Report of Waste Discharge

Submitted by

The County of Orange, Orange County Flood Control District and Cities of Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Habra, La Palma, Laguna Hills, Laguna Woods, Lake Forest, Los Alamitos, Newport Beach, Orange, Placentia, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminster and Yorba Linda

October 3, 2013

Report of Waste Discharge

Prepared for the California Regional Water Quality Control Board

October 3, 2012

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

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Executive Summary

The Orange County Stormwater Program (the Program) is a cooperative municipal regulatory compliance initiative focused on the management of urban and stormwater runoff for the protection and enhancement of Orange County's creeks, rivers, streams, and coastal waters. The primary objective of the Program is to fulfill the commitment of the County of Orange, the Orange County Flood Control District and the cities of Orange County (collectively, the "Permittees"), to develop and implement a program that satisfies the requirements of area-wide Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit No. CAS 618030 – (Order R8-2009-0030) subsequently referred to as the "Fourth Term Permit."

The purpose of this document is to comply with the requirement for submittal of a "Report of Waste Discharge" (ROWD). This report discusses the Permittees' Fourth Term MS4 Permit compliance activities and accomplishments over the period June 2009 to June, 2013. It also identifies all of the activities, research and pilot studies the Permittees propose to undertake during the next permit term based upon a consideration of the effectiveness of the Program and need for additional pollutant control initiatives.

State of the Environment – Key Findings

Bacteria

- The County's beaches support concentrated recreational activities for both residents and visitors and are important contributors to the local and regional economy;
- Concern about swimming safety is consistently high and epidemiology studies in dry weather show that some illness (for example, gastroenteritis) is associated with full immersion swimming in contaminated water ;
- Contamination is very low during dry weather and has dropped steadily over time; beach report card grades are consistently high;
- Sources of contamination have been reduced through targeted actions; remaining problems during dry weather are localized and may have natural components;
- Contamination is more widespread during wet weather; wet weather flows are both larger and qualitatively different;
- Health risks associated with wet weather flows are uncertain, but ongoing research and development focuses on improved monitoring tools and wet weather epidemiology studies; and
- Progress on managing dry weather contamination, and new monitoring tools, suggests that some aspects of current monitoring and regulatory programs be redesigned for greater accuracy and efficiency.

Nutrients

- Nutrient levels in north County streams and channels are frequently above commonly used thresholds that suggest increased likelihood of nutrient impacts. In contrast, there are

substantially less frequent occurrences of impacts, such as macroalgal overgrowth, due to excessive nutrient levels;

- Nutrient problems are not limited to the urban portion of the County; regional monitoring data show nutrient enrichment and impacts such as increased macroalgal cover and/or lower dissolved oxygen in streams and estuaries in undeveloped regions;

- The major point sources of nutrients have been controlled. Therefore, non-point and diffuse sources such as leaching from upland soils and intrusions from shallow groundwater are increasingly important;

- Nutrients can be readily transported in and out of various reservoirs (e.g., sediments, groundwater) and undergo complex biological transformation and cycling. This makes traditional pollutant control strategies less effective for nutrients;

- Nevertheless, BMP implementation in the Newport Bay Watershed has achieved notable long-term success in controlling nutrient inputs and reversing their impacts; and

- Improved management strategies may contribute to further progress, particularly in streams and channels, by accounting for site-specific conditions, promoting Low Impact Development, and accounting for broader regional sources.

Controlling Pollutant Sources - Countywide/Jurisdictional Programs: Accomplishments

- Implementation of a Model Municipal Activities Program at 1700 facilities with consistently high levels of program conformance;

- Implementation of an innovative Integrated Pest Management (IPM) Policy which is producing reductions in municipal use of fertilizers and pesticides;

- Continuing development and implementation of the County Area Spill Containment (CASC) Program to address significant sewage spills which has contributed to a marked decline in reported sewage spills;

- The production of nearly 155 million public education impressions through media outreach and confirmed positive shifts in public awareness and participation in practices protective of water quality;

- American Public Works Association (APWA) recognition of the Orange County Stormwater Program's Project Pollution Prevention Public Education website as a "model practice;"

- Two years of implementation of the new Low Impact Development (LID) based Model Water Quality Management Plan (WQMP) and supporting Technical Guidance Document (TGD) in north Orange County resulting in 9,764 acres now incorporating LID BMPs.

- California Legislature and Orange County Engineering Council recognition for the land development Technical Guidance Document for engineering excellence;

- Completion of infiltration feasibility, hydromodification susceptibility and regional BMP opportunity mapping for

Orange County and completion of web-portal access to the information;

- Completion of 47,006 construction sites inspections demonstrating consistent high levels of compliance from year to year;

- Completion of 36,559 commercial/industrial facility inspections demonstrating consistent high levels of compliance from year to year;

- Implementation of a countywide mobile business database and reduced incidence of pollution reports attributable to mobile businesses;

- Investigation of 16,033 reports of illegal discharges or illicit connections and reduced incidence over successive years of pollution reports requiring investigation;

Controlling Pollutant Sources - Watershed Programs: Accomplishments

- Continued implementation of metals, sediment, selenium, nutrients, toxics and bacteria Total Maximum Daily Load (TMDL) programs and achievement of targets in the Newport Bay, San Gabriel River-Coyote Creek, Aliso Creek and San Juan Creek watersheds.

Program Management and Financing: Accomplishments

- Coordination with Orange County Transportation Authority (OCTA) on development of a Structural BMP Prioritization and Analysis Tool (SBPAT) to support disbursement of Measure M2 funding for water quality projects. SBPAT is a GIS-based decision support tool that is being used to identify and prioritize potential structural BMP retrofit projects throughout Orange County. To date Tier 1 funding of $8.6 million has been awarded to 85 projects and Tier 2 funding of $12.7 million has been awarded to 8 projects.

The Permittees also consider a series of performance metrics to further enable the effectiveness of the Program's elements to be evaluated. This assessment of program effectiveness, comprising consideration of both the state of the aquatic environment and program performance metrics, is the basis for identifying the specific program activities and pilot studies the Permittees propose to undertake during the next permit term. These activities, which are identified as program continuation, program enhancements, or program modifications, together with the Fifth Term MS4 Permit compliance milestones, are noted in each section of the report and are summarized in Section 7.0. The deliberate emphasis on program enhancement, rather than policy and programmatic change, is emblematic of a mature municipal stormwater program that is protective of water quality and is achieving meaningful environmental outcomes.

2013 County of Orange Report of Waste Discharge for the Santa Ana Region

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1.0 Introduction

The Story: Introduction

- Established in 1990, the Orange County Stormwater Program (the Program) is a cooperative regulatory partnership among the cities of Orange County, the County of Orange and the Orange County Flood Control District (collectively the Permittees) who operate an interconnected municipal storm drain system which discharges stormwater and urban runoff pursuant to a National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit.

- The Program is focused on maintaining regulatory compliance of the Permittees and mitigating the water quality impacts to streams, creeks and coastal waters that can arise from the imprint of urban development on the landscape.

- This Report of Waste Discharge (ROWD) constitutes the Permittees' application for a Fifth NPDES Municipal Stormwater and presents specific recommendations for the continuation and future development of the Program.

1.1 Overview

The Orange County Stormwater Program (the Program) is a cooperative regulatory partnership among the cities of Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Habra, La Palma, Laguna Hills, Laguna Woods, Lake Forest, Los Alamitos, Newport Beach, Orange, Placentia, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminster, and Yorba Linda, the County of Orange and the Orange County Flood Control District (collectively the Permittees) who operate an interconnected municipal storm drain system which discharges stormwater and urban runoff pursuant to National Pollutant Discharge Elimination System (NPDES) Permit (MS4 Permit). This permit requires the Permittees to:

- Effectively prohibit non-stormwater discharges to the storm drain system, and
- Implement controls to reduce the discharge of pollutants in stormwater to the Maximum Extent Practicable (MEP).

In anticipation of the expiration of the MS4 Permit in April 2014, this Report of Waste Discharge (ROWD):

- Describes the regulatory basis and environmental rationale for the Program (See – "Introduction");
- Presents an assessment of the state of the environment for the northern portion of Orange County with specific reference to swimming safety and aquatic ecosystem health and makes recommendations for the future allocation of monitoring resources (See – "State of the Environment");
- Evaluates jurisdictional pollutant control program effectiveness and makes recommendations for enhancing future program implementation (See – "Controlling Pollutant Sources: Jurisdictional Management Programs");

- Describes watershed-based planning in Orange County and makes recommendations for addressing Total Maximum Daily Load requirements and further developing an integrated water resource management approach (See – "Controlling Pollutant Sources: Watershed Programs");
- Reviews and makes recommendations regarding the Program's jurisdictional and watershed planning processes (See – "Plan Development")
- Reviews the Program's management structure and describes current program financing including recommendations for future cost studies (See – "Program Management and Financing").
- Discusses future direction of the Program (See – "Summary and Conclusions")

In combination these discussions are intended to answer two questions:

- Are program elements being implemented effectively?
- Are environmental improvements being realized?

1.2 Background

Urban Runoff and Water Quality

The imprint of urban development on the landscape and its consequence for streams and creeks is the focus of this Program. Urbanization creates rooftops, driveways, roads and parking lots (Schueler and Holland, 2000,[1] use the term *Imperviousness* as the unifying theme for understanding the adverse hydrologic impacts of urbanization), which (1) increase the flow rate and volume of rainfall runoff (compared to pre-development conditions) and (2) provide a source of pollutants that are flushed or leached by rainfall runoff into aquatic systems. These pollutants can include pathogens (disease causing bacteria, viruses and protozoan cysts from fecal sources), nutrients (bio-stimulatory substances such as nitrogen and phosphorus from fertilizers and organic wastes), sediments (sands and silts eroded from construction sites) and toxic organic and inorganic constituents (metals from automotive wear surfaces and pesticides applied to structures and landscapes).

> *There are four interrelated but separable effects of land-use changes on the hydrology of an area: changes in peak flow characteristics, changes in total runoff, changes in quality of water, and changes in the hydrologic amenities*
>
> Luna Leopold, 1968

For streams, creeks and coastal waters, urban runoff can result in:

- Water quality degradation from increased loadings of sediment, nutrients, metals, hydrocarbons, pesticides, and bacteria;
- Stream channel modification and habitat loss due to

[1] Thomas R. Schuler and Heather K. Holland. *The Practice of Watershed Protection: Techniques for protecting our nation's streams, lakes, rivers and estuaries* (Maryland: Center for Watershed Protection, 2000).

erosion or channel realignment for flood protection;

- Increased water temperatures resulting from solar energy absorption by urban surfaces and elimination of riparian shading; and

- Loss of groundwater recharge.

Section 2.0 presents an assessment of the "state of the environment" for the northern portion of Orange County based on the results of long-term monitoring and related special studies.

Regulatory History

The Program was initiated in 1990 as a cooperative local government response to a 1987 amendment to the federal Clean Water Act (CWA) that established National Pollutant Discharge System (NPDES) permit requirements for municipal operators of storm drain systems. This amendment was intended to specifically address the adverse water quality impacts of urban runoff. Permit application requirements were promulgated by US Environmental Protection Agency (EPA) in 1990 (40 CFR 122) and form the basis of the current program. There are two fundamental requirements:

Maximum Extent Practicable has been defined in California as follows:

"*Maximum extent practicable (MEP) means to the maximum extent possible, taking into account equitable considerations of synergistic, additive, and competing factors, including but not limited to, gravity of the problem, fiscal feasibility, public health risks, societal concern, and social benefits.*"

- Effectively prohibit non-stormwater discharges to the storm drain system, and
- Implement controls to reduce the discharge of pollutants in stormwater to the Maximum Extent Practicable (MEP).

Orange County's first NPDES Permits were issued in 1990 with renewals in 1996, 2002 and 2009. The Permits require that surface water quality protection be a key consideration in local governments' oversight of construction and development, its regulation of industry and commerce, and in its construction, operation and maintenance of the public urban infrastructure.

There are separate NPDES Permits administered by the Santa Ana and San Diego Regional Water Quality Control Boards (RWQCBs). City and county jurisdictional boundaries rarely coincide with watershed boundaries and in Orange County four jurisdictions within the Program (County of Orange, and cities of Lake Forest, Laguna Hills and Laguna Woods) are subject to both permits. For these jurisdictions, the designation provision in Water Code Section 13228 is an option for seeking a single set of permit requirements in instances, such as Orange County, where there is a trend of increasing divergence in permitting approaches between the regional boards. The adoption of the Fifth Term Permit will be an opportunity for the four split jurisdictions to consider coverage under a single permit.

Management Approach

The management of pollution arising from landscapes involves the strategic application of Best Management Practices (BMPs). The purpose of BMPs is to protect the beneficial uses of water resources through the reduction of pollutant loads and concentrations.

The Program's management approach is a strategic process that involves:

1. Selecting and implementing BMPs to address site specific water quality problems, regulatory requirements; and technical, institutional and economic feasibility;
2. Conducting a comprehensive monitoring program to ensure that the BMPs are correctly implemented and to determine the effectiveness of BMPs in achieving water quality standards; and
3. Revising and/or enhancing BMPs if water quality standards are not being achieved, or evaluating and revising water quality standards where appropriate.

This strategic management approach is applied at two distinct scales: (1) activities conducted by the Permittees implementing jurisdictional programs based on the model programs in the Drainage Area Management Plan (DAMP); and (2) activities conducted by the Permittees and others participating in watershed programs addressing specific waterbody-pollutant combinations and the restorative goals of the Clean Water Act.

Drainage Area Management Plan

The **Drainage Area Management Plan (DAMP)** is the principal policy and program guidance document for the *Program*. The DAMP describes the agreements, structures and programs that:

- Identify urban impacts on receiving waters; produce environmental quality information to direct management activities, including prioritization of pollutants to support the development of specific controls to address these problems; and determine if aquatic resources are being protected;
- Improve existing municipal pollution prevention and removal best management practices (BMPs) to further reduce the amount of pollutants entering the storm drain system;
- Educate the public about the issues of urban stormwater and non-stormwater pollution and obtain their support in implementing pollution prevention BMPs;
- Ensure that all new development and significant redevelopment incorporates appropriate Site Design,

> Best Management Practices
>
> BMPs are defined as "schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants to receiving waters." The types of BMPs are source control, runoff treatment, and flow control.

Source Control and Treatment Control BMPs to address specific water quality issues;

- Ensure that construction sites implement control practices that address control of construction related pollutants discharges including an effective combination of erosion and sediment controls and on-site hazardous materials and waste management;
- Ensure that existing development addresses discharges from industrial facilities, selected commercial businesses, residential development and common interest areas/homeowner associations.
- Detect and eliminate illegal discharges/illicit connections to the municipal storm drain system;
- Assess constituents of concern and manage urban runoff on a watershed basis with an emphasis on Total Maximum Daily Load (TMDL) obligations and the restorative goals of the Clean Water Act;
- Provide the framework for the program management activities and plan development, and
- Provide the legal authority for prohibiting unpermitted discharges into the storm drain system and for requiring BMPs in new development and significant redevelopment;

The model programs in the DAMP are implemented individually by each of the Permittees according to jurisdictional DAMP/Local Implementation Plans (LIPs).

The ongoing development of the DAMP is informed by annual and five year (i.e. ROWD) program effectiveness assessments. An updated 2014 DAMP will be completed upon final approval of hydromodification management requirements for land development by the San Diego Regional Water Quality Control Board which are still pending. This 2014 DAMP will need to be explicitly approved in the adoption of the Fifth Term Permit in 2014.

Orange County – Landscape

Orange County comprises 500,000 acres, beginning on a coastal plain and rising to an elevation of over 5,000 feet in the Puente Hills and Santa Ana Mountains to the north and east. Since the 1950's the population of Orange County has grown approximately 20% per year. Now Orange County is predominantly an urban county (**Figures 1.1 – 1.4**) encompassing 34 cities and a total population of 3.5 million people. Population growth has slowed as the County has become largely built out, and is projected to continue at approximately 1% per year for the next 20 years.

Before urbanization, Orange County was drained by ephemeral streams and agricultural drainage ditches which were dry most of the year and carried measurable flow primarily during short duration flash floods and longer duration general winter storms. As urbanization progressed, man-made agricultural drainage ditches were enlarged to flood control channels and the few natural streams such as Santa Ana River, San Diego Creek and San Juan Creek were constrained within levees to provide flood protection. Ephemeral flows in some of the man-made and natural channels have been replaced with continuous low flows from urban and agricultural irrigation (**Figures 1.5 -1.8**) and treated wastewater effluent.

Figure 1.1: San Gabriel River/Coyote Creek Watershed - Land Use

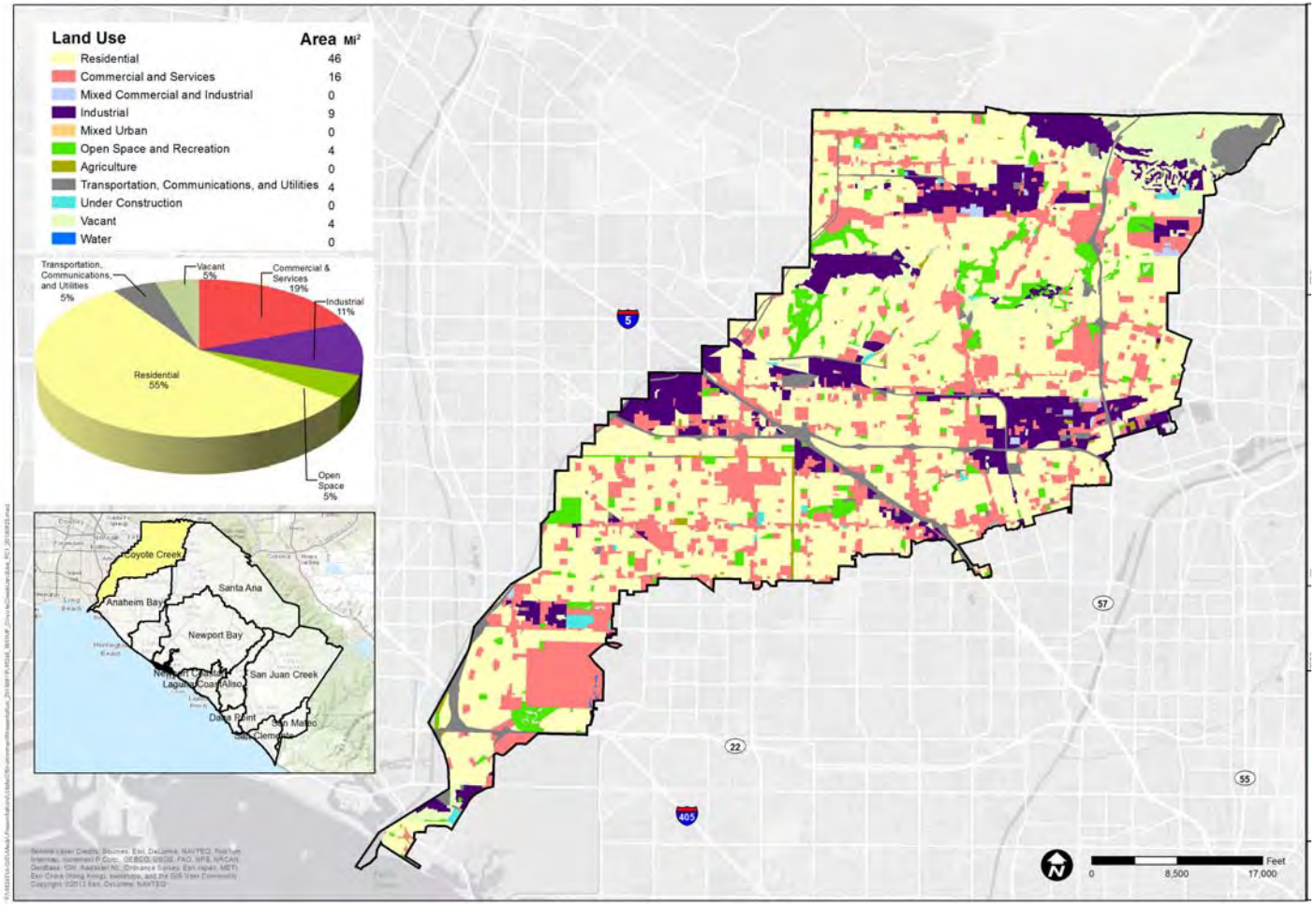


Figure 1.2: Anaheim Bay/Huntington Harbour Watershed - Land Use

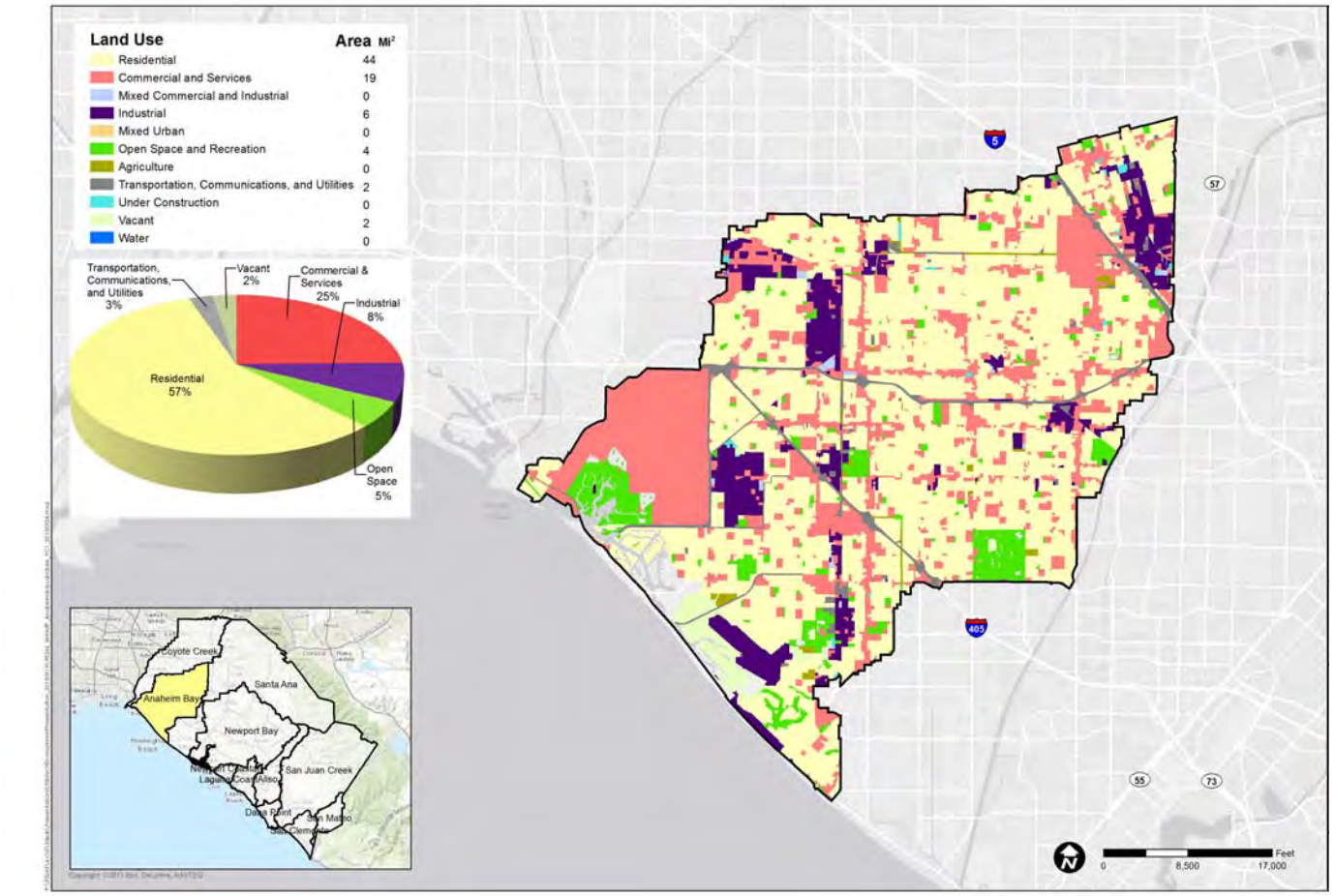


Figure 1.3: Santa Ana River within Orange County - Land Use

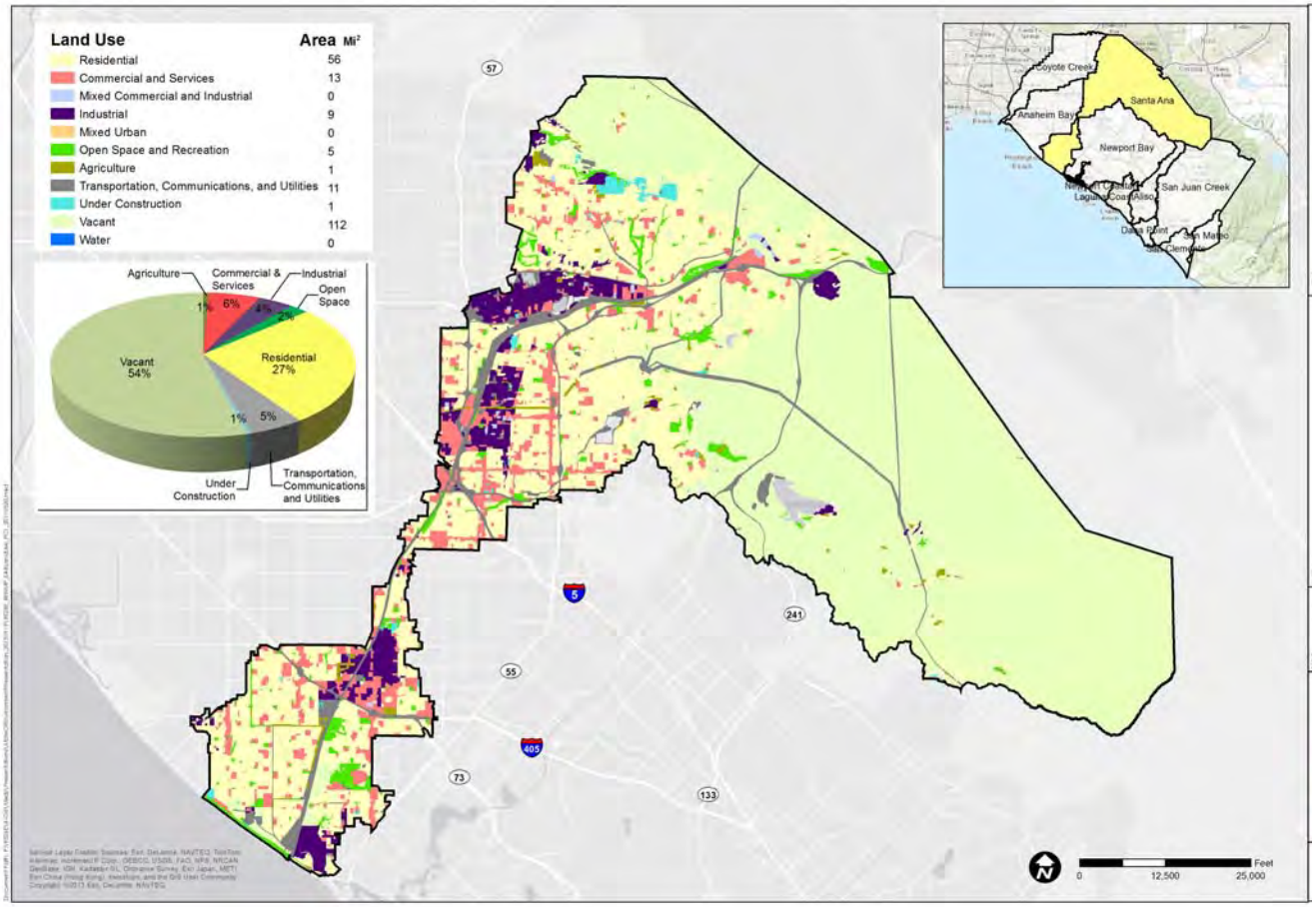


Figure 1.4: Newport Bay Watershed – Land Use

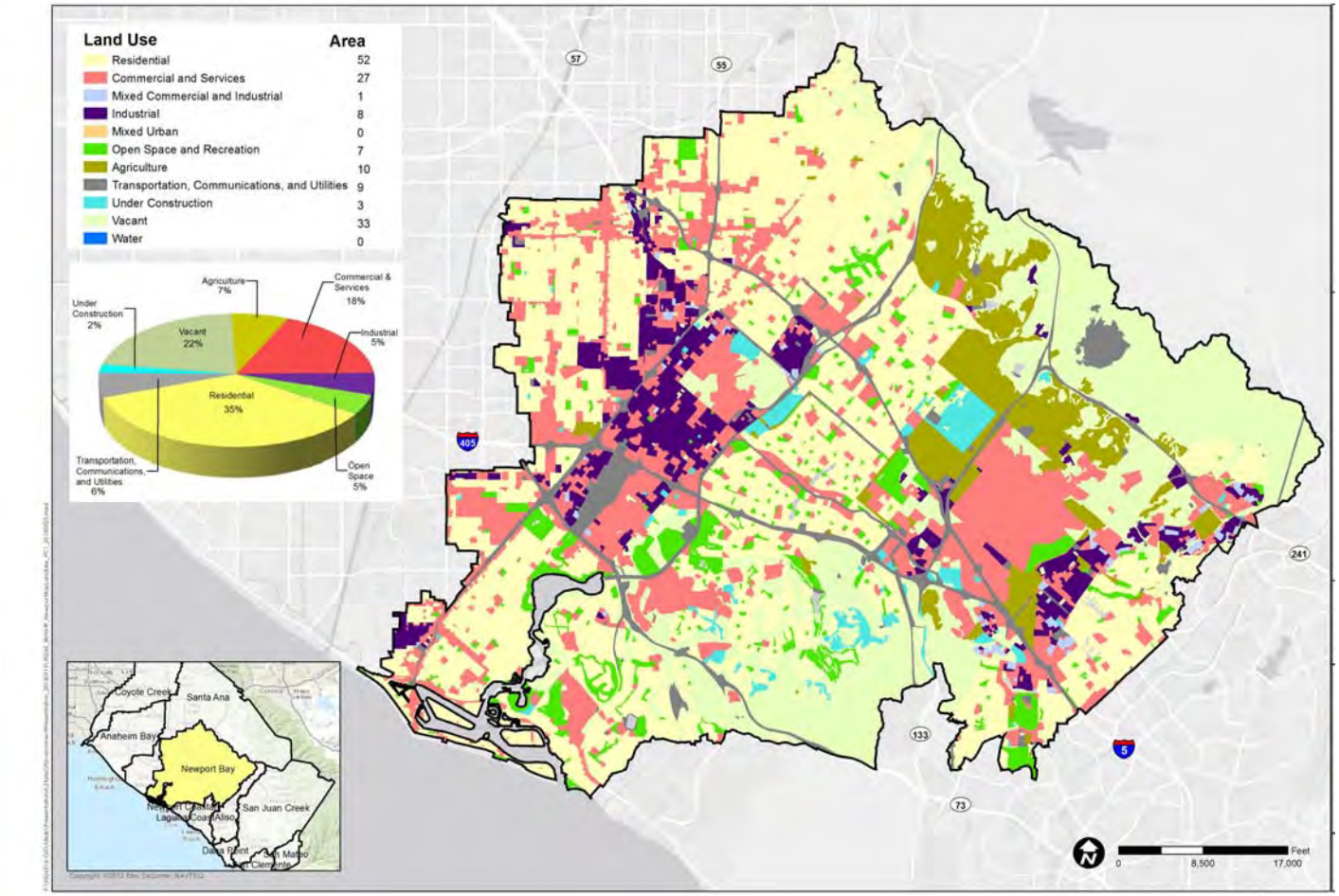


Figure 1.5: San Gabriel River/Coyote Creek Watershed – Channel Type

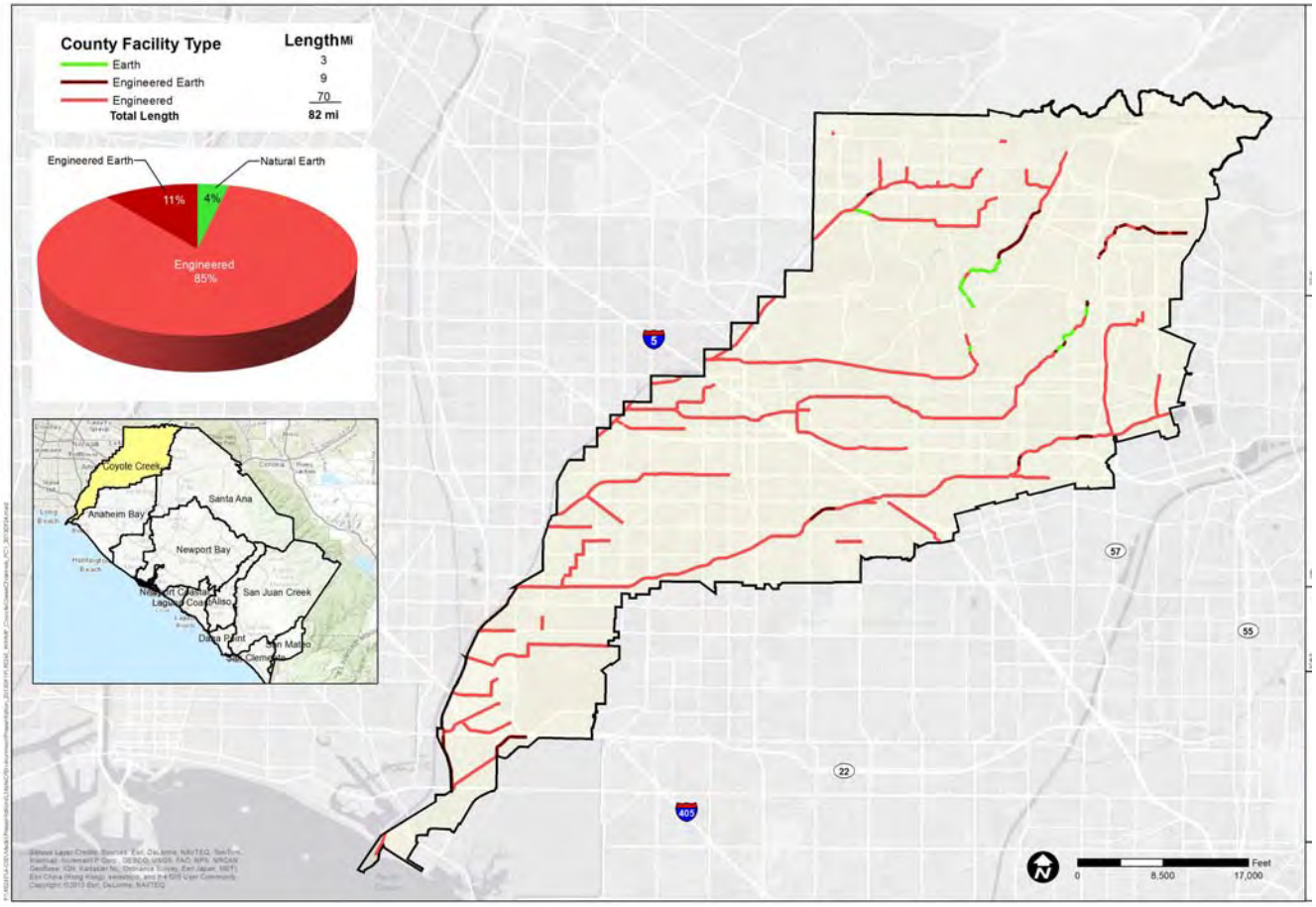


Figure 1.6: Anaheim Bay/Huntington Harbour Watershed - Channel Type

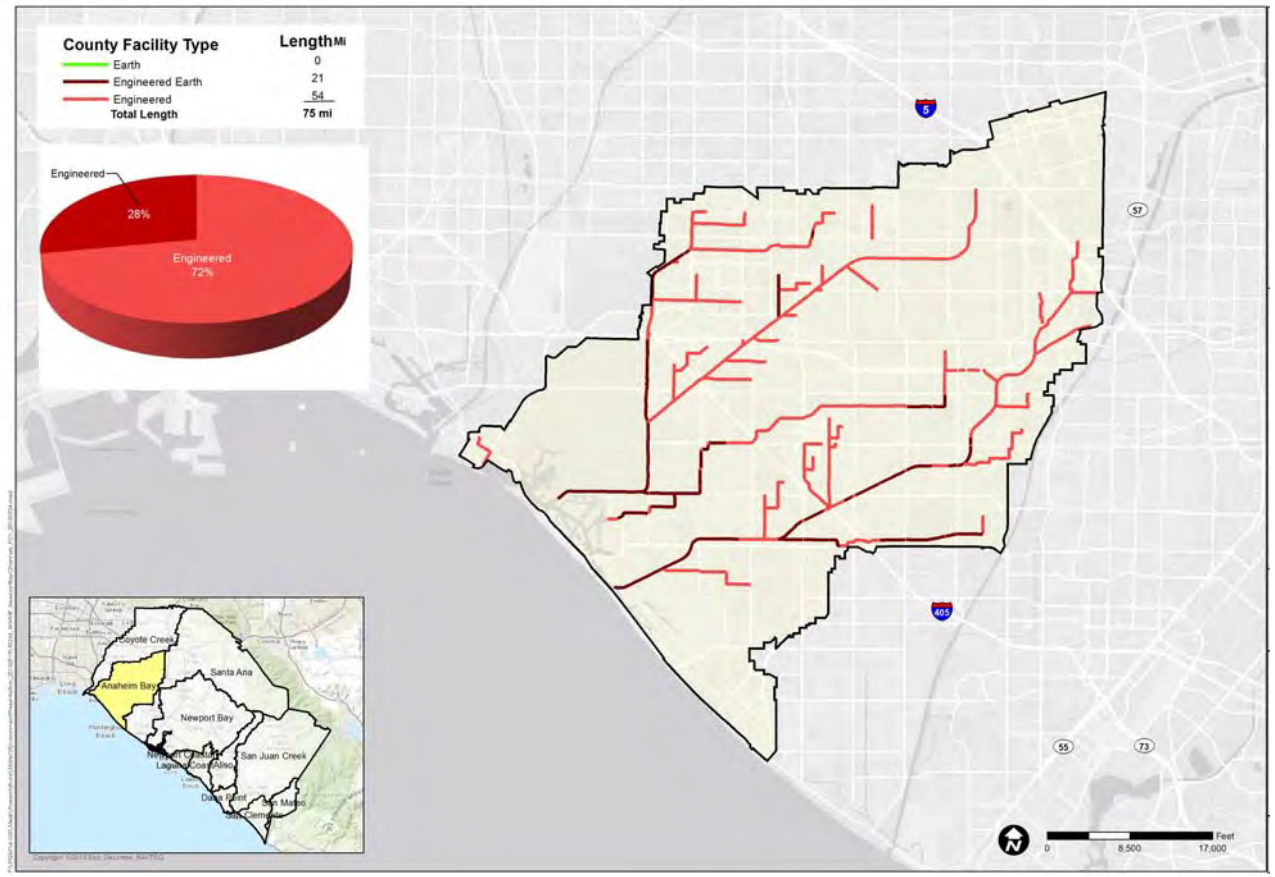


Figure 1.7: Santa Ana River within Orange County - Channel Type

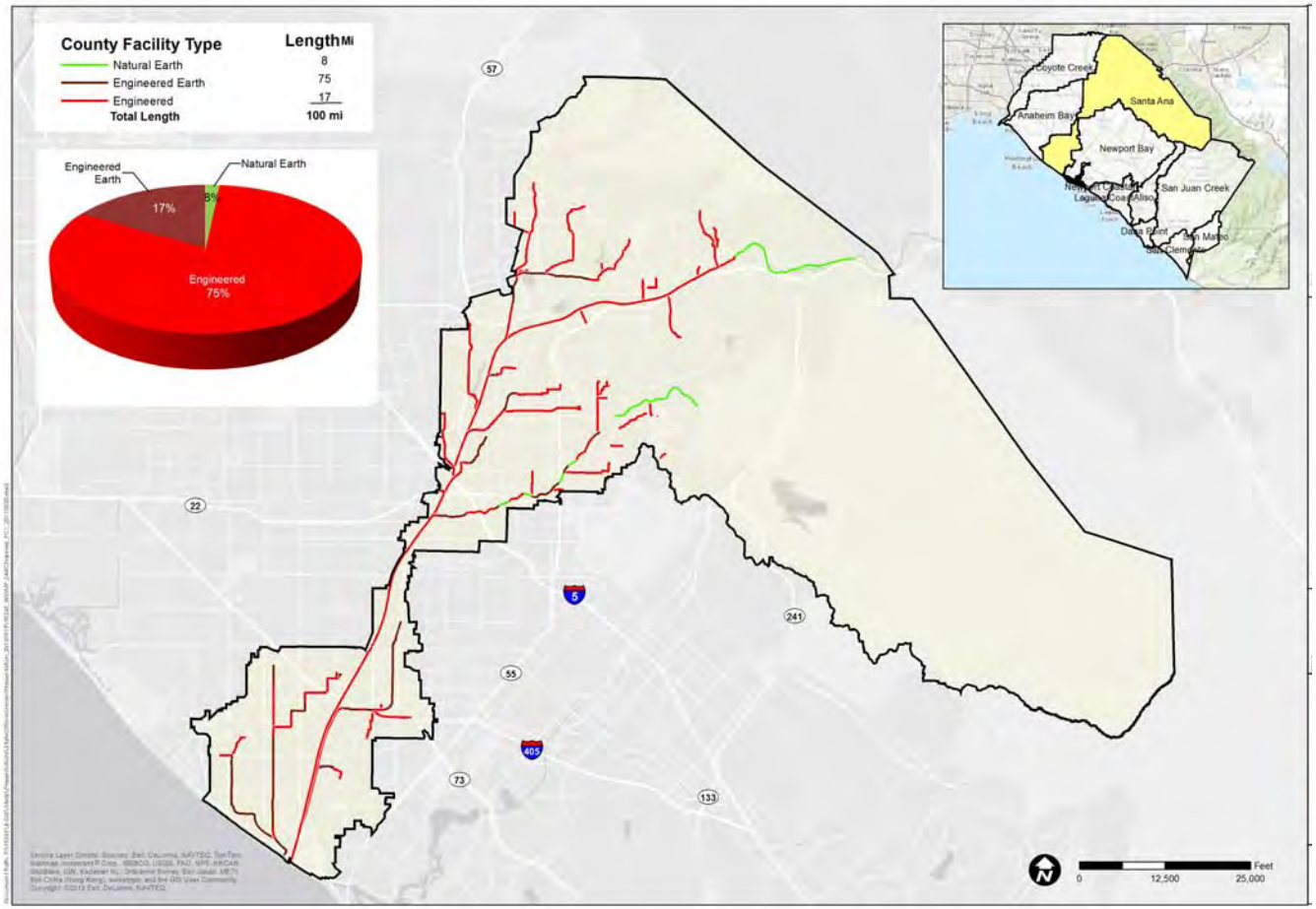
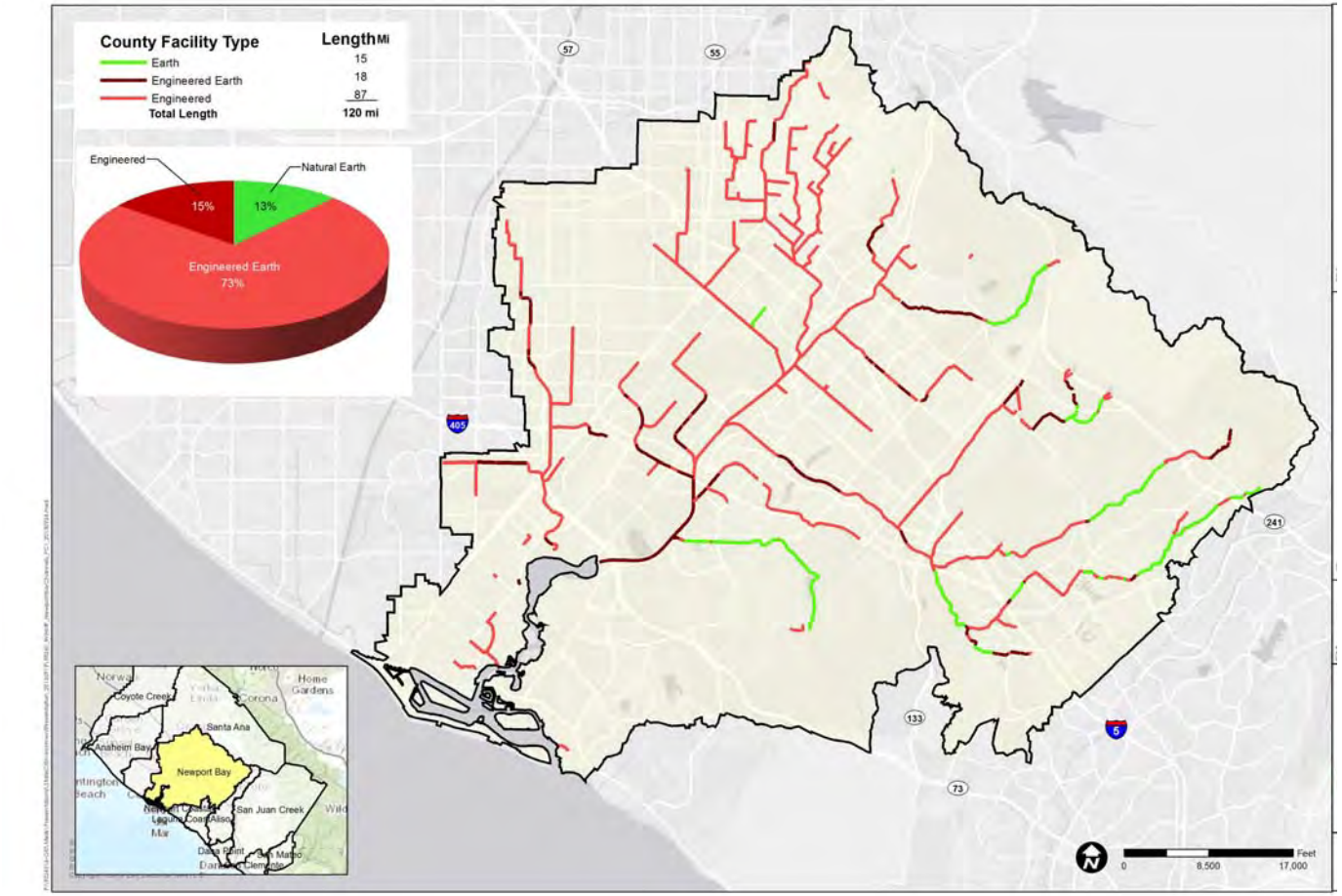


Figure 1.8: Newport Bay Watershed – Channel Type



Orange County - Public Interest

A well informed public regarding methods for preventing water pollution and public acceptance of best practices can be a significant form of pollution source control. However, continually increasing public knowledge of and willingness to prevent water pollution at home and work is an ever-evolving process and significant challenge. Nonetheless, public opinion surveys conducted in 2003, 2005, 2009 and 2012 indicate that Orange County residents have already become both more knowledgeable of and are participating more in behaviors protective of water quality.

Preservation of the environment out of concern for future generations is the number one environmental concern reported by respondents in the most recent opinion survey. A notable eighty-eight percent of respondents reported being concerned about preserving the environment for their children. As a powerful motivator, the connection to future generations can help communicate *why* a particular issue is important and supplement *how* the individual can personally help prevent pollution. Perhaps not surprisingly, parents of children who brought home water quality information were also substantially more likely to perform a greater number of "stormwater safe" behaviors. Of the seven stormwater safe behaviors measured, parents of informed students were more than three times as likely to perform all seven behaviors (22 percent compared to only seven percent).

Orange County residents are clearly concerned about the environment and can be motivated to adopt practices that protect water quality. The Permittees intend to respond to this interest by supplementing continued investment in mass-media education campaigns with targeted outreach that zeroes in on key pollutants and addresses behaviors that most regularly contribute to that source of pollution. This supplemental approach will use Community Based Social Marketing (CBSM) to encourage target audiences to adopt specific BMPs; the process of CBSM is explained further in **Section 3.3.4**. This two pronged approach provides the Permittees the ability to foster long-term in engagement while continuing to provide mass media communication that reaches the entire Orange County population.

1.3 Approach to Preparing Report of Waste Discharge

The ROWD assesses the current Program and proposes revisions to the management program in response to the information learned. Indeed, it is a basic requirement of the Permits' receiving water limitations provisions that the Program continue to adapt and evolve when urban runoff is determined to be causing or contributing to impairments of beneficial uses.

The development of the DAMP is informed by two discrete, yet related water quality planning processes: "countywide/jurisdictional," and "watershed-based" water quality management (See – "Plan Development"). Each process incorporates findings from annual assessments

focused on determining whether desired programmatic outcomes are being achieved. Specifically:

- Are program elements being implemented effectively?
- Are environmental improvements being realized?

In this ROWD, the assessment of the Program has produced three types of recommendations:

1. Program Continuation – Requires no changes in implementation approach, policy or permitting
2. Program Enhancements – Requires shift in implementation approach
3. Program Modifications – Requires shift in policy and permitting

The "Recommendations" are presented throughout the ROWD and are summarized in "Summary and Conclusions."

