CASQA
California Stormwater Quality Association™
Dedicated to the Advancement of Stormwater Quality Management, Science and Regulation

September 13, 2005

Mr. Bruce Fujimoto, Chief
Storm Water Program
State Water Board
P.O. Box 100
Sacramento, CA 95812-0100

Subject: CASQA Information for Blue Ribbon Panel on Development of Quantitative Measurements for Stormwater

Dear Bruce:

On behalf of the California Stormwater Quality Association (CASQA), please share the following CASQA items with the Blue Ribbon Panel considering the question of the feasibility of developing quantitative measures for stormwater. The question is paramount to members of CASQA and, as a result, CASQA appreciates the opportunity to contribute to these early discussions and looks forward to fully contributing to the State Water Board's efforts to address the question.

- Comment letter excerpt – Recommendations for the Revision of the Industrial General Permit, Water Quality Order No. 97-03 DWQ (February 18, 2005)
- Comment letter – State Water Board Process for the Development of Quantitative Measurements for Stormwater Program Compliance (August 15, 2005)
- CASQA White Paper – An Introduction to Stormwater Program Effectiveness Assessment (August 2005)
- Presentation – Blue Ribbon Panel meeting (September 14, 2005)

Thank you for the opportunity to provide our thoughts and recommendations. We look forward to continuing to work with you on this important question.

Yours truly,

Karen Ashby

Karen Ashby, Chair

P.O. Box 2105 Menlo Park CA 94026-2105 650.366.1042 www.casqa.org info@casqa.org

CASQA
California Stormwater Quality Association
"Dedicated to the Advancement of Stormwater Quality Management, Science and Regulation"

February 18, 2005 **[Note: Excerpt only – Main letter and attachments only]**

Debbie Irvin, Clerk to the Board
Executive Office
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100

Subject: Recommendations for the Revision of the Industrial General Permit, Water Quality Order No. 97-03-DWQ

Dear Ms. Irvin and Members of the Board:

On behalf of the California Stormwater Quality Association (CASQA), thank you for the opportunity to provide comments regarding the reissuance of the current General Permit for Storm Water Discharges Associated with Industrial Activities, Water Quality Order No. 97-03-DWQ (General Permit). CASQA has been working with staff over the last several years to develop recommendations for the reissuance, and we previously provided written comments in November 2002 and again in June 2003.

CASQA is composed of stormwater quality management organizations and individuals, including cities, counties, special districts, industries, and consulting firms throughout the state, and was formed in 1989 to recommend approaches to the State Water Resources Control Board (State Board) for stormwater quality management in California. In this capacity, we have assisted and continue to assist the State Board with the development and implementation of stormwater permitting processes.

CASQA's Industrial Subcommittee identified several areas of the 2004 draft General Permit, issued December 15, 2004, that could be improved in the planned 2005 reissuance. To this end, our recommendations are crafted to achieve the following objectives:

- Identify achievable improvements in the stormwater program elements;
- Simplify and streamline the permit format;
- Provide our initial recommendations regarding numeric effluent limits;
- Clarify the intent and use of benchmarks;
- Provide sufficient flexibility to accommodate the diversity of the industrial activities covered by the General Permit;
- Conform with U.S. Environmental Protection Agency (USEPA) Phase II requirements, and;
- Address some of the initial concerns that may be raised by other interested parties.

We feel confident that our recommendations accomplish these goals.

P.O. Box 2105 Menlo Park, CA 94026-2105 (650) 366-1042
www.casqa.org info@casqa.org

We wish to contribute the following comments and recommendations regarding general policy issues, and provide specific recommendations on the 2004 draft General Permit in the attached Recommendations Table. The general policy comments provide recommendations to improve general policy interpretation and implementation, whereas the Recommendations Table identifies specific permit elements of concern, the reason for the concern, and CASQA's recommendation.

GENERAL POLICY COMMENTS

1. Support of the Continued Regulation of Stormwater Discharges through the Iterative Best Management Practice (BMP)-Based Process

CASQA supports the General Permit's iterative BMP-based approach for regulating stormwater discharges from industrial facilities and we appreciate State Board staff's efforts to provide a balanced approach when regulating stormwater. The iterative approach will assist industrial dischargers and the regulators in implementing and evaluating the effectiveness of the stormwater pollution prevention plans (SWPPPs) and in achieving water quality standards. In addition, this is the only approach that is consistent with both State and USEPA guidance on regulating stormwater discharges from industrial facilities.

CASQA and others in the regulatory and scientific communities recognize that, although the science of stormwater quality management continues to emerge and develop, there is currently not enough information to derive appropriate numeric effluent limits for industrial dischargers. In addition, USEPA recognizes this through its continued support of the interim permitting approach, which is applicable to discharges from municipal separate storm sewer systems (MS4s) and stormwater discharges associated with industrial activity. Further, before numeric effluent limits can be appropriately derived and incorporated into stormwater permits, the processes to derive numeric limits for stormwater discharges must be fully developed and incorporate a scientifically sound and defensible methodology that is in accordance with USEPA protocols (see also item #2). However, since such a process has not yet been defined or demonstrated, the permit must continue to clearly emphasize the iterative BMP-based approach as the process for demonstrating permit compliance.

As a result, CASQA strongly recommends the continuation of the iterative BMP-based approach to improve the quality of stormwater discharges from industrial facilities, rather than the imposition of numeric effluent limits.

Notwithstanding our support of the iterative process, CASQA does support the use of benchmarks as a constructive "next step" to provide more accountability and direction to industrial dischargers as they implement stormwater pollution prevention plans and evaluate their effectiveness. However, we support the use of benchmarks only in the context of assessing the effectiveness of a SWPPP and only in accordance with USEPA's intended application, not as an independent compliance standard (see our comments below regarding the use of benchmarks).

2. Development and Incorporation of Numeric Effluent Limits

The 2004 draft General Permit acknowledges that, although numeric effluent limits cannot be scientifically supported in this permit (see also item #1 above), the State Board is considering adopting numeric effluent limits for the next permit term. However, it is unclear whether the State Board is considering the development of technology-based or water quality-based effluent limits.

In either case, the State Board must recognize that, due to a number of factors including the variable nature of stormwater, the diversity among industrial categories, and the functionally different objectives for the proposed analytical monitoring program (i.e., SWPPP and BMP effectiveness assessment), the dataset that will be collected during this permit term will not, on its own, be sufficient for deriving numeric effluent limits. Due to the regulatory approach that is being considered for the next permit term, CASQA recommends the following:

- The iterative BMP-based approach proposed within the 2004 draft General Permit be allowed sufficient time for program implementation and effectiveness monitoring.

- The State Board identify a progressive policy and approach for regulating stormwater discharges through the statewide stormwater policy development process. Among other things, the policy could identify when it is appropriate to shift from an iterative BMP-based approach to technology-based effluent limits and/or water quality-based effluent limits as well as the process that should be followed in order to derive appropriate and scientifically sound numeric limits. This is critically important and should be something that is developed with adequate time as well as public input.

- Given the different objectives for the proposed analytical monitoring program, the inclusion of new requirements (beyond those in the current General Permit) should be deferred until the State Board more clearly defines which objective it desires to meet and what monitoring and data are needed to meet the objective in a statistically valid and scientific manner.

- If deemed appropriate (see bullet #2 above), the development of technology-based effluent limits should follow a similar process used by USEPA when developing national technology-based effluent guidelines (consistent with the pretreatment programs) (see **Attachment 1**).

- If deemed appropriate (see bullet #2 above), the development of water quality-based effluent limits must follow a scientifically sound, and statistically rigorous process (see **Attachment 2**).

Although CASQA understands that the development of numeric effluent limits is a complicated and time-consuming process, a reasonable, scientifically and technically sound process is critical for the successful evaluation and/or development of effluent limits. As such, CASQA would be willing to work with the State to address these issues.

3. Incorporation of EPA Benchmarks

CASQA supports the iterative BMP-based approach and the application of benchmarks to stormwater in a manner consistent with USEPA's Storm Water Multi-Sector General Permit for Industrial Activities (Multi-Sector Permit). However, some ambiguous statements in the 2004 draft General Permit (e.g., Section V.7.c) appear to equate benchmarks with best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) compliance. These ambiguous statements must be revised to clarify that benchmarks are not intended as a measure of BAT/BCT compliance.

