SOUTHERN CALIFORNIA STORMWATER MONITORING COALITION

2022-2023 ANNUAL REPORT

Contents

Introduction to the SMC

The Southern California Stormwater Monitoring Coalition (SMC) is a partnership of 16 stormwater management agencies working to develop solutions to regional challenges in stormwater management. Since its founding in 2001, the SMC has been pooling its members' resources and expertise to collaboratively conceptualize, develop and fund stormwater research and monitoring initiatives across coastal southern California. This collaborative approach to stormwater management has influenced the development of NPDES permits, 303(d) listings and TMDLs, watershed plans, and stormwater monitoring designs.

SMC mission statement

To solve stormwater management challenges across southern California by building regional consensus around best-in-class tools, methods and monitoring strategies

SMC member agencies

The SMC's 16 member agencies represent the region's largest stormwater management agencies and the regulatory agencies that oversee them. Indirectly, SMC member agencies represent many additional co-permittees.

Stormwater regulated agencies

- City of Los Angeles Watershed Protection Division
- City of Long Beach
- City of San Diego
- Orange County Public Works
- San Diego County Watershed Protection Program
- San Bernardino County Flood Control District
- Los Angeles County Flood Control District
- Riverside County Flood Control and Water Conservation District
- Ventura County Watershed Protection District
- State of California Department of Transportation (Caltrans)

Stormwater regulatory agencies

- Los Angeles Regional Water Quality Control Board
- San Diego Regional Water Quality Control Board
- Santa Ana Regional Water Quality Control Board
- California State Water Resources Control Board
- *(collaborating organization)* U.S. Environmental Protection Agency Office of Research and Development

Non-regulatory/R&D

- Southern California Coastal Water Research Project (SCCWRP)

A field crew for the SMC's Regional Watershed Monitoring Program collects data at a stream site in the Santa Monica Mountains. The cyclical stream monitoring program enables SMC member agencies to generate comparable data sets that paint a rich, encompassing portrait of regional ecosystem health.

The SMC was founded in **2001** when a group of local stormwater management agencies decided they could more effectively pursue their stormwater management priorities by working together. SMC member agencies come from both the regulated and regulatory sectors.

Through a cooperative agreement known as the **SMC Master Agreement**, the SMC's 16 agencies come together to investigate stormwater mechanisms and receiving-water impacts on a regional scale, as well as solutions for improving and protecting watershed health.

SMC projects are funded via a **co-funding model**, where SMC member agencies voluntarily pay for just the work that the Steering Committee has agreed to fund for the fiscal year. This co-funding model enables SMC member agencies to directly select which projects they fund.

SMC Progress Report

The SMC invests in high-quality science and engineering research to build a strong technical foundation upon which to optimize the effectiveness of stormwater management practices in coastal southern California. All of the SMC's work is guided by three main goals. The SMC uses multiple indicators to quantify its progress toward achieving these goals.

Fostering cooperation and collaboration

SMC Goal #1

Foster cooperation and collaboration among SMC member agencies to advance regional stormwater management

Progress Indicators

» **43** external organizations that have partnered with the SMC on research and monitoring over the past five years

» **9 out of 10** SMC projects over the past five years that were done in collaboration with partners external to the SMC

» **56:1** projected average cost-leveraging ratio for each SMC member agency when all SMC 2019-2024 Research Agenda projects are completed

Advancing scientific knowledge

SMC Goal #2

Advance and expand understanding of the science and engineering behind stormwater management

Progress Indicators

» **4 out of 5** SMC projects completed on time over the past five years

» **5 out of 5** SMC projects completed on budget over the past five years

» **5 out of 5** SMC projects over the past five years whose findings have been published in technical reports and/or peer-reviewed scientific literature

Improving management practices

SMC Goal #3

Use SMC research and monitoring data to improve stormwater management practices across southern California

Progress Indicators

» **4** informational, briefing-style SMC presentations developed last year that can be delivered upon request to audiences of SMC member agencies' choosing

» **7** SMC member agencies last year that requested SMC Speakers Bureau presentations be delivered to specific audiences

» **4** presentations about the SMC's work given at the California Stormwater Quality Association (CASQA) 2022 annual conference

A 10-member panel of independent technical experts meets at SCCWRP in 2019 to collaboratively develop the SMC's 2019-2024 Research Agenda, a forward-looking document that lays out SMC research priorities over a five-year period. The SMC Research Agenda serves as a roadmap and a guide that helps the SMC decide which research projects to prioritize and fund over the coming five years.

Chair's Message

David Laak

Greetings! This 2022-2023 Annual Report highlights another succesful year of impactful collaborative projects undertaken by the SMC.

Our dedicated member agencies, partners, and stakeholders have demonstrated a strong commitment to our mission to solve stormwater management challenges across southern California by building regional consensus around best-in-class tools, methods and monitoring strategies. Through these collaborative efforts and innovative strategies, we continue to address the challenges posed by urban runoff and its impact on our local watersheds, rivers and coastal areas.

I'd like to highlight a unique effort undertaken to help raise visibility and awareness of the SMC's contributions to stormwater science and management. Over the past year, a subcommittee of SMC members worked diligently to develop a brand-new Speakers Bureau. Four high-quality presentations on thematic SMC topics were developed and made available to be requested on demand by SMC member agencies. The four presentation topics include: a general SMC overview highlighting the SMC's role and value to stormwater managers; how the SMC has contributed to advancing the science of fecal contamination management; the SMC's work on improving the performance of stormwater BMPs in southern California; and how the SMC's Stream Quality Index integrative condition scoring tool helps managers probe stream health. Each presentation can be customized as needed for the intended audiences of Boards, executive management, permittees, and those unfamiliar with the SMC's important work. As of August 2023, seven presentations have been given, and more are in the process of being scheduled. If you have an interest in scheduling a Speakers Bureau presentation, please reach out to me or your SMC Steering Committee representative.