2.0 State of the Environment

2.1 Overview

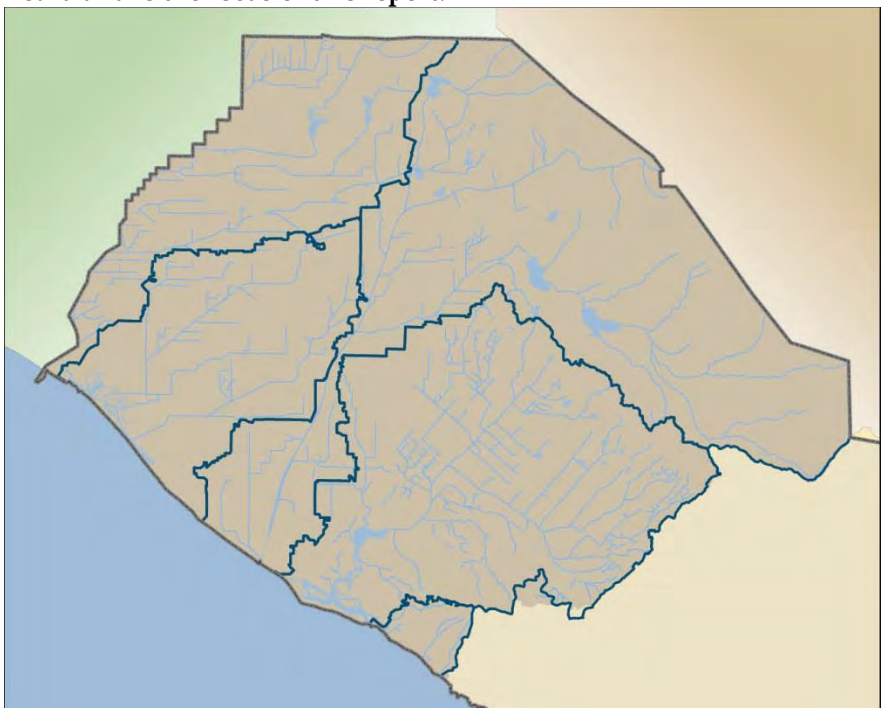
The Program's monitoring, assessment, and environmental research efforts are intended to track progress toward solving existing problems, identify emerging issues that could become problems in the future, and support research and development that improves our understanding of key processes and advances the efficiency and effectiveness of monitoring methods.

Monitoring is most often seen as a response to regulatory requirements, which it is, but it also provides information that guides the use of important resources and answers a set of fundamental questions of keen interest to both managers and the public. The State Water Resources Control Board has articulated the following four questions (based on the federal Clean Water Act) that provide a broad context for water quality monitoring in the state:

- Is our water safe to drink?
- Is it safe to swim in our waters?
- Is it safe to eat fish and shellfish from our waters?
- Are our aquatic ecosystems healthy?

This current assessment of the state of the environment for the northern portion of Orange County (**Figure 2.1.1**) summarizes the results of long-term monitoring and related special studies that address the second and fourth of these questions (related to swimming safety and aquatic ecosystem health). The safety of drinking water is addressed by other agencies and programs that produce independent reports on drinking water quality. The safety of consuming local fish and shellfish is directly managed by the California Office of Environmental Health Hazard Assessment (OEHHA), supported by data and assessments conducted by the California Surface Water Ambient Monitoring Program (SWAMP) and others. In addition, the State Water Resources Control Board is in the process of conducting a statewide assessment of the potential contribution of contaminated sediments in enclosed bays and estuaries (such as Newport Bay) to the levels of contaminants in seafood tissue.

Figure 2.1.1: The northern portion of Orange County that is under the jurisdiction of the Santa Ana Regional Water Quality Control Board and is the focus of this report.



This report therefore focuses on the two core management questions that are within the Stormwater Program's area of responsibility and that are not currently being assessed by other agencies. For each major question (e.g., Is it safe to swim in our waters?), monitoring and assessment should, over time, answer the following assessment questions:

- Is there a problem?
- If so, what is its magnitude and extent?
- What are the sources of the problem?
- Are conditions getting better or worse?
- Are management actions working as intended?

Monitoring, assessment, and research efforts should be tightly focused on one or more of these questions and be managed to ensure that resources are reallocated when questions are answered and new ones arise (**Figure 2.1.2**). Monitoring, assessment, and research should therefore be managed as a portfolio of resources invested in creating the information needed to meet the Program's goals, with the allocation of resources adjusted as needed. Assessment and research are included as a package with monitoring for two reasons. First, the information produced by ongoing monitoring programs is most useful when it is carefully analyzed, evaluated in the context of other related information, and applied to the basic questions motivating monitoring (i.e., assessed). Second, not all questions can be answered by routine monitoring and targeted special studies (i.e., research) are often needed to fill critical data gaps, develop more effective monitoring tools, and/or lay the groundwork for new management approaches.

Figure 2.1.2: Monitoring, assessment, and research provide the data and information required to answer the five key assessment questions. Attention should shift among questions as information improves and priorities change, and the mix of monitoring, assessment, and research activities should be adjusted to correspond.

The Program has identified three themes that help structure the assessment of the status and trends of environmental conditions in north County and accompanying recommendations for restructuring current monitoring programs:

Theme 1: Focus on priority areas and constituents rather than trying to monitor all constituents, potential problems, and locations

Theme 2: Increase the integration of data from a wider range of sources in order to leverage the value and impact of the Program's efforts to address the five assessment questions

Theme 3: Continue evolving from strictly discharge-specific approach to a risk prioritization approach that can highlight problem areas and support more flexible monitoring designs that include data driven adaptive triggers

These three themes motivate the examination, in the following sections of progress toward meeting management goals for three critical areas of concern: bacterial contamination of swimming beaches, effects of nutrient enrichment, and patterns and trends in toxicity in the region's water bodies.

These three areas were selected because they have been core elements of the Program's monitoring efforts for many years and interest from both managers and the public remains high. In addition, there is a substantial amount of data available to support conclusions about progress as well as a reexamination of long-term monitoring designs to take advantage of improved knowledge to improve efficiency and effectiveness. This is an important element of the Program's adaptive approach to monitoring and assessment (**Figure 2.1.2**). Each section ends with recommendations for improving monitoring's effectiveness. Many of these could be implemented as collaborative efforts through the Stormwater Monitoring Coalition (SMC).

2.2 Bacteria

The Story: Bacteria

- The County's beaches support concentrated recreational activities for both residents and visitors and are important contributors to the local and regional economy
- Concern about swimming safety is consistently high and epidemiology studies in dry weather show that some illness (for example, gastroenteritis) is associated with full immersion swimming in contaminated water
- Contamination is very low during dry weather and has dropped steadily over time; beach report card grades are consistently high
- Sources of contamination have been reduced through targeted actions; remaining problems during dry weather are localized and may have natural components
- Contamination is more widespread during wet weather; wet weather flows are both larger and qualitatively different
- Health risks associated with wet weather flows are uncertain, but ongoing research and development focuses on improved monitoring tools and wet weather epidemiology studies
- Progress on managing dry weather contamination, and new monitoring tools, suggests that some aspects of current monitoring and regulatory programs be redesigned for greater accuracy and efficiency

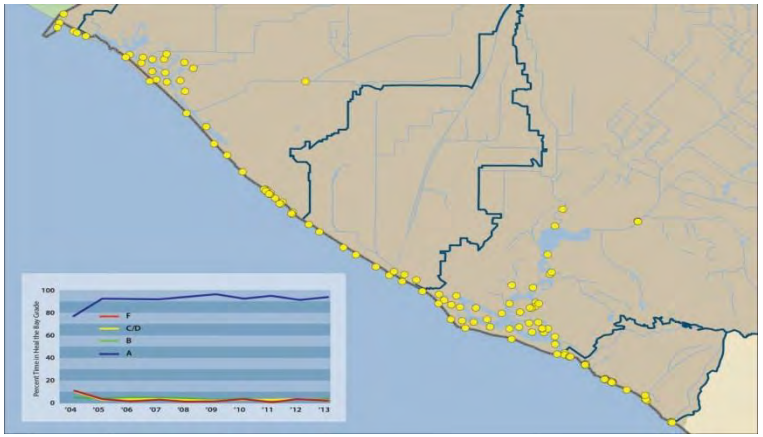
2.2.1 A Valued Resource

Southern California's beaches have been used for recreation at least as far back as the early 20th Century (**Figure 2.2.1**), and the local population as well as visitors from outside the region have enjoyed the opportunities they provide for sightseeing, picnicking, sunbathing, swimming, and surfing. The acceleration of urbanization and population growth in the last century increased beach usage at the same time as growing environmental awareness was intensifying concerns about contamination and its potential health impacts. The nexus of these two trends was illustrated dramatically in 1999 when persistent closures of Huntington Beach due to contamination resulted in substantial economic impacts, anxiety about potential health effects, and concerted efforts to find and control the sources of contamination. With over 100 million visits annually to southern California's beaches (nearly 40 million of which occur in Orange County) (Dwight et al. 2007) that contribute billions of dollars to the regional economy, the stakes related to contamination and public health are higher than ever.

Figure 2.2.1: The beach has been a popular recreational destination even when the Orange County shoreline was dominated by oil extraction in the earlier part of the 20th Century.

The intensity of recreational use at beaches has stimulated a large amount of research, monitoring, and regulation at the federal, state, and local levels. These efforts have identified a number of bacterial, protozoan, and viral pathogens that could be present when contaminated runoff and untreated sewage are released into the ocean (HCA 2012). Epidemiology studies in Santa Monica Bay (1995 & 2007/08) documented higher illness rates (e.g., gastroenteritis) among swimmers, especially near flowing stormdrains. These illnesses are not life threatening. However, the past history of beach contamination due to untreated sewage discharges (prior to passage of the federal Clean Water Act), along with current concerns about sewage spills and untreated stormdrain discharges, has resulted in constant vigilance and one of the preeminent beach water quality monitoring and improvement programs in the state (**Figure 2.2.2**).

Figure 2.2.2: A Coordinated beach monitoring program conducted by the County Health Care Agency, the Stormwater Program, and the Orange County Sanitation Districts regularly monitors a large number of swimming sites. Heal the Bay converts weekly beach monitoring data into letter report card grades (inset figure) that are made available on their website (www.healthebay.org) and that are widely used by beachgoers to quickly and easily assess potential health risk. Most beaches in the north County consistently have an A grade and the proportion of assessments resulting in an A grade reached 90% in 2005 and has remained at that level since then.



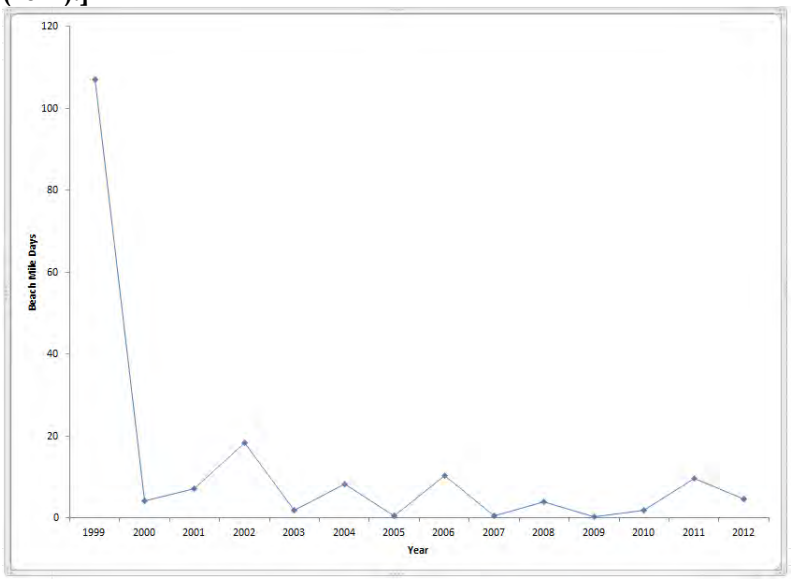
2.2.2 Progress during Dry Weather

Beach use and body contact recreation occur predominantly during the summer and in dry weather, although there is some use, mainly by surfers, during wet weather in the winter storm season. As a result, most regulation and monitoring focuses on dry weather conditions, using three bacterial indicators that indicate the presence of fecal pollution. These indicators are only indirect indicators of illness risk and not themselves pathogens, or disease agents. Thus, they do not provide a direct measure of health risk. However, they have

been correlated with illness rates in dry weather when sewage contamination is present. They and are more easily sampled and analyzed than the larger number of pathogens themselves. Long-term monitoring based on these indicators shows that exceedances of regulatory standards are also low and have been dropping over time and that the annual percentage of Heal the Bay report card grades of A has been between 93% and 97% since 2005 (**Figure 2.2.2**).

This improvement in conditions during dry weather has been mirrored by a decrease over the past several years in beach closures due to contamination, as measured by Beach Mile Days (**Figure 2.2.3**). This metric is calculated by multiplying the length in days of each closure by the length (in miles) of beach affected and is a more accurate measure of the impact on beach users than the simple number of closures.

Figure 2.2.3: The total number of Beach Mile Days (the product of the length of beach closed times the length of the closure) posted due to exceedances of standards during the April 1 – October 31 summer swimming season has declined substantially since 2000 and has remained at a low level since then. Adapted from HCA (2012).]



The improvement over time in these several measures of beach condition has resulted from a better understanding of contamination sources and targeted efforts to address the most severe of these sources. These efforts (**Figure 2.2.4**) initially focused on the discharge from the Orange County Sanitation District's treatment plant, beginning with construction in the 1920s of an outfall reaching 0.6 miles offshore and extending through a series of outfall and treatment upgrades that have continued up until the present. Beginning around 2000, County agencies and individual cities began improving their spill response and prevention capability, supported by a number of state laws and policies targeted at the discharge of

FOG (fats, oils and grease, which can clog sewer lines), with the result that the numbers of spills and beach closures due to spills have declined dramatically (**Figures 2.2.5a-d**). Attention has more recently turned to urban runoff from rivers, creeks, and stormdrains, which can contain high levels of bacterial indicators. Ongoing efforts by cities and their stormwater programs to improve water conservation and reduce nuisance runoff have begun to ameliorate this problem. While concentrations of indicator bacteria in both wet and dry channels combined continue to exceed standards (**Figure 2.2.6**), the diversion of dry weather stormdrain and stream flows to treatment plants and constructed wetlands (**Figure 2.2.7**) has significantly reduced the volume of contaminated flows to beaches. For example, all dry weather discharges to the lower Santa Ana River and Talbert Marsh have been diverted to the Orange County Sanitation Districts' treatment plant (and the allowable daily volume was recently increased to 0 MGD) and the Irvine Ranch Water District's Natural Treatment System wetlands have been shown to reduce bacteria, nutrients, and other contaminants. Such efforts, along with the targeted identification and removal of specific problem sources, have also helped the County and watershed permittees make substantial progress toward meeting the targets of the Fecal Coliform TMDL for Newport Bay (**Section 2.2.3**). As a result of the effectiveness of these complementary actions, Orange County's beaches meet regulatory standards for the large majority of the time in dry weather and the health risks of swimming during dry weather conditions are very low, well understood, and well managed.

Figure 2.2.4: A series of engineering, monitoring, and management actions beginning in the early 20th Century and accelerating beginning in the 1980s has addressed the major sources of beach contamination in turn: untreated sewage discharge from the Orange County Sanitation District's treatment plant; sewage spills from pipe blockages and breaks; and urban runoff from rivers, creeks, and stormdrains. These efforts have helped to improve conditions dramatically, but more work remains to be done, particularly regarding wet weather runoff during winter storms.

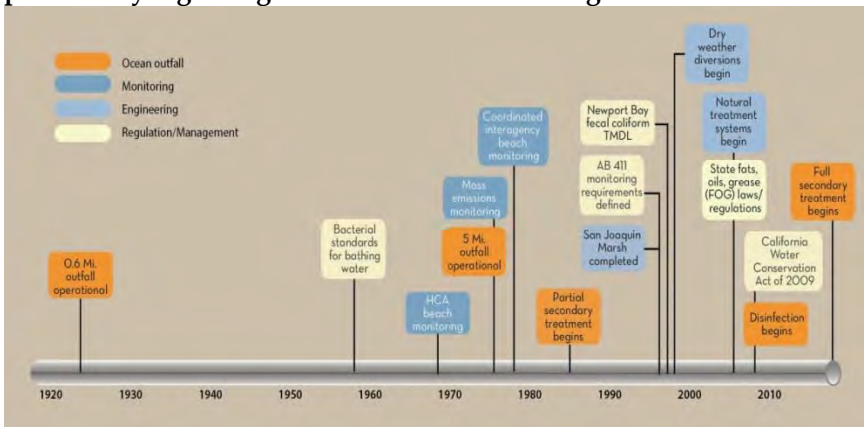


Figure 2.2.5a: The number of reported sewage spills from 1987 through 2011. The number of spills peaked in 2002 and has declined steadily since then (regression significant at p <0 .001), reflecting increased attention to the causes of spills (primarily line blockages).

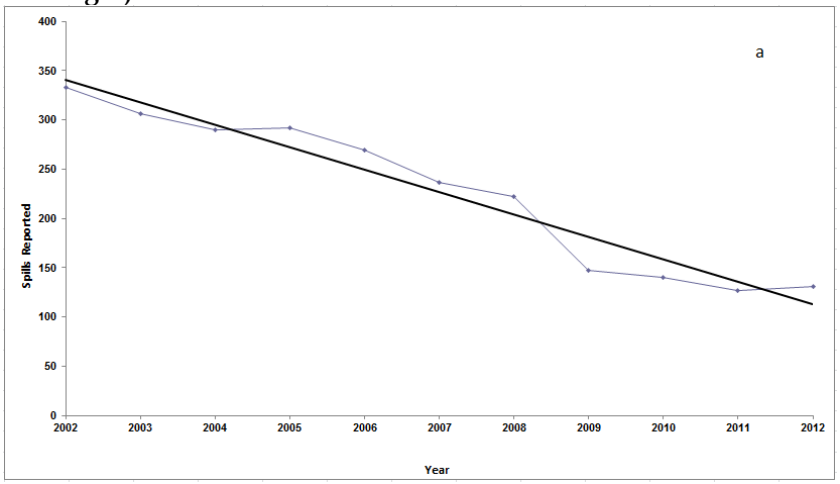


Figure 2.2.5b: The percentage of reported spills from 1987 through 2011 that resulted in beach closures. The declining trend shown is significant at p = 0.06.

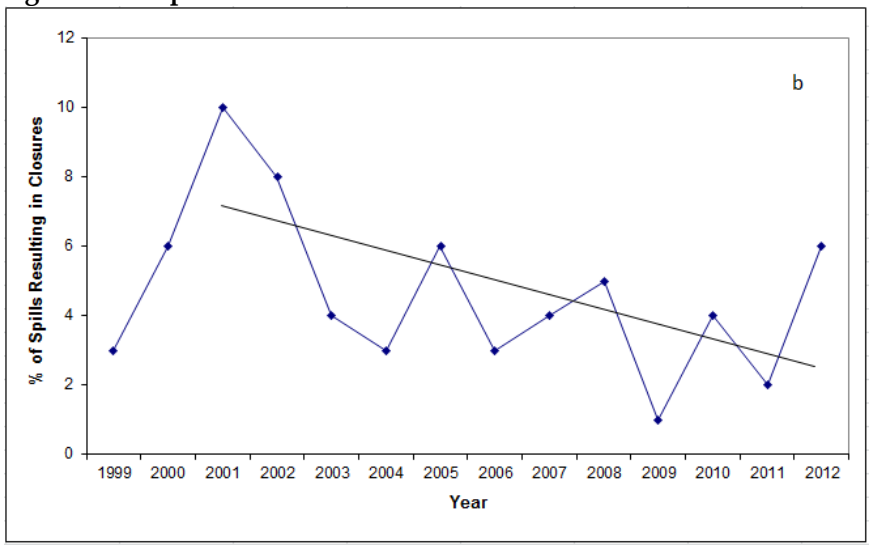


Figure 2.2.5c: The number of beach closures from 1999 through 2011 resulting from sewage spills. After peaking in 2001, the number of closures has declined steadily (regression significant at p = 0.001), reflecting the reduction in the number of sewage spills and in the percentage of spills reaching the beach.

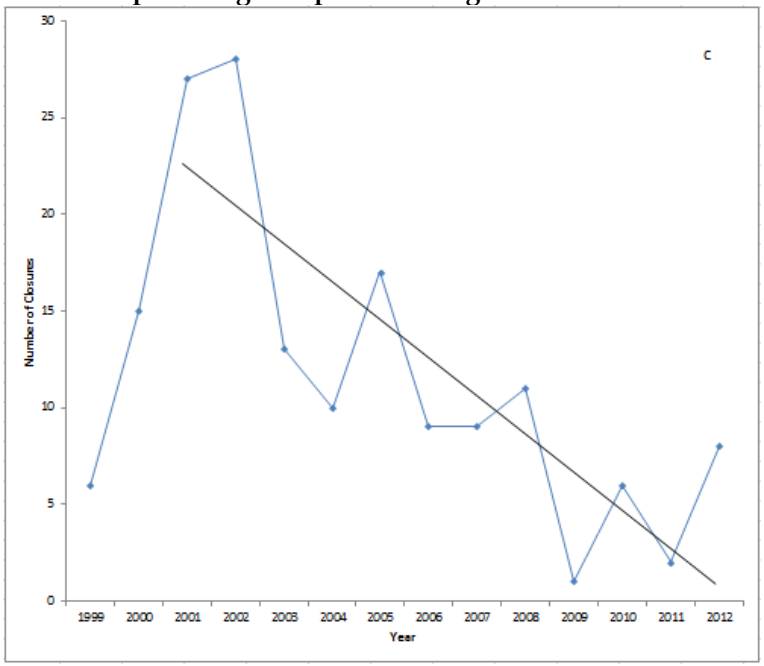


Figure 2.2.5d: The number of Beach Mile Days of closures due to sewage spills reaching the beach. Peaks in 2005 and 2010 are due to an unusual number of larger spills over 1000 gallons. Adapted from HCA (2012).]

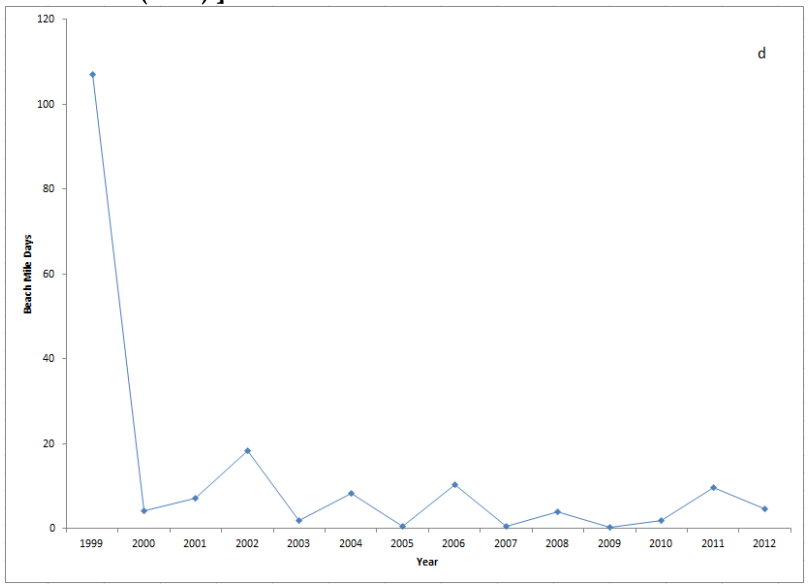


Figure 2.2.6: An overall index of the extent to which indicators meet regulatory standards in both wet and dry weather combined is low (which means poor conditions) and has remained steady since 2005. This index accounts for the number of indicators that exceed standards in each year, the percentage of individual samples that exceed standards, and the average magnitude of any such exceedances (CCME 2001). Such frequency-based indices are widely used in water quality assessment (e.g., by the Central Coast Regional Water Quality Control Board and the Ventura Countywide Stormwater Quality Management Program). It provides a measure, scored from 0 - 100, of the frequency and magnitude of exceedances that can be tracked over time.

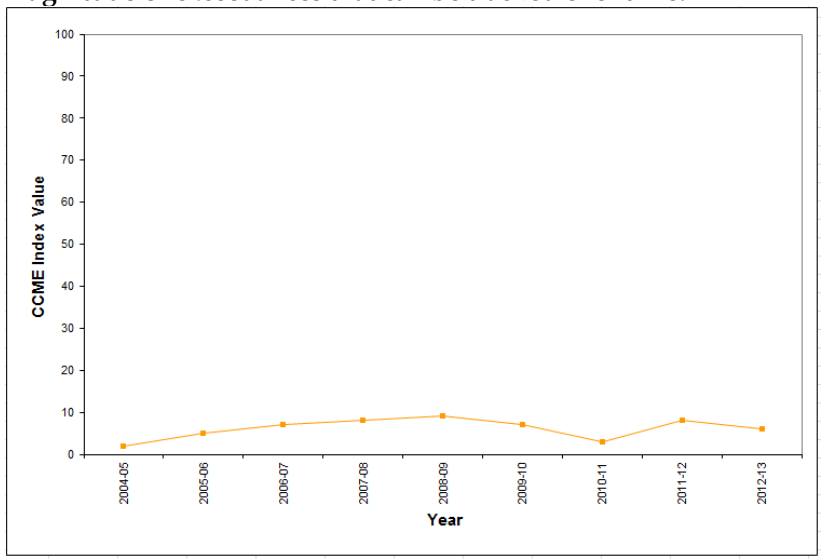
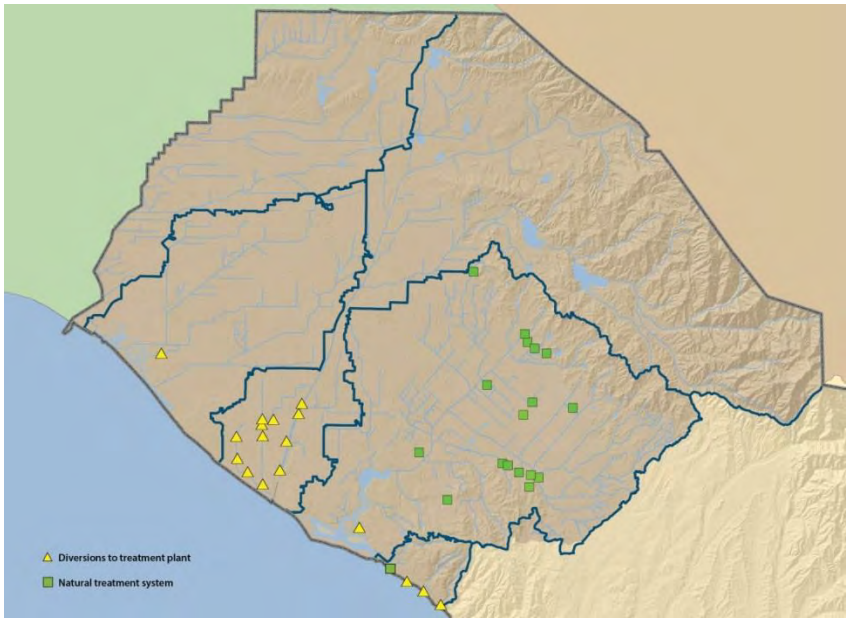


Figure 2.2.7: Following extensive closures of Huntington Beach in 1999, all of the dry weather flow to the Santa Ana River and Talbert Marsh systems was rerouted to the Orange County Sanitation District's wastewater treatment plant through a series of flow diversions. These operate through the entire year except when rainfall causes increased flows. These and other flow diversions across the County, along with the construction of several treatment wetlands, have substantially reduced both flow and contaminant loads to the coastal ocean. Yellow triangles represent diversions to a treatment plant; green squares represent natural treatment.



2.2.3 Continued Challenges in Wet Weather

In contrast to the progress achieved in maintaining clean beaches during dry weather conditions, significant challenges remain during wet weather. Channel flows during and immediately after wet weather storms are substantially higher

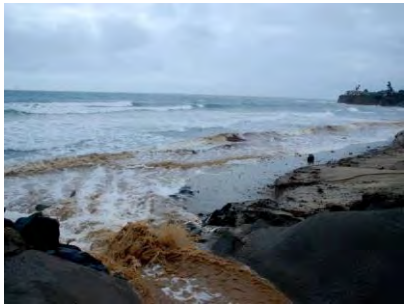
than during dry weather (**Figure 2.2.9a vs. 2.2.9b**) which makes it infeasible to apply the management practices (e.g., diversion to treatment plants) that have been so successful in dry weather. In addition, these flows reach the beach more frequently (**Figure 2.2.9c**), which means that their loads of bacteria and other pathogens are delivered directly to the coastal ocean, with the result that beach grades worsen and exceedances of standards increase during wet weather (**Figure 2.2.10**). Nevertheless, the annual percentage of A grades for wet weather on the Heal the Bay report card has reached 70% in recent years (**Figure 2.2.10**). As a result of these characteristics of wet weather flow, the Orange County Health Care Agency issues routine health advisories recommending that the public stay out of the ocean during and for 72 hours after storms in order to avoid contact with potentially contaminated discharge. Despite this, there is significant recreational use during storms (**Figure 2.2.9d**, primarily by surfers taking advantage of the larger surf that often accompanies winter storms.

Figure 2.9: a) Dry weather flows are much smaller than b) wet weather flows; c) wet weather flows from stormdrains and channels typically reach the ocean in wet weather, in contrast to dry weather flows which rarely reach the ocean; d) surfers often take advantage of the large waves caused by winter storms, despite the increased exposure to contamination this may involve.

a

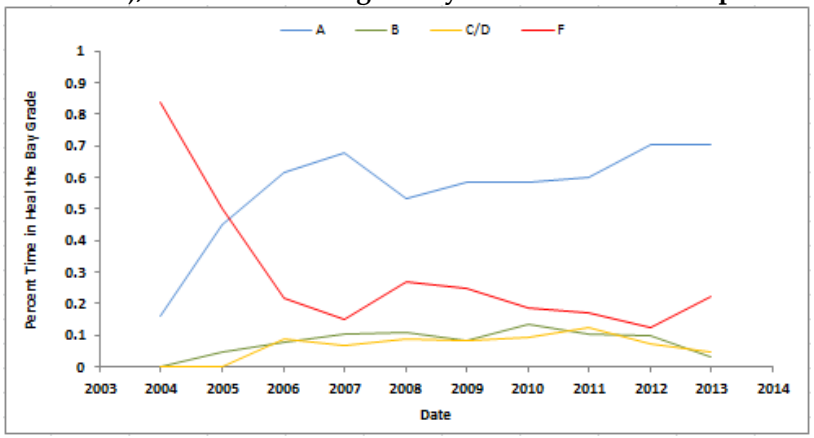
b

c



d

Figure 2.10: The percentage of poor Heal the Bay report card grades at swimming beaches is much higher in wet weather than in dry weather (see insert in Figure 2.2.2), although the annual percentage of A grades has increased gradually in recent years to 70% and the percentage of F grades has averaged about 20% since 2005. The relatively high percentage of F grades in 2004 and 2005 may reflect the very high rainfall in the 2004-2005 rainy season (30.17 inches at Santa Ana), which was the highest by far in the monitored period.



In addition to the higher flows in wet weather, there are two other aspects of this issue that complicate efforts to reduce wet weather contamination and its resultant potential health risks:

- Bacterial contamination in wet weather flows stems from a much wider range of sources than in dry weather
- Limitations in existing monitoring tools make it difficult to know when there is actually human fecal contamination and a resultant health problem

Rainfall and the resulting runoff from land surfaces mobilizes indicator bacteria from a wide range of sources, including humans and animals, soils, vegetation debris, and persistent bacterial films in gutters and stormdrains. These loads stem from sources in both urban and open areas, as documented in a number of studies that have correlated bacterial loading with rainfall and measured loading from both urban and natural landscapes. Controlling this large range of sources and the very large volumes of wet weather flow would present a daunting engineering problem. For example, the long-term (1969 – 2003) mean monthly flow of the Santa Ana River in January, February, and March is approximately 40,000, 45,000, and 36,000 acre feet, respectively. Because treating these runoff volumes is infeasible, other options are being pursued, such as Low Impact Development (which reduces runoff) and amendments to the Basin Plan that include changing bacteria objectives, delisting of some concrete channels, and suspending objectives in highly modified flood control channels during periods of high flow.

Because of the different nature of wet weather flows and the indirect nature of monitoring indicators, it is impossible to draw firm conclusions about health risk in wet weather. Wet weather flows may actually include a large proportion of true pathogens or they may simply be mobilizing non-pathogenic indicator bacteria from multiple sources across the landscape and diluting a stable pool of human fecal pathogens. Epidemiological studies in dry weather, including in Santa Monica Bay in 1995 and 2007 - 08, have established a relationship between levels of indicator bacteria and health risk, as well as documenting that full immersion swimming closer to flowing stormdrains increases risk. In contrast, there are no epidemiological studies in wet weather that can help resolve the fundamental uncertainties that have so far precluded significant management actions.

New studies planned and underway should, over the next few years, provide significant insight into the nature and

magnitude of health risks in wet weather as well as more powerful and targeted monitoring tools to support improved regulation and decision making.

2.2.4 Newport Bay

The recreational use of Newport Bay extends back to at least the early 1900s and concerns about bacterial contamination in the Bay are of long standing. Parts of Upper Newport Bay were closed to swimming in 1974, although the original contamination concern no longer exists. Following the state's promulgation of bacterial standards for beaches in 1958, the County Health Care Agency began routine beach monitoring, including in Newport Bay. When state law AB 411 established new standards and monitoring requirements in 1999, these were incorporated into the Bay's existing monitoring program, which now includes 35 stations.

Efforts to control bacterial contamination also extend back several decades. The Bay was declared a no-discharge harbor for vessel sanitary wastes under federal law in 1976, which required installation of pump out facilities. The Water Boards in 2004 required more pump out stations in the Bay and additional public restrooms have been constructed for the use of boat residents.

In 1999, the Santa Ana Regional Water Quality Control Board adopted a Total Maximum Daily Load (TMDL) for fecal coliform in the Bay. The TMDL establishes a phased approach to meeting targets, by 2014 for swimming and 2019 for shellfish harvesting. Since 1999, TMDL participants diverted dry weather flows from many of the stormdrains discharging to the Bay to treatment plants or constructed wetlands and conducted aggressive efforts to prevent sewage leaks and spills.

These sustained efforts have resulted in significant improvement in levels of fecal coliforms. The rate of exceedance of regulatory standards, the average level of fecal coliforms at all stations, and the incidence of high and very high levels of coliforms have dropped substantially (**Figures 2.2.8a-c**). While additional work remains, particularly in wet weather, these results demonstrate success at controlling a pervasive source contaminant in an urbanized environment. The Program has therefore recommended revisions to the Basin Plan and the TMDL, including to the target indicator, the numeric targets, and load allocations, among others.

Figure 2.2.8a: An overall index of the extent to which the three AB 411 indicators (fecal coliforms, total coliforms, Enterococcus) in Newport Bay exceed regulatory standards has increased over the past ten years (which means improving conditions). This index accounts for the number of indicators that exceed standards in each year, the percentage of individual samples that exceed standards, and the average magnitude of any such exceedances (CCME 2001). It provides a measure, scored from 0 - 100, of the frequency and magnitude of exceedances that can be tracked over time. These are the three indicators the Health Care Agency uses to manage health risk and that Heal the Bay uses to calculate report card grades for the beaches.

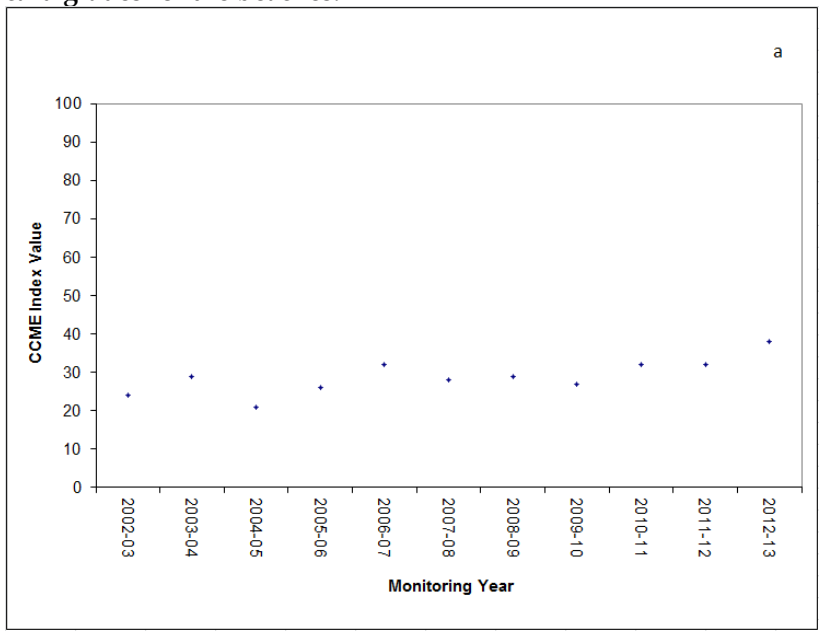


Figure 2.2.8b: The long-term trend (significant at p < 0.001) in the overall yearly average value of the fecal coliform indicator at all sites and conditions, showing a substantial decline both in the overall average concentration and the 90th percentile of values for each year. The horizontal red line in the plot is the regulatory standard of 200 bacteria per 100 ml of sample volume (MPN refers to Most Probable Number).

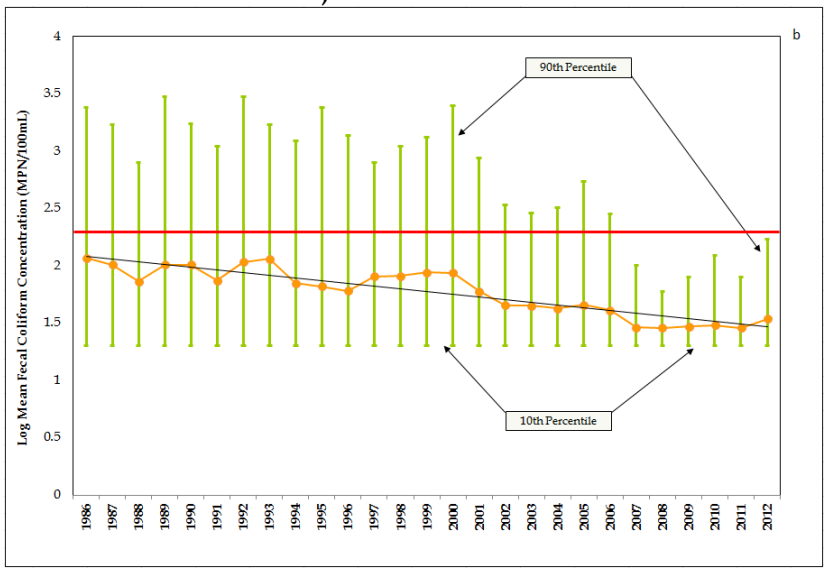
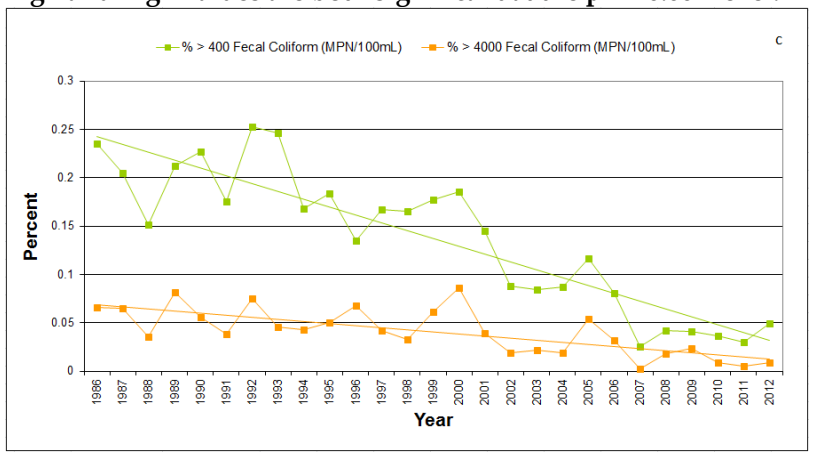


Figure 2.2.8c: The long-term trend in the percent of high and very high coliform values each year, showing a substantial decline in the frequency of extremely high values. The regressions for very high and high values are both significant at the p = <0.001 level.



2.2.5 Monitoring Methods

Current indicators do not measure pathogens directly and do not separate human vs. animal and other sources. This is problematic, especially in wet weather when higher flows mobilize indicator bacteria from a multitude of sources distributed widely across the landscape. The current bacterial indicators are present in soils, leaf litter, other forms of rotting biomass, biofilms in gutters and stormdrains, as well as in both domesticated animals and wildlife, and often recover and grow in the environment even after disinfection. In contrast, the pathogens responsible for human illness (about 90% of which are viruses) all derive from human fecal contamination. These shortcomings of traditional indicators make it difficult to reliably separate human from nonhuman sources, estimate health risk, and accurately track the sources of actual pathogens.

Recent research has led to new tools that resolve some of these handicaps, although further development remains to be done over the next few years. Ongoing research falls into three categories:

- Development of genetic markers that more reliably identify the presence of human fecal material
- Monitoring methods that directly measure the presence and abundance of pathogens, particularly viruses
- Wet weather epidemiology studies that will improve estimates of health risk from exposure to ocean waters during wet weather conditions

We now have the technology to reliably determine if there is a human fecal component to bacterial contamination, using the HF183 genetic marker from a *Bacteriodes* species that is present in large quantities in humans but not in other species. This marker is not itself a pathogen but does enable relatively accurate estimates of the percentage of time human fecal material is present. At present, it is most useful as a means of confirming / eliminating the presence of human sources, a key first step in microbial source tracking studies. However, it is not yet a suitable basis for revised regulatory standards because its persistence in the environment and its behavior compared to that of actual pathogens is poorly understood. A component of Bight '13 aims to improve our understanding of HF183's utility by measuring it, along with traditional indicators, in a number of coastal drainages across southern California in both wet and dry weather.

New monitoring methods that utilize digital polymerase chain reaction (dPCR) technology enable quantification of pathogenic viruses at very low detection limits. Researchers

can now test for the presence of adenoviruses, noroviruses, and rotavisuses in environmental samples, although substantial further development is needed before these methods are available for routine application. Rotaviruses are related predominantly to gastrointestinal illness and some adenoviruses affect a broader range of membranes, including those in the nose and bronchia. Some noroviruses cause intense but shortlived (24 – 48 hour) illnesses that are not life threatening but are extremely unpleasant. With funding from the state of CA, the Southern California Coastal Water Research Project is working with the Monterey Bay Aquarium Research Institute (MBARI) and researchers at Arizona State University to develop mobile digital PCR equipment that could enable new approaches to beach water quality monitoring, such as in situ sensors that provide a stream of real-time data. There are technical complications related to sample processing but once these are resolved, the digital PCR methods could provide the basis for updated standards.

The third area of research is the investigation of health effects associated with swimming and surfing in the ocean during wet weather conditions. SCCWRP is cooperating with the City and County of San Diego and USEPA this winter on a pilot wet weather epidemiology study that will follow a large sample of surfers to estimate the relationship between illness rates and the levels in ocean water of a number of indicator bacteria and pathogens. Plans are in place for a full epidemiology study at more locations the following year, during the winter of 2014/15. The results of these studies, in combination with quantitative risk assessment methods, could show that health risk is either lower or higher than the assumptions built into current regulations. In either case, the epidemiology studies, in combination with new monitoring methods, will provide the basis for improved regulations and more informed management decisions.

2.2.6 Recommendations

Past progress in identifying and controlling sources of contamination, the availability of a long time series of monitoring data, and the development of new monitoring and assessment tools provide the basis for this review of existing bacteria monitoring programs with the goal of improving their utility and efficiency. The following recommendations stem from a data-driven, risk prioritization approach that views monitoring, assessment, research, and management actions as a portfolio of related actions.

1. Conduct targeted data analyses of monitoring data to prioritize problem areas. Conduct pilot source tracking studies using new monitoring methods based on genetic markers to identify potential sources of these problems such as infiltration into the MS4 from sewage lines. This effort should build on results of the Bight '13 Microbiology Study
2. Continue identifying opportunities to reduce and prevent flows in dry weather, where monitoring and source tracking data suggest the presence of human fecal contamination
3. Conduct statistical power analysis and optimization studies to improve existing monitoring program designs to improve efficiency and take advantage of available information about patterns and trends of contamination. **Figures 2.2.11 and 2.2.12** illustrate how two different types of statistical analysis provide information that can reduce and/or better target monitoring resources

4. Pursue proposed revisions to the Newport Bay Fecal Coliform TMDL to adjust objectives, targets, and monitoring designs to reflect current information and conditions
5. Shift resources from routine monitoring to targeted source identification and adaptive response, using new tools such as genetic markers of human fecal contamination as these become available
6. Shift resources from routine monitoring to targeted source tracking and adaptive response, using new tools such as genetic markers of human fecal contamination as these become available
7. Continue supporting regional and collaborative research into better monitoring and source tracking tools
8. Improve understanding of health risk related to high wet weather flows, for example, through the Bight '13 Microbiology Study; follow results of the pilot wet weather epidemiology study planned for San Diego and consider supporting the larger, follow-on study planned for 2014/2015
9. Conduct pilot mass balance studies to determine their utility for improving the prioritization of management actions

Figure 2.11: A cluster analysis of coliform monitoring data through 2005 from Newport Bay shows that the 35 stations fall into five groups that behave similarly over time and in response to rainfall events. A reanalysis of these data, including additional data collected through 2012, might show that the number of monitoring stations could be reduced without loss of useful information.

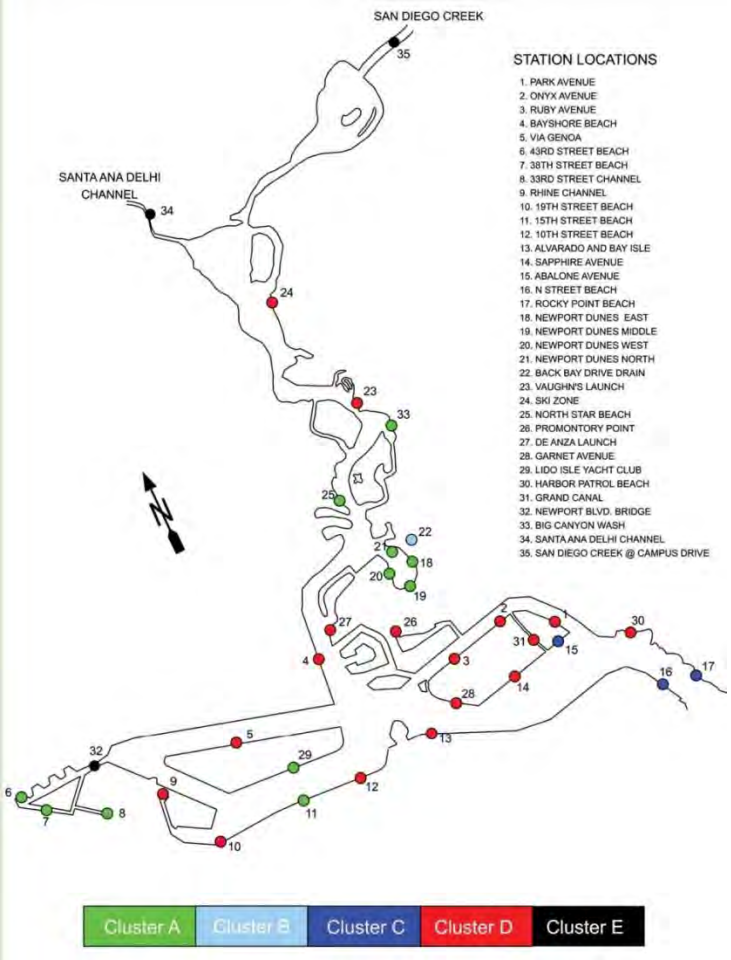
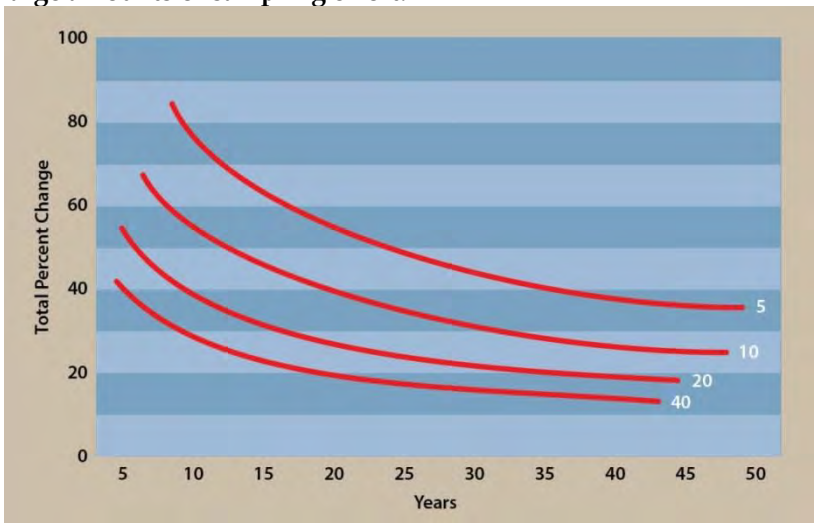


Figure 2.12: Example analysis run with pesticide data to demonstrate statistical power analysis for a trend monitoring program. The number of years of data required to detect varying amounts of change with different numbers of samples per year (5, 10, 20, 40 next to respective curves). This figure illustrates that increased sampling intensity often produces diminishing returns and that such analyses can inform tradeoffs among different types of sampling effort and the amount of change managers with to detect and/or the amount of time they can wait to detect a change. The figure also shows that the inherent variability in a system may make it impossible to detect small amounts of change with even large amounts of sampling effort.