Moreover, the 2004 draft General Permit is inconsistent with the Multi-Sector Permit in several ways that would result in the State's permit being unnecessarily costly to dischargers without increasing beneficial impacts to stormwater quality. These differences include:

- The Multi-Sector Permit clearly recognizes the variable nature of stormwater and specifies, *"An exceedance of a benchmark value does not, in and of itself, constitute a violation of this permit. While exceedance of a benchmark value does not automatically indicate that violation of a water quality standard has occurred, it does signal that modifications to the SWPPP may be necessary."* Additionally, the Multi-Sector Permit refers to <u>average</u> concentrations of pollutant parameters, clearly distinguishing it from a single sample. Although the State Board's Fact Sheet reflects the understanding that stormwater is variable, the 2004 draft General Permit appears to ignore this variability and trigger additional monitoring and additional BMP identification and implementation based on the result of one grab sample;

- The Multi-Sector Permit further recognizes the variable nature of stormwater and the uncertainty of a grab sample result by requiring actions only when the analytical results are considerably above benchmark values. The Multi-Sector Permit states *"...analytic levels considerably above benchmark values can serve as a flag to the operator that the SWPPP needs to be reevaluated and that the pollutant loads may need to be reduced."* The 2004 draft General Permit triggers corrective actions with any level of exceedance beyond benchmarks; and

- The Multi-Sector Permit recognizes the need for flexibility to deal with the variable nature of stormwater and specifies, *"The results of benchmark monitoring are primarily for your[1] use to determine the overall effectiveness of your SWPPP in controlling the discharges of pollutants to receiving waters".*

The State Board should revise the 2004 draft General Permit to be consistent with USEPA's use of benchmarks by: (1) stating that the exceedance of a benchmark is not, in and of itself, a violation of the permit, (2) treating a benchmark exceedance as an event requiring review, but not automatically triggering changes to the SWPPP, (3) allow a reduction in the sampling requirements for dischargers who are meeting the benchmarks, and (4) stating that benchmarks are primarily for the use of the discharger to determine the overall effectiveness of the SWPPP. Moreover, before requiring use of benchmarks, the State Board should identify appropriate constituents and values for benchmarks that are representative of industrial activity-specific impacts.

[1] CASQA note: "your" in this context means discharger

Although CASQA supports the use of benchmarks, applied to stormwater in a manner consistent with USEPA's Multi-Sector Permit, that support does not necessarily extend to the specific constituents and benchmark values in the USEPA Multi-Sector Permit. To fulfill their purpose, benchmark values must be developed that are representative of industrial activities and not background conditions. The majority of the stormwater data available supports the observation that constituents such as iron and aluminum are abundant in background conditions, typically in concentrations significantly above USEPA's benchmark values. Imposition of benchmark values that do not distinguish between activity-specific pollutant sources and background sources will distract from efficient evaluation of BMP effectiveness. Caltrans comments (submitted February 2, 2005 to State Board) suggested a scientific review be conducted to identify appropriate constituents and values for benchmarks for industrial stormwater discharges—CASQA also supports such a scientific review.

4. Monitoring Program

Sampling for Parameters Causing or Contributing to Existing Exceedances of Water Quality Standards (WQS)

The 2004 draft General Permit imposes a new requirement that dischargers must sample for *"Parameters indicating the presence of pollutants that may be causing or contributing to an existing exceedance of a WQS in the facility's receiving waters*" (Section VIII.4.c.iv). This is a new requirement and is problematic for several reasons:

- The statement, as currently written is overly broad and would result in industrial dischargers monitoring for constituents that are not related to their industrial processes (i.e., bacteria).

- Absent an analysis of the 303(d) listed water bodies, it is unclear how the industrial dischargers would know which water quality standards are currently being exceeded in the receiving water. CASQA recommends that the State Board modify this statement so that the dischargers are only required to evaluate the 303(d) list and modify their SWPPP and monitoring program to reflect the site- and industry-specific pollutants that are under the direct control of the discharger and that can reasonably be expected to be discharged from their site.

Additionally, the intent of collecting data on such parameters could be easily misunderstood. The draft Fact Sheet states:

> "The monitoring program requirements are designed to provide useful, cost-effective, timely, and easily obtained information to assist dischargers to identify pollutant sources, implement corrective actions, and revise BMPs."

That statement, as well as the acknowledgement in the 2004 draft General Permit that numeric effluent limits cannot be scientifically supported in this permit make the intended use of data on such parameters very clear, although not in one location in the permit. Therefore, the permit should include a clarification that data collected as a part of the proposed analytical monitoring program is only intended to be used for assessing the adequacy of a facility's SWPPP and BMPs.

One-time Pollutant Scan

Section VIII.6.a of the 2004 draft General Permit requires a one-time pollutant scan for additional parameters (i.e., metals, COD, etc.) listed in Table VIII.2 (pg 25). The Fact Sheet (pg IV) states that the State Board intends to use this database to develop numeric effluent limits. Since there is a tremendous amount of data and supplemental information that is necessary for the development of numeric effluent limits (see **Attachments 1** and **2**), the proposed one-time grab sample will ultimately be of little value and will not provide statistically valid results that could be used to develop numeric effluent limits.

Therefore, CASQA recommends that the one-time pollutant scan be eliminated from the 2004 draft General Permit. However, once a statewide stormwater policy is developed and a progressive policy and approach for regulating stormwater discharges has been identified, CASQA encourages the State Board to facilitate a discussion with appropriate stakeholders to develop a proposal and mechanism for a more appropriate statewide monitoring study of industrial stormwater discharges that would yield statistically valid results.

5. Need for Statewide Guidance

Due to the lack of standardized guidance for industrial dischargers, CASQA recommends that the State Board do the following:

- Reference CASQA's Industrial and Commercial BMP Handbook within the General Industrial Permit as a tool that is available for industrial dischargers. Since this is the only statewide guidance that is currently available and was a project that the State Board helped fund and participate in, the dischargers should be made aware that the Handbook is available and that it provides general guidance regarding the development of the SWPPP and selection of appropriate BMPs;

- The State Board should work with the dischargers and other interested parties in developing standardized guidance on how to comply with the General Industrial Permit through the iterative BMP process (i.e., demonstrating BMP effectiveness).

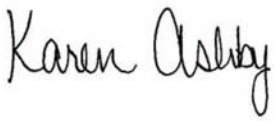
CASQA is committed to working with State Board staff and other stakeholders in development of this compliance guidance.

6. Statewide Stormwater Policy

Consistent with our previous comments, the State Board would be well served to use the development of a statewide stormwater policy as the vehicle to describe the process for having stormwater dischargers meet and protect water quality standards. Once developed, this policy would provide the necessary guidance in the development of general permits, be they construction, industrial or municipal. Therefore, we strongly recommend, prior to the State developing an industrial general permit that switches from an iterative BMP-based process to numeric effluent limits, that the State identify a constructive and progressive approach through the development of a statewide policy.

Thank you for the opportunity to comment on the proposed revisions to the Industrial General Permit. If you have any questions about our comments, please contact me at (530) 753-6400 or Maureen Daggett, Chair – CASQA Industrial Subcommittee, at (916) 972-7947.

Sincerely,



Karen Ashby, Chair
California Stormwater Quality Association

cc: CASQA Board of Directors
CASQA Executive Program Committee

Technology-Based Effluent Limits

Although CASQA strongly recommends that 1) the regulatory approach proposed within the 2004 draft General Permit be allowed sufficient time for program implementation and effectiveness monitoring; and 2) the State Board utilize the development of the statewide stormwater policy to identify a progressive policy and approach for regulating stormwater discharges, CASQA is also offering some initial thoughts regarding the development of technology-based effluent limits (TBELs). However, it should be noted that, given the inherent time constraints in providing the comment letter and the significance of shifting from a BMP-based approach to a numeric limit-based approach, CASQA reserves the right to provide additional comments.

CASQA recognizes that the intent of the TBELs is to require a minimum level of treatment for point source discharges (including industrial discharges) based on available treatment technologies while allowing the discharger to use any available control technique to meet the limits[2]. CASQA also recognizes that, since TBELs are technology-based (i.e., based on the performance of treatment and control technologies), they are not based on risk or impacts on receiving waters, and, as a result, may or may not meet water quality standards (see **Attachment 2**). Although the State Board should utilize the development of the statewide stormwater policy to identify an approach for regulating stormwater discharges, CASQA is providing a series of initial recommendations that should be considered when and if the State Board evaluates the feasibility of developing TBELs.

CASQA's initial recommendations include the following:

- A general permit could incorporate TBELs because it would provide a single standard and/or pollution control obligation for all facilities within an industrial category or subcategory.

- Prior to developing TBELs, the State Board should develop clear guidelines specifying methodologies and criteria for developing TBELs, considering the variability of stormwater and its inherent differences, compared to traditional wastewater effluent discharge.

- Since the best control technology for one industry is not necessarily the same as another, TBELs would have to be developed based on sub-categories of industry.

- Prior to developing TBELs, the criteria for identifying which sub-categories of industry warrant the development of TBELs should be identified.

