California Regional Water Quality Control Board
Santa Ana Region

RESOLUTION NO. R8-2007-0046

Resolution Approving the Middle Santa Ana River Watershed Monitoring Program Proposal Submitted Pursuant to the Middle Santa Ana River Watershed Bacterial Indicator Total Maximum Daily Loads Specified in the Water Quality Control Plan for the Santa Ana River Basin

WHEREAS, the California Regional Water Quality Control Board, Santa Ana Region (hereinafter Regional Board), finds that:

1. An updated Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) was adopted by the Regional Board on March 11, 1994, approved by the State Water Resources Control Board (SWRCB) on July 21, 1994, and approved by the Office of Administrative Law (OAL) on January 24, 1995.

2. Amendments to the Basin Plan to incorporate Middle Santa Ana River Watershed Bacterial Indicator Total Maximum Daily Loads (TMDLs) were approved by the Regional Board on August 26, 2005, by the State Water Resources Control Board on May 15, 2006, by the Office of Administrative Law on September 1, 2006, and by the US Environmental Protection Agency on May 16, 2007.

3. The Middle Santa Ana River Watershed Bacterial Indicator TMDLs were developed in accordance with Clean Water Act Section 303(d) and Water Code Section 13240 *et seq.* The amendment is incorporated into Chapter 5 "Implementation", of the Basin Plan.

4. The Middle Santa Ana River Watershed Bacterial Indicator TMDLs, Task 3 – Watershed–Wide Bacterial Indicator Water Quality Monitoring Program requires specified dischargers to submit a proposed bacterial indicator water quality monitoring program for Regional Board approval by November 30, 2007. The TMDL requires that the monitoring proposal include tasks to provide data necessary to review and update the Middle Santa Ana River Watershed Bacterial Indicator TMDLs. Data to be collected and analyzed shall address, at a minimum, the determination of compliance with the TMDLs, wasteload allocations (WLAs), and load allocations (LAs). The TMDLs require implementation of the monitoring programs upon Regional Board approval.

5. Task 3 also specifies seasonal reporting dates of May 31 and December 31 of each year for reporting the results of the monitoring programs. In addition to these reports, Task 3 also requires submittal of triennial reports summarizing the data collected during the 3 previous years and evaluating compliance with the TMDLs, WLAs, and LAs. The first of these triennial reports must be submitted by February 15, 2010.

6. Bacterial indicator dischargers within the Middle Santa Ana River Watershed have been working together to form a TMDL Task Force to implement requirements of the Middle Santa Ana River Watershed Bacterial Indicator TMDLs.

7. TMDL Task Force members include the following: the cities of Corona, Norco, and Riverside; the County of Riverside; the San Bernardino County Flood Control District (representing the county of San Bernardino and the municipalities named in the TMDL); the Riverside County Flood Control and Water Conservation District; the United States Department of Agriculture, Forest Service; and the Santa Ana Watershed Project Authority.

8. Regional Board would serve on the Task Force as an advisory member in order to facilitate timely compliance with the TMDL requirements.

9. The TMDL Task Force agreement is undergoing review and approval by the Task Force members/agencies. The agreement is expected to be in place no later than September 2007.

10. Members of the TMDL Task Force coordinated their efforts and, in 2006, obtained a Proposition 40 Integrated Watershed Management Program grant from the State Water Resources Control Board. Funds from the grant, along with local matching funds provided by members of the Task Force, are being used to test and evaluate best management practices (BMPs) to address discharges of bacterial indicators, to perform watershed–wide TMDL compliance monitoring, and to perform bacterial indicator source evaluation monitoring.

11. In compliance with the Prop 40 grant agreement and well in advance of the TMDL due date, the consultant for the TMDL Task Force submitted a proposed Watershed-wide Monitoring Plan and a source evaluation monitoring plan, dated June 14, 2007, for Regional Board review and approval. The Monitoring Plan includes a Quality Assurance Project Plan (QAPP) in accordance with TMDL and grant project requirements.

12. The Regional Board has reviewed the proposed monitoring plans and QAPP and find that they comply with the Middle Santa Ana River Watershed Bacterial Indicator TMDLs specified in the Basin Plan.

NOW, THEREFORE, BE IT RESOLVED THAT:

1. The Regional Board approves the watershed-wide Monitoring Plan and source evaluation monitoring plan submitted on behalf of the TMDL Task Force members on June 14, 2007. These plans comply with Task 3 of the Middle Santa Ana River Watershed Bacterial Indicator TMDLs specified in the Basin Plan.

2. The TMDL Task Force – the cities of Corona, Norco, and Riverside; the County of Riverside; the San Bernardino County Flood Control District (and the San Bernardino municipalities represented by the District); the Riverside County Flood Control and Water Conservation District; the United States Department of Agriculture, Forest Service are in compliance with Task 3 of the Middle Santa Ana River Watershed Bacterial Indicator TMDLs.

3. The Regional Board shall serve on the TMDL Task Force as an advisory member.

4. The TMDL Task Force shall finalize the Task Force agreement as soon as possible, but no later than September 2007.

5. The monitoring programs must be implemented immediately upon Regional Board approval.

6. The first seasonal report shall be submitted by December 31, 2007, and the first triennial report shall be submitted by February 15, 2010.

I, Gerard J. Thibeault, Executive Officer, do hereby certify that the foregoing is a full, true and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Santa Ana Region, on June 29, 2007.

Gerard J. Thibeault
Executive Officer

Middle Santa Ana River
Water Quality Monitoring Plan

PREPARED BY
CDM

ON BEHALF OF
Santa Ana Watershed Project Authority
San Bernardino County Stormwater Program
Riverside County Flood Control District
Cities of Pomona, Chino Hills, Upland, Montclair, Claremont, Ontario, Rancho Cucamonga, Rialto, Chino, Fontana, Norco, Corona, and Riverside

Final

June 14, 2007

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Section 1
Introduction

Various waterbodies in the Middle Santa Ana River watershed are listed on the state 303(d) list of impaired waters due to high levels of fecal coliform bacteria. The Middle Santa Ana River (MSAR) Bacterial Indicator Total Maximum Daily Load (TMDL) was adopted by the Santa Ana Regional Water Quality Control Board (RWQCB) and approved by the State Water Resources Control Board (SWRCB) to address these fecal coliform impairments. Environmental Protection Agency (EPA) Region 9 approval is pending. As part of the TMDL Implementation Plan, two bacteria monitoring programs for the MSAR watershed are required. One involves a long term watershed-wide monitoring plan to assess compliance with TMDL targets. The other monitoring program is a study to investigate potential sources of bacteria in the urban environment. This MSAR Water Quality Monitoring Plan ("Monitoring Plan") describes these two monitoring programs and provides information on sample locations, collection, frequency, and the types of analyses that will be conducted.

1.1 Regulatory Background

Table 3-1 of the Santa Ana Regional Water Quality Control Plan (Basin Plan) assigns recreational beneficial use classifications to surface waters in the Santa Ana River watershed (Santa Ana Regional Water Quality Control Board, 1995). Currently, all inland surface waterbodies in the MSAR watershed have a designated beneficial use of REC-1, that is, they are protected for body contact with water where ingestion of water is reasonably possible.

The Basin Plan (Chapter 4) relies on fecal coliform as an indicator for pathogens. Fecal coliform present at concentrations above certain thresholds are believed to be an indicator of the presence of fecal pollution and harmful pathogens, thus increasing the risk of gastroenteritis in bathers exposed to the elevated levels. The existing fecal coliform water quality objectives to protect the REC-1 beneficial use in inland surface waters include:

REC-1 *- Fecal coliform: log mean less than 200 organisms/100 mL based on five or more samples/30 day period, and not more than 10% of the samples exceed 400 organisms/100 mL for any 30-day period.*

The EPA published new bacteria guidance in 1986, which advised that in freshwaters, *Escherichia coli* (*E. coli*) was a better indicator for pathogens than the commonly used fecal coliform (. The basis for this change was new data, which indicated that increased *E. coli* (a subset of fecal coliform) concentrations showed a better correlation with an increased frequency of gastroenteritis than increased concentrations of fecal coliform. In accordance with this EPA recommendation, the RWQCB is currently considering replacing the REC-1 bacteria water quality objectives for fecal coliform with *E. coli* objectives.

In 1994 and 1998, because of exceedences of the fecal coliform objective established to protect the REC-1 use, the Santa Ana RWQCB added various waterbodies in the MSAR watershed to the state 303(d) list of impaired waters. The MSAR Pathogen TMDL Workgroup (Workgroup), which includes representation by many key watershed stakeholders, was subsequently formed to address this impairment through the development of a TMDL for the watershed (. The MSAR Bacterial Indicator TMDL, which was adopted by the RWQCB in 2005 and approved by the SWRCB on May 15, 2006, addresses fecal coliform impairments in the following MSAR watershed waterbodies (Figure 1):

1.1.1 Santa Ana River, Reach 3 – Prado Dam to Mission Boulevard in the City of Riverside

1.1.2 Chino Creek, Reach 1 – Santa Ana River confluence to beginning of hard lined channel south of Los Serranos Road

1.1.3 Chino Creek, Reach 2 – Beginning of hard lined channel south of Los Serranos Road to confluence with San Antonio Creek

1.1.4 Mill Creek (Prado Area) – Natural stream from Cucamonga Creek Reach 1 to Prado Basin

1.1.5 Cucamonga Creek, Reach 1 – Confluence with Mill Creek to 23rd Street in City of Upland

1.1.6 Prado Park Lake

The implementation plan contained in the MSAR Bacterial Indicator TMDL requires that, no later than six months from the effective date of the TMDL (date of EPA approval), the U.S. Forest Service, the County of San Bernardino, the County of Riverside, the cities of Ontario, Chino, Chino Hills, Montclair, Rancho Cucamonga, Upland, Rialto, Fontana, Norco, Riverside, Corona, Pomona, and Claremont, and agricultural operators in the watershed submit as a group to the RWQCB for approval, a watershed-wide monitoring program that will provide the data necessary to review and update the adopted TMDL. The TMDL also requires the development of an Urban Source Evaluation Plan (USEP) to identify activities, operations, and processes in urban areas that contribute bacterial indicators to MSAR watershed waterbodies. The USEP is also required no later than six months after the effective date of the TMDL.

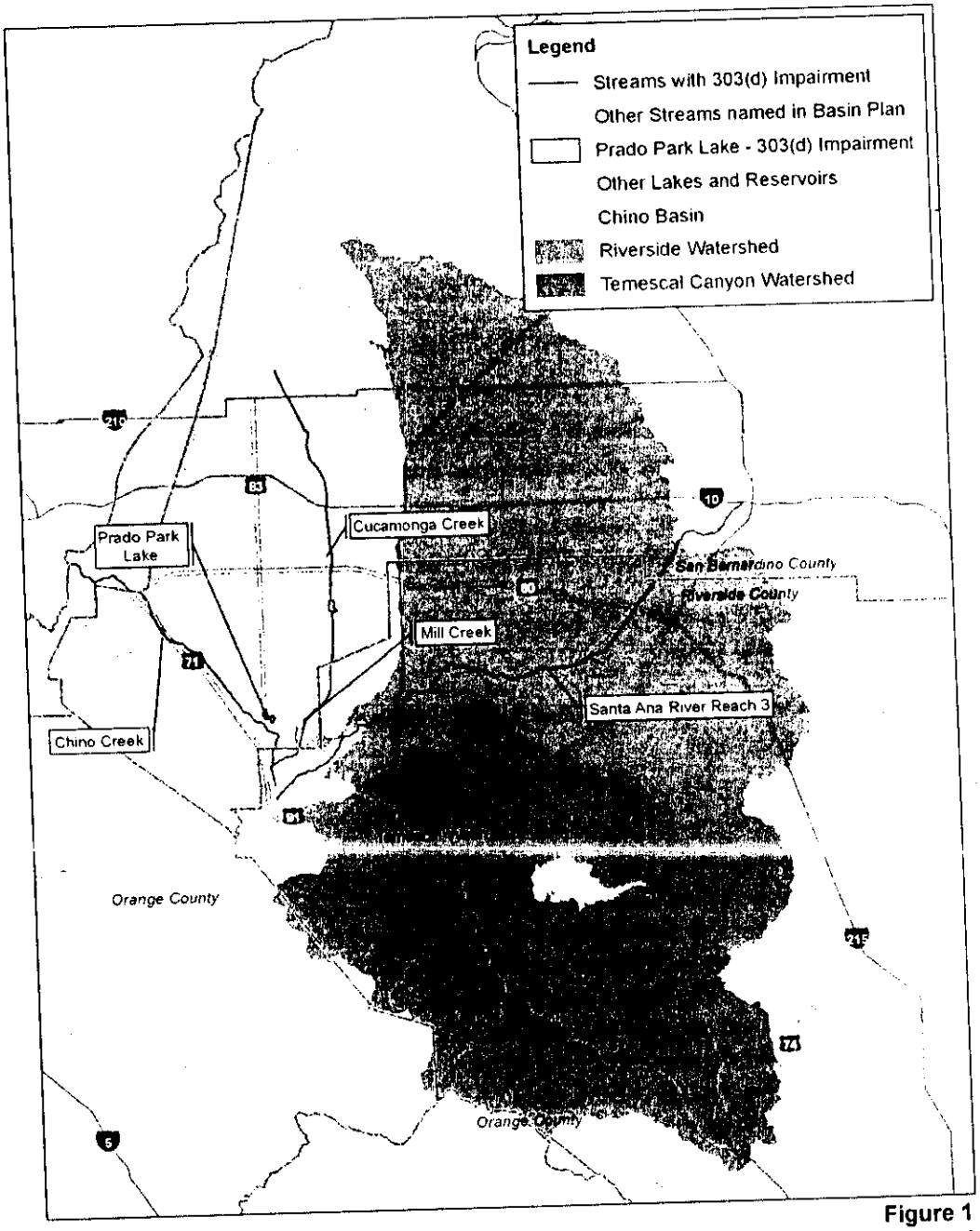


Figure 1
Bacterial Indicator Impairments in the MSAR Watershed

1.2 Proposition 40 State Grant

In anticipation of an approved TMDL, the Santa Ana Watershed Project Authority (SAWPA), in cooperation with the San Bernardino County Flood Control District (SBCFCD), Riverside County Flood and Water Conservation District (RCFWCD), and Orange County Water District (OCWD) submitted a Proposition 40 grant proposal to the SWRCB to support the implementation of TMDL requirements. This grant proposal, *Middle Santa Ana River Pathogen TMDL - BMP Implementation* (Grant Project), was developed, in part, to characterize urban bacteria sources within the watershed. This characterization will provide the basis for the development and implementation of the USEP requirements of the TMDL. The state approved the grant proposal in fall 2006 and the Grant Project, which will be completed by August 2008, was recently initiated.

1.3 Purpose of the MSAR Water Quality Monitoring Plan

This Water Quality Monitoring Plan was prepared to fulfill two objectives:

1.3.1 Establish and implement the Bacterial Indicator Watershed-Wide Monitoring Program required by the TMDL. The monitoring described for this program will continue until the numeric targets described in the MSAR Bacterial Indicator TMDL are achieved and the waterbodies are removed from the 303(d) list upon adoption of the TMDL.

1.3.2 Implement monitoring funded by the Grant Project to characterize urban sources of bacteria within the watershed and support the USEP element of the TMDL. The monitoring described for this program will occur only between July 1, 2007 and March 31, 2008.

It is important to recognize that the Monitoring Plan elements associated with the USEP should be considered distinct from the Monitoring Plan elements associated with the Watershed-Wide Monitoring Program. That is, once USEP-related monitoring activities are complete, the only elements of this Monitoring Plan that will continue are the elements associated with the Watershed-Wide Monitoring Plan.

The requirements for each monitoring program are fully explained in Sections 2 and 3 of this Monitoring Plan. Section 4 provides requirements for water quality sample collection and handling, and collection of field measurements. Section 5 provides a brief synopsis of data management requirements.

1.4 Watershed Description

The MSAR watershed covers approximately 488 square miles and lies largely in the southwestern corner of San Bernardino County, and the northwestern corner of Riverside County. A small part of Los Angeles County (Pomona/Claremont area) is also included. The MSAR watershed includes three sub-watersheds (Figure 1):

1.4.1 Chino Basin (San Bernardino County, Los Angeles County, and Riverside Counties) – Surface drainage in this area, which is directed to Chino Creek and Mill-Cucamonga Creek, flows generally southward, from the San Gabriel Mountains toward the Santa Ana River and the Prado Flood Control Basin.

1.4.2 Riverside Watershed (Riverside County) – Surface drainage in this area is generally westward or southeastward from the City of Riverside and the community of Rubidoux to Reach 3 of the Santa Ana River.

1.4.3 Temescal Canyon Watershed (Riverside County) – Surface drainage in this area is generally northwest to Temescal Creek.

Land uses in the MSAR watershed include urban, agriculture, and open space. Although originally developed as an agricultural area, the watershed is rapidly urbanizing. Incorporated cities in the MSAR watershed include Pomona, Chino Hills, Upland, Montclair, Claremont, Ontario, Rancho Cucamonga, Rialto, Chino, Fontana, Norco, Corona, and Riverside. In addition, there are several pockets of urbanized unincorporated areas. Open space areas include National Forest lands and State Park lands.

The current population of the watershed, based upon 2000 census data, is approximately 1.4 million people. The principal remaining agricultural area in the watershed is the area formerly known as the Chino Dairy Preserve. This area is located in the south central part of the Chino Basin subwatershed and contains approximately 300,000 cows (although this number is quickly declining as the rate of development increases). Recently, 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.

Section 2
Watershed-Wide Monitoring Program

The MSAR TMDL implementation plan contained recommended sample locations, sample frequency, and constituents to be analyzed for water samples. To a large degree, this Watershed-Wide Monitoring Program incorporates the recommendations of the TMDL. The following sections describe the site locations, frequency of sampling, weather conditions, and types of analyses that will be conducted to fulfill requirements for watershed-wide monitoring under the TMDL.

2.1 Watershed-Wide Monitoring Program Framework

The purpose of the Watershed-Wide Monitoring Program is to assess compliance with REC-1 use water quality objectives for fecal coliform and evaluate numeric targets established for *E. coli*. As noted above, the Basin Plan currently relies solely on fecal coliform as the bacterial indicator for protection of the REC-1 use. However, the RWQCB is currently evaluating the use of *E. coli* for the REC-1 use water quality objective. In anticipation of the adoption of new *E. coli* water quality objectives, both fecal coliform and *E. coli* targets were incorporated into the TMDL and will be evaluated in water samples collected under this Watershed-Wide Monitoring Plan.

Consistent with the TMDL, the following constituents will be analyzed in water samples collected at each site on each sample date:

2.1.1 *Field Analysis:* Temperature, conductivity, pH, dissolved oxygen, and turbidity

2.1.2 *Laboratory Water Quality Analysis:* Fecal coliform, *E. coli*, and total suspended solids (TSS)

Table 1
Constituents Monitored and Analytical Methods

Parameter	Laboratory	Units	Analytical Method	Target Report Limits
Temperature	In Field	°C	YSI or equivalent	NA
pH	In Field	Standard Units	YSI or equivalent	NA
Dissolved	In Field	mg/l	YSI or equivalent	NA
Conductivity	In Field	mS/cm	YSI or equivalent	NA
Turbidity	In Field	NTU	YSI or equivalent	NA
E. coli	OC Public Health	cfu/100 ml	EPA 1603	10 cfu/100 mL
Fecal coliform	OC Public Health	cfu/100 ml	SM 9222D[1]	2 cfu/100 mL
TSS	OC Public Health	mg/l	SM 2540D[1]	0.5 mg/L

[1] APHA, 1998

Where appropriate, the results of the water quality sampling will be compared to the TMDL compliance targets for fecal coliform and *E. coli*:

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

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

Other sample results, e.g., for field parameters and TSS, will be compared to bacteria data to evaluate the presence of any correlations.

2.2 Sample Locations

As noted above, the purpose of the Watershed-Wide Monitoring effort is to measure compliance with numeric targets established by the TMDL, which are derived from Basin Plan objectives established to protect the REC-1 beneficial use. Two key factors were used to select watershed sites:

2.2.1 The sites should be located on waterbodies that are impaired and thus incorporated into the TMDL; and

2.2.2 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.

