TECHNICAL MEMORANDUM #1

RE: ANAHEIM BAY / HUNTINGTON HARBOR WATERSHED
DATE: March 14, 2006

Prepared for:	**Prepared by**:
County of Orange Resources & Development Management Department Environmental Resources	Tetra Tech, Inc. Irvine, CA

The County of Orange Resources and Development Management Department (RDMD) is in the process of developing Watershed Chapters for each of the watersheds within Orange County. These Watershed Chapters will be included as an appendix to the Drainage Area Master Plan (DAMP) and will provide specific information regarding the watershed setting, an assessment of the water quality, the plan of action within the watershed to improve the water quality, and the steps to be taken to assess the effectiveness of the program.

In each watershed the first step in the development of the Watershed Chapter is an inventory of the existing studies that are available in that watershed. This Technical Memorandum for the Anaheim Bay / Huntington Harbor Watershed summarizes the studies that were collected as part of this effort.

The Huntington Harbor / Anaheim Bay watershed is located on the northern edge of the Orange County Coast, approximately 20 miles southeast of Los Angeles. Huntington Harbor is in the northern portion of Huntington Beach and encompasses five manmade islands bounded by a network of navigable channels and the land surrounding them. Bounded by the cities of Westminster, Seal Beach, and Sunset Beach, Huntington Harbor connects with Anaheim Bay via a waterway that passes under a bridge on Pacific Coast Highway past the Seal Beach Naval Weapons Station and Anaheim Bay National Wildlife Refuge. Huntington Harbor is the closest mainland point to Catalina Island 22 miles away. Coastal areas between the Santa Ana River Watershed and the San Gabriel / Coyote Creek Watershed are included in the Huntington Harbor / Anaheim Bay Watershed.

The Basin Plan identifies the following receiving waters within this watershed:

- Anaheim Bay – Outer Bay
- Anaheim Bay – Seal Beach National Wildlife Refuge
- Bolsa Bay
- Bolsa Chica Ecological Reserve
- Sunset Bay - Huntington Harbor

<u>Studies Sources / Authors</u>

The data search within the Huntington Harbor / Anaheim Bay Watershed included website searches and contact with staff from municipal agencies and non-profit organizations. The main study contributors include Southern California Coastal Water Research Project (SCCWRP), RDMD, County of Orange Health Care Agency, the United States Geological Survey (USGS),

and University of California, Riverside and Irvine (UCR and UCI). The following table identifies the specific agencies and groups for which contact was made to obtain information.

Table 1. Data Research Contacts

Agency	**Comments**
EPA	No references.
United States Geological Survey	1 report obtained.
U.S. Army Corps of Engineers	No references.
California Department of Water Resources	No references.
State Water Resources Control Board	1 report was obtained
Regional Board, Santa Ana	No references.
County of Orange RDMD	2 reports were obtained.
County of Orange Health Care Agency	1 report was obtained.
SCCWRP	1 report was obtained.
OCSD	No references.
OCWD	No references.
Cities within the Watershed	No references.
UCR and UCI	3 reports were obtained.

Through these sources, a total of 9 studies were obtained that provide information specific to the Huntington Harbor / Anaheim Bay Watershed.

Geographical Extent of Studies

The studies that were obtained through the data collection effort were categorized as coastal or watershed studies. Of the 9 studies obtained, 4 were focused on the coastal area and 5 studies focused on the bay and wetlands.

Water Quality Data

A significant source of persistent water quality data in the watershed is the County of Orange Environmental Health Agency. County of Orange Environmental Health monitors the ocean water in the surf zone and specifically tests for bacteria. Along the harbor, the sampling is performed by County of Orange Environmental Health at 14 locations. One sample is taken at each location every week. Along the beach, sampling is performed by the County of Orange Environmental Health at 4 beach locations once per week. The Orange County Sanitation District samples at 5 locations along the beach. At the locations 5 samples are taken at each location each week.

The County of Orange monitoring program has evolved through the changing requirements of the NPDES permits. The current program includes several types of monitoring programs. Within this watershed there are monitoring stations in the following programs:

1. Two stations in the mass emissions monitoring program in which wet and dry weather monitoring is conducted for a broad range of constituents including heavy metals.
2. Five station in the estuary / wetlands monitoring program which includes chemical and toxicity monitoring in aqueous and sediment samples.
3. Three stations in the bacteriological / pathogen monitoring program in which total coliforms, fecal coliforms, and *Enterococcus* is monitored.

Another significant source of water quality data in Southern California is the Surface Water Ambient Monitoring Program (SWAMP). SWAMP is a statewide monitoring effort designed to assess the conditions of surface waters throughout the state of California. During 2000 – 2002 the SWAMP program monitored waters in Huntington Harbor and Anaheim Bay.

Bibliography of Studies

A bibliography that includes the existing studies collected as part of this effort was developed and is included as Attachment 1 to this Technical Memorandum.

Bibilography for the Huntington-Harbor Anaheim Bay Watersheds

Record #	Program Name or Report Title	Sample Location	Start Date	End Date	flow conditions	entity	Bacteria	nutrients	metals	pesticides	toxicity / TIE studies	water chemistry	fish tissue	sediments	comments
11	Orange County NPDES/TMDL Program	watershed		ongoing	C	OC	x	x	x	x	x	x			
12	2004 Annual Ocean and Bay Water Quality Report	beach	1975	ongoing	c	HCA	x								
3	Huntington Beach Shoreline Contamination Investigation, Phase III, Final Report	Huntington Beach	1999	2001	x	USGS	x				x				Beach closures in huntington beach due to levels of total coliform, fecal coliform, and enterococci bacteria that exceeded newly applied beach sanitation standards
4	Watershed Imapct Report	Huntington bech watershed				UCR						x			This report describes analyses and results of water quality assessment of surface water runoff to the Huntington Beach wetlands
5	Water Quality of California Beaches	California Beaches	2005	2005		UCR/ nrdc						x			water quality measurments of southern california beaches
6	Anaheim Bay Study: From July 1970 to June 1971	Anaheim Bay	1970	1971		UCI									
7	Bioaccumulation of Contaminants in Flatfish of Southern California	Southern California Bight	1977	1985		SCCWRP				x			x		PCB and DDT contaminants in flatfish tissues
8	Report & Studies- Anaheim Bay/ Huntington Harbor Water Quality Assessment Study- Workplan	Anaheim Bay/ Huntington Harbor	Mar-01	Aug-01		Orange County			x			x		x	The overall goal of the study is to attain a comprehensive and current
9	Sediment Chemistry, Toxicity,and Benthic Community Conditions in Selected Water Bodies of the Santa Ana Region	Anaheim Bay/Seal Beach Huntington Harbor/Bolsa Chica	Sep-92	Aug-97		SWRCB			x		x			x	study is based on chemical pollution & biolgical effects of Santa Ana coastal area

DRAFT TECHNICAL MEMORANDUM #2

RE: ANAHEIM BAY / HUNTINGTON HARBOR WATERSHED
DATE: MAY 15, 2006

Prepared for:	**Prepared by**:
County of Orange Resources &	Tetra Tech, Inc.
Development Management Department	Irvine, CA
Environmental Resources	

The County of Orange Resources and Development Management Department (RDMD) is in the process of developing Watershed Chapters for each of the watersheds within Orange County. These Watershed Chapters will be included as an appendix to the Drainage Area Master Plan (DAMP) and will provide specific information regarding the watershed setting, an assessment of the water quality, the plan of action within the watershed to improve the water quality, and the steps to be taken to assess the effectiveness of the program.

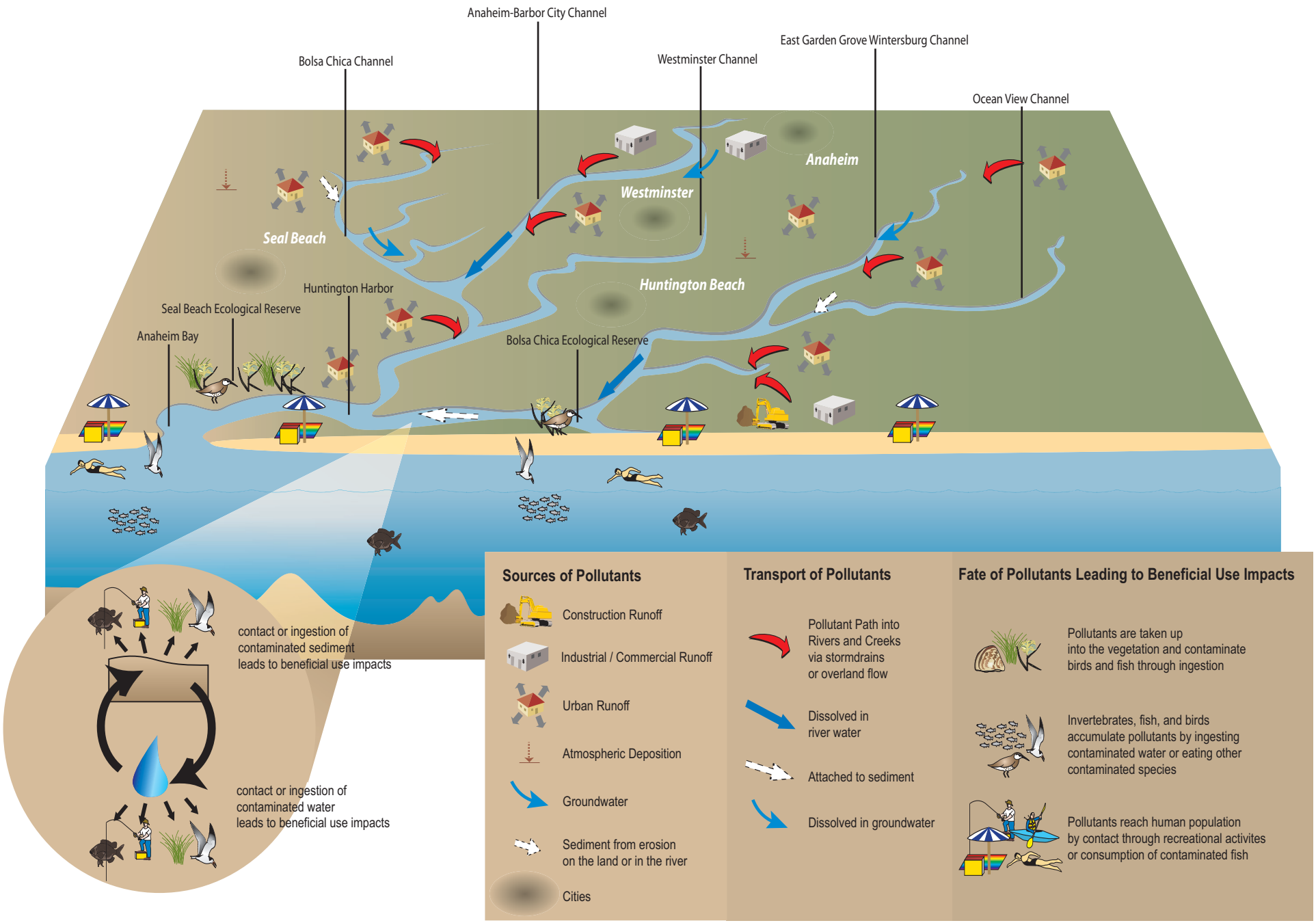
The first step in the development of the Watershed Chapter is an inventory of the existing studies that are available in the watershed. A technical memorandum, Technical Memorandum #1 (dated March 14, 2006), focused on the collection of the existing data. The data collection effort for that memorandum ended in March 2006 and includes studies completed and underway at that time. The second step in the development of the Watershed Chapter is an assessment of the water quality data and identification of data gaps within the body of knowledge that has been generated for the Anaheim Bay / Huntington Harbor Watershed. The assessment and identification of data gaps is presented in this technical memorandum (Technical Memorandum #2).

The Huntington Harbor / Anaheim Bay watershed is located on the northern edge of the Orange County Coast, approximately 20 miles southeast of Los Angeles. Huntington Harbor is in the northern portion of Huntington Beach and encompasses five manmade islands bounded by a network of navigable channels and the land surrounding them. Coastal areas between the Santa Ana River Watershed and the San Gabriel / Coyote Creek Watershed as well as Bolsa Bay and Bolsa Chica Ecological Reserve are included in the Huntington Harbor / Anaheim Bay Watershed.

Before assessing the water quality data, it is helpful to understand the water quality related processes at work within these waterbodies. The following figure provides a graphical representation of those processes. The processes include:

1. Source of pollutants – from where do the pollutants originate. In some instances the origination is known only generally; in others the specific origin is know.
2. Transport of pollutants – how are the pollutants transported from the sources into the receiving waters (the rivers and ocean).
3. Fate of pollutants – how do the pollutants impact various users of the system. The fate of the pollutants is directly tied to the impacts of the beneficial uses present in the watershed.

Huntington Harbor-Anaheim Bay Watershed



WATER QUALITY DATA ASSESSMENT

There is a limited amount of water quality data that is available specific to the Huntington Harbor / Anaheim Bay Watershed. Seventeen (17) studies were identified that provide water quality information specific to the Huntington Harbor / Anaheim Bay Watershed. A matrix was developed to provide a detailed view of each of the studies / programs discussed in this technical memorandum. This matrix is referred to as the Huntington Harbor / Anaheim Bay Environmental Matrix and includes information such as the specific constituents of concern included in the study / program, and details of the monitoring and management issues supported by that study / program. The Huntington Harbor / Anaheim Bay Environmental Matrix is included in this technical memorandum as Attachment 1.

It is a significant challenge to assemble the report references into a meaningful framework that provides the reader with an idea of what type of data or results are available. In order to meet the various types of user needs that were envisioned, the data has been 'cut' in several directions. Each 'cut' or assessment represents the sum total of all the programs and studies that were assembled as part of this technical memorandum; the difference is only in the perspective taken in that assessment.

Assessment #1: Program Management and Policies

A reasonable question to ask when faced with the abundance of data that exists, is whether this data is providing stormwater program coordinators with the information needed to manage the program and make informed decisions for the watershed. The knowledge needed at various stages in the program development must be able to build on previous efforts to attain constantly improving results. The following passage from Managing Troubled Waters (National Academy Co, 2003) explains this iterative process.

> *"The reality of imperfect knowledge about marine systems means that monitoring should be used as an opportunity to increase and refine our knowledge of them. Data and information derived from monitoring programs should be used to check, validate, and refine the assumptions, models, and understandings on which the monitoring was based. This iterative feedback increased predictive ability, reduces uncertainty, and ultimately reduces the monitoring effort needed. As discussed in Chapter 2, risk-free decision making is not achievable, and monitoring must be viewed as a way of reducing uncertainty, not of eliminating it."*

The following table identifies the aspects of a stormwater program that are needed to advance the knowledge of the systems and identifies the number of studies that are relevant to each category. Each of these categories is considered in relation to specific pollutants of concern or elements of the watershed system.

Table 1. Assessment #1 - Studies by Program Management Category.

