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Executive Summary

This "Watershed Action Plan", Appendix D of the Drainage Area Management Plan (DAMP) was prepared to meet the Section XVI of the municipal National Pollutant Discharge Elimination System (NPDES) Stormwater Permit - Order R8-2002-0010 in which the Watershed action plans are referenced through Section 12 of the DAMP. Commitments to watershed planning to address water quality issues are also included in Section 3.0 of the DAMP and within the Report of Waste Discharge.

The purpose of this document is to present a planning framework 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 Newport Bay 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 Newport Bay Watershed is located in southern Orange County, approximately 40 miles south of Los Angeles and 70 miles north of San Diego. The entire watershed spans 154 square miles and is contained in the jurisdictional boundary of Orange County (**Figure D-1**). The largest drainage, San Diego Creek, and its many tributaries begin along the coastal foothills of the Santa Ana Mountains and flow predominantly southwest into Newport Bay. The Watershed Permittees are Costa Mesa, Irvine, Laguna Hills, Laguna Woods, Lake Forest, Newport Beach, Orange, Santa Ana, Tustin, County of Orange, and the Orange County Flood Control District. The watershed is highly developed with approximately half a million residents. There are many major streets and several highways and interstates (I-5, I-405, Hwy 133, Hwy 241, Hwy 55, Hwy 73 and Hwy 1) crossing the watershed. The watershed includes in part or in whole the cities of Costa Mesa, Irvine, Laguna Hills, Laguna Woods, Lake Forest, Newport Beach, Orange, Santa Ana, and Tustin as well as portions of the unincorporated areas of Orange County.

The following sections comprise the Watershed Action Plan:

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 constituents of concern identified for this watershed include fecal coliform, nutrients, sediment, and toxics.

Section 3.0 provides information on the development of existing total maximum daily load (TMDLs) and the schedule for future 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 plan development and provides recommendations for actions to be taken to address the water quality issues of the watershed.

Section 6.0 discusses the short-term and long-term program effectiveness and the adaptive management strategy for the watershed.

D-1.0 Introduction

The designation of "Newport Bay Watershed" refers to the hydrologic watershed that is defined by drainage and only minimally by jurisdictional boundaries. The Newport Bay Watershed drains approximately 154 square miles to the Pacific Ocean within southern Orange County, California. The watershed encompasses all waters draining to Newport Bay. This watershed has been divided into the following four subwatersheds:

- Lower Bay includes all stormwater drains and natural creeks;
- Upper Bay begins at the Hwy 1 bridge and extends across the bay including all drains to the bay as well as Big Canyon Wash, Costa Mesa Channel, and the Santa Isabella Channel;
- Santa Ana Delhi Channel and its tributaries that empty into the far northwestern end of the Upper Newport Bay; and
- San Diego Creek/Peters Canyon Wash and its tributaries that collectively drain into the northeastern end of Upper Newport Bay. San Diego Creek/Peters Canyon Wash is the largest subwatershed within the Newport Bay Watershed.

The Newport Bay Watershed has been impacted by several water quality problems, most of which are from anthropogenic sources or aggravated by human activity. The Watershed Permittees and residents recognized the relationship between water quality and activities within their watershed. In the late 1970s they began collaborating with agencies and landowners to study and implement solutions to the problems in Newport Bay. The Newport Bay Executive Committee was formed in the mid 1980s primarily with a focus on sedimentation issues. An amendment of the cooperative agreement in 1999 broadened its focus to include other water quality impairment of Newport Bay (nutrients, toxics, and pathogens in addition to sediment) and related environmental enhancements. To date there are many organizations and agencies working to enhance Newport Bay and its watershed.

The Watershed Permittees includes nine cities within the watershed (Costa Mesa, Irvine, Laguna Hills, Laguna Woods, Lake Forest, Newport Beach, Orange, Santa Ana and Tustin) and unincorporated County of Orange and the Orange County Flood Control District. Based on their experience, a Watershed Action Plan within the Drainage Area Management Plan (DAMP) has been developed to attain the following multiple objectives:

- To meet the requirement to update Appendix N 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 Newport Bay 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 Newport Bay 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:

- The Newport Bay Executive Committee and the Newport Bay Watershed Management Committee serve as a forum to address water quality issues in the Newport Bay Watershed. These committees were originally formed in the 1980s to manage sediment issues and were known as the Sediment Control Executive Committee and the Technical Committee. The Newport Bay Executive Committee is largely made up of elected officials while the Newport Bay Watershed Management Committee includes a broader range of watershed stakeholders.
- 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.

- Assembly Bill (AB) 411 went into effect in 1999, posting new requirements for surfzone/beach water testing along the California coastline. The Health Care Agency (OCHCA) performs the required testing and postings of beach closures within Newport Bay.

- In 1999 the Regional Water Quality Control Board (Regional Board) issued a Water Code Section 13267 Letter to determine the status of compliance with the Newport Bay Nutrient and Sediment Total Maximum Daily Load (TMDL). The response to this letter is the *Newport Bay Watershed Urban Nutrient TMDL Technical Report* (September 1999).

- Since 2003, each Watershed Permittee has implemented a Local Implementation Plan (LIP, 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.

The Newport Bay Watershed Action Plan borrows much of its organization, structure, and terminology from the 2003 DAMP of which it is an appendix and also from the TMDL reports issued for Newport Bay and San Diego Creek. The following sections are included in the Watershed Action Plan:

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

- Section D-3.0 provides details on the development of the existing TMDLs in the watershed, including the data used and the methodology. This section also provides information on the schedule for future TMDLs.

- Section D-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 D-5.0 identifies the strategy tables that have been developed for the watershed to address water quality issues specific to the constituents of concern.
- Section D-6.0 describes the program effectiveness assessment to be undertaken and the future revision of the Watershed Action Plan.

The Newport Bay Watershed Action Plan 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 the Newport Bay Watershed and also sets the stage for future activities intended to address water quality issues in various stream reaches of the watershed. Figures enclosed represent available information in the Geographic Information System (GIS) mapping format as supplied by the Watershed Permittees. The plan of action contained in this Watershed Action Plan will be reviewed for effectiveness and applicability on a regular basis. As problems are addressed and the state of knowledge about sources and causes becomes better defined, it is expected that the process will become more streamlined and make more efficient use of limited resources.

D-1.1 Watershed Setting

For the purposes of organizing water quality improvement efforts for a watershed-based methodology, the Newport Bay Watershed consists of all waters draining into Newport Bay. The Newport Bay Watershed is located in southern Orange County, approximately 40 miles south of Los Angeles and 70 miles north of San Diego. The entire watershed spans 154 square miles (**Figure D-1**). The Bay itself is made up of two distinct waterbodies – the Upper Bay and the Lower Bay. The Upper Bay is a high quality estuary and contains a State Ecological Reserve. The Lower Bay includes barrier island and lagoons and was created through sand deposition and then modified through dredging and filling. The largest drainage in the watershed, San Diego Creek, and its many tributaries begin along the western foothills of the Santa Ana Mountains and flow predominantly southwest into Newport Bay. San Diego Creek itself drains approximately 122 square miles of the watershed. The major tributaries to the upper reach of San Diego Creek include Peters Canyon Wash, Rattlesnake Canyon, Hicks Canyon, Bee Canyon, Round Canyon, Agua-Chinon, Borrego Canyon, and Serrano Creek. Other major tributaries to the lower reach of San Diego Creek are Bonita Creek, Sand Canyon, Lane Channel, and San Joaquin Channel. San Diego Creek empties into the Upper Bay at the far northeastern corner of the bay. Other streams or channels that drain directly to Newport Bay include Santa Ana-Delhi Channel, Big Canyon Wash, Santa Isabella Channel, Costa Mesa Channel, East Newport Heights storm drain, and the Bayside storm drain.

Figure D-1 Location Map

See next page for figure.

Figure D-1 Location Map
Newport Bay Watershed

Approximately two-thirds of the Newport Bay Watershed is urbanized. Of the remaining land, one-half is un-developable due to mountainous slopes or protected habitat. About 27 square miles of open space area within the watershed are set aside in the Natural Community Conservation Plan & Habitat Conservation Plan (NCCP/HCP) and include Laguna Coast Wilderness Park, Mason Regional Park, Peters Canyon Regional Park, Upper Newport Bay Ecological Reserve, and the University of California Irvine Reserve. Additional habitat areas include the Siphon Reservoir Coastal Sage Scrub Restoration Site, San Joaquin Marsh, the proposed MCAS El Toro Habitat Reserve, and the 17 mitigation sites identified for the Clean Water Act Section 404 by the U.S. Army Corps of Engineers (USACE) Regulatory Branch. The watershed is bound by the Santa Ana River Watershed to the north and east and by three watersheds (Newport Coastal, Aliso Creek and Laguna Canyon Watersheds) to the south and east.

There are currently four major northeast-southwest transportation routes (Hwy 55, Hwy 133, Hwy 241, and Jamboree Road) and four southeast-northwest transportation routes (Interstate 5, Interstate 405, Hwy 1 and Hwy 73) that provide access to the Newport Bay Watershed. The Pacific Coast Highway (Hwy 1) parallels the coast at the Pacific Ocean from the southeast to the northwest of the watershed. Major roadways of the Newport Bay Watershed are shown in **Figure D-2**. 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 show in **Figure D-4**.

Figure D-2 Transportation

See next page for figure.

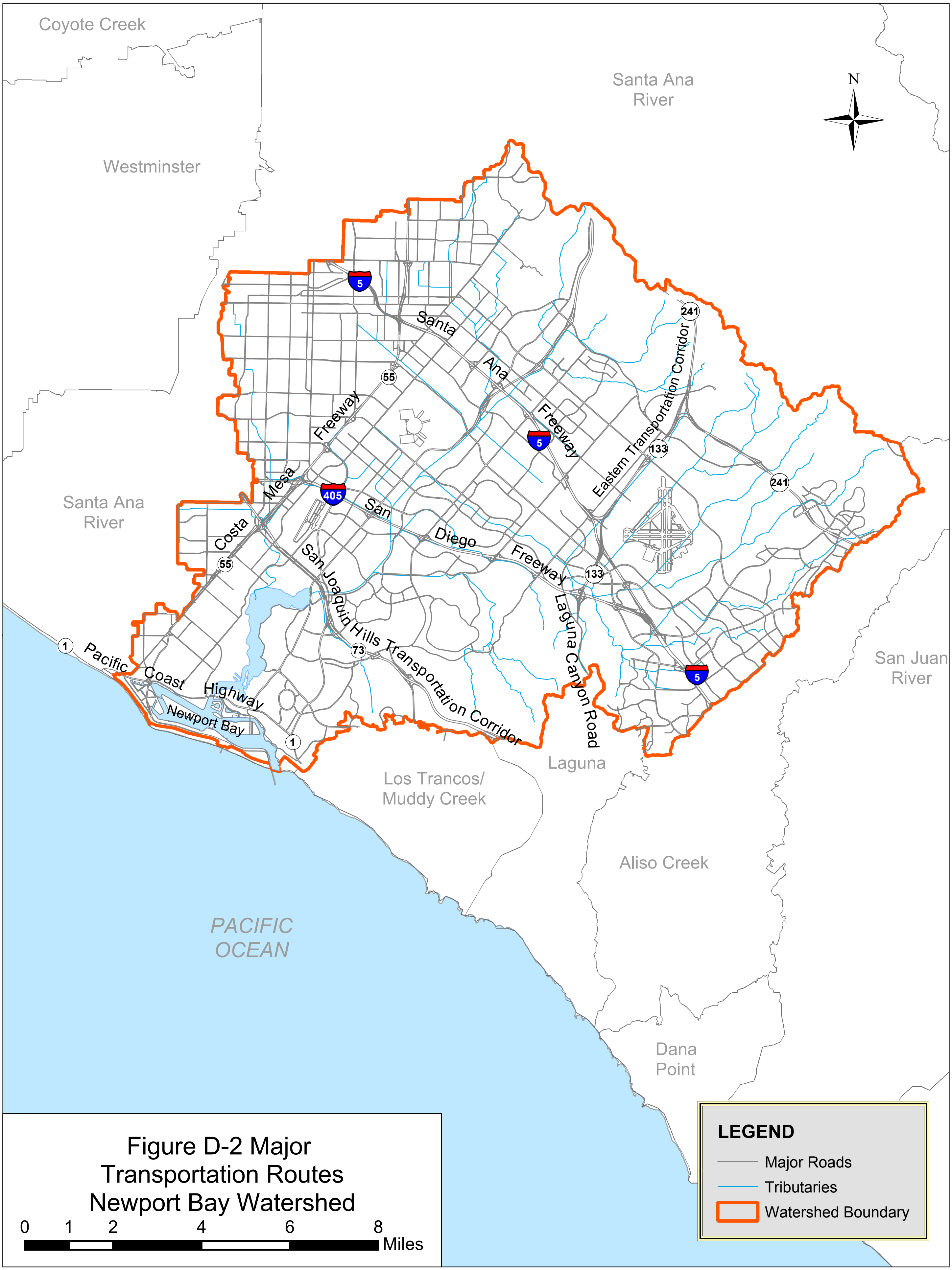


Figure D-2 Major Transportation Routes Newport Bay Watershed

Figure D-3a Unified School Districts

See next page for figure.

Figure D-3a Unified School Districts Newport Bay Watershed

Figure D-3b City Boundaries

See next page for figure.

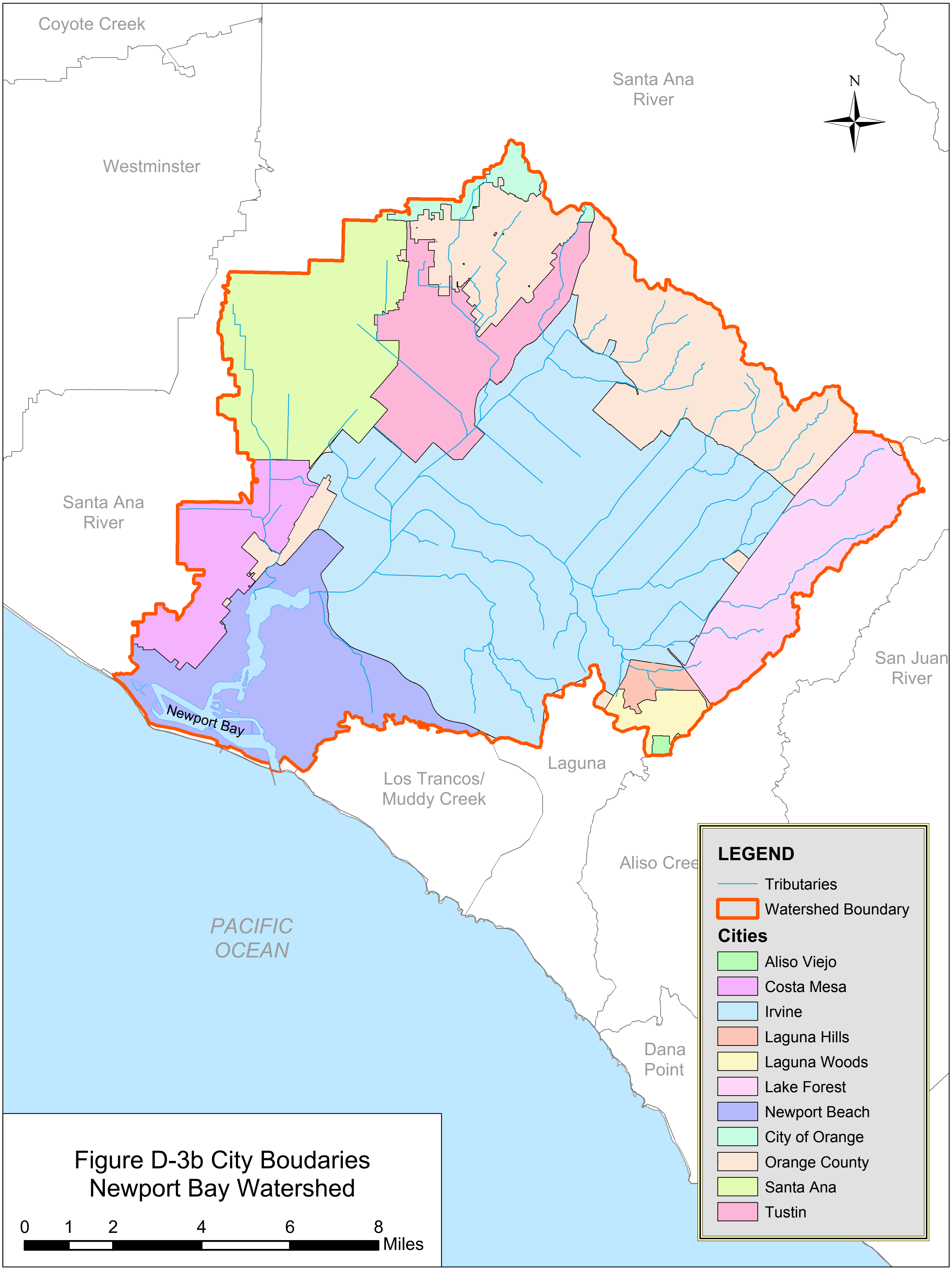


Figure D-3b City Boudaries
Newport Bay Watershed

Figure D-3c Water Providers

See next page for figure.