Using the impaired waters list, recreational use data developed by the Santa Ana River Watershed Stormwater Quality Standards Task Force, and recommendations from Regional Board staff, six sites were selected (Figure 2):

2.2.3 Icehouse Canyon Creek

2.2.4 Chino Creek at Central Avenue

2.2.5 Santa Ana River at Hamner Avenue

2.2.6 Santa Ana River at MWD Crossing

2.2.7 Prado Park Lake at Lake Outlet

2.2.8 Mill Creek at Chino-Corona Road

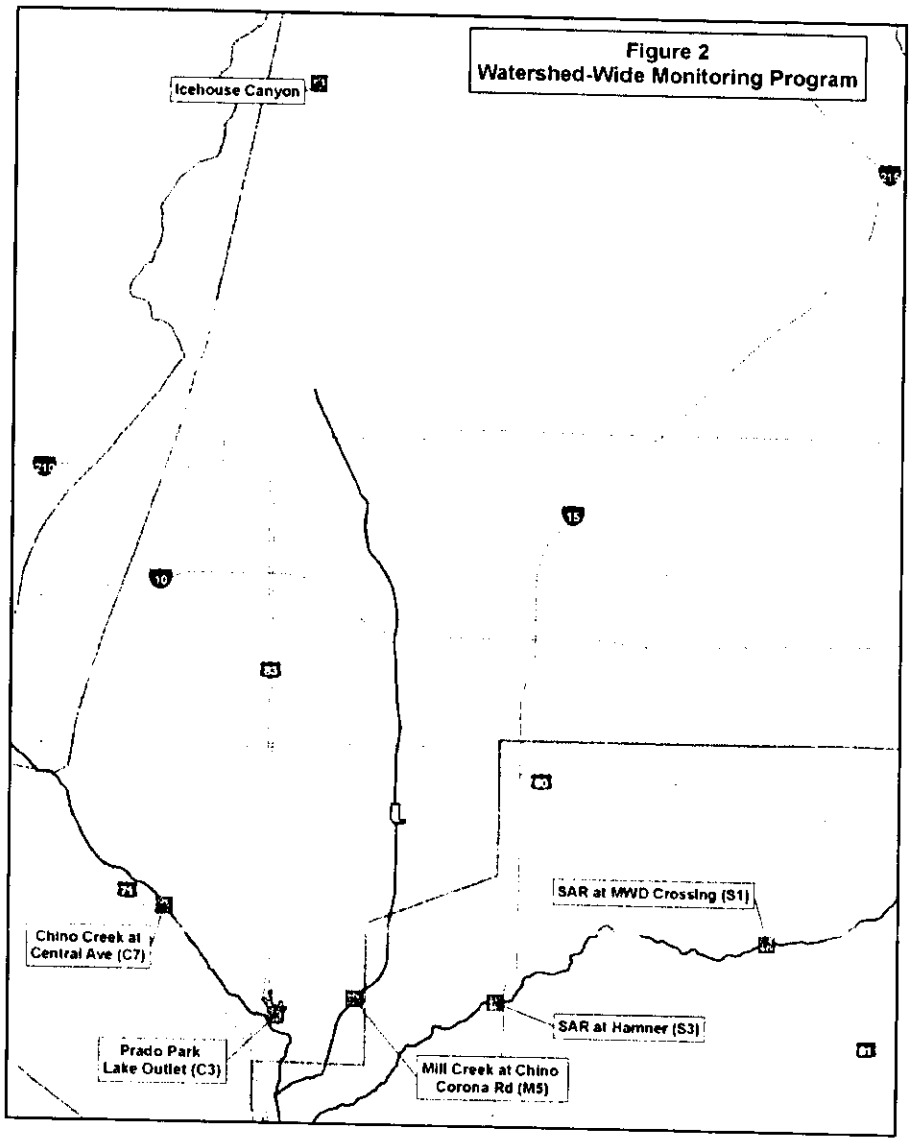


Table 2 provides a brief site description and GPS coordinate location for each of these six Watershed-Wide Monitoring Program sample locations. Attachment A provides site photographs and more detailed field descriptions, including site access information.

Table 2
Watershed-Wide Monitoring Program Sample Locations

Site ID	Site Description	Longitude	Latitude
WW-C1	Icehouse Canyon Creek	-117.6330	34.2510
WW-C3	Prado Park Lake at Lake Outlet	-117.6473	33.9400
WW-C7	Chino Creek at Central Avenue	-117.6884	33.9737
WW-M5	Mill Creek at Chino-Corona Rd	-117.6156	33.9460
WW-S1	Santa Ana River Reach 3 @ MWD Crossing	-117.4479	33.9681
WW-S3	Santa Ana River Reach 3 @ Hamner Ave	-117.5582	33.9451

All of the above sites were recommended as Watershed-Wide Monitoring sites in the TMDL. The rationale for not including other sites recommended in the TMDL is as follows:

2.2.9 Temescal Wash at Lincoln Avenue – This waterbody was incorporated into the USEP Monitoring Program because it is a potential urban source of bacteria to an impaired waterbody (Santa Ana River Reach 3). Also, Temescal Wash itself is not listed as impaired and therefore not subject to MSAR Bacterial Indicator TMDL requirements.

2.2.10 Tequesquite Arroyo at Palm Avenue – This site was incorporated into the USEP Monitoring Program because it is a potential source of bacteria to an impaired waterbody (Santa Ana River Reach 3). Also, Tequesquite Arroyo itself is not listed as impaired and therefore not subject to MSAR Bacterial Indicator TMDL requirements.

2.2.11 Cucamonga Creek at Regional Plant 1 – This site was not included primarily because the channel is concrete-lined; accordingly, there is a very low expectation of recreational activity because of the lack of a natural channel and lack of access. However, nearby storm drains that may contribute elevated bacteria concentrations to this impaired reach of Chino Creek are included in the USEP Monitoring Program.

2.2.12 Chino Creek at Schaeffer – This site was not included primarily because the channel is concrete-lined; accordingly, there is a very low expectation of recreational activity because of the lack of a natural channel and lack of access. The Stormwater Quality Standards Task Force characterized this site in its Phase I efforts, and, based on the findings from that characterization, the likelihood of REC-1 activity is very low. Nearby storm drains that may contribute elevated bacteria concentrations to this impaired reach of Chino Creek are included in the USEP Monitoring Program.

2.2.13 Chino Creek at Prado Golf Course – This site was not included as it would be somewhat redundant to the upstream Chino Creek at Central Avenue site. The Regional Board has evidence that the Central Avenue site is used for REC-1 activities; accordingly, it will serve as a better location for monitoring to meet Watershed-Wide Monitoring Program objectives.

The TMDL recommended that the following four sites be incorporated into the Watershed-Wide Monitoring Program for sampling only during storm events:

2.2.14 Bon View Avenue at Merrill Avenue

2.2.15 Archibald Avenue at Cloverdale Avenue

2.2.16 Grove Channel at Pine Avenue

2.2.17 Euclid Avenue Channel at Pine Avenue

None of these sites were incorporated into the Watershed-Wide Monitoring Program for the following reasons:

2.2.18 Per the Regional Board, the primary reason for the inclusion of these wet weather sites was the need to assess water quality runoff in drains carrying runoff that primarily originates from agricultural areas. Rather than include these sites in the Watershed-Wide Monitoring Program, these sites may be considered for inclusion in the Agricultural Source Evaluation Plan that will be developed as part of the TMDL implementation plan.

2.2.19 All of these sites are storm drains and not listed as impaired waterbodies; accordingly, the objective of the Watershed-Wide Monitoring Program (compliance with the TMDL numeric targets) does not apply at these locations.

2.2.20 None of these sites are locations of expected REC-1 use activity.

2.3 Sample Frequency

Table 3 provides a detailed schedule for monitoring activities at Watershed-Wide Monitoring sites. Sampling events are scheduled for week ending dates, meaning that samples could be collected any day up to the Saturday that marks the end of the week. However, every effort will be made to collect samples during the first two or three days of each week (Monday through Wednesday). This sampling effort is generally described as follows:

2.3.1 Dry Season (April 1 – October 31): Four 30-day intervals will be sampled with five samples collected approximately weekly during each 30-day period. The dry season sampling will begin each year in June. To allow for calculation of a rolling 30-day geometric mean, the four 30-day intervals will occur in

sequence, resulting in 20 samples collected over 20 consecutive weeks (an approximately 120-day period).

2.3.2 Wet Season (November 1 – March 31): The goal of the wet season sampling effort is to obtain samples from both dry and wet weather periods during the wet season. To best accomplish this goal, a sample schedule with some built-in flexibility has been established:

2.3.2.1 *Fixed Sample Dates* – Eleven samples will be collected over an eleven week period from mid-December to mid-February. The collection of samples over a continuous 11-week period will provide the opportunity to calculate a rolling geometric mean. This weekly sampling will occur on a regular schedule regardless of whether flows are at base levels or elevated because of wet weather.

2.3.2.2 *Flexible (Storm Event) Sample Dates* – The goal of having flexible sample dates is to obtain data from the falling limb of the hydrograph following one storm event during the wet season. To the extent practical, taking into account the timing of the storm event, when a storm event occurs, four samples will be collected from each site as follows: Sample 1 will be collected on the day of the storm event and should be taken when it is apparent that flow within the channel is elevated above typical dry weather conditions as a result of rainfall induced runoff. Samples 2, 3 and 4 will be collected 48, 72, and 96 hours following the storm event. If no wet weather events have occurred by late February, then samples will be added to the end of the fixed sample dates—weeks ending March 1 through March 22.

For the purposes of this Monitoring Plan, the decision whether to conduct wet weather sampling should be approached by first preparing to deploy the sampling team if rain is forecasted (National Weather Service forecast on Accuweather.com). If rain develops, monitor rain gauges in the area (Riverside Municipal Airport and Ontario International Airport). When accumulated rainfall exceeds approximately 0.2 inches at these gauges and it is still raining, then mobilize the sampling effort. Samples shall not be collected if conditions are determined to be unsafe by an on- site assessment by the field team leader.

Table 2. Sample Frequency/Schedule for Proposed Sample Sites

	Site Location	Dry Season (Week Ending)																				
		20-Week Sampling Effort - Rolling Geometric Mean																				
		23-Jun			30-Jun			7-Jul			14-Jul			21-Jul			28-Jul			4-Aug		
		W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]
Watershed-Wide Monitoring	Icehouse Canyon Creek (WW-C1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Prado Park Lake at Lake Outlet (WW-C3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Chino Creek at Central Avenue (WW-C7)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Mill Creek at Chino-Corona Road (WW-M5)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at Hamner Avenue (WW-S3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at MWD Crossing (WW-S1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Urban Source Evaluation Monitoring	Santa Ana Reach (SAR) at La Cadena Drive (US-SAR)	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Box Springs Channel at Tequesquite Avenue (US-BXSP)	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Sunnyslope Channel near confluence with SAR (US-SNCH)	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Anza Drain near confluence with Riverside Effluent Channel (US-ANZA)	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	San Sevaine Channel in Riverside near confluence with SAR (US-SSCH)	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Day Creek at Lucretia Avenue (US-DAY)	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Temescal Wash at Lincoln Avenue (US-TEM)	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Cypress Channel at Kimball Avenue (US-CYP)	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	San Antonio Channel at Riverside Drive (US-SACH)	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Carbon Canyon Creek Channel at Pipeline Avenue (US-CCCH)	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Chris Basin Outflow - Lower Deer Creek (US-CHRIS)	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	County Line Channel near confluence with Cucamonga Creek (US-CLCH)	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Cucamonga Creek at Hwy 60 - Above RP1 (US-CUC)	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
	Sample Number (SBC)	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0
	Sample Number (B&C)	0	0	0	0	0	0	13	0	0	13	0	0	13	0	0	13	0	0	13	0	0
	Sample Number (Bacteroides - OCWD)	0	0	0	0	0	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0
	Sample Number (Bacteroides - UC)	0	0	0	0	0	0	0	0	8	0	0	8	0	0	8	0	0	8	0	0	8

	Site Location	Dry Season (Week Ending)																							
		11-Aug			18-Aug			25-Aug			1-Sep			8-Sep			15-Sep			22-Sep			29-Sep		
		W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]
Watershed-Wide Monitoring	Icehouse Canyon Creek (WW-C1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Prado Park Lake at Lake Outlet (WW-C3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Chino Creek at Central Avenue (WW-C7)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Mill Creek at Chino-Corona Road (WW-M5)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at Hamner Avenue (WW-S3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at MWD Crossing (WW-S1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Urban Source Evaluation Monitoring	Santa Ana Reach (SAR) at La Cadena Drive (US-SAR)	N	N	N	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Box Springs Channel at Tequesquite Avenue (US-BXSP)	N	N	N	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Sunnyslope Channel near confluence with SAR (US-SNCH)	N	N	N	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Anza Drain near confluence with Riverside Effluent Channel (US-ANZA)	N	N	N	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	San Sevaine Channel in Riverside near confluence with SAR (US-SSCH)	N	N	N	N	N	N	N	N	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Day Creek at Lucretia Avenue (US-DAY)	N	N	N	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Temescal Wash at Lincoln Avenue (US-TEM)	N	N	N	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Cypress Channel at Kimball Avenue (US-CYP)	N	N	N	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	San Antonio Channel at Riverside Drive (US-SACH)	N	N	N	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Carbon Canyon Creek Channel at Pipeline Avenue (US-CCCH)	N	N	N	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Chris Basin Outflow - Lower Deer Creek (US-CHRIS)	N	N	N	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	County Line Channel near confluence with Cucamonga Creek (US-CLCH)	N	N	N	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Cucamonga Creek at Hwy 60 - Above RP1 (US-CUC)	N	N	N	N	N	N	N	N	N	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
	Sample Number (SBC)	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0
	Sample Number (B&C)	0	0	0	0	0	0	0	0	0	13	0	0	13	0	0	13	0	0	13	0	0	13	0	0
	Sample Number (Bacteroides - OCWD)	0	0	0	0	0	0	0	0	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0
	Sample Number (Bacteroides - UC)	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8	0	0	8	0	0	8	0	0	8

	Site Location	Dry Season (Week Ending)														
		6-Oct			13-Oct			20-Oct			27-Oct			3-Nov		
		W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]
Watershed-Wide Monitoring	Icehouse Canyon Creek (WW-C1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Prado Park Lake at Lake Outlet (WW-C3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Chino Creek at Central Avenue (WW-C7)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Mill Creek at Chino-Corona Road (WW-M5)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at Hamner Avenue (WW-S3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at MWD Crossing (WW-S1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Urban Source Evaluation Monitoring	Santa Ana Reach (SAR) at La Cadena Drive (US-SAR)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Box Springs Channel at Tequesquite Avenue (US-BXSP)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Sunnyslope Channel near confluence with SAR (US-SNCH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Anza Drain near confluence with Riverside Effluent Channel (US-ANZA)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	San Sevaine Channel in Riverside near confluence with SAR (US-SSCH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Day Creek at Lucretia Avenue (US-DAY)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Temescal Wash at Lincoln Avenue (US-TEM)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Cypress Channel at Kimball Avenue (US-CYP)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	San Antonio Channel at Riverside Drive (US-SACH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Carbon Canyon Creek Channel at Pipeline Avenue (US-CCCH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Chris Basin Outflow - Lower Deer Creek (US-CHRIS)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	County Line Channel near confluence with Cucamonga Creek (US-CLCH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Urban Source Evaluation Monitoring	Cucamonga Creek at Hwy 60 - Above RP1 (US-CUC)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Sample Number (SBC)	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0
	Sample Number (B&C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sample Number (Bacteroides - OCWD)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sample Number (Bacteroides - UC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Site Location	Wet Season (Week Ending or Sample No)																	
		11 Week Sampling Effort (Rolling Geometric Mean)																	
		15-Dec			22-Dec			29-Dec			5-Jan			12-Jan			19-Jan		
		W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]
Watershed-Wide Monitoring	Icehouse Canyon Creek (WW-C1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Prado Park Lake at Lake Outlet (WW-C3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Chino Creek at Central Avenue (WW-C7)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Mill Creek at Chino-Corona Road (WW-M5)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at Hamner Avenue (WW-S3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at MWD Crossing (WW-S1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Urban Source Evaluation Monitoring	Santa Ana Reach (SAR) at La Cadena Drive (US-SAR)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	OC	N
Urban Source Evaluation Monitoring	Box Springs Channel at Tequesquite Avenue (US-BXSP)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	OC	N
Urban Source Evaluation Monitoring	Sunnyslope Channel near confluence with SAR (US-SNCH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	OC	N
Urban Source Evaluation Monitoring	Anza Drain near confluence with Riverside Effluent Channel (US-ANZA)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	OC	N
Urban Source Evaluation Monitoring	San Sevaine Channel in Riverside near confluence with SAR (US-SSCH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	OC	N
Urban Source Evaluation Monitoring	Day Creek at Lucretia Avenue (US-DAY)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	N	UC
Urban Source Evaluation Monitoring	Temescal Wash at Lincoln Avenue (US-TEM)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	N	UC
Urban Source Evaluation Monitoring	Cypress Channel at Kimball Avenue (US-CYP)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	N	UC
Urban Source Evaluation Monitoring	San Antonio Channel at Riverside Drive (US-SACH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	N	UC
Urban Source Evaluation Monitoring	Carbon Canyon Creek Channel at Pipeline Avenue (US-CCCH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	N	UC
Urban Source Evaluation Monitoring	Chris Basin Outflow - Lower Deer Creek (US-CHRIS)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	N	UC
Urban Source Evaluation Monitoring	County Line Channel near confluence with Cucamonga Creek (US-CLCH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	N	UC
Urban Source Evaluation Monitoring	Cucamonga Creek at Hwy 60 - Above RP1 (US-CUC)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	B&C	N	UC
	Sample Number (SBC)	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0
	Sample Number (B&C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0
	Sample Number (Bacteroides - OCWD)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
	Sample Number (Bacteroides - UC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8

	Site Location	Wet Season (Week Ending or Sample No)														
		11 Week Sampling Effort (Rolling Geometric Mean)														
		26-Jan			2-Feb			9-Feb			16-Feb			23-Feb		
		W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]
Watershed-Wide Monitoring	Icehouse Canyon Creek (WW-C1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Prado Park Lake at Lake Outlet (WW-C3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Chino Creek at Central Avenue (WW-C7)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Mill Creek at Chino-Corona Road (WW-M5)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at Hamner Avenue (WW-S3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at MWD Crossing (WW-S1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Urban Source Evaluation Monitoring	Santa Ana Reach (SAR) at La Cadena Drive (US-SAR)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Box Springs Channel at Tequesquite Avenue (US-BXSP)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Sunnyslope Channel near confluence with SAR (US-SNCH)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Anza Drain near confluence with Riverside Effluent Channel (US-ANZA)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	San Sevaine Channel in Riverside near confluence with SAR (US-SSCH)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Day Creek at Lucretia Avenue (US-DAY)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Temescal Wash at Lincoln Avenue (US-TEM)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Cypress Channel at Kimball Avenue (US-CYP)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	San Antonio Channel at Riverside Drive (US-SACH)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Carbon Canyon Creek Channel at Pipeline Avenue (US-CCCH)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Chris Basin Outflow - Lower Deer Creek (US-CHRIS)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	County Line Channel near confluence with Cucamonga Creek (US-CLCH)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Cucamonga Creek at Hwy 60 - Above RP1 (US-CUC)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
	Sample Number (SBC)	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0
	Sample Number (B&C)	13	0	0	13	0	0	13	0	0	13	0	0	13	0	0
	Sample Number (Bacteroides - OCWD)	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0
	Sample Number (Bacteroides - UC)	0	0	8	0	0	8	0	0	8	0	0	8	0	0	8

	Site Location	Wet Season (Week Ending or Sample No)											
		Storm Event Sampling[4]											
		1			2			3			4		
		W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]	W[1]	B (OCWD)[2]	B (UC)[3]
Watershed-Wide Monitoring	Icehouse Canyon Creek (WW-C1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Prado Park Lake at Lake Outlet (WW-C3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Chino Creek at Central Avenue (WW-C7)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Mill Creek at Chino-Corona Road (WW-M5)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at Hamner Avenue (WW-S3)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Watershed-Wide Monitoring	Santa Ana River Reach 3 at MWD Crossing (WW-S1)	SBC	N	N	SBC	N	N	SBC	N	N	SBC	N	N
Urban Source Evaluation Monitoring	Santa Ana Reach (SAR) at La Cadena Drive (US-SAR)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Box Springs Channel at Tequesquite Avenue (US-BXSP)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Sunnyslope Channel near confluence with SAR (US-SNCH)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Anza Drain near confluence with Riverside Effluent Channel (US-ANZA)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	San Sevaine Channel in Riverside near confluence with SAR (US-SSCH)	B&C	OC	N	B&C	OC	N	B&C	OC	N	B&C	OC	N
Urban Source Evaluation Monitoring	Day Creek at Lucretia Avenue (US-DAY)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Temescal Wash at Lincoln Avenue (US-TEM)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Cypress Channel at Kimball Avenue (US-CYP)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	San Antonio Channel at Riverside Drive (US-SACH)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Carbon Canyon Creek Channel at Pipeline Avenue (US-CCCH)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Chris Basin Outflow - Lower Deer Creek (US-CHRIS)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	County Line Channel near confluence with Cucamonga Creek (US-CLCH)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
Urban Source Evaluation Monitoring	Cucamonga Creek at Hwy 60 - Above RP1 (US-CUC)	B&C	N	UC	B&C	N	UC	B&C	N	UC	B&C	N	UC
	Sample Number (SBC)	6	0	0	6	0	0	6	0	0	6	0	0
	Sample Number (B&C)	13	0	0	13	0	0	13	0	0	13	0	0
	Sample Number (Bacteroides - OCWD)	0	5	0	0	5	0	0	5	0	0	5	0
	Sample Number (Bacteroides - UC)	0	0	8	0	0	8	0	0	8	0	0	8

SBC = San Bernardino County Flood Control District; B&C = Brown & Caldwell; OCWD = Orange County Water District; UC = University California Davis

1 Collection of water quality samples for laboratory analyses (fecal coliform, E. coli and TSS), field parameter data (temperature, dissolved oxygen, turbidity, pH, and conductivity), or for pathogen scoping study. Samples collected by either San Bernardino County Flood Control District (SBC) or Brown & Caldwell (B&C) staff. "N" means that no sample is collected during that week.

2 Water samples collected for analysis of Bacteroides (B) by Orange County Water District (OCWD)

3 Water samples collected for analysis of Bacteroides (B) by University of California Davis (UC)

4 Sampling conducted during storm event (Day 0) and for days 2, 3 and 4 (representing 48, 72 and 96 hrs) after storm event. If no such event occurs, then sampling will occur weekly beginning week ending March 1.

