Attachment 3
Carlsbad Watershed Management Area Municipal Separate Storm Sewer System Assessments

Prepared For:

Carlsbad Watershed Management Area Responsible Agencies:

City of San Marcos
City of Carlsbad
City of Encinitas
City of Escondido
City of Oceanside
City of Solana Beach
City of Vista
County of San Diego

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ATTACHMENTS

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Acronyms and Abbreviations

Basin Plan	Water Quality Control Plan for the San Diego Basin
CCC	criterion continuous concentration
CCTV	closed circuit television
CEDENCCTV	California Environmental Data Exchange Network
CMC	Criterion Maximum Concentration
D-MAX	D-MAX Engineering, Inc.
DO	dissolved oxygen
DQO	data quality objective
FY	fiscal year
HA	hydrologic area
HOA	homeowner's association
HPWQC	highest priority water quality condition
IC/ID	illegal connections/illicit discharges
IDDE	illicit discharge detection and elimination
MBAS	methylene blue active substances
MCL	Maximum Contaminant Level
MDAL	Maximum Daily Action Level
MLOE	multiple lines of evidence
MS4	municipal separate storm sewer system
NAL	non-stormwater action levels
ND	not detected
NPDES	National Pollutant Discharge Elimination System
OLS	ordinary least squares
Permit	National Pollutant Discharge Elimination System Permit and Waste Discharge Requirements for Discharged from the Municipal Separate Storm Sewer Systems draining the Watersheds within the San Diego Region
PWQC	priority water quality condition
QA/QC	quality assurance / quality control
RL	reporting limit
SAL	stormwater action levels
STV	statistical threshold value
TMDL	total maximum daily load
WESTON	Weston Solutions, Inc.
WMA	Watershed Management Area
Wood	Wood Environmental & Infrastructure Solutions
WQIP	Water Quality Improvement Plan
WQO	water quality objective

Units of Measure

ac	acre
cf	cubic feet
CFU	colony forming unit
cm	centimeter
FNU	formazine nephelometric unit
in	inch
L	liter
lbs	pounds
mg	milligrams
mL	milliliter
MPN	most probable number
NTU	nephelometric turbidity unit
µg	micrograms
µS	microSiemens

1 MS4 OUTFALL MONITORING OVERVIEW

1.1 Introduction

The Carlsbad Responsible Agencies developed the Carlsbad Watershed Management Area (WMA) Municipal Separate Storm Sewer System (MS4) Outfall Monitoring Plan to describe dry and wet weather outfall monitoring and assessment procedures for the watershed. The plan was finalized in 2017 and updated in January 2019 and January 2022 (Attachment 3A). The plan was prepared to meet requirements prescribed by the San Diego Regional Water Quality Control Board (San Diego Water Board) Order No. R9-2013-0001, as amended by Order No R9-2015-0001 and R9-2015-0100, *National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharged from the Municipal Separate Storm Sewer Systems (MS4s) draining the Watersheds within the San Diego Region* (Permit).

The MS4 outfall monitoring and assessment program was developed to meet specific Permit requirements provided in Provision D.2.b, D.2.c, and D.4.b. Program elements were designed to aid in the evaluation of potential impacts from MS4 discharges on the beneficial uses of a receiving waterbody during dry and wet weather conditions. Under dry conditions, the program is also used to assess the ability of jurisdictional and watershed programs to effectively eliminate non-stormwater discharges to receiving waters. The data generated are used to identify persistently flowing outfalls and pollutants in discharges, guide pollutant source identification efforts, and track progress toward achieving numeric goals set forth in the Carlsbad WMA Water Quality Improvement Plan (WQIP).

During the 2013-2014 monitoring year, the inventory of major MS4 outfalls discharging directly to a receiving water was developed in accordance with Provision D.2.a.(1) of the Permit, and refinements were made during subsequent monitoring years. In the 2022-2023 monitoring year, the City of San Marcos removed seven locations from their major MS4 outfall inventory and added sixteen. One site was added to the inventory for the City of Carlsbad.

Dry weather MS4 outfall monitoring program elements include conducting field screening of major outfalls (Provision D.2.b.(1)) and monitoring outfalls determined to be the highest priority major outfalls with persistent flow (Provision D.2.b.(2)). The wet weather MS4 outfall monitoring requirements are provided in Provision D.2.c of the Permit. An overview of the storm drain outfall monitoring activities for the 2022-2023 monitoring year is presented in Table 1-1 and the number of monitored major outfalls is provided in Table 1-2 by monitoring program element and Responsible Agency.

Table 1-1. MS4 Outfall Monitoring During the 2022-2023 Monitoring Year

Monitoring Programs	Dry	Wet	Monitoring Element
MS4 Outfall Field Screening	✓		Visual: Flow condition, presence and assessment of trash in and around the station, IC/IDs, descriptions
MS4 Outfall Monitoring	✓		Field parameters, constituents contributing to the HPWQCs, 2014/2016 303(d) List impairments, TMDLs, constituents with NALs, and constituents listed in Table D-7 of the Permit.
		✓	Field parameters, general chemistry, nutrients, metals, constituents contributing to the HPWQCs, 2014/2016 303(d) List impairments, and constituents with SALs.
Illicit Discharge Detection and Elimination	✓		Visual surveys, field parameter testing, analytical testing and, if warranted, follow-up investigations and/or referral to enforcement

IC/ID – Illegal connection and illicit discharge, HPWQC – highest priority water quality condition, TMDL – Total Maximum Daily Load, NAL – non-stormwater action level, SAL – stormwater action level

Table 1-2. Overview of Major MS4 Outfalls Monitoring per Responsible Agency

Responsible Agency	Number of Major Outfalls (Provision D.2.a(1))	Number of Outfalls Monitored in 2022-2023		
		Dry Weather		Wet Weather Monitoring (Provision D.2.c)
		Field Screening (Provision D.2.b(1))	Highest Priority Monitoring (Provision D.2.b(2))	
City of Carlsbad	150	56*	5	1
City of Encinitas	46	39	5	1
City of Escondido	105	105	5	1
City of Oceanside	60	60	8	1
City of San Marcos	52	47	5	1
City of Solana Beach	3	3	2	1
City of Vista	53	53	5	1
County of San Diego	14	14	5	1

* During the 2022-2023 monitoring year, 161 individual field screenings were conducted at a total of 56 major MS4 outfalls.

1.1.1 Annual Report Review Letters

The San Diego Water Board conducted reviews of the 2017-2018, 2018-2019, 2019-2020, 2020-2021 and 2021-2022 WQIP Annual Reports for the Carlsbad WMA, as well as other watersheds within the San Diego Region. The results of the reviews and deadlines for addressing the items for the Carlsbad WMA were provided in November 1, 2019, October 2, 2020, May 28, 2021, August 30, 2022, and June 19, 2023 letters for the 2017-2018, 2018-2019, 2019-2020, 2020-2021, and 2021-2022 reports, respectively. Several items requested in the 2017-2018 WQIP Annual Report review letter relate to this attachment, including the requirement to conduct a monitoring completeness check for inclusion in the WQIP Annual Reports beginning with the January 31, 2021 submittal. The completeness check for the 2022-2023 monitoring year is provided in Table 1-3. The completeness check is based on sample collection events rather than collection of individual analytes. The quality assurance/quality

control (QA/QC) summary reports provided by monitoring element in attachments to this appendix provide further detail on monitoring completeness, including analytical data collection. A comparison to Data Quality Objectives (DQOs) is also provided in these reports.

In addition to the completeness check, the 2017-2018 WQIP Annual Report review letter requested the criteria upon which outfalls are prioritized. The prioritization process that identified the outfalls monitored during the 2022-2023 year is summarized in Section 2.1.1. A more detailed response to specific comments in the San Diego Water Board's letter, based on their review of the 2017-2018 WQIP Annual Report, was provided in Attachment 3A to the 2019-2020 Carlsbad WMA WQIP Annual Report. The City of Carlsbad updated their prioritization process during the 2022-2023 monitoring year. This update is provided in Attachment 3G.

Table 1-3. MS4 Monitoring Completeness

Program		Total Sampling Events or Visits Required	Total Accomplished	Completeness DQO	Percent Completeness
Dry Weather Visual Observations[1,2]	City of Carlsbad	150	161	100%	>100%
	City of Encinitas	74	78	100%	>100%
	City of Escondido	168	210	100%	>100%
	City of Oceanside	96	135	100%	>100%
	City of San Marcos	84	88	100%	>100%
	City of Solana Beach	5	9	100%	>100%
	City of Vista	85	99	100%	>100%
	County of San Diego	23	30	100%	>100%
Wet Weather MS4 Outfall Monitoring	Samples	8	8	90%	100%
	QA[3]	1	1	90%	100%
HPPF Outfall Monitoring	Samples	72	72*	90%	100%
	QA[3,4]	8	8	90%	100%

HPPF – highest priority persistently flowing; DQO – data quality objective

1 - For Responsible Agencies with greater than 125 major outfalls but less than 500 major outfalls discharging to receiving waters within the WMA, all major outfalls must be screened at least annually. However, agencies may adjust the frequency and location for field screening of the MS4 outfalls in its inventory in order to identify and eliminate sources of persistent flow, provided the number of visual inspections performed is equivalent to the number of visual inspections required.

2 - For Responsible Agencies with fewer than 125 major outfalls in the WMA, 80% of major outfalls must be screened twice per year. However, agencies may adjust the field screening monitoring frequencies and locations for the MS4 outfalls in its inventory to identify and eliminate sources of persistent flow, provided the number of visual inspections performed is equivalent to the number of visual inspections required.

3 - Each QA sample includes a duplicate and a blank.

4 - QA requirements are determined and met programmatically by each Copermittee. QA samples may be collected in other WMAs to meet Copermittee dry weather monitoring program field QA/QC targets.

* One outfall under the jurisdiction of the County of San Diego (MS4-CAR-007) and two outfalls under the jurisdiction of Solana Beach (SB-1 & SB-3) were dry or ponded during both visits. One outfall under the jurisdiction of the County of San Diego (MS4-CAR-059) was dry or ponded during one visit.

1.1.2 Changes to Volume and Load Assessments Beginning in the 2019-2020 WQIP Annual Report

The Copermittees in the San Diego region requested regulatory relief from performing some of the Permit-required assessments for the 2019-2020 monitoring year, including the non-stormwater discharge reduction assessment required by Provision D.4.b(1)(c)(iv) and stormwater discharge reduction assessment given in D.4.b(2)(c). Deferral of the obligation to complete these assessments was requested until after the planned reissuance of the Permit, based on the Copermittees' on-going efforts to address the San Diego Water Board's comment in the 2017-2018 WQIP Annual Report Review letter identifying "inconsistencies with the use of the Land Use Factor (C) in the calculation of pollutant loadings." In an email dated August 19, 2020 the San Diego Water Board granted relief by requiring that the Copermittees only calculate pollutant loads at the outfall level rather than using outfall data to extrapolate to the watershed scale in the 2019-2020 and 2020-2021 WQIP Annual Reports. At the July 21, 2022 Program Planning Subcommittee meeting, Erica Ryan of the San Diego Water Board confirmed that the reduced assessments would continue and the conversation regarding the C-value will be conducted with the reissuance of the Permit. Therefore, the assessments herein are consistent with those provided in the 2019-2020 and 2020-2021 WQIP Annual Reports.

The San Diego Water Board will continue to work with the Copermittees to reevaluate the method by which pollutant loads are calculated and assessed. In addition, the San Diego Board included a new assessment request: "for outfalls that have been monitored for two or more years, tables and figures showing changes in pollutant loads over time from the outfall should also be prepared and reported". The reduced assessments are described in Section 2.3 (dry weather) and Section 3.4 (wet weather). A compilation of pollutant load data for outfalls monitored during the 2021-2022 monitoring year, which have two or more years of data, is provided in Attachment 3C for dry weather and 3F for wet weather.

2 DRY WEATHER OUTFALL MONITORING

2.1 Dry Weather Field Screening and Outfall Prioritization

The Permit requires Responsible Agencies to conduct field screening of major MS4 outfalls during dry weather (Provision D.2.b.(1)). Field screening is conducted to identify non-stormwater and illicit discharges, determine which discharges are transient and which are persistent, and prioritize those discharges that will be investigated and eliminated.

Each Responsible Agency performs field screening of major MS4 outfalls on an annual basis to maintain an up-to-date inventory of persistently flowing outfalls and to initiate follow-up investigations that identify and mitigate the source(s). The number of major outfalls monitored per year is subject to change based on new information, updates to the MS4 outfall inventories, changes in transient or persistent flow classifications, and/or changes or updates to the priority water quality conditions.

The number of major MS4 outfall stations included in dry weather field screening and the total number of visual observations conducted by each Responsible Agency in the WMA during 2022-2023 are shown in Table 2-1. Dry weather field screening at upstream proxy locations (e.g., manholes) for inaccessible outfalls are included in the number of visits.

Table 2-1. Number of Major Outfalls in Carlsbad WMA for 2022-2023

Responsible Agency	Number of Major Outfalls	Number of Major Outfalls Visited	Number of Major Outfalls Visual Observations
City of Carlsbad[1,3]	150	56	161
City of Encinitas[2]	46	39	78
City of Escondido[2,3]	105	105	210
City of Oceanside[2]	60	60	135
City of San Marcos[2,3]	52	47	88
City of Solana Beach[2]	3	3	9
City of Vista[2]	53	53	99
County of San Diego[2]	14	15	30
Total	**483**	**382**	**810**

1 - For Responsible Agencies with greater than 125 major outfalls but less than 500 major outfalls discharging to receiving waters within the WMA, all major outfalls must be screened at least annually. However, agencies may adjust the frequency and location for field screening of the MS4 outfalls in its inventory in order to identify and eliminate sources of persistent flow, provided the number of visual inspections performed is equivalent to the number of visual inspections required.

2 - For Responsible Agencies with fewer than 125 major outfalls in the WMA, 80% of major outfalls must be screened twice per year. However, agencies may adjust the field screening monitoring frequencies and locations for the MS4 outfalls in its inventory to identify and eliminate sources of persistent flow, provided the number of visual inspections performed is equivalent to the number of visual inspections required.

3 - The outfall inventories include updates made during the 2022-2023 monitoring year.

During field screening, Responsible Agencies recorded visual observations of outfall and flow characteristics as required by Table D-5 of the permit including:

- Flow conditions (flowing, ponded, dry, or tidal);
- Whether flow reached the receiving water;
- Whether there was a non-stormwater flow source;
- Potential non-stormwater sources;
- Whether the flow source was eliminated;
- Evidence of obvious illicit connections or illicit discharges (IC/IDs);
- Whether trash was present, and relative amount; and
- Whether there was evidence of illegal dumping.

The complete set of visual observations recorded during dry weather field screening visits is provided in Attachment 3B.

A summary of the flow conditions (i.e., dry, tidal, ponded, flowing, or unknown) observed during 2022-2023 field screening is provided in Figure . The City of Carlsbad targeted field screening efforts to persistently flowing outfalls which may account for the relatively high percentage of flowing observations. Flow conditions were indicated as unknown when sites were not accessible.

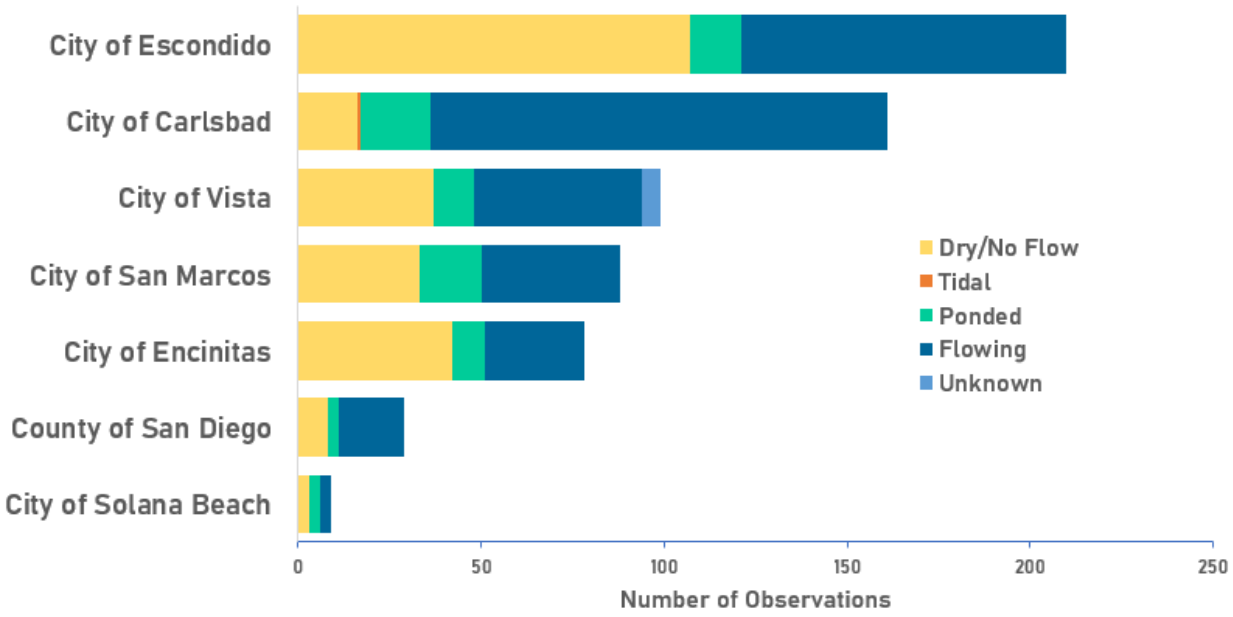

Figure 2-1. Dry Weather Field Screening Flow Observations at Major MS4 Outfall Stations

Where an illicit discharge is observed during field screening, investigations are performed in an effort to locate the source and eliminate the discharge. In cases where flow sources are known due to historical data, this information is listed on the field data sheet and the upstream area is briefly checked for additional sources. In cases where discharges are observed, but no obvious illicit discharge is identified as the source, appropriate documentation is recorded, and the location is prioritized for follow-up.

During dry weather field screening, Responsible Agencies estimated flow rates at stations where flow was present, as required by Table D-5 of the Permit. Fifty-one percent of observations (411 of 810) indicated no flow (dry or pooled/ponded conditions). Some flow observations were noted as trickling, and not all of these flows were measurable. Of the observations where flows could be estimated, 62% (244 observations) had estimated flows of less than five gallon per minute (gpm). A summary of flow estimations is presented in Figure 2-2.

Based on the field screening visits and available historical data, the Responsible Agencies determined the flow status of each major MS4 outfall as persistent, transient, or dry:

- Dry – no flowing or ponded water is observed
- at the outfall over three most recent visits.
- Persistent – presence of flowing or standing water upon three most recent visits.
- Transient – outfalls not meeting definition of dry or persistent.
- Unknown – insufficient data to determine (e.g., less than three visits).

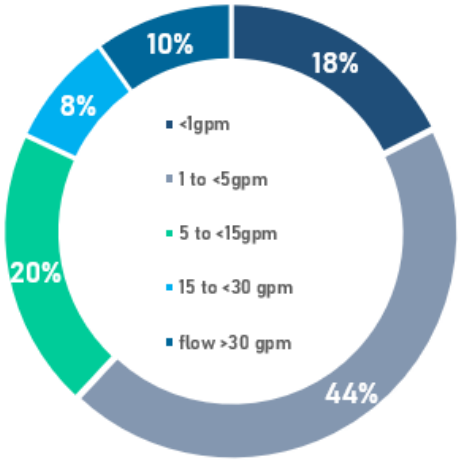

Figure 2-2. Flow Rate Estimations Based on Visual Observations at Major MS4 Outfalls

The number of major MS4 outfalls in each category are shown by Responsible Agency in Table 2-2, and the flow determinations and outfall locations are shown in Figure 2-3.