2.3: Nutrients

The Story: Nutrients

- Nutrient levels in north County streams and channels are frequently above commonly used thresholds that suggest increased likelihood of nutrient impacts. In contrast, there are substantially less frequent occurrences of impacts, such as macroalgal overgrowth, due to excessive nutrient levels
- Nutrient problems are not limited to the urban portion of the County; regional monitoring data show nutrient enrichment and impacts such as increased macroalgal cover and/or lower dissolved oxygen in streams and estuaries in undeveloped regions
- The major point sources of nutrients have been controlled. Therefore, non-point and diffuse sources such as leaching from upland soils and intrusions from shallow groundwater are increasingly important
- Nutrients can be readily transported in and out of various reservoirs (e.g., sediments, groundwater) and undergo complex biological transformation and cycling. This makes traditional pollutant control strategies less effective for nutrients
- Nevertheless, BMP implementation in the Newport Bay Watershed has achieved notable long-term success in controlling nutrient inputs and reversing their impacts
- Improved management strategies may contribute to further progress, particularly in streams and channels, by accounting for site-specific conditions, promoting Low Impact Development, and accounting for broader regional sources

2.3.1: A Complex Regional Problem

Elevated levels of nutrients have become an increasing national and regional concern in recent years because of their impacts on lakes, streams, and estuaries. Nutrient enrichment leads to the overgrowth of algae in streams (**Figure 2.3.1**) and estuaries (**Figure 2.3.2**; see also **Section 2.3.5**) that can reduce dissolved oxygen, sometimes to the point of causing mortality to fish and other aquatic organisms. Dense algal mats can also cause aesthetic (visual and odor) impacts and impair beneficial uses such as boating and swimming. There is also concern that excessive nutrients in runoff has contributed to an increased incidence and severity of harmful algal blooms (HABs) and their toxic effects in the coastal ocean (**Figure 2.3.3**). For example, the Bight '08 Program found that anthropogenic nutrient inputs are co-located with algal bloom hotspots at subregional and seasonal / daily scales. Finally, nutrients are involved in geochemical processes that can amplify ocean acidification impacts in estuaries.

Figure 2.3.1: Nutrient enrichment causes overgrowth of algae in streams, particularly in warmer, low flow conditions. a) algal mats in a slow moving stream. Urban and natural watershed areas can supply excessive nutrients, so algal overgrowth and its secondary impacts (e.g., low dissolved oxygen) occur in both urban channels (b) and streams in undeveloped open space (c).

a

b

c

Figure 2.3.2: Estuarine eutrophication is a regional issue. Almost all estuarine segments in the Southern California Bight show some degradation on at least one of the three response indicators of eutrophication: macroalgal cover, phytoplankton, and dissolved oxygen concentration. Adapted from Bight '08 program data.

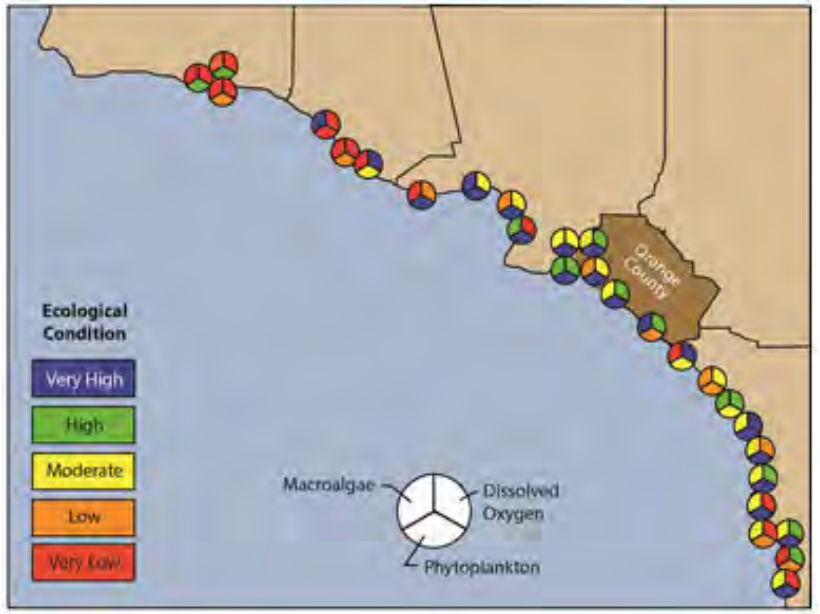
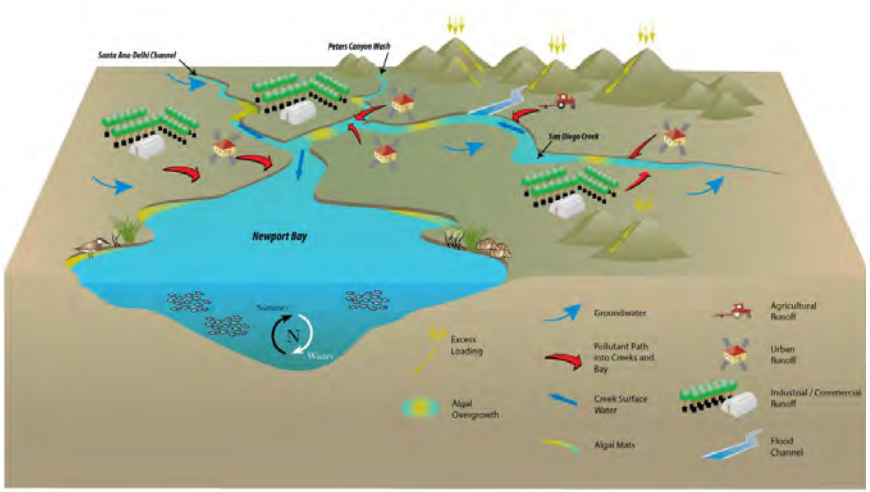


Figure 2.3.3: Bloom of the alga *Lingulodinium polyhedrum* in the coastal ocean off southern California. This alga can be toxic to marine organisms.

Unlike most other pollutants, nutrients are involved in complex biological transformation and cycling processes (**Figure 2.3.4**) and storage in a variety of reservoirs. This complicates nutrient assessment and management in two important ways. First, nutrient impacts can persist even after inputs have been reduced or ended because nutrients stored in sediments, groundwater, and plants can move in and out of these reservoirs on a range of time scales. For example, studies conducted by the Southern California Coastal Water Research Project and others have shown that nutrients cycle in and out of the sediments in Newport Bay on a seasonal basis and Fenn et al. (2010) showed that large portions of several vegetation types in California (e.g., chaparral, oak woodlands, coastal sage scrub, annual grassland) exceed the "critical load" for nitrogen deposition. Excess loading of nitrogen from aerial deposition can cause shifts in the plant community by, for example, changing conditions to favor invasive grasses and other nutrient sensitive species. Where loadings exceed the amount that can be assimilated by plants, rainfall can more easily wash excess nutrients out of soils and into streams.

The second way in which nutrients differ from most other pollutants is that complex bio- and geochemical dynamics can cause very different effects at different locations or times in response to the same nutrient concentration or load. As a result, there is no consistent functional relationship between the exceedance of a single, numeric regulatory standard for nitrogen or phosphorus and the presence or severity of impacts from nutrient overenrichment.

Figure 2.3.4: A graphical conceptual model of nutrient dynamics, using the Newport Bay watershed as a representative example. Nutrients derive from multiple sources, both natural and anthropogenic, spread across the watershed. Atmospheric deposition can exceed the carrying capacity of upland soils, leading to nutrient loading to streams during storm events. Nutrient loadings are higher in wet weather and they can be stored in and move through sediments, groundwater, and riparian and aquatic plants on different timescales. Because of these reservoirs, nutrients can require a lengthy period to move through the system and their impacts can continue long after inputs have been shut off.



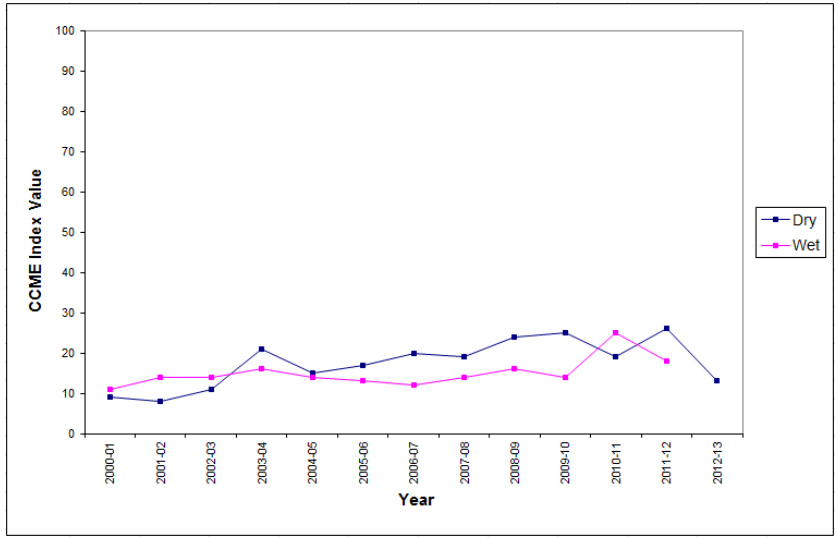
2.3.2: Nutrient Patterns in North County

The Program collects three types of data that help document the extent, severity, and changes over time in nutrient problems:

- Concentrations of nutrients and comparison of these data to commonly used thresholds (1 mg/l for total Nitrogen; 0.1 mg/l for total Phosphorus) that indicate likelihood of impacts
- The percent cover of algae, a measure of nutrient impacts on biological conditions in waterbodies
- Mass loads of nutrients at key mass emission stations

Figure 2.3.5 shows that nutrients (total nitrogen and total phosphorus) commonly exceed thresholds in channels and that a frequency-based water quality index widely used in a number of monitoring and assessment programs has improved only slightly since 2000. While conditions are slightly better in dry weather in most years, index values are consistently low (i.e., poor condition) in all years in both dry and wet weather.

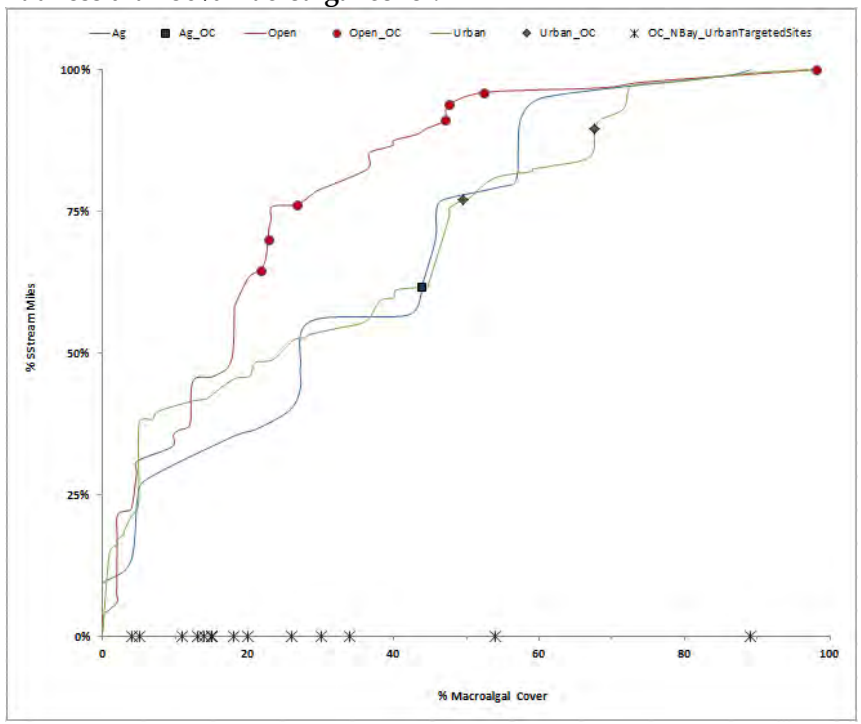
Figure 2.3.5: An overall index of the extent to which total nitrogen and total phosphorus meet thresholds in channels is low (which means poor conditions) and has increased (i.e., improved) only slightly since 2000. The index integrates the number of indicators and the percentage of samples higher than thresholds in each year, and the average magnitude of such excursions (CCME 2001). It provides a score, scaled from 0 – 100, that can readily be tracked over time.



However, this is not strictly an urban problem (see **Figures 2.3.1c and 2.3.4**). The Stormwater Monitoring Coalition (SMC) has for the past five years collected data from sites across southern California in urban, agricultural, and open (undeveloped) natural areas. The locations of SMC sites are selected randomly each year so that they can provide a statistically valid picture of regional conditions, which forms a valuable context for interpreting data from north County. **Figure 2.3.6** shows that targeted monitoring sites in channels in north County clustered in the lower end of the distribution (less than about 30% macroalgal cover) for the urban landuse. In other words, about half of the stream miles in southern California in the urban land use had a greater degree of macroalgal cover than did sites in north County channels. **Figure 2.3.6** also shows about half of the stream miles in southern California in the open (undeveloped) landuse had up to 20% macroalgal cover. Thus, while macroalgal cover is greater in the urban landuse, this problem also occurs in undeveloped streams in the region.

Figure 2.3.5 shows that elevated nutrient levels are pervasive in north County channels but **Figure 2.3.6** documents that the primary nutrient impact monitored in these channels, percent macroalgal cover, is at the lower end of the cumulative frequency distribution for the urban landuse in the region. Thus, nuisance algal growth is not always evident in streams when nutrients are above thresholds, which reflects the lack of a one-to-one correspondence between nutrient levels and impacts such as macroalgal cover and dissolved oxygen. Recognition of this issue is at the heart of the State Water Resources Control Board's attempt to develop a new approach to setting nutrient thresholds (see New Management Approaches below).

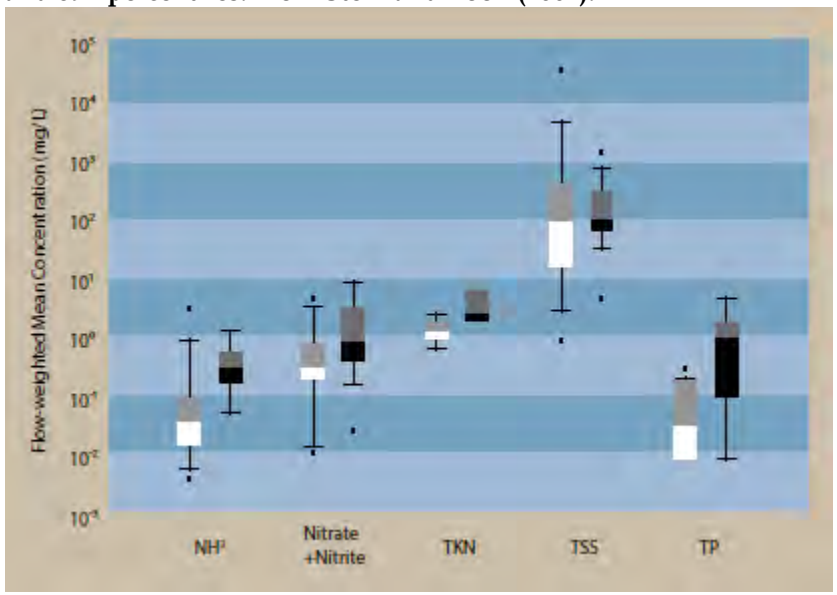
Figure 2.3.6: The cumulative frequency distribution function of macroalgal cover in the three landuse types sampled by the Stormwater Monitoring Coalition's (SMC) regional program. Fifty percent of the stream miles in the open landuse had about 20% or less macroalgal cover, while about 50% of the stream miles in the urban landuse had about 30% or less macroalgal cover. The majority of the County's targeted sites (situated along the X axis) had less than 30% macroalgal cover.



2.3.3 Nutrient Sources

As with many pollutants, the focus on sources of nutrient inputs has gradually shifted from distinct point sources to more widespread and diffuse sources as point sources have been identified, targeted for management action, and removed or reduced (see **Section 2.3.5** for examples). In addition, the percentage of north County devoted to agriculture continues to decline, with consequent reductions in fertilizer use and runoff and loading from this activity. Natural areas such as chaparral, oak woodlands, coastal sage scrub, and annual grassland can also be important sources of nutrient loading, particularly in wet weather. These areas have accumulated excess nutrients from aerial deposition (e.g., nitrogen oxides in smog) which can leach from soils during rain events. **Figure 2.3.7** shows that concentrations of nutrients in wet weather runoff from undeveloped open space are similar to those in runoff from urban sites. As a result, a narrow focus on urban sources of nutrients will miss an important category of inputs.

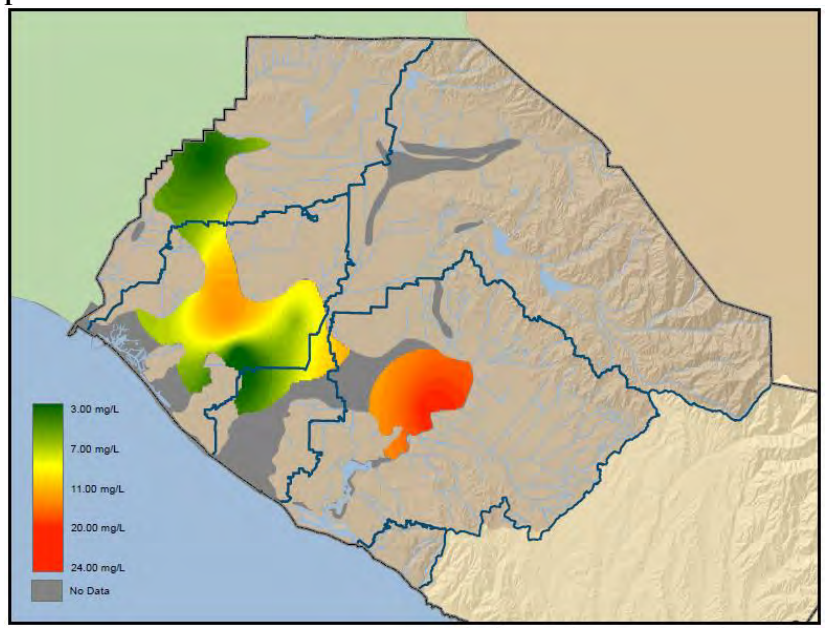
Figure 2.3.7: Wet weather flow-weighted mean concentrations of several forms of nutrients at urban (shaded boxes) and undeveloped open space (clear boxes) sites, as measured in the SCCWRP Natural Loadings Study. These data document that natural areas are sources of nutrients at concentrations that are similar in some cases to those in runoff from urban sites. Boxes indicate the 25th and 75th percentiles and error bars indicate the 10th and 89th percentiles. From Stein and Yoon (2007).



Similarly, a concentration on surface water will miss widespread inputs from groundwater with elevated nitrate concentrations. Groundwater moves to the surface in a variety of ways, by seeping through the bottoms of creeks and the walls of stormdrains and flood control channels, the dewatering of construction sites, and infiltration into basements and low-lying areas such as roadway underpasses. Once it reaches the surface, groundwater moves through the existing network of creeks, stormdrains, and flood control channels. As a result of this infiltration, some proportion of the surface water that had routinely been considered urban runoff actually originated from groundwater.

This transport route is active because groundwater in much of the western part of North County is extremely shallow, often as little as two or three feet from the surface. **Figure 2.3.8** illustrates the extent of the known shallow groundwater layer in the northern portion of the County, large areas of which have nutrient levels that are substantially above regulatory thresholds for surface water. Nitrogen in these groundwater layers stems from past agricultural practices as well as natural sources related to historical wetlands and swamps. The collaborative Nitrogen and Selenium Management Program (NSMP) in the Newport Bay watershed has developed an extensive set of studies and management alternatives addressing groundwater sources (http://www.ocnsmp.com/).

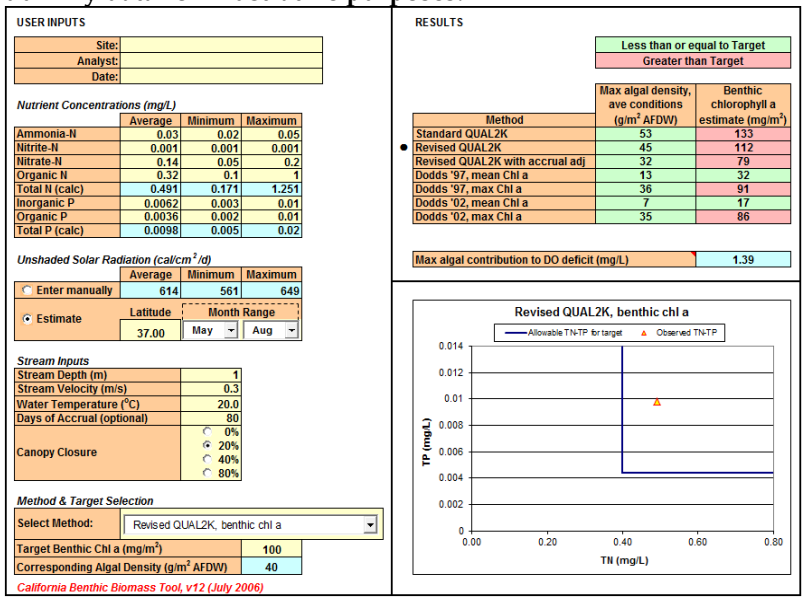
Figure 2.3.8: Extent of shallow groundwater basins in the northern portion of the County, with nitrate levels delineated where data are available. Elevated nitrate from both natural and anthropogenic sources is present in groundwater across a large portion of the urbanized area.



2.3.4 New Management Approaches

Improved knowledge about the lack of a tight correlation between nutrient levels and nutrient impacts, and about the importance of diffuse sources in open areas and in groundwater, has prompted the development of new management approaches at both the statewide and regional / local levels that more accurately measure and address the risk of impairment. For example, the State Water Resources Control Board's Nutrient Numeric Endpoint (NNE) project is developing methods (**Figure 2.3.9**) to derive a maximum allowable nutrient concentration in a particular stream reach, reservoir, or estuary based on local factors such as temperature, irradiance, and flow. The NNE's goal is to ensure that the key ecological indicators of macroalgae and dissolved oxygen remain within acceptable bounds.

Figure 2.3.9: The main user interface for the current version of the freshwater Nutrient Numeric Endpoint (NNE) biomass estimation spreadsheet tool. In this example, data fields are loaded with dummy data for illustrative purposes.



2.3.5 Newport Bay Success Story

Newport Bay presents an illustrative story of increasing nutrient impacts, source identification and control, and significant progress toward meeting regulatory targets and

restoring beneficial uses. Beginning in the mid 1980s, large mats of green algae developed in both the Lower and Upper Bay, primarily in the summer, and became extensive enough to restrict recreation, entangle boat propellers, and affect aesthetics. Portions of the Bay began to resemble mini versions of the Sargasso Sea (**Figure 2.3.10**). During the peak bloom, from the winter of 1985 through the summer of 1986, decomposing algae dramatically reduced dissolved oxygen, resulting in a visible fish kill. Waters in the Upper Bay were discolored and popular beaches at Lido Isle and the Newport Dunes were fouled with mats of algae. Experience from other estuaries worldwide suggested that excessive algal growth and the accompanying depressions in dissolved oxygen could be due to increased nutrient loads from developed watersheds.

Figure 2.3.10: Algal mats in Upper Newport Bay in 1987.

Directed studies began in earnest in the 1990s and annual surveys of algal biomass showed algae was spread throughout the Upper Bay, consisting predominantly of species of *Ulva* and *Enteromorpha* termed "nuisance" algae because of their ready response to nutrient enrichment. While nutrient enrichment was high on the list of likely causes, its magnitude and specific sources were only generally known. Studies in the early 1970s of discharges to San Diego Creek, the main source of water for the Upper Bay, had identified commercial nurseries as a potentially large source of nutrients. A series of studies beginning in 1986 eventually confirmed that commercial nurseries, with their use of large amounts of irrigation water and fertilizer that were discharged to the flood control system, were the largest source of nutrient loads.

As management actions began to reduce nutrient discharges from the commercial nurseries in the late 1990s, new source identification studies looked more closely at the role of groundwater which in many places is only two or three feet from the surface. A significant portion of the watershed was until the early 1900s a large swamp (the Swamp of the Frogs) that was then converted to agriculture. Much of the agricultural runoff collected in the area of the historic swamp and infiltrated into groundwater. When the area of the historic swamp was connected to Upper Newport Bay via a number of flood control channels constructed from 1963 to 1967, this for the first time provided a direct connection for both surface water (including discharges from the nurseries) and groundwater to reach the Bay. The groundwater in this area remains an important source of nutrients (**Figure 2.3.8**) and moves into surface water as described in Nutrient Sources.

At the same time that source identification studies were identifying the large commercial nurseries and groundwater as important sources of nutrients, research conducted by the Southern California Coastal Water Research Project and others began to improve our understanding of how excess nutrients promoted algal growth.

These studies found that:

- Freshwater inputs from the watershed, mostly from San Diego Creek, were the primary source of nutrients
- Algae that are depleted in nutrients can take up nutrients from the water at a higher rate
- Algae can store nutrients in their tissues for up to 28 days
- Sediments in both San Diego Creek and Newport Bay can store nutrients and release them later when water column concentrations are low
- Because of these storage reservoirs, there is little direct correlation between the amount of algal biomass and the levels of nutrients in the water column

This research suggested that management efforts should focus on the loads, or total amount, of nutrients being input to the system and should take account of the complex cycling of nutrients among water, sediments, and algal tissues. This understanding informed a series of management actions including:

- Construction of Natural Treatment System wetlands, including San Joaquin Marsh
- Water conservation efforts including a tiered rate structure
- Implementation of the Permittees' Drainage Area Management Plan
- Landuse conversion from agriculture to other landuses

As a result of these management actions, loads of total nitrogen have declined dramatically (**Figure 2.3.11**) as has mean algal cover in key target areas (**Figure 2.3.12**).

Figure 2.3.11: Historical trends in the daily load of total nitrogen to Upper Newport Bay. Historical data before 2007 is dry weather only; data from 2007 – 2012 includes both wet and dry weather conditions. Average daily load has dropped dramatically and is now consistently below targets. The regression line is significant at $p < 0.001$.

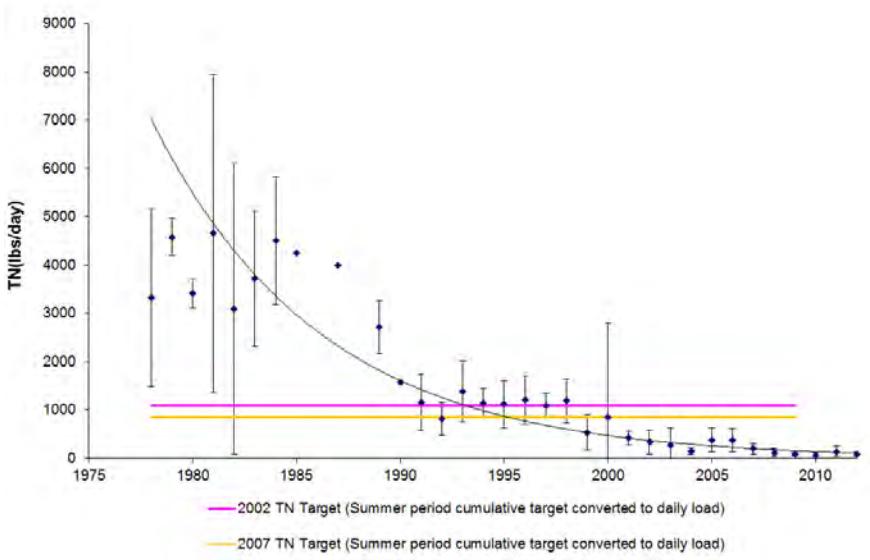
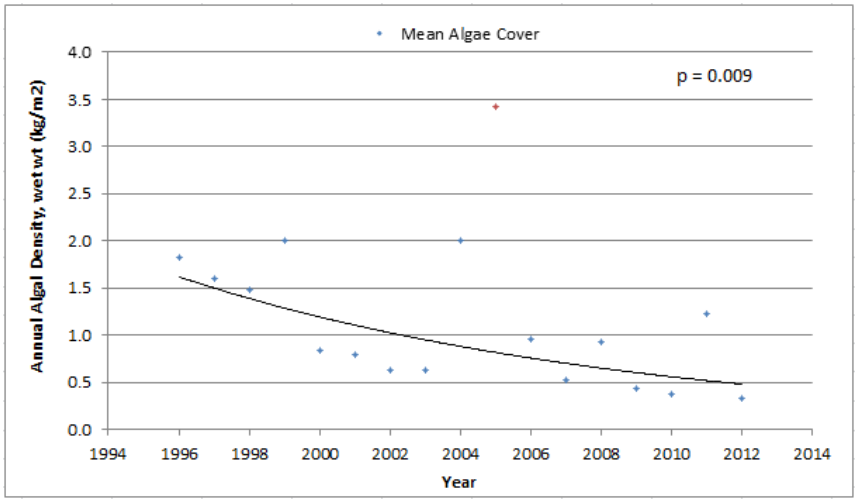


Figure 2.3.12: Trend in mean annual algal density at monitoring stations in Newport Bay. The Y axis is on a log scale. The regression line is significant at the p = 0.009 level and the extremely high value for 2005 (red dot) was treated as an outlier in the regression. The winter of 2004 – 2005 saw extremely high rainfall of over 30 inches recorded in Santa Ana.



2.3.6 Recommendations

Past progress in identifying and controlling sources of contamination, the availability of a long time series of monitoring data, and the development of new monitoring and assessment tools provide the basis for this review of existing nutrient monitoring programs with the goal of improving their utility and efficiency. The following recommendations stem from a data-driven, risk prioritization approach that views monitoring, assessment, research, and management actions as a portfolio of related actions.

1. Conduct an assessment of sources and practices that input to the MS4 to assess the significance of each to downstream problems
2. Improve understanding of groundwater / surface water interactions, perhaps through participation in a regional study to track groundwater inputs to surface water
3. Continue identifying opportunities to reduce and prevent flows in dry weather (e.g., **Figure 2.3.13**)
4. Pilot a regional mass balance nutrient model, even if crude, to help prioritize monitoring and management attention; the Newport Bay watershed and SCCWRP coastal ocean nutrient mass balance models provide useful examples
5. Use available time series of data to streamline monitoring to improve its statistical and economic efficiency. Sampling effort could be reduced by identifying stations that essentially mimic each other (as illustrated for bacteria in **Figure 2.2.11**) and/or by reducing the frequency of sampling, especially in Newport Bay now that key targets are regularly being met. Monitoring could shift to a sentinel program with a lower frequency of monitoring intended to ensure conditions do not worsen

Figure 2.3.13: The San Diego Creek channel before (a) and after (b) diversion of dry weather flow for water conservation, resulting in a dramatic reduction in nuisance algal overgrowth.

a b

2.4 Toxicity

The Story: Toxicity

- Toxicity in freshwater channels in all conditions (aquatic, sediment, wet and dry weather) occurs at low levels and is sporadic, occurring at different locations at different times and varying unpredictably across test species
- Aquatic toxicity in dry weather occurs in open (undeveloped) areas at levels equivalent to those in urban areas; suggesting that dry weather toxicity is not driven predominantly by urban pollutants
- There are no apparent trends in toxicity over time
- Metals, except for some instances of elevated copper, are at low levels and do not appear to contribute to aquatic toxicity in freshwater
- The primary source of toxicity appears to be pesticides, with evidence that pyrethroids contribute to sediment toxicity
- Use of organophosphate pesticides has declined virtually to zero but use of pyrethroid pesticides has increased and exceedances of thresholds for pyrethroid pesticides are high
- Reported pesticide use in the County has declined from just over 2 million pounds a year in 1998 to just under 1 million pounds in 2011, due primarily to reduced use of indoor fumigants
- There is a large data gap in our knowledge of retail pesticide sales and use
- Pesticide use (which is regulated directly at the federal and state levels) presents a moving target for management because of the continued introduction of new products; the most effective management strategies are to continue to reduce dry weather runoff and flows and support education and outreach efforts to reduce pesticide use and runoff
- Sediment toxicity in Newport Bay declined dramatically after the recent (2006 – 2010) dredging event

2.4.1 Low but Puzzling Patterns in Toxicity

Since the publication of Rachel Carson's Silent Spring in 1962, concerns about the potentially destructive impacts of chemicals released into the environment have expanded, supported by an increasingly sophisticated understanding of their impacts and modes of action. Environmental monitoring now provides a range of tools, including sensitive sampling for specific chemicals at very low levels and toxicity tests (**Figure 2.4.1**) that integrate the effects on organisms of multiple chemicals in ambient water and sediments. These tools can indicate the potential for toxic effects before they become major events and provide the means for tracking and managing the distribution and impacts of anthropogenic chemicals.

Figure 2.4.1: The water flea *Ceriodaphnia* which is commonly used as a laboratory test organism in both acute and chronic aquatic toxicity tests.

The Program's monitoring efforts to assess aquatic ecosystem health include a range of toxicity tests (**Table 2.4.1**) including aquatic tests in both dry and wet weather as well as toxicity tests on sediment collected from streams and channels. These tests use a variety of test species sensitive to different types of chemicals and assess both acute (i.e., survival / death) and chronic (i.e., reproduction / growth) endpoints to document a range of potential toxic effects. **Table 2.4.1** summarizes the results of 3,497 separate toxicity tests performed since 2005. The overall level of toxicity is low but is highest in wet weather. Winter storms wash accumulated contaminants off land surfaces and the first flush of storms is known to have higher levels of contamination. In addition, some contaminants, particularly synthetic pyrethroids, bind to sediments where, depending on their solubility, they may be a primary cause of aquatic and/or sediment toxicity in urban streams (Holmes et al. 2008). However, the occurrence of toxicity is highly variable, shifting from site to site at different sampling times; a careful examination of the Program's data shows no consistent spatial patterns or trends over time. The relatively low level of toxicity, combined with the fact it appears sporadically, makes it difficult to control.

Table 2.4.1: Summary of the Program's toxicity testing in north County since 2005, an effort that includes 3,497 tests on multiple species from a range of times, locations, and conditions. The summary includes results of both acute and chronic toxicity tests.

	Dry Weather		Wet Weather		Sediment	
Test species	**Toxic**	**Nontoxic**	**Toxic**	**Nontoxic**	**Toxic**	**Nontoxic**
Mysidopsis bahia	16%	84%	29%	71%		
Strongylocentrotus purpuratus	13%	87%	21%	79%		
Ceriodaphnia dubia	18%	82%	21%	79%		
Pimephales promelas	7%	93%	14%	86%		
Hyalella azteca	11%	89%			18%	82%
Eohaustorius estuarius					26%	74%
Mytilus gallaprovincialis					10%	90%
Overall	15%	85%	25%	75%	22%	78%

The Program also has the benefit of comparing data from its sites in north County to a collection of sites from across southern California sampled by the regional Stormwater Monitoring Coalition (SMC). The locations of SMC sites are selected randomly each year so that they can provide a statistically valid picture of regional background conditions, which forms a valuable context for interpreting data from north County.

A summary of the past five years of SMC aquatic toxicity testing data (**Table 2.4.2**) shows puzzling patterns. Acute toxicity (i.e., mortality) occurs in only a small fraction of stream miles in both open and urban landuses. In contrast, chronic toxicity (i.e., reduced reproduction) is more prevalent in the open landuse than the urban landuse. There is chronic toxicity present in the urban landuse, but in a much smaller portion of stream miles than in undeveloped open space. These results suggest that there are sources of toxicity that are more widely spread throughout the region and may not necessarily be directly associated with urban runoff. Speculation has focused on aerial deposition of airborne contaminants or natural factors such as high conductivity or turbidity. For example, a special study conducted by the Program in the Oso Creek watershed found that high levels of dissolved solids, which can be toxic to aquatic species, derived from natural geologic formations and had increased in recent decades as development patterns caused the groundwater table to rise. However, no regionwide followup studies on the SMC's findings have to date been planned or conducted.

Table 2.4.2: Summary of aquatic toxicity results from the past five years of Stormwater Monitoring Coalition (SMC) samples from random sites across the southern California region. Sites were located in both open (i.e., undeveloped) and urban landuse types. The large majority of stream miles were nontoxic for acute toxicity (i.e., survival) in both landuse categories, with an equivalent amount of sporadic background toxicity in both open and urban landuses. The majority of stream miles were toxic for chronic toxicity (i.e., reproduction) in the open landuse, a strikingly different pattern than seen in the urban landuse.

	% Stream Miles	
	Open	Urban
Ceriodaphnia survival		
Toxic (< 80% survival)	2.1	2.4
Nontoxic (> 80% survival)	97.9	97.6
Ceriodaphnia reproduction		
Toxic (> 20% reduction in biomass)	63.0	37.4
Nontoxic (< 20% reduction in biomass)	37.0	62.6

2.4.2 Metals not a Source of Toxicity

Toxicity is a useful indicator of ecological impacts but toxicity test results by themselves do not identify the specific pollutants or other stressors responsible for toxicity. Instead they can indicate the general category of pollutants, such as metals or organic pesticides, contributing to toxicity. The Program therefore combines three complementary lines of evidence to attempt to isolate the cause(s) of toxicity:

- Correlation between toxicity test results and chemical concentrations in the waters and sediments collected for toxicity tests

- Comparison of these chemical concentrations to regulatory standards in the California Toxics Rule (CTR) which are based on laboratory studies of test organisms' sensitivity to specific chemicals
- More detailed analyses of ambient water and sediments, called Toxicity Investigation Evaluations (TIEs), that sequentially remove classes of chemicals to determine whether toxicity drops in concert

Unfortunately, these studies have not succeeded in clearly identifying the sources of toxicity in the County's streams and channels. The sporadic nature of the toxicity signal makes it difficult to follow up on, correlations are inconsistent, and TIE methods have technical limitations that make their results less specific than desired. However, these methods have succeeded in ruling out metals as a source of toxicity (**Figures 2.4.2a and 2.4.2b**) and suggesting that the observed persistent toxicity patterns in the test species evaluated in urban streams and channels is due to organic compounds, likely pesticides.

Exceedances of CTR standards for metals are consistently low in both dry and wet weather (**Figures 2.4.2a and 2.4.2b**) and there is no apparent trend over time. While copper accounts for over 90% of these limited exceedances, it is not correlated with the occurrence of toxicity in streams and channels and has not been identified as a cause of freshwater toxicity in TIEs. This conclusion matches findings from the SMC's regional program (see **Table 2.4.2**), a regional study of loadings from natural areas (**Figure 2.4.3**), as well as from watershed monitoring programs in the San Gabriel and Los Angeles Rivers watersheds. While copper is a concern in harbors, the 2002 TMDL for Toxic Pollutants in San Diego Creek and Newport Bay estimated that antifouling paint on boat hulls represents nearly 90% of the loading of copper to the Bay. In addition, a Bight '08 study of discharges to Areas of Special Biological Significance (ASBS) (Schiff et al. 2011) found no significant differences between post storm metals concentrations at ASBS discharge sites and at reference drainages. There was some evidence for a slight increase in copper at ASBS discharge sites but this may be due to particular coastal sources such as harbors and coastal developments with copper architectural features (see **Section 2.4.3**)

Figure 2.4.2a: An overall index of the extent to which metals meet regulatory standards in channels and embayments is high (meaning few exceedances) and has remained steady since 2000, in all samples for dry weather. This index accounts for the number of metals that exceed standards in each year, the percentage of individual samples that exceed standards, and the average magnitude of any such exceedances (CCME 2001). It provides a score, scaled from 0 – 100, that can be tracked over time.

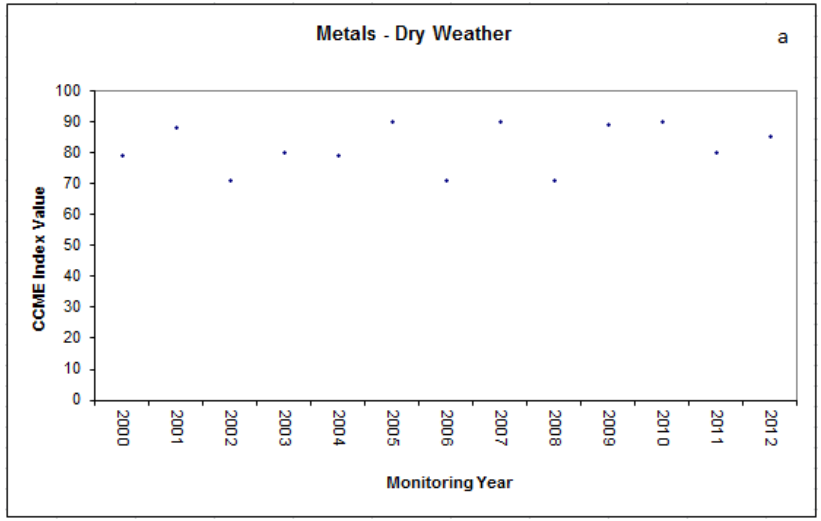


Figure 2.4.2b: An overall index of the extent to which metals meet regulatory standards in channels and embayments is high (meaning few exceedances) and has remained steady since 2000, in all samples for wet weather. This index accounts for the number of metals that exceed standards in each year, the percentage of individual samples that exceed standards, and the average magnitude of any such exceedances (CCME 2001). It provides a score, scaled from 0 – 100, that can be tracked over time.

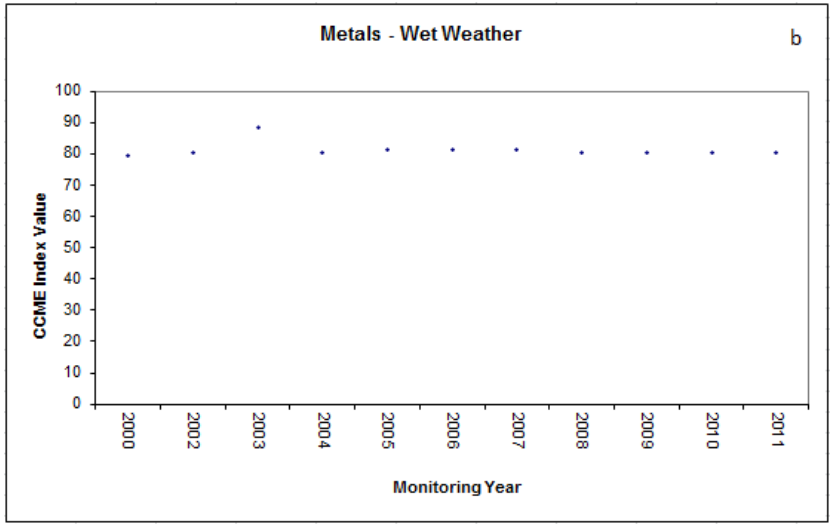
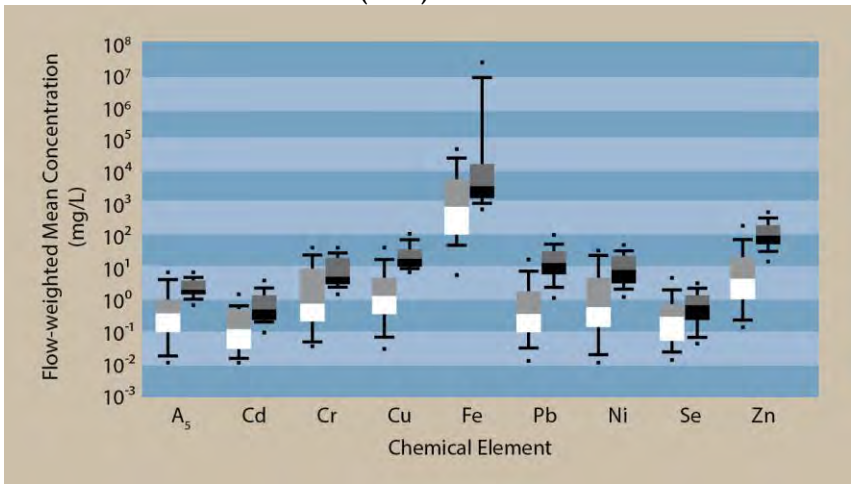


Figure 2.4.3: Wet weather flow-weighted mean concentrations of metals at urban (shaded boxes) and undeveloped open space (clear boxes) sites, as measured in the regional study of runoff characteristics from natural drainages. These data document that natural areas are sources of metals, although concentrations in runoff from natural drainages are somewhat lower than those at urban sites. Boxes indicate the 25th and 75th percentiles and error bars indicate the 10th and 89th percentiles. Dots represent extreme values. From Stein and Yoon (2007).



2.4.3 A Localized Source of Copper

A history of persistent exceedances of regulatory thresholds for copper in the Irvine Cove community triggered a detailed, two-year special study to identify and prioritize sources of copper for future source control efforts. This cooperative effort between the County and the City of Laguna Beach included additional sampling of stormwater runoff at multiple locations along with field reconnaissance to identify potential sources of copper. This information helped focus targeted sampling at specific potential sources to rule them in or out and characterize their contribution to copper levels in runoff. The study showed that copper was concentrated in runoff from Irvine Cove below the Pacific Coast Highway, a spatial pattern that ruled out brake pad dust as a major source. Further reconnaissance focused attention on residential architectural copper uses such as roofs, rain gutters, and flashing (**Figure 2.4.4**). Sampling during a storm event of runoff from homes with and without architectural copper features showed that the average level of copper in runoff from homes with copper features was nearly ten times higher than copper in runoff from homes without copper, and nearly six times the regulatory action level. Maximum levels of copper were more than 1000 times higher. Metals such as copper and zinc (used in rain gutters and corrugated roofing) are readily mobilized by rainfall and runoff and architectural uses are thus an important source of these metals to receiving waters. This information is useful in ruling out other sources and highlights the difficulty of controlling all sources of contaminants from urbanized watersheds.

Figure 2.4.4: Aerial photograph of a portion of the Irvine Cove drainage area identifying various types of structural architectural copper uses.

2.4.4 Trends in Pesticide Use

While pesticides have been implicated as a cause of both aquatic and sediment toxicity (TIEs typically found organic compounds as the source of toxicity), it has been extremely difficult to confirm their role largely because of technical challenges associated with TIEs. There are hundreds of pesticides in current use, neither certified laboratory methods nor toxic thresholds exist for many of these, and legacy pesticides such as DDT are still present in the environment. In addition, the population of pesticides in use changes continually over time in response to new regulatory requirements and increasing knowledge of their targets' physiology (**Figure 2.4.5**). Organochlorine pesticides (e.g., DDT, chlordane) were banned and replaced by organophosphate pesticides (e.g., diazinon and chlorpyrifos), whose use was tightly restricted and were in turn replaced by the synthetic pyrethroids (e.g., permethrin). Most recently, policies have tightened the use of pyrethroids, opening a door for increased use of fipronil. Newer pesticides are often toxic at much lower levels than older pesticides (e.g., pyrethroids exhibit toxic effects at the parts per trillion level), requiring the development of increasingly sensitive methods with lower detection limits. This illustrates a core problem in pesticide monitoring, assessment, and management – the ever-changing cast of characters that pose a constant challenge to monitoring methods and the understanding of toxic processes.

Figure 2.4.5: Trends in the use of the two most widely used organophosphate pesticides, diazinon and chlorpyrifos, and permethrin, the most widely used of the newer synthetic pyrethroids. The organophosphates have virtually disappeared from the County after their residential use was banned by the USEPA, in 2001 for chlorpyrifos and 2004 for diazinon. Trends for all three pesticides are significant at the $p < 0.001$ level.

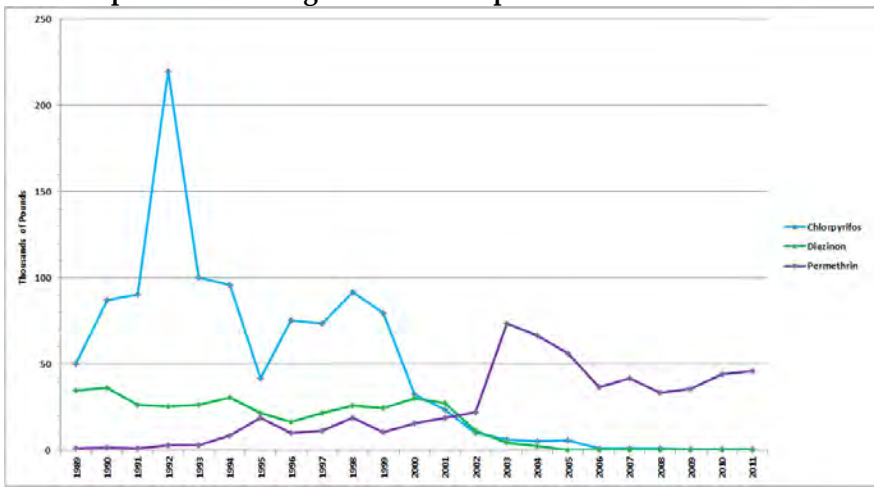


Figure 2.4.5 shows that the use of organophosphate pesticides (chlorpyrifos and diazinon) has declined substantially since the early 1990s, even before their use in residential applications was banned in 2001 and 2004, respectively. Available data from the Program's monitoring efforts shows (**Figure 2.4.6**) that, as a result, the exceedance index for organophosphate pesticides has increased (i.e., improved conditions) significantly in dry weather. While the exceedance index in wet weather is also high, it has not improved, suggesting that there may be reservoirs of these pesticides still present. Because agricultural uses must be reported and the reported use of these pesticides has declined to virtually zero (**Figure 2.4.5**), it is unlikely that still-permitted uses are the source of the remaining wet weather exceedances. In contrast, the exceedance index for pyrethroid pesticides is quite low (i.e., poor conditions) (**Figure 2.4.7**), reflecting their increased use.

Figure 2.4.6: Trends over time in the exceedance index for organophosphate pesticides. Higher values of the index indicate better conditions (see Figure 2.3.5 for explanation of the index). The trend of improved conditions for organophosphate pesticides in dry weather is significant at the $p < 0.001$ level; trends for the other plots are not statistically different from zero. While there are remaining exceedances for organophosphate pesticides in wet weather, these occur to a much lower degree than for pyrethroid pesticides, i.e., the exceedance index for pyrethroid pesticides in wet weather is much lower (Figure 2.4.7).

