Assessment Report on Tetra Tech's Support of California's MS4 Stormwater Program

Produced for:
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California State and Regional Water Quality Control Boards

Produced by:
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Acknowledgments

1.0 Introduction

Tetra Tech, Inc. (Tetra Tech) has supported the California State and Regional Water Quality Control Boards with implementation of the MS4 stormwater program since July 2001 under and EPA Region 9 contract. This support has largely consisted of on-site audits of municipal separate storm sewer system (MS4) programs, along with training and special projects. Tetra Tech has completed 36 MS4 audits in the state that addressed 122 permittees. Special projects have included an evaluation of post-construction development standards, review of a series of stormwater Phase II stormwater management plans (SWMPs), MS4 permit development, and evaluations of stormwater monitoring programs.

Information and data collected during these activities were compiled and disseminated to EPA Region 9, the State Board, and the Regional Water Quality Control Boards through audit reports, progress reports, and presentations to the California Stormwater Quality Association, and telephone conversations with regulatory staff. Prior to this report, Tetra Tech had not performed a holistic analysis of information collected during MS4 audits to identify broader trends, lessons learned, and opportunities for advancing these regulatory programs. This report is intended to do the following:

- Describe MS4 audit procedures
- Discuss special projects completed
- Present an analysis of the MS4 audit findings

The focus of this report is on summarizing the work that Tetra Tech has performed to assist EPA Region 9 and California in assessing the compliance status and quality of MS4 stormwater programs throughout the state. The report also includes a discussion of lessons learned from conducting the MS4 audits and provides some brief recommendations for improvements to California's MS4 stormwater program.

EPA Region 9 has placed copies of the MS4 audit reports on their web site at http://www.epa.gov/region9/water/npdes/ms4audits.html. This web site also includes a link to a series of stormwater case studies that describes how MS4s have implemented specific aspects of the stormwater program.

1.1 Purpose and Goals of an MS4 Audit

MS4 audits are conducted to address several goals. These goals, discussed further below, include determination of compliance status, providing assistance with permit issuance or renewal, developing Phase II stormwater management programs (SWMPs), and assessing pollutants of concern and assigning wasteload allocations.

Determining Compliance Status

The principal goal of an audit is usually to assess the compliance status of a permittee with respect to its NPDES MS4 permit and SWMP. Where

NPDES permits and SWMPs are specific (e.g., inspect construction sites monthly), then determining compliance status is straightforward. When NPDES permits and SWMPs are written more generally (e.g., retrofit flood control BMPs where applicable), then compliance can be more subjective. If previous audits found permittees to be noncompliant, follow-up reviews might be performed to determine whether issues resulting in permit violations areas for program improvement were addressed adequately.

Assisting with Permit Issuance or Renewal

Tetra Tech has performed audits of municipalities in advance of permit renewals to identify areas of the permit that might require further clarification, detail, or refinement. The audits are especially helpful in opening a dialog between permittees and the Regional Water Quality Control Board (Water Board) about the meaning of specific permit language or the intended goal of an individual requirement, for example. On-site program audits also can be helpful after the issuance or renewal of a permit to address implementation questions and clear up potential misunderstandings about the nature and intent of the permit requirements.

Assisting with Phase II SWMP Development

Tetra Tech has performed audits of Phase II MS4 stormwater programs in part as a compliance assistance tool to correct deficiencies in permittees' SWMPs at an early stage of the program. Phase II municipalities are relatively new to the stormwater permitting world and can benefit from the combined knowledge and experience of the auditors, EPA, and Water Board staff, as well as from *lessons learned* from Phase I municipalities who have been implementing the program for more than a decade.

Assessing Pollutants of Concern and Assigning Wasteload Allocations

Where waterbodies have been determined to be impaired for pollutants that are commonly found in urban stormwater, TMDLs are developed and wasteload allocations assigned to dischargers of those pollutants, including MS4 stormwater programs. Therefore, it is helpful to identify and assess the effectiveness of the activities and best management practices (BMPs) of each MS4 stormwater program in the watershed. This assessment can assist the Water Board in assigning wasteload allocations that are appropriate for each stormwater discharger.