	Source Identification	Understanding processes	Developing new tools	Determine compliance with WQs/TMDLs	Evaluate Program/ Measure Effectiveness	Provide Early Warning
Bacteria	6	6	3	4	4	2
Nutrients	1	1	1	1	2	1
Inorganics-Metals	3	4	1	1	2	1
Organics-Pesticides	1	2	1	1	2	1
Toxicity	3	4	1	1	1	1
Water Chemistry	2	2	1	2	1	1
Solids-Sediment	2	3	0	0	1	0
Fish Tissue	0	1	0	0	1	0

Assessment #2 – Study and Program Type

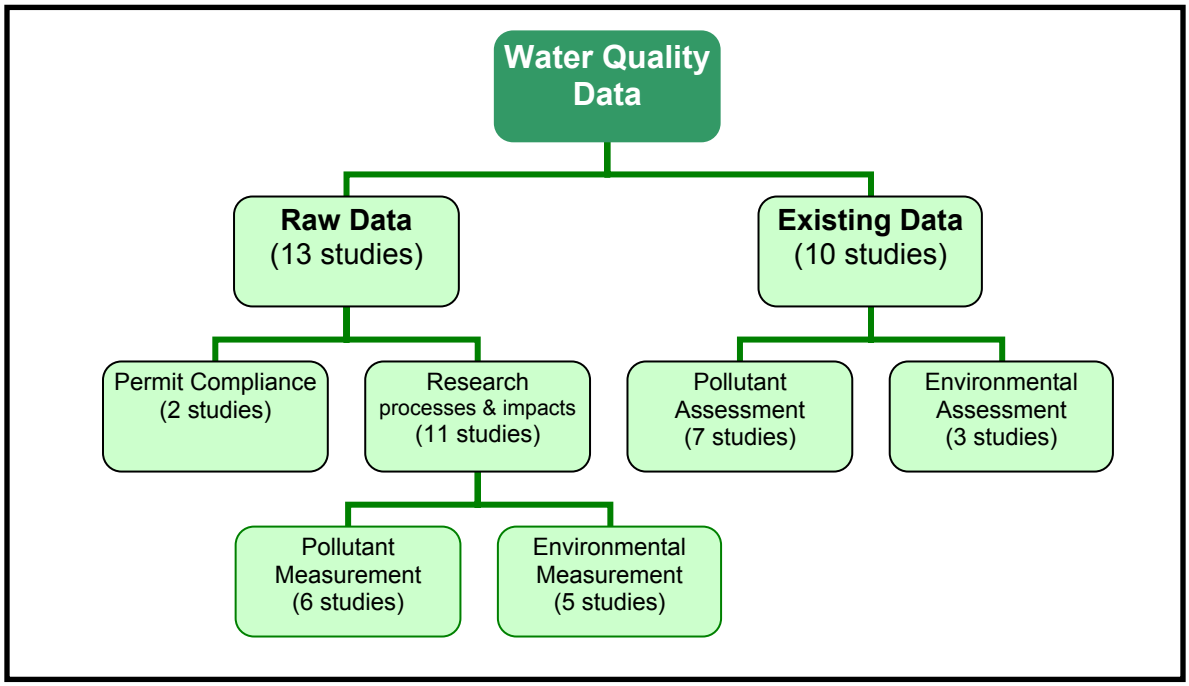
The 17 studies and programs identified within the Huntington Harbor / Anaheim Bay Watershed have generated different types of water quality data. This data falls within two broad categories including: (1) generation of raw data and (2) assessment of existing data.

Raw data studies and programs include specific sampling or monitoring activities. This accounts for the majority of the 17 studies included in this assessment. New data was generated with two different objectives. The first objective was compliance with National Pollutant Discharge Elimination System (NPDES) permits. Compliance activities include the Orange County NPDES and Total Maximum Daily Load (TMDL) monitoring programs as well as monitoring programs conducted by other permitted facilities. The second objective in generating raw data was to understand the concentration levels or processes related to the pollutants, or the impacts of the pollutants, on the ecosystem. Studies targeting pollutant concentrations and processes generally involved direct measurements of the pollutants while studies targeting the impacts of the pollutants generally involved other environmental measurements. Some studies generated new data and used existing data and are included in both categories.

Studies that focused on the assessment of existing data were performed with the objectives of either understanding the behavior of a pollutant within the Huntington Harbor / Anaheim Bay watershed system through direct measurement of those pollutants or understanding the impacts of the pollutants by measuring other environmental parameters. A total of 10 studies are included in this category.

The following figure shows the category breakdown of the studies as well as the general objective of the study.

Figure 2. Study Category Breakdown.



Assessment #3 – Study or Program Details

The final assessment that was made of the studies and programs was to look at basic details such as who performed the study and what pollutants were included in those studies and programs.

Within the Huntington Harbor / Anaheim Bay Watershed the major generators of water quality data are the University of California Irvine (UCI), the Southern California Coastal Water Research Project (SCCWRP), the California Department of Fish and Game (CADFG), the National Resources Defense Council (NRDC), the Southern California Coastal Water Research Project (SCCWRP), the State Water Resources Control Board (SWRCB), and the County of Orange; various agencies. The following table identifies the organizations responsible for each of the 17 studies. For collaborative studies, the primary organization was used for the accounting below.

Table 2. Study Sources

Organization	# of Studies
UCI	3
CDFG	2
County of Orange (RDMD, OCHCA)	4
NRDC	2
SCCWRP	2
USACE	1
USGS	1
SWRCB	1
Other	1

Each of the 17 water quality studies or programs that were identified as part of this data assessment addressed one or more specific pollutants. Eight (8) categories of constituents were identified that encompass nearly all of the specific data that was monitored or assessed. These 8 categories include:

- Bacteria
- Nutrients
- Metals
- Pesticides
- Toxicity – various levels of toxicity studies were performed
- Conventional water chemistry – this includes a wide ranges of variables such as pH, hardness, and temperature
- Sediment – this includes both bulk sediment and sediment contamination
- Fish Tissue

The following table shows the distribution of the studies within each of these categories. Many studies include work related to several constituents.

Table 3. Constituent Focus of Studies and Programs

Constituent	# of Studies
Bacteria	12
Nutrients	2
Metals	5
Pesticides	3
Toxicity	4
Water chemistry	3
Sediment	4
Fish Tissue	2

DATA GAPS

Managing and improving water quality in an urban environment is a complex issue. The science needed to deal with many of the issues that arise during the management process is evolving, and in some cases has not yet developed to the point that important questions can readily be answered in absolute quantifiable terms. Examples where our understanding is not fully developed are as follows:

- Stormwater runoff modeling relative to pollutants of concern. This modeling is not totally reliable for predictive purposes and needs large data sets to calibrate.
- Methods (such as MST (microbial source tracking)) for more accurately identifying sources of pathogens in runoff (e.g., wildlife, pets, humans) are still being refined. Only qualitative methods exist at this time and they are not yet able to be directly translated into a loading assessment. For example, we may be able to say that 50% of the fecal coliform bacteria from a sample are from dogs but this does not imply that 50% of the loading of fecal bacteria is from dogs.
- The effectiveness of various BMPs (Best Management Practices) under varying conditions has not been systematically assessed under field conditions.

These and other data gaps have been identified to some extent in the research study reports, the research agenda for the Stormwater Monitoring Coalition, and the specific requirements of the NPDES permits. However, a thorough and conceptually organized listing of data gaps must stem from a thoughtful description of the key management questions related to the watershed. There are two reasons for this. First, there is a virtually infinite array of scientific data that could be gathered in a complex system such as this. It is essential to focus effort on those data types that are useful in decision making. Second, data gaps sometimes stem, not from the absence of data, but from the inability to adequately integrate existing data. Articulating clear questions enables studies to be designed so that disparate data types can be combined as needed to address complex issues.

Pollutant Data Gaps

The list below identifies data gaps related to a specific pollutant, bacteria. A lengthier discussion of the bacteria-related data gaps follows the summary list below.

- *Bacteria*
  - Urban vs. natural sources

- Rapid Bacteriological Indicators
- MST (microbiological source tracking) identification methods

Bacteria

A special study will be performed to improve understanding of the correlations between levels of indicator bacteria in the surfzone (where most of the contact recreational activities take place) and levels in the stormdrains themselves. This study will be performed by the County as part of the Santa Ana Region Water Quality Monitoring Program based on the approach recommended by the Stormwater Monitoring Coalition.

The applicability of current bacteriological indicators for measuring human health risk and for identifying the sources of pathogen contamination needs further refinement. Two projects identified in SCCWRP Technical Report 35B *Stormwater Research Needs in Southern California* identify plans to address these issues. The first project (Project 12. *Develop rapid response indicator(s) for microbial contamination*) is focused on producing easily used field tests that would provide a reliable measure of bacteriological contamination within a few hours at most. The second project (Project 13. *Develop microbial source tracking protocol*) will select methods (primarily genetic-based) that provide the most dependable means of identifying and distinguishing among sources.

Considerable resources are being expended to reduce bacterial contamination from watershed sources, but in many cases storms drains continue to discharge large concentrations of fecal indicator bacteria (FIB). A study by SCCWRP will examine if FIB can grow in storm drain sediments. This study, *Storm Drains and Sediments as Reservoirs of Fecal Indicator Bacteria*, is being led by John Griffith.

Other Data Gaps

In addition to the data gaps related to specific pollutants, there are data gaps related to specific beneficial use impairments and the use attainability analyses relative to the achievability of a water quality goal. Specifically, what is the direct and indirect link between the beneficial use impairment by a pollutant and how is this linked to the water quality standard? In addition, what is the link between pollutant source control, and pollutant treatment management relative to achieving a specific water quality standard or goal? In other words, is there data to demonstrate that a goal is achievable or not? In the case of bacteria there may be a need to gather data relative to controllable sources to determine what is truly attainable and whether or not a use attainability analysis should be conducted relative to compliance requirements. Studies needed to answer many of these questions (and eliminate the data gap) have been identified in the *Phase 1 Stormwater Quality Standards* report (SAWPA, 2005).

An additional data gap exists with the ability to use any given set of data for further analysis. Figure 2, which identifies the number of studies in each category, indicates a number of studies / programs generating new data. This may indicate that some of the studies have been conducted independent of the overall needs of the regulatory compliance goals throughout the watershed. The Stormwater Monitoring Coalition has recognized the need to develop a regional stormwater monitoring infrastructure. As part

of the *Stormwater Research Needs in Southern California* report (SCCWRP, 2002), the coalition has identified 4 projects to address this need. These projects include (1) integrate and evaluate available data; (2) standardize sampling and analysis protocols; (3) develop a regional data infrastructure; and (4) measure BMP effectiveness.

An additional data gap that the Stormwater Monitoring Coalition (SCCWRP, 2002) has identified is a need to improve fundamental understanding of stormwater mechanisms and processes. To meet this need the following projects have been identified: (1) develop a system wide conceptual model; (2) Determine appropriate reference conditions; (3) develop a regional method for measuring beneficial use condition; and (4) identify relative contribution of nonpoint sources to urban runoff loads.

The final data gap identified by the Stormwater Monitoring Coalition (SCCWRP, 2002) is related to identifying receiving water impacts. The following studies were identified to address this need: (1) identify the causes of impact in receiving waters; (2) develop bioassessment indicators and protocols; (3) develop improved toxicity testing procedures; (4) develop raid response indicator(s) for microbial contamination; (5) develop microbial source tracking protocol; (6) evaluate BMP effects on receiving water impacts; and (7) develop improved indicators of peak flow impacts.

Several of the identified Stormwater Monitoring Coalition projects have been funded and are underway.

Attachment 1: Huntington Harbor / Anaheim Bay Environmental Matrix

Bibilography for the Huntington-Harbor Anaheim Bay Watersheds

Record #	Program Name or Report Title	Sample Location	Start Date	End Date	flow conditions	entity	Bacteria	nutrients	metals	pesticides	toxicity / TIE studies	water chemistry	fish tissue	sediments	comments
1	Orange County NPDES/TMDL Program	watershed		ongoing	c	OC	1	1	1	1	1	1			
2	2004 Annual Ocean and Bay Water Quality Report	beach	1975	ongoing	c	OCHCA	1								
3	Anaheim Bay biological monitoring project : final report / MEC Analytical Systems, Inc	Seal Beach Wildlife Refuge	1990	1995	c	CAL DEPT FISH & GAME							1		Biological monitoring
5	Bioaccumulation of Contaminants in Flatfish of Southern California	Southern California Bight	1977	1985	w	SCCWRP				1			1		PCB and DDT contaminants in flatfish tissues
6	Enumeration and speciation of enterococci found in marine and tidal sediments and coastal water in Southern California	Dana Point Harbor	Aug-02	Jan-04	c	OC Public Health Laboratory	1								sampling was outside of the watershed but within an Orange County harbor
7	Generation of enterococci bacteria in a coastal saltwater marsh and its impact on surf zone water quality	Huntington Beach		2001	w	UCI	1								
8	Huntington Beach Shoreline Contamination Investigation, Phase III, Final Report	Huntington Beach	1999	2001	c	USGS	1				1				Beach closures in huntington beach due to levels of total coliform, fecal coliform, and enterococci bacteria that exceeded newly applied beach sanitation standards
9	Locating sources of surf zone pollution: a mass budget analysis of fecal indicator bacteria at Huntington Beach, California	OC Beaches (Near Talbert SAR Outlet)		2004	n/a	UCI	1								
10	Model Monitoring Program for Large Ocean Discharges in Southern California			2004	n/a	SCCWRP	1								
11	Report & Studies- Anaheim Bay/ Huntington Harbor Water Quality Assessment Study- Workplan	Anaheim Bay/ Huntington Harbor	Mar-01	Aug-01	c	RDMD			1			1		1	The overall goal of the study is to attain a comprehensive and current assessment of water quality in Anaheim Bay/Huntington Harbor complex
12	Scaling and management of fecal indicator bacteria in runoff from a coastal urban watershed in southern California	OC Beaches (Near Talbert SAR Outlet)			c	UCI	1								
13	Sediment Chemistry, Toxicity,and Benthic Community Conditions in Selected Water Bodies of the Santa Ana Region	Anaheim Bay/Seal Beach Huntington Harbor/Bolsa Chica	Sep-92	Aug-97	c	SWRCB			1		1			1	study is based on chemical pollution & biolgical effects of Santa Ana coastal area
14	Testing the Waters: A Guide to Water Quality at Vacation Beaches	OC Beaches			w	NRDC	1								
15	The Natural Resources of Anaheim Bay-Huntington Harbour	Anaheim Bay-Huntington Harbor		May-05	n/a	CAL DEPT FISH & GAME and USFWS			1		1			1	Catalogs state of Bay. Focus likely on Sedimentation and incoming pollutants.
16	The Recreational Health Risks & Public Perception of Beach Water Quality: A Combined Simulation & Survey-Based Approach	Huntington Beach		Jun-05	n/a	David Joseph Turbow	1								Measures public response to closures and effectiveness of public warning system.
17	Water Quality at Southern California Beaches	California Beaches	2005	2005	w	NRDC	1					1			water quality measurments of southern california beaches
18	Westminster Watershed Reconaissance Study	none	2001	2001	n/a	COE	1	1	1	1				1	watershed study

Table 4. Abbreviation Definitions

Abbreviation	Definition
BMP	Best Management Practice
CDFG	California Department Of Fish and Game
DAMP	Drainage Area Management Plan
FIB	Fecal Indicator Bacteria
NPDES	National Pollutant Discharge Elimination System
NRDC	National Resources Defense Council
MST	Microbial Source Tracking
OCHCA	Orange County Health Care Agency
RDMD	Resources & Development Management Department
SCCWRP	Southern California Coastal Water Research Project
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
UCI	University of California Irvine
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

Bibilography for the Huntington-Harbor Anaheim Bay Watersheds

Record #	Program Name or Report Title	Sample Location	Start Date	End Date	flow conditions	entity	Bacteria	nutrients	metals	pesticides	toxicity / TIE studies	water chemistry	fish tissue	sediments	comments
1	Orange County NPDES/TMDL Program	watershed		ongoing	c	OC	1	1	1	1	1	1			
2	2004 Annual Ocean and Bay Water Quality Report	beach	1975	ongoing	c	OCHCA	1								
3	Anaheim Bay biological monitoring project : final report / MEC Analytical Systems, Inc	Seal Beach Wildlife Refuge	1990	1995	c	CAL DEPT FISH & GAME							1		Biological monitoring
5	Bioaccumulation of Contaminants in Flatfish of Southern California	Southern California Bight	1977	1985	w	SCCWRP				1			1		PCB and DDT contaminants in flatfish tissues
6	Enumeration and speciation of enterococci found in marine and tidal sediments and coastal water in Southern California	Dana Point Harbor	Aug-02	Jan-04	c	OC Public Health Laboratory	1								sampling was outside of the watershed but within an Orange County harbor
7	Generation of enterococci bacteria in a coastal saltwater marsh and its impact on surf zone water quality	Huntington Beach		2001	w	UCI	1								
8	Huntington Beach Shoreline Contamination Investigation, Phase III, Final Report	Huntington Beach	1999	2001	c	USGS	1				1				Beach closures in huntington beach due to levels of total coliform, fecal coliform, and enterococci bacteria that exceeded newly applied beach sanitation standards
9	Locating sources of surf zone pollution: a mass budget analysis of fecal indicator bacteria at Huntington Beach, California	OC Beaches (Near Talbert SAR Outlet)		2004	n/a	UCI	1								
10	Model Monitoring Program for Large Ocean Discharges in Southern California			2004	n/a	SCCWRP	1								
11	Report & Studies- Anaheim Bay/ Huntington Harbor Water Quality Assessment Study- Workplan	Anaheim Bay/ Huntington Harbor	Mar-01	Aug-01	c	RDMD			1			1		1	The overall goal of the study is to attain a comprehensive and current assessment of water quality in Anaheim Bay/Huntington Harbor complex
12	Scaling and management of fecal indicator bacteria in runoff from a coastal urban watershed in southern California	OC Beaches (Near Talbert SAR Outlet)			c	UCI	1								
13	Sediment Chemistry, Toxicity,and Benthic Community Conditions in Selected Water Bodies of the Santa Ana Region	Anaheim Bay/Seal Beach Huntington Harbor/Bolsa Chica	Sep-92	Aug-97	c	SWRCB			1		1			1	study is based on chemical pollution & biolgical effects of Santa Ana coastal area
14	Testing the Waters: A Guide to Water Quality at Vacation Beaches	OC Beaches			w	NRDC	1								
15	The Natural Resources of Anaheim Bay-Huntington Harbour	Anaheim Bay-Huntington Harbor		May-05	n/a	CAL DEPT FISH & GAME and USFWS			1		1			1	Catalogs state of Bay. Focus likely on Sedimentation and incoming pollutants.
16	The Recreational Health Risks & Public Perception of Beach Water Quality: A Combined Simulation & Survey-Based Approach	Huntington Beach		Jun-05	n/a	David Joseph Turbow	1								Measures public response to closures and effectiveness of public warning system.
17	Water Quality at Southern California Beaches	California Beaches	2005	2005	w	NRDC	1					1			water quality measurments of southern california beaches
18	Westminster Watershed Reconaissance Study	none	2001	2001	n/a	COE	1	1	1	1				1	watershed study

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXHIBITS

EXECUTIVE SUMMARY

This "Watershed Action Plan (WAP)" was prepared to meet **Section 12** of the **Drainage Area Management Plan (DAMP)**. Commitments to watershed planning to address water quality issues are also included in **Section 3** of the **DAMP**.