- The development of TBELs (effluent guidelines) should utilize a performance-based approach and follow a similar process used by USEPA when developing national effluent guidelines. The process should be modified where appropriate, to make the process compatible with the unique, variable features of stormwater discharges and the difficulties associated with sampling stormwater discharges. In fact, the State should consider following a process similar to what USEPA used when evaluating effluent limitations guidelines for discharges of stormwater from construction sites[3].

[2] http://cfpub.epa.gov/npdes/generalissues/watertechnology.cfm

[3] Similar guidance is identified in USEPA's *Development Document for Proposed Effluent Guidelines and Standards for the Construction and Development Category* (June 2002)

- If TBELs (effluent guidelines) are developed, it should also include guidelines on methodology for sampling and determination of compliance.

- If developing TBELs, the State should consider:
  1. The performance of the best pollution control technologies or prevention practices that are available for an industrial category or subcategory; and
  2. The economic achievability of that technology, which can include consideration of costs, benefits, and affordability of achieving the reduction in the pollutant discharge.

  And follow a process similar to the one that is outlined below.

  In order to appropriately derive a TBEL, the State should consider a number of parameters including, but not limited to, the following: (see also USEPA's Effluent Guidelines Flow Chart Exhibit 5-2 and USEPA's Development Document for Proposed Effluent Guidelines and Standards for the Construction and Development Category (June 2002))

  i. **Data Collection** - Existing technical and economic data should be obtained from various sources and evaluated so that the industry may be profiled with respect to general industry description, trends, environmental impacts, best management practices and economics. Once the information is obtained, data gaps could be identified and prioritized. The data sources that could be used include:
     - Literature searches – obtain information on various BMPs that pertain to the industry (journal articles, professional conference proceedings). This information could be used to summarize the most recent BMP effectiveness data, design and installation criteria, applicability, advantages, limitations and cost.
     - Existing Control Strategies - municipal stormwater permits, state and local guidance materials, and web sites could be reviewed to identify typical BMPs utilized to control industrial stormwater discharges.
     - Other Sources – Other data sources that could be reviewed include (but are not limited to):
       - The 2003 California Stormwater Industrial/Commercial BMP Handbook
       - The ASCE National Stormwater BMP Database
       - EPA's National Menu of BMPs

  ii. **Industry and Site Profile** - Industry specific information should be obtained through surveys, site visits, etc. and a profile developed. The profile should address items such as:
     - General description/definition and NAICS and/or SIC codes
     - Industry practices and trends
     - Manufacturing processes used
     - General facility information (age of equipment and facilities involved)
     - Discharge characteristics
     - Based on the data gaps identified as a part of the existing data collection efforts, additional field sampling and statistical analyses may be necessary
     - Local climatological data.

iii. **Technology Assessment** - The technology assessment should determine the depth and breadth of effectiveness data for various industry related source and treatment BMPs and identify the quantity and quality of data available to describe the performance of all currently used and innovative practices, the ability of each to effectively control impacts due to runoff and the design criteria or standards currently used to size each practice to ensure effective control of runoff. The assessment should include an assessment of difficulties or practicality issues related to the inherent variability of stormwater and the challenges associated with sampling.

For each source and treatment BMP, the assessment should include:

- General Description of the BMP
- Applicability
- Design and installation criteria
- Design and/or siting considerations and/or variations
- Effectiveness
- Limitations
- Maintenance
- Cost

iv. **Regulatory Options** - Once the Data Collection, Industry Profile and Technology Assessment has been completed, the State should identify the regulatory options that are available. This effort should identify industry impacts, which pollutants to address as well as other non-water quality related impacts (such as energy requirements). For example, the regulatory options pursued by USEPA for Construction and Development essentially included:

- Promulgation of effluent guidelines that include minimum requirements deemed to result in an effective stormwater program; and
- Continued reliance on the current State and local programs

v. **Economic analysis**[4] - Once the regulatory options are identified (see above), the State should evaluate the costs and environmental benefits and determine the appropriate option based on factors such as:

- Total Costs
- Monetized and non-monetized environmental benefits[5]
- Ease of implementation
- Industry financial impacts
- Industry acceptance

Although CASQA is not supporting the development of TBELs at this time, we clearly note that the use of this or a similar well-established process would be critical for the successful development of appropriately derived TBELs. Anything short of this effort would likely cast the limits into question.

[4] Similar guidance is identified in USEPA's *Economic Analysis of Proposed Effluent Guidelines and Standards for the Construction and Development Category* (May 2002)

[5] Similar guidance is identified in USEPA's *Environmental Assessment for Proposed Effluent Guidelines and Standards for the Construction and Development Category* (June 2002)

Water Quality-Based Effluent Limits

Although CASQA strongly recommends that: 1) the regulatory approach proposed within the 2004 draft General Permit be allowed sufficient time for program implementation and effectiveness monitoring; 2) the State Board utilize the development of the statewide stormwater policy to identify a progressive policy and approach for regulating stormwater discharges; and 3) it may be more appropriate for the State Board to evaluate the feasibility of developing technology-based effluent limits prior to water quality-based effluent limits (WQBELs), CASQA is also offering some initial thoughts regarding the development of water quality-based effluent limits. However, it should be noted that, given the inherent time constraints in providing the comment letter and the significance of shifting from a BMP based approach to a numeric limit based approach, CASQA reserves the right to provide additional comments.

As previously stated, CASQA recognizes that WQBELs may be necessary if it is determined that TBELs are not sufficient to ensure that water quality standards will be attained in the receiving water. However, it should also be noted that, given the current constraints and limitations with the dataset (including, but not limited to storm variability, intra-storm variability, averaging periods, application of chronic vs. acute criterion as well as human health criterion), it is not currently possible to appropriately derive WQBELs for industrial stormwater discharges

Although the State Board should utilize the development of the statewide stormwater policy to identify an approach for regulating stormwater discharges, CASQA is providing a series of initial recommendations that should be considered when and if the State Board evaluates the feasibility of developing WQBELs.

CASQA's initial recommendations include the following:

- If an industrial discharger is in full compliance with all permit conditions and fully implementing the stormwater BMPs in accordance with industry and stormwater guidance, compliance with water quality standards should be presumed until it is demonstrated that the discharge is causing or contributing or has a reasonable potential to cause or contribute to an exceedance of water quality standards within the receiving water.

- Since there is no Statewide guidance regarding how a discharger determines if their discharge is causing or contributing or has a reasonable potential to cause or contribute to an exceedance of water quality standards within the receiving water, the State Board should work with CASQA and other interested parties in developing such guidance.

- If it has been determined that a discharger is causing or contributing or has a reasonable potential to cause or contribute to an exceedance of water quality standards within the receiving water, due to pollutants that are directly related to the industrial activity, the discharger should take all reasonable actions to ensure that future discharges do not cause or contribute to an exceedance of a water quality standard in the receiving water.

- If it is determined on a categorical or individual basis that, after the full implementation of TBELs that water quality standards are not being attained in the receiving water, individual permits and site specific WQBELs may be necessary (i.e., General Permits can not support site-specific WQBEL),

- Although USEPA and the State Board have provided guidance regarding the calculation of WQBELs for toxic pollutants in traditional NPDES permits[6], the procedures outlined in these guidance documents (such as the determination of reasonable potential) are not directly applicable to highly variable flows such as stormwater. As a result, the State Board would need to work with the stakeholders to develop statewide guidance, policy and/or methodologies for stormwater discharges.

- The State should consider addressing the following in a statewide policy, guidance or methodology:
    - Derivations of WQBELs must require a sufficient amount of industrial discharge and receiving water data regarding frequency, duration and magnitude with which the site-specific conditions occur.
    - Defining the mixing zone and the method for developing dilution credits.
    - Determinations of reasonable potential to cause or contribute to exceedances of water quality standards within the receiving water must require a sufficient amount of industrial discharge and receiving water data as well as dilution considerations (where appropriate),
    - Given the above, detailed data sets may be necessary in order to appropriately derive WQBELs. The storm related data sets may include:
        - Effluent concentrations and flow data (more than 1 sample per hour);
        - Receiving water concentrations and flow data more than 1 sample per hour);
        - Storm event information (antecedent dry period, rainfall amounts, storm hydrograph); and
        - General facility information (facility type, BMPs implemented, etc.)
- When developing WQBELs, the Board must utilize a dynamic modeling approach, especially since dynamic models can explicitly predict the effects of receiving water and effluent flow and concentration variability.

Although CASQA is not supporting the development of WQBELs at this time, we clearly note that the use of a well-defined, scientifically and statistically sound process would be critical for the successful development of appropriately derived WQBELs. Anything short of this effort would likely cast the limits into question.

