Comprehensive Bacteria Reduction Plan

December 31, 2010 (Final Draft)

Submitted to:

California Regional Water Quality Control Board, Santa Ana Region

Submitted by:

San Bernardino County Stormwater Program

Principal Permittee

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City of Chino
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City of Fontana
City of Montclair
City of Ontario
City of Rancho Cucamonga
City of Rialto
City of Upland

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AB	Assembly Bill
BMPs	Best Management Practices
BPS	Bacterial Prioritization Score
CBRMP	Chino Basin Recharge Master Plan
CBRP	Comprehensive Bacteria Reduction Plan
CWA	Clean Water Act
CWP	Center for Watershed Protection
DWF	Dry Weather Flow
EPA	Environmental Protection Agency
IDDE	Illicit Discharge Detection and Elimination
IEUA	Inland Empire Utilities Agency
LID	Low Impact Development
MEP	Maximum Extent Practicable
mL	Milliliters
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
MSAR	Middle Santa Ana River
MST	Microbial Source Tracking
MSWMP	Municipal Storm Water Management Plan
MWD	Metropolitan Water District
NPDES	National Pollutant Discharge Elimination System
OCWD	Orange County Water District
POTW	Publicly-owned Treatment Works
QAPP	Quality Assurance Project Plan
RCFC&WCD	Riverside County Flood Control and Water Conservation District
REC-1	Water Contact Recreation
REC-2	Non-Contact Recreation
RWQCP	Riverside Water Quality Control Plant
SAR	Santa Ana River
SAWPA	Santa Ana Watershed Protection Authority
SB	Senate Bill
SBCFCD	San Bernardino County Flood Control District
SCAG	Southern California Association of Governments
SWQSTF	Stormwater Quality Standards Task Force

TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
USEP	Urban Source Evaluation Plan
USGS	United States Geological Survey
WAP	Watershed Action Plan
WBIC	Weather-based Irrigation Controller
WQMP	Water Quality Management Plan
WWTP	Wastewater Treatment Plant

Section 1
Background and Purpose

The Santa Ana Regional Water Quality Control Board adopted a Municipal Separate Storm Sewer System (MS4) permit for San Bernardino County on January 29, 2010 that requires the development of a Comprehensive Bacteria Reduction Plan (CBRP). The CBRP is a long term plan designed to achieve compliance with dry weather condition (April 1 – October 31) wasteload allocations for bacterial indicators established by the Middle Santa Ana River (MSAR) Bacterial Indicator Total Maximum Daily Load (TMDL) ("MSAR Bacterial Indicator TMDL"). This CBRP, which is due to the Regional Board by December 31, 2010, fulfills this MS4 permit requirement. The following sections provide the regulatory background, purpose, and framework of the CBRP.

1.1 Regulatory Background

1.1.1 Overview

The 1972 Federal Water Pollution Control Act and its amendments comprise what is commonly known as the Clean Water Act (CWA). The CWA provides the basis for the protection of all inland surface waters, estuaries, and coastal waters. The federal Environmental Protection Agency (EPA) is responsible for ensuring the implementation of the CWA and its governing regulations (primarily Title 40 of the Code of Federal Regulations) at the state level.

California's Porter-Cologne Water Quality Control Act of 1970 and its implementing regulations establish the Santa Ana Regional Water Quality Control Board (Regional Board) as the agency responsible for implementing CWA requirements in the Santa Ana River Watershed. These requirements include adoption of a Water Quality Control Plan ("Basin Plan") to protect inland freshwaters and estuaries. The Basin Plan identifies the beneficial uses for waterbodies in the Santa Ana River watershed, establishes the water quality objectives required to protect those uses, and provides an implementation plan to protect water quality in the region (Regional Board 1995).

The CWA requires the Regional Board to routinely monitor and assess water quality in the Santa Ana River watershed. If this assessment indicates that beneficial uses are not met in a particular waterbody, then the waterbody is found to be impaired and placed on the state's impaired waters list (or 303(d) list[1]). This list is subject to EPA approval; the most recent EPA-approved 303(d) list for California is the 2006 list[2].

Waterbodies on the 303(d) list require development of a TMDL. A TMDL establishes the maximum amount of a pollutant that a waterbody can receive (from both point and nonpoint sources) and still meet water quality objectives. Table 1-1 summarizes waterbodies currently listed as impaired in San Bernardino County.

[1] 303(d) is a reference to the CWA section that requires the development of an impaired waters list.
[2] The State Water Resources Control Board (State Board) recently completed its 2010 303(d) List. This list is currently under review by the EPA.

Table 1-1. List of impaired waterbodies for San Bernardino County without a TMDL[1] (Regional Board Order No. 2010-0036, NPDES No. CAS618036)

Waterbody	Pollutant/Stressor	Potential Source	Proposed TMDL Completion Date
Big Bear Lake	Copper[2]	Resource extraction	2007
	Mercury	Resource extraction[5]	2007
	Metals	Resource extraction	2007
	Noxious aquatic plants	Construction/Land development; Unknown point source	2006
	Nutrients	Construction/Land development; Snow skiing activities	2006
	PCBs	Source unknown	2019
	Sedimentation/ Siltation[3]	Construction/Land development; Snow skiing activities; Unknown nonpoint source	2006
Summit Creek	Nutrients	Construction/Land development	2008
Knickerbocker Creek	Pathogens[4]	Unknown nonpoint source	2005
	Metals	Unknown nonpoint source	2007
Grout Creek	Metals	Unknown nonpoint source	2007
	Nutrients	Unknown nonpoint source	2008
Rathbone (Rathbun) Creek	Nutrients	Snow skiing activities; Unknown nonpoint source	2008[2]
	Sedimentation/ Siltation	Snow skiing activities; Unknown nonpoint source	2006
Mountain Home Creek	Pathogens	Unknown nonpoint source	2019
East Mountain Home Creek	Pathogens	Unknown nonpoint source	2019
Lytle Creek	Pathogens	Unknown nonpoint source	2019
Mill Creek (Prado)	Nutrients	Agriculture, dairies	2019
	Total Suspended Solids	Dairies	2019
Prado Park Lake	Nutrients	Nonpoint source	2019
Chino Creek Reach 1	Nutrients	Agriculture, dairies	2019
Mill Creek Reach 1	Pathogens	Unknown nonpoint source	2019
Mill Creek Reach 2	Pathogens	Unknown nonpoint source	2019
Santa Ana River (Reach 4)	Pathogens	Nonpoint source	2019

1 Based on State Board 2006 CWA Section 303(d) List of Water Quality Limited Segments, EPA Approved June 28, 2007 (http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/303dlists2006/epa/r8_06_303d_reqtmdls.pdf)
2 Big Bear Lake is recommended for delisting for copper in the draft 2010 303(d)-305(b) Integrated Report
3 Big Bear Lake is recommended for delisting for sedimentation/siltation in the draft 2010 303(d)-305(b) Integrated Report
4 See MS4 permit for information regarding implementation activities associated with this impairment
5 Resource extraction was removed as a potential source for mercury in Big Bear Lake and replaced with atmospheric deposition in the draft 2010 303(d)-305(b) Integrated Report

1.1.2 MSAR Bacterial Indicator TMDL

On August 26, 2005, the Regional Board adopted the MSAR Bacterial Indicator TMDL. This TMDL was developed based on fecal coliform water quality data collected in 1994 and 1998 that showed that recreational uses in the following County waterbodies were impaired (Regional Board Resolution R8-2005-0001):

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

Following Regional Board approval, the State Board approved the TMDL on May 15, 2006, the California Office of Administrative Law approved the TMDL on September 1, 2006, and EPA Region 9 approved the TMDL on May 16, 2007. The EPA approval date established the TMDL effective date.

The MSAR Bacterial Indicator TMDL established wasteload allocations applicable to the MS4 for both fecal coliform and *E. coli*:[3]

- Fecal coliform: 5-sample/30-day logarithmic mean (or geometric mean) less than 180 organisms/ 100 mL and not more than 10 percent of the samples exceed 360 organisms/100 mL for any 30-day period.
- *E. coli*: 5-sample/30-day logarithmic mean (or geometric mean) less than 113 organisms/100 mL and not more than 10 percent of the samples exceed 212 organisms/100 mL for any 30-day period.

The MSAR Bacterial Indicator TMDL identified implementation requirements applicable to urban (discharges from MS4 facilities) and agricultural discharges. Table 1-2 lists the TDML-specific requirements incorporated into the MSAR Bacterial Indicator TMDL that are applicable to the San Bernardino County MS4 program.

[3] Fecal coliform and *E. coli* are a group of bacteria considered by the Regional Board as bacterial indicators for pathogens. Within this CBRP, references to fecal coliform and *E. coli* should be considered equivalent to the term bacterial indicators.

Table 1-2. MSAR Bacterial Indicator TMDL requirements applicable to portions of San Bernardino County.

Task	Subtask	Required Activity	Schedule/Status
Task 1 – Review/ Revise Existing Waste Discharge Requirements	Task 1.1 – WDR requirements for San Bernardino County MS4	Review and revise the Waste Discharge Requirements for the San Bernardino County MS4 permit as necessary to include the appropriate wasteload allocations, compliance schedules and or monitoring requirements	New MS4 permit was adopted on January 29, 2010. Relevant TMDL requirements, including the preparation of the CBRP for dry weather were included in the permit
Task 3 - Watershed-Wide Water Quality Monitoring Program	NA	All named responsible parties in the TMDL shall, as a group, submit to the Regional Board for approval a proposed watershed-wide monitoring program that will provide data necessary to review and update the TMDL.	All parties (except U.S. Forest Service) are implementing a Regional Board approved monitoring program collaboratively through the MSAR Task Force (see Sections 2.2 and 2.4)
Task 4 – Urban Discharges	Task 4.1 - Develop and Implement Bacterial Indicator Urban Source Evaluation Plan (USEP)	Responsible parties in San Bernardino County (as named in the TMDL) shall develop a Bacterial Indicator Urban Source Evaluation Plan. This plan shall include steps needed to identify specific activities, operations, and processes in urban areas that contribute bacterial indicators to MSAR watershed waterbodies. The plan shall also include a proposed schedule for completion of each of the steps identified. The proposed schedules can include contingency provisions that reflect uncertainty concerning the schedule for completion of the SWQSTF work and/or other investigations that may affect the steps that are proposed. The USEP shall be implemented upon Regional Board approval.	The Regional Board-approved USEP has been implemented by the responsible parties since 2008 (see Section 2.5). In addition, this CBRP incorporates the principles/activities of the USEP and replaces its implementation requirements (See Section 7.3).
	Task 4.2 – Revise the San Bernardino County Municipal Stormwater Management Program (MSWMP)	The Executive Office shall notify the MS4 permittees of the need to revise the MSWMP to incorporate measures to address the results of the USEP and/or other studies. The revised MSWMP will be implemented upon approval by the Regional Board.	The January 29, 2010 MS4 permit includes requirements for MSWMP revisions that are being coordinated with TMDL implementation
	Task 4.3 – Revise the San Bernardino County Water Quality Management Plan (WQMP)	The Executive Office shall notify the MS4 permittees of the need to revise the WQMP to incorporate measures to address recommendations of the SWQSTF or other investigations. The revised WQMP will be implemented upon approval by the Regional Board.	The January 29, 2010 MS4 permit includes requirements for WQMP revisions that are being coordinated with TMDL implementation and this CBRP
Task 6 – Review or Revision of the MSAR Bacterial Indicator TMDL	NA	Regional Board will review all data and information generated pursuant to the TMDL requirements on an ongoing basis (at least every three years). Based on results from the monitoring programs, special studies, modeling analysis, SWQSTF and/or special studies, changes to the TMDL, including revisions to the numeric targets, may be warranted.	The first Triennial Report was submitted on February 15, 2010; additional Triennial Reports will be prepared in 2013 and 2016 as part of this CBRP (see Section 7.1)

1.1.3 San Bernardino County MS4 Program

The San Bernardino County MS4 program operates under a National Pollutant Discharge Elimination System (NPDES) MS4 permit issued by the Regional Board (Order No. 2010-0036, NPDES No. CAS618036). This permit regulates discharges to and from MS4 facilities within the Santa Ana River watershed in San Bernardino County. The permittees covered by this permit include the San Bernardino County Flood Control District (SBCFCD), San Bernardino County and the following Cities: Big Bear Lake, Chino, Chino Hills, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Montclair, Ontario, Rancho Cucamonga, Redlands, Rialto, San Bernardino, Upland, and Yucaipa. The SBCFCD is the Principal Permittee; the remaining jurisdictions are the Co-Permittees.

The Regional Board issued its first MS4 permit to San Bernardino County MS4 in 1990. This permit focused primarily on program development, which included establishment of the Drainage Area Management Plan (replaced in 2002 by the MSWMP) and implementation of public education and staff training on stormwater quality concerns.

Since the issuance of that permit, the MS4 program has gradually evolved from a very basic stormwater management program into a complex program with many requirements that go beyond the program as originally established. The second-term permit, which began in 1996, focused on continued program development, implementation, and reporting. Under this permit, program reporting requirements increased significantly, which required increased staff and financial resources. To address the increased reporting requirements, permittees developed an electronic data collection and management system for the MS4 Area-wide Program. The system provided for more consistent reporting among the permittees and provided a standardized approach for preparation of the required MS4 Annual Report.

The third-term permit, issued in 2002, increased the focus of the permit on program implementation and required more prescriptive data reporting to document program accomplishments. These requirements led to the development of the MS4 Solution Database, which documents well the extent to which program requirements are implemented throughout the County (e.g., see CBRP Section 4). It was during this period that the Regional Board began the adoption of TMDLs that included wasteload allocations applicable to urban stormwater discharges. Although the 2002 MS4 permit did not include specific TMDL implementation programs, the MS4 permittees actively participated in the development and implementation of these TMDLs.

The Regional Board adopted the fourth term MS4 permit on January 29, 2010. This permit contains many new requirements that will further increase the complexity and costs associated with the management of urban discharges in the permitted area. In addition, for the first time the MS4 permit explicitly includes TMDL implementation requirements applicable to waterbodies in San Bernardino County for which TMDLs are effective, specifically Big Bear Lake (nutrients) and the MSAR Bacterial Indicator TMDL. This document fulfills the permit requirement to submit a draft CBRP to the

Regional Board by December 31, 2010. A final plan will prepared based on Regional Board comments. Section 1.2 describes the CBRP development requirements and activities.

1.1.4 Requirements for Protection of Recreational Uses

The Basin Plan specifies requirements for the protection of recreational uses in San Bernardino County. For example, Basin Plan Chapter 3 defines Water Contact Recreation (REC-1) and Non-Contact Recreation (REC-2) uses and their applicability to area waterbodies, Chapter 4 describes the fecal coliform water quality objectives established to protect recreational uses, and Chapter 5 describes the actions necessary to achieve the water quality objectives specified in Chapter 4 and thereby protect the recreational uses in the watershed.

The Regional Board is currently considering changes to the Basin Plan which, if approved, will impact CBRP implementation. These changes are being developed through the work of the Stormwater Quality Standards Task Force (SWQSTF). Since 2003, Regional Board staff and members of the SWQSTF (which includes representatives from the Santa Ana Watershed Protection Authority [SAWPA]; the counties and cities of Orange, Riverside, and San Bernardino; Orange County Coastkeeper; and Inland Empire Waterkeeper) have been engaged in the implementation of a workplan that is evaluating both recreational uses and associated water quality objectives. The key proposed amendments expected to be adopted by the Regional Board in March 2011, and relevant to this CBRP, include:

- Re-definition of REC-1 waters;
- Deletion of the current fecal coliform objectives for REC-1 and REC-2 beneficial uses;
- Adoption of geometric mean *E. coli* objectives for REC-1 waters based on EPA guidance (EPA 1986);
- Sub-categorization of REC-1 waters into classes (based on level of expected water contact) and establishment of a class-specific method for assessing *E. coli* data in the absence of sufficient data to calculate a geometric mean;
- For waters designated only REC-2 (only after approval of a Use Attainability Analysis [UAA] that removes the presumptive REC-1 use), establishment of an antidegradation-based bacterial indicator water quality objective; and
- Temporary suspension of recreational uses during high flow conditions in freshwater streams.

The Basin Plan amendment includes several UAAs to modify presumptive REC-1 uses for specific receiving waters in the MSAR watershed. These UAAs and proposed recreational use changes include:

- *Cucamonga Creek* – Reach 1, confluence with Mill Creek (at Hellman Street) upstream to 23rd Street in Upland, California; remove both REC-1 and REC-2 uses.

- *Temescal Creek* – Reach 1, Lincoln Avenue to the 91 Freeway; remove REC-1 use.

- *Temescal Creek* – Reach 2, 91 Freeway to 1400 feet upstream of Magnolia Street; remove REC-1 and REC-2 uses.

1.2 Comprehensive Bacteria Reduction Plan

This section describes the requirements for CBRP development and its applicability to urban discharges in the San Bernardino County area. This section also describes the general framework of this plan and the process associated with its development.

1.2.1 Purpose and Requirements

The findings section of the San Bernardino County MS4 permit describes the purpose of the CBRP:

- *Section II.F.13.c.vi* - Based on the results of pre-compliance evaluation monitoring (Pre-compliance evaluation monitoring is monitoring conducted prior to the TMDL compliance date to assess the effectiveness of BMPs [Best Management Practices] implemented in reducing pollutant(s) of concern by the compliance date) it has been determined that the short-term solutions discussed above are not expected to achieve the WLAs [wasteload allocations] by the compliance dates. This Order requires the MSAR permittees to develop a long-term plan (a comprehensive bacteria reduction plan, CBRP) designed to achieve compliance with the WLAs by the compliance dates.

- *Section II.F.13.c.vii* - If necessary, the CBRP will be updated based on an evaluation of the effectiveness of the BMPs implemented. In the absence of an approved CBRP the WLAs become the final numeric water quality-based effluent limit that must be achieved by the compliance dates.

Based on these findings, the Regional Board established specific requirements for the CBRP's content. These requirements, found in Section V.D.2.b.i in the San Bernardino County permit, include:

Section V.D.2.b.i - The MSAR permittees shall prepare for approval by the Regional Board a CBRP describing, in detail, the specific actions that have been taken or will be taken to achieve compliance with the urban wasteload allocation under dry weather conditions (April 1st through October 31st) by December 31, 2015. The CBRP must include:

(a) The specific ordinance(s) adopted to reduce the concentration of indicator bacteria in urban sources.

(b) The specific BMPs implemented to reduce the concentration of indicator bacteria from urban sources and the water quality improvements expected to result from these BMPs.

(c) The specific inspection criteria used to identify and manage the urban sources most likely causing exceedances of water quality objectives for indicator bacteria.

(d) The specific regional treatment facilities and the locations where such facilities will be built to reduce the concentration of indicator bacteria discharged from urban sources and the expected water quality improvements to result when the facilities are complete.

(e) The scientific and technical documentation used to conclude that the CBRP, once fully implemented, is expected to achieve compliance with the urban wasteload allocation for indicator bacteria by December 31, 2015.

(f) A detailed schedule for implementing the CBRP. The schedule must identify discrete milestones to assess satisfactory progress toward meeting the urban wasteload allocations for dry weather by December 31, 2015. The schedule must also indicate which agency or agencies are responsible for meeting each milestone.

(g) The specific metric(s) that will be established to demonstrate the effectiveness of the CBRP and acceptable progress toward meeting the urban wasteload allocations for indicator bacteria by December 31, 2015.

(h) MSWMP, WQMP, and Local Implementation Plans shall be revised consistent with the CBRP no more than 180 days after the CBRP is approved by the Regional Board.

(i) Detailed descriptions of any additional BMPs planned, and the time required implementing those BMPs, in the event that data from the watershed-wide water quality monitoring program indicate that water quality objectives for indicator bacteria are still being exceeded after the CBRP is fully implemented.

(j) A schedule for developing a CBRP needed to comply with the urban wasteload allocation for indicator bacteria during wet weather conditions (November 1st thru March 31st) to achieve compliance by December 31, 2025.

1.2.2 Applicability

The applicability of this CBRP is limited to the following:

- *Bacterial Indicator Sources* – The CBRP is designed to mitigate, to the maximum extent practicable (MEP), controllable urban sources of bacterial indicators that cause non-attainment of bacterial indicator water quality objectives at the watershed-wide compliance sites.

- *Jurisdiction* –Though additional responsible parties are named in the TMDL, this CBRP document only applies to the San Bernardino County MS4 permittees named in the TMDL: SBCFCD; San Bernardino County; the Cities of Ontario, Chino, Chino Hills, Montclair, Rancho Cucamonga, Upland, Rialto, and Fontana.

- *Hydrologic Condition* – This CBRP applies only to urban discharges from the MS4 during dry weather conditions (defined as the period April 1st through October 31st each year) that have the potential to impact the downstream Watershed-wide compliance monitoring sites.

1.2.3 Compliance with Urban Wasteload Allocation

This CBRP is designed to achieve compliance with the dry weather urban wasteload allocation to the MEP by December 31, 2015. Compliance with the wasteload allocations will be measured in several ways:

- Water quality objectives are attained at the watershed-wide compliance sites established as part of the implementation of the TMDL (see Section 6). If not attained, then it must be demonstrated that bacterial indicators from controllable urban sources are not the cause of non-attainment.

- Compliance with urban source wasteload allocations is demonstrated from specific MS4 facilities, e.g., sampling demonstrates that MS4 outfalls or drains are in compliance with the wasteload allocation during dry weather conditions.

- MS4 facilities, e.g., outfalls, are dry, contributing no dry weather flow (DWF) to downstream waters.

1.2.4 Conceptual Framework

This CBRP relies primarily on a source evaluation-based approach for identifying urban sources of bacterial indicators, evaluating their controllability, and implementing mitigation activities where necessary and feasible. This approach is a direct extension of the watershed-wide compliance monitoring program and Urban Source Evaluation Plan (USEP) already approved by the Regional Board (see Sections 2.4 and 2.5). In addition, the CBRP incorporates existing MS4 permit requirements and supplements them to provide water quality benefits with regards to the management of bacterial indicators.

This CBRP includes a schedule with an iterative and adaptive management strategy (see Sections 7 and 8). Through this approach, the MS4 permittees will incorporate findings from CBRP implementation activities to evaluate the effectiveness of the plan and revise the plan (with Regional Board approval) as necessary to achieve compliance.

1.2.5 CBRP Development Process

This CBRP has been developed collaboratively by the San Bernardino County Area-wide MS4 Program permittees. Development was coordinated with the Riverside

County permittees and MSAR TMDL Task Force (see Section 2.2). Activities completed or planned include:

- August 18, 2010 – Presentation was made to the MSAR TMDL Task Force on the CBRP program as presented in Section 5.
- San Bernardino County MS4 permittees have worked within their jurisdictions to share information with management.
- San Bernardino County will conduct a parallel public review process between January and March of 2011, during Regional Board review of the draft CBRP.

1.2.6 CBRP Structure

Following is a summary of the purpose and content of each of the remaining sections of this CBRP:

- ***Section 2*** – Summarizes all activities completed to date as part of the implementation of the MSAR Bacterial Indicator TMDL
- ***Section 3*** – Describes the MSAR watershed, including general physical characteristics, dry weather hydrology, relevant MS4 facilities and water quality, and the jurisdictions involved.
- ***Section 4*** – Provides an overview of existing MS4 program activities relevant to the control of bacterial indicators in urban discharges that will continue to be implemented as part of the MS4 permit.
- ***Section 5*** – Describes CBRP elements that will be implemented to achieve compliance with the urban wasteload allocations under dry weather conditions.
- ***Section 6*** – Provides the technical basis for the conclusion that full implementation of this plan will achieve compliance with the urban wasteload allocation under dry weather conditions.
- ***Section 7*** – Establishes the schedule for each of the CBRP elements described in Section 5.
- ***Section 8*** – Describes the implementation strategy associated with this plan.
- ***Section 9*** – Provides the schedule for development of the CBRP for achieving compliance with urban wasteload allocations under wet weather conditions.
- ***Section 10*** - References

Section 2
TMDL Implementation

2.1 Introduction

The MS4 permittees have been actively engaged in implementation of the MSAR Bacterial Indicator TMDL since its 2005 adoption by the Regional Board (almost two years before the TMDL became effective upon EPA approval in 2007). All TMDL requirements with specific completion dates from establishment of a watershed-wide monitoring program to adoption and implementation of the USEP have been met thus far. The outcome of the various TMDL activities completed to date provides the foundation for this CBRP. Each of these activities is described in more detail below.

2.2 MSAR TMDL Task Force

With adoption of the MSAR Bacterial Indicator TMDL on August 26, 2005, stakeholders named in the TMDL began the process to create a formal cost-sharing body, or Task Force, to collaboratively implement a number of requirements defined in the TMDL. These stakeholders include:

- SBCFCD (representing itself, the County of San Bernardino, and the Cities of Chino, Chino Hills, Fontana, Montclair, Ontario, Rancho Cucamonga, and Rialto)
- County of Riverside
- Riverside County Flood Control & Water Conservation District (RCFC&WCD)
- Cities of Corona, Norco, and, Riverside
- Cities of Pomona and Claremont (Los Angeles County, pending formal agreement)
- Agricultural Pool and Milk Producers
- U.S. Department of Agriculture, U.S. Forest Service
- Regional Board
- SAWPA

SAWPA administers the Task Force and provides all Task Force meeting organization/facilitation, secretarial, clerical and administrative services, management of Task Force funds; annual reports of task force assets and expenditures and hiring of Task Force authorized consultants. All documents and presentations (including CBRP presentations to the Task Force) are posted on SAWPA's project website at: www.sawpa.org/roundtable-MSARTF.html.

2.3 Proposition 40 State Grant

In anticipation of EPA approval of the MSAR Bacterial Indicator TMDL, SAWPA, in cooperation with the urban dischargers (SBCFCD and RCFC&WCD and on behalf of the Task Force, submitted a California Proposition 40 grant proposal ("Grant Project") to the State Board to support implementation of the TMDL. The State Board approved the Grant Project in fall 2006 and the project was initiated in early 2007.

The overarching purpose of the Grant Project was to accelerate the TMDL implementation process by supporting efforts by urban dischargers to implement TMDL requirements, including the watershed-wide monitoring program and USEP (which are described in more detail below). Within this framework, the Grant Project focused on identifying sources of bacterial contamination in the MSAR watershed and pilot testing BMP technologies designed to reduce bacteria in storm drains (SAWPA 2010b). The results of these activities were used to support the development of this CBRP to achieve compliance with urban wasteload allocations during dry weather conditions.

2.4 Watershed-wide Compliance Monitoring

Task 3 of the TMDL implementation plan (see Table 1-1) requires the responsible jurisdictions named in the TMDL to submit to the Regional Board for approval a proposed watershed-wide compliance monitoring program. The purpose of this program is to provide the data necessary to review and update the TMDL as needed and evaluate compliance with the TMDL wasteload and load allocations.

Using the Grant Project funding to initiate this TMDL task, the MSAR Task Force worked with the Regional Board to select compliance sites consistent with the purpose of this monitoring program. Compliance sites were selected based on two key criteria:

- The sites should be located on waterbodies that are impaired and subject to Bacteria TMDL compliance requirements; and
- The sites should be located in reaches of the impaired waterbodies where REC-1 activity is likely to occur, i.e., there is an increased risk from exposure to pathogens.

Based on these criteria, six sample locations were selected originally as compliance sites (Table 2-1). One of these sites, Icehouse Canyon Creek was later removed with Regional Board approval. A Monitoring Plan and Quality Assurance Project Plan (QAPP) were prepared to support the monitoring program (available at www.sawpa.org/roundtable-MSARTF.html). Appendix B of the Monitoring Plan provides information regarding each of the sample locations listed in Table 2-1.

The Regional Board approved the Monitoring Plan and QAPP, and the Task Force initiated sampling in summer 2007. Weekly sampling occurs over a 20-week period during the dry season (April 1 – October 31) and an 11-week period during the wet season (November 1 – March 31). Four samples are also collected during and after one wet weather event each year. This sampling program has been implemented since July 2007.

Table 2-1. Watershed-wide monitoring program sample locations

MSAR Waterbody	Sample Location	Site Code[1]
Icehouse Canyon Creek[2]	Icehouse Canyon Creek	WW-C1
Prado Park Lake	Prado Park Lake at Lake Outlet	WW-C3
Chino Creek	Chino Creek at Central Avenue	WW-C7
Mill-Cucamonga Creek	Mill Creek at Chino-Corona Rd	WW-M5
Santa Ana River, Reach 3	Santa Ana River Reach 3 @ MWD Crossing	WW-S1
	Santa Ana River Reach 3 @ Pedley Ave	WW-S4

[1] – Location of sites shown on Figures 3-8 through 3-11.
[2] – Icehouse Canyon Creek was removed from the list of Watershed-wide compliance monitoring sites with Regional Board approval.

2.5 Urban Source Evaluation Plan

The MSAR Bacterial Indicator TMDL required the MS4 permittees to develop the USEP within six months after TMDL adoption or November 30, 2007. Per Section 4.1 of the TMDL (Regional Board 2005), the purpose of the USEP was to identify specific activities, operations, and processes in urban areas that contribute bacterial indicators to MSAR waterbodies. The plan required a proposed schedule for the activities identified and includes contingency provisions as needed to reflect any uncertainty in the proposed activities or schedule.

The urban dischargers developed the USEP as part of Grant Project implementation activities. The Regional Board approved the USEP on April 18, 2008 (Regional Board Resolution R8-2008-0044[4]). The approved plan included a four-step process for fulfilling the purpose of the USEP (as stated by the TMDL):

- *Step 1: Urban Source Evaluation Monitoring Program* – Conduct a monitoring program at key sites to gather bacterial indicator source data associated with urban land uses.

- *Step 2: Risk Characterization* – Evaluate data obtained from Step 1 and other applicable watershed data to characterize the risk of exposure to bacterial indicators and prioritize urban sites for additional investigation.

- *Step 3: Site Investigations* – Describe the types of actions that may be implemented to further investigate urban bacterial indicator sources. Per the outcome of Step 2, site investigation activities would be focused on high priority sites first.

- *Step 4: Adaptive Implementation* - As new data become available or if changes in recreational uses occur on waterbodies as a result of SWQSTF efforts, then site prioritization or the schedule for USEP implementation may change.

[4] Available from the Regional Board's website at: www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/msar_tmdl.shtml

A summary of the elements contained within each of these steps follows. The complete USEP is available at www.sawpa.org/roundtable-MSARTF.html.

2.5.1 Urban Source Evaluation Plan Monitoring Program

The MSAR Task Force implemented the Urban Source Evaluation Monitoring Program during both dry and wet seasons in 2007 and 2008. Monitoring activities occurred at 13 locations, including all major subwatersheds that drain to waters listed as impaired for bacterial indicators in the MSAR watershed. Table 2-2 provides information on the location of each monitoring site. Additional information about each sample location is available in Appendix C of the Monitoring Plan available at www.sawpa.org/roundtable-MSARTF.html.

To characterize bacterial indicator levels at each site (along with flow and other field parameters), samples were collected over four five-week periods in both the dry and wet seasons. Samples were collected from each site to identify sites where human, bovine, or domestic canine sources of bacteria were prevalent. Section 3.4.2 below provides a summary of the results of this monitoring program (see also SAWPA 2009a).

2.5.2 Risk Characterization

The USEP established a framework for prioritizing sites for follow-up investigation of urban sources of bacterial indicators based on a characterization of risk of exposure to pathogens. Three key factors drive the characterization process:

- *Exceedance Factor* – The first factor to be evaluated in the framework is the frequency and magnitude by which the bacterial indicator exceeds the water quality objective. The greater the frequency and magnitude of recorded exceedances, the higher the likelihood that the contamination can be traced back to its source. Intermittent, low intensity events are more difficult to detect and, therefore, more difficult to trace.

- *Contagion Factor* – Human beings, particularly children, are believed to be at greater risk of infection from water-borne pathogens of human origin (EPA 2007). Accordingly, the risk of illness resulting from recreational use is believed to be highest where microbial source tracking methods (e.g. *Bacteroides*) indicate the probable presence of human-sourced pathogens. After human sources, exposure to fecal contamination from agricultural animals is the next most important concern (EPA 2007).

- *Exposure Factor* - A higher investigation/implementation priority should be assigned to locations and conditions where recreational activities are most likely to occur. Exceedances that occur in natural channels, during warmer months with relatively moderate flows, merit a higher priority than those that may occur in a concrete flood control channel during a winter rainstorm. This prioritization is based on the assumption that the number of persons likely to be exposed is much higher in the first case than in the second.

Table 2-2. Urban Source Evaluation Plan Monitoring Program sample locations

MSAR Waterbody	Waterbody Reach[1]	Sample Location	Site Code[2]
Santa Ana River	Reach 3	Santa Ana River (SAR) at La Cadena Drive	US-SAR
		Box Springs Channel at Tequesquite Avenue	US-BXSP
		Sunnyslope Channel near confluence with SAR	US-SNCH
		Anza Drain near confluence with Riverside effluent channel	US-ANZA
		San Sevaine Channel in Riverside near confluence with SAR	US-SSCH
		Day Creek at Lucretia Avenue	US-DAY
		Temescal Wash at Lincoln Avenue	US-TEM
Chino Creek	Reach 1	Cypress Channel at Kimball Avenue	US-CYP
	Reach 2	San Antonio Channel at Walnut Ave	US-SACH
		Carbon Canyon Creek Channel at Pipeline Avenue	US-CCCH
Mill-Cucamonga Creek	Prado Area	Chris Basin Outflow (Lower Deer Creek)	US-CHRIS
		County Line Channel near confluence with Cucamonga Creek	US-CLCH
	Reach 1	Cucamonga Creek at Highway 60 (Above RP1)	US-CUC

[1] - Reaches are defined in the Basin Plan.
[2] – Location of sites shown on Figures 3-8 through 3-11.

The factors described above drive the prioritization of urban source investigation activities established in the USEP. Figure 2-1 provides a framework for priority ranking from high (1) to low (8). Generally speaking, the highest priority sites are those where:

- Magnitude and frequency of bacterial indicator exceedance are high;
- *Bacteroides* marker analysis indicates the persistent presence of human sources of bacteria (persistence is a measure of how frequently human source bacteria is detected in water samples);
- The site is in an area, or is close to an area, where recreational activities are likely to occur; and
- Observed exceedances and the presence of human sources of bacteria occur during periods when people are most likely to be present, e.g., during warm months and dry periods.

In contrast, the lowest priority sites for urban dischargers would be those where the bacterial indicator exceedance frequency and magnitude is low, human or other urban sources, e.g., domestic dogs, are not present, and the site is not used for water contact recreation, e.g., a concrete, vertical-walled flood control channel. Sites with bacteria from bovine sources are referred to the Regional Board for follow-up action with agricultural dischargers.

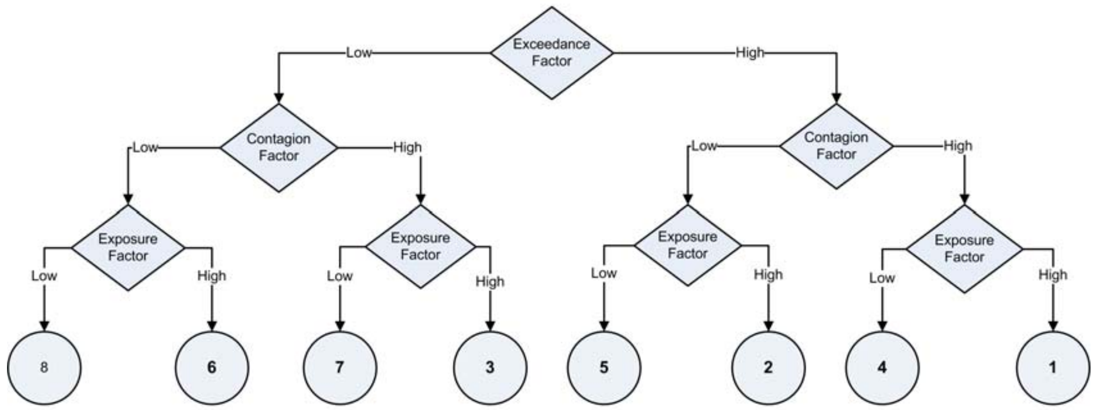


Figure 2-1 Risk characterization framework

The exceedance, contagion and exposure factors provide the basic foundation for prioritizing sites or areas for further investigative activities. As appropriate, additional factors may be considered to more clearly define the priority between several sites with similar priorities based on the three base factors, as described above. For example, other relevant considerations may include regulatory factors, e.g., the waterbody may be reclassified as a result of Basin Plan changes (see CBRP Sections 1.2.2 and 5.2.5) or the source is determined to be uncontrollable.

The results of the 2007-2008 USEP monitoring program provided the first opportunity to rank sites based on the factors described above. This prioritization will be the starting point for this CBRP (e.g., see schedule Section 7.3 for implementation of source evaluation activities in various subwatersheds). However, as additional data collected during CBRP implementation may lead to a revision of priorities (as envisioned in Step 4 of the USEP). Section 3.4.2 summarizes the results of the 2007-2008 USEP and describes how this information provided a basis for prioritizing TMDL implementation activities.

2.5.3 Site Investigations

The USEP describes actions that may be implemented to further investigate urban sources of bacterial indicators. Investigative strategies would be developed at six-month intervals to address the highest priority needs. In principle, resources would be directed to the high priority areas first; implementation activities in lower priority sites would occur only after high priority sites have been addressed. However, when necessary, the priority for any site can be elevated, particularly if new data become available that changes or overrides the priority for action.

The USEP identifies three types of investigative activities: channel surveys; enhanced tracking methods; and controllability assessments. These activities would typically be implemented sequentially at a given site, but a step could be skipped if the source of the elevated bacterial indicators is generally known. Following is a summary of the investigative tools envisioned for implementation in the USEP:

- *Channel Surveys* – Surveys may be conducted to better define bacterial indicator problems. Example survey tools could include:
  - UAA development (consistent with SWQSTF methods) to refine application of the recreational uses in the Basin Plan.
  - Source tracking studies in tributaries or outfalls to better define the source of urban bacterial indicators.
  - Flow loading from tributaries and other outfalls to evaluate potential for these sources to contribute significant numbers of bacteria.
  - Preliminary source reconnaissance to identify potential bacterial sources including (a) direct human sources (e.g., leaking sewers or septic systems, transient camps, illicit discharges); (b) domesticated animals associated with urban land use, especially areas where domesticated animals are concentrated; and (c) wildlife concentration areas (e.g., birds, rodents, squirrels, rabbits, feral cats and dogs)
- *Enhanced Tracking Methods* – These methods provide a means to narrow down urban sources, including where to prioritize implementation efforts. Examples of tools that may be used to support enhanced source tracking include:
  - Evaluation of relative contribution of bacterial indicators by flow sources to determine which tributaries or drains contribute the most bacteria to the waterbody.
  - Use of constituent-specific sampling (analgesics, hormones, caffeine, antibiotics, nutrients, surfactants, etc.) to identify potential flow sources.
  - Use of patterns and trends analyses to identify conditions under which elevated bacterial indicators occur.
- *Controllability Assessments* – Where a bacterial indicator source requiring mitigation is identified, the final step in the investigative process is to determine the controllability of the source. Controllability is largely dependent on the nature of the source. For example, elevated bacterial indicators attributable to wildlife or impacts associated with use of the waterbody as a conduit for water transfers may limit the controllability of the source. In these instances, it may not be feasible to control the source. Controllability assessments will consider three alternatives:

- Prevention (or source control) activities, including for example repair of all sewer leaks, better control of domestic animals, moving transient camps, stronger enforcement of illicit discharges, etc.

- Potential for construction of low flow diversions to intercept DWFs and send the water to a facility for recharge or to a regional wastewater treatment facility.

- Use of on-site or regional BMPs, e.g., detention ponds, wetlands and bioswales for regional treatment. The practicability of using these facilities would be considered on a site-specific basis.

2.5.4 Adaptive Implementation

Adaptive implementation is an iterative process commonly incorporated into TMDL implementation plans to provide a means to reassess compliance strategies based on new data or analyses. Given the large uncertainty associated with control of pollutants such as bacterial indicators, an adaptive implementation component was included in the USEP framework to provide opportunity, where appropriate, to reconsider priorities. This adaptive component has been carried forward into this CBRP (see Section 8). The triennial review process, summarized in Section 2.6 provides an opportunity to implement adaptive management on a regular schedule.

2.5.5 USEP Implementation

The USEP requires periodic implementation of source evaluation activities to identify bacterial indicator sources for potential mitigation. Along with these activities, the USEP requires submittal of a semi-annual report to document ongoing and planned activities related to the management of urban sources of bacterial indicators. These reports have been submitted since July 2009.

In spring 2009 the Task Force established the first priority areas for further investigation based on the findings of the 2007-2008 USEP monitoring program and ongoing Watershed-wide monitoring at the compliance sites (see Section 3.4.2 for a discussion of this prioritization process). In fall 2009 the Task Force authorized two USEP-based studies:

- *Source Evaluation Activities in Carbon Canyon Creek and Cypress Channel* – The data analysis report prepared after completion of 2007-2008 monitoring activities (SAWPA 2009a) prioritized the next steps for USEP implementation based on the risk characterization approach described above. USEP sample locations with a combination of the largest number of bacterial indicator exceedances of water quality objectives, highest magnitude bacterial indicator levels, and most frequent indications of contamination by human sources were given the highest priority for additional source evaluation activities. Accordingly, the Cypress Channel subwatershed was ranked high for follow-up work. In contrast, the Carbon Canyon Creek subwatershed was ranked very low as both the frequency of bacterial indicator exceedances and the magnitude of bacterial indicator levels was relatively low. Both the Cypress Channel and Carbon Canyon Creek drainage areas were recommended for source evaluation studies. Evaluation of the Carbon Canyon Creek subwatershed was included to determine if any site-specific characteristics could be identified that provide insight into how to reduce bacterial loads elsewhere. Source evaluation activities involved a desktop level characterization as well as field reconnaissance to identify subwatershed or in-stream characteristics which may contribute to high or low levels of bacterial indicators at either site. A technical memorandum summarizing the findings of this effort was prepared (SAWPA 2010d).

- *Dry Weather Runoff Controllability Assessment for Lower Deer Creek Subwatershed (Chris Basin)* – SAWPA (2009a) identified Chris Basin as a high priority site for bacteria source evaluation activities. Given its location at the confluence of Cucamonga Creek and Lower Deer Creek, Chris Basin has the potential to be retrofitted for use as a regional treatment BMP for dry weather runoff. The USEP study evaluated opportunities to retrofit the site to capture DWFs and eliminate the existing dry weather discharge to Cucamonga Creek. A technical memorandum summarizing the findings of this study was prepared (SAWPA 2010e).

Both of the above USEP studies recommended a number of follow-up actions applicable to both urban dischargers and the Regional Board. Additional source evaluation studies are currently being developed for 2010-2011 by the Task Force. However, in the future, source evaluation activities described in this CBRP will supersede the USEP and become the driving schedule for source evaluation activities in the MSAR watershed (see Section 5.2.3, and Section 7.3.3).

2.6 Triennial Review Summary

Task 6 in the implementation section of the MSAR Bacterial Indicator TMDL requires preparation of a water quality assessment every three years, that summarizes the data collected for the preceding three year period, and evaluates progress towards compliance with wasteload and load allocations. Referred to as a Triennial Report, the requirement for this assessment is also in the MS4 permit (Section V.D.1.iii). The first of these Triennial Reports was submitted to the Regional Board as required by February 15, 2010 (SAWPA 2010a).

The Triennial Report findings, relevant to the MS4 wasteload allocation, are provided in Section 3.4.1 of this CBRP (the full report is available at www.sawpa.org/roundtable-MSARTF.html). These findings provide the baseline for the CBRP analysis that demonstrates that implementation of this CBRP is expected to achieve compliance with the wasteload allocation by December 15, 2015. Additional Triennial Reports will be prepared in 2013 and 2016 as part of CBRP implementation (see Sections 7.1 and 8).

Section 3
Watershed Characterization

3.1 Middle Santa Ana River Watershed

The following sections provide background information regarding the general characteristics of the MSAR watershed, including major subwatersheds, key jurisdictions and dominant land use.

3.1.1 General Description

The Santa Ana River watershed, located in southern California, is approximately 2,800 square miles in size. Surface water flows begin in the San Bernardino and San Gabriel Mountains and flow in a generally southwest direction to the Pacific Ocean. Flows are detained or retained by numerous features ranging from groundwater recharge basins to Prado Basin Dam. The MSAR watershed is 750 square miles in size and located generally in the north central portion of the Santa Ana River watershed (Figure 3-1).

The MSAR watershed includes the southwestern part of San Bernardino County, the northwestern part of Riverside County, and a small portion of Los Angeles County (Figure 3-1). San Bernardino County jurisdictions participating in this CBRP include the SBCFCD, San Bernardino County and the Cities of Upland, Montclair, Chino, Chino Hills, Rancho Cucamonga, Ontario, Fontana, and Rialto (Figure 3-2).

Due to the semi-arid climate of the region, naturally derived runoff is not common during dry weather conditions in the watershed. Runoff from mountain areas (snowmelt or storm runoff) are mostly controlled by dams or infiltrated in recharge basins. In the transition zone from mountains to lower lying valley areas, the sources of surface water includes dry weather urban runoff, such as occurs from irrigation, stormwater runoff during rain events, treated wastewater effluent, or rising groundwater.

Reach 3 of the SAR includes the river channel from the Mission Avenue Bridge to Prado Dam, which controls releases to the lower reach of the SAR. There are several major tributaries to the MSAR, many of which have been modified for flood control purposes.