Table 2-2. 2022-2023 Dry Weather Flow Determinations at Major MS4 Outfalls

Responsible Agency	Number of Major Outfalls	Persistent	Transient	Dry	Unknown
City of Carlsbad	150	83	13	54	
City of Encinitas	46	16	15	10	5
City of Escondido	105	36	21	47	1
City of Oceanside	60	13	34	13	
City of San Marcos	52	19	7	7	19
City of Solana Beach	3	2		1	
City of Vista	53	13	15	25	
County of San Diego	14	4	8	2	
Grand Total	**483**	**186**	**113**	**159**	**25**

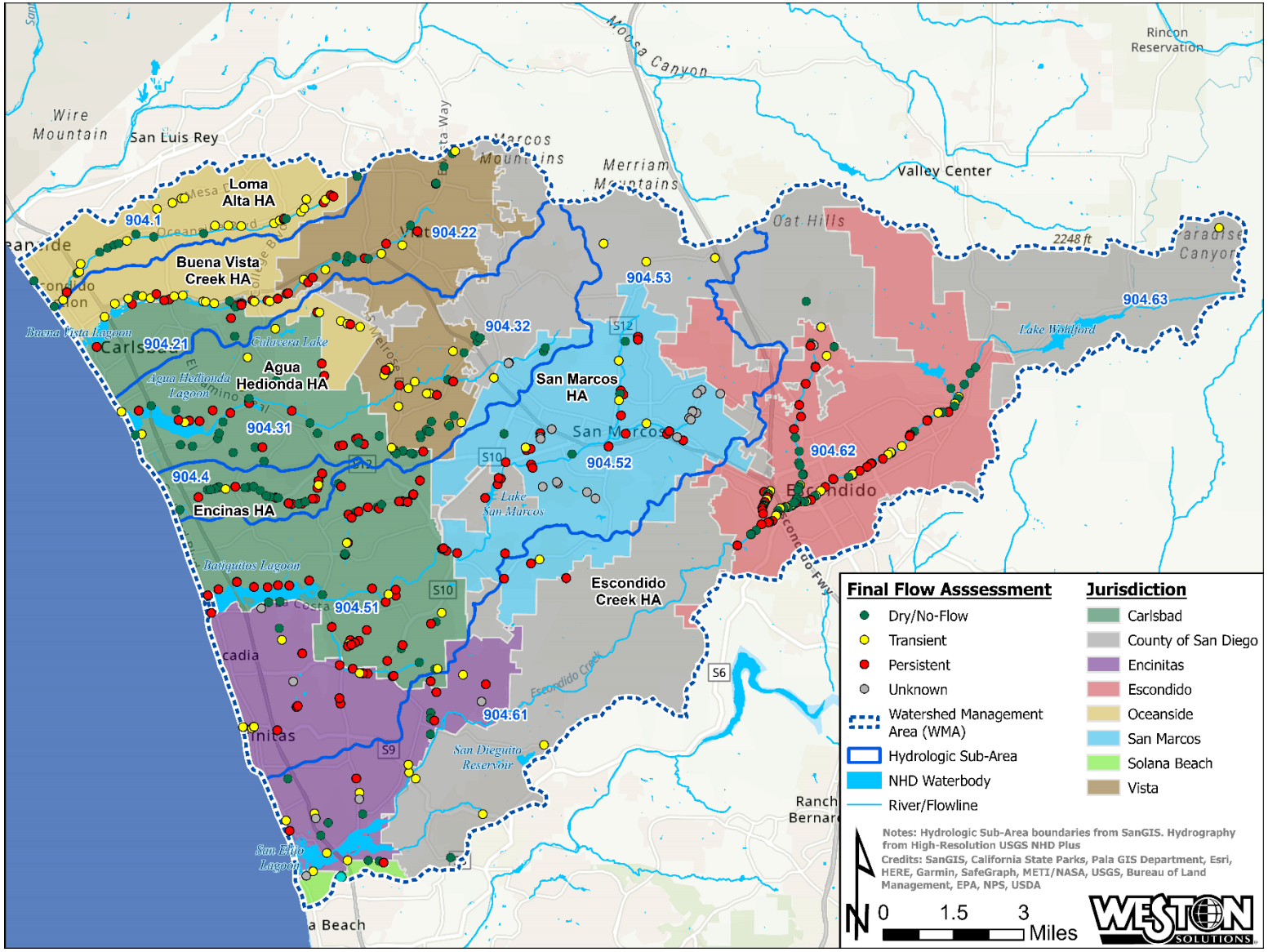

Figure 2-3. 2022-2023 Dry Weather Flow Determinations at Major MS4 Outfall

In accordance with Provision D.2.b.(2)(a) each jurisdiction prioritized major MS4 outfalls based on non-stormwater flow status and the potential threat to receiving water quality. The list of prioritized outfalls is maintained and updated as program implementation develops, and additional monitoring occurs. The highest priority outfalls were identified for each jurisdiction in accordance with Provision D.2.b.(2)(b) and are provided in Table 2-3 and Figure 2-4.

Table 2-3. Highest Priority MS4 Outfalls during the 2022-2023 Monitoring Year

Responsible Agency	Station ID	Latitude (NAD83)	Longitude (NAD83)	Dates Sampled	
City of Carlsbad	16C-61	33.14603704	-117.338057	4/20/23	6/13/23
	1D-21	33.18033147	-117.3290899	4/20/23	6/13/23
	38D-13	33.11650157	-117.2491059	4/20/23[1]	6/13/23
	58A-73	33.07558732	-117.2591738	4/20/23	6/13/23
	63A-49	33.06464527	-117.2430565	4/20/23	6/13/23
City of Encinitas	1002SWOUTL	33.0559006	-117.2625351	5/15/23	6/28/23
	163SWOUTL	33.0163422	-117.2808914	5/15/23	6/28/23
	380SWOUTL	33.047451	-117.285759	5/15/23	6/28/23
	172SWOUTL	33.04796	-117.29508	5/15/23	6/28/23
	248SWOUTL	33.0546875	-117.2787399	5/15/23[2]	6/28/23
City of Escondido	ESC_108	33.1478845	-117.0392308	7/19/23	8/3/23
	ESC_115	33.1407338	-117.053285	7/19/23	8/3/23
	ESC_121	33.131714	-117.067713	7/19/23	8/3/23
	ESC_128	33.126838	-117.081599	7/19/23	8/3/23
	ESC_146	33.1132168	-117.1054409	7/19/23	8/3/23
City of Oceanside	AH-007	33.1612	-117.2707	6/19/23	8/9/23
	AH-008	33.1574	-117.2697	6/19/23	8/9/23
	BV-028	33.1812	-117.2872	6/20/23	8/10/23
	LA-041	33.206	-117.2851	6/20/23	8/10/23
	LA-048	33.21112	-117.27056	6/20/23	8/10/23
	LA-051	33.2134	-117.268	6/20/23	8/10/23
	LA-053	33.1825	-117.36512	6/20/23	8/10/23
City of San Marcos	INL11196	33.14152	-117.18557	8/16/23	8/30/23
	OUT026	33.140360	-117.143040	8/15/23	8/29/23
	OUT053	33.13117	-117.20248	8/16/23	8/30/23
	OUT10236[3]	33.134930	-117.194780	8/15/23	8/29/23
	OUT10330	33.13843	-117.13703	8/17/23	8/31/23
City of Solana Beach	SB-1	33.003875	-117.272063	NS	NS
	SB-9	33.006777	-117.246122	6/8/23	6/29/23

Table 2-3. Highest Priority MS4 Outfalls during the 2022-2023 Monitoring Year

Responsible Agency	Station ID	Latitude (NAD83)	Longitude (NAD83)	Dates Sampled	
City of Vista	AH-02	33.1594	-117.24713	7/8/23	8/8/23
	BV-01	33.18272	-117.28392	7/17/23	8/7/23[4]
	BV-05	33.1878	-117.27434	7/17/23	8/8/23
	BV-12	33.1985	-117.24739	7/17/23	8/7/23[4]
	BV-16	33.21727	-117.22922	7/17/23	8/8/23
County of San Diego	MS4-CAR-007	33.03286	-117.23459	NS	NS
	MS4-CAR-059	33.0437	-117.18743	5/24/23	NS
	MS4-CAR-069	33.12606	-117.2042	5/24/23	7/31/23
	MS4-CAR-070	33.12631	-117.20506	5/24/23	7/31/23
	MS4-CAR-072	33.12007	-117.20991	5/24/23	7/31/23

NS – not sampled – site was dry, ponded or not enough flow to sample.

[1] Nitrate + Nitrite as N, Total Kjeldahl Nitrogen, and Total Nitrogen were re-sampled on 9/19/2023.

[2] *Enterococcus*, fecal coliform and total coliform were sampled on 6/5/2023.

[3] City of San Marcos monitored site at upstream proxy location OUT10236-1.

[4] Fecal indicator bacteria and Pyrethroids were re-sampled on 8/18/2023.

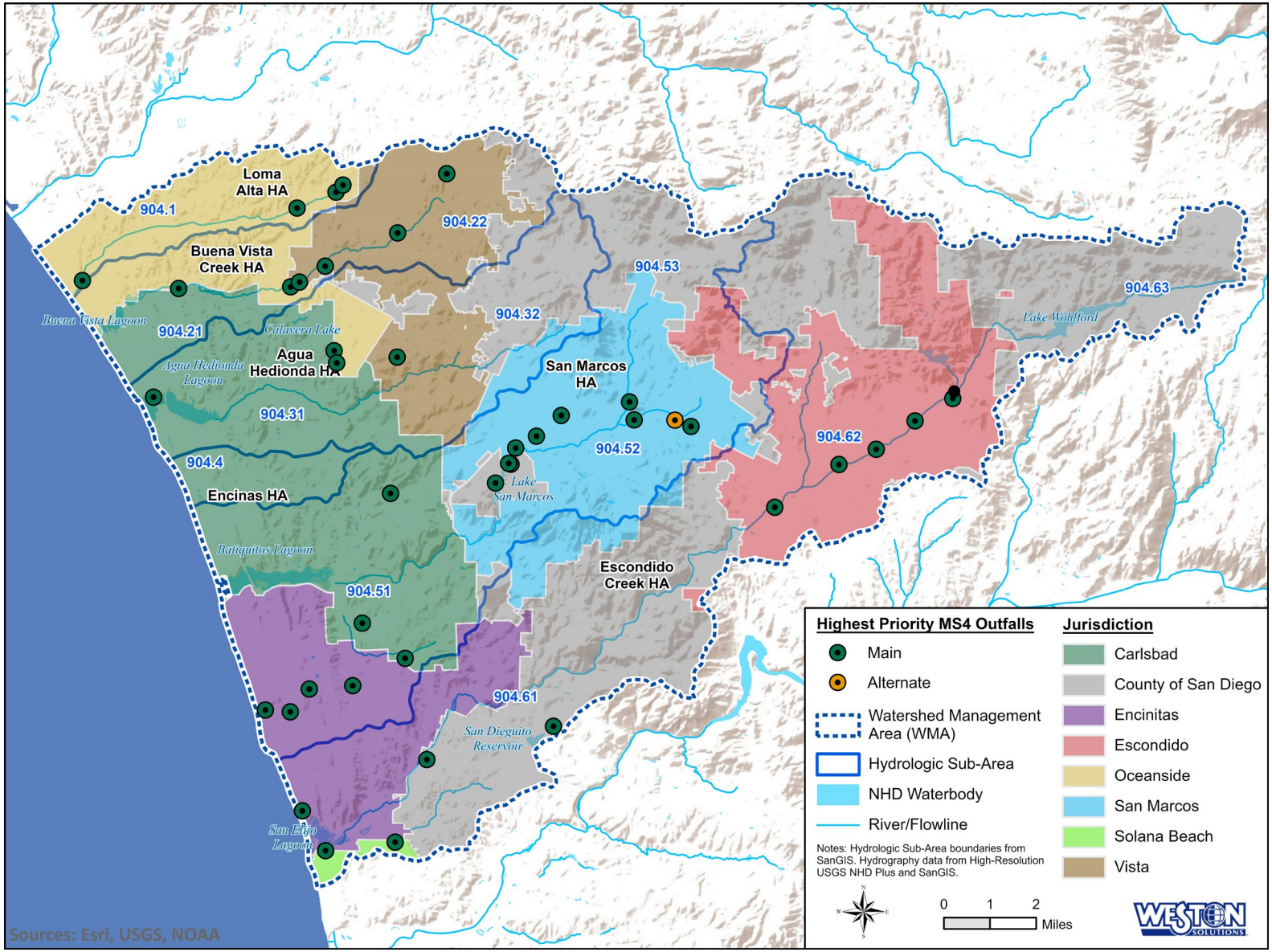

Figure 2-4. Highest Priority MS4 Outfall Monitoring Locations

2.1.1 Updates to the Highest Priority Outfalls

Priority re-assignments are made by the Responsible Agencies based on their prioritization procedures following each year of monitoring, in accordance with Provision D.2.b.(2)(b). A detailed description of each Responsible Agency's outfall prioritization process was provided in Attachment 3A to the 2019-2020 Carlsbad WMA WQIP Annual Report in response to the San Diego Water Board's request in Attachment 1 of the 2017-2018 WQIP Annual Report review letter.

For the 2022-2023 monitoring year, there were several changes made to the highest priority outfall locations. The City of Carlsbad deprioritized three highest priority major outfalls (19C-1, 29B-94, and 55A-51) after several investigations determined that groundwater was the main source of flow. The outfalls were replaced with three sites with unknown sources of flow (38D-13, 58A-73, and 63A-49). More information on the City of Carlsbad's source identifications study can be found in Attachment 6. The City of San Marcos replaced outfall OUT064 when it was determined that INL11196 was defined at the start of the receiving water. For the 2023-2024 monitoring year, the City of Escondido will be replacing highest priority outfall ESC_146 with ESC_134. There are currently no other anticipated updates to the priority outfalls for the 2023-2024 monitoring year. Table 2-4 provides the determinations of the highest priority outfalls at the end of the 2022-2023 monitoring year.

Table 2-4. Flow Determinations for Highest Priority MS4 Outfalls at Completion of 2022-2023 Monitoring Year

Responsible Agency	Station ID	2022-2023 Results	2023-2024 Highest Priority
City of Carlsbad	16C-61	Persistent	Yes
	1D-21	Persistent	Yes
	38D-13	Persistent	Yes
	58A-73	Persistent	Yes
	63A-49	Persistent	Yes
City of Encinitas	1002SWOUTL	Persistent	Yes
	163SWOUTL	Persistent	Yes
	380SWOUTL	Persistent	Yes
	172SWOUTL	Persistent	Yes
	248SWOUTL	Persistent	Yes
City of Escondido	ESC_108	Persistent	Yes
	ESC_115	Persistent	Yes
	ESC_121	Persistent	Yes
	ESC_128	Persistent	Yes
	ESC_146	Persistent	Yes
City of Oceanside	AH-007	Persistent	Yes
	AH-008	Persistent	Yes
	BV-028	Persistent	Yes
	LA-041	Persistent	Yes

Table 2-4. Flow Determinations for Highest Priority MS4 Outfalls at Completion of 2022-2023 Monitoring Year

Responsible Agency	Station ID	2022-2023 Results	2023-2024 Highest Priority
	LA-048	Persistent	Yes
	LA-051	Persistent	Yes
	LA-053	Persistent	Yes
City of San Marcos	OUT026	Persistent	Yes
	OUT053	Persistent	Yes
	OUT10236[1]	Persistent	Yes
	INL111961[2]	Unknown	Yes
	OUT10330	Persistent	Yes
City of Solana Beach	SB-1	Transient	Yes
	SB-3	Transient	Yes
	SB-9	Persistent	Yes
City of Vista	AH-02	Persistent	Yes
	BV-01	Persistent	Yes
	BV-05	Persistent	Yes
	BV-12	Persistent	Yes
	BV-16	Persistent	Yes
County of San Diego	MS4-CAR-007	Transient	Yes
	MS4-CAR-059	Transient	Yes
	MS4-CAR-069	Persistent	Yes
	MS4-CAR-070	Persistent	Yes
	MS4-CAR-072	Persistent	Yes

[1] City of San Marcos monitored site at upstream proxy location OUT10236-1
[2] City of San Marcos added INL11196 to inventory in 2022-2023, while the outfall was flowing during both monitoring events, flow classification cannot be determined until three visits have been made.

2.2 Highest Priority MS4 Outfall Monitoring Results

The 2022-2023 monitoring year was the eighth year of dry weather highest priority MS4 outfall analytical sampling under the WQIP. Sampling was conducted at the outfalls identified for each jurisdiction in the WMA (Table 2-3) between April 20, 2023 and August 31, 2023. Two sampling events were conducted at each outfall with flowing water. One outfall under the jurisdiction of the County of San Diego (MS4-CAR-007) was dry or ponded during both visits and was therefore not sampled. Another County of San Diego outfall, MS4-CAR-059 was ponded during one visit and was therefore sampled only once. Two outfalls in the City of Solana Beach were also ponded during both visits and were therefore not sampled (SB-1, SB-3).

Monitoring was conducted in accordance with the Carlsbad WMA MS4 Outfall Monitoring Plan and included in-situ measurements for pH, temperature, conductivity, dissolved oxygen and turbidity.

Grab samples were collected and analyzed for constituents contributing to the HPWQC, 2020/2022 303(d) List impairments, total maximum daily loads (TMDLs), non-stormwater action levels (NALs), and those listed in Table D-7 of the Permit. Grab samples were also collected from receiving waters to which the sampled outfalls were discharging, when possible. These samples were analyzed for total hardness, a measurement needed to compare concentrations of metals to hardness-dependent NALs. Visual observations were also recorded.

Dry weather results tables are provided in Attachment 3B-1 and the QA/QC summary report is provided in Attachment 3B-2. The majority of highest priority outfalls in the Carlsbad WMA discharge to inland surface waters; however, two outfalls in the City of Encinitas (163SWOUTL and 172SWOUTL), one outfall in the City of Carlsbad (16C-61), and one outfall in the City of Solana Beach (SB-9) discharge to a lagoon or estuary. Results of NAL comparisons for these outfalls are provided in Table 2-5.

Comparison of results to NALs for the remaining highest priority outfalls (those that discharge to inland surface waters) are presented in Table 2-6 through Table 2-12 by Responsible Agency. Indicator bacteria concentrations are compared to instantaneous maximum value (IM) NALs (in accordance with Table C-4 of the Permit). In addition, *E. coli* results for outfalls discharging to inland surface waters were compared to the statistical threshold values (STVs) per the Bacteria Provisions (State Water Board, 2018), which were incorporated into the Water Quality Control Plan for the San Diego Basin (Basin Plan) in 2021. The remaining constituent concentrations are compared to maximum daily action level (MDAL) NALs, where available. Laboratory and field data were uploaded to the California Environmental Data Exchange Network (CEDEN) and these data submittals are provided in Attachment 3H of this appendix.