[6] USEPA *Technical Support Document for Water Quality-based Toxics Control* (TSD) and the State Board's *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (SIP)

California Stormwater Quality Association™
Dedicated to the Advancement of Stormwater Quality Management, Science and Regulation

August 15, 2005

Mr. Bruce Fujimoto, Chief
Storm Water Program
State Water Board
P.O. Box 100
Sacramento, CA 95812-0100

Subject: State Water Board Process for the Development of Quantitative Measurements for Stormwater Program Compliance

Dear Bruce:

On behalf of the California Stormwater Quality Association (CASQA), I am submitting this comment letter to express CASQA's position regarding the State Water Resources Control Board's (State Water Board's) efforts to evaluate the feasibility of developing quantitative measurements for stormwater program compliance. The "Question", as it has become to be known, is paramount to members of CASQA and, as a result, CASQA appreciates the opportunity to contribute to your early planning efforts and looks forward to fully contributing to the State Water Board's efforts to address the Question.

Given the potential ramifications and impacts that the answer to the Question may have, CASQA believes that the State Water Board would be well served to: 1) develop a work plan for answering the Question and incorporating its' context within the overall development of a Statewide Stormwater Policy; 2) include additional statistical, economic, and stormwater program implementation expertise in the Question review process; and 3) actively engage the public and other interested parties. Our specific concerns and recommendations for each of these areas are provided in further detail below.

Need for Work Plan

CASQA believes that there is a vital need for the State Water Board to lay out a work plan for answering the Question as well as for developing the Statewide Stormwater Policy, of which the impending deliberations on the Question are obviously a key element. The listening sessions at the start of this year were a welcome launch of the State Water Board's effort to bring cogent thought to a major area of water quality management that was evolving in a piecemeal fashion. In the absence of any reference to the Statewide Stormwater Policy effort, consideration of the Question risks being more of the same piecemeal effort that has attracted justifiable criticism and concern. Indeed, although CASQA does not believe this to be the case, the formation of the Question and the Blue Ribbon Panel in the absence of a work plan risks projecting the appearance of an overly expedited effort that is primarily set up to provide the most expedient answer so that the Statewide Construction and Industrial General Permits may be reissued.

For the past several years, CASQA has recommended that the State Water Board develop a Statewide Stormwater Policy, via a transparent and structured process, to provide much needed guidance for subsequent permitting and enforcement actions. One benefit of such a process would likely be greater shared commonality regarding schedules and outcomes as well as 'buy-in' from all stakeholders. In this regard, it is instructive to consider the wastewater field. The wastewater field took 30 years to get to a point of developing water quality based effluent limits, which evolved from the initial use of technology based effluent limits (e.g., 30/30 TSS/BOD limits and pond technology). Furthermore, the Clean Water Grant program provided major funding for control efforts and it is this funding, perhaps more than any other factor, which provided for and accelerated the implementation of a water quality based program. If the Question is being considered so as to inform the Statewide Industrial and Construction General Permits, then CASQA believes it to be preemptory, independent of, and potentially detrimental to the Statewide Stormwater Policy effort.

Recommended Approach

While it is presumed that reissuance of the Statewide Industrial and Construction General Permits is a priority, CASQA is advocating that the State Water Board consider a more strategic and defined approach to the Question in order to address the quantitative measures issue and to serve as a model for the development of a Statewide Stormwater Policy. We understand the State Water Board views the Blue Ribbon Panel as the first step in a process of considering the feasibility of quantifiable measures and that the panel may very well propose the technical process necessary for both investigating and ultimately establishing feasible quantifiable measures. However, it is up to the State Water Board to define and establish a public process that integrates with the technical process.

In fact, we would submit that such an approach has already been successfully employed for the State Water Board's efforts to develop the sediment quality criteria. For this effort, the State Water Board developed a work plan that carefully considered the scientific and regulatory challenges and provided for stakeholder involvement. Establishing sediment quality objectives is a three-year effort with significant resources being provided to retain experts in the technical/scientific fields and facilitation. In addition, the work plan recognizes and incorporates three key subcommittees: Advisory, Scientific and Regulatory. By providing such a structure and developing a work plan, the State Water Board has provided an opportunity for the major policy aspects of sediment criteria to be considered and adequately addressed.

Since the Question addresses a defining issue in stormwater management, CASQA strongly recommends that the State Water Board provide a level of effort, strategy, resources, and time commensurate with its significance.

Composition of Blue Ribbon Panel

Pursuant to an e-mail from Mr. Tom Howard, dated July 8, 2005, our understanding is that the following individuals have been selected by the State Water Board to participate on the Blue Ribbon Panel that will be convened on September 14th and 15th to address and attempt to answer the Question:

- Eric Strassler (USEPA);
- Gary Minton (Resource Planning Associates);
- Larry Roesner (Colorado State University);
- Mike Stenstrom (UCLA);
- Robert Pitt (University of Alabama);
- Eric Strecker (GeoSyntec Consultants);
- Ken Schiff (SCCWRP); and
- Brian Currier (CSUS).

While CASQA believes these individuals are well qualified to serve on the panel to consider the technical and scientific elements of the issue, we believe the State Water Board would be well served by the addition of expertise in statistics and, in particular, economics. We also believe the inclusion of this expertise along with personnel involved with the implementation of stormwater programs (i.e., practitioners) should be incorporated into the process, be it with the expert panel or as suggested above through a subcommittee/stakeholder framework.

CASQA interprets State Water Board efforts regarding the Question as the initiation of a process to develop a State Stormwater Implementation Policy for Water Quality Criteria similar to the State's efforts to develop the State Implementation Policy for Toxic Standards. Consistent with that effort, the State should enlist the expertise of statisticians and economists. Pending the recommendations of the panel, this stormwater implementation policy may have major economic ramifications for our members and the State Water Board must address the requirements of Porter Cologne Sections 13241 and 13242. These other aspects of the feasibility question are at least as important and complex as the technical aspects. Moreover, the recent Burbank decision affirmed that the State Water Board must consider cost implications when proposing permit requirements beyond Federal requirements.

Public Participation

Given the complexity and diverse set of the issues that should be considered when answering the Question fully, CASQA would strongly encourage the State Water Board to actively engage the public and interested parties. Various models have been used over the years by the State Water Board to engage the public. As noted previously the Sediment Quality Criteria model appears to be a good fit for this stormwater effort. Regardless of which model is used, we believe the following principles should be incorporated.

Overall Process

- The process must be independently facilitated by an individual who has a strong understanding of stormwater, water quality, and policy development issues. CASQA suggests that the State put forward a short list of 3-4 qualified facilitator candidates for stakeholder groups to review and provide feedback to the State Water Board prior to selection.

- The process must be inclusive. Whatever model is used, the State Water Board should ensure that the process is transparent and does not give any one party interest a stronger position than another. At the same time, CASQA is aware of the disadvantages associated

with the Toxic Hot Spot Public Advisory Group and the AB982 Public Advisory Group. CASQA participants of both of these processes are concerned with committee deadlock that can result from a process that pits one side against another. We are hopeful that a strong facilitator could assist in avoiding a similar situation.

Establishment of an Implementation Advisory Group

- CASQA would recommend that the State Water Board establish an Implementation Advisory or similar group to provide input to the Blue Ribbon Panel and State Water Board.

- Participation in an Implementation Advisory Group should not preclude associations represented from submitting divergent comments during public comment periods.

General Public

- All meetings should be open and noticed. The public should be given the opportunity to provide comments at a designated time during the meetings.

CASQA supports improving water quality programs and developing assessment tools to ensure progress towards the attainment of receiving water standards. Quantitative measurements are one possible proxy for this assessment, but the development of these measurements should be done in the context of a broader and more comprehensive policy for managing stormwater in California. As always, CASQA looks forward to working with you and the State Water Board in crafting stormwater policy that protects our environmental resources and reflects technical and economical feasibility.

Yours truly,

Karen Ashby, Chair

cc: CASQA Board of Directors
CASQA Executive Program Committee
Art Baggett, Chair – State Water Board
Alan Lloyd, Secretary – Cal EPA
Celeste Cantú, Executive Director – State Water Board
Tom Howard, Deputy Director – State Water Board
Betsy Jennings, Staff Counsel – State Water Board
Geoff Brosseau, Executive Director – CASQA

California Stormwater Quality Association
An Introduction to Stormwater Program Effectiveness Assessment

A. Introduction

This paper introduces and discusses key concepts and provides a standardized terminology related to the development of a comprehensive framework for assessing the effectiveness of stormwater management programs. It briefly defines and categorizes potential outcomes, measures, and methods to be used in conducting assessments, and provides examples of how several programs are already utilizing these tools to assess their effectiveness. It also discusses the current needs of stormwater program managers with respect to program assessment. The issues addressed in this paper will form the basis for more detailed guidance on effectiveness assessment that will be developed by the California Stormwater Quality Association (CASQA) Effectiveness Assessment Subcommittee during 2005-06.