Figure D-3c Water Providers
Newport Bay Watershed

Figure D-3d Parks & Open Space

See next page for figure.

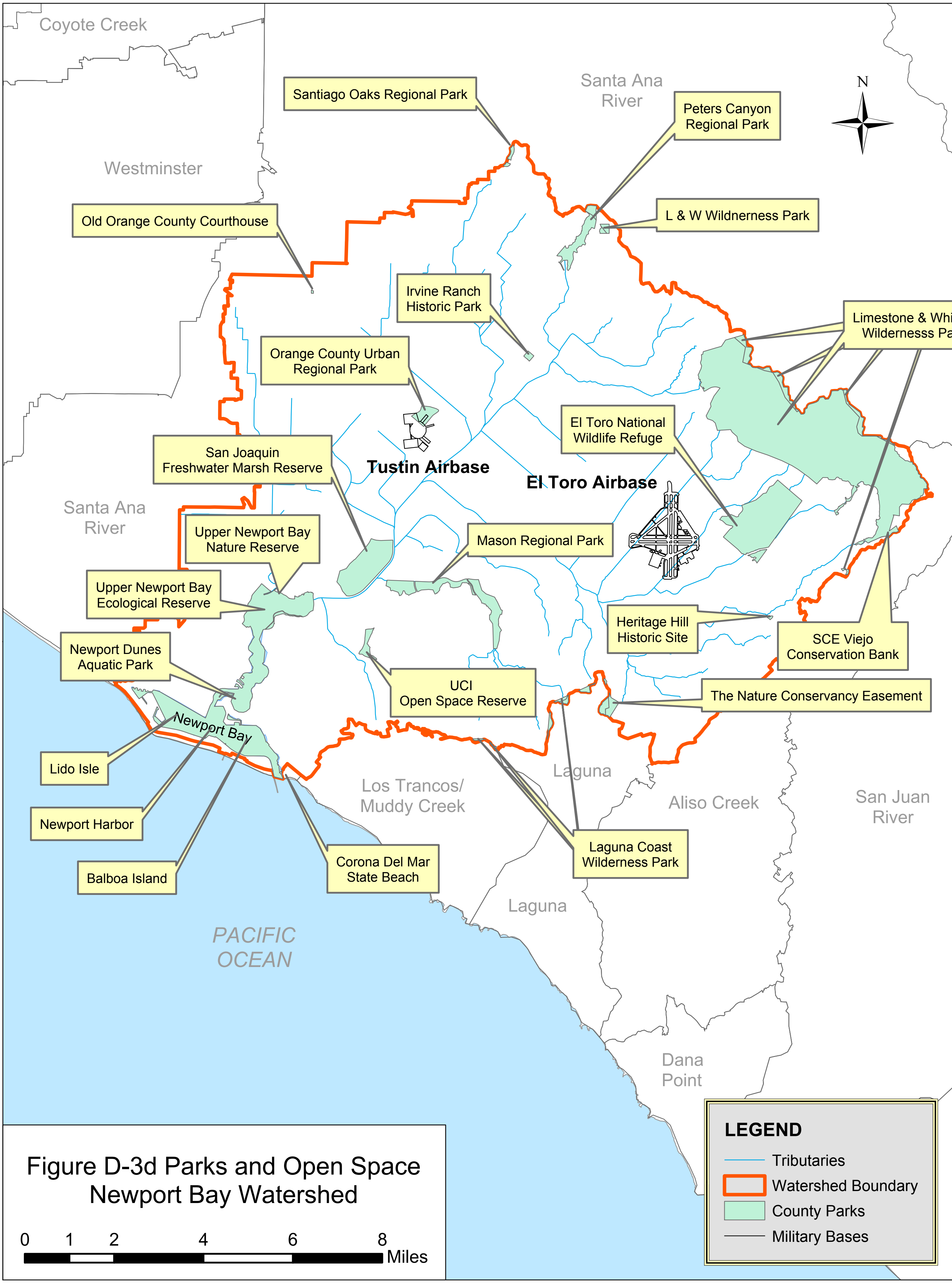


Figure D-3d Parks and Open Space Newport Bay Watershed

Figure D-4 Land Use - Existing

See next page for figure.

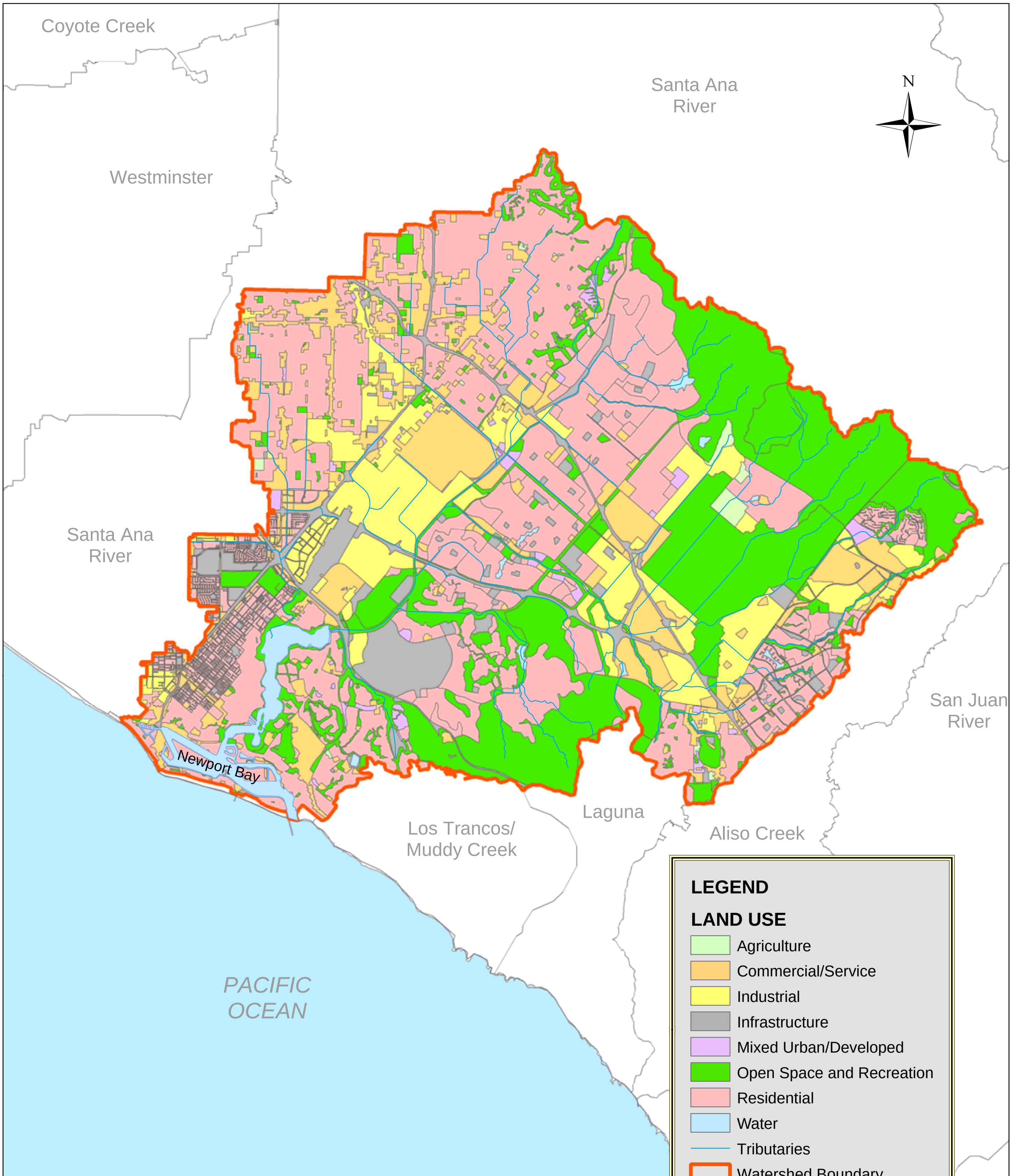


Figure D-4 Land Use Map
Newport Bay Watershed

0 1 2 4 6 8 Miles

This map is a mosaic of Irvine, Lake Forest, and SCAG land use data. Other city's land use data was not available/applicable.

D-1.2 Beneficial Uses

The Newport Bay 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 Newport Bay both Upper and Lower, as tributaries to the Pacific Ocean and also as receiving waters for San Diego Creek. The following existing beneficial uses are designated in the Basin Plan for the reservoirs, bays, estuaries and tidal prisms, watershed streams, and wetlands within the Newport Bay Watershed:

AGR	agricultural supply
BIOL	biological significance
COMM	commercial and sportfishing
EST	estuarine habitat
GWR	groundwater recharge
MAR	marine habitat
MUN	municipal and domestic supply
NAV	navigation
RARE	rare, threatened, or endangered species
REC1	contact water recreation
REC2	non-contact water recreation
SHEL	shellfish harvesting
SPWN	spawning, reproduction, and development
WARM	warm freshwater habitat
WILD	wildlife habitat

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

Table D-1 Beneficial Uses – Newport Bay Watershed

	Beneficial Use																				
Name	**MUN**	**AGR**	**IND**	**PROC**	**GWR**	**NAV**	**POW**	**REC1**	**REC2**	**COMM**	**WARM**	**LWRM**	**COLD**	**BIOL**	**WILD**	**RARE**	**SPWN**	**MAR**	**SHEL**	**EST**	**Hydrologic Unit**
Lakes																					
Laguna, Lambert, Peters Canyon, Rattlesnake, Sand Canyon, and Siphon Reservoirs	+	X						X[1]	X		X				X						801.11
Bays, Estuaries, and Tidal Prisms																					
Lower Newport Bay	+					X		X	X	X					X	X	X	X	X		801.11
Upper Newport Bay	+							X	X	X				X	X	X	X	X	X	X	801.11
Tidal Prisms of Flood Control Channels Discharging to Coastal or Bay Waters	+							X	X	X					X			X			801.11
Inland Surface Streams																					
San Diego Creek:																					
Reach 1- below Jeffrey Road	+							X[2]	X		X				X						801.11
Reach 2- above Jeffrey Road to headwaters	+				•			•	•		•				•						801.11

Name	Beneficial Use																				Hydro logic Unit
	MUN	AGR	IND	PROC	GWR	NAV	POW	REC1	REC2	COMM	WARM	LWRM	COLD	BIOL	WILD	RARE	SPWN	MAR	SHEL	EST	
Other Tributaries: Bonita Creek, Serrano Creek, Peters Canyon Wash, Hicks Canyon Wash, Bee Canyon Wash, Borrego Canyon, Wash, Agua Chinon Wash, Laguna Canyon Wash, Rattlesnake Canyon Wash, and other Tributaries to these Creeks	+				●			●	●		●				●						801.11
Sand Canyon Wash	+				●			●	●		●				●	X					801.11
Wetlands																					
San Joaquin Freshwater Marsh	+							X	X		X			X	X	X					801.11

X Present or Potential Beneficial Use

● Intermittent Beneficial Use

+ Excepted from MUN

[1] Access prohibited by Irvine Ranch Company

[2] Access prohibited in all or part by Orange County Environmental Management Agency (OCEMA)

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

Agricultural Supply (AGR) – Supports uses for farming, horticulture or ranching. Uses may include irrigation, stock watering, and support of vegetation for range grazing.

Biological Significance (BIOL) – Preservation of Biological Habitats of Special Significance. Supports 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.

Groundwater Recharge (GWR) – Supports uses for natural or artificial recharge of groundwater for future extraction, water quality maintenance or halting saltwater intrusion into freshwater aquifers.

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*) – Include uses of water 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) – Includes uses of water to 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) – Includes uses of water to support high quality aquatic habitats necessary for reproduction and early development of fish and wildlife.

Warm Freshwater Habitat (WARM) – Supports warm water ecosystems that may preserve and enhance aquatic habitats, vegetation, fish, and wildlife, including invertebrates.

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

As discussed in the Introduction, the focus of the Watershed Action Plan is to address the constituents of concern within the watershed. The constituents of concern in the Newport Bay Watershed are those pollutants for which a TMDL has been developed or is proposed to be developed. These pollutants, which include sediment, nutrients, toxics, and fecal coliform, are discussed in more detail in **Section D-3.0**.

D-1.4 Watershed Program Management

Program management of various water quality improvement programs within the Newport Bay 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 **2003 DAMP Section 3** and **Section D-1.4**).

The Watershed Permittees coordinate the program management of the Newport Bay Watershed through the program agreements and coordination meetings described below.

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, including monitoring costs.

The Orange County Stormwater Program also has an extensive committee structure that is described in the DAMP (**2007 DAMP Section 2**) and in the LIPs of the Watershed Permittees (**2007 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-1.4.2 *Watershed Management Framework*

Current County-led efforts are focusing on the establishment of a long-term Watershed Management Framework. The entity evolving from this framework will be necessary to implement many of the watershed-scale activities and programs that are discussed in this document. This entity could take many forms, among them a Resource Conservation District or a Committee with select powers. Because the process of watershed management is new and may differ from watershed to watershed, there is no standard structure for this entity. Therefore, responsibilities, and powers must be carefully worked out before its organization and mandate can be established. The form of this management structures is likely to be similar to the existing Newport Bay Management Committee. Currently, the County of Orange is leading the transition to this new management function with active input from the watershed stakeholders as part of the Newport Bay Watershed Management Committee. This committee meets at least twice per year and includes public participation.

The formation of special task groups or continued participation of individuals in the process is vital to the long-term viability of the water quality improvement process (and by extension, watershed management) in the Newport Bay Watershed Management Committee. Consideration of protection of environmental resources, and not only water quality issues, needs to be constantly integrated into this process. The interdependency of many resources requires that public understanding of potential issues related to single-purpose projects must be sought and integrated into the planning process.

It is expected that one of the functions of the management group will be the continued education of the participants and general public on the progress of water quality improvement efforts. The means by which to disseminate information may take the same form as that established by the USACE's Watershed Management Study in the Newport Bay Watershed.

The approach taken to develop the Newport Bay Watershed Action Plan recognizes that the LIP and this Watershed Action Plan represent the principal planning documents for two separate but nonetheless similar and highly interdependent water quality planning processes targeting the control of pollutants in urban runoff. These iterative processes can be represented in each case as shown **Figure D-5** and described in **Table D-2**.