1.2 Benefits of an MS4 Audit

In addition to the goals listed above, numerous ancillary benefits are achieved through the audit process, both for the permittee and the Water Board. These include the following benefits:

- Three days discussing the details of the stormwater program foster stronger coordination and improved working relationships between the Water Board and permittees

- In-depth examinations of permit requirements and program elements yield greater understanding by the permittees of expectations and permit requirements

- Audits provide an opportunity to clarify any misunderstandings in the permit requirements or SWMP

- Direct contact with permittee staff yields improved Water Board knowledge of permittees' operations, priorities, constraints, and challenges faced when implementing a municipal stormwater program

1.3 Roles of Tetra Tech, the Water Board, and EPA

For the past 5 years, Tetra Tech has been assisting the state of California and EPA Region 9 with MS4 stormwater audits. These audits have included large cities, small towns, counties, port authorities, and a California Department of Transportation (Caltrans) district program. Audits covered both Phase I programs and a few Phase II programs, as well as new Phase II programs throughout eight of the Water Board regions. Tetra Tech has enjoyed a strong, effective relationship with Water Board, State Water Quality Control Board, and EPA Region 9 staff.

Typically, Water Board staff members select the programs to be audited; however, Tetra Tech has assisted in making this determination when requested. Once the programs are selected, Water Board staff work with Tetra Tech to determine what type of audit is needed and if any program component focus is necessary. Audit logistics are coordinated with MS4 staff by both Water Board staff and Tetra Tech. Often Water Board staff members participate in the audits as well.

Tetra Tech staff generate audit reports. These reports are subject to rigorous internal Tetra Tech quality assurance protocols before being sent to the Water Board and EPA Region 9 for review and comment. Any requested changes are made, and the reports are then submitted to the Water Board for distribution to the MS4s audited.

2.0 Tetra Tech MS4 Stormwater Audit Approach

2.1 MS4 Audit Preparation

Selecting Permittees

Tetra Tech staff work with Water Board contacts to maximize the value to be gained from each audit. For example, auditing one-fourth to one-half of the permittees covered under a single permit can be very useful in determining the *big picture* of the MS4 program. Of course, an audit of a specific MS4 is sometimes necessary to determine individual compliance with a permit.

Determining Audit Focus

Once the Water Board determines which programs are to be audited, the type of audit must be determined. A component-specific audit focuses on a specific stormwater program area, such as construction activities or new and significant redevelopment. This type of audit is especially helpful if the Water Board has specific concerns about implementation of a particular component (i.e., National Pollution Discharge Elimination System [NPDES] inspections of construction sites

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Advance Preparation

- Select permittees
- Identify audit focus
- Organize logistics
- Review documentation
- Hold conference call

To prepare in advance of an audit, Tetra Tech works with RWQCB staff to identify which permittees will be audited and which topics will be covered. Then Tetra Tech organizes logistics with the permittee contacts and obtains and reviews permits, annual reports, SWMPs, and other relevant documents. Tetra Tech then holds a conference call to brief all parties about the purpose and details of the audit and to answer questions about the audit and logistics.

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within the MS4 revealed a high degree of noncompliance with the MS4's construction requirements).

In contrast, a comprehensive audit addresses all the generally accepted primary stormwater program areas (i.e., program management, municipal activities, construction, post-construction, industrial/commercial, illicit discharge detection and elimination, and public education/participation). The intent of a comprehensive audit is to assess the MS4's entire program and possibly identify specific areas or issues that might require a more detailed, component-specific audit in the future.

A third type of audit, which Tetra Tech has not yet performed, is a program compliance screening. This type of audit is composed of a basic interview with the MS4 SWMP coordinator or main contact with the program. A program compliance screening could be an efficient and cost-effective method for getting a basic impression regarding the compliance status of the program. This type of review might be the precursor to an in-depth compliance audit at a later date.

MS4 Audit Logistics

The number of permittees and the type of audit determines the logistics necessary to conduct the audit. Tetra Tech staff typically work with Water Board staff and primary MS4 contacts in setting up the audit dates, developing the schedule, identifying meeting places, and creating the audit teams. Depending on the type of audit and size of the program, one to two auditors are necessary for each permittee being audited. Tetra Tech typically organizes a pre-audit conference call 1 to 2 weeks before the audit and includes the audit teams and all interested contacts at the MS4s. Tetra Tech and the Water Board review the schedule, the audit process is explained, and any questions are answered.

Materials to Review before the Audit

Tetra Tech typically reviews the following information before conducting an on-site audit:

- MS4 permit
- Stormwater Management Plan document
- Latest annual report
- Water Board correspondence with the permittee
- Water Board inspections within the MS4
- Permittee Web sites
- Legal authority (i.e., ordinances, memorandums of understanding)

Conducting the Audit

- Kickoff meeting
- Staff interviews
- Inspector evaluations
- Maintenance yard inspection
- Outbrief

On the first day of the audit, Tetra Tech leads a kickoff meeting, providing an overview of the agenda and facilitating introductions. Tetra Tech then interviews staff regarding specific SWMP activities, accompanies inspectors in the field, and inspects the permittee's primary maintenance yard.