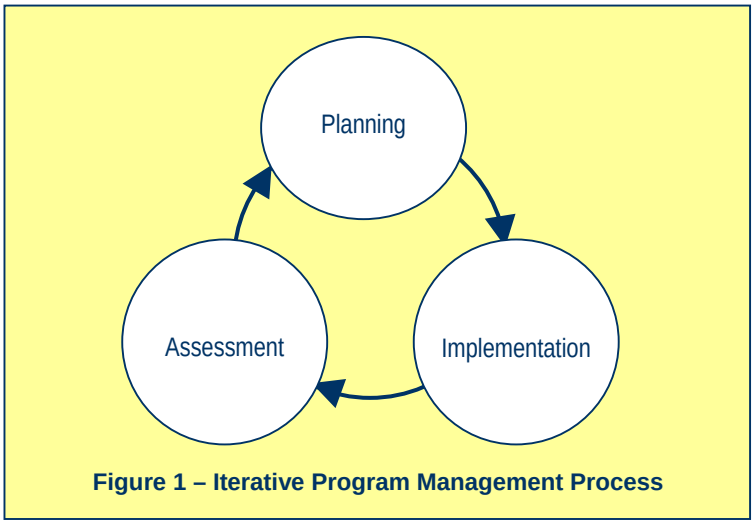


Figure 1 – Iterative Program Management Process

Effectiveness assessment is a fundamental and necessary component of developing and implementing successful programs. It begins with the establishment of goals, objectives, and desired outcomes during program planning, and continues throughout subsequent implementation and review stages. A well-executed assessment element can provide managers the feedback necessary to determine whether their programs are achieving intended outcomes (complying with permit requirements, increasing public awareness, changing behaviors, etc.), and ultimately whether continued implementation will result in water quality and/or habitat improvement. Figure 1 illustrates an idealized model in which each of three management elements continuously informs the next in an iterative cycle of feedback and improvement. While this model is useful for illustration, it bears emphasis that the most successful programs are those that address assessment during all stages of program activity, especially planning.

Municipal stormwater management programs in California are broadly focused on reducing pollutants in stormwater and non-stormwater discharges to the maximum extent practicable (MEP), and on ensuring that these discharges do not cause or contribute to violations of applicable water quality standards. To achieve these objectives, they employ a variety of strategies to bring about the implementation of best management practices (BMPs) in a manner that will most effectively and cost-efficiently achieve regulatory compliance and protect the beneficial uses of receiving waters. To ensure that programs are measurable and effective, most municipal separate storm sewer system (MS4) National Pollution Discharge Elimination System (NPDES) stormwater permits contain specific requirements for periodic assessment. Most programs report on effectiveness as part of their annual report, but effectiveness assessment should be integral to the program and an ongoing process used throughout the year.

Stormwater managers currently find themselves at an important crossroads. Faced with a continually increasing need to demonstrate measurability and accountability, they must have a reasonable expectation of success before committing resources toward specific activities. Therefore, good effectiveness assessment tools are critical. Managers have historically relied on a combination of programmatic or implementation evaluations and direct water quality evaluations to determine whether their efforts are effective in achieving intended outcomes. In addition, some program managers are still in need of basic information on useful assessment methods.

Developing consensus on how to continue improving these approaches and providing guidance on selecting

and using applicable assessment methods must remain priorities. More importantly, a critical need has emerged to work toward integration of assessment methods so that linkages between program activities and measurable changes in water quality can be definitively established and continually refined. A well-conceived integrated approach for assessing the effectiveness of stormwater programs is necessary to ensure their measurability and success in the future.

B. What is Effectiveness Assessment?

Clarifying what is meant by effectiveness assessment, as well as the factors that need to be considered when assessing programs, is an important first step toward developing useful methods and approaches.

Effectiveness Assessment is the process that managers use to evaluate whether their programs are resulting in desired outcomes, and whether these outcomes are being achieved efficiently and cost-effectively. The specific approach to be used in assessing effectiveness will depend on a variety of factors including the type of program element or activity being evaluated and the stage of program development (i.e., planning, implementation, completion). However, as noted earlier, a comprehensive effectiveness assessment strategy should evaluate program implementation and water quality, and seek to find the relationship between the two (Figure 2).

Implementation Assessment provides managers feedback on the effectiveness of their programs in achieving targeted objectives. This type of assessment is essential in determining whether priority sources of pollution are being effectively addressed. Implementation assessment may include any of three levels of analysis: the overall program, the elements that comprise the program (construction sources, municipal sources, etc.), or the specific activities that are conducted within these program elements. Figure 3 shows these levels and provides examples to illustrate their relationship. While assessment strategies most commonly focus on specific activities such as inspections, street sweeping, debris collection, or implementation of best management practices, a comprehensive strategy should also encompass individual program elements and the overall program. Depending on the intended objectives at each level, assessment approaches will necessarily vary. These may range in complexity from simple activities such as verifying the completion of activities to more sophisticated techniques such as assessing the probable or actual locations of these activities and the significance of their spatial distribution.

Water Quality Assessment is the use of sampling data and related information to evaluate the condition of non-stormwater or stormwater discharges, and the water bodies that receive these discharges. This can include a variety of chemical, biological, and physical parameters or outcomes. In instances where water quality assessment is used to draw conclusions about overall program effectiveness, results are usually very general and require extended periods of analysis.

Integrated Assessment is the process of evaluating whether program implementation is resulting in the protection or improvement of water quality. In this process, relationships between program activities and water quality improvements are explored and refined. Because of the number and variety of BMPs and control programs being implemented at any given time, and because many factors external to stormwater programs affect water quality, establishing these relationships is difficult. Efforts to date have included speculative or hypothetical exercises aimed at better understanding likely program outcomes and potential