Over the past year, SMC has also worked to leverage project funding and resources by expanding partnerships. The City of Santa Barbara has signed onto and contributed to funding of the non-structural BMP street sweeping project to expand the project scope to include analysis of microplastics. Additionally, the SMC is co-funding with the State Water Resources Control Board a new mechanistic study on pollutant removal by stormwater BMPs. This project will open the BMP "black box" to identify and quantify the treatment processes in BMPs and build tools to predict BMP performance. This is just another example of how SMC identifies and works on priority projects that have real-world benefits for water quality managers.

As we look to the year ahead, I'm excited to continue working alongside a very dedicated group of stormwater management professionals within the SMC, and have no doubt that the collective effort of all involved will lead to more tangible impacts for each member agency and the entire southern California stormwater community. The success of the SMC is firmly established through the robust participation of each member agency.

I hope you enjoy the 2022-2023 SMC Annual Report and find its contents of interest. I appreciate any feedback on the report and look forward to a productive and exciting year of collaboration ahead.

David Laak
Chair, SMC Steering Committee, 2022-present

Stormwater Resources Manager, Ventura County Watershed Protection District

Reflecting on two decades of solutions-focused BMP research to protect waterway health

The SMC has been front and center in efforts to advance the use of stormwater BMPs as a viable, scalable management solution

For more than two decades, southern California stormwater managers have been studying how urban development and other human activities can adversely affect the ecological integrity of inland waterways.

They've methodically documented major classes of pollutants in runoff, which types of pollutants are coming from which areas, and how urbanization has dramatically altered how stormwater runs off surfaces and changes natural hydrologic patterns. They've also evaluated how aquatic ecosystems are being harmed by these activities.

In parallel, stormwater managers have been evaluating potential management solutions for mitigating and reversing this environmental degradation – solutions that are collectively known as stormwater BMPs (best management practices). BMPs are an umbrella term for a wide range of solutions, both structural and non-structural, that are designed to protect the ecological health of waterways by removing pollution and restoring more natural hydrologic patterns.

At every stage of this solutions-focused BMP research journey over the past two decades, the SMC has been front and center.

Since its founding in 2001, the SMC has helped rally southern California stormwater managers around a common vision for BMPs as a solution for protecting the region's diverse aquatic ecosystems. The SMC also has helped managers work through the practical challenges of planning and building

For more than two decades, the SMC has helped rally southern California's stormwater management community around a common vision for BMPs as a solution for protecting the health of the region's waterways. Above, a bioretention BMP under construction at the Riverside County Flood Control and Water Conservation District.

BMPs, and gain the insights necessary to optimize long-term BMP performance.

Along the way, the SMC has created an invaluable management forum for both regulatory and regulated stormwater agencies to pool their resources and come to agreement about how to expeditiously advance BMP research.

The SMC's contributions to the BMP field are driven by an ambitious, forward-thinking research agenda that has prioritized not just expanding knowledge about BMPs as a stormwater management solution, but also making these insights immediately actionable to end-user managers across southern California and beyond.

Key products of the SMC's BMP research agenda over the past two decades include practical guidance on how to begin infusing BMPs into long-term watershed planning, design guidance on how to optimize BMP performance over the long term, and research to fill critical knowledge gaps in understanding how BMPs perform across diverse local landscapes under southern California's climate regime.

Collectively, these insights have helped southern California emerge as one of the nation's leading BMP research hubs – generating insights that are shaping how stormwater managers invest hundreds of millions of dollars into BMPs across southern California and beyond.

Redesigning flood-control BMPs to provide co-benefits

The SMC's earliest work on BMPs dates back to the early 2000s, as the SMC was conducting foundational assessments of waterway health that increasingly laid bare the challenge of protecting the ecological integrity of

southern California's flood control infrastructure.

Specifically, the hallmark features of southern California's legacy flood control infrastructure – diversions, impound basins, and concrete lining and other hardening of rivers and streams – were often incompatible with aquatic ecosystem protection goals, even as these systems were highly effective at preventing flooding.

The SMC became instrumental in helping stormwater managers rethink how existing flood-control solutions (which were southern California's original BMPs) could be used to both guard against the ecologically and economically destructive effects of erosion and other landscape alterations, and simultaneously still serve the all-important function of protecting property and humans from flooding.

The SMC's foundational erosion-control research, which was published beginning in 2005, showed how development, redevelopment and other changes in land use can trigger dramatic changes in runoff patterns via a phenomenon known as hydromodification.

This research also helped reinforce the relevance of low-impact development (LID) – also known as green infrastructure – as an alternative to southern California's legacy of channel hardening and similar flood-control solutions. LID is a type of structural BMP that uses landscape modifications like bioretention systems and rain gardens to minimize alterations to how water runs off surfaces.

The guidance that the SMC developed for how to incorporate LID and other BMPs into southern California hydromodification management planning has been adopted regionwide, and is still being used today.

The SMC's efforts to advance hydromodification and LID research also dovetailed with stormwater managers' burgeoning interest in using LID as a potential water-quality improvement solution – that is, a way to filter and remove pesticides, metals, nutrients and other chemical contaminants from runoff so this pollution does not pollute downstream waterways.

