

**SECTION C-3**

**PLAN DEVELOPMENT**

**PROGRAM EFFECTIVENESS ASSESSMENT  
2009-10**

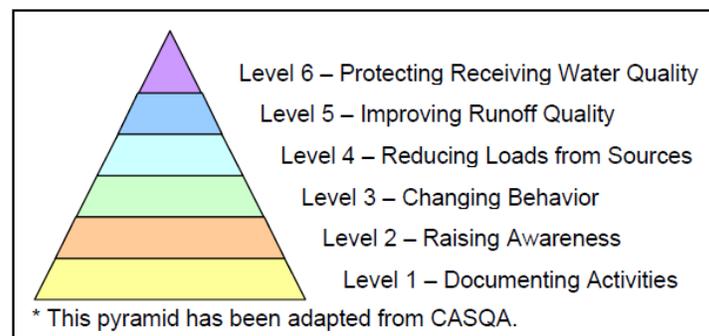


### C-3.0 Plan Development

#### C-3.1 Introduction (LIP Section A-3.1)

This Section provides information on the approach taken by the County in developing and implementing its stormwater program. This section also discusses a number of studies that the County is participating in that will assist in achieving improvements in water quality in the future.

As described in detail in **Section C-2.5** of this PEA, the County utilizes the CASQA method of effectiveness assessment in order to demonstrate if program elements, activities, BMPs, etc., are resulting in desired outcomes. CASQA identifies six Outcome Levels (see pyramid below) and for each measure the County reports, the associated Outcome Level (more than one level may apply) is indicated by a colored triangle with a number.



#### C-3.2 Plan Development (LIP Section A-3.2)

The complexity of the Third Term Permits (and subsequently the Fourth Term Permits) necessitated the development of the LIP in order to provide a County-specific plan within the broader policy and program framework of the 2003 DAMP. The LIP focuses predominantly on the jurisdictional implementation of the model pollution prevention-oriented programs detailed in the 2003 DAMP. The County LIP is a dynamic document that is evaluated on a continuing basis, at least annually, by the County.

As implementation of pollution prevention programs has taken place and evolved, so too has the LIP. The County's stormwater program management has worked closely with all departments to ensure that the goals of the program are met in concert with the County's overall mission of providing and maintaining valuable resources and services to its residents. As County departments have used stormwater inspection forms, implemented model maintenance procedures and BMPs, completed environmental performance reports, etc., they have provided important feedback which has allowed program management to adjust the plan to refine parts of the program that may not be working optimally while continuing forward with elements that are effective.

#### C-3.3 BMP Effectiveness Investigations (LIP Section A-3.3)

An important element of the County's LIP is the implementation of additional/enhanced BMPs and/or the refinement of BMPs within the DAMP programs. The tables that follow list the BMP projects and BMP investigations implemented since the issuance of the Third Term Permits in 2002.



SECTION C-3, Plan Development

Summary of County BMP Projects and Investigations

BMP/Project	Initiated (Reporting Period)	Completed (Reporting Period)	Projected completion	Watershed	CASQA Outcome Level
<b>Structural Source Control/Treatment BMPs</b>					
Ocean Institute BMP	2001-02	2002-03	Completed (& ongoing)	Dana Point Coastal Streams	4
J01P28 Clear Creek System	2001-02	2003-04	Completed (& ongoing)	Aliso Creek	5
J01P01 Munger Media Filter	2001-02	2006-07	Completed, but to be resigned	Aliso Creek	5
Channel Diversion Facilities	2002-03	2002-03	Completed (& ongoing)	Santa Ana River	6
Poche Beach UV Disinfection Facility- Demonstration Facility	2002-03	2003-04	Completed	San Clemente Coastal Streams	2
Poche Beach UV Disinfection Facility – Permanent Facility	2006-07	2009-10	2009-10 (& ongoing)	San Clemente Coastal Streams	6
Selenium Removal Quick Start BMP	2004-05	2004-05	Completed	Newport Bay	2
Nitrogen and Selenium Management Program BMP Pilot Test of Se and N removal BMPs	2006-07	2008-09	Completed	Newport Bay	2
Baby Beach Storm Drain to Sanitary Sewer Diversion and First Flush Filtration System	2004-05	2005-06	Completed (& ongoing)	Dana Point Coastal Streams	6
Bird Exclusion Fencing Baby Beach Public Pier	2004-05	2005-06	Completed (& ongoing)	Dana Point Coastal Streams	4
Sediment removal from San Diego Creek Sediment Basin #2	2004-05	2005-06	Completed	Newport Bay	4
Narco Channel Restoration	2005-06	2007-08	Plantings established by 2011	Aliso Creek	5
Monitoring of Natural Sources from Ambient Geology	2007-08	Ongoing	Ongoing	Multiple	2
<b>Litter Control BMPs &amp; Investigations</b> (See also the discussion of Drainage Facilities and Infrastructure Maintenance in <b>Section C-5.A.3</b> )					
Trash and Litter Monitoring Research Program	2007-08	Ongoing	Unknown	San Gabriel River/Coyote Creek and Newport Bay	2



SECTION C-3, Plan Development

Non-Structural Source Control BMPs					
Countywide Area Spill Control (CASC) Program	2001-02	N/A	Ongoing Project	Multiple Watersheds	
Beach Sweeping at Baby Beach - Bird Feces Control	2006-07	N/A	Ongoing Practice	Dana Point Coastal Streams	

Summary of BMP Effectiveness Investigations

Project	Type of BMP	Manufacturer (if applicable)	Type of Analysis	Report Completed
J01P28 Clear Creek System	Media filter; UV disinfection	Clear Creek	Bacterial Monitoring	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Ocean Institute BMP	Infiltrative swale; In-line separator	Stormceptor®	Runoff Monitoring	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Poche Beach UV Disinfection - Demonstration Facility	Sediment basin; UV disinfection	Suntec Environmental	Bacterial Monitoring	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Warner Channel - Wetland Vegetated Channel	Wetland Vegetated Channel	N/A	Nutrients, Selenium, and Flow Monitoring	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
J01P01 Munger Media Filter	Media Filter	N/A	Bacteria, Solids, Nutrients, Metals Monitoring	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Selenium Removal BMP	Multiple (Physical, chemical, biological)	N/A	Selenium Monitoring	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Nitrogen and Selenium Management Program BMP Pilot Test of Se and N removal BMPs	Multiple (Physical, chemical, biological)	N/A	Selenium and Nitrogen Monitoring	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>



## **BMP Project Updates in the Santa Ana Region:**

### **Newport Bay Watershed**

#### **Nitrogen and Selenium Management Program (NSMP)**

##### **Selenium and Nitrogen BMP Evaluation**

2

In December 2004, the Santa Ana Regional Water Quality Control Board issued a General NPDES Permit regulating certain groundwater-related discharges in the Newport Bay watershed. To comply with terms of the permit, a Working Group of 21 public agencies and private entities funded and implemented a work plan over a five year period to evaluate BMPs and treatment technologies for selenium and nitrogen. The five year program extended into 2010.

One of the work plan tasks was to evaluate BMPs for removal of selenium and nitrogen from surface water and groundwater discharges in the Newport Bay watershed. During 2005-06, a survey of existing and developing technologies was compiled and an initial assessment of applicability to the Newport Bay watershed was conducted. The field scale pilot testing of these technologies and the final report was completed during the 2006-07 reporting period. The summary report of selenium and nitrogen removal BMPs can be found at [www.ocnsmp.com](http://www.ocnsmp.com). The information gained from the pilot testing was used to develop a BMP Strategic Plan for the Newport Bay watershed during the 2008-09 reporting period. Additional pilot scale testing of the ABMet® System was conducted by the County from May-July 2009 and additional testing by IRWD in 2010. The ABMet® System is a patented technology owned by General Electric Company (GE). The system is composed of a series of bioreactors that are filled with media consisting of granular activated carbon (GAC). The GAC provides large surface area and an ideal growth environment for strains of bacteria that are capable of removing both nitrogen and selenium effectively. The nitrogen removal is achieved through anaerobic denitrification process, where the nitrogen is removed in the form of nitrogen gas. Selenium removal is through reduction and immobilization of oxidative forms of selenium into reducing forms of selenium, which are insoluble and can then be removed via periodic backflushing. Both nitrogen and selenium removal requires the mediation of bacteria in a controlled, strongly reducing environment maintained by feeding of electron donors (molasses).