Overall, approximately 77% of measured concentrations were below the applicable NAL. All results for DO met the NAL, 91% met the turbidity NAL, and 88% met the pH NAL. All samples met the NAL for methylene blue active substances (MBAS), and all results for the dissolved fractions of, hexavalent chromium, trivalent chromium, iron, lead, silver and zinc were below the NAL. The only dissolved metals with results above the NAL were dissolved copper (1 sample), dissolved cadmium (2 samples) and dissolved nickel (2 samples). For total metals, 35% of samples were above the NAL for total manganese, and 17% were above the NAL for total iron. Nutrient results were above the NALs in the majority of the samples (85% of samples for total nitrogen and 72% of samples for total phosphorus). At least one bacteria result was above the applicable NAL in all but two samples.

Table 2-5. 2022-2023 NAL Comparison for MS4 Outfalls Discharging to Saltwater Lagoons or Estuaries

Analyte	Unit	NAL	16C-61		163SWOUTL		172SWOUTL		SB-9	
			904.31		904.61		904.61		904.61	
			4/20/2023	6/13/2023	5/15/2023	6/28/2023	5/15/2023	6/28/2023	6/8/2023	6/29/2023
Physical Chemistry										
Turbidity	NTU/FNU	225 (a)	0.57	0	3.55	1.12	8.11	8.11	0.7	0.23
pH	pH unit	6.0-9.0 (a)	8.4	8.3	**9.07**	8.39	8.32	8.3	7.29	7.74
Fecal Indicator Bacteria										
Enterococcus	MPN/100 mL	104 (a)	**504**	**1,184**	**710**	**1,840**	**4,400**	**2,400**	**1,700**	**1,200**
Fecal Coliform	MPN/100 mL	400 (a)	-	-	**790**	**2,120**	**1,100**	400	200	**160,000**
E. coli	MPN/100 mL		146*	**754***	-	-	-	-	-	-
Dissolved Metals										
Cadmium	µg/L	16 (b)	<0.20	<0.20	0.072J	<0.2	<0.2	0.067J	0.12J	0.094J
Chromium VI	µg/L	83 (b)	0.99	<0.10	<0.02H	0.12	0.48H	0.11	0.023	0.054
Copper	µg/L	5.8 (b)	1.2	2.2	**10**	1.3	2.8	**7.6**	**7.7**	**7.2**
Lead	µg/L	14 (b)	<0.20	<0.20	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20
Nickel	µg/L	14 (b)	<2.0	<2.0	7.3	0.55J	0.76J	3.9	4	2.9
Silver	µg/L	2.2 (b)	<0.20	<0.20	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20
Zinc	µg/L	95 (b)	<10	10	31	2J	2.1J	20	29	25

NAL – non-stormwater action level, NTU - nephelometric turbidity unit, MPN – most probable number, mL – milliliter, µg/L – microgram per liter

< - Results are less than the reporting limit.

*Fecal coliform was not analyzed. *E. coli* results were used to compare to the NAL.

H - Analyzed outside of recommended holding time.

J - Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

(a) NALs for MS4 outfalls discharging to saltwater lagoon and estuary waters (Table C-2 of Permit).

(b) NALs for saltwater priority pollutants (Table C-3 of Permit).

Shaded and bolded results greater than NAL.

Table 2-6. 2022–2023 NAL Comparison for MS4 Outfalls – City of Carlsbad

Analyte	Unit	NAL	1D-21		38D-13		58A-73		63A-49	
			904.21		904.51		904.51		904.51	
			4/20/2023	6/13/2023	4/20/2023*	6/13/2023	4/20/2023	6/13/2023	4/20/2023	6/13/2023
Physical Chemistry										
Dissolved Oxygen	mg/L	5 (WARM) (a)	8.5	7.2	9.38	8.59	8.75	8.19	6.5	5.22
Turbidity	NTU/FNU	20 (a)	3.46	4.41	3.41	0.28	**23.31**	**19.63**	**19.7**	0.78
pH	pH unit	6.0-8.5 (a)	7.7	7.5	8.3	8.3	7.5	7.0	7.3	7.0
Fecal Indicator Bacteria										
*E. coli***	MPN/100 mL	320 (b)	**1,935**	**428**	20	41	52	**1,234**	63	185
Enterococcus	MPN/100 mL	61 (c)	**2,540**	**5,910**	**271**	**192**	10	**1,091**	**288**	**831**
General Chemistry										
MBAS	mg/L	0.5 (a)	<0.050	0.048J	0.083	0.0669	0.061	0.0699	0.074	0.0832
Nutrients										
Total Nitrogen	mg/L	1.0 (a)	**5.6**	**7.2**	0.85	**2.5**	**2.1**	**12**	**4.3**	**3.9**
Total Phosphorus	mg/L	0.1 (a)	**0.14**	**0.26**	0.052	**0.11**	0.055	**0.59**	0.051	0.082
Total Metals										
Iron	µg/L	300 (a)	180	58	87	110	**680**	**610**	**340**	60
Manganese	µg/L	50 (a)	**78**	**72**	**140**	**210**	**4,700**	**5,000**	**1,100**	**1,600**
Dissolved Metals										
Cadmium	µg/L	(d)(e)	<0.20	<0.20	<0.20	<0.20	**5.7**	4.9	3.1	**5.6**
Chromium III	µg/L	(d)(e)	<0.20[2]	<0.30	<0.20	<0.30	<0.30	<0.30	<0.60	<0.30
Chromium VI	µg/L	16 (f)	<0.20[2]	<0.10	<0.10	<0.10	<0.10	<0.10	0.61	<0.10
Copper	µg/L	(d)	2.6	3	2.4	2.5	6.8	11	10	6.4
Iron	µg/L	(d)	<20	<20	<20	<20	<20	<20	<20	<20
Nickel	µg/L	(d)(e)	<2.0	<2.0	2.9	2.1	**130**	**130**	31	63
Silver	µg/L	(d)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Zinc	µg/L	(d)	17	39	<10	<10	230	220	200	280

NAL – non-stormwater action level, NTU - nephelometric turbidity unit, MPN – most probable number, mL – milliliter, µg/L – microgram per liter

< - Results are less than the reporting limit.

*Nitrate + Nitrite as N, Total Kjeldahl Nitrogen, and Total Nitrogen were re-sampled on 9/19/2023

** E.coli analyzed in place of fecal coliform per Table D-7 of the Permit.

J - Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

(a) NALs for MS4 outfalls to inland surface waters (Table C-4 of Permit).

(b) Water quality objective for *E. coli* is based on the Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective on or before September 1, 2021).

(c) Instantaneous Maximum for MS4 outfall discharges to inland surface waters with REC-1 beneficial use (Table C-4 of Permit).

(d) Water quality objective for dissolved metal fractions is based on total hardness and is calculated as described by 40 CFR Part 131.38 (May 18, 2000). The criterion continuous concentration (CCC) was applied to dry weather results with the exception of silver for which the criterion maximum concentration (CMC) was applied as there is no CCC.

(e) If calculated CCC values exceeded the Maximum Contaminant Levels (MCLs) as given in the Basin Plan, concentrations were compared to the MCLs. No MCLs were exceeded for these constituents.

(f) NALs for freshwater priority pollutants (Table C-3 of Permit).

[1]Data for Total Chromium III and Total Chromium VI are not available due to laboratory error. These values would be less than or equal to the value for Total Chromium. There is no numeric action level applicable to Total Chromium III or Total Chromium VI.

[2]Data for Dissolved Chromium III and Dissolved Chromium VI are not available due to laboratory error. Data is available for Dissolved Chromium, and the result was not detected, with a reporting limit of 0.20 µg/L. Because the maximum values for Cr III and Cr VI cannot exceed the value for the sum of all chromium species, the values for both Dissolved Chromium III and Dissolved Chromium VI are also reported as <0.20 µg/L.

Shaded and bolded results greater than NAL.

Table 2-7. 2022–2023 NAL Comparison for MS4 Outfalls – City of Encinitas

Analyte	Unit	NAL	1002SWOUTL		248SWOUTL		380SWOUTL	
			904.51		904.51		904.51	
			5/15/2023	6/28/2023	5/15/2023*	6/28/2023	5/15/2023	6/28/2023
Physical Chemistry								
Dissolved Oxygen	mg/L	5 (WARM) (a)	8.95	8.35	7.49	6.25	8.95	8.92
Turbidity	NTU/FNU	20 (a)	**34.14**	**24.28**	4.14	6.78	15.23	10.28
pH	pH unit	6.0-8.5 (a)	7.92	7.84	8.11	7.67	7.9	8.06
Fecal Indicator Bacteria								
E. coli	MPN/100 mL	320 (b)	**790**	**5,200**	230	290	**490**	52
Enterococcus	MPN/100 mL	61 (c)	**1,500**	**3,020**	**4,400**	**180**	**1,400**	**260**
Fecal Coliform	MPN/100 mL	400 (c)	**790**	**6,200**	230	320	**490**	360
General Chemistry								
MBAS	mg/L	0.5 (a)	0.076	0.14	0.086	0.082	0.036J	0.08
Nutrients								
Total Nitrogen	mg/L	1.0 (a)	**3.95**	**3.3**	**6.12**	**8.5**	**4.06**	**3.353**
Total Phosphorus	mg/L	0.1 (a)	**0.51**	**0.43**	**0.77**	**0.71**	**0.12**	**0.16**
Total Metals								
Iron	µg/L	300 (a)	**27000**	**5400**	**1500**	**750**	**3400**	**3300**
Manganese	µg/L	50 (a)	**1500**	**1200**	**60**	36	**990**	**900**
Dissolved Metals								
Cadmium	µg/L	(d)(e)	0.045J	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	µg/L		0.14J	0.14J	0.27	0.18J	0.13J	0.09J
Chromium VI	µg/L	16 (f)	<0.02	<0.02	0.012J	<0.02	<0.02	<0.02
Copper	µg/L	(d)	2.4	2.7	6.3	3.4	2.4	0.94
Iron	µg/L	(d)	22	25	32	44	30	4J
Nickel	µg/L	(d)(e)	6.9	6.5	5.1	4.4	2.1	1.7J
Silver	µg/L	(d)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	µg/L	(d)	2.9J	4J	24	33	2.3J	<10
Chlorinated Pesticides								
DDT(p,p')	µg/L		NR	NR	<0.050	<0.0050	<0.0050	<0.0050

NAL – non-stormwater action level, NTU - nephelometric turbidity unit, MPN – most probable number, mL – milliliter, µg/L – microgram per liter

< - Results are less than the reporting limit.

J - Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

* *Enterococcus*, fecal coliform and total coliform were sampled on 6/5/2023.

NR- Not Required

(a) NALs for MS4 outfalls to inland surface waters (Table C-4 of Permit).

(b) Water quality objective for E. coli is based on the Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective on or before September 1, 2021).

(c) Instantaneous Maximum for MS4 outfall discharges to inland surface waters with REC-1 beneficial use (Table C-4 of Permit).

(d) Water quality objective for dissolved metal fractions is based on total hardness and is calculated as described by 40 CFR Part 131.38 (May 18, 2000). The criterion continuous concentration (CCC) was applied to dry weather results with the exception of silver for which the criterion maximum concentration (CMC) was applied as there is no CCC.

(e) If calculated CCC values exceeded the Maximum Contaminant Levels (MCLs) as given in the Basin Plan, concentrations were compared to the MCLs. No MCLs were exceeded for these constituents.

(f) NALs for freshwater priority pollutants (Table C-3 of Permit).

Shaded and bolded results greater than NAL.

Table 2-8. 2022–2023 NAL Comparison for MS4 Outfalls – City of Escondido

Analyte	Unit	NAL	ESC-108		ESC-115		ESC-121		ESC-128		ESC-146	
			904.62		904.62		904.62		904.62		904.62	
			7/19/2023	8/3/2023	7/19/2023	8/3/2023	7/19/2023	8/3/2023	7/19/2023	8/3/2023	7/19/2023	8/3/2023
Physical Chemistry												
Dissolved Oxygen	mg/L	6 (COLD) (a)	8.22	8.25	8.8	8.66	8.65	8.62	7.95	7.74	7.96	7.75
Turbidity	NTU/FNU	20 (a)	0.69	1.03	0.63	2.5	0.51	0.4	0.15	0.17	0.24	3.69
pH	pH unit	6.0-8.5 (a)	8.17	8.22	8.29	8.32	8.01	8.07	8.1	8.12	8.19	8.18
Fecal Indicator Bacteria												
*E. coli**	MPN/100 mL	320 (b)	**794**	**602**	20	**1,259**	**341**	**420**	**441**	**568**	**2,142**	<10
Enterococcus	MPN/100 mL	61 (c)	**1,184**	**2,380**	**624**	**1,780**	**164**	**560**	**1,445**	**885**	**2,380**	<10
General Chemistry												
MBAS	mg/L	0.5 (a)	0.0669	0.0235J	0.0434J	<0.05	0.0363J	0.021J	0.0424J	0.0332J	0.0322J	0.0261J
Nutrients												
Total Nitrogen	mg/L	1.0 (a)	**11**	**12**	**21**	**23**	0.29	**14**	**13**	**13**	**9.6**	**5.5**
Total Phosphorus	mg/L	0.1 (a)	0.081	**0.11**	0.10	**0.13**	0.089	**0.15**	**0.12**	**0.15**	**0.13**	**0.15**
Total Metals												
Iron	µg/L	300 (a)	50	55	62	140	20	28	44	45	69	260
Manganese	µg/L	50 (a)	10	7.8	30	**53**	4.7	3.9	6.5	5.8	11	37
Dissolved Metals												
Cadmium	µg/L	(d)(e)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium III	µg/L	(d)(e)	<1.2	<0.40	<1.2	<0.40	0.39	<0.40	<0.30	<0.40	<0.30	<0.40
Chromium VI	µg/L	16 (f)	<1.0	<0.20	<1.0	<0.20	<0.10	0.37	0.27	0.79	0.18	6.7
Copper	µg/L	(d)	1.0	1.4	0.76	0.82	1.1	1.7	2.4	1.7	1.8	3.1
Iron	µg/L	(d)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Nickel	µg/L	(d)(e)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Silver	µg/L	(d)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Zinc	µg/L	(d)	<10	<10	<10	<10	<10	<10	22	31	12	26

NAL – non-stormwater action level, NTU - nephelometric turbidity unit, MPN – most probable number, mL – milliliter, µg/L – microgram per liter

< - Results are less than the reporting limit.

J - Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

* E. coli was monitored instead of fecal coliform per Table D-7 of the Permit.

(a) NALs for MS4 outfalls to inland surface waters (Table C-4 of Permit).

(b) Water quality objective for E. coli is based on the Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective on or before September 1, 2021).

(c) Instantaneous Maximum for MS4 outfall discharges to inland surface waters with REC-1 beneficial use (Table C-4 of Permit).

(d) Water quality objective for dissolved metal fractions is based on total hardness and is calculated as described by 40 CFR Part 131.38 (May 18, 2000). The criterion continuous concentration (CCC) was applied to dry weather results with the exception of silver for which the criterion maximum concentration (CMC) was applied as there is no CCC.

(e) If calculated CCC values exceeded the Maximum Contaminant Levels (MCLs) as given in the Basin Plan, concentrations were compared to the MCLs. No MCLs were exceeded for these constituents.

(f) NALs for freshwater priority pollutants (Table C-3 of Permit).

Shaded and bolded results greater than NAL.

Table 2-9. 2022–2023 NAL Comparison for MS4 Outfalls – City of Oceanside

Analyte	Unit	NAL	AH-007		AH-008		BV-028		LA-041		LA-048		LA-051		LA-053	
			904.31		904.31		904.21		904.1		904.1		904.1		904.1	
			6/19/23	8/9/23	6/19/23	8/9/23	6/20/23	8/10/23	6/20/23	8/10/23	6/20/23	8/10/23	6/20/23	8/10/23	6/20/23	8/10/23
Physical Chemistry																
Dissolved Oxygen	mg/L	5 (WARM) (a)	9.03	8.81	8.74	8.49	9.29	8.62	8.79	8.15	8.89	8.39	8.58	8.16	20.07	13.85
Turbidity	NTU/FNU	20 (a)	0.15	0.17	0.47	0.43	0.51	0.01	1.31	0.51	2.51	1.11	1.12	0.67	**37.13**	2.31
pH	pH unit	6.0-8.5 (a)	8.5	8.07	7.79	7.56	**8.6**	8.42	8.38	8.02	8.3	8.2	8.14	8.02	**8.84**	8.25
Fecal Indicator Bacteria																
E. coli	MPN/100 mL	320 (b)	31	**580**	**690**	**8,200**	180	**1,800**	**8,200**	**820**	**4,600**	**10,000**	52	**330**	**20,000**	260
Enterococcus	MPN/100 mL	61 (c)	**210**	**2,600**	**2,900**	**8,700**	**1,000**	**3,900**	**1,600**	**3,700**	**1,400**	**9,200**	**180**	**1,200**	**2,400**	**180**
Fecal Coliform	MPN/100 mL	400 (c)	40	**490**	**490**	68	330	**1,300**	**7,000**	**460**	**9,200**	**2,800**	40	**490**	**5,400**	45
General Chemistry																
MBAS	mg/L	0.5 (a)	0.027J	0.052	0.03J	<0.05	0.046J	0.091	0.054	0.088	0.06	0.074	0.11	0.15	0.035J	0.051
Nutrients																
Total Nitrogen	mg/L	1.0 (a)	0.9	**1.3**	**1.1**	0.78	**3.0**	**2.9**	**2.9**	**2.6**	**3.5**	**3.8**	**3.6**	**5.7**	**2.4**	**1.1**
Total Phosphorus	mg/L	0.1 (a)	0.094	**0.14**	**0.16**	**0.18**	**0.29**	**0.52**	**0.11**	**0.13**	**0.11**	**0.14**	0.093	**0.21**	**0.16**	0.1
Total Metals																
Iron	µg/L	300 (a)	110	110	66	130	53	72	270	220	18J	59	52	130	100	130
Manganese	µg/L	50 (a)	**85**	31	4.9	7.3	16	38	28	23	3.9	4.2	6.2	18	7.5	5.5
Dissolved Metals																
Cadmium	µg/L	(d)(e)	<0.2	<0.2	0.049J	<0.2	0.22	0.18J	<0.2	0.1J	0.062J	<0.2	<0.2	<0.2	0.045J	<0.2
Chromium III	µg/L	(d)(e)	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	0.22	<0.22	0.54	0.39
Chromium VI	µg/L	16 (f)	<0.02	0.12	0.079	0.16	0.017J	0.12	0.023	0.21	0.16	0.44	0.017J	0.2	0.69	<0.02
Copper	µg/L	(d)	5	5.2	20	13	18	20	2.8	6.6	5.6	4.3	4.6	4.2	2.9	0.83
Iron	µg/L	(d)	12J	18J	15J	19J	7.8J	8.4J	19J	21	<20	6.8J	4.4J	<20	5.6J	<20
Nickel	µg/L	(d)(e)	6.5	6.6	2.7	1.9J	2.1	2.7	3.1	3.2	2.4	2.4	4.3	3.7	0.53J	0.7J
Silver	µg/L	(d)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	µg/L	(d)	2.3J	2.3J	7.2J	7.8J	32	22	<10	35	5.1J	2.2J	<10	2J	6.9J	<10

NAL – non-stormwater action level, NTU - nephelometric turbidity unit, MPN – most probable number, mL – milliliter, µg/L – microgram per liter

< - Results are less than the reporting limit.

J - Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

(a) NALs for MS4 outfalls to inland surface waters (Table C-4 of Permit).

(b) Water quality objective for *E. coli* is based on the Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective on or before September 1, 2021).

(c) Instantaneous Maximum for MS4 outfall discharges to inland surface waters with REC-1 beneficial use (Table C-4 of Permit).

(d) Water quality objective for dissolved metal fractions is based on total hardness and is calculated as described by 40 CFR Part 131.38 (May 18, 2000). The criterion continuous concentration (CCC) was applied to dry weather results with the exception of silver for which the criterion maximum concentration (CMC) was applied as there is no CCC.

(e) If calculated CCC values exceeded the Maximum Contaminant Levels (MCLs) as given in the Basin Plan, concentrations were compared to the MCLs. No MCLs were exceeded for these constituents.

(f) NALs for freshwater priority pollutants (Table C-3 of Permit).

Shaded and bolded results greater than NAL.

Table 2-10. 2022–2023 NAL Comparison for MS4 Outfalls – City of San Marcos

Analyte	Unit	NAL	INL11196		OUT026		OUT053		OUT10236-1		OUT10330	
			904.52		904.52		904.52		904.52		904.52	
			8/16/2023	8/30/2023	8/15/2023	8/29/2023	8/16/2023	8/30/2023	8/15/2023	8/29/2023	8/17/2023	8/31/2023
Physical Chemistry												
Dissolved Oxygen	mg/L	5 (WARM) (a)	10.78	12.94	9.71	12.68	5.14	4.31	20.00	24.11	7.78	8.13
Turbidity	NTU/FNU	20 (a)	2.58	11.02	0.03	2.92	2.65	6.77	15.06	5.37	0.99	4.01
pH	pH unit	6.0-8.5 (a)	7.9	7.9	8.3	7.8	7.3	7.4	**9.1**	7.9	7.5	7.5
Fecal Indicator Bacteria												
*E. coli***	MPN/100 mL	320 (b)	110	**471**	41	**733**	**355**	171	**3,448**	**77,010**	**780**	63
Enterococcus	MPN/100 mL	61 (c)	**64**	**697**	**10,130**	**782**	**2,540**	**659**	20	10	**831**	**697**
General Chemistry												
MBAS	mg/L	0.5 (a)	0.0582	0.0964	0.134	0.104	0.0811	0.115	0.217	0.169	0.0388J	0.0908
Nutrients												
Total Nitrogen	mg/L	1.0 (a)	**3.6**	**1.6**	0.62	**1.1**	0.87	**1.8**	**1.7**	**1.4**	**5.4**	**4.9**
Total Phosphorus	mg/L	0.1 (a)	0.097	**0.17**	<0.050	0.077	**0.2**	**0.22**	**0.15**	**0.15**	**0.13**	**0.11**
Total Metals												
Iron	µg/L	300 (a)	93	110	72	64	110	290	120	160	34	37
Manganese	µg/L	50 (a)	19	33	**75**	**330**	**120**	**140**	**160**	**61**	20	21
Dissolved Metals												
Cadmium	µg/L	(d)(e)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium III	µg/L	(d)(e)	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Chromium VI	µg/L	16 (f)	<0.20	2.9	1.9	<0.20	1.5	1.3	<0.20	<0.20	<0.20	<0.20
Copper	µg/L	(d)	**130**	4.2	1.3	1.2	1.0	1.3	2.2	2.1	1.9	2.3
Iron	µg/L	(d)	<20	<20	<20	<20	23	31	49	<20	<20	<20
Nickel	µg/L	(d)(e)	<2.0	<2.0	<2.0	<2.0	<2.0	2.6	<2.0	<2.0	<2.0	<2.0
Silver	µg/L	(d)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Zinc	µg/L	(d)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

NAL – non-stormwater action level, NTU - nephelometric turbidity unit, MPN – most probable number, mL – milliliter, µg/L – microgram per liter

< - Results are less than the reporting limit.

H - Analyzed outside of recommended holding time.

J - Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

* *E. coli* was monitored instead of fecal coliform per Table D-7 of the Permit.

(a) NALs for MS4 outfalls to inland surface waters (Table C-4 of Permit).

(b) Water quality objective for *E. coli* is based on the Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective on or before September 1, 2021).

(c) Instantaneous Maximum for MS4 outfall discharges to inland surface waters with REC-1 beneficial use (Table C-4 of Permit).

(d) Water quality objective for dissolved metal fractions is based on total hardness and is calculated as described by 40 CFR Part 131.38 (May 18, 2000). The criterion continuous concentration (CCC) was applied to dry weather results with the exception of silver for which the criterion maximum concentration (CMC) was applied as there is no CCC.

(e) If calculated CCC values exceeded the Maximum Contaminant Levels (MCLs) as given in the basin plan, concentrations were compared to the MCLs. No MCLs were exceeded for these constituents.

(f) NALs for freshwater priority pollutants (Table C-3 of Permit).

Shaded and bolded results greater than NAL.

Table 2-11. 2022–2023 NAL Comparison for MS4 Outfalls – City of Vista

Analyte	Unit	NAL	AH-02		BV-01		BV-05		BV-12		BV-16	
			904.31		904.21		904.21		904.22		904.22	
			7/18/2023	8/8/2023	7/17/2023	8/7/2023*	7/17/2023	8/8/2023	7/17/2023	8/7/2023*	7/17/2023	8/8/2023
Physical Chemistry												
Dissolved Oxygen	mg/L	5 (WARM) (a)	8.03	5.9	7.83	6.1	8.67	5.3	8.64	6.3	8.53	7.1
Turbidity	NTU/FNU	20 (a)	1.03	1.28	0.25	7.88	0.65	1.26	0.3	0.75	2.84	6.06
pH	pH unit	6.0-8.5 (a)	8.13	8.37	7.96	8.09	8.42	**8.52**	8.37	**8.67**	7.94	7.97
Fecal Indicator Bacteria												
E. coli	MPN/100 mL	320 (b)	74	230	**610**	**8,200**	**20,000**	**24,000**	**1,700**	**1,600**	**490**	190
Enterococcus	MPN/100 mL	61 (c)	**1,300**	**>24,196**	**980**	**710**	**5,200**	**2,000**	**2,200**	**540**	**430**	**6,900**
Fecal Coliform	MPN/100 mL	400 (c)	220	**2,800**	**1,100**	**7,000**	**14,000**	**160,000**	**3,500**	**1,300**	**1,100**	**2,400**
General Chemistry												
MBAS	mg/L	0.5 (a)	0.031J	0.074	0.057	0.061	<0.050	<0.050	<0.050	<0.050	0.026J	0.025J
Nutrients												
Total Nitrogen	mg/L	1.0 (a)	0.85	0.77	**1.1**	**1.3**	0.53	0.81	**5.7**	**5.7**	**17**	**9.5**
Total Phosphorus	mg/L	0.1 (a)	**0.31**	**1.1**	0.09	**0.11**	**0.14**	**0.13**	**0.12**	0.074	0.087	**0.12**
Total Metals												
Iron	µg/L	300 (a)	110	150	88	300	42	78	40	73	12J	**620**
Manganese	µg/L	50 (a)	13	15	16	20	4	8.7	20	8.2	0.77J	16
Dissolved Metals												
Cadmium	µg/L	(d)(e)	0.050J	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium III	µg/L	(d)(e)	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22
Chromium VI	µg/L	16 (f)	0.19	0.016J	<0.020	0.0090J	<0.020	0.086	0.28	0.55	1.1	1.3
Copper	µg/L	(d)	3.3	4.3	2.1	2.5	0.82	1.3	1.9	1.4	1.4	2.5
Iron	µg/L	(d)	8.5J	6.4J	13J	<30	17J	14J	4.4J	<30	<20	<30
Nickel	µg/L	(d)(e)	2.5	2.4	2.1	2.2	0.55J	0.55J	0.81J	0.78J	2.9	2.7
Silver	µg/L	(d)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Zinc	µg/L	(d)	3.8J	7.5J	<10	2.1J	2.3J	4.1J	10	11	12	11

NAL – non-stormwater action level, NTU - nephelometric turbidity unit, MPN – most probable number, mL – milliliter, µg/L – microgram per liter

< - Results are less than the reporting limit.

J - Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

*Fecal indicator bacteria and Pyrethroids were re-sampled on 8/18/2023.

(a) NALs for MS4 outfalls to inland surface waters (Table C-4 of Permit).

(b) Water quality objective for *E. coli* is based on the Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective on or before September 1, 2021).

(c) Instantaneous Maximum for MS4 outfall discharges to inland surface waters with REC-1 beneficial use (Table C-4 of Permit).

(d) Water quality objective for dissolved metal fractions is based on total hardness and is calculated as described by 40 CFR Part 131.38 (May 18, 2000). The criterion continuous concentration (CCC) was applied to dry weather results with the exception of silver for which the criterion maximum concentration (CMC) was applied as there is no CCC.

(e) If calculated CCC values exceeded the Maximum Contaminant Levels (MCLs) as given in the Basin Plan, concentrations were compared to the MCLs. No MCLs were exceeded for these constituents.

(f) NALs for freshwater priority pollutants (Table C-3 of Permit).

Shaded and bolded results greater than NAL.

Table 2-12. 2022–2023 NAL Comparison for MS4 Outfalls – County of San Diego

Analyte	Unit	NAL	MS4-CAR-059	MS4-CAR-069		MS4-CAR-070		MS4-CAR-072	
			904.61	904.52		904.52		904.52	
			5/24/2023	5/24/2023	7/31/2023	5/24/2023	7/31/2023	5/24/2023	7/31/2023
Physical Chemistry									
Dissolved Oxygen	mg/L	5 (WARM) / 6 (COLD) (a)	7.56	14.8	10.63	8.33	8.89	8.89	7.46
Turbidity	NTU/FNU	20 (a)	2.51	9.83	2.28	0.62	0.28	4.27	0.28
pH	pH unit	6.0-8.5 (a)	7.78	**8.97**	**8.62**	8.01	**8.89**	8.13	8.23
Fecal Indicator Bacteria									
E. coli	MPN/100 mL	320 (b)	**1,300**	**3,500**	**92,000**	45	**2,400**	**1,300**	**9,200**
Enterococcus	MPN/100 mL	61 (c)	**9,200**	**16,000**	**140**	**1,300**	**110**	**22,000**	**16,000**
Fecal Coliform	MPN/100 mL	400 (c)	**1,300**	**3,500**	**92,000**	78	**2,400**	**1,300**	**9,200**
General Chemistry									
MBAS	mg/L	0.5 (a)	0.22	0.059	0.094	0.07	<0.050	0.13	0.045J
Nutrients									
Total Nitrogen	mg/L	1.0 (a)	**1.9**	**3.2**	**1.5**	**2**	**1.4**	**3.4**	**1.3**
Total Phosphorus	mg/L	0.1 (a)	**0.57**	**0.59**	**0.23**	0.037J	0.05	**0.2**	**0.16**
Total Metals									
Iron	µg/L	300 (a)	**690**	290	300	23	43	120	64
Manganese	µg/L	50 (a)	**350**	**77**	20	4.2	1.9	29	14
Dissolved Metals									
Cadmium	µg/L	(d)(e)	<0.2	<0.2	<0.2	<0.2	<0.2	0.057J	<0.2
Chromium III	µg/L	(d)(e)	<0.22	<0.22	<0.22	<0.22	<0.22	0.24	<0.22
Chromium VI	µg/L	16 (f)	<0.02	<0.02	<0.02	<0.02	<0.02	0.11	<0.02
Copper	µg/L	(d)	2.1	2.6	1.4	2.6	1.7	6.2	1.7
Iron	µg/L	(d)	54	31	26	4.9J	7.7J	36	31
Nickel	µg/L	(d)(e)	2.1	1.1J	<2	2.2	1.2J	1.8J	0.29J
Silver	µg/L	(d)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	µg/L	(d)	3J	2.9J	<10	6.7J	6.7J	33	12

NAL – non-stormwater action level, NTU - nephelometric turbidity unit, MPN – most probable number, mL – milliliter, µg/L – microgram per liter

< - Results are less than the reporting limit.

J - Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

(a) NALs for MS4 outfalls to inland surface waters (Table C-4 of Permit).

(b) Water quality objective for *E. coli* is based on the Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective on or before September 1, 2021).

(c) Instantaneous Maximum for MS4 outfall discharges to inland surface waters with REC-1 beneficial use (Table C-4 of Permit).

(d) Water quality objective for dissolved metal fractions is based on total hardness and is calculated as described by 40 CFR Part 131.38 (May 18, 2000). The criterion continuous concentration (CCC) was applied to dry weather results with the exception of silver for which the criterion maximum concentration (CMC) was applied as there is no CCC.

(e) If calculated CCC values exceeded the Maximum Contaminant Levels (MCLs) as given in the Basin Plan, concentrations were compared to the MCLs. No MCLs were exceeded for these constituents.

(f) NALs for freshwater priority pollutants (Table C-3 of Permit).

Shaded and bolded results greater than NAL.

2.3 Outfall Dry Weather Monitoring Data Assessments

Table 2-13 summarizes the MS4 dry weather outfall monitoring data assessments required by Permit provision D.4.b.(1)(c)(i-vi). The information necessary to demonstrate compliance with each Provision is outlined in the following sections. In instances where compliance has been demonstrated in previous sections of this Annual Report, those sections are referenced.

Table 2-13. MS4 Outfall Dry Weather Monitoring Data Assessments

Assessment	Components	Provision(s)
WQIP Annual Report		
Identify known and suspected controllable sources.	Identify known and suspected controllable sources (e.g., facilities, areas, land uses, pollutant generating activities) of transient and persistent flows.	D.4.b.(1)(b)(i)
Identify sources that have been reduced or eliminated.	Identify sources of transient and persistent flows that have been reduced or eliminated.	D.4.b.(1)(b)(ii)
Identify necessary modifications to monitoring locations and frequencies.	Identify necessary modifications to monitoring locations and frequencies necessary to identify and eliminate sources of persistent flows.	D.4.b.(1)(b)(iii)
Rank and prioritize non-stormwater discharges.	Rank persistently flowing outfalls according to potential threat to receiving water quality. Produce/update prioritized list of outfalls.	D.4.b.(1)(c)(ii)
Identify sources contributing to NAL exceedances.	Identify known and suspected sources that may cause or contribute to exceedances.	D.4.b.(1)(c)(iii)
Estimate volumes and loads of non-stormwater discharges.*	Analyze data collected as part of the Permit-required dry weather outfall monitoring. Use a model or other method to calculate and estimate collective persistent non-stormwater discharge volumes and pollutant loads. Specific calculations/estimates include: 1) Annual non-stormwater volumes and loads discharged from the Copermittee's major storm drain outfalls to receiving waters within its jurisdiction, with an estimate of the percent contribution from each known source for each storm drain outfall. 2) Annual identification and quantification (by volume and pollutant load) of sources of discharged non-stormwater not subject to the Copermittee's legal authority.	D.4.b.(1)(c)(iv)
Identify data gaps.	Identify data gaps in the monitoring data necessary to fulfill assessment requirements.	D.4.b.(1)(c)(vi)

Table 2-13. MS4 Outfall Dry Weather Monitoring Data Assessments

Assessment	Components	Provision(s)
Once during Permit Term		
Evaluate progress in achieving non-stormwater volume and load reductions.	Identify reductions and progress in achieving reductions.	D.4.b.(1)(c)(v)
	Assess the effectiveness of WQIP improvement strategies, with estimates of volume and load reductions attributed to specific strategies when possible.	
	Identify modifications necessary to increase the effectiveness of WQIP strategies.	

* An email from the San Diego Water Board dated August 19, 2020 granted the Responsible Agencies regulatory relief related to this assessment. See Section 1.1.2 for additional detail.

2.3.1 Provision D.4.b.(1)(b) - Identify Known and Suspected Controllable Sources, Sources that have been Reduced or Eliminated, and Necessary Modifications to Monitoring Locations and Frequencies

The dry weather field screening monitoring assessments that were first required during the transitional monitoring period (Provision D.4.b.(1)(b)(i-iii)) are required to be continued under the WQIP monitoring program. The assessments related to (i) and (ii) are described in Section 2.3.7.1 and 2.3.7.2. To comply with (iii), the data collected under the dry weather MS4 outfall discharge field screening monitoring program (Section 2.1) were assessed. Other than the City of Carlsbad's modification described below, no modifications to field screening monitoring locations or frequencies are planned for 2023-2024.

In the 2019-2020 monitoring year, the City of Carlsbad completed the Groundwater MS4 Outfall Special Study (Groundwater MS4 Study) to better understand the sources of non-stormwater flows at persistently flowing MS4 outfalls and satisfy requirements in Permit Provision D.3. Results from the Groundwater MS4 Study showed clear isotopic distinctions in samples taken from known groundwater sources compared to potable water sources. Outfall samples contained varying concentrations of groundwater and potable water isotopes, indicating some level of groundwater influence. These results were used to prioritize sampled outfalls with the highest percentage of anthropogenic flow. In 2022, the City of Carlsbad conducted additional flow source investigations including desktop analysis of depth to groundwater, and analysis of major ions for comparison to known sources (See Section 2.3.7.3.5).

Per Provision D.4.b.(1)(b)(iii), the City of Carlsbad made modifications in the 2021-2022 monitoring year to locations and frequencies necessary to identify and eliminate sources of flow. These modifications included reducing the number of locations and increasing the frequency of visual observations and IDDE investigations at major MS4 outfalls with persistent flow in order to identify and eliminate sources of non-storm water flows, while maintaining the equivalent number of visual inspections required under Provision D.2.a.(2)(a). During the 2022-2023 monitoring year, more than the required 150 individual field screenings were conducted at a total of 55 major outfalls. Outfalls were selected for increased frequency of observations and/or investigations based on the following prioritization criteria:

- New major outfalls
- Persistently flowing major outfalls
- Higher average flow rate for the previous 3 visits
- Prohibited discharges identified in previous visits
- Major outfalls with greater than 50% estimated anthropogenic flow per the Groundwater MS4 Study
- Major outfalls with low total number of visual observations

In addition, when flow was observed at a major MS4 outfall during the field screening, an IDDE upstream investigation was immediately conducted throughout the entire catchment basin of the outfall.

2.3.2 Provision D.4.b.(1)(c)(ii) Ranking of MS4 Outfalls

In addition to continuing the assessments required by Provision D.4.b.(1)(b)(i-iii), analytical monitoring of dry weather storm drain outfall discharge samples and the associated assessments outlined in Provision D.4.b.(1)(c)(ii-v) are required.

Provision D.4.b.(1)(c)(ii) requires the prioritization of major MS4 outfalls within each Responsible Agency's jurisdiction based on the dry weather MS4 outfall monitoring data. These data are presented in Section 2.1, and the analytical data collected at the highest priority outfalls for each jurisdiction during 2021-2022 are presented in Table 2-5 through Table 2-12.

The prioritization process that identified changes to the HPPF outfalls monitored during the 2022-2023 year is provided in Section 2.1.1. A more detailed response to specific comments in the San Diego Water Board's letter, based on their review of the 2017-2018 WQIP Annual Report, was provided in Appendix 5 of the 2018-2019 WQIP Annual Report (WESTON, 2020a). The Responsible Agencies provided the criteria upon which outfalls are prioritized and provided a response regarding the status of 11 "outfalls" listed in the letter, which had historical WQO exceedances.