Figure D-5 Water Quality Planning Process

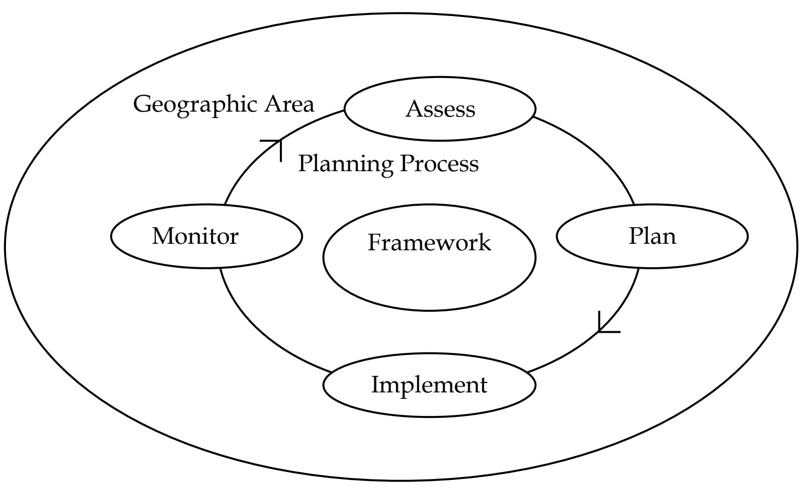


Table D-2 Watershed Management Processes

	Local Implementation Plan	Watershed Action Plan
Geographic Area Covered by Plan	Defined by political (city/county) boundaries	Defined by hydrologic boundaries
Planning Process	Focused on reducing discharges of pollutants in urban runoff and stormwater pollution on a uniform countywide basis. Directed by DAMP/LIP in conformance with NPDES permits requirements.	Focused on improving local receiving water quality where it is adversely impacted by urban runoff and stormwater pollution. Directed by NPDES permit requirements and 303(d) list/TMDLs.
Framework	Directed by Orange County Stormwater Program committee structure and Regional Board review. Public consultation principally through California Environmental Quality Act (CEQA) process/Regional Board review.	Directed by municipal and public agency stakeholders. Characterized by public participation.
Assessment	Based on information from countywide municipal and regional cooperative investigations of stormwater and receiving water quality and are undertaken on an annual and 5 year basis.	Based on information from watershed specific investigations and are undertaken on an annual basis.
Planning	Broad based approach with emphasis on well established pollution prevention and source control measures.	Pollutant specific approach with emphasis on treatment controls and consideration of innovative regional solutions.
Implementation	Individually by the Watershed Permittees.	Individually and collaboratively by Watershed Permittees and other agencies.
Monitoring	Considers pollutant load reduction.	Considers beneficial use attainment.

Based upon the annual watershed assessment, the Watershed Permittees and other participating jurisdictions will work together to address the priority water quality issues identified through this watershed planning process. 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-2.0 Water Quality Assessment

The Watershed Action Plans 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-6**) demonstrates the physical processes involved with generation of pollution and its fate and transport.

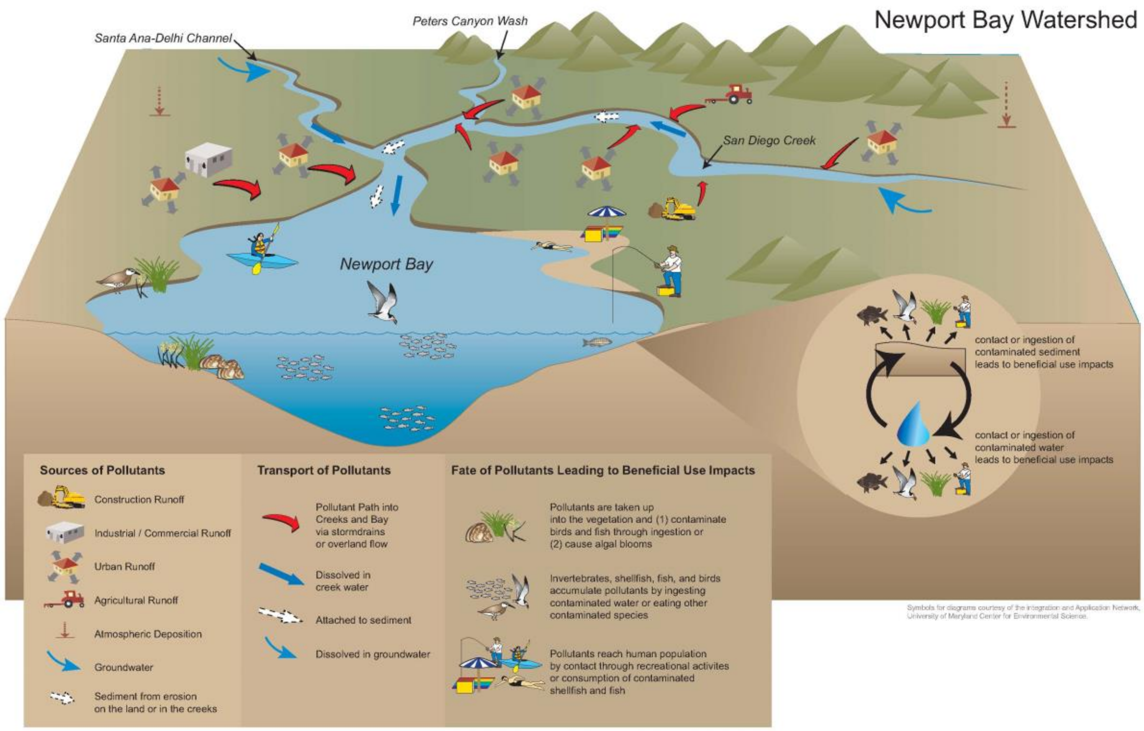


Figure D-6. Newport Bay Watershed Processes.

Within the Newport Bay 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 within Newport Bay is performed by OCHCA. Monitoring data are

compared to the bacteria water quality standards established following the adoption of AB411.

- Other special studies have been undertaken within the watershed to better understand the watershed's water quality. These studies include the Upper Newport Bay/San Diego Creek Watershed Planning Initiative funded by the U.S. Environmental Protection Agency (EPA) and the State Water Resources Control Board (SWRCB) under the 205j granting process, and the Upper Newport Bay Water Quality Enhancement Project funded by EPA/SWRCB under a 319h Grant.

D-2.1 Summary of Monitoring Activities

A bibliography was created in 1998 by the County of Orange Resources & Development Management Department (RDMD) to inventory the available studies related to the Newport Bay Watershed. A total of 236 entries were included in the original bibliography, covering studies performed from 1913 to 1998. Arrangements were made with the University of California (UC) Irvine Libraries to act as the Orange County repository for these documents.

The bibliography has been updated in preparing this WAP to include additional information obtained through Web site searches of various agencies and non-profit organizations as well as correspondence with the County of Orange, USACE, and UC's Cooperative Extension. Based on this work additional studies were added to the bibliography, bringing the total number of entries in the database to 317. The data collection is current through December 2004. Sixty-six new studies related to water quality were obtained through the data collection effort.

The major monitoring programs in the Newport Bay watershed are described below.

D-2.1.1 *NPDES Monitoring and Assessment Program*

NPDES permits are issued for a 5-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.

First Term Permit Monitoring Program 1991 - 1999

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 Newport Bay Watershed included:

San Diego Creek

* Santa Ana-Delhi Channel, 3 sites
* Santa Ana Gardens Channel
* Paularino Channel
* Bonita Canyon Channel
* San Diego Creek at Campus Drive
* Peters Canyon Channel
* El Modena-Irvine Channel
* Lane Channel
* Armstrong Storm Channel
* Barranca Channel
* Santa Ana-Santa Fe Channel
* South West Tustin Channel
* North Tustin Channel
* Redhill Channel
* San Joaquin Channel
* Sand Canyon Channel
* Bee Canyon Channel
* Agua Chinon Channel
* Serrano Creek Channel
* Borrego Canyon Channel
* Canada Channel
* Central Irvine Channel
* Rattlesnake Canyon Wash
* Hicks Canyon Wash

Upper Newport Bay

* Big Canyon Wash
* E. Costa Mesa Channel
* Santa Isabella 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. Within the Newport Bay Watershed, there were 16 channel monitoring locations.

- 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). There were 10 total harbor monitoring locations; six were in the upper bay (at Pacific Coast Highway, Newport Dunes, Shellmaker Island, North Island, ski zone, and near the old salt works) and four sites were in the lower bay (at Harbor Island, Turning Basin, Rhine channel, and the harbor entrance).

Second Term Permit Monitoring Program 1999 - 2005

The First Term Permit 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 second and third 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 Newport Bay Watershed there were nine "warm spots" and twelve CAR monitoring locations.

Third Term Permit Monitoring Program 2005 - present

The current permit period is the most comprehensive monitoring effort to date. It broadens the array of methods for measuring impacts at the following sites:

- Santa Ana-Delhi Channel, 3 sites
- Bonita Canyon Channel
- San Diego Creek at Campus Drive
- Peters Canyon Channel
- El Modena-Irvine Channel
- Lane Channel
- Bee Canyon Channel
- Agua Chinon Channel
- Central Irvine Channel
- E. Costa Mesa Channel

Three kinds of monitoring are included in 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 of the Monitoring Plan. Each of the three 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 monitor progress. Within the Newport Bay Watershed, there are six established stations. These sites include previously designated sites established in the first and second permit programs and sites integral to the regional monitoring programs for the Nutrient and Toxics TMDLs. In addition, these stations complement the Bight 2003 study by adding to long-term data about pollutant inputs to the Newport Bay. The monitoring sites target the following water bodies in the Newport Bay watershed:

- Santa Ana Delhi Channel
- Peters Canyon Wash
- San Diego Creek at Campus Drive
- Central Irvine Channel
- San Diego Creek at Harvard Avenue
- Costa Mesa Channel

Estuary / wetlands monitoring – includes measurements of key pollutants, loads and biological community parameters to describe impacts of urbanization on estuarine and wetland ecosystems. This program includes the following three channel stations and six estuary/wetland sites within the Newport Bay Watershed:

- San Diego Creek at Campus Drive
- Santa Ana Delhi Channel
- Costa Mesa Channel
- Upper Newport Bay-Unit Basin 1
- Upper Newport Bay-Unit Basin 2
- Upper Newport Bay-PCH Bridge
- Upper Newport Bay-North Star Beach
- Lower Newport Bay-Harbor Island Reach
- Lower Newport Bay-Turning Basin

Bacteriological/ pathogen monitoring – 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 to prioritize problem areas. Stations were identified at coastal drains and channels. The following two channel sites are located in the Newport Bay watershed:

- San Diego Creek at Campus Drive
- Santa Ana Delhi Channel

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. The following bioassessment sites have been selected in the Newport Bay watershed:

- Big Canyon Wash u/s Back Bay Drive
- Bonita Canyon Channel
- San Diego Creek at Campus Drive
- Peters Canyon Wash at Barranca Parkway
- San Diego Creek at Harvard Avenue
- San Diego Creek at Highway 133
- Serrano Creek u/s of Bake Parkway

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.

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. Seven monitoring locations that cover three experimental conditions and a reference condition have been selected; all sites are located in the City of Irvine.

Nutrient TMDL monitoring – uses nutrient measurements to track progress in pollutant reduction over time. The nutrient TMDL is further discussed in Chapter 3.0.

D-2.1.2 *OCHCA Bacteria Monitoring*

Over the past 40 years the OCHCA and local sanitation agencies (OCSD and SOCWA) have been testing the coastal waters in Orange County for bacteria that indicate possible presence of human disease-causing organisms. As of 1999, new requirements for frequent testing of surfzone waters and stringent criteria for beach water closures went into effect as part of AB411. Samples are collected weekly at approximately 150 ocean, bay, and drainage locations throughout coastal Orange County. Within the Newport Bay Watershed, there are approximately 55 sample locations. OCHCA is also conducting monitoring at two inland receiving waters, San Diego Creek at Campus Drive and Santa Ana Delhi Channel, within the Newport Bay Watershed. **Figure D-7** shows the subwatersheds and the monitoring locations within the Newport Bay Watershed.

D-2.1.3 *Toxics Substances Monitoring Program and State Mussel Watch*

The Toxic Substances Monitoring Program (TSMP) and California State Mussel Watch Program (SMWP) were initiated by the SWRCB to provide a uniform statewide approach to the detection and evaluation of the occurrence of toxic substances in fresh, estuarine, and marine waters of the State through the analysis of fish and other aquatic life. The TSMP and SMWP primarily target water bodies with known or suspected impaired water quality and are not intended to give an overall water quality assessment. The California Department of Fish and Game (CDFG) carry out the statewide TSMP and SMWP for the SWRCB by collecting and analyzing samples. In the SMWP this is accomplished through the analysis of resident and transplanted mussels and clams. Sampling stations are selected primarily by the Regional Boards and include stations in the Newport Bay Watershed.

Figure D-7 Subwatersheds & Monitoring Locations

See next page for figure.

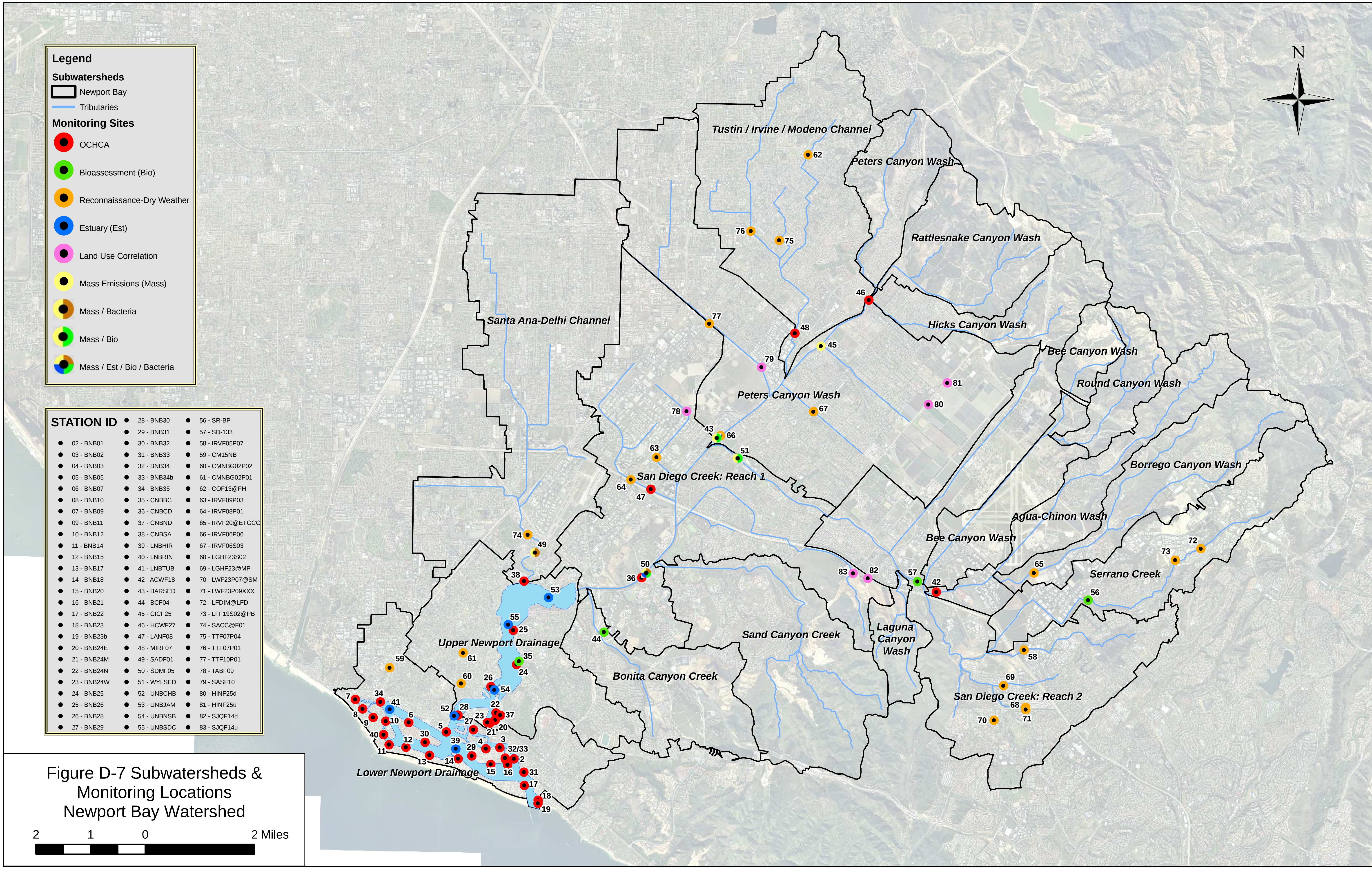


Figure D-7 Subwatersheds & Monitoring Locations Newport Bay Watershed

D-2.1.4 *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 Newport Bay Watershed. The Sediment Toxicity Report (Volume I) has been published and includes monitoring data for stations in Newport Bay and San Diego Creek. Analyses were performed on samples taken at 10 stations and confirmed that sediment toxicity is prevalent throughout Newport Bay and in San Diego Creek. Ongoing surveys for the Coastal Ecology component of the Bight '03 Study will continue to produce data in Newport Bay and watershed.