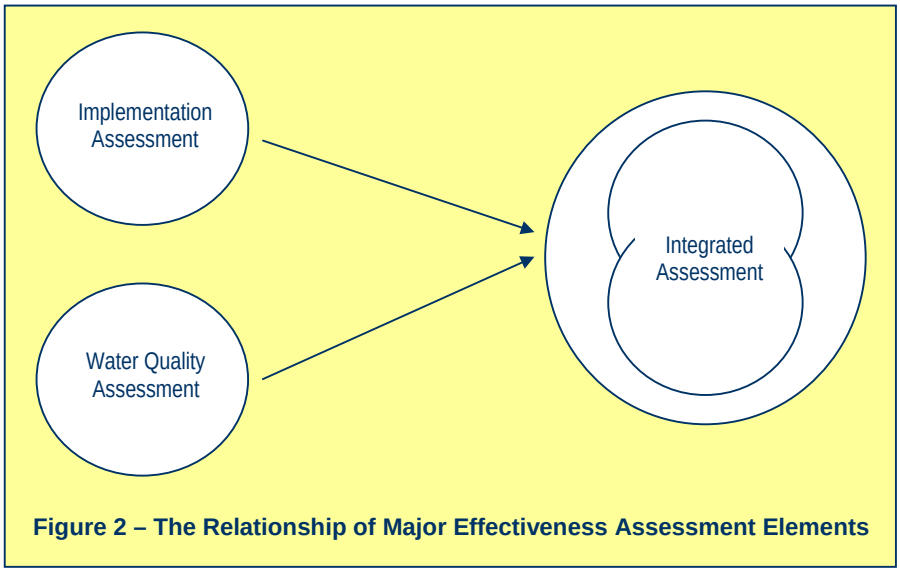


Figure 2 – The Relationship of Major Effectiveness Assessment Elements

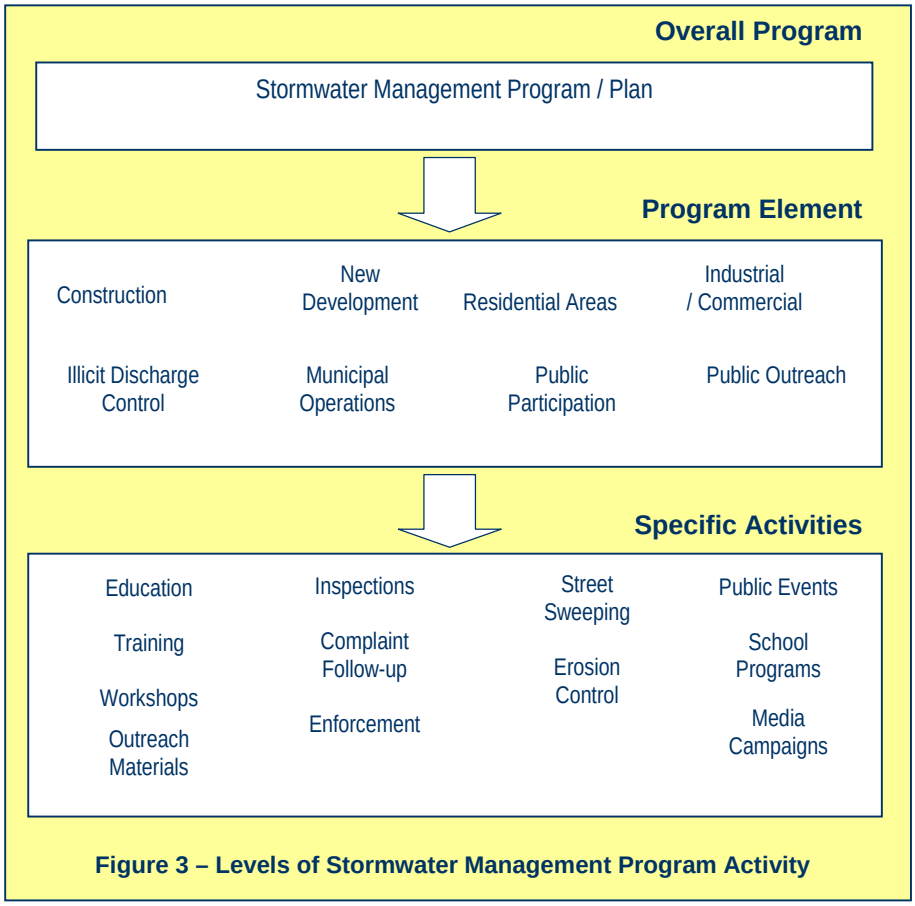


Figure 3 – Levels of Stormwater Management Program Activity

relationships to water quality. Quantitative "cause and effect" relationships will increasingly be sought in the future. This is a critical linkage because implementation assessment is, in many cases, simpler and less costly than water quality assessment. In addition, the time frame needed to see measurable results is shorter for implementation assessments. Over time, correlating water quality improvement to programmatic results will assist stormwater managers in identifying the most expedient and cost-effective approaches to planning and assessing their programs.

C. Types of Assessment Outcomes

Stormwater managers currently use a number of different approaches to draw conclusions about the effectiveness of their activities and programs. This involves the evaluation and measurement of various types of programmatic and environmental outcomes.

Outcomes are the results of an activity, program element, or overall program. The discussion below characterizes the possible types of outcomes in terms of six levels. As illustrated in Figure 4, these levels represent a gradation from activity-based to water quality-based outcomes. Though each level has value in informing management decisions, it bears emphasis that not all are necessary or possible in every instance. For example, in many instances Level 2 or 3 Outcomes will be sufficient for evaluating the effectiveness of implementation of outreach or training programs.

The pyramidal structure of Figure 4 is intended to illustrate the progression of each successive step toward the ultimate goal of environmental improvement. In general, Levels 1 to 3 can be considered Implementation Outcomes, Levels 5 and 6 Water Quality Outcomes and Level 4 a combination of the two types. While an important objective of the effectiveness assessment process is to establish relationships between Levels 1 and 6, this often becomes increasingly difficult as one moves toward higher levels of assessment. It should also be noted that, while these levels are presented in sequence, efforts to address each are independent and ongoing. For example, increases in awareness and knowledge may continue to be assessed even as strategies are broadened to include load reduction estimates.

Level 1: Compliance with Activity-based Permit Requirements. Many specific activities are either prescribed by or established under stormwater NPDES permits. Examples include conducting education to encourage BMP implementation, inspecting facilities, and enforcing discharge prohibitions. The most basic means of assessing effectiveness is to determine compliance with activity-based permit requirements. Level 1 Outcomes may therefore take the form of a simple yes/no answer. They may also be quantified, counted, or tracked over time to demonstrate effort or progress. Level 1 Outcomes are assumed to be beneficial to water quality, but often lack a factual basis to support these assumptions. Their fundamental characteristic is that they reflect program activity only; they are not indicators of the effect of implementation on people or the environment.

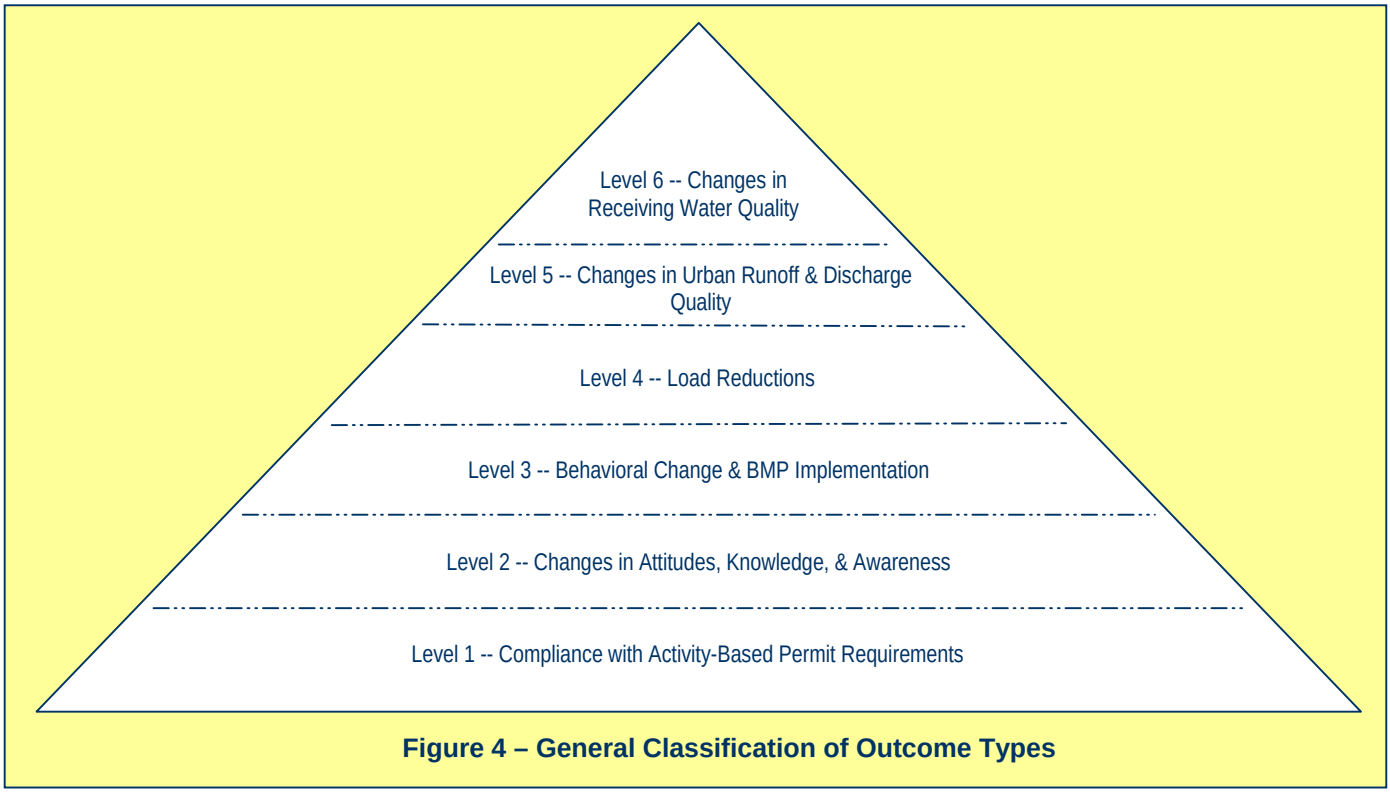


Figure 4 – General Classification of Outcome Types

-- Assessing Level 1 Outcomes -- Program Activity

Basic measurements of program activity are a crucial part of the overall assessment process. Level 1 Outcomes provide managers direct feedback on how well implementation is progressing and whether targeted goals and objectives are being met. Typical examples of targeted outcomes include the following:

- How many trainings or outreach events were conducted?
- How many people were reached?
- How many inspections were conducted?
- Were minimum inspection frequencies met?
- Did the number of inspections increase from previous years?
- How many illicit discharges were identified?
- How many were eliminated?
- Are illicit discharges increasing or decreasing over time?

Level 2: Changes in Attitudes, Knowledge, & Awareness. An important goal of stormwater programs is to increase the level of knowledge and awareness among target audiences such as residents, businesses, and municipal employees. Similar to the discussion above, augmenting awareness and changing attitudes about stormwater pollution and BMPs is generally assumed to be beneficial to the environment because increased awareness and attitudinal changes provide the basis for behavioral change. Measuring Level 2 Outcomes is a useful way of gauging whether educational efforts are progressing toward these changes.

Various methods and tools, both quantitative and qualitative, are currently utilized to measure changes in knowledge and awareness. These generally take the form of surveys and quizzes. Changes may also be inferred by tracking levels of public involvement (e.g., through complaints or requests for information received via stormwater hotlines). However, there may be limitations to using this method because many different factors influence levels of public involvement.

-- Assessing Level 2 Outcomes --
Attitudes, Knowledge, & Awareness

Understanding what people know and care about is the first step in developing effective outreach programs. Two programs in Northern California recently utilized surveys as a tool for refining and evaluating their outreach efforts.

