ANNUAL REPORT 2008-2009

Stormwater Monitoring Coalition
Of Southern California

October 5, 2009

INTRODUCTION

As a result of the increasing regulatory focus and the lack of scientific knowledge base, both stormwater regulators and municipal stormwater management agencies throughout southern California have developed a collaborative working relationship. The goal of this relationship is to develop the technical information necessary to better understand stormwater mechanisms and impacts, and then develop the tools that will effectively and efficiently improve stormwater decision-making. As individuals and agency representatives, there was early recognition that these issues are oftentimes not localized, but typically cross watershed and jurisdictional boundaries. This relationship culminated in a formal letter of agreement, signed in 2000, by all of the Phase I municipal stormwater NPDES lead permittees and the NPDES regulatory agencies in southern California to create the Stormwater Monitoring Coalition (SMC) (Table 1).

Table 1. List of member agencies in the Stormwater Monitoring Coalition.

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
California Department of Transportation, Caltrans
City of Long Beach
City of Los Angeles, Watershed Protection Division
County of Orange, Public Facilities and Resources Dept.
County of San Diego Stormwater Management Program
Los Angeles County Department of Public Works
Riverside County Flood Control and Water Conservation District
San Bernardino County Flood Control District
Southern California Coastal Water Research Project
State Water Resources Control Board
US Environmental Protection Agency, Office of Research and Development
Ventura County Watershed Protection District

The first project supported by the SMC was to develop a five-year Research Agenda. The research agenda, published in 2001, consisted of 15 unique projects that the SMC ranked, prioritized, and then funded on a voluntary basis. The SMC has made tremendous progress implementing the Research Agenda. Ten of the 15 projects have been started and virtually all have been completed.

The value of the SMC to its member agencies is at least four-fold. The first is the ability to share costs for implementing projects. Cost reductions for SMC member agencies can be significant since collaborative projects can reduce costs by more than 90% relative to footing the bill alone. In addition, the majority of projects have nonmember agency cost-matching. Just for the projects described in this report, there has been nearly one million dollars in grant awards, cost-match, or in-kind services. The second value to member agencies is the ability to stretch their agency's skill base. Stormwater management requires a wide variety of knowledge including regulatory policy, engineering, hydrology, biology, chemistry, toxicity, and microbiology, to name a few. Many member

agencies have limited staff and, by working together, garner the additional skills that are not sustainable within each agency. A third asset of membership is the ability to communicate. Discussions among member agencies provide context and a richness of ideas for application to local issues back home. Similarly, discussion between regulatory and regulated agencies in an informal setting leads to more effective implementation of management activities. Finally, projects conducted under the SMC umbrella have nearly always resulted in some management action. Often, it is difficult for a single agency to affect the current course of regulatory management. Because SMC projects are initiated and vetted through all of the regulated and regulatory management agencies, the results are adopted quickly into the management framework including alterations to NPDES permits.

The SMC has been expanding its role beyond just technical projects by emphasizing outreach and communication. This has occurred through three main venues. The first venue is the establishment of an SMC web site [www.socalsmc.org]. The goal of this web site is to showcase the SMC, but to also provide an outlet for each of the products developed by the agency. The second venue is through the development of project specific Technical Advisory Committees and Working Groups. These Committees are valuable for involving outside experts, but also for including technical staff of the individual agencies. The third venue for outreach is through training and workshops. These have initiated as a result of project specific needs such as LID technology for City Planners or the Hydromodification Workshop associated with CASQA Annual Meetings.

The SMC research should be dynamic and is responding to new issues as they arise. For example, the SMC has reacted to important issues such as evolving Low Impact Development technology, new hydromodification permit requirements, and response to catastrophic events such as wildfires.

PROJECT ACCOMPLISHMENTS

Post-fire monitoring plan

Status: Complete
Estimated Budget: $75,000

Periodic wildfires are a natural component of southern California's forest and scrubland and essential to maintaining overall ecological health of these systems. However, the frequency and intensity of wildfires has increased in association with human activities in and near natural forest and foothill areas. The effects of fire on hydrologic response and sediment loads in southern California have been noted for over80 years, yet no coordinated monitoring of water quality following fires currently occurs. The lack of coordinated monitoring is particularly problematic in southern California because watersheds affected by fire often drain to waterbodies that support sensitive resources or that have been designated as impaired under Section 303(d) of the Clean Water Act, often for the same constituents found in post-fire runoff. Consequently, the contribution of

metals, nutrients, and organic contaminants from post-fire runoff to receiving waters is poorly understood in terms of both the magnitude and persistence of potential effects.