D-2.1.5 *Special Studies*

Numerous special studies have been performed in the Newport Bay Watershed. These programs, as well as those described above, are summarized on the Newport Bay Environmental Matrix, which is included in the Appendix to this Watershed Action Plan.

D-2.2 Assessment of Data and Studies

It is a significant challenge to assemble the studies and programs in the Newport Bay watershed into a meaningful framework that identifies the type of data or results available. To meet the various user needs for this document, data collected in this data collection effort (ending in December 2004) were evaluated for different aspects or perspectives, including program management and policies, study and program type, and study or program details.

Assessment #1: Program Management and Policies

When faced with the abundance of data that exist, 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-3**) identifies the management categories 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 for specific pollutants of concern or elements of the watershed system.

Table D-3 Assessment #1 - Studies by Program Management Category*.

	Identify Sources	Understand Processes	Develop New Tools	Determine Compliance with WQS/TMDLs	Evaluate Program/ Measure Effectiveness	Provide Early Warning
Bacteria	6	3	1	6	2	1
Nutrients	14	11	3	11	2	1
Inorganics						
Metals	10	11	1	12	2	1
Selenium	10	14	3	8	3	1
Organics						
Pesticides	13	11	1	8	2	1
Physicals						
Dissolved Oxygen	6	6	0	6	0	0
Solids						
Sediment	10	12	1	8	1	2
Trash & debris						
Toxicity	6	8	1	8	2	1
Biota						
Morphology	1					

*Note: Each study may fall under one or more management categories

Assessment #2 – Study and Program Type

The 66 water quality studies and programs identified in the Newport Bay 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 66 studies included in the bibliography. New data were generated with the following two objectives:

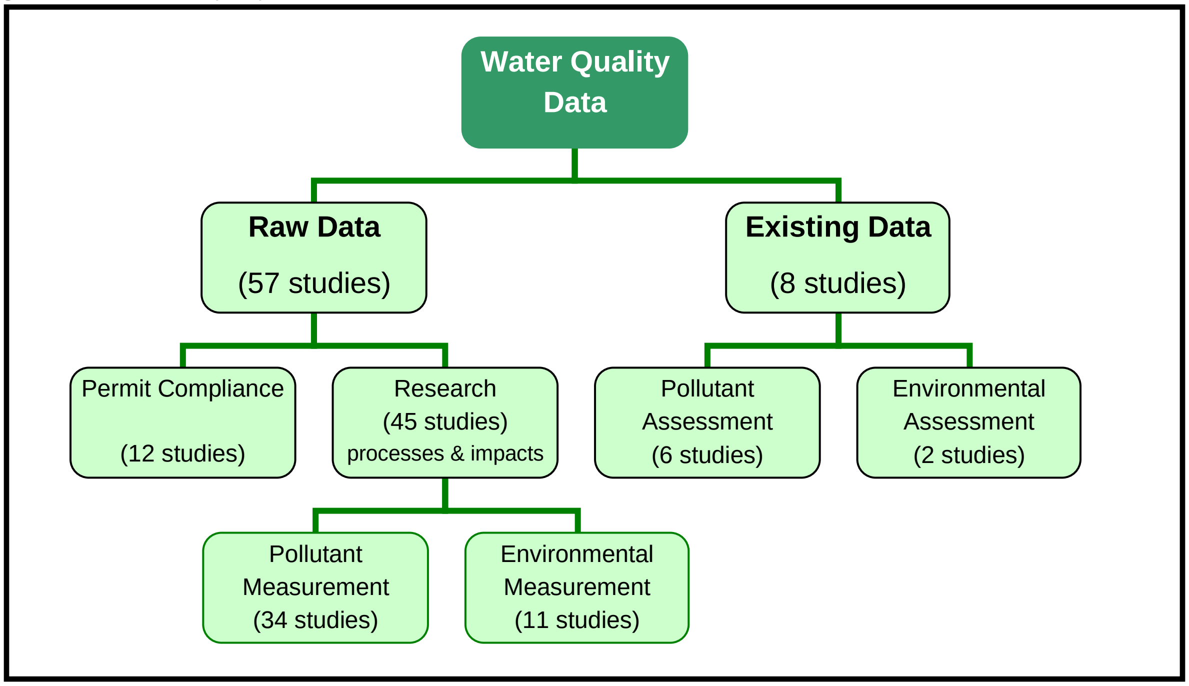
- Compliance with NPDES permits, monitoring, and directives for TMDL monitoring.
- Provide an understanding of the concentration levels or processes related to the pollutants, or the impacts of the pollutants, on the ecosystem. Studies targeting pollutant concentrations and processes generally involve 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 Newport Bay system through direct measurement of the pollutants, or
- Understanding the impacts of the pollutants by measuring other environmental parameters.

The following figure (**Figure D-8**) shows the category breakdown of the studies as well as the general objective of the study.

Figure D-8 Study Type 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 Newport Bay Watershed the major generators of water quality data are the County of Orange, SCCWRP, and University of California, Los Angeles (UCLA). The following table (**Table D-4**) identifies the organizations responsible for each of the 66 studies. For collaborative studies, the primary organization is included in the table.

Table D-4 Study Sources

Organization	Number of Studies
County of Orange (includes RDMD, OCHCA and Integrated Waste Management)	14
SCCWRP	20
Other Agencies (SWRCB, RWQCB, Coast Guard, Cities, Caltrans)	7
Environmental Groups (Defend the Bay, Coastkeeper)	3
Irvine Ranch Water District	5
Universities (UCLA, UCI, UC-Riverside, California State University – Long Beach, UC Coop Extension)	13
Private (nurseries, airport)	4

Each of the 66 water quality studies or programs that were identified as part of this data assessment addressed one or more specific pollutants. Ten categories of constituents were identified that encompass nearly all of the specific data that were monitored or assessed. These 10 categories include:

- Bacteria
- Nutrients
- Metals
- Selenium – selenium was separated from the metals category because of the high level of attention in the watershed on this contaminant
- Pesticides
- Toxicity – various levels of toxicity studies were performed
- Algae
- Dissolved oxygen
- Conventional water chemistry – this includes a wide range of variables such as pH, hardness, and temperature
- Sediment – this includes both bulk sediment and sediment contamination

The following table (**Table D-5**) shows the distribution of the studies within each of these categories. Many studies include work related to several constituents.

Table D-5 Constituent Focus of Studies and Programs

Constituent	Number of Studies
Bacteria	11
Nutrients	22
Metals	23
Selenium	25
Pesticides	23
Toxicity	13
Algae	8
Dissolved oxygen	10
Water chemistry	22
Sediment	15

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.

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 need evidence of the presence of the pollutant(s) that cause or contribute to the adverse condition.

The 2002 303(d) list of impaired waters (approved by the SWRCB) that could potentially be affected by activities occurring within the Newport Bay Watershed, is presented in **Table D-6**. It should be noted that this list is updated every 3 years and will be replaced within this Watershed Action Plan.

Table D-6 2002 303(d) List and TMDL Priority Schedule – Newport Bay Watershed

Type	Name	Hydro Unit	Pollutant/Stressor	Source	Priority	Estimated Size Affected	Proposed TMDL Completion
B	Newport Bay, Lower	801.14	Metals	Urban Runoff/Storm Sewers Contaminated Sediments Boatyards	Medium	767 Acres	
			Pesticides	Agriculture Contaminated Sediments	High	767 Acres	2003
			Priority Organics	Contaminated Sediments Unknown Nonpoint Source	Medium	767 Acres	
E	Newport Bay, Upper (Ecological Reserve)	801.11	Metals	Urban Runoff/Storm Sewers	Medium	653 Acres	
			Pesticides	Agriculture Unknown Nonpoint Source	High	653 Acres	2003
R	San Diego Creek Reach 1	801.11	Fecal Coliform	Urban Runoff/Storm Sewers Other Urban Runoff	Low	7.8 Miles	
			Pesticides	Unknown Nonpoint Source	High	7.8 Miles	2003
R	San Diego Creek Reach 2	801.11	Metals	Urban Runoff/Storm Sewers Other Urban Runoff	Medium	6.3 Miles	
			Unknown Toxicity	Unknown Nonpoint Source	Low	6.3 Miles	

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

In addition to the 303(d) list discussed above, a Monitoring List has been developed by the SWRCB. This list indicates those waterbodies that are being monitored or investigated for potential pollutants of concern but have not been included on the 303(d) list. **Table D-7** identifies the waterbodies included on this list in the Newport Bay Watershed. The monitoring list is currently available through the Regional Board, but is expected to not be continued as part of the 2006 list.

Table D-7 Monitoring List for Newport Bay Watershed

Type	Name	Hydro Unit	Pollutant/Stressor	Estimated Size Affected
Estuary	Newport Bay (Ecological Reserve)	801.11	Trash	653 Acres

Figure D-9 includes a map that shows the 303(d) listed receiving waters.

D-2.3.2 *AB411 Summary*

The 2005 Annual Ocean and Bay Water Quality Report (OCHCA, 2006) summarizes monitoring activities that took place in Newport Bay. Thirty-one sites are monitored around the 39.5 miles of bay front. In 2005 there were 21 beach postings from April-October, a decrease compared with previous years (since 2000) when postings ranged from 68 to 31. In 2005 there were 41 postings throughout the 2005 calendar year. This is a decrease compared with previous years (since 2000, with the exception of 2004 which had 39 calendar year postings) when the postings ranged from 94 to 39.

D-2.3.3 *Fecal Coliform TMDL Annual Report*

Each year a report is submitted on behalf on the watershed Permittees to the Regional Board to summarize the bacteriological data collected in Newport Bay and evaluate compliance with the recreational use bacterial water quality objective established in the Basin Plan. The data used in this evaluation is the data collected by OCHCA. The report discusses the compliance and non-compliance of each station in the wet and dry seasons.

D-2.3.4 *Sediment TMDL Annual Report*

Each year a report is submitted on behalf on the watershed Permittees to the Regional Board to summarize the activities related to the sediment TMDL monitoring and maintenance program.

The report discusses activities related to the San Diego Creek watershed and the Newport Bay as well as sediment control initiatives that are being undertaken.

D-2.3.5 *Nutrient TMDL Annual Report*

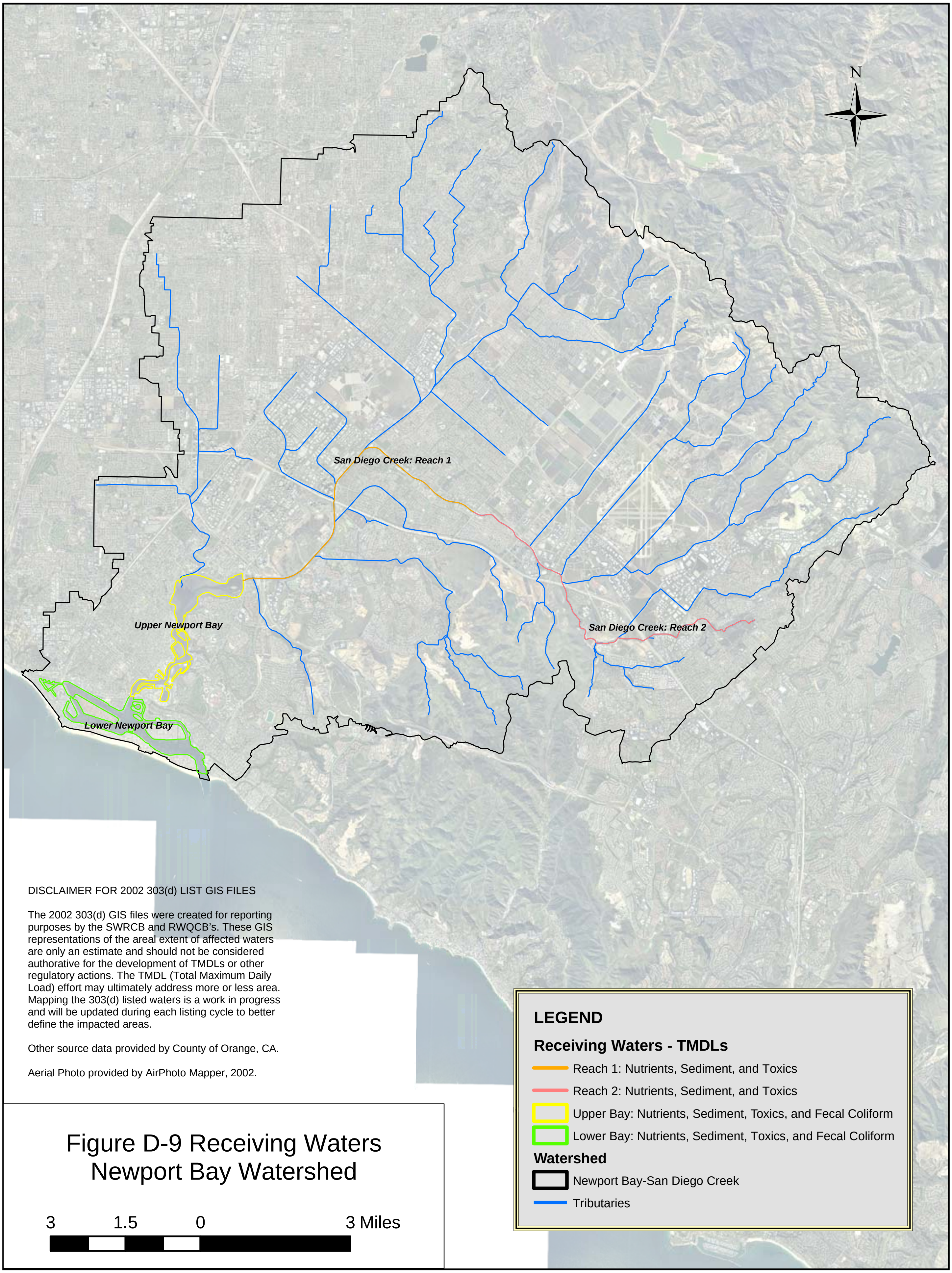
Each year a report is submitted on behalf on the watershed Permittees to the Regional Board to summarize the data and results from the Regional Monitoring Program (RMP). The RMP was developed in order to monitor and evaluate the goals of the Nutrient TMDL. The objectives of the RMP are to quantify the endpoints of the TMDL: (1) the seasonal nutrient loading from the watershed, (2) the nutrient concentrations in San Diego Creek Reaches 1 and 2, and (3) the extent, magnitude, and duration of algal blooms in Sand Diego Creek and Newport Bay.

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.

Figure D-9 Receiving Waters

See next page for figure.



DISCLAIMER FOR 2002 303(d) LIST GIS FILES

The 2002 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.

Figure D-9 Receiving Waters
Newport Bay Watershed

These and other data gaps have been identified to some extent in the research study reports, the research agenda for the Southern California Stormwater Monitoring Coalition, and the specific requirements of the NPDES permits. However, a thorough 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 virtually an infinite array of scientific data that could be gathered in a complex system such as this. It is essential to focus efforts 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. It should be noted that the Newport Bay watershed has more data than almost any other comparatively sized area. Articulating clear questions enables studies to be designed so that disparate data types can be combined as needed to address complex issues.

D-2.4.1 *Pollutant Data Gaps*

The list below identifies data gaps related to specific pollutant categories. It should be noted that some of the gaps do not relate to urban sources which is the primary focus of the Watershed Action Plan. A lengthier discussion of each pollutant category follows the summary list below.