Within Orange County there are both watershed and jurisdictional efforts to improve water quality. The jurisdictional efforts are captured as part of the Local Implementation Plans (LIPs). The WAP was created to capture the regional efforts that are undertaken to provide a watershed-based collaborative effort to address constituents of concern in a specific watershed.

The purpose of this document is to present a planning framework for the Anaheim Bay-Huntington Harbor Watershed to:

- Identify the most significant water quality issues related to urban runoff sources that can be addressed at a multi-jurisdictional watershed-scale,
- Focus jurisdictional pollution prevention and source control programs on local constituents, of concern, to identify treatment control opportunities,
- Incorporate prior data from planning studies,
- Identify indicators to track progress, and
- Ultimately develop an integrated plan of action for urban sources that results in meaningful water quality improvement in the Anaheim Bay-Huntington Harbor Watershed.

The document also describes the numerous existing programs related to water quality and the activities conducted by the Watershed Permittees at the watershed scale.

The following sections comprise the WAP:

Section 1.0 describes the environmental setting of the watershed, discusses program coordination between the Watershed Permittees, and outlines the approach taken in plan development.

Section 2.0 provides an assessment of current water quality conditions and identifies issues and data gaps and constituents of concern. The constituent of concern identified for this watershed is bacteria.

Section 3.0 provides information on the development of total maximum daily load (TMDLs).

Section 4.0 discusses pollution sources and provides an inventory of treatments and enhanced best management practices (BMPs) that have been implemented in the watershed.

Section 5.0 focuses on the recommendations for actions to be taken to address the water quality issues of the watershed and discusses the annual means of assessment of the program effectiveness.

D-1.0 Introduction

The designation of "Anaheim Bay-Huntington Harbor Watershed" refers to the hydrologic watershed that is defined by drainage and only minimally by jurisdictional boundaries. The Anaheim Bay-Huntington Harbor Watershed drains approximately 81 square miles to the Pacific Ocean within Orange County, California.

The Anaheim Bay-Huntington Harbor Watershed has been impacted by water quality problems most of which are from anthropogenic sources or aggravated by human activity. The most well documented problem is high bacteria pollution along the beach. The extent of bacteria contamination has resulted in beach postings and closures which have a significant impact on the beneficial use of the ocean as well as on the local economy. The Anaheim Bay-Huntington Harbor Watershed is a highly urbanized watershed with multiple potential sources of pollution; therefore water resource managers felt that urban runoff would be more appropriately dealt with within the hydrologic boundaries of the watershed, rather than solely on the jurisdictional basis of political boundaries.

The Watershed Permittees includes twelve cities within the watershed (Anaheim, Buena Park, Cypress, Fountain Valley, Garden Grove, Huntington Beach, Los Alamitos, Orange, Santa Ana, Seal Beach, Stanton, and Westminster), unincorporated County of Orange, and the Orange County Flood Control District. Based on their experience and recommendations, a Watershed Action Plan (WAP) within the Drainage Area Management Plan (DAMP) has been developed to attain the following multiple objectives:

- To meet the requirement to update Section 12 of the DAMP as contained in the municipal National Pollution Discharge Elimination System (NPDES) stormwater permit (Order R8-2002-0010).

- To identify the most significant water quality issues and constituents of concern on a watershed scale and relate these to urban sources.

- To focus the pollution prevention and source control programs implemented at an individual jurisdiction level on the identified constituents of concern and to identify any jurisdiction-specific treatment control opportunities.

- To identify the water quality issues that are most appropriately addressed through a multi-jurisdictional watershed-scale approach.

- To identify information that is relevant to the Anaheim Bay-Huntington Harbor Watershed that has been developed as part of local, watershed, or regional studies.

- To develop an integrated plan of action that results in meaningful water quality improvement in the Anaheim Bay-Huntington Harbor Watershed and balances economic, social, and environmental constraints.

- To identify indicators to track progress that lead to improvements in the quality of the receiving waters.

The Watershed Permittees have developed Local Implementation Plans (LIPs) addressing programs and activities that are implemented or being pursued on a jurisdictional basis. Watershed cities and stakeholder groups are also pursuing projects that are intended to have a positive effect on water quality issuing to receiving waters. These include the following major initiatives:

- Since 1990, the Watershed Permittees have developed and implemented common water quality programs within their own jurisdictions in response to the requirements of the municipal NPDES stormwater permit.

- In early 2003, an updated version of the Drainage Area Management Plan (2003 DAMP) was provided to the Santa Ana Regional Water Quality Control Board (Regional Board), including Local Implementation Plans (LIPs – 2003 DAMP Appendix A). The LIPs are detailed plans that focus on specific areas required by the NPDES permits including the legal authority to detect and eliminate pollutant discharges; public education; enhanced standards for new development/significant re-development; implementation of best management practices (BMPs) at municipal facilities, construction sites, and commercial and industrial facilities; and water quality monitoring. The BMPs can, in most cases, be focused on targeted constituents of concern to be identified through the monitoring program.

- In 1999, the Regional Board issued a Cleanup and Abatement Order to the city of Huntington Beach in response to the beach closures at Huntington State Beach and Huntington City Beach during the summer of 1999 for elevated bacterial indicator concentrations. Numerous studies followed to provide a better understanding of bacterial contamination in this watershed and the Santa Ana River Watershed.

The Anaheim Bay-Huntington Harbor WAP borrows much of its organization, structure, and terminology from the 2003 DAMP of which it is an appendix. The following sections are included in the WAP:

- **Section 1.0** describes the watershed and environmental setting, the program management coordination between the Watershed Permittees and other stakeholders, and the approach taken to develop the plan.

- **Section 2.0** assesses the water quality information available and identifies the water quality issues and constituents of concern.

- **Section 3.0** provides information on TMDLs and how they will impact watershed planning.

- **Section 4.0** discusses the urban sources of pollution, the available treatments for pollution control, and an inventory of enhanced BMPs that have been implemented in the watershed that address specific pollutants of concern.

- **Section 5.0** focuses on the recommendations for actions to be taken to address the water quality issues of the watershed and discusses the annual means of assessment of the program effectiveness.

The Anaheim Bay-Huntington Harbor WAP is intended as a living document, one capable of being modified as new information becomes available and problems are addressed. It identifies the current state of knowledge on the issues facing Anaheim Bay-Huntington Harbor. It also identifies the actions to which the Watershed Permittees have made commitments. Annual assessments will be made to identify the progress on these actions and the schedule for continued efforts related to that action. This assessment will be reflected through annual updates to the strategy tables described in **Section 5.0** and included as an Exhibit to the WAP.

D-1.1 Watershed Setting

The Anaheim Bay-Huntington Harbor Watershed is located in northern Orange County, approximately 25 miles south of Los Angeles and 85 miles north of San Diego (**Figure D-1**). The Anaheim Bay-Huntington Harbor Watershed is composed of a number of channels, none of which is a dominant river for the watershed with each draining a substantial portion of the watershed. They include the:

- Stanton Storm Channel;
- Bolsa Chica Channel;
- Anaheim Harbor City Channel;
- Westminster Channel;
- East Garden Grove Wintersburg Channel; and
- Ocean View Channel

These channels are not included in the Water Quality Control Plan for the Santa Ana River Basin (hereafter, Basin Plan). Ultimately, the channels converge along the coast where they empty into Huntington Harbor and Anaheim Bay. The headwaters for these channels begin in the northern and eastern reaches of the watershed which is almost completely urbanized and has a very low slope, having once been primarily swamplands or low coastal floodplains for the San Gabriel and Santa Ana Rivers. All the channel reaches within the watershed are improved (lined) for flood control. Typical flow in the Anaheim Bay-Huntington Harbor Watershed is almost completely dry weather runoff.

At the downstream end of the watershed the channels empty into a series of bays and into the ocean. These bays and beach, which are included in the Basin Plan, are:

- Anaheim Bay (Outer Bay and Seal Beach National Wildlife Refuge)
- Sunset Bay (Huntington Harbor)
- Bolsa Bay and Bolsa Chica Ecological Reserve
- Bolsa Chica State Beach

Figure D-1: Location Map

See next page for figure.

Figure D-1 Location Map
Anaheim Bay - Huntington Harbor Watershed

Almost the entire Anaheim Bay-Huntington Harbor Watershed is covered with dense development with a few coastal fringe areas that are either protected habitat or military property that has not been developed. Within the watershed several agencies and organizations have protected habitat set aside for wildlife species. California State Parks owns 1,200 acres (Bolsa Chica Ecological Reserve) on the south coast of Huntington Beach. The United States Department of the Interior's Fish and Wildlife Service has 920 acres (Seal Beach National Wildlife Refuge) within Seal Beach, just southeast of the mouth of the San Gabriel River. This watershed is bounded by the Santa Ana River Watershed to the south and east, and the San Gabriel/Coyote Creek Watershed to the north. Open spaces consist of the ecologic reserve, wildlife refuge, city and regional parks, and golf courses.

Major transportation arteries through the watershed include Interstate 5 (I-5), Interstate 405 (I-405) and the Pacific Coast Highway (Hwy 1). All three roughly parallel the Pacific Ocean coastline, in southern Orange County I-405 rejoins I-5. Major roadways of the Anaheim Bay-Huntington Harbor Watershed are shown in **Figure D-2**. The school districts are shown in **Figure D-3a**, cities are shown in **Figure D-3b**, water districts are shown in **Figure D-3c**, and parks are shown in **Figure D-3d**. Existing land use within the watershed is shown in **Figure D-4**.

Figure D-2: Transportation

See next page for figure.

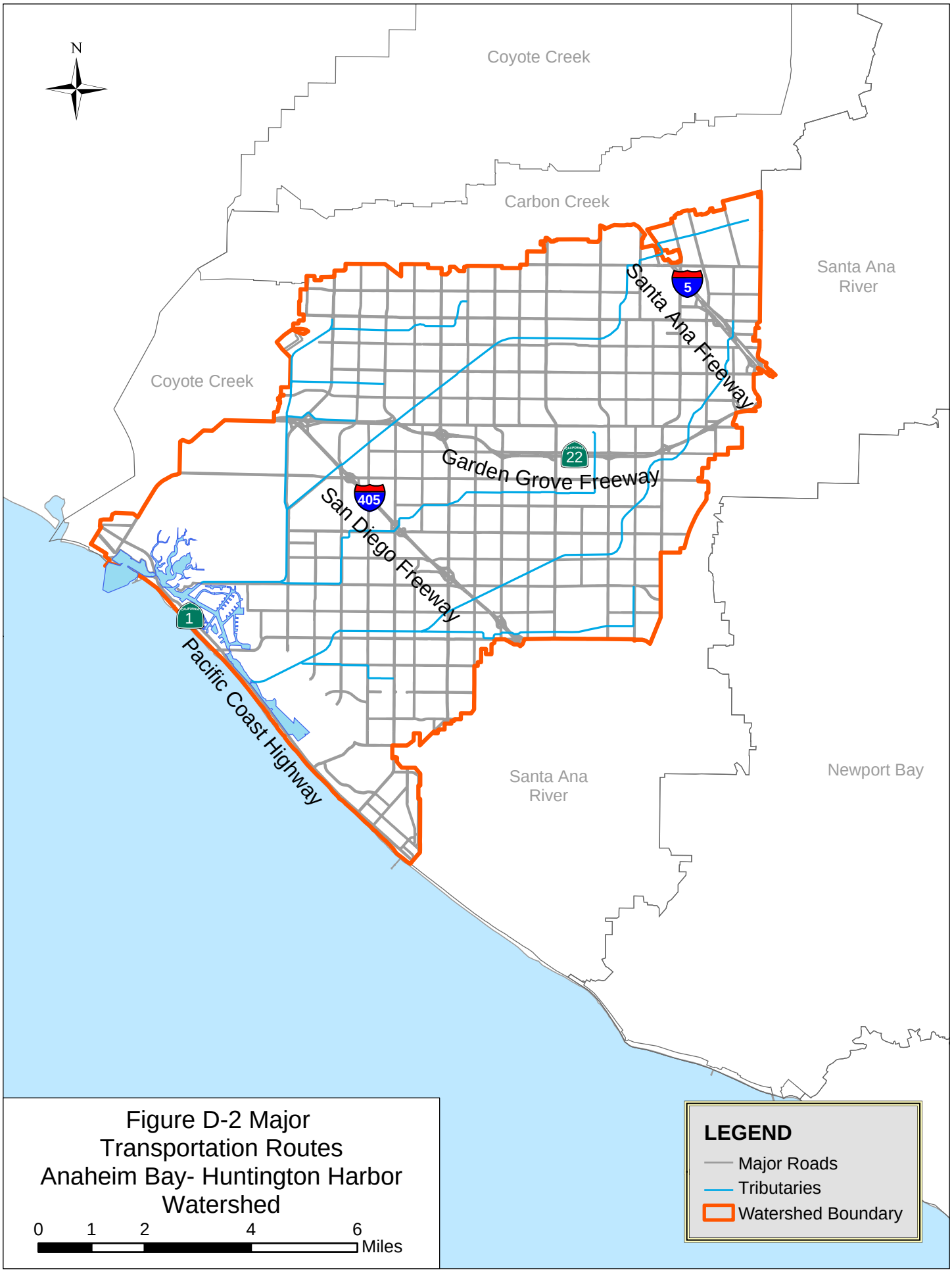

N
Coyote Creek
Carbon Creek
Santa Ana River
Coyote Creek
Santa Ana Freeway
5
Garden Grove Freeway
22
405
San Diego Freeway
1
Pacific Coast Highway
Santa Ana River
Newport Bay
Figure D-2 Major Transportation Routes Anaheim Bay- Huntington Harbor Watershed
0 1 2 4 6
Miles
LEGEND
Major Roads
Tributaries
Watershed Boundary

Figure D-3a: Unified School Districts

See next page for figure.