2.4 Sampling Schedule for 2008-2009 and Subsequent Years

Watershed-wide monitoring for TMDL compliance beginning in spring 2008 and subsequent years will be conducted for the same constituents, site locations, and wet/dry season frequency as during the Grant Project period (2007-2008). However, the start and end date of the dry season sampling period will begin earlier in subsequent years. Table 4 provides the monitoring schedule for the 2008-2009 watershed-wide monitoring. Table 5 provides starting and ending dates for dry and wet season sampling in subsequent years if sampling occurs.

Table 4
Sample Frequency/Schedule for Watershed-Wide TMDL Compliance Monitoring (2008-2009)

Season	Sites	Number of events	Sample Dates *
Dry	Icehouse Canyon Creek Prado Park Lake at lake outlet Chino Creek at Central Avenue Mil Creek at Chino-Corona Road Santa Ana River Reach 3 at MWD Crossing Santa Ana River Reach 3 at Hamner Ave	20	Weekly from week ending May 17 through week ending October 4
Wet	Icehouse Canyon Creek Prado Park Lake at lake outlet Chino Creek at Central Avenue Mil Creek at Chino-Corona Road Santa Ana River Reach 3 at MWD Crossing Santa Ana River Reach 3 at Hamner Ave	15	Fixed Sample Dates: Weekly from week ending December 13 through week ending February 28 Flexible Sample Dates: Grab sample on day of 1/2 rainfall-runoff event and for 48, 72, and 96 hours following the event

* See Table 5 for start weeks in Subsequent Years

Table 5
Start / End Weeks for Wet and Dry Season Sampling in Future Years

Sampling Year	Dry Season	Wet Season
2009 - 2010	May 16 / Oct 3	Dec 19 / Mar 6
2010 - 2011	May 15 / Oct 2	Dec 18 / Mar 5
2011 - 2012	May 14 / Oct 1	Dec 17 / Mar 3
2012 - 2013	May 19 / Oct 6	Dec 15 / Mar 2
2013 - 2014	May 18 / Oct 5	Dec 14 / Mar 1
2014 - 2015	May 19 / Oct 6	Dec 13 / Feb 28
2015 - 2016		Dec 19 / Mar 5
2016 - 2017		Dec 17 / Mar 4
2017 - 2018		Dec 16 / Mar 3
2018 - 2019		Dec 15 / Mar 2
2019 - 2020		Dec 14 / Feb 29
2020 - 2021		Dec 19 / Mar 6
2021 - 2022		Dec 18 / Mar 5
2022 - 2023		Dec 17 / Mar 4
2023 - 2024		Dec 16 / Mar 2
2024 - 2025		Dec 14 / Mar 1

Section 3
USEP Monitoring Program

Elevated levels of indicator bacteria have been documented in most monitored waterbodies within the MSAR watershed; however, the sources of bacteria remain unknown. Thus, the primary goal of the USEP Monitoring Program is to guide efforts to control bacteria sources derived from discharges covered by MS4 NPDES permits. The water quality sampling and analyses conducted for this effort will be coordinated with the Watershed-Wide Monitoring Program described above, but only during the period that the Grant Project, which funds this effort, is active.

3.1 USEP Monitoring Program Framework

Sampling will occur for the USEP Monitoring Program from July 2007 to March 31, 2008. This end date coincides with Grant Project requirements. Although the Grant Project ends August 2008, to meet project goals, it is necessary to complete sampling by the end of March 2008 so that the collected data can be incorporated into the Grant Project deliverables. Once the USEP Monitoring Program sampling effort is completed (March 31, 2008), then no additional sample collection from the USEP sample locations will occur under this Monitoring Plan.

The following data will be collected during each sampling event at each USEP Monitoring Program site:

3.1.1 Field Analysis: Temperature, conductivity, pH, dissolved oxygen, and turbidity

3.1.2 Laboratory Water Quality Analysis: Fecal coliform, *E. coli*, and total suspended solids

3.1.3 Flow: During each sample event, if conditions are safe, flow will be characterized

3.1.4 *Bacteroides* Analysis: All samples will be assayed for *Bacteroides* host-specific markers for humans, ruminant, and domestic canine to provide a semi-quantitative estimate of their relative abundance.

The field and water quality analysis methods for the USEP sites are the same as for the Watershed-Wide monitoring sites. These methods are summarized in Table 1. Methods for the collection of flow data and the collection of water samples for conducting molecular analyses are described below in Section 4.

In addition to collecting a flow measurement at each site during each sampling event, the hydrologic connectivity of the surface flow at each site to the downstream impaired waterbody (Santa Ana River Reach 3, Mill Creek, Cucamonga Creek, and Chino Creek Reach 1 and 2) will be characterized to the extent possible. The purpose of characterizing the hydrologic connectivity is to determine whether flow from the

sampled waterbody reaches the impaired waterbody. Connectivity will be characterized at the following sites prior to all sampling events:

3.1.5 San Sevaine Channel

3.1.6 Box Springs Drain

3.1.7 County Line Channel

The hydrologic connectivity of the remaining USEP Monitoring Program sites will be characterized during at least one field sampling event in each 30-day sampling period in July and September 2007 and in February 2008. In addition, the hydrologic connectivity will be characterized to the extent possible during storm event sampling.

If hydrologic connectivity is not apparent at a given site, samples will not be collected from the site on that day.

3.2 USEP Monitoring Program Locations

Site selection was based on the following general collective and site-specific criteria:

3.2.1 Collectively, selected sites that discharge to an impaired water should, to the extent practical, characterize water quality tributary to the segment with the 303(d) listed impairment, which may include upstream segments of the same waterbody;

3.2.2 Collectively, selected sites tributary to an impaired water should have the potential to contribute a high percentage of the flow (volumetrically) to the impaired water;

3.2.3 A selected site should be close to the base of its watershed so that it characterizes the majority of flow reaching the impaired water from that tributary;

3.2.4 Flow at a selected site should not include any permitted effluent discharge; and

3.2.5 Flow at a selected site should generally occur under both dry and wet weather conditions.

Based on these general considerations, the following sites (with their association to an impaired waterbody) will be sampled under the USEP Monitoring Program (Figure 3):

3.2.6 Santa Ana River, Reach 3

3.2.6.1 Santa Ana River at La Cadena

3.2.6.2 Box Springs Drain (includes Tequesquite Arroyo)

3.2.6.3 Sunnyslope Channel

3.2.6.4 Anza Drain

3.2.6.5 San Sevaine Channel

3.2.6.6 Day Creek

3.2.6.7 Temescal Wash

3.2.7 Chino Creek, Reach 1

3.2.7.1 Cypress Channel

3.2.8 Chino Creek, Reach 2

3.2.8.1 San Antonio Channel

3.2.8.2 Carbon Canyon Creek Channel

3.2.9 Mill Creek (Prado Area)

3.2.9.1 Lower Deer Creek Channel

3.2.9.2 County Line Channel

3.2.10 Cucamonga Creek, Reach 1

3.2.10.1 Cucamonga Creek at Highway 60 (above RP1 discharge)

The specific sampling location on each of the above waterbodies was selected in coordination with staff from the SBCFCD and RCFWCD. Table 6 provides a brief site description and GPS coordinate location for each of the 13 USEP Monitoring Program locations. Attachment B presents photographs and field descriptions for each selected USEP Monitoring Program site.

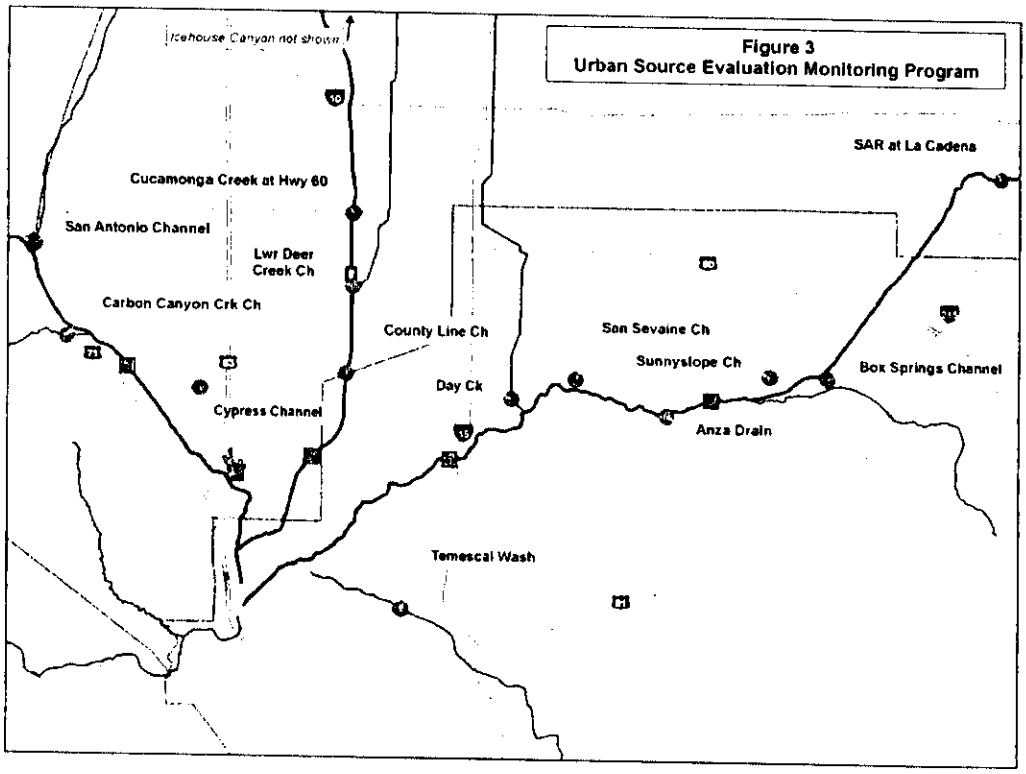


Table 6
USEP Monitoring Program Site Locations

Site ID	Site Description	Longitude	Latitude
Santa Ana River, Reach 3			
US-SAR	Santa Ana River (SAR) at La Cadena Drive	-117.33065	34.04453
US-BXSP	Box Springs Channel at Tequesquite Avenue	-117.40272	33.97592
US-SNCH	Sunnyslope Channel near confluence with SAR	-117.42630	33.97620
US-ANZA	Anza Drain near confluence with Riverside effluent channel	-117.46795	33.96212
US-SSCH	San Sevaine Channel in Riverside near confluence with SAR	-117.50555	33.97430
US-DAY	Day Creek at Lucretia Avenue	-117.53192	33.96708
US-TEM	Temescal Wash at Lincoln Avenue	-117.57723	33.89412
Chino Creek, Reach 1			
US-CYP	Cypress Channel at Kimball Avenue	-117.66043	33.96888
Chino Creek, Reach 2			
US-SACH	San Antonio Channel at Riverside Drive	-117.73417	34.01703
US-CCCH	Carbon Canyon Creek Channel at Pipeline Avenue	-117.71585	33.98617
Mill Creek (Prado Area)			
US-CHRIS	Chris Basin Outflow (Lower Deer Creek)	-117.59802	34.00498
US-CLCH	County Line Channel near confluence with Cucamonga Creek	-117.60063	33.97492
Cucamonga Creek, Reach 1			
US-CUC	Cucamonga Creek at Highway 60 (Above RP1)	-117.59973	34.02447

3.3 Sample Frequency

Table 3 provides a detailed schedule for monitoring activities at USEP Monitoring Program sites. Sampling events are scheduled for week ending dates, meaning that samples could be collected any day up to the Saturday that marks the end of the week. However, every effort will be made to collect samples during the first two or three days of each week (Monday through Wednesday). This sampling effort is generally described as follows:

3.3.1 Dry Season (April 1 – October 31): Two 30-day intervals will be sampled with five samples collected approximately weekly during each 30-day period. Sampling will occur within the 20-week timeframe established for the Watershed-Wide Monitoring Program sites (see above) – generally during the months of July and September.

3.3.2 Wet Season (November 1 – March 31): The goal of the wet season sampling effort is to obtain samples from both dry and wet weather periods during the wet season. To best accomplish this goal, a sampling schedule with some built-in flexibility has been established. Accordingly, the sample effort is divided into a combination of fixed and flexible sample dates:

3.3.2.1 *Fixed Sample Dates* – Six samples will be collected approximately weekly from mid-January through mid-February. Sampling will occur regardless of whether flows are at base levels or are elevated because of wet weather.

3.3.2.2 *Flexible (Storm Event) Sample Dates* – The goal of having flexible sample dates is to obtain data from the falling limb of the hydrograph following one storm event during the wet season. To the extent practical, taking into account the timing of the storm event, when a storm event occurs, four samples will be collected from each site as follows: Sample 1 will be collected on the day of the storm event and should be taken when it is apparent that flow within the channel is elevated above typical dry weather conditions as result of rainfall induced runoff. Samples 2, 3 and 4 will be collected 48, 72, and 96 hours following the storm event. If no wet weather events have occurred by mid-February, then samples will be added to the end of the fixed sample dates – weeks ending March 1 through March 22.

For the purposes of this Monitoring Plan, the decision whether to conduct wet weather sampling should be approached by first preparing to deploy the sampling team if rain is forecasted (National Weather Service forecast on Accuweather.com). If rain develops, monitor rain gauges in the area (Riverside Municipal Airport and Ontario International Airport). When accumulated rainfall exceeds approximately 0.2 inches at these gauges and it is still raining, then mobilize the sampling effort. Samples shall not be collected if conditions are determined to be unsafe by an on- site assessment by the field team leader.

Section 4
Procedures for Field Activities

4.1 Pre-Sampling Procedures

Prior to the collection of field data, the sample teams will complete the following activities:

4.1.1 A Horiba multiparameter instrument should be calibrated every morning prior to sampling (See the equipment operation manual for specific calibration instructions).

4.1.2 Prepare ice coolers with ice packs or crushed ice to transport samples to the laboratory.

4.1.3 Obtain sample containers from labs, including field blanks and water collection bottles

4.1.4 Pre-labeled sampling containers with Site Identification Number (Site ID), sample Identification Number (Sample ID), analysis information, Project Identification Number (Project ID), and blank fields for date and time.

4.1.5 Prepare 70 percent ethanol solution for field sterilization of sampling equipment.

4.1.6 Pack the Hach Portable Turbidity Meter.

4.1.7 Pack a flat head screw driver to loosen the band that holds the sampling bottle to the sampling pole.

4.1.8 Pack safety gear such as waders, protective gloves, and safety vests.

4.1.9 Pack waterproof pen and field log book.

4.1.10 Make sure that a vehicle is available and fueled.

4.1.11 Pack supplies for shipping samples.

4.1.12 Pack chain of custody forms, field data sheets, camera, and zip lock bags.

4.2 Field Documentation

Field crews are required to complete a form with data from each site visit (Attachment C). The form includes the following items that must be recorded for each sampling event at each sample location:

4.2.1 Date and time of sample collection

4.2.2 Project, Site, and Sample ID numbers

4.2.3 Unique IDs for any replicate or blank samples collected from the site

4.2.4 The results of any field measurements (temperature, dissolved oxygen, pH, conductivity, turbidity) and the time that measurements were made

4.2.5 Qualitative descriptions of relevant water conditions (e.g. color, flow level, clarity) or weather (e.g. wind, rain) at the time of sample collection

4.2.6 For USEP sites when such characterizations are required, a characterization of the hydrologic connectivity of the surface flow at the site to the downstream impaired water to which it is tributary. If no connectivity is observed, then the characterization shall, at a minimum, describe the general distance between the point where surface flow ceases and the channel confluences with the downstream impaired water. If connectivity is observed, then the characterization shall, at a minimum, describe the typical width and depth of the surface flow reaching the downstream impaired water, and any observations that suggest that flows have recently been higher than what is currently observed.

4.2.7 A description of any unusual occurrences associated with the sampling event, particularly those that may affect sample or data quality

Field crews are required to take digital photographs during each sampling event at each site and maintain a photo log of all photographs taken. At a minimum, the following digital photographs should be taken during each sampling event:

4.2.8 A photograph which shows a view of the waterbody upstream of the sample site

4.2.9 A photograph which shows a view of the waterbody downstream of the sample site.

4.2.10 Photographs which characterize the width and depth of flow and aesthetic characteristics such as water clarity and algal growth

To the extent possible, the photographs that provide an upstream and downstream view of the waterbody should be taken from the same point during each sample event.

A photo log of all photographs taken at each sample site shall be maintained, which documents the purpose of the photo (for example, upstream or downstream view) and the date and time of the photograph.

4.3 Sample Collection

Water samples are best collected before any other work is done at the site. If other work is done prior to the collection of water samples (for example, flow measurement or other field measurements), it might be difficult to collect representative samples for water chemistry and bacteria analysis from the disturbed stream.

Water samples are collected from a location in the stream where the stream visually appears to be completely mixed. Ideally this would be at the centroid of the flow (*Centroid* is defined as the midpoint of that portion of the stream width that contains 50% of the total flow), but depth and flow do not always allow centroid collection. In addition, the sample should be collected in an area free of debris or algae. Samples shall not be collected if conditions are determined to be unsafe by an on- site assessment by the field team leader.

For sites where the samples will be taken from a distance, a sampling pole similar to that shown in Figure 4 will be used. This sampling pole is approximately 7 feet long and has a mechanism that holds the sampling bottle in place, as shown in Figure 5. The mechanism should be sterilized in the field with a 70 percent ethanol solution prior to the collection of each sample. Allow the pole to air-dry before the sample is taken. A similar sampling pole that extends to greater height may be used for sites where sampling from a bridge is necessary.

The following lists contain specific steps to take when collecting a water sample (adapted from EPA's Volunteer Stream Monitoring: A Methods Monitoring Manual, EPA 841-B-97-003, 1997 and California's SWAMP Quality Assurance Management Plan, Puckett, 2002):

4.3.1 Label each container with Site ID, Sample ID, analysis information, Project ID, date, and time (some of this information may be pre-labeled on the containers). After sampling, secure the label by taping it around the bottle with clear packaging tape.

4.3.2 When wading to the sampling point, try not to disturb bottom sediment.

4.3.3 Stand in the water, facing upstream. Collect the water sample on your upstream side, in front of you. Hold the bottle upright under the surface while it is still capped. Open the lid carefully to slowly let water run in. Avoid touching the inside of the bottle or cap. If you accidentally touch the inside, use another bottle. Fill the bottle leaving a 1-inch air space so that the sample can be shaken just before analysis.

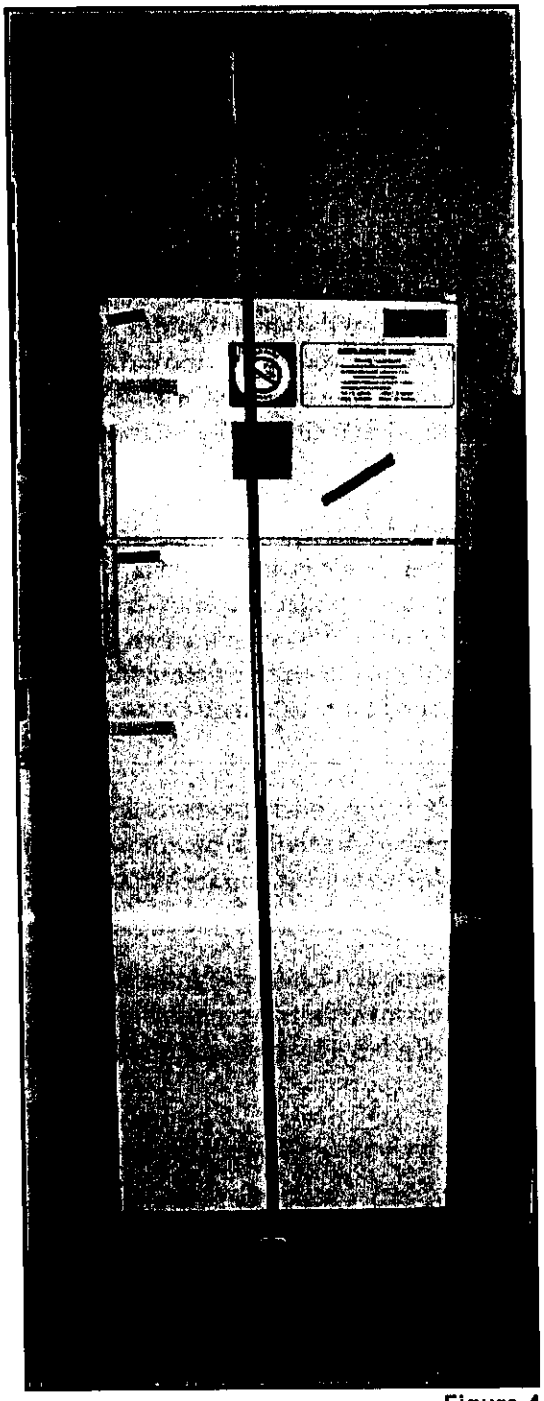


Figure 4
Sampling Pole

Figure 5
Close-up of Sampling Pole

4.3.4 For fecal coliform and E. coli samples the bottles will contain sodium thiosulfate for chlorine elimination; therefore, the bottle cannot be held under the water to collect a sample. Therefore, use a new sterilized water collection bottle to collected water for these parameters at each site. Water can then be decanted from this bottle into the preserved sample containers for the delivery to the laboratory.

4.3.5 The sample collection bottles would then be returned to the analytical lab for decontamination and re-use.

4.3.6 You may also tape your bottle to an extension pole to sample from deeper water. The sampling pole will be cleaned with a 70% ethanol solution prior to use at each sample site.