- *Nutrients* – specifically the macro-nutrients nitrogen and phosphorus and algae related issues
    - Relationship between low dissolved oxygen levels to algal blooms
    - Conceptual models to describe important processes that effect the nitrogen concentrations, bioavailability, or cycle within the watershed
    - Beneficial use impairment, potentials of adverse effects, and key linkages between nitrogen, environmental conditions, algal growth, dissolved oxygen, and beneficial uses
    - Spatial and temporal concentrations of nitrogen in groundwater and urban runoff and sites of excessive algal growth (freshwater and marine)
    - BMP potential effectiveness
- *Bacteria*
    - Relative magnitude of urban versus natural sources
    - Sources
    - Rapid bacteriological indicators
    - MST identification methods
- *Bulk Sediment*
    - Headland sediment source contribution
- *Sediment Contamination* – includes contaminants that are bound to the sediment and transported through the system with the sediment
    - Functional linkage between sediment flows and pollutant
    - Pattern of sediment contamination seasonally and in response to storms
- *Selenium*

  - A conceptual model to describe important processes of selenium
  - Concentrations and loading estimates
  - Foodweb and wildlife impacts in the watershed
  - BMP technology and assessment
- *Toxics* – metals (other than selenium), pesticides, and organochlorinated compounds are included in this category.
  - Organochlorine and PCB concentrations
  - Food web relationships that affect pollutant pathways
  - Risks to human health, fish and other wildlife
  - Technology to identify sources of certain pesticides

Nutrients

High nutrient loads from the surrounding watershed have resulted in excessive growth of macroalgae in the Bay. The large macroalgal blooms seen from the 1980s through the middle 1990s often adversely impacted the beneficial uses of aquatic systems by reducing water column dissolved oxygen concentrations, and fouling beaches and swimming and boating areas. The link between algal blooms and dissolved oxygen needs and the spatial and temporal extent of hypoxic/anoxic events needs to be better understood. This issue is being addressed through a grant-funded study.

The Nitrogen and Selenium Management Program (NSMP) is a five-year work effort to comply with the requirements of a NPDES permit (Order No. R8-2004-0021) issued by the Regional Board for the Newport Bay watershed. The NSMP will provide focused study to better understand selenium impacts and potential treatment methods. Nitrogen issues will also be addressed to support re-evaluation of the existing Nutrient TMDL. The NSMP Working Group consists of staff level technical representatives of watershed stakeholders that include state, county, and city agencies, water districts, and private entities that have agreed to fund and implement a work plan to address selenium and nitrogen groundwater-related inflows in the Newport Bay watershed. The NSMP has identified the following data gaps and proposes to address them in their program:

- Develop a conceptual model to describe important nitrogen cycle processes that determine the availability of nitrogen in the watershed and guide data collection and analysis.

- Clarify the link between algal growth and the degree of beneficial use impairment. Determine thresholds related to increased potential for adverse effects and describe key links between nitrogen, environmental conditions, algal growth, dissolved oxygen, and beneficial uses.

- Identify the areas with the highest concentrations of nitrogen in groundwater and urban runoff as well as estimating nitrogen loadings. Identify sites of excessive algal growth in the watershed, nitrogen concentrations in the waters of those habitats, and frequency of exceedances in each habitat. Identify critical seasons when nitrogen concentrations are highest to better understand the pattern and frequency of exceedances and guide BMP development.

- Develop and evaluate effective BMPs and treatment technologies.

Bacteria

Identification of the source of bacteria is a difficult question. In the Newport Bay Watershed identifying and quantifying the contribution of urban and natural sources of bacterial impairment in Newport Bay is a data gap. The goal of the Newport Bay Fecal Coliform Source Identification and Management Plan Project, a Proposition 13 project, is to identify and quantify the contribution of urban and natural sources of bacterial impairment in Newport Bay. This information will be used to develop a Source Prioritization and Management Plan to address the controllable urban sources of fecal coliform. The Source Management Plan will enable the County and local watershed cities to implement pollution reduction and prevention programs, which will lead to improved water quality at public beaches and to achieving bacteriological standards.

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 storm drains continue to discharge large concentrations of bacteria.

A study by SCCWRP will examine if bacteria can grow in storm drain sediments. This study, *Storm Drains and Sediments as Reservoirs of Fecal Indicator Bacteria*, is being led by John Griffith.

Bulk Sediment

The understanding of the processes associated with the movement of sediment is fairly well understood. Data gaps primarily exist as a result of the changing landscape within the watershed. In particular, the headland areas contain newly cut channels. The sediment source contribution from these channels is not fully understood. Dr. Stan Trimble, Professor, UCLA, is performing field investigations to address this issue.

Sediment Contamination

An important goal of the Newport Bay Toxic TMDL is to improve understanding of the functional linkage between sediment flows and pollutant (especially metals) inputs to the bay. As part of the NPDES monitoring, two special studies will be conducted to further this understanding. The first is a fractionation study that is being designed cooperatively between the County of Orange and the Regional Board. This study will determine the relative distribution of pollutant concentration across particle size categories. This study will enhance the understanding of what sorts of sediment flows transport the largest portion of pollutants, which will assist in the design and evaluation of sediment BMPs. The second study will attempt to develop a quantitative relationship between the characteristics of sediment sampled by the automatic samplers used in the mass emissions program element of the NPDES monitoring program and the vertically integrating samplers used in the Sediment TMDL monitoring. Both of these studies will be performed by the County as part of the Santa Ana Region Water Quality Monitoring Program.

Upper Newport Bay contains sediments contaminated with chlorinated and organophosphorus pesticides. The retail product source of many of these pesticides is unclear. A SCCWRP study will investigate two relatively new analytical methods to help identify the sources and fates of the targeted pesticides.

There are unanswered questions about whether the pattern of sediment contamination changes seasonally and in response to storms that increase loads of contaminated sediment to the bay. A special study will be conducted by SCCWRP to ascertain these relationships.

Selenium

The following data gaps were identified by the Nitrogen and Selenium Management Program and are being addressed through that program:

- To make decisions on the data collection and analysis of selenium data, a conceptual model is needed to describe important processes that determine cycling and effects of selenium in the watershed.
- The existing data do not identify the spatial and temporal extent to which the California Toxics Rule criteria and other guidelines for selenium are exceeded. Areas with the highest concentrations of selenium in groundwater need to be identified and the selenium loadings estimated.
- Selenium is essential for life but toxic at high levels and is unusual in that the difference between essential and toxic levels is relatively small compared to other toxic constituents. Selenium has the potential to bioaccumulate in the food web; however it is not known whether the selenium levels present in the Newport Bay Watershed are causing foodweb and wildlife impacts.
- Efforts are needed to develop and evaluate effective BMPs and treatment technologies.

Toxics

Organochlorine and PCB are pollutants that are no longer in use in the Newport Bay watershed but have potential food web impacts due to historical use. The concentrations of these compounds in the channels discharging to the bay are unknown. A special study will be done to investigate previous sampling of these compounds and potentially perform sampling for these pollutants in the channels that discharge to the bay. This study will be performed by the County as part of the Santa Ana Region Water Quality Monitoring Program under the Mass Emissions Program.

There is a need to improve understanding of the food web relationships that affect toxic pollutant pathways and to understand the risks to human health, fish, and other wildlife that is posed by toxics. Two SCCWRP studies will provide valuable information to begin to fill these data gaps. The first study, *Investigation of Contaminants in Upper Newport Bay Food Web,* is part of the 2004-2005 research plan (Project B4). The second study is Project C1, *Development of Sediment Quality Objectives for Bays and Estuaries*. Newport Bay will be a case study for this project.

D-2.4.2 *Other Data Gaps*

Other data gaps that exist are not pollutant specific. These data gaps are related to a broader understanding of pollutants, such as how they travel, how they impact the habitat, how to develop regional stormwater infrastructure. The following describes actions being taken to address these data gaps.

Stormwater Infrastructure

Guidance on how to use existing data for further analysis is limited. **Figure D-8**, which identifies the number of studies in each category, indicates an imbalance between the number of studies/programs generating new data and those drawing conclusions from existing data sets. The Southern California Stormwater Monitoring Coalition has recognized the need to develop projects to (1) integrate and evaluate available data (Project 1); (2) standardize sampling and analysis protocols (Project 2); (3) develop a regional data infrastructure (Project 3); and (4) measure BMP effectiveness (Project 4).

Stormwater Mechanisms and Processes

The Stormwater Monitoring Coalition has identified a need to improve fundamental understanding of stormwater mechanisms and processes. To meet this need the following project have been identified: (1) develop a systemwide conceptual model (Project 5); (2) determine appropriate reference conditions (Project 6); (3) develop a regional method for measuring beneficial use condition (Project 7); and (4) identify relative contribution of nonpoint sources to urban runoff loads (Project 8).

Additionally, a study will be performed by the County as part of the Santa Ana Region Water Quality Monitoring Program through the Estuary / Wetlands Monitoring Program to assess the transport modes of pollutants into wetland upland areas. The transport modes include two mechanisms: (1) by floating on the surface of the water and collecting on the land/water interface and (2) through periodic flooding of contaminated stormwater into the upland areas. The design process for the study will be developed in cooperation with the Regional Board and SCCWRP.

Receiving Water Impacts

The final data gap identified by the Stormwater Monitoring Coalition 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 (Project 9); (2) develop bioassessment indicators and protocols (Project 10); (3) develop improved toxicity testing procedures (Project 11); (4) develop raid response indicator(s) for microbial contamination (Project 12); (5) develop microbial source tracking protocol (Project 13); (6) evaluate BMP effects on receiving water impacts (Project 14); and (7) develop improved indicators of peak flow impacts (Project 15).

Several of the identified Stormwater Monitoring Coalition projects have been funded and are underway. Projects that are underway or completed included Projects 2, 5, 8,9, 10, 12, 13, and 15.

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. The Regional Board has amended four TMDLs to the Basin Plan for Newport Bay or San Diego Creek: (1) fecal coliforms, (2) nutrients, (3) sediment, and (4) chlorpyrifos and diazinon. In addition, EPA has developed technical TMDLs for several other toxic pollutants; however, these TMDLs have not been amended to the Santa Ana Basin Plan and final versions have not been approved by EPA. All existing TMDLs, including the technical TMDLs, are described in Section D-3.1 and future TMDLs associated with other pollutant-waterbody combinations on the 303(d) list are identified in Section D-3.2.

D-3.1 Existing TMDL Development

The four existing TMDLs in Newport Bay or San Diego Creek are described below in detail. These TMDLs do not apply to the entire length of San Diego Creek and both sections of Newport Bay (Upper and Lower). For example San Diego Creek has been divided into two reaches. Reach 1 refers to the mouth at Newport Bay to Jeffrey Road and Reach 2 is Jeffrey Road to the headwaters. Both the sediment TMDL and nutrients TMDL apply to Reach 1 and 2, whereas metals (part of the toxicity TMDL) apply only to Reach 1. Areas governed by the TMDL pollution reduction allocations are described extensively in each TMDL document. In addition, Annual Reports, which summarize the data collected and evaluate progress and compliance with the TMDL, are submitted to the Regional Board by the Watershed Permittees.

D-3.1.1 *Newport Bay - Fecal Coliform*

Newport Bay was included on California's 1996 section 303(d) list because of pathogen impairment. A TMDL was completed for the bay for fecal coliform bacteria, which is a pathogen indicator, to address the pathogen impairment. The fecal coliform bacteria TMDL was developed by the Regional Board and amended to the Santa Ana Region Basin Plan in April 1999. The TMDL became effective in December 1999. The information provided in this section was summarized from the *Total Maximum Daily Load for Fecal Coliform Bacteria in Newport Bay, California* (Santa Ana RQWCB, 1998a) and Regional Board Resolution 99-10 (Santa Ana RWQCB, 1999a), which formally amended the Basin Plan to incorporate the fecal coliform TMDL.

OCHCA routinely monitors for bacteria in the bay at approximately 30 sampling locations. This routine monitoring is supplemented with focused monitoring in areas with known bacterial water quality problems. OCHCA mostly samples for total coliforms, but samples from certain locations of concern are also analyzed for fecal coliform bacteria. Persistent high concentrations of bacteria as early as 1974 led to the closure of the Upper Bay for shellfish harvesting and later water contact recreation, and the closures are still in effect. The OCHCA has also temporarily closed other parts of the bay to water contact recreation due to results of monitoring efforts. These temporary closures usually occur in response to storm events or sewage spills.

The OCHCA data collected at 34 sampling locations in 1997 and 1998 provide a characterization of the bacterial water quality impairment in the bay and were included in the TMDL report. Fecal coliform bacteria data are available at only five of those stations; therefore, it was assumed that exceedances of the Health and Safety Code total coliform bacteria standards would also result in exceedances of the fecal coliform bacteria water quality objectives. In summary, the 1997 and 1998 data show that the bay rarely meets the water quality objectives for shellfish harvesting in the summer or the winter. The bacteria impairment is most severe in the winter (November through April) because this is the wet season, which experiences runoff during rain events. The water quality in the bay generally meets bacteria objectives in the drier summer months. Some problem areas indicated by the monitoring include the Dunes area in the lower part of the Upper Bay (which is heavily used for water contact recreation) and the channels at the west end of the Lower Bay.

The major sources of fecal coliform bacteria to Newport Bay are the tributaries that discharge to the Bay. These tributaries are composed mostly of urban and agricultural runoff. Wildlife (birds and other animals) in the watershed are considered natural sources of fecal coliform bacteria. Additional sources include discharges of vessel sanitary waste and a proposed discharge by the Irvine Ranch Water District (IRWD) of recycled water from wetland ponds to San Diego Creek and Newport Bay. Although the main sources to the bay have been identified, there is much uncertainty surrounding the origin of the fecal coliform bacteria to those main sources (e.g., what specifically is contributing to fecal coliform bacteria concentrations in urban and agricultural runoff). Because of the diffuse pollutant sources (urban and agricultural runoff), the uncertainty associated with the bacteria sources, expected difficulties in identifying and implementing appropriate control measures, and uncertainty regarding the nature and attainability of the shellfish harvesting use in the bay, the TMDL recommends a phased approach. The phased TMDL includes a schedule for compliance with the final TMDL as well as interim numeric targets (Santa Ana RWQCB, 1998a).

The TMDL was established to ensure protection of the water contact recreation beneficial use through the use of the density-based REC-1 fecal coliform bacteria water quality objectives, with compliance to be achieved no later than 2014. Although the REC-1 objectives are included as a TMDL endpoint, the shellfish harvesting water quality objectives ultimately control the allowable load of fecal coliform bacteria in the Bay because it is more stringent. Therefore, the final TMDL for fecal coliform bacteria in Newport bay is proposed to be the same as the shellfish harvesting objectives for fecal coliform bacteria—median concentration not more than 14 most probable number (MPN)/100 mL for the chronic objective and not more than 10 percent of samples exceed 43 MPN/100 mL for the acute objective. Compliance with the shellfish harvesting objective is to be achieved no later than 2020.

Based on information currently available, wasteload allocations (WLAs) for the TMDL include the tributaries to the bay (since the urban and stormwater runoff is regulated under an NPDES permit), IRWD's proposed discharge of reclaimed water to San Diego Creek and Newport Bay, and vessel sanitary wastes. The load allocations (LAs) include agricultural runoff (although it is mixed with urban runoff, agricultural runoff is not regulated by the NPDES permit) and natural sources (wildlife).

The TMDL's phased approach allows time to conduct further monitoring and assessment, including bacterial dilution and die-off studies relating the shellfish harvesting attainability and activity in the bay. It is possible that the results of these and other studies will provide a basis for modifying the TMDL allocations. There are 10 phases of the TMDL that will result in eventually meeting the water quality objectives. According to the amendment to the Santa Ana Regional Board Basin Plan (Attachment to Resolution No. 99-10; Santa Ana RWQCB, 1999a), the TMDL is to be adjusted, as appropriate, based on the results of 10 implementation tasks (Santa Ana RWQCB, 1998a).

The first implementation task requires routine monitoring of bacterial concentrations for total coliforms, fecal coliform bacteria, and *enterococcus*. The County of Orange and the watershed cities conduct a routine monitoring program that satisfies this requirement. At a minimum, their routine monitoring includes the collection of five samples per 30-day period at 35 stations throughout Newport Bay. The monitoring data are analyzed annually and presented in Annual Data Reports, which are available on the following Web site:

http://www.ocwatersheds.com/watersheds/tmdls_fecal_coliform_intro.asp

The other nine implementation tasks require studies to be completed for several special study areas, many of which are described below.

Previous monitoring and study efforts have included the routine monitoring program described previously, a water quality model for bacterial indicators, a REC-1 beneficial use assessment, health risk assessment and evaluation of the Vessel Waste Program, and source identification and characterization of the Dunes Resort and agricultural runoff sources. The study examining the contribution of bacteria from swimmers at Newport Dunes Resort (Jiang et al., 2004) found that fecal coliform bacteria concentrations were generally low in the Dunes' water column and that bathing activities do not appear to be the causes of elevated concentrations of fecal coliform bacteria at the beaches. It is more likely that sources include ground seepage, small spills from vessel pump-out stations, storm drains, and wildlife.