2.3.3 Provision D.4.b.(1)(c)(iii) – Identify Sources Contributing to NAL Exceedances

This Provision requires further investigation into sources at the highest priority outfalls with persistent flows exceeding NALs. The highest priority outfalls are listed for each jurisdiction in Table 2-3 and the analytical results collected at these outfalls are presented in Table 2-5 through Table 2-12.

These highest priority outfalls were a specific focus for IDDE investigations during the 2022-2023 monitoring year. Results from these investigations are presented in Section 2.3.7.

2.3.4 Provision D.4.b.(1)(c)(iv) – Estimate Volumes and Loads of Non-stormwater Discharges, as revised for 2019-2020 and 2020-2021 Monitoring Years

The Responsible Agencies are required to calculate or estimate the non-stormwater volumes and pollutant loads discharged from their highest priority outfalls monitored during the 2022-2023 monitoring year. In addition, the Responsible Agencies have provided an attachment with compiled historical loads and the 2022-2023 data in tables and graphs (Attachment 3C) in response to the San Diego Water Board's request "for outfalls that have been monitored for two or more years, tables and figures showing changes in pollutant loads over time from the outfall should also be prepared and reported."

2.3.4.1 Discharge Volumes from Persistently Flowing Major MS4 Outfalls

For each highest priority outfall monitored during the 2022-2023 monitoring year, the non-stormwater discharge was modeled by multiplying the total number of dry weather days for the month by an instantaneous flow rate for the outfall for that month. The number of dry weather days (i.e., greater than 72 hours since rain event of 0.1 inches or more) for each calendar month was determined using rainfall data from the County of San Diego ALERT Carlsbad station (No. 27046). Flow measurements were determined as follows:

- For months with field visits, the instantaneous flow measurement recorded for that visit was applied to the month.
- If there were multiple field visits within a given month, flow measurements were averaged and applied to the month (averages included instantaneous flow measurements and zero flow for dry/tidal/ponded conditions).
- For months where no outfall-specific data were available, the average of all instantaneous flow measurements for the outfall was applied to that month.
- Where continuous flow data were available, these data were used instead of instantaneous flow measurements.

The annual non-stormwater discharge for each highest priority outfall represents the sum of cumulative monthly flows. These non-stormwater discharge volumes should be considered rough estimates that are based on limited field observations and measurements. When feasible, instantaneous flow measurements are based on the area-velocity method, which applies measured flow depth, width, and velocity. Velocity is often measured using a float. Although multiple velocity measurements may be collected to overcome inherent variability and a roughness factor may be applied to address friction, the float method represents a rough estimation tool for velocity. Where site conditions limit accurate collection of area-velocity field measurements, non-stormwater discharge may be estimated either using a volumetric flow rate method (e.g., filling a container of known volume in a measured interval of time), or best professional judgement based on field observations.

Several Responsible Agencies collected continuous flow monitoring data at some of their highest priority storm drain outfalls (described in Section 2.3.7.3). Available continuous flow datasets were used to calculate the cumulative monthly discharge for the period when flow was monitored. For months with no continuous flow data, an average of the daily discharge values using the continuous flow dataset was applied to the days of that month.

The estimated annual non-stormwater volumes calculated for the highest priority MS4 outfalls within the Carlsbad WMA are presented by Responsible Agency in Table 2-14. The estimated annual non-stormwater discharge volumes for each major MS4 outfall are presented in Attachment 3C.

Table 2-14. 2022-2023 Dry Weather Cumulative Flow Estimates Highest Priority Major MS4 Outfalls

Responsible Agency	No. Highest Priority Outfalls	Non-Stormwater Discharge at Highest Priority Outfalls (cf)
City of Carlsbad	5	2,975,752
City of Encinitas	5	2,187,785
City of Escondido	5	13,334,464
City of Oceanside	7	3,509,984
City of San Marcos	5	4,083,322
City of Solana Beach	3*	25,261
City of Vista	5	7,177,940
County of San Diego	5*	5,178,023

cf – cubic feet
* Sites SB-1, SB-3 (Solana Beach), and MS4-CAR-007 (County of San Diego) were dry or ponded during both visits.

2.3.4.2 Pollutant Loads for Highest Priority Persistent Flow Outfalls as revised for 2019-2020 and 2020-2021 Monitoring Years

The Responsible Agencies are required to calculate or estimate the non-stormwater volumes and pollutant loads discharged from their highest priority outfalls monitored during the 2022-2023 monitoring year. In addition, the Responsible Agencies have provided an attachment with compiled historical loads and the 2022-2023 data in tables and graphs (Attachment 3C) in response to the San Diego Water Board's request "for outfalls that have been monitored for two or more years, tables and figures showing changes in pollutant loads over time from the outfall should also be prepared and reported."

The annual load represents the product of the outfall-specific annual discharge volume and the mean of the measured pollutant concentrations for the highest priority MS4 outfall if two samples were collected. When a constituent was not detected in both samples, a value of one half the reporting limit was used for the calculation.

Pollutant load estimates are reported as zero for outfalls that were ponded during field screening events. Estimates of annual non-stormwater pollutant loads are provided in Attachment 3C.

2.3.5 Provision D.4.b.(1)(c)(v) – Assessment Required Once per Permit Term

This Provision requires the Responsible Agencies to review the data collected under the dry weather MS4 outfall monitoring program in order to identify pollutant reduction progress, assess water quality improvement strategy effectiveness, and identify modifications necessary to increase effectiveness. This assessment is required once during the Permit term and has been provided in the Carlsbad WMA chapter of the RMAR, which was submitted to the San Diego Water Board in December 2017. Assessments required once during the Permit term will be conducted again after MS4 outfall discharge monitoring data are collected under the next Permit.

2.3.6 Provision D.4.b.(1)(c)(vi) – Identification of Monitoring Gaps

This provision requires the Copermittees to identify gaps in the monitoring data necessary to assess the previous provisions. No gaps have been identified in the monitoring data.

2.3.7 Illicit Discharge Detection and Elimination Program Data and Assessment

Based on results of the dry weather major storm drain outfall monitoring described above, the Responsible Agencies conducted investigations to identify sources of flow or NAL exceedances. Where illegal connections or illicit discharges (IC/IDs) are identified, additional action to address the source(s) is taken. These investigations and source elimination activities related to outfall monitoring are one part of the larger IDDE programs that each Responsible Agency has established. The goals of these IDDE programs are as follows:

- Control the contribution of pollutants to and the discharges from the storm drain system within the Responsible Agencies' jurisdictions.
- Effectively prohibit non-stormwater discharges to the storm drain system.
- Reduce the discharge of pollutants in stormwater to the maximum extent practicable.

In addition to outfall monitoring and associated routine source investigations, the IDDE programs also included the following components to prevent, identify, and eliminate IC/IDs:

- Educating the local community about prohibited discharges and how to prevent them.
- Maintaining phone, email, and/or website tools for public reporting of stormwater pollution and complaints. Investigating reports received.
- Inspecting industrial/commercial and municipal facilities, construction sites, and residential areas for compliance with stormwater pollution prevention requirements and eliminating IC/IDs where applicable.
- Maintaining the storm drain system and sewer system, which provides opportunities to identify unpermitted connections to the storm drain system, cross connections, and other potential sources of IC/IDs.
- Enhanced source investigation studies, such as continuous flow monitoring.

The IDDE components listed above are described in more detail in the jurisdictional strategy tables in Appendix D. The Responsible Agencies' Jurisdictional Runoff Management Program (JRMP) Annual Report forms, also included in Appendix D, list the total numbers of IC/IDs identified and eliminated through all IDDE program activities during the monitoring year. Additional details about source investigation and elimination specifically related to the MS4 outfall dry weather monitoring component of the IDDE program is presented below.

2.3.7.1 Provision D.4.b.(1)(b)(i) -Dry Weather MS4 Outfall Source Identification Results

Provision D.4.b.(1)(b)(i) requires the identification of known and suspected controllable sources of observed transient or persistent non-stormwater flow. The Responsible Agencies prioritized the outfalls under their jurisdictions based on field screening results and analysis of the collected outfall flow data. Field investigations and discharge reconnaissance visits looking for illicit discharges in upstream areas were then conducted to identify and eliminate sources of flow to these priority outfalls. Illicit discharges or connections contributing to non-stormwater flow may be subject to enforcement; however, many sources of non-stormwater flow can be terminated with education or technical assistance.

Table 2-15 summarizes the known transient and persistent flow sources observed by each Responsible Agency during the 2022-2023 monitoring year. It is important to note that more than one source may contribute flow to a single outfall. In cases where flow was observed at the outfall, but the source was not directly observed or otherwise definitively identified, Responsible Agencies may have identified the sources as "suspected" rather than "known." Suspected sources may require additional investigation to identify them more specifically before they can be reduced or eliminated. The counts shown in Table 2-15 are for investigations associated with dry weather monitoring activities and do not include identification of sources during inspections and audits.

The most common known or suspected source of non-stormwater flow from persistent or transient outfalls found during the Responsible Agencies' investigations was irrigation runoff. The number and type of known and suspected runoff sources is presented in Figure 2-5. Other sources included residential washing, water line breaks, or other illicit discharges/connections. Natural sources such as groundwater seepage were also identified. Rationales for groundwater designations can be found in Table 2-16 by outfall.

2.3.7.2 Provision D.4.b.(1)(b)(ii) -Elimination of Non-Stormwater Discharges

Table 2-15 presents the number of discharges eliminated through management actions as a result of visual outfall monitoring, as well as the identified sources of eliminated discharges.

Table 2-15. 2022-2023 Known or Suspected Sources of Transient or Persistent Flow Sources Observed during MS4 Outfall Monitoring and Eliminated Discharges

Responsible Agency	Known Sources		Suspected Sources		Known Groundwater	Suspected Groundwater	Number of Eliminated Discharges	Types of Eliminated Discharges
	Irrigation Runoff	Other	Irrigation Runoff	Other				
City of Carlsbad	14	4	0	0	10	1	38	Irrigation runoff, residential car washing
City of Encinitas	0	0	11	21	0	1	9	Irrigation runoff
City of Escondido	1	3	5	0	0	0	4	Irrigation runoff, wash water, water leaks
City of Oceanside	2	0	7	0	0	3	6	Irrigation runoff
City of San Marcos	0	0	0	1	5	0	0	NA
City of Solana Beach	0	0	0	0	0	0	0	NA
City of Vista	1	1	11(a)	0	0	13	2 (1 partial)	Irrigation runoff, potable water discharge
County of San Diego	0	0	4	1	0	1	0	NA

NA – not applicable
(a) Two observations are also counted as suspected groundwater.

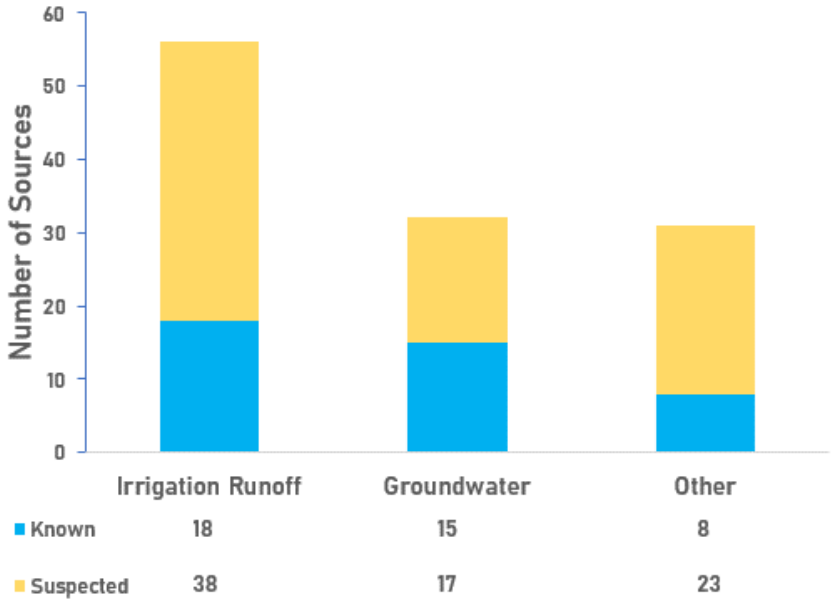

Figure 2-5. 2022-2023 Known and Suspected Runoff Sources

Table 2-16. Rationales for Groundwater Designations at Outfalls in the Carlsbad WMA

Responsible Agency	Site ID	Known or Suspected	Rationale for Identifying Groundwater as a Source
City of Carlsbad	16C-61	Known	Evaluation of recent piper diagram data and historical information indicate groundwater is the main source of flow (D-MAX, 2022).
	19C-1		
	1D-21		
	29B-94		
	55A-51		
City of Encinitas	1002SWOUTL	Suspected	Multiple lines of evidence study (Wood, 2022) indicates mixture of tap and groundwater.
	380SWOUTL		
	163SWOUTL		
	375SWOUTL		Multiple lines of evidence study (Wood, 2022) indicates flow consisted mostly of groundwater.
City of San Marcos	OUT002	Known	2022 ion data identifies the main source of flow leading to the sites (Section 2.3.7.3.2)
	OUT053		
	OUT10236		
City of Vista	AH-02	Suspected	FY21-22 continuous flow study at outfall indicates baseflow.
	AH-05	Suspected	No surface flow was observed in the upstream area during investigation.
	AHS-07	Suspected	No surface flow was observed in the upstream area during investigation.
	AHS-08	Suspected	Open channel where outfall discharges is ponded, no flowing water observed from pipe.

Table 2-16. Rationales for Groundwater Designations at Outfalls in the Carlsbad WMA

Responsible Agency	Site ID	Known or Suspected	Rationale for Identifying Groundwater as a Source
	AH-09-1	Suspected	No surface flow was observed in upstream area during site visits.
	BV-04	Suspected	Followed drain system upstream and found no surface flow.
	BV-05	Suspected	No surface flow was observed in upstream area during site visits.
	BV-12	Suspected	Groundwater seepage was observed. No surface flow was observed in the upstream area during site visits. Per previous upstream investigations, source appears likely to be from groundwater intrusion into the MS4.
	BV-16	Suspected	No surface flow was observed in the upstream area during site visits. Per previous upstream investigations, source appears likely to be from groundwater intrusion into the MS4.
County of San Diego	MS4-CAR-069	Suspected	Seeping water was observed with no evidence of surface flow.

2.3.7.3 Additional Source Investigation Activities

The Responsible Agencies conducted upstream investigations if flow was observed at a HPPF outfall. Table 2-17 details sources identified during these investigations. The Responsible Agencies have also initiated additional studies to identify and eliminate controllable sources of non-stormwater flows including continuous flow monitoring studies, monitoring equipment studies and isotope studies to aid in identifying flow sources. These additional studies are summarized in the following sections by Responsible Agency.

Table 2-17. Highest Priority Persistent Flow Outfall Source Elimination

Jurisdiction	Highest Priority Site ID	Source Investigation Performed?	Type	Known or Suspected Runoff Source(s)	Actions Taken or Planned
County of San Diego	MS4-CAR-007	No (Dry)	N/A	N/A	N/A
County of San Diego	MS4-CAR-059	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
County of San Diego	MS4-CAR-069	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
County of San Diego	MS4-CAR-070	Yes	Unknown	Unknown	Continue monitoring, take follow-up action if sources other than groundwater are identified.
County of San Diego	MS4-CAR-072	Yes	Unknown	Unknown	Continue monitoring, take follow-up action if sources other than groundwater are identified.

Table 2-17. Highest Priority Persistent Flow Outfall Source Elimination

Jurisdiction	Highest Priority Site ID	Source Investigation Performed?	Type	Known or Suspected Runoff Source(s)	Actions Taken or Planned
City of Carlsbad	16C-61	Yes	NPDES Allowable Discharge	Groundwater	Upstream investigation, continue monitoring and source identification.
City of Carlsbad	1D-21	Yes	NPDES Allowable Discharge & Unpermitted Discharge	Groundwater & Irrigation runoff	Upstream investigation, continue monitoring and source identification.
City of Carlsbad	38D-13	Yes	NPDES Allowable Discharge & Unknown	Groundwater & Unknown	Upstream investigation, continue monitoring and source identification.
City of Carlsbad	58A-73	Yes	NPDES Allowable Discharge & Unknown	Groundwater & Unknown	Upstream investigation, continue monitoring and source identification.
City of Carlsbad	63A-49	Yes	NPDES Allowable Discharge & Unknown	Groundwater & Unknown	Upstream investigation, continue monitoring and source identification.
City of Encinitas	EN-1002SWOUTL	Yes	NPDES Allowable Discharge	Foundation Drains	Upstream investigation, continue monitoring and source identification.
City of Encinitas	EN-163SWOUTL	Yes	NPDES Allowable Discharge	Foundation Drains	Upstream investigation, continue monitoring and source identification.
City of Encinitas	EN-172SWOUTL	Yes	Unpermitted Discharge	Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Encinitas	EN-248SWOUTL	Yes	Unpermitted Discharge	Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Encinitas	EN-380SWOUTL	Yes	Unpermitted Discharge	Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Escondido	ESC_108	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
City of Escondido	ESC_115	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
City of Escondido	ESC_121	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
City of Escondido	ESC_128	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
City of Escondido	ESC_146	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.

Table 2-17. Highest Priority Persistent Flow Outfall Source Elimination

Jurisdiction	Highest Priority Site ID	Source Investigation Performed?	Type	Known or Suspected Runoff Source(s)	Actions Taken or Planned
City of Oceanside	BV-028	Yes	Unpermitted Discharge	Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Oceanside	LA-041	Yes	Unpermitted Discharge	Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Oceanside	LA-048	Yes	Unpermitted Discharge	Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Oceanside	LA-051	Yes	Unpermitted Discharge	Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Oceanside	LA-053	Yes	Unpermitted Discharge	Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Oceanside	AH-007	Yes	NPDES Allowable Discharge & Unpermitted Discharge	Groundwater and Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Oceanside	AH-008	Yes	NPDES Allowable Discharge & Unpermitted Discharge	Groundwater and Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of San Marcos	INL11196	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
City of San Marcos	OUT026	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
City of San Marcos	OUT053	Yes	NPDES Allowable Discharge	Groundwater	Upstream investigation, continue monitoring and source identification.
City of San Marcos	OUT10236-	Yes	NPDES Allowable Discharge	Groundwater	Upstream investigation, continue monitoring and source identification.
City of San Marcos	OUT10330	Yes	Unknown & Unpermitted Discharge	Unknown & Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Solana Beach	SB-1	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
City of Solana Beach	SB-9	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.

Table 2-17. Highest Priority Persistent Flow Outfall Source Elimination

Jurisdiction	Highest Priority Site ID	Source Investigation Performed?	Type	Known or Suspected Runoff Source(s)	Actions Taken or Planned
City of Vista	AH-02	Yes	NPDES Allowable Discharge & Unpermitted Discharge	Groundwater and Irrigation Runoff	Upstream investigation, continue monitoring and source identification.
City of Vista	BV-01	Yes	Unknown	Unknown	Upstream investigation, continue monitoring and source identification.
City of Vista	BV-05	Yes	NPDES Allowable Discharge	Groundwater	Continue monitoring, take follow-up action if sources other than groundwater are identified.
City of Vista	BV-12	Yes	NPDES Allowable Discharge	Groundwater	Continue monitoring, take follow-up action if sources other than groundwater are identified.
City of Vista	BV-16	Yes	NPDES Allowable Discharge	Groundwater	N/A Continue monitoring, take follow-up action if sources other than groundwater are identified.