Once the interviews and site visits are complete, Tetra Tech provides a brief overview of the positive program elements and program deficiencies seen during the audit. This allows the permittees to provide feedback and clarification directly and in a timely manner. When multiple permittees are audited during the same week, Tetra Tech holds a joint outbrief so the permittees, Regional Board staff, and EPA staff can hear what the other permittees are doing.

If this information is not available prior to the audit, Tetra Tech staff members obtain it during the audit for consideration and review using the audit process.

MS4 Program Audit Guidance

For the State Board's Water Training Academy, Tetra Tech developed a 2-day course and training manual on *Conducting Audits of Municipal Storm Water Programs*, June 2004. Tetra Tech uses this manual to prepare for and conduct audits in California. The manual was developed to assist state and EPA NPDES permitting authority staff in assessing the compliance and effectiveness of Phase I and Phase II MS4 programs.

2.2 Conducting the MS4 Audit

Depending on the size of the MS4 area, the scope of the SWMP, and the type of audit to be conducted, Tetra Tech requires a maximum of 3 days for a comprehensive, in-depth office and in-field program audit.

Kickoff Meeting and Audit Overview

Tetra Tech auditors prefer to organize a *kickoff* meeting at the start of the audit. The kickoff is typically held separately with each permittee. An audit overview is given and any remaining questions are asked and answered by all parties. The logistics are reviewed and the audit teams are introduced.

Audit Process

Approximately 2 to 4 hours are necessary for an adequate in-depth office audit of each program component. The office audit consists of interviews with essential staff and a review of applicable documents. For example, when auditing the construction component of an MS4 program, Tetra Tech staff reviews ordinances, plan review checklists, any relevant guidance or BMP specifications used, and 3–5 approved and pending erosion and sediment control site plans.

In addition, 4 hours per component (e.g., construction, industrial/commercial) is necessary to audit inspection staff in the field. Tetra Tech staff accompany MS4 inspectors to determine their understanding of the MS4 permit, ordinances, and required stormwater BMPs.

Outbrief

Tetra Tech staff perform an outbrief at the conclusion of each audit to present a tentative summary of findings from the audit. Tetra Tech staff are careful to caveat all findings as preliminary at that time subject to change on the basis of further review of audit materials, permit or SWMP and consideration by Water Board staff.

2.3 MS4 Audit Reporting

Documenting MS4 Audit Findings

After the audit is completed, Tetra Tech staff review all notes and supporting information then write a report summarizing all findings. The findings are divided into three categories: (1) permit violations, (2) deficiencies, and (3) positive or commendable program elements. Permit violations are areas where the audit found the permittee not in compliance with a specific permit requirement or SWMP commitment. Use of the qualifier *potential* is used depending on the severity of the violation.

After an MS4 audit report is developed, the Water Board typically distributes the report to the permittee(s) audited with a cover letter summarizing the findings of the audit and any enforcement action being taken or corrections required.

Using Photographs

Tetra Tech staff sometimes use photos to highlight issues on-site that could lend credence to an issue described in the MS4 audit report or to help recall conditions at the sites visited. For example, stormwater problems at a municipal maintenance yard should be documented with photos to provide additional documentation of problems.

After the Audit

- Prepare the report

- Follow up if needed

- Review and comments

- Distribute final report

Once back in the office, Tetra Tech prepares the report, summarizing key findings and providing examples of model programs where appropriate. If needed, Tetra Tech contacts permittee staff to clarify any ambiguities. The report is then submitted to the RWQCB and EPA for review and comment. A final version is then sent via the RWQCB to the permittees.

3.0 Special Projects

Tetra Tech has conducted a number of special projects for the Water Boards that do not fit in with a typical MS4 audit. A summary of these projects is provided below.

3.1 Los Angeles Construction Inspections

For the Los Angeles Water Board, Tetra Tech conducted a series of 31 NPDES compliance inspections at construction sites primarily in Santa Clarita and Simi Valley. Over half the construction sites were residential development projects, with the average site size approximately 10 acres. Tetra Tech inspectors reviewed the stormwater pollution prevention plans (SWPPPs), inspected BMPs on-site, and documented their inspection findings in an inspection report and photo log.