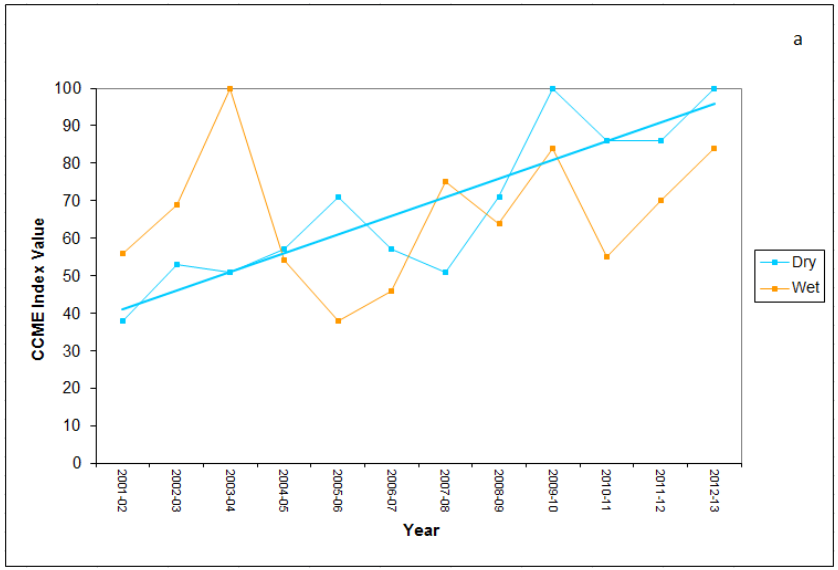
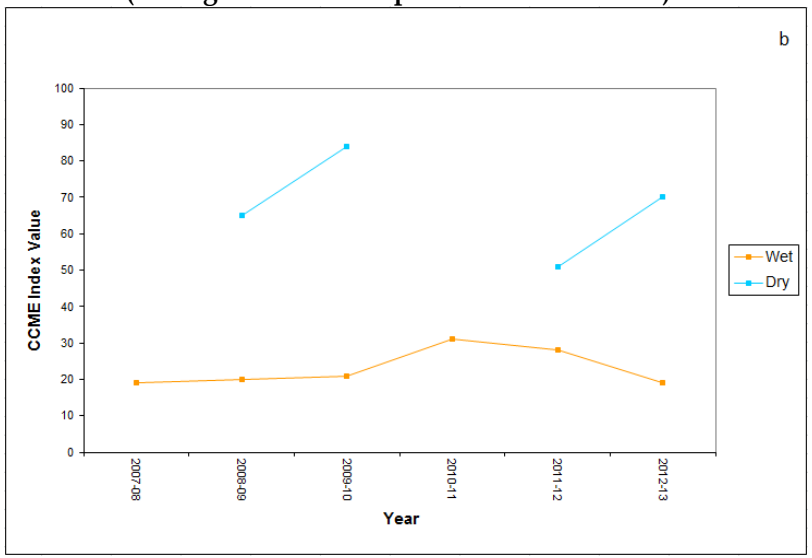
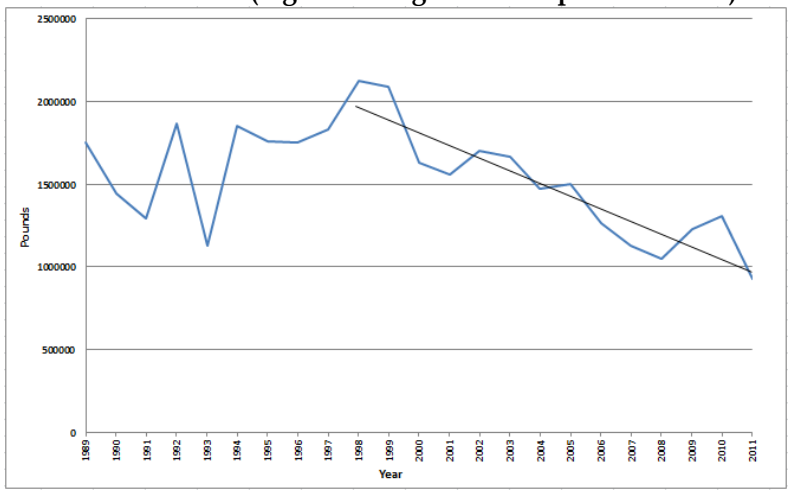


Figure 2.4.7: Trends over time in the exceedance index for pyrethroid pesticides. Higher values of the index indicate better conditions (see Figure 2.3.5 for explanation of the index).



Despite the challenges of assessing pesticides' impacts in waterbodies, we do know that total reported pesticide use in Orange County has declined dramatically since 1998 (**Figure 2.4.8**). Inspection of detailed annual reports on the California Department of Pesticide Regulation's (CDPR) website shows this is due to declines in the use of glyphosate (i.e., Roundup) and a set of indoor fumigants used, for example, in termite treatment of homes and other structures. Glyphosate is an herbicide that is applied in the environment and there are some concerns about its potential water quality impacts. Indoor fumigants, in contrast, are not applied outdoors, degrade relatively quickly, and vent to the atmosphere. Because it has extended over nearly 15 years, this decline is likely due to a combination of causes, including changes in the real estate market (fumigation is required as a condition of sale), growing concern about health effects of toxic compounds, the greater use of spot applications of pesticides, and the increased availability of alternative non-pesticide treatments for indoor and structural pests.

Figure 2.4.8: Total reported pesticide use in Orange County, drawn from the California Department of Pesticide Regulation's website (www.cdpr.ca.gov). The amount applied annually has declined by over 50% since 1998 (regression significant at $p < 0.001$ level).



The CDPR data show that large declines in pesticide use are possible, and provide promise that continued education and improved policy can contribute to environmental improvement. However, the chemicals that contributed most to the decline shown in **Figure 2.4.8** are not those (e.g., pyrethroids, fipronil) most often implicated in environmental toxicity. Further examination of the CDPR database would be needed to determine whether the aggregate amount of reported environmentally toxic pesticide applications has also

declined in recent years. More importantly, there is a large and significant data gap related to retail purchases at hardware, gardening, and home improvement stores. Sales at these outlets are not reported to the CDPR and methods to reliably capture these data have not yet been developed.

Continued efforts to expand the scope of pesticide sales / use reporting and to improve education on proper application and the use of effective alternatives (e.g., botanical oils) could reduce the loading of pesticides to the County's water bodies. For example, CDPR has developed new regulations for pyrethroid application that should substantially reduce pyrethroids in urban runoff. Such efforts will be amplified by the continuing focus on water conservation to reduce dry weather runoff (e.g., through Low Impact Development practices) and on reducing overuse to minimize or prevent toxicity in wet weather runoff, which are the two delivery pathways for moving pesticides from the landscape to water bodies.

2.4.5 Sediment Dynamics and Toxicity in Newport Bay

In general, bays, harbors, and estuaries capture and retain sediments and the pollutants attached to them. Historically, the management of Newport Bay and its tributaries has focused on maintaining (e.g., through dredging) the Bay's ability to transport storm runoff from the watershed and to support navigation. Concerns about sediment contamination and its effects on the Bay's food chains and human uses of these resources date only to the 1990s and increased as monitoring documented persistently high sediment toxicity in Newport Bay. While sediment TIEs and other studies have not precisely identified the source(s) of this toxicity, there is broad scientific agreement that it is not due to organochlorine pesticides (OCs) or to metals. Evidence from Bight Program and other studies instead points to organic compounds such as current use pesticides.

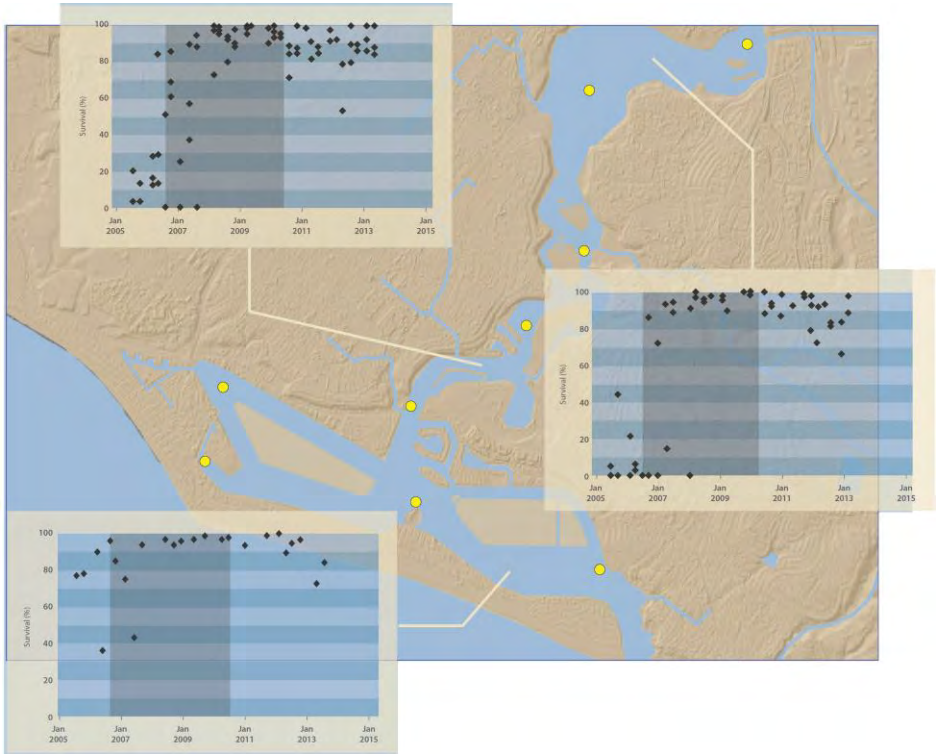
Pollutants enter the Bay in two forms: dissolved in the water column and attached to sediment particles. Dissolved pollutants generally move through the Bay to the ocean as a result of tidal flushing action. Sediments enter the bay primarily through storm flows delivered via tributaries such as San Diego Creek and Santa Ana Delhi Channel (**Figure 2.4.9**). Pollutants attached to larger, heavier sediment particles are transported along the bottom in the "bed load" and can therefore have longer residence times, particularly in the more enclosed portions of the Bay. Smaller particles can remain suspended in the water column for varying amounts of time and can settle out of the water column rather than being flushed out of the Bay, depending on their size and the Bay's flushing rate.

The Program's time series of monitoring data collected in the Bay shows that sediment toxicity, as measured by the *Eohaustorius* survival / mortality test, dropped dramatically (i.e., survival increased) after the beginning of dredging in Upper Newport Bay around 2006 (**Figure 2.4.10**). In the dredged areas, this was due to the removal of contaminated sediment. However, toxicity also dropped in the middle part of the Bay. This area was disturbed during dredging activities by the passage of barges that resuspended sediment and made it more susceptible to mobilization and transport out of the Bay. In addition, dredging in the upper Bay reduced the transport of contaminants to the middle part of the Bay. Because these processes required a longer period of time to

affect sediments, toxicity in the middle Bay dropped more slowly than in the dredged areas. **Figure 2.4.10** also shows that areas in the lower Bay that were not affected by dredging showed no clear response to the dredging activity. Continued monitoring will be required to determine whether toxicity begins to increase again once the effects of the dredging dissipate and new sediments enter the Bay.

Figure 2.4.9: Aerial photograph of a large stormwater runoff plume in Newport Bay on March 29, 2006. Storm flows transport the vast majority of sediment into the Bay in large intermittent pulses such as these.

Figure 2.4.10: Trends in toxicity test results in the *Eohaustorius* survival test over the time period that spans the recent dredging activities in Upper Newport Bay. Survival improved significantly in the dredged areas as well as the areas in the middle Bay disturbed during dredging activities.



2.4.6 Recommendations

Past progress in identifying and controlling sources of contamination, the availability of a long time series of monitoring data, and the development of new monitoring and assessment tools provide the basis for this review of existing

toxicity monitoring programs with the goal of improving their utility and efficiency. The following recommendations stem from a data-driven, risk prioritization approach that views monitoring, assessment, research, and management actions as a portfolio of related actions.

1. Reassess management concerns and priorities (e.g., TMDLS) about metals impacts in freshwater channels, bays and estuaries, and the nearshore coastal zone
2. To the extent that metals, particularly copper, remain a concern because of potential impacts in bays and harbors, and perhaps the nearshore, recognize that inputs from antifouling paint, which are not an urban runoff issue, are likely a more important source than watershed input
3. Improve information on the use of pesticides in the County, particularly by the largest applicators
4. Work with other interested parties to fill the data gap related to retail sales of pesticides
5. Examine the CDPR database to develop a more thorough picture of trends in reported pesticide use
6. Use this information to expand and focus cooperative outreach efforts about proper pesticide application and the use of alternatives such as botanical oils that are effective, but nonlethal, insect deterrents
7. Use available data to streamline monitoring and improve its statistical and economic efficiency. Consider reducing the current focus on metals monitoring and targeting pesticide monitoring on less expensive representative constituents or surrogates. Consider reducing the frequency of sampling for sediment associated constituents to the Bight Program sampling frequency
8. Given the reduction in toxicity in Newport Bay, consider increasing the use of adaptive responses (e.g., TIEs and other investigations) in place of intensive routine monitoring
9. Continue taking advantage of opportunities to reduce dry weather runoff to channels

2.5 References and Photo Credits

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Photo Credits

Figure 2.2.1	Upper: http://www.ascon-hb.com/images/oil_derricks_early_huntington_beach.jpg; Lower: http://pics4.city-data.com/cpicc/cfiles21947.jpg
Figure 2.9	All photos R. Rodarte.
Figure 2.3.1	(a) and (b): R. Rodarte; (c): B. Fetscher.
Figure 2.3.3	K. Schumann, accessed from NOAA HAB: http://oceanservice.noaa.gov/hazards/hab/
Figure 2.3.10	J. Skinner
Figure 2.4.1	Accessed online; no credit available.

Figure 2.4.4 Figure 5 from the Program's Irvine Cove Source Investigation report, September 2012.

Figure 2.4.9 Orange County Stormwater Program.

3.0 Controlling Pollutant Sources: Jurisdictional Programs

3.1 Overview

The management of sources of pollution from diffuse urban areas involves the strategic application of Best Management Practices (BMPs) to activities and drainage systems within the urban environment. The purpose of BMPs is to protect aquatic beneficial uses by reducing pollutant loads and concentrations and by reducing discharges (volumetric flows and flow rates) causing stream channel erosion.

The DAMP is the principal policy and program guidance document for the *Program*. At its core is a series of Model Programs that are individually implemented by the Permittees in accordance with DAMP/Local Implementation Plans (LIPs). These Model Programs are intended to enable the Permittees to:

- Improve existing municipal pollution prevention and removal best management practices (BMPs) to further reduce the amount of pollutants entering the storm drain system (**Model Municipal Activities and Model IPM Program**);
- Educate the public about the issues of urban stormwater and non-stormwater pollution and obtain their support in implementing pollution prevention BMPs (**Model Education and Outreach Program)**;
- Ensure that all new development and significant redevelopment incorporates appropriate Site Design, Source Control and Treatment Control BMPs to address specific water quality issues (**Model Land Development Program)**;
- Ensure that construction sites implement control practices that address control of construction related pollutants discharges including an effective combination of erosion and sediment controls and on-site hazardous materials and waste management (**Model Construction Program)**;
- Ensure that existing development addresses discharges from industrial facilities, selected commercial businesses, residential development and common interest areas/homeowner associations (**Model Existing Development**), and
- Detect and eliminate illegal discharges/illicit connections to the municipal storm drain system (**Model ID/IC Program)**.

3.2 Municipal Infrastructure and Integrated Pest Management

The Story: Municipal

- The Model Municipal Activities Program ensures that BMPs are implemented and maintained at over 1,700 municipal facilities.

- Municipal services, including trash and debris removal, solid waste collection, household hazardous waste disposal and street sweeping were established prior to the First Term MS4 Permits but are monitored and contribute to water quality protection.

- The Model Integrated Pest Management Program ensures municipal conformance with an Integrated Pest Management Policy developed in partnership with University of California Cooperative Extension. Implementation of the policy is resulting in reductions in municipal fertilizer and pesticide use.

3.2.1 Overview

The Permittees own and operate facilities and build and maintain much of the transportation, drainage and recreational infrastructure of the urban environment. To ensure that BMPs are incorporated into municipal facilities and infrastructure maintenance programs, the Permittees have followed a systematic process of BMP evaluation of municipal sites, activities and drainage facilities since the First Term Permits. The Permittees also implement Integrated Pest Management (IPM) approaches at municipal sites to address sources of toxicity from municipal activities.

3.2.2 Municipal Activities Program Implementation and Assessment

The Model Municipal Activities Program has been implemented since 2002-03. It requires the Permittees to:

- Inventory municipal sites
- Prioritize municipal facilities and maintenance activities based upon water quality threat
- Prepare BMP guidance
- Conduct inspections of municipal facilities
- Implement Model Maintenance Procedures
- Conduct training
- Implement an IPM Policy
- Examine retrofit opportunities for municipal facilities

Site Inventories

Annually, the Permittees inspect 1700 fixed facilities comprising 25% high priority sites, 12% medium priority sites and 63% low priority sites.

BMP Guidance

The Permittees have produced BMP factsheets for the Model Municipal Program that are available at www.ocwatersheds.com. In addition to training, these BMP factsheets serve as the primary guidance for Permittee municipal maintenance procedures. The Permittees will complete a review of the BMP factsheets in 2014.

Training

Municipal training materials for "Municipal 101" were available for Permittee use as a "train the trainer" tool covering the minimum required BMPs discussed in the fact sheets. The focus of municipal training during the permit term was on a dynamic piece of the municipal program – development and implementation of jurisdictional IPM programs **(Table 3.2.1)**.

In the Fifth Term MS4 Permit, the Permittees will examine opportunities to enhance training formats to emphasize in-classroom discussion and hands-on application of concepts and focus on BMPs

to reduce or eliminate pollutants of concern arising from response to issues noted during the current permit term (e.g. bacteria from runoff).

Table 3.2.1: Municipal Training

Date	Subject Matter/Title	Target Audience	Permittee Staff in Attendance
September 15, 2010	Integrated Pest Management (IPM) Training	Stormwater Program Managers	23
May 17, 2012	Implementing Integrated Pest Management Policy Within Local Jurisdictions: The Impacts of Pesticide Formulations and Exotic Pests	Municipal Training Instructors and Field Staff	52
May 15, 2013	Implementing Integrated Pest Management Policy Within Local Jurisdiction: The Who, What, Where and Why	Stormwater Program Managers and Field Staff	32

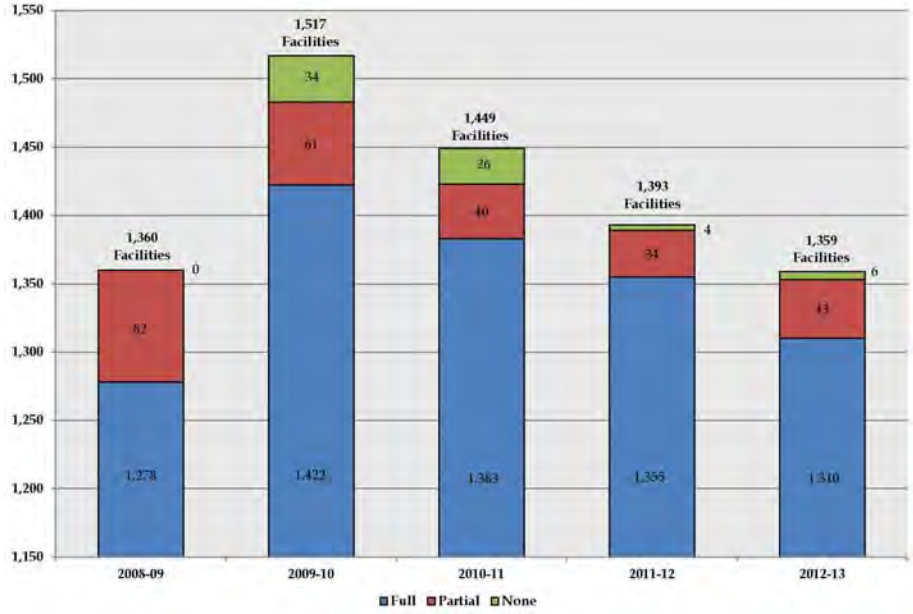
Inspection and BMP Implementation

Municipal Facilities

Inspectors implement the Model Municipal Program by ensuring implementation of the Model Maintenance Procedures. For each facility, inspectors categorize the degree of BMP implementation on site as "fully implemented," "partially implemented" or "not implemented."

Since 2008, more than 90% of facilities have consistently implemented all required BMPs. In addition, the number of facilities with no BMP implementation has decreased significantly since 2009 from 34 to 6 facilities **(Figure 3.2.1)**.

Figure 3.2.1: Municipal Facility Inspections and BMP Implementation from 2008-09 to 2012-13



Between 2008 and 2013, a majority of Permittees reported inspecting an average of more than 90% of catch basins on an annual basis and 100% of catch basins on a bi-annual basis **(Figure 3.2.2)**. The percentage of drainage facilities requiring cleaning as a result of inspections has remained approximately 80% **(Figure 3.2.2)**.

Figure 3.2.2: Drainage Facility Inspections Performed from 2008-09 to 2012-13

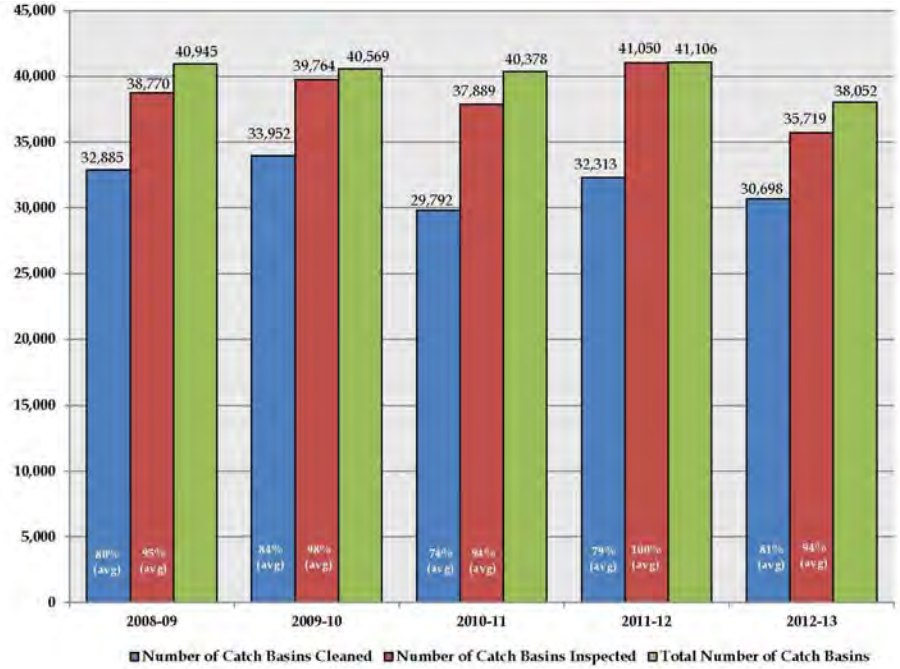


Figure 3.2.3: Storm Drain Maintenance and Material Removed from 2008-09 to 2012-13

Municipal Services (Baseline BMPs)

Permittees collect data on the performance of municipal services that pre-date the stormwater mandate but nonetheless contribute significantly to water quality protection. These "baseline BMPs" include storm drain cleaning, street sweeping, solid waste and household hazardous waste collection, used oil grant participation and trash and debris control.

Storm Drain Maintenance

The Permittees inspected and cleaned an average of 210 miles of storm drain and removed an average of 6,202 tons of material from drainage systems on an annual basis **(Figure 3.2.3)**.

Household Hazardous Waste (HHW) Collection

The OC Public Works memorialized its understanding with OC Waste and Recycling on June 23, 2010 to ensure that household hazardous waste collection, transfer and disposal practices do not cause or contribute to water quality problems. The County on behalf of the Permittees has collected an annual average of almost 3,600 tons of household hazardous waste since 2008 **(Figure 3.2.4).**

Figure 3.2.4: Tons of Household Hazardous Waste Collected from 2008-09 to 2012-13

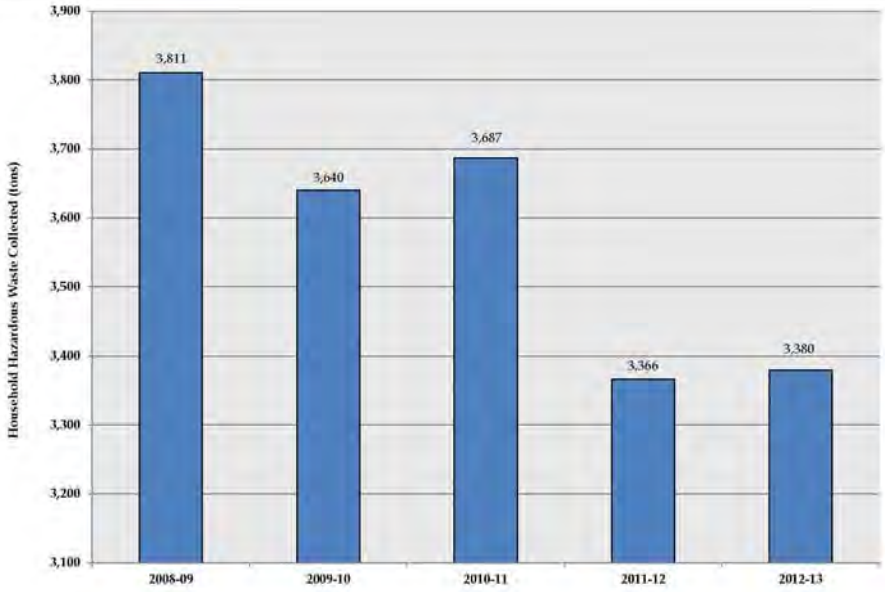
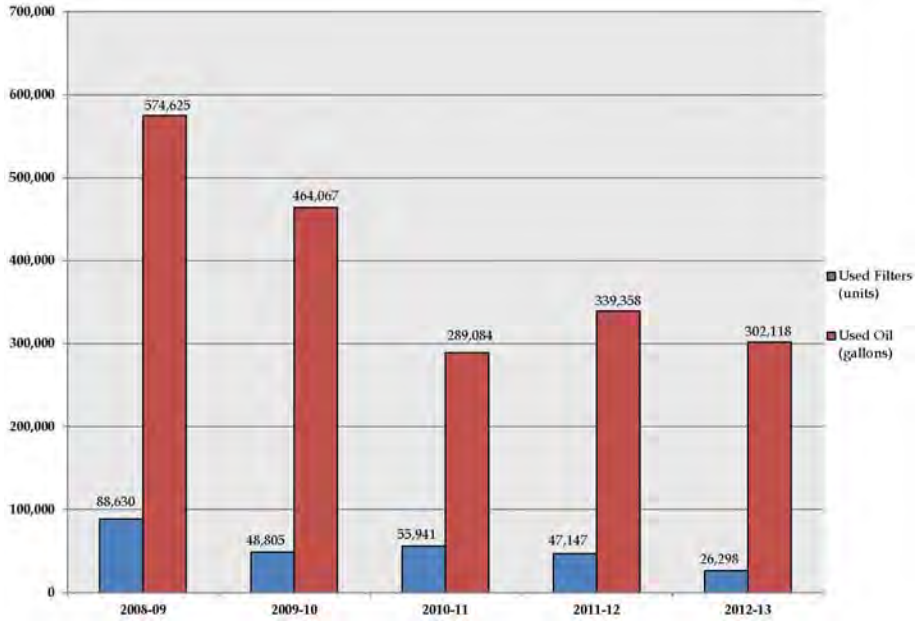


Figure 3.2.5: Used Oil and Filters Collected from 2008-09 to 2012-13



Used Oil Grant Participation

Nearly all of the Permittees and the County's Health Care Agency participated in the Used Oil Grant program during the past five years. Through these programs, hundreds of thousands of gallons of used oil and tens of thousands of used oil filters have been collected and disposed of properly, preventing these contaminants from entering the environment **(Figure 3.2.5)**.

Trash & Debris Control

Trash can degrade surface water quality and negatively impact aquatic habitat. The Permittees utilize a combination of trash and debris controls to address this issue. Controls include structural BMPs such as debris booms, catch basin inserts and continuous deflection separation (CDS) units and source control BMPs such as public education and street sweeping. The Orange County Stormwater Program GIS Cloud layer includes locations of all trash and debris booms (http://viewer.giscloud.com/map/144030/orange-county-stormwater-program-santa-ana-region-monitoring-programs). Additionally, the Permittees engage the public in cleanup events throughout the year when requested and annually every September for Inner-Coastal & Watershed and Coastal Cleanup Day, resulting in the removal of thousands of pounds of trash and debris.

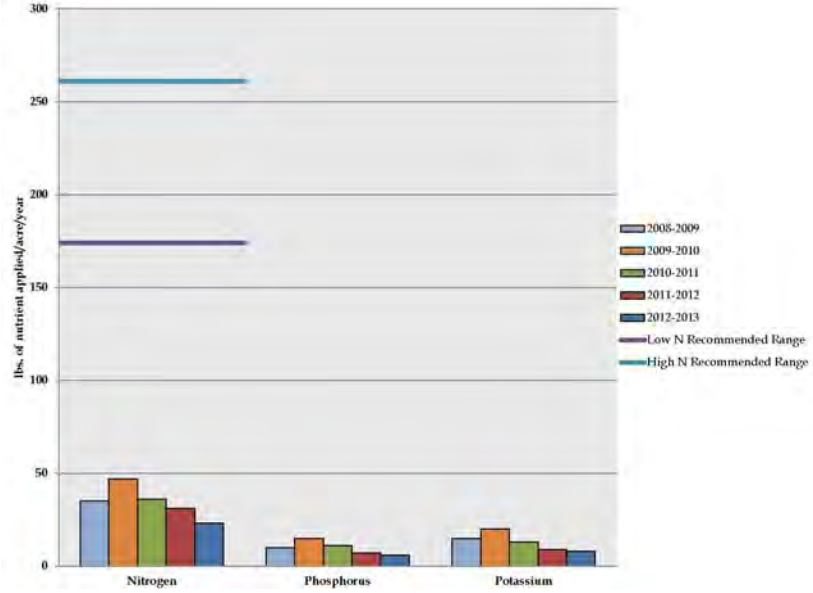
Model Integrated Pest Management Program

A key component of an effective Integrated Pest Management (IPM) Program is a focus on maintaining plant health through proper fertilizer and pest management. Reducing unnecessary fertilizer and pesticide applications reduces the opportunity for these chemicals to inadvertently enter local waters through irrigation and rain events. The Permittees formally adopted individual IPM Policies during the 2010-2011 reporting period based on an IPM Policy template developed with assistance from University of California Cooperative Extension (UCCE). The result has been the adoption of a set of basic IPM guidelines each public agency is able to implement.

Fertilizer

Fertilizer usage is tracked and reported by total nitrogen, phosphorus and potassium applied per acre. Since 2010, the amount of all three nutrients applied per acre has decreased; nitrogen per acre decreased 36%, phosphorus per acre decreased 45% and potassium decreased by 38% **(Figure 3.2.6)**.

Figure 3.2.6: Fertilizer Applied per Acre 2008-09 to 2012-13



Pesticide

Permittees have utilized fewer pounds of insecticides on an annual basis since 2010, especially those recognized by research as having the greatest potential for causing aquatic toxicity. For the 2012-13 reporting year, Permittees reduced application of the herbicide glyphosate by almost 46% **(Figure 3.2.7)**. Additionally, Permittees reduced application of pyrethroid, organophosphate and phenylpyrazole pesticides by 99%, 96% and 99%, respectively between 2012 and 2013 **(Figure 3.2.8)**.

Figure 3.2.7: Active Ingredient Herbicide Applied 2008-09 to 2012-13

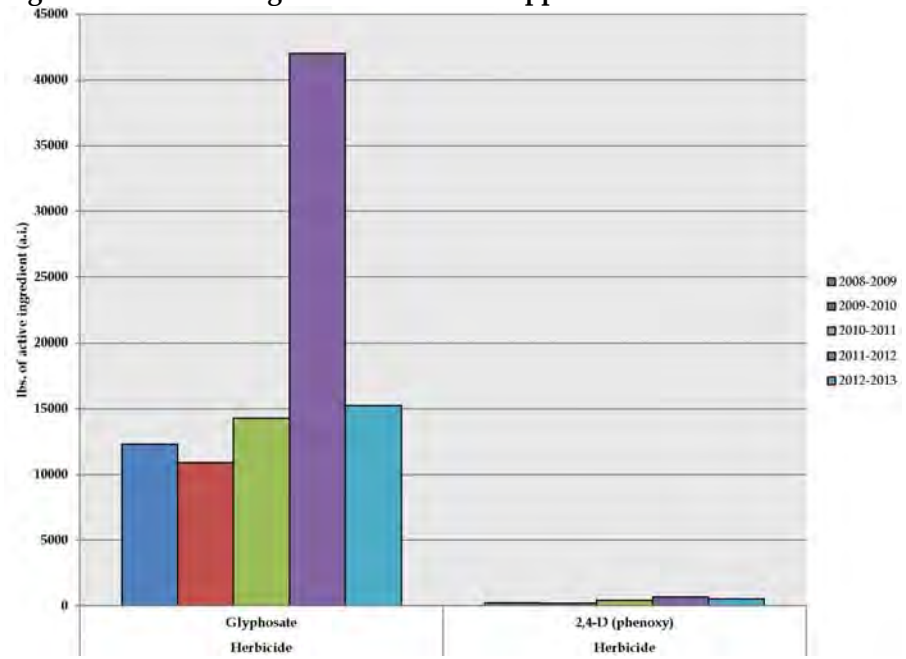
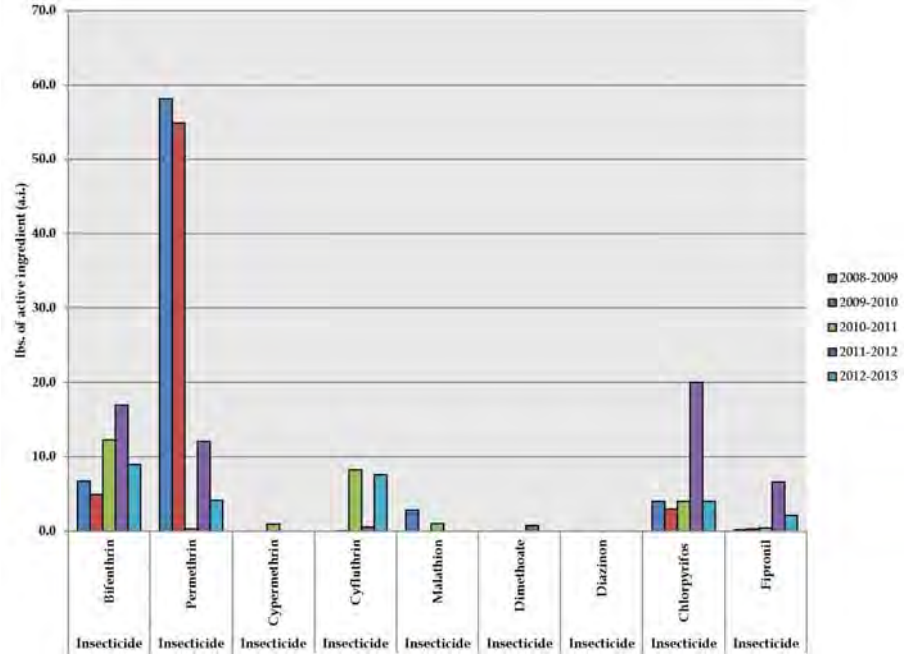


Figure 3.2.8: Active Ingredient Pesticide Applied 2008-09 to 2012-13



Municipal Retrofit Opportunities

Municipal stormwater retrofits and specifically regional stormwater retrofits are potentially an important tool in the municipal stormwater tool box. Municipal stormwater retrofits provide an opportunity to implement BMPs to provide treatment for existing infrastructure, assist with achieving TMDL compliance, and can serve as offset mitigation for the new and redevelopment helping to meet both the Low Impact Development (LID) or retention requirements and hydromodification requirements. Through the Orange County BMP Retrofit Opportunities Study numerous potential stormwater BMP retrofit sites were identified in various municipal right-of-ways. Water quality models have also been developed for some of the watersheds in Orange County that can help identify the water quality benefits of the proposed BMP sites.

Green infrastructure is also an important tool in the municipal stormwater tool box. Green infrastructure incorporates LID concepts to help achieve stormwater management goals of improving water quality and reducing volume of stormwater runoff while also meeting infrastructure needs of municipalities in a sustainable manner. Opportunities exist for implementation of green infrastructure either as a part of municipal capital improvement projects (CIP) or as part of Green Street retrofit projects. Evaluation of how green infrastructure can be incorporated into CIP or as part of green street retrofit projects will be undertaken.

3.2.3 Recommendations

Based upon consideration of the water quality priorities of the Program (bacteria, nutrients and pesticide related toxicity) and the evaluation of program implementation, the recommendations are:

1. **Investigate developing a prioritization process for drainage facilities** based on historical data establishing high, medium and low priority drainage facilities similar to the current structure for fixed facilities. Criteria should be established based on maintenance records to trigger cleaning upon inspection (e.g. requiring cleaning of catch basins with accumulated trash and debris greater than a specified percentage of design capacity). Participation in a re-prioritization effort would be determined by the Permittees.

2. **Investigate developing an inspection regime for drainage facilities based on re-prioritization scheme** resulting in the inspection of all sites once per permit term. High, medium and low priority facilities would be inspected and cleaned, as necessary at least annually prior to the wet season, every other year and once per permit term, respectively.

3. **Enhance municipal training** to address common issues encountered through municipal related complaints and to utilize innovative education formats to encourage discussion-based learning. The four most common types of issues that occur most

frequently include those related to[1]: trash/debris, pathogen/bacteria, hydrocarbons and exempt discharges. Training would focus on in-classroom engagement of concepts learned prior to the training session and focus on reducing issues and pollutants of concern through specific actions (e.g. runoff reduction to reduce bacteria loading).

4. **Conduct a sewage system seepage pilot study** to evaluate the potential for seepage into the MS4 based on available data, and focused on a limited geographic area. The pilot program may consist of a desktop analysis using GIS and water quality data to locate areas where exfiltration from sanitary sewers has the potential to influence water quality in the MS4. This exercise may also be used to rule out areas where there is no potential for cross contamination, allowing the Permittees to focus resources in areas with the most potential for improvements.

5. **Develop a municipal green infrastructure program** that could include evaluation of opportunities for pilot green street projects of different land use/density configurations and development of a green street guidance manual.

6. **Examine municipal retrofit opportunities** for regional BMPs and propose a program to evaluate previously identified retrofit opportunities for use in TMDL compliance and LID and/or hydromodification management alternative compliance. This would involve the development of watershed models for watersheds where no models exist and integration into the models and evaluation of the previously identified potential BMP retrofit sites. Previous reviews (e.g. 2005 RBF retrofit study) will be updated with current mapping tools (e.g. WHIMPs).

7. **Develop and initiate the implementation of individualized IPM Guidelines for each Permittee** with the goal of demonstrating significant and consistent reductions in fertilizer and pesticide applications based on the mission and goals outlined in jurisdictional IPM Policies.

8. **Conduct pilot soil and/or leaf tissue analysis to guide fertilizer use** to ensure nitrogen is not applied at annual rates above those recommended by UCCE research. The Permittees would identify the most fertilizer-intensive area by type (e.g. sports fields) and select one site for analysis. The analysis would assist Permittees in fine-tuning nitrogen application based on the needs of plants at the highest use areas.

9. **Improve methods for documenting usage of fertilizer and active ingredient of pesticide on an annual basis** to allow for more reliable data on the acreage receiving fertilizer applications. In collaboration with the UCCE, a standardized reporting method would be developed, improving reporting accuracy on both the amount of nitrogen and pesticides applied by Permittees on an annual basis. Though data shows a decrease in the amount of nitrogen applied, the acreage reported suggests that Permittees are under-fertilizing. The objective would be to minimize fertilizer applications where annual rates exceed those recommended by UC research (174 -261 lbs. N/acre) while more accurately capturing the acreage to which fertilizer is applied.

10. **Expand training to include peer-reviewed online training courses offered by University of California IPM (UC IPM) and UCCE** to ensure the IPM and water quality message reaches as many field staff as possible. Possible options include the UC IPM Urban Pesticide Runoff and Mitigation online training series developed by UC academics across the state to provide a more suitable method to reach field staff unable to attend in-person training. The online training consists of a series of courses directly addressing the impacts of pesticides on water quality as well as practices to mitigate these impacts (http://www.ipm.ucdavis.edu/training/upr-mitigation.html).

[1] County of Orange PNIR data, n=205 municipal related complaints, 2008-2012

Implementation Schedule – Municipal Infrastructure & IPM

Proposed Municipal Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Source Identification and Facility Inventory						
Update inventory of fixed municipal facilities	C					
Review and update inventory of municipal activities	C					
Update and maintain GIS based storm drain conveyance inventory	C					
Prioritization of Facilities and Activities						
Prioritize facilities added to fixed facilities inventory	C					
Develop prioritization process for drainage facilities	E	X				
Implement prioritization process for drainage facilities	N					
Inspection and Best Management Practice (BMP) Implementation at Fixed Facilities						
Inspect fixed facilities according to established prioritization	C					
Inspect municipal operations/activities annually	C					
Inspect and maintain basin inlets according to prioritization	E					
Install, inspect and maintain basin inlet markings as necessary	C					
Implement and Track Baseline BMPs – Operations and Activities						
Conduct and track street sweeping activities	C					
Promote, facilitate, and track proper disposal of solid waste	C					
Promote, facilitate, and track HHW collection activities	C					
Promote, facilitate, and track proper collection and disposal of used oil	C					

Proposed Municipal Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Maintain debris booms as necessary	C					
Promote, facilitate, and track clean up events	C					
Municipal Training						
Conduct training for staff	C					
Develop and update BMP Fact Sheet and other training materials as necessary	C					
Develop an Integrated Pest Management Policy						
Develop and initiate the implementation of individualized IPM Guidelines for each Permittee	N			X		
Conduct pilot soil and/or leaf tissue analysis to guide fertilizer use	N			X		
Improve methods for documenting usage of fertilizer and active ingredient of pesticide on an annual basis	E	X				
Expand training to include peer-reviewed online training courses offered by UC IPM and UCCE	E		X			
Municipal Green Infrastructure Program						
Evaluation of opportunities for the development of pilot green street projects for different land use/density configurations	N	X				
Development of a green street WQMP template	N		X			
Development of green streets standard design specifications	N			X		
Implementation of one green street pilot project in the 5th term permit term.	N					X
Examine Retrofit Opportunities for Municipal Facilities						
Develop water quality models for those watersheds not yet developed	N			X		

Proposed Municipal Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Integration of the previously identified potential BMP retrofit sites into the models and evaluation of use for TMDL compliance and/or LID and/or hydromodification management offset	E					X

1. C = Continue; E = Enhance; N = New

2. X = Performance Standard will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation.

3.3 Public Outreach

The Story: Public Outreach

- Public awareness surveys conducted approximately every three years demonstrate increased levels of awareness regarding stormwater concerns and several positive behavior changes regarding car washing, use of landscape management products, and pet waste.

- The Program achieved over 155 million impressions through various forms of paid media, and over 5.5 million impressions at outreach events from 2008 to 2013.

- Outreach to school-age children provided water pollution prevention education to over 125,000 students and the Permittees helped support several targeted academic programs developed/conducted by other agencies throughout the Fourth MS4 Permit term.

- The Permittees initiated a strategic behavior-specific outreach program in 2012.

- The Program developed or enhanced continuing partnerships with the Municipal Water District of Orange County and the University of California Cooperative Extension (UCCE) during the Fourth MS4 Permit term.

3.3.1 Overview

Ongoing education of the public about water quality issues is an essential tool in improving stormwater conditions. The goal of the Education Program is to build engagement with residents, encourage and document the adoption of BMPs and increase the overall knowledge of Orange County residents and businesses regarding water quality protection. The Education Program was strategically re-branded from "Project Pollution Prevention" to "H_2OC" in 2012 to stress the importance of water resources for Orange County residents.

3.3.2 Public Outreach Program Accomplishments and Assessment

For the past decade, H_2OC (previously Project Pollution Prevention) has used public awareness surveys to assess awareness of and behavior change regarding stormwater issues. Survey results indicate small but significant increases in awareness around stormwater pollution and prevention and increased levels of participation in BMPs. Most notably, survey results indicate several positive behavior changes among Orange County residents since 2003 including:

- Willingness to use a commercial car wash facility in lieu of home car washing (five percent increase);
- Proper use of lawn and garden fertilizers and pesticides (five percent increase); and
- Picking up waste and droppings from their pet (nine percent increase).

The Permittees will continue to conduct public awareness surveys to measure and assess awareness of Orange County residents on water quality issues. These surveys will seek to measure water quality knowledge, current participation in stormwater safe behaviors, and willingness to participate in the same. Additional tracking of specific behavior campaigns, as discussed below, will be measured with pre-initiation and post-completion surveys to better evaluate effectiveness. Finally, the Permittees will continue to measure outputs and impressions of the mass media campaigns. Collectively, these measures will help evaluate the success of the various public outreach efforts.

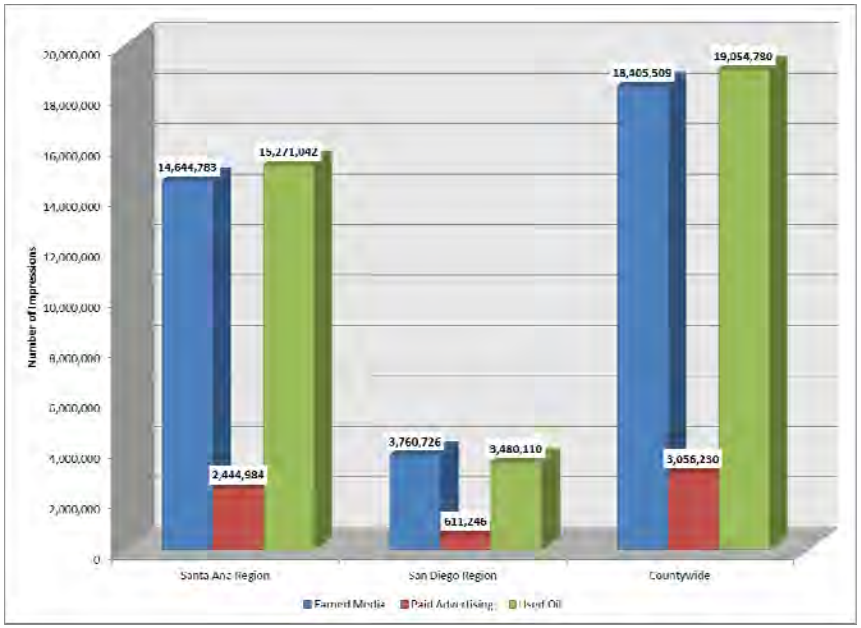
Media Outreach and Impressions

The Permittees have consistently improved the reach of paid advertising since the program began in 2003 and exceeded permit requirements for achievement of impressions through media. The Permittees achieved the following from 2008 through 2013:

- 155 million total paid media impressions including traditional print (e.g. newspaper) ads, bus shelter and bus side posters, billboards, internet banner ads, radio, movie theater and television public service announcements, and gas pump banners; and
- More than 5.5 million grassroots impressions including outreach events like environmental fairs, beach and channel clean-up days, newsletters and workshops.

During the 2012-13 reporting year, the Permittees garnered a total of 40,516,519 impressions through various forms of media.

Figure 3.2.1: Media Impressions by Region 2012-13



Earned Media

Earned media includes any unpaid publicity through sources like television (e.g. news reports), newspaper articles, social media (e.g. Facebook, Twitter, or blogs), or other media platform (e.g. podcasts, YouTube, etc). The inclusion of earned media into the total impression count provides a more accurate assessment of the true number of impressions earned, and helps increase public trust in the program overall. The Permittees garnered a total of 18,405,509 impressions from earned media during the 2012-13 reporting year **(Figure 3.2.1)**.

3.3.3 Youth Outreach

Children are crucial to the dissemination of water quality information as key messengers and influencers of parents' behavior. The Permittees have maintained and enhanced a robust school outreach program since 2008, including:

- Direct outreach to more than 125,000 students through provision of workbooks, support and assistance designing watershed education programs and funding of programming focused on addressing water quality issues;
- Achieved more than 400,000 total impressions through programs to educate teachers (i.e. Project WET) and the general public at the Discovery Science Center; and
- Development and support of targeted academic programs through partnerships with educational institutions in the community to ensure a consistent message and increase breadth of outreach (e.g. Municipal Water District of Orange County, Chapman University).

3.3.4. Behavior Specific Campaigns

There are a variety of actions an Orange County resident can take to help protect water quality, ranging from picking up after their dog to reporting illegal dumping. However, studies have shown that people can become easily overwhelmed when presented with multiple options, leading to inaction.

Through behavior-specific campaigns the Permittees will target narrow behaviors most likely to have a positive impact on water quality. Target behaviors will be selected by assessing public awareness survey data, water quality monitoring results and the needs of the Permittees.

Behavior-specific campaigns began in 2012; assessment of these efforts will serve as a robust foundation from which future campaigns are determined. Specific achievements include:

- Development of a comprehensive strategic plan in 2012 including extensive analysis of Orange County residents, ongoing biennial surveys, and independent research; and
- Prioritization of target behaviors based on public awareness surveys and water quality monitoring data.

The Permittees intend to employ best practices to implement behavior-specific campaigns using the Community Based Social Marketing (CBSM) model. CBSM steps include:

- Identifying barriers and motivators to an activity;
- Developing a strategy that utilizes tools to leverage those barriers and motivators in order to affect behavior change;
- Pilot the strategy; and
- Evaluate the strategy and refine it for broader implementation.

The Permittees will use these principles in tandem with mass media outreach efforts to continue fostering general public awareness of stormwater issues.

