A California Perspective on the Assessment of Municipal Stormwater Programs

Methods and activities to gauge effectiveness and make improvements

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Comments

Introduction

The term *Program Effectiveness Assessment* refers to the methods and activities that stormwater program managers use to evaluate how well their programs are working and to identify modifications necessary to improve them. A comprehensive assessment strategy is fundamental to the development and implementation of a successful stormwater program. A well-developed and well-executed assessment can provide managers with the feedback necessary to determine if their programs are achieving intended results such as compliance with permit requirements, increases in public awareness, or behavioral change—and ultimately to relate such changes to conditions in urban runoff and receiving waters.

After the inception of municipal separate storm sewer system (MS4) programs in the early 1990s, managers' efforts were understandably focused on funding and implementing permit-compliant and legally defensible programs. Program design was guided by a maximum extent practicable (MEP) performance standard that was generally understood to represent an iterative process toward eventual compliance with water-quality standards. However, the relationship of these two endpoints was not well understood. Compliance with permit requirements was often measured on a task basis rather than understanding of how or when permit compliance was likely to bring about corresponding improvements to water quality. Over the next two decades, the cities, counties, districts, and flood control agencies tasked with carrying these programs forward continued to modify their implementation strategies based almost exclusively on the increasingly prescriptive requirements of reissued permits. But, even after multiple rounds of permit reissuance and more than a decade of implementation experience, most

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program managers were still struggling to keep up with minimum permit requirements. The prospect of achieving demonstrably measurable and effective programs remained remote. In hindsight, the absence of substantive assessment provisions in most first- and second-generation municipal stormwater permits and corresponding guidance almost certainly limited the ability of program managers to assess the impacts that their programs were having. The program managers had neither the resources, the mandate, nor the experience required to determine how to demonstrate the effectiveness of their programs—or to balance these considerations with the economic considerations implicit in a MEP standard. Nevertheless, this situation has begun to change, and effectiveness assessment is now emerging as a distinct discipline within the broader stormwater management field with California MS4 managers at the forefront of this movement.

An important advocate for the development and implementation of effectiveness assessment methods and guidance has been the California Stormwater Quality Association (CASQA; www.casqa.org). CASQA assists the State Water Resources Control Board (SWRCB) and municipalities throughout California in implementing the National Pollutant Discharge Elimination System (NPDES) stormwater mandates of the federal Clean Water Act (CWA). There are currently 33 Phase I Area Wide MS4 permits in California. A Phase II Permit (WQ Order No. 2003-0005-DWQ) was adopted in 2003 to extend permit coverage to smaller municipalities, including nontraditional Small MS4s, which are governmental facilities such as military bases, public campuses, and prison and hospital complexes. Most Phase I, and many Phase II, permittees in California are currently represented through CASQA.

In 2004, CASQA initiated a statewide collaborative effort to develop a framework, methodology, and standard terminology for conducting program effectiveness assessments so that program managers could begin to assess the impacts that their programs were having and use that information to refine the stormwater programs. In August 2005, CASQA released a white paper, *An Introduction to Stormwater Program Effectiveness Assessment*, followed in May 2007 with the *Municipal Stormwater Program Effectiveness Assessment Guidance*, available at http://casqa.org. The latter guidance document is considered one of the most comprehensive and fully developed sources of stormwater program effectiveness assessment information and guidance currently available. Since its release, the CASQA *Guidance* has been used in interactive training workshops with almost 300 Phase I and Phase II municipal stormwater program managers and staff, as well as regulators in California. It was also the primary reference for a 2008 USEPA webcast on effectiveness assessment and has been incorporated into other guidance documents, including USEPA's *MS4 Program Evaluation Guidance* manual (USEPA 2007) and *Evaluating the Effectiveness of Municipal Stormwater Programs* document (USEPA 2008). Reissued California stormwater permits are also increasingly reflective of the CASQA *Guidance* and approaches.

In addition to the CASQA efforts, the California State Assembly and the SWRCB have also recently been evaluating effectiveness assessment approaches. Assembly Bill 739, Stormwater Discharge introduced by Assemblymember John Laird in February 2007 and chaptered in October 2007, requires the SWRCB to develop a comprehensive guidance document for evaluating the effectiveness of municipal stormwater management programs and permits issued, and it further requires the SWRCB and Regional Water Quality Control Boards (RWQCBs) to utilize the document when establishing assessment requirements for programs and permits. This is an important step toward bringing regulators and dischargers into greater alignment on assessment requirements and approaches. The draft SRWCB guidance is based on the CASQA *Guidance*, and several CASQA members have played an instrumental role in its development as members of an AB 739 Stormwater Advisory Task Force. The SWRCB staff is currently working to complete the document in 2010.