A nursery greenhouse perches precariously atop an eroded bluff along Oso Creek in southern Orange County. The SMC has played a key role in helping stormwater managers rethink how legacy flood-control BMPs can be used to both guard against the destructive effects of erosion and other landscape alterations, and simultaneously still protect property and humans from flooding.

By the early 2010s, managers' increasing investments in LID became a key driving force that ushered in a groundswell of BMP investments across southern California – and ultimately helped solidify BMPs' place as a cornerstone tool for stormwater management.

Advancing LID as a solution for pollution removal

LID and other types of structural BMPs are viewed as essential tools for removing pollutants in stormwater as it runs off southern California's diverse, highly populated landscapes.

In the early 2010s, however, LID research was still in its infancy and largely siloed within individual stormwater agencies.

The SMC played a key role in helping stormwater managers develop a common language and framework for how to transition LID into widespread adoption and use as a water-quality improvement tool. Through the SMC, managers recognized that many of their pain points were shared, and that they could align and unify their siloed LID research and monitoring initiatives to more expeditiously generate the data and insights they needed.

The SMC's first accomplishment on this front was development of a technical guidance manual, published in 2010, that offered early insights into how to plan for and design LID solutions to optimize their ability to remove pollution and minimize hydromodification risks.

This project was followed two years later by a report that articulated the key reasons that stormwater agencies were experiencing technical and management roadblocks as they pursued implementing LID solutions; the report also provided a roadmap for how stormwater managers could overcome these barriers.

Among the barriers this report identified was a lack of acceptable data on the performance effectiveness of LID – a pervasive challenge that helped usher in the next era of BMP research:

Collecting the data necessary to understand how BMPs perform in southern California.

Closing BMP data gaps

In southern California, much of the BMP performance data that managers rely on to inform how they design structural BMPs were generated in other parts of the country.

The problem with relying on non-southern California data is that structural BMPs can perform very differently in semi-arid southern California than in other, wetter parts of the country. Indeed, the region's extended dry-weather periods provide ample opportunity for contaminants to accumulate on surfaces, which requires BMPs to treat potentially many months of accumulated pollution in compressed time frames.

The SMC responded in 2015 by launching SMC CLEAN (California LID Evaluation and Analysis Network), an initiative that brought together southern California managers for in-depth workshops and conversations examining how to optimize LID.

The most important product of SMC CLEAN was updating and expanding the SMC's original 2010 statewide guidance manual on LID design. The manual, which remains California's definitive LID implementation guidance manual, is now maintained by the California Stormwater Quality Association (CASQA).

The SMC CLEAN project also underscored the need to collect more high-quality, southern California-specific LID data quantifying how water quality and hydrologic patterns improve as runoff enters and subsequently exits these systems.

In 2021, the SMC responded by developing the SMC Regional BMP Monitoring Network to generate high-quality, comparable data sets for the performance of LID and other types of structural BMPs across southern California.

A bioretention BMP that abuts the shoreline in Long Beach filters and removes stormwater contaminants, helping to protect beach water quality. The SMC has been working to generate Southern California-specific data on the performance of these and other types of BMPs in an effort to optimize their ability to treat and remove pollution in runoff.

The regional monitoring network uses standardized monitoring protocols and data analysis methods to collect data at multiple locations under a range of different rainfall and site conditions. More than half of SMC member agencies already have begun collecting BMP monitoring data on a pilot basis.

The SMC is using the monitoring data to generate insights that can help managers improve the design of future BMPs, plus optimize maintenance regimes for existing BMPs.

Opening BMPs' mechanistic "black box"

Even as the SMC has built region-wide capacity to monitor the properties of runoff entering and exiting BMPs, the mechanistic inner processes by which BMPs remove contaminants remains a "black box."

Researchers don't fully understand what happens to runoff while it is being treated inside the BMP – a significant additional knowledge gap that managers recognize must be closed to optimize BMP performance effectiveness.

In spring 2023, in partnership with the State Water Resources Control Board, the SMC launched a study to characterize the mechanistic processes by which biofiltration BMPs – a ubiquitous type of LID – removes common types of stormwater pollutants as runoff flows through them.

While previous studies have attempted to methodically disentangle the processes and mechanisms that explain why BMPs perform as they do, these efforts have fallen short. For example, many past BMP studies have compared the performance of different mixes of commercially available biofiltration media to one another – but none have successfully pinpointed the specific measurable properties of the media that explain why some media mixes perform better than others under different environmental conditions.

Similarly, many studies have sought to optimize BMP designs in a laboratory – but few have attempted to transfer these design specifications into the real world to validate their findings.

The SMC's BMP mechanistic processes study is starting with a two-

year laboratory-based investigation to control and quantify the mechanistic processes that will be studied, followed by field validation. Researchers will work to link the physicochemical and biological processes by which pollution removal occurs – including sedimentation, sorption, chemical transformation, and biological degradation – to measurable properties of biofiltration BMPs.

The mechanistic study marks the start of what the SMC hopes will become a series of studies to more fully open the "black box" around BMPs, with the initial three-year investigation serving as a proof of concept that this study design can be used effectively.

Investigating the effectiveness of non-structural BMPs

While most of the SMC's BMP research agenda is focused on optimizing the performance of structural BMPs, stormwater managers also rely on non-structural BMPs – or non-engineered solutions – for protecting waterway health.

Nonstructural BMPs, which include street sweeping and public education, are routinely integrated into stormwater management planning, even as their effectiveness remains unclear.