N/A – not applicable; NPDES – National Pollutant Discharge Elimination System

2.3.7.3.1 County of San Diego

The County of San Diego has been conducting dry season continuous flow monitoring studies within the Carlsbad WMA since 2016. During the 2023 monitoring year, the County monitored two HPPF outfalls, MS4-CAR-070 and MS4-CAR-072, and three additional upstream outfalls MS4-CAR-072C, MS4-CAR-072H, and MS4-CAR-072Q. The County's other HPPF outfalls, MS4-CAR-069 and MS4-CAR-059, were not monitored from 2019-2023 due to logistical and structural challenges. All sites will be revisited and considered in the prioritization process prior to the 2024 monitoring year.

During the 2023 monitoring year, 33.23 inches of total rainfall was recorded. This is considerably more rainfall than in previous years, with a total of 8.40 inches recorded for the 2022 monitoring year and 26.87 inches recorded for the 2021 monitoring year. To be consistent with previous analyses, continuous flow data from 2023 was compared to 2017 to evaluate progress towards interim dry weather goals. In 2023, the combined mean daily dry weather discharge rate from MS4-CAR-070 and MS4-CAR-072 decreased by 37% when compared to 2017. Table 2-17 provides an overview of dry weather continuous flow results from 2017-2023. Flow data are provided in Attachment 3B-3.

The highest flows observed during seven years of monitoring were attributable to MS4-CAR-072 (Table 2-17). Stable isotope analysis results were inconclusive at this site for evaluating the source of the water discharged. Geochemistry analysis showed that flow from the main outfall, MS4-CAR-072, consisted predominantly of groundwater mixed with some tap water. The golf course and several of the Homeowners Associations (HOAs) in the drainage area irrigate with water from groundwater wells. A flow pattern was noted on the hydrograph with peaks of flow recorded in late evenings or early morning hours, which is typical of an over-irrigation signature.

To further investigate the relative contributions of various potential sources of flow, additional locations upstream of MS4-CAR-072 (MS4-CAR-072C, MS4-CAR-072H, and MS4-CAR-072Q) were outfitted in 2023 with weirs and continuous flow monitoring equipment. The location MS4-CAR-072C drains several Homeowners Association (HOA) neighborhoods. The outfall locations MS4-CAR-072H and MS4-CAR-072Q were installed to specifically measure contributions from the golf course and adjacent neighborhoods.

For the 2023 dry season, flow from MS4-CAR-072C, MS4-CAR-072H and MS4-CAR-072Q accounted for approximately 104% of the flow. Previous year's results from outfall locations MS4-CAR-072H and MS4-CAR-072Q indicate that approximately 40% of flow at the main outfall is attributable to these sites, with less than 10% from the residential areas upstream of the golf course. For the 2023 dry season, flow from these two locations accounted for approximately 44% of the total flow. The location MS4-CAR-072C was designed to measure contributions from the private residential storm drain system located west of MS4-CAR-072. Flow from this location accounted for approximately 60% of the flow. The location may be capturing flow from the residences and main outfall network, but the information suggests a significant contribution of flow is coming from this private residential system.

Table 2-18. 2016-2023 Dry Season Continuous Flow Results – County of San Diego

Outfall	Hydrologic Area	Mean Flow (gal/day)								% Difference					
		2016	2017	2018	2019	2020	2021	2022	2023	(2017-2018)	(2017-2019)	(2017-2020)	(2017-2021)	(2017-2022)[1]	(2017-2023)
MS4-CAR-007	Escondido Creek	-	-	-	-	230	-	-	-						
MS4-CAR-059		-	-	313	-	6,379	18.7	-	-						
MS4-CAR-059G		-	-	-	-	2,966	-	-	-						
MS4-CAR-070	San Marcos	1,472	2,240	1,594	2,760	2,822	1,067	-	1,982	-29%	23%	26%	-52%	-	-12%
MS4-CAR-070E		-	-	-	-	2,131	437	-							
MS4-CAR-072		4,264	7,320	4,245	3,059	6,984	2,816	-	4,063	-42%	-58%	-5%	-62%	-	-44%
MS4-CAR-072C		-	-	-	-	7,142	1,887	-	2,419						
MS4-CAR-072O		-	-	259	185	648	-	-	-						
MS4-CAR-072H		-	-	-	-	1,181	697	1,327	1,009						
MS4-CAR-072Q		-	-	-	-	518	518	-	778						
Mean of San Marcos HA Sites		2,868	4,780	2,920	2,909	4,903	1,942	1,327[1]	6,045	-39%	-39%	3%	-59%		-37%

1 Only one site was monitored in 2022, MS4-CAR_072H. This site was not monitored in 2017; therefore the percent difference and mean could not be calculated.

From 2018-2023, the County prioritized the outfall drainage area of MS4-CAR-072 for targeted inspections and outreach. Overall, high rainfall years result in higher mean daily discharges and suggest that base flows may be augmented by groundwater intrusion in high rainfall years. Nevertheless, the hydrograph supports an overirrigation pattern of peak flows in the late evening and early morning hours. Increased inspection and outreach activities have continued to reduce dry weather flows at MS4-CAR-072. Efforts include reviewing historical continuous flow hydrograph data to target residential inspections during late night/early morning hours to align with observed peaks in flow, working with HOAs to encourage sustainable landscaping through rebates and incentives, and providing outreach materials to individual residents throughout the drainage area. In addition, the County's Rebate and Incentive Program successfully worked with the Fairways HOA (located partially within the MS4-CAR-072Q drainage) to complete a smart controller retrofit of their irrigation system. The County will continue to prioritize this outfall drainage area with a renewed focus on locations contributing significant flow to the main outfall.

The list of County Outreach Focus Sites for 2022-2023 within the Carlsbad Watershed included six priority outfalls (MS4-CAR-007, MS4-CAR-059, MS4-CAR-068, MS4-CAR-069, MS4-CAR-070, and MS4-CAR-072) and two HSAs (CAR RMA 904.31 and CAR RMA 904.52). During the 2022-2023 monitoring year, 54 surveys were conducted in drainage areas contributing to these priority outfalls and HSAs. A total of 10 over-irrigation PGAs were recorded in 2022-2023 (Table 2-17). An initial outreach letter, failed inspection report, and educational flyer were sent to each responsible party (property owner). Follow-up inspections were conducted the following month after the initial outreach package was mailed, on the same day and time of the week that the initial PGA was observed. 7 of the 10 PGAs observed (70 percent) were resolved at the time of the first follow-up. The remaining 3 PGAs were resolved at the time of a second follow-up after contact was made with the property owner following the initial follow-up. All 10 issues observed were corrected and resulted in full compliance.

San Marcos Hydrologic Area (HA)

One of the pathways to demonstrate compliance with the Carlsbad WMA WQIP dry weather interim goal in the San Marcos hydrologic area (HA) for 2023 is to:

> *Effectively eliminate 20% of dry weather flow from identified outfall(s),*

Based on the County's continuous flow data measurements at the two measured highest priority outfalls with persistent non-stormwater flows in the San Marcos HA, a 37% decrease in non-stormwater flows has been observed in comparison to 2017 dry season. At this time the decrease in flow observed achieves the interim WQIP goal of 20%, due in 2023. The County will continue to address potential sources of non-stormwater flows in its highest priority outfall drainage areas in the San Marcos HA to ensure that the flow reduction is maintained, and future goals are achieved. Data gathered from the additional upstream outfalls will allow the County to target the specific areas of high flow. The County will continue targeted outreach and inspections to make progress toward future San Marcos HA dry weather goals.

2.3.7.3.2 City of San Marcos

The City of San Marcos completed continuous flow monitoring at several locations for each of the past several summers as described in the City of San Marcos MS4 Outfall Monitoring and Special

Study Implementation Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) (Mikhail Ogawa Engineering (MOE, 2018). The special study described in that monitoring plan concluded in summer 2021.

In summer 2023, the City of San Marcos completed additional dry season monitoring consistent with the Upper San Marcos Creek Preliminary Monitoring Plan (Attachment 3A). This included continuous flow monitoring at two selected outfalls (Table 3-4). Flow data are provided in Attachment 3B-3.

Table 2-19. USMC HA Continuous Flow Monitoring Outfalls – City of San Marcos

Location Type	Station Name	Years with Continuous Monitoring
Highest priority persistently flowing outfalls	OUT002	2016-2017, 2017-2018, 2018-2019, 2019-2020, 2020-2021, 2021-2022
	OUT023[1]	2016-2017, 2017-2018, 2018-2019
	OUT053	2016-2017, 2017-2018, 2018-2019, 2019-2020, 2020-2021, 2021-2022, 2022-2023
	OUT10237[2]	2016-2017, 2017-2018, 2018-2019
	OUT10330[1]	2016-2017, 2017-2018, 2018-2019
Alternative sites	INL086[2,3]	2019-2020, 2020-2021
	CH043C[3]	2019-2020, 2020-2021, 2021-2022, 2022-2023

Bold text indicates site was monitored during the 2021-2022 monitoring year.
[1] OUT023 and OUT10330 were not monitored in monitoring years 2019-2020 and 2020-2021 due to change of study focus to address commercial and industrial inputs.
[2] In 2022 it was determined that OUT10237 and INL086 were located in the receiving water. These sites were removed from the MS4 outfall inventory.
[3] Alternative sites for OUT10237.

Average daily dry weather flows monitored during the summer months (July through September) are presented by year in Table 3-5. To ensure accurate representation of dry weather flows, wet weather days (rainfall >0.1 inch) and the following 72 hours were removed from consideration. The list of monitored outfalls was changed during the 2019-2020 monitoring year to refine the study to specific commercial/industrial areas.

Table 2-20. City of San Marcos Dry Season Continuous Flow Results

Outfall	Mean Flow (gallons/day)						
	2017	2018	2019	2020	2021	2022	2023
OUT002	18,919	14,678	11,715	12,074	13,762	16,808*	-
OUT023	10,685	6,724	5,083	-	-	-	-
OUT053	18,785	15,230	13,304	14,800	16,618	15,280	17,523
INL086	-	-	-	20,058	18,842	-	-
CH043C	-	-	-	10,377	10,296	9,037	6,267
OUT10237	72,003	40,085	36,758	-	-	-	-
OUT10330	35,821	27,190	26,110	-	-	-	-

* Visual observations indicate that only a portion of measured flow reached the receiving water, though the exact amount is unknown.

2.3.7.3.3 City of Encinitas

In 2021 the City of Encinitas conducted a multiple lines of evidence (MLOE) assessment at five MS4 outfalls to investigate the presence and source(s) of flow observed during dry weather conditions. The assessment used flow classification, stable isotope end-member mixture analysis, geochemistry analysis (Piper diagram), and source indicator analyses. Geochemistry and indicator analyses were mostly inconclusive in 2021, so only flow and stable isotopes were analyzed in 2022.

In 2022, the City conducted dry weather monitoring at five HPPF outfalls, four of which were monitored in 2021. Results from flow and stable isotope end-member mixture analyses were used to identify flow sources and quantify tap vs. groundwater, and where possible, tap vs. reclaimed water. Results of the study are summarized in Table 2-22 and the study report is provided as Attachment 8 to the 2022-2023 Carlsbad WMA WQIP Annual Report.

Table 2-21. City of Encinitas HPPF Additional Flow Source Investigation Results

Flow Source	Site	Results (%TAP±STD)
Mainly Tap Water (>80% tap)	0	0
Mixed Tap/Reclaimed (20-80% tap)	306SWOUTL	61± 21%
Mixed Tap/Groundwater (20-80% tap)	1002SWOUTL	43 ± 4%
	380SWOUTL[1]	
	163SWOUTL	52 ± 15%
	172SWOUTL	50 ± 16%
Mainly Groundwater (<20%)	0	0

[1] 380SWOUTL could not be analyzed for tap in 2022. The assessment of mixed tap/groundwater was based off the flow results only in 2022.

2.3.7.3.4 City of Carlsbad

During the 2022-2023 monitoring year, the City of Carlsbad conducted additional analysis of laboratory samples and additional desktop research to further refine flow sources at the City's HPPF outfalls.

The study included researching depth to groundwater via the State Water Resources Control Board's GeoTracker website and geotechnical reports from projects within the drainage area of each outfall. Shallow groundwater may contribute flow to the MS4 by infiltrating pipe joints or other means. Geotechnical reports noting shallow groundwater were identified in areas upstream of three of the five HPPF outfalls (D-Max 2022).

The second line of evidence pursued was analysis of samples for major-ions and comparison using Piper diagrams to the ion composition of known water sources. Results of the study are provided in Table 2-23, and the study report is provided as Attachment 6 to the 2022-2023 Carlsbad WMA WQIP Annual Report.

Table 2-22. City of Carlsbad HPPF Additional Flow Source Investigation Results

Outfall	Groundwater	Irrigation Runoff	Unknown/ Inconclusive	Notes
Site 1D-21	X	X	X	Low flow from curb cores identified during the November investigation. Ion data suggests groundwater is the main contributing source.
Site 16C-61	X	X	X	Mix of sources including groundwater, irrigation runoff, and other transient discharges.
Site 19C-1	X	X		Irrigation runoff observed during the June investigation. Ion data suggests groundwater is the main contributing source.
Site 29B-94	X	X		Transient contributions of irrigation runoff noted, and one instance of power washing was observed this year. Ion data suggests groundwater is the main contributing source.
Site 55A-51	X		X	Transient contributions from residential curb cores. Ion data suggests groundwater is the main contributing source.
Site 38D-13	X		X	Transient contribution from residential curb cores. Ion data suggests groundwater is the main contributing source at the outfall.
Site 58A-73	X		X	Transient contribution from residential curb cores. Ion data suggests groundwater is the main contributing source at the outfall.
Site 63A	X		X	Transient contribution from residential curb cores. Ion data suggests groundwater is the main contributing source at the outfall.

3 WET WEATHER OUTFALL MONITORING

3.1 Wet Weather Outfall Monitoring Locations

The Responsible Agencies in the Carlsbad WMA monitored eight MS4 outfall locations during the 2021-2022 monitoring year. In accordance with the Carlsbad WMA MS4 Outfall Monitoring Plan, each Responsible Agency monitored one location selected from the inventory of major outfalls developed pursuant to Permit Provision D.2.a.(3)(a)(i).

In selecting the locations for wet weather MS4 outfall discharge monitoring, attempts were made to identify major MS4 outfalls draining single land uses. However, the inventory of major MS4 outfalls for each jurisdiction in the WMA is limited. Outfall selection is further constrained by factors such as physical accessibility, security, safety, and the ability to accurately measure flow at the location. Wet Weather MS4 sampling locations are identified in Table 3-1 and Figure 3-1.

This was the eighth year of monitoring under the Carlsbad WMA MS4 Outfall Monitoring Plan which began in the 2015-2016 monitoring year. The City of Escondido changed their designated wet weather outfall for the 2019-2020 monitoring year due to construction at the previous outfall location, and again in the 2020-2021 due to reclassification of the second monitored outfall.

Table 3-1. 2022-2023 MS4 Outfall Monitoring Locations

Site ID	Jurisdictional Site ID	Responsible Agency	HSA Name/ No.	Latitude	Longitude
MS4-CAR-1	16C-61*	City of Carlsbad	Los Manos / 904.31	33.1460	-117.3380
MS4-CAR-2	CBS-10 (75SWOUTL)	City of Encinitas	San Elijo / 904.61	33.0181	-117.2817
MS4-CAR-3	ESC_108**	City of Escondido	Escondido / 904.62	33.14789	-117.03923
MS4-CAR-4	LA-048*	City of Oceanside	Loma Alta / 904.1	33.2111	-117.2706
MS4-CAR-5	B-02	City of San Marcos	Richland / 904.52	33.146	-117.16024
MS4-CAR-6	North Rios (NRIO)	City of Solana Beach	San Elijo / 904.61	33.0039	-117.2721
MS4-CAR-7	BV-1	City of Vista	El Salto / 904.21	33.1827	-117.2839
MS4-CAR-8	MS4-CAR-007*	County of San Diego	San Elijo / 904.61	33.0329	-117.2352

*Monitoring location added in 2015-2016 monitoring year.
** Monitoring location added in 2020-2021 monitoring year.

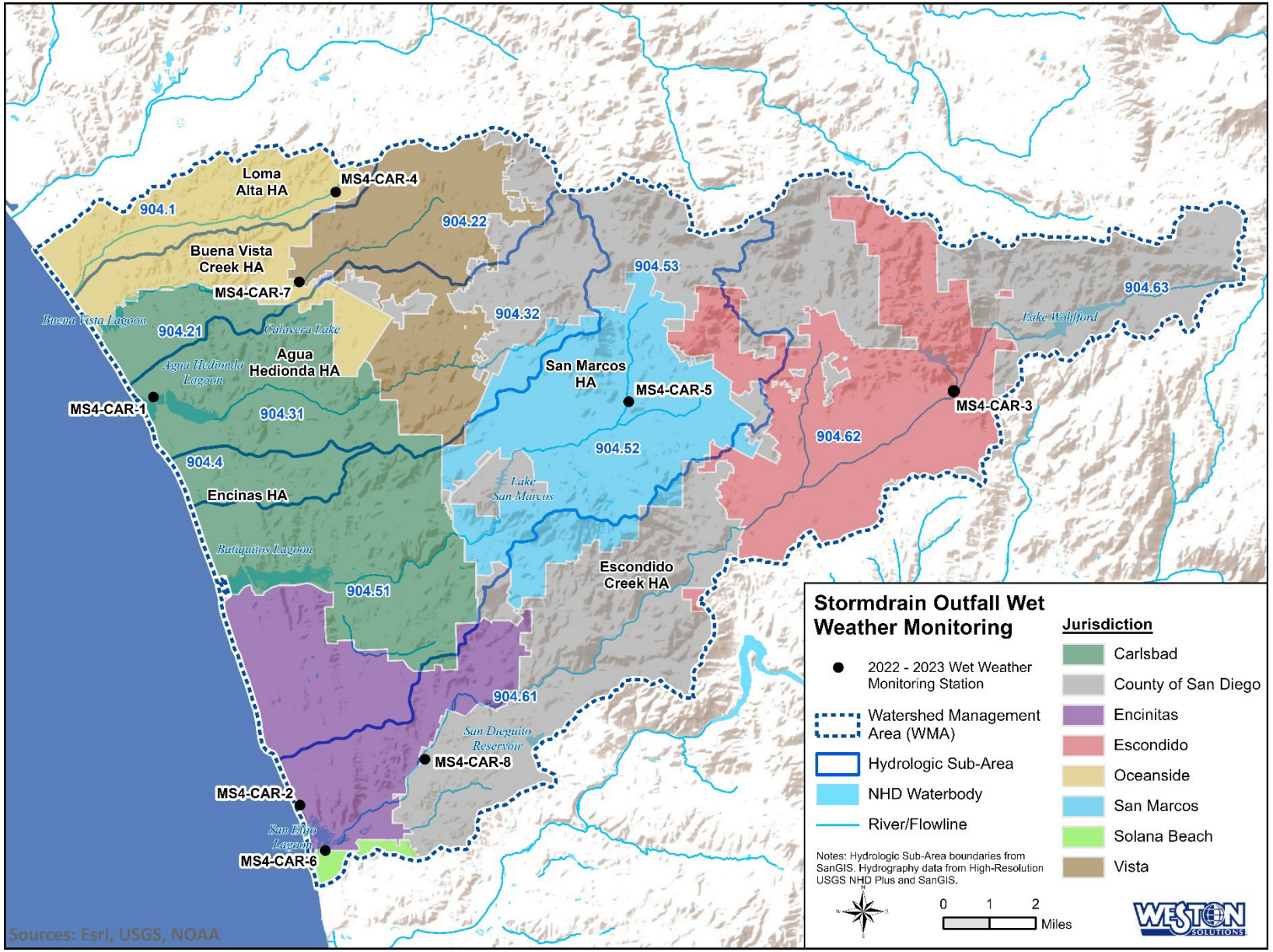

Figure 3-1. 2022-2023 Wet Weather MS4 Outfall Monitoring Locations

3.1.1 Precipitation

The 2022-2023 monitoring year rainfall total across the Carlsbad watershed was greater than the previous four monitoring years. According to data collected at the San Diego County ALERT stations in Encinitas, Escondido, Oceanside, and Carlsbad, the 2022-2023 average rainfall across the Carlsbad WMA was 25.42 inches, compared to 8.07 inches in 2021-2022, 6.48 inches in the 2020-2021 monitoring year, 21.11 inches in the 2019-2020 monitoring year, and 16.65 inches in the 2018-2019 monitoring year. Annual rainfall for the previous five monitoring years at four San Diego County ALERT stations is provided in Figure 3-2.