Considerable experience has been gained in the six years since CASQA began its program effectiveness assessment work. CASQA is continuing to update its *Guidance* to reflect new information, lessons learned, and the refinement of assessment concepts over time. Our current focus is to translate the framework and concepts of the current document to a more specific "how to" guidance for managers. All of this experience, including that gained through the AB 739 process, is being used to inform the next CASQA guidance update, planned for completion by the end of 2010. It also forms the basis of the remainder of this article.

The Effectiveness Assessment Challenge

For the purposes of program planning and assessment, it's helpful to think about MS4 programs within an overall management framework that consists of three components: 1) the stormwater management (or MS4) program itself; 2) the target audiences, sites, or sources to which the program is directed; and 3) the urban runoff and receiving waters that are influenced by discharges from those target audiences, sites, or sources. Figure 1

depicts the relationship of these components. Moving from left to right, the arrows illustrate an implicit causal relationship between them. That is, it's assumed that MS4 program implementation will result in increased awareness and behavioral changes in target audiences, and that these changes will in turn improve, or at least not adversely impact, urban runoff and receiving water conditions.

Considered within this very broad context, effectiveness assessment seems fairly straightforward—establish measures within each component, implement the program, review results, modify the program, and repeat. Were it not for the details, things might actually be this simple. However, MS4 programs are fundamentally more complex than other NPDES permit programs in several important ways, all of which have implications for effectiveness assessment.

The first of these differences is the wide array of sources that are subject to the programs. MS4 programs categorically address almost all major sources of stormwater pollution—construction and development sites, residential areas, municipal operations, and industrial and commercial facilities—meaning that even a very small program must necessarily be administered to thousands of individuals, sites, and sources, with larger programs easily addressing more than a million. From a permitting perspective, it makes good sense to cast a wide net, but successful program implementation depends on the unique behavioral responses of each of the people to whom these programs and activities are directed. Assessments must therefore be conducted at a level of detail and in a way that reflects these individual differences, but that also supports meaningful analysis from a broader programmatic perspective.

Another important characteristic of MS4 programs is their predominant focus on the requirement or use of nonstructural or source control best management practices (BMPs), such as good housekeeping practices, pesticide use reduction, and picking up after pets. This is certainly not to say that larger structural or treatment controls don't have an important place in the MS4 implementation environment, but MS4 managers far more often ask people to change their habits than they do to install expensive treatment controls. To a very large degree, the success of MS4 programs depends on the mass-scale implementation of many very small controls, and it's this multitude of small changes that presents the most acute assessment challenges. One important reason is that programs rely extensively on third parties to select and implement their own BMPs, but lack the specific feedback needed to determine whether and where they were implemented or how well they worked. Add to this the inherent difficulty of measuring the effectiveness of source controls, and the likely negligible individual impact of many of them, and it can become increasingly difficult to paint a clear picture of how well an MS4 program is performing. Of course, there are exceptions, and the positive effect of broadly applied and powerful control measures (i.e., "true source controls") such as product bans or reformulations, can be shown relatively easily. But very few such controls exist.

(There are two types of source control BMPs: true and operational. The more common operational source controls work by physically keeping potential pollutants out of contact with rainfall and runoff through covering, berming, or cleaning. True source control works on the original source of a potential pollutant by eliminating or significantly reducing the existence of the potential pollutant in the first place, thereby negating the need to physically prevent contact between the potential pollutant and rainfall and runoff [i.e., operational source control], let alone the need for treatment controls.)

Although program resources are more often focused on the management and evaluation of regulated sources, MS4 managers also have a broad responsibility for the quality of discharges from their MS4s. The defining characteristic of these discharges is that they are constituted by pollutant sources that are connected via manmade and natural, open systems. This is in contrast to sources to a wastewater system (sinks, toilets, etc.), which are completely anthropogenic and controlled. Sampling of MS4 discharges is comparatively straightforward, but analysis is complicated by the fact that many discharges comingle within the system, pick up windblown and directly deposited materials, and receive aerial deposition along the way. In recent years, many permittees have initiated focused studies to evaluate these relationships, but results tend to be difficult to extrapolate beyond the study area or the specific parameters under investigation. Interestingly, some California MS4 permits have recently begun to require the use of numeric action levels at MS4 outfalls, suggesting that quantitative MS4 runoff quality will increasingly become a focus of program evaluation. While it's clear that important consideration is being given to the role of MS4 discharge quality as a programmatic performance standard, its relationship to specific upstream source contributions remains unclear and difficult to discern.