In 2023, the SMC launched an effort to investigate the effectiveness of routine street sweeping in removing contaminants that enter storm drains and contribute to contamination of downstream ecosystems.

Although managers rely on street sweeping to remove trash and other debris that can clog storm drain systems, stormwater managers don't know what portions of bacteria, nutrients, trace heavy metals, microplastics and other common stormwater contaminants are removed from roadways during street sweeping.

Under stormwater discharge permits, managers commonly receive a runoff pollution credit for implementing routine street sweeping as part of a broader set of non-structural source-control measures. The SMC will probe whether this credit – which is based on limited data and best professional judgment – has been appropriately set.

The SMC's study design calls for isolating segments of streets in a way that prevents runoff from buildings, parking lots and other surfaces from mixing with the runoff generated by the street segments. One set of street segments will be swept, while a corresponding set of similar street segments that will serve as the control group will not be swept.

A custom-built rainfall generator will be used to create controlled rainfall patterns for both street segments, ensuring results are not confounded by the unpredictable timing, intensity and duration of real-life wet-weather events.

The SMC envisions the rainfall generator having widespread utility beyond the street sweeping study. The instrument enables researchers to eliminate much of the variability that surrounds interpreting water-quality data from real-world rainfall and runoff events. Plus, the rainfall generator can create controlled rainfall conditions on demand across 84 square feet – particularly valuable in a region where rain events can be few and far between.

If researchers can measure a difference in pollutant levels generated by swept vs. unswept street segments, the SMC anticipates being able to scale up the monitoring design and incorporate it into the SMC's Regional BMP Monitoring Network.

Across all of these BMP research investments, the SMC is committed to ensuring that stormwater managers across southern California and beyond receive the tools and insights they need to optimally design, construct and maintain hundreds of millions of dollars of BMPs in the coming years.

The SMC's BMP initiatives also underscore the organization's commitment to helping managers develop watershed management plans that are optimally positioned to achieve their water-quality goals, that provide valuable co-benefits to local communities and ecosystems, and that support long-term climate change resiliency goals.

An SMC field crew tests a custom-built rainfall generator that creates controlled rainfall patterns across 84 square feet of surface area. The SMC is using the rainfall generator to investigate the effectiveness of routine street sweeping in removing contaminants that enter storm drains and contribute to contamination of downstream ecosystems.

SMC Project Portfolio

An overview of ongoing, planned and recently completed SMC projects

		SMC 2019-2024 Research Agenda (view)					
		2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
2019-2024 Projects	**Human Fecal Indicators and Health Risk** (Research Agenda Project 2.4)		**ACCOMPLISHMENTS** » Established technical workgroup » Developed project workplan	**ACCOMPLISHMENTS** » Refined pathogen measurement methods » Completed first year of measurements	**ACCOMPLISHMENTS** » Reviewed first-year data » Completed second year of measurements » Initiated health risk modeling	**PLANNED** » Develop health risk estimates » Prepare final report	
	BMP Regional Monitoring (Research Agenda Project 3.4)		**ACCOMPLISHMENTS** » Established technical workgroup » Identified monitoring questions	**ACCOMPLISHMENTS** » Developed workplan » Identified candidate sites » Built portal for metadata	**ACCOMPLISHMENTS** » Trained field crew » Built data portal » Piloted monitoring with 5 member agencies	**PLANNED** » Conduct pilot regional survey » Final report	**PLANNED** » Implement regional BMP monitoring network
	Chemistry Laboratory Intercalibration (Research Agenda Project 6.5)		**ACCOMPLISHMENTS** » Held kickoff meeting » Adopted 3-year schedule and scoring criteria	**ACCOMPLISHMENTS** » Completed first intercalibration round (TSS, nutrients, metals, chlorinated hydrocarbons, pyrethroids)	**ACCOMPLISHMENTS** » Completed second intercalibration round for all first-round analytes, plus polycyclic aromatic hydrocarbons	**PLANNED** » Third intercalibration round for problematic analytes	**PLANNED** » Update laboratory guidance manual
	Streamlining Annual Reporting (Research Agenda Project 4.2)		**ACCOMPLISHMENT** » Created focus group » Reviewed existing reporting practices	**ACCOMPLISHMENTS** » Developed environmental-based and program-based metrics and indicators	**ACCOMPLISHMENTS** » Created data platform template » Pilot-tested new web interface	**PLANNED** » Final report and recommendation for new reporting format	
	Effectiveness of Non-Structural BMPs (Research Agenda Project 3.5)			**ACCOMPLISHMENTS** » Completed literature review » Hosted workshop and developed report » Developed draft workplans for street sweeping and catch basin cleaning	**ACCOMPLISHMENTS** » Finalized workplan » Designed and built field-deployable rainfall generator for dry-weather testing	**PLANNED** » Collect and analyze data	**PLANNED** » Prepare final report
	Stream Ecological Potential Framework (Research Agenda Project 5.3)			**ACCOMPLISHMENT** » Developed workplan	**ACCOMPLISHMENTS** » Established technical workgroup » Identified classes of modified streams » Initiated pilot study	**PLANNED** » Evaluate likelihood of improving biological condition based on existing data, then on new data	**PLANNED** » Prepare five-year report
	BMP Mechanistic Processes (Research Agenda Project 3.1)					**PLANNED** » Develop workplan » Initiate laboratory testing	**PLANNED** » Continue laboratory testing » Initiate model development
Ongoing initiatives	**SMC Regional Watershed Monitoring Program**	**ACCOMPLISHMENTS** » Completed second monitoring cycle (2014-2019) » Published 2018-2019 Report on the SMC Regional Stream Survey	**ACCOMPLISHMENTS** » Developed Workplan 1.0 for third monitoring cycle (2021-2025) » Initiated field sampling	**ACCOMPLISHMENTS** » Completed first-year survey » Report on causal assessment	**ACCOMPLISHMENTS** » Completed second-year survey	**PLANNED** » Complete third-year survey	**PLANNED** » Prepare final report
	Communications Plan	**ACCOMPLISHMENT** » Developed implementation workplan	**ACCOMPLISHMENTS** » Adopted updated mission, vision, and goals/metrics » Updated SMC website » Launched quarterly newsletter	**ACCOMPLISHMENT** » Revamped SMC Annual Report	**ACCOMPLISHMENTS** » Developed SMC Speakers Bureau	**PLANNED** » Sustain communications investments	