Davis Healthy Gardens Program – During 2000, the City of Davis conducted phone and mail surveys to evaluate general levels of awareness and to help target potential behavioral changes for pesticide use and disposal. The City was able to use this information to determine if the basic program message was being effectively communicated, and which outreach methods and locations worked best for creating awareness and for changing behavior.

Woodland Oil and Grease Reduction Project – In 2000, the City of Woodland developed an outreach program to encourage the proper disposal of used cooking oil by residents. The primary means of assessing program effectiveness was the use of intercept surveys. These surveys provided vital information on whether outreach messages were understood, whether identifiable factors influenced the likelihood of improper disposal (e.g., family size, high density vs. low density neighborhoods, renting vs. owning, cooking habits, etc.), and ultimately on which outreach approaches worked the best (e.g., use of more than one language for outreach).

Level 3: Behavioral Change & BMP Implementation. Building on increases in knowledge and awareness, a key focus of management programs is to effect changes in behavior. Level 3 Outcomes measure the effectiveness of programs in motivating target audiences to change their behaviors and implement appropriate BMPs. Methods used to measure behavioral changes include those described above for Level 2 Outcomes, as well as direct observation via site visits and reporting by dischargers or third parties.

Level 4: Load Reductions. Most activities implemented through stormwater programs are intended to reduce the loading of pollutants from targeted sources. Load reductions should in turn result in improvements to discharge and receiving water quality. Load reductions quantify changes in the amounts of pollutants associated with specific sources before and after a BMP or other control strategy is employed.

-- Assessing Level 3 Outcomes --
Behavioral Change & BMP Implementation

Managers are increasingly utilizing a variety of methods to determine whether program implementation is resulting in targeted behavioral changes such as decreases in discharges and increased BMP implementation.

ACCWP Evaluation of Effectiveness Business Inspections – In 2000, the Alameda Countywide Clean Water Program (ACCWP) completed a comprehensive assessment of its facility inspection program using data collected between 1996 and 1999. Data were assessed to determine how well program objectives were being met, whether program implementation was resulting in corresponding behavioral changes, and to provide recommendations for prioritizing facilities and improving inspections. At the end of the four-year study, ACCWP staff was able to determine that non-stormwater discharges had decreased and BMP implementation increased at regulated businesses.

San Francisco Mercury Reduction Project – To evaluate the effectiveness of efforts to educate the public regarding the environmental impact of improperly disposing of mercury fever thermometers, San Francisco Water Pollution Prevention Program staff conducted intercept surveys and tracked the number of thermometers turned in at collection events. A random-digit-dial phone survey was also used to evaluate overall program effectiveness in discouraging the use of thermometers. A separate element of the project utilized site visits to assess whether outreach to dentists is facilitating proper amalgam waste management. This project provides an excellent example of how a variety of simple, low cost approaches to evaluating behavioral change can be used to evaluate the effectiveness of specific activities.

They are most valuable for making broad comparisons or for helping managers to distinguish where resource allocations are likely to be most useful. Developing a baseline of data and information to support load reduction estimates is key to their application. In the future, it is hoped that the development of such a baseline, as well as approaches for incorporating direct measurement, will enable a significant expansion of the use of load reduction estimates.

Level 5: Changes in Urban Runoff & Discharge Quality. As discussed above, a primary focus of stormwater management programs is to reduce pollutants in stormwater and non-stormwater discharges to the maximum extent practicable, and to

-- Assessing Level 4 Outcomes --
Pollutant Load Reductions

Load reduction estimates provide an important focal point for determining whether program implementation is achieving, or likely to achieve, meaningful outcomes. In recent years, many jurisdictions have increasingly used such methods to estimate the benefits of implementation and to prioritize program spending.

ACCWP Street Sweeping Assessment – As part of their annual reporting process, Alameda Countywide Clean Water Program (ACCWP) copermittees track the amount of street sweeping waste collected. ACCWP combines this information with PCB and mercury concentrations measured in sediment samples taken from inlets, catch basins, and pump stations to estimate the loads of these compounds diverted from the storm drain system as a result of street sweeping. Results allow the identification of potential improvements to street sweeping operations (e.g., to determine whether load diversions could be increased relative to costs), as well as comparison to results from storm drain cleaning and desilting operations.

County of San Diego Construction Activities Assessment – Since FY 2002-03, the County of San Diego has estimated load reductions resulting from BMP implementation at construction sites. Because of the extremely large number of permitted sites open throughout the year, the County determined that the collection and analysis of detailed site-specific data and information would generally be infeasible. Instead, the County employed a less direct approach of estimating levels of site protection and projecting loading rates before and after BMP implementation. In other words, reductions were calculated as the difference between completely unprotected and completely protected sites. This analysis relied heavily on the use of literature values and assumptions about site conditions.

-- Assessing Level 5 Outcomes --
Urban Runoff & Discharge Quality

Measuring changes in the quality of urban runoff and conveyance system discharges (before the water reaches receiving waters) is possibly the most direct expression of program effectiveness.

Davis Healthy Gardens Outreach Program – Pesticide levels in runoff from a residential outfall decreased over the same time frame that the Healthy Gardens Outreach Program was implemented in Davis, California. In general, spatial and temporal variability in pollutant concentrations in stormwater make it difficult to establish such cause and effect relationships. In this example, it was possible to isolate a residential area in Davis that had been targeted by the outreach program. This is not always the case. Outfalls typically drain large urbanized areas and the effects of activities and programs implemented are generally not seen in discharge quality measurements.

Ventura Countywide Stormwater Quality Management Program trend analysis - Ventura County has been able to assess long term impacts based on trend analysis. In 2003, all runoff monitoring data collected since 1993 was used to evaluate trends in water quality. While some organics and metals appeared problematic at sampling locations throughout the watershed, the number of detected organics had decreased significantly since the Program was implemented. More importantly, an analysis of Pollutants of Concern (POCs) showed that Sediment/Total Suspended Solids (TSS), initially identified as a POC in 1998, was no longer of concern. This improvement was attributed to the efforts of the copermittees to decrease sediment contributions from construction sites to stormwater runoff. In addition, Mercury and PAHs were no longer top-ranked POCs.

ensure that these discharges do not cause or contribute to violations of water quality standards in receiving waters. In many respects, Level 5 Outcomes are the most direct expression of successful program implementation. They may be measured as reductions in one or more specific pollutants, and may reflect effectiveness at a variety of scales ranging from site-specific to programmatic.

Level 6: Changes in Receiving Water Quality. The ultimate objective of stormwater management programs is the protection of water bodies receiving discharges from MS4s. Changes to receiving water and environmental quality may be expressed through a variety of outcomes such as compliance with regulatory benchmarks, protection of biological integrity, and beneficial use attainment. Regardless of the outcomes targeted, it is useful to keep in mind that receiving water quality often reflects more than the quality of stormwater discharges alone.

D. Assessment Measures and Methods

Once the desired outcomes of program implementation have been clearly defined, specific measures and methods can be developed for evaluating success in achieving them. **Assessment Measures** are established to determine whether or how successfully a

-- Assessing Level 6 Outcomes --
Receiving Water Quality

Improvements in environmental and water quality represent the ultimate goal of stormwater programs. Observable changes in receiving waters may require long time frames to be measurable.

Lead reductions in gasoline – Lead levels in gasoline were reduced by greater than 90% in the 1980s. This drastic source control action cascaded through the environment as evidenced by an approximate reduction of 90% in lead levels in air by the 1990s. Similarly, there has been an approximate 90% reduction in lead–related lung diseases and approximate 90% reduction in lead levels in runoff. As is often the case with environmental improvements resulting from source control, the time frame over which this was observed was several years.

Diazinon phase-out – In the mid-1990's aquatic toxicity in San Francisco Bay Urban Creeks was substantial and linked to relatively high concentrations of the organophosphate pesticide diazinon. Consequently, these creeks were listed as impaired on the 303(d) list as impaired. To address this impairment, wastewater and stormwater programs throughout Northern California conducted extensive outreach and education programs regarding the impacts of diazinon and alternative pest control methods. In addition, the wastewater and stormwater programs worked with EPA, Department of Pesticide Regulation, and the diazinon manufacturers to identify solutions to the impairment. In 2000, the USEPA announced the phase out of diazinon products and since then, the amount of reported diazinon applications has decreased substantially. In turn, aquatic toxicity and diazinon concentration in urban creeks have decreased dramatically.

programmatic or water quality outcome has been achieved. They may be qualitative (e.g., yes / no) or quantitative (% of targeted audience reached, % reduction in a constituent level, etc.). All priority outcomes should have at least one assessment measure associated with them, but some may have multiple measures. As discussed in Section B above, assessment measures can be focused on implementation or water quality assessment.

