water station had exceedances of dissolved copper. Further, the integrated analysis suggests that pH and nitrogen-nutrients do not represent regional pollutants of concern, and management actions should focus on discharges to the PBMZ, where some WQO exceedances still occur (two pH values greater than [>] 8.5 but less [<] than 9, and one nitrogen-nutrient parameter did not meet WQOs in discharges to this waterbody) during the 2018-2019 monitoring year. Targeted efforts, such as activities conducted by the Lake Elsinore and Canyon Lake Nutrient TMDL Task Force, address nutrients on an impaired waterbody basis. The Permittees continue ongoing efforts to improve the quality of the monitoring program by:

- Participating in regional monitoring programs and technical groups designed to address health in the SAR.
- Using new technologies, such as enhanced databases and Geographic Information System (GIS)-based tools, to help increase data collection automation and accuracy; which makes data management, quality assurance and quality control (QA/QC) review, and data assessment more efficient.
- Proactively working with field staff and laboratories on QA/QC.
- Updating the SAR Monitoring Plan (CMP Volume IV) to reflect lessons learned during the 2010 Permit term. The CMP was most recently updated in October 2018.

Recommendations and Recommended Permit Modifications

In anticipation of the upcoming Permit renewal, recommended next steps for the SAR Monitoring Program in the 2019-2020 monitoring year may include, but are not limited to:

- Consider modifications to monitoring stations in order to facilitate assessment of urban runoff as it relates to water quality in receiving waters.

- Consider modifications to the monitoring frequency in order to shift focus to dry weather (non-stormwater) flow monitoring and elimination.
- Continue to use available technologies and tools to improve data management, access, and assessment, for which significant accomplishments were made during the 2018-2019 monitoring year.

The Permittees also request that the Regional Board consider the following actions for the pending MS4 Permit:

- Remove the requirement from the Permit for data comparison to United States Environmental Protection Agency (USEPA) Benchmarks, as the Basin Plan requirements were previously developed and determined by the Regional Board to be adequate for the purpose of protection of beneficial uses.
- Use the parameter monitoring lists generated based on Permit criteria (MRP Section III.E.1(b)(iv)) as the basis for water quality analysis under the next Permit, while streamlining the lists for consistency and comparability across the station and event types. A non-detect analysis was conducted using data collected through the 2018-2019 monitoring year, and updated parameter lists are proposed.

11-1.0 INTRODUCTION

11-1.1 MONITORING AND REPORTING PROGRAM

Monitoring was conducted by the Riverside County Watershed Protection Program during the 2018-2019 monitoring year to address the objectives of the Monitoring and Reporting Program (MRP) (Appendix 3 of the 2010 Municipal Separate Storm Sewer System [MS4] Permit[2]). This report presents the results of this eighth year of monitoring under the MRP of the 2010 MS4 Permit. The activities and objectives of the MRP are summarized in **Table 1-1**. The MRP is limited to the area of Riverside County under Permittee jurisdiction within the Santa Ana River Watershed, referred to throughout this report as the Santa Ana Region or SAR.

Table 1-1: Summary of Monitoring and Reporting Program Overall Activities and Objectives

Activities	Objectives
1. Collect water quality data 2. Collect rainfall/runoff data 3. Establish QA/QC procedures 4. Conduct data analysis and archiving 5. Install and maintain appropriate equipment 6. Prepare an Annual Report	1. Assess rates of mass loading 2. Assess influence of land use on water quality 3. Assess compliance with WQOs 4. Assess effectiveness of water quality controls 5. Detect IC/IDs 6. Identify problem areas and/or trends 7. Identify pollutants of concern 8. Identify baseline conditions 9. Establish/maintain a water quality database

IC/ID – illicit connection/illegal discharge; QA – quality assurance; QC – quality control; WQO – water quality objective

The SAR MRP includes monitoring of receiving waters, outfalls, illicit connection/illegal discharge (IC/ID) monitoring, and special studies, including participation in the Southern California Stormwater Monitoring Coalition (SMC) Regional Bioassessment Monitoring Program. The Consolidated Monitoring Program (CMP, **Attachment A**) developed by the Permittees describes the procedures for each required compliance program. The "monitoring year" begins on July 1, 2018 and ends on June 30, 2019, similar to the fiscal year. The wet season/wet weather (i.e., October 1 through May 31) and dry season/dry weather (i.e., June 1 through September 30) establish monitoring event periods. Monitoring events during wet weather must meet the wet weather mobilization criteria described in the CMP. Samples are analyzed for water quality parameters specific to each monitoring program.

Monitoring data are evaluated to address the assessment and reporting requirements of the MRP. Water quality results are compared to applicable water quality objectives (WQOs). Flow and water quality data are used to calculate instantaneous mass loadings. In addition, the annual monitoring snapshot is evaluated in the context of historical monitoring results using trend analysis, exceedance frequencies, comparison to baseline, and determination of persistence. Integrated results are used to address the five management questions from the Model Monitoring Program for MS4 in Southern California (MMP) (SMC, 2004) as required by the 2010 MS4 Permit.

[2] The 2010 MS4 Permit expired on January 29, 2015. The Regional Board provided direction to the Permittees to continue monitoring under the 2010 Permit MRP and CMP for the 2018-2019 monitoring year.

11-1.2 WATERSHED CHARACTERISTICS

The climate of the SAR is Mediterranean, characterized by warm, dry summers and cool, rainy winters. Annual precipitation ranges from less than 10 inches in the alluvial valleys where urban development is concentrated to over 36 inches in the San Bernardino, Santa Ana, and San Jacinto Mountains. In general, shading from the coastal ranges that form the western boundary of the SAR (Santa Ana Mountains) translates to very little precipitation throughout valley areas of the inland SAR. The Santa Ana River flows perennially (i.e., streams with year-round continuous flow) from the City of San Bernardino through Prado Dam because of permitted discharges from publicly-owned treatment works (POTWs). Under natural conditions, the majority of streams in the SAR are ephemeral (i.e., dry and only flowing during and immediately after rainfall events). The SAR includes Reaches 3 and 4 of the Santa Ana River and its tributaries, the San Jacinto River basin and its tributaries, Lake Elsinore, Canyon Lake, and numerous other lakes, reservoirs, and surface waters.

11-1.3 PRECIPITATION

The Riverside County Flood Control and Water Conservation District (District) uses forecasts and annual precipitation records for five District precipitation stations (Riverside, Corona, Elsinore, Hemet/San Jacinto, and Perris/Moreno Valley) to characterize conditions within the SAR. Annual rainfall data for each precipitation station are summarized in **Table 1-2**. The annual total amount of rainfall measured at each precipitation station for the current Permit term is presented in **Table 1-3**. Wet weather mobilization criteria are defined in the CMP, and additional daily precipitation data for each station are summarized in **Attachment B**.

Table 1-2: Long-Term Average Rainfall by Precipitation Station

Station Name	ID No	Location	Years of Data	Average Annual Rainfall (inches)
Riverside	178	2S/5W-14	71	10.99
Corona	035	4S/7W-02	90	14.46
Elsinore	067	6S/4W-07	122	11.98
Hemet/San Jacinto	186	4S/1W-35	127	12.61
Perris/Moreno Valley	155	4S/3W-30	63	12.22

ID – identification

Table 1-3: SAR Annual Rainfall Summary

Monitoring Year *	Annual Rainfall (inches)				
	Riverside	Corona	Elsinore	Hemet/ San Jacinto	Perris/ Moreno Valley
2011-2012	6.93	9.19	5.78	8.55	7.44
2012-2013	6.22	6.44	4.42	6.33	7.74
2013-2014	6.59	7.22	4.59	6.32	8.28
2014-2015	8.96	7.29	7.01	8.79	9.57
2015-2016	9.49	11.11	6.62	8.81	12.1
2016-2017	13.72	17.66	14.95	14.39	15.96
2017-2018	5.18	4.55	3.38	5.14	7.08
2018-2019	14.48	20.79	14.43	16.35	18.52
* Fiscal Year = July 1 through June 30					

The 2018-2019 monitoring year was a "wet" year with 135% of the long-term average precipitation recorded for the SAR as a whole. **Figure 1-1** shows eight years of rainfall data as a percentage of the long-term average rainfall ("Percent of Normal Precipitation") based on an average of the five rain gauges (Riverside, Corona, Elsinore, Hemet/San Jacinto, and Perris/Moreno Valley).

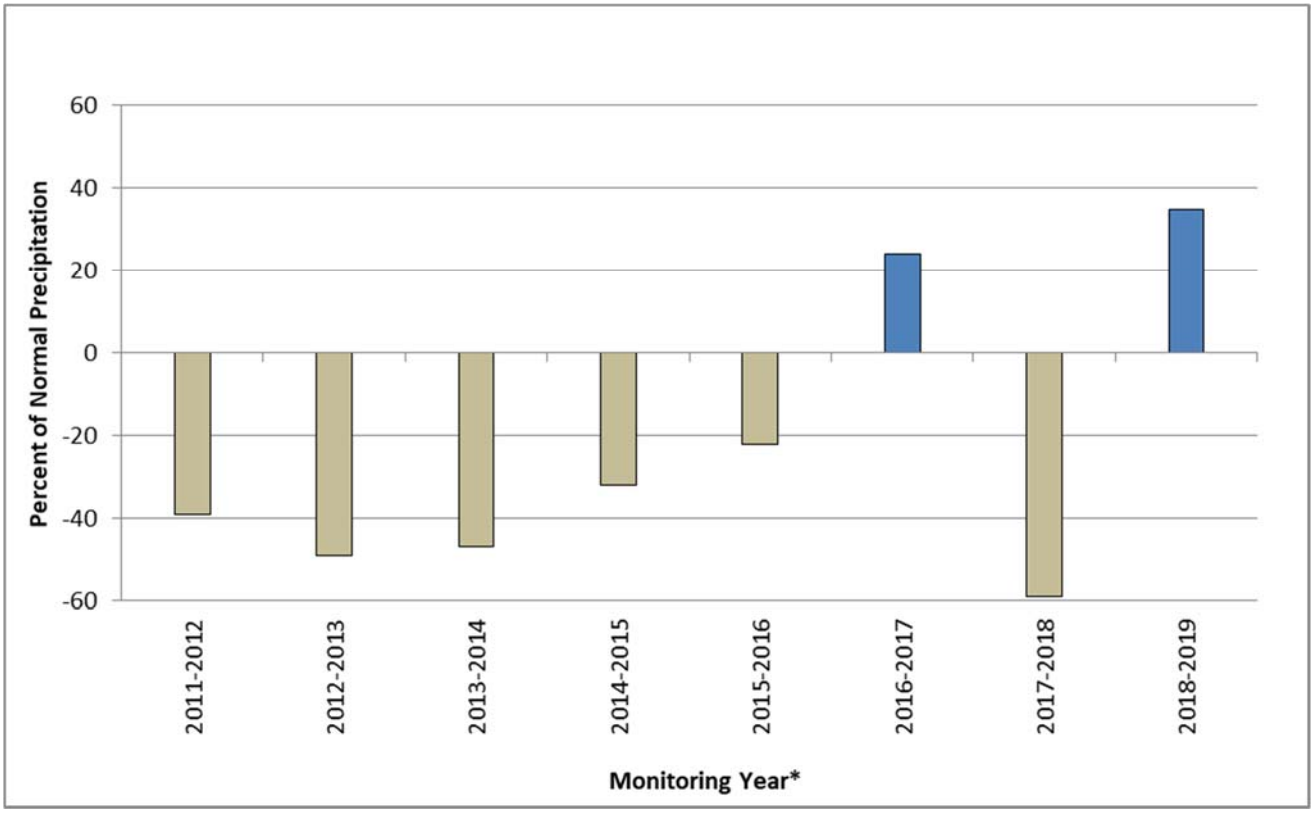


Figure 1-1: Average Annual Rainfall in the SAR as a Percentage of Normal

11-1.4 WILDFIRES

The residual effects of wildfires that have occurred within the Santa Ana River watershed may impact water quality for several years after their initial burn, depending on the severity of the fire, total acreage, and relative location. A combination of factors may impact water quality, such as: loss of vegetation; aerial deposition of ash containing metals, nutrients, particulates, and toxic organics; hydrophobic soils increasing runoff rates and volumes; increased landscape instability, erosion, and sedimentation; wash-off of naturally-occurring elements that are usually retained by vegetation and soils; increased pH in urban runoff; and chemical changes in the soil that may increase metal and nutrient loading (United States Geological Survey [USGS], 2007; Southern California Coastal Watershed Research Project [SCCWRP], 2009; United States Forest Service [USFS], 2009; Cleveland National Forest Service, Schwartz, 2018). In 2014, specialized wet weather sampling was prompted after the Falls Fire (1,383 acres burned) to characterize the potential effect of post-fire sediment flows on the health of Lake Elsinore. The results of this study are presented in the 2013-2014 and 2014-2015 Monitoring Annual Reports.

During the 2018-2019 wet season, the Southern California region received several torrential storm events that prompted the District to initiate post-fire stormwater runoff and sediment studies in areas affected by the Holy Fire (23,025 acres burned). In coordination with Alta Environmental, on behalf of the Permittees within the SAR watershed, and with guidance from the Lake Elsinore/Canyon Lake Total Maximum Daily Load (TMDL) Task Force, the District conducted a post-fire monitoring study to evaluate and assess the potential environmental impact to the downstream receiving waters. The District's overall sample design was driven by understanding post-runoff effects on contaminant flux to downstream receiving waterbodies comparative to reference sites that are unaffected by wildfires. This effort to characterize post-fire pollutants entering Lake Elsinore, a 303(d) listed waterbody for nutrients and organic enrichment/low dissolved oxygen (DO), was guided by the continuing study from SCCWRP and the SMC on the effects on post-fire runoff on surface water quality in Southern California. The full post-fire report, including data and figures, is provided in the SAR Post-Fire Monitoring Report (Alta, 2019) (**Attachment C-1).**

During the 2018-2019 wet season, the District conducted another specialized effort to quantify the total volume of sediment and nutrients removed from two District facilities (i.e., Leach Canyon Dam and McVicker Canyon Basin), which flow into Leach Canyon Channel before entering Lake Elsinore. This study was performed by collecting a single grab sample and analyzing the total nutrient concentrations from sediment stockpiles removed from Leach Canyon Dam and McVicker Canyon Basin. The Sediment Quantity and Nutrient Load Reduction Report 2018-2019 (District, 2019) highlights the magnitude of sediment excavated from both basins during pre-storm facility preparations and nutrient loads removed throughout the recent storm season and is provided in **Attachment C-2**. The District's operational response to maintain and improve the basin capacities was essential to protecting communities from severe flooding and preventing high nutrient concentrations from flowing into Lake Elsinore.

Furthermore, the 2018 Holy Fire was met with red flag warning winds which mobilized ash across the extents of the County. The vastly burned area created a large smoke plume above the City of Lake Elsinore making the area partially dark in the daytime. This resulted in region-wide warnings from Health experts and the South Coast Air Quality Management District. It is expected that with such a large fallout area and with the strong northeasterly winds carrying smoke and ash that the event will

have water quality impacts in parts of the County, specifically as it pertains to phosphorus concentrations.

Although a mostly natural and beneficial process of Southern California's chaparral ecology, wildfires increase the natural terrain's susceptibility to severe erosion and major flooding in the watershed. The Permittees continue to track wildfires within SAR, as it may take several years for ashes and sediment displaced by wildfires to be washed to downstream monitoring stations, thereby making wildfires that occurred in previous years potential sources of elevated levels of pollutants. These additional efforts inform the Permittees about wildfire impacts within the local watershed, which may assist in future decision-making strategies. Noticeably, as more wildfires occur, there are implications for aerially deposited ash and fire suppressant chemicals to be indirectly introduced to waterbodies not directly adjacent to the fire perimeter, but rather located several miles away from the fire extent. Listed in **Table 1-4** are the most current and historical wildfires (since 2011), including general information about the fire event, start date, location description, total burn acreage, and subtotal acreage burned within the SAR watershed. **Figure 1-2** is a wildfire location map that is maintained and updated by the District annually.

Table 1-4: Wildfires within SAR Watershed

Event ID	Fire Name	Start Date	Total Acres	Acres in SAR	Location	Latitude	Longitude
FY 2018-2019 WILDFIRES – Three wildfires in SAR (total of 36,779 acres burned)							
CARRU-079226	Jerry	6/21/2019	525	525	Off Gilman Springs Road, between Highway 60 and Jack Rabbit Trail	33.91951	-117.10377
CACNF-002664	Holy	8/6/2018	23,025	17,053	Holy Jim Canyon, west of North Main Divide	33.69888	-117.52055
CABDF-011390	Cranston	7/25/2018	13,229	13,160	Off Highway 74 and Control Road, east of Hemet	33.71129	-116.76930
FY 2017-2018 WILDFIRES – Seven wildfires in SAR (total of 8,897 acres burned)							
CARRU-082316	Eagle	7/4/2017	205	N/A	Off Tin Mine Road and La Sierra Avenue, near Lake Mathews	33.84750	-117.46139
CARRU-094091	Rose	7/31/2017	200	200	Off Amorose Street, in the community of Lake Elsinore	33.68194	-117.39972
CARRU-099747	Blaine	8/3/2017	1,044	1,044	Off Blaine Road and Terrace Drive in Box Spring Mountain	33.98250	-117.30806
CACNF-002924	Canyon	8/27/2017	46	46	Highway 74 and South Main Divide, 2 miles southwest of Lake Elsinore	33.63525	-117.40110
CARRU-108660	Palmer	9/2/2017	3,874	3,874	Off San Timoteo Canyon Road and Fisherman's Retreat, Beaumont	33.98056	-117.11639
CAORC-105068	Canyon	9/25/2017	2,662	2,662	CA-91 and Cole Canyon, City of Anaheim	33.8668	-117.68598
CACNF-003839	Wildomar	10/26/2017	866	66	South Main Divide Road and Wildomar OHV Park, west of Wildomar City	33.58587	-117.34040

Table 1-4: Wildfires within SAR Watershed

Event ID	Fire Name	Start Date	Total Acres	Acres in SAR	Location	Latitude	Longitude
FY 2016-2017 WILDFIRES – Three wildfires in SAR (total of 8,634 acres burned)							
CARRU-105125	Bogart	8/30/2016	975	693	Off Winesap Avenue and International Park Road, north of Beaumont, near Cherry Valley	33.98310	-116.95390
CA-RRU-053193	Opera	4/30/2017	1,350	1,350	Off Opera Loop & East Palmyrita Avenue, in Highgrove	34.00556	-117.30639
CA-RRU-078840	Manzanita	6/26/2017	6,309	6,309	Off Highway 79 North, Lambs Canyon south of Dump Road, south of Beaumont	33.88167	-116.98972
FY 2015-2016 WILDFIRES – One wildfire in SAR (total of 543 acres burned)							
CA-RRU-090069	Anza	8/10/2015	543	543	Highway 74 east of Highway 371	33.569444	-116.59139

N/A – Not Applicable; OHV – Off highway vehicle

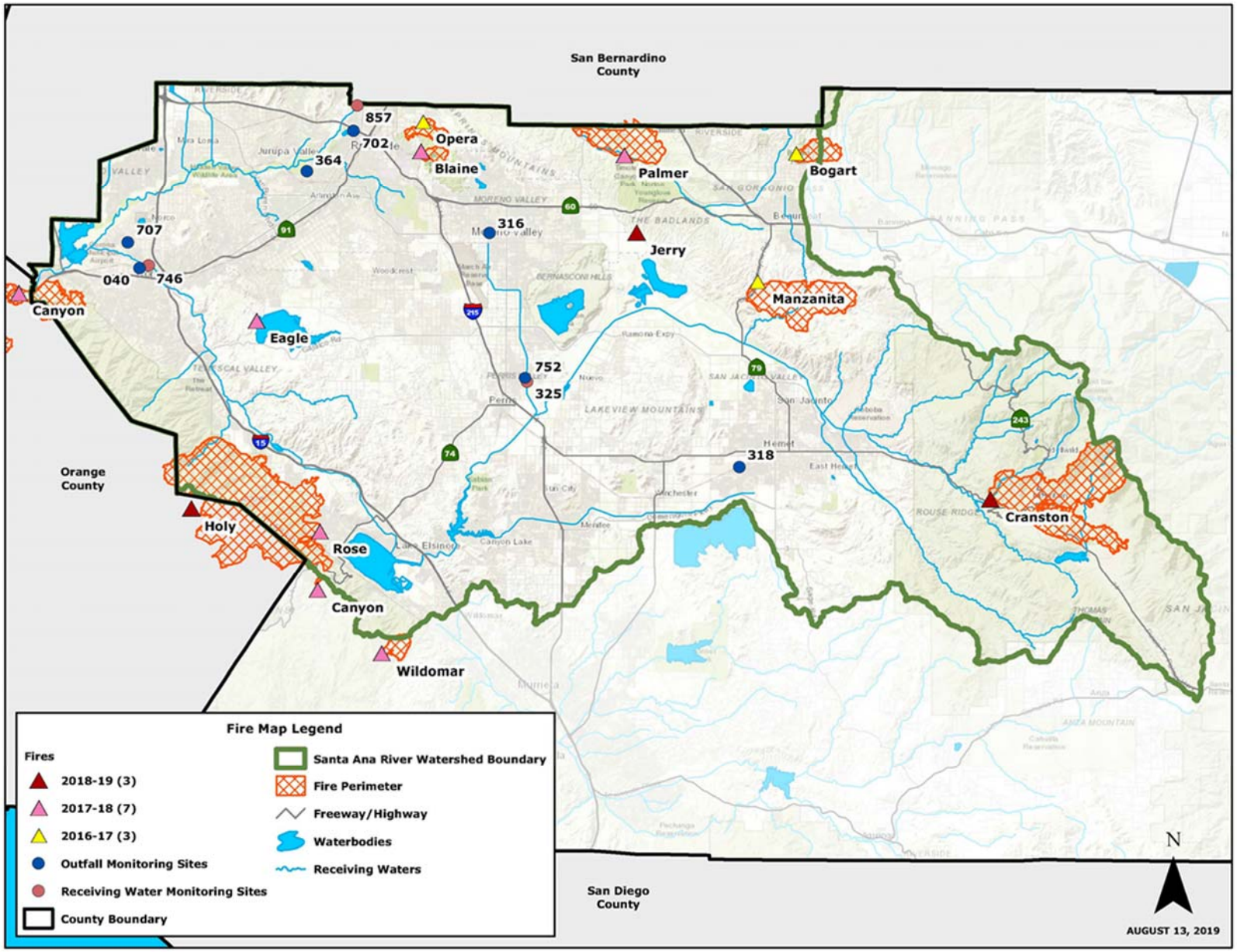


Figure 1-2: Wildfires within SAR Watershed from 2016-2019

11-2.0 MONITORING PROGRAM OVERVIEW AND METHODS

The monitoring program is detailed in the CMP. This section provides an overview of the monitoring program, including monitoring station characteristics, monitoring components and parameters, and water quality issues and assessment criteria.

11-2.1 CMP

Objectives, requirements, and methods of the monitoring and reporting program are all detailed in the CMP, which includes a Quality Assurance Project Plan (QAPP, CMP Volume II) and the SAR Monitoring Plan (CMP Volume IV).

The CMP is updated as needed, most recently in October 2018. The most current version of the SAR Monitoring Plan is available online from the District's website: (http://rcflood.org/NPDES/Monitoring.aspx). The SAR Monitoring Plan and its program components include the following:

- Introduction
- WQOs
- Receiving Water Monitoring Program
- MS4 Outfall and Mass Emissions Monitoring Program
- IC/ID Monitoring
- Special Studies
  - TMDL/303(d) Listed Waterbody Monitoring
  - Regional Monitoring Programs
  - Low Impact Development Best Management Practice (BMP) Monitoring
- Data Records, Management, and Reporting

11-2.2 MONITORING STATIONS

Monitoring stations have been established throughout the SAR, including three receiving water locations and seven historical "Core" MS4 outfalls, hereafter referred to as MS4 outfall stations. Each station has been assigned a nine-digit alpha-numeric code (SAR hydrologic unit code [HUC], site descriptor, three-digit database code)[3], which has been used throughout the Monitoring Annual Report. **Table 2-1** provides a summary of receiving water station locations, and **Table 2-2** provides a summary of MS4 outfall station locations. Additional information about SAR monitoring stations, land uses, changes in land use over time, and population, is provided in **Attachment D**.

[3] These codes were assigned to the historical MS4 outfall stations during the 2009-2010 monitoring year. For simplicity, several maps use the three-digit database code as an identifier for the MS4 outfalls.

Table 2-1: Receiving Water Monitoring Station Summary

Station ID	Station Name	Facility Type	Receiving Water	WQO Receiving Water	HUC	Permittee
801AHG857	Santa Ana River at Highgrove Channel [1]	Natural Channel	Santa Ana River Reach 4	Santa Ana River Reach 4	801.27	Riverside
801TMS746	Temescal Channel at Main Street	Concrete Channel	Temescal Creek Reach 1a	Temescal Creek Reach 1a	801.25	Corona
802NVO325	Perris Valley Channel at Nuevo Road	Natural Channel	San Jacinto River Reach 3	San Jacinto River Reach 3	802.11	Perris

[1] The Santa Ana River at Highgrove receiving water station is located at the County line and does not receive runoff from the Riverside County MS4. It characterizes perennial dry weather flow as it enters the County from San Bernardino.

Table 2-2: MS4 Outfall Monitoring Station Summary

Station ID	Station Name	Facility Type	Receiving Water	WQO Receiving Water [1]	HUC	Permittee
801CRN040	Corona Outfall	Rectangular	Temescal Creek Reach 1a	Temescal Creek Reach 1a	801.25	Corona
802SNY316	Sunnymead Channel NPDES – Line B at Alessandro Boulevard and Heacock Street (Sunnymead Outfall)	Trapezoidal	Perris Valley Storm Drain	San Jacinto River Reach 3	802.11	Moreno Valley
802HMT318	Hemet Channel NPDES – Sanderson Avenue to Cawston Avenue (Hemet Outfall)	Trapezoidal	Salt Creek	Salt Creek	802.12	Hemet
801MAG364	Magnolia Center Outfall	Pipe	Santa Ana River Reach 3	Santa Ana River Reach 3	801.26	Riverside
801UNV702	University Wash Outfall	Natural Channel	Lake Evans	Santa Ana River Reach 4 [2]	801.27	Riverside
801NNR707	North Norco Outfall	Rectangular	Prado Flood Control Basin	PBMZ / Santa Ana River Reach 3 (historically Temescal Creek Reach 1)	801.25	Corona
802PLJ752	Perris Line J Outfall	Trapezoidal	San Jacinto River Reach 3	San Jacinto River Reach 3	802.11	Perris

NPDES – National Pollutant Discharge Elimination System; PBMZ – Prado Basin Surface Water Management Zone

[1] The WQOs for the receiving water associated with each MS4 outfall station were determined by the downstream HUC and beneficial uses. This receiving water is used to determine the site-specific WQOs for water quality parameters at MS4 outfall stations and evaluate the potential impact of urban runoff on receiving waters in accordance with the 2010 MS4 Permit.

[2] There is potential connectivity to Santa Ana River Reach 4 if Lake Evans overflows, which only occurs during significant precipitation events. Hydrologic connectivity is ascertained and documented by field crews during each monitoring event.