The BMP Strategic Plan is intended to be a living document that recognizes BMPs for the treatment of selenium are not yet proven technologies and that better understanding of groundwater in the watershed is needed. Therefore, the BMP Strategic Plan uses a phased approach that incorporates adaptive management principles. The BMP Strategic Plan has a phased approach, Early Action Items, Phase I - Technology Validation and Phase II - Full-Scale Implementation. Early Action Items include construction of a full-scale ABMet® System once funding is secured, and development of a groundwater/surface water water budget / balance report. Phase I includes three demonstration-scale projects that will evaluate the effectiveness of thee technologies in their ability to remove nitrogen and selenium and understand their operation needs, an effectiveness monitoring protocol, and an approach to select the type of BMPs and their locations to be implemented for Phase II.



## SECTION C-3, Plan Development

Phase II includes four alternatives for full-scale implementation of BMPs in the watershed for both the California Toxics Rule (CTR) selenium criterion of 5 ppb and the estimated SSO back calculated water column selenium objective of 12 ppb. The BMP Strategic Plan is undergoing final review and comment by the NSMP Working Group and will be finalized in December 2010. The final plan will be incorporated into the implementation plan for the Selenium Total Maximum Daily Load (TMDL) for the Newport Bay Watershed.

### Multiple Watersheds (Anaheim Bay/Huntington Harbor, Newport Bay & Santa Ana River)

#### Countywide Area Spill Control (CASC)

4

The CASC program began in 2000 as a pilot project between the County and the Orange County Sanitation District (OCSD) to proactively prevent and respond to sanitary sewer overflows (SSOs) in the unincorporated North Tustin area. During the 2009-10 reporting period, in response to Fourth Term Permit requirements, CASC evolved into a true countywide program. The main focus of CASC remains the containment and recovery of large Sanitary Sewer Overflows (SSOs) which have the potential to significantly impact receiving waters resulting in beach closures and health advisory postings.

The overall objectives of CASC are to:

- Create broader awareness regarding the causes of SSOs and development of measures that can be implemented in order to prevent them;
- Improve the interagency coordination when responding to SSOs;
- Identify the resources needed when responding and mitigating impacts;
- Develop predictive tools for identifying potential impacts; and
- Protect the beneficial uses of the local water bodies.



During the 2009-10 reporting period, the following tasks were completed:

- Implementation of “essential elements” of CASC countywide;
- Activation of CASC on three separate SSO incidents resulting in the capture and recovery of nearly 1.5 million gallons of sewage;
- Development of a draft MOU to be executed between all entities implementing CASC; and
- Presentation on CASC at StormCon 2009.

On December 10, 2009, a CASC kickoff meeting was held with Santa Ana Regional Board cities and wastewater agencies. The “essential elements” of CASC were defined as:

1. *Participation in CASC coordination efforts* - Attend kickoff meeting and other meetings as necessary to initiate the CASC program and coordinate with the County, other cities and sewage collection agencies. “Participation” was defined as:



## SECTION C-3, Plan Development

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- Attendance at Orange County Stormwater Program and Waste Discharge Requirement (WDR) General Meetings in order to receive information on CASC program developments and implementation; and
  - Notification to the County of any sanitary sewer overflows (SSO) that may impact or threatens to impact a regional water body.
2. *CASC Area Characterization* - Provide the necessary GIS map layers of the stormdrain system and/or sanitary sewer system to the County in order to define and characterize the area. If GIS map layers are unavailable, other types of maps will be accepted.

By May 24<sup>th</sup>, 2010, the County had completed work on compiling stormdrain and sewer system maps from every municipality and wastewater agency in the Santa Ana Region into one GIS database. This GIS mapping effort continued into the San Diego Region Board area of Orange County and as of now has been completed countywide.

The CASC 2009-10 Progress Report has been prepared to summarize the work that has been completed and identify activities that may be undertaken during the upcoming reporting period. This report is being provided to the Regional Boards as an attachment to the 2009-10 Orange County Stormwater Program Effectiveness Assessment Unified Report.

### Channel Diversion Facilities



6

During the 2002-03 reporting period, the County constructed and subsequently continues to operate diversion facilities at Huntington Beach pump station, Talbert Channel, Greenville Banning Channel, and the Lower Santa Ana River. Dry weather urban runoff is diverted year-round to the sanitary sewer collection system for conveyance to the Orange County Sanitation District (OCSD) Reclamation Plant in Fountain Valley for treatment and ocean outfall discharge. Sampling and analysis of diverted runoff for pesticides and heavy metals is conducted on a semiannual basis at all facilities and results submitted to OCSD as a condition of the County's sanitary discharge permit. Diverted runoff has consistently been in compliance with OCSD maximum allowable concentrations such that it would not disrupt the biological treatment process or materially affect OCSD's own outfall discharge permit.

During the 2009-10 reporting period, the four facilities diverted 147 million gallons of urban runoff to OCSD for treatment. Diverted runoff is substantially less than that reported in 2008-09 (244 million gallons). The reduction in diversion flow may be somewhat attributable to reduced cumulative percent operational time for the four facilities in 2009-10 relative to 2008-09 (56% vs 65%). The Talbert diversion was inactive for approximately 5 months in 2009-10 for pump and flow meter repair/replacement, while Greenville Banning was inactive for 9 months due to the wait time required for custom manufacture and replacement of the three way diversion valve. Finally, the Santa Ana River diversion was inactive for 7 months, as proved cost inefficient to maintain and operate the in-line facility during recurrent rain events.

While diversion volumes may be lower in 2009-10 compared to 2008-09, the disparity in operational time between the two reporting years does not fully explain the lower volumes.



## SECTION C-3, Plan Development

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It appears likely reduced diversion volumes in 2009-10 were also attributable to actual reductions in urban runoff volumes as a result of water conservation and runoff reduction programs being implemented by water districts and local public works agencies.

### **BMP Project Updates in the San Diego Region:**

#### *Aliso Creek Watershed*

##### **J01P28 Clear Creek Treatment System**

5

A proprietary package plant was constructed to treat dry weather urban runoff from Pipe J01P28 prior to its discharge to Aliso Creek. The treatment system (assembled and initially operated by Clear Creek Technologies) consists of sand and clay media filters and ultraviolet radiation features. The system is designed to remove bacteria, suspended solids, and associated particulate pollutants at a maximum rate of 200,000 gallons/day. The treatment system draws its influent runoff from the J01P28 energy dissipation basin. Construction for the project was completed in June 2003, at a total cost of approximately \$750,000.

Operation of the system initiated in July 2003 and continued through the summer of 2005. Performance monitoring conducted during April – June 2004 indicated that the system was routinely achieving a 99.8% reduction in fecal indicator bacteria. However, monitoring downstream of the treated runoff prior to its discharge to Aliso Creek suggested that some bacterial regrowth may be occurring, thereby reducing the effectiveness of the treatment system on bacteria levels in Aliso Creek.

Treatment system operation was suspended in August 2005 due to inefficiency caused by premature clogging of filter media and excessive backwash frequency. The situation was exacerbated due to the difficulty in accessing the basin for maintenance. The system remained inactive from August 2005 to August 2007, while the County constructed a heavy equipment pad adjacent to the basin to improve maintenance access, and removed accumulated sediment from the basin.