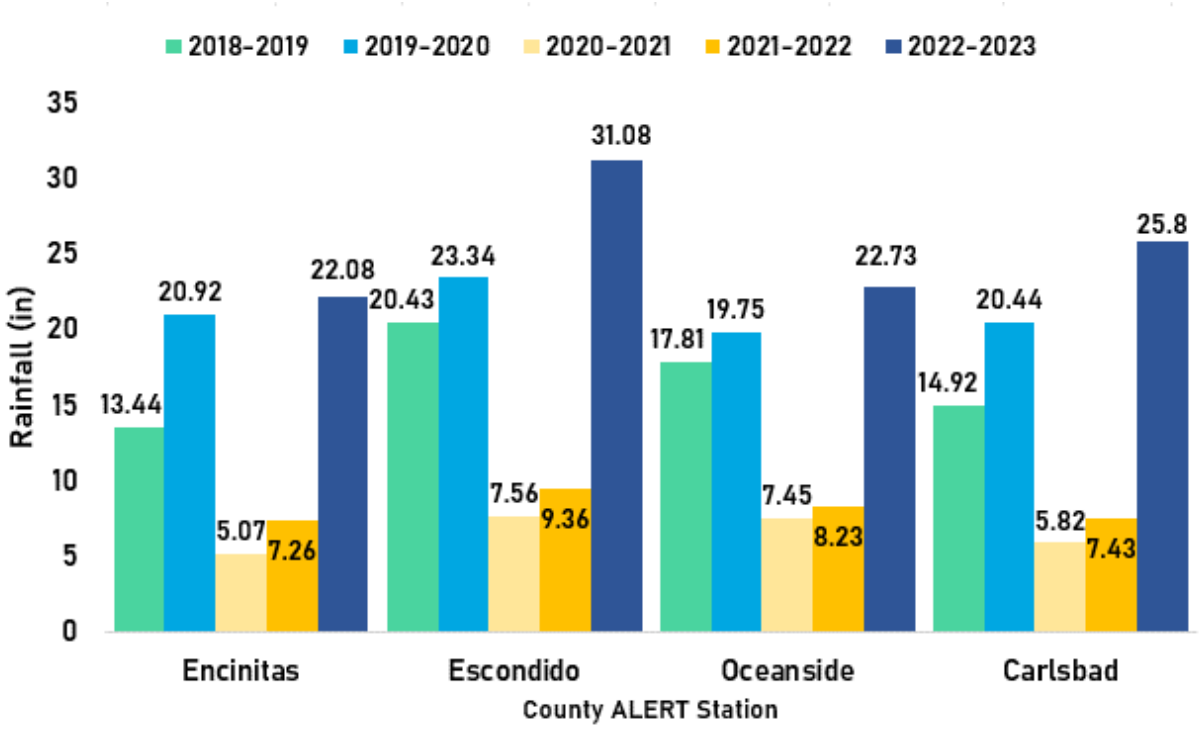

Figure 3-2. Annual Rainfall in the Carlsbad WMA (Oct 1 – Sept 30)

3.2 Wet Weather Outfall Monitoring Event Data

Wet weather monitoring events for the 2022-2023 monitoring year are summarized in Table 3-2. The eight outfalls were monitored across four storm events. Measured on site precipitation for the first event on November 8, 2022 ranged from 1.4 to 1.65 in over 13 to 14 hours. Two outfalls were monitored during this event, MS4-CAR-3 (ESC-108) and MS4-CAR-5 (B-02). Highest peak flows and event volumes were observed at MS4-CAR-5. Two outfalls were also monitored during the second monitored wet weather event on December 11, 2022. Measured on-site precipitation ranged from 0.87 in at MS4-CAR-7 (BV-1) to 1.1 in at MS4-CAR-1 (16C-1). MS4-CAR-4 (LA-048) was the only station monitored on December 28, 2022 which was the smallest monitored event this season with 0.59 in of precipitation. The remaining three stations were monitored during the fourth monitored event on January 15, 2023. Precipitation for this event was approximately 1.5 in.

Wet weather MS4 outfall flow data are presented in Attachment 3D-1, and a QA/QC report is provided as Attachment 3D-2. Hydrographs for each monitored event are provided in Attachment 3D-1.

Table 3-2. 2022-2023 Summary of MS4 Outfall Monitoring Events

Date	Outfall Name/ Jurisdictional Identifier	Rainfall (in)	Rain Gauge	Duration (hours)	Intensity Average (in/hour)	Antecedent Dry Days*	Event Volume (cf)	Peak Flow (cfs)
11/8/22	MS4-CAR-3/ ESC_108	1.4	on-site	13.3	0.39	14	15,524	5.18
11/8/22	MS4-CAR-5/ B-02	1.65	on-site	14.0	0.49	24	376,622	52.71
12/11/22	MS4-CAR-1/ 16C-61	1.1	on-site	8.3	1.64	28	125,334	23.75
12/11/22	MS4-CAR-7/ BV-1	0.87	on-site	8.9	0.55	28	59,902	5.56
12/28/22	MS4-CAR-4/ LA-048	0.59	on-site	9.0	0.08	11	54,907	6.24
1/15/23	MS4-CAR-2/ CBS-10	1.50	on-site	15.2	0.21	3	72,360	9.83
1/15/23	MS4-CAR-6/ NRIO	1.52	on-site	13.0	0.43	3	42,978	9.36
1/15/23	MS4-CAR-8/ MS4-CAR-007	1.50	on-site	9.2	0.37	3	68,862	6.05

* Based on closest ALERT rain gauge. Carlsbad rain gauge used for MS4-CAR-1; Encinitas for MS4-CAR-2, 6, 8; Escondido for MS4-CAR-3; Oceanside for MS4-CAR-4 and 7; San Marcos for MS4-CAR-5.

3.3 Wet Weather Outfall Monitoring Event Analytical Results

Wet weather monitoring was conducted in accordance with the Carlsbad Watershed MS4 Outfall Monitoring Plan. Field measurements of pH, temperature, conductivity, dissolved oxygen, and turbidity were taken during each event. Grab samples were collected at each outfall and were analyzed for hardness and indicator bacteria. Time-weighted composite samples were collected and analyzed for constituents identified in Table D-4 of the MS4 Monitoring Plan. Monitored constituents included constituents with stormwater action levels (SALs) in the Permit, those identified as contributing to the HPWQC in the HA, and those included on the 303(d) list of water quality impairments or included in total maximum daily loads (TMDLs). Observational and hydrologic data were also recorded, and a receiving water sample was collected and analyzed for hardness.

Analytical results for samples collected at the eight wet weather MS4 outfall monitoring locations are provided in Table 3-3. Bacteria results were compared to the statistical threshold values (STVs) for *E. coli* or *Enterococcus* per the Bacteria Provisions (State Water Board, 2018) (incorporated into the San Diego Region Basin Plan on September 1, 2021). All eight samples were above the applicable STV. Results for turbidity, nitrate + nitrite, total phosphorus, total cadmium, total copper, total lead, and total zinc were compared to SALs. The sample collected MS4-CAR-3 (ESC-108) during the November 8, 2023 storm event was above the SAL for nitrate + nitrite. The sample collected at MS4-

CAR-8 (CAR-007) collected on January 14, 2023 was above the SAL for turbidity, nitrate + nitrite, and total phosphorous. No other samples were above the SAL/WQO.

MS4 outfall wet weather monitoring laboratory and field data will be uploaded to the CEDEN database and are also provided in Attachment 3H.

Table 3-3. 2022-2023 Wet Weather MS4 Storm Drain Monitoring Data

Analyte	Unit	SAL/ WQO	MS4-CAR-1	MS4-CAR-2	MS4-CAR-3	MS4-CAR-4	MS4-CAR-5	MS4-CAR-6	MS4-CAR-7	MS4-CAR-8
			16C-61	CBS-10 (75SWOUTL)	ESC-108	LA-048	B-02	North Rios (NRIO)	BV-1	CAR-007
			12/11/2022	1/14/2023-1/15/2023	11/8/2022-11/9/2022	12/28/2022	11/8/2022	1/14/2023-1/15/2023	12/11/2022	1/14/2023-1/15/2023
Physical Chemistry										
Dissolved Oxygen	mg/L		9.60	10.01	9.22	9.97	10.05	10.10	10.06	10.00
pH	pH units		7.75	8.50	7.87	7.65	7.69	7.54	7.75	7.64
Salinity	ppt		0.05	0.36	0.05	0.08	0.06	0.04	1.19	0.09
Specific Conductivity	µS/cm		116	742	110.9	161	126	82	2310	157
Temperature	Celsius		14.95	14.86	16.84	15.00	13.84	15.19	14.11	15.21
Turbidity	NTU/FNU	126	16.52	50.12	23.85	2.80	34.40	114.10	47.31	**201.02**
Fecal Indicator Bacteria										
E. coli	MPN/100 mL	320	-	-	**13,000**	**3,700**	**17,000**	-	**13,000**	**6,900**
Enterococcus	MPN/100 mL	110	**21,000**	**24,000**	110,000	22,000	35,000	**13,000**	92,000	18,000
Fecal Coliform	MPN/100 mL		9,200	2,600	54,000	16,000	22,000	2,600	9,200	4,600
Total Coliform	MPN/100 mL		54,000	200,000	350,000	92,000	240,000	160,000	54,000	240,000
General Chemistry										
Sulfate	mg/L		-	-	96	-	-	-	-	240
Total Dissolved Solids	mg/L		-	340	330	-	-	420	2500	830
Total Hardness	mg/L		40.1	97.7	144	135	91.4	138	721	277
Total Suspended Solids	mg/L		-	150	49	-	-	92	74	790
Nutrients										
Ammonia as N	mg/L		-	0.075J	0.25	0.25	0.25	0.13	0.23	0.42
Nitrate + Nitrite as N	mg/L	2.6	0.80	1.70	**3.90**	1.50	1.70	1.55	0.56	**4.12**
Nitrate as N	mg/L		0.8	1.7	3.9	1.5	1.7	1.5	0.56	4.0
Nitrite as N	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	0.047J	<0.10	0.12
Total Kjeldahl Nitrogen	mg/L		1.9	1.7	1.1	1.3	1.7	1.7	1.5	5.6
Total Nitrogen	mg/L		2.70	3.40	5.00	2.80	3.40	3.25	2.06	9.72
Total Phosphorus	mg/L	1.46	0.34	0.78	0.43	0.37	0.59	0.55	0.37	**1.9**
Total Metals										
Cadmium	µg/L	3	0.082J	0.15J	0.093J	0.11J	0.096J	0.096J	0.083J	0.26
Copper	µg/L	127	22	27	7.7	8.2	21	27	12	43
Lead	µg/L	250	5.4	9.2	1.4	1.2	4.7	4.6	4.2	14
Manganese	µg/L		-	-	55	-	-	-	-	560
Selenium	µg/L		-	-	0.13J	0.38J	0.27J	-	0.34J	1.9
Zinc	µg/L	976	87	74	40	42	65	97	61	140
Dissolved Metals										
Manganese	µg/L		-	-	1.6	-	-	-	-	4.2
Selenium	µg/L		-	-	0.11J	0.32J	0.18J	-	0.33J	1.8
Chlorinated Pesticides										
DDD(o,p')	µg/L		-	-	<0.025*	-	<0.05*	-	-	<0.025*
DDD(p,p')	µg/L		-	-	<0.025*	-	<0.05*	-	-	<0.025*
DDE(o,p')	µg/L		-	-	<0.025*	-	<0.05	-	-	<0.025*
DDE(p,p')	µg/L		-	-	<0.025*	-	<0.05	-	-	<0.025*
DDT(o,p')	µg/L		-	-	<0.025	-	<0.05*	-	-	<0.025
DDT(p,p')	µg/L		-	-	<0.025	-	<0.05*	-	-	<0.025

Table 3-3. 2022-2023 Wet Weather MS4 Storm Drain Monitoring Data

Analyte	Unit	SAL/ WQO	MS4-CAR-1	MS4-CAR-2	MS4-CAR-3	MS4-CAR-4	MS4-CAR-5	MS4-CAR-6	MS4-CAR-7	MS4-CAR-8
			16C-61	CBS-10 (75SWOUTL)	ESC-108	LA-048	B-02	North Rios (NRIO)	BV-1	CAR-007
			12/11/2022	1/14/2023-1/15/2023	11/8/2022-11/9/2022	12/28/2022	11/8/2022	1/14/2023-1/15/2023	12/11/2022	1/14/2023-1/15/2023
Organophosphorus Pesticides										
Malathion	µg/L		-	-	0.16	-	-	-	-	0.013J
Synthetic Pyrethroids										
Bifenthrin	µg/L		-	-	0.0106	0.229	-	-	0.0423	0.037

SAL – stormwater action level, WQO – water quality objective, mg/L – milligrams per liter, µg/L – micrograms per liter, MPN – most probable number, mL – milliliter, FNU – formazin nephelometric unit, NTU – nephelometric turbidity unit

Bold values are above the applicable stormwater action level or water quality objective.

J – analyte was detected above the method detection limit but below the reporting limit, value is estimated.

- Not monitored, not required under 2019 Carlsbad WMA MS4 Monitoring Program

* Not required under the Carlsbad WMA MS4 Monitoring Program

< - Result not detected

3.4 Wet Weather Outfall Assessments

Provision D.4.b.(2)(c) of the Permit requires the Responsible Agencies to conduct several assessments of the wet weather MS4 outfall data. These assessments are summarized in Table 3-4.

On November 1, 2019, the San Diego Water Board issued a letter in regard to their review of the 2017-2018 CAR WMA WQIP Annual Report. Attachment 1 9.a. of the letter included a requirement to review the methodology and land use values used to calculate pollutant loadings. The Responsible Agencies are working cooperatively toward modifying the approach and requested regulatory relief while the revised approach is being developed. The San Diego Water Board granted the Responsible Agencies' request for regulatory relief specific to Provisions D.4.b(1)(c)(iv) and D.4.b(2)(b)(i) (Table 3-4) via email correspondence on August 19, 2020. The San Diego Water Board indicated that the Copermittees should:

1) Submit the raw monitoring data collected to calculate pollutant loads and perform pollutant load calculations as required by provision D.4.b. of the Permit and;
2) Assess the data as required pursuant to provision D.4.b.(1)(c)(iv) and D.4.b(2)(c) by evaluating the pollutant loads from each outfall, i.e., only calculating the pollutant loads at the outfall level and not using the outfall data to extend the load calculation at the watershed scale. For those outfalls that have been monitored for two or more years, tables and figures showing changes in pollutant loads over time from the outfall should also be prepared and reported.

At the July 21, 2022 Program Planning Subcommittee meeting, Erica Ryan of the San Diego Water Board confirmed that the reduced assessments would continue and the conversation regarding the C-value will be conducted with the reissuance of the Permit.

Table 3-4. MS4 Outfall Wet Weather Permit Required Assessments

Assessment	Components	Provision(s)	Report Section
WQIP Annual Report			
Estimate loads and volumes.	Calculate or estimate the average stormwater runoff coefficient for each land use type.	D.4.b.(2).(b)(i)(a)	Not Required
	Calculate or estimate the volume of stormwater and pollutant loads discharged from each monitored storm drain outfall for each qualifying storm event.	D.4.b.(2).(b)(i)(b)	3.4.1.1
	Calculate or estimate the total volume and pollutant load discharged from the Copermittee's jurisdiction over the course of the wet season.	D.4.b.(2).(b)(i)(c)	Not Required*
	Calculate or estimate the percent contribution of stormwater volumes and pollutant loads discharged from each land use type within each hydrologic subarea with a major storm drain outfall or each major storm drain outfall for each qualifying storm event.	D.4.b.(2).(b)(i)(d)	Not Required*
	Identify necessary modifications to monitoring locations and frequencies necessary to identify pollutants in stormwater discharges.	D.4.b.(2).(b)(ii)	3.4.2

Table 3-4. MS4 Outfall Wet Weather Permit Required Assessments

Assessment	Components	Provision(s)	Report Section
Evaluate WQIP analysis.	Using data and applicable SALs, evaluate and compare data collected to the analyses and assumptions used to develop the WQIP.	D.4.b.(2).(c)(ii)	3.4.3
	Evaluate whether analyses and assumptions should be updated as a component of the adaptive management efforts.	D.4.b.(2).(c)(ii)	3.4.3
Identify data gaps.	Identify data gaps in the monitoring data necessary to fulfill assessment requirements.	D.4.b.(2).(c)(iv)	3.4.5
Evaluate trends.	Evaluate data collected pursuant to D.2.c, incorporate new data into time-series plots for each long-term monitoring constituent and perform statistical trends analysis on cumulative long-term wet weather data set.	D.4.b.(2)(d)	3.4.6; Attachment 3E
Once during Permit Term			
Evaluate progress in achieving stormwater pollutant reductions.	Identify reductions and progress in achieving reductions from different land uses and/or drainage areas.	D.4.b.(2).(c)(iii)	Regional Monitoring and Assessment Report (RMAR)
	Assess the effectiveness of WQIP improvement strategies, with estimates of volume and load reductions attributed to specific strategies when possible.		
	Identify modifications necessary to increase the effectiveness of WQIP strategies.		

* Assessment not required for the 2019-2020 and 2020-2021 WQIP Annual Monitoring Reports per the San Diego Water Board[2]

3.4.1 Provision D.4.b.(2)(b) - Calculation of Wet Weather Loads and Volumes

Permit Provision D.4.b.(2)(c)(i) requires that the Responsible Agencies continue to conduct the land-use based wet weather stormwater outfall discharge monitoring assessment previously required by the transitional monitoring requirements of Provision D.4.b.(2)(b). This provision requires the Responsible Agencies to utilize a watershed model or other method to calculate the required pollutant loads and stormwater volume estimates. The technical approach to these calculations and assessments are currently under revision. Per the San Diego Water Board the Responsible Agencies were granted regulatory relief from conducting watershed scale assessments required under D.4.b(2)(b)(i) for the 2019-2020 and 2020-2021 WQIP Annual Report.[1] For the 2019-2020 through 2021-2022 WQIP Annual Reports, the Responsible Agencies continue to calculate pollutant loads at the outfall level only and do not use the outfall data to extend the load calculation to the watershed level.