3.3.5 Runoff Reduction and Water Use Efficiency

Runoff reduction stresses onsite retention of runoff by utilizing BMPs to intercept, capture, and infiltrate rainwater to reduce runoff and pollutant loading. The Permittees will continue to build upon partnerships with water purveyors to marry water use efficiency and runoff reduction messaging, increasing message consistency and breadth. Since 2008, the Permittees have nurtured relationships with other agencies and community groups to accomplish the following:

- Collaborated with water utility providers on water use efficiency messaging by participating in stakeholder meetings and providing presentations on key stormwater pollution issues (e.g. Municipal Water District of Orange County).
- Utilized partnerships with the University of California Cooperative Extension (UCCE) to outreach to plant nursery owners and operators and other landscape representatives.

The Permittees will continue to foster these relationships to promote reductions in runoff and overall water use. Investment in coordination of programs and specific action campaigns will continue with campaigns such as the "Overwatering is Out" initiative launched in 2013.

3.3.6 Recommendations

The recommendations are:

1. **Emphasize programming for outreach to school-age children** to continue building upon existing partnerships and increasing knowledge of the Orange County community as a whole through increasing knowledge of youth.

2. **Incorporate current strategic approach of using public opinion survey results to prioritize outreach efforts** based on behaviors of concern in tandem with water quality results to document small-scale behavior change over time.

3. **Coordinate with water supply agencies** to incorporate water use efficiency and runoff reduction messaging to maximize program reach and ensure requested behavior changes align with water use efficiency techniques supported by other agencies.

4. **Achieve a minimum of 10 million impressions through the use of various types of media; including earned media,** in which the public has greater trust as a third party source of information over paid advertising.

5. **Develop focused outreach campaigns based on water quality and survey results** utilizing CBSM techniques to document changes in targeted behaviors. The Permittees would develop focused campaigns supportive of a singular message with the goal of reducing competing messaging that may lead to inaction.

3.4 New Development/Significant Redevelopment

The Story: New Development/Significant Redevelopment

- The Permittees developed a significantly revised Model Water Quality Management Plan (WQMP) to be consistent with the Fourth Term MS4 Permit.
- The Permittees developed a comprehensive Technical Guidance Document (TGD) to implement new and enhanced requirements for the implementation of Low Impact Development (LID) and Hydromodification Management and to complement the WQMP.
- The Permittees implemented the new Model WQMP and TGD for all priority projects as required.
- During the permit term 1,369 WQMPs for public and private projects were approved for a total of 18,749 acres of development.

3.4.1 Overview

Development creates rooftops, driveways, roads and parking lots which increase the timing and volume of rainfall runoff (compared to pre-development conditions) and provide a source of pollutants that are flushed or leached by rainfall runoff or dry weather runoff into surface water systems. Since the inception of the Program, it has been recognized that the incorporation of BMPs into a development project in its planning stages offers the most effective opportunity to limit increases in pollutant loads and preserve natural hydrologic processes. Consequently, the Program links new development and significant redevelopment BMP design, construction and site operation to the earliest phases of new development project planning, encompassed by the jurisdictional General Plans, environmental review and development permit approval processes.

The New Development/Significant Redevelopment Program has evolved over the MS4 Permit terms from a narrow focus on discharge water quality to a broader consideration of the hydrologic impacts of land use change. Routine structural and non-structural BMPs implemented during the first two permit terms aimed to minimize the introduction of pollutants into the drainage system. In the third MS4 Permit term, the Permittees continued to implement routine structural and non-structural BMPs, but they also worked with project proponents to improve site design. The current Fourth Term Permits emphasize use of site design BMPs and bring the concepts of LID and hydromodification control to the forefront.

The Model WQMP describes the process that Permittees will employ for developing a Project WQMP for individual new development and significant redevelopment projects, which, when implemented will minimize the effects of urbanization on site hydrology, runoff flow rates or velocities and pollutant loads. Following approval of the final project WQMP and construction of the project, the Project WQMP will also serve to maintain the terms, conditions and requirements with the project proponent and their successors over the entire life of the project. The effects of urbanization will be minimized through implementation of practicable and enforceable project-based controls or stormwater BMPs, or through a combination of project-based and regional BMPs.

3.4.2 New Development/Significant Redevelopment Program Implementation and Assessment

Model Water Quality Management Plan (WQMP)

A new WQMP and companion TGD were developed during an eighteen month stakeholder process and approved on March 22, 2011. Implementation of the new WQMP and TGD commenced on August 17, 2011. The revised Model WQMP identifies appropriate LID practices and BMPs and alternative compliance programs for new development and significant redevelopment projects. LID BMPs must be selected based on a hierarchy of control types and sized to capture the maximum feasible portion of the design capture volume using the highest priority control type (e.g., retention). The next lower priority control type (biotreatment) can only be used for any portion of the design capture volume that cannot be feasibly captured by retention BMPs.

In accordance with the Model WQMP, new development and significant redevelopment projects meeting threshold criteria are required to develop and implement a Project WQMP that includes LID and hydromodification control BMPs, where necessary, at the earliest conceptual planning stages of a project for early review. Depending upon the project size and characteristics, these may include:

- BMP site design measures;
- Implementing LID BMPs on-site;
- Constructing or participating in sub-regional/regional LID systems;
- Implementing hydromodification control BMPs; and
- Using alternative programs or treatment control BMPs.

In addition, the Model WQMP includes more rigorous requirements regarding assessing and abating hydromodification impacts. The effects of hydromodification can be mitigated with the use of LID strategies, site design and hydrologic source controls. Hydromodification control is also addressed in Watershed Infiltration and Hydromodification Master Plans (WIHMPs), which are intended to integrate water quality, hydromodification, water supply and habitat protection issues on a watershed basis. A Model WIHMP for the San Gabriel River/Coyote Creek Watershed was submitted to the Santa Ana Regional Water Quality Control Board on May 23, 2011.

Project WQMPs are required for private new development and significant redevelopment projects within Permittees' jurisdictions, and equivalent public agency capital projects undertaken by the Permittees that are either:

- "Priority Projects" meeting one of the criteria identified in the Permit, regardless of project size.

- "Non-Priority Projects" that do not qualify as one of the Priority Project Categories but meet one of the following:

    - Require discretionary action that will include a precise plan of development, except for those projects exempted by the Water Quality Ordinance (as applicable), or

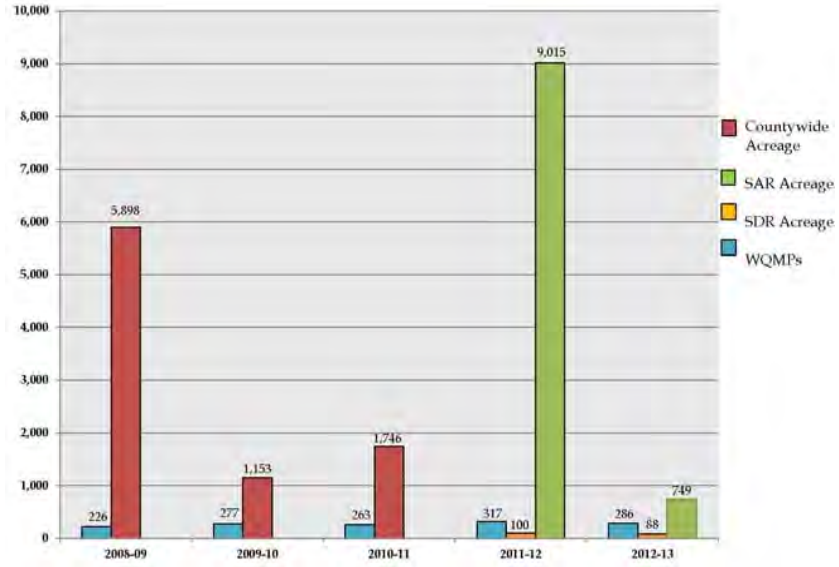
    - Require issuance of a non-residential plumbing permit.

BMP Implementation

Since 2002, a total of 4,152 Project WQMPs have been approved, covering 40,460.8 acres which represents 9.3% of the area within Orange County subject to subject to the regulatory provisions of the Third and Fourth Term MS4 Permits (681.4 square miles).

During the current Fourth Term MS4 permit term 1,369 WQMPs for public and private projects were approved for a total of 18,749 acres of development **(Figure 3.4.1)**.

Figure 3.4.1: Historical WQMPs and Acreage Covered



The Project WQMP for a Priority Project must include:

- Regional or watershed programs (if applicable);
- Routine structural and non-structural Source Control BMPs;
- Site Design BMPs (as appropriate);
- Runoff retention BMPs, also referred to as LID BMPs – requirements may be met through either project specific (on-site) controls or regional or watershed management controls that provide equivalent or better treatment performance, subject to certain conditions described in the Model WQMP; and
- The mechanism(s) by which long-term operation and maintenance of all structural BMPs will be provided.

The Project WQMP for a Non-Priority Project must include:

- Routine structural and non-structural Source Control BMPs;
- Site Design BMPs (as appropriate); and
- The mechanism(s) by which long-term operation and maintenance of all structural BMPs will be provided.

Since approval of the Model WQMP in 2011 9,764 acres of development have incorporated LID BMPs.

Training

The new requirements for New Development and Significant Redevelopment Projects in the area of Orange County under the jurisdiction of the Santa Ana Regional Water Quality Control Board took effect August 17, 2011. To provide land developers, project proponents, and associated consultants and organizations with an overview of the new land development requirements, training for NPDES Program Managers, planners, plan checkers and the development community was provided in July and September 2011. The training provided an overview of the level of detail that must be included at each phase of the WQMP preparation process, site and watershed assessment methods, LID BMP selection and prioritization methods, LID BMP design standards and performance criteria, regional LID BMP options, watershed-

based plans and LID alternative compliance options. All of the training modules have been posted to the OC Watersheds website (http://www.ocwatersheds.com/WQMP_FAQs.aspx).

General Plan Assessment and Development Standards Review

In October 2009, the Principal Permittee hosted a workshop for the Permittees to provide guidance on assessing their General Plans and development standards review to ensure the following LID principles are considered in their review, and considered for inclusion in some fashion as appropriate, in the General Plan and Local Coastal Plan (if applicable):

- Limit disturbance of natural water bodies and drainage systems; conserve natural areas; minimize soil compaction to landscaped areas; protect slopes and channels; and minimize impacts from stormwater and urban runoff on the biological integrity of natural drainage systems and water bodies;

- Minimize changes in hydrology and pollutant loading; ensure that post-development runoff rates and velocities from a site have no significant adverse impact on downstream erosion and stream habitat;

- Maximize the percentage of permeable surfaces to allow more percolation of storm water into the ground; construct streets, sidewalks, or parking lot aisles to the minimum widths necessary, provided that public safety is not compromised;

- Preserve wetlands, riparian corridors, and buffer zones and establish reasonable limits on the clearing of vegetation from the project site;

- Encourage the use of water quality wetlands, biofiltration swales, watershed-scale retrofits, etc., where such measures are likely to be effective and technically and economically feasible;

- Provide for appropriate permanent measures to reduce storm water pollutant loads in storm water from the development site; and

- Establish development guidelines for areas particularly susceptible to erosion and sediment loss.

Enhancements in Methodologies

The County of Orange as Principal Permittee participates in a number of collaborative studies and initiatives on behalf of the Permittees that are aimed at the further development of assessment techniques and methodologies to support more informed and consistent decision making across Southern California. Some examples of current studies and initiatives affecting New Development/Significant Development include:

Stormwater Monitoring Coalition (SMC) – Phase 1 Hydromodification Study

The primary objective of this study was to find relationships between stream channel type and resistance that would allow prediction of channel response under changed conditions associated with increased impervious cover. Ultimately this effort will contribute to the establishment of stormwater management criteria to help minimize the impacts to stream channels from the conversion of undeveloped (or less

developed) areas to residential, commercial, or other intensive land uses.

SMC – Low Impact Development Study

SMC developed a manual of practice for LID that provides:

- Details on how to use LID Principles and LID BMPs to reduce the impacts of land development or re-development on water resources at the project level;

- Guidance for municipalities, land use planners, land developers, consultants, design professionals who prepare stormwater engineering plans and specifications, and others in private industry and public service;

- A site planning and design reference that will facilitate the implementation of LID for projects in Southern California. It is designed to complement the Stormwater BMP Manual(s) that have been developed and are maintained by CASQA;

- A tool that can be applied at the site level for the development of integrated water and stormwater management regulatory compliance and resource protection programs; and

- The SMC LID Manual is available online at the California LID Portal (californialid.org).

SMC – Barriers to Low Impact Development Study

The purpose of this study was to dig deeper into potential barriers to LID by investigating the complex web of codes, processes and perceptions surrounding LID implementation.

3.4.3 Recommendations:

1. **Develop an integrated water resources approach element into the land planning/land development process.** The Permittees understand that an integrated water resources approach is needed to achieve the goals of water quality protection, water conservation, flood control, and stream protection. In order to achieve an integrated water resources approach the Permittees propose to integrated a water resources approach element into the land planning and land development processes so that as development projects begin entitlement this approach and opportunities to achieve this approach are evaluated.

2. **Develop an internet based regional geodatabase. To achieve an integrated water resources and watershed management approach access to information will be critical.** The Permittees are developing an internet-based regional geodatabase to manage this information and provide access to developers, municipal staff, and regulatory staff to evaluate integrated water resource options and assist with WQMP development.

3. **Develop an internet based WQMP Submittal Tool and Database potentially in collaboration with Riverside and San Bernardino.** The Permittees spend a significant amount of time plan checking and tracking Project WQMPs and so the permittees propose development of an internet based Project WQMP review tool to streamline the submittal and review of WQMPs, allow for enhanced tracking of WQMPs and WQMP inspections, and help with effectiveness assessments and annual reporting.

4. **Pilot the use of technology to better track WQMP inspections and follow up actions needed.** To fully utilize the WQMP Submittal Tool and Database WQMP inspections could be performed with tablets or other devices where GIS information and other information can immediately be uploaded to the database. The Permittees propose piloting the use of tablets or other devices linked to the Database for Project WQMP inspections by a select number of cities.

5. **Enhance the data collected for WQMPs to have a better understanding of water quality benefits on an annual basis.** The Permittees desire to perform a better assessment of the New Development/Significant Redevelopment Program. In order to better understand the effectiveness of the program, the Permittees propose to collect new critical data element, and enhance data quality by integrating information into the WQMP Submittal Tool and Database. New data would include volumes of water treated, land area treated, and other relevant information needed to evaluate TMDL compliance, to identify developed/redeveloped areas that meet LID and/or hydromodification requirements, and to track BMP maintenance as a measure of effectiveness.

Implementation Schedule – Land Development

Proposed New Development/Significant Redevelopment Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
New Development/Significant Redevelopment Program						
Development of Program Documentation	C					
Develop an internet based regional geodatabase.	N		X			
Water Quality Management Plans (WQMPs)						
Develop an internet based WQMP Submittal Tool & Database in collaboration with Riverside and San Bernardino	N			X		
Integrate the use of technology to better track WQMP inspections and follow up actions needed.	N			X		
Develop a process for better interaction and education with property owners about the structural BMPs on their property.	N	X				
Enhance the data collected for WQMPs to have a better understanding of water quality benefits on an annual basis.	E			X		
Stormwater Management BMPs						
Stormwater Management BMPs	C					
Training						
Provide Model WQMP & TGD Training Modules	C					
"Help Desk"						
Provide "Help Desk" service	C					

Proposed New Development/Significant Redevelopment Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
General Plan Assessment and Development Standards Review						
Develop an integrated water resources approach element into the land planning/land development process.	N		X			
Enhancements in Assessment Methodologies and Their Role in New Development/Significant Redevelopment						
Continued support of enhancements	C					

1. C = Continue; E = Enhance; N = New

2. X = Performance Standard will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation

3.5 Construction

The Story: Construction

- The Construction Program maintained an inventory of up to 12,000 construction sites, prioritized these sites regarding their threat to water quality, and inspected them at the frequency specified by the permit. Non-compliant sites were educated and required to implement BMPs as required.

- BMP Guidance was updated to address the renewed Statewide General Construction Storm Water Permit, and Permittee construction inspection staff were trained accordingly.
- The Program proposes to implement a GIS-based site inventory and database for inspection records, and to evaluate the use of mobile inspection input devices in the field.

3.5.1 Overview

The Permittees regulate construction activities and have responsibility for the construction and reconstruction of municipal facilities and infrastructure within their jurisdictions. Construction sites and activities are a significant potential source of sediment and other pollutants and have been a priority for the Program since the First Term MS4 Permits.

The Program requires effective BMP implementation by construction site owners, developers, contractors, and other responsible parties. All construction projects, regardless of size, must implement an effective combination of erosion and sediment controls and waste and materials management BMPs. To ensure that effective BMPs are implemented, each jurisdiction conducts inspections to verify the appropriateness and implementation of BMPs and takes enforcement action as necessary. Training is provided annually to support consistent countywide implementation.

3.5.2 Construction Program Implementation and Assessment

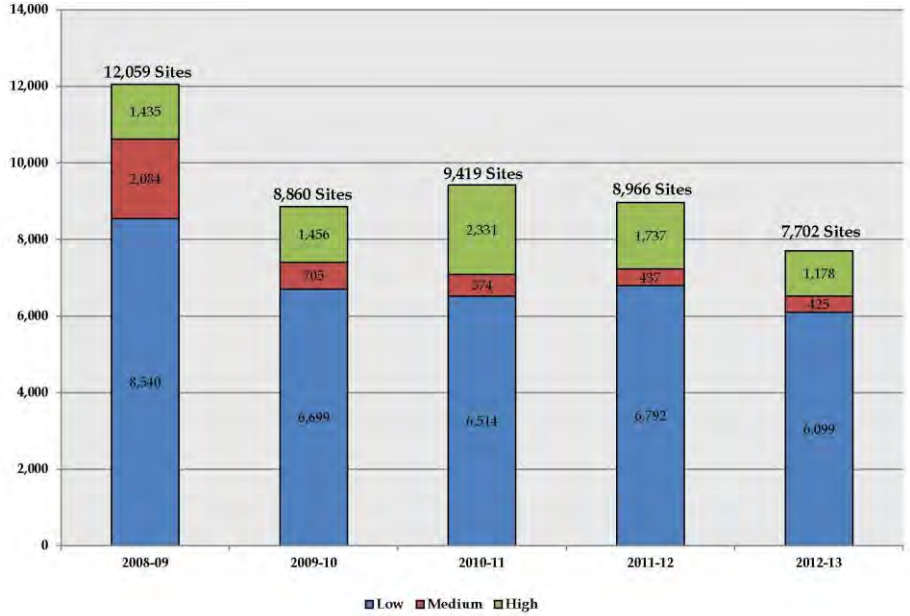
The Model Construction Program has been implemented since the 2002-03. It requires the Permittees to:

- Inventory construction sites;
- Prioritize construction sites based upon water quality threat;
- Prepare BMP guidance;
- Conduct inspections of construction sites;
- Undertake enforcement; and
- Conduct training.

<u>Site Inventories</u>

Between 2008 and 2013, the Permittees reported an annual construction site inventories ranging from 7,702 (2012-13) to 12,059 (2008-2009). The numbers of construction sites and relative proportions of low, medium, and high priority sites for the past five years are shown in **Figure 3.5.1**.

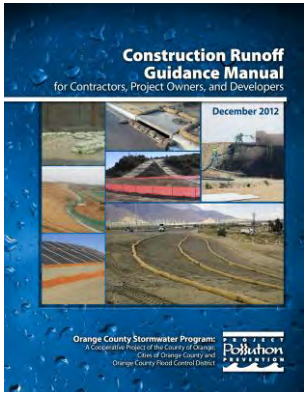
Figure 3.5.1: Construction Site Inspections & Prioritizations, 2008-09 to 2012-13



BMP Guidance

The Permittees have produced a *Construction Runoff Guidance Manual* and it is available at http://ocwatersheds.com/documents/bmp/constructionactivities. The manual was updated in late 2012 to ensure consistency with the renewed Construction General Permit (Order 2009-0009-DWQ) (CGP), to incorporate findings from an Erosion Control BMP Field Evaluation, and to provide guidance on dewatering activities and BMPs appropriate for small construction sites. The manual is the basis for the pre-wet season construction training held each September. CASQA updated their California Stormwater BMP Handbook for Construction in November 2009 as on online portal and the updated BMP Factsheets provide additional, up-to-date guidance for the Permittees.

Inspection and Enforcement



Inspectors implement their jurisdictional program, which is based on the Model Construction Program, by enforcing compliance with grading or building permits, sediment and erosion control plans, and the Water Quality Ordinance(s). Enforcement actions taken by inspectors include, but are not limited to, education, verbal warnings and administrative actions under the Water Quality Ordinance (notice of violation, administrative compliance order, etc.), and written actions under Building/Grading Ordinances (corrective action notice, stop work order, etc.).

As a result of the inspections, between 2008-2013 the Permittees reported issuing 2,300 educational letters, 1,443 notices of non-compliance, 186 administrative compliance orders, 19 cease and desist orders, and 9 misdemeanor/infractions for a total of 3,957 enforcement actions (**Figure 3.5.2**).

Figure 3.5.2: Enforcement Actions Taken, 2008-09 to 2012-13

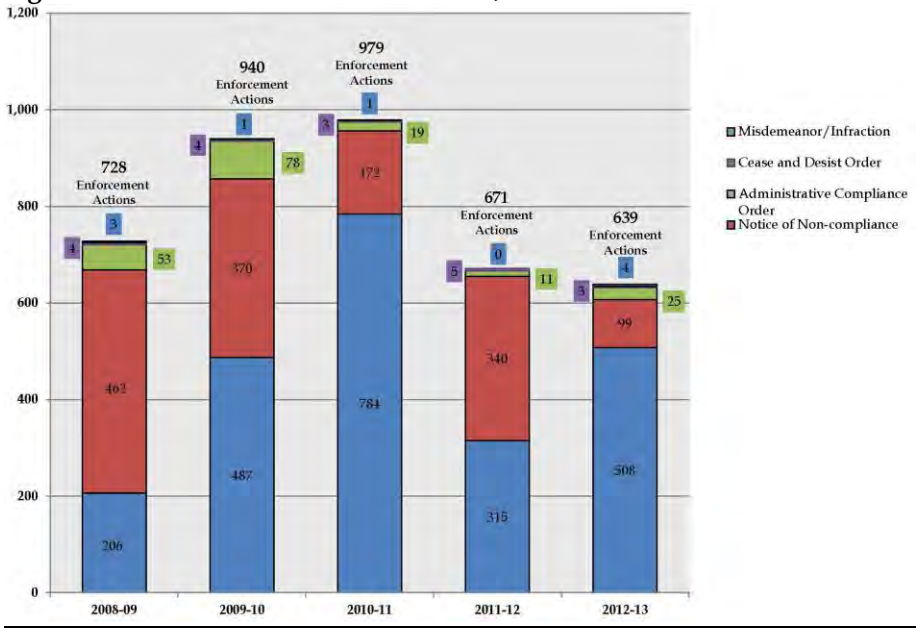
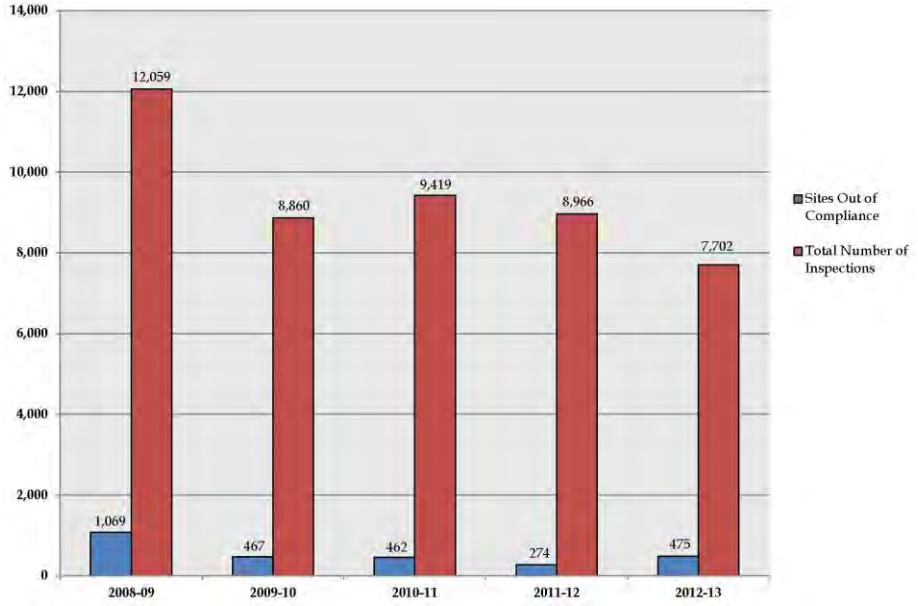


Figure 3.5.3: Construction Sites Out of Compliance, 2008-09 to 2012-13



The number and type of enforcement activities vary greatly from year to year; however, the percentage of construction sites out of compliance is consistently under 10% **(Figure 3.5.3)**. This is a consistently high (i.e. >90%) level of compliance from year to year within the regulated community, which may be attributable to the long term impact of inspection programs, new guidance published by CASQA, and the implementation of the new Construction General Permit requirements, including new requirements for a *Qualified Stormwater Pollution Prevention Plan (SWPPP) Developer* to prepare a construction site's SWPPP, and a *Qualified SWPPP Practitioner* to ensure that the SWPPP is being correctly implemented.

The Fourth Term MS4 Permit requires significant inspection resources for both high priority and medium priority construction sites. Based on **Figure 5.2** and **Figure 5.3**, enforcement actions per capita and the proportion of construction sites out of compliance have decreased over the permit term. Therefore, it is appropriate to consider revising the inspection requirements and inspection frequency for the Fifth-Term MS4 Permit.

Training

Pre-wet season construction inspection training has been provided to inspectors each September during the permit term. A new module for Construction Inspectors, with a focus on interactive exercises for trainees, was developed and provided in September 2012. Qualified SWPPP Developer (QSD) and Qualified SWPPP Practitioner (QSP) training was provided twice in the permit term to NPDES Program staff and construction inspectors. The first QSD/QSP Training was provided on June 9, 13, and 14, 2011 and the second QSD/QSP Training was provided on May 24, 29 and June 5, 2012. Approximately 50 staff attended this training.

3.5.3 Recommendations

The recommendations are:

1. **Reduce the frequency of inspection for high priority sites** from monthly to twice during the wet season and reduce the frequency of inspection for medium priority sites from twice to once during the wet season.

2. **Pilot a GIS and internet-based database to track construction sites**. In order to provide easier tracking of construction sites on a countywide basis, the Permittees will develop a GIS and internet-based database where information regarding each construction site can be entered. The Permittees would examine the benefits of such a database by piloting implementation with a select number of cities.

3. **Conduct pilot field-testing of personal electronic devices to document inspections onsite**. Use of tablets or other electronic devices during inspections will allow inspectors to immediately upload construction site information to the GIS based database. The Permittees would pilot the use of these technologies with a select number of cities.

4. **Conduct QSD/QSP Training.** The QSD/QSP Training developed by the State Board and CASQA provides a detailed understanding of the Construction General Permit. The Permittees propose providing this training to municipal staff every other year to ensure that inspectors and other municipal staff understand the CGP requirements that are to be implemented for construction projects in their jurisdiction. It is anticipated that with potential changes to the CGP being adopted in 2014 that municipal staff should be aware of these changes and any new or modified requirements for CGP compliance.

Implementation Schedule – Construction

Proposed Model Construction Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Inventory Construction Sites						
Maintain inventory of construction sites	C					
Pilot GIS based database system to maintain inventory of construction sites	E		X			
Prioritize Construction Sites based upon Water Quality Threat						
Prioritize as high, medium, low threat to water quality	C					
Prepare BMP Guidance						
Implement BMPs identified in the OC Construction Runoff Guidance Manual	C					
Conduct Inspections of Construction Sites						
Inspectors to pilot use of tablets or other device during inspections to upload information to the GIS based database	N			X		
Perform inspections for high priority sites twice during the wet season	N					
Perform inspections for medium priority sites once during the wet season	N					
Perform inspections for low priority sites once during the wet season	C					
Enforcement						
Enforcing compliance with grading or building permits, sediment and erosion control plans, and the Water Quality Ordinance.	C					

Proposed Model Construction Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Training						
Conduct Training of construction inspectors annually prior to the wet season	C					
Conduct QSD/QSP Training	C	X		X		X

1. C = Continue; E = Enhance; N = New
2. X = Performance Standard will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation

3.6 Existing Development

The Story: Industrial/Commercial

- The Industrial/Commercial Program provided an updated inventory of over 15,000 sites, prioritized sites based on threat to water quality, and conducted inspections of these sites at frequencies specified by the permit.

- The Program trained Authorized Inspectors and provided education and enforcement to address facilities lacking effective BMPs.

- A new Mobile Business Pilot Model Program was developed and implemented.

- Residential sources of pollutants were addressed through the Model Residential Program, which included development of new outreach materials and the development and implementation of an approach for Common Interest Areas and Homeowner's Associations.

3.6.1 Overview

Stormwater discharges from commercial and industrial facilities can become contaminated when material management practices allow exposure of pollutant sources to stormwater and/or there is commingling of runoff with wastes. The Existing Development Model Program provides a programmatic framework to guide Permittees in the regulatory oversight of activities in commercial and industrial areas. Through inspections, outreach and requiring compliance with water quality ordinances, the Permittees are able to effect protection of the quality of urban and stormwater runoff from industrial and commercial facilities. The Model Program also provides a framework, emphasizing education and outreach approaches, for addressing activities in residential and common interest areas that can threaten water quality.

3.6.2 Model Industrial/Commercial Program Implementation and Assessment

The Model Industrial/Commercial Program requires the Permittees to address the following:

- Identify and inventory commercial and industrial facilities;
- Prioritize sites based upon threat to water quality;
- Establish model maintenance procedures;
- Develop and implement a program to address mobile businesses;
- Conduct inspections of food service establishments (FSEs);
- Conduct inspections and undertake enforcement
- Conduct training; and
- Conduct education and outreach.

<u>Facility Inventory and Prioritization</u>

The Permittees maintain a database of industrial and commercial facilities that have a potential impact to water quality. The industrial and commercial inventories are updated annually and quarterly, respectively. This database provides the basis for the prioritization of facilities and documents all information related to the facility such as

outreach, inspection, and any follow up actions required. Industrial and commercial facilities have been identified and inventoried per permit requirements for the past five years.

Following clarification of reporting practices in 2008, the total number of industrial facilities has remained relatively stable. A decrease in total number of industrial facilities during FY 2011-12 may be due to poor economic conditions. There has also been a decline in the number of inventoried commercial facilities over the permit term, most likely for the same reason. The significant drop in number of commercial facilities on the inventory between FY 2009-10 and FY 2010-11 is attributable to the removal of the food service establishments (FSEs) from the commercial inventory that year, as the current permit requires FSEs to be tracked separately.

Industrial and commercial facilities must be classified as high, medium, or low priority to determine the frequency of inspection. The Fourth-Term MS4 Permit specifies that several types of industrial facilities must be classified as high priority. With respect to commercial facilities, the Permit mandates that a minimum of 10% of facilities in the commercial inventory must be prioritized as high and a minimum of 20% of facilities must be prioritized as medium.

In **Figure 3.6.1**, the percentages of industrial facilities prioritized as high, medium or low appears to have remained relatively stable since the 2009-10 reporting period, with some proportional declines evident as the size of the inventory decreased. Due to the prescriptive nature of the high priority prioritization criteria, minimal change is expected; therefore, the industrial inventory prioritization does not correlate well with changes in behavior. **Figure 3.6.2**, shows there has been a decreasing number of high priority commercial facilities over the past four years, corresponding with the decrease in the number of facilities in the commercial inventory from year to year.

Figure 3.6.1: Industrial Facility Prioritization from 2008-09 to 2012-13

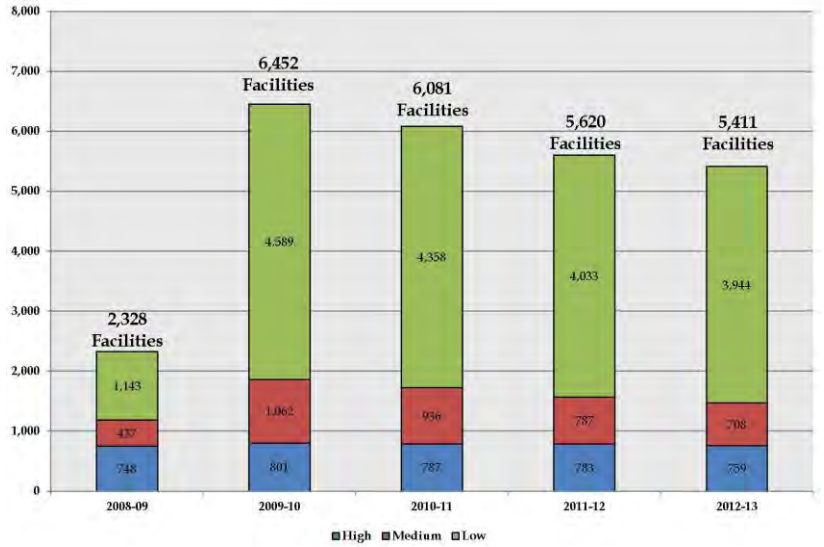
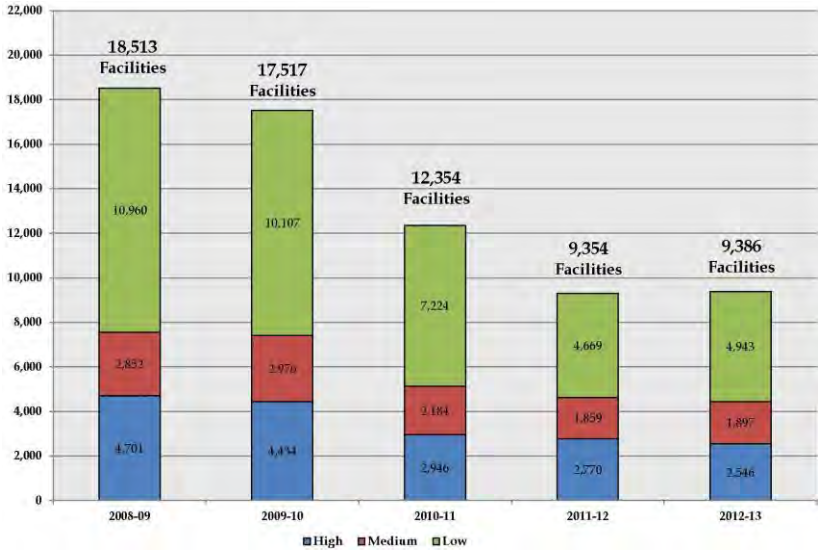


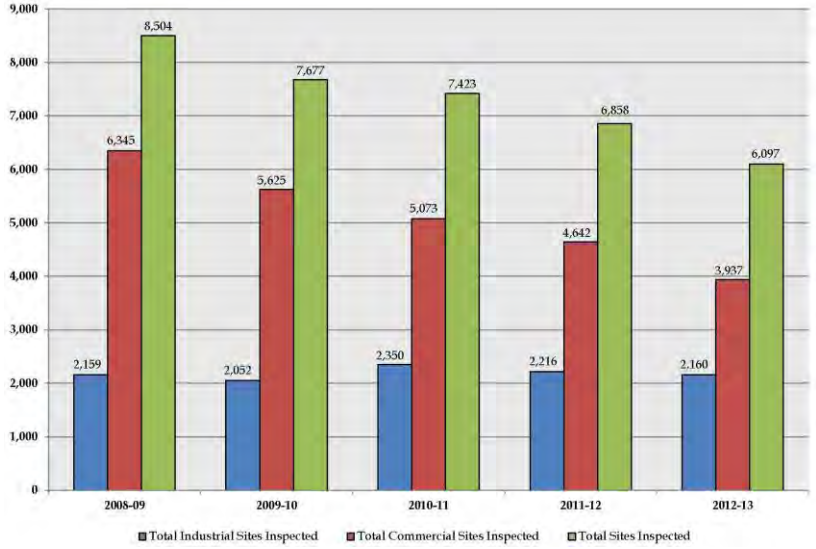
Figure 3.6.2: Commercial Facility Prioritization from 2008-09 to 2012-13



Inspection and Enforcement

The Permittees conducted inspections, follow-up, and enforcement per permit requirements for each of the five years from FY 2008-09 through FY 2012-13 (**Figure 3.6.3)**. This data excludes inspections at Food Service Establishments (FSEs), as these are inspected by the HCA and are tracked separately.

Figure 3.6.3: Total Industrial and Commercial Inspections (excluding FSEs) from 2008-09 to 2012-13



Twenty-four (24) model BMP fact sheets have been prepared (available at http://www.ocwatershed.com/IndustrialCommercialBusinesesActivities.aspx) which include a description of specific minimum source control BMPs for common industrial and commercial activities that may discharge pollutants.

Permittees gauge implementation of the required BMPs through the inspection program. Facilities fall into one of three categories; they have fully implemented, partially implemented, or not implemented any of the required BMPs. As illustrated in **Figure 3.6.4**, the majority of industrial and commercial facilities were implementing BMPs as required upon inspection.

Figure 3.6.4: Industrial and Commercial Site Compliance Rates (excluding FSEs) from 2008-09 to 2012-13

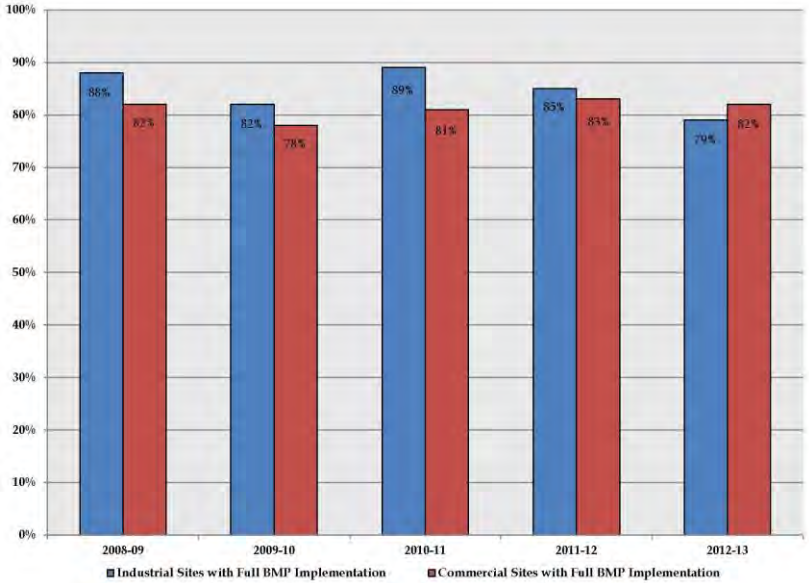
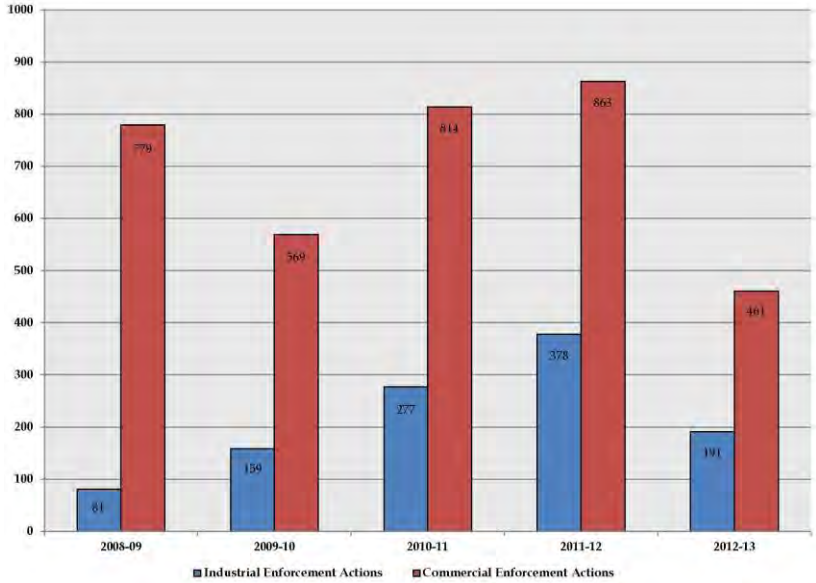


Figure 3.6.5: Industrial and Commercial Enforcement Actions (excluding FSEs) from 2008-09 to 2012-13



Enforcement Activities

Permittees are required to use a progressive enforcement approach and initiate enforcement actions where commercial and industrial facilities are found to be out of compliance. Enforcement for the industrial and commercial component of the Existing Development Program is the responsibility of individual Permittees. Each Permittee has several different levels of enforcement to choose from for different types of situations. This includes – from least severe to most severe – issuance of an educational letter, a notice of non-compliance, an administrative compliance order, a cease and desist order, or a misdemeanor/infraction. Over the past five years, the Permittees conducted enforcement as necessary based on the results of the industrial and commercial inspections.

Where non-compliance is evident during inspections, inspection frequency and enforcement actions are increased until compliance is achieved. Increased follow-up and enforcement appear to be resulting in increased rates of compliance. **Figure 3.6.6** illustrates the number and type of enforcement actions taken at industrial and commercial facilities over the past five years. It appears that lower level enforcement actions such as educational letters and notices of non-compliance are typically successful in gaining compliance, although nearly every year, there are over 100 higher level enforcement actions taken against industrial and commercial facilities.

Figure 3.6.6: Industrial and Commercial Enforcement Actions by Enforcement Types (Excluding FSEs) from 2008-09 to 2012-13

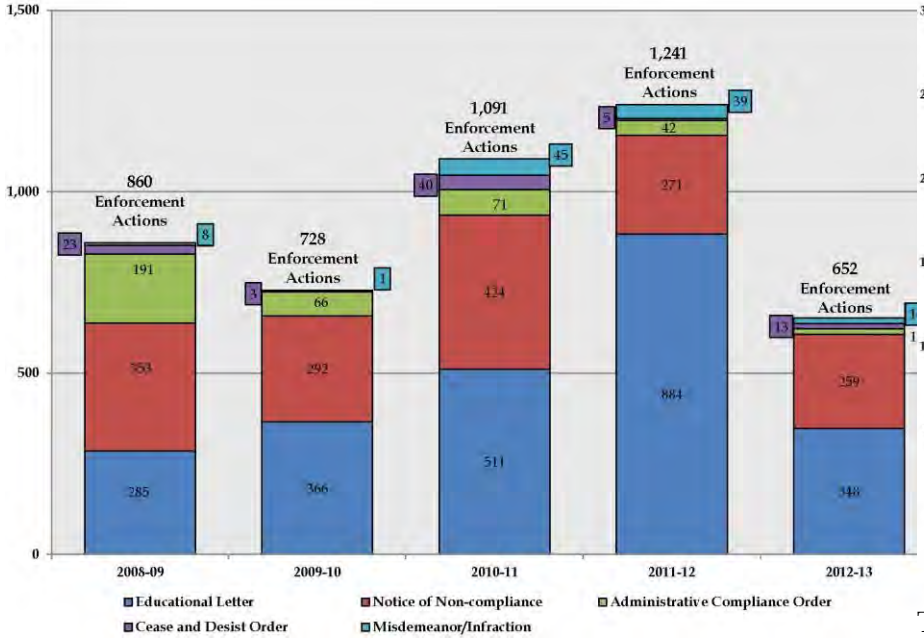
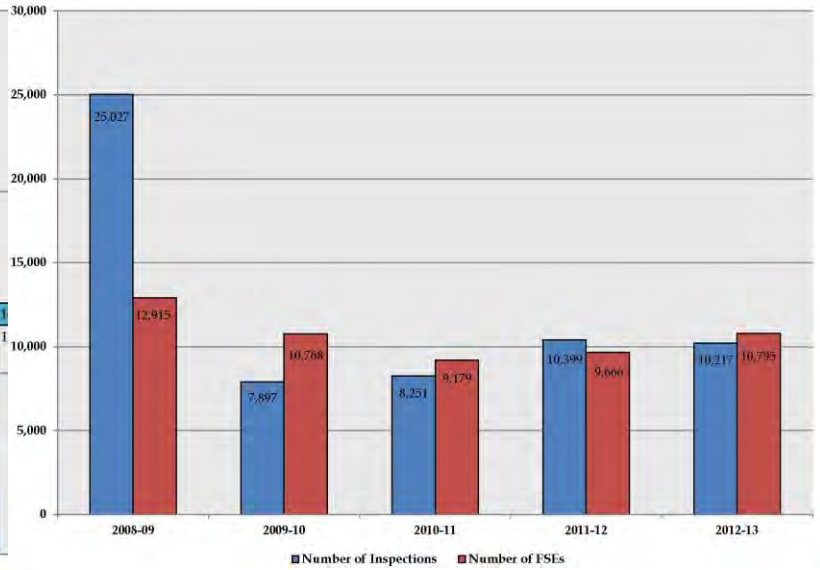


Figure 3.6.7: HCA Annual Inspections at FSEs from 2008-09 to 2012-13

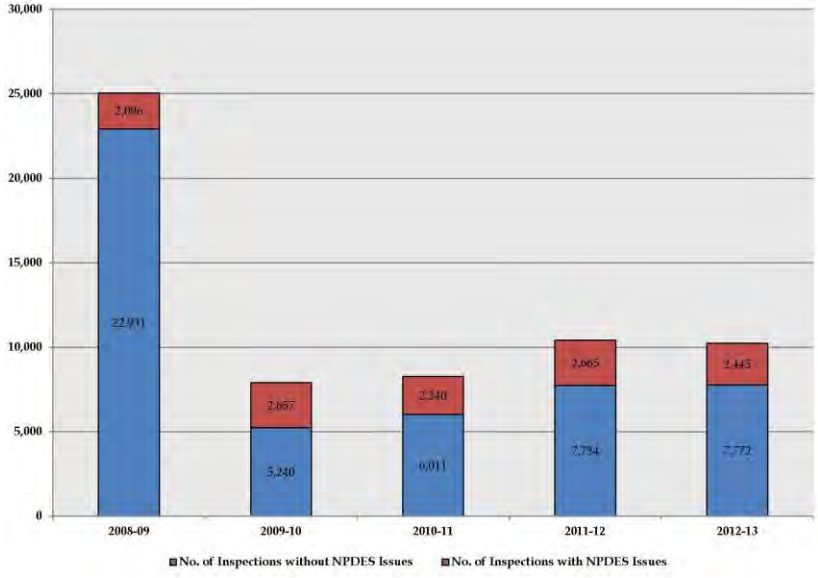


Food Facility Inspection Program

Orange County Health Care Agency (OCHCA) annually conducts up to three inspections of each food service establishment for compliance with the California Uniform Retail Food Facilities Law. The OCHCA inspectors identify NPDES issues during one of these three inspections and they are forwarded to the respective Permittees for follow up. In **Figure 3.6.7**, a sharp decrease in the number of inspections per year is evident between FY 2008-09 and FY 2009-10, due to a clarification in reporting practices.

The numbers of inspections resulting in the detection of NPDES issues at FSEs is illustrated in **Figure 3.6.8**. Where these issues were found, Permittees followed up with the necessary enforcement actions. It appears that the numbers of inspections detecting issues is relatively consistent over the five years.

Figure 3.6.8: NPDES Issues Discovered During FSE Inspections Performed by HCA from 2008-09 to 2012-13



Mobile Business Model Pilot Program

Due to their transitory and regional nature, mobile businesses are a challenging component of the Model Existing Development Program. The Mobile Business Model Pilot Program, which was developed in 2009-2010 and commenced in 2010-2011, is a countywide approach to inventorying and regulating mobile businesses. There are five key elements to the Model Program:

1. Develop an inventory of mobile businesses operating within the County;
2. Identify and require implementation of minimum BMPs for mobile businesses;
3. Provide outreach to the mobile businesses;
4. Perform inspections or provide a self-certification process for the businesses; and
5. Conduct enforcement as necessary to ensure compliance.

In 2011, a web-based Mobile Business Database was developed to serve as a countywide inventory and repository for the information for each business pertaining to inspections and/or self-certification, outreach, and enforcement actions. The database allows Permittees to update the inventory with mobile businesses found to operate within their jurisdiction, as well as enter and track enforcement actions in their jurisdiction and countywide. The database tracks over 1,500 mobile businesses and includes information related to the business type, outreach, and enforcement information.

In order to assist surface cleaners in selecting and implementing the appropriate types of BMPs, a Model Surface Cleaner BMP Fact Sheet was developed in 2011. This BMP Fact Sheet provides the minimum control measures required of the mobile businesses.

A mass-mailing notification was distributed in June 2012 to all mobile detailing businesses in the countywide inventory in conjunction with an outreach workshop held on June 27, 2012. The notification included a workshop flier and mobile detailing brochure. A second mass-mailing notification will be distributed in conjunction with an outreach workshop to be held in November 2013.

The Permittees implemented appropriate enforcement actions where necessary to ensure that Mobile Businesses were implementing the required BMPs **(Figure 3.6.9)**. The increase in enforcement actions in 2010-11 may be due to improved

inventorying countywide after development of the Mobile Business Database (**Figure 3.6.10**).