A study on the contribution of marinas to fecal coliform bacteria impairment in Lower Newport Bay (Grant et al., 2004) found that the two marinas in the study area (Balboa Yacht Basin and Dunes Marina) are not significant sources of fecal coliform bacteria to the bay. It is more likely that surface water runoff (during both dry and wet weather) is the major source of fecal coliform bacteria to the marinas.

To supplement the previous studies and address additional implementation tasks, the County of Orange, on behalf of the watershed cities, recently conducted an assessment of the Newport Bay shellfish harvesting beneficial use. The Newport Bay Shellfish Harvesting Assessment is a multi-year study that focused on the following objectives:

1) Identify historic areas of bivalve mollusk shellfishing (shellfishing) in Newport Bay,

2) Establish the existing level of the shellfishing resource in Newport Bay,

3) Characterize current levels of shellfish collection (for consumption and bait) as a beneficial use in Newport Bay,

4) Investigate impediments to, and the possibility of enhancing the potential for, increased levels of shellfish collection in Newport Bay, and

5) Document the results of the investigation in a manner that will be useful to the Regional Board for decision-making purposes (Kinnetic Laboratories, Inc. and EOA, Inc., 2004).

A final report has been completed and is available on the Web site listed below; however, a modeling study to evaluate options to control bacteria loads is pending to fulfill the requirements established by the Regional Board.

In addition, several researchers from the campuses of University of California at Irvine, Los Angeles, and San Diego (UCI, UCLA, and UCSD, respectively) are currently studying several aspects that relate to bacteria and human health risk in the Newport Bay Watershed. One study that UCI is conducting will characterize the bacterial concentrations from the Upper Bay to the Lower Bay and distinguish between human and natural sources based on location. Additionally, sources of bacteria from bay sediments, floating algal mats, wash down areas and illicit vessel discharges are being evaluated.

The most recent studies completed that support TMDL implementation are available at: http://www.ocwatersheds.com/watersheds/tmdls_fecal_coliform_intro.asp

D-3.1.2 *Newport Bay & San Diego Creek – Nutrients*

The 1996 California section 303(d) list identified Newport Bay and San Diego Creek as a high priority for nutrient TMDL development. Nutrient loading (nitrogen and phosphorus) from the San Diego Creek watershed contributes to seasonal algal blooms in Newport Bay. The algal blooms are a nuisance for recreational uses of the bay as well as aesthetics. The blooms can also affect wildlife. The TMDL was developed using a phased approach so that the allocations may be refined as necessary based on future monitoring and assessment efforts. The TMDL is summarized below based on information found in the *Total Maximum Daily Loads for Nutrients, San Diego Creek and Newport Bay, California* (USEPA, 1998a) and the Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin (Attachment to Resolution No. 98-9; Santa Ana RWQCB, 1998b).

The Basin Plan (Santa Ana RWQCB, 1995) contains numeric water quality objectives for nitrogen in San Diego Creek. Reach 1 of San Diego Creek (Jeffrey Road to Newport Bay) has a total inorganic nitrogen objective of 13 mg/L and Reach 2 of the creek (the headwaters to Jeffery Road) has a total inorganic nitrogen objective of 5 mg/L. There are no numeric objectives for phosphorus in San Diego Creek and there are no numeric objectives for nitrogen or phosphorus in Newport Bay.

Newport Bay has shown signs of nutrient enrichment for more than 25 years, with large mats of green algae common in the bay. Water quality sampling has occurred since 1976 at one location in Upper Newport Bay. Total inorganic nitrogen samples at that station range from 0.1 mg/L (summer 1997) to 19.75 mg/L (summer 1985). There is also one monitoring station in Lower Newport Bay, where nitrogen concentrations range from 0.2 mg/L (1997) to 6.2 mg/L (winter 1986). The Lower Bay generally shows less nutrient enrichment than it did in the mid-1980s. IRWD has also monitored water quality in the bay since 1996. These data indicate that dissolved oxygen in the Upper Bay are periodically less than 3 mg/L, which could impact the beneficial uses of the waterbody. These low dissolved oxygen concentrations correspond to low tide, algal respiration, and areas of high algal biomass.

There are nitrogen data available for many of the nurseries and three in-stream monitoring stations along San Diego Creek (San Diego Creek at Culver, San Diego Creek at Campus, and Peters Canyon Wash). The availability of data in the rest of the watershed is limited and there are not many phosphorus data available in the watershed. Based on data associated with a survey conducted by the Santa Ana Regional Board in 1997, Peters Canyon Wash and its tributaries tend to have nitrogen concentrations greater than the 13 mg/L water quality objective. Reach 2 of San Diego Creek tends to have lower nitrogen concentrations (<5 mg/L), except for Mashburn Channel. Other tributaries to Newport Bay have nitrogen concentrations below 5 mg/L. Reach 1 of San Diego Creek has consistently high concentrations of nitrogen, especially during non-storm events (Santa Ana RWQCB, 1997a).

Studies have shown that 60 percent of the nitrogen loading to Newport Bay is coming from Peters Canyon Wash, which is the main tributary to San Diego Creek. There are three large commercial nurseries on this tributary as well as other agricultural sources. Potential point sources include both NPDES permitted and unpermitted nurseries, urban stormwater runoff, the proposed discharge of dewatered groundwater by Caltrans from the Eastern Transportation Corridor project to Peters Canyon Wash, and IRWD's Wetlands Water Supply Project. Nonpoint sources of nitrogen mostly include agriculture and possibly smaller unregulated nurseries and shallow groundwater.

San Diego Creek is the largest source of phosphorus to Newport Bay (80 percent of the total load). Review of available data indicates that the total phosphorus load is related to sediment loads from the creek.

It is not currently known whether nitrogen or phosphorus is the limiting nutrient in the bay; therefore, allocations are provided for both nutrients. Since the phosphorus loading is generally associated with the sediment loading to the bay, the control of erosion and sedimentation will be important in controlling the phosphorus load.

The TMDLs were developed based on a 15-year phased approach. According to this TMDL plan, the annual loading of nutrients to the bay will be reduced by 50 percent in non-storm winter flows by 2012. To achieve these targets, interim targets were established requiring a 30 percent reduction in nutrients in summer flows by 2002 (5 years) and 50 percent by 2007 (10 years). Allowable nitrogen loads in San Diego Creek were based on the numeric water quality objectives of 13 mg/L (Reach 1) and 5 mg/L (Reach 2). Allowable nitrogen and phosphorus loads for waterbodies without numeric objectives were based on existing loads in the early 1970s prior to the widespread presence of algae and macrophytes in the watershed. The nutrient TMDL allocates allowable loads among identified nutrient sources, including nurseries, groundwater dewatering facilities, urban runoff, agricultural discharges, as well as undefined sources (open spaces, atmospheric deposition, groundwater).

As part of TMDL implementation, the County of Orange initiated a Regional Monitoring Program for nutrients on behalf of the watershed cities (Resolution 99-77; Santa Ana RWQCB, 1999b). The Regional Monitoring Program has two components: a routine monitoring component and a special monitoring component.

The routine monitoring includes most of the traditional monitoring that has occurred in the watershed (i.e., 24 hour composite samples collected either weekly, bi-weekly, or monthly from drainages throughout the watershed) and is separated into three sections—watershed monitoring, in-bay monitoring, and algae monitoring. The data collected are used to assess individual TMDL allocation compliance, overall TMDL compliance, and TMDL endpoint monitoring for seasonal loading and algal blooms. The current nutrients loadings are meeting interim TMDL targets and the results of the routine monitoring are provided in the reports found at http://www.ocwatersheds.com/watersheds/tmdls_nutrient_intro.asp.

The special monitoring component includes intensive studies to better understand the nature of nutrient sources and watershed dynamics. The studies range from focused investigations of the nutrient loading from open space to complex investigations of nutrient concentrations in bay and creek sediments.

D-3.1.3 *Newport Bay & San Diego Creek – Sediment*

Newport Bay and San Diego Creek were included on California's 1996 section 303(d) list because of sediment loading. A TMDL for sediment was subsequently developed for San Diego Creek and Newport Bay and is summarized below based on information found in the *Total Maximum Daily Loads for Sediment and Monitoring and Implementation Recommendations, San Diego Creek and Newport Bay, California* (USEPA, 1998b) and Regional Board Resolution 98-101, which formally amended the Basin Plan to incorporate the sediment TMDL (Santa Ana RWQCB, 1998c).

Significant modifications to the Newport Bay watershed's drainage system over the past 150 years have resulted in an increase in the amount of sediment loading to the bay. The USACE estimates that sedimentation in Upper Newport Bay prior to 1900 might have been as low as 1 inch in 35-40 years (approximately 500-1,000 tons/year). According to recent data from Orange County, approximately 7 feet of sediment have been deposited in Upper Newport Bay in the last 12 years (approximately 7 inches/year or 125,000-250,000 tons/year).

Numeric targets were selected to interpret Basin Plan narrative water quality objectives for the Newport Bay Watershed. Since there were no existing numeric objectives to develop the sediment TMDLs, numeric targets were selected based on a set of surrogate indicators that represent the goals for the reduction of sediment in the watershed. The selected targets were based on analysis conducted by the Regional Board.

The existing sediment load to the watershed was estimated based on analysis in Santa Ana RWQCB (1997). Sediment sources and transport were evaluated by reviewing the results of two sediment budgets (Boyle Engineering, 1983 and Trimble, 1995), reviewing monitoring data, and reviewing bathymetry surveys of the creek channels and Upper Newport Bay. Based on this analysis, annual total sediment loading to the watershed was estimated to be approximately 250,000 to 275,000 tons/year. About half of that sediment load is deposited to Newport Bay, while the other half is deposited in San Diego Creek and its tributaries. It was estimated that approximately 94 percent of the sediment deposited in Newport Bay comes from San Diego Creek. The major sources of sediment to the watershed are the land use categories of open space, agriculture, construction sites, and urban areas. Sediment contributions from each of these individual sources were calculated based on information in the Boyle Engineering sediment budget (1983) and were adjusted to account for land use changes between 1983 and 1993.

The loading capacity for sediment in the watershed was estimated based on analysis of historical sediment loading impacts on the Upper Newport Bay, which is the key habitat area of the watershed, and the main channels of San Diego Creek.

Under Section 208 of the 1972 Federal Clean Water Act, a comprehensive plan was developed to address the erosion and siltation issues in Newport Bay Watershed. The 1983 plan known as the *San Diego Creek Comprehensive Stormwater Sedimentation Control Plan* (OCRDMD, 1983) implemented several strategies to systematically reduce sediment loading into San Diego Creek and Newport Bay. The goal of the plan is to reduce sediment loading to the watershed by 50 percent. This 50 percent reduction is expected to result in the protection of the habitats in the Upper Bay and habitat areas in San Diego Creek Channels. There is some uncertainty regarding the 50 percent reduction because it is based on best professional judgment. Because of this uncertainty, the TMDLs were developed as phased TMDLs that can be revised based on future monitoring and review over a 10-year period. The TMDLs are intended to be implemented as 10-year running averages because sediment loadings vary substantially over long periods of time and different watershed areas.

The portion of the sediment load coming from urban areas and construction areas are subject to NPDES permits and were, therefore, included as point sources and received WLAs. All other sources (open space and agriculture) were considered nonpoint sources and received LAs. The sediment load is allocated equally between Newport Bay and San Diego Creek watersheds.

In March 1999, the state ratified the TMDL for sediment in the Newport Bay watershed. In response to approval of the sediment TMDL, Cooperative Agreement D98-034 (the Cooperative Agreement) was ratified on April 20, 1999, by the Watershed Permittees and the Irvine Company. The Cooperative Agreement, titled *Newport Bay San Diego Creek Sediment Control Monitoring and In-channel Maintenance Program*, established a new monitoring and maintenance program and provided a new funding formula for the implementation of sediment TMDL requirements. On November 19, 1999, the Regional Board adopted Monitoring and Reporting Program No. 99-74 (the Monitoring and Reporting Program; Santa Ana RWQCB, 1999c), which clarifies the monitoring and reporting requirements for compliance with the sediment TMDL.

The Monitoring and Reporting Program consists of two elements—the Upstream Monitoring Element (associated with activities performed in the San Diego Creek watershed upstream of Jamboree Road Bridge and in the Santa Ana Delhi Channel) and the Newport Bay Monitoring Element (associated with activities in Upper and Lower Newport Bay). Annual reports are submitted to the Santa Ana RWQCB and are available at http://www.ocwatersheds.com/watersheds/tmdls_sediment_intro.asp.

The continued monitoring will be used to evaluate the accuracy of the source analysis and allocations in the original TMDL. The TMDL will be reviewed and refined as necessary based on future monitoring and evaluation efforts.

D-3.1.4 *Newport Bay & San Diego Creek – Toxics*

As part of a consent decree (*Defend the Bay, Inc. v. Marcus*, (N.D. Cal. No. C 97-3997 MMC)), EPA was required to develop TMDLs for several toxic pollutants that were exceeding water quality standards in San Diego Creek and Newport Bay. On June 14, 2002, EPA Region 9 established Toxics TMDLs for San Diego Creek and Newport Bay (USEPA, 2002). These TMDLs are referred to as technical TMDLs since they do not include a discussion of the implementation measures that will be used to address the TMDL. The Santa Ana Regional Board is dividing the EPA promulgated Toxics TMDLs into five separate TMDLs based on constituent type and geography. The five resulting TMDLs will include (1) diazinon and chlorpyrifos, (2) organochlorine compounds, (3) selenium, (4) metals, and (5) Rhine Channel. Each of these individual TMDLs must be independently approved and an implementation plan must be developed before they are officially adopted and incorporated into the Basin Plan. Currently, the only TMDL to complete the approval process is the diazinon and chlorpyrifos TMDL, which was approved by the Santa Ana Regional Board in April 2003 (Santa Ana RWQCB, 2003) and by EPA in April 2004.

Fourteen individual pollutants were addressed in EPA's technical TMDLs and they were grouped according to their chemical characteristics (for the final TMDLs under consideration by the Regional Board, the Rhine Channel pollutants were considered separately):

Organophosphate Pesticides – diazinon and chlorpyrifos; not known to bioaccumulate and contamination is primarily limited to San Diego Creek.

Selenium – a toxic bioaccumulative metal, with significant groundwater sources. A study on the spatial distribution of the pollution problem has recently been completed and is summarized in Part D of the TMDL.

Metals – cadmium, copper, lead and zinc are widespread and behave similarly in water.

Organochlorinated Compounds – PCBs, DDT, chlordane, dieldrin and toxaphene are widespread in the watershed and have similar fate (bioaccumulation) and transport mechanisms, usually ending in sediment.

Mercury and Chromium – the Rhine Channel is the watershed's main hot spot. The channel contains high concentrations of the metals, particularly mercury and chromium. The channel has other pollution problems, however, a separate Toxicity TMDL was developed for these two metals in the Rhine Channel.

This section presents a summary of the toxicity TMDLs developed for the Newport Bay Watershed. All information was summarized from Santa Ana RWQCB (2000) and USEPA Region 9 (2002). **Table D-8** presents the specific waterbodies and associated pollutants in the Newport Bay watershed that were addressed by these TMDLs.

Table D-8 Waterbodies and Associated Pollutants in the Newport Bay and San Diego Creek Toxicity TMDLs

Waterbody (type)	Pollutants
San Diego Creek (freshwater)	Cd, Cu, Pb, Se, Zn, chlorpyrifos, diazinon, chlordane, dieldrin, DDT, PCBs, toxaphene
Upper Newport Bay (saltwater)	Cd, Cu, Pb, Se, Zn, chlorpyrifos, chlordane, DDT, PCBs
Lower Newport Bay (saltwater)	Cu, Pb, Se, Zn, chlordane, dieldrin, DDT, PCBs
Rhine Channel, within Lower Newport Bay (saltwater)	Cu, Pb, Se, Zn, Cr, Hg, chlordane, dieldrin, DDT, PCBs

The TMDLs associated with each chemical category are described below and documents associated with the TMDL are available for download at the following websites:

EPA Established TMDLs: http://www.epa.gov/region9/water/tmdl/final.html

Adopted TMDLs: http://www.waterboards.ca.gov/santaana/html/tmdls.html

Organophosphate Pesticide TMDLs

TMDLs for chlorpyrifos and diazinon were developed for San Diego Creek and a TMDL for chlorpyrifos was developed for the Upper Newport Bay. Average chlorpyrifos and diazinon concentrations in San Diego Creek during baseflow and stormflow exceed the chronic water quality targets. Ninety-five percent of the diazinon samples and 59 percent of the chlorpyrifos samples exceed the acute numeric targets. Average chlorpyrifos concentrations also exceed the saltwater chronic targets during stormflow conditions in Upper Newport Bay and 80 percent of the chlorpyrifos samples exceed the acute numeric target. There are no numeric water quality criteria for chlorpyrifos or diazinon, so EPA selected numeric freshwater and saltwater targets based on acute and chronic criteria recommended by the CDFG (2000). These recommended targets are the quantitative interpretation of the narrative water column quality objective as specified in the Basin Plan (Santa Ana RWQCB, 1995).