The relative positions of receiving water stations and the MS4 outfall stations are shown in **Figure 2-1** and described in **Table 2-3.**

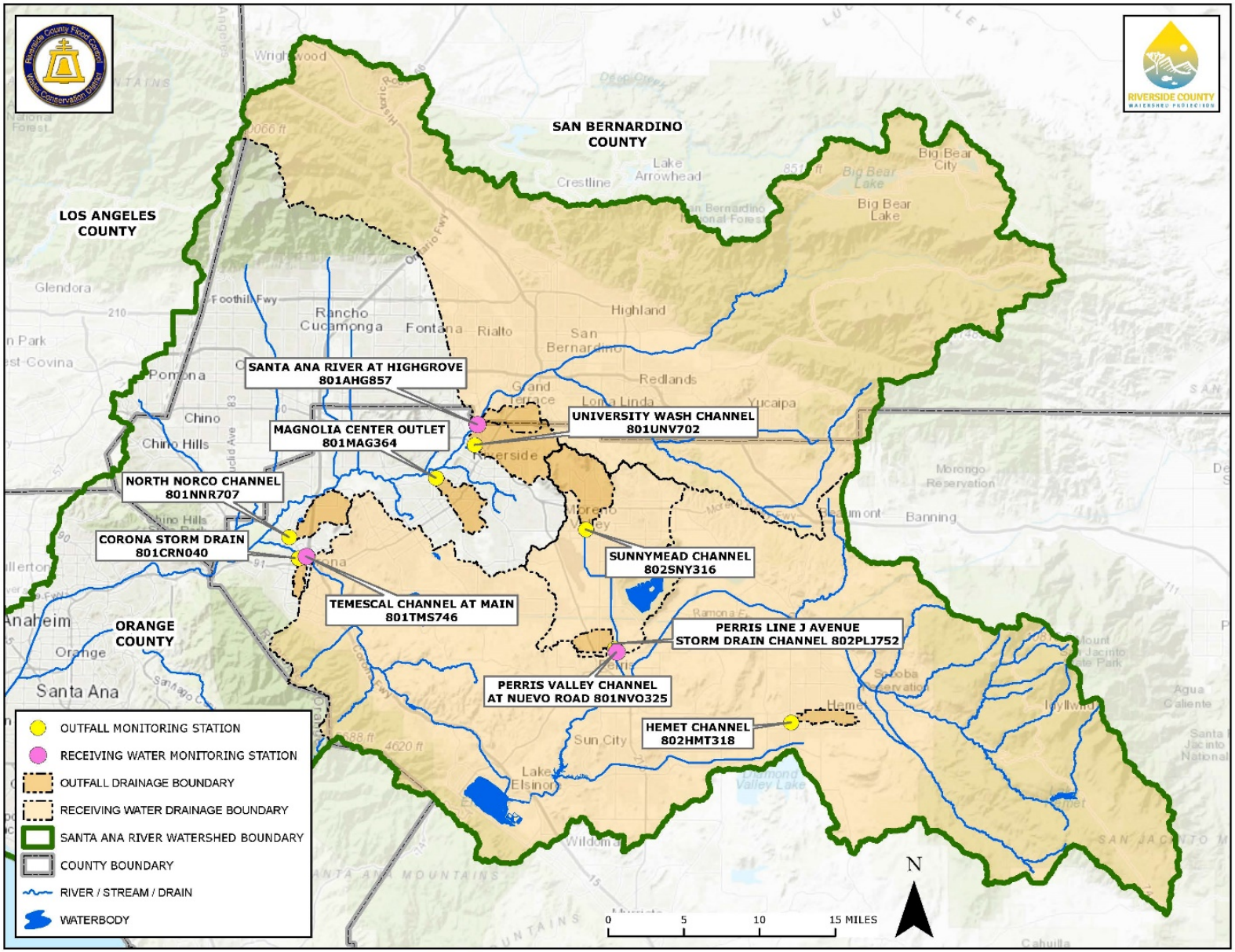


Figure 2-1: MS4 Outfall and Receiving Water Monitoring Station Locations in the SAR

The total distance between a MS4 outfall station and a receiving water station, shown in **Table 2-3**, does not imply a single flow path or imply flow from a MS4 outfall to a receiving water station. The Perris Valley Channel at Nuevo Road receiving water station is the only receiving water location downstream of MS4 outfall stations. As a result, the evaluation of urban runoff and its impact on water quality and beneficial uses of SAR receiving waters is limited to this small portion of San Jacinto River Reach 3. The Santa Ana River at Highgrove receiving water station is located at the County line with San Bernardino County. Data from this station are used to characterize perennial dry weather flows entering Riverside County through Reach 4 of the Santa Ana River. Perennial flows are due to effluent from the Rialto Wastewater Treatment Plan (WWTP) and the Colton/San Bernardino Rapid Infiltration and Extraction Facility (RIX), which are located approximately two miles upstream from this receiving water station. There are no MS4 discharges between these POTWs and the receiving water station; therefore, data from this station represent a permitted discharge outside the control of the Permittees and not the effects of discharges from the Permittees' MS4.

Table 2-3: Relative Location of MS4 Outfall and Receiving Water Monitoring Stations

Station ID	MS4 Outfall Station	Relative Location of MS4 Outfall Station to Nearest Receiving Water Station	Distance from MS4 Outfall Station to Point of Confluence with Receiving Water	Distance from Point of Confluence to a Receiving Water Station	Total Distance between MS4 Outfall and Receiving Water Stations [1]
801CRN040	Corona Outfall	Discharges to the PBMZ/Temescal Creek downstream of 801TMS746	0.6 mile along storm drain channel to Temescal Creek	801TMS746 is 0.8 mile upstream on Reach 1a of Temescal Creek	1.4 miles
802SNY316	Sunnymead Outfall	Discharges to Perris Valley Channel upstream 802NVO325	4.5 miles along storm drain channels to Perris Valley Channel at termination of Lateral A	802NVO325 is 5.0 miles downstream of Lateral A	9.5 miles
802HMT318	Hemet Outfall	Discharges to tributary upstream of Salt Creek	N/A	N/A	N/A
801MAG364	Magnolia Center Outfall	Discharges to Santa Ana River downstream of 801AHG857	1.2 miles along "tributary" to Santa Ana River	RW station is 5.5 miles upstream on Santa Ana River	6.7 miles
801UNV702	University Wash Outfall	Discharges to Lake Evans	0.1 mile to Lake Evans	N/A	N/A
		Discharge from Lake Evans to Santa Ana River downstream of 801AHG857	0.9 mile from Lake Evans spillway to Santa Ana River [2]	RW station is 2.4 miles upstream on Santa Ana River	3.4 miles
801NNR707	North Norco Outfall	Discharges to the PBMZ downstream of 801TMS746	0.9 mile along "tributary" to historical Temescal Creek Reach 1 (now PBMZ)	RW station is 1.9 miles upstream on Reach 1a of Temescal Creek	2.8 miles
802PLJ752	Perris Line J Outfall	Discharges to Perris Valley Channel upstream of 802NVO325	0.2 mile to Perris Valley Channel	RW station is just downstream of Line J intersection with Perris Valley Channel	0.2 mile

N/A – Not applicable. There is no receiving water station associated with this MS4 outfall station

RW – Receiving water; PBMZ – Prado Basin Surface Water Management Zone

[1] Distances are approximate. The "total distance between MS4 outfall and receiving water stations" does not represent a single flow path or imply flow from a MS4 outfall to a receiving water station.

[2] Potential connectivity to the Santa Ana River receiving water if Lake Evans overflows, which may only occur during significant wet weather events. The flow path from Lake Evans to the receiving water is approximate. Total distance does not include lake area.

11-2.3 WATER QUALITY MONITORING AND PARAMETERS

Table 2-4 provides a summary of individual monitoring program requirements and where current year results are presented in this Monitoring Annual Report. Samples are collected at SAR monitoring stations during both wet and dry weather events, with the exception of the Santa Ana River at Highgrove receiving water station, which is monitored during dry weather only, and Temescal Channel at Main, which is monitored during wet weather only. Complete lists of water quality parameters, analytical methods, and reporting limits (RLs) requested of the laboratory for the 2018-2019 monitoring year are provided in **Attachment E.**

Table 2-4: Summary of 2018-2019 SAR Monitoring Program

Monitoring Program (Report Section)	Monitoring Component	Sampling Frequency	No. Stations	Analytical Requirements
MS4 Outfall Monitoring (**Section 11-3.2**)	MS4 Outfall Monitoring	2 Dry Events 3 Wet Events	7 stations	Flow; field parameters; chemistry; bacterial indicators
IC/ID Monitoring (**Section 11-3.2.2**)	IC/ID Investigations	Dry weather, scheduled and monitored per Permittee Local Implementation Plan.		Flow (if present); field parameters (if present)
Receiving Water Monitoring (**Section 11-3.3**)	Receiving Water Monitoring	2 Dry Events 2 Wet Events	3 stations [1]	Flow; field parameters; chemistry; bacterial indicators
	Water Column Toxicity	2 Dry Events 2 Wet Events	3 stations [2]	Toxicity
	Follow-up Toxicity Analyses	Sampling as necessary.		Toxicity for TIEs and TREs; field parameters and chemistry as needed for source identification
	SMC Bioassessment Monitoring Program	1 Dry Event (2019)	2 condition, 2 trend sites	CRAM; benthic algae; benthic macroinvertebrates; physical habitat; flow; hydromodification screening; field parameters; chemistry; invasive vertebrates checklist; channel engineering checklist; bioanalytic screens; hydrologic state checklist; water level logging; sediment toxicity[3]; sediment chemistry[3]
Special Studies (**Section 0**)	TMDL/303(d) Listed Waterbody Monitoring • MSAR Bacterial Indicator TMDL Monitoring • Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Regional Monitoring Programs • SMC LID BMP Special Study • Hydromodification Monitoring Program • Salinity Management Program Post-Fire Monitoring Studies			

MS4 – municipal separate storm sewer system; IC/ID – illicit connection/illegal discharge; CRAM – California Rapid Assessment Method; LID – Low Impact Development; MSAR – Middle Santa Ana River; TIE – toxicity identification evaluation; TRE – toxicity reduction evaluation

[1]Three receiving water stations are monitored as described in the CMP. One receiving water station is monitored during both wet and dry weather, whereas the other two receiving water stations are monitored only during one condition (dry or wet).

[2]These monitoring efforts are typically coordinated with receiving water chemistry sample collection.

[3]Sediment chemistry and sediment toxicity were added to the 2015-2019 SMC Program monitoring protocols in 2017. Testing for these parameters is dependent upon availability of qualifying depositional sediment material at monitoring sites.

During wet weather, the CMP requires the Temescal Channel at Main and Perris Valley Channel at Nuevo Road receiving water stations to be monitored for the first sampleable storm of the wet season (October 1 to May 31) and one additional wet weather event. Flow-weighted composite samples are collected at these receiving water stations. The seven MS4 outfall stations are required to be monitored for the first sampleable storm and two additional wet weather events by collecting grab samples. If samples could not be collected during wet weather monitoring, a wet weather event was determined to be a false start (FS). An FS event can result from station conditions not representative of precipitation-generated runoff, flow insufficient for sample collection, unsafe weather conditions, other safety concerns within the vicinity of the station, station conditions not representative of the forecasted information, etc. If a monitoring station had one or more FS wet weather event(s), field personnel were mobilized to that monitoring station for subsequent storms in attempt to fulfill the required frequency of wet weather events until successfully completed, or until the end of the wet weather season.

Dry weather monitoring is conducted as grab samples at the seven MS4 outfall stations and two receiving water stations. Water quality samples are only collected when there is sufficient flow for sample collection. Care is taken not to collect samples that would characterize ponded, stagnant water. When monitoring stations were dry or observed flow was insufficient for sample collection, a dry weather event was recorded as visited not sampled (VNS). Up to two site visits (samples collected or identified as VNS) are conducted annually at dry weather monitoring stations.

During the 2010 MS4 Permit term, parameter lists were standardized and refined. Several parameters (nutrients, iron, and total petroleum hydrocarbons [TPH]) were re-introduced for a station or type of monitoring event, even though they are not required to be monitored. This update was made to ensure consistent data will be collected at monitoring stations over time. Further, the 2010 MS4 Permit requires monitoring only total phase metals, but the Permittees chose to add dissolved metals to the SAR monitoring program to evaluate metals concentrations using the California Toxics Rule (CTR) WQOs, which are expressed in the dissolved fraction (see **Section 11-2.5**).

The 2010 MS4 Permit allows Permittees to re-evaluate analytical monitoring lists annually. The analysis identifies parameters that have been non-detect (ND) in samples for at least three consecutive monitoring events, as described in MRP Section III.E.1(b)(iv). A thorough analysis of constituents with ND results was completed and presented in the 2013-2014 Monitoring Annual Report. A revised list was agreed upon through discussion with the Regional Water Quality Control Board (Regional Board) and has been used since the 2016-2017 monitoring year. This list will continue to be used for the 2019-2020 monitoring year and is included in **Attachment F**. Constituents that were ND but had analytical detection limits above corresponding CTR/Santa Ana Region Basin Plan (Basin Plan) WQOs or Multi-Sector General Permit (MSGP) benchmarks (current 2008 MSGP) were kept on the list.

An ND analysis was conducted concurrently with the development of this Monitoring Annual Report, using data collected through the 2018-2019 monitoring year. Based on the results of this analysis, revised parameter lists are proposed and provided as **Attachment F** for use in the 2020-2021 monitoring year. The Permittees recommend that the Regional Board adopts the standardized and refined lists in the next Permit term.

The CMP QAPP prescribes program wide quality assurance/quality control (QA/QC) procedures for both field sampling and laboratory analyses (CMP Volume II available at: http://rcflood.org/NPDES/Monitoring.aspx). A QA/QC review for the 2018-2019 monitoring year was conducted to identify issues needing corrective action to facilitate increased data quality and program efficiency in accordance with the QAPP. The results are provided in **Attachment G**. Of note, various analytes were detected in the field and equipment blanks supplied by the analytical laboratory. An investigation determined that the laboratory was not utilizing the appropriate water source, and corrective actions have been taken.

11-2.4 Beneficial Uses and 303(d) Listed Waterbodies by Monitoring Station

Beneficial uses represent the various ways that a waterbody may be used for the benefit of people and/or wildlife (Regional Board, 1995; updated in 2008, 2011, and 2016). The beneficial uses associated with the SAR receiving waters downstream of each MS4 outfall and receiving water station are presented in **Table 2-5**. This table reflects changes made to waterbody delineations and beneficial uses through February 2016.

In accordance with Section 303(d) of the Clean Water Act (CWA), the State Water Resources Control Board (State Board) conducts a biennial assessment of water quality data for California surface waters to determine if pollutant levels exceed water quality standards and, therefore, represent a potential impact to receiving water beneficial uses. Waterbodies and pollutants identified by this assessment are then prioritized and recorded in the 303(d) list. The 2014/2016 Integrated Report (CWA Section 303(d)/305(b) List) (State Board, 2017) provides the most recent list of impaired waterbodies in the SAR watershed. Those waterbodies listed in the Riverside portion of the SAR are presented in **Table 2-6.**

Table 2-5: Beneficial Uses for Receiving Waters Associated with MS4 Outfall and Receiving Water Monitoring Stations

Beneficial Use	Receiving Water Station ID:	-	-	-	-	-	-	-	801TMS746	801AHG857	802NVO325
	MS4 Outfall Station ID:	801CRN040	802SNY316	802HMT318	801MAG364	801UNV702	801NNR707	802PLJ752	-	-	-
	Receiving Waterbody:	Temescal Creek Reach 1a	San Jacinto River Reach 3	Salt Creek	Santa Ana River Reach 3	Santa Ana River Reach 4	PBMZ	San Jacinto River Reach 3	Temescal Creek, Reach 1a	Santa Ana River Reach 4	San Jacinto River Reach 3
Municipal and domestic supply (MUN)		E	E	E	E	E	E	E	E	E	E
Agricultural supply (AGR)			I		X			I			I
Groundwater recharge (GWR)			I		X	X		I		X	I
Water contact recreation / Primary contact recreation (REC-1)		E**	I	I	X	X*	X*	I	E**	X*	I
Non-contact water recreation / Secondary contact recreation (REC-2)		X	I	I	X	X	X	I	X	X	I
Warm freshwater habitat (WARM)		X	I	I	X	X	X	I	X	X	I
Wildlife habitat (WILD)		X	I	I	X	X	X	I	X	X	I
Rare, threatened, or endangered species (RARE)					X	X	X			X	
Spawning, reproduction, and development (SPWN)					X	X				X	

PBMZ = Prado Basin Surface Water Management Zone.
E – Receiving water is exempt from beneficial use.
I – Intermittent beneficial use.
X – Present or potential beneficial use.
*Access prohibited in some portions.
**Primary contact recreation (REC-1) beneficial use was determined to be unattainable for Temescal Creek Reach 1a by means of a use attainability analysis (UAA).

Table 2-6: SAR Receiving Waters and the 2014/16 Section 303(d) List of Impaired Waterbodies

SAR Waterbody on the Section 303(d) List	Watershed ID	Affected Area	Listed Pollutant	Current TMDLs (Office of Administrative Law Approval Date)	Applicable MS4 Outfall Stations	Applicable Receiving Water Stations
Canyon Lake (Railroad Canyon Reservoir)	80211000	453 acres	Nutrients ***	Lake Elsinore and Canyon Lake Nutrient TMDL (7/26/2005)	--	--
Chino Creek Reach 1A (Santa Ana River R5 confluence to just downstream of confluence with Mill Creek)	80121000	0.8 mile	Bacterial indicators; nutrients	MSAR Bacterial Indicator TMDL (9/1/2006)	--	--
Chino Creek Reach 1B (Mill Creek confluence to start of concrete lined channel)	80121000	7.0 miles	Bacterial indicators; nutrients; chemical oxygen demand	MSAR Bacterial Indicator TMDL (9/1/2006)	--	--
Cucamonga Creek Reach 1 (Valley Reach)	80121000	9.6 miles	Cadmium; copper; lead; zinc	MSAR Bacterial Indicator TMDL (9/1/2006)	--	--
Elsinore, Lake	80231000	2,431 acres	Nutrients; organic enrichment/low DO; PCBs; toxicity; DDT	Lake Elsinore and Canyon Lake Nutrient TMDL (7/26/2005)	--	--
Goldenstar Creek	80126000	2.4 miles	Bacterial indicators	--	--	--
Mill Creek (Prado Area)	80121000	1.6 miles	Bacterial indicators; nutrients; TSS	MSAR Bacterial Indicator TMDL (9/1/2006)	--	--
Prado Basin Management Zone (historically, listed as Temescal Creek Reach 1)**	80125000	6,835 acres	pH	--	801CRN040; 801NNR707	801TMS746
San Timoteo Creek Reach 3	80152000	23.5 miles	Bacterial indicators	--	--	--
Santa Ana River Reach 3 *	80121000	26 miles	Bacterial indicators; copper; lead	MSAR Bacterial Indicator TMDL (9/1/2006)	801MAG364	--
Santa Ana River Reach 4	80127000	14.2 miles	Bacterial indicators	--	801UNV702	801AHG857

TMDL – total maximum daily load; DO – dissolved oxygen; DDT – dichlorodiphenyltrichloroethane ; PCB – polychlorinated biphenyl; TSS – total suspended solids
*In 2010, the 303(d) listing for copper included a caveat indicating the impairment only applied to wet weather conditions. The 2014/16 Section 303(d) List did not include a seasonal qualifier for the copper listing.
**Temescal Creek Reach 1 was listed for pH on the 2010 Section 303(d) List. The 2014/16 Section 303(d) List changed the listing to PBMZ due to a mapping change. Lines of Evidence for this listing include samples collected in the Temescal Creek receiving water above Main Street at Corona (approximate location of 801TMS746). Stations located on Temescal Reach 1a have been maintained as applicable MS4 outfall and receiving water stations for this listing.
***The 2014/16 Section 303(d) List delisted Canyon Lake for indicator bacteria impairment because water quality standards for *Escherichia coli* (*E. coli*) are not being exceeded.

11-2.5 COMPARISON CRITERIA FOR WATER QUALITY ASSESSMENT

The 2010 MS4 Permit identifies two sources of WQOs for evaluating water quality within the SAR: WQOs defined in the Basin Plan and WQOs defined in the CTR (40 Code of Federal Regulations [CFR] Part 131). The 2018-2019 Monitoring Annual Report applies the criteria defined in the most recent regulatory documents. The WQOs and CTR WQOs are provided in Table 2-1 of the SAR Monitoring Plan (CMP Volume IV, **Attachment A**). In accordance with the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California*, where a WQO and a CTR criterion are in effect for the same pollutant, the more stringent of the two applies. Discussion of water quality results is provided in comparison to both WQOs and/or CTR WQOs equally. It is important to note that sample results from the MS4 outfall stations were compared to these criteria for comparison purposes only, as WQOs and CTR WQOs are only applicable to receiving waters (State Board, 2005).

Santa Ana River Basin Plan WQOs and Statewide Bacteria Provisions

The Basin Plan contains WQOs that are designed to protect designated beneficial uses of waterbodies in the SAR. Some reaches of a waterbody may have different or multiple beneficial uses and, therefore, may have different or multiple corresponding WQOs. The Basin Plan WQOs are based on the February 2016 version of the Basin Plan, which incorporated several amendments to designated beneficial uses and WQOs, which include but are not limited to:

- Addition of a rare, threatened, or endangered species (RARE) and a spawn (SPWN) beneficial use to Santa Ana River Reach 4.
- Elimination of the WQO for fecal coliform bacteria and establishment of new site-specific and beneficial use-specific WQOs for *Escherichia coli* (*E. coli*).
- Establishment of criteria for temporary suspension of recreation use designations and corresponding *E. coli* objectives during high flow/unsafe flow conditions.
- Shortening and division of Temescal Creek Reach 1 into two reaches, Reach 1a and Reach 1b.
- Determination that the primary contact recreation (REC-1) beneficial use is unattainable for Temescal Creek Reach 1a by means of a use attainability analysis (UAA).

In August 2018, the State Board adopted the *Bacteria Provisions and a Water Quality Standards Policy for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (Statewide Bacteria Provisions). The Bacteria Provisions became effective upon approval by the Office of Administrative Law on February 4, 2019. These Statewide Provisions supersede the Basin Plan WQOs for REC-1 use except where a Basin Plan has established, prior to the Statewide Bacteria Provisions, where there are site-specific objectives (SSOs), when there is an exemption based on UAA, when there are approved high flow suspension criteria, or when there are TMDL numeric targets for the waterbody. The WQOs for *E. coli* include both a geometric mean (applicable to five samples within a six-week period) and a statistical threshold value (STV) applicable to fewer samples within a 30-day period.

Table 2-7 lists the *E. coli* WQOs for REC-1 that were used for water quality data assessment at each monitoring station, unless the Basin Plan criteria for the temporary suspension of REC-1 beneficial use designations and corresponding *E. coli* WQOs were met due to "unsafe flow" conditions in systems engineered or highly modified for flood control purposes. Unsafe flow conditions are presumed given either of two physical site conditions defined in the Basin Plan: 1) Measured stream velocities of greater than eight feet per second (fps); or 2) Measured stream depth-velocity of greater than 10 feet squared per second. Temescal Creek Reach 1a has only a secondary contact recreation (REC-2) beneficial use

because there is a REC-1 exemption based on an approved UAA. Therefore, REC-1 WQOs were not applied to the Temescal Channel at Main (801TMS746) receiving water station or Corona Outfall, which discharges to Temescal Creek 1a. The WQOs used for the Magnolia Center Outfall are based on the Middle Santa Ana River (MSAR) TMDL compliance target for *E. coli*.

Table 2-7: *E. coli* Water Quality Objectives Used for Assessments

MS4 Outfall Station ID	Comparative Receiving Water	Single-Sample *E. coli* Criteria	
		Comparative Basis	*E. coli* WQO
801CRN040	Temescal Creek Reach 1a*	N/A	359 MPN/100 mL (dry weather only)
802SNY316	San Jacinto River Reach 3	STV - Statewide Bacteria Provisions	320 CFU/100 mL
802HMT318	Salt Creek	STV - Statewide Bacteria Provisions	320 CFU/100 mL
801MAG364	Santa Ana River Reach 3	MSAR TMDL	212 MPN/100 mL**
801UNV702	Lake Evans	STV - Statewide Bacteria Provisions	320 CFU/100 mL
	Santa Ana River Reach 4	STV - Statewide Bacteria Provisions	320 CFU/100 mL
801NNR707	PBMZ (wetlands, inland)	STV - Statewide Bacteria Provisions	320 CFU/100 mL
802PLJ752	San Jacinto River Reach 3	STV - Statewide Bacteria Provisions	320 CFU/100 mL
Receiving Water	**Receiving Water**	**Receiving Water Basis**	***E. coli* WQO**
801AHG857	Santa Ana River Reach 4	STV - Statewide Bacteria Provisions	320 CFU/100 mL
801TMS746	Temescal Creek, Reach 1a*	N/A	359 MPN/100 mL (dry weather only)
802NVO325	San Jacinto River Reach 3	STV - Statewide Bacteria Provisions	320 CFU/100 mL

N/A – Not applicable; PBMZ – Prado Basin Surface Water Management Zone; CFU – colony-forming unit; mL – milliliters; MPN – most probable number
STV – statistical threshold value
* This waterbody is designated REC-2 only and, therefore, subject to an anti-degradation WQO (dry weather only).
**Based on numeric target of "not more than 10% of the samples exceed 212 organisms/100mL." The TMDL numeric target for 5-sample/30-day logarithmic mean not applicable to low sampling frequency of SAR monitoring program.

California Toxics Rule WQOs

In addition to the WQOs listed in the Basin Plan (both general and site-specific), the CTR (40 CFR Part 131.38) requires WQOs for priority toxic pollutants for waterbodies within California, including the SAR. The CTR defines up to two freshwater WQOs protective of aquatic life for each parameter, a criteria maximum concentration (CMC) and a criteria continuous concentration (CCC). CMCs are water quality concentrations based on acute conditions, the highest concentration that aquatic life can be exposed to without deleterious effects for a short period of time. CMCs have been applied to wet weather event data. CCCs are water quality concentrations based on chronic water quality conditions and are based on the four-day average concentration to which aquatic life can be exposed without deleterious effects. CCCs have been applied to dry weather event data. Many of the CTR WQOs for dissolved metals are hardness-based calculations.

USEPA Multi-Sector General Permit Benchmarks

The 2010 MS4 Permit also requires water quality results to be compared to the United States Environmental Protection Agency (USEPA) Parameter Benchmark Values (USEPA Benchmarks) defined in the MSGP for stormwater discharges associated with industrial activities (USEPA, 2015). However, application of the USEPA Benchmarks may be inappropriate for the SAR monitoring program because the USEPA Benchmarks lack specificity to MS4 discharges and the SAR. The USEPA Benchmarks are provided in Table 2-1 of CMP Volume IV (SAR Monitoring Plan).

11-3.0 RESULTS

11-3.1 MOBILIZATION HISTORY

During the 2018-2019 monitoring year, the SAR Monitoring Program was implemented as follows:

- All wet weather monitoring components of the MS4 outfall monitoring program and receiving water monitoring program were completed except at Perris Valley Channel at Nuevo Road, where toxicity tests could not be ordered in time for analysis of the sample collected for the under-forecasted wet weather event on October 13, 2018.
- All dry weather monitoring components of the MS4 outfall monitoring program, receiving water monitoring program, and SMC bioassessment monitoring program were completed.
- TMDL monitoring was conducted by task force groups.

A summary of mobilization activities and sampling events for the MS4 outfall and receiving water stations is presented in **Table 3-1**.

Table 3-1: 2018-2019 Monitoring Year Event Summary

Date of Monitoring Event	MS4 Outfall Stations (Station ID)							Receiving Water Stations (Station ID)		
	Corona Outfall (801CRN040)	Sunnymead Outfall (802SNY316)	Hemet Outfall (802HMT318)	Magnolia Center Outfall (801MAG364)	University Wash Outfall (801UNV702)	North Norco Outfall (801NNR707)	Perris Line J Outfall (802PLJ752)	Santa Ana River (801AHG857)	Temescal Channel (801TMS746)	Perris Valley Channel (802NVO325)
Wet Weather Events										
October 13, 2018	VNS	●	●	●	●	●	VNS	N/A	VNS	●[1]
November 29, 2018	●	●	●	●	●	●	●	N/A	●	●
January 12, 2019	●	●	●	●	●	●	●	N/A	●	--
January 31, 2019	●	--	--	--	--	--	●	N/A	--	--
Dry Weather Events										
August 22, 2018	VNS	VNS	VNS	--	--	VNS	VNS	●	N/A	VNS
August 23, 2018	--	--	--	●	●	--	--	--	N/A	--
June 6, 2019	VNS	--	--	--	--	--	--	--	N/A	--
June 10, 2019	--	--	--	--	--	●	--	●	N/A	--
June 11, 2019	--	VNS	VNS	●	●	--	VNS	--	N/A	VNS

● = Sample collected
N/A = Not applicable
VNS = Visited Not Sampled. Site was dry or ponded.
[1] A toxicity sample was not analyzed for this event.

11-3.1.1 Wet Weather Mobilization

Wet weather samples were collected when storm flows were observed and sufficient volume was present for sample collection. To successfully collect wet weather samples as required by the CMP, field crews mobilized four times during the 2018-2019 monitoring year. A summary of mobilization criteria for wet weather sampling is presented in **Table 3-2**.

Table 3-2: 2018-2019 SAR Wet Weather Event Mobilization Summary

Wet Weather Event Date	Quantitative Precipitation Statement Meeting CMP Criteria	Max 6-Hour Forecast (inches); 24-Hour Forecast (inches)[1]	Antecedent Dry Weather Period	Storm Period (Duration, days)	Min. Rainfall Total (inches)[2]	Max. Rainfall Total (inches)[2]	Average Rainfall Total (inches)[2]
October 13, 2018	30 hours prior to storm	**0.34; 0.50**	First flush	10/12-13/2018 (0.25)	0.00	0.87	0.47
November 29, 2018	36 hours prior to storm	**0.38; 0.83**	6 days	11/29-30/2018 (1)	0.67	1.10	0.95
January 12, 2019	18 hours prior to storm	**0.31; 0.44**	6 days	1/12/2018 (0.5)	0.16	0.39	0.26
January 31, 2019	48 hours prior to storm	**0.57; 0.59**	14 days	1/31/2018 (0.25)	0.20	0.39	0.30

Underlined and bolded values indicate storm forecasts that met CMP wet weather mobilization criteria.
[1] Determined by evaluating Quantitative Precipitation Statement forecasts for Riverside, Perris, and Hemet.
[2] Min, max, and average of event rainfall among stations calculated from rainfall recorded on field data sheets.