A number of important issues must be confronted for MS4 program assessment methods to have increasing utility for managers and regulators in the future. In the broadest sense, our goal is to better understand how MS4 program implementation relates to an overarching goal of water-quality protection and improvement. We're unlikely to get there without a blueprint, or, in this case, a conceptual framework for the continued development and improvement of effectiveness assessment methods and approaches into the future. The next section introduces just such a framework as it's currently being developed in California.

Toward a Common Solution: A Short Primer on the California Approach

The following provides an introduction to the program effectiveness assessment approach introduced by CASQA in August 2005. (Some of the content described here, such as the specific naming of Outcome Levels, is updated from that of the May 2007 CASQA *Guidance*. These differences will be reconciled when it is updated later this year.) The primary focus of this approach has been the establishment of consistent metrics and terminology, and a framework to apply them in. The following discussion is focused on the basic elements of this framework.

The fundamental building blocks of the CASQA approach are *Outcomes*. Outcomes are the measures we use to characterize results associated with implementing stormwater management programs. They are essential to effectiveness assessment because they define specific, measurable endpoints by which stormwater programs can be targeted, evaluated, and periodically modified. The CASQA approach utilizes a series of six categories of Outcomes, referred to as *Outcome Levels*, to establish a logical and consistent organizational scheme for assessing and relating individual Outcomes. An additional layer of structure is provided by grouping them in three general areas of assessment activity:

1. Implementation Assessment
2. Target Audience and Source Assessment
3. Urban Runoff and Receiving Water Assessment

These categories mirror the three areas of focus introduced in Figure 1. Their basic relationship to the six Outcome Levels is illustrated in Figure 2. As shown, a fourth category, Integrated Assessment, is also included to further explore the relationships of individual Outcomes and Outcome Levels.

Since these six Outcome Levels illustrate a natural progression from program implementation to receiving water conditions, it may appear that the higher numbered levels have greater relative importance. However, this is not the case. Each Outcome Level is individually necessary to support effective management decisions. It may be useful to visualize them as a chain of six links. Understanding the relationship of each of the links to its nearest neighbor helps us to make informed decisions, learn from our mistakes, and focus on what works. In short, the ability to effectively assess MS4 programs requires that managers recognize the inherent and unique value of each Outcome Level.

Implementation Assessment (Outcome Level 1) analyzes the different activities that make up MS4 programs. It consists exclusively of Level 1 Outcomes (Stormwater Program Activities). These Outcomes, which are often defined by specific stormwater permit requirements, address a variety of program activities such as providing education to residents, inspecting construction sites or industrial facilities, conducting surveys of target audiences, and conducting receiving water monitoring. They are often derided as "bean counting," but their importance is easily underestimated. Without these critical measures, managers would lack the ability to establish a basic understanding of how their programs work. They are essential to effectiveness assessment because they define the means by which MS4 programs facilitate the changes sought in target populations and receiving waters, as well as the methods by which feedback is obtained. It does managers little good to know that targeted changes are occurring if they can't look into their programs to determine the reasons, or where they might make adjustments to repeat or optimize results.

Target Audience and Source Assessment (Outcome Levels 2 through 4) evaluates the impact of program implementation on target audiences and sources. Simply stated, managers need to understand what target audiences know and how they act, and from this information to characterize their potential for impacting MS4s and receiving waters. A couple of definitional distinctions are helpful here. First, the defining characteristic of a "target audience" is that it consists of the people (individuals and populations) that are expected to gain knowledge or engage in the behaviors that the program is intended to elicit. BMPs are implemented by many types of third parties, so the term "target audience" is broadly defined and virtually any group of people could be a target

audience, including fellow municipal staff members, the general public, elected and appointed officials, other government agencies, etc. “Source” means anything with the potential to generate urban runoff pollutants prior to its introduction to the MS4. A typical MS4 program addresses the following source categories: residential areas, construction, and development sites, commercial and industrial sources, and municipal operations. (Residential programs often include outreach to school-aged children, but not because they’re considered significant sources of stormwater pollution; the purpose is primarily to deter them from polluting behaviors in the future.) “Target audience” and “source” can often be used interchangeably, but it’s useful to keep in mind that the changes targeted for sites, facilities, or other areas of focus can’t be achieved unless the people responsible for achieving them understand what they should and shouldn’t do.