SMC Project Descriptions

Research Agenda Project 2.4: Human Health Indicators and Health Risk

Existing regulatory thresholds designed to protect body-contact recreation in southern California focus on fecal indicator bacteria – primarily enterococci and *E. coli,* which may not be relevant to actual health risk for multiple reasons. More recently, numerous alternative indicators of fecal pollution, including human-specific indicators, have been developed. To effectively protect public health, stormwater managers need to better understand the relationship between these newer indicators of fecal pollution in southern California recreational waters and the degrees of human health risk that they correlate to. Then, prediction of human health risk from a given level of existing or new indicators can be achieved by using risk assessment models such as quantitative microbial risk assessment (QMRA).

This project will identify and evaluate indicators that can be used to reliably and accurately assess human health risk posed by fecal contamination during wet weather, paving the way for stormwater managers to answer the fundamental question of "how much of these indicators is too much" from the perspective of protecting beach recreational beneficial uses. This project will also provide identification of potential indicators; test indicators from human sources and non-sources; measurement of pathogens in human sources; and the development of health risk estimates using QMRA.

Research Agenda Project 3.4: BMP Regional Monitoring

Thousands of BMPs have been installed across southern California, and thousands more will be installed over the next 20 years for regulatory compliance, even as little is known about their long-term performance for improving water quality and managing runoff. Despite the growing investment in BMPs, there is a dearth of field data documenting BMP performance for water quality treatment, hydromodification mitigation, operations and maintenance requirements, and other potential benefits. This project will develop a regional BMP monitoring program to generate robust, statistically relevant data sets covering a range of BMP types, serving multiple land uses, across a spectrum of operating conditions. These data will be used to improve BMP selection guidance, streamline annual reporting, develop cost-effective asset management programs, and support Reasonable Assurance Analysis and Alternative Compliance. In addition, this project will inventory existing and planned structural BMPs, create a study design, establish a field technical support team; revise or expand California BMP database and/or SMC Data Portal as repository for field monitoring data; and conduct a pilot regional survey to test the monitoring program.

Research Agenda Project 6.5: Chemistry Laboratory Intercalibration

As part of the SMC's Model Monitoring Program, 11 analytical laboratories previously completed two intercalibration studies to assess interlaboratory variability and enhance comparability for chemical analysis of runoff samples for SMC member agencies. The intercalibration and resulting guidelines/protocols were documented in a Laboratory Guidance Manual for SMC member agency laboratories and supported with draft contract language for member agencies. The Laboratory Guidance Manual and intercalibration efforts, however, were incomplete in two respects, necessitating a follow-up study that will intercalibrate on additional constituents. The original laboratory intercalibrations focused on suspended solids (TSS), nutrients, trace metals, and organic constituents such as chlorinated hydrocarbons (CHC) and pyrethroid pesticides. This round of studies will also include the above constituents and other organic constituents, including organophosphorus pesticides (OP) and polycyclic aromatic hydrocarbons (PAH), that were not part of the original intercalibrations. This follow-up intercalibration also will provide an opportunity to repeat the intercalibration – which needs to be done periodically anyway – and to involve new laboratories and new personnel that were not part of the previous intercalibrations.

Research Agenda Project 4.2: Streamlining Annual Reporting

Although SMC member agencies spend hundreds to thousands of person-hours each year to produce "annual reports" as a compliance requirement, there is little guidance for reporting these compliance requirements. As a result, annual reports are difficult to read and understand, are almost always comprised of non-machine-readable data, and rarely get used beyond their one-time specific application. Both regulated and regulatory agencies are left with a feeling of wasted effort, incomplete outcomes, and lost opportunities to glean more information and insight. Because both regulated and regulatory agencies are members of the SMC, they will work together to dramatically streamline guidance for annual reporting, focusing on performance metrics that provide the key information for decision-making and that facilitate the reports' production using an automated, seamless, and transparent process. This project will accomplish three objectives: 1) identify key metrics that are the essence of program effectiveness, 2) create a data platform for incorporating the data necessary to track and calculate the key metrics, and 3) generate a user interface for quickly and efficiently automating the Annual Report.