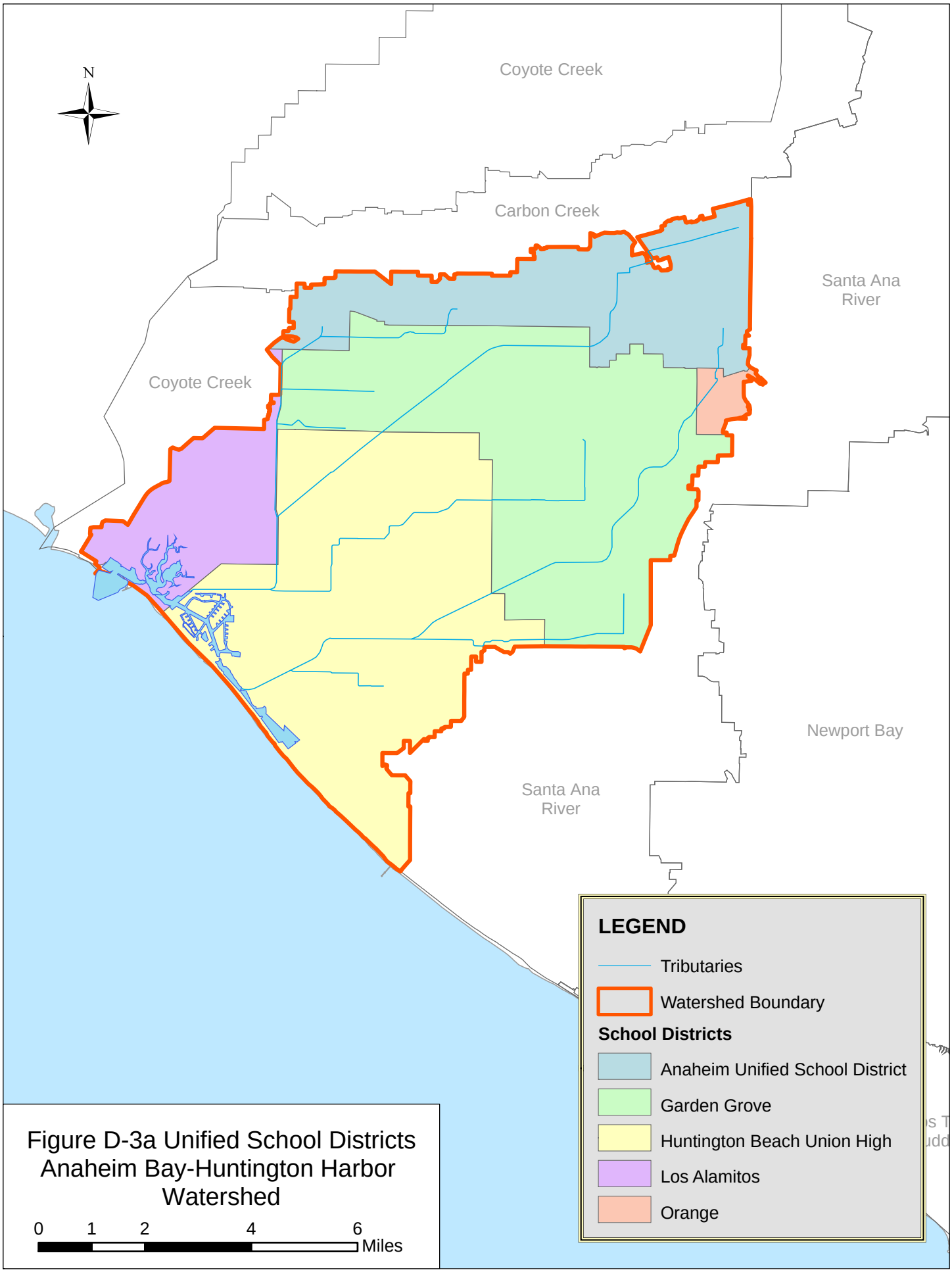


Figure D-3a Unified School Districts
Anaheim Bay-Huntington Harbor
Watershed

Figure D-3b: City Boundaries

See next page for figure.

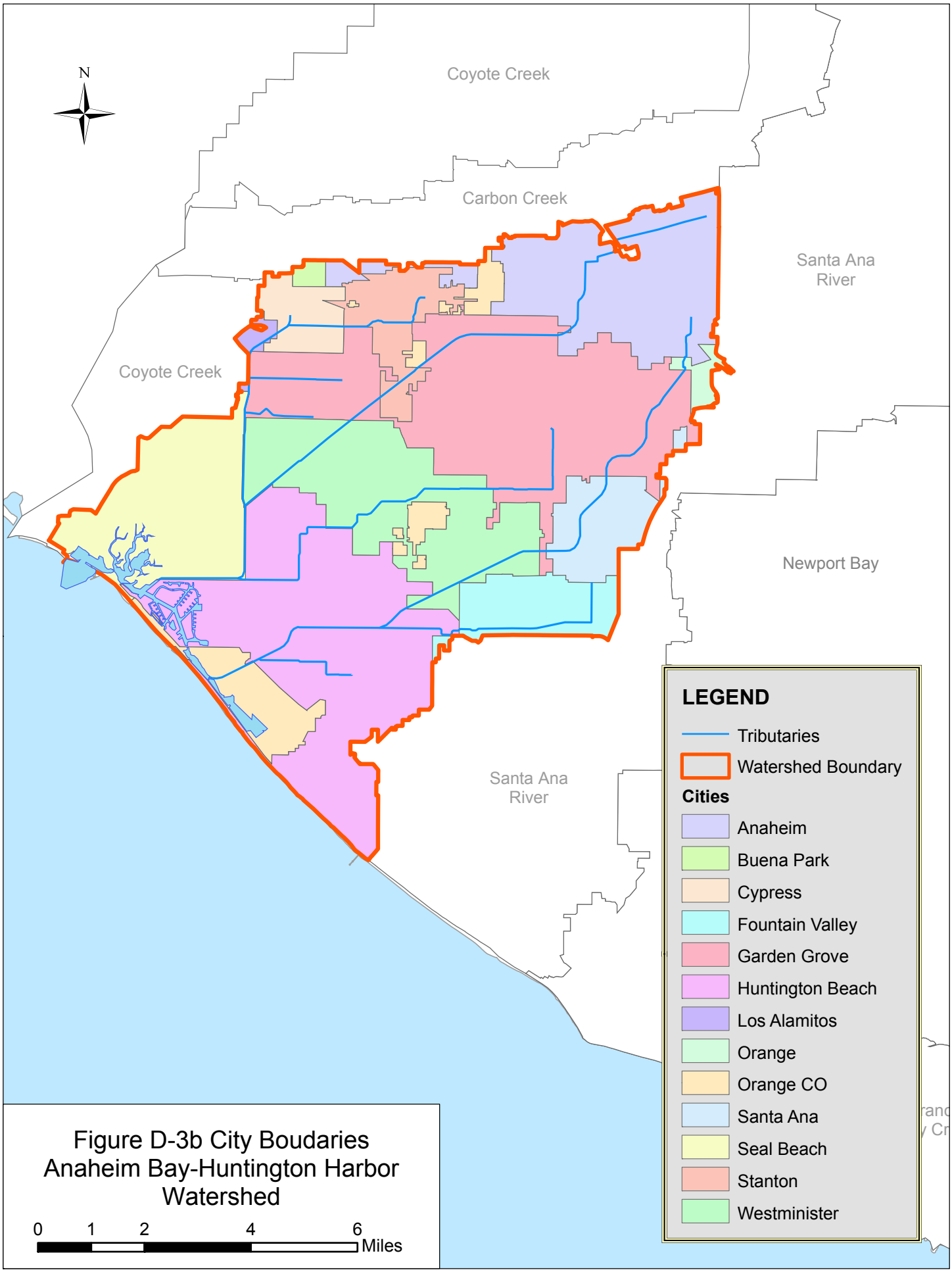


Figure D-3b City Boudaries
Anaheim Bay-Huntington Harbor Watershed

Figure D-3c: Water Providers

See next page for figure.

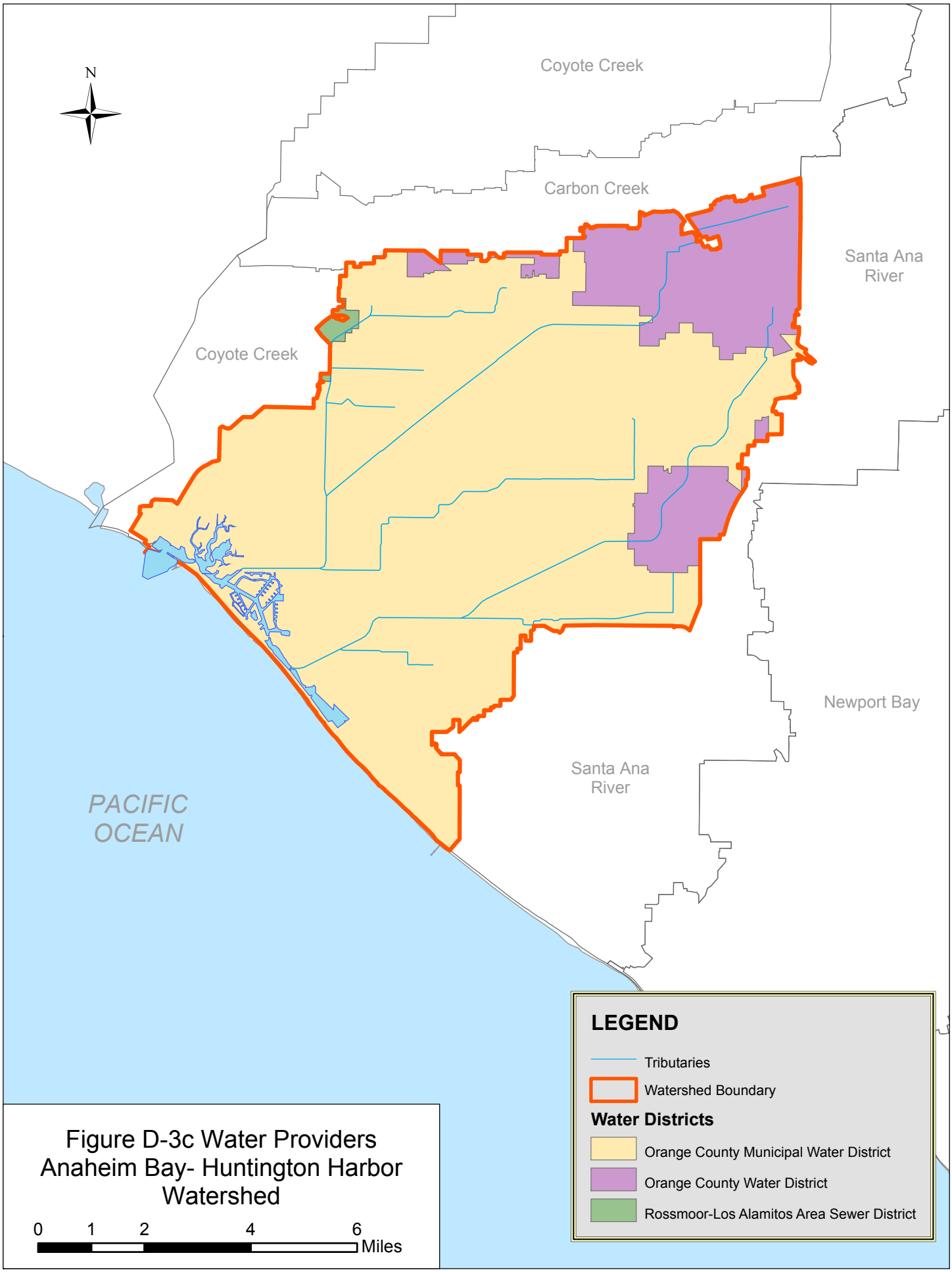


Figure D-3c Water Providers
Anaheim Bay- Huntington Harbor
Watershed

Figure D-3d: Parks and Open Space

See next page for figure.

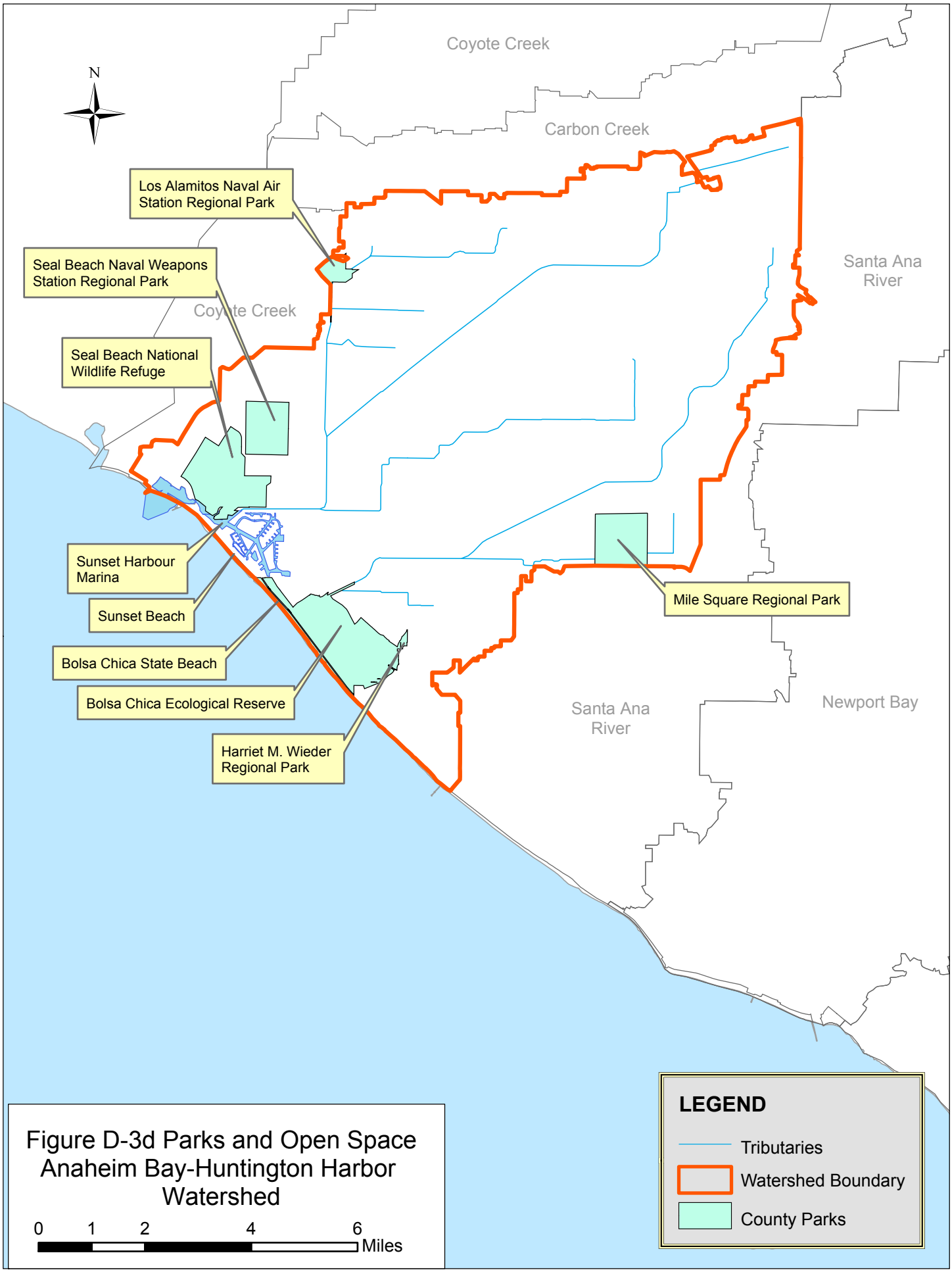

N
Coyote Creek
Carbon Creek
Los Alamitos Naval Air Station Regional Park
Seal Beach Naval Weapons Station Regional Park
Coyote Creek
Seal Beach National Wildlife Refuge
Santa Ana River
Sunset Harbour Marina
Sunset Beach
Bolsa Chica State Beach
Bolsa Chica Ecological Reserve
Harriet M. Wieder Regional Park
Mile Square Regional Park
Santa Ana River
Newport Bay
LEGEND
Tributaries
Watershed Boundary
County Parks
Figure D-3d Parks and Open Space
Anaheim Bay-Huntington Harbor
Watershed
0 1 2 4 6
Miles

Figure D-4: Land Use - Existing

See next page for figure.