Depending on the specific assessment objectives, analysis can be conducted in several different ways. For instance, residential awareness and behavior are often evaluated by conducting representative population-based surveys; however, assessment of construction or industrial operations more typically focuses on conditions observed at sites or facilities using inspection results. Target Audience and Source Assessment encompasses three types of Outcomes: Knowledge and Awareness (Outcome Level 2), Behavior (Outcome Level 3), and Source Reductions (Outcome Level 4).

Outcome Level 2: Knowledge and Awareness. Level 2 Outcomes provide a means of gauging whether outreach, training, or other program activities are producing changes in the awareness, knowledge, or attitudes of target audiences. An important objective of MS4 programs is to utilize these Outcomes as a basis for inducing desired behavioral changes. That is, people shouldn’t be expected to act differently if they don’t first understand why and how. Examples of Level 2 Outcomes range from awareness of basic concepts (why stormwater pollution is a problem, the difference between storm drains and the sanitary sewer, what a watershed is, etc.) to very specific knowledge (e.g., how to dispose of pet waste, or how to properly install and maintain a silt fence). They’re often used to gauge progress in, or to refine approaches for, achieving Level 3 Outcomes. But they may be pursued independently when targeted knowledge is not specifically tied to a behavioral Outcome, or when Level 3 assessment is impracticable.

Outcome Level 3: Behavior. Level 3 assessment examines the behaviors of target populations. As already mentioned, a wide variety of sources and behaviors are addressed by MS4 programs. In one program component, managers may seek to compel residents to report stormwater pollution, to pick up after their pets, or to reduce pesticide use in their gardens. In another, they may require construction-site operators to install and maintain temporary erosion and sediment control BMPs or permanent post-construction treatment controls.

Level 3 Outcomes provide critical feedback on how effective MS4 programs have been in facilitating these and other behavioral changes. It should be emphasized that, while BMP implementation is the most obvious focus of Level 3 assessment, there's also considerable value in understanding other behaviors such as pollution reporting, public involvement, and completion of stormwater pollution prevention plans. Because BMP implementation can’t always be easily characterized, it’s important that managers consider the variety of behavioral Outcomes available to them in defining the success of their programs. That said, it’s also important to note that BMP implementation represents a crucial linkage to Level 4 Outcomes. That is, reductions in pollutants or flows from targeted sources can’t be estimated without at least a partial understanding of BMP implementation.

Outcome Level 4: Source Reductions. Outcome Level 4 addresses two distinct but related types of targeted change: 1) reductions in the discharge of pollutants from sources, and 2) reductions in flow rates and volumes from sites. This latter category is generally associated with selected development and redevelopment activities, but it has the potential to be applied to other program components in the future. (These Outcomes are not addressed in the current CASQA Guidance because it predates the widespread application of new program elements requiring them.) Both types of reduction share a goal of producing corresponding improvements in MS4 discharges and receiving waters.

Outcome Level 4 is considered by many to be the most challenging part of the assessment puzzle. One reason is that there are a limited number of ways to approach measuring source reductions, and all of them have inherent limitations. Pollutant loads from some BMPs such as street sweeping, MS4 cleaning, and used oil and household hazardous waste collection can be directly measured because permittees usually have physical possession of the waste stream, but this doesn’t apply much beyond these activities. (This is, of course, an oversimplification; a number of assumptions may need to be made to convert waste stream quantities to pollutant

loads.) Pollutant and flow reductions can also both be monitored, but the best opportunities are usually for sites with large treatment controls, or where representative monitoring programs already exist. A third approach is to calculate reductions using known results, assumed parameters, or a combination of the two. Calculated reductions often require a heavy reliance on assumptions (e.g., numbers of BMPs, rates of application, pollutant removal efficiencies, or pollutant concentrations in site runoff or effluent), but even where assumptions can be augmented with data from surveys or special investigations, estimates still tend to have the greatest value for making broad comparisons over time or determining where resource allocations are likely to be most useful. An important future focus will be developing consensus on the most useful Level 4 approaches and the highest priority sources to employ them on.

Urban Runoff and Receiving Water Assessment (Outcome Levels 5 and 6) is the use of environmental data and related information to characterize the quality and hydrologic characteristics of stormwater discharges and the water bodies that receive them. This area of assessment is distinct from Target Audience and Source Assessment in that its focus is on the impacts of discharges once they enter or leave the MS4.