Research Agenda Project 3.5: Effectiveness of Non-Structural BMPs

The efficacy of non-structural stormwater BMPs can vary widely and is difficult to accurately quantify, even as all SMC members rely on non-structural BMPs as a first option for

pollutant removal. Non-structural BMPs consist of programmatic activities, such as street sweeping or public education, as well as source control (e.g., plastic bag bans). Virtually no quantitative effectiveness data exist for some non-structural BMPs, and even where data may exist, they may not be from southern California. More reliable and quantitative information for these programs will provide greater confidence in predicting their effectiveness in improving the health of receiving water bodies, which has the potential to reduce dependence on typically more costly structural BMPs. This project will create a comprehensive set of recommendations and associated workplan(s) for implementing research to quantify the contributions of non-structural BMPs to water quality improvements. This recommended workplan will also prioritize subsequent SMC research projects on non-structural BMPs, document challenges and benefits of each research project, and estimate project costs and schedule.

Research Agenda Project 5.3: Stream Ecological Potential Framework

Data from the SMC Regional Watershed Monitoring Program suggest that fully and partially engineered channels can have significantly lower bioassessment index scores compared to natural streams. At the same time, data from the SMC and other studies have observed high index scores in certain partially engineered channels. But it is unclear what sets the biological condition in some engineered channels apart from other engineered channels, and what attributes can contribute to this biological potential. The aim of this project is to inform decision-making that maintains healthy biological conditions as well as flood control goals in modified streams. Ultimately, this project's goal is to provide SMC managers with the tools they need to identify sites with the greatest potential for biological restoration, and what restoration efforts – physical habitat, flow, or water quality either alone or in combination – are expected to be most effective. This outcome should provide SMC members with the tools they need to support healthy streams (as required under stream biointegrity policies), and to target their restoration, water quality improvement, and flow management activities in locations with the greatest likelihood of success.

Research Agenda Project 3.1: BMP Mechanistic Processes

The mechanistic processes by which structural BMPs remove contaminants is a "black box" – with researchers routinely measuring the properties of the runoff entering and exiting the BMP, but not fully understanding what happens to this runoff while it is being treated inside the BMP. This project will characterize the mechanistic inner processes by which biofiltration BMPs remove common types of stormwater pollutants as runoff flows through them – an investigation that has the potential to open the "black box" for how these systems work and how managers can optimize their long-term performance. The project will work to link the physicochemical and biological processes by which pollution removal occurs – including sedimentation, sorption, chemical transformation, and biological degradation – to measurable biofiltration BMP properties.

SMC Regional Watershed Monitoring Program

Comprising more than 7,000 stream-kilometers, southern California's coastal watersheds are diverse, ecologically and economically important habitats. Despite devoting extensive local resources to monitoring their condition, SMC member agencies historically could not draw conclusions about overall regional health until the 2009 establishment of the cyclical SMC Regional Watershed Monitoring Program. In addition to providing critical contextual information for interpreting all other stream monitoring in the region, the SMC regional monitoring program produces data that support numerous local watershed management programs and that inform development of statewide policy. The program also serves to promote data quality and comparability and consistency in field and laboratory data collection efforts. The third cycle of SMC regional monitoring is scheduled to be completed in 2024.

Communications Plan

As the SMC was approaching its 20th anniversary in 2021, the SMC recognized it had grown and matured to a point where it needed to develop a strategic communications vision and action plan for more effectively and consistently publicizing SMC goals, progress and accomplishments. The resulting Communications Plan is the SMC's first formal plan for maximizing the effectiveness and reach of SMC communications among both internal and external audiences. The plan's goals are to get executive management and co-permittees more invested in the SMC, improve the Steering Committee onboarding process (including continuity during transitions), and bring new project partners into the SMC fold. Through the Communications Plan, the SMC has updated its mission and vision statements, developed and reported on strategic goals and organizational performance metrics, introduced a quarterly newsletter and written orientation guide for new Steering Committee members, and revamped existing communications products, including the website and Annual Report.

An update from the
SOUTHERN CALIFORNIA STORMWATER MONITORING COALITION

SMC study examining how much HF183 in stormwater is too much

For years, Southern California's stormwater management community has relied on a DNA marker known as HF183 to detect human sources of fecal contamination in runoff.

Although HF183 is widely used today as a tool for detecting human contamination, HF183 is not itself a pathogen, and there are no health thresholds that have been developed that explain illness risks for beachgoers and other humans who may inadvertently ingest pathogens associated with this contamination.

That's why the SMC is investing in a four-year study to answer the key management question of "How much HF183 is too much?"

The ongoing study, expected to be completed in 2024, is probing the relationship between HF183 levels in wet-weather runoff and the risk of illness from exposure to fecal contamination. By understanding what levels of HF183 correspond to health risks for humans, managers can use HF183 to estimate which areas pose the greatest risks – and prioritize and allocate resources accordingly.

Surfers paddle away from shore at San Diego's Ocean Beach shortly after a storm. The SMC is working to improve the management utility of a DNA marker known as HF183 for detecting human sources of fecal contamination in runoff; the runoff can sicken humans who inadvertently ingest contaminated water.

HF183 is a DNA marker that is found in a type of gut bacteria known as *Bacteroides* spp. It is uniquely associated with human fecal contamination, meaning that when managers detect HF183, they know the fecal source is not from dogs or birds or another animal source that poses a lesser health risk than human fecal sources pose.

HF183 is a relatively new indicator of fecal contamination compared to more established indicators of fecal contamination like *Enterococcus* and *E. coli*. Scientists already have established the relationship between *Enterococcus* and *E. coli* levels and human health risk, which has enabled robust beach water-quality testing programs to be built around measuring *Enterococcus* and *E. coli*. The limitation of these established fecal contamination indicators is that they are not human-specific, meaning that they cannot distinguish between human and nonhuman sources like HF183 can.