3.2 Review of Post-Construction Development Standards Implementation

To assist the associated Water Board, Tetra Tech conducted audits to determine the implementation of post-construction development standards in three different permit geographic areas—Los Angeles Region (CAS004001, Board Order No. 01–182), Ventura County Region (CAS004002, Board Order No. 00–108), and the San Diego Region (CAS0108758). The primary goal of each audit was to determine the status of each permittee's implementation of the post-construction controls permit requirements. Secondary goals included collecting program implementation information that could be used by the Water Board to compile a model or *recommended* post-construction program and verifying the plan review process itself, collecting information for permit reissuance, and providing assistance to the permittees in implementation of the post-construction requirements. Each permittee was assessed regarding overall success in meeting post-construction conditions and requirements contained within each permit, with a focus on how each permittee reviewed, approved, and implemented the requirements for individual development projects.

The Los Angeles report summarized the findings from the four permittees audited, described the type of development planning program (or post-construction program) recommended by the Water Board, and described recommendations for conducting future SUSMP program reviews. The Water Board used this report to describe to the other 80+ MS4 permittees in the Los Angeles program not audited what type of development planning program they should implement.

3.3 Review of Phase II SWMPs

In June 2005 Tetra Tech audited two Phase II MS4 SWMPs—the cities of Napa and Petaluma. Each SWMP was audited for compliance with permit conditions and implementation of the six minimum measures:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-Construction Runoff Control
- Pollution Prevention/Good Housekeeping

The goals of the audit were to review the overall effectiveness of the program, identify and document positive elements of the program that could benefit other Phase I and Phase II municipalities, and identify program areas for further review by the Water Board.

Each audit took approximately 2 days and resulted in a report of findings that was divided into program deficiencies with recommendations and positive attributes.

Tetra Tech also reviewed approximately 14 city/county stormwater Phase II SWMPs, and over 50 school district stormwater Phase II SWMPs.

3.4 City of Salinas Phase I MS4 Permit Development

In September of 2003 Tetra Tech developed a draft permit and fact sheet for the city of Salinas to regulate stormwater discharges from the MS4. The draft permit package was written in conjunction with the Central Coast Water Board. The permit and fact sheet included the following 10 components:

- Development of a stormwater management plan
- Development of an annual work plan
- Determination of legal authority
- Construction site management
- Development standards
- Commercial/Industrial facilities
- Municipal maintenance
- Illicit discharge detection and elimination
- Public education and participation
- Assessment of program effectiveness

To facilitate developing the permit and fact sheet, Tetra Tech performed an audit of the city of Salinas to identify program areas that required more detailed requirements and direction.

3.5 Stormwater Monitoring Program Evaluations

Tetra Tech has evaluated the monitoring programs of two MS4 programs in California—the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) and San Diego County. Tetra Tech supported the California Water Boards (San Francisco and San Diego) in their assessment of permit-required monitoring activities, reporting, and continuity in the long-term monitoring plan for these two MS4 programs.

The SCVURPPP assessment and evaluation included detailed review of monitoring plans and reports for consistency and compliance with permit requirements and continuing initiatives, as well as for responsiveness to specific requests and requirements of the Water Board. The purposes of this evaluation were to evaluate the overall monitoring program components and their respective contributions toward satisfying the requirements of the permit (CAS029718 and Board Order No. 01–024 and 01–119) and to evaluate the current implementation status of the multiyear monitoring plan with respect to the overall purposes of the monitoring program: to characterize drainage areas and stormwater discharges; assess existing or potential adverse impacts on beneficial uses; identify potential pollutant sources; and collect data that will assist in the evaluation of the effectiveness of the overall stormwater pollution prevention program. Other goals of this evaluation included reviewing the overall effectiveness of the monitoring program relative to the permit goals and requirements, identifying strengths of the program that could benefit other Phase I and Phase II municipalities, and identifying weaknesses in the program that might prevent satisfaction of permit requirements.

The San Diego monitoring program evaluation was conducted differently in that the following two specific requests were presented to the evaluation audit team:

1. Review the existing monitoring program and proposed changes for comparison with the recommendations included in the Model Monitoring Program for Municipal Separate Storm Sewer Systems in Southern California (Model Monitoring Program, or MMP)

2. If appropriate, identify a suite of recommendations that could improve the proposed monitoring program but were not specifically included in the proposed changes

A report was generated to address these requests and was organized into four sections: (1) brief overview of the MMP, (2) brief overview of the current monitoring program and proposed changes, (3) broad recommendations for the San Diego monitoring program, and (4) detailed analysis of current and proposed monitoring program adherence to the MMP.