11-3.1.2 Evaluation of Unsafe High Flow Conditions during Wet Weather Events

An analysis of the potential for unsafe flow conditions at MS4 outfall stations and receiving water stations is detailed in **Attachment B** and summarized in **Table 3-3**. For monitored events with these conditions, the REC-1 beneficial use is suspended (i.e., no application of the REC-1 WQO).

Table 3-3: 2018-2019 SAR High Flow Suspension Assessment Results

Station Type	Station ID	Storm Event Date	Determination
MS4 Outfall	801CRN040[1]	11/29/2018	NA - UAA
		1/12/2019	NA - UAA
		1/31/2019	NA - UAA
	802SNY316	10/13/2018	No Suspension
		11/29/2018	No Suspension
		1/12/2019	No Suspension
	802HMT318	10/13/2018	No Suspension
		11/29/2018	No Suspension
		1/12/2019	No Suspension
	801MAG364	10/13/2018	No Suspension
		11/29/2018	**REC-1 Suspended**
		1/12/2019	**REC-1 Suspended**
	801UNV702	10/13/2018	No Suspension
		11/29/2018	No Suspension
		1/12/2019	No Suspension
	801NNR707	10/13/2018	No Suspension
		11/29/2018	No Suspension
		1/12/2019	No Suspension
	802PLJ752	11/29/2018	No Suspension
		1/12/2019	No Suspension
		1/31/2019	No Suspension
Receiving Water	802NVO325[2]	10/13/2018	No Suspension
		11/29/2018	No Suspension
	801TMS746[1]	11/29/2018	N/A - UAA
		1/12/2019	N/A - UAA

[1]N/A – use attainability analysis (UAA) determined that REC-1 not attainable at Temescal Reach 1a. No need to conduct high flow suspension assessment.
[2]Does not apply based on depth-velocity calculation although regional precipitation > 0.5 inch.

11-3.1.3 Dry Weather Mobilization

A summary of mobilization criteria for dry weather sampling is presented in **Table 3-4**. Dry weather samples were collected when flow was observed and sufficient volume was present for sample collection; care was taken not to collect samples that would characterize ponded, stagnant water. When a site was dry, flow was ponded, or flow was too shallow to sample (sheet flow), monitoring events were identified as VNS. Four of seven MS4 outfall stations were VNS for both dry weather events, and one additional station was VNS during the first dry weather event. No dry weather flows were sampleable (flow was insufficient) at the Perris Valley Channel at Nuevo Road receiving water station (i.e., VNS). Perennial flow at the Santa Ana River at Highgrove receiving water station was sampled during two dry weather events to characterize inputs to the SAR from San Bernardino County. In accordance with the CMP, no dry weather events were monitored at the Temescal Channel at Main receiving water station because this station is assigned for wet weather monitoring only.

Table 3-4: 2018-2019 SAR Dry Weather Event Mobilization Summary

Dry Weather Event Date	Antecedent Dry Weather Period for >0.1-inch Rainfall (Days)	Preceding Storm Event	Storm Event Total Rainfall (inches) [1]
August 22, 2018	111	May 3, 2018	0.20
August 23, 2018	112	May 3, 2018	0.20
June 6, 2019	10	May 27, 2019	0.19
June 10, 2019	14	May 27, 2019	0.19
June 11, 2019	15	May 27, 2019	0.19

[1] Based on an average of the five rain gauges (Riverside, Corona, Elsinore, Hemet/San Jacinto and Perris/Moreno Valley) for each storm (see **Attachment B**).

11-3.2 MS4 OUTFALL MONITORING PROGRAM RESULTS

This section summarizes MS4 outfall results for the 2018-2019 monitoring year. Detailed results tables are provided in **Attachment H** with comparison to Basin Plan and CTR WQOs. Comparison to USEPA MSGP Benchmarks per the 2010 MS4 Permit requirements are provided in **Attachment I**.

11-3.2.1 Monitoring Summaries by MS4 Outfall Station

Monitoring results are summarized in the following section by MS4 outfall station and type of monitoring event (i.e., wet or dry weather). In accordance with Section II.K.2.(d) of the 2010 MS4 Permit, **Table 3-5** presents parameters that exceeded WQOs or CTR WQOs at MS4 outfall station for one or more monitoring events. Parameters not shown in **Table 3-5** and not discussed below met WQOs and CTR WQOs, where applicable. A more detailed table of analytical results compared to the WQOs or CTR WQOs is presented in **Attachment H**. It should be noted that sample results from the MS4 outfall stations were compared to these criteria for comparison purposes only, as WQOs and CTR WQOs are applicable to receiving waters and not MS4 samples (State Board, 2005).

Table 3-5: Summary of Parameters that Exceeded WQOs or CTR WQOs by MS4 Outfall Station

MS4 Outfall Station (Station ID)	Wet Weather	Dry Weather
Corona Outfall (801CRN040)	Dissolved Copper, Dissolved Lead, Dissolved Zinc	VNS
Sunnymead Outfall (802SNY316)	*E.coli*, Dissolved Copper, Dissolved Zinc	VNS
Hemet Outfall (802HMT318)	*E. coli*, Dissolved Copper	VNS
Magnolia Center Outfall (801MAG364)	*E. coli,* Dissolved Copper, Dissolved Lead	*E. coli*
University Wash Outfall (801UNV702)	*E. coli*, DO, Dissolved Copper	*E. coli*, DO[1]
North Norco Outfall (801NNR707)	*E. coli*, Dissolved Copper, Dissolved Lead, pH	TDS, Total Boron, Total Nitrogen, pH
Perris Line J Outfall (802PLJ752)	*E. coli*, Dissolved Copper	VNS

DO – dissolved oxygen; TDS – total dissolved solids; VNS – Visited not sampled due to insufficient sampleable flow

[1] During dry weather, flows from University Wash Outfall are not hydraulically connected to the Santa Ana River. Significant algae and wildlife, including an assortment of birds, were observed in earthen channel behind the spillway

MS4 Outfall Station No. 801CRN040: Corona Outfall

The proximate receiving water for the Corona Outfall is Temescal Creek Reach 1a, which was listed as impaired for pH in 2010.[4] The Regional Board determined that a REC-1 beneficial use is not attainable for Temescal Creek Reach 1a. Therefore, the Statewide Bacteria Provisions *E. coli* WQO is not applied to this monitoring station. The Basin Plan lists a REC-2 beneficial use for Temescal Creek Reach 1a, which has only a dry weather WQO.

Wet Weather Monitoring Results

Three measured parameters exceeded Basin Plan WQOs or CTR WQOs (CMCs) during wet weather monitoring. Dissolved copper concentrations exceeded the site-specific Basin Plan WQO and the hardness-based CTR WQO for all three wet weather events sampled. Dissolved lead exceeded the Basin Plan WQO and dissolved zinc exceeded the CTR WQOs during the January 31, 2019 event.

Dry Weather Monitoring Results

This station was VNS during dry weather.

MS4 Outfall Station No. 802SNY316: Sunnymead Outfall

The proximate receiving water for the Sunnymead Outfall is the Perris Valley Channel and, ultimately, San Jacinto River Reach 3. This waterbody is not listed as impaired for any monitored parameters. Perris Valley Channel also has limited access, with a subsection of bike trail along one side, and it is also a low flowing, ephemeral receiving water that historically has been observed to be dry during dry weather monitored events.

[4] Temescal Creek Reach 1 was listed for pH on the 2010 Section 303(d) List. The 2014/16 Section 303(d) List changed the listing to PBMZ due to a mapping change. Lines of Evidence for this listing include samples collected in the Temescal Creek receiving water above Main at Corona (approximate location of 801TMS746).

Wet Weather Monitoring Results
Three measured parameters exceeded WQOs or CTR WQOs (CMCs) during wet weather monitoring. During all three wet weather events, dissolved copper concentrations exceeded the CTR WQO, and measurements of *E. coli* exceeded the statistical threshold value (STV) from the Statewide Bacteria Provisions. The dissolved zinc concentration also exceeded the CTR WQO during the January 12, 2019 event.

Dry Weather Monitoring Results
This station was VNS during dry weather.

MS4 Outfall Station No. 802HMT318: Hemet Outfall
The proximate receiving water for the Hemet Outfall is Salt Creek. This waterbody is not listed as impaired for any monitored parameters.

Wet Weather Monitoring Results
Two measured parameters exceeded WQOs or CTR WQOs (CMCs) during wet weather monitoring. Dissolved copper concentrations measured during all three wet weather events exceeded the CTR WQO. There are no site-specific Basin Plan WQOs for metals for Salt Creek. Site flow conditions during the three monitored wet weather events did not meet the high flow suspension criteria, and *E. coli* concentrations exceeded the STV from the Statewide Bacteria Provisions.

Dry Weather Monitoring Results
This station was VNS during dry weather.

MS4 Outfall Station No. 801MAG364: Magnolia Center Outfall
The proximate receiving water for the Magnolia Center Outfall is the Santa Ana River Reach 3. This waterbody is listed as impaired for bacterial indicators, lead, and copper and is subject to the MSAR Bacteria TMDL. The TMDL numeric target for *E. coli* includes a threshold of no more than 10% of the samples exceeding 212 organisms/100 milliliters (mL) and is used to determine REC-1 compliance unless the high flow suspension criteria are met.

Wet Weather Monitoring Results
E. coli results were above the TMDL numeric target during all three wet weather events. Two of these wet weather events (November 29, 2018 and January 12, 2019) were associated with site-specific, field-documented conditions that met the high flow suspension criteria due to unsafe flow conditions. The TMDL numeric target was not applied to these *E. coli* results; therefore, the only exceedance was for the October 13, 2018 event.

Dissolved copper concentrations measured in two of the three wet weather samples exceeded the Basin Plan WQO, and one concentration also exceeded the CTR WQO. The dissolved lead concentration also exceeded the WQO during the November 29, 2018 event. This result is qualified because the parameter was detected in the method blank at a concentration greater than the RL.

Dry Weather Monitoring Results
Field crews successfully collected dry weather samples on August 23, 2018 (instantaneous flow of 0.47 cubic feet per second [cfs]) and June 11, 2019 (instantaneous flow of 0.26 cfs). The only parameter exceeding WQOs was *E. coli*; results were above the TMDL numeric target during both dry weather events. Because of the arid climate dry weather flows, such as those observed at this MS4 outfall

station, tend to evaporate and/or infiltrate without reaching surface receiving waters. Ponding was noted downstream.

MS4 Outfall Station No. 801UNV702: University Wash Outfall

The proximate receiving water for the University Wash Outfall is Lake Evans. Lake Evans is not listed as impaired for any water quality parameters. If Lake Evans overflows during a significant precipitation event, there is potential connectivity to Santa Ana River Reach 4. Hydrologic connectivity is ascertained and documented by field crews during each monitoring event. The Santa Ana River Reach 4 is listed as impaired for bacterial indicators.

Wet Weather Monitoring Results

Parameters not meeting WQOs or CTR WQOs (CMCs) included *E. coli*, DO, and dissolved copper. *E. coli* measurements were above the STV from the Bacteria Provisions in all three samples. None of the measured site flows during wet weather events met the Basin Plan high flow suspension criteria. Dissolved copper concentrations in samples collected during all three monitored wet weather events exceeded the site-specific WQOs, and one concentration also exceeded the CTR WQO. One of the three DO concentrations was below the minimum limit of the WQO range.

Dry Weather Monitoring Results

Field crews successfully collected samples on August 23, 2018 (instantaneous flow of 0.29 cfs) and June 11, 2019 (instantaneous flow of 0.98 cfs). Two parameters exceeded WQOs or CTR WQOs during dry weather monitoring. During both events, *E. coli* results exceeded the STV, and DO concentrations were measured below the minimum limit of the WQO range. During the August 23, 2018 event, an abundance of algal growth and numerous emergent reeds were observed that could decrease DO in the water column. Ponded conditions can also lead to low DO measurements due to elevated water temperature. During dry weather events when ponding was present upstream and samples were collected, there was no connectivity from Lake Evans to the Santa Ana River receiving water.

MS4 Outfall Station No. 801NNR707: North Norco Outfall

The proximate receiving water for the North Norco Outfall is the Prado Basin Surface Water Management Zone (PBMZ), a surface water management zone with artificially created wetlands. The PBMZ was identified as impaired for pH on the 2014/2016 Section 303(d) List.

Wet Weather Monitoring Results

Four parameters exceeded WQO or CTR WQOs during wet weather monitoring. All three wet weather samples had *E. coli* results that were greater than the STV from the Statewide Bacteria Provisions, and flows did not qualify for high flow suspension of the REC-1 beneficial use. The dissolved copper concentration measured during all three wet weather events exceeded the Basin Plan WQO, and two concentrations also exceeded the CTR WQO (CMC). The dissolved lead concentration measured in the January 12, 2019 sample exceeded the Basin Plan WQO, and the field-measured pH during the October 13, 2018 event slightly exceeded the upper limit of the Basin Plan WQO range.

Dry Weather Monitoring Results

Typically, the outfall monitoring station has been dry or it did not have sufficient flow to sample during dry weather monitoring events. During one visit on June 10, 2019, sediment within the channel was reduced the flowing width to approximately one-third of normal which caused the flow to be sufficient (instantaneous flow of 0.27 cfs) for dry weather sampling. Four parameters did not meet WQOs: pH,

total dissolved solids (TDS), total boron, and total nitrogen. Given the hotter temperatures observed, minimal flow, and that this is an open concrete box channel exposed to the elements, it's not unexpected that this station had high concentrations in the SAR for each of these parameters. During this monitoring event, flow was observed ponding at the end of North Norco Channel at the boundary of the Prado Management Zone receiving water. Approximately 1,500 ft downstream staff observed that dry weather flows had infiltrated, and there was no evidence of surface water.

MS4 Outfall Station No. 802PLJ752: Perris Line J Outfall

The proximate receiving water is Perris Valley Channel, ultimately discharging to the San Jacinto River Reach 3. This waterbody is not listed as impaired for any monitored parameters. Perris Valley Channel is earthen and flows only during, or immediately following storm events.

Wet Weather Monitoring Results

Two parameters exceeded WQOs or CTR WQOs during wet weather monitoring. During all three wet weather events, *E. coli* results exceeded the STV from the Basin Plan and the high flow suspension of the REC-1 beneficial use did not apply. Dissolved copper concentrations for two wet weather events (November 29, 2018 and January 12, 2019) exceeded the CTR WQO (CMC).

Dry Weather Monitoring Results

This station was VNS during dry weather.

11-3.2.2 Detection and Elimination of IC/IDs to the MS4

During regular maintenance, MS4 facilities are inspected to identify potential IC/IDs. When an observed discharge warrants further investigation, such as when field parameter thresholds are exceeded (see Section 5.2, CMP Volume IV, **Attachment A**), a source investigation is conducted by the Permittee in accordance with their Local Implementation Plan (LIP) and Section 5.3 of CMP Volume IV. Lines of communication within each Permittee's jurisdiction and between Permittees represents an extremely important method for responding to IC/ID incidents. Permittee contact information is continually updated in the CMP, as needed (Appendix K of CMP Volume II – QAPP). The establishment and promotion of a toll-free hotline (1-800-506-2555) encourages County residents to report possible IC/ID incidents.

The National Pollutant Discharge Elimination System (NPDES) complaints received by District staff are included in the main body of the SAR 2018-2019 Annual Progress Report (Appendix E – Public Education). For the 2018-2019 reporting period, 72 IC/ID reports were received and reviewed by the District. Of the incidents reported, 60 of these required follow-up investigations and/or field visits by District staff. Results of the IC/ID monitoring and any follow-up investigations conducted during the 2018-2019 monitoring year are addressed in the individual Permittees' Annual Reports. In accordance with the 2015 Report of Waste Discharge (ROWD), dated July 29, 2014, a summary of the effectiveness of the Illicit Discharge Detection and Elimination (IDDE) Program within the Permit area shows that the number of illegal discharges, dumping, and spill events are steadily declining. Only one reported incident that may have impacted water quality results occurred in the SAR watershed during the 2018-2019 monitoring year (**Table 3-6**). Response to this incident included containment and clean-up activities by the reporting party.

Table 3-6: Reportable Incidents in the SAR Watershed during the 2018-2019 Monitoring Year

Date of Incident	Description of Incident	Release to Storm Drain or Waterway	Potentially Impacted Station	Potential Impacted Parameters
1/5/2019	City of Riverside Sanitary Sewer Overflow, approximately 1 gallon of sewage leaking into University Wash Outfall	Yes	801UNV702	Bacterial Indicators

11-3.2.3 Instantaneous Mass Loads for MS4 Outfall Stations

Instantaneous mass loads are calculated for each monitored event at each MS4 outfall station. The instantaneous mass load for each station and parameter is calculated by multiplying the instantaneous flow and the concentration of the detected water quality parameter. Instantaneous mass loads may be subject to significant variability because the SAR MS4 outfall water quality data reflect discharges from many sources, including discharges from non-urban land uses and permitted discharges. Varying flows between events and/or monitoring years may also result in significant variability. The estimated instantaneous mass load results for each MS4 outfall station are presented in **Attachment H**.

11-3.3 RECEIVING WATER MONITORING PROGRAM RESULTS

This section summarizes the receiving water results as required by Section III.E.8 of the MRP.

11-3.3.1 Monitoring Summaries by Receiving Water Station

Table 3-7 provides a summary of parameters that exceeded WQOs or CTR WQOs at the receiving water stations during the 2018-2019 monitoring year. Parameters not shown in **Table 3-7** and not discussed below met WQOs and CTR WQOs, where applicable. A more detailed table of analytical results compared to the WQOs or CTR WQOs is presented in **Attachment H**. Monitoring results are summarized in the following section by receiving water station and are discussed according to wet weather and dry weather monitoring results.

A table of receiving water monitoring results compared to the USEPA MSGP Benchmarks is presented in **Attachment I**.

Table 3-7: Summary of Parameters that Exceeded WQO or CTR WQOs by Receiving Water Station

Receiving Water Station (Station ID)	Wet Weather	Dry Weather
Perris Valley Channel at Nuevo Road (802NVO325)	*E.coli*	VNS
Temescal Channel at Main Street (801TMS746)	Dissolved Copper	N/A
Santa Ana River at Highgrove (801AHG857)[1]	N/A	None

N/A – Not applicable, monitoring not required.

VNS – Visited not sampled due to insufficient sampleable flow.

[1] The Santa Ana River at Highgrove receiving water station is located at the County line and, therefore, characterizes conditions in the receiving water from San Bernardino County.

Receiving Water Station No. 801AHG857: Santa Ana River – Highgrove Channel

The Santa Ana River at Highgrove receiving water station is located at the County line with San Bernardino County, and the data from this station characterize perennial dry weather flow entering Riverside County. The receiving water station is the Santa Ana River Reach 4, which is listed as impaired for bacterial indicators. The Santa Ana River is a perennial stream at this location due to effluent from two POTWs located approximately two miles upstream from the station. There are no MS4 discharges between the effluent from these POTWs and the receiving water station; therefore, this receiving water station does not represent the effects of discharges from the Permittees' MS4. Sampled flow is representative of a permitted discharge outside the control of the Permittees.

Dry Weather Monitoring Results

No parameters exceeded applicable WQOs or CTR WQOs during dry weather monitoring.

Receiving Water Station No. 801TMS746: Temescal Channel at Main

The Temescal Channel at Main receiving water is Temescal Creek Reach 1a, a concrete channel that was listed as impaired for pH in 2010.[5] The Regional Board determined that the REC-1 beneficial use is not attainable for Temescal Creek Reach 1a. The reach is designated with a REC-2 beneficial use, which does not have a corresponding wet weather WQO for *E. coli.*

Wet Weather Monitoring Results

The only parameter that exceeded applicable WQOs or CTR WQOs during wet weather monitoring was dissolved copper, which exceeded the site-specific Basin Plan WQO and the CTR WQO (CMC) during both monitoring events.

Receiving Water Station No. 802NVO325: Perris Valley Channel at Nuevo Road

The receiving water for the Perris Valley Channel at Nuevo Road receiving water station is San Jacinto River Reach 3, which is an ephemeral waterbody. This station is the only receiving water location downstream of MS4 outfall stations. The San Jacinto River Reach 3 is not listed as impaired for any water quality parameters.

Historical station flow consistently illustrates a two-part wet weather flow response at the Perris Valley Channel at Nuevo Road receiving water station. Hydrographs from the local USGS gauge show a small flow response representative of the local drainage area, followed hours later by a second flow response, magnitudes greater, which is representative of runoff from the larger Moreno Valley. Therefore, sampling at this receiving water station has been conducted only when flows include inputs from the entire upper tributary area. Field protocols determine this occurs when hydraulic connectivity between the upstream watershed (above Orange Street) and local flows from Perris Line J is observed.

Wet Weather Monitoring Results

The only parameter that exceeded applicable WQOs during wet weather was *E. coli*, which exceeded the STV from the Statewide Bacteria Provisions during both monitoring events. Estimated flows were 31.43 cfs on October 13, 2018 and 247 cfs on November 29, 2018.

[5] Temescal Creek Reach 1 was listed for pH on the 2010 Section 303(d) List. The 2014/16 Section 303(d) List changed the listing to PBMZ for samples collected on Temescal Creek Reach 1a.

Dry Weather Monitoring Results
This station was VNS during dry weather.

11-3.3.2 Instantaneous and Mass Load Calculations for Receiving Water Stations

Wet weather mass loads were calculated for receiving water stations using the following method. The cumulative discharge volume for each receiving water was calculated using flow data obtained from the proximate USGS station during the three-hour wet weather monitoring period (based on aliquot sample times). The wet weather mass load was calculated by multiplying the discharge volume and the concentration of the detected water quality parameter. Instantaneous mass loads were calculated for wet weather grab samples (bacterial indicators, oil and grease, volatiles, and hydrocarbons). Instantaneous mass loads were also calculated for all dry weather receiving water samples. The estimated instantaneous and mass loads for each water quality parameter detected in discharges from the receiving water stations are presented in **Attachment H**. Note that instantaneous mass loads may be subject to significant variability because flows vary between events and/or monitoring years.

11-3.3.3 Water Column Toxicity Results for Receiving Water Stations

Section III.E.2 of the 2010 MS4 Permit requires receiving water samples to be tested for toxicity to aquatic species. Toxicity of water samples was measured using the following three species and USEPA protocols:

- Acute test methods:
  - *Ceriodaphnia dubia* (water flea) – EPA-821-R-02-012 (USEPA, 2002a).
  - *Pimephales promelas* (freshwater fish, fathead minnow) – EPA-821-R-02-012 (USEPA, 2002a).
- Chronic test method:
  - *Pseudokirchneriella subcapitata,* formerly *Selenastrum capricornutum*, (unicellular green algae) – EPA-821-R-02-013 (USEPA, 2002b).

Toxicity is expressed in toxic units (TUs) for both acute and chronic toxicity. Survival is the endpoint used for the acute toxicity tests using the fathead minnow (*P. promelas*) and the water flea (*C. dubia*). Acute toxicity units (TU_a) are calculated as follows:

$$TU_a = 100/LC_{50}.$$

The LC_{50}, or median lethal concentration, is the concentration of a sample that causes a lethal effect on 50% of the toxicity test organisms. The LC_{50} is extrapolated from the results of the toxicity test and cannot be calculated if no toxicity is observed. The lower the LC_{50}, the more toxic the sample; for example, when a laboratory reports an "LC_{50} >100%," it means that the full-strength (undiluted) sample did not kill more than half of the organisms. An LC_{50} of 50% means that a half-strength (2:1 dilution) sample killed 50% of the organisms. In cases where there is less than 50% mortality in the undiluted sample, the TU_a value is classified as being <1.0. Conversely, TU_a values above 1.0 are associated with samples that exhibit greater than 50% mortality and have an LC_{50} of less than 100%.

The organism used to assess chronic toxicity was the freshwater green algae, *P. subcapitata*, and growth inhibition (i.e., cell numbers) was the endpoint used to measure chronic toxicity. Similar to the LC_{50} for acute toxicity, the EC_{50} is the median effective concentration (i.e., concentration that has an

effect on 50% of the population). Toxicity is determined using a no observed effect concentration (NOEC) value, which is defined as the highest concentration tested where no toxicity is statistically discernible. The lower the NOEC value, the more toxic is the sample. The NOEC is used to calculate chronic toxicity units (TU_c), which can range from a lower limit of 1.0 (in the case of no toxicity) to values much greater than 1.0 (in the case of a very high toxicity). TU_c are calculated as follows:

$$TU_c = 100 / NOEC$$

11-3.3.3.1 Wet Weather Toxicity Results

Wet weather samples were assessed for toxicity for two wet weather events at the Temescal Channel at Main receiving water station, and one wet weather event at the Perris Valley Channel at Nuevo Road station.[6] A summary of toxicity testing statistical results for the 2018-2019 monitoring year are presented in **Table 3-8** and **Table 3-9**. No acute or chronic toxicity was observed in wet weather event samples from either receiving water station.

Table 3-8: Wet Weather Event Toxicity Testing Results in Toxicity Units

Receiving Water Station (Station ID)	Date	Acute Toxicity *P. promelas*	Acute Toxicity *C. dubia*	Chronic Toxicity *P. subcapitata*^
Temescal Channel at Main Street (801TMS746)	11/29/2018	<1.0	<1.0	1.0
	1/12/2019	<1.0	<1.0	1.0
Perris Valley Channel at Nuevo Road (802NVO325)	11/29/2018	<1.0	<1.0	1.0

^Formerly *Selenastrum capricornutum.*

[6] The forecast for the first storm did not meet mobilization criteria for the Perris Valley Channel receiving water station. Upon the start of the event, actual rain totals were higher than forecasted. In response to the updating USGS flow gauge data, the Monitoring Program Manager directed a field team which was mobilized for sampling at other stations, to conduct a reconnaissance visit to the receiving water station for observation of the condition. Once it was confirmed that flow was present, the teams were rapidly reorganized and mobilized for the October 13, 2018 event in order to sample the first storm of the season. Samples were collected for analysis and submitted to the laboratory, however due to timing constraints the laboratory did not have the sufficient time to order the required species for toxicity testing. Post-storm event testing would have resulted in all toxicity analysis being outside of the holding times, thus compromising the validity of the test results.

Table 3-9: Summary of Wet Weather Event Statistical Results for Toxicity Testing

Receiving Water Station (Station ID)	% Sample Conc.	Acute Toxicity *P. Promelas*		Acute Toxicity *C. dubia*		Chronic Toxicity *P. subcapitata*^	
		Survival (%)	LC_{50} (% Sample)	Survival (%)	LC_{50} (% Sample)	Algal Growth (cells/mL x10^6)	EC_{50} (% Sample)
Temescal Channel at Main Street (801TMS746)	**Date: 11/29/2018**						
	Lab Control	100	>100	100	>100	3.41	>100
	100	100		100		4.20	
	Date: 1/12/2019						
	Lab Control	97.5	>100	90	>100	3.45	>100
	100	95.0		100		3.94	
Perris Valley Channel at Nuevo Road (802NVO325)	**Date: 11/29/2018**						
	Lab Control	100	>100	100	>100	3.41	>100
	100	97.5		100		3.90	

^Formerly *Selenastrum capricornutum.*

EC_{50} – effect concentration; concentration of a sample that caused an adverse effect on 50% of the toxicity test organisms.
LC_{50} – lethal concentration; concentration of a sample that caused a lethal effect on 50% of the toxicity test organisms.

11-3.3.3.2 Dry Weather Toxicity Results

Samples were assessed for toxicity for the two dry weather events monitored at the Santa Ana River at Highgrove receiving water station. A summary of toxicity testing statistical results for the 2018-2019 monitoring year is presented in **Table 3-10** and **Table 3-11**. No acute or chronic toxicity was observed in either dry weather sample.

Table 3-10: Dry Weather Event Toxicity Testing Results in Toxicity Units

Receiving Water Station (Station ID)	Date	Acute Toxicity *P. promelas*	Acute Toxicity *C. dubia*	Chronic Toxicity *P. subcapitata*^
Santa Ana River at Highgrove (801AHG857)	8/22/2018	<1.0	<1.0	1.0
	6/10/2019	<1.0	<1.0	1.0

^Formerly *Selenastrum capricornutum.*

Table 3-11: Summary of Dry Weather Event Statistical Results for Toxicity Testing

Receiving Water Station (Station ID)	% Sample Conc.	Acute Toxicity *P. Promelas*		Acute Toxicity *C. dubia*		Chronic Toxicity *P. subcapitata*^	
		Survival (%)	LC_{50} (% Sample)	Survival (%)	LC_{50} (% Sample)	Algal Growth (cells/mL x10^6)	EC_{50} (% Sample)
Santa Ana River at Highgrove (801AHG857)	**Date: 8/22/2018**						
	Lab Control	97.5	>100	100	>100	4.18	>100
	100	97.5		100		4.28	
	Date: 6/10/2019						
	Lab Control	100	>100	100	>100	3.62	>100
	100	100		100		4.10	

^Formerly *Selenastrum capricornutum.*

EC_{50} – effect concentration; concentration of a sample that caused an adverse effect on 50% of the toxicity test organisms.

LC_{50} – lethal concentration; concentration of a sample that caused a lethal effect on 50% of the toxicity test organisms.