During this same period, the County prepared plans for structural modifications to the energy dissipation basin, in order to provide better pre-treatment of runoff before entry to the treatment system. It was subsequently decided to defer implementation of these improvements and instead reinstate treatment facility operations under an increased backwash allowance volume and improved maintenance access.

During 2009-10 the treatment facility has continued to operate intermittently due to the need for additional plumbing modifications to enable drawdown of basin to the sanitary sewer, an extended filter media replacement due to impacting of filter media, and other incidental valve or float switch replacements. However, an important operational refinement was made to the water supply recycle to the intake screen wash mechanism, which is expected to greatly reduce the frequency of holding basin drawdown for maintenance and improve long term operational efficiency.



## SECTION C-3, Plan Development

The facility was finally successfully restarted in early June 2010 and was operated very effectively through the end of the reporting period, treating 1.11 MG during the one month period, with 99.5% bacteria removal efficiencies. It is hoped that the 2009-10 improvements and reconditioning efforts has prepared the facility to produce sustained and effective runoff treatment in 2010-11.

### J01P01 Munger Storm Drain Sand/Media Filter



This sand filter was intended to treat dry season urban runoff from the Munger Storm Drain (J01P01) prior to its discharge to Aliso Creek. The system is comprised of a pre-sedimentation vault, pump station/wet well and sand filter vault, with gravity discharge to the creek. The system was expected to provide meaningful removal of suspended solids, bacteria, and other pollutants.

The project was designed in 2003, then redesigned in 2004 in order to relocate the filter vault out of the stream course onto the top of the streambank. System construction was completed in December 2005 with funds from a State Water Resources Control Board Proposition 13 grant. However, it was immediately apparent that the system was substantially undersized to treat the required flow rate, and could not be operated in a safe and effective manner. Operation was suspended while system modifications were made to allow the system to be safely operated at a much lower than desired treatment flow rate. While the low amount of flow treated resulted in minimal water quality benefits to Aliso Creek, the modifications allowed the County to conduct a meaningful water quality performance evaluation of the sand filtration treatment technology under a constant dry weather urban runoff flow regime. The performance evaluation was conducted from October 2006 – January 2007. The filter achieved 90% removal of all three fecal indicator bacteria, and favorable (75 – 86%) removal of suspended solids and turbidity, as well as particulate nutrients and metals. Results were better than expected based on available performance data from other filter treatment systems, and affirmed the effectiveness of the sand filter treatment technology for application to dry weather urban runoff flows.

The filter system has been inactive since 2007 pending the conclusion of County discussions with the system’s consultant designer on arrangements to redesign an expanded treatment component for the system. In May 2010 the County completed an agreement with the consulting firm; the redesign effort is expected to initiate in 2010-11. The total cost of the project to date is approximately \$1 million.

### Narco Channel Restoration in Laguna Niguel Regional Park



This project featured the restoration of approximately 1000 feet of Narco Channel immediately adjacent to Laguna Niguel Regional Park. The project involved the transformation of a section of earthen and rock-lined trapezoidal channel devoid of vegetation to a more natural drainage corridor for both water quality improvement and wildlife habitat benefits. Restoration elements included dredging and planting of native wetland vegetation within the stream channel, and bank regrading, widening, terracing, and planting of native riparian vegetation along the stream bank.



**Pre-restoration**



## SECTION C-3, Plan Development

The City of Laguna Niguel received a \$1.4 million grant from the State Water Resources Control Board to implement the project. The County entered into a cooperative agreement with the city to administer the general construction contract.

Project construction was initiated in 2007, and formally completed in January 2008 with the planting of native riparian vegetation. After a sustained program of careful irrigation and selective weeding of invasive species, the native vegetation is close to becoming fully established along the drainage corridor.



Post-restoration

### Dana Point Coastal Streams Watershed

#### **Ocean Institute Stormwater Treatment System**



The County received a State Clean Beach Initiative grant to construct and evaluate the performance of stormwater treatment features at the Ocean Institute in Dana Point Harbor (Part of the Dana Point Coastal Streams Watershed) as an element of facility redevelopment. Stormwater treatment features consist of two parking area infiltrative swales with under drains leading to a Stormceptor® suspended solids separator. Site reconstruction was completed in the fall of 2002, whereupon the County performed a two year performance evaluation of the system, with the final report submitted in March 2006. Findings suggested that relatively minor pollutant removals were achieved by the system. The limited performance was attributable in large part to the backwater influence of tidal fluctuations on the Stormceptor unit, and the apparent poor performance of the infiltrative swales. Design modifications were recommended to potentially improve performance.

#### **Baby Beach BMPs**



The following projects and practices have been implemented to improve and protect bacterial water quality at Baby Beach in Dana Point Harbor. These BMPs are believed to have collectively contributed to a dramatic improvement in bacterial quality at the beach in recent years. The Health Care Agency water quality advisory posting activity of Baby Beach during the 2009 calendar year was 0.23 Beach Mile Days posted out of a maximum 13.8 BMD possible, or a 98% clean beach percentage. In the **2009-10 Beach Report Card**, Heal the Bay awarded an A grade to all four Baby Beach stations for the second consecutive year during the summer dry weather period (winter season surf zone sampling at the beach was not performed by the Orange County Health Care Agency in 2009-10). The substantial improvement from historically poor water quality at the beach reinforces the intent to continue the following BMPs as ongoing long term recreational beach protection measures.

#### *Baby Beach Urban Runoff Management Facility*



The County received a Proposition 40 Phase II Clean Beaches Initiative grant from the State Water Resources Control Board to construct an urban runoff management facility just upstream of where a 24-inch diameter storm drain enters Dana Point Harbor near Baby Beach. The facility serves drainage from a commercial and residential contributory drainage area on the headlands above the harbor. The facility is a combined sanitary diversion and first flush treatment system. Urban runoff is diverted to the sanitary sewer during the dry summer



## SECTION C-3, Plan Development

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season. Sanitary diversion is suspended during the winter season, whereupon urban runoff and first flush storm runoff is treated prior to discharge to the harbor. Treatment is accomplished by filtration through 154 filter media cartridges manufactured by Contech, Inc. There is also a prescreening component for trash/debris interception. The diversion and treatment system is contained within several underground concrete vaults within the parking area adjacent to Baby Beach.

Construction of the urban runoff management facility was completed during the summer of 2005, whereupon it went into immediate operation of summer diversion and winter treatment of low flow and first flush flow. Operation of the system was continued through the 2009-10 reporting period. The filter media cartridges were replaced in February 2008; the intent is to replace filter cartridges every 2-3 years.

### *Bird Exclusion Fencing*



The County received a Proposition 40 Phase II Clean Beaches Initiative grant from the State Water Resources Control Board to place anti-bird netting under the Baby Beach public pier. The existing bird netting had disintegrated and pigeons had begun to roost under the pier. The bird exclusion fencing consists of vinyl coated chain link fencing. The work was completed in September of 2005, and it continues to be in place.

### *Stormdrain Flap Gate*



The 24 inch stormdrain pipe outfall in the harbor sea wall approximately 20 feet north of the Baby Beach pier is typically submerged at medium to high tide. In order to prevent intrusion of seawater into this stormdrain pipe and thus potential growth of bacteria, a stainless steel flap gate was installed near the sea wall. Installation was completed in November of 2005.

### *Beach Sweeping*



In January 2007 the County initiated a daily beach sweeping demonstration program at Baby Beach. Beach sweeping entails the collection of shorebird feces from the exposed intertidal area along the beach before they are re-suspended into the surf zone by the incoming tide. Preliminary indications are that the beach sweeping practice is contributing to what have been low bacteria counts and greatly reduced water quality advisory postings for the last three reporting years. Given the apparent water quality benefit and modest cost, beach sweeping will be practiced as an ongoing BMP.