3.6 Stormwater Training

Tetra Tech developed three 2-day stormwater training courses for state water quality staff as part of the State Water Training Academy. The courses were intended to instruct the staff on all aspects related to managing, reviewing, auditing and issuing municipal stormwater permits. These courses were developed and taught in the first half of 2004 and covered the following topics:
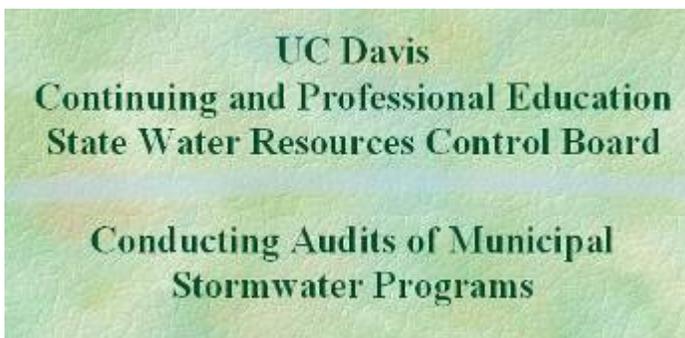
- Reviewing Stormwater Management Plans
- Conducting Audits of Municipal Stormwater Programs
- Municipal Stormwater Permit Writer's Course

Each course was presented by two Tetra Tech stormwater experts, and consisted of a series of modules covering specific program topics, examples, and photographs. Exercises were also included, and ample discussion time was allotted for attendees. In addition to development of the course materials, Tetra Tech also developed an *MS4 Audit Guide* as a reference for the municipal audit course.

4.0 MS4 Audit Analysis

Tetra Tech has audited 84 different MS4 permittees during the past 5 years. These permittees are covered by 23 different permits from eight of the nine Regional Water Boards and one statewide permit issue by the State Board. Most audits were program-wide audits, but some assessed only certain program components. Tetra Tech performed stormwater audits of small municipalities (e.g., Walnut Grove) and of very large urban areas such as Orange County. Several nontraditional MS4s have also been audited such as Caltrans District 5 and the Sonoma County Water Agency.

Table 1: Summary of Phase I MS4 audits performed by Tetra Tech

Permit no.	Permit name or sole permittee	Water Board	Co-permittees	Co-permittees audited[1]	Program management	Municipal activities	Construction	Post-construction	IDDE	Public education participation	Industrial/ commercial
CAS004003	Long Beach	Los Angeles	1	1	●			●	●	●	●	
CAS0029831	Alameda Countywide	San Francisco	17	5	●				●		●
CAS004002	Ventura Countywide	Los Angeles	12	5	●	●	●	●	●	●	●
CA0025038	Santa Rosa	North Coast	3	3	◘	●	●	●	●	●	●
CAS0082597	Sacramento Area	Central Valley	4	4	◘	●	●	●	●	●	●
CAS108758	San Diego Area (County)	San Diego	20	19	●	●	●	●	●	●	●
CAG616001	Lake Tahoe Hydrologic Unit	Lahontan	3	3		●	●	●	●	●	●
CAS0029921	San Mateo Area	San Francisco	21	6	●	●	●	●	●	●	●
Order No. 99-06-DWQ	Caltrans, District 5	Central Coast	1	1	●	●	●			●	
CAS0108758	City of San Diego	San Diego	20	1	●	●	●	●	●	●	●
CA00883399	Bakersfield/Kern County	Central Valley	2	2	●	●	●	●	●	●	●
CAS083470	City of Stockton/ Joaquin County	Central Valley	2	2	●	●	●	●	●	●	●
CA0029912	Contra Costa Clean Water Program	San Francisco	18	7	◘	†	†	†	†		†
CAS0108740	Orange County	San Diego	13	8	●	●	●	●	●	●	●
CA0049981	City of Salinas	Central Coast	1	1	●	●	●	●	●	●	●
CAS029718	Santa Clara	San Francisco	15	2	●	●	●		●		●
CAS083526	City of Modesto	Central Valley	1	1	◘	●	●	●	●		●
CAS6188033	Riverside Area	Santa Ana	14	3	●	●	●	●	●	●	●
CAS618036	San Bernardino	Santa Ana	16	3	●	●	●	●	●	●	●
CA0083313	Contra Costa Clean Water Program	Central Valley	5	3	●	●	●	●	†	†	
CA0083800	Fresno Metropolitan	Central Valley	5	3	●	●	●	●	●	●	●
CAS082597	City of Elk Grove	Central Valley	1	1	●	●	●	●			●

◘ Includes an evaluation of the water quality monitoring program
† Components not audited for each co-permittee
[1] Includes all co-permittees audited by Tetra Tech to date, possibly during multiple audits

4.1 Summary of Positive Findings

In summary, many permittees have found unique and notable ways to implement aspects of their stormwater programs. Even small programs have invested creativity, staff time, and capital into building strong procedures and practices. Some of the key positive elements to highlight include