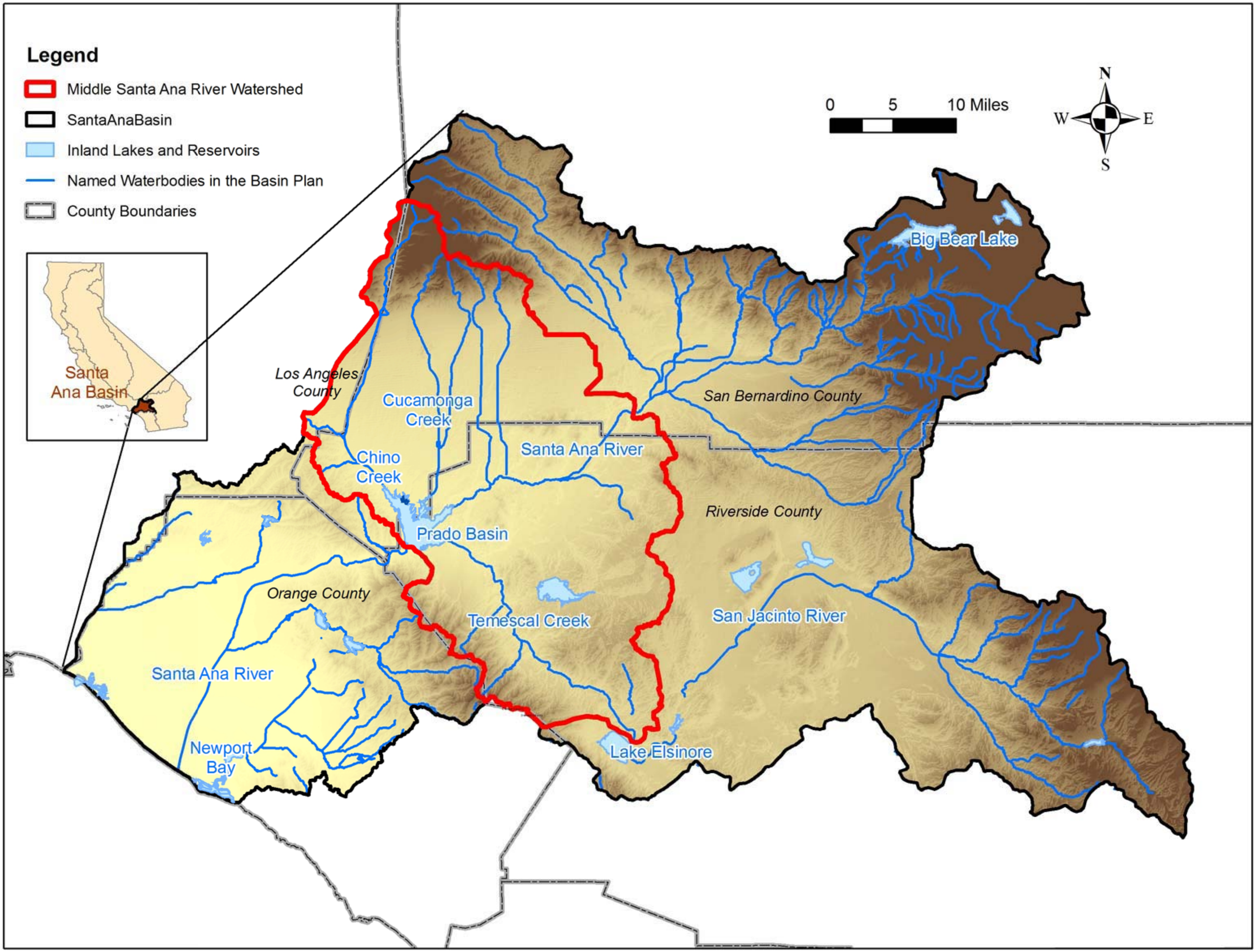


Figure 3-1. Santa Ana River Watershed

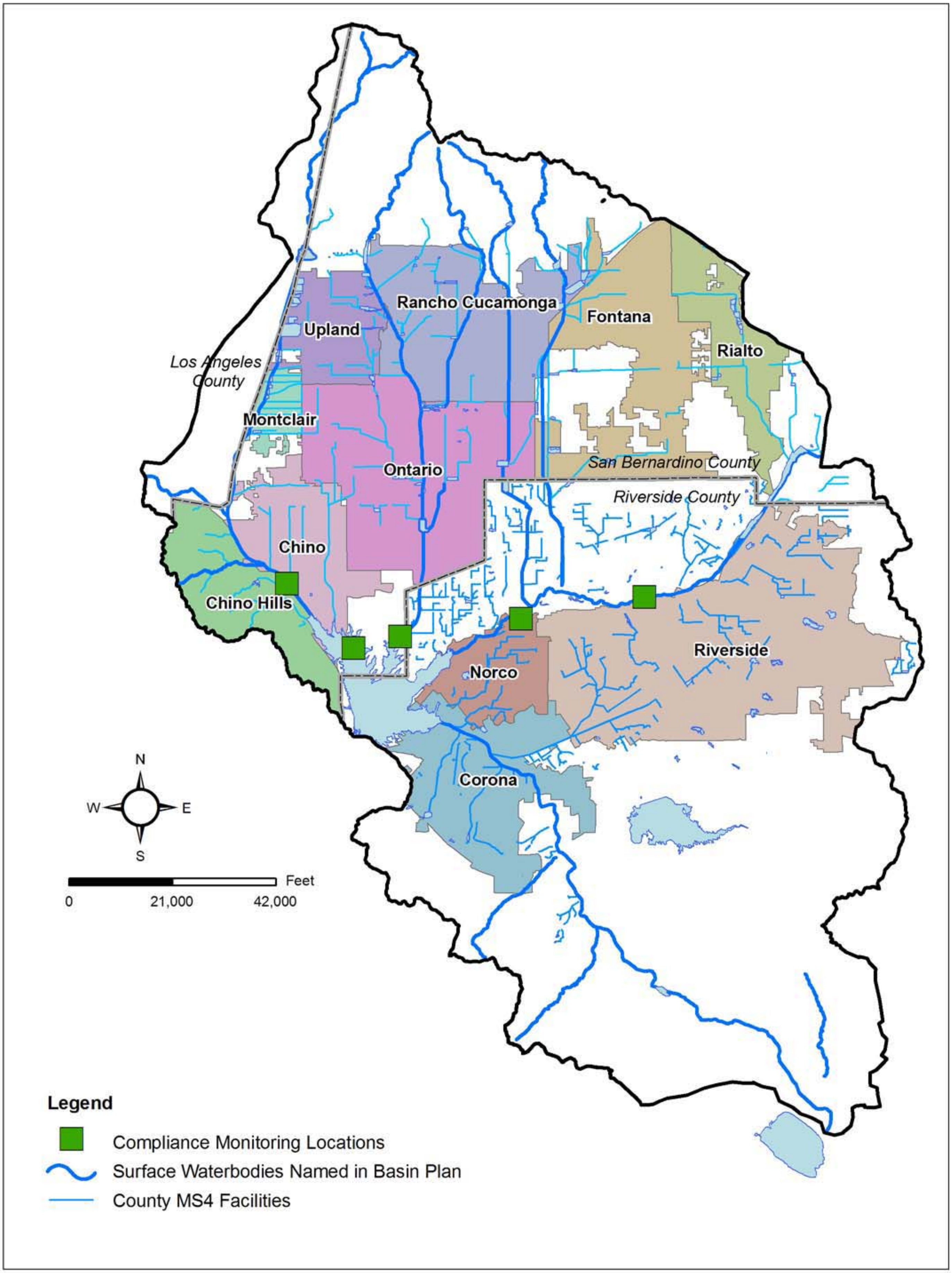


Figure 3-2. Jurisdictional Areas

Based on 2000 census data, the population of the watershed is approximately 1.4 million people. Although most lowland areas are highly developed, a portion of the watershed remains largely agricultural - the area formerly known as the Chino Dairy Preserve. This area is located in the south central part of the Chino Creek Basin subwatershed. At the time of TMDL development the area contained approximately 300,000 cows (Regional Board 2005). As of January 2009, this number was down to about 138,500 (email communication, Ed Kashak, Regional Board, to Pat Boldt, representative of agricultural interests and MSAR Task Force member, December 8, 2009). In recent years, the cities of Ontario, Chino, and Chino Hills annexed the San Bernardino County portions of this area. The remaining portion of the former preserve, which is in Riverside County, remains unincorporated (Regional Board 2005).

3.1.2 Major Subwatersheds

The MSAR watershed has been divided into several major subwatersheds to provide a basis for evaluating compliance with TMDL urban wasteload allocations. These subwatersheds drain to the following watershed-wide compliance points as established in the watershed-wide monitoring program (see Section 2.4) (Figure 3-3; see Table 2-1):

- Chino Creek at Central Avenue (WW-C7) – Drainage area is mostly in San Bernardino County, plus a small area in Los Angeles County.
- Mill-Cucamonga Creek at Chino-Corona Road (WW-M5) – Drainage area is mostly in San Bernardino County, plus a small area in Riverside County.
- Santa Ana River at MWD Crossing (WW-S1) – Areas of both San Bernardino and Riverside County drain to this site.
- Santa Ana River at Pedley Avenue (WW-S4) - Areas of both San Bernardino and Riverside County drain to this site.
- Prado Park Lake (WW-C3) – Entire drainage area to this location is in San Bernardino County.

3.1.3 Jurisdictions

Table 3-1 summarizes the jurisdictional area of each MS4-permitted city and unincorporated county area that drains to each of the MSAR watershed-wide compliance monitoring sites. Although this CBRP only applies to areas within San Bernardino County, the jurisdictional areas outside of San Bernardino County are included in Table 3-1 to illustrate the relative importance of San Bernardino and Riverside County MS4 programs to the watershed-wide compliance locations.

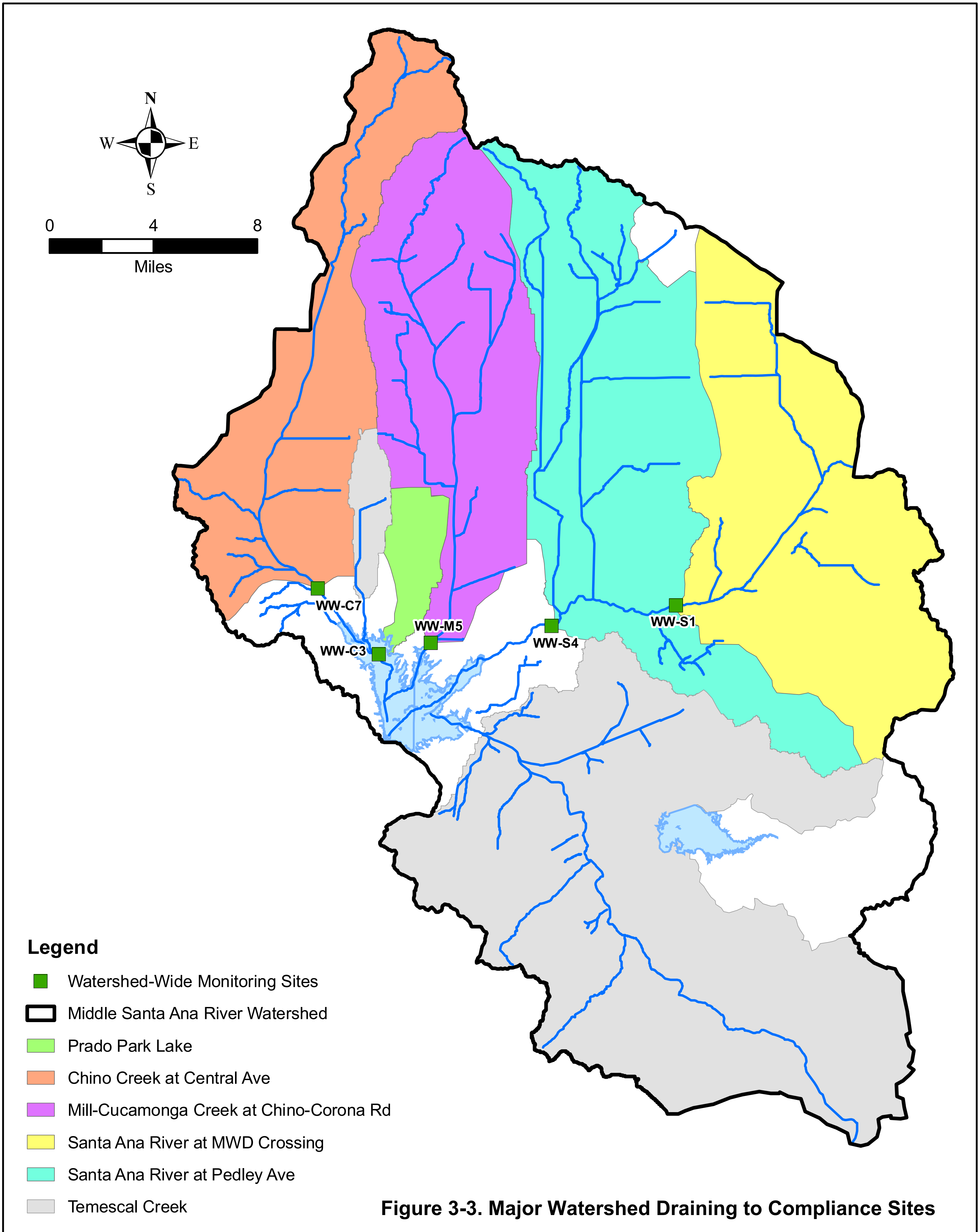


Figure 3-3. Major Watershed Draining to Compliance Sites

Table 3-1. Jurisdictional area and percent land use in 2005 for each of the major MSAR subwatersheds (areas outside of San Bernardino County included to show land use percentages of all areas draining to Watershed-wide compliance sites).

Jurisdictions within MSAR Subwatersheds	Drainage Area (acres)	Agricultural	Commercial Institutional	Industrial	Infrastructure	Mixed Urban	Natural Vacant	Open Space Recreation	Residential	Water Wetlands
Chino Creek at Central Avenue (WW-C7)	**54,607**									
Chino	7,659	10%	15%	25%	4%	1%	4%	2%	38%	0%
Chino Hills	6,125	6%	7%	0%	3%	0%	42%	2%	40%	0%
Montclair	3,537	1%	24%	12%	5%	1%	4%	2%	51%	0%
Ontario	2,721	3%	16%	6%	1%	1%	3%	4%	67%	0%
Upland	5,161	0%	13%	17%	6%	0%	11%	1%	51%	0%
Unincorporated San Bernardino	13,714	2%	1%	1%	1%	0%	81%	1%	13%	0%
Claremont	3,011	0%	21%	2%	6%	0%	30%	8%	32%	1%
Pomona	6,707	0%	15%	10%	6%	0%	9%	3%	57%	0%
Unincorporated Los Angeles	5,972	0%	0%	0%	0%	0%	99%	0%	1%	0%
Mill-Cucamonga Creek at Chino-Corona Road (WW-M5)	**55,456**									
Chino	618	65%	0%	0%	2%	2%	26%	0%	5%	0%
Ontario	18,006	20%	7%	19%	13%	1%	13%	2%	22%	0%
Rancho Cucamonga	5,256	1%	10%	8%	4%	1%	11%	3%	60%	0%
Upland	4,871	2%	10%	5%	6%	5%	4%	4%	62%	1%
Unincorporated San Bernardino	13,860	0%	0%	0%	4%	0%	91%	0%	5%	0%
Eastvale	2,815	32%	1%	10%	3%	5%	28%	1%	20%	0%
Unincorporated Riverside	30	1%	0%	20%	0%	0%	19%	0%	1%	0%
Prado Park Lake (WW-C3)	**6,878**									
Chino[1]	2,255	45%	4%	1%	15%	10%	18%	5%	1%	2%
Ontario	4,623	66%	2%	0%	1%	0%	6%	2%	21%	0%

Table 3-1. Jurisdictional area and percent land use in 2005 for each of the major MSAR subwatersheds (areas outside of San Bernardino County included to show land use percentages of all areas draining to Watershed-wide compliance sites).

Jurisdictions within MSAR Subwatersheds	Drainage Area (acres)	Agricultural	Commercial Institutional	Industrial	Infrastructure	Mixed Urban	Natural Vacant	Open Space Recreation	Residential	Water Wetlands
Santa Ana River at MWD Crossing (WW-S1)	**65,017**									
Fontana	4,486	1%	9%	1%	2%	0%	33%	1%	53%	0%
Rialto	11,490	0%	7%	13%	10%	4%	21%	1%	41%	0%
Riverside	26,442	3%	11%	7%	3%	2%	25%	4%	43%	0%
Unincorporated San Bernardino	5,867	4%	6%	12%	2%	1%	18%	3%	47%	0%
Jurupa Valley	8,772	7%	5%	10%	3%	0%	34%	11%	28%	0%
Unincorporated Riverside	7,155	7%	12%	1%	3%	3%	40%	22%	10%	0%
San Bernardino	804	1%	11%	2%	5%	1%	10%	2%	66%	0%
Santa Ana River at Pedley Avenue (WW-S4)	**89,253**									
Fontana	21,620	3%	9%	11%	7%	3%	25%	4%	37%	0%
Norco	141	4%	0%	0%	1%	0%	35%	7%	53%	0%
Ontario	3,819	0%	11%	59%	11%	0%	12%	0%	0%	0%
Rancho Cucamonga	10,457	1%	8%	13%	14%	6%	23%	1%	31%	0%
Riverside	12,990	14%	12%	4%	4%	1%	23%	2%	41%	0%
Unincorporated San Bernardino	19,047	0%	4%	12%	6%	1%	67%	0%	9%	0%
Eastvale	317	43%	1%	18%	14%	5%	3%	0%	1%	0%
Jurupa Valley	17,952	5%	5%	11%	3%	1%	25%	10%	39%	0%
Unincorporated Riverside	2,909	6%	2%	6%	5%	1%	23%	0%	52%	0%
Temescal Creek	**118,583**									
Corona	18,879	5%	9%	8%	5%	4%	22%	3%	42%	0%
Norco	2,372	4%	9%	4%	2%	1%	37%	4%	40%	0%
Riverside	11,998	15%	11%	2%	2%	2%	23%	1%	44%	0%
Unincorporated Riverside	85,333	4%	1%	2%	1%	2%	78%	1%	12%	0%
Lake Mathews	**24,671**									

Table 3-1. Jurisdictional area and percent land use in 2005 for each of the major MSAR subwatersheds (areas outside of San Bernardino County included to show land use percentages of all areas draining to Watershed-wide compliance sites).

Jurisdictions within MSAR Subwatersheds	Drainage Area (acres)	Agricultural	Commercial Institutional	Industrial	Infrastructure	Mixed Urban	Natural Vacant	Open Space Recreation	Residential	Water Wetlands
Unincorporated Riverside	24,664	6%	3%	0%	1%	2%	54%	2%	22%	11%
Other Drainages to Prado Basin	**39,842**									
Chino	8,440	47%	3%	4%	5%	1%	19%	6%	14%	1%
Chino Hills	7,626	0%	2%	1%	3%	3%	56%	5%	29%	0%
Corona	3,483	0%	7%	23%	8%	0%	30%	4%	28%	0%
Norco	6,328	4%	13%	1%	3%	2%	21%	1%	54%	1%
Ontario	2,778	20%	12%	2%	1%	0%	3%	1%	57%	0%
Riverside	139	0%	0%	0%	0%	0%	98%	0%	1%	0%
Unincorporated San Bernardino	127	11%	0%	0%	1%	0%	59%	23%	0%	5%
Eastvale	6,279	26%	1%	0%	3%	16%	19%	9%	25%	0%
Jurupa Valley	382	13%	0%	0%	0%	0%	26%	11%	50%	0%
Unincorporated Riverside	4,256	1%	1%	2%	13%	0%	46%	27%	6%	4%

1) Jurisdiction where significant new development has occurred since 2005 that is not reflected in the land use distribution shown in this table

3.1.4 Land Use

Land use distribution has the potential to affect flow volume and bacterial indicator levels under dry weather conditions. Table 3-1 provides the land use distribution for each jurisdiction in each of the areas draining to the watershed-wide compliance monitoring sites.

Land use in the MSAR watershed includes a variety of categories as defined by the Southern California Association of Governments (SCAG 2005). Related categories were lumped together to reflect major types of land uses, e.g., agricultural or industrial related land uses. Figure 3-4 illustrates the resulting spatial land use pattern, at least as most recently available in the 2005 SCAG dataset. Residential land uses make up the greatest fraction of urbanized drainage area in the MSAR watershed (~50 percent). In some areas there is more agricultural land use than urban. Accordingly, compliance activities targeted at agricultural lands might provide the most significant water quality benefits. These compliance activities are not the responsibility of the MS4 program; they are the responsibility of the agricultural dischargers named in the TMDL.

3.2 Dry Weather Hydrology

Regular flows exist in many MSAR waterbodies during dry weather conditions. Sources of dry weather runoff include:

- Effluent from publically owned treatment works (POTWs)
- Imported water purchased from Metropolitan Water District (MWD)
- Groundwater inputs
- Well blow-offs
- Other allowable discharges (as defined by the MS4 permit)
- Non-permitted discharges

Each of these sources of runoff has a different pathway and potential to transport bacteria to receiving waterbodies. Thus, it is important to understand the relative role of each of these categories of DWF.

Within the MSAR watershed there are many MS4 drainage areas that do not typically cause or contribute to flow at the compliance monitoring sites. DWF at these MS4 outfalls is hydrologically disconnected from the TMDL receiving waterbodies, by either purposefully recharging groundwater in constructed regional retention facilities or through losses in earthen channel bottoms, where the recharge capacity of underlying soils exceeds dry weather runoff generated in upstream drainage areas (Figure 3-5).

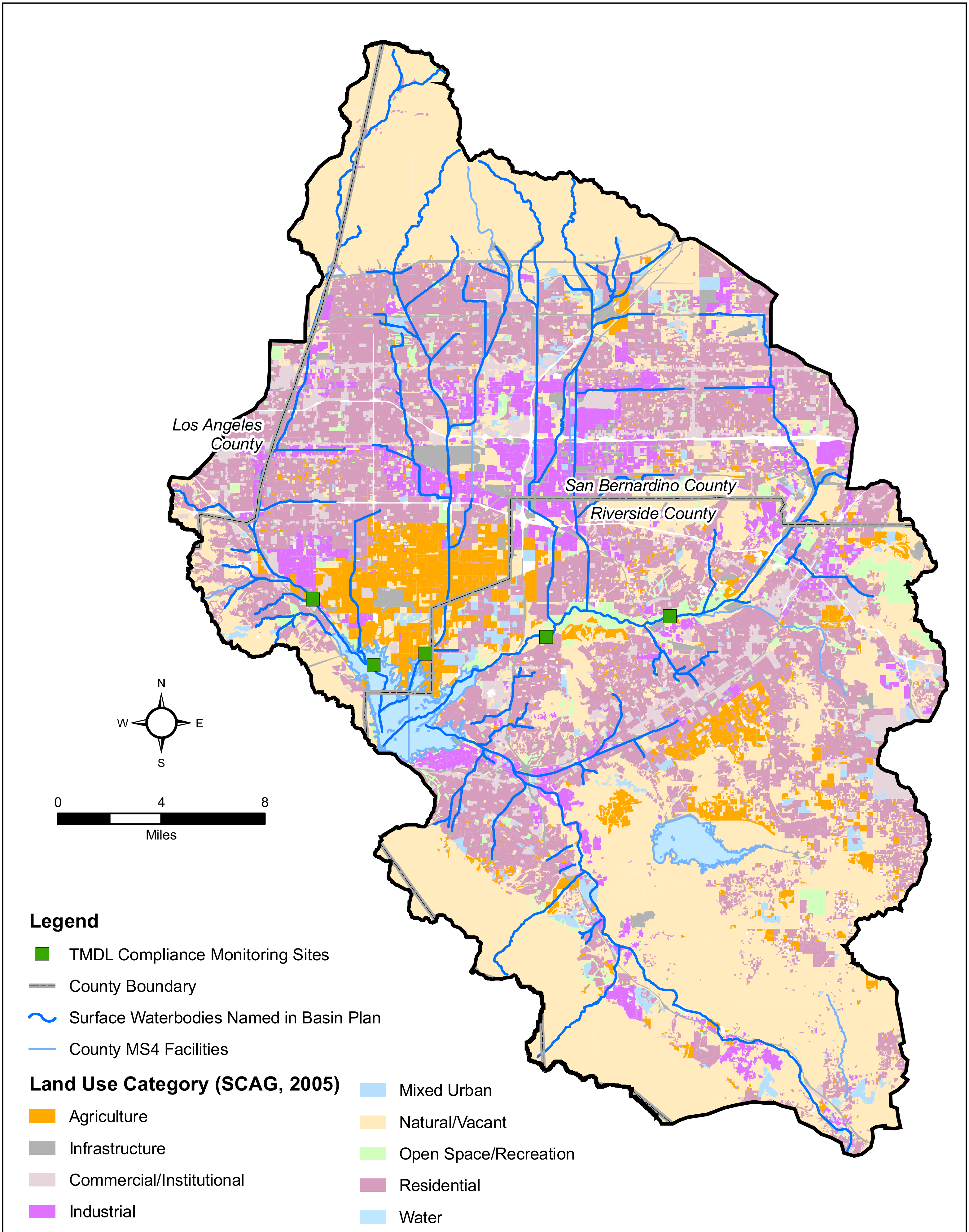


Figure 3-4. Land Uses

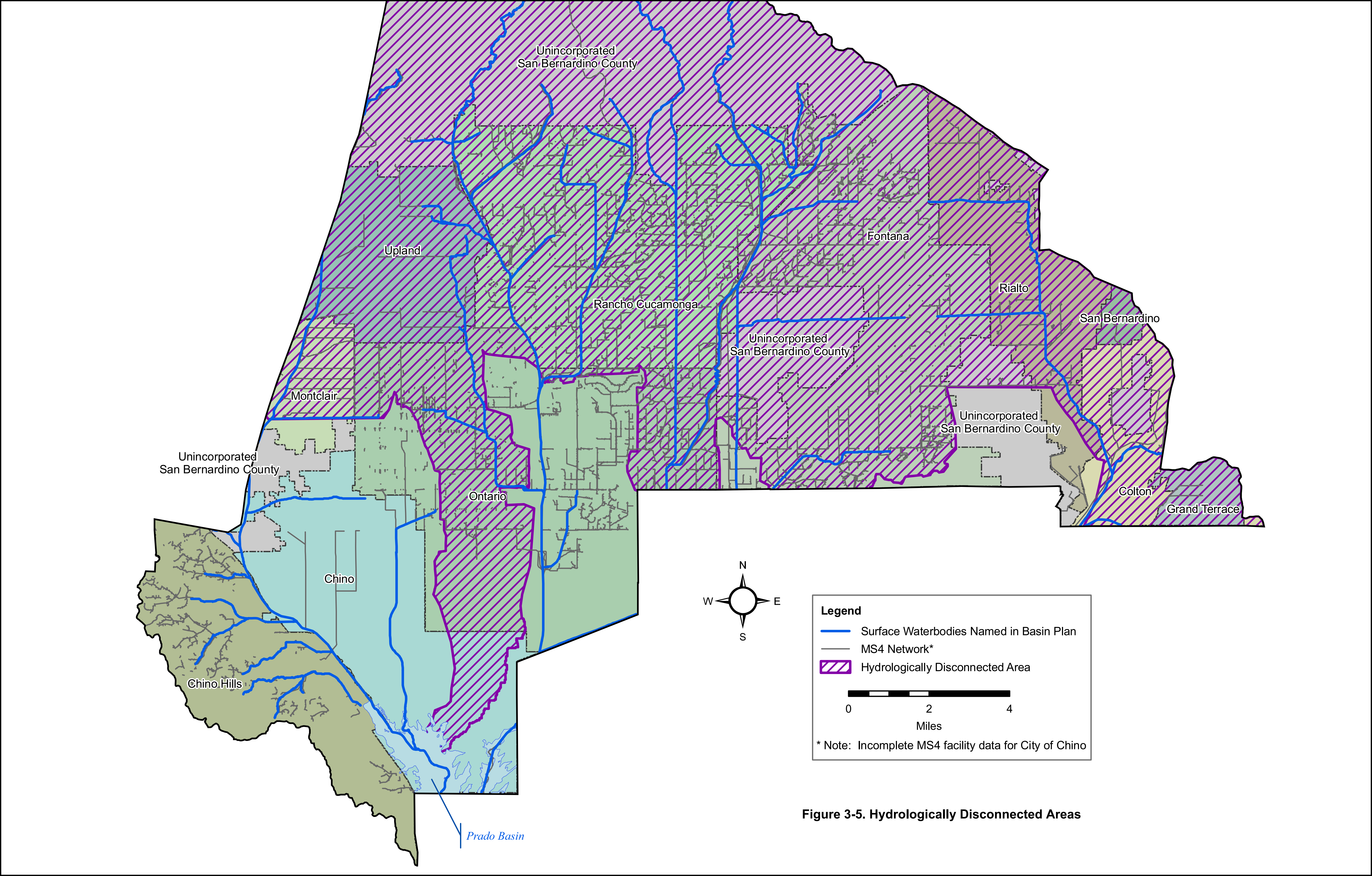


Figure 3-5. Hydrologically Disconnected Areas

Flow data was not available downstream of some portions of MS4 drainage areas; therefore it was necessary to approximate DWF from these areas to complete a water balance for each compliance monitoring site. Within the Chino Basin portion of the MSAR watershed, the Inland Empire Utilities Agency (IEUA) measures flow at a number of locations to quantify groundwater recharge for water supply benefit. Flow measurements, on days when DWF is predominantly from urban sources, suggest that DWF from urban sources occur at an average rate of 100 gal/acre/day in the MSAR watershed, ranging from 20 to 280 gal/acre/day (Table 3-2). This is consistent with DWF generation rates developed to support the City of Los Angeles Integrated Resources Plan (2004), which estimated DWF rates from urban watersheds ranging from zero to 300 gallons/acre/day. Thus, it was reasonable to use a rate of 100 gal/acre/day to approximate urban sources of DWF from unmonitored MS4 outfalls that may be hydrologically connected to a TMDL waterbody.

The USEP flow measurements indicated that some tributaries have significantly greater DWF rates per acre of urbanized drainage area than would be expected solely from urban sources. In these cases, the presence of a non-urban source was determined to be responsible for the elevated DWF rates. At a few locations, field measured runoff equated to less than 100 gal/acre/day; therefore all of the DWF could be attributed to urban sources from MS4s (i.e., assumption that non-urban sources in these subwatersheds are negligible).

Table 3-2. Urban DWF in MSAR watershed upstream of IEUA flow measurement locations

Location	Average Dry Weather Flow (cfs)	Urban Runoff Rate (gal/ac/day)
Grove Basin	0.04	111
West State Street Storm Drain	0.05	19
8th St. Storm Drain into 8th St.	0.17	82
West Cucamonga Inlet @ 8th St. B	0.41	92
Turner 1 Inlet from Cucamonga Cr	0.49	36
Deer Creek Drop Inlet @ Turner 4	1.58	110
Deer Creek @ 4th St. Overpass	1.06	105
Turner 4 - Guasti Creek	0.19	219
Lower Day Basin Forebay Storm Dr	0.02	63
San Sevaine Basin 5 Storm Drain	0.19	81
Victoria Basin Inlet	0.05	49
RP3 Basin Distribution Channel Inlet	0.32	53
Declez Channel at Live Oak	0.27	282
Declez Channel by School	0.16	98
	Average of all Sites	100

3.2.1 Chino Creek

Most of the DWF in Chino Creek at Central can be attributed to three sources, as described below:

- Urban DWF from the Cities of Chino, Chino Hills, and Montclair, as well as Pomona and Claremont (within Los Angeles County).
- Effluent from the IEUA Carbon Canyon Water Reclamation Facility
- Contributions from areas of rising groundwater and springs within the Carbon Canyon Creek Channel subwatershed.

U.S. Geological Survey (USGS) flow gauges measure flows at points downstream of 80 percent of the drainage area tributary to the Chino Creek at Central Avenue compliance point. Continuous flow data are available from a USGS gauge on Chino Creek at Schaeffer Avenue (USGS Gauge# 11073360) and a SBCFCD gauge on Carbon Canyon Creek Channel (SBCFCD# 2853). The urban DWF generation rate of 100 gal/acre/day was used to estimate the potential flow coming from the remaining 20 percent of unmonitored drainage areas.

The portion of the Chino Creek watershed upstream of Schaeffer Avenue (including San Antonio Channel) contributes ~3 cfs of flow during dry weather. This flowrate equates to an urban DWF generation rate of ~40 gallons/acre/day, based on the size of the upstream drainage area. The lower than typical rate could be the result of retention of DWF from portions of the MS4 drainage in recharge basins alongside San Antonio Channel (Table 3-3). Conversely, DWF in Carbon Canyon Creek Channel (~5 cfs) significantly exceeds the expected flow from a typical urban watershed in southern California (equating to an urban DWF generation rate of ~2,400 gal/acre/day). This subwatershed has historically experienced high groundwater conditions resulting in natural springs, which may provide one explanation for the elevated DWF rates (personal communication, Peter Hainey, San Bernardino County Department of Public Works, Water Resources Division, and May 6, 2010).

Table 3-3. SBCFCD or other facilities receiving DWF from MS4 drainages in the MSAR watershed

Facility Name	Owner	DWF Retained [1]	Subwatershed	Drainage Area (acres)
8th Street Basin	SBCFCD	Yes	West Cucamonga Creek	4,855 [2]
Banana Basin	SBCFCD	Yes	San Sevaine Channel	2,189 [2]
Brooks Basin	SBCFCD	Yes	San Antonio Channel	28,650
Cactus Basin	SBCFCD	Yes	Rialto Channel	4,240
Chris Basin	SBCFCD	No	Lower Deer Creek	5,196
Declez Basin	SBCFCD	Yes	San Sevaine Channel	8,405
Ely Basins	SBCFCD	Yes	West Cucamonga Creek	10,105

Table 3-3. SBCFCD facilities that receive DWF from MS4 drainages in the MSAR watershed

Facility Name	Owner	DWF Retained [1]	Subwatershed	Drainage Area (acres)
Etiwanda Basin	SBCFCD	Yes	Day Creek	6,024 [2]
Grove Avenue Basin	SBCFCD	Yes	Prado Park Lake	684
Jurupa Basin	SBCFCD	Yes	San Sevaine Channel	3,861
Bickmore Basin and Kimball Basin	Lewis Operating Corp.	Yes	Prado Park Lake	1,487
Merrill Basin	SBCFCD	Yes	Rialto Channel	3,426
Riverside Basin	SBCFCD	Yes	Day Creek	17,538
San Sevaine Basins	SBCFCD	Yes	San Sevaine Channel	2,800 [2]
Turner Basins	SBCFCD	Yes	Upper Deer Creek	9,924
Wineville Basin	SBCFCD	No	Day Creek	17,187 [2]
			Total (DWF retained)	**86,833**

1) Some facilities are detention basins by design, but have been configured by IEUA to retain natural and introduced DWF in order to maximize groundwater recharge
2) Basin is nested within the drainage area of a larger downstream basin

In addition to DWFs from the MS4 system, Chino Creek receives intermittent turnouts of imported water of approximately 45 cfs purchased from MWD by Orange County Water District (OCWD) at turnout OC-59 (Table 3-4). Turnouts to San Antonio Channel for OCWD are conveyed past the Chino Creek at Central Avenue compliance monitoring site.

Lastly, effluent from the IEUA Carbon Canyon WRRF contributes ~ 9 cfs of flow during dry weather conditions to Chino Creek upstream of the compliance monitoring site (Table 3-5).

Table 3-4. MWD turnouts of imported water in the MSAR watershed

Meter Number	Receiving Waterbody	Period of Record	Days With MWD Turnout[1]	Percent of Days with Turnout	Average Flow Rate of Turnout (cfs)
OC-59	San Antonio Channel	1/1/2005 – 4/30/2010	531	27%	45
CB-11	Upper Deer Creek	1/1/2005 – 4/30/2010	55	3%	6
CB-13	San Sevaine Channel	1/1/2005 – 12/31/2008	473	32%	18
CB-15	Day Creek	1/1/2005 – 4/30/2010	329	17%	8
CB-18	San Sevaine Channel	1/1/2005 – 4/30/2010	193	10%	5
CB-20	West Cucamonga Channel	9/1/2009 – 4/30/2010	4	2%	2

1) A turnout is the transfer of water from MWD transmission system to a flood control channel

Table 3-5. Average daily effluent from POTWs in the MSAR watershed

Treatment Facility	Receiving Waterbody	Dry Season (cfs)
Riverside Water Quality Control Plant (RWQCP)	Santa Ana River Reach 3	49
Colton/San Bernardino RIX	Santa Ana River Reach 4	59
Rialto Wastewater Treatment Plant (WWTP)	Santa Ana River Reach 4	10
IEUA RP1 WRRF Outfall 1	Cucamonga Creek	27
IEUA RP1 WRRF Outfall 2	Prado Park Lake	8
IEUA Carbon Canyon WRRF (CCWRF)	Chino Creek	9
Yucaipa Valley Water District	Santa Ana River Reach 4	6
Lee Lake WWTP	Temescal Creek	0.9
Corona WWTP No.1 and No.3	Temescal Creek	5
Western Municipal Water District West Riverside WWTP	Santa Ana River Reach 3	7
	Totals	**181**

3.2.2 Mill-Cucamonga Creek

DWF in Mill-Cucamonga Creek consists of primarily effluent from the IEUA RP1 WRRF, as well as nuisance flows from urbanized drainages in the Cities of Upland, Ontario, and Rancho Cucamonga. Several retention basins capture most of the DWF from portions of the MS4 that are tributary to Cucamonga Creek (Table 3-3). In addition, IEUA intermittently purchases imported water from MWD, delivered from MWD's transmission system to Upper Deer Creek and West Cucamonga Creek at turnouts CB-11 and CB-20, respectively (Table 3-4). This water is recharged in IEUA basins prior to reaching the compliance monitoring site.

Effluent from IEUA RP1 WRRF to Cucamonga Creek contributes ~27 cfs, ranging from 16 to 42 cfs (Table 3-5). A berm in the center of Cucamonga Creek keeps effluent separated from DWFs from MS4 outfalls, from the discharge location for about 1 mile to Chino Avenue.

Flow measurements recorded in the USEP study, Cucamonga Creek upstream of the IEUA RP1 WRRF (US-CUC), show DWF of 2-3 cfs. Flow at this location represents 80 percent of the MS4 drainage area to the Mill-Cucamonga Creek compliance point at Chino-Corona Road. However, most of this drainage area is hydrologically disconnected during dry weather (Figure 3-5). SBCFCD conducted a Bacteriological Background Study in July of 2005 to assess dry weather inflows to Cucamonga Creek, approximately one mile upstream of the US-CUC monitoring location. Field measurements of all MS4 outfalls with runoff equaled a total discharge of 0.6 cfs and 1.0 cfs for two survey days; July 7 and July 13, respectively. Additional flow measurements would be needed to understand the differences between the 2005 SBCFCD Bacteriological Background Study and the 2007-2008 USEP study for this MS4 drainage area.

Downstream of the IEUA RP1 WRRF, there are two important tributaries; Lower Deer Creek and County Line channels. These channels were included in the USEP monitoring activities and monitoring data provides an estimate of DWF. County Line channel did not generate measurable discharges of DWF during most field visits during the 2007-2008 USEP monitoring program. Average DWF from the Lower Deer Creek drainage area is approximately 1 cfs.

There is a USGS continuous flow gauge at Merrill Avenue. This gauge is downstream of 95 percent of the MS4 drainage area in the Mill-Cucamonga Creek watershed. Median flow during dry weather in the dry season at this flow gauge is 36 cfs.

3.2.3 Prado Park Lake

Flow entering Prado Park Lake during dry weather is predominantly comprised of effluent from IEUA RP1 WRRF. Effluent from the IEUA RP1 WRRF is split between discharges to Mill-Cucamonga Creek and to Prado Park Lake. The portion discharged to Prado Park Lake is ~20 percent of the plant's treated effluent. The park surrounds the lake and does not generate any measurable flow during dry weather conditions. The Prado Park Lake drainage area includes primarily agricultural areas, where runoff is required to be kept on-site. The drainage area also includes a small portion of the Cities of Chino and Ontario MS4. DWF from this MS4 drainage area is retained within the Grove Avenue and Kimball basins. Effluent rates from the IEUA RP1 WRRF to Prado Park Lake range from 7-10 cfs. The median of measured outflows from Prado Park Lake averaged 6 cfs during dry weather in the dry season; thus, data suggest that other sources of DWF into the lake are minimal.

3.2.4 Santa Ana River at MWD Crossing

Continuous flow occurs in the Santa Ana River at MWD Crossing. The primary source of this flow is a combination of treated effluent from the Rialto WWTP and RIX facility serving San Bernardino and Colton. Combined, these sources of effluent discharge approximately 70 cfs to Reach 4 of the Santa Ana River, upstream of Riverside Avenue (Table 3-5). There is typically no flow during dry weather in the Santa Ana River upstream of these plants.

In addition to effluent from these plants, urban DWF at MS4 outfalls is persistent in several tributary areas. The USEP monitoring program visited outfalls from MS4 drainages within Riverside County only. Potential sources of urban DWF from San Bernardino County jurisdictional areas to the Santa Ana River upstream of the MWD crossing compliance monitoring site are limited to Rialto Channel and an unincorporated area on the south side of Bloomington. Historical surveys suggest that these areas do not contribute any urban DWF to the Santa Ana River (Figure 3-5). Additional field monitoring is needed to confirm whether these areas are hydrologically disconnected.

3.2.5 Santa Ana River at Pedley Avenue

The compliance point at Pedley Avenue (WW-S4) is approximately 5 miles downstream of the MWD Crossing compliance point. Between these compliance points, the RWQCP discharges ~50 cfs of treated effluent to the Santa Ana River (Table 3-5).

MS4 outfalls in this reach are also sources of flow to the Santa Ana River. The MS4 drainage areas on the south side of the Santa Ana River fall entirely within Riverside County and are outside of the geographic planning area of this CBRP for San Bernardino County. Drainage areas north of the Santa Ana River include San Sevaine Channel and Day Creek. The portions of these subwatersheds within San Bernardino County are almost entirely upstream of one of IEUA's regional groundwater recharge basins, and are therefore hydrologically disconnected from the Santa Ana River (Figure 3-5). A small industrial area in the southwest corner of the City of Fontana may generate urban DWF that has the potential to reach the Santa Ana River (downstream of the Jurupa Basin along San Sevaine Channel). This drainage area will require further investigation to determine if DWF is present at outfalls to San Sevaine Channel.

In addition to urban DWF, there are intermittent turnouts from MWD's transmission system to San Sevaine Channel at CB-13 and CB-18 for recharge in the San Sevaine and Jurupa Basins, respectively. These flows are captured, and therefore do not reach the Santa Ana River.

3.3 MS4 Facilities

This section describes the MS4 facilities within the major subwatershed areas draining to each of the watershed-wide compliance locations. Based on available MS4 facility data[7], Figure 3-6 illustrates the MS4 facilities including major outfalls to waterbodies for permittees in San Bernardino County. This figure illustrates the significant number of outfalls that drain to each of the watershed-wide compliance monitoring sites.

Figure 3-7 provides an Index Map for subsequent detailed figures that depict key characteristics associated with the MS4 facilities located within each of the major MSAR subwatersheds. These figures include:

- Chino Creek at Central Avenue (Figure 3-8); below San Antonio Dam
- Mill-Cucamonga Creek at Chino Corona Road (Figure 3-9)
- Santa Ana River at MWD Crossing (Figure 3-10)
- Santa Ana River at Pedley Avenue (Figure 3-11)

[7] GIS-based MS4 facility data are not currently available from City of Chino

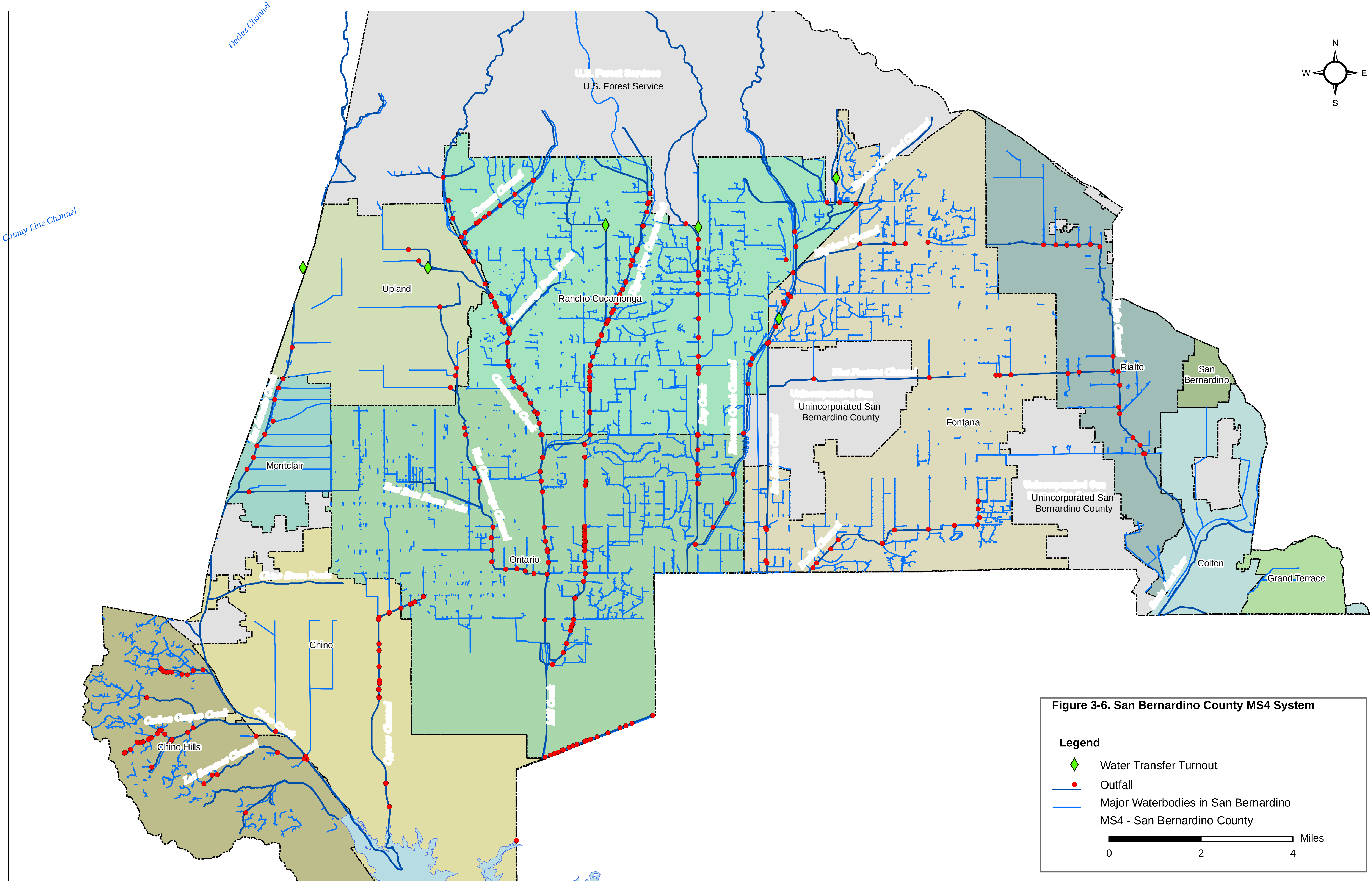
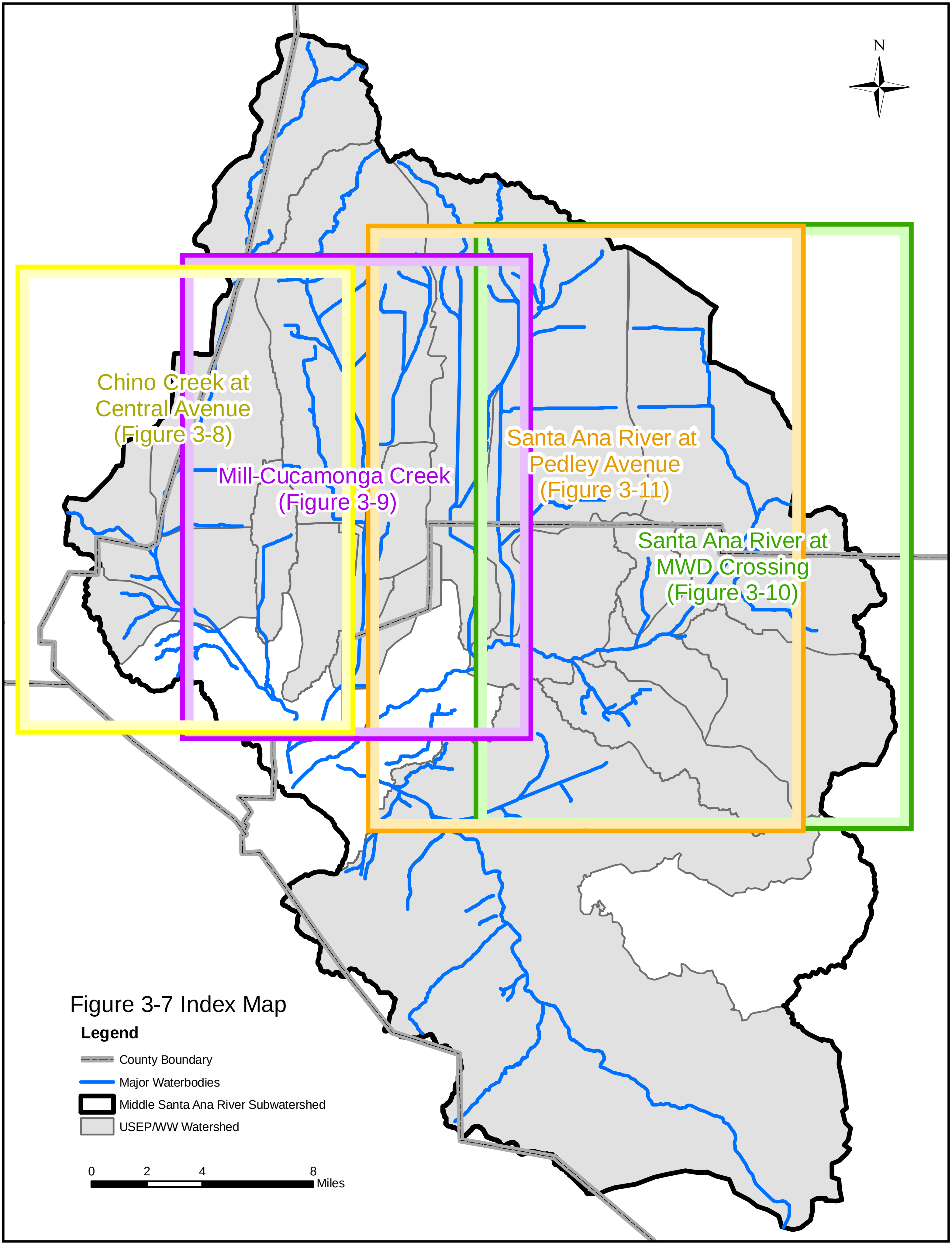