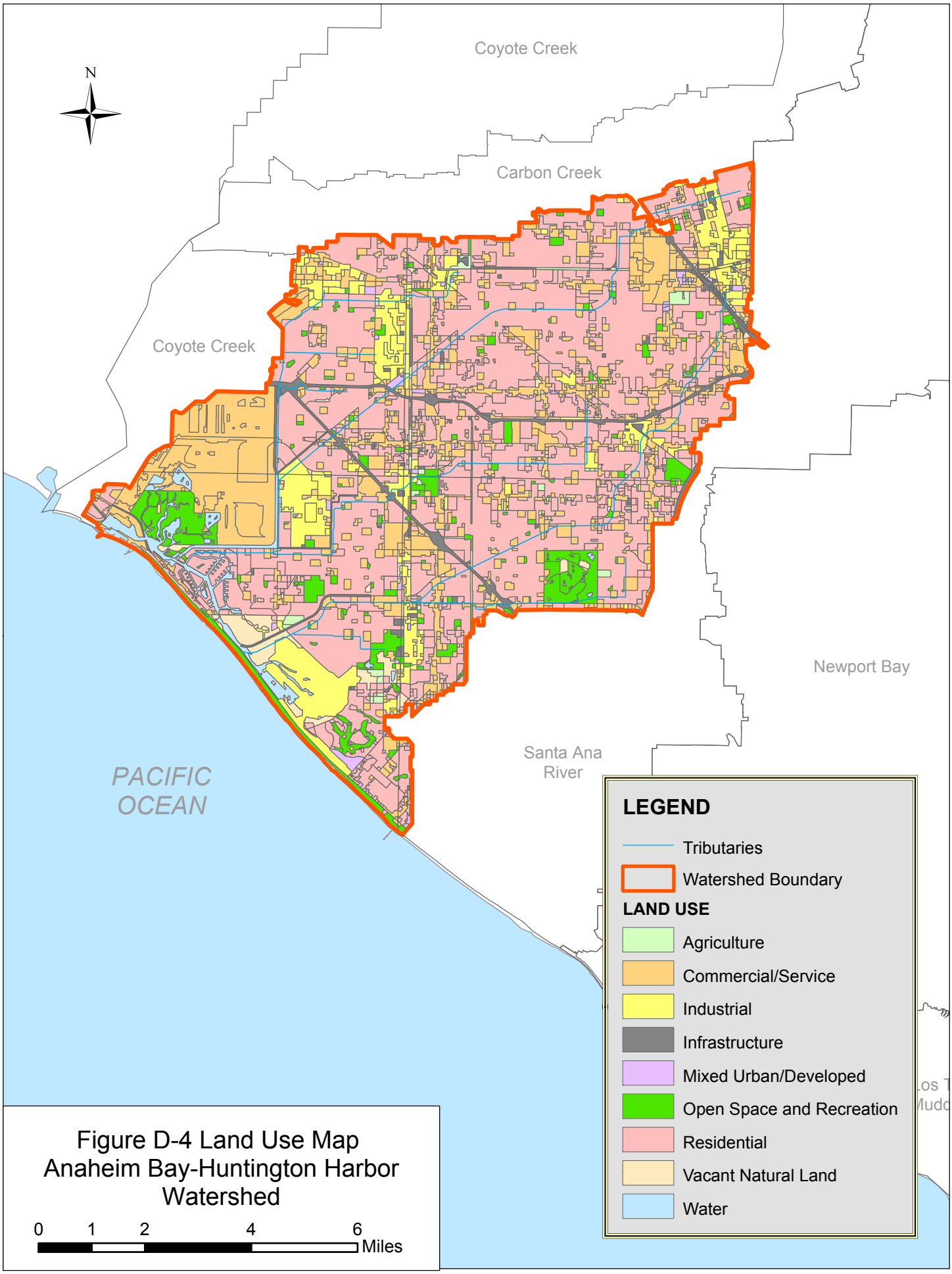


Figure D-4 Land Use Map
Anaheim Bay-Huntington Harbor
Watershed

D-1.2 Beneficial Uses

The Anaheim Bay-Huntington Harbor Watershed is within the jurisdiction of the Santa Ana Regional Water Quality Control Board (Regional Board), within the subunit of the Lower Santa Ana River Basin (designated Hydrologic Unit 801.11). The Water Quality Control Plan for the Santa Ana River Basin (hereafter, Basin Plan) lists a number of water bodies in the following table (**Table D-1)** as receiving waters. The following existing beneficial uses are designated in the Basin Plan for the lakes, bays, estuaries and tidal prisms shown in **Table D-1**:

BIOL – biological significance
COMM – commercial and sportfishing
EST – estuarine habitat
MAR – marine habitat
MUN – municipal and domestic supply
NAV - shipping, travel or other transportation
RARE - rare, threatened, or endangered species
REC1 – contact water recreation
REC2 – non-contact water recreation
SHEL - habitats for shellfish collected for human consumption
SPWN - aquatic habitats for reproduction of fish and wildlife
WILD – wildlife habitat

Table D-1 shows the beneficial uses associated with each waterbody.

Table D-1: Beneficial Uses – Anaheim Bay-Huntington Harbor Watershed

	Beneficial Use																				
Name	**MUN**	**AGR**	**IND**	**PROC**	**GWR**	**NAV**	**POW**	**REC 1**	**REC 2**	**COMM**	**WARM**	**LWRM**	**COLD**	**BIOL**	**WILD**	**RARE**	**SPWN**	**MAR**	**SHEL**	**EST**	**Hydrologic Unit**
Coast, Bays, Estuaries, and Tidal Prisms																					
Anaheim Bay – Outer Bay	+					X		X	X					X	X	X	X	X			801.11
Anaheim Bay – Seal Beach National Wildlife Refuge	+							X[1]	X					X	X	X	X	X		X	801.11
Sunset Bay – Huntington Harbor	+					X		X	X	X					X	X	X	X			801.11
Bolsa Bay	+							X	X	X				X	X	X	X	X	X		
Bolsa Chica Ecological Reserve	+							X	X					X	X	X	X	X		X	801.11
Bolsa Chica State Beach																					

X Present or Potential Beneficial Use + Excepted from MUN

[1] No access per agency with jurisdiction (U.S. Navy)

The following is a description of the relevant beneficial use designations:

Biological Significance (BIOL) – Preservation of Biological Habitats of Special Significance. These waters support designated areas or habitats, including, but not limited to, established refuges, parks, sanctuaries, ecological reserves or preserves, and Areas of Special Biological Significance (ASBS), where the preservation and enhancement of natural resources requires special protection.

Commercial and Sportfishing (COMM) – Includes uses of water for commercial or recreational collection of fish or other organisms, including those collected for bait. These uses may include, but are not limited to, uses involving organisms intended for human consumption.

Estuarine Habitat (EST) – Include uses of water to support estuarine ecosystems, which are not limited to, preservation and enhancement of estuarine habitats, vegetation, fish and shellfish, and wildlife, such as waterfowl, shorebirds, and marine mammals.

Marine Habitat (*MAR*) – Include uses of water to support marine ecosystems that are not limited to, preservation and enhancement of marine habitats, vegetation (e.g., kelp), fish and shellfish, and wildlife (e.g., marine mammals and shorebirds).

Municipal and Domestic Supply (*MUN*) – Supports use for community, military, municipal or individual water supply systems, including drinking water supply.

Navigation (NAV) -- Waters are used for shipping, travel or other transportation by private, commercial or military vessels.

Rare, Threatened, or Endangered Species (RARE) – Includes uses of water that support habitat necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered. Among plants or animal species which were used in the designation of specific water bodies with RARE beneficial uses are: least Bell's vireo (bird), California least tern (bird), light-footed clapper rail (bird), California brown pelican (bird), Belding's savannah sparrow (bird), willowy monardella (plant), humpback and blue whale (mammals), bald eagle (bird), tidewater goby (fish), southwestern willow flycatcher (bird), salt-marsh bird's beak (plant), Pacific green sea turtle (reptile), and western snowy plover (shore bird). The RARE designation is placed on water bodies where the protection of a threatened or endangered species depends on the water either directly, or to support its habitat.

Contact Water Recreation (REC1) – Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, white water activities, fishing, or use of natural hot springs.

Non-Contact Water Recreation (REC2) – Includes uses of water for recreational activities involving proximity to water, but not normally involving body contact with water where ingestion of water would be reasonably possible. These uses include, but are not limited to, picnicking,

sunbathing, hiking, beach combing, camping, boating, tidepool, and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Shellfish Harvesting (SHEL) -- Waters support habitats necessary for shellfish (e.g., clams, oysters, limpets, abalone, shrimp, crab, lobster, sea urchins, and mussels) collected for human consumption, commercial or sports purposes.

Spawning, Reproduction, and Development (SPWN) -- Waters support high quality aquatic habitats necessary for reproduction and early development of fish and wildlife.

Wildlife Habitat (WILD) – Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

D-1.3 Constituents of Concern

The focus of the WAP is to address the constituents of concern within the watershed. The constituent of concern in the Anaheim Bay-Huntington Harbor Watershed is bacteria. In 1999 the Regional Board issued a Cleanup and Abatement Order for the Huntington Beach area, which includes this watershed to address bacteria. Considerable research and study continues to be done related to this constituent. In addition, the data produced through the County of Orange NPDES monitoring program is currently under assessment.

As additional constituents of concern are identified, the Watershed Permittees will address those concerns and they will be reflected in the WAP.

D-1.4 Watershed Program Management

Program management of various water quality improvement programs within the Anaheim Bay-Huntington Harbor Watershed occurs at two distinct levels: (1) activities conducted by the Watershed Permittees individually in implementing jurisdictional programs in their LIPs based on the model programs in the DAMP and in compliance with the municipal NPDES stormwater permits and (2) activities conducted by the Watershed Permittees and others collectively to address specific water quality issues on a watershed scale identified through the Water Quality Planning Process (see **DAMP Section 3**).

Within the Anaheim Bay-Huntington Harbor Watershed an initiative is currently underway to form an Anaheim Bay-Huntington Harbor Watershed Committee which will meet twice annually. Based upon the annual watershed assessment (discussed in **Section 5.0**), the Watershed Permittees and other participating jurisdictions will work together to address the priority water quality issues identified through the watershed planning processes. It is anticipated that water quality issues that are determined to be specific to a jurisdiction would be referred to that jurisdiction and thereafter be addressed as a jurisdictional program initiative through the LIP. Alternatively, the issue may originate from multiple jurisdictions within the watershed. In this instance, the problem would be addressed as a watershed cooperative effort.

Updates to this program will be the subject of annual reporting each November, which will include a water quality assessment and revisions to the listed water quality improvement initiatives.

D-1.4.1 NPDES Coordination

The Orange County Stormwater Program is underpinned by an Implementation Agreement between the County of Orange, the Orange County Flood Control District, and the 34 cities of Orange County. The Agreement provides a funding formula and budgeting process for shared countywide costs and Regional Board monitoring costs by area.

The Orange County Stormwater Program also has an extensive committee structure that is described in the DAMP (**2003 DAMP Section 2**) and in the LIPs of the Watershed Permittees (**2003 DAMP Appendix A-2**). Each of the Watershed Permittees participates in the General Permittee meeting and, selectively, in the other oversight and technical committees.

D-2.0 Water Quality Assessment

The WAPs of the DAMP focus on the water quality within particular watersheds and how the water quality is impacted by urban discharges. Urban discharges include surface runoff from residential, commercial, and industrial areas. Pollution sources that are not considered as part of the urban watershed planning responsibilities are atmospheric deposition and agricultural runoff. The following figure (**Figure D-5**) demonstrates the physical processes involved with generation of pollution and its fate and transport.