### *Beach Sand Replacement*



Recent research literature suggests that Enterococcus bacteria is able to propagate in the natural environment outside of a host, especially in silty sediments or fine sandy beaches, thereby adversely impacting surf zone bacterial quality. In October 2008, as part of Dana Point Harbor maintenance dredging, the County excavated and disposed of 2,500 cubic yards of fine silty sand from Baby Beach, and replaced it with hydraulic dredge transfer of clean coarser sand from a bar on the leeward side of the harbor breakwater. The action was taken as an effort to protect and extend the water quality improvements presently being achieved at the beach.



*San Clemente Coastal Streams Watershed*

**Poche Beach Ultraviolet Bacteria Disinfection System**



During the 2008-09 reporting period, the County completed construction of the Poche Clean Beach Project (PCBP), a sand filtration and ultraviolet (UV) disinfection facility for the treatment of urban runoff from Prima Deshecha Channel prior to discharge to the surf zone at Poche Beach. Poche Beach is chronically posted for exceeding AB 411 limits for bacteria in the surf zone. This new facility is intended to remove suspended solids and bacteria before the runoff is allowed to reach the beach.

An interim facility was fabricated and installed during the 2002-03 reporting period and operated during the 2003-04 reporting period. The original facility was designed as a gravity-flow-through UV disinfection system installed inside the Prima Deshecha storm channel. The system was to be operated as a dry season facility, with the system installed in the channel in the spring and removed for the winter. The system removed approximately 70 percent of influent bacteria. However, the in-channel concept was fundamentally flawed, as the system experienced operational difficulties which precluded consistent, dependable performance, and was limited in terms of an annual performance period.

The new system is sited on railroad right of way adjacent to the channel. An inflatable diversion dam directs runoff into an adjacent wet well for pumping into the sand filter and UV disinfection features. Sand filtration reduces suspended solids and turbidity in the runoff such that UV disinfection of bacteria will be most effective. The off channel design will allow the system to operate during dry weather periods throughout the year.

During the 2009-10 reporting period the facility was subjected to several requisite performance trials and subsequent system/operational modifications in order to meet the desired water quality performance objectives. The facility finally passed its performance objectives in May 2010, and is scheduled to begin fulltime dry weather operation in July 2010. The County intends to engage the South Coast Water District (SCWD) to operate the system on behalf of the County. Total facility capital cost is approximately \$3 million. Funding for both the original and new facility was supported in part by Proposition 13 Clean Beaches Initiative (CBI) grants; the City of San Clemente, the County, and the Miocean public interest group were other funding sponsors. The City of San Clemente and the County will share facility operational costs.

### C-3.4 Improvements in Stormwater Science (LIP Section A-3.4)

The County as Principal Permittee continues to conduct and sponsor investigations and special studies that will better characterize the sources of pollutants in urban and stormwater runoff, and the impacts these pollutants exert on beneficial uses in receiving waters. During the reporting period the County participated in the following studies:

#### Rapid Methods Beach Water Quality Monitoring Demonstration Project

2

During the reporting period, the County of Orange began a demonstration project with Southern California Coastal Water Research Project (SCCWRP) to utilize rapid testing methods for beach water quality to produce same-day results. This project is a first of its kind in the nation and a quantitative polymerase chain reaction (QPCR) rapid method was selected.

In partnership with SCCWRP, US EPA, Orange County Sanitation District (OCSD), and the South Orange County Wastewater Authority (SOCWA), the County's Health Care Agency agreed to use results from the QPCR rapid method to provide same-day information to the public at four popular beaches in Orange County:

- 1) Doheny State Beach, Dana Point
- 2) Huntington State Beach, Huntington Beach
- 3) Newport Pier, Newport Beach
- 4) Big Corona Beach, Newport Beach

As part of the demonstration project, the nonprofit water quality foundation, Miocean, funded the purchase of flat screen monitors that were installed at the entrances to Doheny and Huntington State Beach, as well as highly visible locations at Big Corona Beach and the Newport Pier. As results from the QPCR rapid method are obtained, HCA/Environmental Health/Water Quality staff is able to post information on beach water quality at the locations with the video monitors in real time, before noon on the same day the samples were collected. The information that is displayed on the video monitors is also displayed on a website as well: <http://bim.inertiaim.com/huntington-state-beach>



Example of Information Displayed



Video Display at Big Corona Beach



SECTION C-3, Plan Development

The County is proud to be part of this groundbreaking demonstration project which began with a one-month trial in June 2010, and went operational in July of 2010. Results from the project will be reported in the 2011-12 PEA.

**Regional Bight '08 Characterization**



Bight '08 is a collaborative effort of more than 50 organizations to conduct a regional survey to assess the environmental health of coastal waters in the Southern California Bight (the coastal area from Point Conception to the territories of northern Baja Mexico). This survey is the fourth regional survey of its kind, preceded by a Pilot Project in 1994, Bight '98, and Bight '03. The BIGHT '08 consists of six planning committees (Coastal Ecology, Shoreline Microbiology, Offshore Water Quality, Rocky Reef Habitats, Areas of Special Biological Significance, and Coastal Wetlands and Estuaries), each of which are developing unique study designs. A Steering Committee oversees the efforts of the six planning committees, ensuring that synergy occurs throughout the entire Bight '08 study. A major focus of Bight '08 activities will be the characterization of water quality along the Bight and determine the extent to which storm flows might influence from major river systems influence the development of harm algae blooms.

As Principal Permittee, the County has taken an active role in the development of three planning committee study designs (Shoreline Microbiology, Offshore Water Quality, and Areas of Special Biological Significance) in addition to serving on the Steering Committee. The Orange County Stormwater Program is further supporting the efforts of the BIGHT '08 program through in-kind contributions of analytical monitoring equipment for the Coastal Wetlands and Estuaries component.

**Regional Research Monitoring Program (Stormwater Monitoring Coalition "SMC")**



The County continues to participate in a leadership role in this collaborative effort by southern California Phase I municipal stormwater programs, NPDES regulatory agencies and SCCWRP. The goal of the SMC is to identify region-specific research needs to better understand stormwater mechanisms and impacts, and to collectively sponsor the development of assessment techniques and methodologies that will enable more informed and consistent stormwater management decision-making across the region. The SMC relationship was formalized in an agreement signed in 2000, and extended in 2007. The current member agencies are:

- California Regional Water Quality Control Board, Los Angeles Region
- California Regional Water Quality Control Board, San Diego Region
- California Regional Water Quality Control Board, Santa Ana Region
- City of Long Beach
- County of Orange, OC Public Works
- County of San Diego
- Los Angeles County Department of Public Works (LACDPW)
- Riverside County Flood Control and Water Conservation District
- San Bernardino County Flood Control District
- Ventura County Watershed Protection District
- Southern California Coastal Water Research Project (SCCWRP)



## SECTION C-3, Plan Development

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- Caltrans
- State Water Resources Control Board
- City of Los Angeles
- US Environmental Protection Agency

The multi-agency collaboration has demonstrated its effectiveness in working together to identify common needs and to efficiently use public funds in coordinating regional stormwater research efforts. To date, the SMC has initiated a dozen of the 15 research projects identified in the research agenda. A summary of project accomplishments during the 2009-10 reporting period are as follows (Information taken from the *2009-10 SMC Annual Report*):

### *Stormwater Data Compilation Study*

Status: 90% complete

Assessment and prioritization for mitigating water quality requires context. Knowledge of mean concentrations across watersheds, counties, and regulatory jurisdictions provides the perspective needed for managers to rank waterbodies for management action. Regional reference condition, frequency of water quality objective exceedances, extent and distribution of parameter concentrations all play a part in determining where a manager's worst problem occur.