There were no studies to identify discrete sources of chlorpyrifos and diazinon to San Diego Creek and chlorpyrifos to the Upper Newport Bay, but it appears that the pollutants can be mostly attributed to agricultural and residential use in the watershed. Runoff from urban land uses accounts for approximately 85-88 percent of the pollutant load, while agriculture accounts for the remainder of the load.

The organophosphate pesticide TMDLs applied concentration-based loading capacities and allocations for chlorpyrifos and diazinon. The concentration-based loading capacity values are the same as the selected numeric targets. The organophosphate pesticide TMDLs include a 10 percent margin of safety, therefore, the concentration-based allocations are calculated as 90 percent of the numeric TMDL target for each pollutant under acute and chronic conditions. The organophosphate Pesticide TMDLs apply all year, regardless of season or flow.

Selenium TMDLs

TMDLs for selenium were developed for San Diego Creek, Upper Newport Bay, Lower Newport Bay and Rhine Channel. Monitoring data have shown that dissolved selenium concentrations in San Diego Creek and its tributaries consistently exceed the chronic (4-day average) criterion for freshwater and occasionally exceed the acute criterion (Hibbs and Lee, 1999; IRWD, 1999; and Lee and Taylor, 2001). Dissolved selenium concentrations in Newport Bay do not exceed the saltwater criterion. However, fish tissue data indicate that selenium loadings to the bay might be causing toxicity or threatening conditions to wildlife in the Upper and Lower Newport Bay. The selenium TMDLs were developed based on the existing numeric water quality objectives for fresh and saltwater found in the California Toxics Rule (CTR) (USEPA, 2000).

Shallow groundwater is the most significant source of selenium to San Diego Creek. Groundwater seeps into the Creek naturally (nonpoint source) or it may be pumped as part of groundwater cleanup or dewatering operations that discharge into the creek (point source). Runoff from urban areas, nurseries, agriculture, open space and hillsides, as well as atmospheric deposition, represent additional minor sources. San Diego Creek is the largest source of selenium to Newport Bay.

The selenium TMDLs are expressed as mass loads per time and different approaches were applied to calculate loading capacities for the freshwater and saltwater waterbodies. A flow-based approach was used to calculate the loading capacity for selenium in San Diego Creek. This approach was used to address selenium loadings under various flows. Four flow tiers were selected based on statistical analysis of daily flow records for San Diego Creek. Loading capacities for each flow tier were calculated using the numeric target and the annual mean flow volume associated with each flow tier. The sum of these four loads resulted in the total annual loading capacity for San Diego Creek.

The loading capacity for Newport Bay was calculated using the selenium saltwater target of 71 µg/l and the mean volume of water in the bay (19 million cubic meters). The selenium TMDLs are expressed as mass-based annual loads. The WLA applies to groundwater cleanup, groundwater dewatering, and urban runoff. The LA applies to groundwater (background conditions), nurseries and agricultural runoff, open space and hillside runoff, and atmospheric deposition. The existing load was calculated based on IRWD (1999) monitoring data in San Diego Creek. Since San Diego Creek is the major source of selenium to the bay, it is assumed that the TMDLs for the creek will result in meeting the water quality targets for the impaired waterbodies in the bay (Upper and Lower Bay and Rhine Channel).

Metals TMDLs

TMDLs for dissolved copper, lead, and zinc were developed for San Diego Creek, Upper Newport Bay, Lower Newport Bay, and Rhine Channel. TMDLs for cadmium were also developed for San Diego Creek and the Upper Newport Bay. Available dissolved metals data for cadmium, copper and lead (OCPFRD, 2000) exceed the chronic CTR criteria (USEPA, 2000) for San Diego Creek and its tributaries and the copper and zinc data exceed the applicable acute CTR criteria. The OCPFRD (2000) data for the bay generally exceed the applicable water quality criteria, but the IRWD (1999) data for the bay rarely exceed the criteria. Some problems with the saltwater OCPFRD (2000) data were identified and these data were used with caution while developing these TMDLs. Sediment metal concentrations tend to increase along the gradient from freshwater to saltwater and sediment toxicity has often been observed in sediment and porewaters of the Upper and Lower Bay and Rhine Channel (BPTCP, 1997; Bay et al., 2000; SCCWRP, 2001).

Urban runoff appears to be the largest source of metals to San Diego Creek. Some additional sources include runoff from open spaces, nurseries and agriculture, groundwater dewatering and cleanup, and atmospheric deposition. The largest source of metals to Newport Bay is San Diego Creek. Santa Ana-Delhi Channel, other drainages, and surface seawater represent minor sources to Newport Bay. Passive leaching from recreational boats and underwater hull cleaning are also estimated to make up a significant portion of the dissolved copper loading to the Lower Bay, Rhine Channels, and to a lesser extent, the Upper Bay.

TMDLs were developed based on concentration for San Diego Creek and for both concentration and mass loads for Newport Bay. The loading capacity for San Diego Creek is equivalent to the applicable numeric water quality targets. The loading capacities for the saltwater waterbodies (Upper and Lower Newport bay and Rhine Channel) were calculated based on the chronic and acute saltwater numeric targets (concentration-based TMDL) as well as the chronic numeric target and the volume of the bay (mass-based TMDL).

Organochlorine TMDLs

The organochlorine technical TMDLs established by USEPA in 2002 include TMDLs for chlordane, total DDT, total PCBs, dieldrin and toxaphene. Specifically, chlordane, total DDT and total PCBs TMDLs were developed for San Diego Creek and Newport Bay (Upper and Lower Bay and Rhine Channel), dieldrin TMDLs were developed for San Diego Creek, Lower Newport Bay and Rhine Channel, and a TMDL for toxaphene was developed for San Diego Creek (USEPA, 2002). None of these TMDLs are currently adopted. The Regional Board is revising the technical TMDLs (USEPA, 2002) and developing implementation plans before incorporating the TMDLs into the Santa Ana Basin Plan.

Although all of the pollutants addressed by these TMDLs have been banned, they are still a concern because of their ability to persist for long periods of time in water, soil, and biological tissue. The available monitoring data show exceedances of EPA and California fish tissue screening values.

Monitoring results (SMW 2000, TSMP 1987-1999, Coastal Fish Contamination Study [CFCS], and SCCRWP) show exceedances of EPA and California fish tissue screening values for organochlorine compounds. Eighty-seven percent of the toxaphene tissue samples from San Diego Creek exceed the Office of Environmental Health Hazard Assessment (OEHHA) tissue screening value. Tissue data also exceed the screening values for chlordane (40 percent), dieldrin (93 percent), total DDT (93 percent), and total PCBs (67 percent) in San Diego Creek. Based on the monitoring data, sediment quality guidelines were prioritized over tissue screening values and water quality criteria as the TMDL targets because the pollutants are directly associated with the sediments.

Most of the pollutants addressed in these TMDLs are no longer discharged in the watershed and enter the waterbodies mostly through the erosion of sediments to which the pollutants have historically adhered. Watershed data suggest that there is an existing reservoir of historically deposited organochlorine pollutants in the Newport Bay sediments, which may lead to resuspension of the pollutants from the contaminated sediments. Groundwater might also be a minor source due to percolation.

A hydrologic model previously developed by Resource Management Associates (RMA) for the USACE (RMA, 1997, 1998, and 1999) was used to assist in development of these TMDLs. The model provided sediment deposition information that was used to determine loading capacities and existing pollutant loads for the Upper and Lower Newport Bay and Rhine Channel. The RMA model did not provide specific data for spatial distribution of sediment in San Diego Creek, so pollutant loads from the creek were calculated using stream flows, the sediment target concentrations, and sediment loads estimates based on regression results in the RMA model linking flow with sediment loads. The water column loading capacity was back-calculated from sediment loads to particulate and dissolved concentrations, using partition coefficients. The sum of the allowable particulate and dissolved loads represent the loading capacity for San Diego Creek. The loading capacity for Newport Bay was based on the RMA (1998) sediment deposition budget and bottom sediment conditions with target concentrations.

The TMDLs were expressed as mass-based allocations (grams per year) for each waterbody. There were some situations in which existing loads were less than the calculated loading capacity. In these cases, to ensure the greatest protection of beneficial uses and to prevent future degradation, the TMDLs were set equal to the lower value (the existing load), which ensures that pollutant loads do not increase above existing levels. Where existing loads were more than the loading capacity, the TMDLs were set equal to the loading capacity and reductions were required (USEPA, 2002).

Chromium and Mercury TMDLs

TMDLs for chromium and mercury were developed for the Rhine Channel area of Newport Bay. Thirty-one percent of the chromium mussel tissue samples for Rhine Channel exceed the fish tissue screening value and 8 percent of the sediment samples exceed the sediment quality guidelines. All of the mercury sediment samples (100 percent) in Rhine Channel exceed the sediment quality guidelines.

Sources of chromium to the channel include historically contaminated sediments, previous discharges by nearby metal plating facilities and atmospheric deposition. There have been no studies done to explain the elevated mercury concentrations in Rhine Channel, but it is assumed that historically contaminated sediments are the major source of mercury to the waterbody. Atmospheric deposition is considered to be a minor source of mercury to Rhine Channel.

Sediment deposition in Rhine Channel was estimated using previous modeling studies performed by RMA for the USACE (RMA, 1997, 1998). Historical pollutant loading to the sediments was estimated by using the observed chromium and mercury concentrations in bottom sediments and net sedimentation rates. Existing loads were calculated based on sediment deposition rates and deposition patterns (RMA, 1997) and the sediment monitoring data. The loading capacities were determined by back-calculating the allowable load from the selected sediment target and sediment load estimates.

The chromium and mercury TMDLs for Rhine Channel are expressed as mass loadings (kg/year). Pollutant loadings from historically contaminated sediments and atmospheric deposition are included in the LA. The WLA consists of the sediment deposition from San Diego Creek into Rhine Channel because this source is subject to coverage under the existing NPDES stormwater permit. The existing mercury load in the Rhine Channel exceeds the loading capacity; therefore, the TMDL is equal to the loading capacity. The existing chromium load, however, is lower than the loading capacity. Therefore, the TMDL for chromium is equal to the existing load.

D-3.1.5 *Ongoing TMDL Studies*

Several recent studies have been performed to further characterize toxicity in Newport Bay and San Diego Creek, including two SCCWRP studies, Newport Bay Sediment Toxicity Studies (Bay et al., 2004) and Investigation of Metals Toxicity in San Diego Creek (Bay et al., 2003). The Newport Bay study was conducted over three years and investigated the extent and characteristics of sediment contamination. This investigation concluded that sediment toxicity was present at 70 percent of the stations sampled in both September 2000 and May 2001. Sediment toxicity was determined with the amphipod survival test using the test species Eohaustorius estuarius. Sediment chemistry concentrations frequently exceeded the sediment quality guidelines used for TMDL development and the exceedances were often due to elevated concentrations of copper, mercury, zinc, and DDT. In addition, there was evidence to indicate a linkage between sediment contamination and impaired water quality (surface water samples also exhibited toxicity). Toxicity Identification Studies were performed at two locations in Newport Bay (Rhine Channel and Upper Newport Bay Sedimentation Basin) and it was concluded that additional studies are needed to identify specific toxicants, but the results indicate that multiple toxicants of concern are present at each site and that the effects are not due to naturally occurring factors such as sediment grain size and ammonia (Bay et al., 2004).

The metals toxicity study in San Diego Creek investigated the contribution of selenium and other trace metals to toxicity in San Diego Creek and evaluated the relationship between selenium exposure and its impacts on fish populations. Similar to the Newport Bay study, water samples were frequently toxic; however, trace metals were not believed to contribute to toxicity due to their low concentrations in the water samples (it is anticipated that unidentified organics were present in the samples). Prolonged exposure to selenium in food was found to cause a reduction in body weight and fork length for the fish studied, when compared to control samples (Bay et al., 2003). These studies, along with other toxicity investigations, will help focus TMDL implementation efforts on the pollutants and sources of concern.

D-3.2 Status of Future TMDL Development

TMDLs will be developed in the future for all waterbody-pollutant combinations on the current 303(d) list. The 2002 303(d) list is the active, approved list. A draft 2006 list is available; however, the final version may change based on comments from the County and other interested parties. It is unknown when the final list will become available.

Section D-2.3.1 identifies the waterbodies in the Newport Bay watershed that are on the 2002 303d list. TMDLs have been completed and approved (including implementation plans) for many of these listings; however, some of the metals and organics listings have not yet been addressed, although for several of the waterbodies specific metals (to replace the general listing for metals) have been proposed in the draft 2006 list (**Table D-9**). In addition, during the assessment associated with the draft 2006 303(d) list, several waterbody-pollutant combinations not previously addressed were recommended for inclusion on the list of impaired waterbodies. These listings are presented in **Table D-9**; however, it should be noted that these listings are not approved and finalized. TMDLs will only be required for the final list of impaired waters.

Table D-9 Proposed 2006 303(d) List* - Newport Bay Watershed

Water Body Name	Pollutant	Listing Status	TMDL Status
Newport Bay, Lower	Chlorpyrifos	Place in Segments Being Addressed category	TMDL approved 2003 (EPA approval in 2004)

Water Body Name	Pollutant	Listing Status	TMDL Status
	Copper	List on Section 303(d) List	Toxics TMDL+ – Metals should address this listing
	DDT	List on Section 303(d) List	Toxics TMDL+ – Organochlorine Compounds should address this listing
	Diazinon	Place in Segments Being Addressed category	TMDL approved 2003 (EPA approval in 2004)
	Fecal Coliform	Place in Segments Being Addressed category	TMDL approved 2000
	Nutrients	Place in Segments Being Addressed category	TMDL approved 1999
	PCBs	List on Section 303(d) List	Toxics TMDL+ – Organochlorine Compounds should address this listing
	Sediment	Place in Segments Being Addressed category	TMDL approved 1999
Newport Bay, Upper (Ecological Reserve)	Chlorpyrifos	Place in Segments Being Addressed category	TMDL approved 2003 (EPA approval in 2004)
	Copper	List on Section 303(d) List	Toxics TMDL+ – Metals should address this listing
	DDT	List on Section 303(d) List	Toxics TMDL+ – Organochlorine Compounds should address this listing
	Diazinon	Place in Segments Being Addressed category	TMDL approved 2003 (EPA approval in 2004)
	Fecal Coliform	Place in Segments Being Addressed category	TMDL approved 2000
	Nutrients	Place in Segments Being Addressed category	TMDL approved 1999
	PCBs	List on Section 303(d) List	Toxics TMDL+ – Organochlorine Compounds should address this listing
	Sediment	Place in Segments Being Addressed category	TMDL approved 1999
Peters Canyon Channel	DDT	List on Section 303(d) List	Not scheduled
	Toxaphene	List on Section 303(d) List	Not scheduled
Rhine Channel	Copper	List on Section 303(d) List	Toxics TMDL+ – Rhine Channel should address this listing
	Lead	List on Section 303(d) List	Toxics TMDL+ – Rhine Channel should address this listing
	Mercury	List on Section 303(d) List	Toxics TMDL+ – Rhine Channel should address this listing

Water Body Name	Pollutant	Listing Status	TMDL Status
	PCBs	List on Section 303(d) List	Toxics TMDL+ – Rhine Channel should address this listing
San Diego Creek, Reach 1	Fecal Coliform	Place in Segments Being Addressed category	TMDL approved 2000
	Nutrients	Place in Segments Being Addressed category	TMDL approved 1999
	Sediment	Place in Segments Being Addressed category	TMDL approved 1999
	Selenium	List on Section 303(d) List	Toxics TMDL+ – Selenium should address this listing
	Zinc	List on Section 303(d) List	Toxics TMDL+ – Metals should address this listing
San Diego Creek, Reach 2	Diazinon	Place in Segments Being Addressed category	TMDL approved 2003 (EPA approval in 2004)
	Nutrients	Place in Segments Being Addressed category	TMDL approved 1999
	Sediment	Place in Segments Being Addressed category	TMDL approved 1999
	Unknown Toxicity	Place in Segments Being Addressed category	TMDL approved 2003 (EPA approval in 2004)
Santa Ana Delhi Channel	Toxaphene	List on Section 303(d) List	Not scheduled

*All waterbody-pollutant combinations listed in this table are based on the draft 2006 303(d) list. Because this list is in draft format, deletions and/or additions to the list can be expected. TMDLs will only be completed for waterbody-pollutant combinations on the final 303(d) list.