Figure 3-6. San Bernardino County MS4 System


N
Chino Creek at
Central Avenue
(Figure 3-8)
Mill-Cucamonga Creek
(Figure 3-9)
Santa Ana River at
Pedley Avenue
(Figure 3-11)
Santa Ana River at
MWD Crossing
(Figure 3-10)
Figure 3-7 Index Map
Legend
County Boundary
Major Waterbodies
Middle Santa Ana River Subwatershed
USEP/WW Watershed
0
2
4
8
Miles

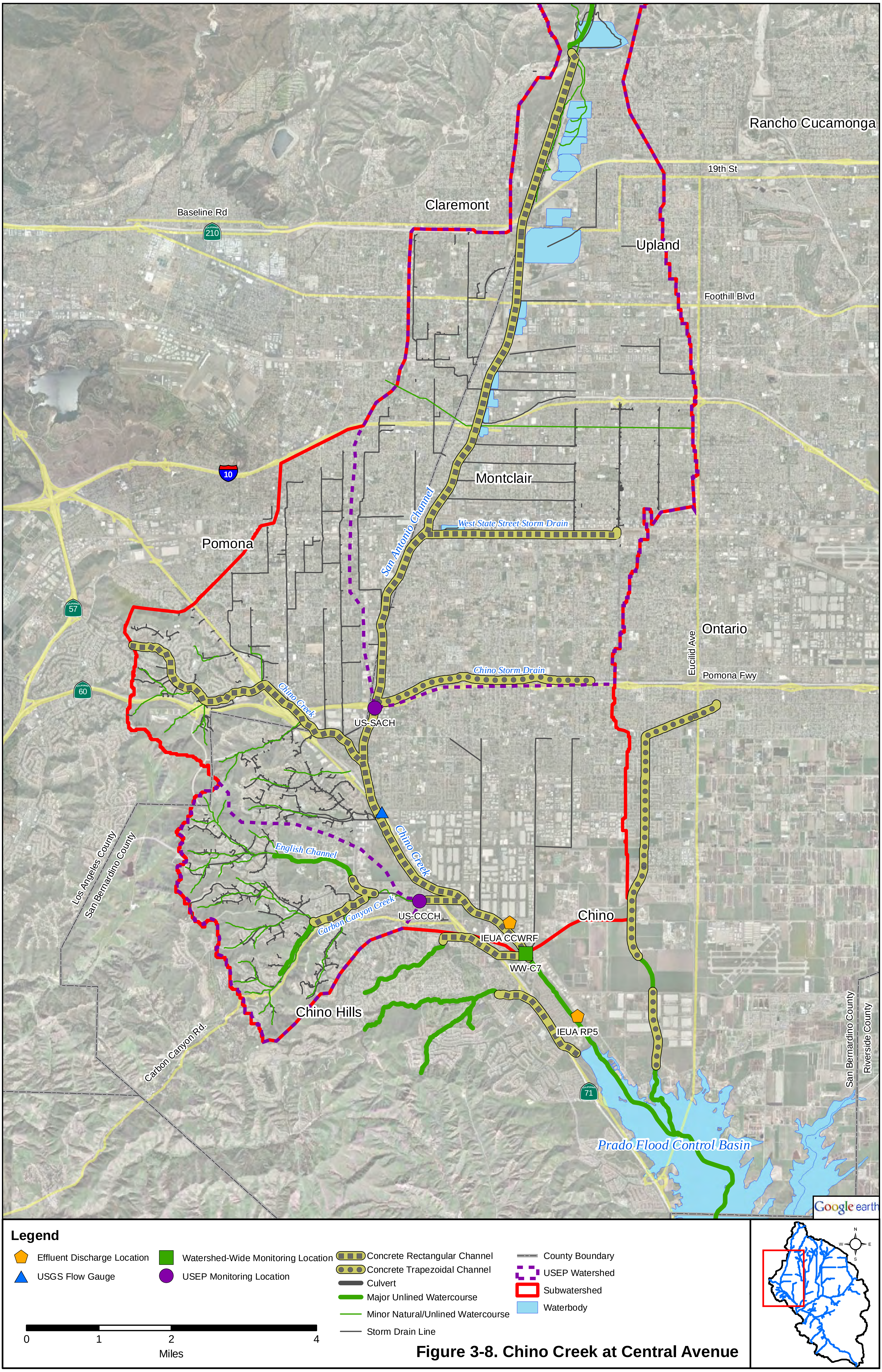


Figure 3-8. Chino Creek at Central Avenue

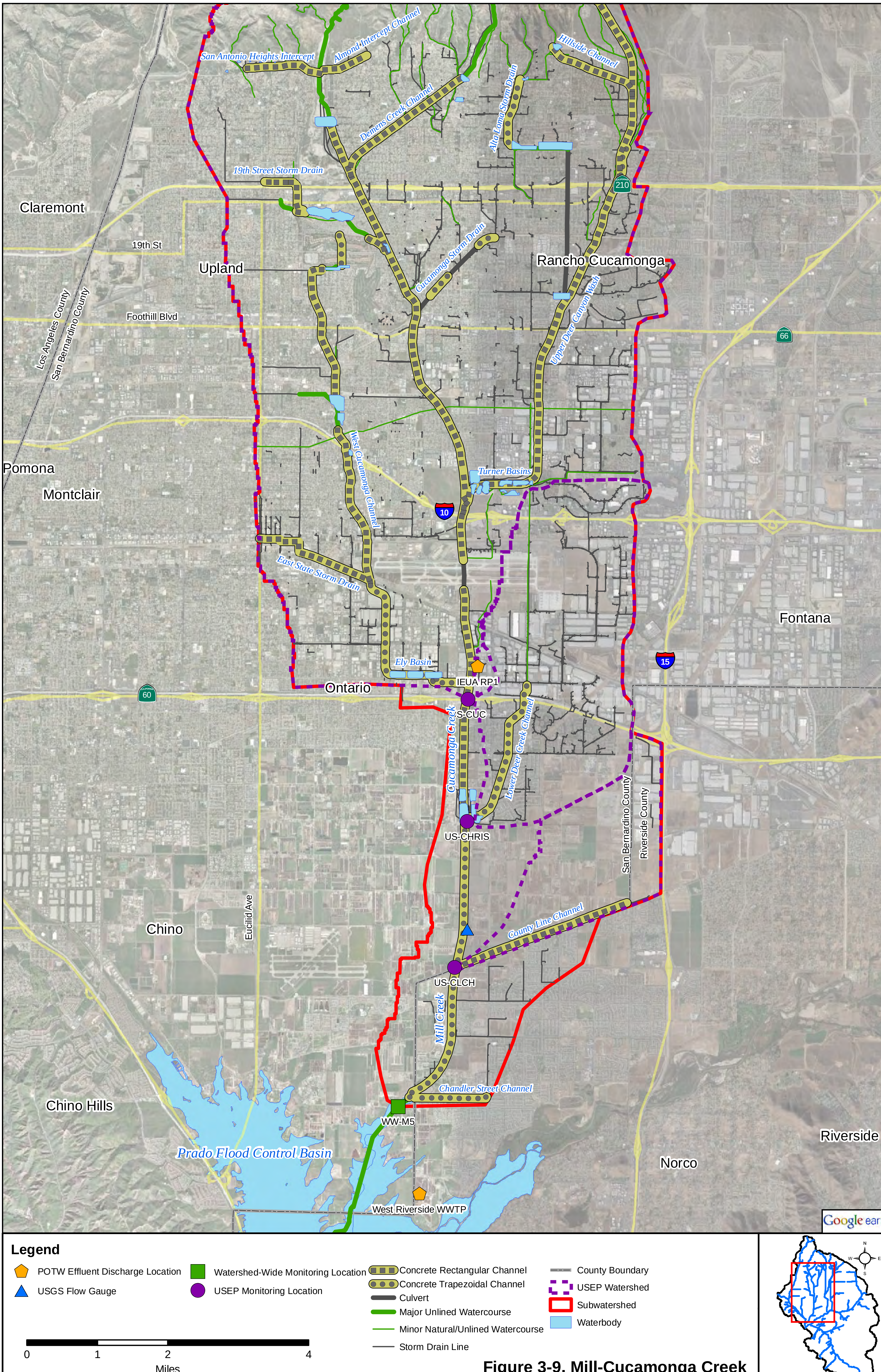


Figure 3-9. Mill-Cucamonga Creek

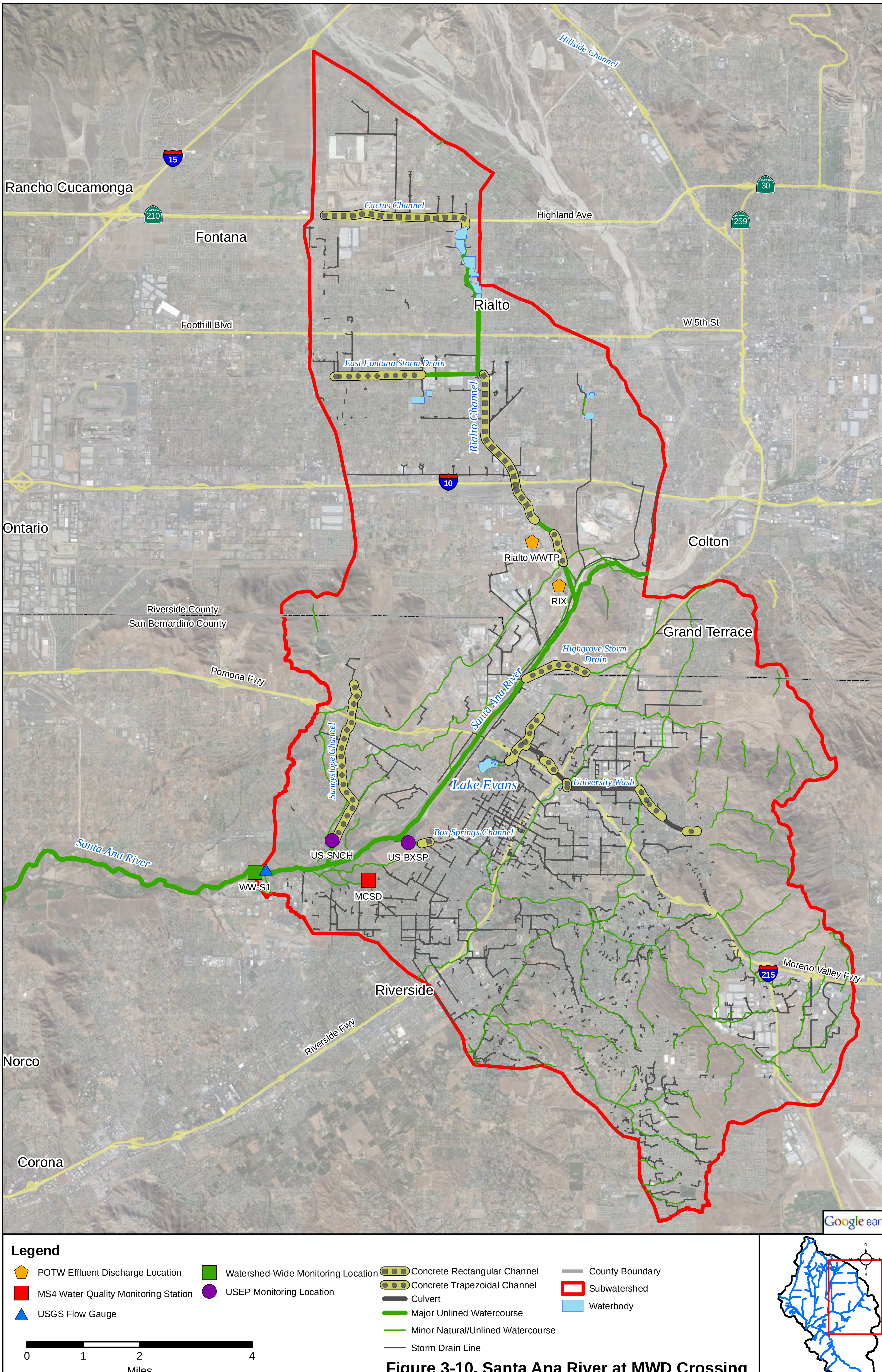


Figure 3-10. Santa Ana River at MWD Crossing

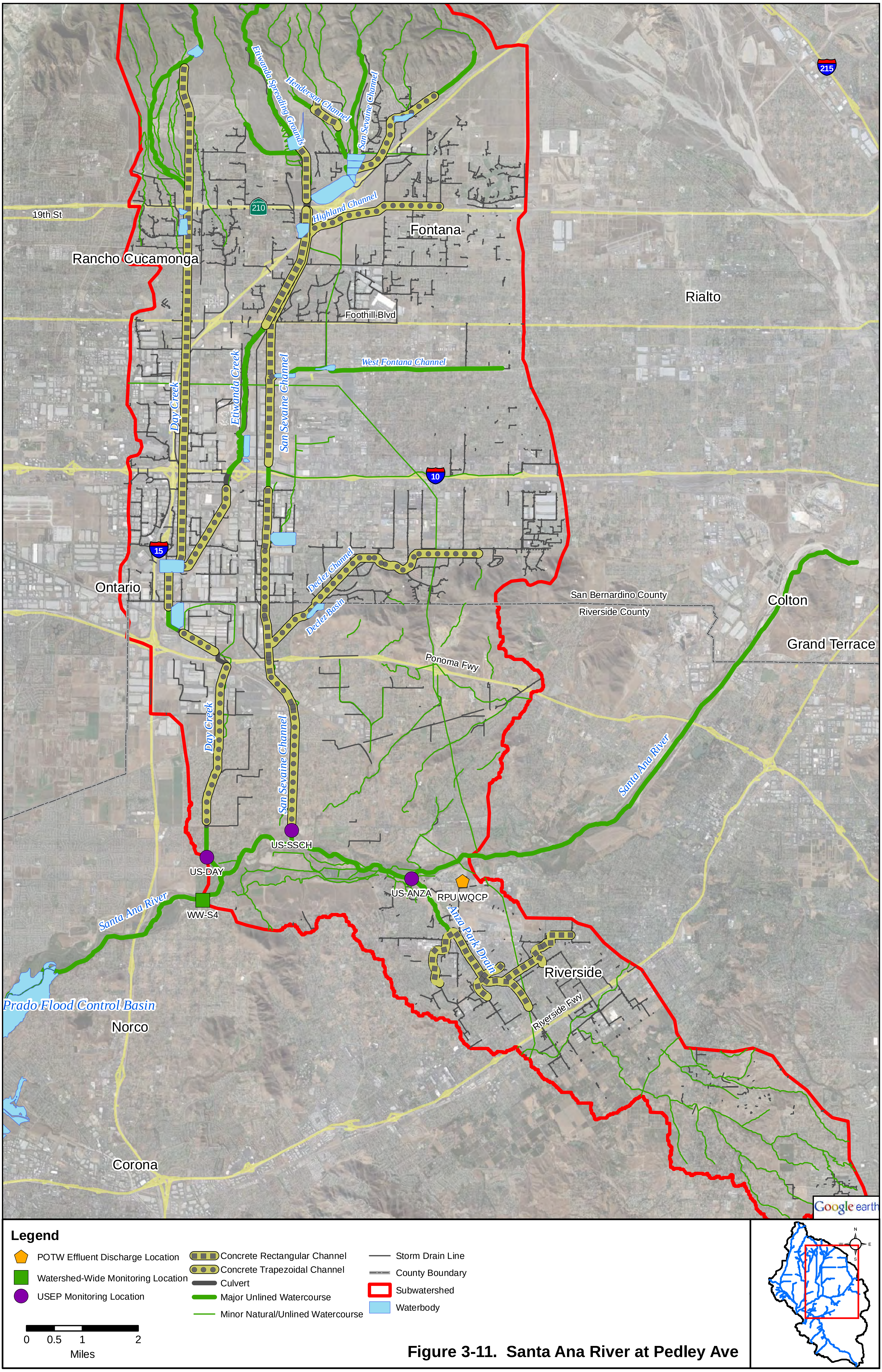


Figure 3-11. Santa Ana River at Pedley Ave

No map is provided for the area draining to the Prado Park Lake watershed-wide compliance point since there are no known MS4 facilities draining to this man-made lake. The following sections provide more detailed descriptions of the primary MS4 characteristics and subwatershed features in each drainage area. The information on the physical characteristics of key waterbodies is provided as background to support the discussion regarding UAA opportunities in Section 5.2.5.

3.3.1 Chino Creek at Central Avenue Subwatershed

The area encompassed by the Chino Creek watershed-wide compliance site is 90 mi^2 square miles. Mainstem Chino Creek may be divided into three reaches based on different physical attributes (underground, concrete-lined, and earthen-bottomed segments) (Table 3-6, Figure 3-8). Significant tributaries to Chino Creek include:

- *San Antonio Channel* – This channel drains a 61 mi^2 subwatershed. It is divided into two segments – above and below the San Antonio Dam. At the confluence with Chino Creek, the combined channel is commonly referred to as San Antonio Channel, to the end of the concrete channel.

- *Carbon Canyon* – This tributary drains a relatively small subwatershed (~ 6 mi^2) and discharges to a concrete-lined segment of San Antonio/Chino Creek. The lower portion of Carbon Canyon Creek is constructed with a series of regularly spaced grade control structures, which were designed to reduce flow velocities during wet weather. This feature may contribute to lowering bacterial levels in the creek, and is more fully described in SAWPA (2010d). The English Canyon tributary confluences in this lower reach.

In addition to the two tributaries described above, two significant storm drain systems discharge to San Antonio Channel, upstream of Chino Creek: West State Storm Drain and Chino Storm Drain.

3.3.2 Mill-Cucamonga Creek at Chino-Corona Road Subwatershed

The area encompassed by the Mill-Cucamonga Creek watershed-wide compliance site is 70 mi^2. In addition to the mainstem Cucamonga Creek, significant tributaries include (Table 3-7, Figure 3-9):

- *Demens Creek* - This channel drains a 5.7 mi^2 subwatershed. It may be divided into two segments – one above and the other below the detention basins that capture flows from undeveloped canyon areas in the headwaters.

- *Upper Deer Creek* - This channel drains an 18 mi^2 subwatershed. It may be divided into two segments – one above and the other below the detention basins that capture flows from undeveloped canyon areas in the headwaters.

Table 3-6. Characteristics of channels draining to the Chino Creek at Central Avenue watershed-wide compliance monitoring site

Reach	Segments	Description
Chino Creek	Headwaters to Hwy 71/Hwy 60 Interchange	2.4 mi underground drainage
	Hwy 71/Hwy 60 Interchange to Central Avenue	5.6 mi concrete-lined trapezoidal reach; includes San Antonio Channel confluence
	Central Ave. to Prado Basin	6.5 mi trapezoidal earthen bottom channel
San Antonio Channel	Headwaters to San Antonio Dam (not shown on Figure 3-8)	Discharge from headwater area captured by San Antonio Dam
	Below San Antonio Dam to Chino Creek confluence	9.7 mi concrete-lined reach
Carbon Canyon Creek (incl. English Canyon)	Upper - Headwaters to Chino Hills Parkway	0.9 mi reach with natural characteristics
	Middle - Chino Hills Parkway to ~1000 ft upstream of English Canyon confluence	0.8 mi vertical concrete-lined reach
	Lower - ~1000 ft upstream of English Canyon confluence to confluence with Chino Creek	0.9 mi trapezoidal channel with concreted-rock bottom and grade control structures
West State Street Storm Drain	Headwaters to San Antonio Channel confluence	2.7 mi concrete-lined rectangular reach
Chino Storm Drain	Headwaters to San Antonio Channel confluence	3.1 mi concrete-lined trapezoidal reach; enters San Antonio Channel just upstream of San Antonio Creek/Chino Creek confluence

Table 3-7. Characteristics of channels draining to the Mill-Cucamonga Creek watershed-wide compliance monitoring site

Reach	Segments	Description
Cucamonga Creek	Headwaters to Cucamonga Canyon Dam (not included on Figure 3-9)	Discharge from undeveloped canyon headwater area captured by Cucamonga Canyon Dam
	Below Cucamonga Canyon Dam to Hellman Avenue	14 mi concrete-lined reach; includes discharge from RP1 WRRF
	Hellman Ave. to Chino-Corona Rd	0.25 mi concrete-lined trapezoidal reach
	Chino-Corona Rd to Prado Basin	3.4 mi earthen bottom trapezoidal reach
Demens Creek	Headwaters to Detention Basin	Discharge from undeveloped canyon headwater area captured by detention basin
	Below Detention Basin to Cucamonga Cr. confluence	2.2 mi concrete-lined reach
Upper Deer Creek	Headwaters to Detention Basin	Discharge from undeveloped canyon headwater area captured by detention basin
	Below Detention Basin to Cucamonga Cr. confluence	3.6 mi concrete-lined reach
Lower Deer Creek (Chris Basin)	Headwaters to Chris Basin at Cucamonga Cr. confluence	2.1 mi concrete-lined reach
County Line Channel	Headwaters to Cucamonga Cr. confluence	2.6 mi concrete-lined reach
West Cucamonga Creek	Headwaters to Ely Basins at Cucamonga Cr. confluence	8.2 mi combination of culvert and concrete-lined rectangular and trapezoidal reaches; upper reach of segment drains to 8^{th} Street Basins
Cucamonga Storm Drain	Headwaters to Cucamonga Creek confluence	1.6 mi reach of concrete lined rectangular and culvert

- *Lower Deer Creek* – This waterbody drains a small subwatershed (~10 mi^2) entirely within the City of Ontario. Chris Basin is at the downstream end of Lower Deer Creek, and transitions flows to Cucamonga Creek. As a result of poor infiltration rates in Chris Basin (due to soil characteristics), dry weather runoff flows through the basin to Cucamonga Creek.

- *County Line Channel* – This waterbody consists of a concrete-lined channel in the lower part of the subwatershed which drains a small subwatershed (~6 mi^2). This channel collects urban runoff primarily from the City of Ontario, with a small portion coming from Riverside County

- *West Cucamonga Channel* – This channel is ~8.2 miles of a combination of concrete-lined rectangular and trapezoidal reaches; upper reach of this segment drains to 8th Street Basins. Prior to the confluence with Cucamonga Creek, DWF in West Cucamonga Channel is captured in the Ely Basins. IEUA operates these basins to maximize recharge of the underlying Chino groundwater basin.

In addition to the tributaries described above, one significant storm drain system discharges to Cucamonga Creek: Cucamonga Storm Drain. Other potentially important storm drain systems that discharge to tributaries to Cucamonga Creek include the Alta Loma Storm Drain and the East State Storm Drain.

Riverside County maintains one significant tributary, Chandler Storm Drain, which collects primarily agricultural flows from Riverside County, south of County Line Channel.

3.3.3 Santa Ana River at MWD Crossing Subwatershed

The area upstream of this location encompasses the upper portion of the MSAR watershed (Figure 3-10). In addition to drainage within the MSAR watershed, it receives flows from Santa Ana River Reach 4, but typically only during wet weather. Within the MSAR watershed, water flowing to this location drains 101 mi^2, much of it in Riverside County. Within San Bernardino County, there are two significant tributaries to Santa Ana River Reach 3 upstream of MWD Crossing: Rialto Channel (Figure 3-10), whose structure is a combination of trapezoidal and rectangular concrete-lined segments and native earth reaches (~ 9 miles in length).; and Highgrove Storm Drain, which contributes flows during wet weather only from Grand Terrace, which is not named in the TMDL. Highgrove Storm Drain is owned by the City of Riverside.

3.3.4 Santa Ana River at Pedley Avenue Subwatershed

This subwatershed (126 mi^2, not including the portion of the Santa Ana River Reach 3 watershed upstream of the MSAR Reach 3 MWD Crossing Watershed-wide compliance monitoring site) generally encompasses the portion of the MSAR watershed upstream of Prado Basin Dam and below the MSAR Reach 3 MWD Crossing location. This drainage area receives flow from the portion of the MSAR above the MWD Crossing compliance location. In addition, flow is received from three key tributaries. The upper reaches of two of these tributaries are located in San Bernardino County (Table 3-8, Figure 3-11):

Table 3-8. Characteristics of channels draining to the Santa Ana River Pedley Avenue watershed-wide compliance monitoring site

Reach	Segments	Description
San Sevaine Channel & Tributaries	Headwaters to San Sevaine Basins	Discharge from headwater area captured by San Sevaine Basins
	San Sevaine Basins to Santa Ana River confluence	11 mi concrete-lined reach from San Sevaine Basins to Santa Ana River confluence
	Highland Channel - Headwaters to San Sevaine Channel confluence	2.5 mi concrete-lined trapezoidal reach
	Declez Channel - Headwaters to San Sevaine Channel confluence	~2.5 mi concrete-lined rectangular segment and 2.2 mi concrete lined trapezoidal reach; lower portion including confluence with San Sevaine Channel is in Riverside County.
	West Fontana Channel – Headwaters to Banana Basin	~ 3 mi earthen trapezoidal channel from Beech Avenue to Banana Basin
Day Creek & Tributaries	Headwaters to Day Creek Basins	Discharge from undeveloped areas captured by Day Creek Basins
	Day Creek Basins to Limonite Avenue	11 mi concrete-lined reach - lower end of this reach is in Riverside County
	Limonite Avenue to Lucretia Avenue	0.6 mi earthen bottom trapezoidal channel – within Riverside County
	Lucretia Avenue to MSAR confluence	Natural characteristics – within Riverside County
	Etiwanda Channel - Headwaters to Etiwanda Debris Basin	Discharge from undeveloped areas captured in the Etiwanda Debris Basin
	Lower Etiwanda Creek Channel - Etiwanda Debris Basin outflow to Day Creek confluence	8.5 mi concrete-lined for entire length except for short segment between Foothill Boulevard and the Etiwanda Conservation Basins on either side of I-10 Fwy

- *San Sevaine Channel* - This channel drains a relatively large area encompassing approximately 51 mi^2. It may be divided into two segments – a headwaters area that discharges to the San Sevaine Basins upstream of the MS4 and a lengthy engineered segment. The lower part of the engineered segment is in Riverside County. Three important tributaries to San Sevaine Channel include the Highland Channel, West Fontana Channel and Declez Channel. The Highland Channel enters San Sevaine in the upper part of its watershed in San Bernardino County. West Fontana Channel collects surface flows from a majority industrial component, which has no other MS4 infrastructure (storm drains). Declez Channel enters San Sevaine Channel in the lower part of the watershed in Riverside County, but the upper part of this channel is in San Bernardino County. There is a large detention basin just below the County line, which treats low flows; a short segment connects the basin through Riverside County, to the San Sevaine Channel confluence.

- *Day Creek/Etiwanda Channel* – The Day Creek drainage area encompasses an approximately 33 mi^2 area. It has one major tributary - Etiwanda Creek. The mainstem of Day Creek may be divided into four segments with varying characteristics (see Table 3-8) and the Etiwanda tributary may be divided into four segments, the headwaters, an engineered upstream portion, which outlets to a native portion in the middle, and engineered downstream segment.

3.4 Baseline Water Quality

Water quality monitoring in the MSAR watershed to support TMDL implementation has been ongoing since 2007 at all five watershed-wide compliance monitoring sites. To date, this effort has included (see also Sections 2.4 and 2.5.1):

- Collection of 20 bacterial indicator samples during the dry season (April 1 – October 31), dry weather conditions in 2007, 2008, 2009 and 2010.

- Collection of 11 bacterial indicator samples during wet season (November 1 – March 31), dry weather conditions in 2007, 2008, and 2009.

- Collection of 4 bacterial indicator samples during and after a wet weather event in each of the wet seasons of 2007, 2008 and 2009.

- Collection of approximately 20 bacterial indicator samples during dry weather conditions in both dry and wet seasons from 13 USEP monitoring program locations in 2007-2008.

In addition to TMDL-related monitoring, sampling has been conducted by the SBCFCD to fulfill San Bernardino County MS4 permit monitoring requirements; however, this sampling occurs only during wet weather. The following sections summarize baseline water quality for bacterial indicators in the MSAR watershed. Detailed information is available in data reports prepared to support TMDL implementation: SAWPA (2009a) summarizes the findings from the 2007 dry season and 2007-08 wet season monitoring; SAWPA (2009b) and SAWPA (2009c) summarize the findings from the 2008 dry and 2008-2009 wet seasons, respectively; SAWPA (2009d) and SAWPA (2010c) summarize the results from the 2009 dry and 2009-2010 wet seasons; and SAWPA (2010f) summarizes the results from the 2010 dry season, respectively.

3.4.1 Watershed-wide Compliance Monitoring

Table 3-9 and Figure 3-12 present the geometric mean, median, and coefficient of variation of the *E. coli* level from samples collected during dry weather in the dry and wet weather seasons at each of the compliance monitoring sites[8,9]. Generally, *E. coli* levels within the Santa Ana River are lower than in Chino Creek and Mill-Cucamonga Creek. Prado Park Lake bacterial indicator levels are also comparatively low. These summary statistics are presented to provide an overall view of water quality; actual measures of compliance are based on geometric mean calculations from samples collected over a period of no more than 30 days. Exceedances of *E. coli* water quality objectives expected to be adopted in the ongoing Basin Plan amendment process (see Section 1.1.4) occur regularly at all sites. In addition, exceedances of the TMDL urban wasteload allocations regularly occur.

Figures 3-13 through 3-17 illustrate the pattern in single sample and geometric mean results for *E. coli* over the 2007-2010 period for all five compliance monitoring sites. In general, the observed overall dry weather season geometric mean *E. coli* concentrations at each watershed-wide TMDL compliance monitoring site declined over the period from 2007-2009, but then increased in 2010 (dry season. Bacterial indicator concentrations remain well above the urban wasteload allocations at the Mill-Cucamonga Creek and Chino Creek compliance monitoring sites.

Table 3-10 summarizes the frequency of compliance with single sample and geometric mean Basin Plan REC-1 water quality objectives proposed for *E. coli (*235 cfu/mL for single sample and 126 cfu/mL) during dry weather conditions in the dry season 2007-2010. At some locations there has been an improvement in compliance frequency since data collection began in 2007, e.g., as observed at the Santa Ana River watershed-wide compliance monitoring sites. The frequency of exceedance of fecal coliform samples collected in 2002 through 2004 to develop the TMDL is also shown in Table 3-10. These values are based on samples collected in the dry and wet seasons during dry and wet weather conditions, so it is difficult to make any direct comparisons with samples collected in 2007-2009. Generally, bacteria indicator exceedances are comparable between the recent monitoring and the data used to develop the TMDL.

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8 Similar data are available for fecal coliform, but are not presented in this document (they may be viewed in the SAWPA references provided above). It is expected that the Regional Board will adopt a Basin Plan amendment by Spring 2011 replacing fecal coliform water quality objectives with *E. coli* objectives. Accordingly, all bacterial indicator summaries and analyses in this CBRP are based on *E. coli*.

9 The wet season data collected under dry conditions is provided in this CBRP for informational purposes only. This CBRP only applies to dry weather conditions from April 1 – October 31.

Table 3-9. Summary statistics for *E. coli* levels (cfu/100 mL) and data variability by sample location during dry weather conditions in the dry and wet seasons (2007-2010)

Site	Dry Season				Wet Season			
	N	Geometric Mean	Median	Coefficient of Variation[1]	N	Geometric Mean	Median	Coefficient of Variation[1]
Prado Park Lake (WW-C3)	57	80	80	0.25	28	184	120	0.19
Chino Creek at Central Ave (WW-C7)	55	394	370	0.13	27	227	210	0.21
Mill-Cucamonga Creek at Chino-Corona Rd (WW-M5)	56	877	770	0.11	26	198	225	0.23
Santa Ana River at MWD Crossing (WW-S1)	58	149	140	0.12	23	90	90	0.26
Santa Ana River at Pedley Ave (WW-S4)	55	149	140	0.14	26	95	120	0.17

[1] - Coefficient of variation was calculated using natural log-transformed data

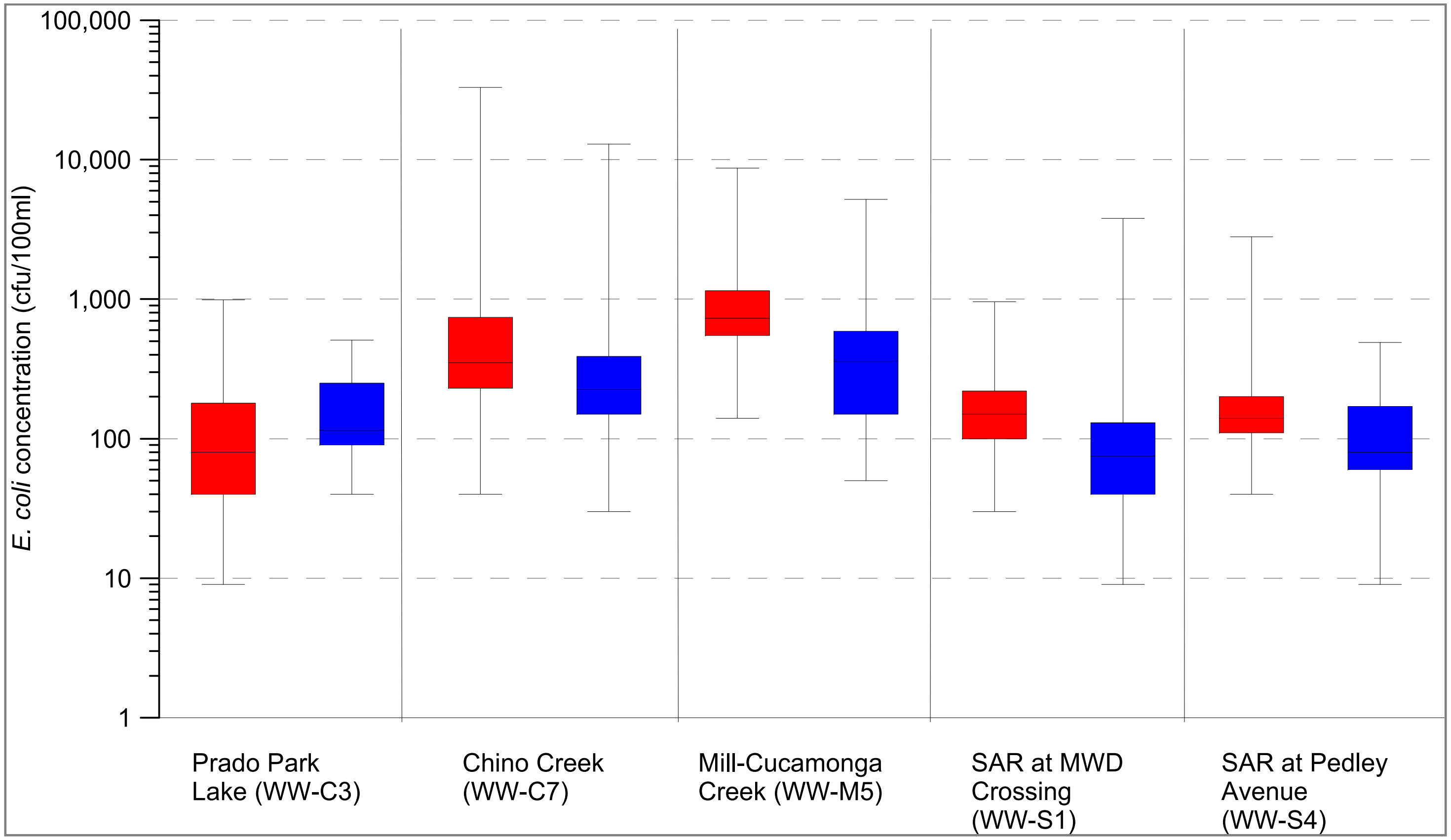


Figure 3-12. Box-Whisker Plots of *E. coli* concentration in samples collected under dry weather conditions during the dry season (red) and wet season (blue) at MSAR watershed-wide compliance monitoring sites

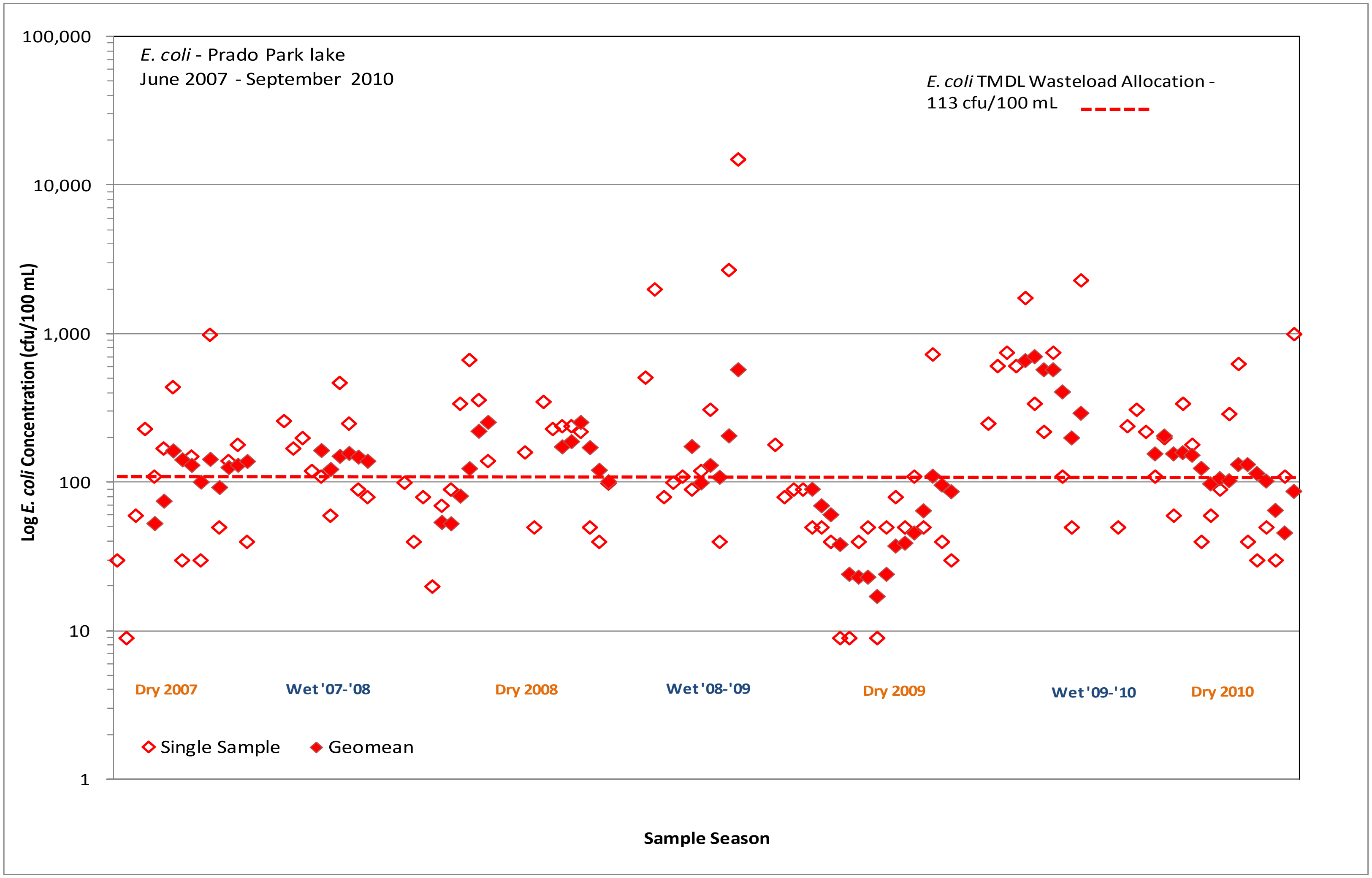


Figure 3-13. Time series plot of *E. coli* single sample results and geometric means for samples collected from Prado Park Lake (WW-C3, 2007-2010). Geometric mean was calculated only if five samples were collected during the previous five weeks.

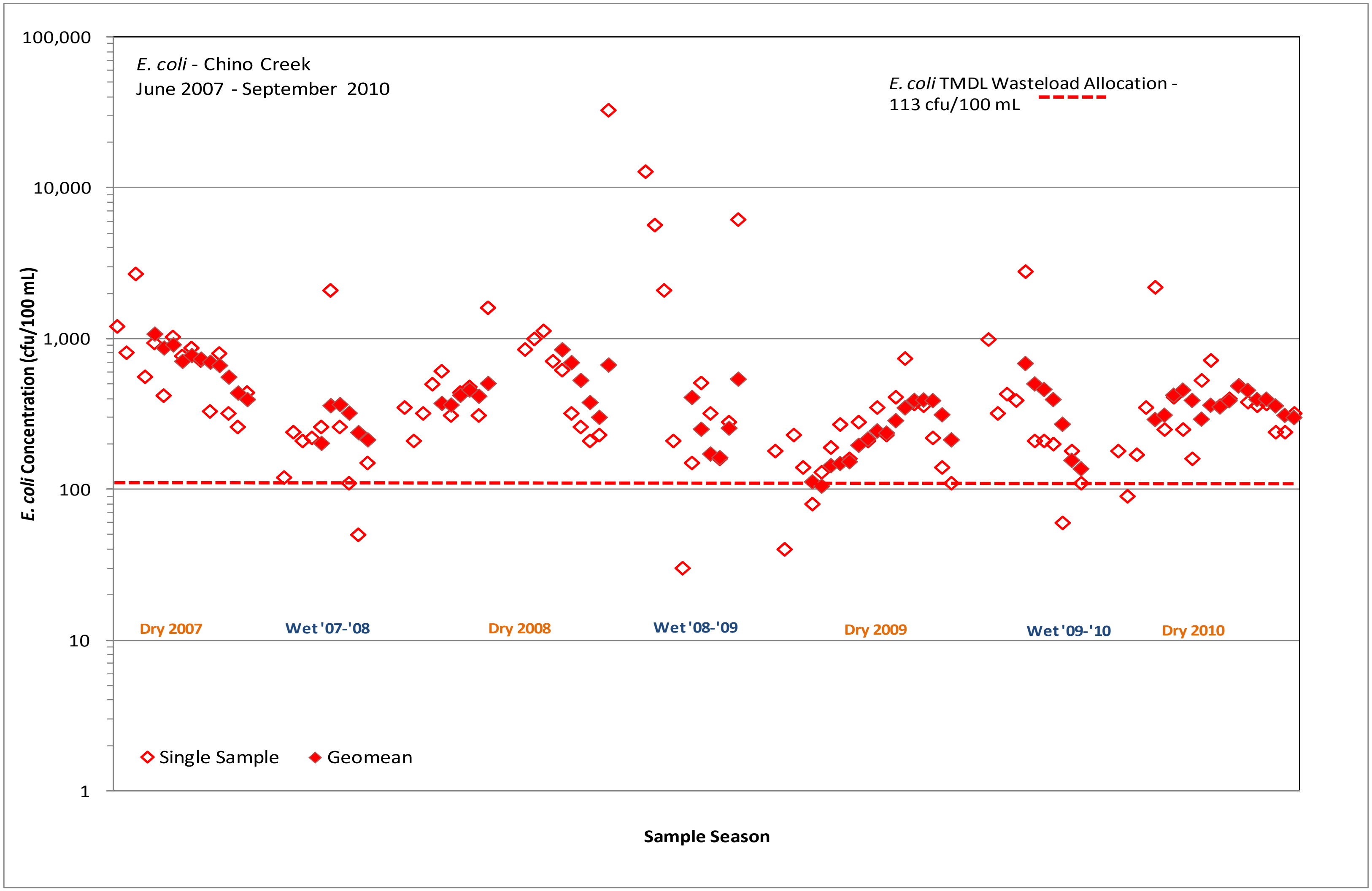


Figure 3-14. Time series plot of *E. coli* single sample results and geometric means for samples collected from Chino Creek (WW-C7, 2007-2010). Geometric mean was calculated only if five samples were collected during the previous five weeks.

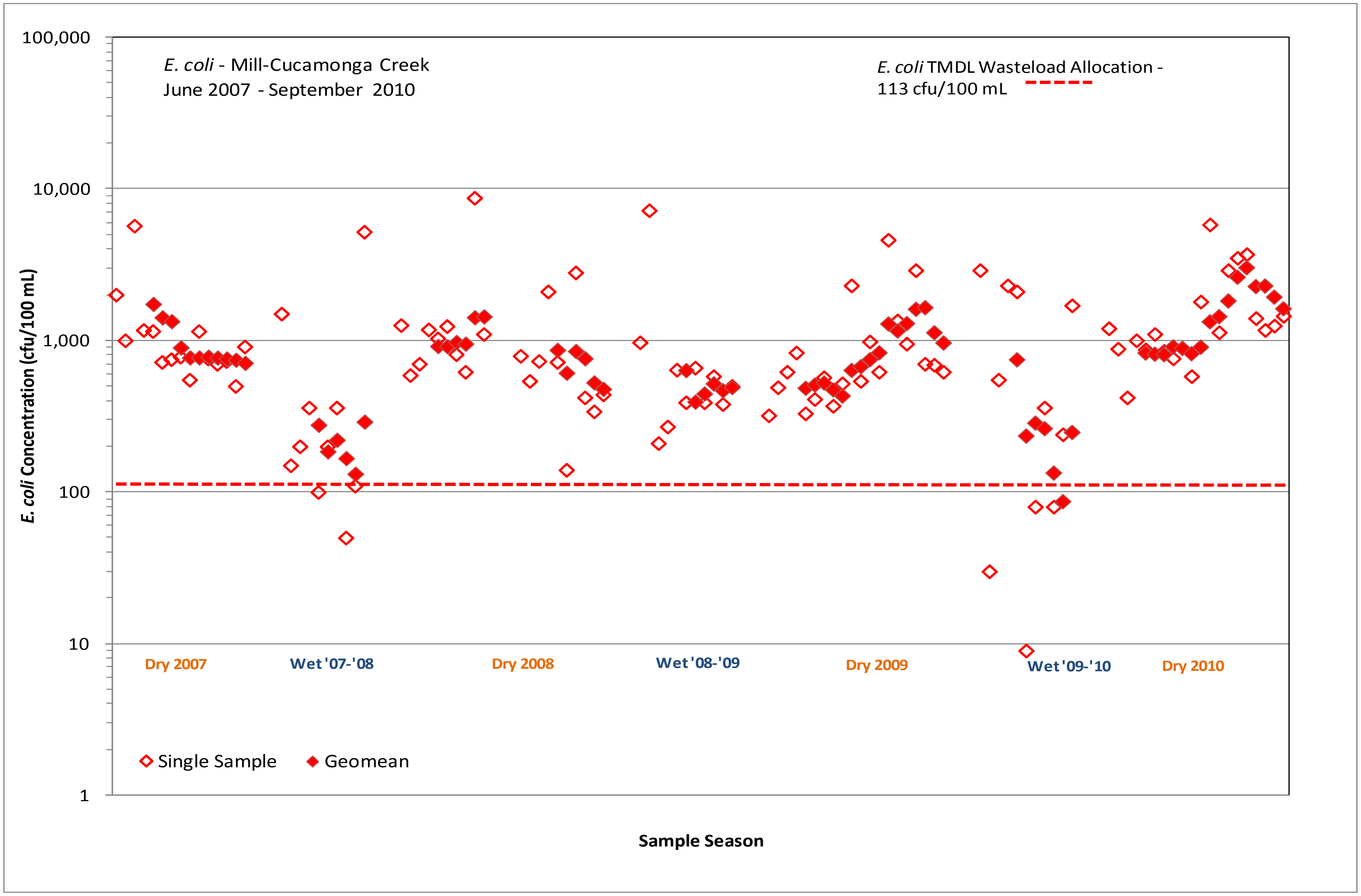


Figure 3-15. Time series plot of *E. coli* single sample results and geometric means for samples collected from Mill-Cucamonga Creek (WW-M5, 2007-2010). Geometric mean was calculated only if five samples were collected during the previous five weeks.