They should be selected based on their ability to provide useful information to the program manager. Attributes of a good assessment measure include:

- Measurability (statistically measurable on a frequent basis)
- Relevance (significant, demonstrable relation to strategy and objectives)
- Reliability (easily documented and reproducible)
- Availability (based upon data obtainable at reasonable cost)
- Scientific Validity (based on sound science)
- Replicability (capable of being regularly updated)
- Appropriately Focused (ideally measures outcomes, not inputs or outputs)

As noted above in the discussion of outcome levels, some effectiveness measures are based on assumptions and will have significant uncertainties associated with them. Other measures may be more statistically significant, allowing assessment of central tendencies (e.g., mean or median values) and data variability (e.g., standard deviations). Clearly, measuring the impact of stormwater programs is much easier and more meaningful if baseline levels can be established. It is therefore useful to evaluate available data at each outcome level prior to implementing a program (e.g., awareness levels before an outreach campaign is conducted, water quality before a series of BMPs is implemented). Example assessment measures are listed in Table 1 and are categorized by assessment method.

Assessment Methods are the specific activities, actions, or processes used to obtain and evaluate assessment data or information. Depending on the particular outcome in question, numerous assessment methods may be possible. Reasons for selecting a particular method include cost, ease of use, need for statistical rigor, applicability, and clarity in communicating progress to the general public. For example, headline indicators are objective measurements that reflect in simple terms how a stormwater program is progressing towards its goals. They are based on fundamental factors determining environmental quality and how easily they are understood. Assessment methods can be broadly categorized according to the following types of activity:

- **Confirmation** consists of documenting whether an activity or task has been completed. It is always expressed as a positive or negative outcome (i.e., yes or no), and should be used almost exclusively at Outcome Level 1.

Table 1 -- Examples of Assessment Methods and Measures by Outcome Level

	Outcome Level	Assessment Method Type	Assessment Measure	Examples
1	Activity-based	Confirmation	o Task completion (Y/N)	o Completed update of source inventory
		Tabulation	o Implementation (# or %) o Change	o Number of inspections completed o Increase since 2001
2	Attitudes, Knowledge, & Awareness	Survey	o Knowledge	o Knowledge of storm drain vs. sanitary sewer
		Tabulation	o Change o Action o Change	o Increase in awareness since last survey o Number of hotline calls/ website hits o Increase over last year
3	Behavioral Change & BMP Implementation	Inspection	o Implementation (# or %) o Change	o Installation of berms around trash areas o Increase since beginning of program
		Reporting (discharger)	o Implementation (# or %) o Change	o Installation of storm drain inserts o % increase
		Reporting (3rd party)	o Implementation / non-compliance (# or %) o Change	o No. of Complaints reported o Decrease since beginning of program
		Survey	o Implementation (# or %) o Change	o No. of people picking up pet waste o Increase over last year
4	Load Reduction	Quantification	o Loading o Change	o Copper released from brake pads o Decrease since 1996
		Monitoring (Sampling)	o Loading o Change	o Diazinon loading from lawns o Decrease since 2002
5	Urban Runoff & Discharge Quality	Monitoring (Sampling)	o Benchmark o Loading o Change o Concentration o Change	o Comparison of Cu to Water Quality Objective o Phosphorous loading to MS4 o Increase since 1993 o TSS levels in runoff o Increase since 1995
6	Receiving Water Quality	Monitoring (Sampling)	o Benchmark o Concentration	o Comparison of Zn to Water Quality Standard o Nitrate concentration in Rainbow Creek
		Monitoring (Observation)	o Biological condition o Physical habitat o Biological condition o Physical habitat	o Stream biodiversity o Scouring of Stream bank o Loss of riparian canopy o Erosion of stream bank

- **Tabulation** consists of simple accounting, and can be expressed in both absolute (e.g., the number of people participating in an event) and relative terms (e.g., percent increase in pounds of household hazardous waste collected). Tabulation is an extremely common and useful method for assessing activities at Outcome Levels 1 through 3.

- **Surveying** encompasses a variety of methods (e.g., random-digit-dial phone surveys, intercept surveys in a shopping mall) designed to discern the knowledge, attitudes, awareness, or behaviors of a specific population (residents, schoolchildren, automotive enthusiasts, etc.). Surveys vary greatly in the degree to which they are quantitative and statistically valid. Surveys are applicable for Outcome Levels 2 and 3.

- **Quantification** applies primarily to Outcome Levels 4-6 and refers to efforts to quantify reductions in loading or runoff discharges, or to improvements in environmental quality. Often,

particularly at Outcome Level 4, quantification requires the use of estimates that are based on various untested assumptions. Estimation will remain a highly utilized method until many of these assumptions can be verified or refined.

- **Inspections or Site Visits** include any method utilized to directly observe or assess practices used by a targeted audience. They may be regulatory or conducted as part of an information gathering exercise or educational outreach effort. Inspections may be proactive or reactive. Proactive, or scheduled, inspections are most commonly conducted to assess practices at commercial or industrial facilities, construction sites, and municipal facilities. In addition to each of these source types, reactive, or complaint-initiated, inspections are also conducted at residences in addition to commercial and industrial sites.

- **Reporting** is the receipt of implementation, compliance, or other assessment-related information generated by other parties. This may include discharger reporting or third party audits.

- **Monitoring** is the measurement of environmental or water quality conditions, including changes over time. Monitoring methods apply exclusively at Outcome Levels 4, 5, and 6. Monitoring is accomplished through sampling or through observation. Sampling involves collecting water, sediment, or biota in order to directly measure pollutant levels in the environment. Observation involves visual surveys of habitat condition and the use of remote sensing to assess environmental conditions such as vegetative cover or imperviousness.

E. Effectiveness Assessment Needs and Future Directions

The goals of the CASQA Effectiveness Assessment Subcommittee are to continue developing consensus on general approaches, and to further the development of specific tools that will improve the state-of-the-art in this field. Stormwater program managers need guidance on which assessment methods are effective and how to use them to ensure that useful information will be obtained. To evaluate managers' needs, a survey of CASQA members was conducted. The results of this survey are found in Attachment A.

Survey findings include the following:

- The most common reason stormwater management programs conduct effectiveness assessments is to demonstrate compliance with NPDES permit requirements, but several programs reported using assessment results to plan program activities.

- Although direct measures of effectiveness are included in most current stormwater NPDES permits, indirect measurements are used to a much greater extent by stormwater management programs. In particular, programs are most likely to measure the implementation of program elements rather than the impacts resulting from them.

- Survey results indicate that guidance is needed for all program elements and outcome levels. However, respondents ranked post-construction stormwater runoff, water quality monitoring, and watershed assessment as the program areas with the greatest needs. Results also indicated that specific guidance is needed on methods to measure pollutant load reductions, changes in public knowledge and awareness, stormwater discharge quality, and behavior change and BMP implementation.

As noted, there are certain levels at which evaluation is difficult due to resource limitations or the complexity of the measurement needs. Certain evaluation measures, particularly those associated with monitoring or measurement over long time frames, would benefit from development and research conducted on a regional or statewide level. Identification of these evaluation measures, approaches to developing such measures so they are more widely useful, and identification of funding mechanisms to facilitate their development, may be appropriate tasks for an organization such as CASQA.

Process and methods for conducting integrated assessment need to be established. As noted above, assessment methods at the higher outcome levels (i.e., levels 4-6) may be costly and require longer timeframes. The cost-effectiveness of assessment is a critical factor. Assessment tools that are more costly

than the program or activity being evaluated are not practical. Therefore, efforts to pool resources and to develop low cost tools are needed. It may be possible to identify correlations between effective implementation and water quality improvement. This would allow program managers to use implementation assessments (which are simpler and less costly) as indicators of water quality and environmental improvement. Approaches to more definitively linking stormwater program implementation to resulting environmental improvements may also benefit from a regional or statewide approach making this another potential future task for CASQA.

Future efforts should include the following:

- Development of a guidance document describing the process for identifying effectiveness measures and incorporating these measures into both existing and new stormwater programs. Assessment measures for all outcome levels should be included.

- Identification of cost-effective approaches to assessment measurement. One of the critical roles of assessment measurement is to assist program managers in optimizing their resources when developing successful programs. Clearly, low-cost approaches to effectiveness assessment are needed to accomplish this.

- Development of the tools needed to facilitate water quality assessment. Most stormwater programs are required to directly measure improvements in water quality. However, this type of assessment is conducted to a far lesser extent than implementation assessment, often due to a lack of readily available and understandable methods.

- Creation of opportunities for stormwater programs to pool their resources to develop the tools, data, and information needed to assess program costs effectively. Specifically, statewide efforts should be initiated to develop the methods needed to correlate water quality and environmental assessment with implementation assessments.