During the SMC study, researchers will work to establish the relationship between HF183 levels and human health risk via modeling. Previous studies have modeled the health risks associated with swimming in water contaminated with raw sewage during dry weather, but not the health risks associated with exposure to contaminated stormwater.

The SMC's member agencies initiated field sampling during the 2021-2022 wet season and are completing sampling during the current 2022-2023 wet season. Then, the SMC will use a health risk modeling approach known as quantitative microbial risk assessment (QMRA) to model illness rates from water contact. QMRA is an approach for setting water-quality standards that is approved by the U.S. Environmental Protection Agency.

Dive deeper

- Overview of the HF183 health risks study design
- How HF183 came to be used to detect human sources of fecal contamination
- Study workplan: Human Fecal Indicators and Health Risk (PDF)
- SMC 2021-2022 Annual Report feature article on the SMC's contributions to fecal contamination management (see Page 4)

Originally published in the SMC Winter 2023 Newsletter

SMC study working to identify stressors responsible for stream biological degradation

The SMC has begun working to identify the environmental stressors in Southern California modified channels that are major contributors to the degradation of the streams' biological communities – key insights that could help watershed managers take more informed, effective actions to improve the ecological health of these streams.

The three-year study, expected to be completed in 2025, is evaluating multiple candidate stressors – including eutrophication, salinization, habitat alteration, and water temperature – to understand which stressor(s) are having the biggest influence on the biological integrity of Southern California's perennially and intermittently flowing modified channels.

Researchers also are evaluating if routine channel maintenance activities that are intended to preserve a channel's flood protection functions can have an influence on its biological integrity. The goal is to help city and county stormwater managers achieve their dual mission to protect biological integrity and to maintain the channels' crucial flood protection and water conveyance services.

Compared to unmodified streams, streams that have been modified through hardening of their banks and/or bottom, and/or through changes to their channel shape, are much more likely to receive lower biological condition scores. Channel modification can eliminate habitats for aquatic organisms, disrupt natural hydrologic and sediment regimes, result in water temperature changes, and enhance susceptibility to eutrophication.

As part of routine maintenance, sediment is removed from a Southern California stream that has been modified through hardening of its banks. The SMC is working to identify key stressor(s) that adversely affect the health of biological communities in modified streams across Southern California.

The biological integrity of modified channels has come into sharp focus in recent years following the development of stream condition scoring tools – namely, the California Stream Condition Index

(CSCI) and the Algal Stream Condition Index (ASCI) – that can quantify the biological condition of streams statewide.

Already, the San Diego Regional Water Quality Control Board has responded by developing water-quality objectives that provide a foundation for protecting the biological integrity of streams across the region, including modified channels with soft bottoms. (Fully hardened channels are excluded from the San Diego Regional Board's bio-objectives.) About one-third of the hundreds of miles of modified channels across Southern California are soft-bottom channels, according to an analysis of SMC modified channel data collected since 2014.

Based on previous SMC analyses, soft-bottom channels generally receive higher biological condition scores than fully hardened channels. Thus, researchers' focus during the ongoing SMC study is to identify stressors in soft-bottom channels that, if mitigated, would be most likely to result in the greatest improvements to biological health.

The SMC's study involves an in-depth, retrospective analysis of 15 years of SMC bioassessment data for modified channels to evaluate patterns in their biological condition relative to the major types of stressors they are experiencing. A goal of this study is to rule out candidate stressors – and ultimately to identify which candidate stressor(s) are most likely responsible for lower biological condition scores.

Numerous candidate stressors will be examined during the retrospective data analysis, including eutrophication, salinization, water temperatures, pesticides, and altered flows. The SMC, which has previously examined the influence of channel hardening itself as a stressor affecting biological health, will look for approaches to improve biological condition that don't involve reversing existing modifications to channels.

A separate phase of the SMC modified channels study that is still being developed will examine how routine channel maintenance – especially removal of sediment, debris and vegetation – can influence biological condition in modified channels. This research will involve measuring biological condition before and after the maintenance activities have occurred, looking for differences in stream bioassessment scores. The goal is to help managers better understand how routine channel maintenance affects biological condition, and how to take mitigation measures – which are often required under federal and state permits – that are effective in reducing any adverse effects from channel maintenance.

Dive deeper

- What the SMC has already learned about the biological condition of Southern California's modified channels
- Composition of the SMC's modified channels workgroup
- PowerPoint slides from a March 2023 update to the SMC's ongoing modified channels study (PDF; see Slide 15)
- Workplan for the SMC's ongoing 2021-2025 Regional Watershed Monitoring Program (PDF)

Originally published in the SMC Spring 2023 Newsletter

SMC investigating effectiveness of street sweeping for reducing runoff pollution

The SMC has launched a multi-year effort to measure whether routine street sweeping makes a measurable impact in reducing contamination in runoff that enters storm drains and contributes to impaired water quality.

The investigation, which is beginning with a three-year pilot study, is working to measure how much bacteria, nutrients, trace metals and other common contaminants are transported from streets into storm drains via runoff, and whether street sweeping can be effective in preventing at least some of this pollution from finding its way into runoff.

In addition to monitoring traditional runoff pollutants, the SMC also is investigating if street sweeping reduces the levels of microplastics in runoff; the microplastics investigation is being conducted in partnership with the City of Santa Barbara.

Street sweeping is routinely used in stormwater management programs across southern California to prevent trash and other debris from entering and clogging storm drain systems.

What managers want to know is whether street sweeping also can be effective at removing stormwater pollutants – pollutants that may otherwise be impairing downstream water quality.