Outcome Level 5: Runoff Quality & Hydrology. Level 5 Outcomes apply exclusively to MS4s. When Congress amended the CWA to permit MS4s in 1986, it made a deliberate decision to treat them as point sources, imposing a very broad responsibility on managers to ensure the quality of discharges into and from these systems. Phase I California permits have recently added requirements to mitigate flows from upstream development and redevelopment sites and to ensure that they don't cause downstream erosion and sedimentation problems in receiving waters. Level 5 Outcomes provide a direct linkage between upstream sources and receiving waters, and as such are a critical expression of how well these responsibilities are being met.

Monitoring programs have recently been modified to increase their emphasis on characterizing the quality of discharges from MS4s, and this has coincided with more recent changes in some permits to impose "action levels" on these discharges. Taken as a whole, it appears that Level 5 Outcomes will continue to play an increasingly important role in the evaluation of MS4 programs. However, this type of analysis is complicated by a variety of factors such as the comingling of discharges, characteristics and timing of storm events, wind patterns, and economic activity. While this makes it difficult to differentiate the contributions of individual upstream sources or to relate them to receiving water impacts, the central importance of discharge characteristics to interpreting program success underscores the importance of continuing to focus on them in the future.

Outcome Level 6: Receiving Water Conditions. The fundamental objective of MS4 programs is the protection of water bodies receiving discharges from MS4s. Level 6 Outcomes can provide managers the data and information necessary to determine the overall success of their programs. Receiving water conditions can be evaluated in a variety of ways, including comparison of monitoring results to benchmarks, compliance with water-quality standards, protection of biological integrity, and beneficial use attainment. Each of these approaches presents its own issues and challenges for monitoring design, representative data collection, and interpretation of results. In California, most Phase I programs have had extensive monitoring programs in place for at least 15 years. Although these programs provide a fairly extensive record of receiving water data and results, they continue to evolve with each permit reissuance. A significant change is the recent modification of some reissued permits to add requirements to monitor potential hydromodification impacts from significant development and redevelopment sites. As with Level 5 analysis, receiving water assessment will continue to be confronted by existing and new challenges, ensuring that it will remain a work in progress into the foreseeable future.

Integrated Assessment (Outcome Levels 1 through 6). The three types of assessment described above have a predominant focus on improving the measurability and interpretation of individual Outcome Levels; in contrast, Integrated Assessment focuses on understanding the relationships between them. This is a particularly challenging task because of the many variables that can complicate our understanding of correlative or causal relationships. The most important of these is simply the number of different program activities converging on individual target audiences and behaviors. For example, while it might be shown relatively easily that residents are increasing their use of integrated pest management practices, it's another matter to demonstrate which of the multiple program activities that targeted these changes, or which influences outside of the MS4 program, actually caused them to occur.

Considered very broadly, Integrated Assessment addresses the relationship between program implementation

and receiving water conditions. But, to foster real progress, efforts must necessarily address numerous other, more narrowly prescribed objectives such as the relationship of program implementation to targeted changes in awareness or behavior, or that of individual behaviors to pollutant load reductions. For the present and near future, Integrated Assessment will have to focus on discrete and achievable objectives; lining up these results to draw larger conclusions will be a longer-term endeavor.

The Road Ahead

Up to this point, we've provided a cursory introduction to some of the key issues and concepts shaping the development of effectiveness assessment approaches in California. We believe that program effectiveness assessment is an indispensable discipline within the stormwater management field—and that, through the application of the scientific principles of measurability, repeatability, predictability, and causality to management practices, these approaches will provide solutions to many existing measurability and effectiveness problems. However, we're also mindful of the challenges that lie ahead. Some aspects of MS4 programs will continue to elude measurability well into the future, if not permanently. For reasons already described, the quantification of load reductions from many pollutant sources and the establishment of causal relationships between different outcome types (e.g., between outreach conducted and the implementation of BMPs by target audiences) will remain particularly challenging.

Albert Einstein presciently anticipated the complexity faced by MS4 program managers when he said "Not everything that can be counted counts, and not everything that counts can be counted." In this respect, it's useful to emphasize the difference between measurement and assessment. Measurability means that something can be computed or estimated (e.g., 100 industrial inspections conducted), but assessment requires that measurements also be given a context for interpretation (e.g., that completion of 100 of 125 targeted inspections constitutes 80% success).