4.3.7 Place the sample containers in a cooler with cold packs for transport to the laboratory. **The maximum holding time prior to water quality analysis for bacteria indicator concentrations is 6 hours; the maximum holding time prior to *Bacteroides* analysis is 24 hours**. Sampling bottles and parameter specific sample containers will be provided by the laboratories for each sample and will include:

4.3.7.1 Water Quality Analysis Laboratory – 120 mL for fecal coliform, 120 mL bottle for *E. coli*, and 1 liter bottles for TSS

4.3.7.2 OCWD or University of California-Davis Laboratory – 1 liter bottles for *Bacteroides* analysis

4.3.7.3 Sterilized water collection bottle for fecal coliform and *E. coli* water sample collection and transfer to containers with preservative.

4.3.8 Field QA Samples

4.3.8.1 *Field Equipment Blanks* – One set of field equipment blank samples (equal volume for each constituent) is to be included for each day of field sampling. Sterile deionized water is poured through any equipment used to collect samples at the site where the field equipment blank is being collected and then into the respective sample containers for each constituent. The site selected for collection of a field equipment blank is shown in Table 7

4.3.8.2 *Field Replicates* – Field replicates will be collected at one site for every ten sites visited during one sample day. If less than 10 sites are visited in a day, then 1 field replicate is taken from one site. The site selected for collection of a field replicate is shown in Table 7. Field replicates are taken by collecting two sets of samples at the same location within five minutes of each other.

Table 7
Schedule for Collection of Field Replicate and Field Equipment Blank Water Samples

Sample Week Ending Date	Watershed-Wide	USEP
6/23/2007	Icehouse Canyon Creek	
6/30/2007	Prado Park Lake at Lake Outlet	
7/7/2007	Chino Creek at Central Avenue	Santa Ana River Reach 3 at La Cadena Drive
7/14/2007	Mill Creek at Chino-Corona Road	Box Springs Channel at Tequesquite Avenue
7/21/2007	Santa Ana River Reach 3 at Hamner Avenue	Sunnyslope Channel near confluence with SAR
7/28/2007	Santa Ana River Reach 3 at MWD Crossing	Anza Park Drain near confluence with Effluent Channel
8/4/2007	Icehouse Canyon Creek	San Sevaine Channel near confluence with SAR
8/11/2007	Prado Park Lake at Lake Outlet	
8/18/2007	Chino Creek at Central Avenue	
8/25/2007	Mill Creek at Chino-Corona Road	
9/1/2007	Santa Ana River Reach 3 at Hamner Avenue	Day Creek at Lucretia Avenue
9/8/2007	Santa Ana River Reach 3 at MWD Crossing	Temescal Wash at Lincoln Avenue
9/15/2007	Icehouse Canyon Creek	Cypress Channel at Kimball Avenue
9/22/2007	Prado Park Lake at Lake Outlet	San Antonio Channel at Riverside Drive
9/29/2007	Chino Creek at Central Avenue	Carbon Canyon Creek Channel at Pipeline Avenue
10/6/2007	Mill Creek at Chino-Corona Road	
10/13/2007	Santa Ana River Reach 3 at Hamner Avenue	
10/20/2007	Santa Ana River Reach 3 at MWD Crossing	
10/27/2007	Icehouse Canyon Creek	
11/3/2007	Prado Park Lake at Lake Outlet	
12/15/2007	Chino Creek at Central Avenue	
12/22/2007	Mill Creek at Chino-Corona Road	
12/29/2007	Santa Ana River Reach 3 at Hamner Avenue	
1/5/2007	Santa Ana River Reach 3 at MWD Crossing	
1/12/2007	Icehouse Canyon Creek	
1/19/2007	Prado Park Lake at Lake Outlet	Chris Basin Outflow (Lower Deer Creek)
1/26/2007	Chino Creek at Central Avenue	County Line Channel at Cucamonga Creek confluence
2/2/2007	Mill Creek at Chino-Corona Road	Cucamonga Creek at Hwy 60 (Above RP1)
2/9/2007	Santa Ana River Reach 3 at Hamner Avenue	Santa Ana River Reach 3 at La Cadena Drive
2/16/2007	Santa Ana River Reach 3 at MWD Crossing	Box Springs Channel at Tequesquite Avenue
2/23/2007	Icehouse Canyon Creek	Sunnyslope Channel near confluence with SAR
Storm 1	Prado Park Lake at Lake Outlet	Anza Park Drain near confluence with Effluent Channel
Storm 1 + 48hrs	Chino Creek at Central Avenue	San Sevaine Channel near confluence with SAR
Storm 1 + 72hrs	Mill Creek at Chino-Corona Road	Day Creek at Lucretia Avenue
Storm 1 + 96 hrs	Santa Ana River Reach 3 at Hamner Avenue	Temescal Wash at Lincoln Avenue

4.4 Sample Handling and Custody

Proper gloves must be worn to prevent contamination of the sample and to protect the sampler from environmental hazards (disposable polyethylene, nitrile, or non-talc latex gloves are recommended). Wear at least one layer of gloves, but two layers help protect against leaks. One layer of shoulder high gloves worn as first (inside) layer is recommended to have the best protection for the sampler. Safety precautions are needed when collecting samples, especially samples that are suspected to contain hazardous substances, bacteria, or viruses.

Properly store and preserve samples as soon as possible. Usually this is done immediately after returning from the collection by placing the containers on bagged, crushed or cube ice in an ice chest. Sufficient ice will be needed to lower the sample temperature to at least 4°C within 45 minutes after time of collection. Sample temperature will be maintained at 4°C until delivered to the appropriate laboratory. Care should be taken at all times during sample collection, handling, and transport to prevent exposure of the sample to direct sunlight.

Samples that are to be analyzed for bacteria indicators must be kept on ice or in a refrigerator and delivered to **Orange County Health Care Agency Water Quality Laboratory, (700 Shellmaker Road, Newport Beach, CA, 92660; 949-219-0423)** water quality laboratory within 6 hours. Samples analyzed for *Bacteroides* must be kept on ice or in a refrigerator and delivered to the appropriate laboratory, **Orange County Water District laboratory (10500 Ellis Avenue, Fountain Valley, CA, 92708; 714-378-3313, contact Menu Leddy)** <u>or</u> **University California Davis laboratory (University of California, Department of Civil & Environmental Engineering, One Shields Avenue, Davis, CA 95616, 3157 Engineering III; 530-754-6407, contact Dr. Stefan Wuertz)** within 24 hours of collection. A detailed sample delivery schedule is presented in Table 3 of this Monitoring Plan. Every shipment must contain a complete Chain of Custody (COC) Form (see Attachment D) that lists all samples taken and the analyses to be performed on these samples. COCs must be completed every time samples are transported to a laboratory. Include any special instructions to the laboratory. The original COC sheet (not the copies) is included with the shipment (insert into zip lock bag); one copy goes to the sampling coordinator; and the sampling crew keeps one copy. Samples collected should have the depth of collection and date/time collected on every COC.

Due to increased shipping restrictions, samples being sent via a freight carrier require additional packing. Although care is taken in sealing the ice chest, leaks can and do occur. Samples and ice should be placed inside a large plastic bag inside the ice chest for shipping. The bag can be sealed by simply twisting the bag closed (while removing excess air) and taping the tail down. Prior to shipping the drain plug of the ice chests have to be taped shut. Leaking ice chests can cause samples to be returned or arrive at the laboratory beyond the required holding time. Although glass containers are acceptable for sample collection, bubble wrap must be used when shipping glass.

4.5 Field Measurements

After collecting the water samples, record the water temperature, pH, conductivity, turbidity, and dissolved oxygen concentration. These parameters as well as other field data are measured and recorded using a YSI or equivalent probe. When field measurements are made with a multi-parameter instrument, it is preferable to place the sonde in the body of water to be sampled and allow it to equilibrate in the dissolved oxygen mode while water samples are collected. Field measurements are made at the centroid of flow, if the stream visually appears to be completely mixed from shore to shore. For routine field measurements, the date, time and depth are reported as a grab. To provide QA/QC of field instruments and sampling personnel, three replicates of each field measurement will be collected at 10 percent of the sites for each sampling event (one site per day of sampling). The site for replication of field measurements will be selected randomly for each day of sampling. Below is a brief discussion of each recorded field measurement (California SWAMP Procedures for Conducting Routine Field Measurements):

4.5.1 Dissolved Oxygen - Calibrate the dissolved oxygen sensor on the multi-probe instrument at the beginning of each day of field measurements. Preferably, dissolved oxygen is measured directly in-stream close to the flow centroid. The dissolved oxygen probe must equilibrate for at least 90 seconds before dissolved oxygen is recorded to the nearest 0.1 mg/L. Since dissolved oxygen takes the longest to stabilize, record this parameter after temperature, conductivity, and pH.

4.5.2 pH - If the pH meter value does not stabilize in several minutes, out-gassing of carbon dioxide or hydrogen sulfide or the settling of charged clay particles may be occurring. If out-gassing is suspected as the cause of meter drift, collect a fresh sample, immerse the pH probe and read pH at one minute. If suspended clay particles are the suspected cause of meter drift, allow the sample to settle for 10 minutes, and then read the pH in the upper layer of sample without agitating the sample. With care, pH measurements should be accurately measured to the nearest 0.1 pH unit

4.5.3 Conductivity - Preferably, specific conductance is measured directly in-stream close to the flow centroid. Allow the conductivity probe to equilibrate for at least one minute before specific conductance is recorded to three significant figures (if the value exceeds 100 mS/cm). The primary physical problem in using a specific conductance meter is entrapment of air in the conductivity probe chambers. The presence of air in the probe is indicated by unstable specific conductance values fluctuating up to ±100 mS/cm. The entrainment of air can be minimized by slowly, carefully placing the probe into the water; and when the probe is completely submerged, quickly move it through the water to release any air bubbles.

4.5.4 Temperature is measured directly in-stream close to the flow centroid. Measure temperature directly from the stream by immersing a YSI instrument.

4.5.5 Measure turbidity by collecting a sample close to the stream centroid to be used in a Hach Portable Turbidity Meter. The glass sample container must be wiped with a soft cloth before placing into the turbidity meter for analysis. Be careful not to scratch the glass sample container as this will impact the turbidity meters accuracy.

4.6 Instantaneous Flow Monitoring

Flow measurements will be recorded by field personnel for every site visit during the period of the Grant Project. A depth-discharge rating curve can be developed by conducting multiple flow measurements at water depths in 0.1 ft increments. Once developed, only depth measurements would be required during site visits, assuming the depth of flow is within 0.1 ft of a previously completed flow measurement.

4.6.1 Volumetric Flow Estimate

Where possible, a volumetric flow measurement approach will be used. This method shall not be used if conditions are determined to be unsafe by an on-site assessment by the field team leader. A volumetric flow measurement entails estimation of the time in seconds (t) required to fill a 5 gallon bucket with concentrated runoff. Sites with low flow and a free outfall would allow for this type of flow measurement. The following equation would then give the flow rate for a test with one 5-gallon bucket of volume captured, Q (cfs) = 0.67 * t. If there are multiple points where runoff is concentrated, then volumetric measurements can be made at each point along the stream and summed to provide total discharge.

4.6.2 Cross-Section Velocity Profile Flow Measurement

The following steps guide the development of a velocity profile for a streamflow cross section. This approach will require that the field personnel be equipped with a Marsh-McBirney Electronic meter or equivalent, top-setting wading rod (preferably measured in tenths of feet) (Figure 6), and a tape measure. This method shall not be used if conditions for wading are determined to be unsafe by an on-site assessment by the field team leader.

4.6.2.1 Stretch the measuring tape across the stream at right angles to the direction of flow. When using an electronic flow meter, the tape does not have to be exactly perpendicular to the bank (direction of flow). Avoid measuring flow in areas with back eddies. The first choice would be to select a site with no back eddy development.

However, this cannot be avoided in certain situations. Measure the negative flows in the areas with back eddies.

4.6.2.2 Record the following information on the flow measurement form (Attachment E):

4.6.2.2.1 Site Location and Site ID

4.6.2.2.2 Date

4.6.2.2.3 Time measurement is initiated and ended

4.6.2.2.4 Name of person(s) measuring flow

4.6.2.2.5 Note if measurements are in feet or meters

4.6.2.2.6 Total stream width and width of each measurement section

4.6.2.2.7 For each measurement section, record the mid-point, section depth, and flow velocity

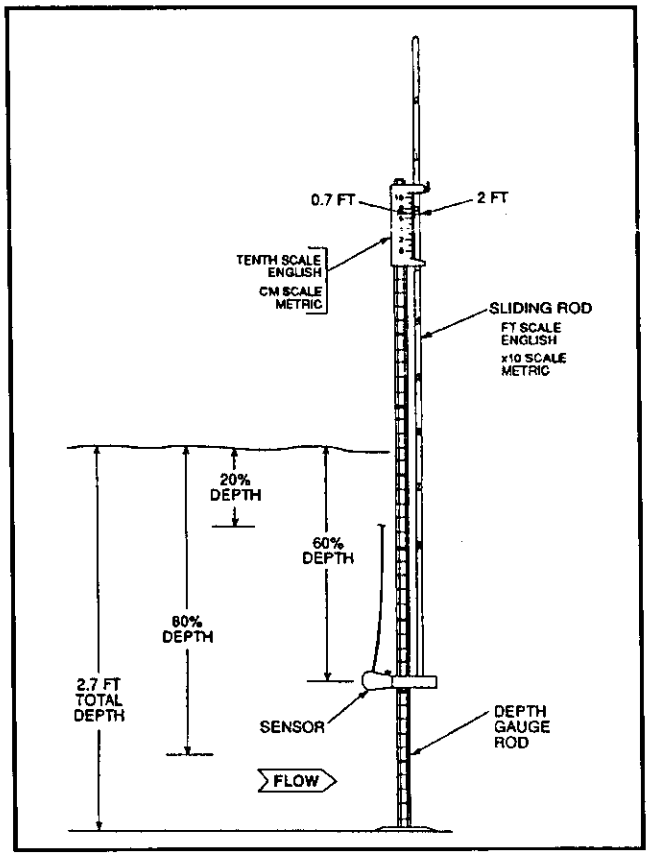


Figure 6
Top-Setting Wading Rod
Source: California's SWAMP Quality Assurance Project Plan, Appendix E, December 2002

4.6.2.3 Determine the spacing and location of flow measurement sections. Measurements will be taken at the midpoint of each of the flow measurement sections. Flow measurements will be taken at the following locations, as shown in Figure 7.

4.6.2.3.1 A point from the left bank representing 10% of the total width. This measurement will provide a velocity estimate for the section representing 0 % - 20% of the total width from the left bank;

4.6.2.3.2 A point from the left bank representing 50% of the total width. This measurement will provide a velocity estimate for the section representing 20 % - 80% of the total width from the left bank;

4.6.2.3.3 A point from the left bank representing 90% of the total width. This measurement will provide a velocity estimate for the section representing 80 % - 100% of the total width from the left bank;

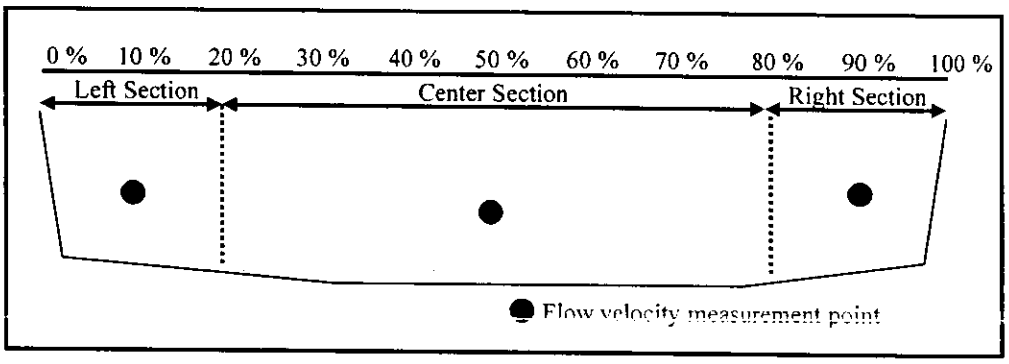


Figure 7
Approach Used in Cross Section Velocity Profile Flow Measurements

4.6.2.4 Place the top setting wading rod at each flow measurement point.

4.6.2.5 Using a tape measure, measure the depth of water to the nearest ½ inch.

4.6.2.6 Adjust the position of the sensor to the correct depth at each flow measurement point. The purpose of the top setting wading rod is to allow the user to easily set the sensor at 20%, 60%, and 80% of the total depth. On the wading rod, each single mark represents 0.10 foot, each double mark represents 0.50 foot, and each triple mark represents 1.00 foot (Figure 6). Position the meter at 60% of the total depth from the water surface (if depth of flow is greater than 2.5ft, then take two readings, at 20% and 80% of total depth).

4.6.2.7 Measure and record the velocity and depth. The wading rod is kept vertical and the flow sensor kept perpendicular to the cross section. Permit the meter to adjust to the current for a few seconds. Measure the velocity for a minimum of 20 seconds with the Marsh-McBirney meter. When measuring the flow by wading, stand in the position that least affects the velocity of the water passing the current meter. The person wading stands a minimum of 1.5 feet downstream and off to the side of the flow sensor.

4.6.2.8 Report flow values less than 10 ft^3/s to two significant figures. Report flow values greater than 10 ft^3/s to the nearest whole number, but no more than three significant figures.

4.6.2.9 Calculate flow by multiplying the width x depth (ft^2) to derive the area of each of the three flow measurement sections. The area of the section is then multiplied by the velocity (ft/s) to calculate the flow in cubic feet per second (cfs or ft^3/sec) for each flow measurement section. Do not treat cross sections with negative flow values as zero. Negative values obtained from areas with back eddies should be subtracted during the summation of the flow for a site. When flow is calculated for all of the measurement sections, they are added together for the total stream flow.

4.6.3 Visual Flow Estimate

Flow estimate data may be recorded for a non-tidally influenced stream when it is not possible to measure flows by the volumetric or cross section velocity profile methods described above either because flows are too high or so shallow that obtaining a velocity measurement is difficult or impossible. Visual flow estimates are subjective measures based on field personnel's experience and ability to estimate distances, depths, and velocities.

4.6.3.1 Observe the stream and choose a reach of the stream where it is possible to estimate the stream cross section and velocity. Estimate stream width (feet) at that reach and record.

4.6.3.2 Estimate average stream depth (feet) at that reach and record.

4.6.3.3 Estimate stream velocity (ft/s) at that reach and record. A good way to do this is to time the travel of a piece of floating debris. This can be done by selecting points of reference along the stream channel which can be used as upper and lower boundaries for an area of measurement. After establishing the boundaries, measure the length of the flow reach. One person stands at the upper end of the reach and drops a floating object and says "start." A second person stands at the lower end of the reach and times the number of seconds for the floating object to float the reach.

This measurement is conducted three times and the three results are averaged. The velocity is the length of the reach in feet divided by the average time in seconds.

4.6.3.4 If doing this method from a bridge (for example, because flows are too high to be in the channel), measure the width of the bridge. Have one person drop a floating object (something that can be distinguished from other floating material) at the upstream side of the bridge and say "start". The person on the downstream side of the bridge will stop the clock when the floating object reaches the downstream side of the bridge. Divide the bridge width by the number of seconds to calculate the velocity. The velocity should be measured at multiple locations along the bridge at least three times. These velocities are averaged.

4.6.3.5 Multiply stream width (feet) by average stream depth (feet) to determine the cross sectional area (ft^2) which when multiplied by the stream velocity (ft/s) and a correction constant, gives an estimated flow (ft^3/s).

4.7 Personnel and Training

Prior to the start of sampling, a day of training will be held to instruct the sampling team on appropriate sample collection methods. All field sampling teams will attend this training.

Water quality samples for the Watershed-Wide Monitoring Program will be collected by **San Bernardino County Flood Control District staff (Contact: Janet Dietzman, 825 East Third Street, San Bernardino, Ca 92415 Phone 909-387-8109)**. One team of two will collect water samples from the six sites over the course of two days. Preferably, the same sites will be visited on the same day of the week.

Water quality samples for the USEP will be collected by **Brown and Caldwell (Contact: Nancy Gardiner, 9665 Chesapeake Drive, Suite 201, San Diego, CA 92123 Phone 858-571-6742)**. For fixed schedule samples during the dry and wet seasons, one team of two will collect water samples from the thirteen sites over the course of two days. Preferably, the same sites will be visited on the same day of the week. For the flexible samples intended for wet weather monitoring, two teams of two will collect wet-weather grab samples from the thirteen sites during the storm event and at 48, 72, and 96 hours following the event.

The selected laboratories for water quality analyses have the appropriate qualifications for bacteria indicators and other constituents to be measured. For this project water samples will be analyzed for TSS, fecal coliform and E. coli by **Orange County Health Care Agency Water Quality Laboratory, (Contact: Martin Getrich, 700 Shellmaker Road, Newport Beach, CA, 92660; 949-219-0423)**. Specialized analyses required for Bacteroides analysis will be conducted jointly by **OWCD (Contact: Menu Leddy, 10,500 Ellis Avenue, Fountain Valley, CA 92708 Phone 714-**

378-3200) and University of California-Davis (Contact: Alexander Schriewer, UC Davis Department of Civil & Environmental Engineering, One Shields Avenue, Davis, CA 95616) laboratories. Samples will be submitted to laboratories for processing within the maximum holding times.

All personnel that will be involved in the implementation of this Monitoring Plan, including the primary contacts for each entity are presented in Table 8.