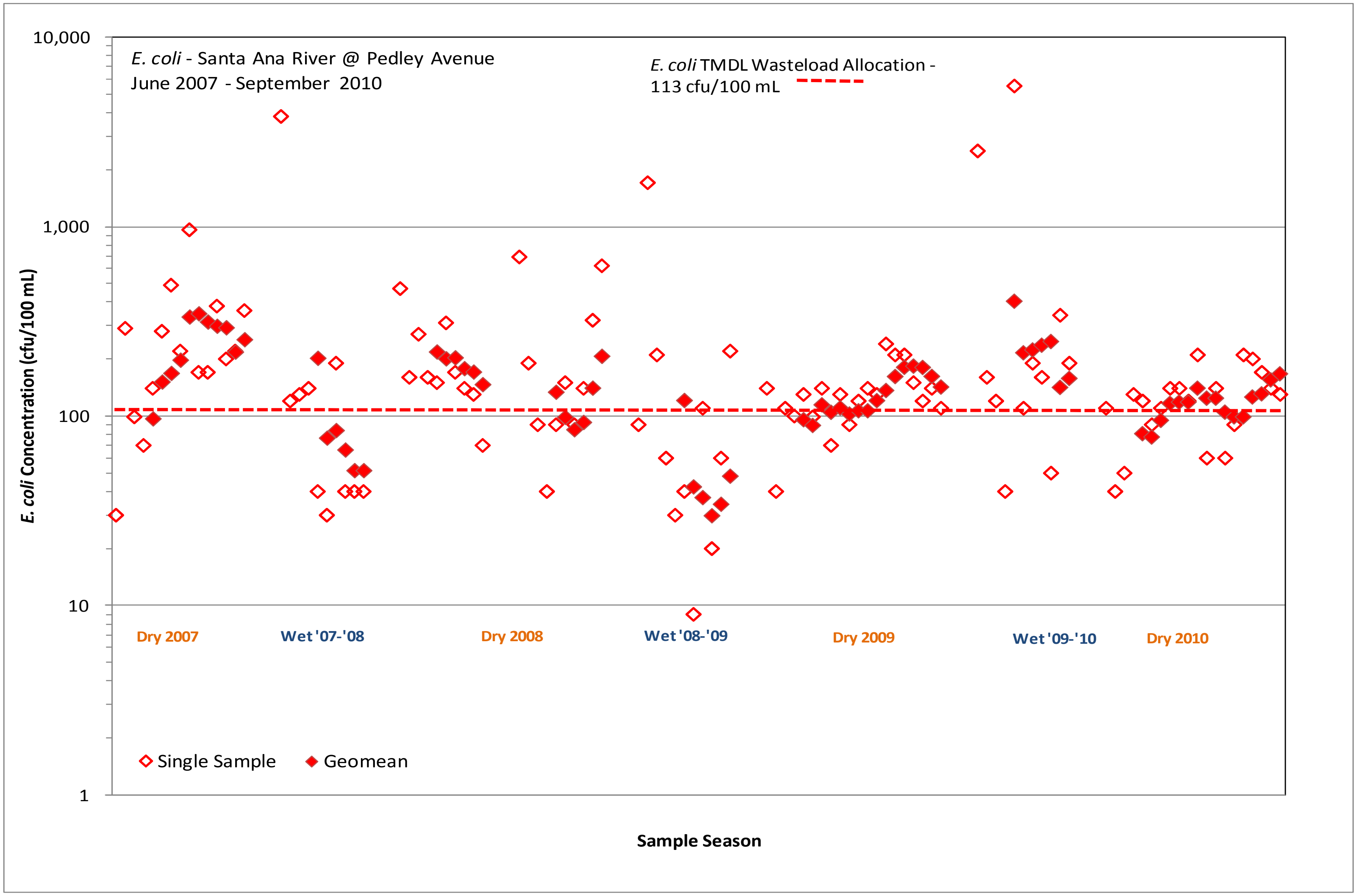


Figure 3-16. Time series plot of *E. coli* single sample and geometric mean results for samples collected from Santa Ana River @ Pedley Avenue (WW-S4, 2007-2010). Geometric mean was calculated only if five samples were collected during the previous five weeks.

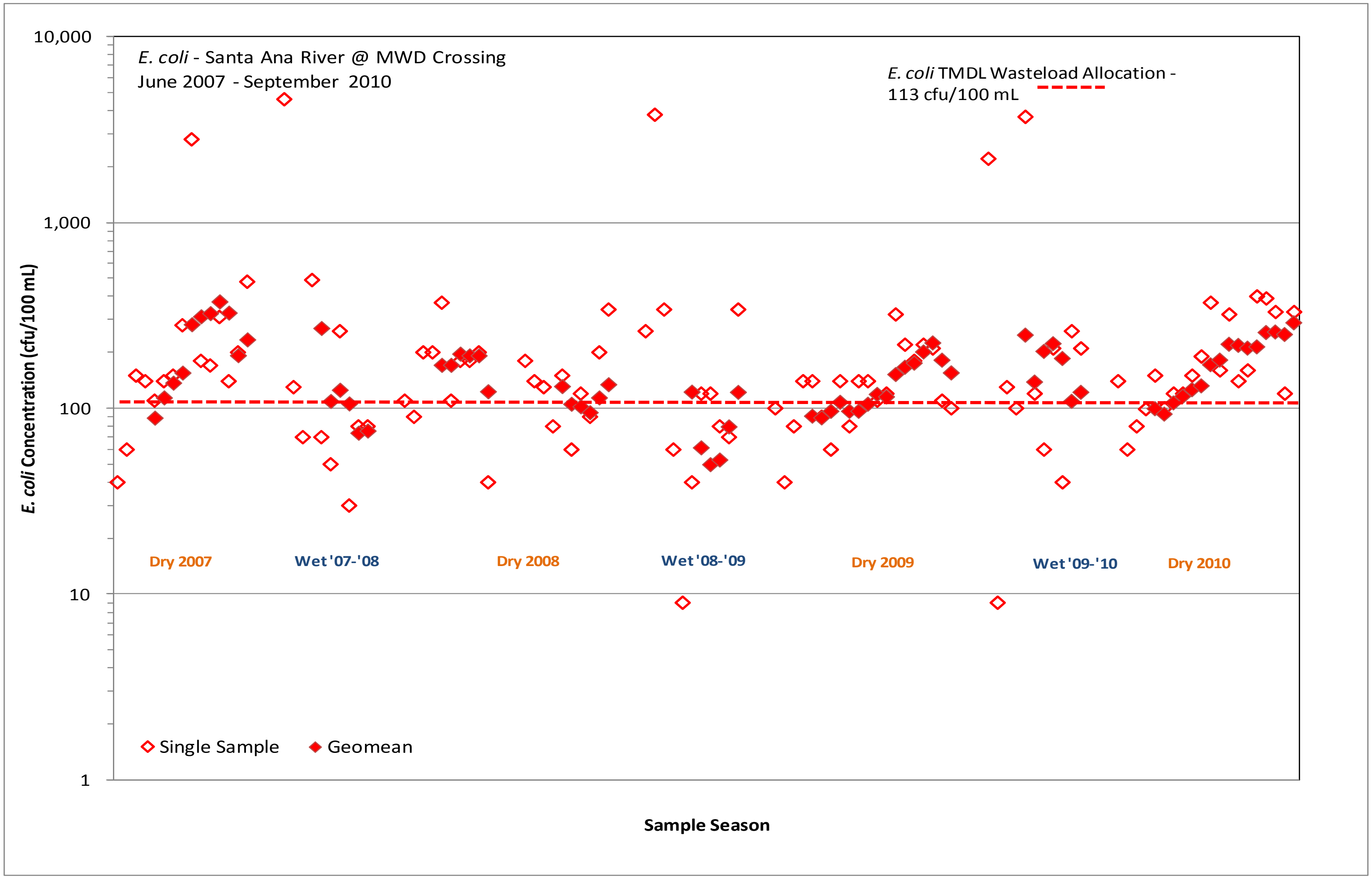


Figure 3-17. Time series plot of *E. coli* single sample and geometric mean results for samples collected from Santa Ana River @ MWD Crossing (WW-S1, 2007-2010). Geometric mean was calculated only if five samples were collected during the previous five weeks.

Table 3-10. Compliance frequency for *E. coli* under dry weather conditions during various dry seasons (as compared to proposed Basin Plan objectives for *E. coli*)

Site	Single Sample Criterion Exceedance Frequency (%)					Geometric Mean Criterion Exceedance Frequency (%)				
	TMDL Staff Report (2002-04)[1]	2007	2008	2009	2010	TMDL Staff Report (2002-04)[1]	2007	2008	2009	2010
Prado Park Lake	12%	20%	30%	5%	5%	56%	64%	50%	0%	6%
Chino Creek	7%	100%	85%	35%	55%	33%	100%	100%	88%	100%
Mill-Cucamonga Creek	47%	100%	95%	100%	95%	78%	100%	100%	100%	100%
SAR @ MWD Crossing	18%	40%	15%	5%	30%	33%	91%	58%	44%	63%
SAR @ Pedley Ave.	13%	27%	25%	5%	5%	67%	82%	75%	44%	19%

3.4.2 Urban Source Evaluation Plan Monitoring

The USEP monitoring program (2007-2008) analyzed bacterial indicator levels and bacteria sources (using microbial source tracking [MST] tools) to characterize key urban MS4 facilities in San Bernardino and Riverside Counties. The MSAR Task Force used the 2007-2008 USEP data results to prioritize steps for mitigating controllable urban sources of bacteria within the MSAR watershed. High priority sites included those where:

- Magnitude and frequency of bacterial indicator exceedances was high;
- MST analysis indicated presence of human sources of bacteria relatively frequently;
- Site is in an area, or is close to an area, where water contact recreational activities are likely to occur; and
- Observed bacterial indicator exceedances and presence of human bacteria sources occur during periods when people are most likely to be present, e.g., during warm months and dry weather periods.

In contrast, the lowest priority sites for urban dischargers would be those where the bacterial indicator exceedance frequency and magnitude is low, human or other urban sources, e.g., dogs, are not present, and the site is not used for water contact recreation, e.g., the site is a concrete-lined, vertical-walled flood control channel.

A complete summary of USEP monitoring results may be found in SAWPA (2009a). Compliance with Basin Plan objectives was evaluated using geometric mean and single sample results (Table 3-11). Geometric means were calculated only when at least five sample results were available from the previous five week period. Bacterial indicator levels frequently exceeded water quality objectives at most of the sampling locations. Despite this commonality, the range of bacterial indicator levels varied significantly among sites (Figure 3-18).

MST analyses detected bacterial contamination originating from human sources at some sites. The detection frequency of human sources indicated that some tributaries to impaired waterbodies could pose a greater risk of contributing harmful pathogens to downstream waters than others (Table 3-12). Sites were ranked based on three factors:

- Frequency of exceedances of water quality objectives (R_F)
- Magnitude of bacterial indicator level (R_C)
- Number of detections of human source bacteria (R_D)

From these ranks, a single normalized index referred to as a Bacterial Prioritization Score (BPS) was calculated using the following equation:

$$BPS = \frac{R_F * R_C * R_D}{MAX_{R_F * R_C * R_D}}$$

Table 3-13 shows the relative ranks and computed BPS for each of the subwatersheds represented by USEP monitoring locations. These BPS values are being used as the basis for prioritizing TMDL implementation activities within each of the areas draining to watershed-wide compliance monitoring sites. This analysis shows that highest priority drainage areas within larger subwatersheds are Box Springs and Lower Deer Creek (Chris Basin). In contrast, drainage areas that appear to be of low priority include Sunnyslope Channel and Carbon Canyon Creek.

Table 3-11. Compliance frequency based on proposed *E. coli* water quality objectives at USEP monitoring program sites during dry weather

USEP Site	Single Sample Criterion Exceedance Frequency (%)		Geometric Mean (cfu/100 mL)				Geomean Criterion Exceedance Frequency (%)
	Dry Season	Wet Season	Dry Season 2007 (7/14 – 8/11)	Dry Season 2007 (9/1 – 9/29)	Wet Season 2008 (1/19 – 2/16)	Wet Season 2008 (1/26 – 2/23)	
Anza Drain[1]	80%	25%	380	638	177	341	100%
Box Springs Channel[1]	89%	75%	1,149	4,793	655	939	100%
Carbon Canyon Cr.	20%	25%	44	84	200	177	50%
Chris Basin	80%	100%	1,758	429	1,530	1,447	100%
County Line Channel[2]	80%	50%	1,194	n/a	n/a	n/a	100%
Cucamonga Cr.	50%	38%	74	262	176	356	50%
Cypress Channel	100%	100%	4,745	1,981	n/a	n/a	100%
Day Creek[2]	71%	60%	n/a	n/a	n/a	n/a	n/a
San Antonio Channel	78%	56%	n/a	718	2,085	1,394	100%
SAR @ La Cadena[2]	100%	50%	n/a	n/a	n/a	n/a	n/a
Sunnyslope Channel[1]	20%	33%	165	204	72	207	75%
San Sevaine Channel[2]	75%	83%	n/a	n/a	n/a	n/a	n/a
Temescal Cr. [1]	89%	43%	491	3,127	162	143	100%

[1] – Site in Riverside County
[2] – Site receives DWF from both counties

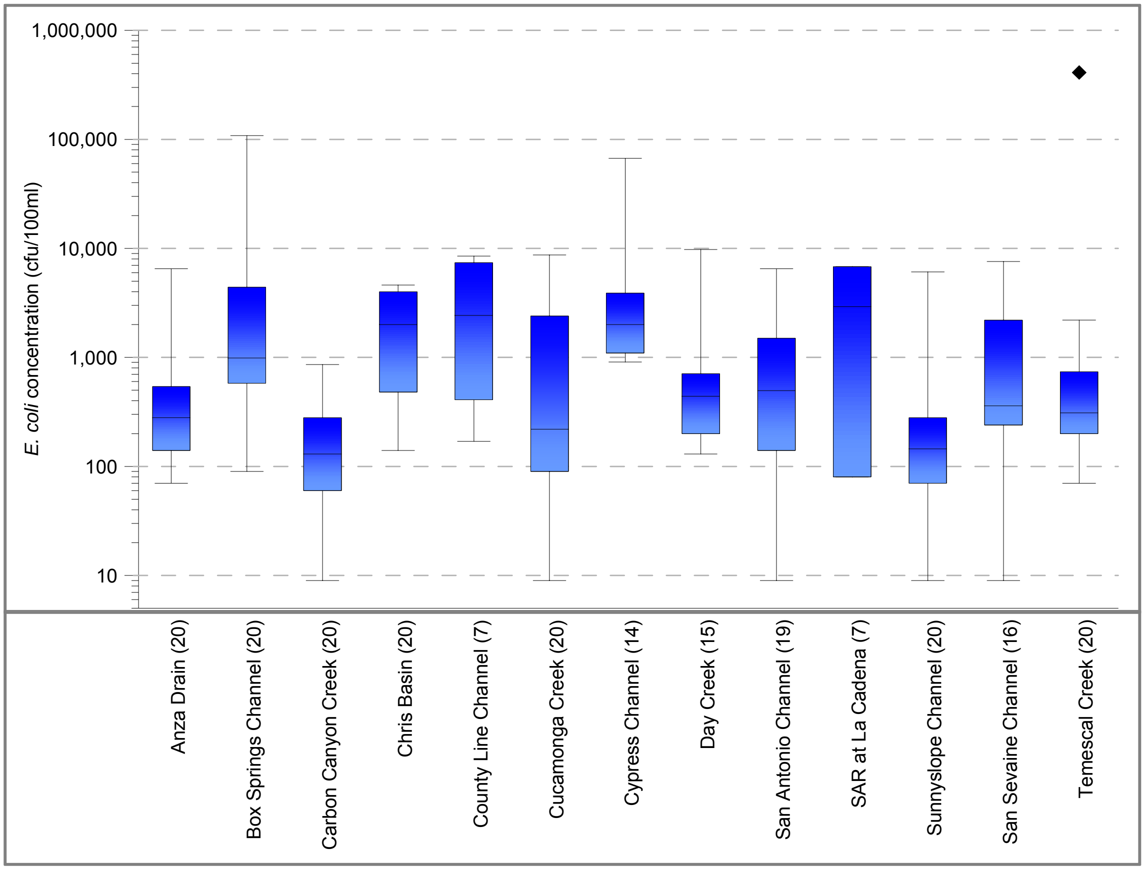


Figure 3-18. *E. coli* levels at USEP monitoring program sites during dry weather conditions

Table 3-12. Summary of human source bacteria detections at USEP monitoring program sites

USEP Site	N	Number of Detections of Human Sources (Maximum N = 20)	Frequency of Detection
Anza Drain[1]	20	1	5%
Box Springs Channel[1]	20	18	90%
Carbon Canyon Creek	20	0	0%
Lower Deer Creek (Chris Basin)	20	5	25%
County Line Channel[2]	7	0	0%
Cucamonga Creek	20	1	5%
Cypress Channel	14	1	7%
Day Creek[2]	15	1	7%
San Antonio Channel	19	3	16%
San Sevaine Channel[2]	7	3	43%
Santa Ana River at La Cadena[2]	20	3	15%
Sunnyslope Channel[1]	16	2	13%
Temescal Creek[1]	20	1	5%

[1] – Site in Riverside County
[2] – Site receives DWF from both counties

Table 3-13. Bacteria Prioritization Score for USEP monitoring program sites

Site	Relative Rank of Bacterial Indicator Water Quality			Normalized BPS
	Frequency of Single Sample Exceedance (R_F)	Magnitude of Exceedance (R_C)	Proportion of Human Detect (R_D)	
Box Springs Channel[1]	11	13	13	100
Chris Basin Outflow	12	11	11	78
Cypress Channel	13	12	7	59
San Antonio Channel	6	9	10	29
Santa Ana River @ La Cadena[2]	5	8	12	26
San Sevaine Channel[2]	10	4	8	17
Day Creek[2]	8	6	6	15
County Line Channel[2]	9	10	1	5
Cucamonga Creek	3	7	3	3
Anza Drain[1]	4	5	3	3
Temescal Creek[1]	7	2	3	2
Sunnyslope Channel[1]	1	3	9	1
Carbon Canyon Creek	1	1	1	0

[1] – Site in Riverside County
[2] – Site receives DWF from both counties

3.4.3 NPDES Monitoring Activities

Monitoring activities within the MSAR watershed to comply with the San Bernardino County MS4 permit have occurred during wet weather. Accordingly, no dry weather data from this monitoring program were included in CBRP water quality analyses. The Integrated Watershed Management Plan, currently being developed as an MS4 permit requirement, will expand the monitoring program to include dry weather events. As data become available from this monitoring, they will be included in CBRP data reviews.

SAR at MWD Crossing has been designated as a trend analysis site for a watershed-wide study, coordinated by the Southern California Coastal Water Research Project (Regional Monitoring of California's Coastal Watersheds, Stormwater Monitoring Coalition Bio-assessment Working Group, Technical Report 539, December 2007). A dry weather monitoring event is required, that includes a suite of parameters, e.g., biological toxicity, nutrients and organics. The first dry weather monitoring event was completed in September 2010. This location most likely will be relocated to the Santa Ana River at Pedley site, given the availability of historic data at this location. As data become available, they will be considered along with CBRP monitoring data.

3.4.4 Special Water Quality Studies

Periodically, special studies have been completed to evaluate specific water quality issues. Within San Bernardino County one such study was recently completed that provided data relevant to this CBRP. A recent study was conducted to determine the sources of elevated bacterial indicator levels in Cucamonga Creek (Surbeck et. al., 2010). To evaluate the bacterial indicator sources to the creek, the project team collected samples at eight locations along the creek during seven sample events that characterized a range of air temperatures and antecedent dry periods. Additionally, microcosm studies were performed using treated wastewater and urban DWF collected during the sampling program to investigate bacteria growth when bacterial indicators were exposed to nutrients and dissolved organic carbon (DOC).

Study findings demonstrated that almost 100 percent of the bacterial indicator loading can be attributed to urban DWF while treated wastewater was found to be the primary source of nutrient loading. Microcosm studies demonstrated that *E. coli* levels are strongly dependent upon DOC and phosphorus. Levels of 7.0 mg/L DOC and 0.07 mg/L total phosphorous, were identified as thresholds for creating conditions that favor growth (at higher levels) and decay (at lower levels).

Section 4
Existing Urban Source Control Program

4.1 Introduction

This section documents existing MS4 permit activities that have been implemented by the San Bernardino County MS4 permit program. Emphasis was on non-structural and structural BMP actions implemented or completed since January 1, 2005 (year of MSAR Bacterial Indicator TMDL adoption), that are providing water quality benefits to the MSAR watershed.

4.2 Non-Structural BMPs

This section describes all completed non-structural BMP program activities implemented by the San Bernardino County MS4 permittees since TMDL adoption by the Regional Board in 2005. Program areas evaluated for the potential to reduce bacterial indicators under dry weather conditions include:

- WQMP Implementation
- Public Education and Outreach Targeting Bacterial Indicators
- Ordinance Adoption
- Inspection and Enforcement activities
- Illicit Discharge/Spill Response
- Street Sweeping
- MS4 Facility Inspection and Cleaning Programs

4.2.1 Water Quality Management Plan Implementation

WQMPs are prepared for new development or significant redevelopment projects classified as category projects. This section examines WQMPs completed for projects since the beginning of 2005 which have resulted in the implementation of BMPs expected to reduce bacterial indicator loads above and beyond what would have been expected from the area if the project had not been implemented.

Using WQMP records provided by the MS4 Area-wide Program, projects were screened for those approved after 2005 and designated as “significant redevelopment” projects. The presumption is that for existing developments, stormwater management controls were not designed to today’s standards, which encourage the use of site design and source control BMPs, and therefore some degree of DWF occurred prior to redevelopment. With significant redevelopment of the project site, an approved WQMP may include BMPs that provide capture or treatment of DWF, as site design and source control BMPs were encouraged in the San

Bernardino County Stormwater Program's 2005 Model WQMP Guidance. New development projects that included a WQMP that may reduce or eliminate off-site DWF were not included in this analysis because these projects replace previously undeveloped land that likely did not generate any runoff under dry weather conditions.

The MS4 Area-wide Program provided WQMP data from the MS4 Solution Database for each of the permittees within the MSAR watershed. Table 4-1 describes for each jurisdiction the number of approved WQMPs for significant redevelopment projects and the total project development area. A brief description of the type of BMPs implemented for each project is provided.

4.2.2 Public Education and Outreach

Through the MS4 Area-wide Program, the MS4 permittees collectively participate in public education and outreach efforts to emphasize stormwater pollution prevention. Each permittee also conducts its own education and outreach with varying levels of attention to bacteria in DWF. Although outreach events may not specifically focus on reducing bacterial indicators, events which highlight the elimination or reduction of debris or pollutants from entering the MS4 system or runoff under dry weather conditions have the potential to reduce bacterial indicators.

Information related to public education outreach efforts is maintained in the stormwater program's MS4 Solution Database. The database includes information regarding each outreach event type, the date conducted, a brief description of materials distributed, and the number of "impressions" (estimated number of persons contacted through personal communication, audience attendance, or brochure distribution). Activities have included billboard placement, mail inserts, presentations at schools and pet stores, and educational displays at community and regional fairs.

Most of the recorded events educate the public on general stormwater pollution prevention and water conservation (Table 4-2). The table identifies relevant events, i.e., those that have the potential to reduce bacterial indicators; the description of the materials presented was used to determine applicability. Events that provided materials focusing on paint waste, household hazardous waste, pesticide disposal, and automotive waste disposal were not included.

The public education sub-committee is developing informational flyers to address bacterial contamination issues. The topics of trash bin enclosures and pet waste have been high priorities. Flyers on those topics will be ready before the end of 2010. Multi-dwelling complexes and restaurants will be targeted for the trash bin flyers. Flyers for pet and horse owners will be distributed at appropriate venues. The MS4 permittees are also developing a portable toilet educational flyer that can be handed out at City permit counters for large events.

Table 4-1. Summary of WQMPs approved for significant redevelopment projects, San Bernardino County, 2005-2009

Jurisdiction	No. of Projects	Total Acres	Description
Chino	4	13	Four significant redevelopment projects were approved from 2006 to 2008. BMPs implemented included efficient irrigation, buffer strips/bioswales, and proprietary flow-based BMPs
Chino Hills	-	-	No significant redevelopment projects listed
Fontana	6	38	Six re-development projects approved from 2005 to 2008 which implemented a variety of BMPs such as efficient irrigation, vegetated swales, infiltrations basins, and proprietary flow-based BMPs
Montclair	8	14	Eight significant redevelopment projects approved from 2007 to 2008. BMPs included efficient irrigation, bio-retention, permeable pavement, vegetated swales, water quality inlets
Ontario	8	26	Eight significant redevelopment projects approved from 2005 to 2007. BMPs included efficient irrigation, bio-retention, vegetated swales, infiltration basins, and flow-based proprietary devices at catch basins.
Rancho Cucamonga	3	6	Three significant redevelopment projects approved from 2005 to 2006. BMPs included efficient irrigation, water quality inlets, media filters, extended detention basins
Rialto	5	27	Five significant BMPs approved from 2006 to 2008 implemented a variety of BMPs such as buffer strips/bioswales, media filters, vegetated swales, infiltration basins, efficient irrigation, and proprietary flow-based BMPs.
San Bernardino County	4	7	Four significant redevelopment projects were approved from 2007 to 2008. BMPs included efficient irrigation, vegetated swale, infiltration basin, extended detention basin, and bio-retention system
Upland	3	1	Two significant redevelopment projects approved from 2006 to 2007. BMPs implemented include bio-retention BMPs
Total	**43**	**133**	

Table 4-2. Public education and outreach activities for San Bernardino County MS4 Program, 2005-2009 (IMP = Impressions)

Jurisdiction	2005		2006		2007		2008		2009		Comments
	No. of Events	No. of IMPs	No. of Events	No. of IMPs	No. of Event s	No. of IMPs	No. of Events	No. of IMPs	No. of Events	No. of IMPs	
Chino	5	4,215	27	20,730	37	9,325	29	3,900	6	650	Touring theatrical production depicting resource conservation and pollution prevention recorded 8,000 impressions. Pet owners were targeted by 26 of the events.
Chino Hills	9	328	2	740	0	0	3	265	1	30	Events consist of presentations in schools and libraries, booths at community fairs, and displays set up at pet stores and clinics. Enviroscape models, PowerPoint presentations, posters and brochures used as appropriate. One event targeted directly at pet owners; remaining events focused on educating the public about their impact on stormwater quality.
Fontana	3	360	49	8,610	13	2,645	12	8,915	3	5,000	Outreach events in Fontana were almost exclusively science fairs and large regional or local fairs.
Montclair	1	0	1	1,200	0	0	0	0	1	1,200	Outreach events in Montclair consisted of booths at two Earth Day festivals and a Home Improvement and Outdoors Fair where brochures, magnets, etc., were distributed.
Ontario	5	56,533	6	163,959	5	109,531	2	57,953	2	100	This outreach effort included exhibits at various fairs and festivals. In addition, outreach efforts included extensive print media distribution through (1) letters sent to new businesses; and (2) yearly calendars sent to residents (50,000+). Seven of the 20 Ontario outreach events recorded distribution of over 50,000 fliers/letters each.
Rancho Cucamonga	2	1,600	2	70	1	2,500	9	644,614	14	199,195	Outreach events consisted of school presentations, booths at large fairs and minor league baseball games, and advertisements in media outlets (radio, newspaper: 792,000 impressions).
Rialto	0	0	12	4,481	18	3,893	7	1,452	2	1,800	Outreach events consisted of displays at local fairs, school presentations, and the distribution of flyers at home improvement stores, pet stores, and animal hospitals. Impressions were not recorded for these flyer events.

Table 4-2. Public education and outreach activities for San Bernardino County MS4 Program, 2005-2009 (IMP = Impressions)

Jurisdiction	2005		2006		2007		2008		2009		Comments
	No. of Events	No. of IMPs	No. of Events	No. of IMPs	No. of Event s	No. of IMPs	No. of Events	No. of IMPs	No. of Events	No. of IMPs	
Upland	19	3,633	31	4,505	28	7,860	5	1,184	11	897	62 of the 94 outreach events consisted of the distribution of print media or the placement of a display at pet facilities (stores, hospitals, groomers) and home improvement retail establishments. Remaining events were primarily school visits/presentations.
SBCFCD	1	289	6	2,270	1	0	1	7,880	1	0	Seven of the 10 events consisted of displays with cards and brochures placed at local and regional fairs.
San Bernardino Co.	1	0	1	150	1	650	2	313	2	0	Four of the events consisted of displays and handouts at regional events, while the other three consisted of school visits/presentations. Impression numbers were not always available.
Total	**46**	**66,958**	**137**	**206,715**	**104**	**136,404**	**65**	**726,824**	**41**	**207,072**	

4.2.3 Ordinance Adoption

The CBRP requires the identification of specific ordinances that will be adopted during implementation that reduce the level of indicator bacteria in urban sources. All San Bernardino County MS4 permittees have adopted ordinances which provide legal authority to control non-permitted discharges from entering the MS4 system. The majority of these ordinances were originally established in 1993. They have been amended as needed in subsequent years to strengthen their applicability. San Bernardino County MS4 permittees have adopted ordinances which provide legal authority to:

- Control discharges associated with industrial activities (all permittees)
- Prohibit illicit discharges (all permittees)
- Control the discharge of materials other than stormwater
- Require compliance with regulators (all permittees)
- Conduct inspections, surveillance, and monitoring (all permittees)

In addition to adopting ordinances to provide legal authority to control non-permitted discharges, some permittees have adopted water conservation ordinances which can reduce the volume of runoff under dry weather conditions. As shown in Table 4-3, legal authority already exists in many areas to manage outdoor water use. Ordinance prohibitions include failure to repair water leaks, use of water to wash any impervious surface, and irrigation water from flowing off property.

In addition to local water conservation ordinances, recently adopted Assembly Bill 1881 (AB 1881) requires improved landscaping and irrigation practices on some types of new and significant redevelopment projects. Jurisdictions in the MSAR watershed have already adopted landscaping and irrigation ordinances that are at least as stringent as the statewide guidelines developed to support implementation of AB 1881. These ordinances include the Chino Basin Water Efficient Landscape Ordinance, which was developed collaboratively by cities and water agencies in the Chino Basin as a regional model ordinance that meets AB 1881 requirements

Because AB 1881 applies only to new development and significant redevelopment projects, the water quality benefits expected from implementation of these new requirements are expected to be limited within the next five years, especially under dry weather conditions.

Table 4-3. Existing water conservation ordinances in the San Bernardino County portion of the MSAR watershed

Proponent	Ordinance Name	Applicability	Key Prohibitions
City of Chino	Water Conservation	City of Chino	• Runoff of irrigation water to impermeable surfaces • Operation of sprinklers for > 15 minutes/day/station for spray irrigation • Scheduling of spray irrigation between the hours of 6:00 am and 8:00 pm • Failure to repair a water leak • Use of water to wash any impervious surfaces
Cucamonga Valley Water District	Water Use Efficiency	Cities of Fontana, Ontario, Rancho Cucamonga, Upland, and portions of unincorporated San Bernardino County	• Any irrigation water leaving the property • Failure to repair a water leak
City of Ontario	Stormwater Drainage System	City of Ontario	• Runoff of wastewater from most potential outdoor washing activities • Draining of pools or fountains and pool filter backwash containing chlorine or other harmful chemicals
City of Upland	Water Conservation	City of Upland	• Scheduling of spray irrigation between the hours of 10:00 am and 6:00 pm • Failure to repair a water leak • Use of water to wash any impervious surfaces
City of Chino Hills	Water Conservation	City of Chino Hills	• No prohibitions, voluntary conservation measures only
Monte Vista Water District	Water Use Efficiency Best Practices	City of Chino, Montclair, and portions of unincorporated San Bernardino County	• Any irrigation water leaving the property • Operation of sprinklers for > 15 minutes/day/station for spray irrigation • Scheduling of spray irrigation between the hours of 8:00 am and 8:00 pm • Irrigation when it is raining • Failure to repair a water leak
City of Rialto	Water Conservation Requirements; Stormwater	City of Rialto	• No prohibitions; ordinance discourages specific activities that waste water and encourages minimizing off site runoff to the MEP

4.2.4 Inspection and Enforcement Activities

MS4 permittees conduct inspections of commercial and industrial facilities as part of municipal NPDES programs to assess compliance of facilities with local stormwater ordinances and, where applicable, potential noncompliance with California's General Permit for Storm Water Discharges Associated with Industrial Activities.

In evaluation of these programs for water quality benefits, restaurant inspections are of particular interest since restaurant activities are potential sources of indicator bacteria. The permittees have developed a model restaurant inspection program, as well as a poster targeted for restaurant BMPs. Restaurants are automatically assigned a high priority rating for inspection and development purposes. The trash bin educational materials will be targeted at restaurants, and a new restaurant BMP flyer is being developed.

The enforcement of trash and pet waste issues are especially difficult, as they usually occur at the residential level. Residential inspections are not required; however, a residential inspection program is under development. Pet waste flyers are being developed, and will be distributed at appropriate venues. Trash bin outreach materials will be targeted at apartment and condominium complex managers.

San Bernardino County MS4 permittees maintain inventories of commercial and industrial facilities within their jurisdictions. The facilities in these inventories are prioritized and inspection schedules are established based on this prioritization. The San Bernardino County MS4 Area-wide Program provides annual reports regarding inspection and enforcement activities. This information reports the number of annual inspections of commercial and industrial facilities; however, the data could not be quantified in a manner that could be then be related specifically to restaurant inspections and the control of bacterial indicators.

4.2.5 Illicit Discharge/Spill Response

San Bernardino County permittees implement programs to reduce illicit discharges and prevent spills from reaching the MS4. San Bernardino County permittees collect data annually on illicit discharge/spill response activities. The discharge database records include the following information:

- Discharge type
- Discharge description and estimated quantity of material discharged
- Response action

Events which involve the discharge of sewage and trash have the highest potential to result in significant bacterial inputs to MS4 facilities. A review of database records for the period 2005-2009 shows that many discharge or spill events involved raw sewage. Table 4-4 summarizes the total number of reported incidents and estimated quantity of sewage and other bacteria containing spills within MS4 drainage areas. The table does not show the portion of that was contained and recovered, which ranges from zero to 100 percent, depending upon the nature of the spill and timing and effectiveness of reporting and jurisdiction response.

4.2.6 Street Sweeping

Street sweeping removes debris, which has been shown to contain bacteria (see Section 5.2.2.3, and 6.5.2.2). Bacteria become entrained in urban runoff, which is then discharged to the MS4. While the benefits of street sweeping are assumed to be most closely associated with wet weather runoff, which has the greatest capacity to flush unswept debris into the storm drain, there is recent evidence that DWFs along curbs have the potential to mobilize significant numbers of bacteria (Skinner et al 2010; Ferguson 2006).

San Bernardino County permittees annually report their annual street sweeping efforts by the approximate number of curb-miles swept. Table 4-5 shows only the curb-miles swept by each jurisdiction for the period of 2005 to 2009. Several permittees sweep streets more than once per week in some areas. The total volume of debris removed during sweeping activities is reported individually by each permittee. It may represent an actual total collected, or an estimated quantity derived from an extrapolated value based on a test area.

4.2.7 MS4 Facility Inspection and Cleaning Programs

The MS4 permittees implement MS4 facility inspection and cleaning programs to satisfy minimum facility maintenance requirements contained in their MS4 permit. The debris that builds up in MS4 facilities has the potential to become a significant bacteria reservoir that can be mobilized when water moves through. While wet weather flows would be most likely to mobilize this debris and associated bacteria, steady flows through the facility under dry weather conditions also have the potential to move bacteria into downstream receiving waters. Tables 4-6 and 4-7 summarize the amount of debris removed annually from drain inlets, open channels, below ground drains, and debris basins in San Bernardino County area. The amount of debris removed fluctuates on an annual basis and is particularly influenced by the volume removed by SBCFCD from its debris and detention basins.

Table 4-4. Illicit Discharge Spill Response, San Bernardino County MS4 Program, 2005-2009

Jurisdiction	2005		2006		2007		2008		2009	
	Incidents	Quantity (gal)	Incidents	Quantity (gal)	Incidents	Quantity (gal)	Incidents	Quantity (gal)	Incidents	Quantity (gal)
Chino	7	5,875	2	2,010	-	-	-	-	1	2,000
Chino Hills	0	0	1	0	1	0	4	831	6	10,332
Fontana	-	-	3	2,100	-	-	-	-	-	-
Montclair	1	1,600	-	-	-	-	-	-	-	-
Ontario	7	5,261-	4	11,625	7	11,400	9	2,220	11	44,435
Rancho Cucamonga	1	1,750	-	-	1	3,000	-	-	-	-
Rialto	-	-	-	-	-	-	1	1,000	-	-
Upland	1	50	-	-	-	-	-	-	1	200
San Bernardino County	-	-	1	250	-	-	2	1,200	-	-
SBCFCD	2	1,001,000	1	200-500 (gpm)	1	500	1	1,000	1	500

Note: Incidents shown in this table are those reported as "sewage" in the MS4 database or other discharges that were determined to have a high potential to contain elevated levels of bacteria; The quantity shown is the total volume of the spill, including both the portion that is contained and the portion that could not be contained

Table 4-5. Summary of annual street sweeping activity (number of curb miles), San Bernardino County MS4 Program

Jurisdiction	2005	2006	2007	2008	2009	Comments
Chino	518	519	520	526	526	
Chino Hills	385	385	385	388	388	
Fontana	903	955	1,015	1,019	837	
Montclair	132	144	147	151	155	
Ontario	1,075	1,075	1,075	1,078	1,078	
Rancho Cucamonga	1,164	1,164	1,164	1,179	1,179	
Rialto	585	585	525	525	525	
San Bernardino County	0	0	0	0	0	Majority of roads in unincorporated County streets are natural earthen and asphalt swales not suitable for street sweeping
Upland	510	515	437	437	437	
SBCFCD	NA	NA	NA	NA	NA	SBCFCD does not own or operate streets facilities
Total Miles	**5,272**	**5,342**	**5,268**	**5,303**	**5,125**	

Table 4-6. Debris collected from drain inlets and open channels, San Bernardino County MS4 Program, 2005 - 2009

Jurisdiction	Drain Inlets (cubic yards)					Open Channels (cubic yards)				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
Chino	20	20	20	20	20	40	40	40	40	33
Chino Hills	3	4	30	3	30	10	100	100	50	50
Fontana	101	109	114	121	108	21	19	9	12	14
Montclair	60	80	75	70	60	25	26	25	35	40
Ontario	3,000	3,000	3,200	3,570	1,800	240	200	175	150	125
Rancho Cucamonga	200	225	280	240	180	1	10	12	8	10
Rialto	0	12	24	300	500	0	225	350	450	400
San Bernardino County	0	160	34	36	127	0	50	35	20	57
SBCFCD	NA	NA	NA	NA	NA	700,000	100,000	500	0	100
Upland	4	4	23	20	23	5	5	39	31	20
Total	**3,388**	**3,614**	**3,800**	**4,380**	**2,848**	**700,342**	**100,675**	**1,285**	**796**	**849**

Table 4-7. Debris collected from underground drains and debris/detention basins, San Bernardino County MS4 Program, 2005 - 2009

Jurisdiction	Underground Drains (cubic yards)					Debris & Detention Basins (cubic yards)				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
Chino	10	2	16	16	16	0	0	0	0	0
Chino Hills	0	1	1	8	8	50	80	60	38	38
Fontana	11	11	12	14	11	49	51	36	38	58
Montclair	1	1	1	1	0	0	0	0	0	30
Ontario	5,140	5,140	3,650	4,560	5,400	0	0	0	0	0
Rancho Cucamonga	0	0	2	2	4	0	0	0	100	100
Rialto	0	30	0	0	0	0	0	0	0	18
San Bernardino County	0	315	100	100	234	0	20	0	0	0
SBCFCD	100	0	0	0	0	1,700,000	100,000	1,000	0	500
Upland	2	2	16	19	16	200	200	96	37	23
Total	**5,264**	**5,502**	**3,798**	**4,720**	**5,689**	**1,700,299**	**100,351**	**1,192**	**213**	**767**

4.3 Structural BMPs

This section describes relatively large-scale projects that include structural BMPs that reduce urban runoff under dry weather conditions that have been completed since January 1, 2005. Two large scale projects with capacity to address runoff under dry weather conditions constructed since 2005 were identified:

- In the City of Chino, as part of the development of the Preserve master development, an extended detention basin/wetland (Bickmore Basin) was constructed in early 2006. Bickmore Basin is located on the southwest corner of Bickmore Avenue and Rincon Meadows Avenue. The basin has a drainage area of approximately 270 acres. It is estimated that at complete build-out the community surrounding the basins will have approximately 2,400 homes. During dry weather conditions, urban runoff from the residential development flows into the basin to sustain the wetland. No supplemental recycled water is required to sustain the wetland.

- In the City of Chino, as part of mitigation for future development and flood control, the Kimball Basin (extended detention basin/constructed wetland) was constructed in 2006-2007. The Kimball Basin is comprised of a series of three basins covering approximately 40 acres and located east of Rincon Meadows on the southern side of Kimball Avenue in Chino. The basin has a tributary area of over 1,200 acres with tributary areas to include portions of northern Chino and Ontario (Ontario Airport and New Model Colony West). The basin has significant capacity to treat DWF. The basin is currently fully dependent on supplemental recycled water to sustain the wetland.

Section 5
Comprehensive Bacteria Reduction Program

5.1 Introduction

This section describes the CBRP program planned for implementation to achieve compliance with urban wasteload allocations under dry weather conditions. The CBRP program relies on a combination of ordinance adoption or revision, implementation of specific BMPs, a comprehensive inspection program (i.e., source evaluation program), development of UAAs, and where determined necessary, regional treatment. The recommended approach focuses both on the elimination of DWFs from MS4 facilities and reductions of urban bacterial indicator sources.

5.2 CBRP Elements

As discussed in CBRP Section 1.2.1, Section V.D.2.b.i of the San Bernardino County MS4 permit lists the requirements for preparation of the CBRP. These requirements call for the inclusion of four key program elements. These elements and their corresponding reference in the CBRP are as follows:

- Ordinances – Element 1
- Specific BMPs - Element 2
- Inspection Criteria – Element 3
- Regional Treatment – Element 4

The following sections describe the CBRP program activities planned for implementation under each of these elements.

5.2.1 Element 1 - Ordinances

The CBRP requires the identification of specific ordinances that will be adopted during implementation that reduce the level of indicator bacteria in urban sources. Two options for ordinance adoption are described in the sections below: Water Conservation and Pathogen Control.

5.2.1.1 Water Conservation Ordinance

A number of water conservation ordinances have been established in San Bernardino County jurisdictions to address outdoor water use efficiency (see Table 4-3). Most of these ordinances prohibit at least some outdoor water use activities that have the potential to create DWFs in the MS4. Specifically, prohibited activities range from those allowing runoff to leave a property from over-irrigation and washing of impervious surfaces to failure to repair leaks, or use of water to irrigate during daytime hours. Jurisdictions with less rigorous language could consider updating the nature and extent of prohibitions on outdoor water use.

In November 2009, Senate Bill (SB) 7 was enacted, which requires water districts throughout California to improve the efficiency of water use. The bill requires a 20 percent reduction in potable water demand by 2020; an interim target of 10 percent reduction of statewide use is set for 2015. This reduction can be achieved by providing recycled water to offset a direct potable demand or by applying indoor/outdoor water use efficiency BMPs. Specific BMPs that would be implemented to achieve this goal are listed in each water purveyor's Urban Water Management Plan. However, quantification of expected potable water conservation from proposed projects in not required by SB 7. Therefore, if San Bernardino County permittees want to rely on implementation of SB 7 as a tool to reduce dry weather runoff, it will be important for jurisdictions to collaborate with water purveyors to ensure they incorporate outdoor water use efficiency BMPs as a key component to achieve the 10 and 20 percent potable water demand reduction targets for 2015 and 2020, respectively.

CBRP Implementation: Generally speaking, the permittees' ability to promote water conservation on their own is somewhat limited. Local water districts measure water use, set rates, and set water use policies, including fines for water waste. Local ordinances can complement these measures, but water district participation is critical to a successful water conservation program that also provides water quality benefits. Accordingly, CBRP activity in the area of water conservation will be coordinated to the MEP with local water purveyors.

During CBRP implementation, the permittees will evaluate whether existing authority is adequate to manage DWFs to reduce bacterial indicators. In some cases it may be more appropriate to target DWFs through specific BMPs (see Element 2) rather than modify existing water conservation authority. Also, it may be determined that adequate authority exists, but enforcement levels need to be increased. All of these evaluations are currently being addressed with water purveyors in the development of San Bernardino County's Watershed Action Plan (WAP).

5.2.1.2 Pathogen Control Ordinance

Pathogen control through ordinance development is a component of the San Bernardino County MS4 permit:

> *San Bernardino County MS4 permit Section VII.D* – "Within 3 years of adoption of this Order, the permittees shall implement fully adopted ordinances that would specify control measures for known pathogen or bacterial sources such as animal wastes if those types of sources are present within their jurisdiction."

With a permit adoption date of January 29, 2010, this MS4 permit requirement must be addressed by January 29, 2013. The permit language specifically mentions animal wastes but could address other bacterial indicator sources as well. A pathogen ordinance may also support development of the Residential Program, as required by the MS4 permit by January 29, 2013.

Some municipalities in the MSAR watershed have existing ordinances prohibiting the discharge of domestic waste from sewer lines overflows, septic tanks, portable toilets, boats, and animal feces. Typical ordinances make unlawful the failure to exercise due care or control over an animal such that solid waste is to allowed to be deposited on any public sidewalks, parks or other public property, or private property other than that of the owner.

CBRP Implementation: Existing ordinances do not establish specific requirements to properly dispose of pet waste with accompanying penalties for failure to comply. As part of CBRP implementation, the permittees will re-visit existing ordinances that address any type of animal waste and look at ways to enhance waste management requirements, compliance and enforcement. For example, a pathogen control ordinance could specifically require owners/keepers of pets to properly dispose of pet waste that is deposited on any property, whether public or private. Proper disposal would be defined as placement of pet waste in waste receptacles or containers that are regularly emptied or to a sanitary sewage system for proper treatment. Penalties or fines could be also included.

In addition to the above recommendations, it is possible that during implementation of the inspection program (Element 3), additional ordinance needs may be identified that could be addressed through a pathogen control ordinance. This potential will be evaluated continually during CBRP implementation.

5.2.2 Element 2 - Specific BMPs

The CBRP requires the identification of specific BMPs that will be implemented to reduce bacterial indictor levels. These BMPs range from programmatic activities that set the stage for other CBRP elements (e.g., DWF inspections) to specific activities that can reduce DWFs or control bacterial indicators at the source. Some of the recommended BMPs are also MS4 permit requirements, which will be noted as appropriate. In addition, some of these BMP activities may be coordinated between San Bernardino and Riverside County to improve the effectiveness and feasibility of the effort required to implement the activity.

5.2.2.1 Transient Camps

Transient encampments near receiving waters or within MS4 facilities are often cited as a potential source for bacterial indicators and a reason for closure of these encampments. It is not certain to what degree water quality is impacted by these encampments, especially under dry weather conditions. Two essential questions need to be evaluated prior to engaging fully in a process that involves closing down transient camps that have the potential to impact water quality:

- *Water quality impact*: An investigation will be conducted to examine to what degree transient activities, including illicit discharges, are impacting DWFs. It may be possible that such encampments are more of a wet weather concern. Such an investigation may include field observations of camp activities and water quality sampling upstream and downstream of selected camps located adjacent to waterbodies.

- *Location of camps in relation to the MS4:* If a water quality impact is determined, an inventory of encampments will be developed. Common locations often cited for transient camps are under bridge channels, or near or adjacent to waterbodies within the flood control facility right-of-way or within a natural channel. To assist in identifying which camps have the highest potential to impact water quality, San Bernardino County jurisdictions will compile an inventory of encampments to better understand their location and extent.