11-3.3.4 Bioassessment Results

The bioassessment component of the 2018-2019 receiving water monitoring program was fulfilled through District participation in the SMC Regional Monitoring Program. The District participated in the fifth year of the current SMC Regional Monitoring Program in 2019 by sampling two condition and two trend locations in the SAR. For more information about bioassessment monitoring see **Section 11-4.1** and **Attachment J**.

11-3.4 RESULTS ASSESSMENT

An evaluation of 2018-2019 monitoring year results in the context of historical data is presented in this section. With a focus on historical pollutants of concern, 2010 MS4 Permit-required assessments are addressed herein including an analysis of trends, persistence, comparison to baselines for total inorganic nitrogen (TIN) and TDS, and land use correlations.

Historical priority pollutants of concern are signified in **Table 3-12** for wet weather (•) and dry weather (♦). Bacterial indicators are considered a regional pollutant of concern for the entire Santa Ana River watershed due to the MSAR Bacterial Indicator TMDL and specific language in Section II.E of the 2010 MS4 Permit. Parameters on the Section 303(d) List are also considered receiving water-specific pollutants of concern. These pollutants of concern apply to: 1) receiving water monitoring stations associated with the listed waterbody, and 2) MS4 outfall stations that discharge to that receiving water.

Nitrogen-nutrients are considered a historical pollutant of concern for the PBMZ (North Norco Outfall) and Santa Ana River Reach 3 (Magnolia Center Outfall) due to dry weather surface water evaluation and management requirements established by the Basin Plan, and are identified as pollutants of concern in the 2010 MS4 Permit. None of the proximate receiving waters for monitoring stations evaluated by the three receiving water and seven MS4 outfall monitoring stations that comprise the MRP are listed for nutrients. Data collection and evaluation efforts for the Lake Elsinore and Canyon Lake Nutrient TMDL are separate from this MRP and are conducted in accordance with the Comprehensive Nutrient Reduction Plan (CNRP).

Because of the dry, arid environment, hydraulic connectivity within the SAR watershed only occurs during wet weather conditions. Perris Valley Channel at Nuevo Road is the only receiving water station with MS4 outfall stations located upstream. Therefore, the relative contribution from the MS4 to the receiving water may be directly evaluated only for San Jacinto River Reach 3 (see **Section 11-5.0**). For the remainder of the SAR wet weather monitoring data, the relative contributions from the MS4 to the receiving water cannot be directly assessed because the receiving water station is either located upstream of, or in a different receiving water from, MS4 outfall stations. To provide a more robust assessment of historical pollutants of concern, the integrated findings in **Section 11-5.0** give consideration to waterbodies upstream of inland surface waters with a wet weather priority pollutant. These parameters are denoted in **Table 3-12** with footnotes describing the reasons for these considerations. Dry weather results were not considered because flows tend to evaporate and infiltrate without reaching receiving waters.

Table 3-12: Historical SAR Pollutants of Concern and Priority Constituents

Receiving Water	**Temescal Creek Reach 1a**		**PBMZ**	**Santa Ana River**			**San Jacinto River Reach 3**			**Salt Creek**
				Reach 3	**Reach 4**					
Station *Station Type*	**801CRN040** *MS4 Outfall*	**801TMS746** *Receiving Water*	**801NNR707** *MS4 Outfall*	**801MAG364** *MS4 Outfall*	**801UNV702** *MS4 Outfall*	**801AHG857 #** *Receiving Water*	**802SNY316** *MS4 Outfall*	**802PLJ752** *MS4 Outfall*	**802NVO325** *Receiving Water*	**802HMT318** *MS4 Outfall*
Bacterial Indicators	UAA	UAA N/A	--	● ♦	● ♦	N/A ♦	-- --	-- --	-- --	-- --
Copper	1 --	1 N/A	1 --	● ♦ *	--	--	--	--	--	--
Lead	1 --	1 N/A	1 --	● ♦	--	--	--	--	--	--
pH	● ** ♦ **	● ** N/A	● ♦	--	--	--	--	--	--	--
Nitrogen-Nutrients	-- --	-- N/A	-- ♦ ^	-- ♦ ^	-- 2	N/A --	3 --	3 --	3 --	3 --

TABLE KEY:
● – Wet Weather Historical Pollutant of Concern
♦ – Dry Weather Historical Pollutant of Concern
N/A – Not applicable, monitoring is only required for wet or only dry season.
UAA – Only the REC-2 dry weather anti-degradation WQO applies to this station. The Regional Board determined by use attainability analysis that a REC-1 beneficial use is not attainable.

HISTORICAL SAR POLLUTANT OF CONCERN NOTES:
Historical pollutants of concern are based on TMDL or 303(d) listing for the proximate receiving water.
– 801AHG857 characterizes perennial dry weather flow from San Bernardino County.
* – In 2010, the 303(d) listing for copper included a caveat indicating the impairment only applied to wet weather conditions. The 2014/16 Section 303(d) List did not include a seasonal qualifier for the copper listing; therefore, dry weather is also listed herein.
** – The 2014/16 Section 303(d) List changed the listing to PBMZ due to a mapping change. The pH listing was retained for stations located on Temescal Reach 1a based on a review of the supporting Lines of Evidence.
^ – Total nitrogen/TIN and TDS objectives are required by the Basin Plan for groundwater and surface water management zones for control of dry weather flows from Permittee activities. Dry weather data assessments were conducted for monitoring stations with applicable proximate receiving waters, including Reach 3 of the Santa Ana River (801MAG364) and the PBMZ (801NNR707).

UPSTREAM/DOWNSTREAM CONSIDERATIONS:
The discussion of monitoring data in the integrated assessment also considers wet weather parameters at monitoring locations upstream of SAR historical water quality conditions of concern as follows:
[1]Temescal Creek and the PBMZ are located upstream of Santa Ana River Reach 3, which is listed as impaired for copper and lead.
[2]The Basin Plan establishes WQOs for Santa Ana River Reach 4 for TDS and TIN. Because a long-term dry weather record is available for 801UNV702, consideration was given to dry weather data from this station for comparison to 801MAG364.
[3]Salt Creek and San Jacinto River are located upstream of Canyon Lake, which is subject to the Lake Elsinore and Canyon Lake Nutrient TMDL. TMDL data are collected during and analyzed separately from data collected under this MRP, in accordance with CNRP.

PBMZ - Prado Basin Surface Water Management Zone; TDS – total dissolved solids; TIN – total inorganic nitrogen; CNRP – Comprehensive Nutrient Reduction Plan.

11-3.4.1 Mann-Kendall Trend Analysis Results

Current and historical monitoring data for the SAR monitoring stations were analyzed for statistically significant trends using the nonparametric Mann-Kendall test for linear trend. The results of the trend analyses for SAR pollutants of concern (**Table 3-12**) and parameters with results that exceeded applicable WQOs during the current monitoring year are presented in **Table 3-13** (wet weather) and **Table 3-14** (dry weather). Reported trend results include the number of monitoring years of data, p-value, trend, proportion of ND results, and, if calculable, the Theil-Sen's slope (i.e., the change in concentration in terms of parameter-specific units per years of data). The trend result is signified by an arrow, where an upward arrow (△) signifies a statistically significant increasing long-term trend and a downward arrow (▽) signifies a statistically significant decreasing long-term trend. The potential effect of a water quality trend is signified by color-coding. Water quality improvements are colored **green**, whereas declines in water quality are colored **orange**. Where the long-term water quality implication of a trend could not be easily determined (e.g., as usually the case for pH field measurements), these results are colored **black**. Trends for parameters that exceeded WQO or CTR WQOs during 2018-2019 wet weather monitoring are indicated with **bold typeface**. Parameters identified as historical pollutants of concern for a monitoring station are indicated with underlined typeface.

A compilation of all statistically significant trends for the 2018-2019 trend analysis are presented in **Attachment K**. Additional discussion of trend results in the context of pollutants of concern and regional water quality is provided in **Section 11-5.0**.

Table 3-13: Statistically Significant Long-Term Wet Weather Trends for Pollutants of Concern and Parameters with 2018-2019 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-Value	Trend	% Data with ND Result	Theil-Sen's Slope
MS4 Outfall Station						
Corona Outfall (801CRN040)	Copper, Total	27	0.003	▼	1.4%	-0.00159
	Lead, Total	27	<0.001	▼	11.1%	-0.00204
	Zinc, Dissolved	8	0.015	▼	0.0%	-0.01270
	Nitrite (as N)	27	<0.001	▼	47.2%	N/A
	Total Phosphorus	27	0.001	▼	0.0%	-0.00004
	pH	21	<0.001	▼	0.0%	-0.00022
Sunnymead Outfall (802SNY316)	Fecal Streptococci	13	0.029	▼	0.0%	-11.76
	Copper, Total	16	0.024	▲	0.0%	0.00160
	TKN	15	0.014	▲	0.0%	0.00019
	Total Nitrogen	15	0.008	▲	0.0%	0.00031
	pH	15	0.026	▼	0.0%	-0.00014
Hemet Outfall (802HMT318)	Copper, Total	15	0.002	▲	2.4%	0.00233
	Lead, Dissolved	8	0.040	▼	4.5%	0.00000
	TKN	18	0.001	▲	4.0%	0.00015

Table 3-13: Statistically Significant Long-Term Wet Weather Trends for Pollutants of Concern and Parameters with 2018-2019 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-Value	Trend	% Data with ND Result	Theil-Sen's Slope
	Total Nitrogen	15	<0.001	▲	0.0%	0.00035
	Total Phosphorus	18	<0.001	▲	0.0%	0.00005
	Ammonia (as N)	13	0.001	▲	0.0%	0.00004
	Nitrogen, Total Inorganic	12	0.003	▲	0.0%	0.00008
	Orthophosphorus	12	0.012	▲	0.0%	0.00001
	pH	17	<0.001	▼	0.0%	-0.00019
Magnolia Center Outfall (801MAG364)	Copper, Total	28	0.002	▼	1.2%	-0.00148
	Lead, Total	28	<0.001	▼	6.2%	-0.00261
	Zinc, Total	28	0.036	▼	1.2%	-0.00399
	Nitrate (as N)	28	0.012	▼	0.0%	-0.00007
	Total Nitrogen	27	0.048	▼	0.0%	-0.00014
	pH	19	<0.001	▼	0.0%	-0.00026
University Wash Outfall (801UNV702)	***E. coli***	13	<0.001	▲	0.0%	3.886
	Fecal Coliform	13	<0.001	▲	0.0%	3.711
	Total Coliform	13	0.032	▲	0.0%	27.360
	Nickel, Total	17	0.022	▼	7.1%	-0.00044
	Copper, Dissolved	8	0.048	▼	0.0%	-0.00105
	Lead, Dissolved	8	0.017	▼	4.3%	-0.00007
	Zinc, Dissolved	8	0.018	▼	0.0%	-0.00789
	Nitrogen, Total Organic	11	0.022	▲	0.0%	0.00014
	pH	16	<0.001	▼	0.0%	-0.00030
North Norco Outfall (801NNR707)	Copper, Total	18	0.013	▲	0.0%	0.00117
	Zinc, Total	18	0.022	▲	0.0%	0.00952
	Nitrite (as N)	17	0.001	▼	22.7%	N/A
	Nitrogen, Total Organic	10	0.013	▲	0.0%	0.00055
	pH	14	0.005	▼	0.0%	-0.00032
Perris Line J Outfall (802PLJ752)	***E. coli***	14	0.005	▲	0.0%	2.11700
	Fecal Coliform	14	0.011	▲	0.0%	2.72000
	Copper, Total	17	0.013	▲	5.0%	0.00176
	Zinc, Total	17	0.043	▲	2.5%	0.01110
	TKN	17	0.007	▲	0.0%	0.00028
	Total Nitrogen	17	0.017	▲	0.0%	0.00027
	Ammonia (as N)	11	0.005	▲	4.8%	0.00010
	Nitrogen, Total Organic	11	0.001	▲	0.0%	0.00038
	Orthophosphorus	8	0.029	▲	0.0%	0.00009
	pH	15	<0.001	▼	0.0%	-0.00028

Table 3-13: Statistically Significant Long-Term Wet Weather Trends for Pollutants of Concern and Parameters with 2018-2019 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-Value	Trend	% Data with ND Result	Theil-Sen's Slope
Receiving Water Station						
Perris Valley Channel at Nuevo Road (802NVO325)	Fecal Streptococci	7	0.043	▼	0.0%	-44.800
	Copper, Dissolved	7	0.020	▲	0.0%	0.00189
Temescal Channel at Main Street (801TMS746)	Fecal Coliform	8	0.046	▼	0.0%	-4.437
	Copper, Total	8	0.037	▼	0.0%	-0.00368
	Lead, Total	8	0.018	▼	0.0%	-0.00195
	Zinc, Total	8	0.046	▼	0.0%	-0.02690
	Nitrogen, Total Organic	8	0.023	▼	0.0%	-0.00047

TKN - Total Kjeldahl Nitrogen
▽ – Statistically significant downward (inverse) trend.
△ – Statistically significant upward (direct) trend.
Green arrow signifies potential improving water quality.
Orange arrow signifies potential declining water quality.
Black arrow signifies a change within a range, which could identify improving or declining water quality (i.e., pH).
N/A – Not Applicable. Sen's slope not calculated for parameters with greater than 15% ND.
Underlined parameters designate pollutants of concern.
Bold parameters did not meet WQO or CTR WQOs during the 2018-2019 monitoring year.

Table 3-14: Statistically Significant Long-Term Dry Weather Trends for Pollutants of Concern and Parameters with 2018-2019 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-Value	Trend	% Data with ND Result	Sen's Slope
MS4 Outfall Station						
Corona Outfall (801CRN040)	VNS in 2018-2019	*	*	*	*	*
Sunnymead Outfall (802SNY316)	VNS in 2018-2019	*	*	*	*	*
Hemet Outfall (802HMT318)	VNS in 2018-2019	*	*	*	*	*
Magnolia Center Outfall (801MAG364)	***E. coli***	15	<0.001	▲	11.0%	0.952
	Enterococcus	14	0.010	▲	3.0%	0.634
	Fecal Coliform	15	0.001	▲	9.0%	0.798
	Copper, Dissolved	11	0.025	▼	0.0%	-0.00082
University Wash Outfall (801UNV702)	***E. coli***	8	0.007	▲	7.0%	0.980
	Fecal Coliform	7	0.050	▲	8.0%	1.039
	Boron, Total	21	0.007	▼	0.0%	-0.00795
	Boron, Dissolved	7	0.002	▼	0.0%	-0.04900
	Nitrate (as N)	21	0.003	▼	13.0%	-0.00013
	TKN	20	<0.001	▲	2.0%	0.00011
	Ammonia (as N)	20	<0.001	▲	30.0%	N/A

Table 3-14: Statistically Significant Long-Term Dry Weather Trends for Pollutants of Concern and Parameters with 2018-2019 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-Value	Trend	% Data with ND Result	Sen's Slope
	Nitrogen, Total Organic	17	0.021	▲	8.0%	0.00008
	DO	21	<0.001	▼	0.0%	-0.00097
	pH	22	<0.001	▼	0.0%	-0.00012
	TDS	21	0.001	▼	10.0%	-0.01150
North Norco Outfall (801NNR707)	Insufficient data for trends					
Perris Line J Outfall (802PLJ752)	VNS in 2018-2019	*	*	*	*	*
Receiving Water Station						
Perris Valley Channel at Nuevo Road (802NVO325)	VNS in 2018-2019	*	*	*	*	*
Santa Ana River at Highgrove (801AHG857)**	Boron, Total	8	0.033	▲	0.0%	0.00559
	Zinc, Total	8	0.048	▲	0.0%	0.00136
	Copper, Dissolved	8	0.031	▲	0.0%	0.00053
	Zinc, Dissolved	8	0.012	▲	0.0%	0.00204
	Nitrite (as N)	8	0.040	▼	0.0%	-0.00003

TKN - Total Kjeldahl Nitrogen; DO – dissolved oxygen; TDS – total dissolved solids; VNS – visited not sampled
▽ – Statistically significant downward (inverse) trend.
△ – Statistically significant upward (direct) trend.
Green arrow signifies potential improving water quality.
Orange arrow signifies potential declining water quality.
Black arrow signifies a change within a range, which could identify improving or declining water quality (i.e., pH).
N/A – Not Applicable. Sen's slope not calculated for parameters with greater than 15% NDs.
* No samples were collected during dry weather during the 2018-2019 Monitoring Year.
** The Santa Ana River at Highgrove receiving water station characterizes perennial dry weather flow from San Bernardino County.
Underlined parameters indicate pollutants of concern.
Bold parameters did not meet WQO or CTR WQOs during the 2017-2018 monitoring year.

11-3.4.2 Persistence Analysis

The object of the persistence analysis is to evaluate which parameters, if any, are regularly measured at concentrations that could impact existing or potential beneficial uses designated for SAR receiving waters. The SAR CMP defines persistence as "an exceedance of the relevant Basin Plan or CTR objectives by 20% for three sampling periods" (SMC, 2004). Therefore, a parameter was determined to be persistent for a monitoring station when concentrations exceeded an applicable WQO or CTR WQO by 20% or more for all monitored events during the three most recent monitoring years (i.e., 2016-2017, 2017-2018, and 2018-2019). Wet weather and dry weather monitoring data were evaluated separately. Monitoring stations with a high flow suspension applied within the evaluation period were determined not to have a persistent exceedance. Parameters with persistent exceedance of WQOs and CTR WQOs at receiving water and MS4 outfall stations are presented in **Table 3-15**. Additional discussion of persistence in the context of pollutants of concern and regional water quality is provided in **Section 11-5.0.**

Table 3-15: Parameters with Persistent Exceedances of the WQOs and CTR WQOs at MS4 Outfall and Receiving Water Stations

Station Name (Station ID)	Wet Weather Persistent Exceedances	Dry Weather Persistent Exceedances
MS4 Outfall Stations		
Corona Outfall (801CRN040)	N/A[1]	VNS
Sunnymead Outfall (802SNY316)	No persistence identified.	VNS
Hemet Outfall (802HMT318)	*E. coli*	VNS
Magnolia Center Outfall (801MAG364)	No persistence identified.[2]	*E. coli*
University Wash Outfall (801UNV702)	*E. coli*	No persistence identified.
North Norco Outfall (801NNR707)	*E. coli*	N/A[3]
Perris Line J Outfall (802PLJ752)	*E. coli*	VNS
Receiving Water Stations		
Temescal Channel at Main Street (801TMS746)	N/A[1]	--
Santa Ana River at Highgrove (801AHG857)	--	No persistence identified.
Perris Valley Channel at Nuevo Road (802NVO325)	No persistence identified.[2]	VNS

N/A – Not applicable; VNS – visited not sampled.
-- Receiving water station is not monitored during for this type of event.
[1] This monitoring station is only subject to the REC-2 dry weather anti-degradation WQO for *E. coli*.
[2] Monitoring stations that had one or more high flow suspensions of the *E. coli* WQO within the evaluation period were determined not to have a persistent exceedance.
[3] This monitoring station has been VNS for the past 2 years and persistence could not be evaluated.

11-3.4.3 Dry Weather Baseline Conditions Assessments for TIN and TDS

The Basin Plan and Section II.L.3 of the 2010 MS4 Permit requires the Permittees to establish baseline dry weather discharge concentrations for TIN and TDS. Further, this assessment addresses the MRP objective to "identify baseline conditions." Baseline dry weather concentrations for the Magnolia Center Outfall and the University Wash Outfall, the only two MS4 outfall stations with some flow in dry weather, were evaluated based on available historical dry weather data. Baselines were not developed for stations that are consistently VNS. The TIN dry weather baseline was established using data from 2011-2012 through 2016-2017, and the TDS dry weather baseline was based on data collected prior to the start of the 2010 MS4 Permit. The baseline is numerically represented by the average measured dry weather concentrations, with consideration for standard deviations around the average. The dry weather baseline also evaluates the range of measured concentrations (minimum and maximum). **Table 3-16** presents the range and average dry weather concentrations for TIN and TDS from the Magnolia Center Outfall and the University Wash Outfall. These data are compared to current

year analytical results for each constituent for dry weather sampling conducted on August 23, 2018 and June 11, 2019. Results are also graphically presented as box whisker plots in **Figure 3-1**. The green shading represents the historical concentrations and the yellow diamonds represent current-year results.

Both dry weather results for both evaluated MS4 outfall stations were less than the WQO and historical maximum for TIN and TDS, but the Magnolia Center Outfall results were greater than the historical average.

During the 2018-2019 monitoring year, one dry weather event was monitored at the North Norco Outfall. This station has historically had insufficient flow to sample (VNS), and a baseline had not been developed for this station due to a lack of dry weather analytical results under the 2010 MS4 Permit. During the June 10, 2019 event, both total nitrogen (26.22 mg/L) and TDS (2,800 mg/L) were measured above Basin Plan WQOs for the station's receiving water (PBMZ). TIN was last measured during the 1994-1995 monitoring year, and the results were 0.2 mg/L, 3.8 mg/L, and 24.8 mg/L, as compared to the June 2019 result of 26 mg/L. TDS was measured from September 6, 1997 through March 20, 2005, and the range of the results was 560 mg/L to 1,300 mg/L during this time. The 2018-2019 results are above these ranges for TIN and TDS. The required evaluation of TIN and TDS monitoring results compared to baselines focuses on dry weather only, as stormwater was considered to be an insignificant source of TIN and TDS (Regional Board, 2010).

Table 3-16: Comparison of TIN and TDS Baseline Dry Weather Results Compared with 2018-2019 Dry Weather Results

2018-2019 Results	Magnolia Center Outfall (801MAG364)		University Wash Outfall (801UNV702)	
	TIN	TDS	TIN	TDS
WQO (mg/L)	10#	700	10	550
8/23/2018 Result (mg/L)	6.1	580	0.8	480
6/11/2019 Result (mg/L)	6.7	660	1.4	350
Baseline Parameter	**Dry Weather Baseline**			
Number of Samples	10	43	8	39
Number of Monitoring Years	6	16*	5 ^	14*
Minimum (mg/L)	0.34	290	0.2	320
Maximum (mg/L)	6.8	1,000	5.2	640
Average ± Std Dev (mg/L)	4.89 ± 2.2	617 ± 176	1.69 ± 1.5	482 ± 81

TIN – total inorganic nitrogen; TDS – total dissolved solids; mg/L – milligram per Liter
* Represents data collected up to the start of the 2010 MS4 Permit.
# Applies to total nitrogen not TIN.
^ Represents data collected during the 2010 MS4 Permit term (2011-2012 through 2016-2017). Both dry weather events were VNS during the 2012-2013 monitoring year.

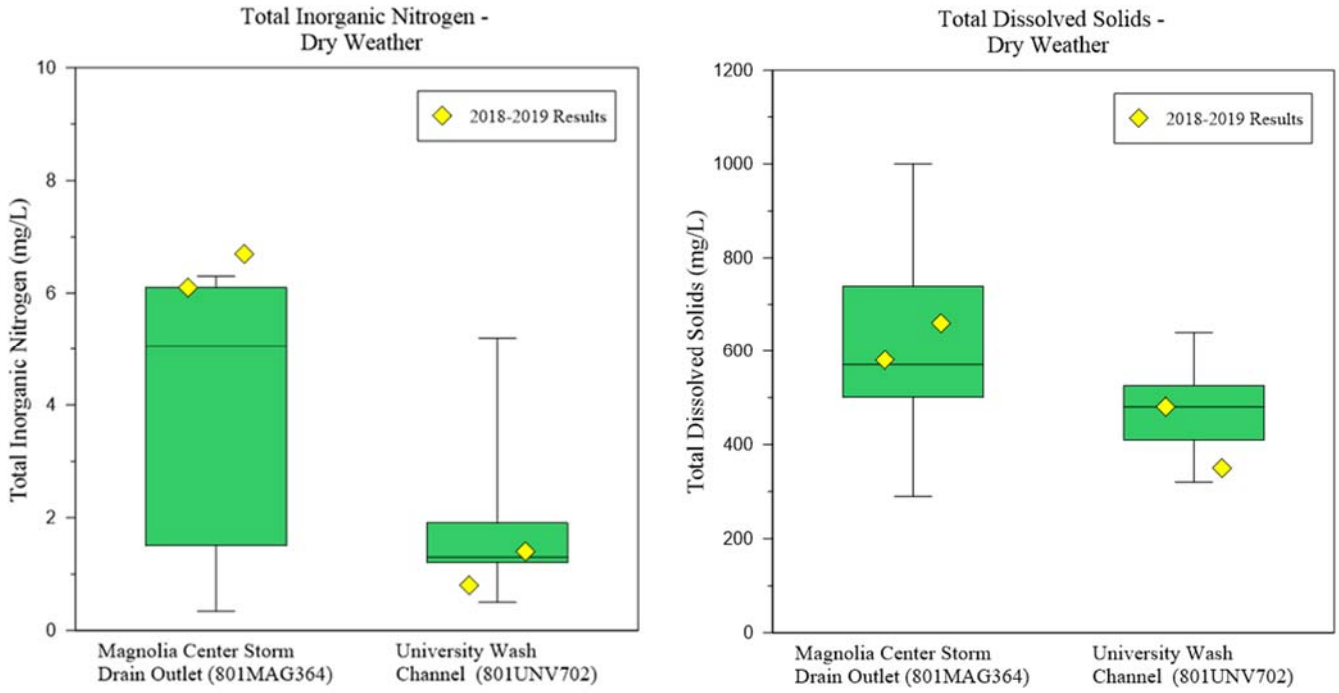


Figure 3-1: TIN (Left) and TDS (Right) 2018-2019 Dry Weather Concentrations (Points) Compared to Baseline Dry Weather Results (Box and Whisker Plots)

11-3.4.4 Frequency Analysis

A historical frequency analysis of station events above receiving water WQOs, although not required by the 2010 MS4 Permit, was conducted to provide a broader context for the current monitoring year's data. Historical frequencies, given as percentages, document the number of times water quality results for a given station, monitoring type, and parameter were outside the bounds of receiving water WQOs and/or CTR WQOs. For simplicity the term "exceedance frequency" is used to refer the historical results for MS4 outfall stations as well as receiving water stations, even though WQOs do not need to be applied to stormwater. This comparison of MS4 outfall monitoring results to receiving water WQO is provided for assessment purposes only and does not imply compliance.

This analysis focuses on historical pollutants of concern, as well as other constituents with results that exceeded applicable WQOs at least once during the 2018-2019 monitoring year (e.g., DO and zinc). The same constituents were analyzed for wet weather and dry weather to illustrate potential seasonal variations. The high flow suspension criteria for recreational beneficial uses and the *E. coli* WQO (Basin Plan Amendment No. R8-2012-0001) were applied as applicable to historical datasets for consistency between exceedance frequencies and results reported in the monitoring annual reports.

Wet Weather Frequency Analysis

Wet weather exceedance frequencies are presented in **Table 3-17** and **Table 3-18** for SAR receiving water monitoring stations and MS4 outfall stations, respectively. The number of samples represented by the percentage exceedance is also provided for each assessment. The historical frequency percentages do not include the 2018-2019 monitoring year data to allow comparison to the most recent

monitoring results. An integrated analysis of exceedance frequencies in the context of pollutants of concern and regional water quality is provided in **Section 11-5.0.**

Table 3-17: Wet Weather WQO and CTR WQO Exceedance Frequencies for Receiving Water Stations

Analyte	802NVO325				801TMS746			
	Perris Valley Channel at Nuevo Road				Temescal Channel at Main Street			
	2018-2019		Historical		2018-2019		Historical	
	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed
E. coli	2	100%	9	33%*	No numeric WQO – UAA			
DO	2	0%	9	0%	2	0%	13	0%
pH-Field	2	0%	9	11%	2	0%	13	15%
TDS	2	0%	9	0%	2	0%	13	0%
Boron	2	0%	9	0%	2	0%	13	0%
Copper, Dissolved	2	0%	9	0%	2	100%	13	46%
Lead, Dissolved	2	0%	9	0%	2	0%	13	8%
Zinc, Dissolved	2	0%	9	0%	2	0%	13	0%
Total Nitrogen (calculated)	No numeric WQO				2	0%	11	0%
Nitrogen, Total Inorganic	2	0%	9	0%	No numeric WQO			

DO – dissolved oxygen; TDS – total dissolved solids; WQO – water quality objective
UAA – Use Attainability Analysis; the Regional Board found the REC-1 beneficial use to be unattainable for Temescal Creek Reach 1a.
*The *E. coli* WQOs were suspended for one wet weather event in 2017-2018, one wet weather event in 2016-2017, one event in 2015-2016, and for both wet weather events in 2014-2015.