The lack of a coordinated post-fire monitoring program results from several factors. First, there is no procedure for post-fire water quality monitoring that identifies a standard set of constituents and monitoring protocols appropriate for assessing water quality following fires. Second, resources are often scarce following fires making it difficult for various entities to coordinate. Third, there is no regional entity responsible for coordinating post-fire sampling, compiling the resultant data, and disseminating the information back to mangers at the local and regional levels. Fourth, because fires occur unexpectedly, there is often insufficient available funding for conducting post-fire sampling. This document describes a regional post-fire water quality monitoring program. The goal of the program is to help address the current information gaps by providing agreed upon regional post-fire water quality sampling procedures, including an implementation plan and a funding strategy. This plan was developed by a team of technical experts, stormwater managers, and regulators from academia, government, and the private sector. The plan provides a ready "off-the-shelf" response plan that can be quickly implemented after fires.

The post-fire monitoring program is organized around three priority management questions:
1. How does post-fire runoff affect contaminant flux?
2. What is the effect of post-fire runoff on downstream receiving waters?
3. What are the factors that influence how long post-fire runoff effects persist?

Although they are related, monitoring to address each of the questions is not interdependent. The three major monitoring elements are separable and can be implemented as distinct units or as an integrated program.

A Conceptual Workplan was generated from the workshop participants entitled "Effects of post-fire runoff on surface water quality: Development of a southern California regional monitoring program with management questions and implementation recommendations"
<ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/598_SoCalRegionalFireMonitoringPlan.pdf>. The regional plan captures sampling design, site selection process, sampling approach, and recommended indicators for each of the monitoring questions. The regional plan includes site selection criteria that allow for pre-selection and prioritization of potential sampling sites based on the sensitivity of potentially affected resources, presence of previous and available monitoring data, feasibility, accessibility, and ability to coordinate with other monitoring programs. Pre-selection of sites and up-front coordination will allow for more rapid and effective response following fires. Finally, the plan includes preliminary recommendations for quality assurance procedures, data management, and communication that will facilitate information sharing and ongoing coordination.

Ongoing program development and coordination will be accomplished through a post-fire runoff working group that consists of the U.S. Forest Service, U.S. Geological Survey,

CAL FIRE, the regional water quality control boards, major municipalities, key landowners, and local researchers. The working group is currently investigating monitoring sites for the Morris, Station and Cottonwood fires.

Stormwater Data Compilation Study
Status: 90% complete
Project Budget: $75,000 (Resources provided by SCCWRP)

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 exceedences, 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 regionwide. 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 xx watersheds between Ventura and San Diego.

Remarkable progress was made this year. More than 500,000data records were 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 2009-2010 storm season and address remaining issues to improve load estimation.

Implementing A Regionally Consistent and Integrated Freshwater Stream Bioassessment Monitoring Program
Status: 50% complete
Project budget: $150,000 ($75,000 contract from the SWRCB)

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 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 regionwide 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? Over the last year, over 110 sites were sampled between Ventura and San Diego counties for biological communities, water quality, physical habitat, and riparian condition. Laboratory analysis is currently underway.

While the monitoring information will be extremely useful for assessing cumulative impacts and regional reference condition, a number of useful products have already been achieved. One example is the creation of the Project Quality Assurance Plan (QAPP). To date, the State did not have a QAPP for analysis of biological samples. The SMC working group embraced this challenge and the SWRCB now uses the data quality objectives we established as their standard statewide. Other examples include refined GIS layers of stream networks, staff training for sampling, and field audits to ensure high levels of quality. These milestones translate into not just a high quality regional monitoring program, but rolls over into the ongoing local monitoring programs of each member agency.

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). This will provide further value to SMC member agencies.

Laboratory Intercalibration Study
Status: 90% complete
Project budget: $17,000 (in-kind services from all participating laboratories)

One goal of the southern California Stormwater Monitoring Coalition (SMC) is to compile monitoring data from separate monitoring programs to make regionwide 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 by the SMC. The first involved 11 analytical laboratories and focused on suspended solids (TSS), nutrients, and trace metals. The first intercalibration distributed samples to each laboratory blind and in

triplicate, thus assessing both within and between lab variations. Multiple iterations were required for some constituents, 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>.

The second laboratory intercalibration three years later focused on the same constituents and most of the same laboratories. Interestingly, the range of variability achieved in the previous intercalibration was repeated during the first iteration; a good sign for member agencies indicating that quality assurance was maintained between intercalibrations. A revised Guidance Manual was produced including a scoring system that defined letter grades for intercalibration performance. The SMC began using this laboratory intercalibration as a screening tool for selecting contractors.

The two laboratory Guidance Manual and intercalibration efforts, however, were incomplete in two areas. The first area was the need to repeat the intercalibration periodically as new laboratories, or new personnel at existing laboratories, come along. The second area was the need to intercalibrate on additional constituents. While the original laboratory calibration focused on TSS, nutrients, and trace metals, trace level organic constituents were not included.

The goal of this project is to fill in the missing information to make the Laboratory Guidance Manual an ongoing and effective document. It will involve 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 has been formed to assist in the study.