4.8 Water Quality Analysis

Standard operating procedures for the analysis of water quality samples are provided in the Quality Assurance Protection Plan (QAPP).

Table 8
Key Personnel for Pathogen TMDL Monitoring Project

Title	Name (Affiliation)	Tel. No.
Regional Board Contract Manager	William Rice (Regional Board)	951-782-4130
Regional Board QA Officer	Pavlova Vitale (Regional Board)	951-782-4130
Grantee Project Director	Mark Norton (SAWPA)	951-354-4220
Grantee Project Manager	Rick Whetsel (SAWPA)	951-354-4220
Grantee Database Manager	Dean Unger (SAWPA)	952-354-4224
Contractor Strategic Planner	Tim Moore (Risk Sciences)	615-370-1655
Contractor Project Manager	Richard Meyerhoff (CDM)	303-298-1311
Contractor QA Officer	Barbara Wells (CDM)	760-438-7755
Contractor Project Scientist	Steven Wolosoff (CDM)	909-579-3500
Contractor Project Scientist	Thomas Lo (CDM)	909-579-3500
Monitoring Contractor 1 Project Manager	Matt Yeager (SBCFCD)	909-387-8109
Monitoring Contractor 1 QA Officer	Janet Dietzman (SBCFCD)	909-387-8109
Monitoring Contractor 2 Project Manager	Chris Knoche (B&C)	714-689-4836
Monitoring Contractor 2 QA Officer	Nancy Gardiner (B&C)	858-571-6742
Water Quality Laboratory 1 Project Director	Douglas Moore (OC Health Care WQ Lab)	949-219-0423
Water Quality Laboratory 1 QA Officer	Joseph Guzman (OC Health Care WQ Lab)	949-219-0423
Water Quality Laboratory 2 Project Director	Donald Phipps (OCWD)	714-378-3200
Water Quality Laboratory 2 QA Officer	Menu Leddy (OCWD)	714-378-3200
Water Quality Laboratory 3 Project Director	Dr. Stefan Wuertz (UC Davis)	530-754-6407
Water Quality Laboratory 3 QA Officer	Alexander Schriewer (UC Davis)	530-752-1755

Section 5
Data Management and Reporting

5.1 Documents and Records

All laboratory and field data submitted to SAWPA will follow the guidelines and formats established by California Surface Water Ambient Monitoring Program (SWAMP) (http://www.waterboards.ca.gov/swamp/qapp.html). The CDM Project Manager will maintain a record of all field analyses and samples collected. All samples delivered to contract laboratories for analysis will include completed Field Chain of Custody forms (Attachment D). All contracted laboratories will generate records for sample receipt and storage, analyses, and reporting.

Copies of Chain of Custodies (Attachment D) and original Field Data Sheets (Attachment C) and flow measurement forms (Attachment E) for sites where a velocity cross section profile method was used to measure flow will be sent to the CDM QA Officer at the beginning of each month (9220 Cleveland Ave., Suite 100, Rancho Cucamonga, CA 91730, Phone: 909-579-3500, Fax: 909-980-5185).

All chemical monitoring records generated by these monitoring programs will be stored at CDM and SAWPA. Each of the contract laboratory records pertinent to the program will be maintained at the each of the contract laboratory main offices. Copies of all records held by the contract laboratories will be provided to CDM and SAWPA and stored in the SAWPA archives.

Copies of this Monitoring Plan and corresponding Quality Assurance Protection Plan (QAPP) will be distributed to all parties involved with the project. Copies will be sent to each Contract Laboratory QA Officer for distribution to appropriate laboratory staff. Any future amended Monitoring Plans and/or QAPPs will be held and distributed in the same fashion.

Reports generated as part of the QA/QC protocols for assessment of compliance with procedures outlined in the QAPP will be provided to SAWPA and stored in the SAWPA archives. This includes internal quarterly QA/QC updates and final QA/QC reports from each laboratory, and the QA/QC report(s) generated by the CDM QA Officer based on annual reviews of field sampling teams, and the SAWPA Database Manager's technical audit of database management procedures. Oversight and assessment procedures are described in more detail in Section 20 of the QAPP.

5.2 Database Management

A MSAR Pathogen TMDL project database (as part of the Santa Ana Watershed Data Management System [SAWDMS]) will be maintained by the SAWPA under the direction of the SAWPA Database Manager. SAWDMS is a watershed-wide database management system, which is linked to SAWPA's geographic information system (GIS). The system establishes a foundation for the standardization of data collected from various watershed stakeholders, creates a platform for Internet access to

watershed data by appropriate entities, and provides a tool to manage water quality activities in the watershed.

All laboratory and field measurement data submitted to SAWPA for inclusion in the project database will follow the guidelines and formats established by SWAMP (http://www.waterboards.ca.gov/swamp/qapp.html). The laboratories will be required to provide data in both hard copy and electronic formats to CDM and SAWPA. The electronic form of submittals will be provided to the laboratories to ensure that the files can be imported into the project database with minimal editing. Data transmitted to SAWPA in a standard electronic format and uploaded to the database through batch set electronic means. The SAWPA Database Manager will periodically check the inventory of sampling activities against the results in the SAWDMS.

Prior to upload, a QA/QC review will be conducted by the SAWPA Database Manager to check new data against existing data in the database for completeness, validity of analytical methods, validity of sample locations, and validity of sample dates. The QA/QC will involve using automated data checking tools, which assess that new data to be uploaded follow specified rules, including issues such as alpha-numeric formatting, units of measurement, missing information, and others. The sample location information will be checked to ensure that sites are correctly referenced and that identifiers and descriptions match corresponding records from the existing database. Data not passing this QA/QC review will be returned to the originating laboratory or generator for clarification and or correction. When all data within a batch set have passed QA/QC requirements, the data will be uploaded to the database. A unique batch number, date loaded, originating laboratory, and the person who loaded the data will be recorded in the database, so that data can be identified and removed in the future if necessary.

The project database is backed up using built-in software backup procedures. In addition, all data files will be backed up on tape on a weekly basis as part of SAWPA's SOP for disaster recovery. Back up tapes are kept for a minimum of four weeks before they are written over. Tapes are rotated off-site for separate storage on a monthly (or more frequent) basis, in accordance with SAWPA Information Systems SOPs. Each back up session validates whether the files on tape are accurate copies of the original. SAWPA also maintains an access log showing who accessed the database, when, and what was done during the session. All changes to the database are stored in a transaction database with the possibility of rollback, if necessary.

Data will be stored on a Windows 2003 Server with a 2 GHz + CPU and 2Gb RAM with a fail safe RAID 5 configuration. The server checks for operating system updates daily and downloads and installs patches and service packs as necessary. The current server is two years old, and as per SAWPA policy, will be replaced after a maximum of 4 years of service. The server is also protected with Norton Anti-Virus software which is updated daily. The database software is Microsoft SQL Server 2000 standard

edition with Service Pack 4. The database administrator checks the Microsoft Website for new patches and service packs on a monthly basis and installs updates as necessary. The general policy for updating operating system and database software is to evaluate the software on a test machine after a new version has been out for approximately 1 year. The new version is then installed at the discretion of the network or database administrator.

The database will be operated with a transaction log recording all changes with ability to roll back if necessary. Full database backups will occur on a weekly basis and immediately before batch uploads. It is expected TMDL data will be loaded quarterly to twice per year. At the time when data is uploaded, the SAWPA Database Manager will check that the inventory of monitoring activities adequately matches with the number and type of records in the database.

Data will be exported from SAWDMS into the SWAMP format using a pre-made query that will map data fields from SAWDMS to the SWAMP template. The exported data will then be sent to the SWRCB IM Coordinator for processing into the SWAMP database. The data will be retrieved for analysis and report writing by exporting from SAWDMS using pre-made queries.

5.3 Data Analysis

Basic descriptive statistics will be developed based on results on water quality analyses and presented to the Workgroup by CDM during progress updates, when appropriate. Also, the data analysis report will present descriptive statistics based on all data collected during the Grant Project period. CDM will use Microsoft Excel to conduct all data analyses. Rolling geometric means will be computed for bacteria indicator concentrations and plotted in the data analysis report. Geometric means will be used to assess frequency of compliance with numeric targets in the TMDL.

In addition, a qualitative analysis of trends will be conducted. This analysis will use a variety of plotting techniques to assess the relationship between bacteria indicator concentrations or relative abundance of different source organisms to factors including but not limited to season, weather conditions, POTW effluent influences, land use within drainage area, and both structural and non-structural stormwater controls.

5.4 Project Reporting

CDM will be share data and preliminary analyses with the MSAR Pathogen TMDL Workgroup, including the RWQCB, in the form of oral presentations with supporting slides at regularly scheduled Taskforce meetings, when appropriate and in quarterly progress reports.

All contract laboratories will prepare a QA/QC report, which summarizes the Projects overall adherence to established analytical SOPs.

Following the completion of water quality monitoring under the Grant Project in March 2008, CDM will prepare a draft data analysis report. This report will include a summary of each laboratory specific QA/QC reports. The Workgroup will review this report and provide comments to CDM. CDM will then provide a final data analysis report. Table 9 summarizes reporting that will be conducted during the Project.

Table 9
Summary of Project Reporting

Report	Reporter	Type	Report Date
Interim Progress Update	CDM	Oral Presentations	Workgroup Meetings
Interim Progress Report	CDM	Report	Quarterly
QA/QC Updates	OC Health Care WQ Lab	E-mail status update	Quarterly
QA/QC Final Report	OC Health Care WQ Lab	Report	April 4, 2008
QA/QC Updates	OCWD Water Quality Laboratory	E-mail status update	Quarterly
QA/QC Final Report	OCWD Water Quality Laboratory	Report	April 4, 2008
QA/QC Updates	UC Davis Water Quality Laboratory	E-mail status update	Quarterly
QA/QC Final Report	UC Davis Water Quality Laboratory	Report	April 4, 2008
Field Sampling Review	CDM QA Officer	Report	April 18, 2008
Internal Technical Audit of Database Management	SAWPA Database Manager	Report	April 18, 2008
Draft Data Analysis Report	CDM	Draft Document	May 2, 2008
Review of Draft Data Analysis Report	MSAR Pathogen TMDL Workgroup	Comments	May 15, 2008
Final Data Analysis Report	CDM	Final Document	May 30, 2008

Section 6
References

APHA, 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. American Public Health Association, Washington DC.

Puckett, M. 2002. Quality Assurance Management Plan for the State of California's Surface Water Ambient Monitoring Program ("SWAMP"). California Department of Fish and Game, Monterey, CA. Prepared for the State Water Resources Control Board, Sacramento, CA. 145 pages plus Appendices.

Santa Ana Regional Water Quality Control Board, 2005. Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate Bacterial Indicator Total Maximum Daily Loads (TMDLs) for Middle Santa Ana River Watershed Waterbodies, Resolution No. R8-2005-0001, Adopted May 15, 2005.

Santa Ana Regional Water Quality Control Board, 1995. Water Quality Control Plan. Resolution No. 94-60.

US EPA, 1986. Ambient Water Quality Criteria for Bacteria. Office of Water Regulations and Standards, Criteria and Standards Division, EPA 440/5-84-002, January.

US EPA, 1997. Volunteer Stream Monitoring: A Methods Manual. Office of Water, EPA 841-B-97-003, 1997.

Attachment A

Site Photographs and Field Description for the Watershed-Wide Monitoring Sites

Attachment A

Santa Ana River at MWD Crossing

Sample Location:
Sampling for this site will be conducted on the south side of the SAR, east of the MWD aqueduct crossing.

Site Access:
This site is accessed via the City of Riverside Wastewater Treatment Plant, located at 5950 Acorn Street, in the City of Riverside. With prior coordination with the Plant Senior Operator, sampling teams can access the "De Anza Gate" located within the plant. This gate exits to a bike trail that parallels the SAR for about 1/4 mile west to the MWD aqueduct. Park on the left side of the bike path between the Santa Ana River and the bike path and follow the sandy path to the southern bank of the Santa Ana River.

A secondary access location would be to park at the end of Wilderness Avenue, north from Jurupa Ave and walk for about ¼ mile past the MWD gate and proceed toward the Santa Ana River. This access approach will be used when the Plant Operators are unable to meet.

Looking north from under MWD aqueduct crossing to Santa Ana River

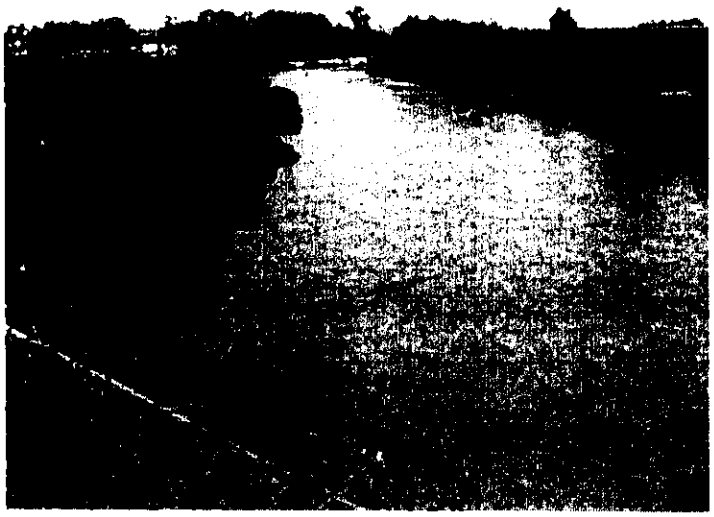
Attachment A

Attachment A

Santa Ana River at Hamner

Sample Location:
Sampling at this site will be conducted on the upstream side of Hamner Avenue, on the south side of the Santa Ana River.

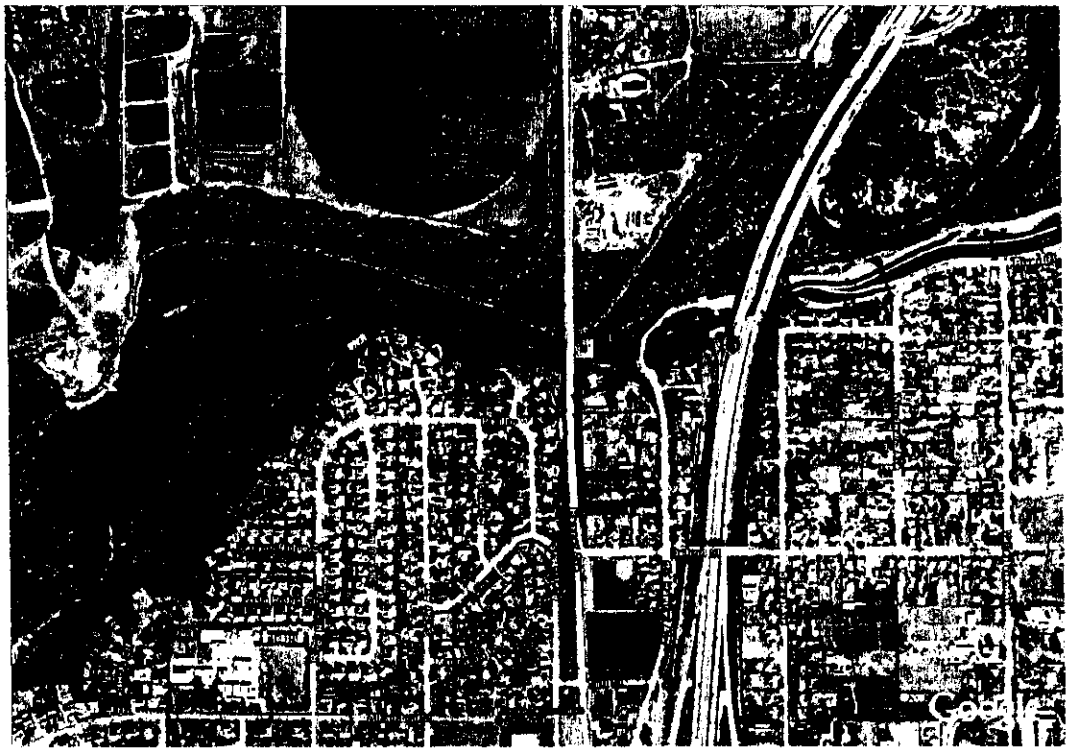
Site Access:
Park at the horse stable on Hamner Avenue north of the Santa Ana River and walk across the Hamner Avenue Bridge using the pedestrian sidewalk. Proceed down the hill side along the bridge abutment and collect samples with a sampling pole by standing along the Santa Ana River on the shoreline concrete blocks (bottom picture).



Santa Ana River looking upstream from Hamner Avenue Bridge

Looking at south shore of Santa Ana River from Hamner Avenue Bridge; Collect samples by standing on concrete blocks along shoreline

Attachment A

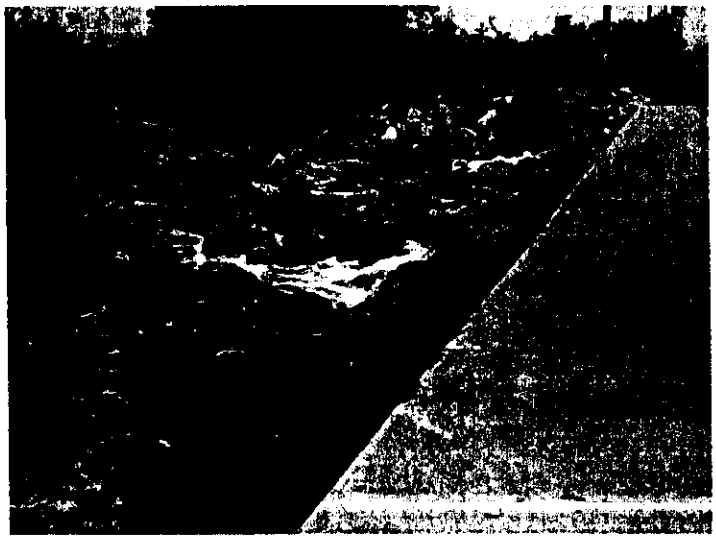


Attachment A

Mill Creek at Chino Corona Road

Sample Location:
Sampling at this site will be conducted at the upstream side of Mill Creek and Chino Corona Road.

Site Access:
Park on the shoulder area on the downstream side of Chino Corona Road and during dry weather conditions, walk to the upstream side of the road. Samples can be collected by standing on the roadway using a sterilized sampling pole.



Mill Creek looking downstream from Chino Corona Road

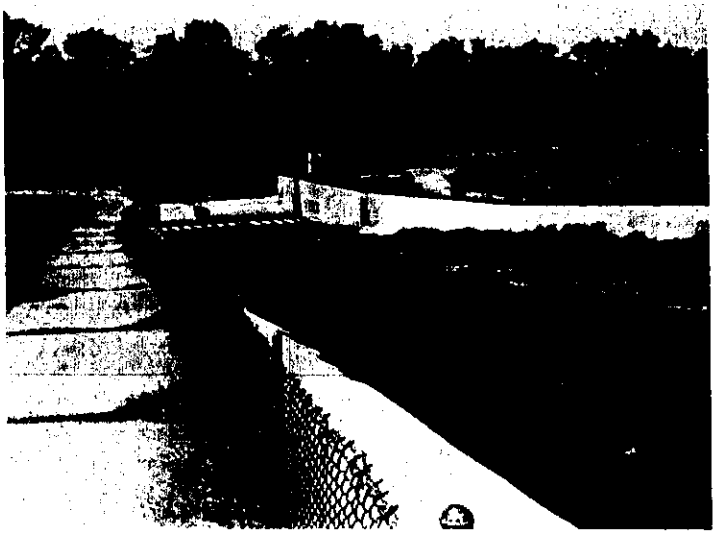
Attachment A

Attachment A

Prado Park Lake Outlet

Sample Location:
Sampling will be conducted at the outlet of Prado Park Lake.

Site Access:
Enter the Prado Regional Park entrance (inform the gate operator that you are working on the Middle Santa Ana River TMDL Implementation Project to avoid paying the fee) and proceed along the roadway driving eastward around the lake until you reach the southeastern end of the lake. Drive along a maintenance road until you reach the spillway. Proceed to the sampling area located at the lake outlet area.



Looking downstream from Prado Park Lake outflow channel

Outlet Structure from Prado Park Lake spillway; collect sample downstream from berm

Attachment A

Attachment A

Chino Creek at Central Avenue

Sample Location:
Sampling at this site will be conducted in the creek on the upstream side of the Central Avenue Bridge.

Site Access:
Park in the commercial parking lot (Coldwell Banker) on Central Avenue north of Chino Creek and walk south on Central Ave along guardrail and enter Chino Creek via rocks that line the creek side slopes. Collect sample by standing on the rocks and using a sampling pole.

Attachment A

Attachment A

Icehouse Canyon

Sample Location:
Sampling at this site will be conducted in the creek, 100 feet upstream from the Icehouse Canyon trailhead parking lot.

Site Access:
Park in the Icehouse Canyon trailhead parking lot off Mountain Baldy Road and walk up hiking trail 100 feet to sample location.