Table 3-18: Wet Weather WQO and CTR WQO Exceedance Frequencies for MS4 Outfall Stations

Analyte	801CRN040 Corona Outfall				802SNY316 Sunnymead Outfall				802HMT318 Hemet Outfall				801MAG364 Magnolia Center Outfall *				801UNV702 University Wash Outfall				801NNR707 North Norco Outfall				802PLJ752 Perris Line J Outfall			
	2018-2019		Historical		2018-2019		Historical		2018-2019		Historical		2018-2019		Historical		2018-2019		Historical		2018-2019		Historical		2018-2019		Historical	
	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed
E. coli	No WQO – UAA				3	100%	31	94%	3	100%	32	94%	3	100%*	32	91%	3	100%	31	100%	3	100%	31	100%	3	100%	29	97%
DO	3	0%	35	0%	3	0%	30	0%	3	0%	32	0%	3	0%	37	0%	3	33%	31	0%	3	0%	30	0%	3	0%	28	0%
pH-Field	3	0%	46	26%	3	0%	37	8%	3	0%	71	18%	3	0%	47	19%	3	0%	38	18%	3	33%	35	43%	3	0%	34	18%
TDS	3	0%	53	6%	3	0%	22	0%	No numeric WQO				3	0%	62	5%	3	0%	30	0%	3	0%	29	7%	3	0%	21	0%
Boron	3	0%	69	0%	3	0%	40	0%	3	0%	38	0%	3	0%	78	0%	3	0%	44	0%	3	0%	43	2%	3	0%	37	0%
Copper, Dissolved	3	100%	20	95%	3	100%	19	84%	3	100%	19	89%	3	67%	20	75%	3	100%	20	80%	3	100%	20	40%	3	67%	17	41%
Lead, Dissolved	3	33%	20	35%	3	0%	19	0%	3	0%	19	0%	3	33%	20	25%	3	0%	20	40%	3	33%	20	0%	3	0%	17	0%
Zinc, Dissolved	3	33%	20	20%	3	33%	19	21%	3	0%	19	21%	3	0%	20	5%	3	0%	20	10%	3	0%	20	0%	3	0%	17	0%
Total Nitrogen (calculated)	3	0%	67	3%	No numeric WQO				No numeric WQO				3	0%	74	8%	No numeric WQO				3	0%	39	13%	No numeric WQO			
Nitrogen, Total Inorganic	No numeric WQO				3	0%	17	0%					No numeric WQO				3	0%	18	0%	No numeric WQO				3	0%	15	0%

DO – dissolved oxygen; TDS – total dissolved solids; WQO – water quality objective

UAA – Use Attainability Analysis; the Regional Board found the REC-1 beneficial use to be unattainable for Temescal Creek Reach 1a.

* The *E. coli* WQOs were suspended for two events at Magnolia Center Outfall (801MAG364) during the 2018-2019 monitoring year; one event at Sunnymead Outfall (802SNY316) and two events at Magnolia Center Outfall (801MAG364) during the 2017-2018 monitoring year; and one event at both Magnolia Center Outfall (801MAG364) and Perris Line J Outfall (802PLJ752) during the 2015-2016 monitoring year in accordance with Basin Plan Amendment No. R8-2012-0001.

Dry Weather Frequency Analysis

Over the period of record, VNS results have become more common during dry weather events. To provide a more holistic view of water quality conditions in the Santa Ana River Watershed, the dry weather frequency of exceedance analysis is presented in the context of VNS results.

VNS Frequency

During the 2018-2019 monitoring year, four of the seven MS4 outfall stations were reported as VNS during both dry weather events. These same four MS4 stations have been VNS for all dry weather monitoring activities conducted in accordance with the 2010 MS4 Permit (**Figure 3-2**).

Dry weather flows are typically very low, where they occur at MS4 outfall stations. When field personnel have tracked flows downstream, these small dry weather flows have been generally observed to evaporate and/or infiltrate without reaching downstream receiving waters. Dry weather samples collected at the University Wash Outfall station were associated with instantaneous field flow measurements of 0.29 and 0.98 cfs. Magnolia Center Outfall dry weather samples were associated with instantaneous field flow measurements of 0.47 cfs and 0.26 cfs. North Norco Outfall was associated with an instantaneous field flow measurement of 0.27 cfs, and during that event the flow was recorded as connecting and infiltrating into the soil of the receiving water.

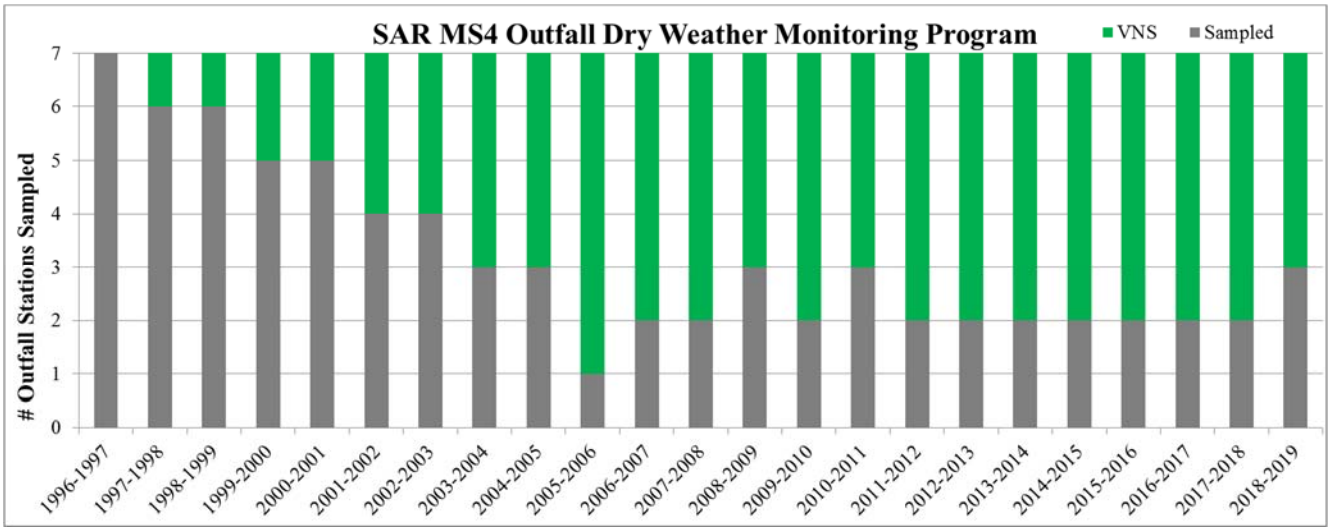


Figure 3-2: Increasing Frequency of VNS Results at SAR MS4 Outfall Stations

For receiving water stations, which are not shown in **Figure 3-2**, the Perris Valley Channel at Nuevo Road station has been VNS for all dry weather site visits since monitoring began at this location in 2011. Flow has been observed and sampled since monitoring began in 2011 at the Santa Ana River at Highgrove station. The Santa Ana River is a perennial stream at this location due to permitted discharges from the Rialto WWTP and the Colton/San Bernardino RIX. Therefore, dry weather samples collected at this location tend to characterize inputs to the Santa Ana River from San Bernardino County. Flow rates during dry weather sampling were 14.11 cfs and 26.32 cfs.

Exceedance and VNS Frequency Analysis

During the 2018-2019 monitoring year, the only stations that had sampleable dry weather flow were University Wash Outfall, Magnolia Center Outfall, and North Norco Outfall, and the Santa Ana River at Highgrove receiving water station. **Table 3-19** presents the current and historical WQO and CTR

WQO dry weather exceedance frequencies and VNS frequencies for these stations during the 2018-2019 monitoring year. An integrated analysis of exceedance frequencies in the context of pollutants of concern and regional water quality is provided in **Section 11-5.0**.

Table 3-19: Dry Weather WQO and CTR WQO Exceedance Frequencies and VNS Results for MS4 Outfall Station and Receiving Water Stations with Sampleable Flow

Analyte	MS4 Outfall Stations																				Receiving Water Station								
	801MAG364							801UNV702							801NNR707						801AHG857								
	Magnolia Center Outfall							University Wash Outfall							North Norco Outfall						Santa Ana River at Highgrove								
	2018-2019		Historical		Total Samples	Total VNS	% VNS	2018-2019		Historical		Total Samples	Total VNS	% VNS	2018-2019		Historical		Total Samples	Total VNS	% VNS	2018-2019		Historical		Total Samples	Total VNS	% VNS		
	n	% Exceed	n	% Exceed				n	% Exceed	n	% Exceed				n*	% Exceed	n	% Exceed				n	% Exceed	n	% Exceed				
E. coli	2	100%	33	70%	35	1	3%	2	100%	12	58%	14	9	39%	1	0%	2	0%	3	34	92%	2	0%	14	14%	16	0	0%		
DO	2	0%	50	0%	52	2	4%	2	100%	33	36%	35	23	40%	1	0%	8	0%	9	42	82%	2	0%	14	0%	16	0	0%		
pH	2	0%	66	39%	68	2	3%	2	0%	45	24%	47	23	33%	1	100%	13	92%	14	42	75%	2	0%	14	14%	16	0	0%		
TDS	2	0%	55	27%	57	2	3%	2	0%	48	19%	50	23	32%	1	100%	14	93%	15	42	74%	2	0%	14	0%	16	0	0%		
Boron	2	0%	72	0%	74	2	3%	2	0%	51	2%	53	23	30%	1	100%	14	79%	15	42	74%	2	0%	14	0%	16	0	0%		
Copper, Dissolved	2	0%	17	0%	19	0	0%	2	0%	10	10%	12	5	29%	1	0%	0	0%	1	14	93%	2	0%	14	0%	16	0	0%		
Lead, Dissolved	2	0%	17	0%	19	0	0%	2	0%	10	0%	12	5	29%	1	0%	0	0%	1	14	93%	2	0%	14	0%	16	0	0%		
Zinc, Dissolved	2	0%	17	0%	19	0	0%	2	0%	10	0%	12	5	29%	1	0%	0	0%	1	14	93%	2	0%	14	0%	16	0	0%		
Total Nitrogen (calculated)	2	0%	70	13%	72	2	3%	No numeric WQO							1	100%	15	40%	16	42	72%	No numeric WQO								
Nitrogen, Total Inorganic	No numeric WQO							2	0%	13	0%	15	5	25%	No numeric WQO							2	0%	14	14%	16	0	0%		

VNS - Visited not sampled; DO – dissolved oxygen; TDS – total dissolved solids; WQO – water quality objective

*Outfall was dry during one dry weather monitoring event, and the percent exceedance reflects only one data point for the year

11-3.4.5 Land Use Correlations

As stated in the Drainage Area Management Plan (DAMP), "The Permittees are collecting stormwater monitoring data from each region of Riverside County. This data is analyzed for trends in Pollutant loading and to see if Pollutant problems can be tied to particular activities or land uses" (https://www.waterboards.ca.gov/santaana/water_issues/programs/stormwater/docs/rcpermit/damp/SAR_DAMP2014.pdf). Permittees use land use data to help understand potential sources of pollutants in the SAR, and then implement effective management actions for these different land uses and associated sources to prevent impacts to receiving waters. Land use considerations play a key role in IC/ID and TMDL pollutant source investigations (see Section 13 of this 2018-2019 Annual Report) and have helped Permittees identify possible sources of SAR historical pollutants of concern and appropriate targeted management actions (**Table 3-20**). These actions and controls, which are defined in each Permittee's LIP, consider dry and wet weather sources and flows as they relate to land use.

Table 3-20: Potential Sources of SAR Pollutants of Concern

Potential Pollutant Source	Indicator Bacteria	pH	Nutrients		Metals			Potential Pollutant Management Measure(s)
			Nitrogen Compounds	Phosphorus Compounds	Copper	Lead	Zinc	
Potential Permitted Sources								
POTW *	● ♦	● --	● ♦	--	● ♦	--	--	Direct flows to the Brine Line
Industrial (IGP Permittee)	--	● --	● --	--	● --	● --	● --	Outreach, inspection, enforcement programs
Construction (CGP Permittee)	● --	● --	● --	● --	● --	● --	● --	
Potential Urban Sources								
Spills & Other IC/IDs	-- ♦	-- ♦	-- ♦	-- ♦	-- ♦	-- ♦	-- ♦	IC/ID Program
Human Fecal Wastes	● ♦	--	● ♦	● ♦	--	--	--	
Vehicles (brake pads, tires, wheel weights, gasoline)	--	● ♦	--	--	● ♦	● ♦	● ♦	Street sweeping; Source control (State Bill 346)
Landscaping (irrigation, fertilizers, pesticides)	-- ♦	-- ♦	● ♦	● ♦	● ♦	--	--	Green Gardening (e.g., water conservation; native landscaping; integrated pesticide management)
Nursery	-- ♦	-- ♦	● ♦	● ♦	● ♦	--	--	
Atmospheric Deposition	--	--	● ♦	● ♦	● ♦	● ♦	● ♦	Street sweeping
Potential Uncontrollable Natural Sources								
Non-Human Fecal Wastes	● ♦	--	● ♦	● ♦	--	--	--	Dry weather flow elimination and management
Bio-film (natural regrowth)	-- ♦	--	--	--	--	--	--	
Plants (decomposition)	-- ♦	-- ♦	--	--	--	--	--	Channel/ catch basin cleaning
Soils & Sediments	-- ♦	● --	● --	● --	--	● --	--	Erosion controls (binders/ hydroseeding)
Wildfires	--	● --	● --	● --	● --	● --	● --	--

POTW – publicly owned treatment works; CGP – Construction General Permit; IGP – Industrial General Permit; IC/ID - illicit connection/illegal discharge

Potential Pollutant Source *(Reference Sources: USEPA, 1999; District, 2016)*

● – Wet Weather

♦ – Dry Weather

*The Santa Ana River is a perennial stream near the County boundary in large part due to permitted effluent from the Rialto Wastewater Treatment Plant and the Colton/San Bernardino Rapid Infiltration and Extraction Facility.

Attachment D presents land uses associated with the drainage area for each MS4 outfall and receiving water monitoring station based on Riverside County Assessor parcel data. Between 2018 and 2019, slight increases in urban area and decreases in open space were identified (1-2% per drainage area). Historically (over a longer period of record), land use data have reflected significant variability as the assessor made a series of changes in the zoning designation of land uses that are unrelated to the actual

changes. As a result, attempts to directly correlate water quality to land use changes over the historical record are problematic. Therefore, the assessment presented herein considers potential sources in several categories in addition to land use, and relates potential sources to pollutants of concern.

Table 3-21 relates current year water quality results that exceeded the WQO and/or CTR WQO for at least one wet or dry weather sample (**Section 11-3.2** and **Section 11-3.3**), land uses, and potential associated pollutant sources. As an ephemeral watershed, large and/or high intensity precipitation is needed to generate flow in the SAR receiving waters. SAR receiving waters are typically dry or ponded (VNS), except where permitted discharges (such as POTWs) generate localized flows, suggesting that water quality issues are limited in geospatial extent. Therefore, the analysis presented in **Table 3-21** focuses on the land uses in closest proximity to the monitoring station location. Based on data exported from the State Board's Storm Water Multiple Application & Report Tracking System (SMARTs database at: https://smarts.waterboards.ca.gov/smarts/faces/Reports/SwIndustrialReports.xhtml), this table also identifies industrial facilities in Level 1 or Level 2 for SAR pollutants of concern (e.g., pH, nitrate + nitrite, ammonia, phosphorus, copper, lead, and zinc) within the monitored drainage areas. Industrial facilities that are in Level 1 and/or Level 2 have measured water quality data that for pH; exceeded either the instantaneous numeric action level (NAL) range twice in a single monitoring year; or, for other pollutants, the average annual concentration for all monitored stations at the site exceeded the average annual NAL for the site. SMARTs records for 2018 showed increases over the previous year in the number of Level 1 and Level 2 facilities in the receiving water station drainage areas.

Table 3-21: 2018-2019 Water Quality and Land Use/Sources Comparison

Receiving Water	Temescal Creek Reach 1a		PBMZ	Santa Ana River			San Jacinto River Reach 3			Salt Creek
				Reach 3	Reach 4					
Station *Station Type*	**801CRN040** *MS4 Outfall*	**801TMS746** *Receiving Water*	**801NNR707** *MS4 Outfall*	**801MAG364** *MS4 Outfall*	**801UNV702** *MS4 Outfall*	**801AHG857** *Receiving Water*	**802SNY316** *MS4 Outfall*	**802PLJ752** *MS4 Outfall*	**802NVO325** *Receiving Water*	**802HMT318** *MS4 Outfall*
2018-2019 Parameters that Did Not Meet WQO and/or CTR WQOs										
Copper, dissolved	● --	● --	● --	● --	● --	--	● --	● --	--	● --
Lead, dissolved	● --	-- --	● --	● --	--	--	--	--	--	--
Zinc, dissolved	● --	--	--	--	--	--	● --	--	--	--
E. coli	UAA	UAA	● --	● ♦	● ♦	--	● --	● --	● --	● --
pH	--	--	● ♦	--	--	--	--	--	--	--
TIN/ Nitrogen	--	--	-- ♦	--	--	--	--	--	--	--
DO	--	--	--	--	● ♦	--	--	--	--	--
TDS	--	--	-- ♦	--	--	--	--	--	--	--
Boron	--	--	-- ♦	--	--	--	--	--	--	--
2019 Land Uses by Drainage Area										
% Urban	91%	19%	56%	70%	41%	20% *	48%	50%	40%	86%
% Open	0%	17%	4%	3%	13%	24% *	23%	28%	18%	5%
Proximate 1 sq. mi.	IND, COM	COM, RES	RES	RES	COM, RES	RES, AG	RES, COM	RES	IND	COM, IND
Potential Source of Pollutants of Concern										
POTW	--	X	--	--	--	X*	--	--	X	--
Brine Line Connection	Indirect	Direct/ Indirect	--	Indirect	--	Direct/ Indirect	--	--	--	--
Industrial WDIDs with HPOC in Level 1 or 2 *'15*	--	2	--	--	0	1*	--	--	--	--
Industrial WDIDs with HPOC in Level 1 or 2 *'16*	--	7	--	--	1	--	--	--	1	--
Industrial WDIDs with HPOC in Level 1 or 2 *'17*	--	5	--	--	1	--	--	--	3	--
Industrial WDIDs with HPOC in Level 1 or 2 *'18*	--	11	--	--	1	--	--	--	6	
Urban Landscaping	--	X	X	X	X	*	X	X	--	X
Nursery	1	>25	1	--	--	*	--	--	4	--
Vehicles	X	X	X	X	X	X*	X	X	X	X
Atmospheric Deposition	CA-91	I-15 CA-91	--	--	I-215 CA-60 CA-91	*	--	--	--	--

Table 3-21: 2018-2019 Water Quality and Land Use/Sources Comparison

AG – agriculture land uses
CA – California State Route
COM – commercial type land uses
HPOC – historic pollutant of concern
I – Interstate Highway System
IND – industrial type land uses
RES – single or multi-family residential land uses
UAA – use attainability analysis
WDID – Waste Discharge Identification

Current Year Exceedance of WQO and/or CTR WQO
● – Wet Weather
♦ – Dry Weather
Gray shading – Historical Pollutant of Concern per **Table 3-12**

* Only 43,942 acres of the tributary area is in Riverside County. The Santa Ana River is a perennial stream at the County boundary in large part due to permitted effluent from the Rialto POTW and the Colton/San Bernardino RIX.

11-4.0 REGIONAL MONITORING AND SPECIAL STUDIES

Special studies are intended to address specific research or management strategies that are not addressed by the Permit-prescribed monitoring program. The Permittees participate in the Southern California SMC through a cooperative agreement with its member agencies and by providing in-kind support. The bioassessment component of the CMP receiving water monitoring program was fulfilled through the SMC Regional Monitoring Program, which began a second 5-year cycle in 2015 that ended with the 2019 survey. An overview of the current program and a summary of the results is discussed in **Section 11-4.1**.

The Permittees also participate in TMDL task forces, regional monitoring programs, and have provided funds for specific studies, as discussed below. Efforts by Permittees conducted with the MSAR Bacterial Indicator TMDL and Lake Elsinore and Canyon Lake Nutrient TMDL Task Forces are summarized in **Section 11-4.2** and **Section 11-4.3**, respectively. The Permittees continue to take interest in these special efforts to have a better understanding of the watershed's characteristics, as well as to leverage support for improving the science, monitoring methods, and protection of the water quality.

11-4.1 SOUTHERN CALIFORNIA STORMWATER MONITORING COALITION

11-4.1.1 SMC Regional Program Description

Through the Southern California SMC, the SAR MS4 Permittees participate in the Regional Watershed Monitoring Program (RWMP). Participation is facilitated by the District as the Principal Permittee participating on behalf of the Permittees for the three MS4 Permit compliance programs in Riverside County. The SMC is a regional monitoring consortium that consists of Southern California agency members. The consortium includes SCCWRP; the Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards; Principal Permittees in Southern California (Counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura); the Cities of Los Angeles, San Diego, and Long Beach; as well as the California Department of Transportation (Caltrans) and the State Board. The overall goal of the RWMP is to increase the compliance and effectiveness of existing NPDES monitoring programs by integrating information among Permittees and Surface Water Ambient Monitoring Program (SWAMP) to achieve a large-scale assessment of the watershed condition. Additionally, the program focuses on improvement of stormwater monitoring science, development and improvement of monitoring standards and techniques, coordination among data collection programs, and evaluation of the effects of stormwater discharges to receiving waters. SMC annual reports may be viewed and/or downloaded at: http://socalsmc.org/services/annual-reports/. Additional information regarding completed SMC projects may be viewed and/or downloaded at: http://socalsmc.org/completed-projects/. These projects include the following:

- Stormwater Research Needs in California
- Regional Hydromodification Study
- Regional Bioassessment Program
- Low Impact Development Manual for Southern California
- Barriers to Low Impact Development Study
- Toxicity Testing Laboratory Intercalibration
- Effects of Wildfires on Contaminant Runoff and Emissions

Through the SMC, the Permittees are participating in the RWMP to address three key questions regarding the health of receiving waters in Southern California:

- What is the condition of streams in Southern California?
- What are the major stressors to aquatic life?
- Are conditions in locations of special interest getting better or worse?

Each of these questions is answered by a different component of the monitoring program. Together, these components determine the spatial and temporal extent of impacts, their magnitude, and potential causes. The indicators selected for answering these questions under the study design included the following:

- California Rapid Assessment Method (CRAM), which provides an observational approach looking at riparian wetlands for characteristics of the landscape, hydrology, physical structure, and biotic structure;
- Benthic Macroinvertebrates (aquatic invertebrates that live on the bottom of streams), as measured by the California Stream Condition Index (CSCI); and
- Benthic Algae (assemblages attached to substrata); the algal Index of Biotic Integrity (IBI) evaluates the health of algal communities and is a good indicator because algae represent a primary food source for the benthic community and is sensitive to change.

11-4.1.2 SMC Program 2015-2019

To address the bioassessment requirement of the 2010 MS4 Permit's MRP (Section III.E.5), the Permittees continue to participate in and coordinate with the SMC regional bioassessment monitoring. The study design for the 2015-2019 program was modified based on lessons learned from the previous five-year period of the regional monitoring program. The current five-year SMC Regional Monitoring Program, *Bioassessment Survey of the Stormwater Monitoring Coalition, Workplan for Years 2015 through 2019, Version 1.0* (SMC Workplan) (SCCWRP, 2015) may be viewed and/or downloaded at: http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/849_SMCWorkplan2015.pdf.

11-4.1.2.1 2019 SMC Participation and Preliminary Results

The District participated in the 2015-2019 SMC Program in 2019. Four sites were monitored, including two trend sites and two condition sites (**Table 4-1**). In accordance with the SMC Workplan, trend sites have been monitored annually through 2019 to evaluate changes over time in the SAR and regionally. Condition sites vary from year to year and are selected from a new probabilistic sample draw to estimate prevailing regional conditions. The two SAR trend sites are located in Strawberry Creek and Cucamonga Channel, and the condition sites monitored in 2019 were in Mockingbird Canyon and Cottonwood Canyon.

Table 4-1: 2019 SMC Program Condition and Trend Sites

Station Type	Station Code	Stream Name	Watershed	Land Use	Latitude, Longitude	Date Assessed
Trend	SMC09698	Strawberry Creek	San Jacinto	Open Space (San Jacinto Mountains)	33.74903, -116.70739	6/19/2019
	SMC11581	Cucamonga Channel	Middle Santa Ana	Developed	33.95218, -117.60630	6/19/2019
Condition	801M16957	Mockingbird Canyon	Middle Santa Ana	Developed	33.85539, -117.35511	5/10/2019
	802M16985	Cottonwood Canyon	Middle Santa Ana	Developed	33.67433, -117.26734	5/10/2019

Each SMC station was evaluated using three major metrics. The CRAM score evaluates physical habitat quality for riverine wetlands (Collins et al., 2013). The CSCI score evaluates benthic macroinvertebrates (BMI) community health (Mazor et al., 2016). The CSCI combines a predictive multi-metric index (pMMI) with a predictive observed to expected (O/E) ratio index, and also incorporates local watershed geology and climate factors. The algal IBI evaluates the health of diatom communities (D18), which represent approximately 75% of typical biomass communities and soft algae and cyanobacteria communities (S2). Algal data are pending, and algal IBI scores are not yet available for data assessment. The 2019 dry weather flows and calculated metrics for each SMC station are summarized in **Table 4-2**.

Table 4-2: SMC Bioassessment Monitoring Results

Station Type	Station Code	Stream Name	Date	Flow (cfs)	Habitat	BMI
					CRAM Score	CSCI Score
Condition	801M16957	Mockingbird Canyon	5/10/2019	0.12	65 Fair	0.52 Very Likely Altered
	802M16985	Cottonwood Canyon	5/10/2019	0.36	70 Fair	0.79 Possibly Altered
Trend	SMC09698	Strawberry Creek	6/19/2019	2.01	72 Fair	0.59 Very Likely Altered
	SMC11581	Cucamonga Channel	6/19/2019	15.66	27 Poor	0.33 Very Likely Altered

The riverine wetland physical habitat assessment represents a possible range of 25 to 100 CRAM points, with higher scores indicating higher quality conditions. A CRAM score of 27 at Cucamonga Channel is in the lower portion of the poor range for physical habitat quality and suggests that the BMI community quality may have been affected by physical habitat limitations independent of water quality. Poor physical habitat scores are common for engineered channels like Cucamonga Channel. The other

trend station, Strawberry Creek, received a CRAM score of 72, indicating fair quality physical habitat. The Mockingbird Canyon and Cottonwood Canyon condition sites also received CRAM scores that indicated fair physical habitat quality.

CSCI scores indicate benthic communities that are very likely altered (scores of 0.00 to 0.62), likely altered (0.63 to 0.78), possibly altered (0.79 to 0.91), or likely intact (at least 0.92). The 2019 CSCI score for the engineered channel at Cucamonga Channel was in the very likely altered range. The Strawberry Creek trend site and the Mockingbird Canyon condition site were also in the very likely altered range, and the Cottonwood Canyon condition site was in the possibly altered range.

Water quality grab samples were also collected at each SMC station. Water quality samples were tested for field measurements and submitted for laboratory analysis for ammonia, total nitrogen, nitrate-nitrite, orthophosphate, total phosphorus, hardness, alkalinity, chloride, sulfate, and total suspended solids (TSS). Samples of fine-grained depositional sediments were collected at the Mockingbird Canyon site for physical, chemical (pyrethroids, grain size, total organic carbon, and percent solids), and toxicity analyses. Qualifying depositional sediment material was not observed at the Cottonwood Canyon, Strawberry Creek, or Cucamonga Channel sites. Data collected for the SMC Regional Monitoring Program are submitted to SCCWRP at the conclusion of surveys. A more detailed discussion of the locations, methods, and results are provided in the 2018-2019 Bioassessment Monitoring Report (**Attachment J**).

This was the fifth year of bioassessment monitoring at the two trend sites. These stations were initially assessed under a previous five-year cycle study design. The five years of trend site data are presented in **Table 4-3**. CSCI scores have declined to the very likely altered range for Strawberry Creek and have remained in the very likely altered range for Cucamonga Channel. CRAM scores have indicated physical habitat quality that is poor to good at Strawberry Creek and consistently poor at Cucamonga Channel.

Table 4-3: Comparison of Historical Trend Site Bioassessment Data

Year	Flow (cfs)	CRAM	CSCI	Algae IBI
	Strawberry Creek (SMC09698)			
2010 (baseline)	--	--	0.86 Possibly Altered*	--
2015	0.06	Fair	1.0 Likely Intact	Lower Quality
2016	0.26	Fair	0.97 Likely Intact	Higher Quality
2017	1.44	Good	0.88 Possibly Altered	Lower Quality
2018	0.08	Good	0.80 Possibly Altered	Higher Quality
2019	2.01	Poor	0.59 Very Likely Altered	TBD
Year	**Cucamonga Channel (SMC11581)**			
2009 (baseline)	--	--	0.56 Very Likely Altered*	--
2015	25	Poor	0.56 Very Likely Altered	Lower Quality
2016	1.2	Poor	0.66 Likely Altered	Lower Quality
2017	0.84	Poor	0.66 Likely Altered	TBA
2018	19.03	Poor	0.38 Very Likely Altered	Lower Quality
2019	15.66	Poor	0.33 Very Likely Altered	TBD

TBA – To be analyzed. Algal taxonomy results were received on 11/15/19 with insufficient time to analyze IBI quality for inclusion of this report submittal.
TBD – To be determined. Algal taxonomy results have not been received.
*Average CSCI result obtained from SMC site draw tables.