Based on the findings from the above activities, an evaluation of the potential benefits of implementation of a transient encampment strategy focused on closing down camps near waterbodies will be made. Specifically, this evaluation will look at the social and financial impacts of program implementation relative to the water quality benefits achieved as compared to other bacterial indicator reduction strategies. This evaluation is needed prior to implementation since camp closure requires participation by multiple agencies, which will tax already limited resources, e.g., law enforcement, public works, environmental health, and social services.

If the decision is made to close transient encampments to support CBRP implementation an area-wide model program will be developed to guide jurisdictional agencies. For example, The Center for Problem-Oriented Policing and the U.S. Department of Justice Office of Community Oriented Policing Services developed *Homeless Encampments* (2009 guidance document), which presents recommended steps for closing down transient camps. The objective of relocating transient camps would be to reduce bacteria indicator levels in receiving waterbodies. These steps are summarized as follows:

- Assess encampment to identify the number of occupants and any hazardous conditions - This initial step is critical as it provides information regarding what additional local resources (law enforcement, public works, and social services) would be required to close the camp.

- Determine jurisdiction for multi-agency coordination – The exact location of the encampment determines which municipal entities and department should be involved.

- Arrange alternative shelter prior to removal of individuals from encampments to prevent legal challenges.

- Engage homeless advocacy groups to explain what process will be followed and what alternative shelter arrangements are available; this will ease tensions and controversy prior to implementing camp closure activities.

- Understand jurisdictional laws regarding removal of transient/ property to prevent latter claims of violations of such laws.
- Provide and post written advance notice to camp occupants that they are trespassing, provide a deadline to vacate and remove all property, and identify location(s) of alternative shelter.
- Issue citations after passage of the first deadline and notify occupants that they are subject to arrest and property seizure if the camp is not vacated after a second deadline.
- Conduct arrests if occupants have not vacated and removed property by second deadline.
- Clean-up site after camp has been vacated, and remove and cut back foliage/natural cover as this action tends to remove incentive for the camps to be rebuilt in the same location; it also provides unobstructed views of the area.
- Inspect the site periodically to ensure camp is not reestablished.
- Post signage prohibiting establishment of encampments in the area.

Other methods which have been used in the local area will be considered as well. For example, in Riverside County the City of Corona and the RCFC&WCD have local experience working with a transient task force to address concerns associated with transient camps.

CBRP Implementation: The following activities will be implemented as part of this BMP:

- Identify locations of suspected transient encampments in receiving waters or MS4 facilities.
- Implement an investigation at one or more locations to evaluate potential DWF water quality impacts from transient camps.
- If transient camps are identified as a potential urban bacterial indicator source in DWFs, develop a model program to address transient encampments targeted for closing because of expected water quality impacts.
- As determined necessary, implement transient camp closures and follow-up activities to prevent re-establishment of closed camps in the same locations.

5.2.2.2 Illicit Discharge, Detection and Elimination Program (IDDE)

The MS4 permit for San Bernardino County requires the development of a pro-active IDDE program (MS4 permit Section VIII). This effort is to review and update ongoing MS4 permit activities to eliminate illegal connections and illicit discharges to the MS4.

The purpose of this program is to specify a procedure to conduct focused, systematic field investigations, outfall reconnaissance surveys, indicator monitoring and tracking of discharges to their sources. The CBRP will benefit from the development of the IDDE procedures, which should be effective in identifying and eliminating or reducing DWFs to the MS4 (see CBRP Section 5.2.3).

The Regional Board recommends that the IDDE program be based on the IDDE Guidance Manual developed by the Center for Watershed Protection (CWP 2005) or an equivalent program. Key elements recommended by the CWP document include mapping, field observation and survey, monitoring and spatial analysis.

The MS4 Area-wide Program currently implements many effective IDDE elements. The Program already utilizes an in-depth business inspection system, as well as training to all employees to observe and report illegal discharges. Each agency employs the centralized MS4 database to standardize the reporting format, and a model enforcement document has been prepared. Procedures to locate and remediate illegal discharges are implemented by each Agency, and reported to the Regional Board.

The IDDE will specify the required documentation of these procedures, as well as outlining additional measures that can be implemented to improve the effectiveness of the IDDE program.

CBRP Implementation: San Bernardino County permittees will develop the IDDE Program as required by the MS4 permit. Development of this program is critical to the implementation of an inspection program under CBRP Section 5.2.3 (Element 3). The San Bernardino County MS4 permit contains no defined date for development of the IDDE program. However, given that establishment of the IDDE program is a precursor to full implementation of the CBRP inspection program, a schedule for development of this program has been included in the CBRP schedule.

5.2.2.3 Street Sweeping

Trash and other accumulated materials in streets and within MS4 facilities provide a habitat and food source for bacterial indicators. Dry weather runoff in street gutters, drains, and catch basins keeps these facilities damp, which supports bacteria survival and growth. Biofilms often develop under these types of conditions within catch basins, along street gutters, or within flood control channels, and contribute to bacterial pollution (e.g., see Skinner et al 2010; Fergusson 2006). Biofilms are dynamic microbial communities that attach as a group to suitable substrates, and are subject to erosion or detachment creating a source of bacterial contamination.

Managing or eliminating biofilm development has the potential to substantially reduce bacterial indicators. A recent study by the City of San Diego shows that enhanced cleaning of catch basins provided minimal benefits in terms of reducing bacterial indicators. However, there is evidence that enhanced street sweeping will provide benefits. This can be accomplished by using vacuum street sweepers to reduce biofilm habitat and food sources from street gutters. Skinner et al. (2010) found very high bacterial indicator counts in initially bacteria free hose water running along street gutters. Implementing improved street sweeping practices resulted in an order of magnitude reduction in fecal coliform level (14,000 MPN/100 mL to 870 MPN/100 mL) in a 300 feet section of gutter before and after street sweeping. This finding suggests that the use of newer vacuum street sweepers targeting the street gutter could provide significant water quality benefits.

CBRP Implementation: San Bernardino County MS4 permittees will evaluate existing street sweeping programs (e.g., method, frequency, equipment) to determine potential to modify programs to reduce bacterial indicator sources. Based on the findings of this evaluation, a plan and schedule will be developed for implementation.

5.2.2.4 Irrigation or Water Conservation Practices

CBRP Section 5.2.2.1 (water conservation ordinance) describes expectations associated with water conservation ordinance development under this plan. A separate but related CBRP element is the implementation of BMPs that target irrigation practices with a goal of reducing/eliminating DWFs to the MS4. These practices not only benefit water quality but reduce water use. The development and implementation of these practices will be carried out collaboratively with water purveyors to support development of the Residential Program, as required by the MS4 permit by January 29, 2013. Specific practices that would be effective at reducing dry weather runoff include:

- *Replacement of grass with artificial turf* – The use of artificial turf provides a low maintenance, no irrigation alternative to grass lawns. Costs of materials and installation to replace a grass lawn with artificial turf can range from $6-14 per square foot. In the past in neighboring Riverside County, through partnerships with MWD and Western Municipal Water District, Cities of Riverside and Corona have offered a $1 per square foot rebate for property owners that replace existing grass lawns with artificial turf.

- *Replacement of grass with drought tolerant native plant species* – California drought tolerant native plants/gardens require minimal watering and therefore reduce the likelihood of off-site dry weather runoff (see the California Native Plant Society webpage for more information at www.cnps.org). Property owners that replace existing grass lawns with drought tolerant plants in the Cities of Riverside and Corona have through past programs been eligible to receive a rebate of $0.90/square foot (sq. ft.) and $0.40/sq. ft., respectively.

- *Installation of Weather Based Irrigation Controllers (WBICs)* – WBICs use climate measurements to determine the amount of water needed to meet evapotranspiration requirements of grass lawns and other landscaped areas on a given day. Limiting irrigation to the needs of the plants can reduce the amount of water that leaves a property as dry weather runoff. WBICs can be distributed to potential users via several types of programs, including partial rebates/vouchers, equipment exchanges, or direct installation.

Typical costs for WBICs range from $300 - $800 for a small residential application, to $2,000 - $3,000 for a property with large landscaped areas. The cost effectiveness of installing WBICs to a property owner or water agency is dependent upon the existing water use (potential to reduce demand), avoided cost of water, water rates, and expected lifespan of the device (Mayer et al. 2009). Given these variables, it would likely not be cost effective to distribute WBICs to individual homeowners who do not typically over-irrigate. Conversely, applications of WBICs would likely be cost effective on large landscape properties where excess water is used and the potential to generate off-site runoff is high. The most cost effective implementation approach would need to be evaluated by the local jurisdiction.

- *Landscape irrigation audits* – Most water purveyors in southern California provide free landscape irrigation audits to customers, if requested. An audit involves checking the irrigation system for leaks, ensuring spray heads are properly directed and operational, capping unused spray heads, and providing a watering schedule based on precipitation rate, local climate, irrigation system performance, and landscape conditions. A potential implementation approach would be to target landscape audits in areas that are hydrologically connected to downstream receiving waterbodies/compliance sites. The cost of conducting a landscape irrigation audit is low relative to other irrigation practice BMPs; however, the effectiveness is unpredictable. To be effective, property owners would need to consistently implement the audit recommendations.

- *Public education and outreach* - Public education and outreach activities to encourage water conservation are already ongoing (both by the MS4 programs and water purveyors). The CBRP does not recommend any new or modified public education and outreach activities unless it is determined that potential additional benefits could be achieved from additional collaboration between the MS4 permittees and water purveyors in this area.

The benefits expected from each of the above BMPs vary (see Table 5-1). For grass replacement BMPs, dry weather runoff is mostly eliminated while WBICs can reduce dry weather runoff by approximately 50 percent (Jakubowski 2008). Runoff reduction from landscape irrigation audits and ongoing public education and outreach activities are more difficult to quantify, as they are largely dependent on changing human behavior. These types of BMPs may reduce runoff from an individual property by only a small amount; however, because implementation may be more widespread the overall benefit may be relatively high. Factors associated with each of the above BMPs impact will affect decisions on how such BMP practices can be developed and implemented at the local level as part of the CBRP. These factors include cost, public perception, reliability, ease of implementation, and expected runoff reduction. Table

5-1 provides an evaluation of each of these factors by ranking them has low, medium or high with regards to expected benefits from their implementation.

Other types of water conservation BMPs could be used in-lieu of the ones included in this CBRP such as high efficiency spay nozzle installations, water brooms, and large landscape water budgets. The effectiveness of these BMPs would need to be evaluated further to estimate the DWF and associated bacteria reduction that could be achieved.

CBRP Implementation: To the MEP and where feasible, water conservation BMPs will be implemented, as they can provide important benefits in reduced DWFs. The MS4 Area-wide Program will evaluate options and minimum requirements for implementation of water conservation BMPs. Individual permittees will implement these BMPs through local authority. Development and implementation of these BMPs will be closely coordinated with the CBRP water conservation ordinance implementation activity (see Section 5.2.2.1).

Table 5-1. Evaluation matrix for irrigation practices/ water conservation BMPs (high benefit ●; medium benefit ⦿; low benefit ○)

Water Conservation BMP	Dry Weather Runoff Reduction	Cost	Ease of Implementation	Water Conservation
Replacement of grass with artificial turf	●	○	○	●
Replacement of grass with drought tolerant plant species	●	⦿	○	●
Installation of WBICs	⦿	○	⦿	⦿
Landscape irrigation audits	○	●	●	○
Public education and outreach	○	●	●	○

5.2.2.5 Water Quality Management Plan Revision

The San Bernardino County MS4 program is required to update its WQMP Guidance and Templates to incorporate low impact development (LID) practices to reduce runoff from new development and significant redevelopment activities. BMP emphasis will be on infiltration, capture and use, evapotranspiration, and treatment through use of biotreatment type BMPs. Revised WQMP documents are required for submittal to the Regional Board for review by July 29, 2011.

The revised WQMP program will provide water quality benefits, but these benefits will be somewhat limited for DWFs. For example, for new development projects the water quality benefit will apply only to wet weather runoff since the pre-project condition would not have produced any dry weather runoff. However, for significant redevelopment projects, the WQMP approval process will result in the introduction of

LID practices to existing developed areas where dry weather runoff may be occurring. The presumption is, that for these existing developments, stormwater management controls were not designed to control non-storm runoff. Therefore, some degree of runoff (e.g., from irrigation runoff) likely currently occurs under dry weather conditions. With significant redevelopment of the project site, an approved WQMP would require implementation of site design, source control, and/or structural control BMPs to address pollutants of concern by reducing or treating runoff during dry and wet seasons.

While water quality benefits are expected to be achieved for significant redevelopment projects, the pace at which such projects are expected to be completed in the MSAR watershed is likely to be slow given economic factors. Moreover, even if the rate of development activities increase in the near term, given the December 31, 2015 compliance date for meeting urban wasteload allocations for dry weather conditions in the dry season, the numbers of acres of redevelopment relative to the total numbers of acres where dry weather runoff likely occurs will be relatively small. Over a much longer time horizon, e.g., 50-100 years, the cumulative benefits will be much greater.

CBRP Implementation: Revision of the WQMP Guidance and Template is a permit requirement that will be completed by July 29, 2011. Implementation will occur after review by the Regional Board and submittal of a final WQMP Guidance, likely by 2012.

5.2.2.6 Septic System Management

The San Bernardino County MS4 permit requires permittees to develop a septic system inventory and a septic system program to minimize failure rates of septic systems. Poorly operating septic systems can potentially lead to the discharge of pollutants to surface waters; however, the extent to which septic systems are currently a source of bacterial indicators in DWFs from the MS4 is unknown. Moreover, while development of this inventory may identify areas with problematic septic systems, the potential for water quality improvement may be limited to surface water impacts that occur only during wet weather runoff events.

CBRP Implementation: CBRP implementation will include fulfillment of the MS4 permit requirements to ensure that septic systems are not contributing bacterial indicators to the MS4 under dry weather conditions. Activities will include:

- *Develop septic system inventory* – Develop an inventory of septic systems which includes, to the extent practicable, information such as location, system type and age, depth to groundwater, and soil type. This database can be used to then better track other operations and maintenance information such as dates of inspection, service and failures.

- *Evaluate potential water quality impacts* - With an accurate inventory, mapping the location of septic systems relative to MS4 facilities provides an opportunity to evaluate the potential impact to water quality under dry weather conditions, if a septic system is failing.

- *Conduct public education* – Educate owners regarding how to properly maintain their on-site systems and distribute materials explaining recommended operation and maintenance schedules.

- *Conduct inspections and initiate enforcement, where appropriate* – Where the potential for water quality impacts is identified, conduct inspections to determine the need for mitigation. Where appropriate, conduct enforcement actions to mitigate the water quality concern.

5.2.3 Element 3 - Inspection Criteria

Element 3 addresses the CBRP requirement for inclusion of specific inspection criteria that are used to identify and manage the urban sources most likely causing exceedances of water quality objectives for indicator bacteria. This required element is incorporated into the development of an inspection program, which includes not only a systematic source evaluation program but also the preparation of UAAs, which will help guide the controllability assessment of the inspection program. The Inspection Program would be consistent with the requirements of the Residential Program specified in the MS4 permit.

The inspection program envisioned for the CBRP is a systematic campaign to conduct dry weather and bacterial indicator source evaluation activities within each subwatershed draining to a watershed-wide compliance site. The foundation for this approach is defined by the USEP, prepared by the MSAR Task Force to satisfy a TMDL requirement (see Section 2.5). USEP activities are currently being implemented by the MSAR Task Force; however, under the CBRP the pace and extent of these activities will be significantly increased to eliminate or reduce controllable urban sources of DWF. Implemented in parallel with source evaluation activities will be the completion of UAAs (discussed in Section 5.2.5).

As noted above, several of the specific BMPs included in Element 2 directly support the implementation of Element 3, e.g., development of the IDDE program and implementation of water conservation BMPs. Completion of these elements will help guide implementation of the inspection program. Conversely, implementation of the inspection program may impact how or where specific BMPs are implemented, or what decisions are made regarding the need for additional ordinance authority. For example, over time the inspection program may identify a particular bacterial indicator or DWF source that can be managed better by the adoption of an ordinance. The overall inspection program includes two general components:

- *Reconnaissance of MS4 system nodes* – The purpose of this component is to prioritize MS4 sub-drainages for follow-up actions based on historical or newly collected flow and bacterial indicator level data. To accomplish this purpose, the MSAR watershed is organized into a system of Tier 1 and Tier 2 nodes, which can be inspected for DWF, bacterial indicators, and where necessary human bacteria sources. Figure 5-1 illustrates this process using a flow chart format. A system node may be anywhere within the MS4 facility, but generally nodes are located at major outfalls from underground storm drains to impaired receiving waters or at the confluence of an open channel with one of the impaired receiving waters (Chino Creek, Mill-Cucamonga Creek, or the Santa Ana River). Breaking up the drainage area into a series of nodes allows for organized source evaluation activities and establishes a means to prioritize follow-up activities to mitigate DWFs or bacterial indicators, if deemed necessary.

- *Evaluation of potential flow and bacterial indicator sources* - Where DWF is persistent and bacterial indicators are elevated, the inspection program will include an inspection strategy that focuses on identifying potential controllable sources. Figure 5-2 illustrates the components of the inspection strategy. Prior to implementing this strategy, the data from the initial reconnaissance component can be used to prioritize inspection activities.

The following sections describe the activities associated with each of the inspection program components in more detail.

5.2.3.1 Component 1 - Reconnaissance of MS4 System Nodes

A preliminary set of nodes has been developed for San Bernardino County based on a desktop GIS analysis (Figure 5-3). These preliminary nodes have been divided into two tiers to help prioritize the start of inspection program activities:

- *Tier 1 nodes* are defined as locations where DWF may directly impact an impaired waterbody (Chino Creek, Mill-Cucamonga Creek, or the Santa Ana River). Many of these Tier 1 nodes are at the same locations sampled as part of implementation of the USEP in 2007-2008. Additional Tier 1 nodes have been added to expand the coverage provided by the USEP sites. Many of these Tier 1 locations may be dry or have minimal DWF, but until a reconnaissance is completed, their potential to contribute bacterial indicators to impaired waters is unknown.

- *Tier 2 nodes* are predominantly locations where MS4 storm drain outfalls discharge to open channels. Where a Tier 2 node is determined to be a potential contributor to non-compliance (e.g., persistent flow or elevated bacterial indicators), additional inspection activities are proposed, as described below (Note: Aside from outfalls to Cypress Creek, Tier 2 nodes in the City of Chino were not mapped due to a lack of GIS data on their MS4 facilities. Additional mapping by the City of Chino will be necessary to identify Tier 2 nodes in that area).

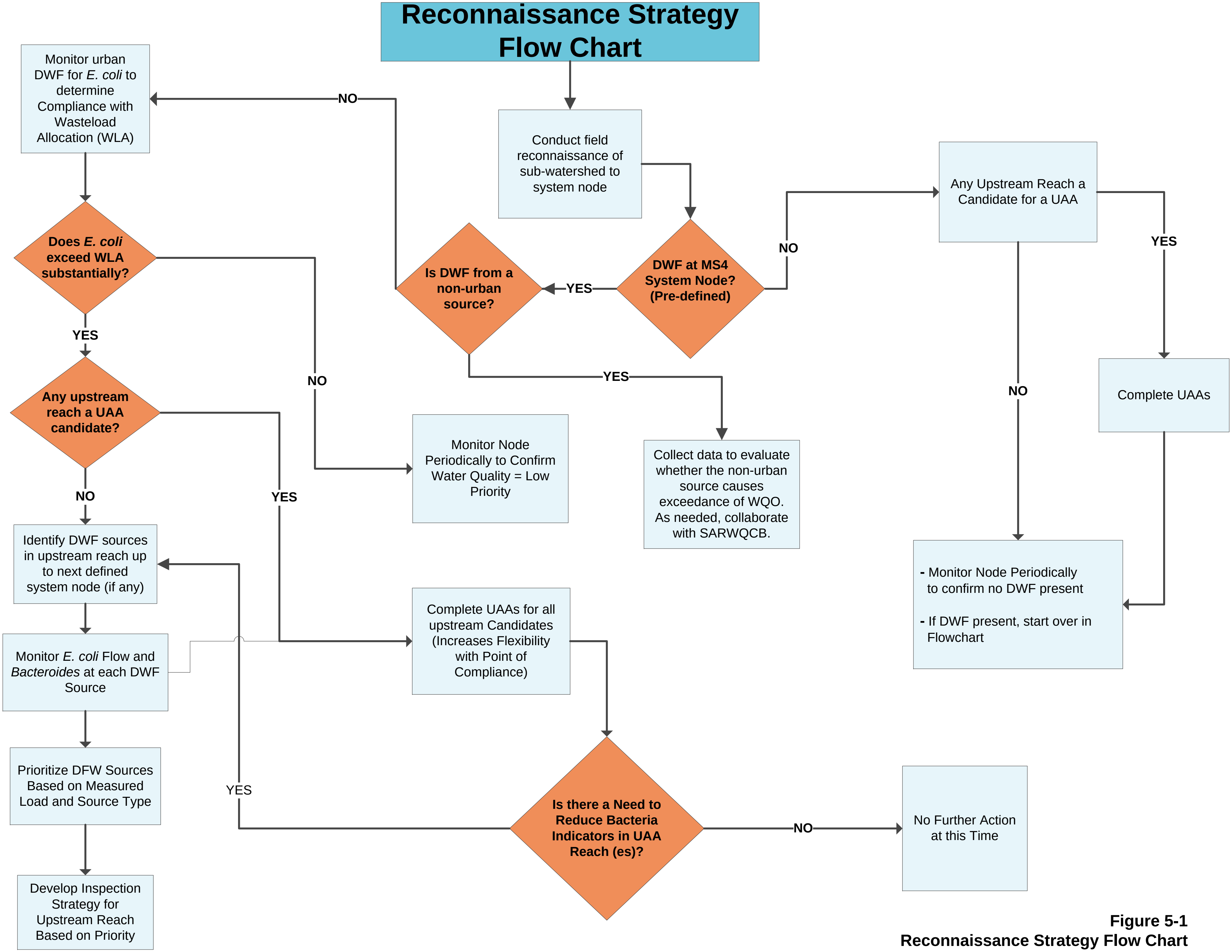


Figure 5-1
Reconnaissance Strategy Flow Chart

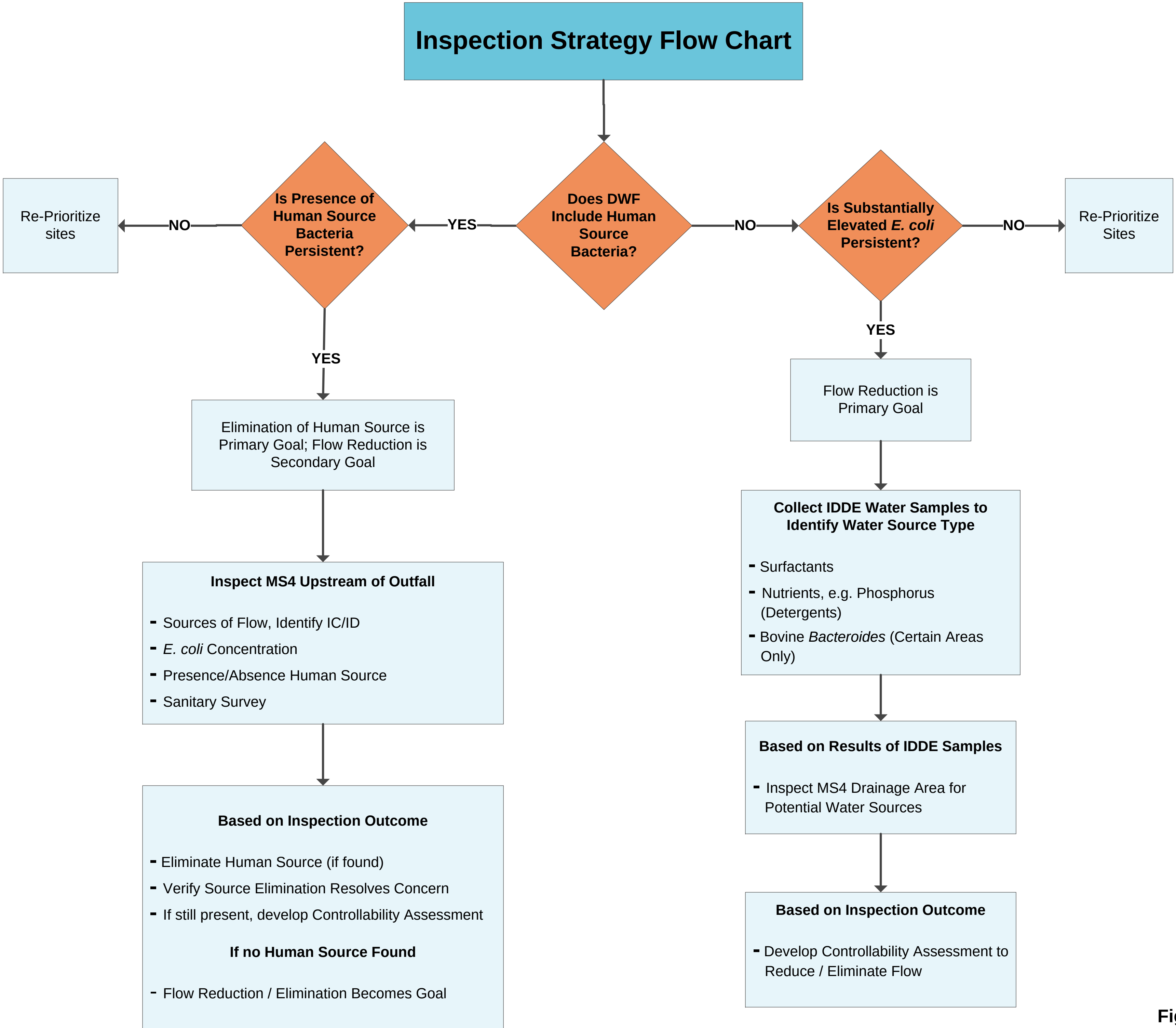


Figure 5-2
Inspection Strategy Flow Chart

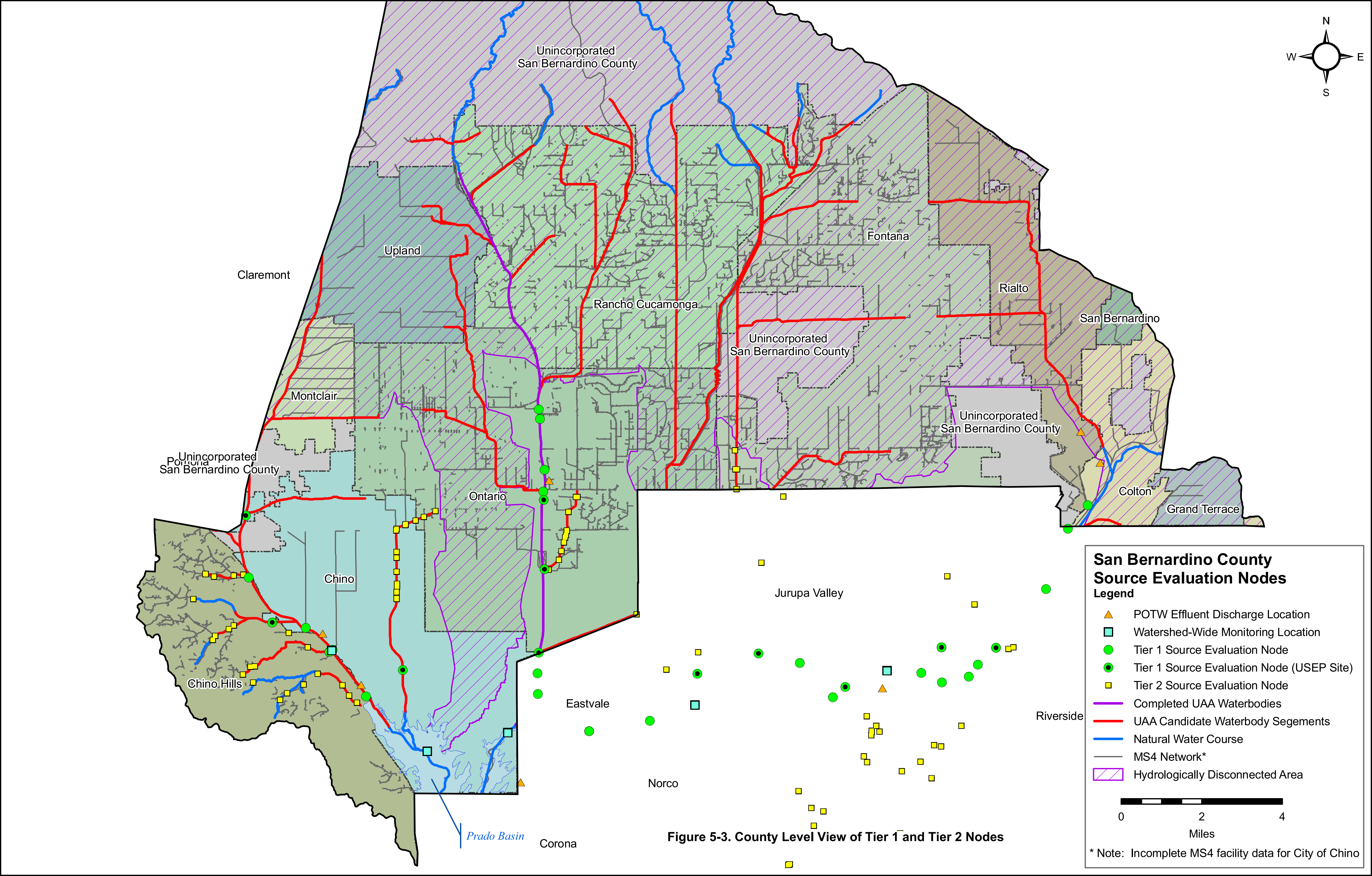


Figure 5-3. County Level View of Tier 1 and Tier 2 Nodes

Figures 5-4 through 5-10 provide a detailed view of recommended Tier 1 and Tier 2 nodes in each San Bernardino County jurisdiction. It should be noted that none of the recommended Tier 1 and Tier 2 nodes are located in areas that have been determined to be hydrologically disconnected from impaired waterbodies during dry weather conditions (see hatched areas in Figures 5-4 through 5-10). The initial inspection program may identify additional hydrologically disconnected areas that can be removed from further consideration for DWF or bacterial indicator reduction activities. Although hydrologically disconnected waterbodies may not need to implement an inspection program, as described below, these waterbodies should still have UAAs completed on them to ensure the appropriate recreational use and bacterial indicator water quality objectives are applied (see Section 5.2.5 for UAA discussion).

Table 5-2 summarizes the number of Tier 1 and Tier 2 sites that are recommended for inspection for each San Bernardino County jurisdiction. Figure 5-1, above, illustrated the evaluation that is expected to guide inspection activities at each of the system nodes. General descriptions and assumptions associated with initial outfall inspection activities include:

- *Presence of Dry Weather Flow* – Determining the presence or absence of DWF at a given node is a critical step. Routine field observation and measurement (if possible) will be conducted during dry weather at varying times of day and on different days of the week for up to one year to develop sufficient data to characterize frequency/volume of DWFs at Tier 1 system nodes. Ideally, at least 10 field visits will be made over a one-year monitoring period. If the node is dry on at least 80% of the visits, the area upstream of the node can be assumed to have little to no impact on downstream water quality. While up to a year is recommended to collect flow data to look at seasonal variability, if a site is found to have persistent or substantial flow after only as few as three visits that occur over a short period of time, it can be presumed that the area draining to the node is a candidate for additional inspection activity to determine the source of the flow. If a site is found to be typically dry after ten visits, then only occasional inspections would be required in the future to provide certainty that this conclusion remains correct. If a Tier 1 node indicates the need for additional inspection, then a similar level of effort may be necessary for Tier 2 system nodes tributary to the Tier 1 node.

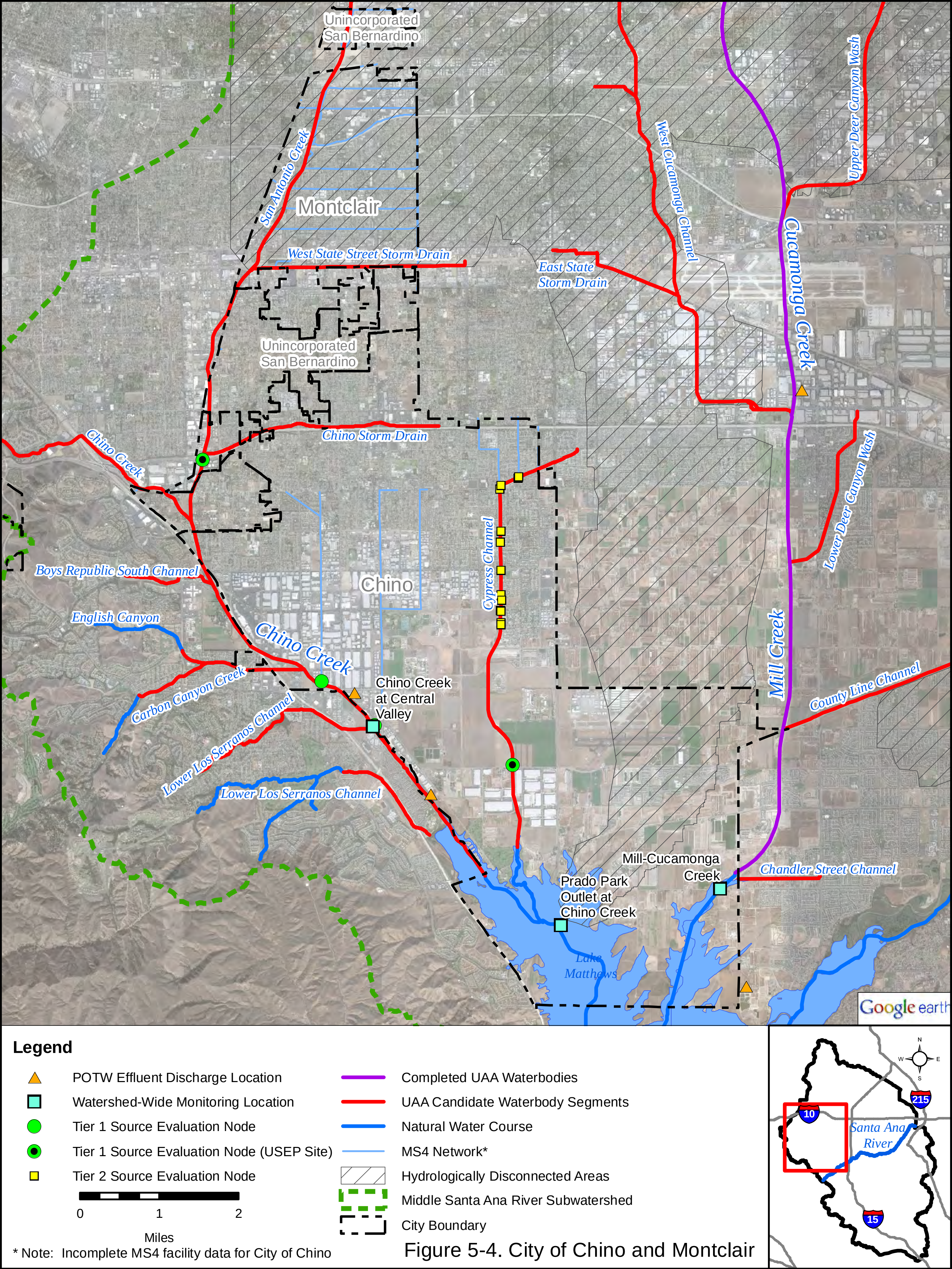


Figure 5-4. City of Chino and Montclair

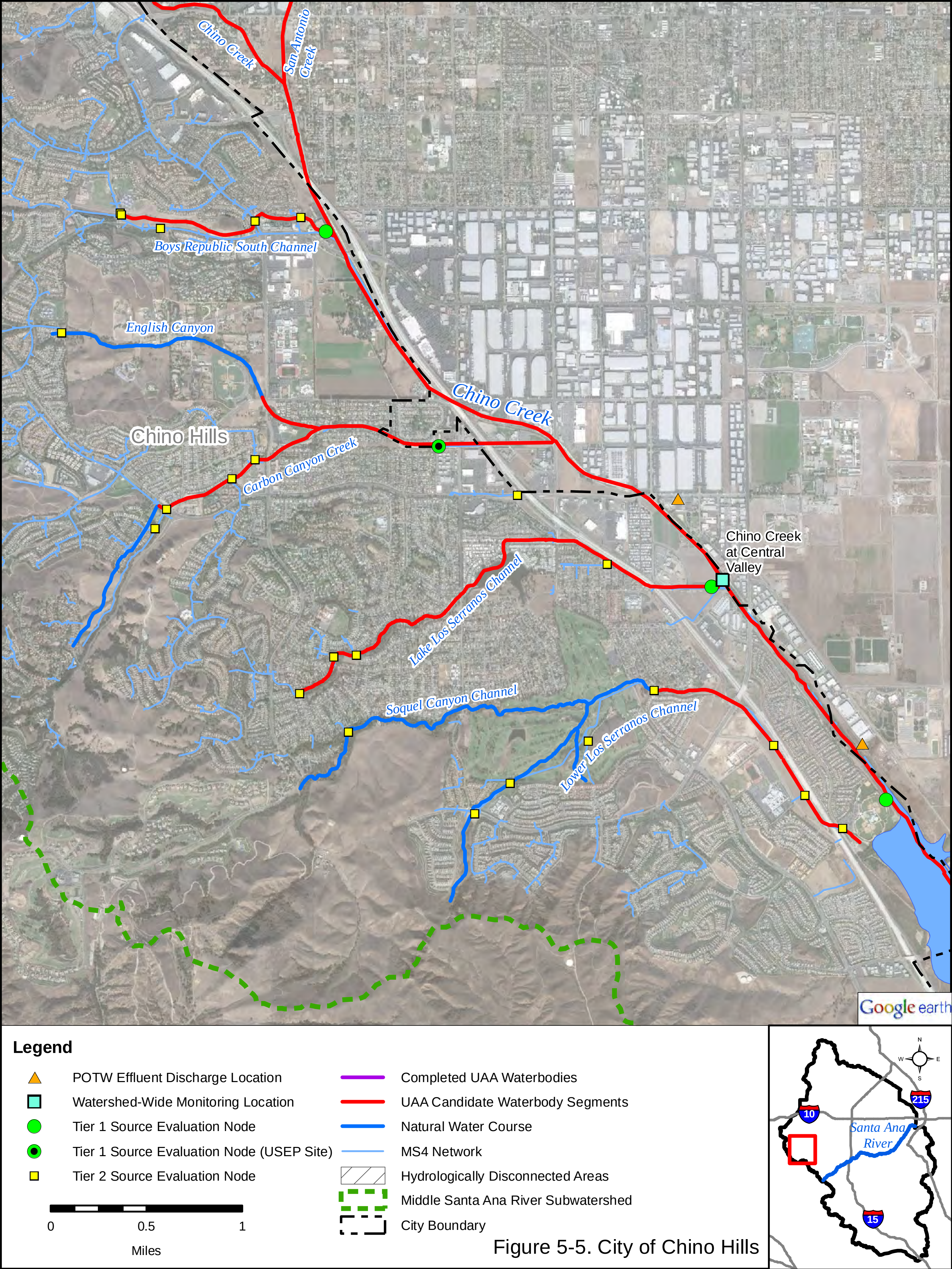


Figure 5-5. City of Chino Hills

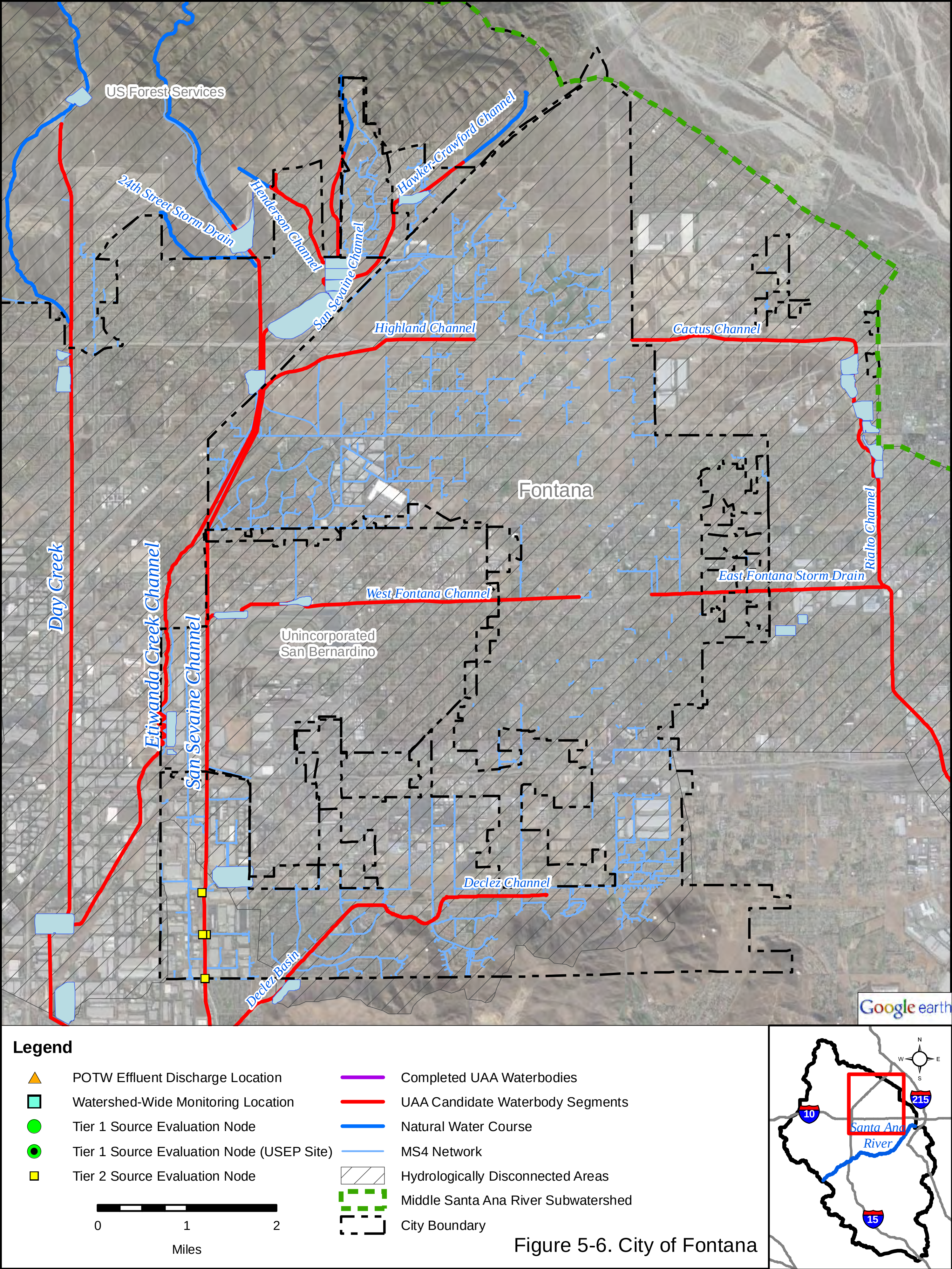


Figure 5-6. City of Fontana

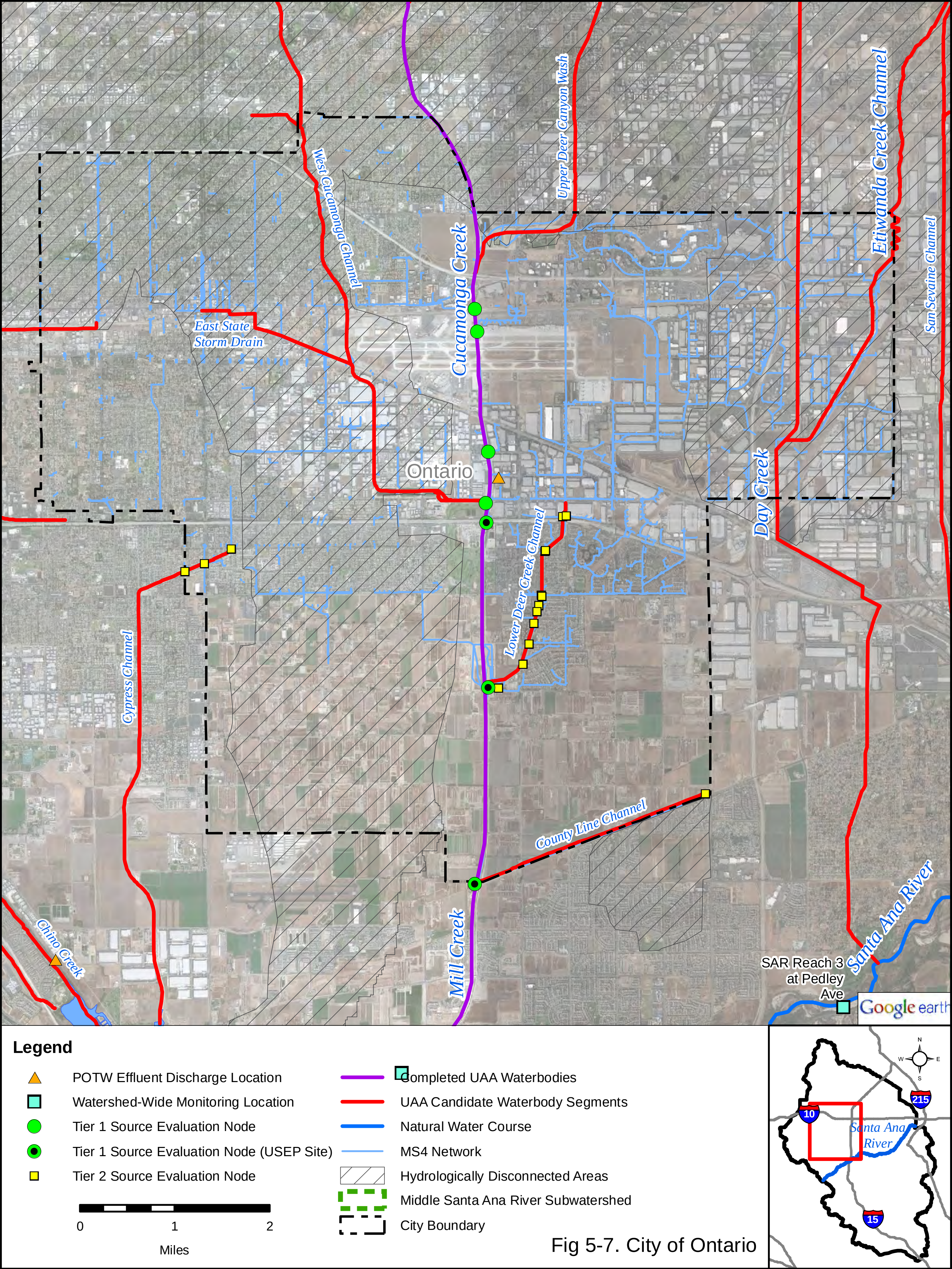


Fig 5-7. City of Ontario

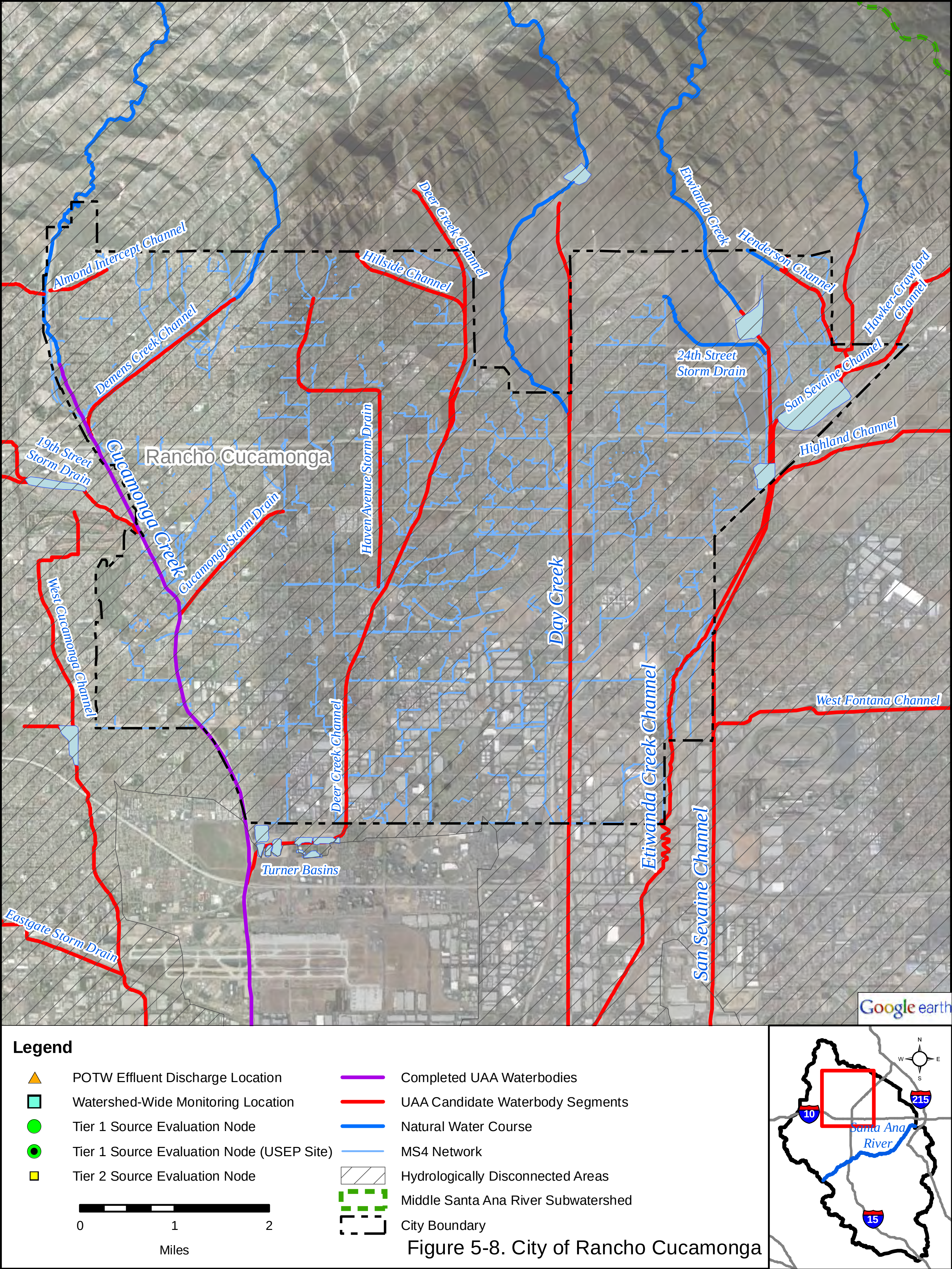
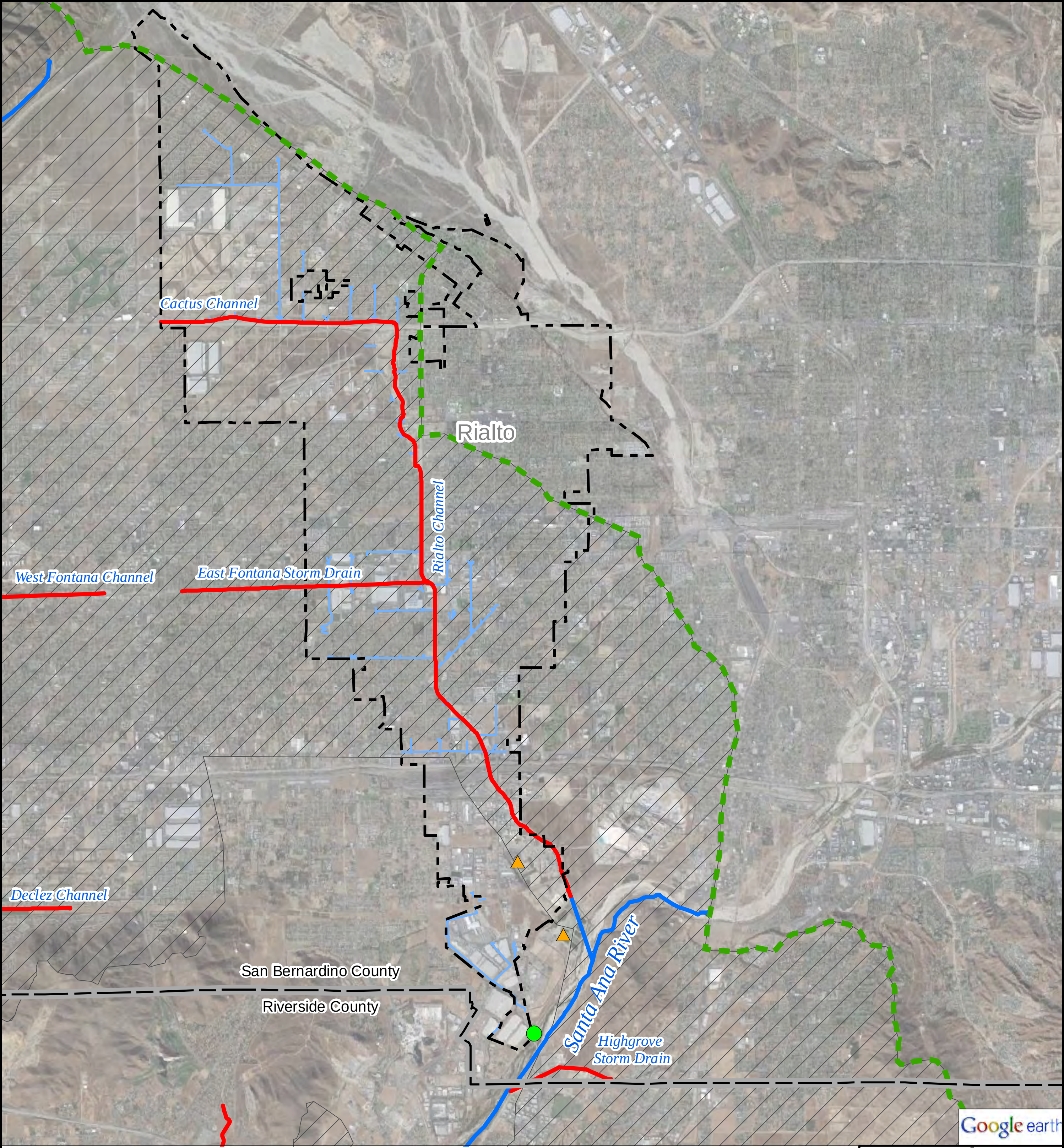