Attachment B
Site Photographs and Field Description for the USEP Monitoring Sites

Attachment B

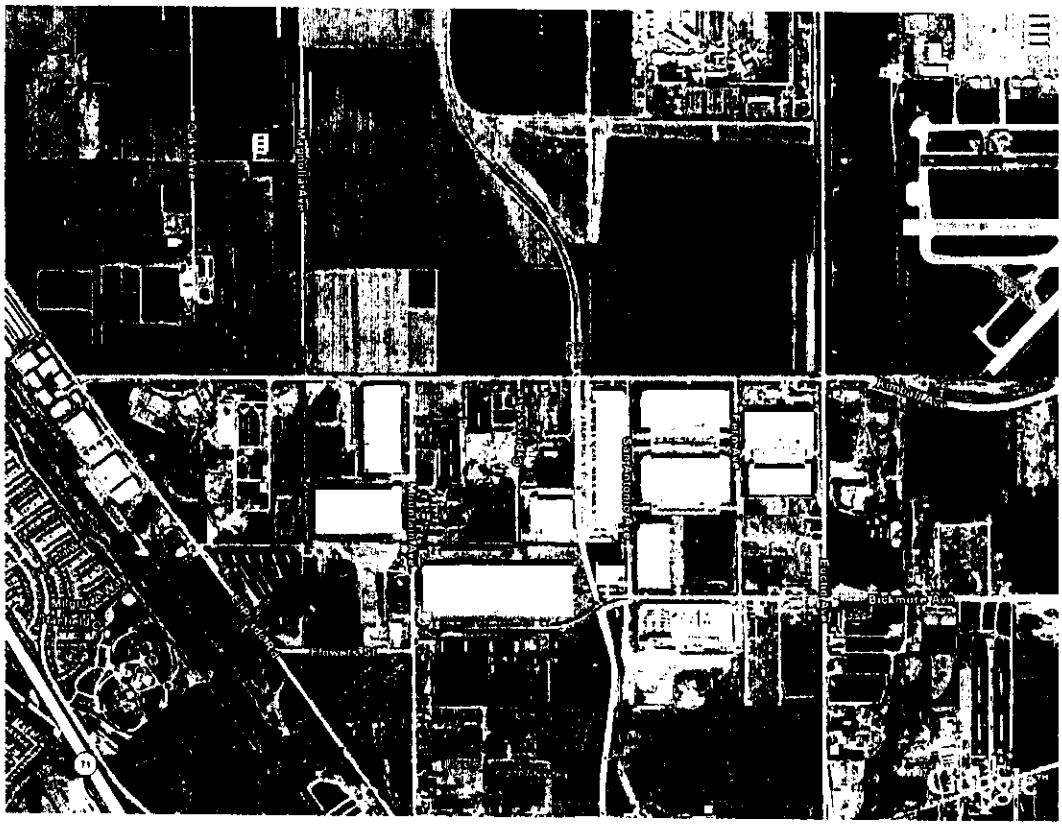
Cypress Channel

Sample Location:
Monitoring on Cypress Channel will be conducted on the upstream side of the Kimball Avenue road crossing. The best location for collection of water samples and flow measurements is approximately 150 feet north of the road crossing. This segment of Cypress Channel is unlined and there is a sufficient depth of flow during dry weather to collect a sample. Collection of a cross section velocity profile for measurement of flow is feasible at this location.

Site Access:
This site is accessed by parking on the Cypress Channel SBCFCD access road on the north side of Kimball Avenue across from the Inland Empire Utilities Agency offices. There is no fencing or access gate at this location.

Cypress Channel looking upstream from Kimball Avenue

Attachment B

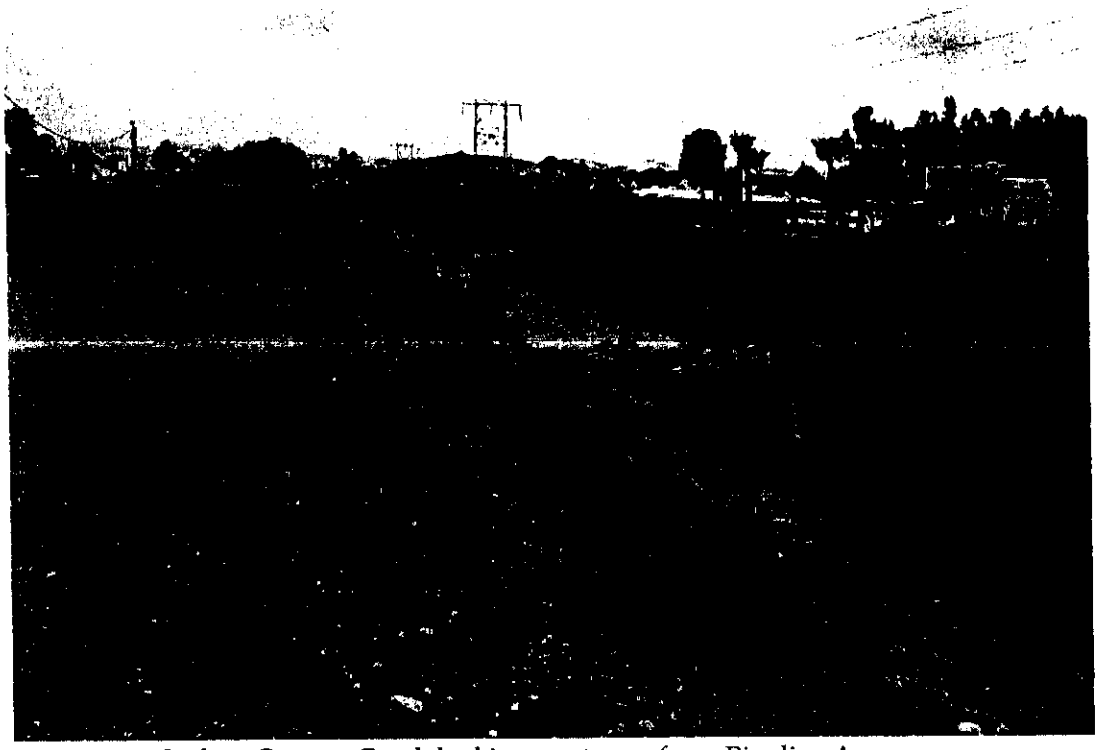


Attachment B

Carbon Canyon Creek

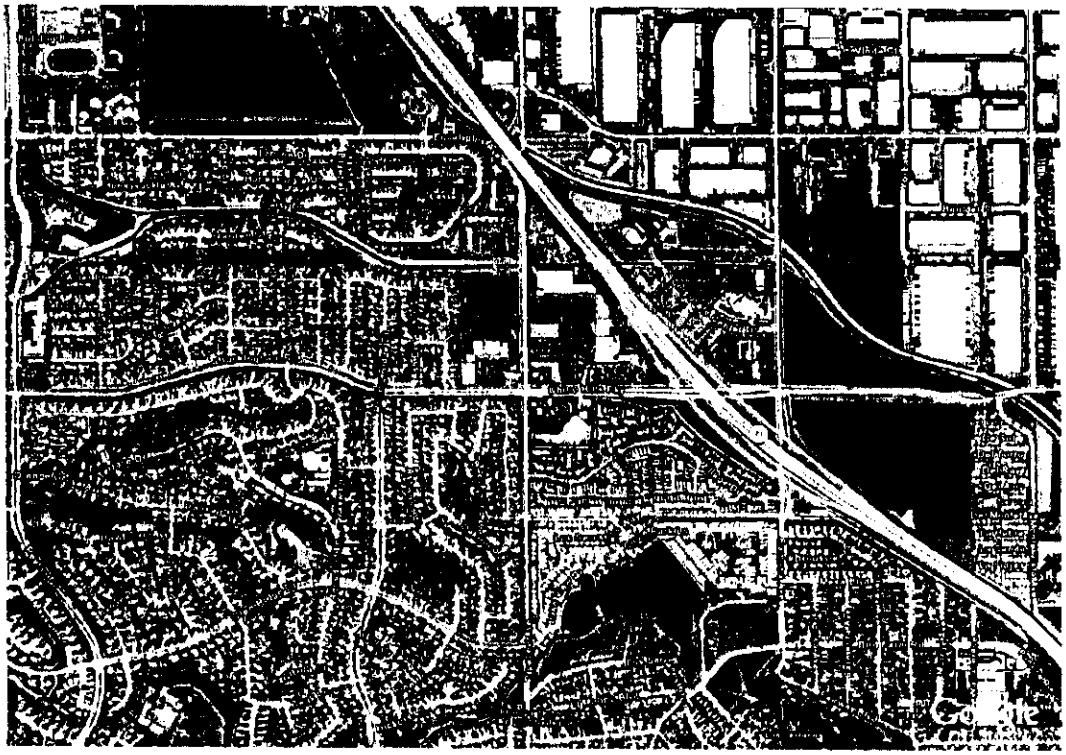
Sample Location:
Monitoring on Carbon Canyon Creek will be conducted on the upstream side of the Pipeline Avenue road crossing. The best location for collection of water samples and flow measurements is approximately 200 feet west of the road crossing. This segment of Carbon Canyon Creek is unlined and there is a sufficient depth of flow during dry weather to collect a sample. Collection of a cross section velocity profile for measurement of flow is feasible at this location.

Site Access:
This site is accessed by parking on the Carbon Canyon Creek SBCFCD access road on the westside of Pipeline Avenue. There is an access gate at this location that can be opened using the SBCFCD master key.



Carbon Canyon Creek looking upstream from Pipeline Avenue

Attachment B



Attachment B

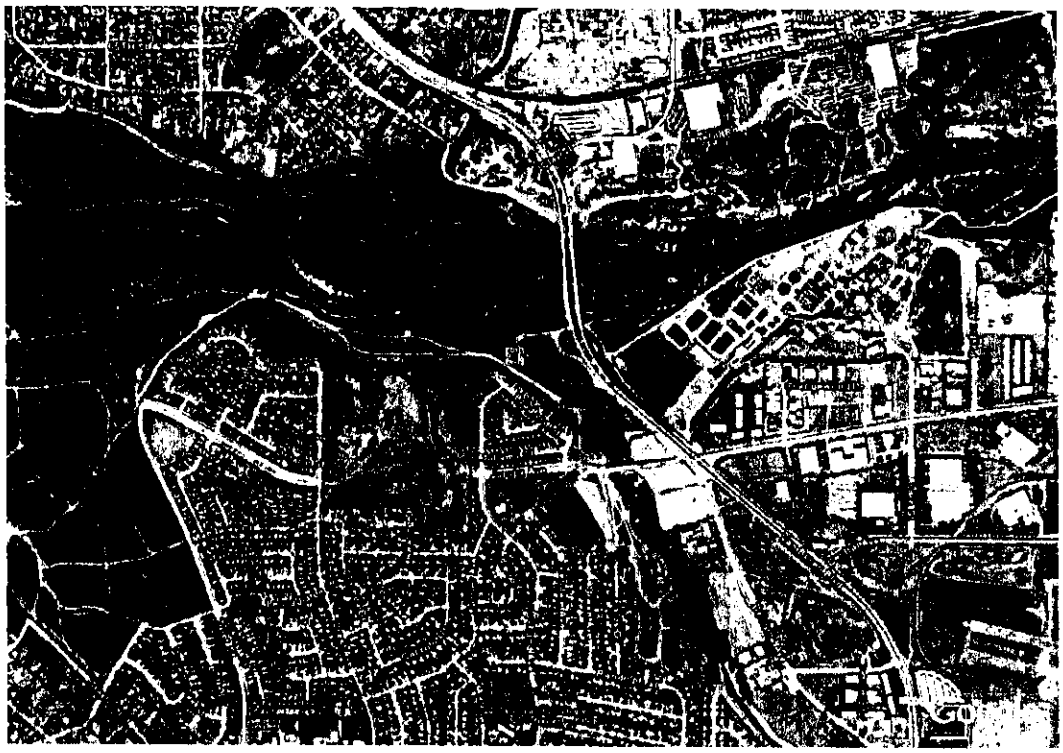
Anza Drain

Sample Location:
Monitoring of the Anza Drain will be conducted downstream of the Hole Lake outflow and upstream of the confluence with the City of Riverside WWTP effluent channel. The best location for collection of water samples and flow measurements is approximately 100 feet upstream (southeast) of the confluence. This segment of the Anza Drain is unlined and there is a sufficient depth of flow during dry weather to collect a sample. Collection of a cross section velocity profile for measurement of flow is feasible at this location.

Site Access:
This site is accessed by driving northbound on Van Buren Boulevard. Before crossing over the Santa Ana River, park on the right hand shoulder just before the regional bicycle path bridge crossing. Walk down to the bicycle path and follow it under the Van Buren Boulevard Bridge. Once under the bridge, walk southwest approximately 300 feet across the large open field to access the stream. The monitoring location is 100 feet upstream of the confluence with the City of Riverside WWTP effluent channel. This confluence is at the northwest corner of the open field. There is no fencing or access gate at this location.

Anza Drain looking downstream toward confluence with City of Riverside WWTP effluent channel

Attachment B

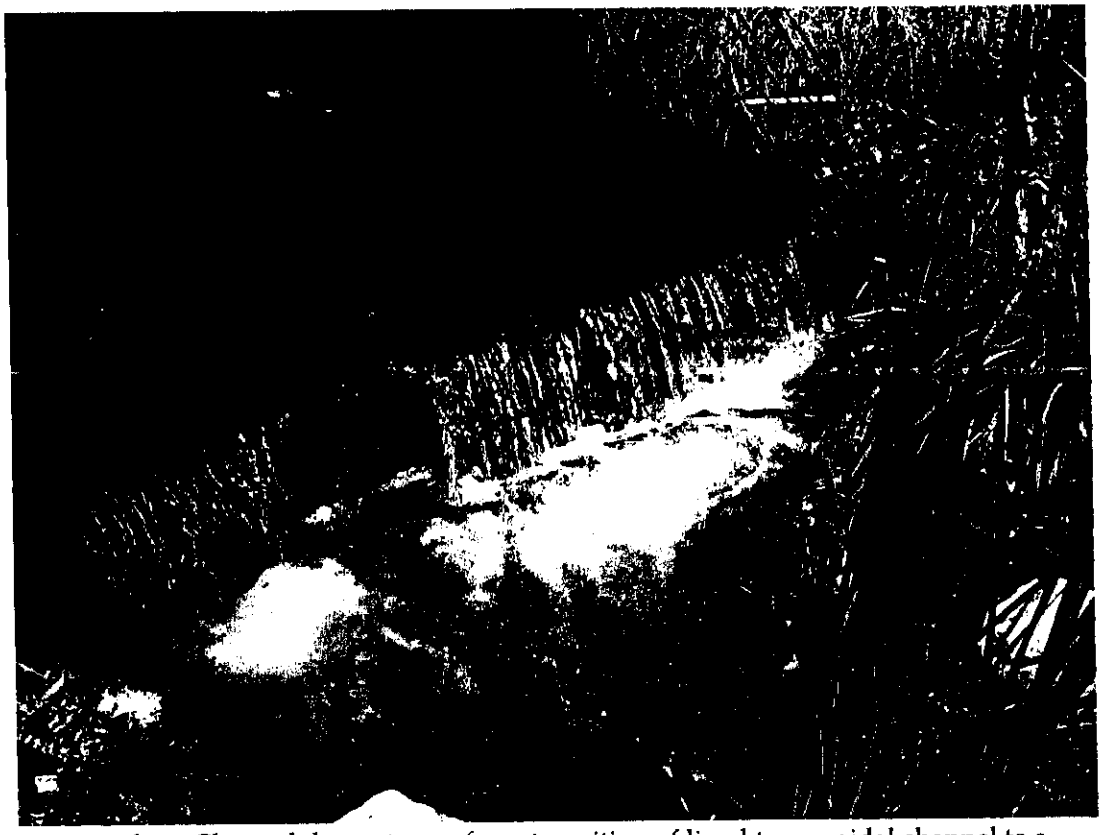


Attachment B

Sunnyslope Channel

Sample Location:
Monitoring on Sunnyslope Channel will be conducted upstream of a small broad crested weir located about 100 feet downstream of the transition from a lined concrete trapezoidal channel to a channel with natural banks and substrate. While samples are collected upstream of the weir, flow can be measured using volumetric methods due to the free outfall over the weir control structure during dry weather conditions. During wet-weather, a cross section velocity profile approach upstream of the weir will be conducted if conditions are safe.

Site Access:
This site is accessed by the RCDFD access road on the west side of Sunnyslope Channel at the junction of Rio Rd and Calle Hermosa. There is an access gate at this intersection. Continue along the west side of the concrete lined trapezoidal channel, through a second set of gates to the end of the lined section.



Sunnyslope Channel downstream from transition of lined trapezoidal channel to a channel with natural banks and substrate

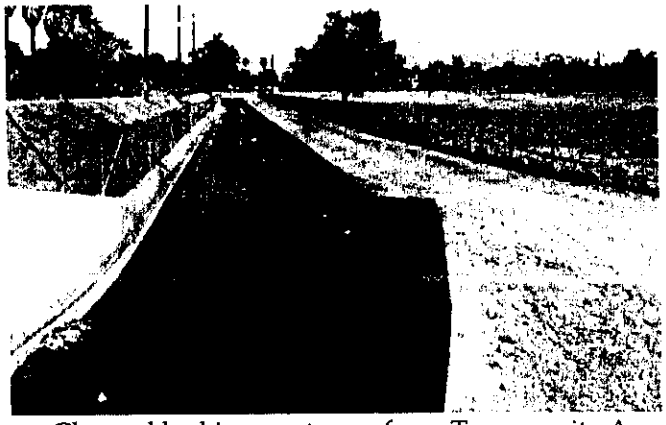
Attachment B

Attachment B

Box Springs Channel

Sample Location:
Monitoring on the Box Springs Channel will be conducted sufficiently upstream from the Tequesquite Ave crossing (top picture) to avoid stagnant water. Prior to collection of water samples, the sampling team will assess flow connectivity with the Santa Ana River by determining if there is flow over a sand bar approximately 200 feet south of the Tequesquite Ave crossing. If flow is present over the sand bar (bottom picture), then a flow measurement will be taken using the cross section velocity profile method on the downstream side of the sand bar. If no flow is observed over the sand bar, then samples will not be collected at the upstream location.

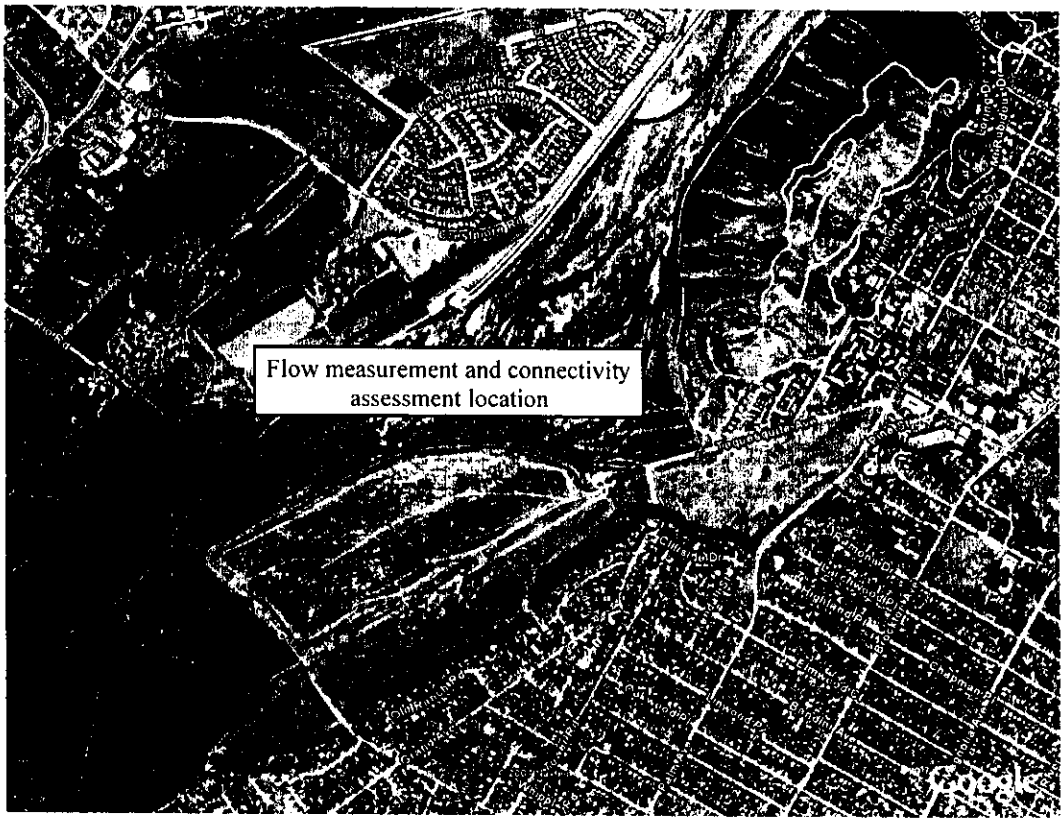
Site Access:
This site is accessed by the RCFCD access gate at the corner of Tequesquite Ave and Elderwood Court. Unlock the gate to access the east side of Box Springs Channel, where samples can be collected. To access flow measurement location, continue downstream along the east side of the channel and enter the RCFCD access gate to get back onto Tequesquite Ave, then drive across Tequesquite Ave and enter a third RCFCD access gate to access the unlined section of Box Springs Channel.



Box Springs Channel looking upstream from Tequesquite Avenue Road

Box Springs Channel 200 feet downstream from Tequesquite Avenue Road

Attachment B



Attachment B

Temescal Wash

Sample Location:
Water quality samples for the Temescal Wash location will be collected on the downstream side of the Lincoln Ave Bridge (see top picture). Flow measurements will be conducted in the lined section on the upstream side of the Lincoln Ave Bridge (see bottom picture), using the cross section velocity profile method.

Site Access:
This site is accessed at the Lincoln Ave Bridge crossing of Temescal Wash. There is no fencing or access gate at this location.