11-4.1.3 Other SMC Special Studies

The Permittees also participate in additional special studies for the benefit of their local and regional program efforts. Some of the current ongoing SMC that are under development include the SMC Data Portal and a Stream Quality Index (SQI) developed from the input of the regional monitoring efforts. Information regarding ongoing projects can be found on the SMC website (http://socalsmc.org/portfolio/).

11-4.1.3.1 SMC Water Quality Index

One of the SMC projects of particular interest is anticipated to further developments in regional comparability and interpretation of data through the use of an SQI. The SQI would look at specific results from analyses of chemistry, habitat, benthic organisms, and algae to calculate one value to communicate the overall health condition of the site (**Figure 4-1**). This index builds upon metrics from the CSCI, algal stream condition index (ASCI), CRAM, pHab and three chemistry results to categorize the waterbody as Healthy, Resilient, or Impacted by known chemistry or physical measure, or Impacted, causes unknown. This overall category would be easy to understand and interpret by

managers and the public to facilitate understanding of issues impacting waterbodies within their preview. The SQI may also highlight data gaps where more information is needed to understand any underlying issues contributing to the condition of a waterbody.

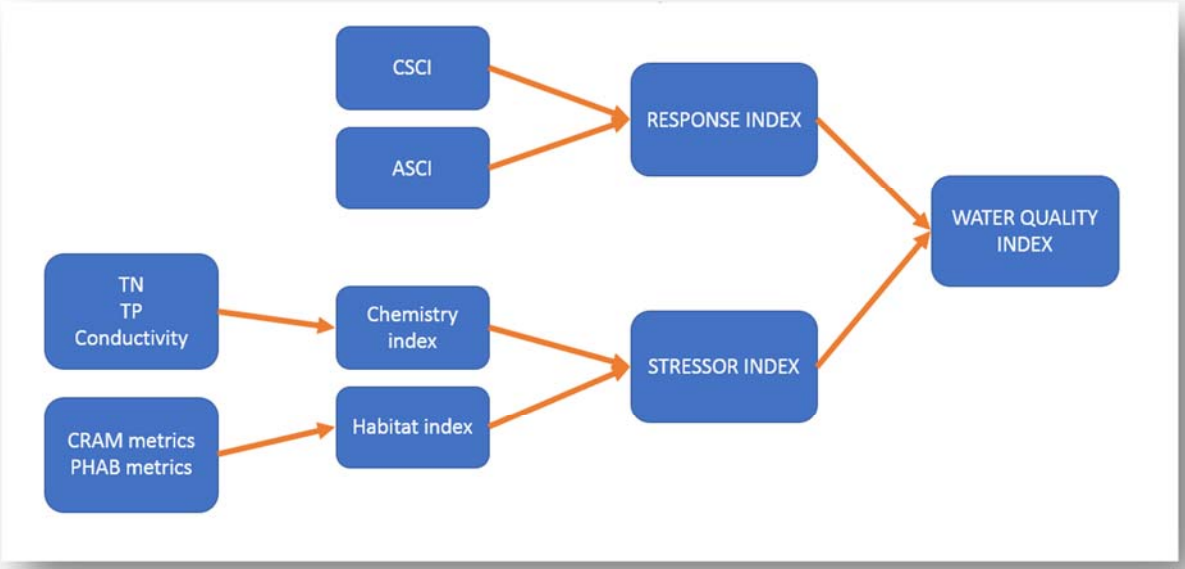


Figure 4-1: SMC Flowchart of Stream Quality Index Calculations

11-4.1.3.2 SMC Five-Year Program (2015-2019)

Looking ahead, the SMC Regional Bioassessment Technical Workgroup will develop monitoring study concepts for approval by the Executive Steering Committee for inclusion in the 2020 regional monitoring. A future five-year study plan has not yet been developed, but its development is under discussion. Additionally, the Executive Steering Committee is currently working on forming a panel of stormwater professional experts to aid in the development of project concepts for the next five-year SMC Research Agenda. The Permittees will continue to participate in the SMC during the 2019-2020 year.

11-4.2 MSAR Bacterial Indicator TMDL Monitoring

The MSAR Bacterial Indicator TMDLs became effective on May 16, 2007, and include the following waterbodies:

- Santa Ana River Reach 3 – Prado Dam to Mission Boulevard Bridge (excludes PBMZ)
- Chino Creek Reach 1 – Santa Ana River confluence to beginning of concrete-lined channel south of Los Serranos Road
- Chino Creek Reach 2 – Beginning of hard lined channel south of Los Serranos Road to confluence with San Antonio Creek
- Mill Creek (Prado Area) – Natural stream from Cucamonga Creek Reach 1 to Prado Basin
- Cucamonga Creek Reach 1 – Confluence with Mill Creek to 23rd Street in City of Upland
- Prado Park Lake

The MSAR Bacterial Indicator TMDL Task Force, which includes the responsible parties named in the TMDL, collaboratively implements requirements defined in the TMDL. The Santa Ana Watershed Project Authority (SAWPA) serves as administrator of the Task Force. In this role, SAWPA provides all Task Force meeting organization/facilitation, secretarial, clerical and administrative services, management of Task Force funds, annual reports of task force assets and expenditures, and hiring of Task Force authorized consultants.

11-4.2.1 Comprehensive Bacteria Reduction Plan

Through the MSAR Bacterial Indicator TMDL Task Force, the Permittees implement the Comprehensive Bacteria Reduction Plan (CBRP). The CBRP is a long-term plan designed to achieve compliance with the urban wasteload allocation (WLA) during the dry season (April 1 to October 31) by the compliance date of December 31, 2015. The CBRP was developed and finalized in June 2011. The Regional Board approved the CBRP in February 2012. The CBRP includes an implementation schedule with contingencies built in to allow consideration of new data, modified regulations, changed priorities, or new technologies. The CBRP implementation includes the following:

- Tier 1 monitoring: A 10-week monitoring program implemented at selected major outfalls to the Santa Ana River to evaluate bacterial indicator sources.
- Establishment of a risk-based framework for evaluating water quality data obtained from the Tier 1 monitoring. Based on data from Tier 1 efforts, the major outfalls were prioritized for focused source assessments.
- Tier 2 source assessments: A follow-up to the Tier 1 monitoring. Detailed source assessments in prioritized Tier 1 outfalls. The methods developed for these source assessments are based on the IC/ID procedures (CMP Volume IV, **Attachment A**).
- Synoptic Study: A 6-week monitoring program implemented in 2019-2020 monitoring year, at selected major outfalls to the Santa Ana River to re-evaluate bacterial indicator sources.
- The CBRP, MSAR Bacterial Indicator TMDL compliance monitoring, as described in the approved Monitoring Plan and QAPP, and related evaluation plans and data reports are available for viewing on the SAWPA website at:
- https://sawpa.org/task-forces/regional-water-quality-monitoring-task-force/#.

Monitoring associated with the MSAR Bacterial Indicator TMDLs is coordinated and administered through the MSAR TMDL Task Force, led by SAWPA staff. Results of the 2018-2019 monitoring effort are provided in **Attachment L**.

The District is moving forward with several projects to divert dry weather flows to the sanitary sewer system from MSAR outfalls in an effort to address the TMDL. The proposed dry weather flow diversion projects include Phoenix Storm Drain in the City of Riverside and Eastvale Master Drainage Plan (MDP) Lines D and E in the City of Eastvale. The District has partnered with the City of Riverside and hired a consultant to finalize design plans for Phoenix Storm Drain. The groundbreaking for the project is expected to begin in 2020. For Eastvale MDP Lines D and E, the District continues to work with the Jurupa Community Services District and completed water quality monitoring for which the findings will help to determine if low flows meet target limits for diversion to sewer.

11-4.2.2 Triennial Review and Regional Monitoring Program

The last integrated analysis of the long-term CBRP monitoring efforts was presented in the 2016 Triennial Review and was included in the 2017-2018 Annual Monitoring Report. Based on the findings of the Triennial Review, the Task Force developed a Regional Monitoring Program (RMP) to facilitate the TMDL implementation process and track progress toward attainment of applicable water quality standards. The RMP was submitted to the Regional Board in February 2016 and was approved on March 11, 2016. The June 2017 Work Plan and QAPP leverages information from the risk-based approach ("Tier" system) defined in the February 2016 Basin Plan to prioritize MSAR waterbodies as follows:

- Tier A/Priority 1: Priority monitoring to establish that these locations are "safe" where people engage in REC-1 activities.
- Priority 2: Second priority monitoring to evaluate progress towards existing TMDL WLAs and water quality standards.
- Priority 3: Third priority monitoring for 303(d) listed waterbodies where a TMDL has not yet been established, and periodic sample collection is conducted annually.
- Priority 4: Data collected to evaluate waterbodies with a REC-2 designated beneficial use to evaluate compliance with the anti-degradation targets. Data would also be used to assess status and trend of bacteria indicator water quality as part of the Triennial Review process.

To address Priority 4 listed above, a synoptic study design was implemented in the 2019-2020 monitoring year. On May 30, 2019, the Santa Ana Regional Board approved the Task Force's request to defer the Triennial Report for one year to evaluate the new monitoring data collected in 2019-2020.

Implementation of the 2017 Workplan began during the 2017-2018 monitoring year. The 2017 Workplan and QAPP may be viewed on the SAWPA website at:
https://sawpa.org/task-forces/regional-water-quality-monitoring-task-force/.

11-4.3 Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring

The Lake Elsinore and Canyon Lake Nutrient TMDL for nitrogen and phosphorus has been in place since September 2005 and includes the following waterbodies:

- Canyon Lake (Railroad Canyon Reservoir)
- Lake Elsinore

The responsible parties named in the TMDL created a formal cost sharing body, or Task Force, to collaboratively implement a number of requirements defined in the TMDL. The Lake Elsinore and San Jacinto Watersheds Authority (LESJWA) serves as administrator of the Task Force. In this role, LESJWA provides: all Task Force meeting organization/facilitation; secretarial, clerical and administrative services; management of Task Force funds; annual reports of task force assets and expenditures; and hiring of Task Force authorized consultants.

Through the Lake Elsinore and Canyon Lake Nutrient TMDL Task Force, the Permittees implement the CNRP, a long-term plan designed to achieve compliance with WLAs established in the Lake Elsinore and Canyon Lake Nutrient TMDLs. CNRP implementation includes the following:

- Funding continued operation of the aeration and mixing system in Lake Elsinore.
- Implementation of the Canyon Lake Alum Treatment Project. Alum treatments are applied to Canyon Lake twice per year (February and September) to sequester excessive phosphorus levels. This project includes effectiveness monitoring to quantify the benefits of alum additions to water quality in the lake.
- Lake Elsinore and Canyon Lake Nutrient TMDL compliance monitoring, as described in the approved Monitoring Plan and QAPP, can be viewed or downloaded at https://sawpa.org/task-forces/lake-elsinore-and-canyon-lake-tmdl-task-force/#monitoring-program. Monitoring is handled through the Lake Elsinore and Canyon Lake Nutrient TMDLs Task Force, led by the LESJWA staff.

Two monitoring programs were initiated to track the progress of the CNRP, one specific to Lake Elsinore and Canyon Lake, and one watershed-wide program; some program revisions were made over the years. In April 2015, the Task Force submitted the Lake Elsinore & Canyon Lake Nutrient TMDL Compliance Monitoring Workplan to the Regional Board, which addresses the compliance monitoring requirement of the Lake Elsinore and Canyon Lake Nutrient TMDL and the 2010 MS4 Permit. The Task Force prepared the Compliance Monitoring Workplan to reassess the current conditions and establish a monitoring framework to assess trends towards meeting TMDL targets. Implementation of the San Jacinto River Watershed Monitoring Program Phase II resuming in-lake monitoring of Lake Elsinore and Canyon Lake began in July 2015. Based on monitoring results, the TMDL criteria are being reevaluated. The TMDL is currently being updated, and the Task Force will continue to work with the Regional Board on the revisions.

Results of the 2018-2019 compliance monitoring effort have been provided in **Attachment L**. In 2018, large areas within Lake Elsinore drainage areas were significantly burned by the Holy Fire, and winter storms created large debris flows throughout the city. Additional monitoring was conducted to evaluate the sediment within the flood control basin, debris flows, and sediment plume within the lake. Details regarding these monitoring efforts and analytical results are presented in **Attachment C**.

11-4.4 HYDROMODIFICATION MANAGEMENT PROGRAM

The Watershed Action Plan (WAP) and its supporting documents, including the Hydromodification Management Plan (HMP), were approved in April 2017 and can be downloaded from http://rcflood.org/downloads/NPDES/Documents/SA_WAP/WatershedActionPlan.pdf.

The SAR HMP Evaluation Program is an extension of the HMP and can be downloaded from http://rcflood.org/downloads/NPDES/Documents/SA_WAP/AppG_HydromodificationManagementPlanEvaluationProgram.pdf. The HMP Evaluation Program extends through fiscal year 2021; this period of time is necessary to implement monitoring, analyze data from selected sites, and account for spatial and temporal variability of the conditions in the SAR amongst other metrics. Data will be collected from two monitored sites within the watershed area. Assessment survey data will be gathered at each site and will be used to track site geomorphic evolution and assess what types of impacts may have occurred.

Based on the hydrology assessment and analysis of the San Jacinto River, it has been determined that the San Jacinto River is a natural resistant feature that shows no signs of it being a hydrologic condition of concern. The assessment is included as Attachment D to the Hydromodification Susceptibility Documentation Report and Mapping.

Implementation of the SAR HMP Evaluation Program will be discussed in the SAR Monitoring Annual Reports, as well as how the data gathered will be used in future monitoring. During the 2018-2019 monitoring year initial field surveying, GIS metrics and field observations for both approved HMP sites was completed.

11-4.5 SALINITY MANAGEMENT PROGRAM

In 1995, the Basin Plan incorporated site-specific regional TDS/nutrient management strategies (2010 MS4 Permit, Section II.L.2). The SAWPA, in partnership with Permittees, owns and operates a pipeline system within San Bernardino and Riverside Counties referred to as the Brine Line (historically referred to as the Santa Ana Regional Interceptor). The Brine Line accepts brine and other wastewater discharges within the SAR. It provides wastewater disposal for industries that generate salty wastewater during the manufacturing process, or from cooling, boiler blowdown, or other processes. The Brine Line redirects this wastewater from POTWs, thus reducing the TDS concentrations and salt load discharged into the Santa Ana River. The Inland Empire Brine Line Overflow Emergency Response Plan (OERP) was published in January 2016 and defines operations and procedures for managing Brine Line flows in the event of sanitary sewer overflow, earthquake and other measures. Additional information regarding the Brine Line may be viewed and/or downloaded at: https://sawpa.org/inland-empire-brine-line/

11-4.6 LID BMP SPECIAL STUDY

11-4.6.1 Participation in SMC California LID Evaluation and Analysis Network (SMC CLEAN) Project

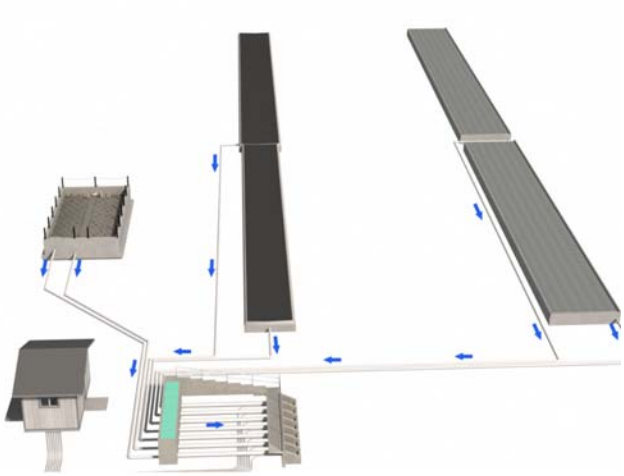
The District coordinated with the Santa Ana Watershed Project Authority on a Proposition 84 grant to construct a 15-acre Low Impact Development (LID) Testing and Demonstration Facility at the District's headquarters in Riverside. The LID Testing and Demonstration Facility (**Figure 4-2**), which began operation in 2012, is being used to monitor the performance of LID BMP systems during storms and to assist in the development of technical guidance regarding LID BMP design. The facility collects data regarding LID BMP effectiveness through volume and pollutant concentration reduction in accordance with the LID Monitoring Plan and QAPP. Flow data and influent and effluent samples from BMPs were sampled five times during the 2018-2019 wet season. Dates and sites monitored are shown in **Table 4-4** below.

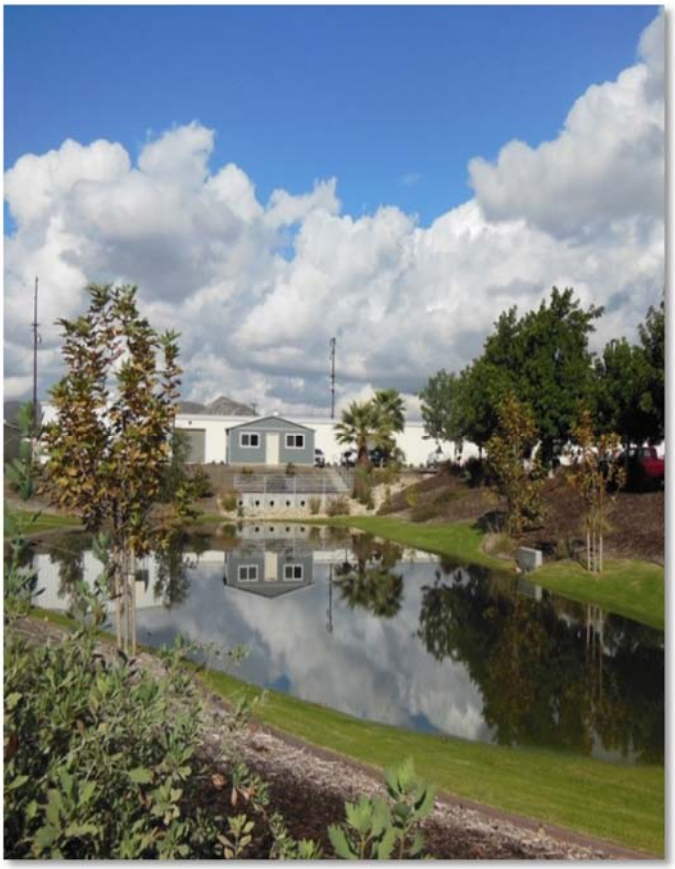
Table 4-4. LID Storm Events Monitored

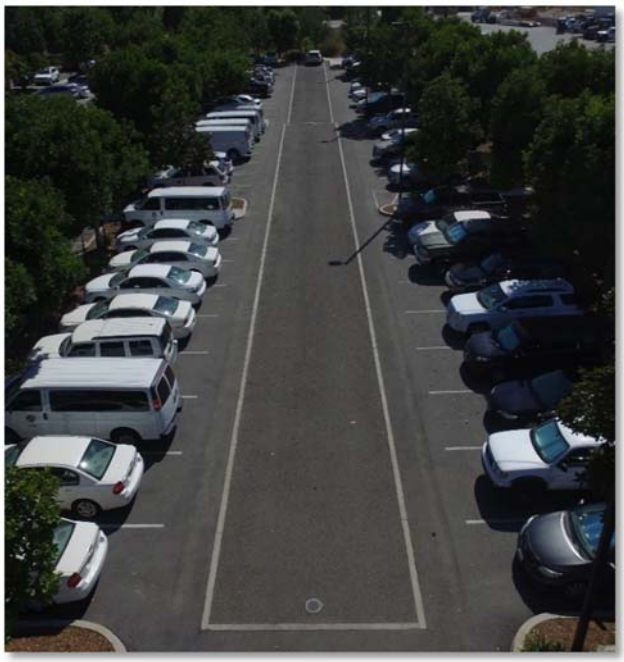
Date	Stations Monitored	Rainfall
11/29/18	601, 602, 604, 605, 606, 608, 609, 610	0.85"
12/5/18	601, 602, 603, 604, 605, 606, 608,	1.27"
1/12/19	601, 602, 603, 605, 606, 608,	0.31"
1/31/19	606, 608	0.34"
2/14/19	609, 610	2.75"
11/29/18	601, 602, 604, 605, 606, 608, 609, 610	0.85"

The District is collaborating with the SMC CLEAN's overarching LID BMP evaluation project. The project is designed to understand the effectiveness of LID BMPs in California "both in the short term for use in calibration of watershed programs and the long term for modification of LID design, construction, and maintenance" (SMC, 2017). SMC CLEAN involves project partners and others performing LID monitoring and serves as a clearing house for LID monitoring information; the District is one of the participating agencies. The results of the District's monitoring, along with results from other agencies involved, will be used to establish water quality treatment effectiveness and numeric criteria for crediting flow reductions to developments that implement these BMPs.

After five years of monitoring the LID Testing and Demonstration Facility, the District reviewed the data collected to determine if conclusions can be made regarding performance and design. Based on the trends in the data, the District has been revitalizing some systems to implement designs that have been shown in other studies to improve pollutant removal and volume reduction performance. These changes, as well as the rest of the LID Testing and Demonstration Facility, will continue being monitored to learn how these systems perform over time.







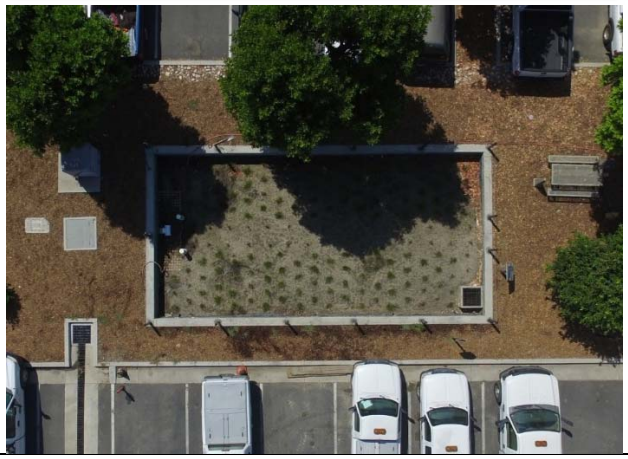


Figure 4-2: Photographs of the LID Integrated Management Plan Testing and Demonstration Facility

11-4.7 PARTICIPATION IN OTHER REGIONAL MONITORING EFFORTS

The Permittees, individually or jointly, participate in the regional efforts outlined below:

MSAR TMDL Task Force

The Riverside and San Bernardino County Permittees developed the CBRPs for those Permittees named in the MSAR Bacterial Indicator TMDL and submitted the final drafts for approval by the Regional Board on June 28, 2011. The CBRP was approved at the Regional Board meeting on February 10, 2012. The Permittees continue to implement the CBRP and will update as needed upon an approved MS4 Permit. In 2016, the Task Force developed and is currently implementing a RMP to facilitate the TMDL implementation process and track progress toward attainment of applicable water quality standards for bacterial indicators (see **Section 11-4.2.2**).

Lake Elsinore/San Jacinto Watershed Authority

As part of the Proposition 13 funding of $15,000,000, a Joint Powers Authority, LESJWA, was formed in April 2000. Members of LESJWA include the Elsinore Valley Municipal Water District, the City of Lake Elsinore, the County of Riverside, the City of Canyon Lake, and SAWPA. The purpose of LESJWA is to bring together member agencies and stakeholders in an effort to identify solutions to water and habitat problems that no single agency could effectively address before. Projects that LESJWA has funded include fishery management (e.g., carp), Lake Elsinore Island well improvements, and the installation and operation of the Lake Elsinore Aeration and Mixing System.

Lake Elsinore and Canyon Lake Nutrient TMDLs Task Force

The Lake Elsinore and Canyon Lake Nutrient TMDLs Task Force acts as a technical advisory group to LESJWA. Since the TMDL was adopted on December 20, 2004, the Permittees have continued to provide input on Task Force products such as the proposed Task Force agreement for TMDL implementation, and a cost-sharing framework for stakeholders to share implementation costs. In June 2004, the Permittees also supported recommendations to retain consultant services to examine options for an alternative monitoring approach. The Task Force continues to implement these monitoring studies for Canyon Lake, Lake Elsinore, and the San Jacinto River Watershed.

The Task Force, composed of stakeholders in the San Jacinto River Watershed, met on a regular basis throughout the 2017-2018 monitoring year. The Watershed model results and the technical aspects of the TMDL Load Allocations (LAs) and WLAs were discussed as standing Task Force meeting agenda items. The Task Force has focused on providing support and direction for the development implementation of the CNRP, as described in **Section 11-4.3**.

San Jacinto River Watershed Council

The San Jacinto River Watershed Council (SJRWC) is a non-profit organization of community groups; tribal, farming, and dairy representatives; water agencies; government agencies; businesses; and all interested stakeholders working cooperatively to address water quality concerns in the San Jacinto River Watershed. The goal of the group is to provide educational, scientific, and technical assistance that will help sustain, restore, and enhance the natural resources of the San Jacinto River Watershed while promoting long-term social and economic vitality to the region. The Permittees coordinate with the SJRWC to collect data on Canyon Lake and within the San Jacinto River Watershed.

Stormwater Quality Standards Task Force

The Stormwater Quality Standards Task Force (SWQSTF) is a partnership with an aim is to review the REC-1 designations, the associated WQOs, and the permit implementation approaches for the major waterbodies and their tributaries within the SAR. The SWQSTF uses a Delphi decision-making process, which allows the stakeholders to participate equally and minimizes bias. The following are the project goals of the SWQSTF:

- Revise Santa Ana River (and tributaries) REC-1 designations to more accurately reflect the true nature of recreational uses occurring throughout the watershed.
- Update WQOs to consider USEPA guidance on bacterial indicators and other relevant scientific research.
- Develop MS4 Permit implementation and monitoring strategies to ensure cost-effective compliance with WQOs.

The SWQSTF's analyses and recommendations of modifications to the REC-1 and REC-2 beneficial uses and maximum expected single values for *E. coli* were incorporated into the Basin Plan in February 2016.

Southern California Water Committee

The Southern California Water Committee is a non-profit, non-partisan, public education partnership dedicated to informing Southern California about water needs and the water resources of the state. It is a cooperative effort of businesses, government, water agencies, agriculture, and public interests. The District contributes $15,000 per year as part of Riverside County's support of the committee.

Santa Ana Technical Advisory Committee Meetings

The Santa Ana Technical Advisory Committee (TAC) met 10 times during the fiscal year to coordinate the implementation of the DAMP, LIP, Water Quality Management Plan, and the overall MS4 Permit compliance program. The District, as the Principal Permittee, chairs and provides staff support to the TAC. Areas of focus for the TAC are providing technical support to the Permittees to facilitate coordination and collaboration with related water quality management programs, monitoring program development, and response to new legislative and regulatory initiatives. Meetings have also focused on the implementation of the requirements of the 2010 MS4 Permits and coordination of associated compliance program elements. A majority of the meetings have focused on the MSAR Bacterial Indicator and Lake Elsinore and Canyon Lake Nutrient TMDLs, WQMP implementation, and the ongoing discussion of pursuing alternate means of program funding. The TAC consists of representatives formally appointed by the city manager or equivalent of each Permittee.

11-5.0 FINDINGS

The 2018-2019 monitoring year water quality data, in conjunction with historical monitoring results, were used to evaluate the five management questions from the Model Monitoring Program for Municipal Separate Storm Sewer Systems in Southern California (MMP) (SMC, 2004). In part, this section also addresses the MRP objective to assess the effectiveness of water quality controls. Note that in this evaluation, sample results from the MS4 outfall stations were compared to WQO and CTR WQO criteria for comparison purposes only, as these objectives are applicable to receiving waters not the MS4 (State Board, 2005).

MMP Question #1: Are conditions in receiving waters protective, or likely to be protective, of beneficial uses?

This question is addressed using the monitoring results from the three receiving water stations. Overall, only two exceedances of applicable WQOs were measured at SAR receiving water stations during the 2018-2019 monitoring year.

San Jacinto River Receiving Water

The Perris Valley Channel at Nuevo Road receiving water station characterizes conditions of San Jacinto River Reach 3. This receiving water has no listed water quality impairments. It is the only monitored receiving water station with an MS4 outfall station located upstream (i.e., Perris Line J Outfall). The relative contributions from the MS4 to the receiving water may be directly evaluated for San Jacinto River Reach 3 only (See **MMP Question #3**).

Based on applicable WQO and CTR WQOs for the monitoring data, the intermittent beneficial uses of the receiving water were protected during the 2018-2019 monitoring year, with the exception of REC-1 during wet weather. *E. coli* levels exceeded the STV WQO from the Statewide Bacteria Provisions for both wet weather events (October 13, 2018 and November 29, 2018) at the receiving water station. Perris Valley Channel also has limited access, with a subsection of bike trail along one side. No aquatic toxicity was observed at the Perris Valley Channel at Nuevo Road receiving water station and, unlike the upstream MS4 station, there were no exceedances of metals at this receiving water station. There is insufficient water in this reach during dry weather events for sampling.