- Effectively using technology to organize data and schedule day-to-day activities
- Involving multiple stakeholders in stormwater decision making (e.g., interdepartmental, elected officials, members of the public) using stormwater committees
- Developing concise, transparent, enforcement escalation procedures to address stormwater-related violations
- Focusing BMPs and activities to address pollutants of concern that are specific to local water quality problems
- Allocating staff efficiently, either by training staff from other departments to address stormwater concerns as part of their work or by dedicating one or more positions solely to stormwater compliance
- Actively tracking and assessing progress using measurable goals and performance standards

The following are 10 positive findings that have recurred in multiple audit reports. They are not ranked because they had nearly the same frequency of incidence.

Using GIS to track the location of projects, priority facilities, inspections, and illicit discharges

Many permittees are using a geographic information system to geo-locate potential and actual sources of illicit discharges, which allows staff to target resources and educational efforts most effectively.

Using well-organized (often electronic) methods to track and document inspection and enforcement activities

Effective tracking and documentation is not only crucial to developing the annual reports, but is absolutely necessary to effectively follow up on noncompliance activities. Reinspections must be conducted in a timely manner, and enforcement actions must be issued according to an established timeline. These activities are best tracked using a database or time management software. Some MS4s are able to effectively track these activities using hard copy files, but an electronic system typically works best to remind staff of important deadlines. In addition, very effective tracking systems allow staff to geo-locate noncompliant sites using addresses or GIS.

Performing routine dry-weather inspections of outfalls

All permits issued in California do not require that permittees conduct dry-weather inspections; however, the Tetra Tech audit teams feel that they are a valuable illicit discharge detection tool. The appropriate location and necessary frequency of the inspections vary among permittees on the basis of land uses, size of the MS4, *hotspots* for illicit dischargers, or other factors.

Implementing exemplary public education programs

Permittees are required to educate the general public about stormwater issues; however, several MS4s that were audited had implemented exceptional educational efforts. The audit teams

especially recognize those that are based on pollutants of concern, behaviors of concern, are assessed regularly for effectiveness, and carefully consider the method of delivery according to the desired audience.

Using enforcement response plans to respond to illicit discharge reports

Permittees are typically required to *eliminate illicit discharges*, however, few develop an approved enforcement response plan (ERP) to consistently deal with discharge cases. It is critical that permittees have a documented protocol for the receipt of reports, investigation and follow up, and the issuance of enforcement actions. Some MS4s modify existing ERPs, such as those developed for pretreatment violations or code enforcement.

Using stormwater committees to manage various aspects of the stormwater program

This finding describes committees that are composed of representatives from each of the co-permittees or of staff members from various applicable departments within the same MS4. Regardless of whether the permit covers multiple permittees, managing an MS4 stormwater program generally requires the cooperation of many different departments or agencies. Even in small MS4s, the stormwater coordinator will typically communicate with other departments or contractors to implement various programs. A central committee or task force helps to encourage ownership in the program by various departments, facilitate the necessary reporting, assist in the education of the necessary staff people, and establish a responsible party or contact person from each affected department or agency.

Dedicating staff members solely to inspect construction sites or industrial facilities for stormwater compliance

While it is often impossible for some MS4s to dedicate an inspector to stormwater issues, some MS4s have budgeted for this level of staffing. Typically, having staff dedicated to stormwater issues increases the frequency of project and facility inspections, improves the level of follow up for noncompliance, and improves facility compliance because of the heightened level of technical assistance and oversight provided by the inspector.

Targeting stormwater resources and activities to address pollutants of concern

Most MS4s have limited resources to dedicate to stormwater programs; therefore it is critical that funding and staff time are targeted appropriately. The audit team commends MS4 stormwater managers for proactively implementing programs that address specific pollutants of concern (i.e., 303(d) listed pollutants) and the associated behaviors of concern such as how the public handles pet waste. While general stormwater awareness is important (i.e., stormwater is not treated), to make real progress toward measurable stormwater goals, it is important to focus resources on the most important water quality issues.

Using measurable goals or other performance standards to assess the effectiveness of the program and compliance with the permit

All Phase I MS4 programs are required to assess the effectiveness of the SWMP components; however, many permits in California do not specify that official measurable goals be developed and assessed as is required of Phase II MS4s. Some permittees audited, however, have established stormwater management plans with appropriate goals or standards and regularly assess progress toward meeting those goals. These types of goals are essential in assessing the effectiveness of individual program components and the program in general. Being able to

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quantify progress is important not only to the permitting authority, but to the permittee itself to justify budget requests, staffing requirements, and the like.