Temescal Wash downstream of Lincoln Avenue Bridge

Temescal Wash upstream from Lincoln Avenue Bridge

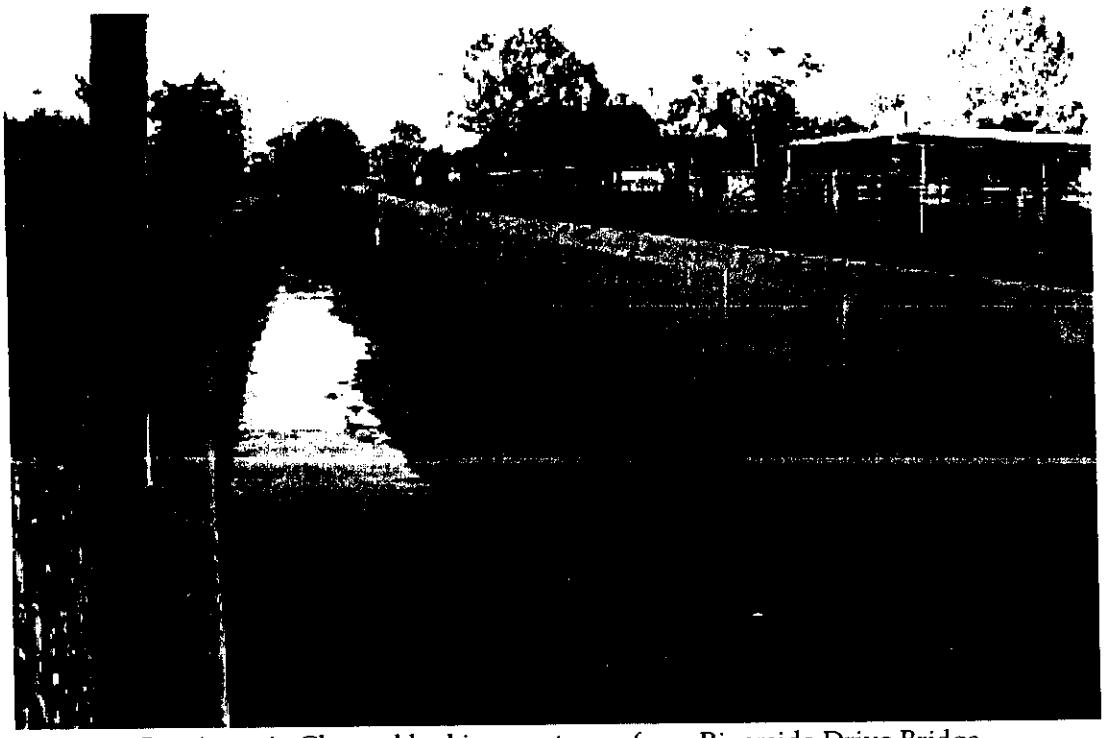
Attachment B

Attachment B

San Antonio Channel

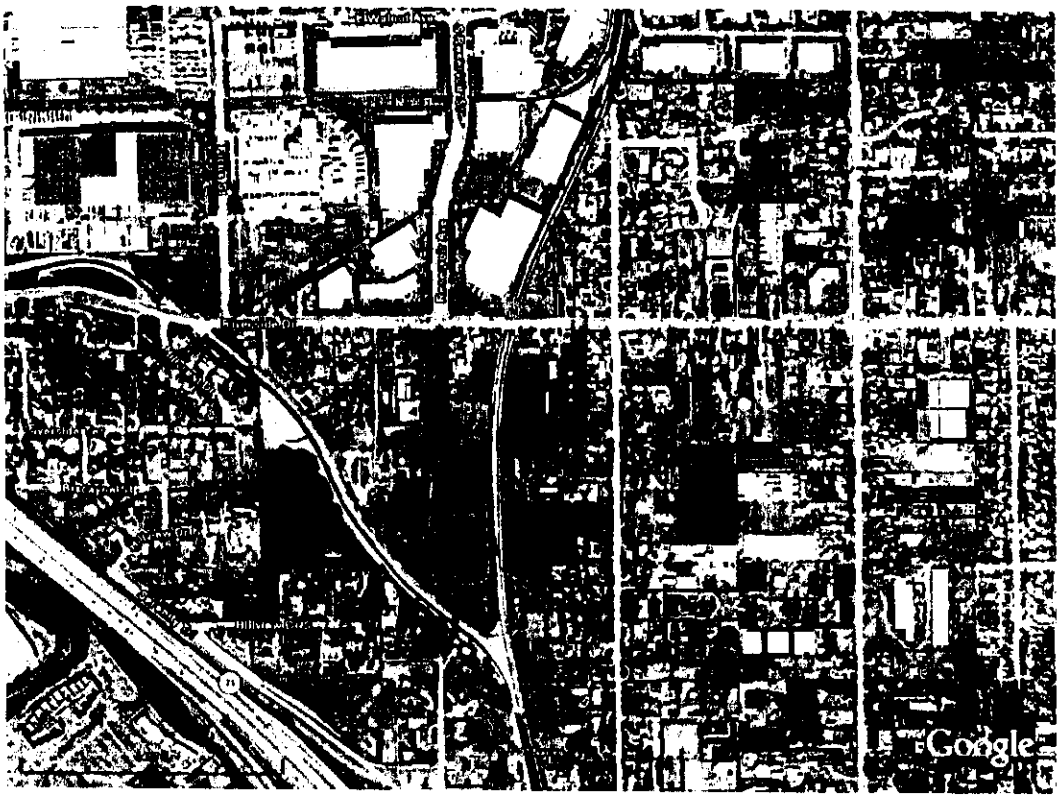
Sample Location:
Water quality samples for the San Antonio Channel location will be collected on the upstream side of the Riverside Drive Bridge. During dry weather, the low flow sampling device will be utilized. Flow in the channel will be estimated using visual methods.

Site Access:
This site is accessed at the Riverside Drive Bridge crossing of San Antonio Creek. Enter the SBCFCD access gate on the west side of the channel to get off the road for sample collection.



San Antonio Channel looking upstream from Riverside Drive Bridge

Attachment B

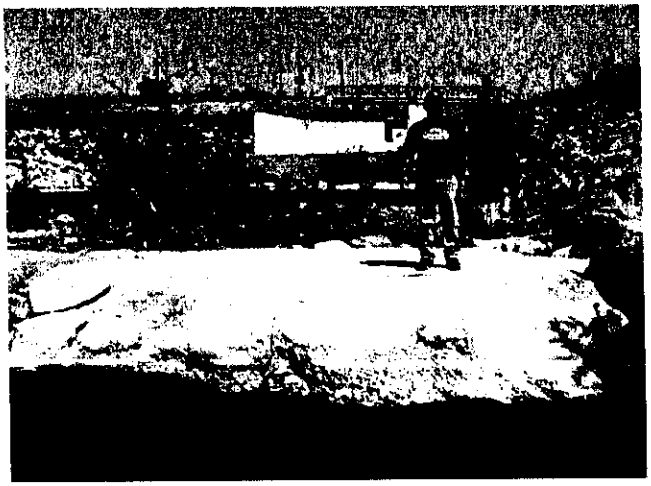


Attachment B

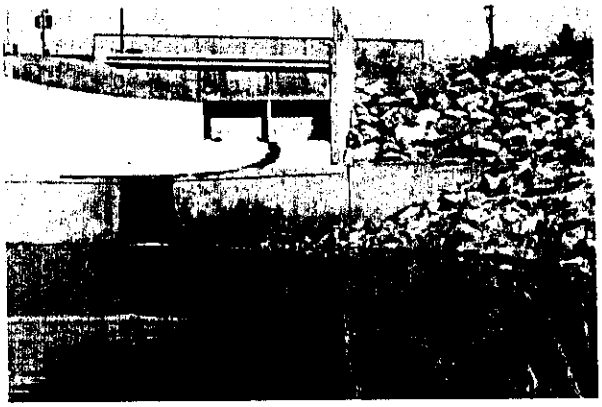
San Sevaine Channel

Sample Location:
Monitoring on the San Sevaine Channel will be conducted downstream from the Limonite Ave crossing at the end of the concrete lined section. Prior to collection of water samples, the sampling team will assess flow connectivity with the Santa Ana River by determining if there is flow over a small concrete berm approximately 100 feet south of the end of the lined section (top picture). If flow is present over the berm, then a flow measurement will be taken using volumetric methods at the free outfall from the concrete lined section (bottom picture) or by developing a cross section velocity profile 10 feet upstream of the berm. If no flow is observed over the berm, then samples will not be collected at the upstream location.

Site Access:
This site is accessed by the RCFCD access gate on Limonite Avenue. Unlock the gate off of Limonite Avenue to access the west side of San Sevaine Channel and park in large unpaved parking area, then walk down path to sampling location.

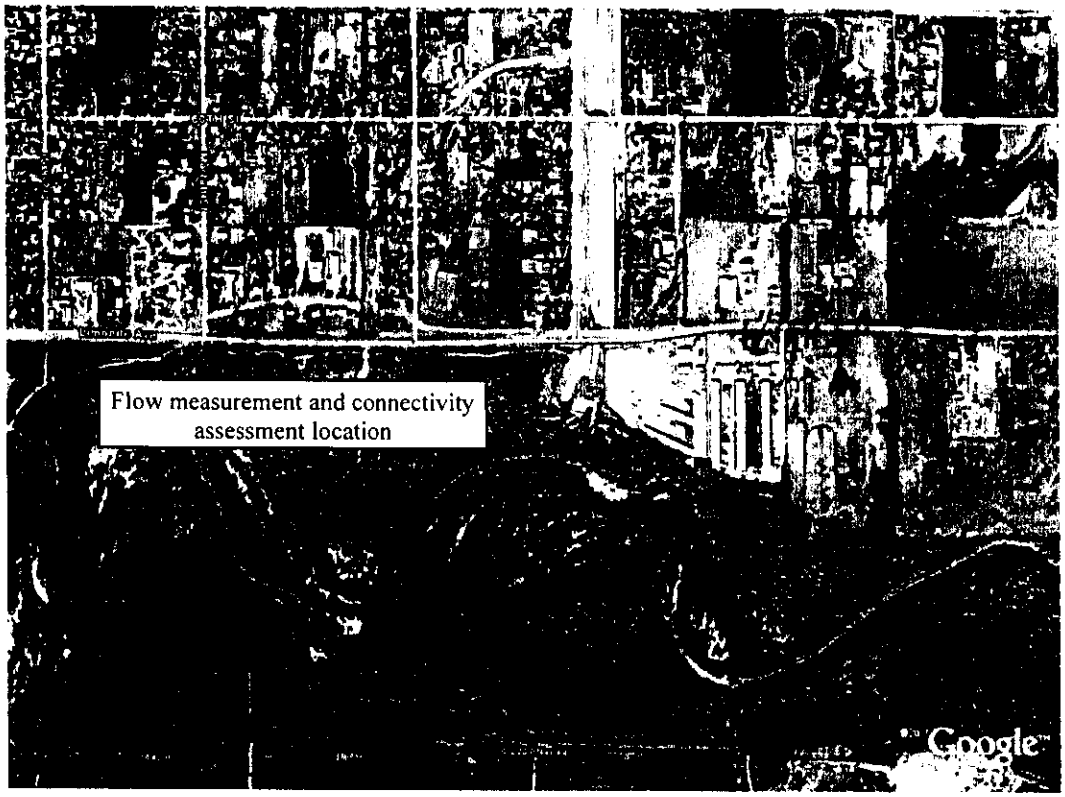


San Sevaine Channel looking upstream from a concrete berm; water in foreground is part of a Santa Ana River backwater area



San Sevaine Channel looking upstream

Attachment B



Attachment B

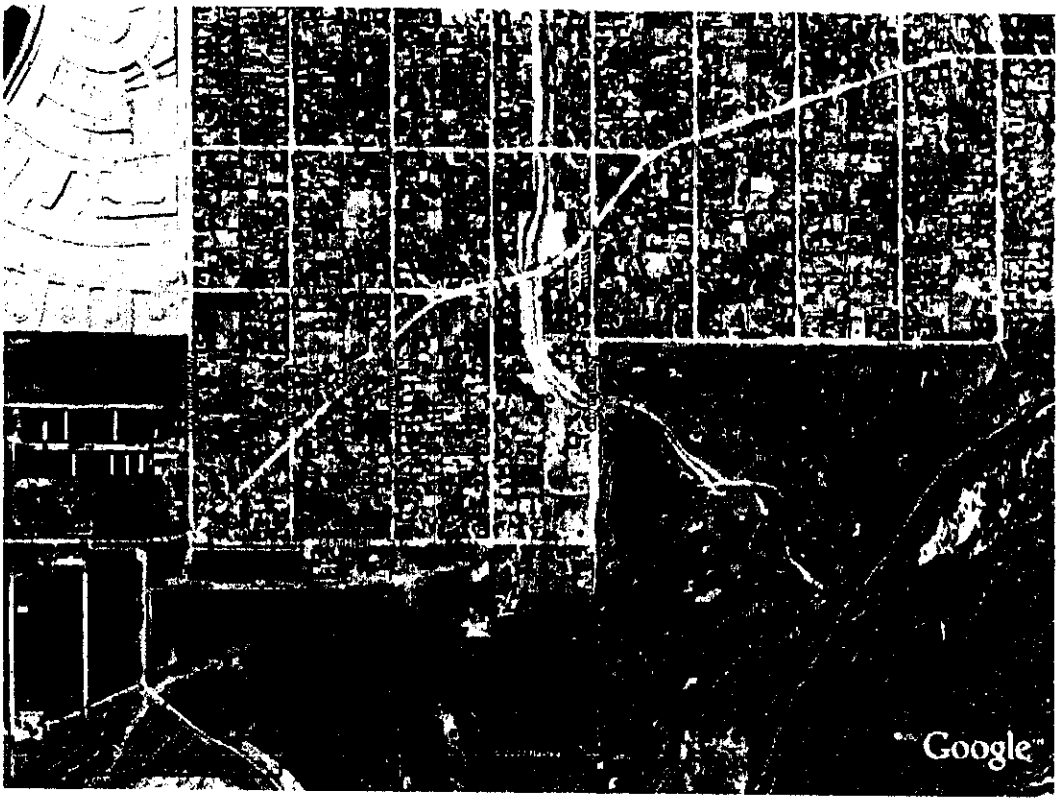
Day Creek

Sample Location:
Water quality samples for the Day Creek location will be collected on the downstream side of Lucretia Avenue. Flow measurements will be downstream of Lucretia Avenue either by volumetric methods using the culvert free outfalls or by cross section velocity profile measurement.

Site Access:
This site is accessed at the Lucretia Avenue crossing of Day Creek at the northwest boundary of the Goose Creek Golf Club. There is no fencing or access gate at this location.

Day Creek looking downstream from Lucretia Avenue toward the Goose Creek Golf Club

Attachment B

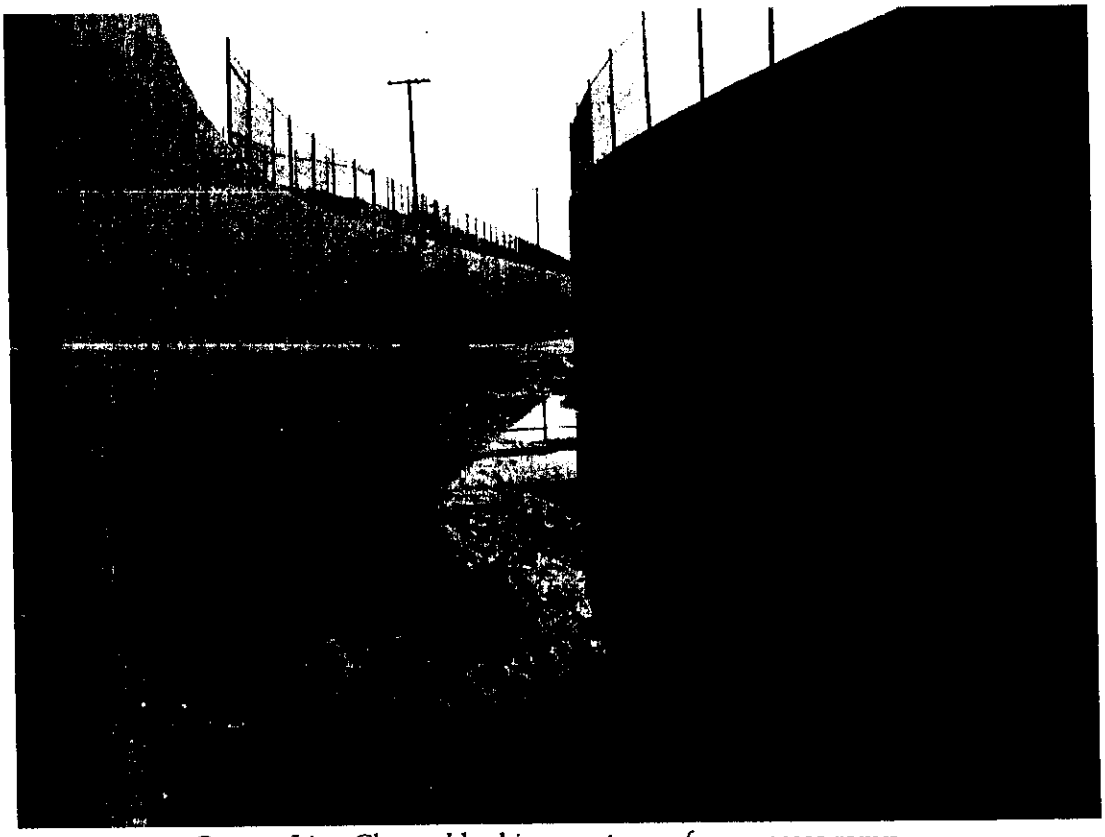


Attachment B

County Line Channel

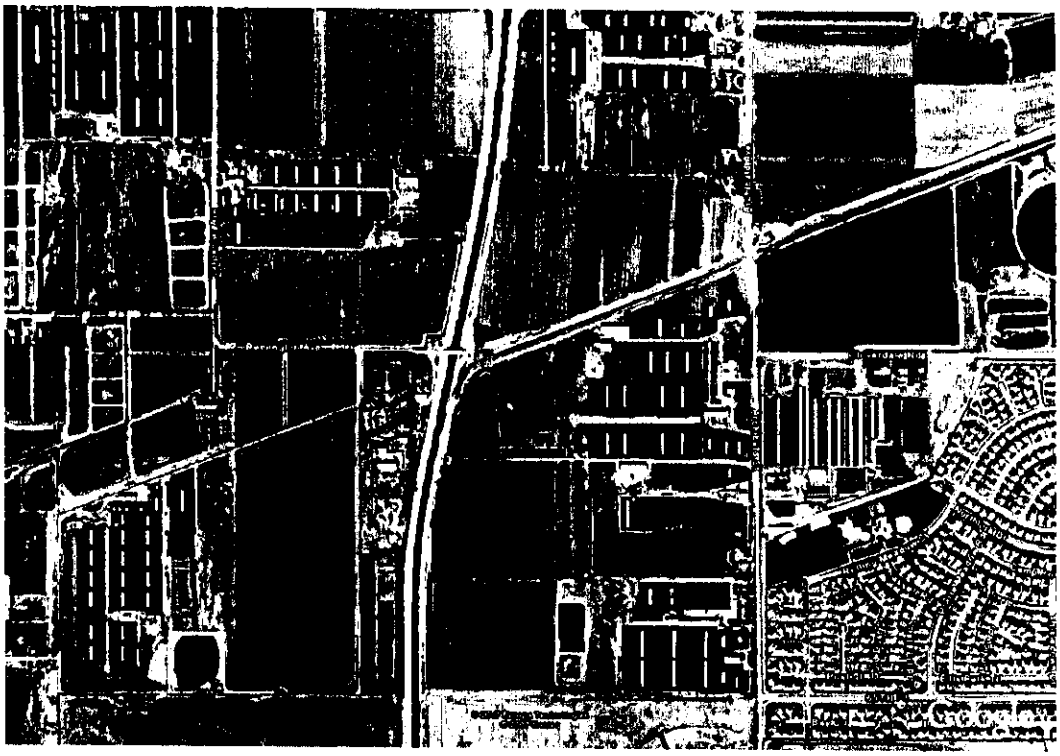
Sample Location:
Monitoring on the County Line Channel will be conducted upstream of the confluence with Cucamonga Creek. There is limited runoff in the County Line Channel that reaches Cucamonga Creek during dry weather flow conditions. If the flow is stagnant and does not reach Cucamonga Creek, then samples will not be collected.

Site Access:
This site is accessed by turning west from Archibald Avenue, approximately 200 feet north of the intersection of Archibald and Cloverdale Avenues, onto a SBCFCD access road follows along the north wall of County Line Channel. Drive down the paved SBFCD access ramp for County Line Channel, which is located directly upstream from Cucamonga Creek.