To help managers gain the necessary perspective, the SMC described a project in their Research Agenda that compiles water quality monitoring information region wide. For several years, the SMC has been building the necessary infrastructure to support such an effort. Data sharing protocols, interlaboratory calibrations, and web-enabled interfaces all enhance the SMC's ability to share data. The goal of this project is to compile the existing water quality monitoring information. Initially starting with nutrients, the objective will be to make annual estimates of concentrations and mass emissions from 25 watersheds between Ventura and San Diego.

To date, more than 600,000 data records have been compiled among all SMC agencies. Initial assessments indicated that there was tremendous variation and completeness among the data submittals. However, the greatest hindrance towards achieving our goal was not the lack of concentration data, but the lack of flow data. Ultimately, this impacted the ability to estimate annual loads. The data set is currently being augmented with the missing data prior to final load estimates. SCCWRP staff is working with SMC agencies to update data submittal procedures for the coming storm season and address remaining issues to improve load estimation.

### *Implementing A Regionally Consistent and Integrated Freshwater Stream Bioassessment Monitoring Program*

Status: 65% complete

Assessment of freshwater biological communities represents a potentially powerful tool for evaluating the effects of discharges in southern California creeks and streams. Bioassessments integrate the effects of multiple stressors, including chemical pollutants and physical alterations in receiving waters. The value of biological assessments is that they are closer to many of the defined beneficial uses of receiving waters (i.e. aquatic life, warm water habitat, cold water



## SECTION C-3, Plan Development

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habitat) than chemically-derived water quality objectives. As a result, virtually every SMC member agency has biological community monitoring in their respective NPDES permits.

The goal of this study is to implement a coordinated, integrated regional bioassessment monitoring program. Previously, the SMC had worked together to design an optimal monitoring program that satisfied both local needs, but simultaneously provided information that could be combined to make region wide assessments. Monitoring questions included: 1) What is the extent of impact in streams of southern California? 2) What are the stressors that impact southern California streams? and 3) Is the extent of stream impacts changing over time?

This is the second year of a five-year project. In the first year, over 110 sites were sampled between Ventura and San Diego counties for biological communities, water quality, physical habitat, and riparian condition. Preliminary results indicated that roughly 50% of the stream miles in southern California have healthy biological communities. In addition, the extent of chemical contamination appears lower than previously thought. For example, less than 3% of the stream miles exceeded the chronic water quality criterion for copper. Sampling for the second year is now finished and samples are at the laboratory for analysis.

The SMC regional watershed monitoring program is now serving as a model for other parts of the state. Regional watershed programs in the San Francisco Bay and the Central Valley are planning to use the SMC as a model for their design and implementation. Perhaps the biggest value of the SMC regional watershed monitoring, however, is its connection to the SWRCB's development of biological objectives. This new policy will set narrative and numeric limits on biological condition in streams statewide. Because of the unique collaboration in southern California, approximately one-third of the data used to develop the biological objectives will come from the SMC region.

Our main collaborator on this project is the California Department of Fish and Game (CDF&G) and SWRCB. The project is 50% funded by the SWRCB, whose main desire is to ensure integration with the Surface Water Ambient Monitoring Program (SWAMP).

### *Laboratory Intercalibration Study*

Status: 100% complete

One goal of the southern California Stormwater Monitoring Coalition (SMC) is to compile monitoring data from separate monitoring programs to make region wide assessments. For example, the SMC is participating in Regional Monitoring and Regional Data Compilation studies (see previous studies). Both of these studies require not only high quality data, but comparability among laboratories. Despite all SMC laboratories being State-certified, previous intercalibration studies have demonstrated interlaboratory coefficients of variation in excess of 100% for many constituents. As a result, the SMC has endorsed laboratory intercalibration studies based on the types of samples for which they are responsible.

Two laboratory intercalibrations have been conducted previously by the SMC. Both intercalibrations utilized approximately a dozen laboratories and focused on suspended solids (TSS), nutrients, and trace metals. Samples were distributed to each laboratory blind and in



## SECTION C-3, Plan Development

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triplicate, thus assessing both within and between lab variation. Multiple iterations were required for some constituents in the first iteration, but the variability between laboratories was reduced to within laboratory variance ( $\leq 20\%$ ) for most constituents. The end result was a performance-based Guidance Manual that defines the sensitivity, accuracy, and precision necessary for analyzing samples for any SMC member agency:

[ftp://ftp.sccwrp.org/pub/download/PDFs/420\\_smc\\_chem.pdf](ftp://ftp.sccwrp.org/pub/download/PDFs/420_smc_chem.pdf)

Ultimately, a scoring system that defined letter grades for intercalibration performance was developed and the SMC began using these grades as a screening tool for selecting contractors.

The goal of this project, the third laboratory intercalibration, was to fill in the missing information to make the Laboratory Guidance Manual an ongoing and effective document. It involved four steps: 1) recruiting laboratories; 2) repeating the laboratory intercalibration for TSS, nutrients, and trace metals; 3) initiate an intercalibration for organic constituents; and 4) revise and update the Laboratory Guidance Manual. A technical Working Group consisting mostly of laboratory managers was formed to assist in the study.

The SMC has successfully finished the intercalibration this year. The number of participating laboratories increased to fifteen. Certified reference materials, a dry weather runoff sample, and a wet weather runoff sample from an urban land use were all delivered blind and in triplicate to participating laboratories. A longer list of nutrients and metals were added to mimic the list being analyzed for the regional watershed monitoring program. In addition, a number of the constituent reporting limits were lowered to ensure consistency with the SWRCB's ambient monitoring program. The intercalibration for organics focused on over 50 chlorinated hydrocarbons (CHCs; i.e., DDTs, chlordanes, and PCBs) and eight pyrethroid pesticides (i.e., bifenthrin). CHCs were one focus because of the difficulty in confident low level analysis and implication in TMDLs for each of the RWQCB jurisdictions. Pyrethroid pesticides were selected because of its increasingly wide use in the urban landscape by homeowners. To ensure measureable levels of organic analytes, samples were created by distributing unknown calibration standards or by mixing contaminated sediments into a dry weather runoff sample.

Once again, the laboratories performed well after the first iteration for TSS, nutrients, and trace metals. Nearly all laboratories, including the new laboratories, achieved a grade of A or B. Laboratories required multiple iterations to achieve a level of moderate success for the organic analytes. Only a subset of laboratories had the capacity to analyze these difficult compounds, and not all that did participate could achieve the desired reporting levels. Interlaboratory variability achieved a level of acceptable level of comparability, but this was for a calibration sample of known concentration in the simplest of all matrices. Future intercalibrations should challenge the laboratories with in-matrix samples.

The SMC is pursuing a future interlaboratory calibration agreement to maintain the periodicity of the intercalibration, add further organic constituents (i.e., PAHs), and increase the quality and comparability of toxicity measurements.

### *Hydromodification Study*

Status: 50% complete



## SECTION C-3, Plan Development

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The process of urbanization has the potential to affect stream courses by altering watershed hydrology. Development and redevelopment can increase the amount of impervious surfaces on formerly undeveloped landscapes. This reduces the capacity of remaining pervious surfaces to capture and infiltrate rainfall and, as a result, a larger percentage of rainfall becomes runoff during any given storm. In addition, runoff reaches the stream channel much more efficiently, so peak discharge rates post-development are higher compared to predevelopment for an equivalent rainfall event. This process has been termed hydromodification.

Hydromodification can result in adverse effects to stream habitat, surface water quality, and water supply. The stream erosion that results from the increased peak flow can threaten infrastructure, homes, and businesses. Intermittent and ephemeral streams that possess riparian and wetland habitat are at particular risk from effects of hydromodification. Streams in semi-arid regions are especially vulnerable to urbanization due to a prevalence of sand bed channels, lack of vegetative reinforcement, and relatively large net changes in water and sediment supply associated with stormwater runoff. Recent studies by the SMC have indicated that intermittent and ephemeral streams in southern California degrade at lower levels of watershed urbanization than streams in the eastern US.