+EPA Region 9 established the Toxics TMDL in 2002. The Regional Board subsequently divided these TMDLs into separate categories based on geography and constituent type (Diazinon & Chlorpyrifos; Organochlorine Compounds; Metals; Selenium; Rhine Channel). Each individual TMDL must be approved independently. The Diazinon and Chlorpyrifos TMDL is the only Toxics TMDL to complete this process.

D-4.0 Pollution Source, Control and Treatment Inventories

In developing a plan to address water quality within the Newport Bay Watershed, it is important to (1) understand the sources of pollution within the watershed and (2) know the specific controls and treatments 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 2 areas and identifies the related gaps that exist.

D-4.1 Watershed Pollution Sources

Pollution sources in the Newport Bay Watershed include urban runoff, atmospheric deposition, agriculture, and wildlife. Because the mandate of the Orange County Stormwater Program is to address urban runoff, this Watershed Action Plan and planning effort will focus solely on the urban sources.

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

D-4.2 Existing Enhanced Non-Structural BMPs

Non-structural BMPs include many activities that are performed by the individual jurisdictions. These activities include, but are not limited to, good housekeeping practices, street sweeping, catch basin stenciling, public outreach and education. Enhanced non-structural BMPs include activities in which a specific pollutant of concern for that watershed is addressed.

Excessive application of fertilizers, applying fertilizer prior to rain or at the incorrect time of the year can lead to runoff of those fertilizers and subsequent nutrient contamination of nearby waters. During 2004-2005 a telephone survey was conducted by UC Cooperative Extension with random residences in the watershed to determine the landscaping services that were used. Contact was made with landscape service providers allowed development of tools appropriate for the users. Educational materials were developed (in English and Spanish) to provide information on proper fertilization application and lawn care methods. These materials were provided to retail lawncare outlet centers as well as independent gardeners. UC Cooperative Extension continues to stock the educational materials at cooperating independent nurseries and provide this information to professional groups, such as the Orange County Gardeners' Association, and at garden shows throughout the County..

D-4.3 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-10** identifies the enhanced structural BMPs that have been implemented in the Newport Bay Watershed and a description of each BMP is included following the table.

Table D-10 Enhanced Structural BMPs

Project	Location	Performance Measures
Sediment Trapping Basins	Hicks Canyon, East Hicks Canyon, Round Canyon, Agua Chinon, Bee Canyon, Marshburn, Orchard Estates	Sediment
In-Channel Sediment Basins	San Diego Creek; Jamboree Road – Michelson Drive	Sediment
San Joaquin Marsh	San Diego Creek; near IRWD WTP	Nutrients – primary Sediment - secondary
Sewer Diversion Projects	Newport Dunes	Bacteria - primary
Serrano Creek Rehabilitation	Lake Forest	sediment control habitat restoration
Santa Ana Delhi Channel Trash Boom	At Mesa Drive In Newport Beach	Trash

D-4.3.1 *Sediment Trapping Basins*

Hicks Canyon, East Hicks Canyon, Round Canyon, Agua Chinon, Bee Canyon, Marshburn Channel, and Orchard Estates include basins that attenuate large floods as well as trap sediment from the watershed.

D-4.3.2 *In-Channel Sediment Basins*

Three in-channel sediment basins are located in San Diego Creek between Jamboree Road and Michelson Drive. The operation and maintenance of these basins are reported as part of the Sediment TMDL Annual Report. Significant sediment has been trapped within these basins, particularly the upper basin. Modifications to the lower basin weir are being considered to improve the efficiency of the basin system.

D-4.3.3 *San Joaquin Marsh*

The San Joaquin Marsh Project was constructed by IRWD adjacent to San Diego Creek. Monitoring results have demonstrated that this project has significantly reduced the nitrogen levels and sediment content of water that is discharged to the creek. Water is diverted from San Diego Creek, routed through the marsh, and then returned to the creek.

D-4.3.4 *Newport Dunes Sewer Diversion Project*

Phase 1 of this project funded the diversion of urban runoff from the storm drain system into the sanitary sewer system. This diversion is within the OCWD service area; it should be noted that not all water districts support the use of diversions. Phase 2 of this project includes an investigation of the feasibility of the installation of aerators in Newport Bay to improve the circulation to decrease the fecal bacteria contamination.

D-4.3.5 *Serrano Creek Rehabilitation*

Following significant erosion of Serrano Creek, phased projects were implemented to stabilize the banks of the creek and improve the riparian habitat.

D-4.3.6 *Santa Ana Delhi Channel Trash Boom*

The County of Orange deployed a trash boom in the Santa Ana Delhi Channel near Mesa Drive. This boom has been in operation for a number of years. The system consists of an 18 inch wide suspended net; its limitation is that heavier trash and debris can pass under the net or turbulence can push the trash and debris over the net.

D-4.3.7 *Warner Channel Nutrient BMP*

This open storm channel contains vegetated swales, which were not originally intended in the design, that were evaluated for their BMP effectiveness concerning Nitrogen, Selenium, and Phosphorus. According to the report evaluation of March 2005, by the Watershed and Coastal Resources Division of Orange County, "The wetland vegetated channel is believed to have potential for meaningful nutrient and selenium immobilization and removal. Recommendations were proposed to enhance the channel's treatment capabilities, with corresponding estimates of treatment efficiency and planning level costs."

D-4.4 Proposed Structural Enhanced BMPs

The following structural enhanced BMPs have been proposed in the watershed and are at some stage of planning (**Table D-11**).

Table D-11 Proposed Enhanced Structural BMPs.

Project	Location	Performance Measures
Natural Treatment System	37 proposed wetlands throughout watershed.	Nutrients
Proposed Storm Drain to Sewer Diversions Projects	City of Newport Beach 4 locations	Bacteria
Big Canyon Creek Restoration Project	City of Newport Beach	Habitat Restoration
El Modena Irvine Channel & Peters Canyon Trash Booms	City of Irvine	Trash

D-4.4.1 *Natural Treatment System*

Following the success of the San Joaquin Marsh Project, IRWD has proposed a Natural Treatment System (NTS) that includes 31 wetlands throughout the IRWD service area. In many locations, the NTS has been incorporated into public flood control facilities. The EIR for the NTS was approved on April 26, 2004. By mid-2006, 4 of the projects had been constructed and are in the process of being turned over to IRWD. Once an NTS projects is accepted by IRWD, it will be incorporated into WetTraq, the long-term comprehensive monitoring program established by IRWD. It is expected that the long-term monitoring program for the 4 initial projects will begin in April 2007.

Most of the NTS sites are located in the City of Irvine and have been established to treat runoff from new development within the City. The NTS constitutes the only approved 'regional program' in Orange County. More information of this project and its status can be found at http://www.naturaltreatmentsystem.org.

D-4.4.2 *Newport Beach storm drain diversion projects*

Four locations have been selected within the City of Newport Beach for diversion of urban runoff in storm drains into the sanitary sewer system. The goal of these projects is to reduce the bacteria levels in the bay and ocean that lead to beach postings and closures. These diversions will be located within the OCWD service area; it should be noted that not all water districts support the use of diversions.

D-4.4.3 *Big Canyon Creek Restoration*

The Big Canyon Creek Restoration Project is a $5.0 million (estimate) restoration of the 55-acre Big Canyon Nature Park between Jamboree Road and Upper Newport Bay. The Project is designed to (1) increase valuable habitat by increasing the area subject to bay tidal flows; (2) improve water quality in Big Canyon Creek; (3) allow for better public access into the Nature Park; (4) remove non-native vegetation and replace it with native plantings; and (5) provide for interpretive signage which assists the public in understanding the habitat.

D-4.4.4 *El Modena Irvine Channel-Peters Canyon Channel Trash Booms*

The El Modena Irvine Channel (Facility F07) is the selected location for installation of a trash boom. The site is associated with improvements to the Eastern Transportation Corridor (ETC), serves a watershed that is virtually 100 percent urbanized with mixed land uses, has a rectangular cross section with subcritical flow, has perennial flow, and has very good maintenance access. For these reasons, this location scored highest in the matrix selection process and has been selected as the site for installation of the initial trash boom. A second trash boom was will be located in the F06 (Peters Canyon Channel) location. Its proximity to the El Modena location makes it attractive from a maintenance perspective.

D-4.5 Estimates of Load Reductions of Existing BMPs

Understanding the load reduction of implemented BMPs is critical 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 would be useful in assessing the load reduction of the existing BMPs. The following table presents that information as available.

Table D-12 Pollutant Removal for Existing Enhanced Structural BMPs

Project	Constituent	Pollutant Reduction
Sediment Trapping Basins	Sediment	unknown
In-Channel Sediment Basins	Sediment	unknown
San Joaquin Marsh	Nutrients (Nitrogen) Total Coliform/Fecal Coliform	65% - 70% 65% / 50%
Sewer Diversion Projects	Bacteria	unknown
Serrano Creek Rehabilitation	Sediment	unknown
El Modena Irvine Channel & Peters Canyon Trash Booms	Trash	unknown
Santa Ana Delhi Channel Trash Boom	trash	unknown

D-4.6 Recommendations for BMPs in the Watershed

An assessment of the effectiveness of BMPs was performed by the Orange County Stormwater Program (RBF, 2005) to determine which BMPs are recommended for consideration in the Orange County area. Through this study the following BMPs were recommended for watersheds in Orange County:

- Extended detention basins
- Vegetated swales
- Vegetated buffer strips
- Bioretention
- Sand and organic filters
- Infiltration basins
- Infiltration trenches
- Wet ponds (where substantial dry weather flow is present)
- Constructed wetlands (where substantial dry weather flow is present)

The 2005 study also indicated that the following BMPs may need to be considered in retrofit situations where available space is a constraint.

- Water quality inlet
- Proprietary end-of-pipe controls
- Proprietary drain inlet inserts

The report provides ranges of pollutant removal efficiency for the pollutants of concern in the Newport Bay Watershed. These efficiencies generally agree with the level of pollutant removal identified in the CASQA BMP Handbook (CASQA, 2003). The efficiency removal levels for the recommended BMPs are included in Section 7.0 of the DAMP. The portion of that table reflecting information for the constituents of concern in the Newport Bay watershed are shown on **Table D-13** as available.

Table D-13 Treatment Control BMP Selection Matrix

	INFILTRATION [2]			***WET PONDS AND WETLANDS***		***DETENTION BASINS***	***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-22 Extended Detention Basin**	**TC-30 Vegetated Swale**	**TC-31 Vegetated Buffer Strip**	**TC-32 Bioretention**	**TC-40 Media Filter**	**TC-50 Water Quality Inlet**	**TC-60 Multiple Systems**	**MP-51 Vortex Separator** [3]
Sediment	H	H	H	H	H	M	M	H	H	H	L	H	M
Nutrients	H	H	H	M	M	L	L	L	M	L	L	L	L
Trash & Debris	H	H	H	H	H	M	M	H	H	H	L	H	H/M
Metals	H	H	H	H	H	M	L	L	H	M	L	M	L/M
Bacteria & Viruses	H	H	H	H	H	M	M	H	H	H	M	H	U

(1) 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.
(3) Also known as hydrodynamic separators/devices. Include swirl concentrators, cyclone separators, and baffle boxes.
L Low removal efficiency
M Medium removal efficiency
H High removal efficiency
U Unknown 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 Development

Strategy Tables have been developed for the Newport Bay Watershed that identifies the specific actions that are being undertaken to improve the 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. The Newport Bay Watershed Strategy Tables are in the Appendix to this Watershed Action Plan are the Strategy Tables for the Newport Bay Watershed.

D-6.0 Program Effectiveness 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). A principle objective of the Watershed Action Plan is to present an integrated plan of action that will result in meaningful water quality improvements in the Newport Bay Watershed while balancing economic, social and environmental constraints. 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 D-1.0. In considering program approaches to program assessment, it is recognized that both short- and long –term strategies are needed to assess the effectiveness of the Watershed Action Plan. The short-term strategy measures of program effectiveness are related to actions that can be taken by the Permittees. The long-term strategy measures of program effectiveness are related to the measurable impacts to the environment. The annual program effectiveness assessment feeds into the iterative program management process that includes planning, implementation, and assessment.

D-6.1 Short Term Strategy

The short-term strategy initially focuses on the implementation of the watershed planning framework. In this watershed, the watershed planning framework is based on the activities of the Newport Bay Watershed Committee. The goals of this committee are summarized on the following table.

Table D-13 Short Term Strategy Goals

Measure	Method of Assessment
Biannual Coordination Meetings	
Specific Recommendations from the Newport Bay Watershed Committee	

D-6.2 Long-term Strategy

Long term strategies for assessing effectiveness apply to programs and activities conducted with the expectation that outcomes will occur outside of the current permit period. The outcomes anticipated from the long-term assessment strategies include the following:

Table D-14 Long Term Strategy Goals

Action	Method of Assessment
Reduction in loading of the constituents of concern	
Removal in impairments from the 303(d) list	
Restored beneficial uses of receiving waters	

D-6.3 Review of Management Program

In each year the short-term and long-term effectiveness assessment strategies are used to verify and ultimately validate the implementation of the watershed program. This assessment is completed through the Unified Annual Progress Report Program Effectiveness Assessment in which each section of the DAMP is assessed to measure the success of that program element. The Permittees have selected a series of Headline Measures to verify program implementation and the achievement of the program goals. The Headline Measures include both Process and Result (Direct and Indirect) actions. It is expected that the program objective and supporting management actions will be revised as the program evolves; therefore the Headline Measures for the Newport Bay Watershed are included in the Appendix of this Watershed Action Plan to facilitate annual updates.

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Nomenclature (Abbreviations)

Table D-15 Abbreviation Definitions

Abbreviation	Definition
NPDES	National Pollutant Discharge Elimination System
OCHCA	Orange County Health Care Agency
SCCWRP	Southern California Coastal Water Research Project
SWAMP	Surface Water Ambient Monitoring Program
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
RWQCB	Regional Water Quality Control Board
GIS	Geographic Information System/Science
NCCP/HCP	Natural Community Conservation Plan & Habitat Conservation Plan
USACE	United States Army Corps of Engineers
ASBS	Areas of Special Biological Significance
CEQA	California Environmental Quality ActNe
NEPA	National Environmental Protection Act
SOCWA	South Orange County Wastewater Authority
SWRCB	State Water Resources Control Board
NWRI	National Water Research Institute
RDMD	Resources & Development management Dapartment
PCB	Polychlorinated Biphenyls
PAH	Polycyclic Aromatic Hydrocarbons
CARs	Critical Aquatic Resources
TSMP	Toxic Substances Monitoring Program

SMWP	California Sate Mussel Watch Program
CDFG	California Department Of Fish and Game
DO	Dissolved Oxygen
TOD	Trash or Debris
UCLA/UCI	University of California Los Angeles / Irvine
IBI	Index of Biotic Integrity
IRWD	Irvine Ranch Water District
MPN	Most Probable Number
WLA / LA	Waste Load Allocation / Load Allocation
CTR	California Toxics Rule
RMA	Resource Management Associates
NTS	Natural Treatment System
CASQA	California Stormwater Quality Association
OCFCD	Orange County Flood Control District

Appendix

Environmental Matrix

Newport Bay Strategy Tables.