Using inspectors from other departments to monitor compliance with construction and industrial/commercial stormwater requirements

Often, inspectors from various departments or agencies within an MS4 will visit a construction site or industrial/commercial facility for different reasons. For example, a restaurant will be regularly inspected by the health department for food-related requirements and a pretreatment inspector will inspect the grease trap in the kitchen to determine compliance with source control regulations designed to protect the wastewater treatment plant. It is important that these inspectors be educated about stormwater issues to act as additional *eyes and ears* for the stormwater program during their regular inspections. Or if the MS4 does not have dedicated stormwater inspectors, these existing staff could be used to monitor stormwater compliance at the industrial/commercial facilities they regulate or at additional facilities as necessary. The same concept applies to the various inspectors that visit a site during active construction. Some MS4 programs train grading, right-of-way, electrical, plumbing, or other inspectors in basic erosion and sediment control principals to ensure that stormwater issues are being monitored during all phases of construction.

4.2 Innovative Approaches

Tetra Tech has observed a number of MS4 programs using new or innovative approaches to stormwater management. A few of these innovative approaches are summarized below.

Measuring the Effectiveness of Stormwater Programs

Many stormwater Phase I permittees analyze water quality samples and report the data, but are unable to determine whether their stormwater program is effective in protecting and improving water quality. In order to address the question of how effective MS4 programs are, the San Diego co-permittees formed a program effectiveness assessment workgroup to develop a regional approach to assessing the long-term effectiveness of municipal stormwater programs in San Diego County. The workgroup developed a *Framework for Assessing the Effectiveness of Jurisdictional Urban Runoff Management Programs* (the *Framework*), and a *Baseline Long-Term Effectiveness Assessment*. Both of these documents are available at http://www.projectcleanwater.org/html/wg_assessment.html. The workgroup is also coordinating closely with the California Stormwater Quality Association (CASQA) as it addresses effectiveness assessment on a statewide level.

The *Framework* describes six levels of targeted outcomes that municipalities can use to measure their efforts (illustrated below). The higher levels provide a more direct link to water quality improvements, but are much harder to measure. Municipalities must develop a plan that takes into account all levels of targeted outcomes in order to measure and quantify progress. San Diego's effectiveness assessment reports are a large step forward as municipal stormwater programs attempt to demonstrate how their activities protect water quality.
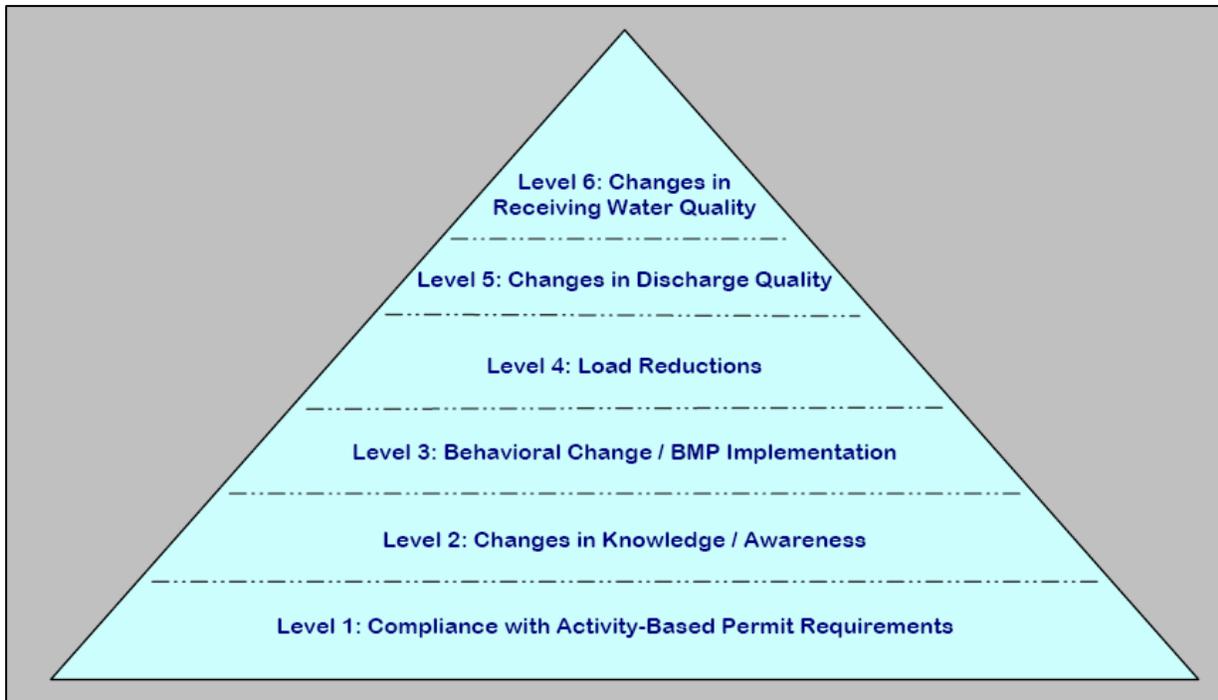
Corporation Yard BMPs