In response to the effects of hydromodification, state and local agencies are developing standards and management approaches to control and/or mitigate the effects of hydromodification on natural and semi-natural stream courses. Successful implementation of these regulatory programs requires development of tools to better assess hydromodification effects and develop appropriate mitigation and management strategies.

The goal of this project is to develop a series of tools supporting implementation of hydromodification management measures that could be used to better protect the physical, chemical, and biological integrity of streams and their associated beneficial uses. This project will provide tools to answer the following questions: 1) Which streams are at the greatest risk from the effects of hydromodification? 2) What are the anticipated effects in terms of increased erosion, sedimentation, or habitat loss, associated with increases in impervious cover? 3) What are some potential management measures that could be implemented to offset hydromodification effects and how effective are they likely to be?

This project is being conducted in collaboration with researchers from Colorado State University, Fort Collins. Several milestones have been reached over the previous year. First we completed a review of mapping and classification literature that will serve as the foundation for the classification system developed by this project:

[ftp://ftp.sccwrp.org/pub/download/PDFs/562\\_Hydromod\\_LitReview.pdf](ftp://ftp.sccwrp.org/pub/download/PDFs/562_Hydromod_LitReview.pdf)

Second, we completed an extensive field campaign that has resulted in a database containing detailed information on channel condition, hydraulics, sedimentary characteristics and other attributes of over 30 stream segments across a gradient of urbanization and landscape settings. Drainage basins have been delineated for all sites and we have quantified several essential watershed metrics for each stream (e.g. watershed area, % impervious, annual rainfall, % burned within last few years, and NRCS soil types vs. rock). Several tools were developed to



## SECTION C-3, Plan Development

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support processing of the field data, including automated spreadsheets for combining sieve and pebble count sediment samples, as well as for performing numerous hydraulic analyses and generating stream stability metrics. We have also made progress in developing tools for classification and extrapolation flow duration curves from gauged to ungauged sites in regional hydrologic analyses and have populated a database with pre-development flood estimates for each field site.

### *Low Impact Development Study*

Status: 80% complete

The Low Impact Development Guidance (LID) Study is being conducted with funding from the State Water Resource Control Board's Consolidated Grants Program, under the Urban Runoff Program of Proposition 40. The LID Project will develop a comprehensive program to incorporate LID strategies and techniques into the planning and design of public and private sector projects. The LID Project will develop a model program for localities in California that are interested in adopting LID strategies and techniques.

This project has been successful in attaining these goals:

- *Develop interim guidance and training for LID implementation:* Four training sessions were held throughout the Southern California region from 2007 through 2008.
- *Determine effectiveness of LID for reduction of pollutant loads and hydrologic changes in Southern California:* Monitoring results were used to assess the volume and concentration benefits to discharges, the percentage of runoff from various BMPs and LID systems measured, and a review of the soil type. There are ongoing LID monitoring programs that will provide additional results regarding the effectiveness of LID in Southern California.
- *Develop guidelines on specifications and standards for Project design and review:* The SMC and CASQA finalized the LID Guidance Manual in April 2010. It is now located on the CASQA web site.
- *Develop final guidance and training materials using field data:* This goal was partially met. The San Bernardino Flood Control District and the SMC have developed final guidance and training materials using the feedback from interim trainings, the literature review, and using the final LID Guidance Manual. However, field data collected as part of this project has yet to be incorporated into the LID Guidance Manual.
- *Conduct training workshops in Southern California:* In addition to the interim training workshops, final Training was provided by online web access to the Manual and presentations that provided manual content and access information.

The District coordinated with various regional and statewide efforts that involved LID training, including San Diego County, the California Water and Land Use Partnership, the California Coastal Commission, the Local Government Commission, and the Chino Basin Landscape Alliance. The collaborative regional effort was a critical networking tool that provided additional funding, technical support, and LID monitoring opportunities. Partner agencies



## SECTION C-3, Plan Development

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included the County of San Diego, Riverside County, and CASQA, all of whom helped support the project when Grant funding was frozen mid-project by the State of California. Approximately \$260,000 has been leveraged for future activities during the 2010-2011 and 2011-2012 fiscal years.

SMC and CASQA plan to continue updating the LID Guidance Manual and provide training sessions. Monitoring is planned to continue through spring of 2012. Monitoring reports are expected to be provided upon completion of data analysis and reporting. The Local Government Commission, in conjunction with the SMC, has planned a program to identify barriers to LID implementation. This project will conduct a literature review focusing on the site design and approval processes and associated codes, processes and perceptions, generating and distributing a survey to identify the barriers. The program will then develop strategies to overcome barriers to LID implementation.

### *Effects of Wildfires on Contaminant Runoff and Emissions*

Status: 75% complete

Fire is a natural component of Mediterranean ecosystems, such as those found in southern California. Due to loss of plant cover, severe burns have been shown to increase runoff and sediment generation to downstream areas. Constituents associated with the increased runoff have the potential to affect water quality in downstream receiving waters and the near-shore coastal environment. This may be especially problematic for streams that are already impaired. Most research on post-fire water quality has focused on nutrient and sediment enrichment in relatively natural areas. However, post-fire runoff also has the potential to increase loadings of carbon, organic compounds such as PAHs, and trace metals. Constituent loadings may occur by several mechanisms over a range of spatial and temporal scales. Potential loading mechanisms include direct runoff, debris flows, or atmospheric deposition of ash followed by storm runoff. Investigating the magnitude and duration of fire effects in downstream and/or adjacent watersheds is critical to accounting for its influence on cumulative water quality impacts and attaining water quality standards.

This goal of this project is to investigate the fate of water quality constituents resulting from southern California wildfires in order to quantify the effects of post-fire runoff on downstream metals and organic constituent concentrations and loads. Contaminant loading and effects on in stream biota will be investigated as part of this project.

A regional post-fire monitoring strategy was completed in 2009 (SCCWRP Technical Report # 598) that describes an agreed-upon approach for post-fire sampling. This plan was implemented for the first time following the 2010 Station Fire, which burned portions of the Los Angeles and San Gabriel River watersheds. Two sites were sampled for solids, metals, and PAHs over six storms following the 2010 fires; Tujunga Wash and Arroyo Seco. Results showed dramatic increases in concentrations and loads of all constituents sampled following storms, but returning to near pre-fire levels by the end of the storm season. The results of this analysis are currently being written up as for submittal a journal and inclusion in next year's SCCWRP Annual Report. In addition, six sites in the affected burn area that were sampled in 2009 as part of the SMC Regional Bioassessment Program were resampled in spring 2010 for



## SECTION C-3, Plan Development

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basic water chemistry, CRAM, and benthic macroinvertebrates. Analysis of the data from these sites is pending and will be completed over the next year.

### **Newport Bay Fecal Coliform TMDL Source Identification and Management Plan**

The fecal coliform TMDL for Newport Bay was adopted in 1999 to improve bacterial quality, reduce public health risks and improve water contact recreational activities. The development of a Source Management Plan, as required by the fecal coliform TMDL, is made difficult by the many different urban and natural sources of fecal indicator bacteria in the Bay, the apparently episodic and diffuse nature of these sources, and the fact that bacteria are intrinsically non-conservative (i.e., they die-off and grow in the environment). In February 2005, the County received a Proposition 13 grant from the State Water Resources Control Board to identify and quantify the contribution of urban and natural sources of fecal indicator bacterial (FIB) impairment in Newport Bay to define the relative contribution of FIB and viruses to water quality impairment of the Bay, and to prepare a Fecal Coliform TMDL Source Management Plan evaluating and prioritizing sources of fecal coliform bacteria and BMPs to address the sources.