The SMC has successfully finished the first three tasks of the study. Fifteen laboratories participated in this intercalibration study; increasing the number of participants by nearly 40%. The intercalibration of TSS, nutrients, and trace metals was based on certified reference materials, a dry weather runoff sample, and a wet weather runoff sample from an urban land use. 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 including the new laboratories. Minimum levels of comparability were attained after the first iteration for TSS, nutrients, and trace

metals. Laboratories were able to achieve the lowered detection limits and additional analytes. Laboratories were less successful for the organic analytes. Many organic compounds had coefficients of variation exceeding 300%, which is extreme for samples such as standards. However, each of the laboratories has committed to future iterations to ensure quality and comparability for these problematic organic compounds.

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
Project budget: $1,137,440 ($1,137,440 State Prop 50 Grant)

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. 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 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 gaged to ungaged sites in regional hydrologic analyses and have populated a database with pre-development flood estimates for each field site.

Over the past year, we have completed a draft hierarchical, multi-scale screening tool for assessing relative risk of stream reaches to the effects of hydromodification. The screening tool includes office/GIS and field assessment levels at watershed, valley and reach scales. Based on extensive field reconnaissance we have identified descriptors of the key physical processes influencing channel responses to hydromodification. For the watershed scale component of the screening tool, there has also been progress on developing a simple classification basin types in terms of the spatial arrangement of channel forms and prevalence of relatively susceptible channel segments. Fourth, we have continued work on developing the modeling tools, focusing on two fronts. This tool will undergo field testing, followed by initial “trial application” in early 2010.

Over the past year, we have also continued testing several existing mobile boundary sediment transport models for potential use in developing simplified tools (nomographs/regressions) of probable channel responses to hydromodification. Towards this end, we have identified a range of hydrologic-geomorphic scenarios for testing the models for their applicability to streams in the study region. We have also developed phase diagram/regime relationships based on sediment transport theory to examine their consistency with results from the more complex mobile boundary models in terms of the extent of channel changes initiated by varying degrees of altered water and sediment regimes. Finally, we have taken advantage of several opportunities for outreach and education. Outreach activities over the past quarter included meeting with the Orange County stormwater copermittees, participating with the San Diego County

hydromodification Technical Advisory Committee, attending a meeting on the Stormwater Monitoring Coalitions's LID/hydromodifcation workgroup, meeting with the Los Angeles Regional Water Quality Control Board and Ventura County on hydromodification management, and participating with the California Association of Stormwater Quality Agencies (CASQA) hydromodification workgroup.

Low Impact Development Study
Status: 70% complete
Project budget: $1,100,000 ($500,000 SMC plus $600,000 State Prop 40 Grant)

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. A proposal was submitted by the County of San Bernardino on behalf of the SMC for the LID Project known as "LID Guidance and Training for Southern California."

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 will include determining the key technical and institutional issues that must be addressed for successful implementation, pilot projects that demonstrate the effectiveness of LID, and training and outreach to help solidify an implementation strategy to ensure large-scale and long-term success.

The grant funded portion of the project is organized into the following funding areas:

1. **Pilot Project Planning and Design**. *Establish design criteria and site selection*
2. **Monitoring.** *Implementation and demonstration of technology*
3. **Outreach and Training.** *Reporting and facilitation of wide-spread programmatic implementation*

The SMC will provide the required 25% matching funds ($200,000) for the grant funded tasks. These tasks include preparing a literature review, conducting a series of training workshops, and developing a field monitoring program for LID features. The Literature Review has been completed and the final report will be made available through the California Stormwater Quality Association Website and the SMC website when operational.

A Technical Advisory Committee (TAC) has been established and has reviewed the Literature Review, the initial training materials. The TAC will meet as needed to advise the project as it proceeds.

The SMC completed focused on three major milestones thus far. First, the literature review was completed in year 1. The literature review can be found on the SMC web site [www.socalsmc.org]. Second, the SMC supported several training workshops including August 29, 2007 at Inland Empire Utilities Agency in Chino; November 6, 2007 at the

Urban Water Institute in Costa Mesa; and June 6, 2008 at the Metropolitan Water District in Los Angeles. Third, the SMC drafted the Technical Design and Guidance Document. This document captures the essential elements of LID selection, guidance criteria, and implementation recommendations. The Guidance Manual is being prepared in a web-portal format to allow efficient access via the World Wide Web. Fourth, the SMC initiated monitoring of LID technology. One site has is being monitored in Irvine and several others are in preparation to be monitored in Los Angeles, Riverside (Riverside County Flood Control and Water Conservation District pilot LID testing facility), and Rancho Cucamonga.

Work on this project was reduced from December 2008 to June 2009 due to State's freeze on all Proposition 40 Grant projects. The SMC and the County of San Diego provided bridge funding to ensure cost-effective opportunities are not lost, but completion of project milestones has been delayed. The web-based Guidance Manual is expected to be completed by the end of 2009.