County Line Channel looking upstream from access ramp

Attachment B

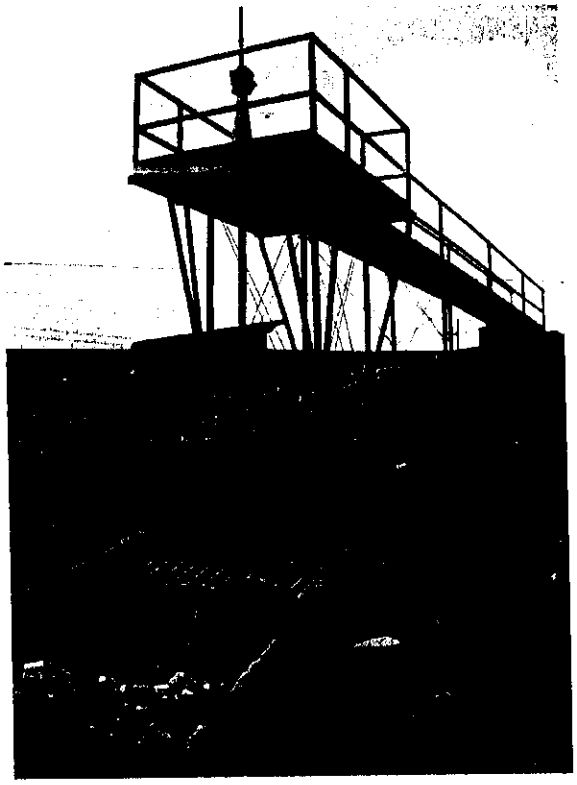


Attachment B

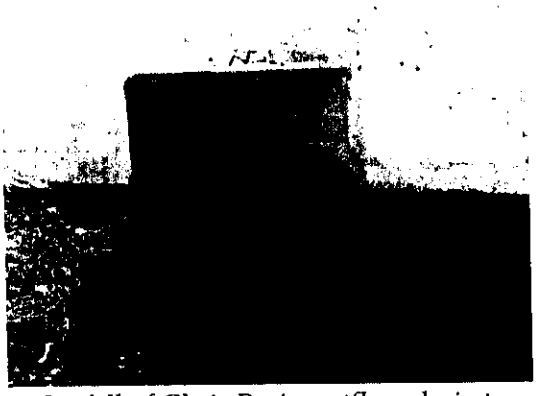
Lower Deer Creek Channel

Sample Location:
Monitoring of the Lower Deer Creek Channel drainage will be conducted at the outfall from the Chris Detention Basin. Lower Deer Creek flows through the Chris Detention Basin prior to being discharged to Cucamonga Creek. Unlike many other SBCFCD detention basins, there is a continuous discharge during dry weather. During dry weather water samples will be collected from the outfall to Cucamonga Creek (right picture). During wet weather, runoff in Cucamonga Creek will mix with the outfall, therefore samples will be collected at the Chris Detention Basin outflow structure (left picture), on the other side of the access road. Prior to collecting a sample from this structure, ensure that there is no trash accumulated. If there is trash that is resulting in ponding of water, clear the trash from the rack and allow the water level to return to normal depth prior to collecting a water sample.

Site Access:
The site is accessed by unlocking the SBCFCD gate on the south side of the Archibald Avenue crossing of Lower Deer Creek. Follow the access road west approximately 1,000 feet to the Chris Detention Basin. During dry weather, continue over the spillway to access the outfall to Cucamonga Creek (right picture).

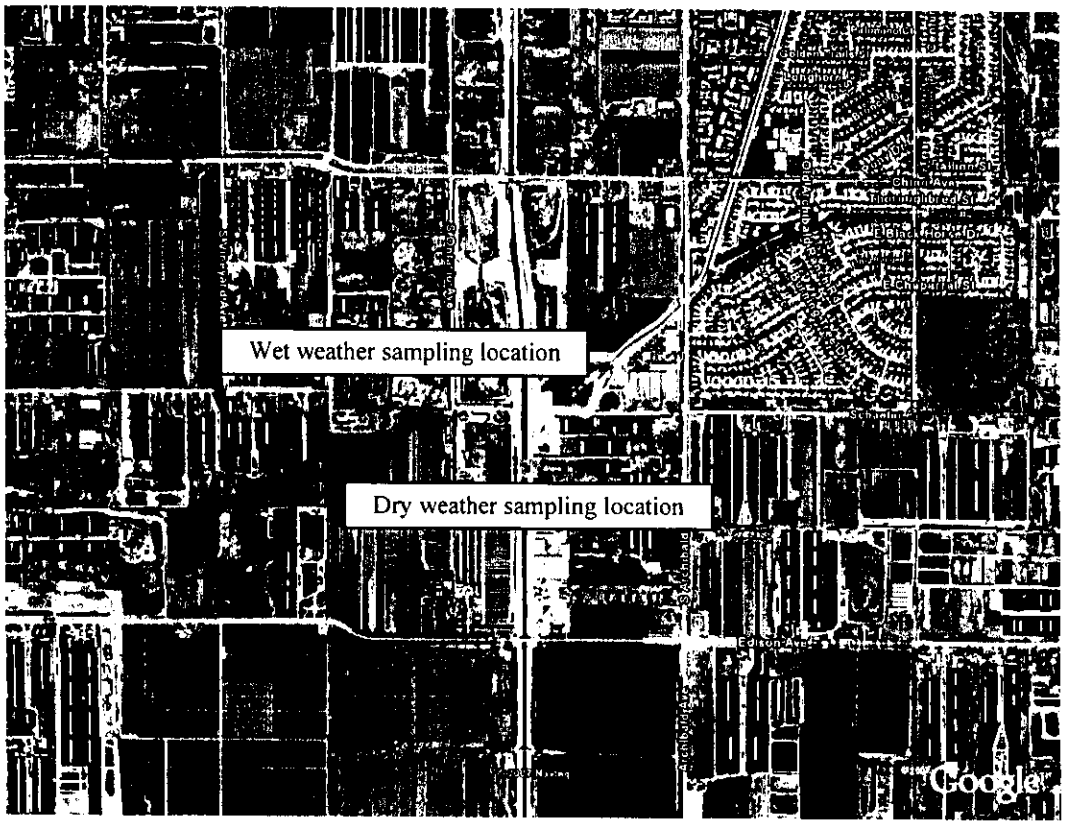


Chris Basin outflow structure



Outfall of Chris Basin outflow drain to Cucamonga Creek

Attachment B

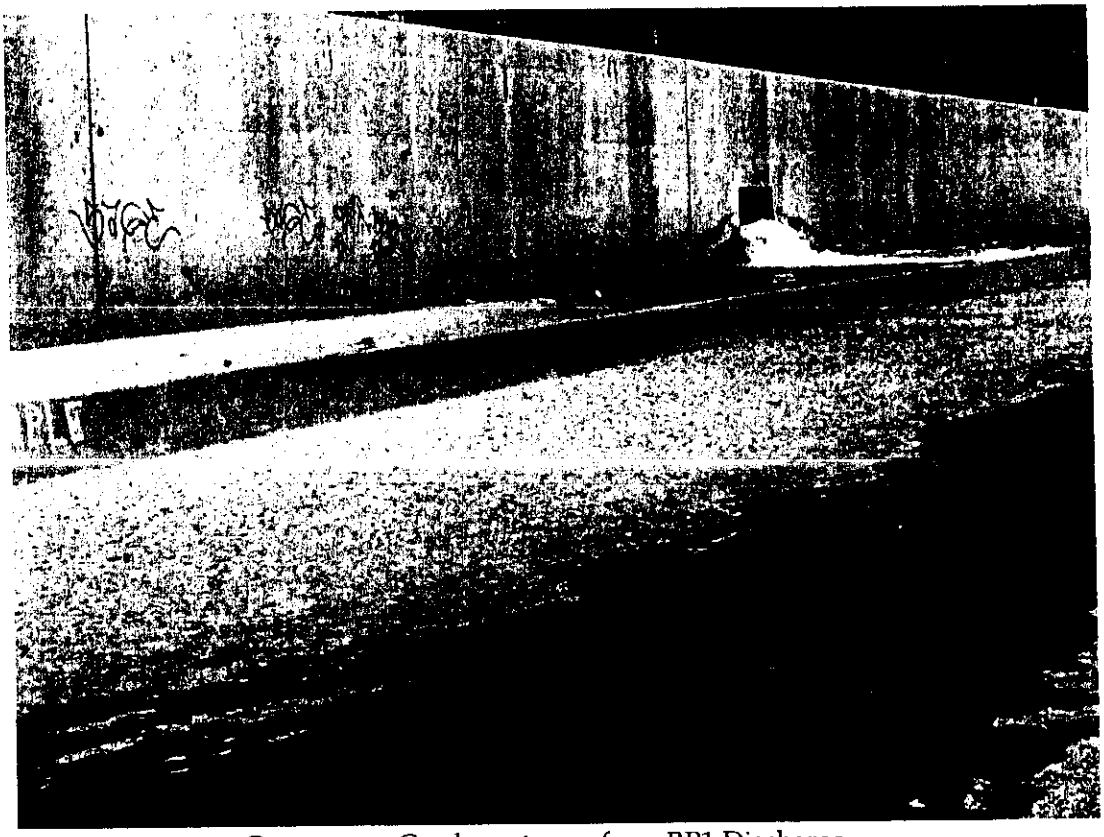


Attachment B

Cucamonga Creek above RP1 Discharge

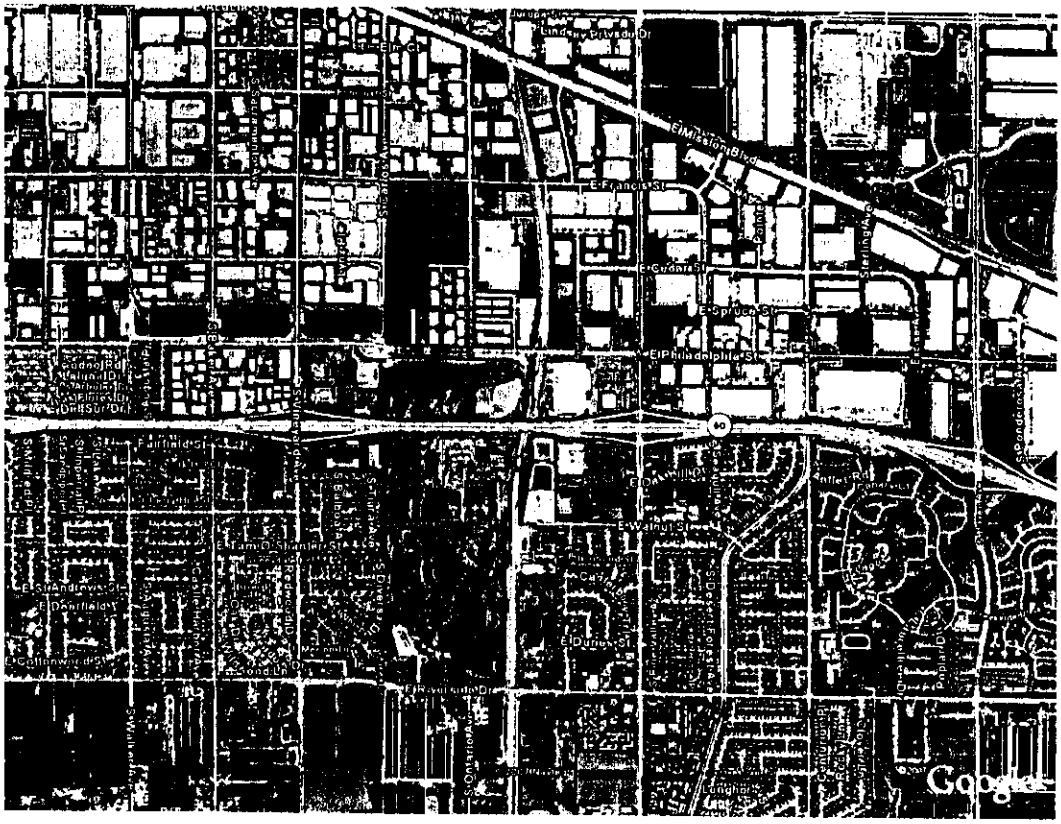
Sample Location:
Monitoring of Cucamonga Creek will be conducted at the access ramp directly upstream from the IEUA RP1 wastewater discharge outfall. Flow will be measured by developing a cross section velocity profile when conditions are safe.

Site Access:
Access to the site is best gained via the SBCFCD maintenance ramp which is accessed through IEUA. Enter through the SBCFCD gate access and proceed to the sample location at the access ramp upstream of the discharge.



Cucamonga Creek upstream from RP1 Discharge

Attachment B



Attachment B

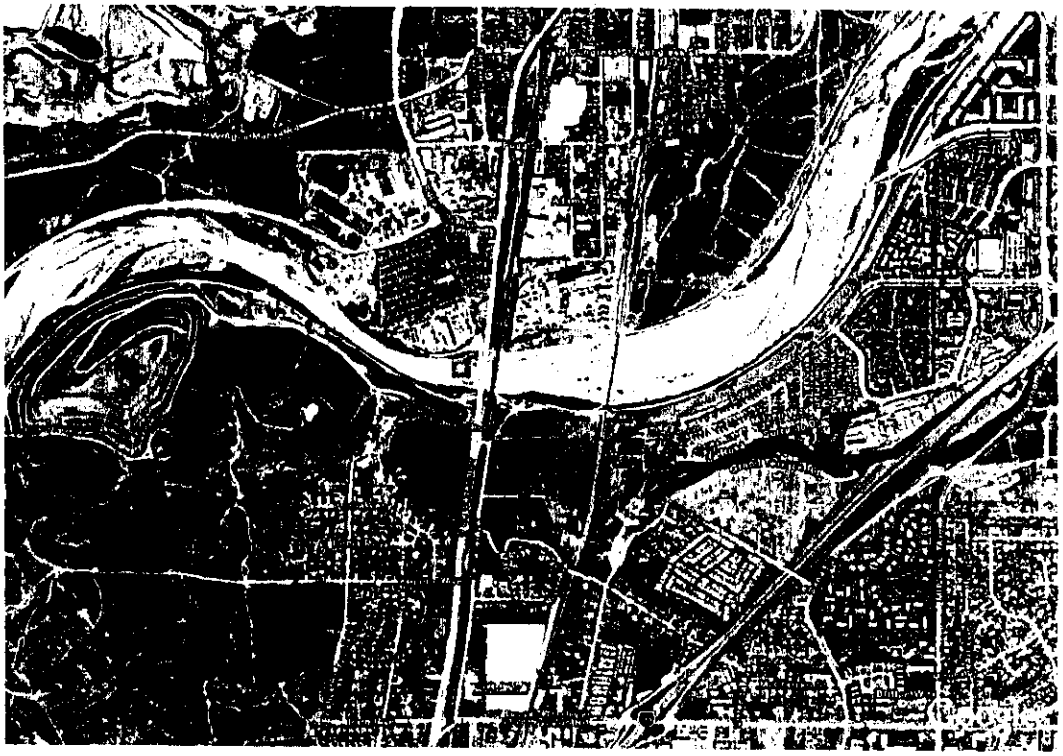
Santa Ana River at La Cadena Avenue

Sample Location:
Monitoring of Santa Ana River will be conducted at the upstream side of the La Cadena Road Bridge crossing. There is limited runoff in the Santa Ana River at this location during dry weather flow due to high permeability of bottom sediments. If no water is present or the flow is determined to be stagnant and not connecting to downstream segments of the Santa Ana River, then samples will not be collected.

Site Access:
This site is accessed west of La Cadena Drive, on the south side of the Santa Ana River via a RCFCD access ramp. Vehicles may be parked outside of the gate and entry into the river can be made by foot. The SAR is not fenced at this location.

Looking north from west side of La Cadena Drive to the Santa Ana River

Attachment B



Attachment C
Field Data Sheet Form

Attachement C

MSAR Pathogen TMDL
Field Data Sheet

General Information:

Site Name: _____

Site ID: _____

Date: ___/___ /_____

Time (24-hr clock): _____

Sampling Team: _____ /_____

Field Measurements:

Conductivity: _____ (m S/cm)

Dissolved Oxygen: _____ (mg/L)

pH: _____

Turbidity: _____ (NTU)

Temp (water): _____ (°C)

For USEP Monitoring Program Sites Only:

Flow: _____ (m/sec)

Flow Connectivity: Y/N (Describe) _____

_____

Grab Sampling: Filled and labeled (check)

1 - 120 mL polyethylene bottle (add sodium thiosulfate preservative after collection) for *E. coli*:

_____

1 - 120 mL polyethylene bottle (add sodium thiosulfate preservative after collection) for **Fecal Coliform**

_____

2 - 1,000 mL polyethylene bottle for *Bacteroides*

_____

2 - 1,000 mL polyethylene bottle for **TSS**:

_____

Note:

Additional bottles sets are included for field duplicates and field blanks (Check if applicable): _____

Other Observations:

_____

_____

_____

Attachment D
Chain of Custody Forms

Attachment D

County of Orange, Health Care Agency
Water Quality Laboratory
700 Shellmaker Rd.
Newport Beach, CA 92660
PHONE: (949) 219-0423 FAX: (949) 219-0426

ELAP #2545

STUDY: _____

SUBMITTING AGENCY: _____

WEATHER: _____

To be completed by Field Sampler

To be completed by Laboratory

FIELD DATA

Date Collected
Sampler

Constituent	Time	Sample Type (Grab, Duplicate, Equipment Blank)	Station Number / Location of Sampling Station

Laboratory No.

LABORATORY REPORT

Date Received _____ Received by _____
Time In _____ Time Run _____ Date/Time Read _____

Total Suspended Solids	Fecal Coliforms		Escherichia coli		
TSS	m-FC Agar		m-TEC		Report Date/ Initials
mg TSS/1L	CFU's	CFU/100ml	CFU's	CFU/100ml	

FIELD DATA

Date Collected
Sampler

Constituent	Time	Sample Type (Grab, Duplicate, Equipment Blank)	Station Number / Location of Sampling Station

Laboratory No.

LABORATORY REPORT

Date Received _____ Received by _____
Time In _____ Time Run _____ Date/Time Read _____

Total Suspended Solids	Fecal Coliforms		Escherichia coli		
TSS	m-FC Agar		m-TEC		Report Date/ Initials
mg TSS/1L	CFU's	CFU/100ml	CFU's	CFU/100ml	

FIELD DATA

Date Collected
Sampler

Constituent	Time	Sample Type (Grab, Duplicate, Equipment Blank)	Station Number / Location of Sampling Station

Laboratory No.

LABORATORY REPORT

Date Received _____ Received by _____
Time In _____ Time Run _____ Date/Time Read _____

Total Suspended Solids	Fecal Coliforms		Escherichia coli		
TSS	m-FC Agar		m-TEC		Report Date/ Initials
mg TSS/1L	CFU's	CFU/100ml	CFU's	CFU/100ml	

FIELD DATA

Date Collected
Sampler

Constituent	Time	Sample Type (Grab, Duplicate, Equipment Blank)	Station Number / Location of Sampling Station

Laboratory No.

LABORATORY REPORT

Date Received _____ Received by _____
Time In _____ Time Run _____ Date/Time Read _____

Total Suspended Solids	Fecal Coliforms		Escherichia coli		
TSS	m-FC Agar		m-TEC		Report Date/ Initials
mg TSS/1L	CFU's	CFU/100ml	CFU's	CFU/100ml	

SUBMITTOR INFORMATION / SUBMITTOR NUMBER

Field or Lab Remarks:

Attachment D

ORANGE COUNTY WATER DISTRICT

10500 Ellis Avenue, Fountain Valley, CA 92708

Telephone: (714) 378-3200 Fax: (714) 378-3373

CHAIN OF CUSTODY RECORD

NO.	SAMPLING AGENCY	WRMS STATION NAME	Sample Date	Sample Time	Sampled BY	COMMENTS		NO. OF Bottles	ANALYSIS
1						EC=	Ph=		
						TEMP=	DO=		
2						EC=	Ph=		
						TEMP=	DO=		
3						EC=	Ph=		
						TEMP=	DO=		
4						EC=	Ph=		
						TEMP=	DO=		
5						EC=	Ph=		
						TEMP=	DO=		
6						EC=	Ph=		
						TEMP=	DO=		
7						EC=	Ph=		
						TEMP=	DO=		
8						EC=	Ph=		
						TEMP=	DO=		
9						EC=	Ph=		
						TEMP=	DO=		
10						EC=	Ph=		
						TEMP=	DO=		

RELINQUISHED BY: DATE/TIME ED BY:

RELINQUISHED BY: DATE/TIME ED BY: DATE/TIME

SPECIAL INSTRUCTIONS: B LL ACCOUNT NO.:

Attachment D

Dr. Wuertz Laboratory

University of California, Davis Civil & Environmental Engineering TEL: 530.754.6107 FAX: 530 752 7872

CHAIN-OF-CUSTODY **DATE** **Lab**

Origination	
ADDRESS	
PHONE	
FAX	
SAMPLED	
PROJECT:	
Wuertz	
Wuertz PROJECT	

Client Sample	Sample Date	Sample Time	Sample Matric	Container #	Container Type	Container Pres.	REQUESTED								Note

SENDER	RELIQUINSHED	
	Signature:	
	Print	
	Company	
	Date:	Time

LABORATORY	RECEIVED	
	Signature:	
	Print	
	Company	
	Date:	Time

Attachment E
Form for use in Conducting Flow Measurements by Developing a Cross Section Velocity Profile

Attachment E

FLOW MEASUREMENTS

Location _____
Recorder _____
Date _____
Time _____
Page ___ of ___

Portable Flowmeter Used _____

Left Bank _____ Right Bank _____

	Distance from Left Bank	Section Width	Section Depth	Flow Velocity				Average V*	Area A**	Discharge (avg VXA)
				VO.6	VO.2	VO.8	VO.9			
1										
2										
3										
								Total Discharge		

Stream Flow Conditions (I.e., muddy, clear, debris, etc...): _____

* Average Velocity =VO.6 for stream depths between 0.3 and 2.5 feet (six-tenths method).
=(VO.2 + VO.8)/2 for stream depths greater than 2.5 feet (two-point method).
=VO.9 if flow is less than 0.3 feet deep (maximum velocity X 0.9).

** Area =total depth x width