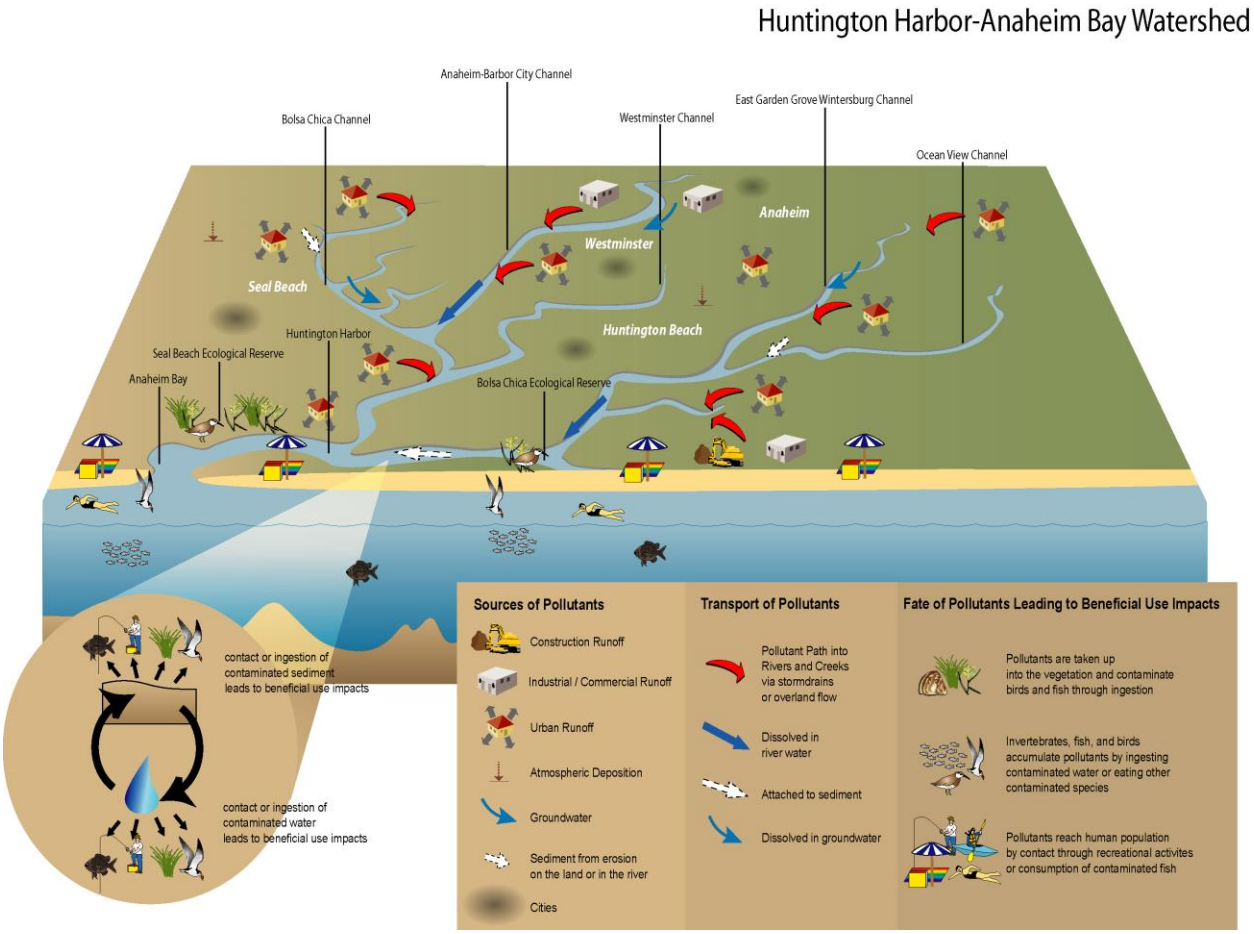


Figure D-5: Anaheim Bay-Huntington Harbor Watershed Processes

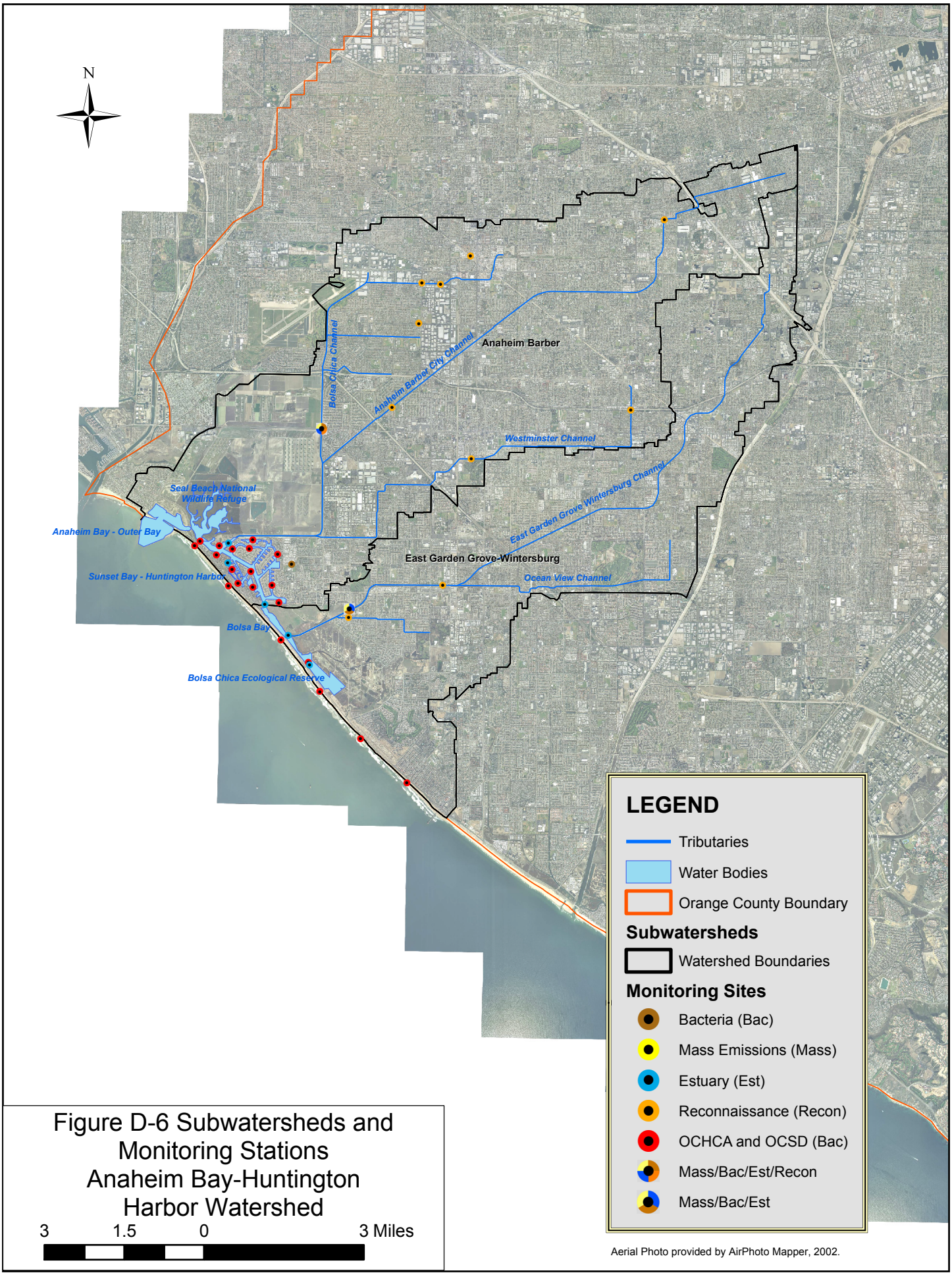


Figure D-6 Subwatersheds and Monitoring Stations Anaheim Bay-Huntington Harbor Watershed

Within the Anaheim Bay-Huntington Harbor Watershed there have been several major initiatives to monitor and assess the water quality:

- The NPDES Program began in 1990 and is anticipated to continue into the foreseeable future.

- The OCHCA (in cooperation with OCSD) has been testing coastal waters in Orange County over the past 40 years for bacteria that indicate the possible presence of disease-causing organisms. Monitoring the Anaheim Bay-Huntington Harbor coastal system is performed by OCHCA. Monitoring data are compared to the bacteria water quality standards established following the adoption of AB411.

D-2.1 Summary of Monitoring Activities

D-2.1.1 NPDES Program

NPDES permits are issued for a five-year term and are issued on an area-wide basis. The first municipal NPDES Stormwater Permit was for the period 1990-1996; the Second Term Permit covered 1996-2002; and the Third Term Permit covers 2002-2007. Each of the permits has required the development and implementation of a monitoring program to support an effective County-wide urban stormwater management program.

D-2.1.1.1 *First Term Permit*

The monitoring program for the First Term Permit, which extended through 1998, consisted of four elements—field screening, channel monitoring, harbor/bay monitoring, and sediment sampling.

- Field Screening was performed to detect the presence of illegal discharges or illicit connections. Physical and chemical analyses were conducted in the field. The annual evaluation of each station included two dry-weather samplings and one storm sampling. Field screening monitoring stations within the Anaheim Bay-Huntington Harbor Watershed included:

    * Los Alamitos Channel
    * Los Alamitos Basin
    * Bolsa Chica Channel
    * Stanton Storm Channel
    * Jonathan Storm Channel
    * Anaheim-Barber City Channel
    * Humboldt Storm Channel
    * Westminster Channel
    * East Garden Grove Wintersburg Channel
    * West Street Basin
    * Haster Basin
    * Ocean View Channel

- Channel monitoring focused on specific watercourses with beneficial uses identified in the Basin Plan. Stations were monitored monthly and during storms. Samples were collected using automatic samplers and analyzed for pH, electrical conductivity, turbidity, nutrients, total suspended solids, volatile suspended solids, and total recoverable metals.

- Harbor/bay sites were monitored semiannually and during storms for nutrients in the water column and trace metals and organics in the sediment. In addition sediment sampling was conducted semiannually from designated channels and several bays and harbors. Samples were evaluated for metals, pesticides, herbicides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs).

D-2.1.1.2 *Second Term Permit*

The First Permit Term monitoring program was continued into the second permit term. In 1999, the 99-04 Plan was developed and implemented as a transition program between the 2nd and 3rd term permits. This Plan revised the geographic focus of the monitoring effort by designating "warm spots" (where constituents are substantially above system-wide averages) and "Critical Aquatic Resources" or CARs. The CARs were prioritized and additional monitoring stations selected to gather data at those sites. In the Anaheim Bay-Huntington Harbor Watershed there was one 'warm spot' at Christiana Bay (HUNCRB) and six second priority CAR monitoring sites in Sunset Harbor and Bolsa Chica Channel (HUNSUN, HUNBCC, HUNWAR, HUNCRB, HUNHAR, and BBOLR).

D-2.1.1.3 *Third Term Permit*

This current permit period is the most comprehensive monitoring effort to date. It extends the monitoring program to a broader range of locations and to a wider array of methods for measuring impacts. Three kinds of monitoring are considered for this plan.

- Core Monitoring – routine and related to small-scale or site-specific problems and processes,

- Regional Monitoring – periodic, collaborative, and larger-scale surveys, and

- Special Studies – tightly focused and relatively short-term studies.

The following is a list of the seven Program Elements. Each of the 3 types of monitoring listed above are considered and incorporated as appropriate into each of the program elements.

Long-term mass emissions monitoring – includes measurements of key pollutants, loads and exceedances to monitoring progress. There are two (2) established stations. One on the East Garden Grove Wintersburg Channel at Graham Street, and one at the Bolsa Chica Channel at Westminster Avenue.

Estuary / wetlands monitoring – includes measurements of key pollutants, loads and biological community parameters to describe impacts of urbanization on estuarine and wetland ecosystems. There five (5) established stations. One at the Bolsa Chica Channel at Sunset Harbor, two in Huntington Harbor (at Edinger and at Warner), one in the Bolsa Chica Ecological Reserve, and one at the East Garden Grove Wintersburg Channel outlet in Bolsa Bay.

Bacteriological/ pathogen – uses a suite of bacterial indicators to determine the impacts of stormwater and non-stormwater runoff and identify spatial and temporal patterns of elevated concentrations in order to prioritize problem areas. Stations were identified through a joint field reconnaissance effort between the County Health Care Agency (HCA) and the County Sanitations Districts of Orange County. Within the Anaheim Bay-Huntington Harbor watershed there are three (3) established stations. One on the East Garden Grove Wintersburg Channel at Graham Street, one at the Bolsa Chica Channel at Westminster Avenue, and one in channel C07 at Heil Avenue.

Urban stream bioassessment monitoring – uses a triad of indicators (bioassessment, chemistry, and toxicity) to define the impacts to stream communities and the relationship of the impacts to runoff. Within the Anaheim Bay-Huntington Harbor watershed there are currently no established stations.

Dry weather reconnaissance – uses measurements of key pollutants to identify illegal discharges and illicit connections. Throughout the County approximately 30 sites will be monitored, with 10 additional sites selected at random. Within the Anaheim Bay-Huntington Harbor watershed there are currently eleven (11) established stations. These are located as follows:

- East Garden Grove Wintersburg Channel at Graham Street in Huntington Beach
- East Garden Grove Wintersburg Channel at Gothard Street in Huntington Beach
- Bolsa Chica Channel at Westminster Avenue in Huntington Beach
- Anaheim-Barber City Channel downstream of Edwards Street in Westminster
- Westminster Channel along Hazard Avenue in Westminster
- Stanton Storm Channel at Pacific Street in Stanton
- Anaheim-Barber City Channel at West Ball Road in Anaheim
- Stanton Storm Channel at Knott Street in Garden Grove
- Stanton Storm Channel upstream of Knott Street at Hood Way in Garden Grove
- Belgrave Culvert at Chapman and Knott Street in Garden Grove
- Westminster Channel at Taft Street in Garden Grove

Land use correlations– uses available experimental designs to identify changes in runoff and sediment load associated with the urbanization of previously agricultural land. Two land use sites will represent both a flat and a hillside agricultural plot. Within the Anaheim Bay-Huntington Harbor watershed there are currently no established stations.

D-2.1.2 Orange County Health Care Agency

Over the past 40 years, the Orange County Health Care Agency (also known as Environmental Health) and local sanitation agencies (Orange County Sanitation District and South Orange County Wastewater Authority) have been testing the coastal waters in Orange County for bacteria that indicate possible presence of human disease-causing organisms. Samples are collected weekly at approximately 150 ocean, bay, and drainage locations throughout coastal Orange County. Within the Anaheim Bay-Huntington Harbor Watershed, there are approximately 20 sample locations along the coast. **Figure D-6** shows the subwatersheds and the monitoring locations within the Anaheim Bay-Huntington Harbor Watershed.

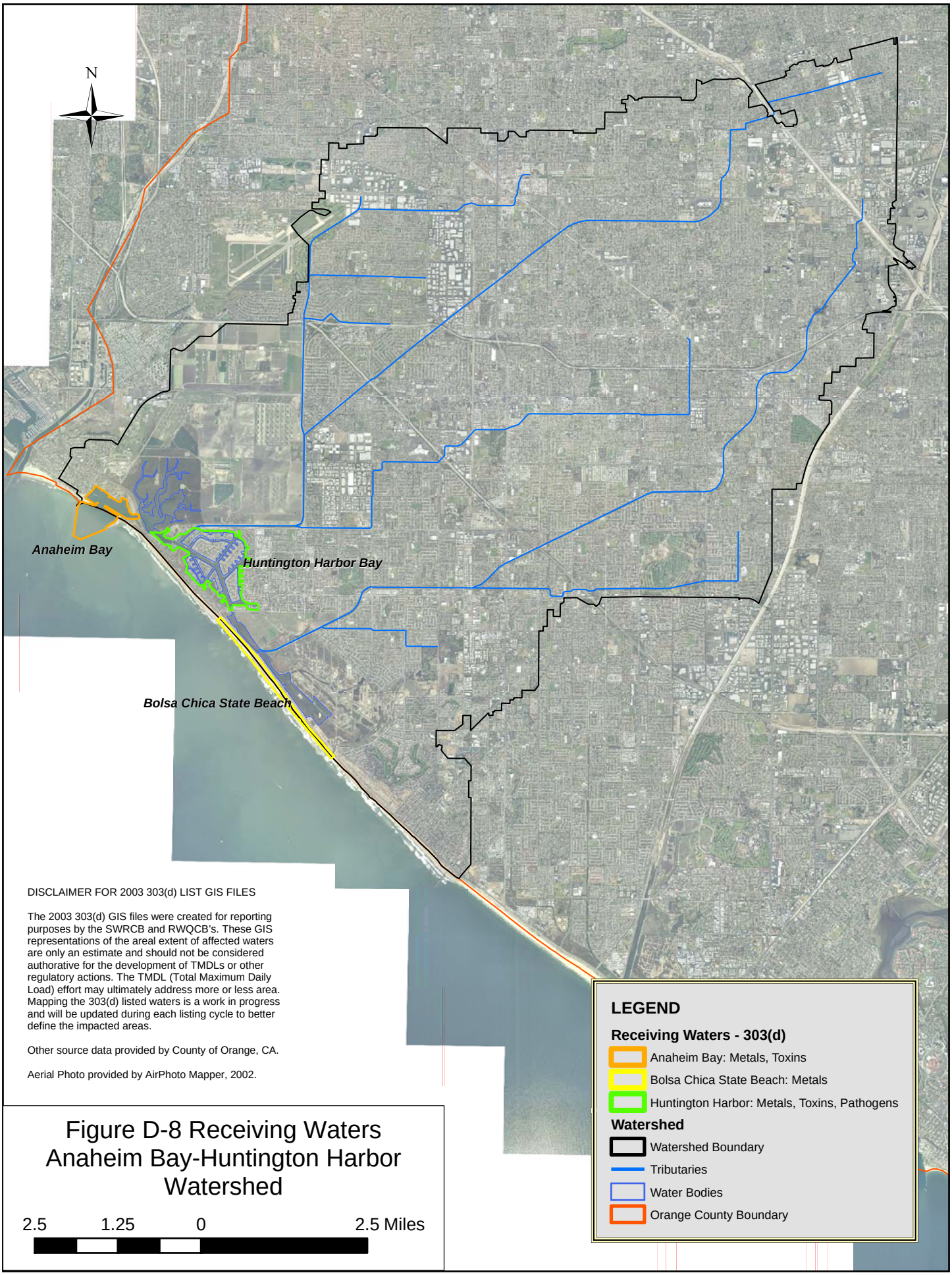
On July 26, 1999, State law (AB411), mandating new protocols for surf zone monitoring of indicator bacteria, went into effect. The new law requires posting advisory signs to warn against swimming when indicator bacteria exceed regulatory thresholds for total coliform, fecal coliform, and enterococcus. Beach closures during the summer months of 1999 were the response of health officials to the elevated levels of indicator bacteria at Huntington State Beach and Huntington City Beach. The Orange County Sanitation District with Orange County Health Care Agency, the California State Department of Parks and Recreation, the City of Huntington Beach, and the Regional Board partnered to conduct a series of investigations to ascertain the sources of bacterial contamination in the near shore environment.

D-2.1.3 SCCWRP Bight Study

SCCWRP coordinates regular monitoring efforts of the Southern California Bight from Point Conception to the Mexico border. The most recent Bight '03 Study was divided into three program components—coastal ecology, water quality, and shoreline microbiology. The coastal ecology component includes monitoring and assessment within coastal reaches of the Anaheim Bay-Huntington Harbor Watershed. The Sediment Toxicity Report (Volume I) has been published and includes monitoring data for stations along the beach in proximity to the Anaheim Bay-Huntington Harbor Watershed. As part of the Sediment Toxicity work, analyses were performed on samples taken at 359 sites with varying toxicity level results. Ongoing surveys for the Coastal Ecology component of the Bight '03 Study will continue to produce data along the coastal reach of the Anaheim Bay-Huntington Harbor watershed. The planned reports that will include this information are: Sediment Chemistry, Benthic Macrofauna, and Demersal Fish and Megabenthic Invertebrates.

Figure D-6: Subwatersheds and Monitoring Stations

See next page for figure.



DISCLAIMER FOR 2003 303(d) LIST GIS FILES

The 2003 303(d) GIS files were created for reporting purposes by the SWRCB and RWQCB's. These GIS representations of the areal extent of affected waters are only an estimate and should not be considered authorative for the development of TMDLs or other regulatory actions. The TMDL (Total Maximum Daily Load) effort may ultimately address more or less area. Mapping the 303(d) listed waters is a work in progress and will be updated during each listing cycle to better define the impacted areas.

Other source data provided by County of Orange, CA.

Aerial Photo provided by AirPhoto Mapper, 2002.

LEGEND

Receiving Waters - 303(d)

- Anaheim Bay: Metals, Toxins
- Bolsa Chica State Beach: Metals
- Huntington Harbor: Metals, Toxins, Pathogens

Watershed

- Watershed Boundary
- Tributaries
- Water Bodies
- Orange County Boundary

Figure D-8 Receiving Waters Anaheim Bay-Huntington Harbor Watershed

2.5 1.25 0 2.5 Miles

D-2.2 Assessment of Data and Studies

Specific to the Anaheim Bay-Huntington Harbor Watershed, eighteen (18) studies were identified that provide water quality information. The data collection effort ended in June of 2005. A matrix was developed to provide a detailed view of each of the studies / programs discussed in this technical memorandum. This matrix is referred to as the Anaheim Bay-Huntington Harbor Environmental Matrix and includes information such as the specific constituents of concern included in the study / program, and details of the monitoring and management issues supported by that study / program. The Anaheim Bay-Huntington Harbor Environmental Matrix is attached as Exhibit 1 to this WAP.