It's this simple distinction that can add value to results, but it also leads us to more difficult questions about how to determine whether a program is effective. In particular, where should we set our goals, and what level of effort or performance constitutes success? From a strict compliance standpoint, many of these answers have at least been partially answered through the specificity or "prescriptiveness" of existing permit requirements. But that situation has begun to change as programs have been more closely scrutinized and permitting agencies have continued to impose new performance standards. These changes bring to light important questions about whether the emphasis of permitting approaches should be primarily implementation based, achievement based (i.e., discharge or water quality), or a combination of the two. Ironically, the convergence of these factors may have added more confusion than clarity to an already complicated situation.

In California, MS4 programs have historically focused on reducing pollutants in stormwater discharges and urban runoff to the maximum extent practicable. Most observers have understood MEP to constitute an iterative "ratcheting down" toward eventual compliance with water-quality standards, but mounting frustration throughout the 1990s led many to conclude that the vagueness of the MEP standard was undermining the accountability that the CWA was intended to establish. Today, all Phase I MS4 permits in California retain the MEP standard, but since the mid-1990s they've also specifically prohibited discharges from MS4s that cause or contribute to the violation of water-quality standards. Moreover, some recently adopted permits have begun to incorporate "action levels" for MS4 discharges, bringing into the mix what many contend is the beginning of the incorporation of water-quality-based effluent limits. (For example, see Section C and D within Order No.R9-2009-0002 at www.waterboards.ca)

The message is clear, but the meaning less so. Accountability and enforceability are clearly at a premium, and tougher performance standards seem to be the preferred method of achieving them, possibly leading some observers to question the value of investing new effort into the continued improvement of assessment methods. In essence, if water-quality improvements can be mandated through stricter standards, why not just do so? We believe that such a position is unsupported by experience, and that even the most stringent performance standards will fall short if they fail to produce corresponding programmatic improvements. In short, without the targeted feedback that can be provided through expanded program effectiveness assessment efforts, it will be difficult to achieve the significant water-quality improvements we'd like to see in the future.

We should also consider the fact that MS4 programs aren't static. In particular, the increasing influence of watershed management as an organizing principle is likely to have a strong influence on the way we approach

assessment in the future. Certainly, all of the concepts and methods developed through CASQA to date are intended to be scalable. While jurisdictionally based programs have traditionally tended to be preventive and generically applied across broad source categories, watershed programs are typically more water-quality-based, i.e., specifically targeted to identified water-quality problems. Certainly, the most obvious benefit of conducting watershed-based effectiveness assessments is the increased potential for aligning source management strategies to observed urban runoff and receiving water conditions. This has important implications in particular for the refinement of integrated assessment approaches in the future. Because of their potential for decreasing the distance between the six levels of outcomes, watersheds may well end up being the future testing ground for many of our integrated assessment methods.

In closing, the role of effectiveness assessment as an inseparable part of a larger planning and implementation process should once again be emphasized. Assessment and program design are two sides of the same coin, linked in an ongoing, iterative cycle of planning, implementation, feedback, and adjustment. In the end, the greatest benefit of keeping a steady gaze on effectiveness assessment is the insight it provides into the design and execution of MS4 programs. Looking back, opportunities to better define and utilize assessment methods have clearly been missed. Clean Water Act requirements are blameworthy not so much in the lack of specific guidance they provide for assessing MS4 programs, but in the implicit expectation that those details would have been subsequently developed through regulation and permitting. This task is clearly much more complex than could have been anticipated when Congress amended the CWA in 1987 or when the EPA promulgated Phase I regulations in November 1990. (In the Water Quality Act of 1987, Congress required that industrial stormwater dischargers and municipal separate storm sewer systems obtain NPDES permits by specific deadlines; in November 1990, EPA adopted Phase I regulations requiring NPDES permits for stormwater discharges from certain industrial and construction sites.) In the intervening years, state and local governments and the regulatory community have struggled with this challenge. Through CASQA and others, we now have a chance to put our heads together and improve on this. Certainly, opportunities to address existing and future technical and design considerations are directly impacted by the staffing and economic resources that can be brought to bear on them, but managers and regulatory agencies alike should embrace this opportunity because it will drive corresponding improvements to our programs that move us closer to the vision of water-quality protection and improvement that we all share.

For more information, or to become involved in the future development of effectiveness assessment strategies, please contact Jon Van Rhyn at Jon.VanRhyn@sdcounty.ca.gov or Karen Ashby at karena@lwa.com.

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