Figure 3.6.9: Enforcement Actions Issued to Mobile Businesses in Orange County from 2008-09 to 2012-13

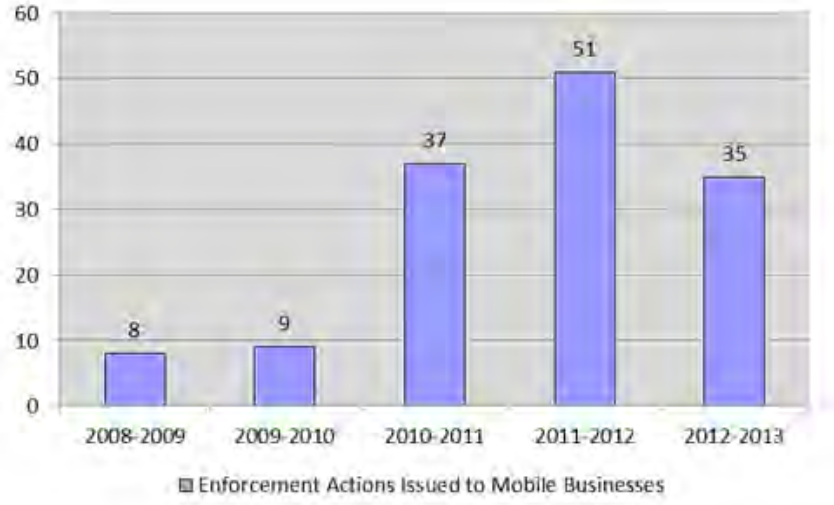
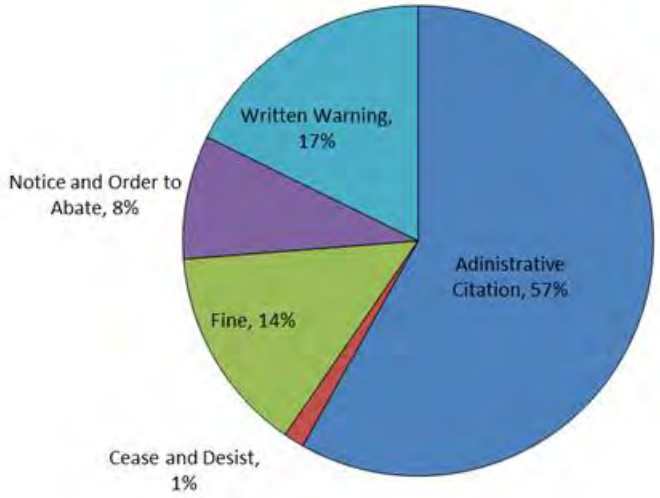


Figure 3.6.10: Types of Enforcement Actions Issued to Mobile Businesses from 2008-09 to 2012-13



Training

Over the permit term the County developed the *Training Program Framework Core Competencies Document*. The *Training Program Framework Core Competencies* document defines the core competencies (knowledge, level of experience, and skills) necessary to ensure the capabilities of individuals carrying out specialized municipal stormwater program compliance responsibilities. It is expected that an individual or group of individuals who has/have developed these competencies will be able to affect jurisdictional conformance with the DAMP/ LIP and the compliance of their jurisdiction.

The Permittees developed and implemented the training program pursuant to Permit requirements and the DAMP. A

region-wide training session was held specific to industrial commercial inspections on April 7, 2009. The NPDES Inspection Sub-Committee also provided training on various subjects relevant to the Existing Development and ID/IC programs. This sub-committee meets quarterly to provide training to inspectors and others on issues related to spill response, inspection and enforcement.

3.6.3 Model Residential Program Implementation and Assessment

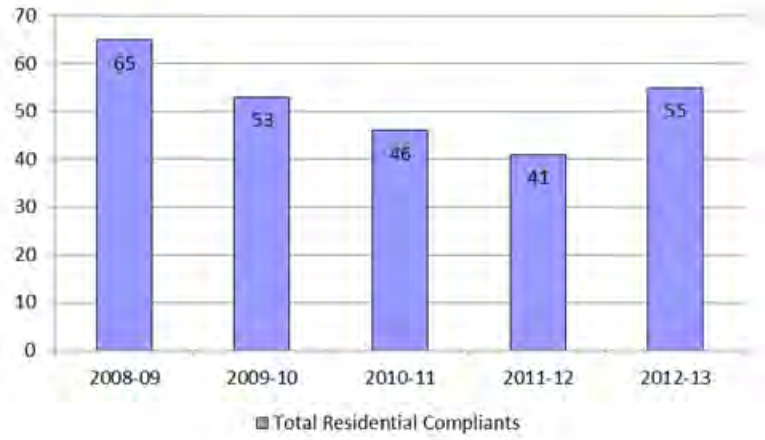
Residential areas comprise a significant portion of the land area of each Permittee's jurisdiction. The Model Residential Program was developed to further reduce pollutants potentially released into the environment from residential activities, including efforts to reduce over-watering. It encourages use of pollution prevention practices as the most effective method to protect receiving water quality and comprises:

- Best Management Practice (BMP) Requirements
- Program Implementation
- Enforcement

During the 2012-13 reporting period, the LIP/PEA Sub-committee updated the eight (8) model BMP fact sheets which include a description of specific pollution-prevention activities for residential areas. The BMP fact sheets are available at http://ocwatersheds.com/ResidentialActivities.aspx. Each fact sheet contains the following sections: targeted pollutants, required activities, and recommended activities. BMP factsheets have been prepared for the following activities:

The implementation of the residential program relies on education and outreach to notify and urge residents to observe the designated sets of BMPs for each of the high threat activities. Permittees encourage the implementation of the designated BMPs for each residence within its jurisdiction principally through the overall public education element of the Program. Over the last five years, the County (as manager of the reporting system) has responded to, or forwarded to Permittees, a total of 260 residential complaints **(Figure 3.6.11)**.

Figure 3.6.11: Residential Complaints, County of Orange, from 2008-09 to 2012-13



Enforcement in residential areas begins with outreach and education and most often compliance is achieved without formal enforcement remedies. However, where necessary, the Permittees have the legal authority to increase the level of enforcement to gain compliance. Where necessary, enforcement actions were taken to achieve compliance. Indeed, between 2008-09 and 2011-12, the County has relied

on formal enforcement actions to gain compliance in residential areas in only seven cases. These included two citations, three criminal cases, and two notices of non-compliance. However, many of the residential cases tracked by the County were referred to other agencies for follow-up and enforcement. The analysis of residential enforcement data performed only includes those actions taken by the County.

3.6.4 Common Interest Areas (CIAs) and Homeowner's Associations (HOAs) Program Implementation and Assessment

Orange County is home to over 3,000 CIAs/HOAs and common interest developments account for 80% of all new housing in the County. Within Orange County, approximately 90% of incorporated residential areas lie within the purview of the maintenance associations that govern CIAs/HOAs. The Permittees developed a CIA/HOA pilot program in 2010-11, and have since coordinated with the University of California Cooperative Extension (UCCE) to outreach to CIAs/HOAs throughout the County. The Model Common Interest Area and Homeowners Association Activities Program includes specifications for pollution-prevention methods for CIA/HOA areas and activities, and includes the following program elements:

- Identification of CIA/HOA Areas and Activities of Concern
- Best Management Practices Implementation
- Program Implementation Strategy
- Enforcement

Nineteen (19) model BMP fact sheets were developed which include a description of specific pollution-prevention activities for CIAs/HOAs. The BMP Fact Sheets are available at http://ocwatersheds.com/CommonInterestActivities.aspx.

Enforcement of BMPs in common interest developments relies on the following mechanisms: public reporting hotline, analysis of dry weather/illicit discharge monitoring results, and municipal employee observations. During the permit term, the County responded to, or forwarded to Permittees, 37 complaints related to CIA/HOA issues. When necessary, enforcement may be accomplished in two ways: through enforcement of conditions and restrictions (CC&Rs) enacted by the associations or through the Permittees' enforcement processes. However, because the program is relatively new, the initial implementation relies on outreach to the CIA/HOAs as a first remedy for violations.

3.6.5 Recommendations

Model Industrial/Commercial Program

Recommendations for program implementation for the upcoming permit term are presented in **Table 3.6.1**.

Table 3.6.1: Industrial and Commercial Recommendations, 2013-2018

Task	Option 1		Option 2	Mobile
	Industrial	Commercial	Industrial / Commercial	
Inventory	No changes	Align inventory list with DAMP and LTEA[1]	No changes to Industrial inventory; align Commercial inventory list with DAMP and LTEA[1]	* Automobile Detailers * Carpet Cleaners * Pet Services
Prioritization	Based on Past Performance	Based on Watershed Pollutants of Concern and Enforcement Data	None	None
Inspections	* On Site - Individual * Drive By + Outreach * Outreach Only	* On Site - Individual * On Site - Property-based * Drive By + Outreach * Outreach Only	* On Site - Individual	As needed
Frequency	* High Priority - Annual * Medium / Low - As needed	* High - Annual On Site * Medium - Annual Drive By + Outreach * Low - 2x/Permit Term Outreach	* 20% of inventory per year *100% of invenotry over permit term	As needed
Follow-up	As needed	As needed	As needed	As needed
Minimum	20% per year	None	20% per year; 100% over permit term	Address within permit term

1. **The commercial site inventory list should be minimally modified to align with the commercial inventory requirements in the current South Orange County Permit**. This would include adding/modifying the following categories:

    - Botanical or zoological gardens
    - Cement mixing, cutting, masonry
    - Golf courses, parks and other recreational areas/facilities, cemeteries
    - Retail or wholesale fueling

2. **The Permit should allow two options for industrial and commercial facility inspections** – Option 1 would consist of a targeted approach, with inspection frequency based on prioritization; Option 2 would consist of a synoptic approach, with no fluctuation in inspection frequency from year to year.

<u>Option 1</u>

a. **Develop a prioritization process for industrial facilities based on past performance** focusing on the 20% of industrial facilities that are non-compliant.

b. **Develop an inspection regime that allows for two types of formal inspections at industrial facilities based upon compliance history**. These should include (1) on-site individual inspections and (2) drive by inspections. Where a business does not receive a formal inspection, outreach should be provided periodically.

c. **The medium and low priority industrial sites should be inspected on an as needed basis**, with no minimum inspection frequency. However, each site that is not inspected (either on-site individual or drive-by) should receive outreach information, including BMP Fact Sheets twice per permit term.

d. **Develop a prioritization process for commercial facilities based on past performance** focusing on the 20% of commercial facilities that are non-compliant.

e. **Develop an inspection regime that allows for three types of formal inspections at commercial facilities based upon compliance history**. These should include (1) on-site individual inspections, (2) on-site property-based inspections, and (3) drive by inspections. Where a business does not receive a formal inspection, outreach should be provided periodically.

f. **The medium and low priority industrial sites should be inspected on an as needed basis**, with no minimum inspection frequency. However, each site that is not inspected (either on-site individual or drive-by) should receive outreach information, including BMP Fact Sheets twice per permit term.

Based upon a preliminary evaluation of the current commercial inspection program, watershed priorities, and enforcement data, the commercial inspection program under

this option would be structured as illustrated in **Table 3.6.2**. This summary table contains the results of the proposed inventory, prioritization, and inspections criteria as described above.

Option 2

a. **Annually inspect 20% of the industrial and commercial facility inventory, with 100% of the industrial and commercial facility inventory inspected over the permit term.**

3. The recently developed program to address mobile businesses appears to be effective. However, based on an analysis of the County's complaint data from 2008-2012, the majority of the violations related to mobile businesses are related to three business types: automobile detailers, carpet cleaners, and pet services. Based on this analysis, the program should focus on these key mobile business types in the next permit term.

Table 3.6.2: Option 2: Proposed Commercial Inspections Program Criteria and Results

	Associated Commercial Sources	Inspection Type	Inspection Frequency	Watershed				
				San Gabriel/ Coyote Creek	Anaheim Bay-Huntington Harbor	Santa Ana River	Newport Bay	Newport Coast
				Bacteria Metals	Metals Nutrients	Bacteria	Bacteria Nutrients Sediments Pesticides	Bacteria
High	**Eating or drinking establishments**	**On-site Individual**	**Annual**	X	X	X	X	X
High	**Auto mechanical repair, maintenance, fueling, or cleaning**	**On-site Property Based**	**Annual**	X	X		X	
High	**Auto impound or storage facilities**			X	X		X	
High	**Auto and other vehicle body repair or painting**			X	X		X	
High	**Portable sanitary service facilities**			X	X	X	X	X
Med	Botanical or zoological gardens, nurseries and greenhouses	**Drive By + Outreach**	**Annual**	X	X	X	X	X
Med	Building materials retail and storage facilities			X	X		X	
Med	Animal facilities such as petting zoos and boarding and training facilities			X	X	X	X	X
Low	*Airplane maintenance, fueling, or cleaning*	**Outreach Only**	**2x/Permit Term**	X	X		X	
Low	*Marinas and boat maintenance, fueling, or cleaning*			X	X	X	X	X
Low	*Equipment repair, maintenance, fueling, or cleaning*			X	X		X	
Low	*Pest control services*						X	
Low	*Painting and Coating*			X	X			
Low	*Landscape and hardscape installation*				X	X	X	X
Low	*Pool, lake, and fountain cleaning*			X	X	X	X	X
Low	*Retail or wholesale fueling*			X	X			
Low	*Cement mixing, cutting, masonry*						X	
Low	*Golf courses, parks and other recreational areas/facilities, cemeteries*			X	X	X	X	X

BOLD indicates >1% of PNIR cases related to POCs

Normal text indicates 1% of PNIR cases related to POCs

Italics indicates 0% of PNIR cases related to POCs

RED indicates new category

Implementation Schedule – Industrial, Commercial, Mobile Program

Industrial, Commercial, and Mobile Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Source Identification and Facility Inventory						
Maintain inventory of required industrial sites	C					
Maintain inventory of required commercial facilities	C					
Prioritization for Inspection (Option 1)						
Update prioritization procedures for industrial and commercial facilities in the DAMP	E	X				
Prioritize industrial facilities based on enforcement history	E	X				
Prioritize commercial facilities based on watershed POCs and enforcement history	E	X				
Facility Inspection Activities						
Inspect 20% of industrial facilities utilizing a combination of on-site, drive-by inspections, and outreach (Option 1)	E					
Inspect commercial facilities according to watershed based prioritization (Option 1)	C					
Track numbers and types of inspections performed at industrial and commercial facilities, including numbers of high, medium, and low priority inspections performed (Option 1)	E					
Annually inspect 20%of the industrial and commercial inventory, with 100% of the industrial and commercial inventory inspected over the permit term (Option 2)	E	X				

Industrial, Commercial, and Mobile Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Best Management Practice (BMP) Implementation						
Update BMP Fact Sheets for existing development as necessary	C					
Provide outreach to all industrial commercial facilities during the Permit term	C					
Enforcement Activities						
Conduct follow-up inspections and enforcement as necessary to ensure compliance	C					
Track types of enforcement actions by facility type	E					
Food Facility Inspection Program						
Maintain and update inventory of FSEs	C					
Inspect FSEs according to prioritization	C					
Track follow-up and enforcement actions related to FSEs	E					
Mobile Business Model Pilot Program						
Maintain inventory of mobile businesses operating within the County focusing on automobile detailers, carpet cleaners, pet services	E					
Identify and require implementation of minimum BMPs for mobile businesses, focusing on automobile detailers, carpet cleaners, and pet services	E					
Provide outreach to the mobile businesses	C					
Perform inspections or provide a self-certification process for the businesses	C					
Conduct enforcement as necessary to ensure compliance	C					

Industrial, Commercial, and Mobile Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Training						
Train inspections and field staff as necessary	C					

1. C = Continue; E = Enhance; N = New

2. X = Performance Standard will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation.

Implementation Schedule – Residential Program

Residential Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Source Identification and Prioritization						
Update and maintain residential source inventories as necessary	C					
Evaluate difference in residential areas within watersheds	E					
Best Management Practice (BMP) Requirements						
Update BMP Fact Sheets as necessary	C					
Program Implementation						
Respond to notifications of NPDES issues from the public, municipal staff, and other regulatory agencies	C					
Facilitate proper collection and management of used oil and household hazardous waste	C					
Track amounts of used oil and HHW collected	C					
Enforcement						
Enforce ordinances as appropriate	C					
Track enforcement actions	C					

1. C = Continue; E = Enhance; N = New

2. X = Performance Standard will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation.

Implementation Schedule – CIA/HOA Program

CIA/HOA Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Identification of CIA/HOA Areas and Activities of Concern						
Update inventory of CIA/HOAs as necessary	C					
Best Management Practices Implementation						
Update BMP Fact Sheets associated with activities of concern as necessary	C					
Program Implementation Strategy						
Develop guidance for inclusion in CCRs for CIA/HOAs	C					
Require new HOAs to include guidance in CCRs	E					
Perform outreach to CIA/HOAs	C					
Coordinate with UCCE and water districts to enhance approaches to IPM implementation and reducing irrigation runoff	C					
Enforcement						
Enforce ordinances as necessary to ensure BMPs are implemented as required	C					

1. C = Continue; E = Enhance; N = New

2. X = Performance Standard will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation.

3.7 Illegal Discharges/Illicit Connections

The Story: ID/IC

- The Permittees continued to aggressively detect and eliminate Illicit Discharges and Illegal Connections through inspection, investigation, and enforcement.

- Spill reporting hotlines provided a resource for public spill and problem reporting, and an iPhone reporting application was developed. All complaints were responded to and resolved.

- The *Model Investigative Guidance for Orange County Illegal Discharges and Illicit Connections Program* was updated.

- Permittee inspection staff were trained on new procedures.

- Essential elements of the Countywide Area Spill Control Program were completed and implemented.

- The Dry Weather Reconnaissance Program was implemented to monitor dry weather discharges and identify potential problem sites for follow-up evaluations. An evaluation of dry weather sampling data indicates that there is a high potential to exceed Numeric Action Levels as specified in the South Orange County MS4 Permit. The Tolerance Interval approach is therefore recommended.

- The Program recommends development of a standardized reporting database accessible by all Permittees.

3.7.1 Overview

It is a specific requirement of the Federal Clean Water Act that non-stormwater discharges, arising from illegal discharges and illicit connections (ID/IC) to the municipal storm drain system, must be effectively prohibited. Since the first term MS4 permit, a programmatic framework for detecting and quickly responding to non-stormwater discharges has been integral to the Program.

3.7.2 Illegal Discharges/Illicit Connections Program Implementation and Assessment

The Model ID/IC Program provides guidance for Permittees when identifying, responding to, and mitigating the effects of non-stormwater discharges**.** The Model Program requires the Permittees to address the following:

- Detect illegal discharges and illicit connections;
- Enable public reporting;
- Investigate illegal discharges and illicit connections;
- Undertake enforcement; and
- Conduct Training.

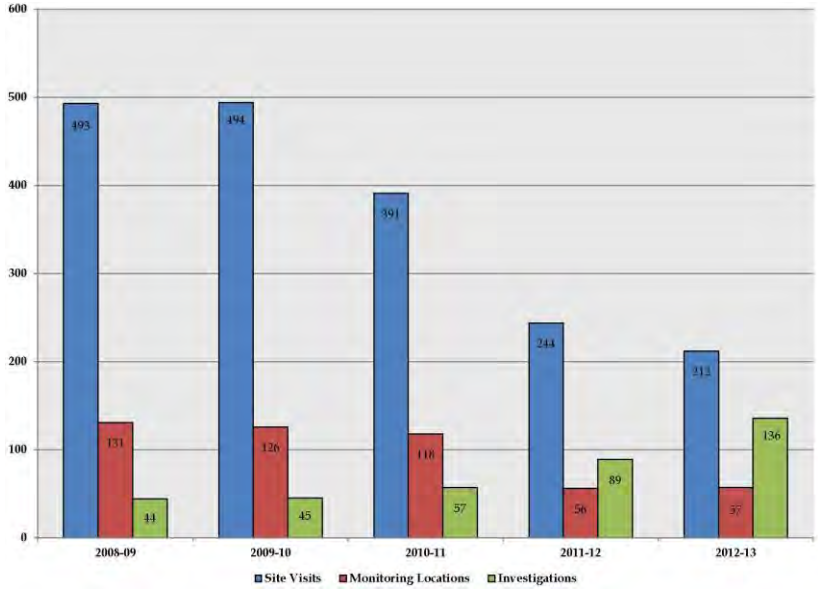
<u>Detection of Illegal Discharges and Illicit Connections</u>

The Permittees implemented an innovative Dry Weather Reconnaissance Program during the Fourth Term MS4 Permit. The Dry Weather Reconnaissance Program is based upon statistically derived benchmarks, specifically aimed at identifying illegal discharges and illicit connections during the typically dry summer months of May through September. The Dry Weather Reconnaissance Program uses a suite of water quality analyses conducted in the field at designated random and targeted drains. The Permittees use the findings of the Dry Weather Reconnaissance Program to trigger

investigations and evaluate BMP performance. Field data is entered into the County's CBI MS4 on-line database system to which Permittees have been provided with login information and have immediate access to all field data once it is entered into the system.

The Dry Weather Reconnaissance Program requires three visits to the random sites and five visits to the targeted sites during the dry season (note: the dry weather monitoring season runs from the beginning of May through the end of September each calendar year). Over the past five years, the Permittees conducted a total of 1,834 site visits. Prompted by findings of elevated contaminant concentrations, investigations were triggered on a total of 371 occasions (**Figure 3.7.1**).

Figure 3.7.1: Dry Weather Reconnaissance Program Results from 2008-09 to 2012-13



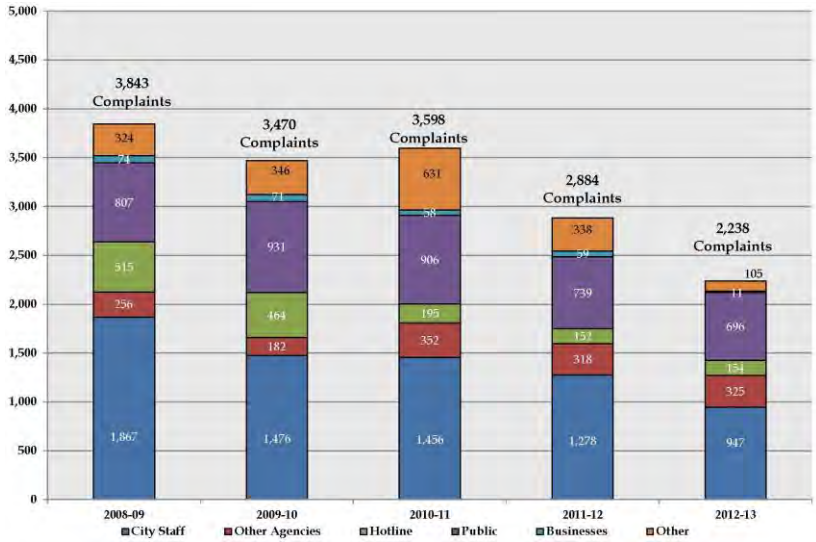
Reporting

The Permittees continue to field complaints stemming from numerous sources, including the water pollution telephone hotlines. Telephone and web-based reporting systems (both countywide and in individual cities) for the general public have been established and are advertised in the Program's public education materials, Orange County "White Pages" telephone directories, and Permittee websites.

The Permittees' field inspectors are trained to detect illegal discharges as part of their daily activities and, indeed, the majority of illegal discharges continue to be detected by Permittee staff. In addition, the Permittees promote hotline numbers, principally 1-877-89-SPILL, to receive water pollution complaints and incident information from the public and use database software to document the reported incidents which assists with the tracking of water pollution complaints by source. The Permittees also developed an iPhone application to provide another tool for the general public to use when reporting water pollution issues

Over the past five years there has been a decrease in the total number of complaints received (**Figure 3.7.2**).

Figure 3.7.2: Source of Complaints from 2008-09 to 2012-13



Investigate Illegal Discharges and Illicit Connections

Each Permittee has designated Authorized Inspectors to investigate compliance with, detect violations of, and take actions pursuant to their Water Quality Ordinance. Authorized Inspectors follow specific procedures documented in the *Model Investigative Guidance for Orange County Illegal Discharges and Illicit Connections Program* (*Investigative Guidance Manual*). The *Investigative Guidance Manual* was updated by the Permittees during the permit term. The revision included adding resources and tools as appendices and updating key resources.

The Permittees maintain records of information from a complaint, notification, or response request. To ensure that the necessary information is collected, the Permittees use pre-established forms to collect information. After the initial entry of the information on the Pollution Notification/Investigation Request (PNIR) or related form, the information is generally entered into a database. The data from the Permittees' databases is analyzed to increase the Permittees' awareness regarding the most problematic waste categories and facility activity types.

Figure 3.7.3 and **Figure 3.7.4** display results from the County-maintained PNIR database covering the 2008-09 to 2011-12 reporting periods. **Figure 3.7.3** provides a breakdown of the waste category under which each ID/IC discharge investigation was classified. The waste categories appear to be well-distributed resulting in the lack of dominant waste categories. **Figure 3.7.4** displays a breakdown of the facility activity type under which each ID/IC discharge investigation was classified. The most dominant facility activity types encountered during ID/IC discharge investigations are Industrial and Commercial Activities, Municipal, and Residential Activities. To further understand the management actions that the Permittees may take to address these facility activity types, additional analyses are conducted in the sections of this document that address these facility activity types. [See **Section 3.2** (Municipal Activities) for the additional analyses conducted for the Municipal facility activity type and see **Section 3.6** (Existing Development)].

Figure 3.7.3: Waste Categories Encountered during ID/IC Discharge Investigations

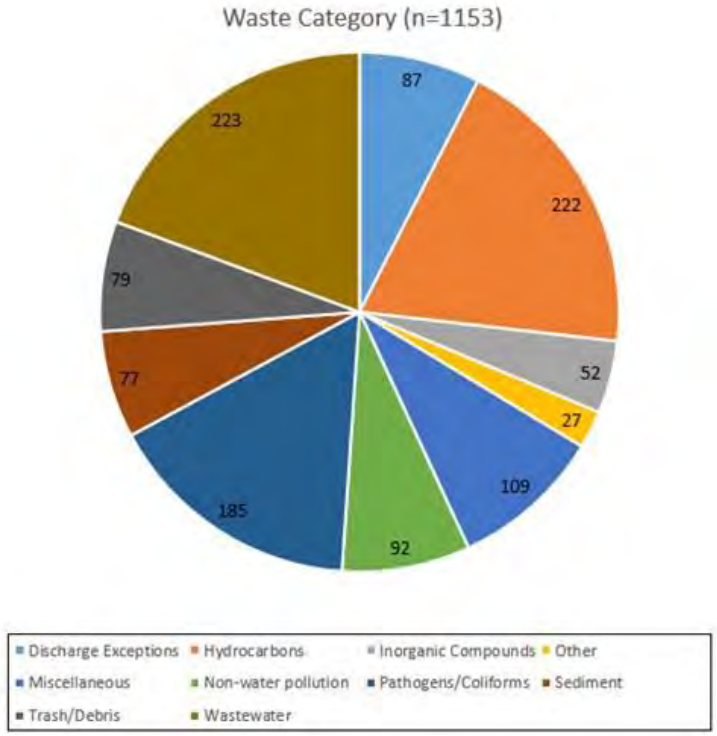
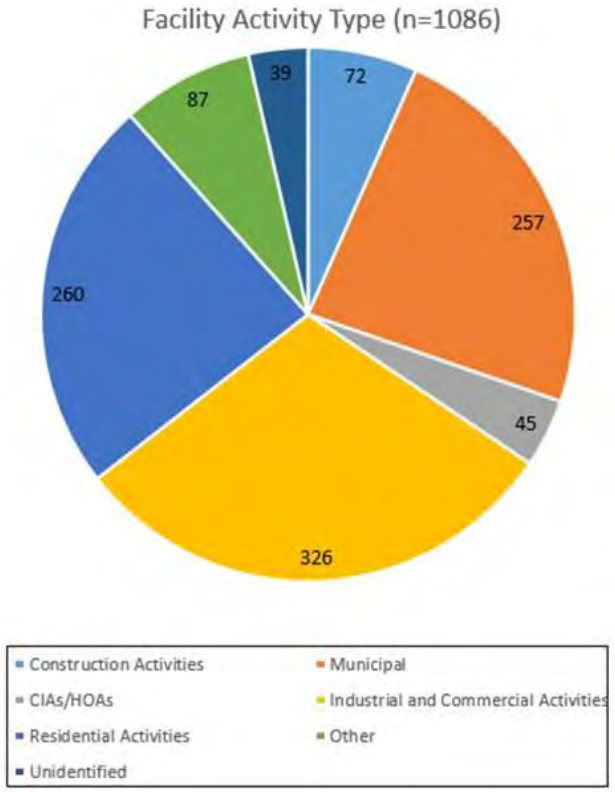


Figure 3.7.4: Facility Activity Types Encountered during ID/IC Discharge Investigations

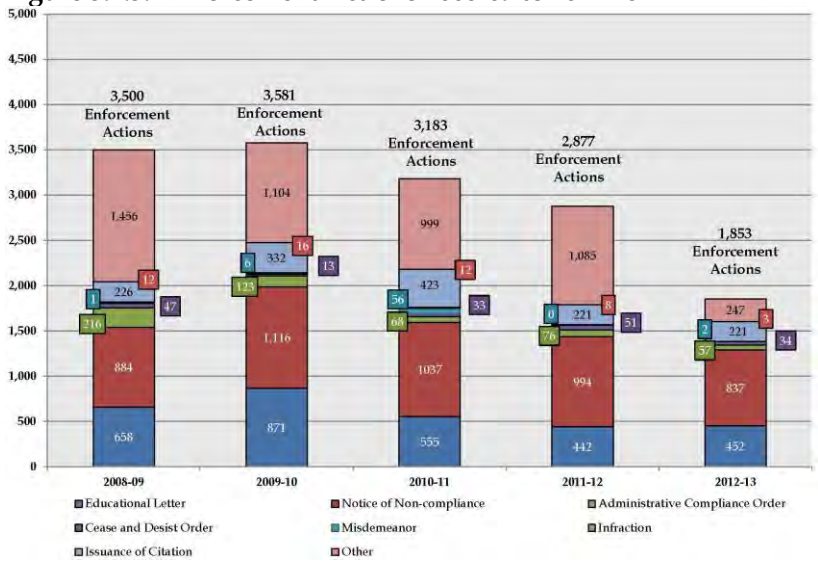


<u>Enforcement</u>

Enforcement actions are undertaken according to the adopted Water Quality Ordinances and accompanying Enforcement Consistency Guide. In instances of noncompliance, the Permittees adopted one of four types of remedies, including educational letters, administrative remedies, criminal

remedies, or other civil or criminal remedies, as appropriate. **Figure 3.7.5** displays the number and type of enforcement actions undertaken during the past five reporting periods. The five year trend largely represents a decrease in the total number of enforcement actions. Given the correlating decrease in the total number of complaints received over the same time period, the decrease in the total number of enforcement actions indicates a change in behavior which is causing a decrease in the total number of ID/IC incidents occurring.

Figure 3.7.5: Enforcement Actions 2008-09 to 2012-13



Training

During the permit term, the Permittees developed a training program, including curriculum content. The training program defined expertise and competency for each key area of jurisdictional stormwater program responsibility, including Authorized Inspectors. Illegal Discharges/Illicit Connections (ID/IC) Training Sessions for Authorized Inspectors and spill responders were conducted on May 18, 2010 (66 attendees) and April 16, 2013 (69 attendees). In addition the NPDES Inspection Sub-Committee also provided training on various subjects relevant to the ID/IC program. This sub-committee meets quarterly to provide training to Authorized Inspectors and others on issues related to spill response, inspection and enforcement. It also serves as a forum for the coordination and discussion of ongoing difficult or new enforcement, investigation, or enforcement issues and to profile cases or incidents.

Model Sewage Spill Response Procedures

Starting in 2000, the County and OCSD began development and implementation of a coordinated sewage spill prevention and response demonstration project (i.e. the "Countywide Area Spill Control (CASC) Program"). Initially intended to be implemented Countywide over a period of 10 years, the implementation schedule was expedited by Section VII.7. of the Santa Ana Fourth Term Permit which required implementation of the CASC Program's "essential elements" by May 2010.

During the permit term, the Permittees successfully implemented the CASC Program's "essential elements". The Permittees have defined "essential elements" to include the following:

1. *Participation in CASC coordination efforts* – attend meetings in order to receive information on CASC Program developments, and provide notifications to the County of any sanitary sewer overflow (SSO) that may impact or threatens to impact a regional water body.

2. *CASC Area Characterization* – Each Permittee to provide GIS map layers (or other maps if GIS map layers are unavailable) of the stormdrain system and sanitary sewer system to the County in order to define and characterize the area.

During the 2011-12 reporting period, the CASC Program was activated three times: (1) on January 13, 2011, to respond to a 100,000 gallon spill; (2) on April 12, 2012, to respond to a 1,900 gallon sewage spill; and, (3) on April 18, 2012, to respond to a 77,500 gallon sewage spill. During the 2012-13 reporting period, the CASC Program was activated twice: (1) on July 25, 2012, to divert 355,000 gallons of clarifier wastewater from Fullerton Creek/Coyote Creek/San Gabriel River to the sanitary sewer; and, (2) on February 4, 2013, to divert 200 gallons of runoff with ammonia discharge from Santa Ana Delhi Channel to the sanitary sewer.

CASC Response on April 18, 2012, Santa Ana River

Actions Levels

The Permittees have been implementing the seasonal Dry Weather Reconnaissance Program in the Santa Ana Region since May 2006. Although the San Diego Regional Board has modified the dry weather reconnaissance-based monitoring to include numeric action levels (NALs), the Permittees are proposing the continued implementation of the seasonal Dry Weather Reconnaissance Program in the Santa Ana Region since it is more effective and allows the Permittees to identify high priority discharges to investigate.

The Dry Weather Reconnaissance Program's hybrid reconnaissance monitoring design combines probabilistic and targeted sampling and the use of formal statistical tools (tolerance intervals and control charts). This design enables the program to systematically prioritize problematic sites, compare conditions to the regional urban background, and track trends over time.

- A *tolerance interval* bound is the upper or lower confidence-interval bound of a quantile of the background data distribution. Tolerance intervals are derived from the probabilistic site data and are used to quantify the key aspects of the regional background.
- *Control charts* are used to establish an upper or lower bound on a data distribution, based on previous monitoring data. They are created for each site and provide a means of tracking data at individual sites and identifying when new data values deviate substantially (either upward or downward) from previous experience.
- Used together, tolerance intervals and control charts provide a consistent and quantitative means of identifying sites that exhibit excursions in pollutant values.

In order to demonstrate the effectiveness of the Dry Weather Reconnaissance Program, a comparison of this program and the NALs-based program is provided below.

This comparison shows that the NALs-based program requires increased resources because investigations are triggered at a much higher frequency for many constituents (e.g. enterococci and reactive orthophosphate as P; **Figure 3.7.6** and **Figure 3.7.7** respectively).

- For example, based upon historical data **(Figure 3.7.6)**, the probability that a sample does not exceed the NAL for enterococci is approximately 3%. As a result, roughly 32 out of 33 sampling events would be required to be investigated.
- In contrast, the probability that a sample does not exceed the enterococci tolerance interval is 90%, which results in only 1 out of 10 sampling events requiring an investigation.
- Moreover, the Permittees will be unable to discriminate between instances of ID/IC and conditions that are essentially artifacts of a constructed storm drain system and/or the local geology.

Figure 3.7.6: Enterococci Exceedance Frequencies Associated with Dry Weather Reconnaissance Tolerance Intervals Compared with Exceedance Frequencies Associated with NALs

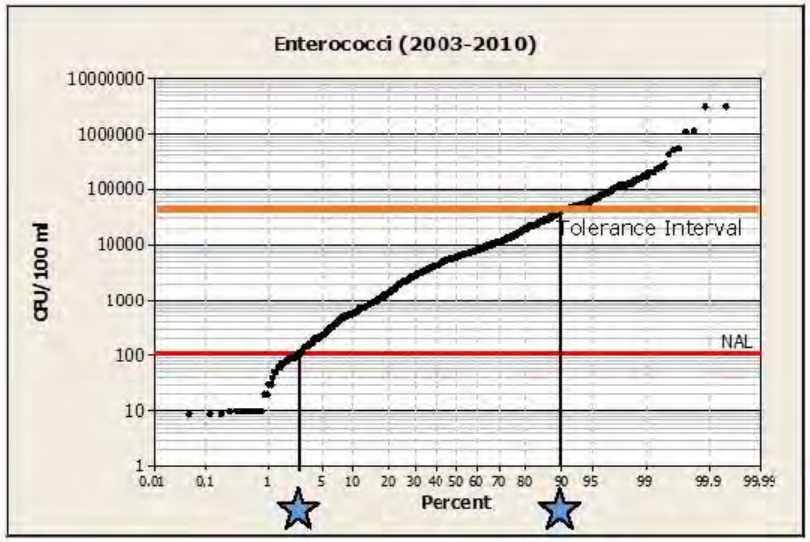
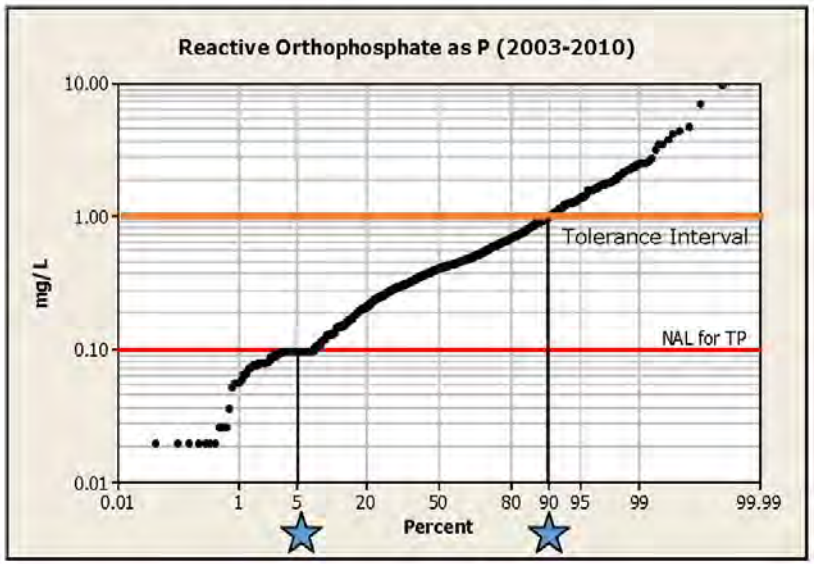


Figure 3.7.7: Reactive Orthophosphate as P Exceedance Frequencies Associated with Dry Weather Reconnaissance Tolerance Intervals Compared with Exceedance Frequencies Associated with NALs



Comparison of the 2011-12 NALs data collected in the San Diego Region with the data from the dry weather hybrid reconnaissance monitoring program for the 2009-10 reporting period shows how the focus of efforts to address ID/IC has been ineffectively re-directed in the South Orange County MS4 Permit (see **Table 3.7.1**).

- For the Dry Weather Reconnaissance Program the Permittees conducted 274 site visits; whereas for the NAL-based program the Permittees conducted 45 site visits.
    - Although the Permittees collected data and information for six times more stations as a part of the Dry Weather Reconnaissance Program, the NALs-based program identified more than six times the number of exceedances
        - Dry Weather Reconnaissance Program – 274 site visits/36 Exceedances
        - NALs-Based Program – 45 site visits/240 Exceedances
    - The Dry Weather Reconnaissance Program identified exceedances primarily associated with turbidity, surfactants, unionized ammonia, and total phosphate.
    - The NALs-based program identified exceedances for all fifteen (15) constituents analyzed, with the top three exceedances associated with TDS, entercoccus, and total nitrogen.
- The South Orange County Permittees have found strong positive linear relationships between metals associated with runoff and seepage from the Monterey and Capistrano marine sedimentary formations. Both formations are known to be enriched in trace metals and are common across southern Orange County. This evidence suggests that many exceedances are due to non-ID/IC factors (i.e. local geology - Ni, Cd). This evidence reaffirms the concern noted previously regarding being unable to discriminate between instances of ID/IC and non-ID/IC conditions.

Table 3.7.1. Comparison of the 2011-12 NALs Data Collected in the San Diego Region with the Data from the Dry Weather Hybrid Reconnaissance Monitoring Program for the 2009-10 Reporting Period

Constituent	# of NAL Exceedances	% of NAL Exceedances	# of Reconnaissance Action Level Exceeedances	% of Reconnaissance Action Level Exceeedances
	2011-2012		2009-2010	
pH	1	2	0	0
TDS	42	93	0	0
Dissolved Oxygen	2	4	0	0
Turbidity	3	7	3	1
Surfactants	3	7	14	5
Total Coliforms	24	53	0	0
Fecal Coliforms	19	42	0	0
Enterococcus	42	93	0	0
Unionized Ammonia	3	7	8	3
Total Nitrogen	41	91	0	0
Total Phosphate	38	84	11	4
Cadmium	13	28	0	0
Copper	1	2	0	0
Nickel	7	15	0	0
Zinc	1	2	0	0
Total # of Site Visits	**45**		**274**	

In summary, if the current, Dry Weather Reconnaissance Program is revised to include NALs based on Basin Plan objectives similar to the program required within the San Diego Region, the Permittees will lose the ability to discriminate between true instances of ID/IC and ambient conditions in a storm drain system draining landscapes underlain by marine sedimentary formations containing phosphorus and a number of heavy metals. The Permittees propose that the Dry Weather Reconnaissance Program remain unchanged; thus, retaining the statistical underpinnings of the hybrid reconnaissance monitoring design.

3.7.3 Recommendation

The major elements of the program (e.g. the Dry Weather Reconnaissance Program, the facilitation of public reporting of complaints, and the designation and training of Authorized Inspectors) continue to be vital and successful pieces of the Program. The recommendation is:

1. **Continue current Model ID/IC Program.**

Implementation Schedule – ID/IC

Proposed ID/IC Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Detect Illegal Discharges and Illicit Connections						
Implement Dry Weather Reconnaissance Program	C					
Facilitate Reporting						
Advertise telephone, web-based, and applications-based reporting systems	C					
Coordinate amongst Permittees to ensure that the appropriate staff are notified when illicit connections are detected	C					
Investigate Illegal Discharges and Illicit Connections						
Investigate compliance with, detect violations of, and take actions pursuant to each Permittee's respective Water Quality Ordinance and the *Investigative Guidance Manual*	C					
Maintain records of information from a complaint, notification, or response request in an ID/IC database	C					
Evaluate using a standardized ID/IC record-keeping system and/or database amongst all Permittees	N		X			
Enforce upon Illegal Discharges and Illicit Connections						
Take enforcement actions according to each Permittee's respective Water Quality Ordinances and accompanying Enforcement Consistency Guide	C					

Proposed ID/IC Program Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Track enforcement actions	C					
Conduct Training						
Develop additional training modules as needed	E	X				
Conduct training of Authorized Inspectors	C					
SSR1 – Model Sewage Spill Response Procedures						
Implement CASC Program countywide	C					

1. C = Continue; E = Enhance; N = New

2. X = Performance Standard will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation.

4.0 Controlling Pollutant Sources: Watershed Programs

4.1 Overview

Watershed management is the term used for the approach to water quality planning that places an emphasis on the watershed (the area draining into a river system, ocean or other body of water through a single outlet) as the planning area and looks to multi-jurisdictional solutions to problems that cut across programs and jurisdictional boundaries.

Table 4.1: Santa Ana Region Watersheds

Watershed Planning Area	Major Watercourses
San Gabriel River/Coyote Creek	Coyote, Carbon, Fullerton, and Brea Creeks
Anaheim Bay/Huntington Harbour	East Garden Grove Wintersburg Channel, Bolsa Chica Channel
Santa Ana River (within Orange County)	Talbert Channel, Santiago Creek and Santa Ana River
Newport Bay	San Diego Creek, Santa Ana Delhi Channel
Newport Coastal Streams	Buck Gully, Los Trancos Canyon Creek, Muddy Canyon Creek

While the focus of watershed planning in North Orange County is on specific pollutants of concern associated with urban stormwater, particularly TMDLs, this management approach is also supportive of broader objectives such as watershed habitat restoration and integrated water resource management.

There are five distinct watersheds within the Santa Ana Regional Board area which are identified in **Table 4.1** and shown **in Figure 4.1**

4.2 Non-TMDL Watershed Accomplishments

Non-TMDL watershed management efforts have included both mapping of the landscape characteristic that are significant for hydrologic processes and a number of environmental restoration studies and projects. Initial extensive mapping of hydromodification susceptibility, infiltration feasibility and regional BMP opportunity sites for the entire north Orange County area has been completed and is available through an web-based portal..

Environmental restoration efforts have focused on ecological outcomes rather than water quality outcomes. These efforts are broad stakeholder initiatives rather than permit compliance driven planning processes, and are predominantly cooperative projects with the Army Corps of Engineers. The availability of federal funding will be a major determinant of progress with respect to these initiatives.

San Gabriel River - Coyote Creek*: Coyote Creek - Lower San Gabriel River Watershed Feasibility Study*

The Army Corps of Engineers (Corps) completed a hydrology study for the Lower San Gabriel River Coyote Creek Watershed in May 2011. The intent of the Hydrology study was to prepare a baseline hydrology report that provides a hydrologic analysis of the Coyote Creek Watershed to help determine the feasibility of restoration opportunities in the watershed.

***Anaheim Bay/Huntington Harbour**: Westminster Watershed Management Plan*

The Corps is undertaking a comprehensive study of the Westminster Watershed including the East Garden Grove-Wintersburg Channel and the Bolsa Chica Channel in order to develop a rehabilitation plan that will investigate flood control, ecosystem restoration, recreation, water quality and shoreline protection. The feasibility study phase is estimated to cost $5,500,000 and will be completed in two to three years.

***Santa Ana River**: Fairview Park Wetlands and Riparian Habitat Project*

The City of Costa Mesa's Fairview Park Wetlands and Riparian Habitat Project include the restoration of approximately 30 acres containing the following four major design elements:

- 17-acre riparian habitat area;
- 5-acre area of water treatment ponds for water quality improvement and percolation;
- 13-acre area of upland habitat including a 2-acre public park; and
- Water delivery system to the ponds and riparian area from a modified pump station along the Greenville-Banning Channel.

Phase 1 of the project, which has been completed, included grading one of the large wetland channels that meanders though the site and planting of native plants, shrubs and trees to create the 17-acre riparian habitat area

Phase 2 of the project has recently been completed. This phase included building the remaining ponds, constructing the water delivery system and completing planting. Existing dry weather flows from nearby Greenville-Banning Channel are now diverted into the wetlands to flow through a series of engineered wetland channels and infiltration ponds. Water diverted into the wetlands infiltrates into the groundwater or removed through evapotranspiration as well as supporting riparian habitat throughout the park. The completed project will includes walking paths, flow diversion structures and bridges located amongst a series of streams and channels covered with thick wetland vegetation.

The City of Costa Mesa continues to look for funding to complete Phase 3 that will include amenities such as interpretive centers, picnic tables and other educational features for the park.

***Santa Ana River:** Huntington Beach Wetlands Restoration*

The Orange County Flood Control District (OCFCD) has been cooperating on a large scale restoration of tidal wetlands complex that once formed a portion of the Santa Ana River's estuary. The Huntington Beach Wetlands Conservancy owns Talbert Marsh, a 25-acre site adjacent to the River restored in 1990. The Conservancy acquired additional acreage along Pacific Coast Highway and completed a comprehensive wetlands restoration plan for 191 acres in March 2005. Restoration of the Brookhurst and Magnolia Marshes commenced in 2008 and was completed in 2010 with funding from NOAA/Recovery Act funds ($3.5 million), the Orange County Flood Control District ($1.2 million), the Montrose Settlement Fund ($2.0 million), the City of Huntington Beach ($0.12 million), and AES Corporation ($3.9 million).

Newport Coastal Streams: *City of Newport Beach Initiatives*

The Newport Coast Watershed area covers about 10 square miles and eight coastal canyons; it extends south of Corona Del Mar in Newport Beach to El Morro Canyon in Crystal Cove State Park. Two of the canyons are 303(d) listed and the entire watershed drains to one of two Areas of Special Biological Significance (ASBS's) (the Newport Beach Marine Life Refuge and/or the Irvine Coast Marine Life Refuge). The following actions are under way by the City of Newport Beach to address canyon degradation, ASBS concerns and the 303(d) listing:

- Newport Coast Runoff Reduction Project;
- Lower Buck Gully Erosion Control Project;
- Cameo Shores Runoff Reduction Project;
- Shore Cliffs infiltration galleries;
- Installation of a CDS unit at Pelican Point;
- ASBS program implementation, including runoff reduction and the installation of structural BMPS
- Pilot project installing pervious pavers at the State Parks' parking lot, and
- Installation of over 800 ET Controllers and 3,000 high efficient nozzles within the watershed.

Santa Ana River*: Talbert Channel and Lower Santa Ana River Water Quality Diversions and Investigation*

On October 15, 1999, the Santa Ana Regional Board issued a Section 13267 Directive to the County of Orange and five cities concerning bacteriological water quality impairments in the Talbert and Lower Santa Ana River watersheds that may be affecting surfzone water quality. In response to the Regional Board's Directive, the County of Orange constructed dry weather urban runoff diversion projects in four flood control facilities [Huntington Beach Pump Station (D01PS1), Talbert Channel (D03), Santa Ana River (E01); and Greenville Banning Channel (D03)] for the diversion of dry weather urban runoff, an area of 16,575 acres. Runoff is diverted to the sanitary sewer collection system for conveyance to OCSD, where it is treated prior to offshore ocean outfall discharge. Similar diversion actions were taken by the City of Huntington Beach at a number of pump stations. The project goals were to divert all dry weather urban runoff from the watershed year-round and reduce the number of beach postings and closures due to high bacteria counts at the Huntington Beach State Beach.

The Talbert Channel, Greenville Banning Channel, and Huntington Beach pump station diversion facilities have been continuously operational, excepting periods of rainfall and subsequent storm runoff. The Santa Ana River diversion was generally operated only during the dry season (May – October) due to operational issues during the rainy season. As a result of these diversion programs, there has been no re-occurrence of the extensive beach closures of 1999.