It is a significant challenge to assemble the report references into a meaningful framework that provides the reader with an idea of what type of data or results are available. In order to meet the various types of user needs that were envisioned, the data has been 'cut' in several directions. Each 'cut' or assessment represents the sum total of all the programs and studies that were assembled as part of this technical memorandum; the difference is only in the perspective taken in that assessment.

Assessment #1: Program Management and Policies

When faced with the data that exists, it is appropriate to assess whether the data are providing stormwater program coordinators with the information needed to manage the program and make informed decisions for the watershed. The knowledge needed at various stages in the program development must be able to build on previous efforts to attain constantly improving results. The following passage from *Managing Troubled Waters* (National Academy Co, 2003) explains this iterative process.

> *"The reality of imperfect knowledge about marine systems means that monitoring should be used as an opportunity to increase and refine our knowledge of them. Data and information derived from monitoring programs should be used to check, validate, and refine the assumptions, models, and understandings on which the monitoring was based. This iterative feedback increased predictive ability, reduces uncertainty, and ultimately reduces the monitoring effort needed. As discussed in Chapter 2, risk-free decision making is not achievable, and monitoring must be viewed as a way of reducing uncertainty, not of eliminating it."*

The following table (**Table D-2**) identifies the management categories of a stormwater program that are needed to advance the knowledge of the systems and identifies the number of studies within the data collection effort that are relevant to each category. Each of these categories is considered for specific pollutants of concern or elements of the watershed system. The table shows that the majority of the study effort has been placed in identifying sources, understanding processes, and determining compliance with water quality standards and TMDLs. Less study efforts have been made towards developing new tools and evaluating program and measure effectiveness. This indicates the need to further assess the management needs in these areas and potentially focus efforts on improving the level of knowledge in these areas.

Table D-2: Assessment #1 - Studies by Program Management Category

	Source Identification	Understanding Processes	Developing New Tools	Determine Compliance with WQs/TMDLs	Evaluate Program/ Measure Effectiveness	Provide Early Warning
Bacteria	6	6	3	4	4	2
Nutrients	1	1	1	1	2	1
Inorganics-Metals	3	4	1	1	2	1
Organics-Pesticides	1	2	1	1	2	1
Toxicity	3	4	1	1	1	1
Water Chemistry	2	2	1	2	1	1
Solids-Sediment	2	3	0	0	1	0
Fish Tissue	0	1	0	0	1	0

The Anaheim Bay-Huntington Harbor Environmental Matrix identifies which program aspects relate to which specific reports. The matrix uses the following abbreviations: Source Identification (SI), Understanding Processes (UP), Developing New Tools (NT), Determine compliance with WQs / TMDLs (WT), Evaluate Program / Measure Effectiveness (EP), Provide Early Warning (EW)

Assessment #2 – Study and Program Type

The 18 water quality studies identified in the Anaheim Bay-Huntington Harbor Watershed have generated different types of water quality data. The data fall into two broad categories—generation of raw data and assessment of existing data. Raw data studies and programs include specific sampling or monitoring activities and account for most of the 18 studies added to the bibliography. New data were generated with the following two objectives:

- Compliance with NPDES permits, monitoring, and directives for TMDL monitoring.
- Provide an understanding of the concentration levels or processes related to the pollutants, or the impacts of the pollutants, on the ecosystem. Studies targeting pollutant concentrations and processes generally involve direct measurements of the pollutants while studies targeting the impacts of the pollutants generally involve other environmental measurements (e.g., analysis of fish tissue).

Studies that focus on the assessment of existing data are performed with the objective of:

- Understanding the behavior of pollutants within the Anaheim Bay-Huntington Harbor system through direct measurement of the pollutants, or
- Understanding the impacts of the pollutants by measuring other environmental parameters.

The following figure (**Figure D-7**) shows the category breakdown of the studies as well as the general objective of the study. Some studies fell into both the raw data and existing data category.

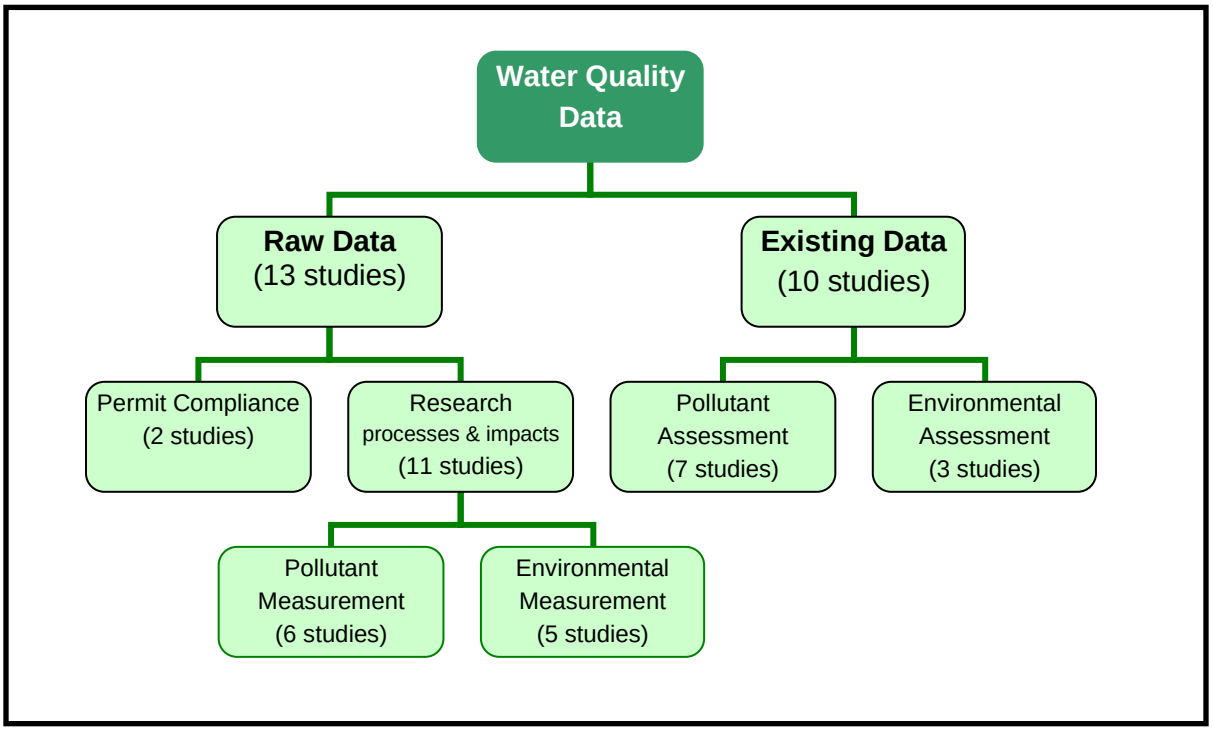


Figure D-7: Study Category Breakdown

Assessment #3 – Study or Program Details

The final assessment that was made of the studies and programs was to look at basic details such as who performed the study and what pollutants were included in those studies and programs.

Within the Anaheim Bay-Huntington Harbor Watershed the major generators of water quality data are the California Department of Fish and Game (CDFG), the County of Orange, United States Geologic Survey (USGS), Santa Ana Watershed Project Authority (SAWPA), and the University of California Irvine (UCI). The following table (**Table D-3**) identifies the organizations responsible for each of the 18 studies. For collaborative studies, the primary organization was used for the accounting below.

Table D-3: Study Sources

Organization	Number of Studies
RDMD, OCWD, OCSD, OCHCA, Cities	6
Private (Journal, other)	4
NRDC	2
CDFG	2
SCCWRP	2
USGS	1
USACE	1

Each of the 18 water quality studies or programs that were identified as part of this data assessment addressed one or more specific pollutants. Eight (8) categories of constituents were identified that encompass nearly all of the specific data that was monitored or assessed. These categories include:

- Bacteria
- Nutrients
- Metals
- Pesticides
- Toxicity – various levels of toxicity studies were performed
- Conventional water chemistry – this includes a wide ranges of variables such as pH, hardness, and temperature
- Sediment – this includes both bulk sediment and sediment contamination
- Fish Tissue

The following table (**Table D-4**) shows the distribution of the studies within each of these categories. Many studies include work related to several constituents.

Table D-4: Constituent Focus of Studies and Programs

Constituent	Number of Studies
Bacteria	12
Nutrients	2
Metals	5
Pesticides	3
Toxicity	4
Water chemistry	3
Sediment	4
Fish Tissue	2

D-2.3 Water Quality Status

D-2.3.1 Impaired Waters

Under section 303(d) of the 1972 Clean Water Act, states, territories, and authorized tribes are required to develop a list of water quality limited segments—waters that do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that state or local jurisdictions establish priority rankings for water quality impairment on the list and develop action plans, referred to as TMDLs, to improve water quality.

The SWRCB and the Regional Board staff have evaluated each addition, deletion, and change to section 303(d) based on all the data and information available for each water body and pollutant. These recommendations are based upon "all existing and readily available data and information" (40 CFR 130.7(b)(5)). In developing the recommendations, the SWRCB staff used the recommendations and analysis of the Regional Board as the basis of its analysis.

A new listing policy was used to develop the 2006 303(d) list. Based on that policy, some data, for purposes of developing the section 303(d) list, are sufficient by themselves to demonstrate non-attainment of standards. Examples of these listing factors are (1) numeric data exceeding numeric water quality objectives, maximum contaminant levels, or California/National Toxics Rule water quality criteria and (2) use of numeric evaluation values focused on protection of consumption of aquatic species. Other data types require that multiple lines of evidence be used for listing and de-listing. The listing factors that require multiple lines of evidence are (1) toxicity, (2) health advisories, (3) nuisance, (4) beach postings, (5) adverse biological response,

and (6) degradation of aquatic life populations or communities. Each of these lines of evidence generally needs evidence of the presence of the pollutant(s) that cause or contribute to the adverse condition.

The 2006 303(d) list of impaired waters (approved by the SWRCB on October 25, 2006) within the Huntington Harbor – Anaheim Bay Watershed is presented in **Table D-5**. It should be noted that this list is updated every 2 years and will be replaced within this Watershed Action Plan.

Figure D-8 includes a map that shows the 303(d) listed receiving waters.

Table D-5: Proposed 2006 303(d) List and TMDL Priority Schedule

Type	Name	Hydro Unit	Pollutant/Stressor	Source	Estimated Size Affected	Proposed TMDL Completion
B	Anaheim Bay	801.11	Dieldrin (tissue)	Source Unknown	402 Acres	2019
			Nickel			
			PCBs (tissue)			
			Sediment Toxicity			
C	Bolsa Chica State Beach	801.11	Copper	Source Unknown	2.6 Miles	2019
			Nickel			
B	Huntington Harbor	801.11	Chlordane	Source Unknown	221 Acres	2019
			Copper	Source Unknown		
			Lead	Source Unknown		
			Nickel	Source Unknown		
			Pathogens	Urban Runoff / Storm Sewers		
			PCBs	Source Unknown		
			Sediment Toxicity	Source Unknown		

(Note: B – Bay; R – Rivers; E – Estuary; C – Coastal Shoreline/Beaches)

D-2.3.2 AB411 Summary

The 2006 Annual Ocean and Bay Water Quality Report (OCHCA, 2007) summarizes bacteria monitoring activities that took place in the Anaheim Bay-Huntington Harbor Watershed. One site is monitored along the 1.0 mile of beach front at Sunset Beach. In 2006 there were 0 beach postings from April-October, no change compared with previous years (since 2000). In 2006 there were 0 postings throughout the 2006 calendar year. This is no change compared with previous years since 2000 during this time period. Two sites are monitored along the 2.8 miles of beach front at Bolsa Chica State Beach. In 2006 there were 7 beach postings from April-October, a high number compared with previous years (since 2000) when postings ranged from 1 to 8. In 2006 there were 10 postings throughout the 2006 calendar year. This matches the

highest number compared with previous years since 2000 when the postings ranged from 1 to 10. Fourteen sites are monitored along the 31.1 miles of beach front at Huntington Harbor Beach. In 2006 there were 21 beach postings from April-October, a high number compared with previous years (since 2000) when postings ranged from 8 to 34. In 2006 there were 29 postings throughout the 2006 calendar year. This is a moderate value compared with previous years since 2000 when the postings ranged from 20 to 56.

D-2.4 Priority Water Quality Needs

Managing and improving water quality in an urban environment is a complex issue. The science needed to deal with many of the issues that arise during the management process is evolving, and in some cases has not yet developed to the point that important questions can readily be answered in absolute quantifiable terms. Examples where our understanding is not fully developed are as follows:

- Stormwater runoff modeling relative to pollutants of concern. This modeling is not totally reliable for predictive purposes and needs large data sets to calibrate.
- Methods (such as MST (microbial source tracking) for more accurately identifying sources of pathogens in runoff (e.g., wildlife, pets, humans) are still being refined. Only qualitative methods exist at this time and they are not yet able to be directly translated into a loading assessment. For example, we may be able to say that 50% of the fecal coliform bacteria from a sample are from dogs but this does not imply that 50% of the loading of fecal bacteria is from dogs.
- The effectiveness of various BMPs (Best Management Practices) under varying conditions has not been systematically assessed under field conditions.

These and other data gaps have been identified to some extent in the research study reports, the research agenda for the Stormwater Monitoring Coalition, and the specific requirements of the NPDES permits. However, a thorough and conceptually organized listing of data gaps must stem from a thoughtful description of the key management questions related to the watershed. There are two reasons for this. First, there is a virtually infinite array of scientific data that could be gathered in a complex system such as this. It is essential to focus effort on those data types that are useful in decision making. Second, data gaps sometimes stem, not from the absence of data, but from the inability to adequately integrate existing data. Articulating clear questions enables studies to be designed so that disparate data types can be combined as needed to address complex issues.

Figure D-8: Receiving Waters

See next page for figure.

D-2.4.1 Pollutant Data Gaps

The list below identifies data gaps related to a specific pollutant, bacteria. A lengthier discussion of the bacteria-related data gaps follows the summary list below.

- *Bacteria*
  - Urban vs. Natural Resources
  - Rapid Bacteriological Indicators
  - MST (microbiological source tracking) identification methods

D-2.4.1.1 *Bacteria*

A special study will be performed to improve understanding of the correlations between levels of indicator bacteria in the surfzone (where most of the contact recreational activities take place) and levels in the stormdrains themselves. This study will be performed by the County as part of the Santa Ana Region Water Quality Monitoring Program based on the approach recommended by the Stormwater Monitoring Coalition.

The applicability of current bacteriological indicators for measuring human health risk and for identifying the sources of pathogen contamination needs further refinement. Two projects identified in SCCWRP Technical Report 35B *Stormwater Research Needs in Southern California* identify plans to address these issues. The first project (Project 12. *Develop rapid response indicator(s) for microbial contamination*) is focused on producing easily used field tests that would provide a reliable measure of bacteriological contamination within a few hours at most. The second project (Project 13. *Develop microbial source tracking protocol*) will select methods (primarily genetic-based) that provide the most dependable means of identifying and distinguishing among sources.

Considerable resources are being expended to reduce bacterial contamination from watershed sources, but in many cases storms drains continue to discharge large concentrations of fecal indicator bacteria (FIB). A study by SCCWRP will examine if FIB can grow in storm drain sediments. This study, *Storm Drains and Sediments as Reservoirs of Fecal Indicator Bacteria*, is being led by John Griffith.

D-2.4.2 Other Data Gaps

In addition to the data gaps related to specific pollutants, there are data gaps related to specific beneficial use impairments and the use attainability analyses relative to the achievability of a water quality goal. Specifically, what is the direct and indirect link between the beneficial use impairment by a pollutant and how is this linked to the water quality standard? In addition, what is the link between pollutant source control, and pollutant treatment management relative to achieving a specific water quality standard or goal? In other words, is there data to demonstrate that a goal is achievable or not? In the case of bacteria there may be a need to gather data relative to controllable sources to determine what is truly attainable and whether or not a use attainability analysis should be conducted relative to compliance requirements. Studies needed to answer many of these questions (and eliminate the data gap) have been identified in the *Phase 1 Stormwater Quality Standards* report (SAWPA, 2005).