Data collection was initiated in December 2005 and continued through February 2007. Data collection efforts included:

- 46 Bay-to-Ocean (BTO) transects were completed and an intensive survey of the upper basin of Upper Newport Bay (BTO4) was conducted to assess the impact of a large macroalgae bloom on FIB concentrations.
- Inventory of storm drains within the City of Newport Beach has been completed. Dry weather sampling of irrigation water run-off at curbside on the PCH side of the Bay, Balboa Peninsula, Balboa Island and Lido Island, as well as sampling of water from beach trenches was conducted in the early morning hours on November 16, 2006. Twenty-one drains were surveyed and 5 trenches were sampled. The wet weather storm drain survey was conducted on January 31, 2007, where the same twenty one drains were sampled from the dry weather study. Drains were sampled at the end of the pipe at low tide. In addition, irrigation water from the curbside was collected at street-level for each of the storm drains during both dry and wet weather.
- Two synoptic studies of water quality along the perimeter of the Lower Newport Bay (LNB) at most of the storm drain outlets (those that could be identified from the Bay side) were conducted in August 2007. Measurements of FIB, pH and salinity were taken at each storm drain outfall and 50-100 feet away from the outfalls at low-tide and high tide in the night-time hours when FIB concentrations were estimated to be highest. These results were used to generate a map of FIB exceedances from storm drain outfalls in LNB.
- Four diurnal intertidal sediment studies (wet season and dry) were completed. Wet weather surveys occurred during storms on March 1-2 and March 18-19, 2006. The dry weather studies were completed on October 19 and October 26, 2006.



## SECTION C-3, Plan Development

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- Microcosm studies have been conducted assessing the die-off and re-growth of FIB from runoff in Newport Bay waters, bird feces, macroalgae, sediment, and runoff. In total 70 separate microcosms have been conducted:
  - 28 microcosm studies have been conducted assessing the die-off and/or re-growth of FIB associated with macroalgae and bird feces;
  - 14 microcosm studies have been conducted assessing the die-off and/or re-growth of FIB associated with sediments of various grain sizes;
  - 27 microcosm studies have been conducted assessing the die-off and/or re-growth over a range of salinities, creek sources and bay sources;
  - 4 microcosms were conducted to assess the influence of wrack line debris;
  - 3 microcosms were conducted to assess FIB in runoff.
- E. coli and enterococcus isolates were obtained from the Newport Bay BTO study and the microcosm studies. Biochemical identification for both Enterococcus and E. coli was conducted. Approximately 200 Enterococcus isolates were identified and approximately 200 E. coli isolates were characterized. E. coli gene expression patterns were analyzed to distinguish environmental adapted strains from those of fecal origin.

Preliminary data results were presented to the Newport Bay Fecal Coliform TMDL Technical Advisory Committee on July 21, 2006 and April 13, 2007. The final Newport Bay Fecal Indicator Bacteria Source Identification Project Report was submitted to the Regional Board in July 2009.

Information from this report, as well as all previous TMDL studies and stakeholder efforts were used to formulate the Fecal Coliform Source Management Plan, the second task of the project. During this reporting period, the final Source Management Plan was submitted to the Regional Board in November 2009. The grant award amount for the studies was \$780,000 with a \$50,000 match provided by the Watershed Permittees and other stakeholders. Both the Newport Bay Fecal Indicator Bacteria Source Identification Project report and Fecal Coliform Source Management Plan were accepted by Regional Board staff and the grant was successfully closed out.

### **Development of California Sustainable Watershed/Wetland Information Manager (CalSWIM) – Prototype Database**

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In response to a commitment to develop a prototype watershed database for cumulative impact assessment, the County on behalf of the Orange County Stormwater Program has joined with the University of California, Irvine (UCI) in developing and implementing a prototype database called the California Sustainable Watershed/Wetland Information Manager (CalSWIM).

CalSWIM will be a web-based expert system and database focused, initially, on Newport Bay and the Newport Bay watershed. CalSWIM will be designed with a user friendly and instruction-rich interface to facilitate its use by individuals from a wide spectrum of educational backgrounds and technical expertise. The technical objective of CalSWIM is to provide an interactive platform for coastal wetland and watershed managers, planners, and engineers to explore alternative wetland



## SECTION C-3, Plan Development

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and watershed management strategies. By exploring the (often unintended) consequences of management decisions in a virtual environment *before* implementation, CalSWIM should promote cost-effective and scientifically justifiable decisions regarding the monitoring, management, and alternation of coastal urban wetlands and their associated watersheds. While the focus is on providing a decision making platform for coastal managers, the "SimCity" character of CalSWIM's design may also lead to its use by other user groups, including educators, environmentalists, and the lay public.

A highly interdisciplinary team of researchers from four universities (UCSD-Scripps Institution of Oceanography, UCI, UCLA, and Caltech-JPL) participated in the development of the CalSWIM concept. From this concept, a formal research proposal was developed and submitted to NOAA's 2004 call for "Ecological Forecasting" proposals. The CalSWIM proposal was designated by the review panel as "fundable", and scored in the top four of all proposals submitted to the program. Unfortunately, due to funding reductions in the Ecological Forecasting program, NOAA could fund only the top two proposals.

In the interim, the County funded a small subset of the original research team (a computer scientist and environmental engineer) to construct a prototype CalSWIM web site that will focus on two components: 1) the assimilation of data and information on Newport Bay and Newport Bay watershed; 2) the integration of a subset of the data for fecal indicator bacteria impairment with a forecasting model developed by UCI. During the 2006-07 reporting period, a prototype web site was completed ([www.calswim.org](http://www.calswim.org)). The web page provides information on the San Diego Creek/Newport Bay watershed to visitors through four tools:

1. Explore - Through this portal visitors can explore the watershed through an interactive map, view its creeks and tributaries, land uses, and monitoring stations. Geo-referenced photos, reports, and monitoring data are also available through this portal;
2. Simulate - Users are able to evaluate the behavior of the watershed in Upper Newport Bay using an advanced model of pollutant concentration developed at UCI;
3. Analysis - Monitoring data for specific constituents and time periods can be displayed graphically; and,
4. Data Query - Monitoring data and reports are made available through direct queries to monitoring program databases.

During the 2009-10 reporting period, the primary focus was refinement of the water quality simulation tool, as described in a research article titled *Beach Boundary Layer: A Framework for Addressing Recreational Water Quality Impairment at Enclosed Beaches* that will be published in the journal of Environmental Science and Technology.

### **Trash and Litter Monitoring Research Program**

Trash and litter in surface waters is a major concern for environmental management. It can cause significant water quality, biological and aesthetic problems.



## SECTION C-3, Plan Development

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Specifically, trash and debris may inhibit the growth of aquatic vegetation, harm aquatic organisms by ingestion or entanglement, convey other pollutants such as toxic substances, and cause visual blight on shorelines. A major source of trash in the environment is litter that is intentionally or accidentally discarded in watershed drainage areas. This material can then be transported in storm drains to the creeks, rivers and ocean during and after rainstorms. Each year the Orange County Permittees make significant efforts to minimize trash and litter levels at significant expense.

Stormwater agencies throughout southern California share many similar issues regarding trash and debris monitoring and management but to date there have been no coordinated effort to develop a consistent method of estimating loadings, understanding pathways into the environment and identifying and prioritizing sources for remediation at a watershed scale.

A collaborative project with the SMC will seek to develop some of these regional tools and apply them in a case example for management controls in the Newport Bay and selected watersheds of Orange County. Currently, several member agencies have trash abatement requirements in their stormwater permits, but little information is collected to assess if the abatement is effective.