Newport Bay*: Upper Newport Bay Ecosystem Restoration Project*

The Upper Newport Bay, located in Newport Beach, is one of the last remaining coastal wetlands in Southern California. The wetlands play a crucial role in providing habitat for migratory waterfowl, shorebirds and endangered bird and plant species. In the past decades, rapid urbanization of the watershed has significantly increased the flow of sediment into the Bay. The original watershed area was 15 square miles, but with the San Diego Creek channelization for flood control purposes, it expanded the drainage area to 152 square miles.

The condition of the Upper Newport Bay required restoration to preserve this vital natural resource for the future. Without dredging the Bay, the ocean inlet would have choked with sediments, restricting the tidal influence, gradually turning the Bay into a sediment filled meadow.

The Upper Newport Bay Ecosystem Restoration Project was achieved in 2 construction phases, beginning in spring 2006. The project included two expanded sediment basins, dredged to deepen and widen the sediment collection facilitated at the north end of the Bay. The sediment basins will capture incoming sediment allowing TDML limits to be met. Restoration measures included the relocation of a tern island from the upper basin to the lower basin, wetland creation and restoring degraded habitat, resulting in improved tidal circulation and habitat enhancement. When completed, a total of 2.3 million cubic yards was dredged and safely disposed offshore or used to improve/create new islands and mudflats. The increased sediment basin capacity reduces the maintenance dredging cycle to approximately once every 21 years.

The County of Orange, and California Department of Fish & Game, as the local sponsors, joined with the Corps, the California Coastal Conservancy, and the City of Newport Beach, to form a multi-agency partnership. The project cost of approximately $50 million project was shared with 65 percent Federal (Corps), and 35 percent local sponsor contributions. The final phase was accomplished with an appropriation of $17 million in federal funds from the American Recovery and Reinvestment Act (ARRA). The Upper Newport Bay Ecosystem Restoration Project was completed ahead of schedule and under budget in September, 2010.

4.3 TMDL Watershed Accomplishments

The Permittees' TMDL watershed-based water quality planning efforts are focused on achieving urban waste load allocations (WLAs). In the Santa Ana Regional Board area of Orange County, TMDL promulgation has resulted in three regulatory approaches, specifically (1) incorporation of requirements into the permit based on issues in neighboring Los Angeles County; (2) California Water Code 13267 Directives and (3) the incorporation TMDL into the Fourth Term MS4 Permit.

Through the Fourth Term Permit term, the Permittees have made significant progress in waterbodies with effective TMDLs. Accomplishments include:

***San Gabriel River/Coyote Creek**: San Gabriel River Regional Monitoring Program*

The Sanitation Districts of Los Angeles County are required, as a condition of their NPDES Permit, to work with all agencies and interested parties in developing a watershed-wide monitoring program for the San Gabriel River Watershed. The County, as Principal Permittee, is participating in this workgroup which is facilitated by the Council for Watershed Health. The Principal Permittee provided sample collection and analysis for up to three random sites in Orange County per year since the beginning of the monitoring program. The data are presented in annual reports available through the Council for Watershed Health.

***San Gabriel River/Coyote Creek:** Coyote Creek Metals TMDL*

The San Gabriel River and Impaired Tributaries TMDLs (Coyote Creek Metals TMDL) established mass-based WLAs for total copper, total lead, and total zinc in wet weather and total copper in dry weather. The TMDLs were established for the Los Angeles Region since most of the San Gabriel River watershed lies within that region, but 54% of the Coyote Creek watershed lies in Orange County within the jurisdictional boundary of the Santa Ana Regional Board. While the Los Angeles Regional Board has no jurisdiction over portions of Coyote Creek within Orange County, the Santa Ana Regional Board deferred to the findings of Los Angeles Regional Board and incorporated some TMDL requirements into the Orange County MS4 Permit, particularly the development of a Source Control Plan and Monitoring Program (SCP).

In 2009, the County initiated SCP development. A Work Group was convened, consisting of the County and the cities of Anaheim, Brea, Buena Park, Cypress, Fullerton, La Habra, La Palma, Los Alamitos, Placentia, and Seal Beach (watershed cities), to help guide SCP development. The SCP was finalized and approved by the Work Group in June 2010.

In July 2010, the County initiated monitoring activities under the SCP on behalf of the watershed cities. Since then, a total of six sites have been monitored monthly for total and dissolved metals, hardness, and other parameters. These sites will continue to be monitored to establish baseline water quality conditions in the watershed.

***Newport Bay**: Nitrogen and Selenium Management Program (NSMP)*

The NSMP was created in 2004 in response to a general NPDES permit (Order No. R8-2004-0021, which was replaced by R8-2007-0041 and subsequently amended by R8-2009-0045). The permits establish waste discharge requirements for certain groundwater-related discharges and regulate *de minimus* discharges in the Newport Bay Watershed. The NSMP is a collaborative effort of up to 20 stakeholders, including various State, county, and local agencies, environmental groups, and private entities with the goal of developing management strategies and treatment technologies for both selenium and nitrogen for the watershed. The Principal Permittee is the Chair of the NSMP, providing program leadership and ensuring implementation of the work plan and consequential compliance with the terms of the permit. A work plan was developed by the NSMP and approved by the Santa Ana Regional Water Quality Control Board in 2005. The work plan focused on development of treatment technologies and BMPs; development of an offset, trading or mitigation program; and development of a tissue-based site-specific water quality objective. Participation in the NSMP and implementation of the approved Work Plan constituted compliance with the permit. Since permit expiration in December 2009, a Time Schedule Order R8-2009-0069 (TSO) has been in place to provide interim coverage for groundwater-dewatering discharges of NSMP stakeholders.

Since issuance of the TSO, the efforts of the NSMP have focused on development of a BMP Strategic Plan, which outlines a phased, adaptive approach to achieving applicable selenium water quality standards. The cornerstone of the BMP Strategic Plan will be two dry weather diversion pipeline projects, located at Peters Canyon Wash and Santa Ana-Delhi Channels, respectively, that will intercept and divert dry weather flows to OCSD for treatment and/or reuse. It is expected that these projects will achieve significant selenium and nitrogen reductions in the watershed.

For Big Canyon Wash watershed, which is located within the City of Newport Beach and drains directly to the Upper Newport Bay, the City has developed a comprehensive selenium management program. This program includes groundwater-surface water investigations, water conservation, diversion, and other projects that will lower the selenium loadings as well as limiting bioavailability of selenium to the biota within the habitat areas, which include the lakes in the Big Canyon Golf Course and in the Big Canyon Nature Park.

The NSMP is assisting the Regional Board on revising the selenium TMDL and associated site-specific water quality objectives. Since 2010, the NSMP has carried out selenium-related watershed monitoring including fish and bird egg tissue sampling and special studies.

In June 2013, the OCSD Board of Directors approved an increase of the effective cap of the Urban Runoff Diversion Program from 4 million gallons a day (MGD) to 10 MGD. This increase enables the two NSMP diversions to be built as well as other future projects when treatment or other BMPs are not available or feasible.

***Newport Bay**: Newport Bay Watershed Nutrient Total Maximum Daily Load (TMDL)*

The nutrient TMDL establishes mass-based WLAs to reduce the annual loading of nitrogen and phosphorus to Newport Bay by 50% in order to attain the numeric and narrative water quality objectives by 2012. To achieve these WLAs, the TMDL established a number of interim targets requiring a 30% and 50% reduction in nutrients in summer flows by 2002 and 2007, respectively, and a 50% reduction in non-storm winter flows by 2012.

In February 2000, the Principal Permittee on behalf of the Watershed Permittees, initiated the Regional Nutrient Monitoring Program (RMP) for the Newport Bay watershed pursuant to requirements established by the Santa Ana Regional Board (Resolution 99-77). Annual data analysis reports were submitted each November from 2000-2005 to document watershed nutrient concentrations and loadings, algal biomass, and bay nutrient concentrations. At the request of the Regional Board, the Principal Permittee has submitted quarterly data analysis reports and data transmittals in lieu of the annual report since 2006.

Analysis of the RMP watershed and Bay data indicate the overall TMDL[1] is being met. However, the urban runoff wasteload allocation for both nitrogen and phosphorus has not been consistently achieved, despite meeting the cumulative loading to Newport Bay. The difference can be attributed to the way the urban runoff allocation is assessed through the monitoring program. Currently, certain channels are supposed to represent urban discharges. Therefore, all nitrogen and phosphorus measured at these locations is deemed urban runoff for compliance purposes. Several channels, including Lane Channel and Santa Ana-Delhi Channel, are heavily influenced by rising groundwater, which has been documented as a significant source of nitrogen. Rising groundwater has a separate load allocation under the TMDL and therefore should not be included in assessing urban runoff. For phosphorus, the current allocation would require sustained drought conditions (<5 inches of rain per

[1] As demonstrated in the Newport Bay Nutrient TMDL Quarterly Data Report #25

year) to meet the urban runoff target, despite the total load to Newport Bay in attainment of the overall TMDL. Revisions to the TMDL have been recommended in the quarterly nutrient reports.

***Newport Bay**: Newport Bay Watershed Sediment TMDL*

In April 1999, the Regional Board approved a sediment TMDL for the Newport Bay watershed to address water quality impairment due to excessive sedimentation. It requires implementation and maintenance of sediment control measures aimed at ensuring that existing habitat acreages of Upper Newport Bay are not significantly changed and that sediment discharges in the watershed are reduced by 50% within 10 years. The load allocations for sediment discharges to Newport Bay from urban areas shall not exceed 2,500 tons per year, implemented as a 10-year running annual average. The long term goal of the sediment TMDL is to reduce the frequency of dredging Upper Newport Bay to once every 20 to 30 years.

To comply with the sediment TMDL, an annual basin report is to be submitted to the Santa Ana Regional Board by November 15 of each year verifying that the foothill and in-channel retarding basins in the watershed have at least 50% available capacity. Additionally, an annual compilation of sediment monitoring data and TMDL compliance analysis is required by February 27 of each year. Analysis of the past 11 years of monitoring data indicates that sediment loads in the San Diego Creek/Newport Bay Watershed have been reduced significantly from rates recorded in the pre-TMDL period and that compliance with the 50% reduction (62,500 tons per year) is being achieved. Compliance is evaluated as 10 year running average of the suspended sediment load measured at San Diego Creek at Campus Drive which is approximately 51,056 tons per year. The load from urban sources to Newport Bay has been estimated to be 1,200 tons per year.

***Newport Bay**: Fecal Coliform TMDL*

In April 1999, the Santa Ana Regional Board amended its Basin Plan by adopting a Fecal Coliform TMDL. The TMDL requires an annual data report, and a series of investigations and studies intended to result in the development of a TMDL implementation plan to meet water quality objectives.

In recognition of the complexity of bacterial water quality issues, the paucity of relevant data on bacterial sources, and anticipated difficulties in identifying and implementing appropriate BMPs, the fecal coliform TMDL established a long-term, prioritized, phased approach to meeting recreational contact (REC1) and shellfish harvesting (SHELL) wasteload allocations in Newport Bay by December 30, 2014, and December 30, 2019 respectively.

A Source Management Plan[2], and Source Investigation Project[3] for sources of fecal coliform was completed and submitted to the Santa Ana Regional Board in fulfillment of requirements of a Proposition 13 grant. The *Newport Bay Fecal Coliform Source Management Plan* provides an accounting of the BMPs being used in the watershed to reduce bacterial loads from urban sources. The *Newport Bay Fecal Indicator Bacteria Source*

[2] EOA, Inc. Newport Bay Fecal Coliform Source Management Plan, December 31, 2009.
[3] Grant, Stanley B, S. Jiang, B. Sanders, K. McLaughlin, J. Ahn, R. Litton, and L. Ho. Newport Bay Fecal Indicator Bacteria Source Identification Project, July 26, 2009.

Identification Project assesses natural and urban sources of fecal coliform.
A review of recommended revisions to the Newport Bay Fecal Coliform TMDL is being prepared. This report includes an evaluation of trends in long-term data, comprising over 28,000 fecal coliform samples and over 19,000 enterococci samples collected during the period January 1986 through December 2012. This analysis shows that average fecal coliform concentrations have decreased substantially throughout the Bay over this time period. Concurrently, the frequency of "high" (>400MPN/100ml) and "very high" (>4,000 MPN/100ml) fecal coliform concentrations has decreased substantially. This review will also integrate and evaluate the results of studies required by the TMDL and provide recommendations for revisions to the fecal coliform TMDL and 303(d) List.

***Newport Bay**: Newport Bay Watershed Toxics TMDL*

On June 14, 2002, EPA Region 9 established the Toxics TMDL for the Newport Bay Watershed. The Santa Ana Regional Board is currently splitting the EPA promulgated Toxics TMDL into five separate constituent and geographically specific TMDLs. 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 proceed through the full approval process before they are officially adopted and effective. To date, the Santa Ana Regional Board has adopted two of the five TMDLs. The development status of these separate TMDLs is as follows:

- **Organophosphate Pesticides:** A BPA was adopted by the Regional Board in 2003 and the associated WLAs were incorporated into the existing MS4 Permit.
- **Organochlorines**: At the time the existing MS4 permit was issued in 2009, the Regional Board had adopted a BPA for the Organochlorines TMDL in the San Diego Creek and Newport Bay watershed. The BPA had not yet been approved by the State Water Resources Control Board (State Board), the Office of Administrative Law (OAL), or USEPA and therefore was not yet effective. During the permit term, this TMDL was subsequently remanded to the Regional Board. It was readopted and has been approved by the State Board and Office of Administrative Law. Full approval by USEPA is expected prior to the reissuance of the North Orange County MS4 Permit.

  The existing MS4 Permit includes WLAs based upon the original Organochlorine TMDL, but as it was never approved, those WLAs never became effective. Therefore, this TMDL will be incorporated for the first time in the reissued North Orange County MS4 Permit.
- **Selenium:** The existing permit acknowledges ongoing efforts to develop a Selenium TMDL for the San Diego Creek and Newport Bay watershed. This TMDL continues to remain under development and will not be effective prior to the issuance of the Fifth Term MS4 Permit. Permittees' accomplishments for this TMDL are discussed under the Nitrogen and Selenium Management Program.
- **Metals:** No additional TMDL is expected prior to permit reissuance.
- **Rhine Channel (Mercury and Chromium):** No additional TMDL is expected prior to permit reissuance.

In response to the OCs TMDLs and to address issues of direct toxicity in the San Diego Creek and Newport Bay watershed, the County has formed a stakeholder working group, the Toxicity Reduction and Investigation Program (TRIP). Stakeholders include watershed cities, the Santa Ana Regional Board, environmental representatives and local business interests. The TRIP, through the National Water Research Institute, convened an independent panel of experts to review the targets in the OCs TMDLs. The Independent Advisory Panel met on April 7-8, 2009. The final report of the IAP entitled, "Final Report of the April 7-8, 2009 Meeting of the Independent Advisory Panel for the Assessment of TMDL Targets for Organochlorine Compounds for the Newport Bay" was finalized on August 8, 2009.

Based on the recommendations of the Final Report as well as stakeholder inputs, a TRIP Work Plan has been drafted to detail watershed-wide efforts needed to address issues related to sources and effects of toxicity in the San Diego Creek and Newport Bay Watershed. The Work Plan focuses primarily on the indirect effects of organochlorine pesticides and other toxic constituents on key wildlife species of concern that consume contaminated prey items, on humans consuming contaminated seafood from the Bay and on the causes of direct toxicity to sediment dwelling organisms. The ultimate goal of the Work Plan tasks is to use the best available scientific knowledge to reassess 303(d) listings and the TMDL's target chemicals, numeric targets, and load allocations. The Work Plan tasks also include evaluating current sediment-related best management practices (BMPs) to determine whether they are adequate to meet the Toxicity TMDL goals and on designing a watershed scale monitoring program to track progress over time. The Work Plan includes a number of decision points designed to ensure that available resources are used as cost effectively as possible.

4.4 Recommendations

Based upon the effective results of the Permittees' existing TMDL efforts, the Permittees' recommend continuing with the existing permitting approach. Central to the existing permitting approach is the inclusion of BMP-based compliance for the TMDL provisions. This approach has not only been effective in Orange County, but it is also consistent with the approach of the Santa Ana Regional Board in the current MS4 permits in Riverside County and San Bernardino County, as well as the approach of several other Regional Boards, including the San Diego[4] and San Francisco[5] Regional Boards, as well as guidance from USEPA[6].

During discussions with Regional Board staff on the ROWD, staff noted that recommendations and suggestions for the TMDL provisions would be particularly helpful. Therefore, the Permittees are providing recommended language as an attachment (Attachment A) to this ROWD.

The recommended language specifically addresses the following:

1. **Structure/organization of TMDL Provisions**: Recent MS4 permits adopted in the Los Angeles and San

[4] See Order No. R9-2013-0001
[5] See Order No. R2-2009-0074
[6] USEPA, 2002. Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs. P. 4.

Diego regions organized the TMDL provisions in a manner that provided clarity. The attached language leverages the structures of those permits and reorganizes the provisions to more clearly define the requirements for TMDLs.

2. **Compliance assessment:** The method(s) to assess compliance is one of the most important permit provisions. As noted above, the Permittees are recommending the continuation of BMP-based compliance for the TMDL provisions. In addition, Permittees are also recommending additional compliance pathways, similar to compliance pathways provided in other recently adopted MS4 permits in Southern California. Further, clarifying language regarding how the WLAs are incorporated into the permit (as a performance standard, not as numeric effluent limitations) has been added. This language is based on the current Bay Area MS4 Permit[7] in the San Francisco region.

3. **Consistency with TMDLs:** The Permittees have evaluated the existing MS4 permit to ensure that the recommended language is consistent with the effective TMDLs. Notable revisions recommended include:

    - **Removal of the Sediment TMDL in the Newport Bay Watershed:** While many of the Newport Bay Watershed Permittees have implemented significant sediment control measures over the years, the TMDL does not establish WLAs for MS4 Permittees. The TMDL is based upon load allocations and control measures to be implemented through the Newport Bay Executive Committee. These actions have been very effective and have resulted in attainment of the load allocations and associated TMDL targets. However, absent wasteload allocations assigned to the MS4 Permittees, the MS4 Permit is not the appropriate regulatory mechanism for this TMDL. Therefore, it has been removed from the recommended TMDL provisions.

    - **Correction to the WLAs for the San Gabriel River Metals TMDL (Coyote Creek):** This TMDL was established by EPA in the Los Angeles region. The TMDL establishes mass-based WLAs derived from a formula that multiplies the TMDL numeric target by the storm volume. For illustrative purposes, the TMDL includes the resulting WLA based upon a theoretical storm volume measured at a Los Angeles County Flood Control District gauging station. In the current North Orange County MS4 Permit, the WLA is based upon the illustrative example and not the actual WLA. The corrected WLA is included in the recommended language (Attachment A) and is consistent with the WLA included in the recently reissued Los Angeles Region MS4 Permit[8].

4. **Monitoring and reporting requirements:** To ensure that monitoring and reporting requirements are consistent with adopted TMDLs. The Permittees are recommending a specific provision for each TMDL that

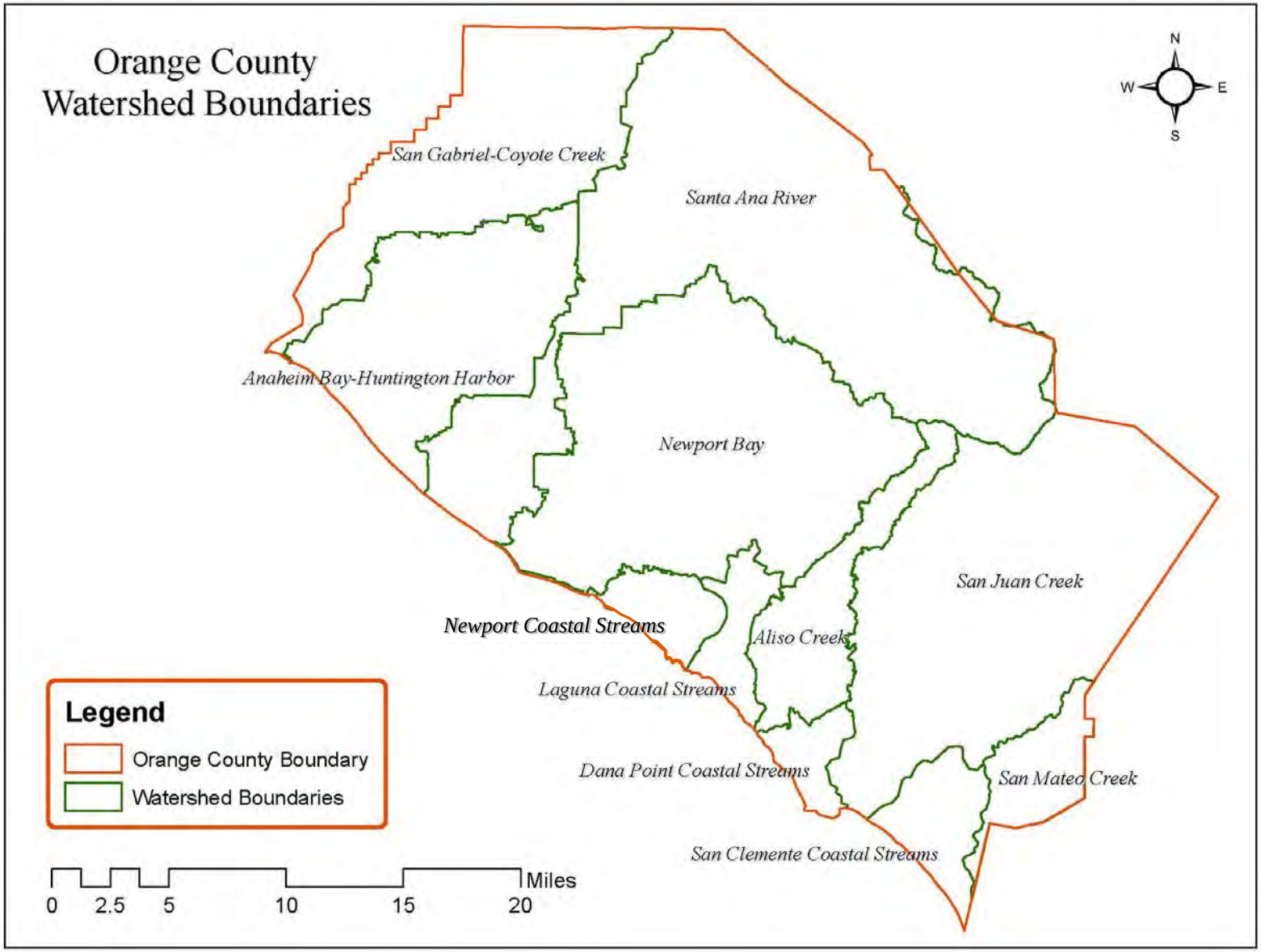
[7] See Order R2-2009-0074

[8] Order No. R4-2012-0175

addresses these requirements. In addition, by separating the compliance assessment and monitoring requirements, the permit can clearly distinguish between assessing achievement of a WLA and compliance with the permit provision(s).

5. **Receiving Water Limitation Provisions:** The issue of complying with the Receiving Water Limitations provision of the permit is also an important issue for the Permittees. In terms of TMDLs, this issue is of particular importance for TMDLs that have approved compliance schedules. Where Permittees are implementing actions consistent with the requirements of the TMDL provisions, including per approved compliance schedules, Permittees request that specific language is included that explicitly states they shall be in compliance with the applicable receiving water limitations for the TMDL-receiving water combination. Otherwise, the Permittees may be found in violation of the Receiving Water Limitations provision while they are implementing and complying with a TMDL.

Figure 4.1: Orange County Watershed Boundaries



5.0 Plan Development

5.1 Overview

The Story: Plan Development

- The Permittees have been implementing a strategic management approach that includes model programs specified in the permit and the DAMP, and watershed programs focused on specific water bodies and pollutants.

- The Program employs an iterative, adaptive management approach that includes monitoring, evaluation, program revision, BMP implementation adjustment/enhancement, and continued monitoring.

- The Program conducts annual and permit term (i.e. ROWD) using the guidance from CASQA approach.

- The ROWD recommends an evolution to a more holistic watershed management approach that will consider the impacts and benefits from anthropogenic activities and work toward optimizing watershed functions over time.

The Permittees have developed a strategic approach to stormwater management that is a cyclical process of measurement, analysis and program improvement. This approach is applied at two distinct scales: (1) regionally by the Permittees implementing jurisdictional programs based on the model programs in the DAMP; and (2) in specific watersheds by the Permittees and others participating in watershed programs addressing specific waterbody-pollutant combinations and the restorative goals of the Clean Water Act.

Two basic categories of assessment measure have been used related to (1) the shorter term confirmation of BMP implementation (Implementation or Process Measures, also termed Programmatic Indicators) and (2) the longer term verification of environmental improvement (Validation or Results Measures, including indicators of environmental change). This categorization of measures is intended to reflect two basic assessment questions: (1) are program elements being implemented correctly and effectively? And (2) are environmental improvements being realized? The planning process has been given particular regulatory significance by the approach to MS4 permitting in California. Indeed, the approach was developed as a model for fulfilling the Receiving Water Limitations and Discharges Prohibitions of the Permits. These provisions are based on State Water Resources Control Board Water Quality order 99-05 which creates an iterative management approach as the basis for compliance.

> *…. Upon determination by either the permittees of the Regional Water Board that discharges are causing or contributing to an exceedance of an applicable Water Quality Standard, the permittees shall promptly notify and thereafter submit a report to the Regional Water Board that describes BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce any pollutants that are causing or contributing to the exceedances of Water Quality Standards. The report may be incorporated in the annual update to the Stormwater Management Plan unless the Regional Water Board directs an earlier submittal. WQO-99-05*

5.2 Plan Development and Effectiveness Assessment

Strategic Management Approach

The Permittees' strategic approach to stormwater management is defined by a cyclical (iterative) process, or *Quality Loop*, of measurement, analysis, and improvement of the program (Figure 5.1). An analogue for this approach is the formal environmental management system for which ISO 14001 establishes standards. It provides a structure that enables the Permittees to *think* about new ways of working, *measure* existing policies and procedures and/or just *implement* existing activities in different ways. The key is the continual search for improvement in the way that regulatory compliance is maintained and the surface water environment protected and enhanced through implementation of BMPs until protection of beneficial uses is achieved.

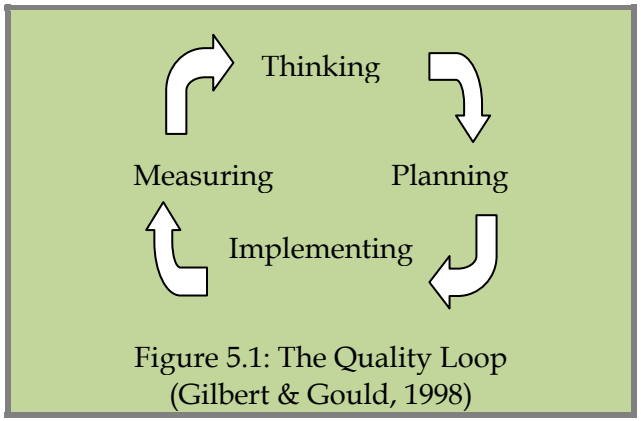


Figure 5.1: The Quality Loop (Gilbert & Gould, 1998)

Due to the episodic and highly variable nature of stormwater, strict compliance with regulatory water quality standards is problematic, especially for wet weather runoff discharges. In recognition of the nature of wet weather discharges, WQO 99-05 requires application of an iterative management process as the basis of compliance with the MS4 permit Receiving Water Limitations provisions. The Permits have required this process be conducted a minimum of once each year. This process is outlined in Figure 5.3.

Plan development occurs at two distinct scales: (1) activities conducted by the Permittees implementing BMPs in their DAMP/LIPs based on the model programs in the DAMP; and (2) activities conducted by the Permittees and others participating in watershed programs addressing specific waterbody-pollutant combinations.

Countywide/Jurisdictional BMPs are specified in the Permits, are applicable on a countywide basis and are proven and cost-effective. They include BMP requirements for municipal maintenance activities, public and business education and outreach, BMP requirements for land development and redevelopment, structural and non-structural BMP requirements for construction projects), BMPs for existing development and identification and elimination of illegal discharges/illicit connections.

For the watershed-based programs, the planning process has been focused principally on specific water quality problems in receiving waters, with impaired waters or TMDLs having a higher priority, and implementation of additional *Watershed BMPs* on an individual and/or collaborative basis. However, watershed-based planning has also led to restoration projects.

At both scales the approach uses information obtained from program effectiveness assessment, the countywide baseline water quality monitoring program, and from the additional water quality planning initiatives that have been or are currently being conducted in a number of the watersheds to determine those with beneficial use impairments potentially attributable to urban stormwater. New candidate BMPs can be prevention or removal oriented and can be considered either for updating *Countywide/Jurisdictional BMPs* or for incorporation as *Watershed BMPs*. New BMPs are generally identified from one or more of the following:

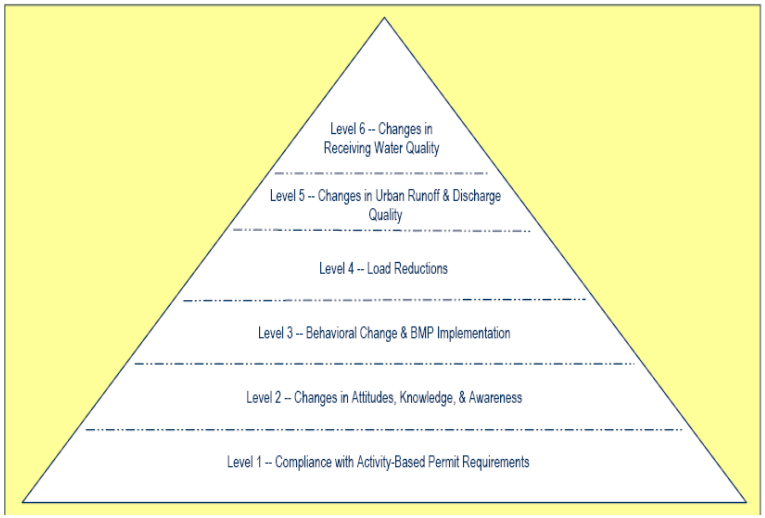
- A review of technical literature (such as the ASCE/EPA database);
- A review of existing control programs;
- Demonstration or research projects;
- Input from consulting firms and municipalities already involved in new BMP implementation; or
- Other sources.

New BMPs, chosen for broad implementation, are selected from candidate BMPs that have been field-tested and evaluated as to their pollutant removal efficiency and cost effectiveness. Methodologies for assessing Program and BMP effectiveness include conventional monitoring (such as water quality monitoring) and non-conventional monitoring. Conventional monitoring can provide a more direct indication of actual BMP performance, but is very challenging for a number of reasons. Water quality monitoring is costly, particularly given the highly variable nature of stormwater runoff, and targeted on a limited number of BMPs. Furthermore, not all BMPs are readily evaluated through water quality monitoring. Therefore, an accurate, quantifiable assessment of the cumulative effectiveness of current BMPs is difficult for a variety of reasons, including:

- A number of BMPs predate the Program which means that there is no "baseline" monitoring data representative of "pre-BMP" conditions;
- Since, to date, no watershed has been uniquely subject to a single BMP, the influence of an individual BMP upon the overall surface water quality cannot yet be readily determined;
- The temporal and spatial variability in water quality, particularly in wet weather, complicates any statistical correlation of the data with storm frequency, storm length and intensity, land use, or land management practices. This confounding factor in statistical analyses has been exacerbated by storm seasons in recent years that have varied much in their intensity, duration and volume;
- Many of the BMPs are implemented to address the issues associated with a specific land use. However, since the land uses are extremely varied within the watersheds, it has not proven possible to characterize the effects of those specific BMPs; and
- Factors other than chemical water quality may be more directly responsible for impairment of beneficial uses, yet all these factors combine in their effects and are difficult to separate one from another.

A method for evaluating overall stormwater program effectiveness on both a programmatic and individual BMP level has been documented by the California Stormwater Quality Association **(Figure 5.1)**. The approach presents a hierarchy of potential outcomes that can be evaluated ranging from programmatic permit compliance assessment to demonstrated changes in receiving water quality. Tiers 1-3 are assessment measures that support the shorter term confirmation of BMP implementation (Implementation or Process Measures, also termed Programmatic Indicators). Tiers 4-6 are assessment measures that reflect the longer term verification of environmental improvement (Validation or Results Measures, including indicators of environmental change).

Figure 5.1: CASQA Assessment Pyramid



In addition, a number of important initiatives are being supported by the Permittees aimed at the further development of assessment techniques and methodologies to support more informed and consistent decision making across Southern California. Notable amongst these initiatives are the Regional Bioassessment Monitoring Program of the Stormwater Monitoring Coalition.

5.3 Watershed Approach

Managing water quality on a watershed, rather than jurisdictional basis (see **Table 5.1** for comparison), is generally recognized as offering a more holistic and thereby effective basis for ultimately achieving meaningful environmental outcomes. Watersheds are defined hierologically and are therefore independent of jurisdictional boundaries. Consequently, the ROWD recommends a watershed-based approach as a fundamental structure for the future of the Program.

The development of a Watershed Plan would generally include the following steps:

- Conduct a watershed assessment to identify the watershed issues and establish desired beneficial use outcomes;
- Establish watershed-specific implementation strategies to address the highest priority issues and concerns; and
- Submit to the Regional Board Executive Officer for review and approval.

A Watershed Plan is consistent with federal regulations regarding the development of NPDES permit conditions, as well as the implementation of storm water management programs, at a watershed scale (40 CFR §§ 122.26(a)(3)(ii), 122.26(a)(3)(v), and 122.26(d)(2)(iv)). This approach is also consistent with USEPA's Watershed-Based NPDES Permitting Policy Statement[1] that defines watershed-based permitting as an approach that produces NPDES permits that are issued to point sources on a geographic or watershed basis. In this policy statement, USEPA explains that, "[t]he utility of this tool relies heavily on a detailed, integrated, and inclusive watershed planning process." USEPA identifies a number of important benefits of watershed permitting, including more environmentally effective results; the ability to emphasize measuring the effectiveness of targeted actions on improvements in water quality; reduced cost of improving the quality of the nation's waters; and more effective implementation of watershed plans, including TMDLs, among others.

The watershed approach requires development and implementation of a comprehensive, collaborative, and prioritized Watershed Plan. A Watershed Plan will allow for the more effective linking of existing stormwater program elements to create an implementation strategy tailored to the needs of the watershed(s). In Orange County, such an approach would also presents an opportunity to bring greater cogency to ongoing sub-regional and watershed

[1] Memorandum from G. Tracy Meehan, III, Assistant Administrator to Water Division Directors, Regions I-IX, titled "Watershed-Based National Pollutant Discharge Elimination System (NPDES) Permitting Policy Statement," USEPA, December 3, 2002.

initiatives including the Integrated Water Regional Management Plan processes of the northern and central watershed management areas and the Watershed Hydromodification and Infiltration Management Plans, respectively.

5.4 Recommendations

The recommendations are:

1. **Continue to implement the Strategic Countywide/Jurisdictional Management approach**.
2. **Develop a comprehensive Watershed Plan** to evaluate the watershed and to prioritize implementation efforts and associated resource allocation.
3. **Develop pilot program(s) for regional water quality** or groundwater recharge BMPs
4. **Develop model program(s) for water quality/quantity trading** to facilitate off-site BMP implementation where appropriate and to address existing developed areas.

Implementation Schedule – Plan Development

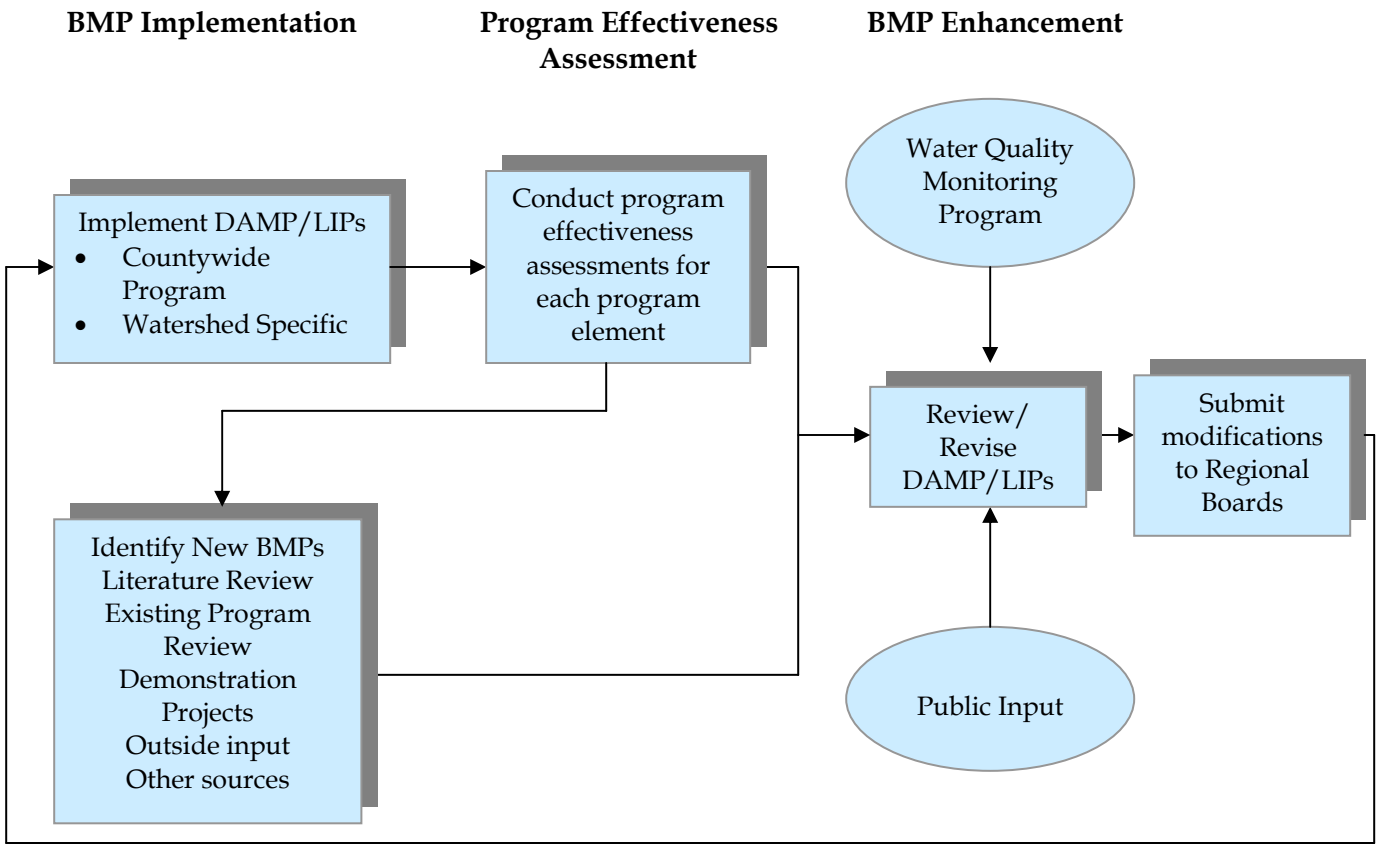
Proposed Plan Development Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Strategic Management Approach						
Countywide/Jurisdictional Management approach	C					
Complete model program for a water quality/quantity trading	E		X			
Complete identification of regional runoff retention BMPs opportunity sites	E		X			
Complete model watershed management plan	N		X			

1. C = Continue; E = Enhance; N = New
2. X = Performance Standard will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation

Table 5.1 Comparison of Planning Processes		
	Local Implementation Plan	**Watershed Plans**
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 (or other stressors). Directed by NPDES permit requirements and 303(d) list/TMDLs. Should optimize all watershed attributes and functions (water supply, energy, habitat, economic development, housing, trans…)
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 broad participation among municipal and public agency stakeholders. Characterized by public participation.
Assessment	Based on information from countywide municipal and regional cooperative	Based on information from watershed-specific investigations and are

	investigations of stormwater and receiving water quality and are undertaken on an annual and 5 year basis.	undertaken on an annual basis, or timescale appropriate to the process, impact, or management strategy.
Planning	Broad based approach with emphasis on well established pollution prevention and source control measures.	Includes both pollutant specific approach, with emphasis on treatment controls and consideration of innovative regional solutions, and projects addressing restorative goals of the Clean Water Act.
Implementation	Individually by the Permittees.	Individually and collaboratively by Watershed Permittees and other agencies.
Monitoring	Considers pollutant load reduction.	Considers beneficial use attainment.

Figure 5.2: Strategic management flow diagram



6.0 Program Management and Financing

The Story: Program Management/Financing

- The Program continued to operate with the County of Orange as the Principal Permittee during the permit term.

- The Program operated under a four-tier committee structure with participation at all levels of Permittee staff and management.

- Activities during the permit term were conducted under a cooperative Implementation Agreement, which establishes responsibilities and provides a funding mechanism for cooperative activities. Funding has been sufficient to complete common program activities.

- The Program benefitted strongly from cooperation and representation among several regional and statewide groups including the California Stormwater Quality Association and the Southern California Coastal Water Research Project.

6.1 Overview

The Program is a cooperative regulatory compliance initiative comprised of 36 separate municipal entities. It addresses Clean Water Act mandates and is focused on the management of urban and stormwater runoff for the protection and enhancement of Orange County's creeks, streams, rivers and coastal waters. The County of Orange is the Principal Permittee and the cities and the Orange County Flood Control District are Co-Permittees on the permits. Principal Permittee and Permittee responsibilities are specified in the permit. Permittee collaboration and cooperation is enabled by an Implementation Agreement. The designation of a Principal Permittee has provided for cost effective management of the overall stormwater program by combining resources to complete those activities which benefit all of the Permittees.

To enable the development and implementation of the Program a program management framework has been established. This management framework comprises a four tier committee structure (Permittees, City Managers' Water Quality Committee, Technical Advisory Committee (TAC)/Planning Advisory Committee (PAC) and Program Committees/Task Forces/Ad Hoc Groups).

6.2 Program Implementation and Assessment

<u>Implementation Agreement</u>

A formal agreement enabling Permittee cooperation is the NPDES Stormwater Permit Implementation Agreement (the "Implementation Agreement") which establishes the responsibilities of the Permittees with respect to compliance with the Permits. The Implementation Agreement also establishes a funding mechanism for the shared costs of the Program, based on each municipality's area and resident population, and formally recognizes the role of the TAC.

The Implementation Agreement, originally entered into in December of 1990, was amended in October of 1993 to include two additional Permittees (the cities of Laguna Hills and Lake Forest) and formally established the TAC. The Implementation Agreement was amended again, effective June 25, 2002, to include three additional Permittees (the cities of Aliso Viejo, Laguna Woods and Rancho Santa Margarita)

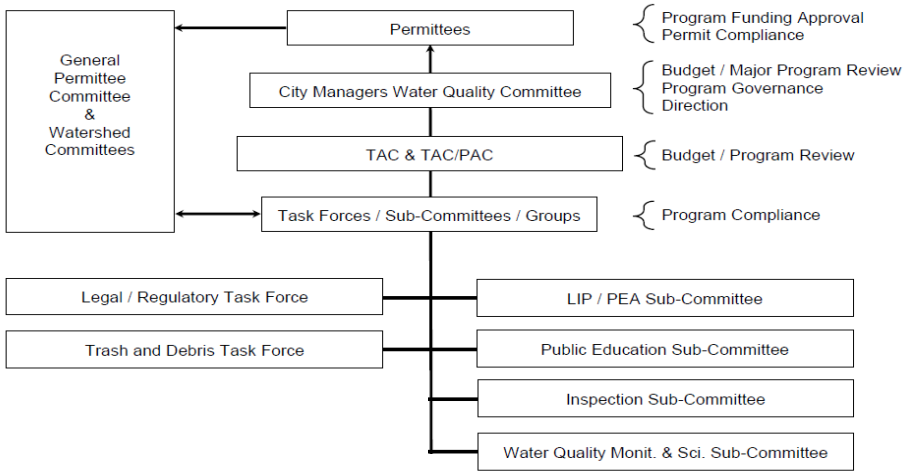
and to incorporate modifications to the management structure and cost-sharing formulas.

The structure of the Agreement has accommodated the expansion of the Program and the significant escalation of shared costs with the adoption and implementation of the Third- and Fourth-Term MS4 Permits. It has also served as a model for cost sharing collaboration related to the Newport Bay TMDL compliance effort (including the related Nitrogen Selenium Management Program), Aliso Creek TMDL, San Juan Creek TMDL, Coyote Creek TMDL and Regional Harbor Monitoring Program.

Management Framework

The USEPA defines a management framework as "*a lasting process for partners working together. It's a support structure making it easier to coordinate efforts – a structure made of agreed upon standard operating procedures, timelines and forums for communicating with each other*" (USEPA, 2002). The four tier management framework was established in early 2002 to support the development and implementation of the Program. The Permittee committees, subcommittees, task forces and ad-hoc working groups are shown in **Figure 6.1**.

Figure 6.1: Orange County Municipal NPDES Management Framework



City Manager's Water Quality Committee

The City Manager's Water Quality Committee meets annually and as otherwise needed and provides budget and overall program review and governance direction. The Committee is comprised of several City Managers and is supported by County staff.

City Engineer's Technical Advisory Committee (TAC)/ Planning Advisory Committee (PAC)

The TAC acts in an advisory role to the Permittees and implements policy previously established by the Permittees. The TAC is comprised of one City Engineer, or selected representative from each of the County Supervisorial Districts and a representative from the County of Orange. The TAC is expanded to the TAC/PAC when matters relating to land development are considered. It meets 4-6 times annually.

Meetings of the TAC and the TAC/PAC are subject to the Brown Act.

General Permittee Committee

The General Permittee Committee is the principal forum for disseminating information for program coordinators. The Committee meets monthly (except November). The Committee periodically evaluates the need for creating standing sub-committees and ad hoc committees as needed in order to accomplish the objectives of the Orange County NPDES Stormwater Program.

Sub-Committees/Task Forces

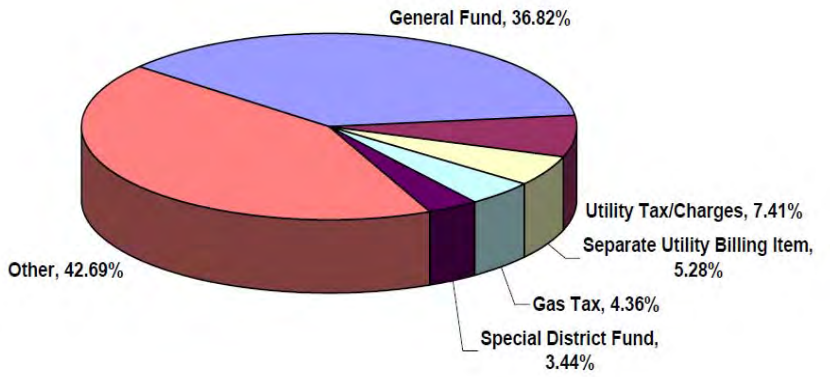
The task forces, sub-committees and ad-hoc working groups provide for the continued development of the Program in specialized areas. The management framework is reviewed annually to ensure it meets program needs. All of the task forces, sub-committees and ad-hoc working groups have brought forward initiatives to meet the requirements of the Fourth Term Permits and to address Program needs under a consensus building process. The frequency (i.e. number of meetings) of meetings is undergoing re-evaluation with respect to the upcoming Fifth Term MS4 Permit as programs attain maturity and require less oversight.

Program Funding

Over the last 10 years the countywide cost of compliance with the permits has almost doubled from approximately $55m in FY2000-01 to $95m in FY2011-12. These costs are anticipated to continue to increase as the Program shifts toward a greater emphasis on watershed management approaches to address burgeoning TMDL requirements.

In FY2011-12, the funding sources used by the Permittees to meet these costs included: General Fund, Utility Tax, Separate Utility, Gas Tax, and Special District Fund, Others (Sanitation Fee, Fleet Maintenance, Community Services District, Water Fund, Sewer & Storm Drain Fee, Grants, and Used Oil Recycling Grants) (See Figure 6.2). While increasingly more stringent regulatory obligations prompt consideration being given to creation of dedicated stormwater funding, there are significant obstacles to overcome.

Figure 6.2: FY2011-12 Funding Sources



In November 1996, California voters approved Proposition 218 which requires that any new or increased property-related fee be subject to voter approval. Proposition 218 has created a significant hurdle for municipalities seeking to levy charges for storm water management programs that, with successive permits are becoming increasingly complex. The Proposition did create an exemption to the voter approval requirement for water, sewer and trash collection fees, and some municipalities adopted the position that stormwater fees were akin to water or sewer fees, and thus exempt from the voter approval requirement. However, the 2002 court decision in

Howard Jarvis Taxpayers Association v. City of Salinas established definitively that storm water or storm drainage fees are property-related fees subject to Proposition 218, and are not exempt from voter approval requirements. Based on this ruling, any new or increased stormwater fee must be approved by 66% of voters (Office of the Independent Budget Analyst Report, City of San Diego, 2009).

The uncertainty regarding future compliance costs is a concern to the Permittees. Consequently, a costs study, including a review of funding options, will be completed in the next permit term.

6.3 Program Representation and Coordination with Other Agencies

The Principal Permittee represents the Permittees in meetings with regulatory agencies and on the CASQA, the SMC and SCCWRP.

California Stormwater Quality Association

Since 1989, CASQA has assisted the State of California, USEPA, municipalities, special districts and businesses in developing and implementing effective water quality management programs in California. CASQA is a leader in helping California comply with the municipal and industrial NPDES stormwater mandates of the federal Clean Water Act. The Principal Permittee is active on the Board of Directors, Executive, Program Committee, Policy and Permitting Sub-Committee and Public Information – Public Participation Sub-Committee.

Stormwater Monitoring Coalition

The SMC was formed in 2001 and revised in 2008 by cooperative agreement of the Phase I municipal stormwater NPDES lead Permittees, Caltrans, the NPDES regulatory agencies in southern California, SCCWRP and USEPA Office of Research. The SMC seeks to improve the effectiveness of existing programs, particularly monitoring, by promoting standardization and coordination, and reducing duplication of effort across individual programs.