The first round of field work launched in summer 2023 at a single site. Based on results from this initial proof of concept, the SMC will have the option to expand the study to include more sites.

The study design that researchers envision using will compare street segments that are swept with similar street segments that are not swept to serve as the control group. A custom-built rainfall generator will be used to create controlled rainfall patterns for both sets of street segments along 84 square feet of surface area.

A field crew tests a custom-built rainfall generator that creates controlled rainfall patterns across 84 square feet of surface area. Right, Jerod Gray inspects the rainfall generator's nozzles. The field-deployable instrument is being used in an ongoing SMC effort to measure the effectiveness of routine street sweeping in preventing contaminants from entering storm drains and contributing to downstream water quality impairments.

Researchers will then compare any differences in pollutant levels generated by the street segments that were swept vs. the street segments that were not swept.

For more information, contact Dr. Elizabeth Fassman-Beck with the Southern California Coastal Water Research Project (SCCWRP).

Dive deeper

- Overview of the SMC street sweeping study design
- How stormwater managers can benefit from knowing street sweeping's effectiveness at removing contaminants from runoff
- Expanding the study's scope to include microplastics
- June 2023 progress report on the SMC street sweeping study (PDF)
- Read the full scope of work for the SMC street sweeping study (PDF)

Originally published in the SMC Summer 2023 Newsletter

Contributors to Success

The SMC's success is rooted in the talents, dedication and collaboration of the many individuals and organizations that generously give their time, expertise and funding to support the SMC.

SMC Steering Committee Members

	Agency	Lead Member		Alternate Member	
		Name	Job Title	Name	Job Title
Regulated Agencies	City of Long Beach	Melissa You	Compliance Officer	Cecilia Salazar	Environmental Specialist Associate
	City of Los Angeles Watershed Protection Division	Charlie Yu	Senior Chemist	Zora Baharians	Senior Water Biologist
	City of San Diego	Andre Sonksen	Program Manager, Transportation & Storm Water	Eric Gwynn	Storm Water Environmental Specialist III
	Los Angeles County Flood Control District	Melissa Turcotte	Head Environmental Engineering Specialist	Geremew Amenu	Civil Engineer
	Orange County Public Works	James Fortuna	Manager, North OC Watershed Management Area	Grant Sharp	Manager, South OC Watershed Management Area
	Riverside County Flood Control and Water Conservation District	Rebekah Guill	Senior Flood Control Planner	Richard Boon	Chief of Watershed Protection
	San Bernardino County Flood Control District	Christopher Bland	Stormwater Program Manager	Anthony Pham	Division Chief
	San Diego County Stormwater Management Program	Dr. Joanna Wisniewska	Landuse Environmental Planner III	Jo Ann Weber	Water Resources Manager
	Ventura County Watershed Protection District	David Laak	Stormwater Resource Manager	Arne Anselm	Deputy Director
	California Department of Transportation (Caltrans)	Bhaskar Joshi	Chief, Office of Stormwater Program Development	Cornelis Hakim	Senior Transportation Engineer
	Southern California Coastal Water Research Project	Ken Schiff	Deputy Director	Elizabeth Fassman-Beck	Department Head, Engineering
Regulatory Agencies	California Regional Water Quality Control Board, Los Angeles Region	Ivar Ridgeway	Senior Environmental Scientist	Vacant	
	California Regional Water Quality Control Board, San Diego Region	Chad Loflen	Senior Environmental Scientist	Wayne Chiu	Senior WRC Engineer Specialist
	California Regional Water Quality Control Board, Santa Ana Region	Adam Fischer	Chief, Inland Storm Water Unit	Vacant	
	California State Water Resources Control Board	Nicholas Martorano	Executive Director, Water Quality Monitoring Council	Amanda Magee	STORMS Unit Chief, Division of Water Quality
	U.S. Environmental Protection Agency Office of Research and Development	Mike Borst	Engineer	Vacant	

External partners in the SMC's success

Dozens of organizations contribute to the SMC's success every year by offering their technical expertise, counsel, resources and perspective. The following is a list of every organization external to the SMC that has partnered on SMC projects over the past five years.

- AECOM
- Aquatic Bioassay & Consulting
- Babcock Laboratories
- Building Industry Association
- Caltest Analytical Laboratory
- California Department of Fish and Wildlife
- California State University, Long Beach
- California State University, Sacramento
- California Stormwater Quality Association
- City of Santa Barbara
- CloudCompli
- Colorado School of Mines
- Contech Engineered Solutions
- Council for Watershed Health
- County of San Diego Department of Public Health
- County of Orange Health Care Agency
- Enthalpy Laboratory
- Eurofins Laboratory
- Frog Environmental
- Heal the Bay
- Larry Walker & Associates
- Marine Pollution Studies Laboratory at Granite Canyon
- MBC Aquatic Sciences
- Michael Baker International
- Moss Landing Marine Laboratories
- National Park Service
- Nautilus Environmental
- Olaunu
- Oregon State University
- Pacific EcoRisk
- Physis Laboratory
- San Francisco Estuary Institute
- Sanitation Districts of Los Angeles County
- State Water Resources Control Board Surface Water Ambient Monitoring Program
- Tetra Tech
- Truesdail Laboratory
- U.S. Army Corps of Engineers
- University of Maryland, College Park
- University of California Extension
- University of South Florida
- Ventura Regional Sanitation District
- Vista Analytical Laboratory
- Weck Laboratory
- Weston Solutions
- WSP