An additional data gap exists with the ability to use any given set of data for further analysis. The Stormwater Monitoring Coalition has recognized the need to develop a regional stormwater monitoring infrastructure. As part of the *Stormwater Research Needs in Southern California* report (SCCWRP, 2002), the coalition has identified 4 projects to address this need. These projects include (1) integrate and evaluate available data; (2) standardize sampling and analysis protocols; (3) develop a regional data infrastructure; and (4) measure BMP effectiveness.

An additional data gap that the Stormwater Monitoring Coalition (SCCWRP, 2002) has identified is a need to improve fundamental understanding of stormwater mechanisms and processes. To meet this need the following projects have been identified: (1) develop a system wide conceptual model; (2) Determine appropriate reference conditions; (3) develop a regional method for measuring beneficial use condition; and (4) identify relative contribution of nonpoint sources to urban runoff loads.

Another data gap identified by the Stormwater Monitoring Coalition (SCCWRP, 2002) is related to identifying receiving water impacts. The following studies were identified to address this need: (1) identify the causes of impact in receiving waters; (2) develop bioassessment indicators and protocols; (3) develop improved toxicity testing procedures; (4) develop raid response indicator(s) for microbial contamination; (5) develop microbial source tracking protocol; (6) evaluate BMP effects on receiving water impacts; and (7) develop improved indicators of peak flow impacts.

Several of the identified Stormwater Monitoring Coalition projects have been funded and are underway.

D-3.0 TMDLs in the Watershed

Section 303(d) of the Clean Water Act requires that each State identify waters that are not meeting the water quality standards for their applicable beneficial uses. This process involves requesting and compiling readily available data and comparing these data to the appropriate water quality objectives (WQOs). The waterbody-pollutant combinations exceeding WQOs at predefined frequencies, which are specified in the Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List, are placed on the 303(d) list of impaired waters. Section 303(d) also requires states to establish a priority ranking for waterbody-pollutant combinations on the 303(d) list and to subsequently establish TMDLs for each.

The goal of the TMDL process is to attain water quality standards and protect the beneficial uses of water bodies. It is defined as "the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR 130.2) and requires that the capacity of the water body to assimilate pollutant loadings (the Loading Capacity) is not exceeded.

The TMDL process begins with the development of a technical analysis which includes the following 7 components: (1) a **Problem Statement** describing which WQOs are not being attained and which beneficial uses are impaired; (2) identification of **Numeric Targets** which will result in attainment of the WQOs and protection of beneficial uses; (3) a **Source Analysis** to identify all of the point and nonpoint sources of the impairing pollutant in the watershed and to estimate the current pollutant loading for each source; (4) a **Linkage Analysis** to calculate the Loading Capacity of the waterbodies for the pollutant; i.e., the maximum amount of the pollutant that may be discharged to the waterbodies without causing exceedances of WQOs and impairment of beneficial uses; (5) a **Margin of Safety** to account for uncertainties in the analyses; (6) the division and **Allocation** of the TMDL among each of the contributing sources in the watersheds, wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint and background sources; and (7) a description of how **Seasonal Variation and Critical Conditions** are accounted for in the TMDL determination. The write-up of the above components is generally referred to as the technical TMDL analysis.

In addition to a technical TMDL analysis, the State is required to incorporate the TMDLs and their appropriate implementation measures into the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7), such as the Regional Board Basin Plan. After a TMDL is adopted into the Basin Plan, it is submitted to EPA and reviewed. Approval from EPA is the last step in the TMDL process.

D-3.1 Status of Future TMDL Development

TMDLs will be developed in the future for all waterbody-pollutant combinations on the current 303(d) list. The Proposed 2006 303(d) list is the active, approved list (approved by the SWRCB on October 25, 2006).

Table D-5 identifies the waterbodies in the Anaheim Bay – Huntington Harbor watershed that are on the 2006 303(d) list. While some of these listings were recommended on the 2002 303(d) list, several are new listings based on the review of additional data. The 2006 list includes a proposed TMDL completion date of 2019 for each of the listings. Unless there is a future change in listing status, prior to 2019, metal, toxicity, and pathogen TMDLs will be developed and approved to address these impairments. The Regional Board or EPA will likely lead the TMDL development effort , which will include stakeholder involvement . Additional data collection can help confirm impairments and/or identify potential sources that can be addressed to reduce bacteria loadings.

D-4.0 BMP Inventory

In developing a plan to address water quality within the Anaheim Bay-Huntington Harbor Watershed, it is important to (1) understand the sources of pollution within the watershed and (2) know the specific source and treatment controls that have been implemented (or proposed to be implemented) within the watershed to deal with the watershed constituents of concern. This section provides the available information for these two areas and identifies the related knowledge gaps that exist.

D-4.1 Watershed Pollution Sources

Pollution sources in the Anaheim Bay-Huntington Harbor Watershed include urban runoff, open space runoff, groundwater, permitted discharges, atmospheric deposition, agriculture, and wildlife. Because the mandate of the Orange County Stormwater Program is to address urban runoff, this WAP and planning effort will focus mainly on the urban sources although it is inherently recognized that in many cases, such as sediment control, the Watershed Permittees have taken on a broader role as responsible stakeholders even though the urban contribution is limited.

The urban sources in the watershed include runoff generated during storm events and non-storm related runoff from municipal facilities, residential, commercial, and industrial areas and parks.

D-4.2 Existing Structural Enhanced BMPs

Structural BMPs include engineered facilities that are designed to remove pollutants. These facilities can include, but are not limited to wetlands, bioswales, extended detention basins, and proprietary separator units. Enhanced structural BMPs include facilities in which a specific pollutant of concern for that watershed is addressed. Enhanced BMPs are considered to be regional and treat runoff from more than a single developed area, such as a single residential tract. **Table D-6** identifies the enhanced structural BMPs that have been implemented in the Anaheim Bay-Huntington Harbor Watershed and a description of each BMP is included following the table.

Table D-6: Enhanced Structural BMPs

Project	Location	Constituent of Concern
Dry Weather (year-round) diversion into sewer system	Following Huntington Beach locations: Adams Pump Station Flounder Pump Station Hamilton Pump Station Indianapolis Pump Station Meredith Pump Station Yorktown Pump Station Newland Pump Station Banning Pump Station Atlanta Pump Station Scenario Pump Station First Street Watershed Pump Station	Bacteria
Waterfront Residential Constructed Wetlands Urban Runoff Treatment Facility	Behind the Hyatt Hotel at Beach Boulevard near Pacific Coast Highway and PCH	bacteria

D-4.3 Proposed Structural Enhanced BMPs

The following structural enhanced BMPs have been proposed in the watershed and are in planning stages (**Table D-7**).

Project	Location	Performance Measures
Talbert Lake Urban Runoff Diversion Project – Phase 1	Central Park, Huntington Beach	Flow and bacteria
Talbert Lake Urban Runoff Diversion Project – Phase 2	Central Park, Huntington Beach	Flow and bacteria
Irby Lake Urban Runoff Treatment System	Irby Park, Huntington Beach	Flow and bacteria
Newland Street Watershed Dry Weather Urban Runoff Diversion into sewer system	Newland Street Pump Station	Flow
Abtech Smartsonge First Street Watershed Regional Treatment System	First Street	Bacteria
Heil Pump Station Urban Runoff Diversion Project	Heil Street Pump Station	Flow

D-4.3.1 Talbert Lake Urban Runoff Diversion Project Phase 1 and 2

This project consists of a constructed wetland within Central Park. Phase 1 is located east of Goldenwest Street and Phase 2 is located west of Goldenwest Street. Phase 1 received a $2.3 million dollar Proposition 13 grant with an estimated completion date of July 2009. Phase 2 received a $2 million dollar Proposition 50 grant with an estimated completion date of March 2010.

D-4.3.2 Irby Park Urban Runoff Treatment System

This project will divert dry weather urban runoff from the East Garden Grove Wintersburg Channel into Irby Park for treatment and re-use. This project received a $1.9 million dollar Proposition 40 grant with an estimated completion of September 2008.

D-4.3.3 Newland Street Watershed Dry Weather Urban Runoff Diversion into sewer system

This project will divert the dry weather urban runoff from the approximate 13 acre drainage area into the sanitary sewer. The project completion estimated to be December 2008.

D-4.3.4 Abtech Smartsponge First Street Watershed Regional Treatment System

This pilot project will provide bacteria treatment of first flush stormwater runoff for the approximate 90 acre First Street Watershed (discharges directly onto the beach).

D-4.3.5 Heil Pump Station Urban Runoff Diversion Project

This project will divert the dry weather urban runoff from the Heil Pump Station into an adjacent area for natural treatment and re-use.

D-4.4 Estimates of Load Reductions of Existing BMPs

Understanding the load reduction of implemented BMPs is important in assessing whether or not those BMPs are improving the quality of the receiving waters. Guidelines available through the DAMP (Appendix E-1, BMP Effectiveness and Applicability for Orange County) as well as California Stormwater Quality Association (CASQA) (CASQA BMP Handbook) associate wide ranges of estimates for the reduction in pollutants with various types of BMPs. Because the pollutant reductions are highly variable, actual monitoring data is often collected to assess the load reduction of the existing BMPs. In the case of diversions, the effectiveness is considered to be 100% because all of the polluted water treated by the BMP is removed from the system. The following table (**Table D-7**) presents that information as available.

Table D-7: Pollutant Removal for Existing Enhanced Structural BMPs

Project	Constituent	Pollutant Reduction
Dry Weather (year-round) diversion	Bacteria	100%

Project	Constituent	Pollutant Reduction
into sewer system		
Waterfront Residential Constructed Wetlands Urban Runoff Treatment Facility	Bacteria	unknown

D-4.5 Recommendations for BMPs in the Watershed

New candidate BMPs can be prevention or removal oriented and can be considered either for updating baseline BMPs or for incorporation as watershed based BMPs. New BMPs are generally identified from one or more of the following:

- A review of technical literature (such as the ASCE/EPA database);
- A review of existing control programs;
- Demonstration or research projects;
- Input from consulting firms and municipalities already involved in new BMP implementation; or
- Other sources.

Consistent with DAMP Section 3.0, the process for BMP selection and implementation at the watershed scale involves consideration of a candidate BMP with respect to:

- The Watershed Permittees' needs, goals, and objectives
- Consistency with federal and state programs
- Economies from streamlined analysis and implementation procedures
- Opportunities for flexibility in the development of management alternatives
- Decision-making based on environmental and local considerations
- Effective Capital Improvement Program planning and budgeting

The following table (**Table D-8**) has been modified from that presented in DAMP Section 7.0 referencing the effectiveness of BMPs for specific pollutants. Specifically the types of BMPs have been reduced to reflect those that are more effective in reducing the pollutant of concern (bacteria) within the Anaheim Bay-Huntington Harbor Watershed. In particular the infiltration BMPs (shaded in the table) have high removal efficiencies for all pollutants of concern in this watershed.

Table D-8: BMPs that Target Anaheim Bay-Huntington Harbor Watershed Pollutants of Concern

	INFILTRATION (2)			*WET PONDS AND WETLANDS*		BIOFILTERS		*FILTRATION*	
Pollutant of Concern	**TC-10 Infiltration Trench**	**TC-11 Infiltration Basin**	**TC-12 Retention/ Irrigation**	**TC-20 Wet Pond**	**TC-21 Constructed Wetland**	**TC-31 Vegetated Buffer Strip**	**TC-32 Bioretention**	**TC-40 Media Filter**	**TC-60 Multiple Systems**
Bacteria & Viruses	H	H	H	H	H	H	H	H	H

Cooperative periodic performance assessment may be necessary. This Treatment Control BMP table will be updated as needed and as knowledge of stormwater treatment BMPs improves.

(2) Including trenches and porous pavement.

H High removal efficiency

Sources:

International Stormwater Best Management Practices Database (2001), including Analysis of treatment system performance (1999 - 2005), dated February 2006

California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook – New Development and Redevelopment (January 2003 with September 2004 Errata)

Guide for BMP Selection in Urban Developed Areas (2001) Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (1993)

D-5.0 Plan Implementation and Assessment

D-5.1 Plan Implementation

Strategy Tables have been developed for the Anaheim Bay-Huntington Harbor Watershed that identifies the specific actions that are being undertaken to improve urban water quality within the watershed. These strategy tables are specific to the constituents of concern for the watershed and include information on past progress as well as the scheduled tasks to support this action. On an annual basis these tables will be updated to identify the progress made in that year as well as the schedule for the subsequent year. The Anaheim Bay-Huntington Harbor Watershed Strategy Tables are included as **Exhibit 2** to this WAP.

D-5.2 Plan Assessment

Effectiveness Assessment is the process that managers use to evaluate whether their programs are resulting in desired outcomes, and whether these outcomes are being achieved efficiently and cost-effectively (CASQA, 2003). A principle objective of the WAP is to present an integrated plan of action that will result in meaningful water quality improvements in the Anaheim Bay-Huntington Harbor Watershed while balancing economic, social and environmental constraints. This plan of action is laid out in the strategy tables which are referenced in **Section 5.1**. The program effectiveness assessment strategy requires the identification and thereafter annual consideration of measures that indicate whether progress is being made toward attainment of this objective and the other program objectives discussed in **Section 1.0**.

Assessment measures that are pertinent to the WAP are related to the confirmation of progress on the actions identified in the strategy table. The assessment of progress is integrated in the strategy tables through the annual update to the tables that require documentation on the progress that has been made on that specific action. Reasonable progress on these action items indicates that the WAP is effective.

D-6.0 References

Bay, S.M., D. Lapota, J. Anderson, J. Armstrong, T. Mikel, A.W. Jirik, and S. Asato. 2000. *Southern California Bight 1998 Monitoring Program: IV Sediment Toxicity*. Southern California Coastal Water Research Project. Westminster, CA.

CASQA (California Stormwater Quality Association). January 2003. *California Stormwater BMP Handbook*.

County of Orange, Orange County Flood Control District and the incorporated cities of Orange County. 2003. *Identification of Retrofitting Opportunities – Existing Channel Assessment*. Included as Appendix E7 of the DAMP.

National Research Co. 2003. *Managing Troubled Waters.* National Academy Press.

OCHCA. March 2005. *2005 Annual Ocean and Bay Water Quality Report*.

OCPFRD. 2000. *Orange County NPDES Stormwater Program, Annual Progress Report*. Data from 1996 to June 2000. Orange County Public Facilities and Resources Department, Santa Ana, California.

OCRDMD. 2003. Drainage Area Management Plan, Appendix E1, and Appendix E7.

Santa Ana RWCQB (Regional Water Quality Control Board). 1995. *Water Quality Control Plan for the Santa Ana River Basin* California Regional Water Quality Control Board, Santa Ana Region, California Environmental Protection Agency, Riverside, California.

SAWPA. 2005. *Stormwater Quality Standards Study*. http://www.sawpa.org/projects/planning/stormwater.htm

USEPA (United States Environmental Protection Agency). 2000. *California Toxics Rule [CTR], Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California*; Federal Register Rule—40CFR Part 131. U.S. Environmental Protection Agency, Washington, D.C.

Nomenclature (Abbreviations)

Table D-9: Abbreviation Definitions

Abbreviation	Definition
NPDES	National Pollutant Discharge Elimination System
OCHCA	Orange County Health Care Agency
SCCWRP	Southern California Coastal Water Research Project
TMDL	Total Maximum Daily Load
BMP	Best Management Practice
USEPA / EPA	United States Environmental Protection Agency
DAMP	Drainage Area Management Plan
LIP	Local Implementation Plan
OCSD	Orange County Sanitation District
USACE	United States Army Corps of Engineers
ASBS	Areas of Special Biological Significance
SWRCB	State Water Resources Control Board
RDMD	Resources & Development management Department
PCB	Polychlorinated Biphenyls
PAH	Polycyclic Aromatic Hydrocarbons
CARs	Critical Aquatic Resources
CDFG	California Department Of Fish and Game
UCI	University of California Irvine
WLA / LA	Waste Load Allocation / Load Allocation
CTR	California Toxics Rule
CASQA	California Stormwater Quality Association

EXHIBIT D-1

ENVIRONMENTAL MATRIX

EXHIBIT D-2

STRATEGY TABLES