Figure 5-8. City of Rancho Cucamonga



Legend

- POTW Effluent Discharge Location
- Watershed-Wide Monitoring Location
- Tier 1 Source Evaluation Node
- Tier 1 Source Evaluation Node (USEP Site)
- Tier 2 Source Evaluation Node
- Completed UAA Waterbodies
- UAA Candidate Waterbody Segments
- Natural Water Course
- MS4 Network
- Hydrologically Disconnected Areas
- Middle Santa Ana River Subwatershed
- City Boundary

0 1 2
Miles

Figure 5-9. City of Rialto

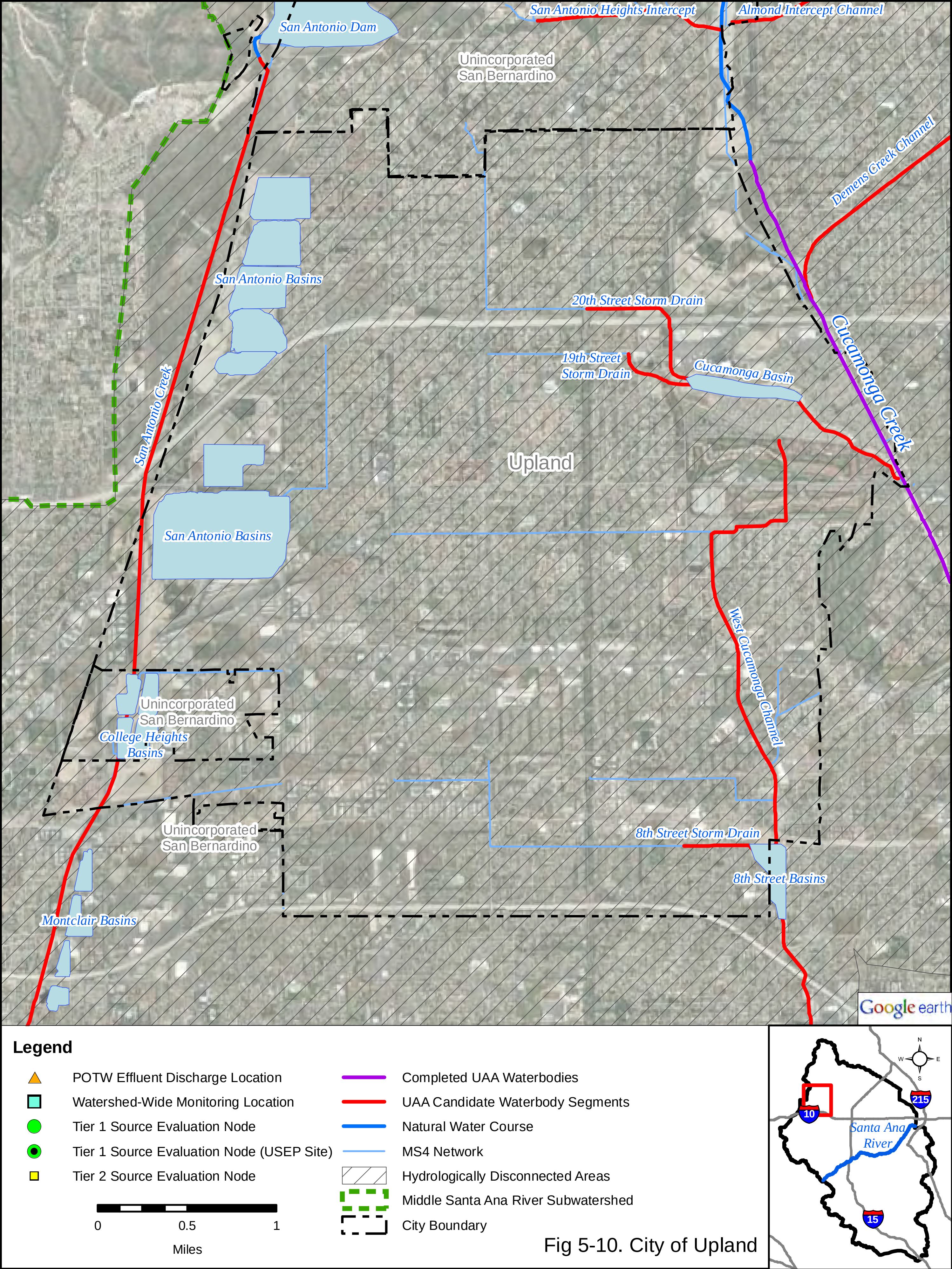


Fig 5-10. City of Upland

Table 5-2. Summary of recommended Tier 1 and Tier 2 nodes in each San Bernardino County jurisdiction

Jurisdiction	Receiving Waters	System Nodes	
		Tier 1	Tier 2
Chino	Chino Creek, Cypress Channel [1]	4	13
Chino Hills	Carbon Canyon Creek, English Canyon, Boys Republic South Channel, Chino Creek, Lake Los Serranos Channel	4	23
Fontana	San Sevaine Channel	0	4
Montclair	City is hydrologically disconnected from downstream impaired waters under dry weather conditions [1]	0	0
Ontario	Cypress Creek, Lower Deer Creek, County Line Channel	6	16
Rancho Cucamonga	City is hydrologically disconnected from downstream impaired waters under dry weather conditions	0	0
Rialto	Rialto Channel	1	0
Unincorporated San Bernardino County	Jurisdiction is hydrologically disconnected from downstream impaired waters under dry weather conditions	0	0
Upland	City is hydrologically disconnected from downstream impaired waters under dry weather conditions [1]	0	0
	Total	**15**	**52**

1) Intermittent turnouts of imported water at OC-59 from MWD purchased by OCWD create a condition of hydrologic connectivity between urban DWF from MS4s and Chino Creek

- *Non-Urban Dry Weather Flow Sources* - If there are any non-urban sources of DWF to a system node (such as from a well blow off, water transfer, or rising groundwater), it is important to identify the frequency and relative contribution of these flows. Generally, it is assumed that these non-urban flow sources will have very low levels of bacterial indicators. However, it is possible that the physical nature of the discharge generates sufficient shear stress to mobilize bacteria associated with sediment or biofilms present in the receiving water (as compared to the low shear stress generated from MS4 urban sources due to their relatively low flow rates). Elimination of the non-urban source could also result in conditions that enhance decay of bacteria in channel bottom sediments or biofilms, resulting in fewer bacteria available for mobilization during wet weather events. If the non-urban flow source is suspected as the cause of downstream exceedances, a site-specific study would need to be implemented to verify the assumption. The nature of such a study would be dictated by local circumstances, but could require a fairly complex sample plan. If it is determined that the non-urban source is contributing to the exceedance of bacterial indicator water quality objectives, resolution of the issue may occur independent of the MS4 permit in collaboration with the Regional Board.

- *Dry Weather Flow Water Quality* – Where flow is observed at Tier 1 and Tier 2 nodes, an evaluation of *E. coli* levels is necessary to determine whether the bacterial indicator load in the DWF has the potential to contribute to bacterial indicator exceedances in downstream waters. An important consideration during this evaluation is the nature of the receiving water. Several of the impaired waters are effluent-dominated, thus *E. coli* levels in flows upstream of a system node could exceed the applicable TMDL wasteload allocation, but not cause an exceedance of a water quality objective in the receiving water. Therefore, only those nodes that substantially exceed the wasteload allocations should be prioritized for further inspection program activities. A minimum of five samples over a 30-day period will be collected at a particular node to determine its priority for additional action. If the geometric mean of the sample results exceeds the REC-1 water quality objective of 126 cfu/100 mL by at least 10 times, then the node is categorized as substantially exceeding the wasteload allocation. This value represents the 85th percentile of geometric means of *E. coli* based on data from the 2007-2008 USEP monitoring program.

- *Presence of Human Source Bacteria* – If a site is found to have elevated *E. coli* levels that substantially exceed the wasteload allocation and then additional water quality sampling is recommended to determine if human source bacteria are present. The result of this analysis will assist with the prioritization of areas for additional source evaluations and guide the implementation of the inspection strategy on priority sites.

- *UAA Candidates* – UAAs are incorporated into the inspection program, because implementation actions may be dependent upon their completion. For the purposes of this CBRP, it was assumed that recently completed UAAs will be approved by all required regulatory agencies. If there is no dry weather runoff at a system node, but the upstream channel is a UAA candidate, then it is important to complete the UAA to ensure proper application of recreational use water quality objectives to any discharge to that upstream channel, e.g., it could eliminate the need to implement any activities to achieve wasteload allocations in upstream channels. This desired outcome includes channels which are hydrologically disconnected from downstream impaired receiving waters. For those UAA candidates that are hydrologically connected, it is especially important to complete UAAs, as UAAs, which indicate limited or no recreational use, facilitate moving the point of compliance, which provides more flexibility in determining where mitigation actions can or should be implemented. Additional information regarding the development of UAAs under this CBRP is provided below in Section 5.2.5.

Inherent in the inspection program described above is the need to prioritize where to start inspection activities. The USEP program results prioritized future source evaluation activities by major subwatershed (SAWPA 2009a): Mill-Cucamonga Creek and Chino Creek subwatersheds are the highest priority; SAR Reach 3 and Prado Park

Lake are the lowest priorities. More recent water quality data at watershed-wide compliance sites reaffirms these priorities (e.g. SAWPA 2010a).

5.2.3.2 Component 2 - Evaluation of Dry Weather Flow and Bacterial Indicator Sources

The second component of the inspection program focuses on the inspection strategy that will be employed to identify potential controllable sources – both DWF and bacterial indicators. This component provides the basis for determining where source reduction activities need to be carried out to achieve compliance. Two circumstances may exist:

- *Dry Weather Flow Includes Human Source Bacteria* - Under this circumstance, the priority is to eliminate the human bacteria source. A secondary goal is to reduce or eliminate the DWF; however, this may be unnecessary if eliminating the human source mitigates the presence of elevated bacterial indicators.

  Eliminating the human bacteria source involves inspecting the MS4 system upstream of the outfall for sources of flow and applying IDDE program elements. By systematically moving upstream from the outfall along the trunk line (largest diameter pipe leading to outfall), manholes and/or catch basins are inspected and visual observations are made to isolate flow sources. .This systematic approach can continue upstream until the location of the source of flow has been identified. Additional bacterial indicator and human source bacteria sampling may be conducted as needed.

  If the inspection and targeted sampling results isolate the human bacteria source, e.g., a cross-connection or illicit discharge, then appropriate action can be taken to correct the problem. Additional sampling can be conducted at the outfall after corrective action is complete to verify that the human bacteria source is eliminated. If corrective actions have been completed but the human bacteria source is still present, then inspection activities continue to look for additional human bacteria sources. If no additional sources are found, but bacterial indicators and/or human bacteria sources remain present, and then a controllability assessment is required to determine the next course of action (see below).

- *Dry Weather Flow has Elevated E. coli, but No Human Bacteria Sources* - For this situation, rather than trying to mitigate non-human bacterial sources, the primary goal is to reduce or eliminate the DWF. A systematic approach, similar to that used to identify human bacteria sources, is applied: moving upstream from the outfall along the trunk line and inspecting the storm drain network, manholes and/or catch basins are inspected and visual observations are made to isolate flow sources. Once the source of flows has been located, targeted sampling may be conducted to identify the bacterial source and assess additional pollutants.

Based on results of the inspection strategy and targeted sampling, several outcomes are possible:

- The flow source is found to be specific, e.g., over-irrigation. Source control activities (such as targeted BMPs or enforcement if the over-irrigation is an ordinance violation) may be targeted to the area to reduce or eliminate the flow source.

- Microbial source tracking analyses may show that the source indicator bacteria may be from birds or other animals, and therefore uncontrollable, or the source is subject to a different jurisdiction. For example, if bovine sources are identified and the inspection strategy finds DWF entering the MS4 from agricultural areas, then this information would be turned over to the Regional Board for their action.

- The flow source is diffuse, i.e., it cannot be attributed to a specific area or cause. In these situations, a controllability assessment will be needed (see below), which may include mitigating the source through structural BMPs somewhere within the MS4 facility.

5.2.3.3 Controllability Assessment

The ultimate goal of the inspection program is to locate and eliminate controllable sources of bacterial indicators. As described above, systematically conducting source evaluation activities in the MS4 should identify which outfalls or channels are primary contributors of DWF and elevated bacterial indicators. The controllability of flows is largely dependent on the source (specific vs. diffuse) and the controllability of bacterial indicators is largely dependent on the nature of the source, with urban sources likely to be more controllable than non-urban sources, e.g., wildlife. In many cases, it is anticipated that the elimination or significant reduction of the DWF will also mitigate elevated bacterial indicators.

A controllability assessment will evaluate alternatives for reducing or eliminating controllable sources of bacteria, such as:

- *Prevention (or source control)* – As noted above, if the source of the water or bacterial indicators can be specifically identified, and then implementation of local control measures is the best approach for mitigating the problem. The controllability assessment consists of evaluating which BMPs or programmatic tools can be applied to the situation to reduce or eliminate the source. If a targeted solution is not available, then the controllability assessment may need to consider more costly solutions, as described below.

- *Retention Structures or Low Flow Diversions* – The implementation of relatively local structural controls to prevent the DWFs from impacting downstream waters may be an outcome of the controllability assessment. Options may range from the modification of existing retention structures to capture all DWFs to the construction of new retention facilities or construction of diversions to intercept the DWFs and conveying them to a treatment facility.

- *On-Site or Regional Treatment* – The use of on-site treatment facilities, e.g., bio-retention (drainage area < 20 acres) and subsurface flow wetlands (drainage area < 1,000 acres), is largely dependent on drainage area, facility sizing criteria and land availability. The practicability of these systems will have to be considered on a site-specific and subwatershed specific basis. In many cases, implementation of a regional treatment solution such as conveying dry weather runoff to a regional storage basin requires successful completion of a UAA for upstream waters, which also provides greater flexibility where the regional treatment may be sited. The MS4 permit for San Bernardino County requires the completion of a system-wide evaluation to identify retrofit opportunities of existing stormwater conveyances (see additional information in Section 5.2.4, Element 4 – Regional Treatment). Development of this information coupled with the establishment of the County's WAP (see Section 5.2.4) will support the preparation of controllability assessments.

5.2.3.4 Inspection Criteria Summary

Element 3 – Inspection Criteria implements the USEP to its fullest extent, building on source evaluation work already completed in the watershed. Execution of this element is the key to the success of CBRP implementation. Understanding the localized nature of DWFs and associated bacterial indicators provides the basis for determining where BMPs need to be targeted (Element 2 – Specific BMPs, Section 5.2.2), whether there is a need for additional ordinance authority (Element 1 – Ordinances, Section 5.2.1), and where regional structural controls may be necessary (Element 4 – Regional Treatment, Section 5.2.4).

5.2.4 Element 4 - Regional Treatment

A large portion of upper part of the MSAR watershed in San Bernardino County is hydrologically disconnected from impaired waters (see Figure 5-3). This is primarily because of the extensive use of basins to capture and recharge dry and wet weather flows. The desire to recharge water in the watershed coupled with the development of the WAP and outcome of inspection program findings will drive decisions regarding siting of regional facilities. As a result, for the most part, with the exception of UAA development, the emphasis of CBRP implementation activities will be focused on the lower portions of the MSAR watershed in San Bernardino County. With the excpetion of the proposed Mill Creek Wetland, it is too soon to propose specific locations for new regional treatment facilities given the lack of knowledge regarding the best locations to site such facilities. Too little is known regarding urban sources of DWF and the relative bacterial indicator levels associated with these sources. The inspection program (Element 3, Section 5.2.3) has been designed to address this knowledge void with a key outcome of that program being controllability assessments that will lead to decisions on where to site regional treatment facilities, if they are needed. Given the December 31, 2015 dry weather condition compliance date, the inspection program will be implemented aggressively so that discussions regarding the need/siting of regional treatment facilities is occurring by 2013-2014 (see Section 7). The following sections describe the approach for implementation of this element.

5.2.4.1 Groundwater Recharge of Dry Weather Flows

Regional storage basins overlying the Chino groundwater basin, primarily owned by SBCFCD or the Chino Basin Water Conservation District, provide regional capture of dry weather runoff from upstream MS4 facilities. IEUA conducts groundwater recharge operations in many of these basins, to maximize recharge of groundwater using a combination of dry weather runoff, stormwater, and supplemental imported water, while maintaining the flood control functionality required by SBCFCD. The recharge activities in these facilities s hydrologically disconnect vast areas of drainage area within the Cities of Upland, Montclair, Rancho Cucamonga, Ontario, and Fontana (see Figure 5-3).

The Chino Basin Watermaster recently completed its 2010 Recharge Master Plan Update (CBRMP). The purpose of the CBRMP is to maximize the capture of stormwater for recharging groundwater to reduce reliance on imported sources of water and improve groundwater quality. Proposed projects in the initial phases of the plan only serve to enhance capture of wet weather runoff from larger storms or to provide additional capacity for supplemental imported water, and do not provide any additional benefit toward achieving compliance with the urban wasteload allocation applicable to dry weather conditions during the dry season.

IEUA's existing groundwater recharge system is so effective that incorporation of new drainage areas would require conveying stormwater from areas with limited recharge potential (generally south of Highway 60) to basins where underlying soils are more favorable to support groundwater recharge. This concept is incorporated into a potential project considered for a later phase of the CBRMP. The project involves a new large in-line detention facility on lower Cucamonga Channel to store dry and wet weather runoff to be pumped to a recharge facility in the upper part of the basin. This is a very preliminary concept and it has not been fully evaluated for cost, technical feasibility, environmental concerns and other issues. However, if there were such a detention facility on lower Cucamonga Channel, it could be technically feasible to capture dry weather runoff from additional MS4 drainage areas in the City of Ontario. The need for this type of project is an example of how the findings of the inspection program will be key for determining if such a regional facility would provide sufficient wasteload allocation compliance benefits to justify a portion of the cost.

5.2.4.2 Mill Creek Wetland Project

One regional facility is planned for implementation within San Bernardino County at the downstream end of the concrete lined section of Cucamonga Creek. This project would capture a portion of DWF from the entire watershed to the Mill-Cucamonga Creek at Chino-Corona Road (WW-M5) compliance monitoring site, and therefore has the potential to provide reduction in bacterial indicators. The project would divert DWF from the concrete lined channel to a debris basin northwest of the Chino-Corona Bridge over Mill-Cucamonga Creek and then under Chino Corona Road into a series of basins (Stephenson and Susilo 2009). The basins would be operated as free surface wetlands during dry weather to provide a hydraulic residence time of seven days. The treated DWF would then be discharged back to Mill-Cucamonga Creek, about 0.5 miles downstream of Chino-Corona Road. During wet weather, water level rise within the basins would result in the basins functioning as extended detention or wet ponds. The DWF that would be diverted is not yet determined, and will be influenced by the need to maintain existing habitat areas within Mill-Cucamonga Creek, between Hellman Avenue and ~0.5 miles downstream of Chino-Corona Road, and by the wetland treatment capacity, which is a function of the hydraulic residence time selected for optimal pollutant removal.

The City of Ontario will fund a portion of this project through fees for the ~3,000 acre, New Model Colony development, located within the upstream drainage area. The project team is currently preparing grant proposals for the remaining funds needed to implement the proposed project concept. Once implemented, the effectiveness of this regional BMP should be incorporated into future water quality evaluations for the Mill-Cucamonga Creek watershed.

5.2.4.3 San Bernardino County Watershed Action Plan

As noted above, specific regional treatment facilities have not yet been identified as part of this CBRP. However, if through implementation of the inspection program (Element 3, Section 5.2.3) a controllability assessment determines that a structural BMP is the best solution at a given MS4 outfall or for a collection of outfalls, then regional treatment projects may be proposed as a solution. This type of analysis and decision will be closely coordinated with the WAP (under development) and the needs of water agencies such as IEUA. For example, MS4 permit includes the following requirement as part of the development of the WAP (see MS4 permit Section XI.B.3.a.ix):

> "…conduct a system-wide evaluation to identify opportunities to retrofit existing stormwater conveyance systems, parks, and other recreational areas with water quality protection measures, and develop recommendations for specific retrofit studies that incorporates opportunities for addressing applicable TMDL Implementation Plans, hydromodification management, and/or LID implementation within the permitted area…"

This evaluation will be completed as part of Phase 1 of WAP development, by January 29, 2011. Once complete, structural BMP retrofit opportunities identified in the WAP can be used to support controllability assessments, e.g., identifying where the best opportunities are for siting regional treatment facilities to manage dry weather runoff, if such facilities are needed.

5.2.5 Use Attainability Analyses

The development of UAAs is an integral part of the implementation of the CBRP, especially Element 3 – Inspection Criteria. This section provides additional information regarding the purpose of UAAs and the approach for implementation approach under the CBRP.

5.2.5.1 Current Recreational Use Designations

All waterbodies in the MSAR watershed are presumptively classified as REC-1 protected waterbodies. This means that all waterbodies in the watershed must meet the REC-1 water quality objectives regardless of their characteristics and ability to support REC-1 type activity (see Section 1.1.4). The REC-1 presumption may be inappropriate for a number of reasons including channel physical attributes (see Section 3.3) and flow volume. To establish more appropriate recreational uses that recognize these factors, a UAA is required. As defined by the Basin Plan, the purpose of a UAA is "to evaluate the physical, biological, chemical, and hydrological conditions of a river to determine what specific beneficial uses the waterbody can support." For a UAA to be implemented it must receive regulatory approval, from the Regional Board, State Board and EPA Region 9.

The outcome of a UAA could be removal of either the REC-1 use or removal of both REC-1 and REC-2 uses. Either outcome would substantially change the basis for determining compliance with water quality objectives and compliance with TMDL wasteload allocations. For example, if the waterbody is not designated REC-1, then the applicable bacterial indicator water quality objectives are much less stringent than would be the case if the REC-1 use was applicable. These changes could greatly reduce the number of locations where implementation of water quality control activities is necessary to achieve compliance. Modification of recreational uses would also provide additional flexibility for deciding *where* implementation of a water quality control measure is needed. For example, if a regional treatment facility is needed to meet compliance at a downstream site, the number of potential locations where that facility can be sited is increased.

5.2.5.2 Recreational Use Basin Plan Amendment

Section 1.1.4 described ongoing work by the Regional Board to adopt a Basin Plan amendment to modify recreational uses and associated water quality objectives. The Regional Board is developing this Basin Plan revision in collaboration with the SWQSTF. Adoption of the Basin Plan Amendment, planned for Spring 2011, will include the establishment of a UAA for the following San Bernardino County waterbody: *Cucamonga Creek* – Reach 1, confluence with Mill Creek (at Hellman Street) upstream to 23rd Street in Upland, California; remove both REC-1 and REC-2 uses.

5.2.5.3 UAA Template

The Cucamonga Creek UAA will be used as the template for all future UAAs developed in San Bernardino County. These UAAs will include the following key sections:

- *Waterbody Description*, including candidate reach coordinates and channel characterization;

- *Eligibility Analysis*, including existing and probable future recreational use based on water quality data and known recreational use activity; and

- *UAA Factor Evaluation*, which provides the justification for modifying recreational uses based on federal and state regulatory requirements.

The recreational use survey database developed by the SWQSTF will be used to support development of these UAAs. This database was developed through the use of remote camera technology coupled with occasional site visits to document area recreational activity at 17 locations in the Santa Ana River watershed (Table 5-3). Eight of these sites are located in the MSAR watershed; several are in San Bernardino County.

With the exception of recreational use activity data, which is part of the eligibility analysis, most of the information required for each of the UAA sections is relatively simple to compile. It is expected that the existing large recreational use survey image dataset will provide a basis for predicting the level of recreational use activity in non-surveyed waterbodies based on similarities in waterbody characteristics. As a result, for some future UAAs it may not be necessary to collect additional recreational use survey data. However, if unusual site-specific conditions exist, e.g., in areas where a waterbody is within a residential area or near a school and access to the channel is not restricted, there may be some concern with relying solely on the recreational use survey image database to document the existing or potential for recreational use activities in the waterbody. In these situations, it is understood that the Regional Board may require the collection of site-specific use survey data.

The Regional Board's decision to approve a UAA and modify recreational uses is largely based on an evaluation of the potential risk of human exposure to bacterial indicators in a particular waterbody. The potential risk is related to the characteristics of the waterbody and the likelihood of water contact recreational activities occurring given those characteristics. For example, where water contact recreation is likely to occur, such as a natural waterbody with sufficient flow, the risk of exposure is higher than where such recreation is unlikely, e.g. in a vertical-walled concrete-lined engineered channel.

Results from SWQSTF surveys, which are now stored in the recreational use survey image database (currently available at SAWPA), show that channel characteristics are a strong indicator of existing and potential recreational use activity in the Santa Ana River watershed (however, ultimately it is up to the Regional Board to determine applicable uses):

Table 5-3. Summary of recreational use surveys completed by SWQSTF in the Santa Ana River watershed

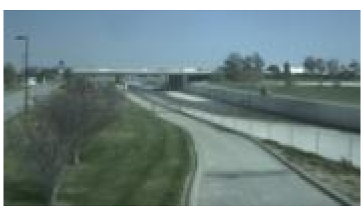
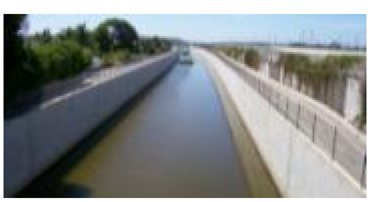
Representative Photo of Site	Summary of Recreational Use Survey
	**Greenville Banning Channel at Adams Avenue Bridge** ■ Concrete lined, vertical walled channel ■ Land use: Residential and open space ■ Period of Survey: 11/17/05 – 1/3/06 ■ Images collected: 2552 ■ Water contact recreational use events: 0
	**Greenville Banning Channel at Pedestrian Bridge** ■ Concrete lined, vertical walled channel ■ Land use: Residential and vacant natural land ■ Period of Survey: 7/7/2005 – 7/27/2005 ■ Images Collected: 45 ■ Water contact recreational use events: 0
	**Santa Ana Delhi Channel at Mesa Ave** ■ Concrete lined, vertical walled channel ■ Land use: Residential / open space and recreation ■ Period of Survey 6/20/2005 – 7/13/2006 ■ Images Collected: 21,284 ■ Water contact recreational use events: 0
	**Cucamonga Creek at RP1** ■ Concrete lined, vertical walled channel ■ Land use: Industrial/commercial and open space/recreation ■ Period of Survey 10/2/2007 – 10/10/2008 ■ Images Collected: 27,122 ■ Water contact recreational use events: 0
	**Anza Channel at John Bryant Park** ■ Concrete lined, vertical walled channel ■ Land use: Residential and open space/ public park ■ Period of Survey 6/6/2008 – 9/29/2009 ■ Images Collected: 20,386 ■ Water contact recreational use events: 2
	**Greenville Banning Channel at Adams Avenue Bridge** ■ Concrete lined, vertical walled channel ■ Land use: Residential and open space ■ Period of Survey: 11/17/05 – 1/3/06 ■ Images collected: 2552 ■ Water contact recreational use events: 0

Table 5-3. Summary of recreational use surveys completed by SWQSTF in the Santa Ana River watershed

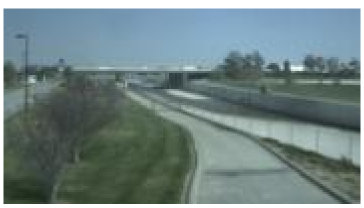
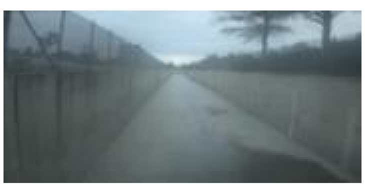
Representative Photo of Site	Summary of Recreational Use Survey
	**Greenville Banning Channel at Pedestrian Bridge** ■ Concrete lined, vertical walled channel ■ Land use: Residential and vacant natural land ■ Period of Survey: 7/7/2005 – 7/27/2005 ■ Images Collected: 45 ■ Water contact recreational use events: 0
	**Santa Ana Delhi Channel at Mesa Ave** ■ Concrete lined, vertical walled channel ■ Land use: Residential / open space and recreation ■ Period of Survey 6/20/2005 – 7/13/2006 ■ Images Collected: 21,284 ■ Water contact recreational use events: 0
	**Cucamonga Creek at RP1** ■ Concrete lined, vertical walled channel ■ Land use: Industrial/commercial and open space/recreation ■ Period of Survey 10/2/2007 – 10/10/2008 ■ Images Collected: 27,122 ■ Water contact recreational use events: 0
	**Demens Channel** ■ Concrete lined, vertical walled channel ■ Land use: Residential and open space ■ Period of Survey 2/1/2008 – 2/9/2009 ■ Images Collected: 21,382 ■ Water contact recreational use events: 0
	**Cucamonga Creek at Hellman Ave (Upstream)** ■ Trapezoidal channel, concreted lined wall and bottom ■ Land use: Agriculture ■ Period of Survey 11/1/2005 – 11/1/2006 ■ Images Collected: 2,546 ■ Water contact recreational use events: 0
	**Temescal at Main Street** ■ Trapezoidal channel, concreted lined wall and bottom ■ Land use: Industrial / Commercial ■ Period of Survey 7/26/2005 – 8/4/2005 ■ Images Collected: 513 ■ Water contact recreational use events: 1

Table 5-3. Summary of recreational use surveys completed by SWQSTF in the Santa Ana River watershed

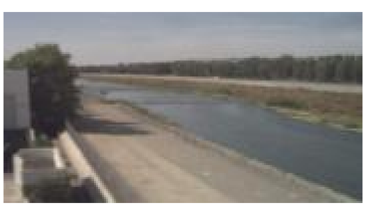
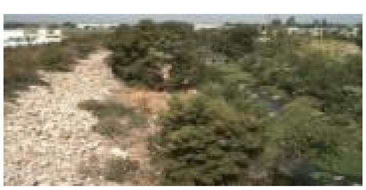
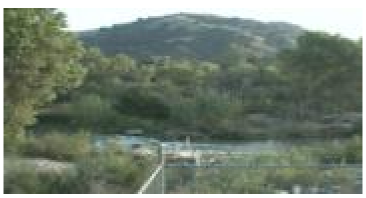
Representative Photo of Site	Summary of Recreational Use Survey
	**Temescal at City of Corona WWTP No. 2** ■ Trapezoidal channel, concreted lined wall and bottom ■ Land use: Industrial / Commercial ■ Period of Survey 11/1/2005 – 11/1/2006 ■ Images Collected: 10,653 ■ Water contact recreational use events: 1
	**Santa Ana Delhi Channel at Sunflower Ave** ■ Trapezoidal channel, rip rap side slopes, natural bottom ■ Land use: Commercial/ residential/ school ■ Period of Survey 7/7/2005 – 7/9/2006 ■ Images Collected: 20,978 ■ Water contact recreational use events: 1
	**Cucamonga Creek at Hellman Ave (Downstream)** ■ Trapezoidal channel, rip rap side slopes, natural bottom ■ Land use: Agriculture ■ Period of Survey 7/26/2005 – 11/1/2006 ■ Images Collected: 16,678 ■ Water contact recreational use events: 8
	**Perris Valley Channel at Moreno Valley WRF** ■ Trapezoidal channel / concrete lined side slope and concrete/natural bottom ■ Land use: Industrial/ Residential/school and open space/public park ■ Period of Survey 10/3/2007 – 10/10/2008 ■ Images Collected: 21,962 ■ Water contact recreational use events: 0
	**SAR at Anaheim** ■ Trapezoidal channel, rip rap side slopes, natural bottom ■ Land use: Industrial/ commercial and open space/public park ■ Period of Survey 10/2/2007 – 10/5/2008 ■ Images Collected: 25,904 ■ Water contact recreational use events: 0
	**Chino Creek at Central Ave** ■ Trapezoidal channel / rip rap slope and bottom ■ Land use: Industrial / commercial ■ Period of Survey 12/19/2007 – 5/23/2009 ■ Images Collected: 23,913 ■ Water contact recreational use events: 10

Table 5-3. Summary of recreational use surveys completed by SWQSTF in the Santa Ana River watershed

Representative Photo of Site	Summary of Recreational Use Survey
	**San Diego Creek at Irvine** ■ Trapezoidal channel / natural side slopes and bottom ■ Land use: Residential/commercial/school and open space ■ Period of Survey 6/10/2008 – 9/30/2009 ■ Images Collected: 24,801 ■ Water contact recreational use events: 4
	**Santa Ana Delhi Channel at Newport Bay** ■ Natural Channel ■ Land use: Open space / commercial ■ Period of Survey 6/20/2005 – 6/6/2006 ■ Images Collected: 20,203 ■ Water contact recreational use events: 2
	**SAR at Yorba Linda** ■ Natural Channel ■ Land use: Residential / open space ■ Period of Survey 4/11/2006 – 4/6/2007 ■ Images Collected: 12,645 ■ Water contact recreational use events: 0

- *Vertical-walled, Concrete-lined Channels* - Based on over 93,000 images collected from all seasons and different areas of the Santa Ana River watershed, no water contact recreation has been observed in vertical-walled channels. Accordingly, no exposure risk has been identified and a UAA could result in the removal of both REC-1 and REC2 uses.

- *Trapezoidal-walled, Concrete-lined bottom Channels* - Based on over 35,000 images collected from all seasons and different areas of the watershed, only one contact with water was observed – a person kneeling at the edge of a low flow channel contacted the water on two occasions for a period of less than 30 minutes. In these situations, a UAA could result in the removal of the REC-1 use.

- *Trapezoidal-walled, Natural bottom Channels* – Based on over 113,000 images, only a few images (23) showed some type of contact with the water, but limited to shallow wading, e.g., Chino Creek at Central Avenue where 10 observations occurred. The outcome of the UAA in these situations is unclear and site-specific recreational use survey may need to be collected.

- *Natural Stream Channels* – Three natural or somewhat natural stream channels have been surveyed (Santa Ana Delhi Channel at Newport Bay and Reach 2 of the Santa Ana River at Yorba Linda and Anaheim). Based on over 32,000 images, only two observations of contact with the water were observed and these occurrences were limited to hand/water contact at the Santa Ana Delhi Channel at Newport Bay site. Regardless, because of the natural features of the channel, it is likely that REC-1 and REC-2 uses would still be applied by the Regional Board.

5.2.5.4 UAA Candidate Segments

Figure 5-11 provides an overview of where UAAs have been completed in the MSAR watershed or where they are recommended for future development (see also Figures 5-4 through 5-10). Table 5-4 summarizes the UAAs recommended for development within each jurisdiction. These recommendations are based on the channel characteristics and UAA findings already completed by the SWQSTF.

5.2.5.5 UAA Development Process

Regional Board staff will be consulted prior to initiating development of UAAs. In addition (but subject to confirmation), it is expected that that Regional Board would prefer that UAAs be submitted as packages (i.e., multiple UAAs submitted for approval as one Basin Plan amendment) rather than as individual UAAs, which would require multiple Basin Plan amendments and multiple approval processes. With these considerations in mind, the following process will be implemented as part of the CBRP:

- Conduct meeting with Regional Board to obtain agreement on the following:
  - Identify groups of UAAs to be submitted as one Basin Plan Amendment;
  - Determine minimum water quality data requirements;

Table 5-4. UAA candidate waterbodies in San Bernardino County

Primary Jurisdiction of Waterbody	UAA Candidate Waterbody	Additional Jurisdictions	Waterbody Length (miles) Classified as UAA Candidate
Chino	Chino Storm Drain	Unincorporated San Bernardino	3.05
	Cypress Channel	Ontario	5.78
Chino Hills	Boys Republic South Channel		1.24
	Carbon Canyon Creek	Chino	2.21
	Lake Los Serranos Channel		2.69
	Lower Los Serranos Channel		1.44
Fontana	Declez Channel	Unincorporated Riverside	4.75
	Highland Channel		2.54
	San Sevaine Channel	Unincorporated Riverside, Unincorporated San Bernardino, Rancho Cucamonga	17.62
Montclair	San Antonio Creek	Unincorporated San Bernardino, Claremont, Upland, Chino	10.44
	West State Street Storm Drain	Ontario	2.73
Ontario	County Line Channel		2.59
	East State Storm Drain		1.86
	Lower Deer Canyon Wash		2.08
	Lower Etiwanda Creek Channel		2.15
	West Cucamonga Channel	Upland	7.12
Rancho Cucamonga	Almond Intercept Channel	Unincorporated San Bernardino	0.65
	Alta Loma Storm Drain		3.87
	Cucamonga Storm Drain		1.56
	Demens Creek Channel	Upland	2.21
	Etiwanda Creek Channel	Unincorporated San Bernardino, Ontario, Fontana	3.66
	Henderson Channel	Chino Hills	2.16
	Hillside Channel		1.42
	Upper Deer Canyon Wash	Ontario	7.59

Table 5-4. UAA candidate waterbodies in San Bernardino County

Primary Jurisdiction of Waterbody	UAA Candidate Waterbody	Additional Jurisdictions	Waterbody Length (miles) Classified as UAA Candidate
Rialto	Cactus Channel		2.62
	East Fontana Storm Drain	Fontana, Unincorporated San Bernardino	2.61
	Rialto Channel	Unincorporated Riverside	6.79
Upland	8th Street Storm Drain		0.37
Unincorporated San Bernardino County	Chino Creek	Chino Hills, Chino	10.26
	Deer Creek Channel	Rancho Cucamonga	1.52
	Hawker-Crawford Channel	Rancho Cucamonga, Fontana	2.11
	San Antonio Heights Intercept		1.06
	West Fontana Channel	Fontana	4.19
Unincorporated Riverside County	Day Creek	Ontario, Rancho Cucamonga, and unincorporated San Bernardino	15.43

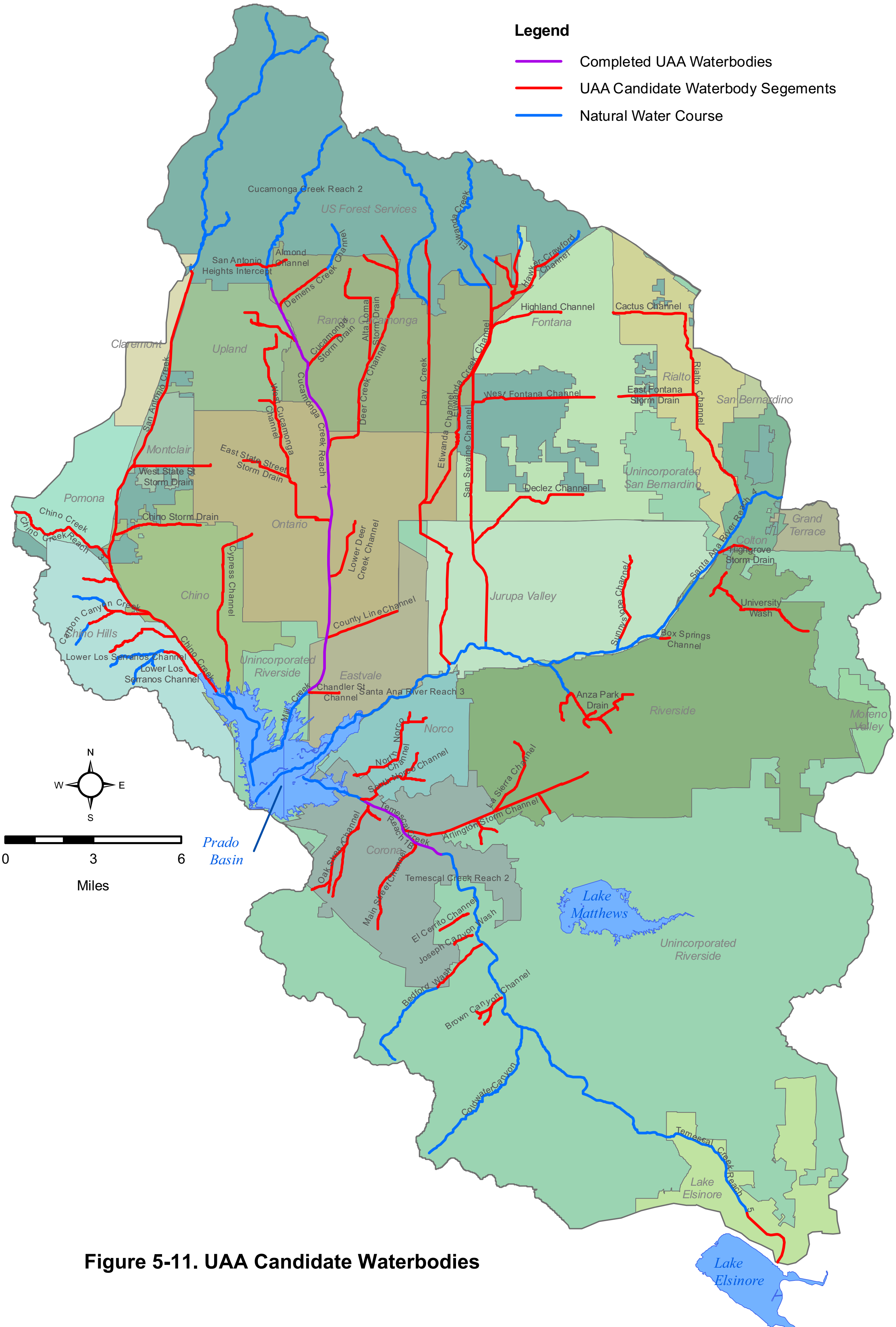


Figure 5-11. UAA Candidate Waterbodies

  - Determine whether any additional recreational survey data collection is required; and

  - Agree on UAA structure and content, i.e., is the existing UAA template adequate or are there any site-specific issues that need to be addressed.

- Collect any necessary data (time period could range from a few weeks or months to a year if substantial recreational use survey data is required).

- Submit draft UAA to the Regional Board for review and comment. Draft UAA will be in the same format as the existing Cucamonga Creek UAA.