Temescal Creek Receiving Water

The Temescal Channel at Main receiving water station characterizes conditions in Reach 1a of Temescal Creek. This reach is a concrete-lined trapezoidal channel. The three beneficial uses assigned to this waterbody include REC-2, WARM, and WILD, and it is exempt from the MUN beneficial use. By means of a UAA, the REC-1 beneficial use was determined unattainable and only the dry weather anti-degradation targets associated with REC-2 are applied to this receiving water. pH is considered a historical pollutant of concern for Temescal Creek Reach 1a based on a pH listing of waterbody impairment from 2010. However, the 2014/2016 Section 303(d) List updated the listing from Temescal Reach 1a to the PBMZ due to a mapping change. Lines of evidence for this listing include samples collected in the Temescal Creek receiving water above Main Street at Corona (approximate location of 801TMS746). The beneficial use associated with this impairment is WARM.

During 2018-2019 wet weather monitoring, both pH measurements taken at the Temescal Channel at Main receiving water station were within the Basin Plan WQO range, and no statistically significant trend for pH was identified. Since the inception of monitoring at the Temescal Channel at Main

receiving water station, only two wet weather pH measurements have been slightly less than the WQO lower limit of 6.5 units (historical exceedance frequency of 15%). The results from the current year monitoring data suggest that the WARM beneficial use of this waterbody is not impacted by pH during wet weather conditions.

The only parameter that exceeded applicable WQOs or CTR WQOs during wet weather monitoring was dissolved copper, which exceeded the WQO and the CTR WQO (CMC) during both events. Copper does not persistently exceed WQOs at this location, but it has a historical frequency of exceedance of 46%. No acute or chronic toxicity was observed in wet weather samples from this receiving water station during the 2018-2019 monitoring year. Although pesticides are historically associated with aquatic toxicity and associated beneficial use impairments, detections at the Temescal Channel at Main receiving water station are infrequent. Based on these results, wet weather conditions in the Temescal Creek receiving water may be considered protective of applicable beneficial uses with the exception of WARM, which may potentially be impacted by dissolved copper levels.

In accordance with the CMP, dry weather events were not monitored at the Temescal Channel at Main receiving water station because this station is assigned for wet weather monitoring only. Therefore, the REC-2 beneficial use does not apply.

Santa Ana River Receiving Water

Santa Ana River Reach 3 is regulated by the MSAR Bacterial Indicator TMDL, and Santa Ana River Reach 4 is included on the Section 303(d) List as impaired for bacterial indicators, suggesting regional impairment to the REC-1 beneficial use. The Basin Plan generally recognizes that access to the receiving water is prohibited in some portions, limiting the likelihood of this type of recreational activity. In 2016, the MSAR Bacterial Indicator TMDL Task Force developed, and is currently implementing, an RMP to facilitate the TMDL implementation process and track progress toward attainment of applicable WQOs. The findings were presented in the 2016 Triennial Review. The June 2017 Work Plan and QAPP of the TMDL MRP leverages information from the risk-based approach ("Tier" system) defined in the February 2016 Basin Plan to prioritize MSAR waterbodies. The Santa Ana Regional Board approved the Task Force's request to defer the next Triennial Report for one year to evaluate the new monitoring data collected in 2019-2020.

The Santa Ana River at Highgrove receiving water station is located at the County line and characterizes the impact of perennial dry weather flows from San Bernardino County POTWs into Santa Ana River Reach 4. Perennial flow at the Santa Ana River at Highgrove receiving water station was sampled during two dry weather events to characterize inputs to the SAR from San Bernardino County; wet weather monitoring is not required at this location.

During the 2018-2019 monitoring year, *E. coli* was below the WQO for both dry weather samples collected at this receiving water station. Further, no other parameters exceeded applicable WQOs or CTR WQOs, and no acute or chronic toxicity was observed in either dry weather sample. When detected at this receiving water station, pollutants of concern have infrequently exceeded WQOs (14% historical frequency of exceedance for *E. coli*, pH, and TIN). Dissolved copper, dissolved lead, dissolved zinc, boron, TDS, and DO have not exceeded applicable WQOs or CTR WQOs during the sampling period of record. These integrated assessment results suggest that ephemeral dry weather flow entering the County via Reach 4 is likely protective of receiving water beneficial uses.

MMP Question #2: What is the extent and magnitude of the current or potential receiving water problems?

As an ephemeral watershed, large and/or high intensity precipitation is needed to generate flow in the receiving waters within the SAR, which are typically dry or ponded during dry weather. The effect of water quality exceedances identified during MS4 outfall monitoring is limited in geospatial extent because flows generally do not reach SAR receiving waters. The key exception is where permitted discharges (such as POTWs) generate localized flows. The CMP has incorporated dry weather receiving water monitoring to evaluate these non-jurisdictional flows.

E. coli and dissolved copper concentrations at receiving water and MS4 outfall stations across the SAR were measured above receiving water WQOs and/or CTR WQOs. *E. coli* is not persistent at either of the receiving water stations with wet weather monitoring, but was found to be persistent at four of the seven MS4 outfall stations during wet weather. **Figure 5-1** displays the magnitude of exceedances for *E. coli* during the 2018-2019 monitoring events as a ratio plot with all stations shown. A ratio of greater than one indicates the *E. coli* result exceeded the WQO, except when site conditions met one or more of the high flow suspension criteria, in which case the WQO is not applied to the measured wet weather result. These events are flagged with a (*). A ratio of less than one indicates the *E. coli* result was below the WQO. The y-axis of the plot is at a log-scale to clearly illustrate both types of ratios. In terms of receiving water monitored during 2018-2019, Perris Valley Channel at Nuevo Road (802NVO325) had wet weather exceedances ratios of 500 and 41 times the WQO. The Temescal Channel at Main receiving water station is not shown due to the UAA that excludes the REC-1 beneficial use.

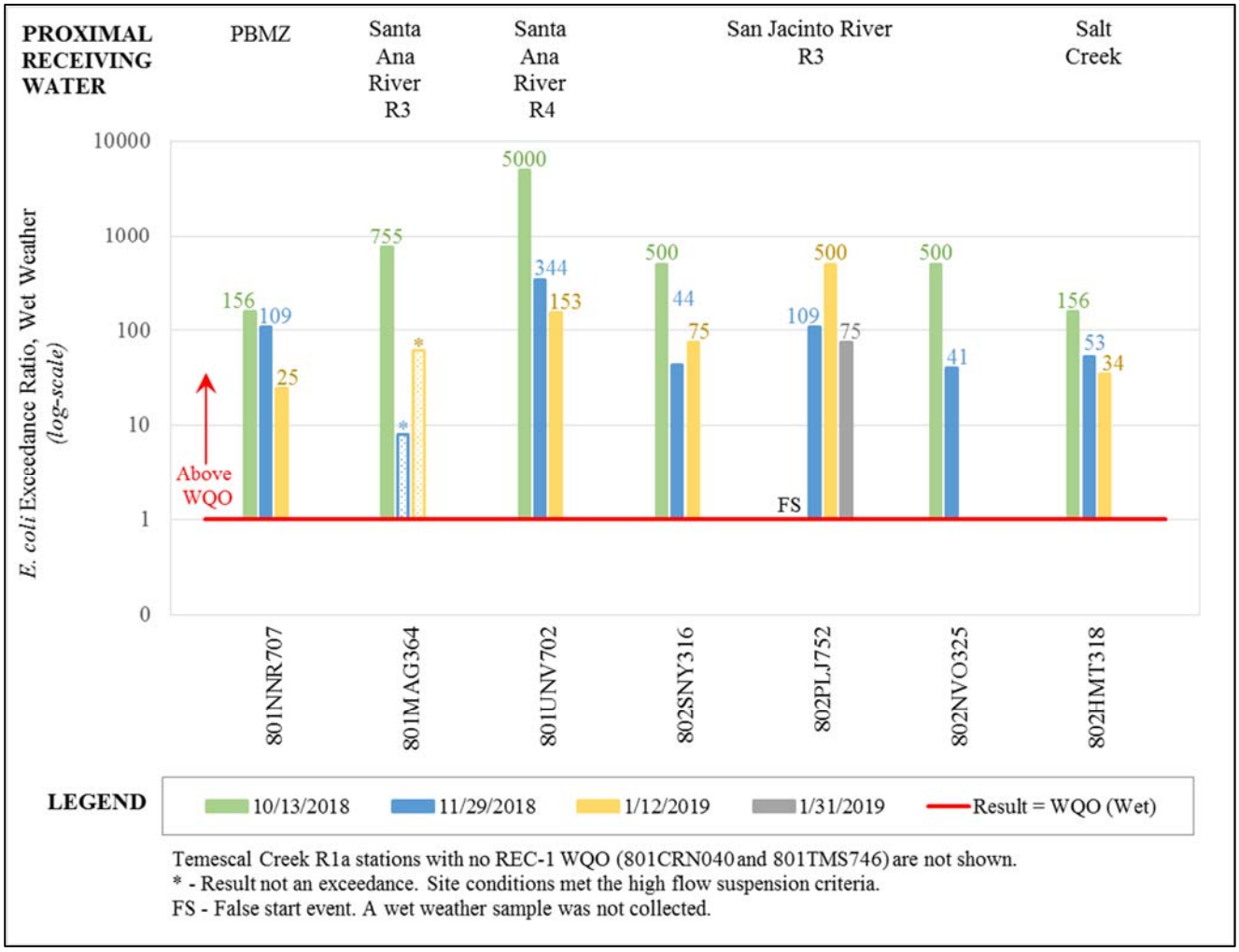


Figure 5-1: Exceedance Ratio Plots for *E. coli* at SAR Monitoring Stations

Similarly, the magnitude of dissolved copper exceedances can be ascertained by calculating the ratio of the result to the applicable water quality standard. **Figure 5-2** plots the ratio of the results to either the site-specific WQO or the CTR WQO. The plot is based on the greater ratio (typically the site-specific WQO from the Basin Plan is more conservative, if applicable, due to the water effects ratio [WER] coefficient). A ratio below one indicates the result is below the applicable WQO. Overall, the ratios were 1 to 3 times the applicable water quality standard, but dissolved copper did not exceed WQOs at the Perris Valley Channel at Nuevo Road (802NVO325) receiving water station during the 2018-2019 monitoring year. No acute or chronic toxicity was observed in wet weather event samples from receiving water stations. In accordance with the MMP criteria, the 2018-2019 assessments determined dissolved copper was not a persistent exceedance at any of the monitoring stations.

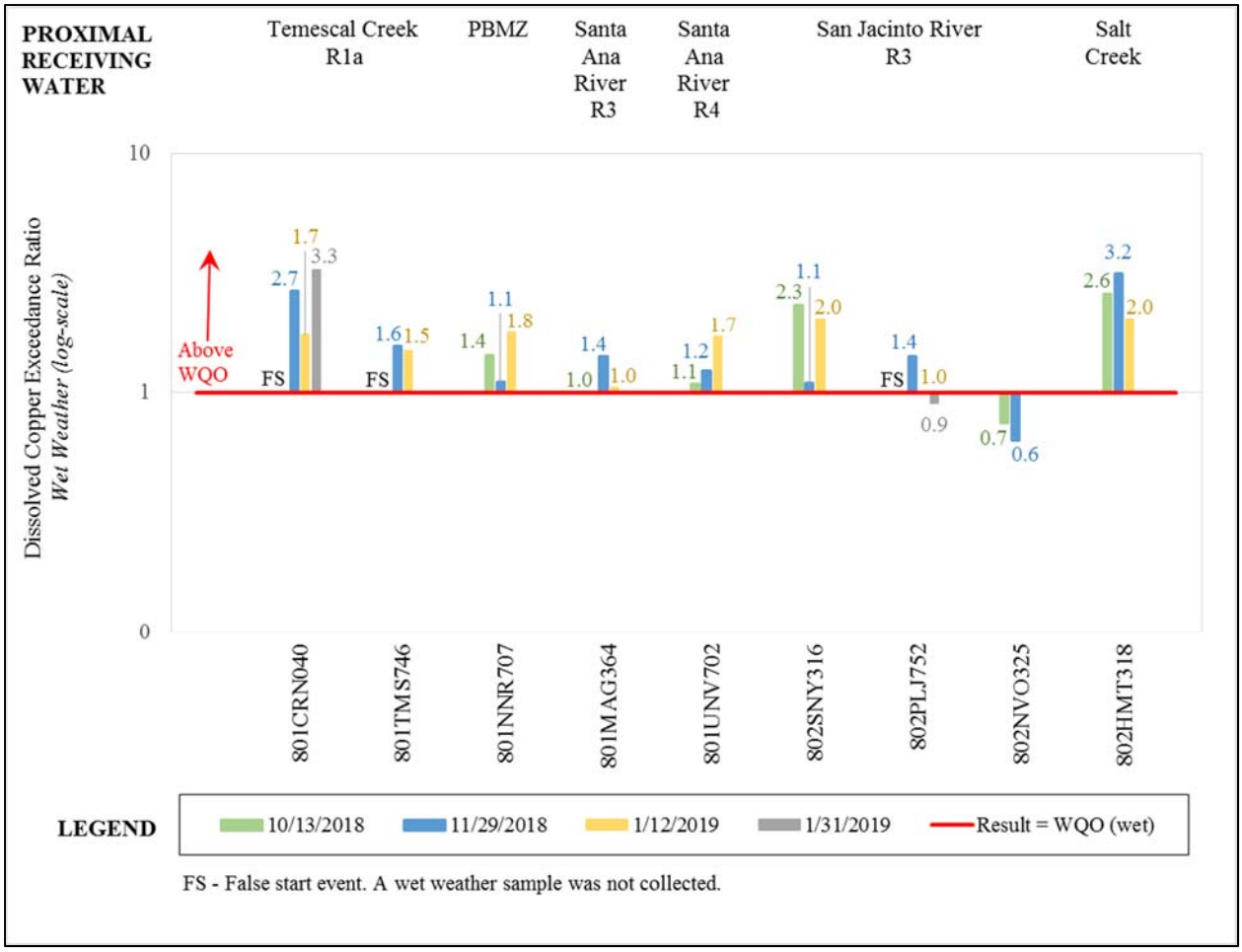


Figure 5-2: Exceedance Ratio Plots for Dissolved Copper at SAR Monitoring Stations

MMP Question #3: What is the relative urban runoff/MS4 discharge contribution to the receiving water problem(s)?

Conditions in the SAR are typically ephemeral, except near the County line (Santa Ana River at Highgrove receiving water station), which limits the geospatial extent of flows across the watershed and region. A review of flow observations for the eight monitoring years under the 2010 MS4 Permit shows that five of seven MS4 outfall stations were VNS during dry weather for seven of the eight years (**Figure 3-2**). This represents more frequent VNS results compared to the mid-1990s. Observed dry weather flows at MS4 outfall locations are often less than one cfs. Based on field observations made at MS4 outfall stations, and as corroborated by IC/ID field investigations of major outfalls (IC/ID Monitoring Results Database), dry weather low flows tend to evaporate and/or infiltrate without reaching receiving waters.

Figure 5-3 and **Figure 5-4** present a spatial overview of 2018-2019 monitoring results for wet and dry weather, respectively, at all monitoring stations. Only parameters with concentrations exceeding WQOs or CTR WQOs are shown on these figures. For these parameters, statistically significant long-term trends and results that persistently exceed WQOs or CTR WQOs are also presented as symbols on the maps. In general, a greater number of exceedances occur at MS4 outfall stations than at receiving water stations, but sample results from the MS4 outfall stations have been evaluated with

these criteria for comparison purposes only, as WQOs and CTR WQOs are applicable to receiving waters not the MS4 (State Board, 2005).

Perris Valley Channel at Nuevo Road (802NVO325) is the only receiving water station with MS4 outfall stations located upstream. The Perris Line J Outfall and Sunnymead Outfall are located 0.2 mile and 9.5 miles upstream of the receiving water station, respectively. Therefore, monitoring data for these stations may be used to understand the relative contribution of MS4 discharge to receiving water problems. Only wet weather contributions can be evaluated, as these receiving water stations and MS4 outfall stations were VNS during dry weather. Both MS4 outfall stations had wet weather exceedances for *E. coli* and dissolved copper during 2018-2019, whereas the receiving water station had only exceedances for *E. coli*. In fact, Perris Valley Channel at Nuevo Road has a 0% historical exceedance frequency for dissolved copper, despite upstream MS4 outfall exceedance frequencies of 41% and 84% for Perris Line J Outfall and Sunnymead Outfall, respectively, during wet weather. Further, no aquatic toxicity was observed at the Perris Valley Channel at Nuevo Road receiving water station. San Jacinto River Reach 3 is not listed as impaired for any monitored parameters, which is consistent with the 2018-2019 monitoring year receiving water results.

For the remainder of the wet weather monitoring data, the relative contributions from the MS4 to the receiving water cannot be directly assessed because the receiving water station is either located upstream of, or in a different receiving water from MS4 outfall stations. The Corona Outfall discharges to Temescal Creek Reach 1a downstream of the Temescal Channel at Main receiving water station (801TMS746). The Hemet Outfall does not have an associated receiving water monitoring station and is located approximately 14.5 miles upstream of Canyon Lake. Observed wet weather flows would likely pond, evaporate, and infiltrate prior to reaching the lake, which is subject to the Lake Elsinore and Canyon Lake Nutrient TMDLs. The North Norco Outfall is tributary to the PBMZ, an artificial inland wetland and groundwater management area formed by the Prado Dam. Flow through the dam structure is managed by the Santa Ana River Waterkeeper in accordance with the Prado Settlement. The Magnolia Center Outfall (801MAG364) and the University Wash Outfall are not associated with monitored receiving water stations during wet weather.

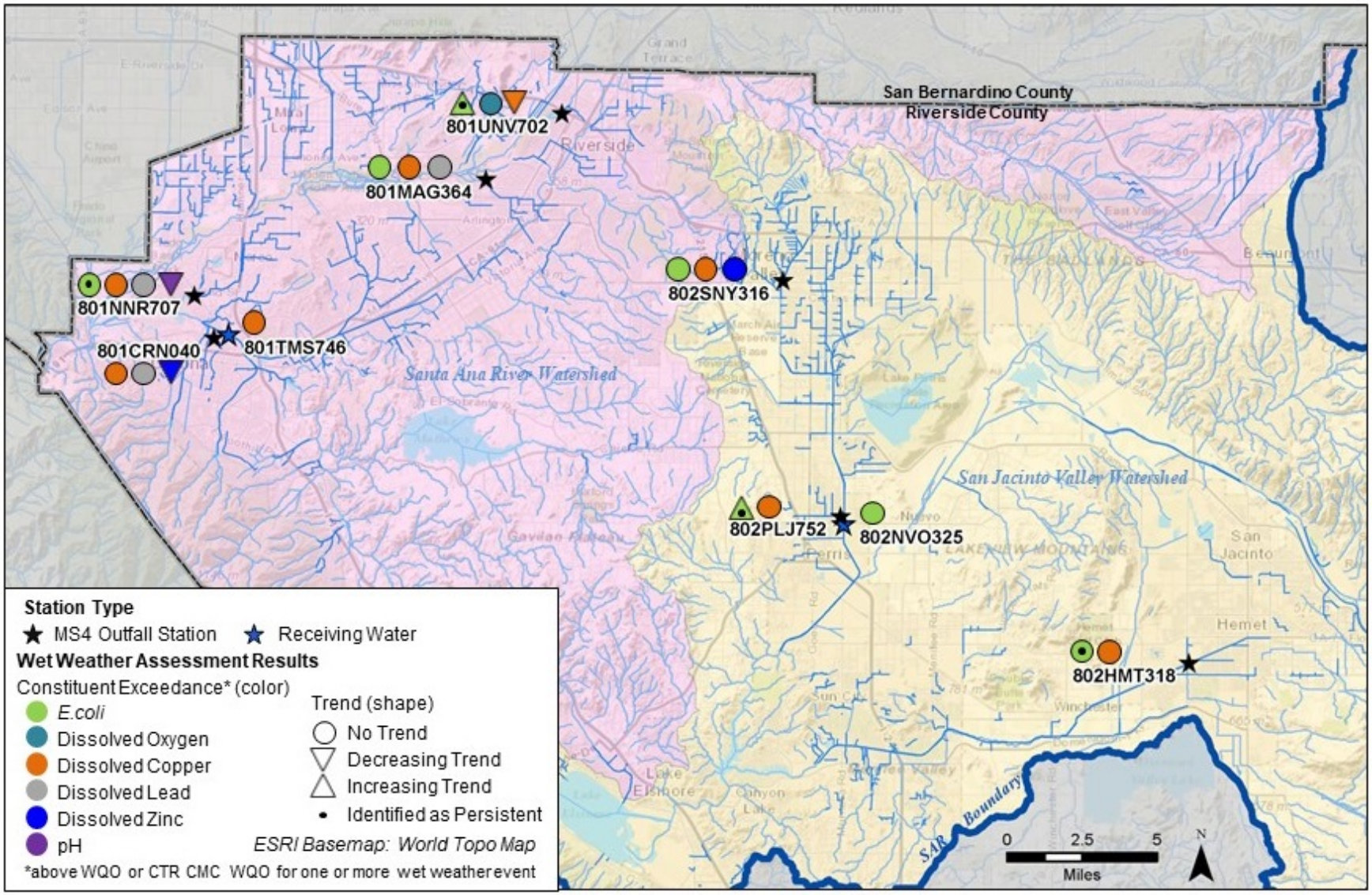


Figure 5-3: 2018-2019 Wet Weather Monitoring Results by Monitoring Station

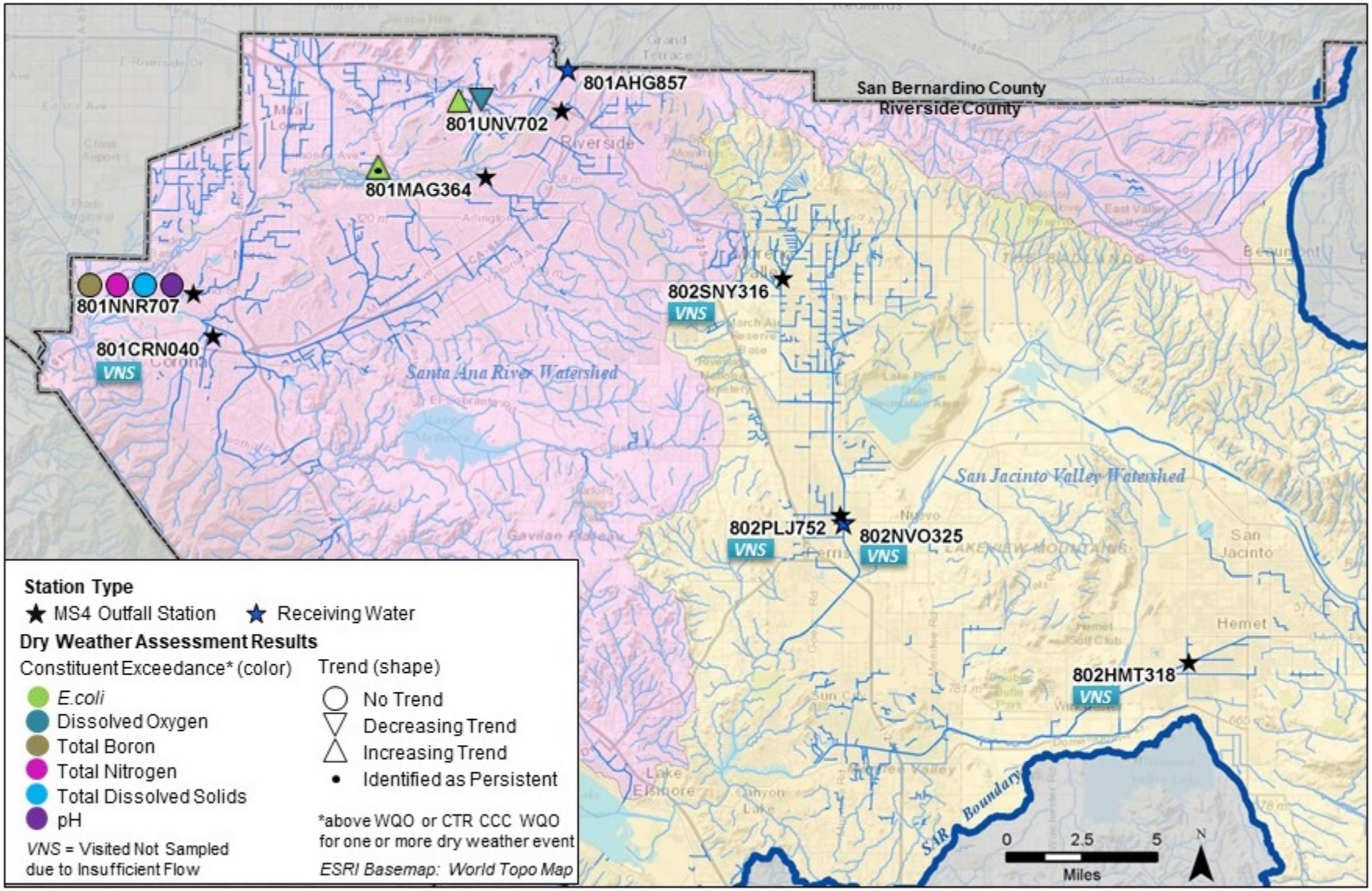


Figure 5-4: 2018-2019 Dry Weather Monitoring Results by Monitoring Station

MMP Question #4: What are the sources of MS4 discharge that contribute to receiving water problem(s)?

Potential sources of SAR pollutants of concern vary by land use and facilities in monitored drainage areas, as discussed in **Section 11-3.4.5** and illustrated in **Table 3-20** and **Table 3-21**. Based on monitoring results during the 2010 MS4 Permit term, the most prevalent water quality issues are *E. coli* and dissolved copper during wet weather, potentially impacting REC-1 and WARM beneficial uses. Therefore, the response to MMP Question #4 focuses on sources of bacteria and metals, particularly copper.

For *E. coli*, objectives of the MSAR Bacterial Indicator TMDL Monitoring Program include source identification and assessment. Human sources of bacteria pose the highest risk. The Annual Monitoring Report for this project is provided in **Attachment L**. In, addition, 72 IC/ID reports were received and reviewed by the District for the 2018-2019 reporting period, of which 60 required follow-up investigation and/or field visits by District staff. Only one of the reported incidents that occurred in the SAR watershed during the 2018-2019 monitoring year, a combined sewer overflow from the City of Riverside Sanitary Sewer Overflow near the University Wash Outfall, may have impacted water quality results for *E coli*. The Permittees expect that future monitoring and source identifications will foster better understanding of the natural and urban sources of priority water quality conditions, as well as further improvement of water quality. In accordance with the findings of the CBRP, mitigation of dry weather flows within Phoenix Storm Drain and Eastvale MDP Line D and Line E is expected to help address the MSAR Bacterial Indicator TMDL. The District is actively investigating potential BMPs to address this MS4 discharge (**Section 11-4.2.1**).

For dissolved copper, brake pads and air deposition are known sources of copper, and true source control is underway to address this source of copper through enacted brake pad legislation (SB 346). Dissolved copper exceedances have occurred historically at the Temescal Channel at Main receiving water station, but not at the Perris Valley Channel at Nuevo Road receiving water station. This may be due to differences in sources, but could also be related to stormwater hardness due to the close relationship between hardness and dissolved copper WQOs. **Figure 5-5** presents the relationship between dissolved copper results, calculated CTR CMCs and site-specific WQOs, and hardness results, and demonstrates that low hardness increases exceedance frequencies. Total hardness was less than 50 mg/L at the Temescal Channel at Main receiving water station during both wet weather events, as well as during several MS4 station wet weather events, resulting in a very low concentration threshold for exceedance of dissolved copper (**Figure 5-5)**. Low hardness values may result in WQO criteria that are overprotective of beneficial uses.