The project being lead by the County is a multi-tiered research based project being designed to answer a wide array of scientific and management based questions. It is intended to develop the regional tools that will dovetail with grant funding directed towards improving management of trash in Newport Bay. The intent of the project is to address 1) rapid assessment monitoring methods; 2) BMP effectiveness evaluations; and 3) source tracking methodologies.

This project is intended to develop a rapid assessment method that utilizes a multimetric approach to score storm channel/stream reaches in terms of the overall trash and litter condition similar to the rapid assessment methods already utilized by agencies for programs such as bioassessment and wetland habitat evaluations. It is anticipated that with a multimetric approach a rapid assessment method can be developed that will minimize labor time, adapt to a wide array of channel conditions, and provide flexibility across programs including volunteer and County sponsored events. This project will also develop tools to identify and prioritize sources for remediation and develop a system of weighting sources based on potential impacts. The intent of this project is to develop tools that will allow watershed scale plans to be developed in a cost-effective and time-efficient manner. The project will potentially address the following questions:

1. What is the current state of knowledge including defining common terminology?
2. Do hotspots for trash and debris exist?
  - a. What categories of land use represent the most significant input of trash and debris into storm channel/stream reaches?
  - b. How do you determine the relative contribution of various sources such as storm drain outfalls, fugitive trash, illegal dumping, recreational areas, homeless encampments, fast food outlets/convenience stores, etc.?



## SECTION C-3, Plan Development

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3. Are existing management programs working or are additional controls required?
  - a. Are the levels of trash and debris in decline?
  - b. What are the relationships between the land area coverage for trash control and waterway conditions?
4. What are the appropriate trash and debris management controls?
5. How can trash and debris controls be applied most efficiently spatially and by land use to reduce levels in storm channels/stream reaches?

The project will use the regional tools developed and then apply them to develop a Trash Management Plan (TMP) for selected watersheds as regional case examples for the selection and installation of trash and litter controls.

### Monitoring of Natural Sources from Ambient Geology

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Beginning in late 2007 the County initiated a proactive effort to identify constituents of concern from MS4 discharges that had no apparent source. The source identification used a hybrid investigation style by reexamining regulatory monitoring data followed by intensive drainage area reconnaissance of problematic monitoring sites. By examining the data against a geological map, it was discovered that trace metal exceedance patterns follow the distinct geological divide between the non-marine alluvial deposits of northern Orange County and the volcanic and marine sedimentary formations that predominate in southern Orange County. Further investigations have shown that the Capistrano, Monterey, Santiago, Silverado, Vaqueros, and Puente Formations represent significant natural sources of certain metals for specific Orange County watersheds.

Naturally derived pollutants in surface waters can often exceed water quality criteria both in undeveloped catchments as well as developed watersheds. Further work is needed to understand the geochemical variability across Orange County in order to set benchmarks of the ambient contributions as well as examine the range of constituents affected by geology. Efforts in the 2010-11 reporting period will be focused on attempting to connect with other stormwater agencies outside of Orange County that may be experiencing similar issues and possibly assess a greater diversity of natural conditions.

### C-3.5 Regulatory Directives

#### 13225 Directive for Aliso Creek

On March 2, 2001 the San Diego Board issued a written directive pursuant to California Water Code Section 13225 to the County of Orange, Orange County Flood Control District and the Aliso Creek watershed cities (Watershed Permittees). The directive found that the Watershed Permittees may be discharging waste with high bacteria levels from municipal storm drain outfalls into Aliso Creek and its tributaries. As a result the Watershed Permittees were directed to conduct an evaluation of the relative contribution of the urban stormwater discharges to the impairment of beneficial uses or the exceedances of water quality objectives and, where necessary, take appropriate measures to eliminate the sources of pollution.



## SECTION C-3, Plan Development

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The County is responsible for implementing elements of its LIP in unincorporated areas of the County. The County's unincorporated areas within the Aliso Creek watershed contain one storm drain outfall that meets the minimum size criteria of 39 inches, but otherwise does not contain drainage areas with significant urban land use. Therefore, the County's main responsibilities pursuant to the Regional Board's Directive include coordinating the Watershed Permittees' activities, conducting the monitoring program, and compiling Watershed Permittee information and monitoring data necessary to prepare the quarterly progress reports, and developing prototype bacteria BMP projects (see prior discussion on J01P28 Clear Creek System and J01P01 Munger Storm Drain Sand/Media Filter).

Detailed information on the Permittees' efforts to identify, evaluate, and reduce or eliminate sources of bacterial contamination, including the County's efforts described below, may be found in these quarterly progress.

The Regional Board's Directive required the Watershed Permittees to submit an initial report by April 30, 2001 and submit quarterly progress reports by July 31, October 31, January 31, and April 30 of each year until the San Diego Regional Board determines that the nuisance discharges have been prevented to the Maximum Extent Possible (MEP). The County on behalf of the Watershed Permittees submitted the initial report on April 30, 2001, and has submitted progress reports quarterly from 2001 through September 2005. In 2005 the County worked with the Watershed Permittees and Regional Board staff to revise the Aliso Creek Watershed Action Plan (Formerly Watershed Chapter) to incorporate the requirements of the Directive and to provide information on planned activities and progress made in reducing bacteria loads to Aliso Creek. As part of this update a revised monitoring program was developed providing more focus on source identification and local evaluation of the effectiveness of the Watershed Permittees' activities to reduce bacteria levels. The revised monitoring program was approved by the Regional Board at the October 2005 Board meeting and implemented beginning in June 2006. As a part of the revised monitoring program, annual rather than quarterly reports are now submitted.

The revised program focuses monitoring efforts on a group of status and trends sites near the bottom of the watershed and a second set of BMP evaluation sites at high-priority drains throughout the watershed. Monitoring occurs at a higher frequency than in the original program, but only during the summer when bacteria levels are highest. Analyses of the available monitoring data show that this design will sufficiently track compliance with REC1 standards in the area of highest recreational use in the lower watershed and document the effectiveness of BMPs implemented at the high-priority drains. Data and results of the revised monitoring program are submitted on an annual basis on March 15<sup>th</sup> of each year (annual reporting date changed in the Fourth Term Permit). The revised monitoring program for Aliso Creek is designed to track certain levels of change over a 10 year period of time.

In December of 2009, the Regional Board adopted the adopted the Fourth Term Permits for south Orange County. The permit included the incorporation of the previous Aliso Creek 13225 directive requirements. Subsequently in February 2010 the Regional Board adopted TMDLs for indicator bacteria to address impaired beaches and creeks in the San Diego region including Aliso Creek and its tributaries, the Aliso Creek mouth, and Aliso Beach.



## SECTION C-3, Plan Development

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The TMDLs must now be approved by the State Water Board, the Office of Administrative Law (OAL), and the U.S. Environmental Protection Agency, after which the TMDLs would supersede the previous directive/permit requirements. OAL approval may not occur until 2011, after which TMDL compliance must occur within 10 years. Compliance for wet weather may be extended to 20 years if a Comprehensive Load Reduction Plan (CLRP) targeting all watershed 303(d) listed constituents is developed by permittees. During the reporting period the County and permittees began development of a Bacteria Load Reduction Plan in advance of the effective date of the TMDL. A flow study was begun in June 2010 and continued through September. Data from this study will be compared to prior flow data to determine if reductions due to watering restrictions are occurring and to test/validate the flow values in the model used by the Regional Board to develop TMDL allocations.

### **C-3.6 Plan Development Modifications**

As the last step in the effectiveness assessment process, the County has evaluated the outcomes for this program element to determine if any program modifications are necessary. During the 2009-10 reporting period, the County continued to increase its knowledge and awareness while achieving notable improvements in water quality through the various BMP projects, studies and investigations discussed in this section. Based on the assessment of this program element, no major modifications are planned.