- Prepare revised UAA to the Regional Board for adoption as a Basin Plan amendment.

5.3 Waterbody-Specific Plans – Prado Park Lake

CBRP development has focused on achieving compliance with the watershed-wide compliance sites other than Prado Park Lake. DWF into Prado Park Lake consists primarily of effluent from IEUA RP1 WRRF. Open space park grounds surround Prado Park Lake and it is currently believed that there are no urban DWF sources to the lake, suggesting that non-attainment of the water quality objectives during dry weather conditions in the dry season may not be the responsibility of the MS4. To verify this assumption, the MS4 Area-wide Program will work with San Bernardino County Regional Parks, which has oversight authority over the lake. An investigation will be conducted to verify that there are no urban DWF sources to the lake. This investigation may include the following elements:

- Review Prado Park Lake as-built drawings, where available, to better understand the design of the lake and sources of water inputs to the lake; and

- Conduct a field walk of the lake perimeter and surrounding area to look for any potential DWF inputs and, as needed, reconcile field observations with as-built drawing review.

The findings of this investigation will be provided to the Regional Board with recommendations for any follow-up actions.

Section 6
Compliance Analysis

6.1 Introduction

The MS4 permit requires that the CBRP provide the scientific and technical documentation used to conclude that the CBRP, once fully implemented, is expected to achieve compliance with the urban wasteload allocation for indicator bacteria by December 31, 2015 (MS4 permit Section V.D.2.b.i.(e)). Wasteload allocations were developed for both fecal coliform and *E. coli*:

- Fecal coliform: 5-sample/30-day Logarithmic Mean less than 180 organisms/ 100 mL and not more than 10 percent of the samples exceed 360 organisms/100 mL for any 30-day period.

- *E. coli*: 5-sample/30-day Logarithmic Mean less than 113 organisms/100 mL and not more than 10 percent of the samples exceed 212 organisms/100 mL for any 30-day period.

This analysis used the 5-sample/30-day Logarithmic Mean for *E. coli* of 113 cfu/100 mL to demonstrate that this plan, once implemented, is expected to achieve compliance with the urban wasteload allocation. This level-based wasteload allocation for MS4 permittees is a target for all urban sources of flow; however, it would be nearly impossible to monitor bacteria at all MS4 outfalls. Consequently, compliance with the TMDL is assessed at four of the five watershed-wide compliance monitoring sites. No analysis was done for the Prado Park Lake compliance location as there currently are no known MS4 facilities discharging DWF to the lake. This presumption will be verified during CBRP implementation.

Several key questions were addressed in order to complete this analysis, including:

- What is the relative contribution of urban DWF from MS4 outfalls to receiving waterbodies during dry weather conditions? This contribution determines the volume of DWF that that is potentially controllable by the MS4 program. See Section 6.2.1.

- To what level must *E. coli* (cfu/day) from urban sources of DWF from MS4 permittees be reduced to demonstrate compliance? This question assesses current bacterial indicator levels at the compliance monitoring sites in relation to the wasteload allocation in the TMDL. Only the portion of the baseline bacteria in excess of the TMDL wasteload allocation that are controllable by implementing BMPs within MS4 systems is targeted for bacteria indicator reduction by MS4 permittees. Section 6.4 computes this daily bacterial indicator level targeted for removal through CBRP implementation. Other sources of bacteria to downstream compliance monitoring sites, such as agricultural land uses, illegal discharges, wildlife, or environmental growth, are not well understood. The inspection program is designed to provide information to assist the permittees in developing an approach to manage these sources, determined to be uncontrollable within MS4 facilities.

- How is compliance with the wasteload allocations for MS4 permittees best demonstrated? See Section 6.3.
- How many daily *E. coli* bacteria (cfu/day) from urban sources of DWF from MS4 permittees must be removed to demonstrate compliance? This question assesses current bacterial indicator levels at the compliance monitoring sites in relation to the wasteload allocation in the TMDL. A portion of the baseline bacteria in excess of the TMDL wasteload allocation is attributable to urban sources of DWF from MS4 permittees. Section 6.4 computes the daily bacteria targeted for removal through CBRP implementation.
- How do the proposed CBRP elements achieve the targeted daily *E. coli* bacteria (cfu/day) removal? Section 6.5 discusses the water quality benefits (quantifiable and non-quantifiable) expected from CBRP implementation.
- Section 6.6 summarizes the findings of this compliance analysis and discusses key assumptions and uncertainties associated with computation.

6.2 Baseline Dry Weather Flow and Bacterial Indicator Data

6.2.1 Dry Weather Flow Sources to MS4 System

Regular flows exist in many MSAR waterbodies during dry weather conditions. Sources of DWF include:

- Effluent from POTWs
- Turnouts of imported water by the MWD
- Well blow-offs
- Groundwater inputs
- Other authorized discharges (as defined by permit)
- Non-permitted discharges

Each of these sources of runoff has a different pathway and potential to transport bacteria to receiving waterbodies. Thus, it is important to understand the relative role of each of these categories of DWF. Section 3.2 provided an overview of dry weather hydrology in the MSAR watershed. This information provides a basis for the compliance analysis described in this section of the CBRP.

Flow and bacterial indicator level data are available from several sources for all of the compliance monitoring sites and most of the major tributaries to the impaired receiving waterbodies. Table 6-1 provides a summary of the sources of data used to characterize flow and bacterial indicator water quality in the MSAR Bacterial Indicator TMDL waterbodies and their tributaries.

Table 6-1. Available data for characterization of baseline flow and bacterial indicators in areas draining to watershed-wide compliance sites

Site	Flow	Bacterial Indicator Concentration
Downstream: Chino Creek at Central Ave (WW-C7)	Watershed-wide field measurements 2007-2009 (n=82)	Watershed-wide compliance monitoring 2007-2009 (n=82)
POTW Effluent	Daily effluent at IEUA Carbon Canyon WRRF (2007 - 2008)	Assumed effluent of 2.2 MPN/100 mL
Carbon Canyon Creek Channel	SBCFCD Little Chino Creek gauge 2843 (2007-2008)	USEP samples (n=19)
Chino Creek above Schaeffer	USGS Gauge 11073360 (2005-2009)	USEP samples at San Antonio Channel (n=19)
Downstream: Mill Creek at Chino Corona Rd (WW-M5)	USGS Gauge at Merrill Ave 11073495 (2005-2009)	Watershed-wide compliance monitoring at Chino-Corona Road 2007-2009 (n=80)
POTW Effluent	Daily effluent at outfall 001 of IEUA RP1 WRRF (2007 - 2008)	Assumed effluent of 2.2 MPN/100 mL
Lower Deer Creek (CHRIS)	USEP field measurements samples at CHRIS (n=17)	USEP samples at CHRIS (n=17)
County Line Channel (CLCH)	USEP field measurements samples at CLCH (n=16)	USEP samples at CLCH (n=7)
Cucamonga Creek (CUC) above IEUA RP1 WRRF	USEP field measurements at CUC (n=16)	USEP samples at CUC (n=16)
Downstream: Santa Ana River at MWD Crossing (WW-S1)	USGS Gauge at MWD Crossing 11066460 (2005-2009)	Watershed-wide compliance monitoring at MWD Crossing 2007-2009 (n=82)
POTW Effluent	Daily effluent from RIX Facility and Rialto WWTP (2007 - 2008)	Assumed effluent of 2.2 MPN/100 mL
Sunnyslope Channel (SNCH)	USEP field measurements at SNCH (n=17)	USEP samples at SNCH (n=17)
Box Spring Channel (BXSP)	USEP field measurements at BXSP (n=17)	USEP samples at BXSP (n=17)
Downstream: Santa Ana River at Pedley Ave (WW-S4)	Sum of POTW effluent and estimated dry weather runoff from ANZA, DAY, and SSCH	Watershed-wide compliance monitoring at Pedley Ave 2007-2009 (n=82)
POTW Effluent	Daily effluent from RIX Facility, Rialto WWTP, and RWQCP (2007 - 2008)	Assumed effluent of 2.2 MPN/100 mL
Anza Drain (ANZA)	USEP field measurements at ANZA (n=14)	USEP samples at ANZA (n=18)
Day Creek (DAY)	USEP field measurements at DAY (n=13)	USEP samples at ANZA (n=13)
San Sevaine Channel (SSCH)	USEP field measurements at SSCH (n=13)	USEP samples at ANZA (n=13)

Within the MSAR watershed there are many MS4 drainage areas that do not typically cause or contribute to flow at the compliance monitoring sites. DWF at these MS4 outfalls is hydrologically disconnected from the TMDL receiving waterbodies, by either purposefully recharging groundwater in constructed regional retention facilities or through losses in earthen channel bottoms, where the recharge capacity of underlying soils exceeds dry weather runoff generated in upstream drainage areas. The acreage of hydrologically connected drainage area is shown in column 1 of Table 6-2.

Flow data from these sources characterize the role of DWF from major tributaries and POTW effluent to baseline flow at the compliance monitoring sites. For each of the compliance monitoring sites, column 2 in Table 6-2 shows the median of flow measurements from upstream USEP sites (major tributaries) and POTW effluent locations, during dry weather conditions in the dry season. Typical DWF at each of the compliance monitoring sites is also shown in column 2 of Table 6-3. These values are determined by summing inputs from USEP subwatersheds and effluent from upstream POTWs. This approach ensures a balance of runoff between inflows and outflows. The downstream flow estimates fell within expected ranges based on long-term daily data collected at USGS gauging stations in the MSAR watershed. As expected, dry weather runoff at each of the compliance monitoring sites consists primarily of POTW effluent (Figure 6-1).

Flow data was not available downstream of some portions of MS4 drainage areas; therefore it was necessary to approximate DWF from these areas to complete a water balance for each compliance monitoring site. Within the Chino Basin portion of the MSAR watershed, IEUA measures flow at a number of locations to quantify groundwater recharge for water supply benefit. Flow measurements, on days when DWF is predominantly from urban sources, suggest that DWF from urban sources occur at a rate of 100 gal/acre/day in the MSAR watershed, ranging from 20 to 280 gal/acre/day (see Table 3-2 for summary of field measured flows). This is consistent with DWF generation rates developed to support the City of Los Angeles Integrated Resources Plan (2004), which estimated DWF rates from urban watersheds ranging from zero to 300 gallons/acre/day. Thus, it was reasonable to use a rate of 100 gal/acre/day to approximate urban sources of DWF from “other MS4 areas” that may be hydrologically connected to a TMDL waterbody (Table 6-1).

The USEP flow measurements indicated that some tributaries have significantly greater DWF rates per acre of urbanized drainage area (column 3 of Table 6-1) than would be expected solely from urban sources. In these cases, the presence of a non-urban source was determined to be responsible for the elevated DWF rates. Assuming flow in excess of 100 gal/acre/day is from non-urban sources, Column 4 of Table 6-2 shows the portion of DWF that would be attributed to urban sources. At a few locations, field measured runoff was less than 100 gal/acre/day; therefore all of the DWF could be attributed to urban sources from MS4s (i.e., assumption that non-urban sources in these subwatersheds are negligible. Figure 6-1 shows the relative split between urban and non-urban sources of DWF within each of the compliance monitoring watersheds.

Overall, the contribution of DWF from urban sources relative to total downstream flow is very small in all of the TMDL waterbodies. This finding suggests that *E. coli* in urban DWF could be very high, or environmental growth of bacteria is occurring, assuming non-urban flows (potable water transfers, groundwater, etc.) and POTW effluent are largely free of fecal indicator bacteria.

6.2.2 Bacterial Indicator Levels

Section 3.4 summarized the bacterial indicator levels observed at watershed-wide compliance sites since 2007 and the levels observed during the USEP monitoring program implemented in 2007-2008. These data were used to provide baseline data for this compliance analysis.

The geometric mean of all dry weather *E. coli* levels measured at the watershed-wide compliance locations is shown in column 5 of Table 6-2. Geometric means of dry weather *E. coli* levels at each USEP site provide an estimate of baseline bacterial indicator levels from the major subwatersheds draining to each watershed-wide compliance site (column 5 of Table 6-2. These values show a wide range of observed *E. coli* levels, which suggests that targeted inspection and BMP implementation, would be an effective approach for mitigating controllable bacterial indicator sources.

Bacterial indicator data was not available downstream of some portions of MS4 drainage areas; therefore it was necessary to approximate *E. coli* level from these areas to develop a compliance analysis for the entire MSAR watershed. For purposes of this compliance analysis, the geometric mean of all dry weather *E. coli* monitoring data from the USEP study of 476 cfu/100 mL provides an initial estimate of bacteria from drainage areas that have no available data. Monitoring of bacterial indicators downstream of these areas is a key component of the CBRP, and results should be used to update this compliance analysis once available.

6.2.3 Relative Source Contribution

Relative source contribution analyses were prepared for each of the watershed-wide compliance locations. This analysis provided a comparison of monitored inputs of flow (Q_{inflow}) and bacterial indicator levels (C_{inflow}) from MS4 facilities and POTWs with downstream flow (Q_{comp}) and bacterial indicator levels (C_{comp}), as follows:

$$FIB_{comp} = Q_{comp} * C_{comp} = \left| \sum_{i}^{J} Q_{inflow} * C_{inflow} \right| + e$$

This type of analysis characterizes the relative role of different flow sources in the watershed on downstream bacterial indicator levels. An important outcome of this analysis is the identification of the amount of bacteria (*e*) at the compliance locations that cannot be explained by known flow sources within the watershed (referred to as "unaccounted-for sources"). The presence of an unbalanced set of inputs and outputs in relation to downstream bacterial indicator levels is not surprising, given the dynamic in-stream processes, which can increase (growth) or decrease (decay) bacterial indicator levels as instream flows move from their point of origin to the downstream watershed-wide compliance locations.

Table 6-2. Baseline DWF and bacterial indicator levels in areas that drain to watershed-wide compliance sites

Site	1 Hydrologically Connected Area (Acres)	2 Dry Weather Flow (cfs)	3 Total Dry Weather Flow Generation (gal/acre/day)	4 Percent of Dry Weather Flow from Urban Sources[1]	5 Dry Weather Geometric Mean of *E. coli* (cfu/100 mL)	6 Dry Weather *E. coli* (cfu/day)
SAR at MWD Crossing	14,832	75.6			149	276
POTW Effluent	n/a	68.7	n/a	n/a	2	4
Sunnyslope Channel	2,217	2.9	844	12%	183	13
Box Springs Channel	4,421	3.3	487	21%	1,686	137
Other MS4 Areas	5,887	0.9	100	100%	476 [3]	8
					Unaccounted-for Sources	114
SAR at Pedley Avenue	22,549	58.2			149	213
POTW Effluent	n/a	49.4	n/a	n/a	2	3
Anza Drain	6,994	6.1	566	18%	492	74
Day Creek	3,374	0.5	100	100%	577	7
San Sevaine Channel	2,869	1.3	293	34%	320	10
Other MS4 Areas	6,561	1.0	100	100%	476 [3]	10
					Unaccounted-for Sources	109
Chino Creek at Central Ave	11,821	16.8			394	162
POTW Effluent	n/a	8.8	n/a	n/a	2	0
Carbon Canyon Creek Ch.	1,820	6.5	2,323	4%	61	10
San Antonio Channel	5,315	0.7	86	100%	412	7
Other MS4 Areas	4,685	0.7	100	100%	476 [3]	8
					Unaccounted-for Sources	136
Mill-Cucamonga Creek at Chino-Corona Rd	13,024	31.1			877	667
POTW Effluent	n/a	27.1	n/a	n/a	2	1
Chris Basin (Lower Deer Ck.)	4,043	0.8	126	79%	868	17
County Line Channel	518	0.1	69	100%	1,194	2
Cucamonga Creek	2,134	2.8	839	12%	139	9
Other MS4 Areas	1,155	0.2	100	100%	476 [3]	4
					Unaccounted-for Sources	634

1) DWF generation up to 100 gal/acre/day is assumed to come from urban sources
2) n/a means value is not applicable
3) Geometric mean of all dry weather *E. coli* monitoring data from the USEP study

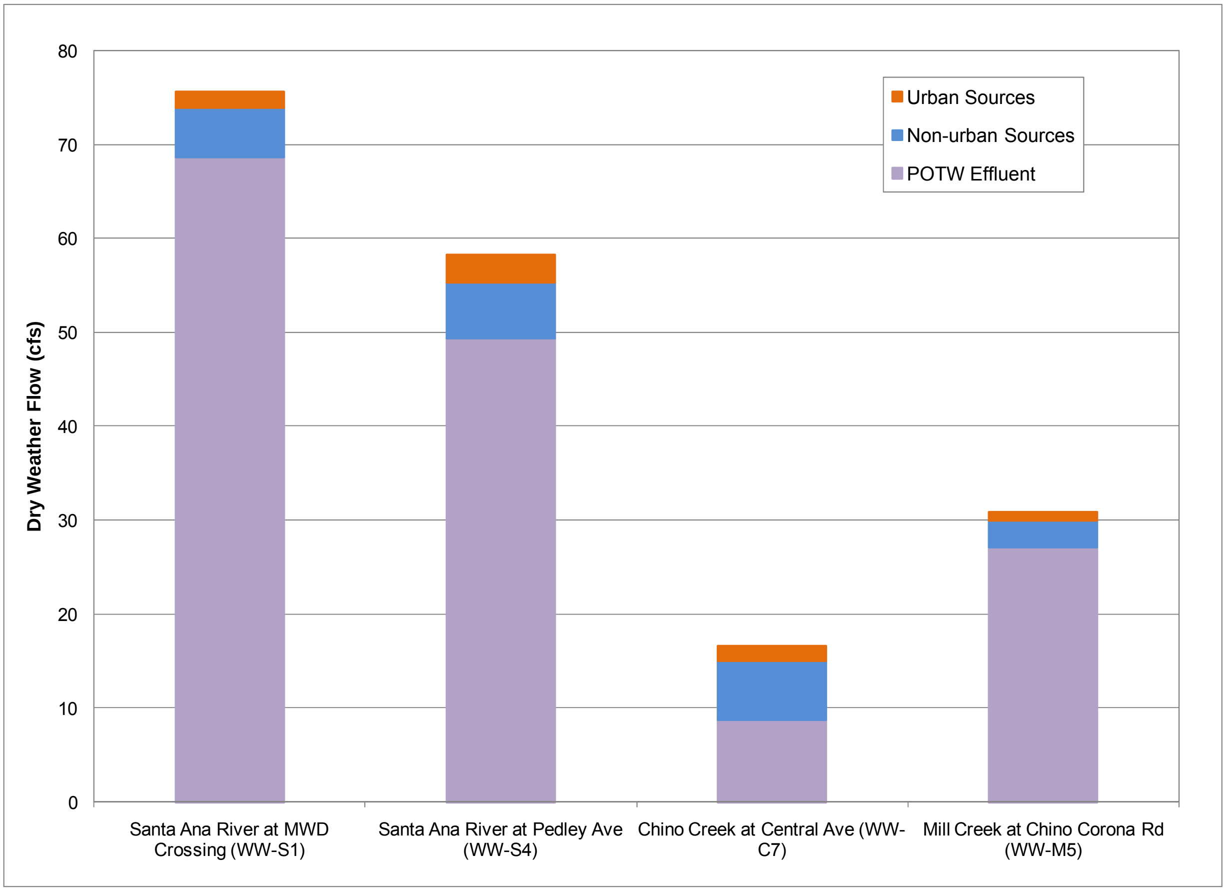


Figure 6-1. Estimated relative DWF contributions to watershed-wide compliance sites

The relative source contribution showed high amounts of unaccounted-for bacteria at all four compliance points during dry weather conditions in the dry season. Figure 6-2 summarizes the relative contribution of bacteria from various sources based on existing data. Figure 6-2 shows that the contribution of bacteria from POTW effluent, assuming a level of 2.2 cfu/100 mL is minimal.

6.3 Criteria for Demonstrating Compliance

Two alternative approaches were considered for demonstrating how implementation of the CBRP would achieve compliance with urban source wasteload allocations:

Alternative 1 - Demonstrate that implementation of the CBRP would result in achieving the wasteload allocation at every outflow to a receiving waterbody. This approach involves either reducing *E. coli* concentrations at flowing MS4 outfalls to 113 MPN/100 mL or eliminating dry weather runoff from the majority of urban area draining to each outfall. While this approach may be feasible in some smaller subwatersheds, it may be infeasible to implement watershed-wide.

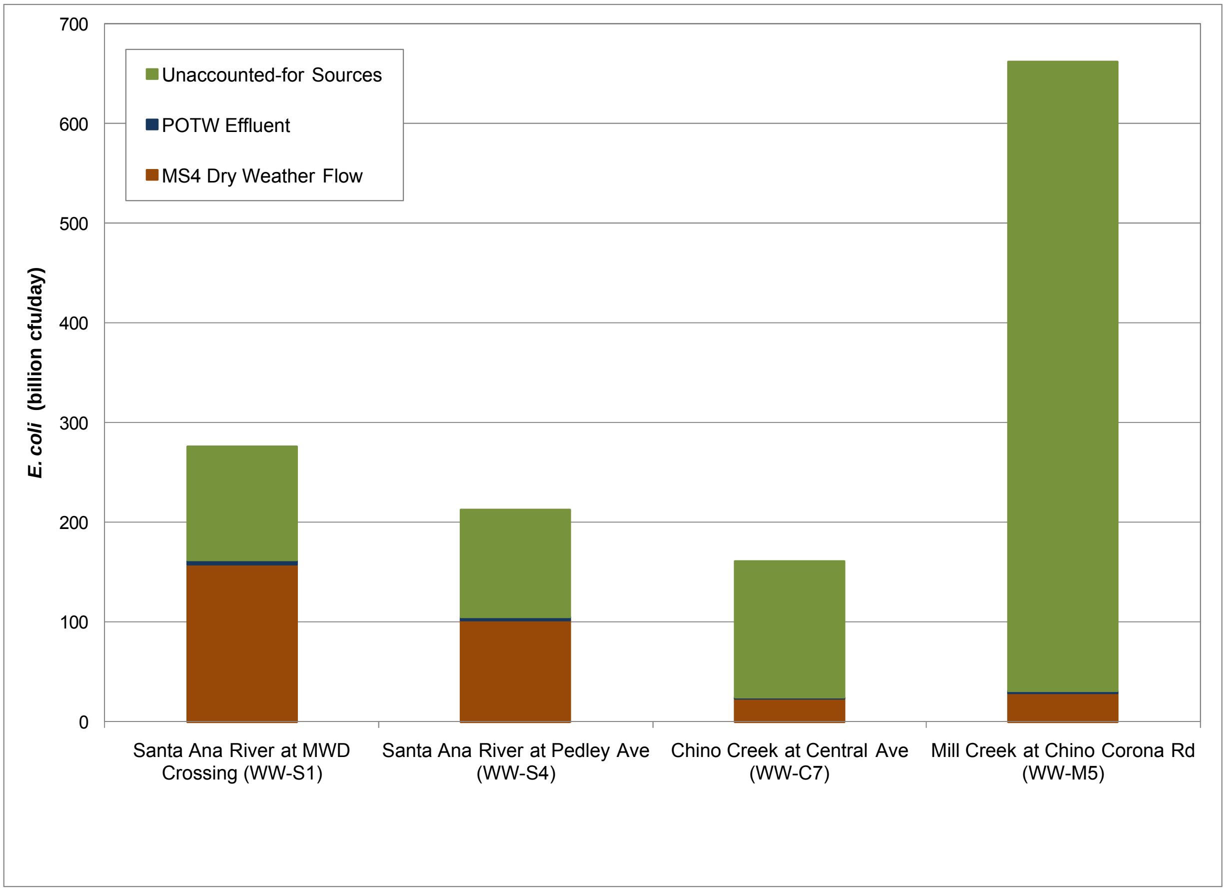


Figure 6-2. Estimated relative sources of bacterial indicators at watershed-wide compliance locations

Alternative 2 – If data demonstrate that receiving water impairment is potentially caused by the MS4, then demonstrate sufficient reduction in bacterial indicator loads in DWF from MS4 facilities to not cause an exceedance of the *E. coli* WQOs at downstream watershed-wide compliance monitoring sites. This approach assumes that UAAs will be adopted for selected waterbodies (as described in Section 5.2.5). Required bacterial indicator reductions are determined by comparing baseline *E. coli* loads at the compliance sites with the TMDL numeric target (product of DWF at compliance monitoring site and *E. coli* concentration equal to the WQO of 126 cfu/100 mL). Figure 6-3 shows that there are large amounts of unaccounted-for bacterial indicators in some watersheds.

The MS4 permittees pan to use the second approach to evaluate compliance. This approach allows for a watershed-wide assessment of bacterial water quality in downstream receiving waterbodies and consideration of the relative role of MS4 sources in downstream receiving waterbody bacterial indicator water quality.

The second approach allows for conversion of the concentration based WLA to a watershed wide numeric load (TMDL numeric target), assuming UAAs are adopted as described in Section 5.5.5.5. Demonstration of compliance using loads allows for prioritization of BMP implementation in select MS4 drainage areas, as long as removals are sufficient to have a blended concentration at the downstream point of compliance meets the WQO.

6.4 Bacterial Indicator Reduction from the MS4

6.4.1 Controllability

The relative source contribution analysis showed that substantial unaccounted-for sources of bacterial indicators exist in impaired waterbodies. For the Santa Ana River compliance monitoring locations, approximately 50 percent of E. coli is comprised of unaccounted-for sources. Unaccounted-for sources make up the majority of bacterial indicators during dry weather at the Chino Creek and Mill-Cucamonga Creek TMDL compliance monitoring sites (see Figure 6-2). For this compliance analysis, contributions of unaccounted-for sources of bacterial indicators to the TMDL compliance monitoring sites are not the responsibility of the MS4 permittees. The inspection program is designed to identify sources of bacterial indicators not previously monitored, which could provide more insight into these unaccounted-for sources and allow further refinement of MS4 contributions.

6.4.2 Gap Analysis for Bacterial Indicators

Bacterial indicator data collected from each of the watershed-wide TMDL compliance monitoring sites provide an estimate of existing *E. coli* concentrations in receiving waters. The magnitude of exceedances of the TMDL numeric target provides a basis for estimating the *E. coli* load removal needed from all sources to reduce current bacterial indicator concentrations to the WQO of 126 MPN/100 mL. Table 6-3 shows the daily amount of *E. coli* load at each compliance monitoring site based on current flow and bacterial indicator concentrations (column 1). The TMDL numeric targets are converted to a load of bacteria that would result in a downstream concentration equal to the WQO of 126/cfu/100mL (column 2). The difference between current *E. coli* loads at the compliance monitoring sites and the TMDL numeric target is the total bacterial indicator reduction needed to achieve compliance (column 3).

The portion of the current bacterial indicator load at the compliance monitoring sites attributable to measured MS4 sources is shown as a percentage in column 4 and *E. coli* load in column 5. The basis for the values in Table 6-3 is geometric means of dry weather *E. coli* concentrations and field measurement of flow from the 2007 dry season USEP monitoring, with a sample size of ~20 for most monitored drainages. Follow up monitoring will provide additional information to update the assessment of dry weather compliance in the dry season.

Table 6-3. Relative contribution to bacterial indicator water quality objective exceedances from MS4 DWFs

Compliance Monitoring Location	1 Baseline Dry Weather *E. coli* (billion cfu/day)	2 Numeric Target[1] (billion cfu/day)	3 Total Bacteria Reduction Needed (billion cfu/day)	4 Contribution of MS4 DWF to Bacteria at Compliance Monitoring Site	5 Bacteria from MS4 (billion cfu/day)
Santa Ana River at MWD Crossing	276	233	43	57%	157 [3]
Santa Ana River at Pedley Ave [2]	213	180	33	48%	102 [3]
Chino Creek at Central Ave	161	55	106	15%	24 [4]
Mill-Cucamonga Creek at Chino Corona Rd	662	95	567	4%	26 [5]

1) Water quality objective is a rolling five sample geometric mean of *E. coli* of 126 MPN/100 mL. TMDL numeric target is expressed as daily bacteria load.
2) Values do not include the drainage area to the Santa Ana River at MWD Crossing
3) Bacteria generated in both Riverside and San Bernardino Counties, with most coming from Riverside County
4) Bacteria generated in San Bernardino County only
5) Bacteria generated in both Riverside and San Bernardino Counties, with most coming from San Bernardino County

Two conditions are apparent from comparing the bacterial indicators coming from the MS4 with the bacterial indicator reduction needed to achieve compliance:

- *E. coli* load measured from all upstream MS4 discharges is less than the load reduction that would reduce bacteria to the numeric targets. This makes it impossible to attain the water quality objective even if MS4 discharges were eliminated entirely. Available data show this condition exists in both the Mill-Cucamonga and Chino Creek watersheds. The recommended course of action is then to determine whether the unaccounted source of bacteria is from a controllable non-urban source (e.g. agriculture) or if the source is naturally occurring and uncontrollable. Section 8 describes the CBRP compliance strategy associated with these conditions.

- Conversely, if the *E. coli* load measured from all upstream MS4 discharges is greater than the load reduction needed to reduce bacteria to the numeric targets, then it should be physically possible to attain the water quality objective by reducing bacteria loads from MS4 outfalls. Available data show this condition exists for the two subwatersheds draining to the Middle Santa Ana River compliance sites. Under this condition, the MS4 permittees will implement BMPs to the MEP within the MS4 drainage system and continue to collect water quality data to assess effectiveness. Options for implementation also could include a trading or offset approach for achieving compliance by mitigating unaccounted for sources of bacteria in lieu of directly controlling bacteria at MS4 outfalls.

6.5 Water Quality Benefit Estimates

CBRP Section 5 describes the key elements that make up CBRP activities planned for implementation to achieve DWF compliance with urban wasteload allocations during the dry season. The following sections provide the expected water quality benefits of these elements where such quantification is possible. Water quality benefits are shown for implementation of CBRP elements within jurisdictions of San Bernardino County MS4 permittees only. Levels of implementation incorporated in the following sections were developed so that, when combined with Riverside County's CBRP implementation, the wasteload allocation would be achieved for all compliance monitoring sites, if compliance can be achieved with reductions from MS4 sources alone.

There is a clear division of primary responsibility for bacterial indicator reduction by compliance monitoring site between the two County MS4 programs. San Bernardino County jurisdictions make up 100 and 85 percent of the hydrologically connected MS4 drainage area to the Chino Creek at Central Avenue and Mill-Cucamonga Creek at Chino-Corona Road compliance sites, respectively. Conversely, San Bernardino County jurisdictions make up only 23 and 4 percent of the hydrologically connected MS4 drainage area to the Santa Ana River at MWD Crossing and Pedley Avenue compliance sites, respectively.

6.5.1 Element 1: Ordinances

As discussed in CBRP Sections 4 and 5, most jurisdictions in the MSAR watershed have adopted ordinances that prohibit common sources of urban dry weather runoff, such as excess or improper irrigation causing off-site runoff, hosing of driveways, and in some cases, driveway car washing. While these ordinances exist, enforcement actions at the residential level are limited, as can be seen from the stormwater program annual reports over the past five years. One alternative to reducing dry weather runoff is to increase enforcement actions for existing ordinances or for some jurisdictions to revise the language of their water conservation ordinances from "encouraging" good behaviors to "prohibiting" specific types of outdoor water waste. For example, there may be substantial water quality benefit to identifying the most significant areas with excessive DWF and targeting them for enforcement actions.

The expected water quality benefit of this CBRP implementation activity can be calculated as follows: The compliance analysis computes *E. coli* reductions from increased enforcement using the following key assumptions:

- Targeted properties have off-site DWF that is five times a typical pre-intervention DWF generation rate of 100 gal/acre/day.
- Average single-family residential lot size is 0.15 acres in hydrologically connected drainage areas.
- Enforcements actions will be implemented on five of 100 properties in hydrologically connected drainage areas.

- Enforcement actions are effective measures to minimize future DWF leaving a property

The level of *E. coli* in DWF leaving all properties in the MSAR watershed would be impossible to monitor. Therefore, it is necessary for the quantification of bacterial indicator reduction to assume some bacterial indicator level in eliminated or captured DWF. For this compliance analysis, the level of *E. coli* in pre-intervention DWF is approximated as the area-weighted average of geometric mean concentrations from USEP monitoring sites in each of the compliance monitoring sites, during dry weather in the dry season. Assuming non-urban sources of DWF are free of bacterial indicators, this level is divided by the portion of MS4 flow that is attributable to urban DWF to estimate *E. coli* levels in urban DWF. The resulting values are shown below:

- Santa Ana River at MWD Crossing: 3,900 cfu/100 mL
- Santa Ana River at Pedley Avenue: 1,500 cfu/100 mL
- Chino Creek at Central Avenue: 600 cfu/100 mL
- Mill-Cucamonga Creek at Chino-Corona Road: 1,400 cfu/100 mL

Given the approximated reduction in DWF, the potential water quality benefit of increased enforcement actions is shown in Table 6-4. For purposes of this compliance analysis, the approximate bacterial indicator reductions per ordinance enforcement action are extrapolated to achieve a portion of the necessary bacterial indicator reduction target for MS4 permittees. Thus, the numbers of enforcement actions shown in Table 6-5 are initial targets. The degree to which individual jurisdictions can increase enforcement actions to meet reduction targets will be a local decision. In addition, actual levels of implementation will be dependent upon the nature of the problems identified (i.e. the amount of flow and bacteria that is controlled in each enforcement action). For example, the City of Chino may only need to conduct enforcement actions on 400 properties to achieve the same DWF reduction that is shown in Table 6-5.

Additional benefits may be obtained through the development and implementation of a pathogen control ordinance as required by the MS4 permit. However, the estimated benefits cannot be quantified at this time, as information generated during CBRP implementation is needed to determine the content of this ordinance.

6.5.2 Element 2: Specific BMPs

Where possible, water quality benefits expected from the implementation of the specific BMPs identified in Element 2 were quantified. These BMPs include water conservation, enhanced street sweeping practices, and MS4 facility retrofits associated with significant redevelopment projects.

Table 6-4. Estimated bacterial indicator reduction associated with increased enforcement of water conservation ordinances to restrict outdoor water use in San Bernardino County

Watershed-wide Compliance Location	Hydrologically Connected Jurisdiction	Single Family Residential Properties [1]	Number of Enforcement Actions	Estimated Bacteria Reduction (billion MPN/day)
SAR at MWD Crossing	Unincorporated	3,157	158	1.7
	Rialto	40	2	0.0
	Total	3,197	160	1.7
SAR at Pedley Avenue	Fontana	237	12	0.1
Chino Creek at Central	Unincorporated	3,588	171	1.9
	Chino	13,837	692	7.7
	Chino Hills	10,448	523	5.8
	Montclair	1,239	62	0.7
	Ontario	2,500	125	1.4
	Total	31,612	1,573	17.4
Mill-Cucamonga Creek @ Chino Corona Road	Ontario	10,081	505	5.6
Total for San Bernardino County Hydrologically Connected Areas		59,205	2,250	24.9

1) Census Block 200 Data. California Department of Forestry and Fire Protection: Fire and Resource Assessment Program (CDF-FRAP) (2002). http://frap.fire.ca.gov/data/frapgisdata/download.asp?rec=cen00bl

6.5.2.1 Water Conservation

Water conservation BMPs are effective because they eliminate or reduce the rate of runoff from outdoor water uses during dry weather. To provide a basis for quantification of the potential benefits of this BMP, assumptions needed to be made regarding the number of properties where water conservation BMPs would be implemented:

- Two of 100 houses in hydrologically connected drainage areas replace grass with artificial turf.
- Ten of 100 houses in hydrologically connected drainage areas replace grass with native plants.
- Twenty-five of 100 houses in hydrologically connected drainage areas install a WBIC.
- Twenty-five of 100 houses have an irrigation audit or change behavior due to education and outreach programs.

Using these assumptions, Table 6-5 summarizes the number of properties in each jurisdiction where conservation BMPs would be targeted.

Table 6-5. Preliminary distribution of water conservation BMPs in hydrologically connected drainage areas under dry weather conditions

Watershed-wide Compliance Location	Hydrologically Connected Jurisdiction	Number of Single Family Residence Properties	Replace Grass with Artificial Turf (# of properties)	Replace Grass with Native Plants (# of properties)	Installation of a WBIC (# of properties)	Landscape Irrigation Audit (# of properties)
SAR at MWD Crossing	Unincorporated	3,157	64	316	789	789
	Rialto	40	1	4	10	10
	Total	3,197	65	320	799	799
SAR at Pedley Avenue	Fontana	237	5	24	59	59
Chino Creek at Central	Unincorporated	3,412	69	341	853	853
	Chino	13,837	277	1,384	3,459	3,459
	Chino Hills	10,447	209	1,045	2,612	2,612
	Montclair	1,235	25	124	309	309
	Ontario	2,500	50	250	625	625
	Total	31,431	630	3,144	7,858	7,858
Mill-Cucamonga Creek @ Chino Corona Road	Ontario	10,081	202	1,008	2,520	2,520
Total for San Bernardino County Hydrologically Connected Areas		44,946	902	4,496	11,236	11,236

Findings of a recent study conducted by Metropolitan Water District of Orange County and the Irvine Ranch Water District on residential runoff reduction facilitated the translation of number of properties into DWF reductions (Jakubowski, 2008). This study evaluated DWF from residential drainage areas with and without use of WBICs. Several key findings of this study provide estimates of DWF reduction that may be used to quantify benefits of increased use of water conservation BMPs in the MSAR watershed:

- Dry weather runoff from excess irrigation is 550-650 gal/irrigated acre/day. This rate is used to approximate the runoff reduction benefit of replacing grass lawns with artificial turf or native plants (i.e. no expected runoff). This rate suggests that the urban DWF could largely be attributed to excess landscape irrigation because, if all runoff was to be attributable to excess landscape irrigation, then the irrigated landscape portion of an urban watershed would be approximately 100 gal/acre/day divided by 550-650 gal/acre/day or 15-18 percent of an urbanized subwatershed. This fraction is a reasonable estimate of irrigated landscaped area in the MSAR watershed.

- Education and outreach reduced dry weather runoff by ~190 gal/irrigated acre/day. This rate is used to approximate the runoff reduction from education and outreach BMPs, including an on-site irrigation audit.

- Installation of a weather based irrigation controllers on a large portion of the urban landscape provided an additional 170 gal/irrigated acre/day. Assuming education and outreach would be included in the installation process for a WBIC; the runoff reduction from installing a WBIC was approximated as 360 gal/irrigated acre/day.

Quantification of the bacterial indicator reductions from water conservation BMPs required an estimate of the irrigated acreage of the initial set of projects. Accordingly, the following assumption was developed:

- The extent of irrigated area per single family residential property was assumed to be 2,000 ft^2. The actual extent of irrigated area is dependent upon property specific landscaping features. This estimate is based on an assumed typical residential development of 5 units per acre and a landscaped fraction of 25 percent (approximated percent of landscape area based on desktop assessment of aerial photography).

To convert DWF reduction to bacterial indicator reductions, it is necessary to assume some bacterial indicator level in eliminated or captured DWF. The level of *E. coli* in DWF leaving all properties in the MSAR watershed would be impossible to monitor. Therefore, it is necessary for the quantification of bacteria reduction, to assume some concentration in eliminated or captured DWF. For this compliance analysis, the level of *E. coli* in pre-intervention DWF is approximated as the area-weighted average of the geometric mean from USEP monitoring sites in each of the compliance monitoring sites, during dry weather in the dry season. Assuming non-urban sources of DWF are free of bacteria, this bacterial indicator level is divided by the portion of MS4 flow that is attributable to urban DWF to estimate *E. coli* levels in urban DWF. The resulting values are shown below:

- Santa Ana River at MWD Crossing: 3,900 cfu/100 mL
- Santa Ana River at Pedley Avenue: 1,500 cfu/100 mL
- Chino Creek at Central Avenue: 600 cfu/100 mL
- Mill-Cucamonga Creek at Chino-Corona Road: 1,400 cfu/100 mL

Table 6-6 summarizes expected water quality benefits of this level of water conservation BMP implementation. Bacteria reductions are computed as the product of avoided DWF and bacterial indicator level in the assumed flow. For example, replacement of grass with native plants on 250 properties in the City of Ontario jurisdiction within the Chino Creek at Central Avenue watershed, estimated bacteria reduction is 0.13 billion cfu/day (250 properties *2,000 ft^2/property / 43560 ft^2/acre * 500 gal/irrigated acre/day * 600 cfu/100 mL * 37.85 100 mL aliquots/gal).

For purposes of this compliance analysis, the approximate bacteria reductions per water conservation BMP are extrapolated to achieve a portion of the necessary bacteria reduction target for MS4 permittees. Thus, the numbers of water conservation BMPs shown in Table 6-6 are initial targets. Actual implementation will be dependent upon the nature of the problems identified (i.e. the amount of flow and bacteria that is controlled in water conservation BMP project). For example, the City of Chino Hills may only need to install WBICs on 2,000 existing properties to achieve the same DWF reduction that is shown in Table 6-6. Moreover, the mix of water conservation BMPs could be modified from this initial scenario.

6.5.2.2 Enhanced Street Sweeping

Trash and other materials accumulated within MS4 facilities provide a habitat and food source for bacterial indicators. In addition, flows present under dry weather conditions keeps these facilities damp, which also supports bacteria survivability. Biofilms typically form under these types of conditions. Biofilms are dynamic microbial communities that go through an attachment phase and then ultimately a detachment, erosion or "sloughing" phase from the surface to which they are attached. The rate of attachment/detachment depends on a variety of environmental conditions (EPA, 1983). In a recent study within the Newport Bay watershed, Skinner et al. (2010) showed that bacterial indicators in clean water running along residential street gutters (with no additional flow sources) increased to as high as 14,000 MPN/100 mL. Given these types of bacterial indicator sources, enhanced street sweeping has been included as specific BMP under CBRP Element 2.

Table 6-6. Estimated bacteria reduction (billions of cfu/day) from implementation of water conservation BMPs in hydrologically connected drainage areas under dry weather conditions

Watershed-wide Compliance Location	Hydrologically Connected Jurisdiction	Replace Grass with Artificial Turf	Replace Grass with Native Plants	Installation of a WBIC	Landscape Irrigation Audit	Combined Water Conservation BMPs
SAR at MWD Crossing	Unincorporated	0.2	1.1	0.9	0.5	2.7
	Rialto	0.0	0.0	0.0	0.0	0.0
	Total	0.2	1.1	0.9	0.5	2.7
SAR at Pedley Avenue	Fontana	0.0	0.0	0.0	0.0	0.1
Chino Creek at Central	Unincorporated	0.0	0.2	0.2	0.1	0.5
	Chino	0.1	0.7	0.6	0.3	1.7
	Chino Hills	0.1	0.5	0.5	0.2	1.3
	Montclair	0.0	0.1	0.1	0.0	0.2
	Ontario	0.0	0.1	0.1	0.1	0.3
	Total	0.3	1.6	1.4	0.7	4.1
Mill- Cucamonga Creek @ Chino Corona Road	Ontario	0.2	1.2	1.0	0.5	3.0
Total for San Bernardino County Hydrologically Connected Areas		0.8	4.0	3.4	1.7	9.9

To quantify the bacteria reduction that could be achieved from enhanced street sweeping, it is necessary to estimate the concentration of *E. coli* coming from DWF in street gutters. This approach involves the following assumptions:

- Implementation of the CBRP would involve a 15 percent increase in the average sediment removal per day over the hydrologically connected drainage area.
- The average drainage area to a catch basin downstream of enhanced street sweeping is 10 acres.
- Urban DWF generation rates for existing development of 100 gal/acre/day, based on the measured flows at IEUA DWF monitoring stations (see Table 3-2).

To estimate the bacteria reduction from enhanced street sweeping, it is necessary to assume some concentration of *E. coli* that could be attributed to mobilization during gutter flow. Considering the findings of Skinner et al. (2010) discussed above, it would be conservative to assume that *E. coli* concentration in DWF may typically be at least one order of magnitude over the wasteload allocation (1,130 cfu/100 mL). As the inspection program is implemented, this assumption can be replaced with real data intended to characterize specific MS4 drainage areas.

Given these assumptions, the potential water quality benefit of enhanced street sweeping is shown in Table 6-7.

Table 6-7. Estimated bacteria reduction associated with enhanced street sweeping in hydrologically connected drainage areas under dry weather conditions

Watershed-wide Compliance Location	Hydrologically Connected Jurisdiction	Drainage Area with Increased Street Sweeping	Estimated Bacteria Reduction (billion MPN/day)
SAR at MWD Crossing	Unincorporated	286	1.4
	Rialto	74	0.4
	Total	360	1.8
SAR at Pedley Avenue	Fontana	99	0.5
Chino Creek at Central	Unincorporated	273	1.3
	Chino	906	4.3
	Chino Hills	442	2.1
	Montclair	96	0.5
	Ontario	123	0.6
	Total	1,840	8.8
Mill-Cucamonga Creek @ Chino Corona Road	Ontario	698	3.3
Total for San Bernardino County Hydrologically Connected Areas		2,997	14.3

6.5.2.3 Stormwater Retrofit on Redevelopment

Stormwater management controls in most existing developments within the MSAR watershed were not designed to today's standards and therefore there is potential for the development to contribute runoff to MS4 facilities during dry weather conditions. With significant redevelopment of a project site, an approved WQMP that incorporates LID practices consistent with 2010 MS4 permit requirements would address pollutants of concern by eliminating most, if not all, runoff from the site under dry weather conditions. Estimated bacteria reduction that may be achieved from these significant redevelopment projects is a function of flow and bacteria from the existing development and the rate of redevelopment expected prior to 2016, per the following assumptions.

- Redevelopment in the MSAR watershed prior to the December 31, 2015 compliance date may occur in 0.5 percent of the MS4 drainage area (46,000 urban acres * 0.005 = 230 acres of redevelopment). This estimate is low relative to historical development rates, but redevelopment in the 2010-2015 time periods is expected to be reduced due to economic factors.

- Urban runoff generation rates for existing developments of 100 gal/acre/day, based on the measured flows at IEUA DWF monitoring stations (see Table 6-1).

To convert DWF reduction to bacteria reductions, it is necessary to assume some concentration in eliminated or captured DWF. The concentration of *E. coli* in DWF leaving all properties in the MSAR watershed would be impossible to monitor. Therefore, it is necessary for the quantification of bacteria reduction, to assume some concentration in eliminated or captured DWF. For this compliance analysis, the concentration of *E. coli* in pre-intervention DWF is approximated as the area-weighted average of geometric mean concentrations from USEP monitoring sites in each of the compliance monitoring sites, during dry weather in the dry season. Assuming non-urban sources of DWF are free of bacteria, this concentration is divided by the portion of MS4 flow that is attributable to urban DWF to estimate *E. coli* concentration in urban DWF. The resulting values are shown below:

- Santa Ana River at MWD Crossing: 3,900 cfu/100 mL

- Santa Ana River at Pedley Avenue: 1,500 cfu/100 mL

- Chino Creek at Central Avenue: 600 cfu/100 mL

- Mill-Cucamonga Creek at Chino-Corona Road: 1,400 cfu/100 mL

Given these assumed values, the bacteria reduction from redevelopment projects is minimal (less than 1 percent of the targeted bacteria removal needed to demonstrate compliance).

6.5.2.4 Other Non-Quantifiable BMPs

The CBRP includes other recommended specific BMPs that have the potential to reduce bacteria from urban DWFs (see Section 5.2.2). While these BMPs have been included to address potential urban bacteria sources, the ability to quantify water quality benefits is greatly limited. For example, transient camps could be an important bacterial indicator source in certain areas, but the benefits of mitigation are unknown since studies have not been done that demonstrate the water quality impacts of such camps under dry weather conditions. If the planned study demonstrates that impacts exist, then mitigation would provide benefits, but the nature of those benefits would be somewhat localized. Given such limitation, the water quality benefits were not quantified. However, the potential reductions in bacteria that will be achieved from implementing these BMPs provide an additional margin of safety toward achieving urban wasteload allocation by the compliance date.