In addition, for those outfalls that have been monitored for at least two years, tables showing changes in annual pollutant loads over time are provided in Appendix 4D.

[1] Email dated August 19, 2020. At the July 21, 2022 Program Planning Subcommittee meeting, Erica Ryan of the San Diego Water Board confirmed that the reduced assessments would continue and the conversation regarding the C-value will be conducted with the reissuance of the Permit.

3.4.1.1 *Provision D.4.b.(2)(b)(i)(b) - Monitored MS4 Outfall Volume and Pollutant Loads*

In accordance with Provision D.4.b.(2)(b)(i)(b), the volume of stormwater and pollutant loads discharged from each of the monitored MS4 outfalls were calculated for each wet weather event. Rainfall data from the closest ALERT rain gauge were used to determine the qualifying measured rainfall for each location. Table 3-5 presents pollutant volumes and loads for each outfall for the monitored event. Table 3-6 presents the calculated annual pollutant volumes and loads.

Table 3-5. 2022-2023 Monitored Wet Weather Event Volumes and Pollutant Loads

Parameter	Units	MS4-CAR-1	MS4-CAR-2	MS4-CAR-3	MS4-CAR-4	MS4-CAR-5	MS4-CAR-6	MS4-CAR-7	MS4-CAR-8
		16C-61	CBS-10 (75SWOUTL)	ESC-108	LA-048	B-02	North Rios (NRIO)	BV-1	CAR-007
		12/11/2022	1/15/2023	11/8/2022	12/28/2022	11/8/2022	1/15/2023	12/11/2022	1/15/2023
Area	Acre	443.2	423.7	166.7	86.5	382.5	69.1	149.8	48
Qualifying Measured Rainfall	in	1.10	1.5	1.4	0.59	1.65	1.52	0.87	1.50
Measured Outfall Runoff "C"		0.4	0.1	0.0252	0.30	0.2	0.2	0.2	0.26
Event Volume	cf	701,128	239,416	23,756	54,907	454,011	74,904	95,304	68,862
Fecal Indicator Bacteria									
E. coli	MPN	-		8.74E+10	5.75E+10	2.19E+12	-	3.51E+11	1.35E+11
Enterococcus	MPN	4.17E+12	1.63E+12	7.40E+11	3.42E+11	3.09E+13	2.76E+11	2.48E+12	3.51E+11
Fecal Coliform	MPN	1.83E+12	1.76E+11	3.63E+11	2.49E+11	2.35E+12	5.51E+10	2.48E+11	8.97E+10
Total Coliform	MPN	1.07E+13	1.36E+13	2.35E+12	1.43E+12	2.56E+13	3.39E+12	1.46E+12	4.68E+12
General Chemistry									
Sulfate	lbs	-	-	142.4	-	-	-	-	1,031.7
Total Dissolved Solids	lbs	-	5,081.67	489.4	-	-	1,963.9	14,873.9	3,568.1
Total Suspended Solids	lbs	-	2241.915	72.66717359	-	-	430.2	440.3	3,396.1
Nutrients									
Ammonia as N	lbs	-	1.12	0.371	0.86	7.09	0.6	1.368	1.806
Nitrate as N	lbs	35.0	25.41	5.784	5.14	48.18	7.0	3.332	17.196
Nitrite as N	lbs	2.2 Ω	0.75 Ω	0.074 Ω	0.17 Ω	1.42 Ω	0.2 Ω	0.297 Ω	0.516
Total Kjeldahl Nitrogen	lbs	83.2	25.41	1.631	4.46	48.18	7.9	8.924	24.074
Total Nitrogen (calc)	lbs	118.2	50.82	7.415	9.60	96.36	15.2	12.256	41.785
Total Phosphorus	lbs	14.9	11.66	0.638	1.27	16.72	2.6	2.201	8.168
Total Metals									
Cadmium	lbs	0.0036	0.0022	0.000138	0.0004	0.0027	0.0004 Ω	0.0005	0.0011
Copper	lbs	0.9629	0.4035	0.011419	0.03	0.5952	0.1263	0.0714	0.1849
Lead	lbs	0.2364	0.1375	0.002076	0.004	0.1332	0.0215	0.0250	0.0602
Manganese	lbs			0.081565	-				2.4074
Selenium	lbs			0.000193	0.001	0.0077		0.0020	0.0082
Zinc	lbs	3.8079	1.1060	0.059320	0.14	1.8423	0.4536	0.3629	0.6018
Dissolved Metals									
Manganese	lbs	-	-	0.002373	-	-	-	-	0.0181m
Selenium	lbs	-	-	0.000163	0.0011	0.00510	-	0.0020	0.0077
Chlorinated Pesticides									
DDD(o,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDD(p,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDE(o,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDE(p,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDT(o,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDT(p,p')*	lbs	-	-	ND	-	ND	-	-	ND

Table 3-5. 2022-2023 Monitored Wet Weather Event Volumes and Pollutant Loads

Parameter	Units	MS4-CAR-1	MS4-CAR-2	MS4-CAR-3	MS4-CAR-4	MS4-CAR-5	MS4-CAR-6	MS4-CAR-7	MS4-CAR-8
		16C-61	CBS-10 (75SWOUTL)	ESC-108	LA-048	B-02	North Rios (NRIO)	BV-1	CAR-007
		12/11/2022	1/15/2023	11/8/2022	12/28/2022	11/8/2022	1/15/2023	12/11/2022	1/15/2023
Organophosphorus Pesticides									
Malathion	lbs	-	-	0.000237	-	-	-	-	0.0001
Pyrethroids									
Bifenthrin	lbs	-	-	0.00002	0.0008	-	-	0.00025	0.00016

in – inches, cf – cubic feet, MPN – most probable number, lbs - pounds

- Not monitored, not required under Carlsbad WMA MS4 Monitoring Program

*For organic analytes, loads not calculated for analytes not detected above the method detection limit.

Ω Result was not detected above the method detection limit, 1/2 the reporting limit was used for purposes of load calculation

Table 3-6. 2022-2023 Annual Wet Weather Volumes and Pollutant Loads

Parameter	Units	MS4-CAR-1	MS4-CAR-2	MS4-CAR-3	MS4-CAR-4	MS4-CAR-5	MS4-CAR-6	MS4-CAR-7	MS4-CAR-8
		16C-61	CBS-10 (75SWOUTL)	ESC-108	LA-048	B-02	North Rios (NRIO)	BV-1	CAR-007
Area	Acre	443.2	423.7	166.7	86.5	382.5	69.1	149.8	48
Qualifying Measured Rainfall	in	22.8	19.33	28.07	20.39	24.17	19.33	20.39	19.41
Average outfall Runoff "C" (2013-2023)[1]		0.431	0.038	0.053	0.453	0.224	0.173	0.201	0.410
Annual Volume	cf	15,798,757	1,133,252	906,044	2,897,105	7,524,850	840,046	2,234,093	1,385,013
Fecal Indicator Bacteria									
E. coli	MPN	-	-	3.34E+12	3.04E+12	3.62E+13	-	8.22E+12	2.71E+12
Enterococcus	MPN	9.39E+13	7.70E+12	2.82E+13	1.80E+13	7.46E+13	3.09E+12	5.82E+13	7.06E+12
Fecal Coliform	MPN	4.12E+13	8.34E+11	1.39E+13	1.31E+13	4.69E+13	6.18E+11	5.82E+12	1.80E+12
Total Coliform	MPN	2.42E+14	6.42E+13	8.98E+13	7.55E+13	5.11E+14	3.81E+13	3.42E+13	9.41E+13
General Chemistry									
Sulfate	lbs	-	-	5,429.9	-	-	-	-	20,751.0
Total Dissolved Solids	lbs	-	24,053.6	18,665.4	-	-	22,025.6	348,670.7	71,763.9
Total Suspended Solids	lbs	-	10,611.9	2,771.5	-	-	4,824.6	10,320.7	68,305.4
Nutrients									
Ammonia as N	lbs	-	5.3	14.1	45.2	117.4	6.8	32.1	36.3
Nitrate as N	lbs	789.0	120.3	220.6	271.3	798.6	78.7	78.1	345.9
Nitrite as N	lbs	49.3Ω	3.5Ω	2.8Ω	9.0Ω	23.5Ω	2.6Ω	7Ω	10.4Ω
Total Kjeldahl Nitrogen	lbs	1873.9	120.3	62.2	235.1	798.6	89.2	209.2	484.2
Total Nitrogen (calc)	lbs	2662.9	240.5	282.8	506.4	1597.2	170.3	287.3	840.4
Total Phosphorus	lbs	335.3	55.2	24.3	66.9	277.2	28.8	51.6	164.3
Total Metals									
Cadmium	lbs	0.08	0.0106	0.005	0.02	0.05	0.005Ω	0.012	0.022
Copper	lbs	21.70	1.9101	0.436	1.48	9.86	1.42	1.67	3.72
Lead	lbs	5.33	0.6509	0.079	0.22	2.21	0.24	0.59	1.21
Manganese	lbs	-	-	3.111	-	-			48.42
Selenium	lbs	-	-	0.007	0.07	0.13		0.05	0.164
Zinc	lbs	85.81	5.2352	2.262	7.60	30.53	5.09	8.51	12.10
Dissolved Metals									
Manganese	lbs	-	-	0.09	-	-	-	-	0.36
Selenium	lbs	-	-	0.01	0.06	0.08	-	0.05	0.156
Chlorinated Pesticides									
DDD(o,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDD(p,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDE(o,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDE(p,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDT(o,p')*	lbs	-	-	ND	-	ND	-	-	ND
DDT(p,p')*	lbs	-	-	ND	-	ND	-	-	ND

Table 3-6. 2022-2023 Annual Wet Weather Volumes and Pollutant Loads

Parameter	Units	MS4-CAR-1	MS4-CAR-2	MS4-CAR-3	MS4-CAR-4	MS4-CAR-5	MS4-CAR-6	MS4-CAR-7	MS4-CAR-8
		16C-61	CBS-10 (75SWOUTL)	ESC-108	LA-048	B-02	North Rios (NRIO)	BV-1	CAR-007
Organophosphorus Pesticides									
Malathion*	lbs	-	-	0.009	-	-	-	-	0.001
Pyrethroids									
Bifenthrin	lbs	-	-	0.0006	0.04	-	-	0.006	0.0032

in – inches, cf – cubic feet, MPN – most probably number, lbs - pounds
[1] - Number of years included in average varies by station.
- Not monitored, not required under Carlsbad WMA MS4 Monitoring Program
*For organic analytes, loads not calculated for analytes not detected above the method detection limit.
Ω Result was not detected above the method detection limit, 1/2 the reporting limit was used for purposes of load calculation

3.4.2 Provision D.4.b.(2)(b)(ii) - Evaluation of Monitoring Locations and Frequencies

In compliance with Provision D.4.b.(2)(b)(ii), the wet weather MS4 outfall discharge monitoring locations were evaluated in the 2016-2017 CAR WMA WQIP Annual Report. Conclusions reached in that assessment include: MS4 wet weather monitoring locations are representative of land uses in the WMA; agricultural, open space and rural residential land uses are under-represented; single-family residential and transportation land uses may be over-represented (Carlsbad WMA Responsible Agencies, 2017).

During the 2019-2020 monitoring year, the monitoring location within the City of Escondido was moved due to construction activities at the previous location (ESC-134). The drainage area for the new monitoring location (IWS-113) consisted of primarily commercial land uses (81.5%) whereas the drainage area for ESC-134 consisted of mostly single family residential (39.7%) and transportation (32.3%) land uses. The City of Escondido determined that IWS-113 does not meet the definition of major outfall; therefore, wet weather monitoring has been conducted at high priority outfall ESC-108 since the 2020-2021 monitoring year. The drainage area for ESC-108 consists mainly of single family residential (34%), agriculture (orchard/vineyards, 16%), and transportation (14%).

The evaluation of monitoring frequency included a review of the monitoring data to determine how well the data from the single storm event monitored at each outfall represented the wet weather conditions on an annual basis. The total qualifying rainfall characterizing storms greater than 0.1 inch from July 2022 to June 2023 was 22.8 inches at the Carlsbad ALERT precipitation station. There were 14 discreet (separated by at least 72 hours of dry weather) wet weather events during this time period. Precipitation ranged from 0.14 inches to 4.59 inches per event. The three events monitored ranged from 1.11 in to 4.59 in of precipitation (as measured at the Carlsbad ALERT station).

3.4.3 Provision D.4.b.(2)(c)(ii) - Comparison to WQIP Analyses and Assumptions

Provision D.4.b.(2)(c)(ii) requires the Responsible Agencies to evaluate and compare data collected during 2020-2021 to the analyses and assumptions used to develop the WQIP and evaluate whether adaptive management is necessary for updates.

The analytical results for samples collected at the eight MS4 outfall wet weather monitoring locations are summarized in Table 3-3 in Section 3.3. Table 3-7 presents a summary of the results compared to applicable SALs or STVs. Results showed that indicator bacteria concentrations in wet weather discharges were above the STV for *E. coli* in all five monitored outfalls that discharge to freshwater receiving waters and above the *Enterococcus* STV in the three monitored outfalls that discharge to saltwater lagoons or the Pacific Ocean.

Nitrate + nitrite results were above the SAL at MS4-CAR-3 (ESC-108) and MS4-CAR-8 (CAR-007). Turbidity and total phosphorus were also above the SALs at MS4-CAR-008 (CAR-007). All other constituents were below the applicable SALs. The analyses and assumptions used to develop the WQIP resulted in the selection of bacteria as the HPWQC or PWQC for several of the HAs in the WMA. The only other existing SALs that relate to HPWQCs in the WMA are for nitrate/nitrite as N and total phosphorus. Nitrate + nitrite was above the SAL at MS4-CAR-3 (ESC-108) and MS4-CAR-8 (CAR-007) which are in the Escondido Creek HA. Total phosphorus was also above the SAL for MS4-CAR-8 (CAR-007). Nutrients in wet weather conditions are not considered a PWQC in the Escondido Creek HA.

Table 3-7. 2022-2023 MS4 Outfall Stormwater Action Level Comparison

Analyte	Unit	SAL/ WQO	MS4-CAR-1	MS4-CAR-2	MS4-CAR-3	MS4-CAR-4	MS4-CAR-5	MS4-CAR-6	MS4-CAR-7	MS4-CAR-8
			16C-61	CBS-10 (75SWOUTL)	ESC-108	LA-048	B-02	North Rios (NRIO)	BV-1	CAR-007
			12/11/2022	1/14/2023-1/15/2023	11/8/2022-11/9/2022	12/28/2022	11/8/2022	1/14/2023-1/15/2023	12/11/2022	1/14/2023-1/15/2023
Physical Chemistry										
Turbidity	NTU/FNU	126	16.52	50.12	23.85	2.80	34.40	114.10	47.31	**201.02**
Fecal Indicator Bacteria										
E. coli	MPN/100 mL	320	-	-	**13,000**	**3,700**	**17,000**	-	**13,000**	**6,900**
Enterococcus	MPN/100 mL	110	**21,000**	**24,000**	110,000	22,000	35,000	**13,000**	92,000	18,000
Nutrients										
Nitrate + Nitrite as N	mg/L	2.6	0.80	1.70	**3.90**	1.50	1.70	1.55	0.56	**4.12**
Total Phosphorus	mg/L	1.46	0.34	0.78	0.43	0.37	0.59	0.55	0.37	**1.9**
Total Metals										
Cadmium	µg/L	3	0.082J	0.15J	0.093J	0.11J	0.096J	0.096J	0.083J	0.26
Copper	µg/L	127	22	27	7.7	8.2	21	27	12	43
Lead	µg/L	250	5.4	9.2	1.4	1.2	4.7	4.6	4.2	14
Zinc	µg/L	976	87	74	40	42	65	97	61	140

SAL – stormwater action level, WQO – water quality objective, mg/L – milligrams per liter, µg/L – micrograms per liter, MPN – most probable number, mL – milliliter, FNU – formazin nephelometric unit, NTU – nephelometric turbidity unit

Bold values are above the applicable stormwater action level or water quality objective.

- Not monitored, not required under 2019 Carlsbad WMA MS4 Monitoring Program

J - Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated

3.4.4 Provision D.4.b.(2)(c)(iii) - Assessment of MS4 Outfall Wet Weather Monitoring Data

This Provision requires the Copermittees to review the data collected under the MS4 outfall wet weather monitoring program in order to identify pollutant reduction progress, assess water quality improvement strategy effectiveness, and identify modifications necessary to increase effectiveness. This assessment is required once during the Permit term and has been provided in the RMAR, which was submitted to the San Diego Water Board in December 2017.

3.4.5 Provision D.4.b.(2)(c)(iv) - Identification of Data Gaps

No gaps have been identified in the wet weather MS4 outfall monitoring data. The MS4 Outfall Monitoring Plan was updated in January 2019 to reflect the Section 303(d) listings of the 2014 and 2016 Integrated Report (State Water Board, 2017). The Plan was updated in January 2022 for station locations and editorial updates. The Plan was updated again in January 2023 to reflect the Section 303(d) listings of the 2020/2022 Integrated Report (State Water Board, 2022).

3.4.6 Provision D.4.b.(2)(d) - Long-term Wet Weather Trends Analysis

Permit provision D.4.b.(2)(d) requires assessment of trends for wet weather outfall data collected under Provision D.2.c as well as creation of time-series plots for long-term monitoring constituents. To assess trends, data for each station/parameter combination with at least three monitoring years data were tested for normality to determine the appropriate trend methodology. Data with normal or approximate normal distribution were assessed using ordinary least squares (OLS) regression and data with lognormal or approximate lognormal distribution were log-transformed and assessed with OLS regression. All data assessed fit one of these two distribution patterns. Significance was based on a 95% confidence level (e.g., a 5% probability of obtaining a test statistic, or a p-value of less than 0.05. The assessment of trends is based on a limited dataset, each additional monitoring result added to the dataset will increase the robustness of the assessment.

A summary of these trends is shown in Table 3-8. There were no statistically significant trends identified for MS4-CAR-1 (16C-1), MS4-CAR-3 (ESC-108), MS4-CAR-5 (B-02) or MS4-CAR-6 (North Rios).

Of the four statistically significant trends, three were decreasing trends and one was an increasing trend. Trends for total copper were decreasing at MS4-CAR-2 (CBS-10) and, MS4-CAR-7 (BV-1), indicating improving water quality. Trends for ammonia were also decreasing at MS4-CAR-8 (CAR-007). The only increasing trend identified was for nitrate at MS4-CAR-4 (LA-048).

Plots for all the identified significant trends are presented in Attachment 3E.

Table 3-8. Statistically Significant Trends for Wet Weather MS4 Outfall Discharges

Station	Jurisdictional ID	Analyte	Statistic Test	Trend	p-value	Slope	R-squared	ND Percent
MS4-CAR-2	CBS-10 (75SWOUTL)	Total Copper	OLS Regression (normal)	Decreasing	0.02	-0.00826	0.53	0%
MS4-CAR-4	LA-048	Nitrite as N	OLS Regression (normal)	Increasing	0.02	0.00001	0.60	25%
MS4-CAR-7	BV-1	Total Copper	OLS Regression (lognormal)	Decreasing	0.04	-0.00018	0.44	0%
MS4-CAR-8	MS4-CAR-007	Ammonia as N	Mann-Kendall	Decreasing	0.04	-0.00077	NA	0%

NA - Not applicable.

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