Southern California Coastal Water Research Project

The SCCWRP is a joint powers agency research institute focusing on the coastal ecosystems of Southern California from watersheds to the ocean. It was formed in 1969 to enhance the scientific understanding of linkages among human activities, natural events, and the health of the Southern California coastal environment; to communicate this understanding to decision makers and other stakeholders; and to suggest strategies for protecting the coastal environment. Current SCCWRP studies of particular significance to the Program include Bight '13, investigations into toxicity, trash and debris and microbiology, and the effort to better coordinate environmental monitoring in the Newport Bay watershed.

The Principal Permittee participated as a Commissioner on SCCWRP's governing board and as the Program's representative on the Commission Technical Advisory Group (CTAG).

6.4 Recommendations

The recommendations are:

1. **Retain the NPDES Stormwater Permit Implementation Agreement**.

2. **Continue the program management framework, albeit with a reduction in meeting frequencies**.

3. **Complete study of future stormwater compliance costs and funding alternatives**.

4. **Continue collaborative regional studies**.

Implementation Schedule – Program Management and Financing

Proposed Program Management and Financing Actions	Type of Standard[1]	Implementation Schedule[2]				
		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Implementation Agreement						
Retain agreement	C					
Program Management Framework						
Retain management framework	C					
Program Costs and Funding						
Complete cost and funding options study	N			X		

1. C = Continue; E = Enhance; N = New
2. X = Project will be completed during this fiscal year. Gray shaded cells indicate ongoing implementation

7.0 Recommendations for Fifth Term Permit

7.1 Overview

Established in 1990, the Program is a cooperative regulatory partnership of the Permittees who operate an interconnected municipal storm drain system which discharges stormwater and urban runoff and at the same time provides flood protection to the United States' sixth most populous county. In Orange County, the impact of urbanization on hydrologic systems and the adverse consequences of both changed hydrology and pollutant source creation are evident today in Orange County's principal drainage systems. However, at the same time, there are very significant water quality successes, such as coastal water quality and nutrient control in the Newport Bay watershed that can unequivocally be attributed to the impact of the Program and the Permittees

7.2 Future Program Development and Implementation

During the Fourth Term Permit period there has continued to be a significant allocation of resources the integration of LID and hydromodification control practices into local land development regulation. Going forward, this element of the Program will continue to be a major focus of activity as the Permittees look to create off-site and in-lieu fee options for alternative compliance pathways for land development and re-development. This focus also aligns with broader State Board integrated water resource management goals centered on better use of stormwater for local water supply augmentation and increasing interest in "green infrastructure" solutions

Development of a watershed-based planning approach is viewed as the most important next step to take in the development of the Program. Such an approach offers the opportunity for more comprehensively identifying the meaningful environmental and recreational amenities that can be realized in each watershed and the management strategies that will most effectively ensure their realization. These plans will also provide an opportunity, through linkage and integration, for cogency to be brought to a number of related restoration projects and sub-regional water management efforts such as the Integrated Regional Water Management Plans.

With respect to specific water quality constituents of concern, there will be additional effort directed toward pollutant control and research into the environmental significance of pesticide related toxicity, bacteria, and nutrients.

<u>Pesticides</u>

Synthetic pyrethroids have been identified as a significant urban runoff water quality issue on a statewide basis. Directly as a consequence of the efforts of CASQA, the Department of Pesticide Regulation enacted regulations that became effective in July, 2012, specifically intended to limit where structural pest control businesses can apply pesticides in an effort to protect water quality in urban areas. The rules restrict the use of 17 pyrethroid insecticides applied by businesses and significantly limit the amount of pesticides that can be applied outdoors, especially to concrete and other hard surfaces more susceptible to runoff. The regulations also prohibit outdoor pest control applicators and maintenance gardeners from spraying when it rains or to standing water due to rainfall or watering. An evaluation of the regulations by UC Davis suggested that they could affect an 80% reduction in

pyrethroid concentrations in runoff. Nonetheless, the Program will continue to seek to make additional progress with IPM policy implementation and general public education and outreach.

Bacteria

There is significant progress to be reported in Orange County regarding trends in bacterial contamination. For example, Huntington State Beach which was closed due to bacterial contamination for an extended period in 1990, is now one of 3 Orange County beaches identified by Natural Resources Defense Council as a "5 star beach for outstanding water quality." Indeed, long-term monitoring of bacterial indicators of contamination shows that exceedances of regulatory standards are low and have been dropping over time and that the annual percentage of Heal the Bay report card grades of A has been between 93% and 97% since 2005. This very significant progress with respect to shoreline water quality underscores the impetus for action that comes from broad societal recognition of a problem, an unequivocally favorable cost-benefit analysis and the ability to implement pragmatic cost effective solutions. In inland surface waters the issue of systemic elevated concentrations of bacteria persists. However, intensive monitoring of the Aliso Creek watershed (in south Orange County) appears to show that reductions in dry weather flow have produced significant reductions in bacterial concentrations. This finding points to the value of efforts to curtail outdoor water usage. Consequently, collaboration with water districts on water conservation themed education and outreach will continue to be the focus of efforts to engage the general public and sustain the ongoing reductions in bacteria concentrations being observed in inland surface waters.

Nutrients

Eutrophication of estuaries and coastal waters has been linked to anthropogenic changes in watersheds and is of concern because of the potential for harmful algal blooms, hypoxia, and impacts on aquatic food webs. Nutrient fluxes in the Newport Bay watershed are being addressed by a nutrient TMDL; indeed, the TMDL targets are being met (See Section 4.0), and there is a long history in this watershed of extensive study and effective control efforts related to nutrients. Across Orange County's other watersheds nutrients continue to present a regulatory concern although the environmental significance of nutrients and the specific contribution of urban sources is less understood in these other areas. Nutrient thresholds are frequently exceeded in the County's streams and channels. However, there are many less frequent occurrences of impacts, such as macroalgal overgrowth, due to these exceedances. Moreover nutrient problems are not limited to the urban portion of the County; regional monitoring data show nutrient enrichment and impacts such as increased macroalgal cover and/or lower dissolved oxygen in streams and estuaries in undeveloped regions. Pending further research, the Program will continue to effect reductions in municipal fertilizer use through implementation of the Program's IPM policy and encourage water quality-sensitive landscape maintenance practices in the general population through education and outreach.

7.3 Proposed Management Program

Based upon the prior discussion and in response to the findings of the environmental quality monitoring program, the Program proposes the following management program for the period of the Fifth Term MS4 Permit:

State of the Environment: Bacteria

- Conduct targeted data analyses of monitoring data to prioritize problem areas. Conduct pilot source tracking studies using new monitoring methods based on genetic markers to identify potential sources of these problems such as infiltration into the MS4 from sewage lines. This effort should build on results of the Bight '13 Microbiology Study (**see Section 2.2.6**);

- Continue identifying opportunities to reduce and prevent flows in dry weather, where monitoring and source tracking data suggest the presence of human fecal contamination (**see Section 2.2.6**);

- Conduct statistical power analysis and optimization studies to improve existing monitoring program designs to improve efficiency and take advantage of available information about patterns and trends of contamination. (**see Section 2.2.6**);

- Pursue proposed revisions to the Newport Bay Fecal Coliform TMDL to adjust objectives, targets, and monitoring designs to reflect current information and conditions (**see Section 2.2.6**);

- Shift resources from routine monitoring to targeted source identification and adaptive response, using new tools such as genetic markers of human fecal contamination as these become available (**see Section 2.2.6**);

- Shift resources from routine monitoring to targeted source tracking and adaptive response, using new tools such as genetic markers of human fecal contamination as these become available (**see Section 2.2.6**);

- Continue supporting regional and collaborative research into better monitoring and source tracking tools (**see Section 2.2.6**);

- Improve understanding of health risk related to high wet weather flows, for example, through the Bight '13 Microbiology Study; follow results of the pilot wet weather epidemiology study planned for San Diego and consider supporting the larger, follow-on study planned for 2014/2015 (**see Section 2.2.6**); and,

- Conduct pilot mass balance studies to determine their utility for improving the prioritization of management actions (**see Section 2.2.6**).

State of the Environment: Nutrients

- Conduct an assessment of sources and practices that input to the MS4 to assess the significance of each to downstream problems (**see Section 2.3.6**);

- Improve understanding of groundwater / surface water interactions, perhaps through participation in a regional study to track groundwater inputs to surface water (**see Section 2.3.6**);

- Continue identifying opportunities to reduce and prevent flows in dry weather (**see Section 2.3.6**);

- Pilot a regional mass balance nutrient model, even if crude, to help prioritize monitoring and management attention; the Newport Bay watershed and SCCWRP coastal ocean nutrient mass balance models provide useful examples (**see Section 2.3.6**); and,

- Use available time series of data to streamline monitoring to improve its statistical and economic efficiency. Sampling effort could be reduced by identifying stations that essentially mimic each other and/or by reducing the frequency of sampling, especially in Newport Bay now that key targets are regularly being met. Monitoring could shift to a sentinel program with a lower frequency of monitoring intended to ensure conditions do not worsen (**see Section 2.3.6**).

State of the Environment: Toxicity

- Reassess management concerns and priorities (e.g., TMDLS) about metals impacts in freshwater channels, bays and estuaries, and the nearshore coastal zone (**see Section 2.4.6**);

- To the extent that metals, particularly copper, remain a concern because of potential impacts in bays and harbors, and perhaps the nearshore, recognize that inputs from antifouling paint, which are not an urban runoff issue, are likely a more important source than watershed input (**see Section 2.4.6**);

- Improve information on the use of pesticides in the County, particularly by the largest applicators
- Work with other interested parties to fill the data gap related to retail sales of pesticides (**see Section 2.4.6**);

- Examine the CDPR database to develop a more thorough picture of trends in reported pesticide use (**see Section 2.4.6**);

- Use this information to expand and focus cooperative outreach efforts about proper pesticide application and the use of alternatives such as botanical oils that are effective, but nonlethal, insect deterrents (**see Section 2.4.6**);

- Use available data to streamline monitoring and improve its statistical and economic efficiency. Consider reducing the current focus on metals monitoring and targeting pesticide monitoring on less expensive representative constituents or surrogates. Consider reducing the frequency of sampling for sediment associated constituents to the Bight Program sampling frequency (**see Section 2.4.6**);

- Given the reduction in toxicity in Newport Bay, consider increasing the use of adaptive responses

(e.g., TIEs and other investigations) in place of intensive routine monitoring (**see Section 2.4.6**); and,

- Continue taking advantage of opportunities to reduce dry weather runoff to channels (**see Section 2.4.6**).

Controlling Pollutant Sources: Watershed Programs

- Structure/organization of TMDL Provisions: Recent MS4 permits adopted in the Los Angeles and San Diego regions organized the TMDL provisions in a manner that provided clarity. The attached language leverages the structures of those permits and reorganizes the provisions to more clearly define the requirements for TMDLs (**see Section 4.4**);

- Compliance assessment: The method(s) to assess compliance is one of the most important permit provisions. As noted above, the Permittees are recommending the continuation of BMP-based compliance for the TMDL provisions. In addition, Permittees are also recommending additional compliance pathways, similar to compliance pathways provided in other recently adopted MS4 permits in Southern California. Further, clarifying language regarding how the WLAs are incorporated into the permit (as a performance standard, not as numeric effluent limitations) has been added. This language is based on the current Bay Area MS4 Permit[1] in the San Francisco region (**see Section 4.4**);

- Consistency with TMDLs: The Permittees have evaluated the existing MS4 permit to ensure that the recommended language is consistent with the effective TMDLs. Notable revisions recommended include:

    - Removal of the Sediment TMDL in the Newport Bay Watershed: While many of the Newport Bay Watershed Permittees have implemented significant sediment control measures over the years, the TMDL does not establish WLAs for MS4 Permittees. The TMDL is based upon load allocations and control measures to be implemented through the Newport Bay Executive Committee. These actions have been very effective and have resulted in attainment of the load allocations and associated TMDL targets. However, absent wasteload allocations assigned to the MS4 Permittees, the MS4 Permit is not the appropriate regulatory mechanism for this TMDL. Therefore, it has been removed from the recommended TMDL provisions.

    - Correction to the WLAs for the San Gabriel River Metals TMDL (Coyote Creek): This TMDL was established by EPA in the Los Angeles region. The TMDL establishes mass-based WLAs derived from a formula that multiplies the TMDL numeric target by the

[1] See Order R2-2009-0074

storm volume. For illustrative purposes, the TMDL includes the resulting WLA based upon a theoretical storm volume measured at a Los Angeles County Flood Control District gauging station. In the current North Orange County MS4 Permit, the WLA is based upon the illustrative example and not the actual WLA. The corrected WLA is included in the recommended language (Attachment A) and is consistent with the WLA included in the recently reissued Los Angeles Region MS4 Permit[2].

- Monitoring and reporting requirements: To ensure that monitoring and reporting requirements are consistent with adopted TMDLs. The Permittees are recommending a specific provision for each TMDL that addresses these requirements. In addition, by separating the compliance assessment and monitoring requirements, the permit can clearly distinguish between assessing achievement of a WLA and compliance with the permit provision(s) (**see Section 4.4**); and,
- Receiving Water Limitation Provisions: The issue of complying with the Receiving Water Limitations provision of the permit is also an important issue for the Permittees. In terms of TMDLs, this issue is of particular importance for TMDLs that have approved compliance schedules. Where Permittees are implementing actions consistent with the requirements of the TMDL provisions, including per approved compliance schedules, Permittees request that specific language is included that explicitly states they shall be in compliance with the applicable receiving water limitations for the TMDL-receiving water combination. Otherwise, the Permittees may be found in violation of the Receiving Water Limitations provision while they are implementing and complying with a TMDL (**see Section 4.4**).

Municipal Infrastructure and Integrated Pest Management

Continue current model programs and*:*

- Investigate developing a prioritization process for drainage facilities based on historical data establishing high, medium and low priority drainage facilities similar to the current structure for fixed facilities. Criteria should be established based on maintenance records to trigger cleaning upon inspection (e.g. requiring cleaning of catch basins with accumulated trash and debris greater than a specified percentage of design capacity). Participation in a re-prioritization effort would be determined by the Permittees (**see Section 3.2.3**);
- Investigate developing an inspection regime for drainage facilities based on re-prioritization scheme resulting in the inspection of all sites once per permit term. High, medium and low priority facilities would be inspected and cleaned, as necessary at least annually prior to the wet season, every other year and once per permit term, respectively (**see Section 3.2.3**).
- Enhance municipal training to address common issues

[2] Order No. R4-2012-0175

encountered through municipal related complaints and to utilize innovative education formats to encourage discussion-based learning. The four most common types of issues that occur most frequently include those related to[3]: trash/debris, pathogen/bacteria, hydrocarbons and exempt discharges. Training would focus on in-classroom engagement of concepts learned prior to the training session and focus on reducing issues and pollutants of concern through specific actions (e.g. runoff reduction to reduce bacteria loading) (**see Section 3.2.3**);

- Conduct a sewage system seepage pilot study to evaluate the potential for seepage into the MS4 based on available data, and focused on a limited geographic area. The pilot program may consist of a desktop analysis using GIS and water quality data to locate areas where exfiltration from sanitary sewers has the potential to influence water quality in the MS4. This exercise may also be used to rule out areas where there is no potential for cross contamination, allowing the Permittees to focus resources in areas with the most potential for improvements (**see Section 3.2.3**);

- Develop a municipal green infrastructure program that could include evaluation of opportunities for pilot green street projects of different land use/density configurations and development of a green street guidance manual (**see Section 3.2.3**);

- Examine municipal retrofit opportunities for regional BMPs and propose a program to evaluate previously identified retrofit opportunities for use in TMDL compliance and LID and/or hydromodification management alternative compliance. This would involve the development of watershed models for watersheds where no models exist and integration into the models and evaluation of the previously identified potential BMP retrofit sites. Previous reviews (e.g. 2005 RBF retrofit study) will be updated with current mapping tools (e.g. WHIMPs) (**see Section 3.2.3**);

- Develop and initiate the implementation of individualized IPM Guidelines for each Permittee with the goal of demonstrating significant and consistent reductions in fertilizer and pesticide applications based on the mission and goals outlined in jurisdictional IPM Policies (**see Section 3.2.3**);

- Conduct pilot soil and/or leaf tissue analysis to guide fertilizer use to ensure nitrogen is not applied at annual rates above those recommended by UCCE research. The Permittees would identify the most fertilizer-intensive area by type (e.g. sports fields) and select one site for analysis. The analysis would assist Permittees in fine-tuning nitrogen application based on the needs of plants at the highest use areas (**see Section 3.2.3**);

- Improve methods for documenting usage of fertilizer and active ingredient of pesticide on an annual basis to allow for more reliable data on the acreage receiving fertilizer applications. In collaboration with the UCCE, a standardized reporting method would be developed, improving reporting accuracy on both the amount of

[3] County of Orange PNIR data, n=205 municipal related complaints, 2008-2012

nitrogen and pesticides applied by Permittees on an annual basis. Though data shows a decrease in the amount of nitrogen applied, the acreage reported suggests that Permittees are under-fertilizing. The objective would be to minimize fertilizer applications where annual rates exceed those recommended by UC research (174 -261 lbs. N/acre) while more accurately capturing the acreage to which fertilizer is applied (**see Section 3.2.3**); and,

- Expand training to include peer-reviewed online training courses offered by University of California IPM (UC IPM) and UCCE to ensure the IPM and water quality message reaches as many field staff as possible. Possible options include the UC IPM Urban Pesticide Runoff and Mitigation online training series developed by UC academics across the state to provide a more suitable method to reach field staff unable to attend in-person training. The online training consists of a series of courses directly addressing the impacts of pesticides on water quality as well as practices to mitigate these impacts (http://www.ipm.ucdavis.edu/training/upr-mitigation.html) (**see Section 3.2.3**).

Public Outreach

Continue current model program and:

- Emphasize programming for outreach to school-age children to continue building upon existing partnerships and increasing knowledge of the Orange County community as a whole through increasing knowledge of youth (**see Section 3.3.6**);

- Incorporate current strategic approach of using public opinion survey results to prioritize outreach efforts based on behaviors of concern in tandem with water quality results to document small-scale behavior change over time (**see Section 3.3.6**);

- Coordinate with water supply agencies to incorporate water use efficiency and runoff reduction messaging to maximize program reach and ensure requested behavior changes align with water use efficiency techniques supported by other agencies (**see Section 3.3.6**);

- Achieve a minimum of 10 million impressions through the use of various types of media; including earned media**,** in which the public has greater trust as a third party source of information over paid advertising (**see Section 3.3.6**); and,

- Develop focused outreach campaigns based on water quality and survey results utilizing CBSM techniques to document changes in targeted behaviors. The Permittees would develop focused campaigns supportive of a singular message with the goal of reducing competing messaging that may lead to inaction (**see Section 3.3.6**).

New Development / Significant Redevelopment

Continue current model program and:

- Develop an integrated water resources approach element into the land planning/land development process**.** The Permittees understand that an integrated

water resources approach is needed to achieve the goals of water quality protection, water conservation, flood control, and stream protection. In order to achieve an integrated water resources approach the Permittees propose to integrated a water resources approach element into the land planning and land development processes so that as development projects begin entitlement this approach and opportunities to achieve this approach are evaluated (**see Section 3.4.3**);

- Develop an internet based regional geodatabase. To achieve an integrated water resources and watershed management approach access to information will be critical. The Permittees are developing an internet-based regional geodatabase to manage this information and provide access to developers, municipal staff, and regulatory staff to evaluate integrated water resource options and assist with WQMP development (**see Section 3.4.3**);

- Develop an internet based WQMP Submittal Tool and Database potentially in collaboration with Riverside and San Bernardino**.** The Permittees spend a significant amount of time plan checking and tracking Project WQMPs and so the Permittees propose development of an internet based Project WQMP review tool to streamline the submittal and review of WQMPs, allow for enhanced tracking of WQMPs and WQMP inspections, and help with effectiveness assessments and annual reporting (**see Section 3.4.3**);

- Pilot the use of technology to better track WQMP inspections and follow up actions needed. To fully utilize the WQMP Submittal Tool and Database WQMP inspections could be performed with tablets or other devices where GIS information and other information can immediately be uploaded to the database. The Permittees propose piloting the use of tablets or other devices linked to the Database for Project WQMP inspections by a select number of cities (**see Section 3.4.3**); and,

- Enhance the data collected for WQMPs to have a better understanding of water quality benefits on an annual basis. The Permittees desire to perform a better assessment of the New Development/Significant Redevelopment Program. In order to better understand the effectiveness of the program, the Permittees propose to collect new critical data element, and enhance data quality by integrating information into the WQMP Submittal Tool and Database. New data would include volumes of water treated, land area treated, and other relevant information needed to evaluate TMDL compliance, to identify developed/redeveloped areas that meet LID and/or hydromodification requirements, and to track BMP maintenance as a measure of effectiveness (**see Section 3.4.3**).

Construction

Continue current model program and

- Reduce the frequency of inspection for high priority sites from monthly to twice during the wet season and reduce the frequency of inspection for medium priority sites from twice to once during the wet season (**see Section 3.5.3**);

- Pilot a GIS and internet-based database to track construction sites. In order to provide easier tracking of construction sites on a countywide basis, the Permittees will develop a GIS and internet-based database where information regarding each construction site can be entered. The Permittees would examine the benefits of such a database by piloting implementation with a select number of cities (**see Section 3.5.3**);

- Conduct pilot field-testing of personal electronic devices to document inspections onsite. Use of tablets or other electronic devices during inspections will allow inspectors to immediately upload construction site information to the GIS based database. The Permittees would pilot the use of these technologies with a select number of cities(**see Section 3.5.3**); and,

- Conduct QSD/QSP Training. The QSD/QSP Training developed by the State Board and CASQA provides a detailed understanding of the Construction General Permit. The Permittees propose providing this training to municipal staff every other year to ensure that inspectors and other municipal staff understand the CGP requirements that are to be implemented for construction projects in their jurisdiction. It is anticipated that with potential changes to the CGP being adopted in 2014 that municipal staff should be aware of these changes and any new or modified requirements for CGP compliance (**see Section 3.5.3**).

Existing Development

Continue current model program and

- The commercial site inventory list should be minimally modified to align with the commercial inventory requirements in the current South Orange County Permit. This would include adding/modifying the following categories:

    - Botanical or zoological gardens
    - Cement mixing, cutting, masonry
    - Golf courses, parks and other recreational areas/facilities, cemeteries
    - Retail or wholesale fueling (**see Section 3.6.5**);

- The Permit should allow two options for industrial and commercial facility inspections – Option 1 would consist of a targeted approach, with inspection frequency based on prioritization; Option 2 would consist of a synoptic approach, with no fluctuation in inspection frequency from year to year (**see Section 3.6.5**); and,

- The recently developed program to address mobile businesses appears to be effective. However, based on an analysis of the County's complaint data from 2008-2012, the majority of the violations related to mobile businesses are related to three business types: automobile detailers, carpet cleaners, and pet services. Based on this analysis, the program should focus on these key mobile business types in the next permit term.

Illegal Discharges/Illicit Connections

- Continue current model program (**see Section 3.7.3**).

Plan Development

- Continue to implement the Strategic Countywide/Jurisdictional Management approach (**see Section 5.4**);

- Develop a comprehensive Watershed Plan to evaluate the watershed and to prioritize implementation efforts and associated resource allocation (**see Section 5.4**);

- Develop pilot program(s) for regional water quality or groundwater recharge BMPs (**see Section 5.4**); and

- Develop model program(s) for water quality/quantity trading to facilitate off-site BMP implementation where appropriate and to address existing developed areas (**see Section 5.4**).

Program Management and Financing

- Retain the NPDES Stormwater Permit Implementation Agreement (**see Section 6.4**);

- Continue the program management framework, albeit with a reduction in meeting frequencies (**see Section 6.4**);

- Complete study of future stormwater compliance costs and funding alternatives (**see Section 6.4**); and

- Continue collaborative regional studies (**see Section 6.4**).

ATTACHMENT A
Proposed TMDL Provisions

ATTACHMENT A
Proposed TMDL Provisions

This attachment provides potential revisions to the TMDL provisions for the North Orange County Municipal Separate Storm Sewer System (MS4) Permit. The potential language provided herein is preliminary and additional modifications or revisions may be provided as discussions evolve during the permit reissuance process.

The first section, labeled as Provisions I.A through I.B below, contains provisions for the main body of the Permit. The second section, TMDL specific provisions identified in Attachment A, contains provisions to be included as attachments to the Permit.

Note that the numbering scheme in the recommended language is included for context purposes only. Where specific cross-references are included, the reference is to a provision within this proposed language. Where cross-references state "xxx," the reference is to a provision outside of the TMDL provisions recommended here. Actual numbering and cross-references will depend upon where the provisions ultimately are placed within the overall Permit.

Recommended Language for Main Body of the Permit

[include Provision I.A through I.B within the main body of the Permit]

I. Total Maximum Daily Load Provisions

A. Where a TMDL has been approved, NPDES permits must contain effluent limitations and conditions consistent with the requirements and assumptions in the TMDL (40 CFR 122.44(d)(1)(vii)(B)).

B. Effluent limitations are generally expressed in numerical form. However, USEPA recommends that for NPDES-regulated municipal and small construction stormwater discharges, effluent limitations should be expressed as BMPs or other similar requirements rather than as numeric effluent limitations.[1]

C. Consistent with USEPA's recommendation, this section implements TMDLs through an iterative BMP approach capable of achieving the WLAs in accordance with the associated compliance schedule. The Permit includes numeric WLA as a performance standard and not as an effluent limitation. The WLA can be used to assess if additional BMPs are needed to achieve the TMDL in the waterbody.

D. The provisions of this Part I implement and are consistent with the assumptions and requirements of all WLAs established in TMDLs for which some or all of the Permittees in this Order are assigned.

1. TMDL-specific provisions are grouped by watershed in Attachment A.

[1] USEPA, 2002. Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs. P. 4.

2. The Permittees subject to each TMDL are identified in Attachment A.

3. The Permittees shall implement BMPs to achieve the applicable TMDL provisions contained in Attachment A, consistent with the assumptions and requirements of the WLAs established in the TMDLs, including implementation plans and schedules, where provided for in the State adoption and approval of the TMDL (40 CFR§122.44(d)(1)(vii)(B); Cal. Wat. Code §13263(a)).

4. A Permittee may comply with the applicable TMDL provisions in Attachment A using any lawful means, including the compliance mechanisms identified in Provision 1.B.

5. Pursuant to Provision XXX[2], a Permittee may, individually or as part of a watershed-based group, develop and submit for approval by the Regional Water Board Executive Officer a Strategic Compliance Program to address and provide compliance with the requirements of this Order, including TMDL requirements to which the Permittee is subject as identified in Attachment A.

6. Permittees that are in compliance with the TMDL provisions of this Provision I and Attachment A shall be deemed in compliance with Provision [XXX][3] of this Order for the specific pollutant addressed in the TMDL.

E. Compliance Determination

1. A Permittee shall be considered in compliance with an applicable TMDL if any one of the following is demonstrated:

a. The Permittee has submitted and is fully implementing an approved Strategic Compliance Program pursuant to Part [XXX][4], or a plan that addresses specific TMDL(s) that is deemed by the Executive Officer to be equivalent for the applicable TMDL(s),

i) To be considered fully implementing an approved Strategic Compliance Program, or equivalent plan, a Permittee must be implementing all actions consistent with the approved program and applicable compliance schedules.

ii) A Permittee that does not implement the Strategic Compliance Program, or equivalent plan, in accordance with the milestones and compliance schedules shall demonstrate

[2] This cross-reference refers to the section of the Order that will specify the watershed-based program for the entire MS4 permit. For purposes of this language, the term "Strategic Compliance Program" is used to identify this plan/permit section.

It is envisioned that the Permit will specify requirements for the Strategic Compliance Program in a section outside of these TMDL provisions. Therefore, within the TMDL provisions, there is a simple cross-reference to the applicable part of the permit.

[3] Refers to the Receiving Water Limitations provision of the Permit

[4] This cross-reference refers to the section of the Order that will specify the watershed-based program for the entire MS4 permit

compliance with the TMDL provisions pursuant to Provision I.B.1.b-e.

iii) Upon notification of a Permittee's intent to develop Strategic Compliance Program, or equivalent plan, and prior to approval of its Strategic Compliance Program, or equivalent plan, a Permittee's full compliance with all of the following requirements shall constitute a Permittee's compliance with provisions pertaining to the applicable TMDL(s) deadline(s) occurring prior to approval of a Strategic Compliance Program or equivalent plan.

a. Provides timely notice of its intent to develop a Strategic Compliance Program or equivalent plan,

b. Meets all interim and final deadlines for development of a Strategic Compliance Program or equivalent plan

c. For the area to be covered by the Strategic Compliance Program or equivalent plan, targets implementation of watershed control measures in its existing storm water management program to address known contributions of pollutants from MS4 discharges that cause or contribute to the impairment(s) addressed by the TMDL(s), and

d. Receives final approval of its Strategic Compliance Program or equivalent plan within xxxx months[5], respectively.; OR

b. There are no exceedances[6] of the interim or final WLA for the pollutant associated with a specific TMDL at the Permittee's applicable MS4 outfall(s), including an outfall to the receiving water that collects discharges from multiple Permittees' jurisdictions; OR

c. There are no exceedances[6] of the interim or final WLAs for the pollutant associated with a specific TMDL in the receiving water(s) at a designated monitoring location in the receiving water at, or downstream of, the Permittee's outfall(s); OR

d. The exceedance frequency in the receiving water(s) of the applicable water quality standard is less than or equal to the allowable exceedances per the State's 303(d) Listing Policy for the pollutant associated with a specific TMDL at a designated monitoring location in the receiving water at, or downstream of, the Permittee's outfall(s); OR

There is no discharge from the Permittee's MS4 to the receiving water during the time period subject to the WLA for the pollutant associated with a specific TMDL.

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[5] Timeframe would be linked to the schedule developed for the watershed-plan (Strategic Compliance Program) section.

[6] An exceedance of an interim or final WLA shall be consistent with the averaging and assessment period defined in the applicable TMDL. [This footnote to be included as part of the TMDL provisions]

Recommended Language for an Attachment to the Permit

ATTACHMENT A

SPECIFIC PROVISIONS FOR TOTAL MAXIMUM DAILY LOADS
APPLICABLE TO ORDER NO. R8-XXXX-XXXX

Table X identifies the Permittees subject to certain TMDL provision of this Order.

	San Diego Creek and Newport Bay Watershed TMDLs					San Gabriel River TMDLs
Permittee	Nutrient TMDL	Fecal Coliform TMDL	OC Compounds TMDL	Diazinon & Chlorpyrifos TMDL	Toxics TMDL	Coyote Creek Metals TMDL
County of Orange	√	√	√	√	√	√
Orange County FCD	√	√	√	√	√	√
City of Costa Mesa	√	√	√	√	√	
City of Irvine	√	√	√	√	√	
City of Laguna Hills	√		√	√	√	
City of Laguna Woods	√		√	√	√	
City of Lake Forest	√	√	√	√	√	
City of Newport Beach	√	√	√	√	√	
City of Orange	√	√	√	√	√	
City of Santa Ana	√	√	√	√	√	
City of Tustin	√	√	√	√	√	
City of Anaheim						√
City of Brea						√
City of Buena Park						√
City of Cypress						√
City of Fullerton						√
City of Garden Grove						√
City of La Habra						√
City of La Palma						√
City of Los Alamitos						√
City of Placentia						√
City of Seal Beach						√
City of Yorba Linda						√

II. Total Maximum Daily Loads for Nutrients in San Diego Creek and Newport Bay

A. Applicability

1. **TMDL Basin Plan Amendment:** Attachment to Resolution No. 98-9, amended by Resolution No. 98-100

2. **TMDL Adoption and Approval Dates:**

   a. Regional Board Adoption: April 17, 1998; amendment adopted October 9, 1998
   b. State Board Adoption: May 13, 1998
   c. OAL Approval: TBD[7]
   d. USEPA Approval: TBD[7]

3. **TMDL Effective Date: TBD[7]**

4. **Watershed:** San Diego Creek and Newport Bay Watersheds

5. **Water Body:** San Diego Creek and Newport Bay

6. **Responsible Permittees**:

   a. County of Orange, Orange County Flood Control District, City of Costa Mesa, City of Irvine, City of Laguna Hills, City of Laguna Woods, City of Lake Forest, City of Newport Beach, City of Orange, City of Santa Ana, City of Tustin

B. Final TMDL Compliance Requirements

1. **Final WLAs and Compliance Dates**

   a. The Responsible Permittees shall implement BMPs to achieve the following WLAs for the San Diego Creek and Newport Bay Watershed:

[7] TMDL adoption, approval, and effective dates are included to the extent these dates are readily available on the Regional Board's website. Permittees request that the Regional Board work with Permittees to identify any missing dates for these TMDLs.

Nutrient TMDL	2002 Summer Allocation (Apr-Sept)	2007 Summer Allocation (Apr-Sept)	2012 Winter Allocation (Oct-Mar) [2],[3]	2002 Annual Allocation	2007 Annual Allocation
Urban Runoff WLA Lbs/season TN[1]	20,785	16,628	55,442	Not Applicable	Not Applicable
Urban Runoff WLA Lbs/year TP	Not Applicable	Not Applicable	Not Applicable	4,102	2,960

[1] TIN = (NO3 + NH3); TN = (TIN + organic N)

[2] Total Nitrogen winter loading limit applies between October 1 and March 31 when the mean daily flow rate in San Diego Creek at Campus Drive is less than 50 cubic feet per second (cfs), and when the mean daily flow rate in San Diego Creek at Campus drive is more than 50 cubic feet per second (cfs), but not as the result of precipitation.

[3] Assumes 67 non-storm days

b. The Responsible Permittees shall implement BMPs to achieve the following WLAs for San Diego Creek, Reach 2 during non-storm conditions:

Nutrient TMDL	**2012 Allocation[1]**
Urban Runoff WLA	5.5 lbs/day TN

[1] Total nitrogen loading limit applies when the mean daily flow rate at San Diego Creek at Culver Drive is below 25 cfs, and when the mean daily flow rate in San Diego Creek at Culver Drive is above 25 cfs, but not as the result of precipitation.

2. **Final TMDL Compliance Determination**

i. Compliance with final requirements for this TMDL shall be determined pursuant to Part I.B.

ii. Compliance with this TMDL was achieved prior to the final compliance dates identified in Special Provision II.B.1.a. Pursuant to Special Provision II.C.4 and 5, Responsible Permittees shall continue to verify compliance through the monitoring and reporting program.

C. **Specific Monitoring and Reporting Requirements**

1. **Monitoring**

a. Responsible Permittees shall conduct monitoring consistent with the requirements of the TMDL. Such monitoring can be integrated into the overall monitoring requirements specified in Provision XXX[8].

2. **Reporting**

Responsible Permittees shall submit reports consistent with the requirements of the TMDL.

[8] Cross reference to monitoring program.

III. Total Maximum Daily Loads for Fecal Coliform in Newport Bay

A. Applicability

1. **TMDL Basin Plan Amendment**: Attachment to Resolution No. 99-10

2. **TMDL Adoption and Approval Dates**:

   a. Regional Board Adoption: April 9, 1999
   b. State Board Adoption: TBD[9]
   c. OAL Approval: TBD[9]
   d. USEPA Approval: TBD[9]

3. **TMDL Effective Date**: TBD[9]

4. **Watershed**: Newport Bay Watershed

5. **Water Body**: Newport Bay

6. **Responsible Permittees**

   a. County of Orange, Orange County Flood Control District, City of Costa Mesa, City of Irvine, City of Lake Forest, City of Newport Beach, City of Orange, City of Santa Ana, City of Tustin

B. Final TMDL Compliance Requirements

1. **Final TMDL Compliance Date**

   a. The Responsible Permittees shall implement BMPs to achieve the final WLAs for water contact recreation standards by December 30, 2014 and with shellfish standards no later than December 30, 2019.

2. **Final WLAs**

   a. The Responsible Permittees shall implement BMPs to achieve the following WLAs for water contact recreation standards:

Fecal Coliform TMDL	**As soon as possible, but no later than December 30, 2014**
Urban Runoff Waste Load Allocation for Fecal Coliform (REC-1)	5-Sample/30-day Geometric Mean less than 200 organisms/100mL, and not more than 10% of the samples exceed 400 organisms/100mL for any 30-day period.

[9] TMDL adoption, approval, and effective dates are included to the extent these dates are readily available on the Regional Board's website. Permittees request that the Regional Board work with Permittees to identify any missing dates for these TMDLs.

b. The Responsible Permittees shall implement BMPs to achieve the following WLAs for shell fish harvesting standards:

Fecal Coliform TMDL	**As soon as possible, but no later than December 30, 2019**
Urban Runoff Waste Load Allocation for Fecal Coliform	Monthly Median less than 14 MPN/ 100mL, and not more than 10% of the samples exceed 43 MPN/ 100mL.

3. **Final TMDL Compliance Determination**

   a. Compliance with final requirements for this TMDL shall be determined pursuant to Part I.B.

C. **Specific Monitoring and Reporting Requirements**

1. **Monitoring**

   a. Responsible Permittees shall conduct monitoring consistent with the requirements of the TMDL. Such monitoring can be integrated into the overall monitoring requirements specified in Provision XXX[10].

2. **Reporting**

   a. Responsible Permittees shall submit reports consistent with the requirements of the TMDL.

[10] Cross reference to monitoring program.

IV. Total Maximum Daily Loads for Organochlorine Compounds in the San Diego Creek and Newport Bay Watersheds

A. Applicability

1. **TMDL Basin Plan Amendment**: Resolution No. R8-2011-0037, modifying Resolution No. R8-2007-0024
2. **TMDL Adoption and Approval Dates**:
    a. Regional Board Adoption July 15, 2011
    b. State Board Adoption: October 16, 2012
    c. OAL Approval: July 26, 2013
    d. USEPA Approval: [pending, insert date once approved]
3. **TMDL Effective Date**: TBD[11]
4. **Watershed**: San Diego Creek and Newport Bay Watershed
5. **Water Body**: San Diego Creek and Newport Bay
6. **Responsible Permittees**
    a. County of Orange, Orange County Flood Control District, City of Costa Mesa, City of Irvine, City of Laguna Hills, City of Laguna Woods, City of Lake Forest, City of Newport Beach, City of Orange, City of Santa Ana, City of Tustin

B. Final TMDL Compliance Requirements

1. **Final TMDL Compliance Date**
    a. The Responsible Permittees shall implement BMPs to achieve the WLAs by December 31, 2020.
2. **Final WLAs**
    a. The Responsible Permittees shall implement BMPs to achieve the following WLAs for organochlorine compounds:

OCs TMDL	Total DDT	Chlordane	Total PCBs	Toxaphene
San Diego Creek	128.3 g/yr	NA	NA	1.9 g/yr
Upper Newport Bay	51.8 g/yr	30.1 g/yr	29.8 g/yr	NA
Lower Newport Bay	19.1 g/yr	11.0 g/yr	78.1 g/yr	NA

[11] TMDL adoption, approval, and effective dates are included to the extent these dates are readily available on the Regional Board's website. Permittees request that the Regional Board work with Permittees to identify any missing dates for these TMDLs.

3. **Final TMDL Compliance Determination**

    a. Compliance with final requirements for this TMDL shall be determined pursuant to Part I.B.

    b. For Permittees that opt to comply with this TMDL pursuant to Part I.B.1.a, the Strategic Compliance Program, or equivalent plan, shall include the following:

        i. The tasks identified for MS4 permittees in Table NB-OCs-13 of the Basin Plan Amendment for this TMDL

C. **Specific Monitoring and Reporting Requirements**

1. **Monitoring**

    a. Responsible Permittees shall conduct monitoring consistent with the requirements of the TMDL. Such monitoring can be integrated into the overall monitoring requirements specified in Provision XXX[12].

2. **Reporting**

    a. Responsible Permittees shall submit reports consistent with the requirements of the TMDL.

[12] Cross reference to monitoring program.

V. Total Maximum Daily Loads for Diazinon and Chlorpyrifos in the San Diego Creek and Newport Bay Watersheds

A. Applicability

1. **TMDL Basin Plan Amendment:** Resolution No. R8-2003-0039

2. **TMDL Adoption and Approval Dates:**

   a. Regional Board Adoption: April 4, 2003
   b. State Board Adoption: TBD[13]
   c. OAL Approval: TBD[13]
   d. USEPA Approval: TBD[13]

3. **TMDL Effective Date:** TBD[13]

4. **Watershed:** San Diego Creek and Upper Newport Bay Watershed

5. **Water Body:** San Diego Creek and Upper Newport Bay

6. **Responsible Permittees**

   a. County of Orange, Orange County Flood Control District, City of Costa Mesa, City of Irvine, City of Laguna Hills, City of Laguna Woods, City of Lake Forest, City of Newport Beach, City of Orange, City of Santa Ana, City of Tustin

B. Final TMDL Compliance Requirements

1. **Final TMDL Compliance Date**

   a. The Responsible Permittees were required to implement BMPs to achieve the WLAs by December 1, 2007.

2. **Final WLAs**

   a. The Responsible Permittees shall implement BMPs to achieve the following WLAs for diazinon and chlorpyrifos in San Diego Creek:

Category	Diazinon (ng/L)		Chlorpyrifos (ng/L)	
	Acute	Chronic[1]	Acute	Chronic[1]
Wasteload Allocation	72	45	18	12.6

[1] Chronic means 4-consecutive day average.

[13] TMDL adoption, approval, and effective dates are included to the extent these dates are readily available on the Regional Board's website. Permittees request that the Regional Board work with Permittees to identify any missing dates for these TMDLs.

b. The Responsible Permittees shall implement BMPs to achieve the following WLAs for diazinon and chlorpyrifos in Newport Bay:

Category	Acute (ng/L)	Chronic (ng/L)[1]
Wasteload Allocation	18	8.1

[1] Chronic means 4-consecutive day average.

3. **Final TMDL Compliance Determination**

a. Compliance with final requirements for this TMDL shall be determined pursuant to Part I.B.

b. Achievement of the WLAs for this TMDL was demonstrated prior to December 1, 2007. Pursuant to Special Provision V.C.4 and 5, Responsible Permittees shall continue to verify achievement of the WLAs through the monitoring and reporting program.

C. **Specific Monitoring and Reporting Requirements**

4. **Monitoring**

a. Responsible Permittees shall conduct monitoring consistent with the requirements of the TMDL. Such monitoring can be integrated into the overall monitoring requirements specified in Provision XXX[14]

5. **Reporting**

a. Responsible Permittees shall submit reports consistent with the requirements of the TMDL.

[14] Cross reference to monitoring program.

VI. Total Maximum Daily Loads for Toxics in the San Diego Creek and Newport Bay Watershed

A. Applicability

1. **USEPA Promulgation Date:** June 14, 2002

2. **TMDL Effective Date:** June 14, 2002

3. **Watershed:** San Diego Creek and Newport Bay Watershed

4. **Water Body:** San Diego Creek and Newport Bay

5. **Responsible Permittees**

   a. County of Orange, Orange County Flood Control District, City of Costa Mesa, City of Irvine, City of Laguna Hills, City of Laguna Woods, City of Lake Forest, City of Newport Beach, City of Orange, City of Santa Ana, City of Tustin

B. Final TMDL Compliance Requirements[15,16]

1. **Final TMDL Compliance Date**

   a. The Responsible Permittees shall submit compliance schedules as part of the [insert name of watershed plan here].

2. **Final WLAs**

   a. The Responsible Permittees shall implement BMPs to achieve the following WLAs for selenium in the San Diego Creek watershed:

WLAs for Selenium				
Base flows (<20 cfs)	Small flows (21 – 181 cfs)	Medium flows (182 – 814 cfs)	Large flows (> 814 cfs)	Annual Total[1]
0.4 lbs/yr	1.0 lbs/yr	1.0 lbs/yr	5.3 lbs/yr	7.6 lbs/yr

[1] Sum of loading capacity for San Diego Creek only (based on 5 µg/L applied to all flow tiers).

   b. The Responsible Permittees shall implement BMPs to achieve the following WLAs for metals in the San Diego Creek watershed:

[15] The WLAs for the Toxics TMDL for the San Diego Creek and Newport Bay watershed are limited to the pollutants identified in Special Provision VI.B.2. All other pollutants included in the Toxics TMDL have been superseded by Basin Plan Amendments adopted by the Regional Board.

[16] The Regional Board is actively developing individual Basin Plan Amendments for Selenium, Metals, and pollutants from the Toxics TMDL specific to Rhine Channel. Once the Basin Plan Amendments are adopted by the Regional Board and approved by the State Water Resources Control Board, Office of Administrative Law, and USEPA, the Toxics TMDL WLAs will be superseded by the WLAs identified in the Regional Board's Basin Plan Amendment(s).

WLAs for Dissolved Metals in San Diego Creek[1]							
	Base flow (<20 cfs) Hardness @ 400 mg/L		Small flows (21-181 cfs) Hardness @ 322 mg/L		Med. flows (182 – 815 cfs) Hardness @ 236 mg/L		Large flows (>815 cfs) Hardness @ 197 mg/L
	Acute (µg/L)	Chronic (µg/L)	Acute (µg/L)	Chronic (µg/L)	Acute (µg/L)	Chronic (µg/L)	Acute (µg/L)
Cd	19.1	6.2	15.1	5.3	10.8	4.2	8.9
Cu	50	29.3	40	24.3	30.2	18.7	25.5
Pb	281	10.9	224	8.8	162	6.3	134
Zn	379	382	316	318	243	244	208

[1] Actual ambient hardness must be determined for each monitoring sample regardless of which flow condition exists.

c. The Responsible Permittees shall implement BMPs to achieve the following WLAs for metals in the Newport Bay watershed:

	Concentration-Based WLAs for Dissolved Metals in Newport Bay		Mass-Based WLAs
	Acute (µg/L)	Chronic (µg/L)	
Cd[1]	42	9.3	9,589 lbs/yr
Cu	4.8	3.1	3,043 lbs/yr
Pb	210	8.1	17,638 lbs/yr
Zn	90	81	174,057 lbs/yr

[1] Values apply to Upper Bay only (estimated as 40% of Newport Bay volume).

d. The Responsible Permittees shall implement BMPs to achieve the following WLAs for mercury and chromium in Rhine Channel:

WLAs for Rhine Channel	
Mercury (Hg)	Chromium (Cr)
0.0171 kg/yr	5.66 kg/yr

3. **Final TMDL Compliance Determination**

   a. Compliance with final requirements for this TMDL shall be determined pursuant to Part I.B.

   b. For Responsible Permittees who opt to comply with EPA-promulgated TMDLs pursuant to Provision I.B.1.a, Responsible Permittees shall propose BMPs to achieve the WLAs and the schedule to implement the BMPs in the Strategic Compliance Program or equivalent plan.

D. **Specific Monitoring and Reporting Requirements**

1. **Monitoring**

   a. Responsible Permittees shall propose a monitoring program consistent with the requirements of the TMDL. Such monitoring can be integrated into the overall monitoring requirements specified in Provision XXX[17]

2. **Reporting**

   a. Responsible Permittees shall submit reports as part of an annual report for this Order consistent with the requirements of the TMDL.

[17] Cross reference to monitoring program.

VII. Total Maximum Daily Loads for Metals in the San Gabriel River Watershed (Coyote Creek)

A. Applicability

1. **USEPA Promulgation Date:** March 26, 2007
2. **TMDL Effective Date:** March 26, 2007
3. **Watershed:** San Gabriel River
4. **Water Body:** Coyote Creek
5. **Responsible Permittees**
   a. County of Orange, Orange County Flood Control District, City of Anaheim, City of Brea, City of Buena Park, City of Cypress, City of Fullerton, City of Garden Grove, City of La Habra, City of La Palma, City of Los Alamitos, City of Norwalk, City of Placentia, City of Seal Beach, City of Yorba Linda

C. Final TMDL Compliance Requirements

1. **Final TMDL Compliance Date**
   a. The Responsible Permittees shall comply with final WLAs by September 30, 2026.
2. **Final WLAs and Compliance Dates**
   a. The Responsible Permittees shall implement BMPs to achieve the following final WLAs for total recoverable copper, lead, and zinc in Coyote Creek:

	WLAs Daily Maximum (kg/day)		
	Copper	Lead	Zinc
Dry Weather[1]	0.941	NA	NA
Wet Weather[2]	24.71 µg/L x daily storm volume (L)	96.99 µg/L x daily storm volume (L)	144.57 µg/L x daily storm volume (L)

[1] Calculated based upon the median flow at LACDPW Station F354-R of 19 cfs multiplied by the numeric target of 20 µg/L, minus direct air deposition of 0.002 kg/d.
[2] In Coyote Creek, wet weather TMDLs apply when the maximum daily flow in the creek is equal to or greater than 156 cfs as measured at LACDPW flow gauge station F354-R, located at the bottom of the creek, just above the Long Beach WRP.

3. **Final TMDL Compliance Determination**
   a. Compliance with final WLAs shall be determined pursuant to Part I.B.

b. For Responsible Permittees who opt to comply with EPA-promulgated TMDLs pursuant to Provision I.B.1.a, Responsible Permittees shall propose BMPs to achieve the WLAs and the schedule to implement the BMPs in the Strategic Compliance Program, or an equivalent plan.

D. **Specific Monitoring and Reporting Requirements**

1. **Monitoring**

a. Responsible Permittees shall conduct monitoring consistent with the requirements of the TMDL. Such monitoring can be integrated into the overall monitoring requirements specified in Provision XXX[18]

2. **Reporting**

a. Responsible Permittees shall submit reports consistent with the requirements of the TM

[18] Cross reference to monitoring program.