6.5.3 Element 3: Inspection Criteria

The inspection program involves monitoring of flow, bacterial indicators, and human sources of fecal bacteria (using human *Bacteroides* markers) at key locations in the MS4 drainage system. The purpose of conducting these monitoring activities is to identify portions of MS4 drainage areas that may be responsible for disproportionately high levels of bacteria (referred to as a "hot spot"). The temporal variability of available bacteria indicator concentrations from downstream monitoring sites (from both the USEP study and watershed-wide compliance monitoring) suggests that in some drainage areas, urban sources may be contributing to increases in downstream bacteria. However, because of the high percentage of unaccounted-for sources of bacteria apparent in the system, the degree to which the MS4 is a contributor to elevated bacteria needs to be evaluated.

The inspection program provides a method to identify urban sources and target mitigation activities. For instance, an MS4 outfall may be determined to be consistently dry or to contain a lower level of *E. coli* than expected. If so, there would be no need to implement upstream BMPs for the purposes of reducing bacterial indicators. At the same time, the inspection program could identify drainage areas that generate DWF and have bacteria at levels greater than was assumed in this quantification effort. Targeted BMPs within the watershed upstream would be prioritized, and mitigation efforts would likely provide more benefit than is estimated in this compliance analysis. Accordingly, the inspection program provides the information necessary to use an iterative adaptive watershed management approach, which allows for the best use of resources to mitigate urban bacteria sources to the MEP. Moreover, data collected under the inspection program will allow the program to further analyze the relative contribution of bacteria from urban sources to downstream waters.

6.5.4 Element 4: Regional Treatment

The CBRP does not include consideration of any specific regional structural BMPs at this time. The inspection program is intended to identify the highest priority MS4 drainage areas that need to be targeted for runoff reduction or treatment prior to reaching a receiving waterbody. Once identified, a controllability assessment will be completed to determine the most effective course of action on a drainage area by drainage area basis. In some cases, a regional structural BMP solution may be the best alternative, given the high cost of widespread non-structural BMPs upstream and the potential for mutual benefits of recharging groundwater.

The Mill Creek Wetlands project will provide significant water quality benefits for bacterial indicators during dry weather, once implemented. The area of wetlands needed to provide *E. coli* load removal equal to the total that can be attributed to measured MS4 discharges, is approximated by applying a first-order k-C* model (Kadlec and Knight 2009). This model estimates the acreage of wetland necessary to reduce the wetland influent concentration of fecal coliform ($C_{influent}$) to an achievable[8] effluent concentration ($C_{effluent}$) for a given flowrate (Q_{cfs}):

$$A_{wetland} = \frac{179Q_{cfs}}{k} \times \ln\frac{(C_{influent})}{(C_{effluent})}$$

Bays and Palmer (2003) evaluated performance of a constructed wetland system in southern California and estimated a k value of 75 for removal of *E. coli.* The geometric mean of *E. coli* in Mill-Cucamonga Creek at Chino-Corona Road is 880 cfu/100 mL. With an effluent concentration of 100 cfu/100 mL and DWF treatment rate of 1.5 cfs, a wetland footprint of eight acres may be sufficient to reduce bacteria loads by 26 billion cfu/day, which is the sum of all measured loads to MS4 discharges to Cucamonga Creek per the USEP dry season data.

The project owner, Lewis Corporation, projects the facility will be on-line in the summer of 2013. Once implemented, this estimate of potential *E. coli* load removal will be amended. In addition, CBRP implementation can be revisited to account for bacteria reductions achieved by this regional treatment facility.

6.6 Compliance Analysis

6.6.1 Summary of Compliance of Urban Runoff Bacteria Sources

Combining the estimated bacteria reductions from ordinance enforcement, water conservation BMPs, enhanced street sweeping, and significant redevelopment projects, demonstrates that reduction targets for MS4 runoff are achievable with the proposed CBRP for all compliance locations except Mill-Cucamonga Creek (Table 6-8). This estimate is conservative since (1) only a few BMPs can be properly quantified; (2) the inspection program will provide additional information to target DWF and bacterial indicator reduction efforts to the key specific drainage areas; and

[8] Natural treatment systems are not effective at reducing bacterial indicator concentrations to very low concentrations. Bays and Palmer (2003) identify 100 cfu/100 mL as an irreducible limit of expected effluent concentration.

(3) the Mill Creek Wetland regional BMP is not incorporated into the reductions shown in Table 6-8.

6.6.2 Uncertainty of Analysis

Each of the sources of data used in the compliance analysis has significant variability. Some of the data sets showed greater variations. Also, the robustness of each data set varies, which suggests there could be greater uncertainty in some of the inputs. For instance, daily flow data from USGS gauges are less variable and have less uncertainty than field flow measurements at USEP monitoring sites. Lower variability comes from the relatively larger watersheds, consistent POTW effluent outflows and established gauging instruments. Conversely, runoff measured at MS4 outfalls has greater variability due to changing water use patterns in smaller subwatersheds, and uncertainly is greater due to the limited number of data points and use of simple field measurements rather than established flow gauges. To address variations and uncertainty, a stochastic modeling approach was used to assess a range of potential bacteria reductions that may be achieved from implementing the CBRP.

Stochastic simulations of the bacteria source contribution were performed using @Risk, an Excel add-in software (Palisade, Inc.). The stochastic model incorporates probabilistic representations of multiple variables and calculates the balance between bacterial indicator concentrations at specific inflows and concentrations at downstream compliance points. Monte Carlo simulations sample each parameter in the source contribution analysis 10,000 times, using fitted distributions on model variables subject to variability. These distributions were developed using BestFit, a standard @RISK add-in module, which uses the "Maximum Likelihood Estimator" approach to fit distributions to sample data. Distributions were fitted to the following model inputs to test the impact of their combined variability on estimated bacterial indicator reductions needed to demonstrate compliance:

- *Dry weather runoff from MS4 systems* - USEP flow measurements varied widely at most sites. This could be due to diurnal patterns in DWF generation, the presence of intermittent non-urban discharges during some field visits, and errors in field measurements.

- *E. coli concentrations at USEP and watershed-wide compliance monitoring sites* – Widespread variability in bacterial indicator concentrations is common at many sample locations. Several locations showed order of magnitude fluctuations from week to week.

These two model parameters affect the estimate of *E. coli* concentration in DWF eliminated or treated by different CBRP elements, as well as the baseline load from USEP and watershed-wide compliance monitoring sites. Figure 6-3 shows the probability of achieving compliance given the variability of potential flows and *E. coli* concentrations. For example, in the Santa Ana River at Pedley Avenue and in Chino Creek at Central Avenue the probability of achieving the targeted reduction is about 50 percent.

Table 6-8. Compliance analysis summary

Watershed-wide Compliance Location	Hydrologically Connected Jurisdiction	Ordinance Enforcement	Combined Water Conservation BMPs	Enhanced Street Sweeping	Retrofit on Redevelopment	Total Estimated Bacteria Reduction
SAR at MWD Crossing	Unincorporated	1.7	2.7	1.4	0.05	5.9
	Rialto	0.0	0.0	0.4	0.01	0.4
	Total	1.8	2.7	1.7	0.06	6.3
SAR at Pedley Avenue	Fontana	0.1	0.0	0.5	0.02	0.7
Chino Creek at Central	Unincorporated	1.9	0.5	1.4	0.04	2.5
	Chino	7.7	1.7	4.3	0.14	7.9
	Chino Hills	5.8	1.3	2.1	0.07	4.9
	Montclair	0.7	0.2	0.5	0.02	0.9
	Ontario	1.4	0.3	0.6	0.02	1.2
	Total	17.4	4.1	8.8	0.29	30.6
Mill-Cucamonga Creek @ Chino Corona Road	Ontario	5.6	2.9	3.3	0.11	12.1 [1]
	Total for San Bernardino County Hydrologically Connected Areas	24.9	9.9	14.3	0.5	49.6

1) Does not include potential load reduction that may be achieved by the proposed Mill Creek Wetlands project.

The stochastic simulation shows a very high probability of compliance in the Santa Ana River at MWD Crossing. For example, there is a 90 percent probability that the CBRP will achieve at least 100 percent of the targeted bacteria reduction from MS4 systems. Conversely, it is not expected that compliance would be achieved at the Mill-Cucamonga Creek site solely through the management of controllable urban sources (this is not unexpected given the unaccounted-for bacterial indicator sources in this subwatershed); however, these results show that the proposed BMPs do provide a measurable reduction (20-60 percent of the target). The Santa Ana River at Pedley Avenue and Chino Creek at Central Avenue results show a very high variability in compliance, with the probability of achieving compliance at approximately 50 percent. With the regular collection of additional flow and bacterial indicator data as part of the inspection program, the data variability can be better characterized which will result in an improved compliance estimate.

This uncertainty analysis does not account for additional uncertainty associated with the effectiveness of the recommended BMPs, which is not well studied. Also, uncertainty related to the nature of unaccounted-for sources of bacteria indicators is not addressed by this analysis.

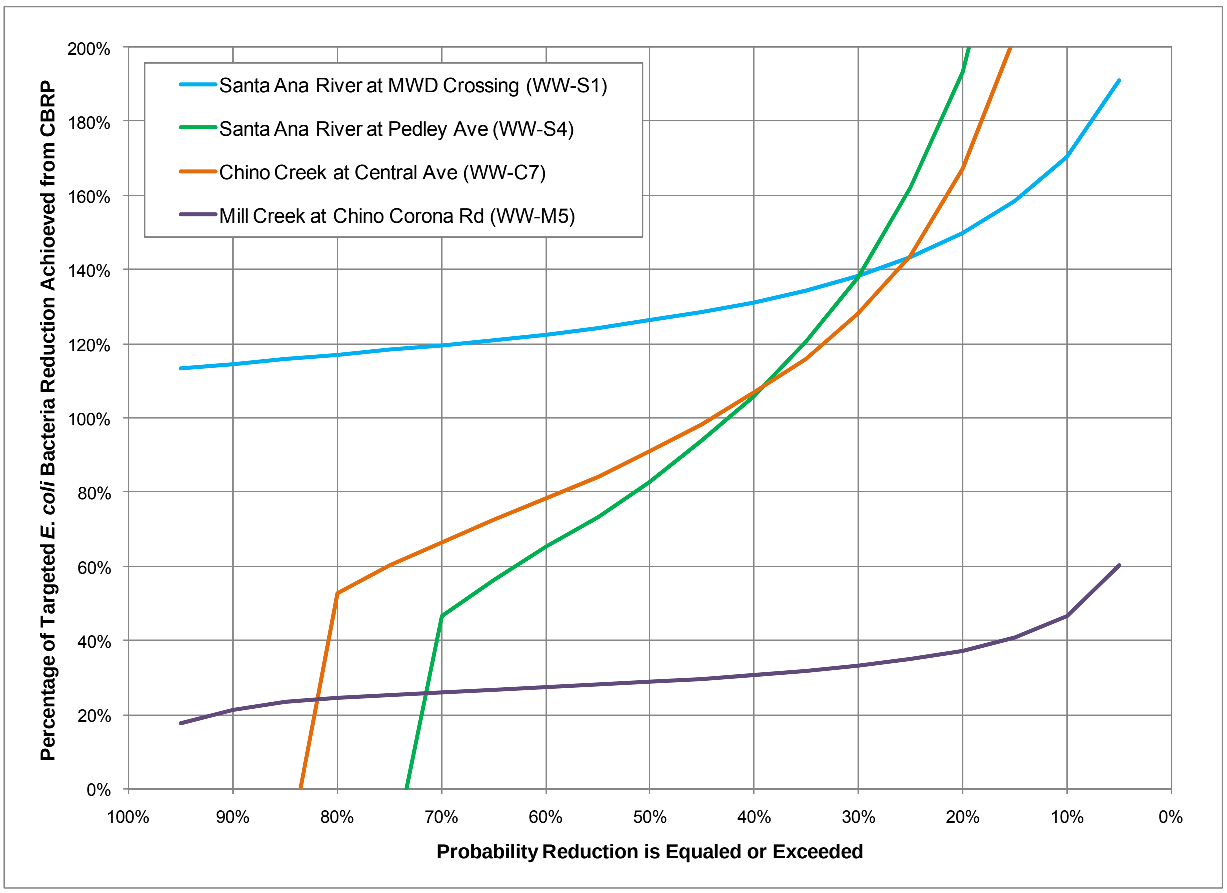


Figure 6-3. Probability density function showing results of Monte Carlo simulation of bacteria reduction achieved by implementing quantified CBRP elements

Section 7
CBRP Implementation

7.1 Introduction

Section 1 summarized the required elements for inclusion in the CBRP. These elements included:

- A detailed schedule with discrete milestones to assess satisfactory progress toward meeting urban wasteload allocations for dry weather
- Designation of the specific agency or agencies responsible for meeting each milestone.
- Specific metrics to demonstrate the effectiveness of the CBRP and acceptable progress for meeting the urban wasteload allocations for dry weather.

The following sections provide information regarding the key elements of CBRP implementation.

7.2 Compliance Monitoring

A watershed-wide compliance monitoring program was established in 2007 and will continue as designed during CBRP implementation (see Section 2.4 for program description). A report summarizing sample results from dry weather conditions from April 1 to October 31 is submitted to the Regional Board by December 31st of each year. In addition, a 3-year summary (or Triennial Report) is due to the Regional Board by February 15th every three years since TMDL adoption. The first of these reports was submitted on February 15, 2010 (SAWPA 2010a; see Section 3.4 for synopsis of the 2010 report).

Table 7-1 provides the Implementation of activities associated with this plan that provide the basis for an assessment of compliance with urban wasteload allocations. As part of the CBRP, the watershed-wide compliance monitoring program will continue to be the primary means of evaluating progress toward meeting the wasteload allocations for dry weather. The Monitoring Plan and QAPP will be revised as needed to facilitate source evaluation activities implemented as part of Element 3 – in particular allowing the use of alternative EPA-approved bacterial indicator laboratory analysis methods.

The schedule includes the regular reporting of seasonal sampling results that is ongoing. In addition, during CBRP implementation two Triennial Reports will be prepared that will provide opportunity to evaluate newly collected data and the effectiveness of CBRP implementation over the long term:

Table 7-1. Implementation of activities to assess compliance with urban wasteload allocations

CBRP Activity	Milestones	Metrics	Responsibility	Complete by
Watershed-wide Compliance Monitoring	Revise Monitoring Plan and QAPP as needed to facilitate Element 3 activities, including modifying the approved *E. coli* laboratory analysis method to another EPA-approved method to allow use of local laboratories[1]	Revised Monitoring Plan and QAPP approved by Regional Board	Area-wide MS4 Program through MSAR Task Force	June 30, 2011
	Collect 20-weekly samples during dry season (April 1 – October 31)	Submittal of Dry Season Report to Regional Board	Area-wide MS4 Program through MSAR Task Force	Ongoing annual activity
	Collect 11 weekly samples during wet season (November 1 – March 31)	Submittal of Wet Season Report to the Regional Board	Area-wide MS4 Program through MSAR Task Force	Ongoing annual activity
	Collect 4 samples during and after one wet weather event			
2013 Triennial Report	Review and revise compliance analysis contained in CBRP Section 6 based on most recent data (e.g., flow, bacterial indicators, special studies) including additional analysis on relative contribution of bacterial indicators from controllable urban sources	Revised compliance analysis for incorporation into the 2013 Triennial Report	Area-wide MS4 Program through MSAR Task Force	December 31, 2012
	As part of 2013 report, evaluate progress towards meeting urban wasteload allocations, in particular during dry weather conditions (April 1 – October 31)	Submit Triennial Report to the Regional Board by February 15, 2013; incorporate recommendations for modifications to CBRP	Area-wide MS4 Program through MSAR Task Force	February 15, 2013
2016 Triennial Report	Review and revise compliance analysis contained in CBRP Section 6 based on most recent data (e.g., flow, bacterial indicators, special studies) including additional analysis on relative contribution of bacterial indicators from controllable urban sources	Revised compliance analysis for incorporation into the 2016 Triennial Report	Area-wide MS4 Program through MSAR Task Force	December 31, 2015
	As part of 2016 report, evaluate progress towards meeting urban wasteload allocations, in particular during dry weather conditions (April 1 – October 31)	Submit Triennial Report to the Regional Board by February 15, 2016; incorporate recommendations for modifications to CBRP including additional BMPs planned if compliance monitoring indicates additional measures are required (see Section 8)	Area-wide MS4 Program through MSAR Task Force	February 15, 2016

Table 7-1. Implementation of activities to assess compliance with urban wasteload allocations

CBRP Activity	Milestones	Metrics	Responsibility	Complete by
Water Quality Objective Review	Based on the findings/outcomes of CBRP implementation activities, evaluate whether to revise geometric mean *E. coli* water quality objective applicable to Chino Creek, Mill-Cucamonga Creek, Santa Ana River Reach 3 and Prado Park Lake from 126 to 206 cfu/100 mL	Regional Board decision on whether to implement Basin Plan amendment process	Regional Board with MSAR Task Force	Spring 2016

[1] The Basin Plan amendment under development by the SWQSTF allows for the use any EPA-approved *E. coli* method for evaluating compliance. Implementation of the CBRP will require use of local laboratories to facilitate inspection program activities; the existing Monitoring Plan will be revised to accommodate this requirement.

- *2013 Triennial Report* – This report will provide an interim evaluation of progress towards meeting the urban wasteload allocation by the December 21, 2015 compliance date. As part of the preparation of this report, the compliance analysis contained in CBRP Section 6 will be reviewed, and where appropriate, revised to take into account newly available bacterial indicator, flow, and special study data which provide additional information regarding controllable urban sources and the relative contribution of bacteria from the MS4 to impaired waters.

- *2016 Triennial Report* – This report, due to the Regional Board by February 15, 2016, will provide an analysis of the most recent dry weather condition results obtained through October 2015. As part of the preparation of this report, the compliance analysis contained in CBRP Section 6 (and potentially revised in 2013) will be reviewed, and where appropriate, further revised to take into account newly available bacterial indicator, flow, and special study data which provide additional information regarding controllable urban sources and the relative contribution of bacteria from the MS4 to impaired waters.

The submittal dates for each of the Triennial Reports are timely and will provide a basis for evaluating the need to make program modifications (as part of an iterative adaptive management strategy – see Section 8).

7.3 CBRP Elements

This section provides an implementation plan for each of the four key CBRP elements described in Section 5. Each plan includes the following information:

- *CBRP Activity* – Programmatic area to be implemented.

- *Milestones* – Discrete actions associated with the completion of each CBRP activity.

- *Metrics* – Specific outcomes to demonstrate completion of each milestone; in addition, metrics for some activities are related to mitigation of identified urban sources of bacteria and provide a means to measure effectiveness of activity.

- *Responsible Agency* – Assignment of the activity to either the Area-wide MS4 Program or to local permittees. In some cases, identification of the responsible agency is deferred to a later date when additional required information is complete.

- *Completion Date* – Each CBRP milestone has been given a completion date. Where the activity is also an MS4 permit requirement, the completion date is the same as the date contained in the permit.

The following sections provide a brief summary of the implementation plan associated with each of the CBRP elements.

7.3.1 Element 1 – Ordinances

Two activities comprise this Element 1 - water conservation and pathogen control ordinances. Table 7-2 provides the implementation activities planned for each of these CBRP activities. Evaluations of legal authority and the development of minimum ordinance requirements are expected to be completed collectively by the Area-wide MS4 Program. Local ordinance development will be implemented by individual permittees. Development of the pathogen control ordinance is an MS4 permit requirement and the completion date is consistent with the permit. Progress towards implementing Element 1 activities will be summarized and reported in the Annual Report prepared under the MS4 permit.

7.3.2 Element 2 – Specific BMPs

Six specific BMPs or CBRP activities are included in Element 2. Table 7-3 provides the implementation plan associated with each of these activities. Many of the activities will be implemented collectively by the Area-wide MS4 Program. Exceptions are where local implementation is required, e.g. mitigation of a problem transient camp or implementation of modified street sweeping practices. Some activities are closely linked to other CBRP Elements, e.g., implementation of irrigation practices is closely linked with the water conservation ordinance under Element 1. Several activities are also permit requirements, e.g., IDDE program development, WQMP revisions, and septic system management. The completion dates for these activities are consistent with the MS4 permit requirements. Progress implementing Element 2 activities will be summarized and reported in the Annual Report prepared under the MS4 permit.

7.3.3 Element 3 – Inspection Criteria

This element includes six key CBRP activities ranging from preparation of UAAs to preparation of controllability assessments where necessary (Table 7-4). Several of the activities require data collection, the results of which lead to decisions regarding next steps. Accordingly, this element contains several deliverables that provide additional information regarding implementation schedules. For example, the need for controllability assessments is dependent on data collected as part of reconnaissance and inspection activities. When inspection of a particular portion of the MS4 identifies required actions to mitigate a bacterial indicator source, a plan and schedule will be developed at that time to guide subsequent activities.

Currently, the USEP (approved by the Regional Board in 2008) and the 2010 MS4 permit require the completion of semi-annual USEP reports to describe progress and plans associated with the implementation of urban source evaluation activities. Element 3 activities, described in Table 7-4, will replace the need to periodically identify source evaluation activities for implementation. Reports regarding the outcome of annual CBRP activities will be summarized in the MS4 permit Annual Reports due to the Regional Board each November. The Annual Report will also be used to report key decisions or recommendations for changes to CBRP implementation (see also Iterative and Adaptive Management Strategy, Section 8).

Table 7-2. Implementation Plan for CBRP Element 1 - Ordinances

CBRP Activity	Milestones	Metrics	Responsibility	Complete by
1.A - Water Conservation Ordinance	1.A.i – Evaluate existing legal authority to manage and enforce dry weather runoff	Establish minimum dry weather runoff management and enforcement requirements for the area based on outcome of milestones 1.A.i, 1.A.ii, 2.D.i, and CBRP Element 3 activities	Area-wide MS4 Program	June 30, 2012
	1.A.ii - Evaluate opportunities to collaborate with water purveyors on implementation of SB7 to maximize use of outdoor water use efficiency BMPs and reduce dry weather runoff			
	1.A.iii –Evaluate need to revise local ordinances to incorporate more stringent dry weather runoff management requirements	Prepare draft revised ordinances, as needed	Permittees	December 31, 2012
	1.A.iv - Adopt revised water conservation ordinances (as appropriate)	Revised ordinances adopted	Permittees	December 31, 2013
1.B – Pathogen Control Ordinance	1.B.i – Evaluate existing legal authority to manage animal wastes	Establish minimum requirements for the control of pathogen or bacterial sources based on outcomes of 1.B.i,1.B.ii, and CBRP Element 3 activities	Area-wide MS4 Program	June 30, 2012
	1.B.ii –Identify other controllable pathogen or bacterial sources (other than pet waste) that may contribute to bacterial indicator exceedances in the MS4			
	1.B.iii –Evaluate need to establish/revise local ordinances to incorporate minimum pathogen control requirements	Prepare draft revised ordinances, as needed	Permittees	December 31, 2012
	1.B.iv – Adopt/revise pathogen control ordinances	Revised ordinances adopted	Permittees	January 29, 2013[1]
1.C - Reporting	1.C.i – Provide annual summary of ordinance development activities and recommendations for CBRP modification as identified by Element 1 implementation	MS4 permit Annual Report with incorporation of CBRP update	Area-wide MS4 Program	Annually by November 15

[1] - Consistent with MS4 permit requirement

Table 7-3. Implementation Plan for CBRP Element 2 – Specific BMPs

Activity	Milestones	Metrics	Responsibility	Complete by
2.A –Transient Camps	2.A.i - Identify locations of transient encampments in receiving waters or MS4 facilities	Establish GIS-based map of known transient camp locations	Area-wide MS4 Program	December 31, 2011
	2.A.ii – Develop and implement water quality study to evaluate potential water quality impacts to the MS4 from transient camps during dry weather	Identify spatial and temporal nature of water quality impacts to the MS4 from transient camps during dry weather conditions	Area-wide MS4 Program	December 31, 2012
	2.A.iii - Develop model program for mitigating water quality impacts from transient encampments	Establish model program for use by individual jurisdictions	Area-wide MS4 Program	December 31, 2012
	2.A.iv - Develop targeted transient camp mitigation plan	Based on the outcome of 2.A.i, 2.A.ii and 2.A.iii, prepare mitigation plan that includes prioritized schedule for implementation	Area-wide MS4 Program	June 30, 2013
	2.A.v - Implement transient camp mitigation plan	Complete targeted activities based on mitigation plan	Permittees	December 31, 2014
2.B – IDDE	2.B.i - Develop draft IDDE Program that is consistent with permit requirements and supports CBRP Element 3 (Inspection Program)	Develop program guidance based on permit requirements and needs of inspection program	Area-wide MS4 Program	March 31, 2011
	2.B.ii – Develop final IDDE Program for submittal to the Regional Board	Submit final guidance to Regional Board	Area-wide MS4 Program	July 29, 2011[1]
	2.B.iii – Implement IDDE Program	Implementation of Inspection Program (Element 3)	Area-wide MS4 Program	As required by Element 3
2.C- Street Sweeping	2.C.i - Evaluate existing street sweeping programs (e.g., method, frequency, equipment) to determine potential to modify programs to reduce bacterial indicator sources	Develop recommendations for modified street sweeping program targeted at bacterial indicators	Area-wide MS4 Program	June 30, 2012
	2.C.ii - Develop plan/schedule for implementation of modified program (as appropriate)	Establish plan/schedule for implementation of modified street sweeping program, including financial feasibility	Area-wide MS4 Program	September 30, 2012
	2.C.iii – Implement modified street sweeping program	Compliance with established plan/schedule	Permittees	As required by 2.C.ii

Table 7-3. Implementation Plan for CBRP Element 2 – Specific BMPs

Activity	Milestones	Metrics	Responsibility	Complete by
2.D – Irrigation or Water Conservation Practices	2.D.i - Develop irrigation and water conservation BMP programs in coordination CBRP activity 1.A	Identify irrigation and water conservation BMP practices for implementation	Area-wide MS4 Program	December 31, 2012
	2.D.ii - Develop plan/schedule for implementation of BMP practices	Establish plan/schedule for implementation of BMP practices	Area-wide MS4 Program	March 31, 2013
	2.D.iii – Implement BMP practices	Compliance with established plan/schedule	Permittees	As required by 2.D.ii
2.E – Water Quality Management Plan Revision	2.E.i - Submit draft WQMP revision to Regional Board	Submit draft WQMP Guidance and Template revisions as required by permit	Area-wide MS4 Program	July 29, 2011[2]
	2.E.ii - Submit final WQMP to Regional Board	Submit final WQMP Guidance and Template as required by permit	Area-wide MS4 Program	Based on Regional Response to Draft[2]
	2.E.iii - Incorporate WQMP revisions into training programs	Establish revised training modules to incorporate new WQMP provisions	Area-wide MS4 Program	July 29, 2012[2]
	2.E.iv – Implement revised WQMP	WQMP approved by Regional Board	Permittees	Within 90 days of Board approval[2]
2.F –Septic System Management	2.F.i – Identify location (inventory) of septic systems in MSAR watershed	Establish inventory and GIS-based map of known septic system locations	Area-wide MS4 Program	January 29, 2012[2]
	2.F.ii – Analyze relationship between location of septic systems and MS4 facilities to evaluate potential for impacts from septic systems on water quality under dry weather conditions.	Identify areas where septic systems have the potential to impact the MS4; establish plan to target areas for education, inspection and enforcement activities	Area-wide MS4 Program	January 29, 2012[2]
	2.F.iii – Develop educational materials and conduct public education activities to inform septic system owners on proper maintenance of septic systems	Complete targeted educational activities	Area-wide MS4 Program	January 29, 2012[2]
	2.F.iv – Conduct inspection and enforcement activities as needed, to ensure potential water quality impacts to MS4 are mitigated	Complete targeted inspections and implement enforcement actions as needed	Permittees	December 31, 2014
2.G - Reporting	2.G.i – Provide annual summary of BMP activities and recommendations for CBRP modification as identified by Element 2 implementation	MS4 permit Annual Report with incorporation of CBRP update	Area-wide MS4 Program	Annually by November 15

[1] - Program guidance is an MS4 permit requirement with no due date; the CBRP establishes a due date 18 months after permit adoption
[2] - Consistent with MS4 permit requirement

Table 7-4. Implementation Plan for CBRP Element 3 – Inspection Criteria

Activity	Milestones	Metrics	Responsibility	Complete by
3.A – Reconnaissance of Tier 1 Nodes	3.A.i - Revise Watershed-wide Monitoring Program Monitoring Plan and QAPP, as needed	Revised Monitoring Plan and QAPP approved by Regional Board	Area-wide MS4 Program	June 30, 2011
	3.A.ii - Collect required data to prioritize Tier 2 reconnaissance activities (divided into at least 3 priority categories: high = 1; medium = 2; low = 3)	Prioritize Tier 2 reconnaissance activities with implementation schedule, including economic feasibility considerations	Area-wide MS4 Program	December 31, 2011
3.B – Reconnaissance of Tier 2 Nodes	3.B.i - Collect required Tier 2 data for Priority 1 areas	Identify MS4 drainage areas for inspection (Element 3.D)	Area-wide MS4 Program	September 30, 2012
	3.B.ii - Collect required Tier 2 data Priority 2 areas	Identify MS4 drainage areas for inspection (Element 3.D)	Area-wide MS4 Program	September 30, 2013
	3.B.iii - Collect required Tier 2 data for Priority 3 areas	Identify MS4 drainage areas for inspection (Element 3.D), if needed	Area-wide MS4 Program	September 30, 2014
3.C – Inspection Strategy Implementation	3.C.i - Based on the findings of Elements 3.B.i, schedule and implement inspections, as needed, in Priority 1 sub-drainages.	Identify follow-up actions, including need for controllability assessments, and schedule for implementation of any next steps	Area-wide MS4 Program	June 30, 2013 (subject to economic considerations)
	3.C.ii - Based on the findings of Elements 3.B.ii, schedule and implement inspections, as needed, in Priority 2 sub-drainages.	Identify follow-up actions, including need for controllability assessments, and schedule for implementation of any next steps	Area-wide MS4 Program	June 30, 2014 (subject to economic considerations)
	3.C.iii - Based on the findings of Elements 3.B.ii, schedule and implement inspections, as needed, in Priority 3 sub-drainages.	Identify follow-up actions, including need for controllability assessments, and schedule for implementation of any next steps	Area-wide MS4 Program	June 30, 2015 (subject to economic considerations)
3.D – Controllability Assessments	3.D.i - Complete Controllability Assessments in Priority 1 areas, if needed	Identify site-specific or regional BMP solutions to address urban source; develop mitigation plan and schedule	Area-wide MS4 Program	December 31, 2013, dependent on 3.C
	3.D.ii - Complete Controllability Assessments in Priority 2 areas, if needed	Identify site-specific or regional BMP solutions to address urban source; develop mitigation plan and schedule	Area-wide MS4 Program	December 31, 2014, dependent on 3.C
	3.D.iii - Complete Controllability Assessments in Priority 3 areas, if needed	Identify site-specific or regional BMP solutions to address urban source; develop mitigation plan and schedule	Area-wide MS4 Program	December 31, 2015, dependent on 3.C

Table 7-4. Implementation Plan for CBRP Element 3 – Inspection Criteria

Activity	Milestones	Metrics	Responsibility	Complete by
3.E – Use Attainability Analyses[1]	3.E.i - Meet with Regional Board to establish UAA development schedule and waterbody-specific data requirements	UAA schedule and waterbody specific approaches established	Area-wide MS4 Program	January 31, 2012
	3.E.iv - Collect required data for UAAs in Mill-Cucamonga Creek drainage area	Complete data collection needs for Mill-Cucamonga Creek drainage area	Area-wide MS4 Program	December 31, 2012
	3.E.v - Complete UAAs in Mill-Cucamonga Creek drainage area	Submit draft Mill-Cucamonga Creek UAAs to Regional Board	Area-wide MS4 Program	June 30, 2013
	3.E.ii - Collect required data for UAAs in Chino Creek drainage area	Complete data collection needs for Chino Creek drainage area	Area-wide MS4 Program	December 31, 2013
	3.E.iii - Complete UAAs in Chino Creek drainage area	Submit draft Chino Creek drainage area UAAs to Regional Board	Area-wide MS4 Program	June 30, 2013
	3.E.vi - Collect required data for Santa Ana River Reach 3 drainage area[2]	Complete data collection needs for Santa Ana River Reach 3 drainage area	Area-wide MS4 Program	December 31, 2014
	3.E.vii - Complete UAAs in Santa Ana River Reach 3 drainage area	Submit draft Santa Ana River Reach 3 UAAs to Regional Board	Area-wide MS4 Program	June 30, 2015
3.F - Prado Park Lake	3.F.i - Conduct inspection of Prado Park Lake drainage area to identify any sources of dry weather runoff	Complete drainage area inspection of Prado Park Lake drainage area	Area-wide MS4 Program	December 31, 2011
	3.F.ii - Develop and implement mitigation activities deemed necessary to manage DWFs from MS4 to Prado Park Lake (if any)	Mitigate DWF sources to Prado Park Lake (if needed)	Area-wide MS4 Program	December 31, 2013
	3.F.iii – If no dry weather urban sources to Prado Park identified, remove Prado Park Lake from urban source wasteload allocation for dry weather conditions	Regional Board acts to remove dry weather condition wasteload allocation applicable to MS4 on Prado Park Lake from San Bernardino County MS4 program responsibility	Regional Board and Area-wide MS4 Program	December 31, 2013
3.G - Reporting	3.G.i – Provide annual summary of inspection activities and recommendations for CBRP modification as identified by Element 3 implementation	MS4 permit Annual Report with incorporation of CBRP update	Area-wide MS4 Program	Annually by November 15

[1] – The scheduling of UAAs assumes Regional Board adoption of Basin Plan amendment in Spring 2011 and approval by the State Board and EPA Region 9 by Spring 2012.

[2] - UAAs in the Santa Ana River Reach 3 drainage area will be coordinated with Riverside County, as needed

7.3.4 Element 4 – Regional Treatment

This element includes two key CBRP activities: Completion of the WAP, which will guide regional urban runoff management issues (including treatment needs); and regional treatment implementation (Table 7-5), if required. The WAP element is an MS4 permit requirements and the milestones, metrics and schedule are consistent with the permit. The need, locations for and extent of regional treatment of dry weather runoff is unknown at this time.

The development/implementation of the WAP coupled with the outcome of Element 3 activities, i.e., controllability assessments, will dictate the responsibility and schedule for implementation of regional treatment. An aggressive Element 3 schedule has been incorporated into this CBRP to facilitate the timing of regional treatment decisions so that a determination regarding when and where regional treatment is needed is made prior to the dry weather compliance date of December 31, 2015. Actual design and construction, which will likely require extensive regional coordination, funding, environmental permitting and even land acquisition, may occur beyond the 2015 compliance date. Decisions regarding plans for regional treatment will be summarized and reported in the Annual Report prepared under the MS4 permit.

Table 7-5. Implementation Plan for CBRP Element 4 – Regional Treatment

Activity	Milestones	Metrics	Responsibility	Complete by
4.A – Watershed Action Plan	4.A.i - Conduct system wide MS4 evaluation for retrofit opportunities (Section XI.B.3.a.ix of the permit)	Completed evaluation (to be included as WAP Phase I deliverable)	Area-wide MS4 Program	January 29, 2011
	4.A.ii - Prepare Phase 1 WAP	Phase 1 WAP submitted to the Regional Board	Area-wide MS4 Program	January 29, 2011
	4.A.iii - Prepare Phase 2 WAP	Phase 2 WAP submitted to the Regional Board	Area-wide MS4 Program	January 29, 2012
	4.A.iv - Implement WAP	Compliance with established WAP and associated schedule	To be determined as part of WAP development	WAP dependent
4.B – Regional Treatment Implementation	4.B.i - Implement regional treatment recommendations identified by Element 4.A.i, as appropriate	Compliance with plan/schedule	To be determined by affected stakeholders	Project-specific
	4.B.ii - Implement BMP solutions identified under CBRP Activity 3.D	Compliance with plan/schedule established under CBRP Activity 3.D	To be determined by affected stakeholders	Project-specific
4.C - Reporting	4.C.i – Provide annual summary of activity involving regional treatment evaluations and decisions as identified by CBRP implementation	MS4 permit Annual Report with incorporation of CBRP update	Area-wide MS4 Program	Annually by November 15

Section 8
Implementation Strategy

8.1 Introduction

This CBRP describes required activities and expected effectiveness in reducing bacterial indicators to the extent possible with present information and evaluation techniques, but considerable uncertainties remain, especially when planning five years out to 2015 and given the state of science with regards to bacterial indicator management in urban environments (e.g., CREST 2007). Given this uncertainty, this section provides a compliance strategy to guide decision-making during the implementation process, and an iterative and adaptive management strategy for making course corrections to the CBRP as new data are collected and evaluated. Collectively, these two strategies comprise the implementation strategy for the CBRP.

8.2 Compliance Strategy

Figure 8-1 provides a flow chart that illustrates the overall compliance strategy associated with this CBRP. The CBRP is designed to mitigate, to the MEP, controllable urban sources of bacterial indicators that cause non-attainment of bacterial indicator water quality objectives at the watershed-wide compliance sites. In contrast, the CBRP is not intended to address bacterial indicator impairments attributable to non-MS4 sources (e.g., agricultural or water transfers) or to sources that cannot be accounted for, e.g., wildlife, or that arise from within the impaired waterbody (per Findings, Sections I.D, and II.E.1 of the MS4 permit). These types of sources of bacterial indicators are not the responsibility of the MS4.

Fundamental to the compliance strategy is the development and implementation of ordinances and specific BMPs targeted to reduce dry weather runoff and sources of bacterial indicators in the area (Figure 8-1, Box 1). In addition, the compliance strategy relies on the Regional Board's approval of UAAs for channels where REC uses are not occurring (Box 1).

To determine whether the MS4 is potentially responsible for a receiving water impairment, the CBRP includes a comprehensive source evaluation to locate sources of DWFs that contain levels of bacterial indicators that may cause or contribute to impairment of receiving waters (see Boxes 2 and 3). Data from the source evaluation will be used to make key decisions regarding the need for further source evaluation activities and/or potentially the selection of an appropriate mitigation approach for achieving compliance. Figure 8-1 illustrates when these key decision points occur (Boxes 4, 5a, 5d).

Where source evaluation data demonstrate that an MS4 discharge has a reasonable potential to cause or contribute to impairment of a receiving water, then the MS4 program will prioritize the contributing drainage area to attempt to isolate the source(s), and, as needed, develop controllability assessments and evaluate mitigation alternatives. Such a finding will be made if the analysis of flow and bacterial indicator data show reasonable potential that non-compliance in the receiving water downstream of an outfall or collection of outfalls is attributable to MS4 discharge. Reasonable potential would include a finding that human sources of bacterial indicators are present and persistent.

Prioritization of inspection activities is the second key decision point, and is especially relevant as all permittees are working with limited resources. Accordingly, where necessary within subwatersheds, the activities described in Boxes 5b through 5d will be prioritized based on relative contribution of bacterial indicator loads as well as the source of the bacteria, with the highest priority areas being those where human sources are present and persistent.

Where the source investigation identifies areas where mitigation of bacterial indicators is deemed necessary to achieve compliance and mitigation alternatives have been evaluated, a third decision point occurs. Selection of an alternative must include consideration of regional watershed and local jurisdictional planning goals. Accordingly, selection of an alternative will consider a wide range of issues, including, but not limited to:

- Technical feasibility to mitigate the bacterial indicator source;
- Regional water supply management plans and objectives;
- Environmental considerations (CEQA/NEPA analysis with consideration of issues ranging from in-stream flow and habitat to energy and greenhouse gas emissions, where appropriate);
- Offset and trading strategies with compliance objectives and metrics designed to be applicable within a larger area (e.g., the Mill Creek Wetlands could provide offsets for overall bacterial indicator reductions needed within an upstream drainage area); and
- Economic feasibility, which will consider the capital cost and the long term operation and maintenance cost (which can in some instances exceed the original construction cost over the long-term).

Implementation of a selected alternative will typically require multi-stakeholder input from regulatory agencies, city councils, taxpayers, and groups with varied watershed interests ranging from water supply utilities to environmental advocacy groups.

Source evaluation studies may demonstrate that MS4 discharges are not the source of bacterial indicators that are causing or contributing to impairments to receiving waters (Box 6). This CBRP identifies two situations where this may occur:

- Data indicate that elevated bacterial indicators are caused by discharges not under the jurisdiction of the MS4 permittees, such as agricultural activities or water transfers (Box 7). In such cases, the information will be submitted to the Regional Board for action (Box 7a).

- Data cannot identify the specific source of bacterial indicators, which may include wildlife or *in-situ* sources, such as bacteria growing in sediments (Box 8). In this situation the MS4 permittees will be required to reduce bacterial indicators to the MEP, which includes implementation to the MEP of the elements in Box 1 (Box 8a). Where appropriate, periodic sampling will be conducted in future years to verify that MS4 discharges are not causing or contributing to any observed bacterial indicator impairments (Box 8b).

8.3 Iterative and Adaptive Management Strategy

This CBRP is based on: (1) the current level of knowledge of urban sources of bacterial indicators, and (2) current practices regarding how water is managed in the County. However, both of these foundational elements will be modified by the implementation of the MS4 permit and this CBRP. Specifically,

- Implementation of the inspection program described under Section 5.2.3 – Inspection Criteria will result in the collection of a large volume of new data regarding urban sources of DWF and bacterial indicators. These new data will greatly narrow down where mitigation of dry weather urban sources of flow or bacterial indicators is needed.

- San Bernardino County has implemented a WAP strategy that includes collaboration with area water purveyors that will change how urban runoff is managed in the watershed. Once completed, elements of WAP development, which include evaluating MS4 facility retrofit and restoration opportunities, will enhance the evaluation and selection of regional or sub-regional BMP sites.

Given the expected changes in knowledge expected from MS4 permit and CBRP implementation, an iterative and adaptive management strategy has been built into the CBRP to provide opportunities to revise CBRP implementation, where appropriate. This approach includes the following elements:

- *Triennial Reports* – The TMDL requires these reports as part of TMDL implementation. As noted in Section 7, these reports will include an evaluation of CBRP implementation including progress towards meeting the urban wasteload allocation for dry weather conditions in the dry season. This evaluation may include recommendations for CBRP revisions to the Regional Board on how the CBRP to incorporate new data or programmatic requirements (e.g., as related to WAP implementation). Two Triennial Reports are required within the timeline of CBRP implementation:

    - *2013 Report* – This report will evaluate activities completed through 2012, which corresponds to progress on early CBRP activities and any important findings from ongoing data collection efforts that may result in recommendations for CBRP modification.

    - *2016 Report* – This report (due on February 15, 2016) will evaluate the overall effectiveness of CBRP implementation. The report will provide the means to determine if compliance with urban wasteload allocations for dry weather conditions has been achieved. The 2016 Report will also provide detailed descriptions of any additional BMPs planned and the schedule for implementation in the event data from source evaluation activities and the watershed-wide water quality monitoring program indicate that a reasonable potential still exists that the MS4 is contributing to non-compliance at the watershed-wide compliance sites.

- *MS4 permit Annual Reports* – As stated in Section 7.3.3, the MS4 permit Annual Report will include a summary of CBRP implementation activities. This summary will replace the semi-annual USEP reports as a USEP and MS4 permit reporting requirement. The MS4 Annual Reports will also include recommendations to the Regional Board for modifications to the CBRP if alternative approaches or actions are identified that will contribute to the goal to achieve compliance with urban wasteload allocation during dry weather conditions.

Successful CBRP implementation requires timely input and decisions by the Regional Board so that new information or outcomes (anything from completion of a UAA to DWF and bacterial indicator data) can be quickly integrated into the decision-making process. This is especially true for efficient implementation of the compliance strategy. Accordingly, the Principal Permittee will provide as much advanced notice as possible regarding the need for Regional Board approval of decisions associated with CBRP implementation and any recommendations for CBRP modification.

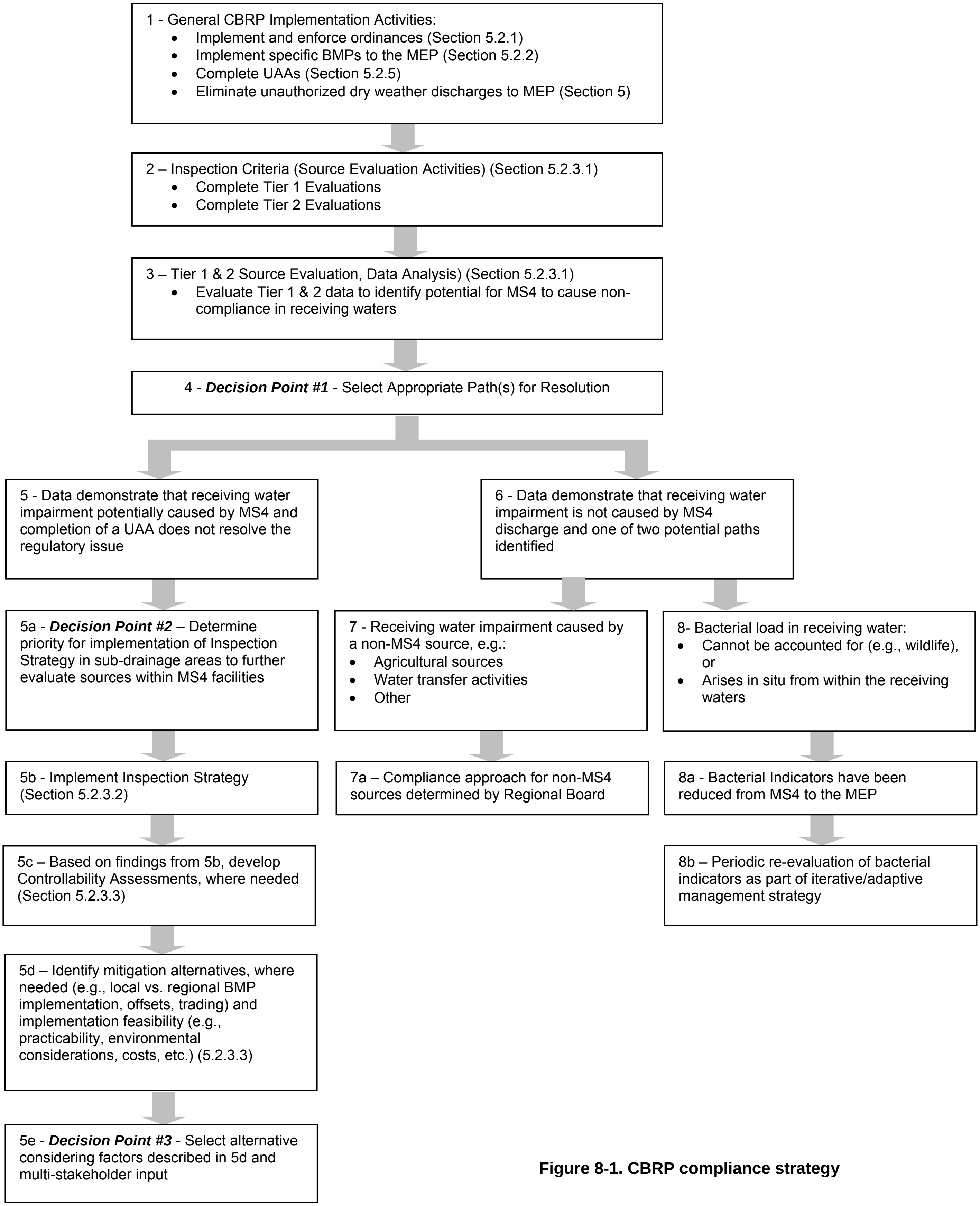


Figure 8-1. CBRP compliance strategy

Section 9
Wet Weather Condition CBRP

The requirements for development of a dry weather condition CBRP include establishing a schedule for developing a wet weather condition CBRP (November 1st through March 31st) to comply with urban wasteload allocations for indicator bacteria by December 31, 2025.

The Regional Board will issue the next MS4 permit on or after January 29, 2015 when the existing MS4 permit expires. Similar to the requirements contained in the existing MS4 permit, it is recommended that the next MS4 permit include a requirement to develop a CBRP for wet weather conditions. Given the expected challenges associated with compliance with wasteload allocations under wet weather conditions, the wet weather CBRP will require more time to develop. Accordingly, the earliest a draft wet weather condition CBRP will be submitted to the Regional Board for review will be 24 months following adoption of the next MS4 permit.

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