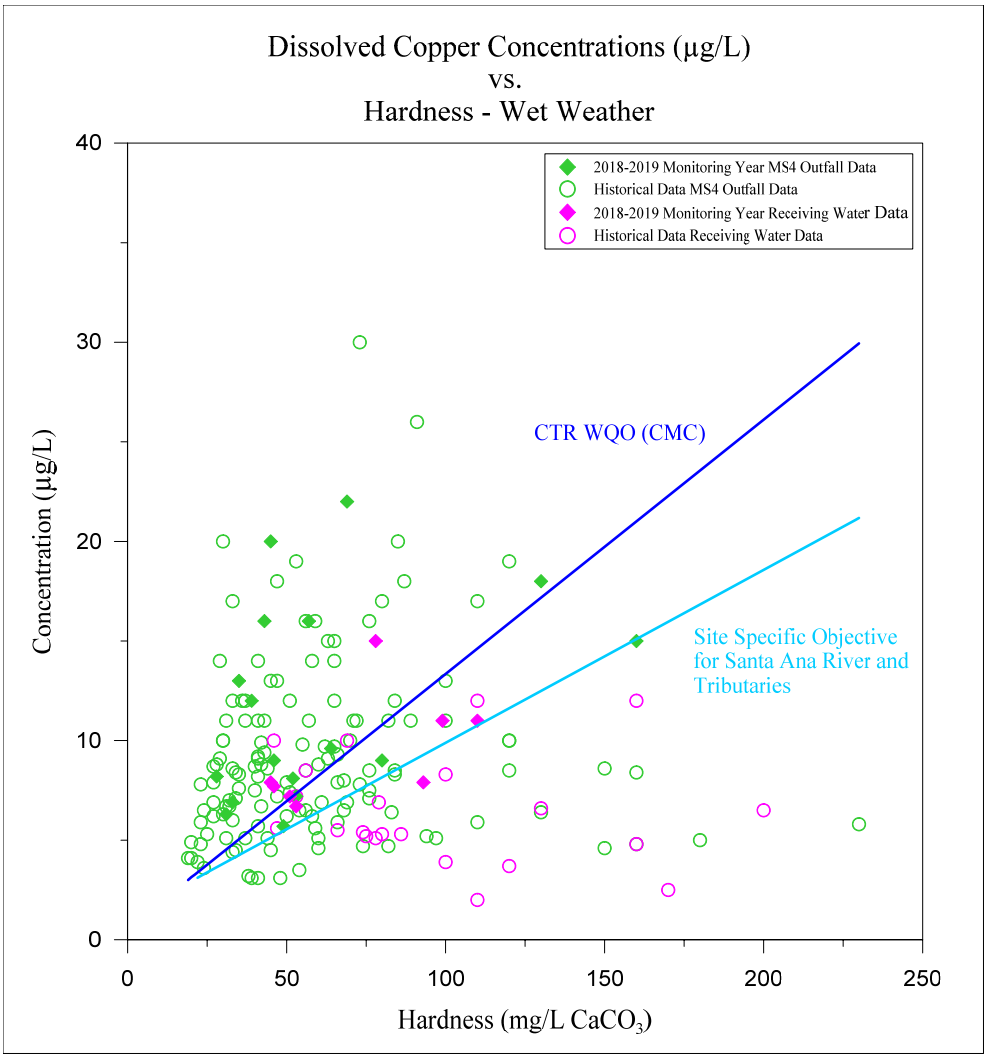


Figure 5-5: MS4 Outfall and Receiving Water Wet Weather Dissolved Copper Concentrations vs. Hardness Measurements

In addition to the prevalence of *E. coli* and dissolved copper, some less frequent water quality results were observed during dry weather at the North Norco Outfall location, including exceedance of pH, TDS, boron, and total nitrogen. Sources of nutrients may include discharges from POTWs or septic tanks, fertilizers, and emissions from fossil-fuel combustion. A primary source of salts is generally imported water and over-irrigation. North Norco Outfall discharges to the PBMZ, where TIN and TDS levels are a focus of management actions to protect groundwater. A Basin Plan Amendment was adopted in 2004 and approved by USEPA in 2007 and it incorporated new nitrate-nitrogen and TDS objectives for groundwater sub-basins and required the Permittees to establish baseline dry weather discharge concentrations for TIN and TDS. No baseline concentrations have been established for the North Norco Outfall location because this monitoring station has historically had insufficient water for sampling (VNS) during dry weather monitoring. This station typically exhibits sheet flow conditions with water flowing across the entire 30-foot width of the channel. During this year's second monitoring event sediment from storm events had built up and was channelizing the flow to less than 10 feet creating the depth needed to collect a water sample. The TIN and TDS concentrations measured during 2018-2019 were greater than those measured previously at this location.

Local implementation and management programs may be updated, as necessary, to assist Permittees with identification, prioritization, and implementation of actions necessary to prevent degradation of waterbodies within the SAR and to improve water quality conditions, where feasible. It should be noted that MS4 outfall station discharges contain inputs from other, non-urban land uses and permitted discharges; therefore, the sources of pollutants contributing to receiving water exceedances may not be specific to urban runoff.

MMP Question #5: Are conditions in receiving waters getting better or worse?

This question can be answered by evaluating trends. Based on monitoring data, the condition of SAR receiving waters generally remains unchanged despite increasing population and development, two factors that could negatively impact water quality. Trend data through the 2018-2019 monitoring years show several decreasing trends, indicating potential improvements, at the Temescal Channel at Main receiving water station during wet weather for historical constituents of concern. Santa Ana River at Highgrove Channel, which is monitored during dry weather only had no water quality exceedances for applicable WQOs, although some constituents of historical concern showed increasing trends.

Sample results from the MS4 outfall stations have been compared to receiving water criteria for comparison purposes, and trends are considered at MS4 outfalls in terms of potential to impact receiving waters, while not indicative of actual changes in receiving waters. During dry weather, trends at MS4 outfalls generally indicate increasing concentrations where flow is sampleable; however, VNS events at MS4 stations have become more common as discharges are eliminated. Further, due to the arid climate, dry weather flow discharges tend to evaporate and/or infiltrate without reaching surface receiving waters. During wet weather, trends at the Corona Outfall and Magnolia Center Outfall generally indicate improving conditions. Trends at the Sunnymead Outfall, Hemet Outfall, and Perris Line J Outfall generally indicate declining water quality conditions. Water quality conditions related to each SAR pollutant of concern are discussed below.

Bacterial Indicators – E. coli

The occurrence of bacterial indicators in receiving waters varies by storm event, site conditions, and receiving water conditions. During the 2018-2019 monitoring year, *E. coli* exceedances were observed during wet weather at every station with an applicable wet weather *E. coli* WQO that was not suspended by high flow conditions. Field-documented wet weather flow conditions at only one MS4 outfall station, Magnolia Center Outfall (801MAG364), met the required high flow suspension criteria during two storms (November 29, 2018 and January 12, 2019).

Long-term trend analysis identified statistically significant increasing wet weather trends at two MS4 monitoring stations, University Wash Outfall (associated with Lake Evans and Santa Ana River Reach 4) and Perris Line J Outfall (associated with San Jacinto River Reach 3). In addition, persistent exceedance of *E. coli* WQOs during wet weather was identified at these stations and two other MS4 stations, North Norco Outfall (PBMZ receiving water) and Hemet Outfall (Salt Creek receiving water).

For dry weather conditions, an increasing *E. coli* trend was observed at the University Wash Outfall and Magnolia Center Outfall, and persistent exceedance was shown at the Magnolia Center Outfall station. Wet and dry weather trend plots for University Wash Outfall are shown in **Figure 5-6**.

At the County boundary, perennial dry weather flows from permitted POTWs continue to discharge into Santa Ana River Reach 4. At the Santa Ana River at Highgrove receiving water station, *E. coli*

concentrations were below the WQO. Historically, only two exceedances have been recorded since monitoring began at this receiving water station.

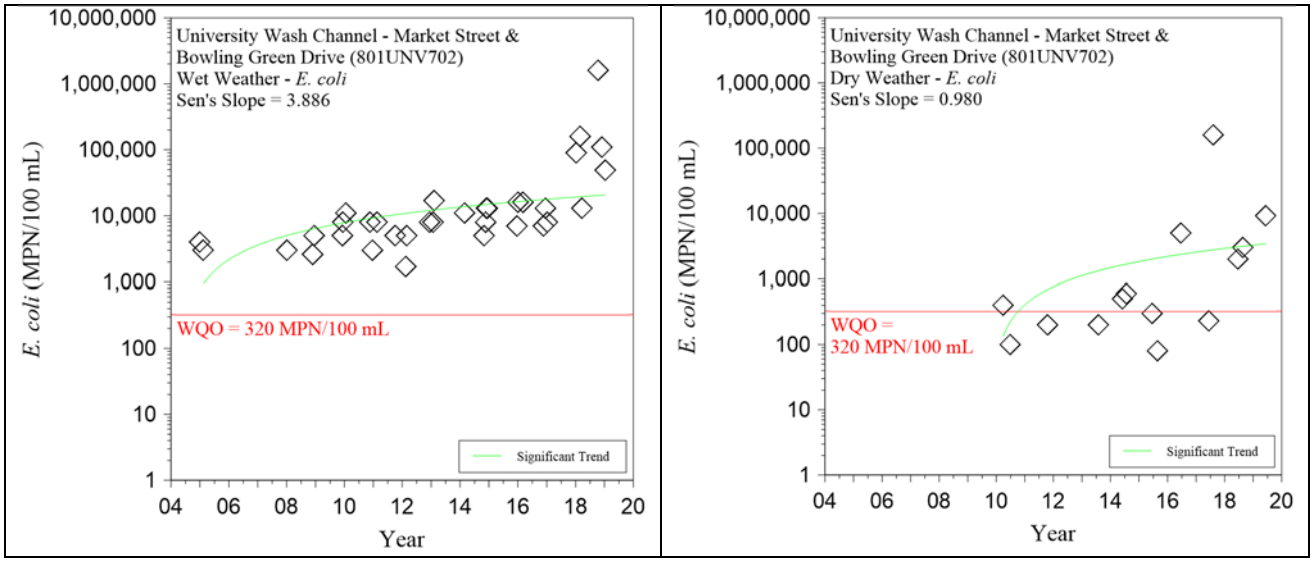


Figure 5-6: Bacterial Indicator (*E. coli*) Long-Term Trend Plots for University Wash Outfall (Left – Wet Weather, Right – Dry Weather)

Metals – Copper

Water quality samples were analyzed for both total metals (required parameter) and dissolved metals. Total metals analyses include all metals bound to particulate matter, whereas dissolved metals analyses represent the bioavailable fraction of metals dissolved in the water column.

For the purposes of this Monitoring Annual Report, copper is a historical SAR pollutant of concern based on 303(d) listings for copper during wet weather in Santa Ana River Reach 3. The Magnolia Center Outfall is tributary to the Santa Ana River Reach 3. Wet weather trend plots for this station are shown in **Figure 5-7**.

Dissolved copper exceedances of WQOs occurred during wet weather events at every MS4 outfall station and at one of two monitored receiving water stations during the 2018-2019 monitoring year. During the three wet weather events, exceedance ratios at MS4 outfall stations were generally 1.0 to 3.2 times, or one order of magnitude, above the WQOs. Samples from MS4 outfall stations are stormwater discharges; therefore, hardness measurements are generally less than 100 mg/L $CaCO_3$, leading to lower thresholds for exceedance because the CTR and SSO WQOs are hardness-based calculations. Natural-bottom surface waterbodies in contact with weathered rock and sediments tend to have higher hardness values. Dissolved copper exceedances occurred during both wet weather events at the Temescal Channel at Main receiving water station, which is concrete-lined. No acute or chronic toxicity was observed in samples from this station collected during the 2018-2019 monitoring year. These very low thresholds for exceedance may be overprotective of beneficial uses.

Trends related to copper are variable across the watershed during wet weather. Statistically significant trends were identified for total or dissolved copper at all seven MS4 outfall stations. Three of these were decreasing trends, which indicate improving water quality for copper, including at the Magnolia

Center Outfall, which is tributary to Santa Ana River Reach 3 (**Figure 5-7**). The other four were increasing trends, which indicate a potential decline in water quality for copper. For the receiving water stations, a decreasing trend for total copper was observed at Temescal Channel at Main, and an increasing trend for dissolved copper was observed at the Perris Valley Channel at Nuevo Road. Copper exceedances were not found to be persistent during wet weather conditions at any of the SAR monitoring stations.

There were no dry weather exceedances of dissolved copper WQOs during the 2018-2019 monitoring year. A statistically significant decreasing dry weather trend for dissolved copper was identified for the Magnolia Center, which is tributary to Santa Ana River Reach 3, thus showing a potential water quality improvement for copper. At the Santa Ana River at Highgrove receiving water station, there is an increasing trend for dissolved copper (i.e., a potential decline in water quality for copper). No other statistically significant trends were identified for dry weather copper results.

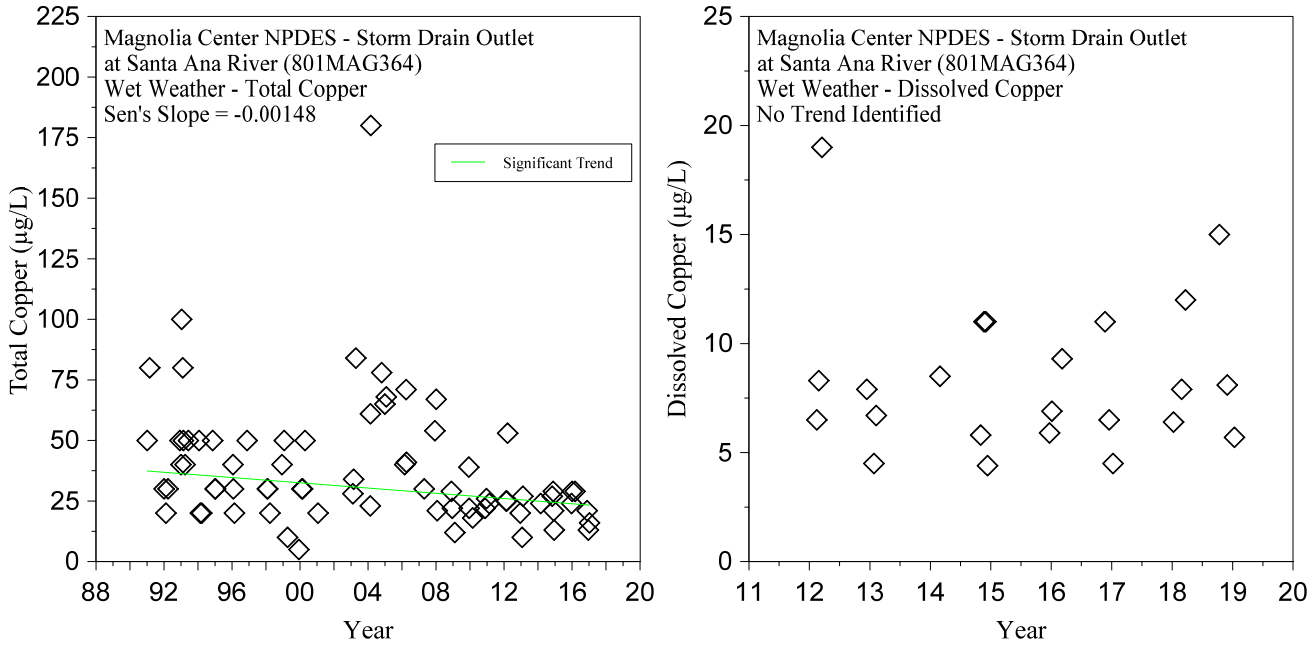


Figure 5-7: Copper Long-Term Trend Plots for Magnolia Center Outfall (Left – Significant Wet Weather Trend for Total Copper, Right – No Trend for Dissolved Copper)

Metals – Lead

For the purposes of this Monitoring Annual Report, lead is a historical SAR pollutant of concern based on 303(d) listings for lead in Santa Ana River Reach 3. The Magnolia Center Outfall is tributary to the Santa Ana River Reach 3.

During the 2018-2019 monitoring year, dissolved lead concentrations measured at three of the MS4 outfall stations, including the Magnolia Center Outfall, were above applicable WQOs during wet weather. Dissolved lead exceedances have occurred for seven of 20 samples (35% historical frequency of exceedance) at the Corona Outfall MS4 outfall station, and five of 20 samples (25% historical frequency of exceedance) at the Magnolia Center Outfall.

Lead exceedances during wet weather are relatively infrequent across the SAR. The highest historical frequency of exceedance is 40% (eight of 20 samples) at the University Wash Outfall. With the

exception of one dissolved lead exceedance of the Basin Plan WQO at Temescal Channel at Main during the 2017-2018 monitoring year, there have been no dissolved lead exceedances reported for receiving water stations since wet weather monitoring began at these locations.

Four decreasing wet weather trends were identified for total or dissolved lead at MS4 outfall stations, including the Magnolia Center Outfall. A decreasing trend for total lead was also identified at the Temescal Channel at Main receiving water station. No increasing trends for lead were identified, and lead exceedances were not found to be persistent during wet weather conditions at any of the SAR monitoring stations. This suggests that lead concentrations in the watershed, although continuing to be detected, may be improving over time.

Since monitoring of dissolved lead began in 2011, concentrations have not exceeded the site-specific WQO or CTR WQO at any MS4 outfall or receiving water station during dry weather. No statistically significant dry weather trends have been identified for total or dissolved lead. Therefore, the SAR Monitoring Program data suggest that lead is not a dry weather pollutant of concern for the SAR.

Nitrogen-Nutrients

Exceedances of applicable nutrient WQOs were generally not observed during wet or dry weather at MS4 outfall and receiving water stations during the 2018-2019 monitoring year. The only exceedance was for total nitrogen during dry weather at the North Norco Outfall. Historical exceedance frequencies for total nitrogen and TIN were also generally low. The only SAR monitoring station with historical exceedances of the TIN WQO (where applicable) was the Santa Ana River at Highgrove receiving water station during dry weather (14% exceedance frequency). The only stations with historical exceedances of the total nitrogen WQO (where applicable) were the Corona Outfall during wet weather (3% exceedance frequency), Magnolia Center Outfall during wet weather (8% exceedance frequency) and dry weather (13% exceedance frequency), and North Norco Outfall during wet weather (13% exceedance frequency) and dry weather (40% exceedance frequency based on 15 samples). North Norco Outfall is typically dry during dry weather monitoring events (72% VNS for period of record for total nitrogen data collection).

Both increasing and decreasing wet weather trends have been identified for nutrients in the SAR. At the receiving water stations, the only wet weather trend related to nutrients was a decreasing trend for total organic nitrogen at Temescal Channel at Main. During dry weather, both increasing and decreasing trends for nutrients were observed. The cumulative results suggest that nutrient loading to this portion of the SAR is improving or generally remains unchanged, with limited impact to receiving water quality.

There was one exceedance of the nutrient-associated parameter TDS during the 2018-2019 monitoring year, measured at the North Norco Outfall. Historical exceedance frequencies for TDS are low (0 to 7%), where applicable, during wet weather. During dry weather, historical exceedance frequencies range from 0 to 93%, with the highest frequency observed from 1995-2005 at the North Norco Outfall. This station has been VNS for many years prior to the June 2019 monitoring event, when TDS, total nitrogen, and boron were levels were measured above WQOs in the sample. Sediment within the channel reduced the flowing width to approximately one-third which caused the flow to be sufficient (instantaneous flow of 0.27 cfs) for dry weather sampling. During this monitoring event, flow was observed ponding at the end of North Norco Channel into the start of the Prado Management Zone receiving water. Approximately 1,500 ft downstream staff observed that dry weather flows had infiltrated and there was no evidence of surface water.

Three DO measurements (two dry, one wet) at the University Wash Outfall were below the lower limit of the Basin Plan WQO range. These results were not associated with elevated nutrient concentrations or other discernable nutrient causes. Most likely, the results are a product of ponded conditions upstream due to sediment and heavy vegetation.

pH

For the purposes of this Monitoring Annual Report, pH is a historical pollutant of concern for historical Temescal Creek Reach 1 (now associated with Temescal Reach 1a and the PBMZ). During 2018-2019 wet weather monitoring, both pH measurements taken at the Temescal Channel at Main receiving water station were within the Basin Plan WQO range, and no statistically significant trends were identified. Dry weather monitoring is not conducted at the Temescal Channel at Main receiving water station. Since the inception of monitoring at the Temescal Channel at Main receiving water station in 2011, only two wet weather pH measurements have been slightly less than the WQO lower limit of 6.5 units (historical exceedance frequency of 15%). When pH exceedances have occurred during the current Permit term, results were usually only slightly below the acceptable WQO range. The pH WQO range was exceeded at North Norco Outfall, which discharges to the PBMZ, during one wet and one dry event.

Bioassessment

In addition to the parameters described above, trends were evaluated for CSCI scores at SMC Program trend sites using the Mann-Kendall trend test. A significant decreasing trend was identified at Strawberry Creek, where CSCI scores have decreased from the likely intact range to the very likely altered range since 2015. The Cranston Fire that burned near the community of Idyllwild in July 2018 burned portions of the Strawberry Creek watershed and may have affected the BMI community structure. In addition, the 2019 spring season was wetter than average, and it is possible that a wetter and cooler than average spring also influenced CSCI scores at this site.

11-6.0 CONCLUSIONS AND RECOMMENDATIONS

The Permittees' recommended future monitoring actions and updates to monitoring protocols are provided in this section. The Permittees will continue to revise their local programs based on these recommendations, as necessary, to fulfill the requirements of the Permit.

11-6.1 PROGRESS OF THE SAR MONITORING PROGRAM

The SAR Monitoring Program was implemented per the CMP during the 2018-2019 monitoring year. The wet and dry weather monitoring programs, including the dry weather MS4 outfall and receiving water programs, IDDE program, and SMC Regional Monitoring Program efforts were completed as required except at Perris Valley Channel at Nuevo Road, where a toxicity sample was not analyzed due to insufficient response time for ordering the required test organisms during the October 13, 2018 wet weather event. The Permittees have continued ongoing efforts to improve the quality of the SAR Monitoring Program. The current ongoing programmatic improvement effort focuses on regional coordination, fostering a close working relationship with contract laboratories and using new electronic technologies to streamline and improve data tracking protocols. Key ongoing efforts to improve the SAR Monitoring Program are described below.

Regional Coordination

Wet and dry weather monitoring activities were coordinated so that samples were collected at all SAR monitoring stations for the same sampling dates to the maximum extent feasible. This effort ensures that results can be evaluated regionally as required by the CMP and 2010 MS4 Permit.

The Permittees also continue to participate in regional monitoring programs implemented by the SMC and the California Stormwater Quality Association, as well as several technical advisory committees, task forces, and other groups designed to address health within the SAR.

Revisions to the Monitoring Program Parameter Lists

In the 2015 ROWD and 2014-2015 Monitoring Annual Report, the Permittees proposed monitoring lists to be incorporated into the new Permit based on findings of a comprehensive ND analysis and conservative approach to removal of parameters. During this process, the Permittees reviewed the MS4 outfalls and receiving water parameter monitoring lists and created a consistent, comprehensive list that has been used to evaluate SAR monitoring stations. These lists have been used since the 2015-2016 monitoring year. This list includes several parameters, such as dissolved metals, that while are technically not required by the 2010 MS4 Permit, have been monitored in order to better understand water quality conditions across the SAR. An ND analysis was conducted again for this Monitoring Annual Report, using data collected through the 2018-2019 monitoring year. Based on the results of this analysis, revised parameter lists are proposed for the 2019-2020 monitoring year (**Attachment F)**. These additional parameters are identified with (i) in the results table provided in **Attachment H**.

Implementation of Program-Specific Laboratory Standards to the Maximum Extent Practicable

The Permittees continue to foster a close working relationship with contractor laboratories to communicate program needs in order to improve the quality of water quality analysis. During the 2017-2018 monitoring year, the QA/QC protocols associated with the SAR Monitoring Program

identified several field and laboratory errors that were addressed through additional training and discourse to ensure consistent results will be achieved in the future (Attachment G). The District continues to work with the laboratory to provide lower detection limits for monitoring parameters and ensure consistent data reporting techniques are implemented. This approach will continue to be used during the 2019-2020 monitoring year.

Updated Electronic Data Collection and Management Tools

In 2017, the District acquired a new database management system. In the future, the capabilities and use of this system will continue to be tested, refined and expanded (as appropriate), based on lessons learned during each year of use and the needs of the MRP.

11-6.2 IMPLEMENTATION OF THE 2018-2019 MONITORING YEAR PROGRAM

The 2010 MS4 Permit expired on January 29, 2015. The Regional Board has indicated that the new permit is expected to be issued in 2020 and has provided direction to the Permittees to continue monitoring under the 2010 Permit MRP and CMP for the 2019-2020 monitoring year. **Table 6-1** provides a summary of anticipated monitoring efforts for the 2019-2020 monitoring year. The Permittees will also continue to participate in, and coordinate with the SMC Regional Bioassessment Monitoring Program, as facilitated by the District, on behalf of the Permittees.

Table 6-1: Proposed 2019-2020 Monitoring Program Summary

Monitoring Component	Sampling Frequency	Monitoring Stations (Station ID)	Analytical Requirements
MS4 Outfall Monitoring	2 Dry Events 3 Wet Events	• Corona Outfall (801CRN040) • Sunnymead Outfall (802SNY316) • Hemet Outfall (802HMT318) • Magnolia Center Outfall (801MAG364) • University Wash Outfall (801UNV702) • North Norco Outfall (801NNR707) • Perris Line J Outfall (802PLJ752)	Chemistry, bacterial indicators, field parameters, and flow
IC/ID Monitoring	Dry weather, scheduled per Permittee LIP	Per Permittee LIP	Flow (if present); field parameters (if present)
Receiving Water and Water Column Toxicity	2 Dry Events 2 Wet Events	• Santa Ana River at Highgrove (801AHG857) – dry only • Temescal Channel at Main Street (801TMS746) – wet only • Perris Valley Channel at Nuevo Road (802NVO325)	Chemistry, bacterial indicators, field parameters, flow, and toxicity
Bioassessment (SMC Regional Monitoring Program)	1 Dry Event (2020)	TBD*	TBD*

*The 2015-2019 SMC Regional Monitoring Program is complete, and the 2020-2024 Workplan has not yet been drafted.

11-6.3 RECOMMENDED CHANGES FOR THE NEXT SAR PERMIT FOR CONSIDERATION BY THE REGIONAL BOARD

The Permittees request that the Regional Board recognize one of the program's major accomplishments, standardization of the SAR monitoring parameter lists for MS4 outfall stations and receiving water stations, by adopting **Attachment F** as the basis for water quality analysis under the next Permit. These comprehensive lists include:

- 114 parameters for the SAR receiving water monitoring stations and 114 to 90 parameters for the MS4 outfall stations (lists vary between events and event types).
- Several parameters that were voluntarily added by the Permittees (e.g., dissolved phase metals, nutrients) in order to fill data gaps.
- The results represent extensive analysis that conservatively identified parameters that could be removed from the monitoring program based on Permit criteria (MRP Section III.E.1(b)(iv)). As a result of the 2019 ND analysis, 20 VOCs, 1 OC Pesticide, 41 OP Pesticides, and 2 Other Toxic (cyanide and phenols) are proposed for removal from the current parameter monitoring list.
- A standardized monitoring approach applied across the SAR since the 2015-2016 monitoring year.
- Modified analytical methods for aroclor PCBs and organochlorine pesticides, which allows for results to be compared to the CTR WQOs (Babcock, 2016).
- Incorporated modifications based on guidance from the Regional Board given during the 2014-2015 monitoring year.

The Permittees also request that the Regional Board consider adopting the following changes under the next Permit term:

- Removal of data comparison to the USEPA Benchmarks from the MSGP, as these benchmarks do not appear to be appropriate for urban runoff discharges in the SAR, and do not add assessment value. The WQO and CTR WQO provide the water quality standards for protection of beneficial uses in the SAR. The details of this recommendation can be found in the FY 2013-2014 Monitoring Annual Report.
- Allow data uploads directly to the USEPA data portal as an alternate to CEDEN. CEDEN's current data portal is cumbersome, difficult to use and ever in flux.
- Modifications to the monitoring program to shift focus on dry weather flow elimination. This could include focused, targeted outfall sampling throughout the watershed in an effort to address non-stormwater flows. The early stages of the permit term would shift the focus on the outfall field screening in lieu of routine outfall monitoring and receiving water monitoring. Receiving water monitoring has been historically characterized in the prior term. Subsequent years under this program could then include monitoring a subset of outfall locations as prioritized from actively flowing outfalls identified during field screening efforts. Based on findings of focused monitoring at outfalls, Permittees may better assess effectiveness of management actions and trigger additional response as needed in attempt to eliminate unauthorized non-stormwater flows.

11-6.4 RECOMMENDED MONITORING PROGRAM ENHANCEMENTS FOR THE 2019-2020 MONITORING YEAR

In addition to the efforts and accomplishments described in this Monitoring Annual Report, the Permittees continue to seek out additional means to improve the monitoring program. Looking forward to the 2019-2020 monitoring year and the anticipated Permit renewal, recommended next steps for the SAR Monitoring Program may include, but are not limited to:

- Consider modifications to monitoring stations in order to fill data gaps and facilitate assessment of urban runoff as it relates to water quality in receiving waters, which would help fulfil the objectives of the MRP by:
    - Improving the program's ability to evaluate water quality conditions within the SAR. Under the 2010 MS4 Permit, receiving water monitoring stations have met the Permit objectives of proximity to major MS4 outfalls, but may not represent the SAR (e.g., the Santa Ana River at Highgrove receiving water station is at the County line and represents flows from San Bernardino).
    - Improving the monitoring program's ability to determine if urban runoff is causing or contributing to water quality issues in receiving waters. Currently only one receiving water station (Perris Valley Channel at Nuevo Road) is located downstream of monitored MS4 outfalls.
    - Allow receiving water stations to be sited and monitored to evaluate outfalls with sample results above receiving water WQOs in dry and wet weather (e.g., Magnolia Center Outfall MS4 outfall station), thus improving TMDL compliance efforts.
- Use available technologies and tools to improve programmatic efficiency and effectiveness through better data management, access, and assessment. For example, Permittees may:
    - Continue to expand the use of GIS tools, such as Survey123, to standardize data entry and help facilitate complete and accurate collection of water quality data in the field.
    - Implement new technologies, such as the District's new database system, Kisters' Water Quality Module, to improve access to historical data, management of historical and new data, and enhance data assessment capabilities.
- Continue to work closely with the contracted laboratory(s) to ensure cohesive programmatic implementation from year to year, improve data analysis and reporting, ensure analyses meet applicable reporting limits, and that the program meets the overall data QA/QC goals established by the CMP.

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