Not every innovation needs to be complicated or expensive. A county in southern California needed to cover a stockpile at their maintenance yard. They found that maintenance staff were not replacing the tarp used to cover the stockpile, so a maintenance supervisor came up with a solution to use a roll-on cover that is typically used on large trucks. Now, maintenance staff can quickly and easily access the stockpile and replace the cover.

Education/Outreach for Construction Operators

Providing clear outreach to construction operators is necessary to ensure they are aware of the local stormwater requirements and what the MS4 expects of them. The City of Coronado developed a simple and graphic brochure was developed for construction site operator. The brochure illustrates the typical construction project within the city and shows what type of BMPs should be installed and where. This gives the operator a clear idea of what the City expects to see at the site in an easy to use format.
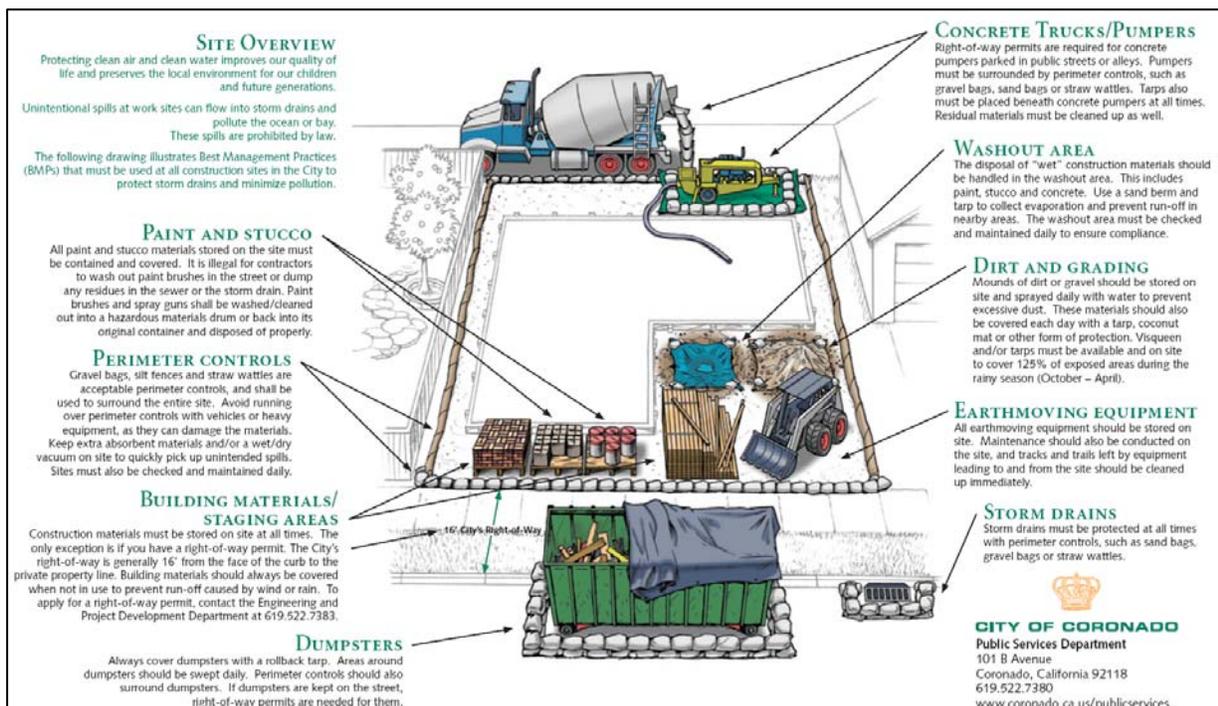
4.3 Summary of Program Deficiencies

For the purposes of this report, program deficiencies, potential permit violations, and permit violations all are considered *deficiencies*. Each Regional Water Board determines which, if any, audit finding constitutes a permit violation; therefore, it is too subjective a term to be categorized in this document. The deficiencies noted have been summarized and ranked according to incidence in the reports reviewed, as summarized in Figure 1.
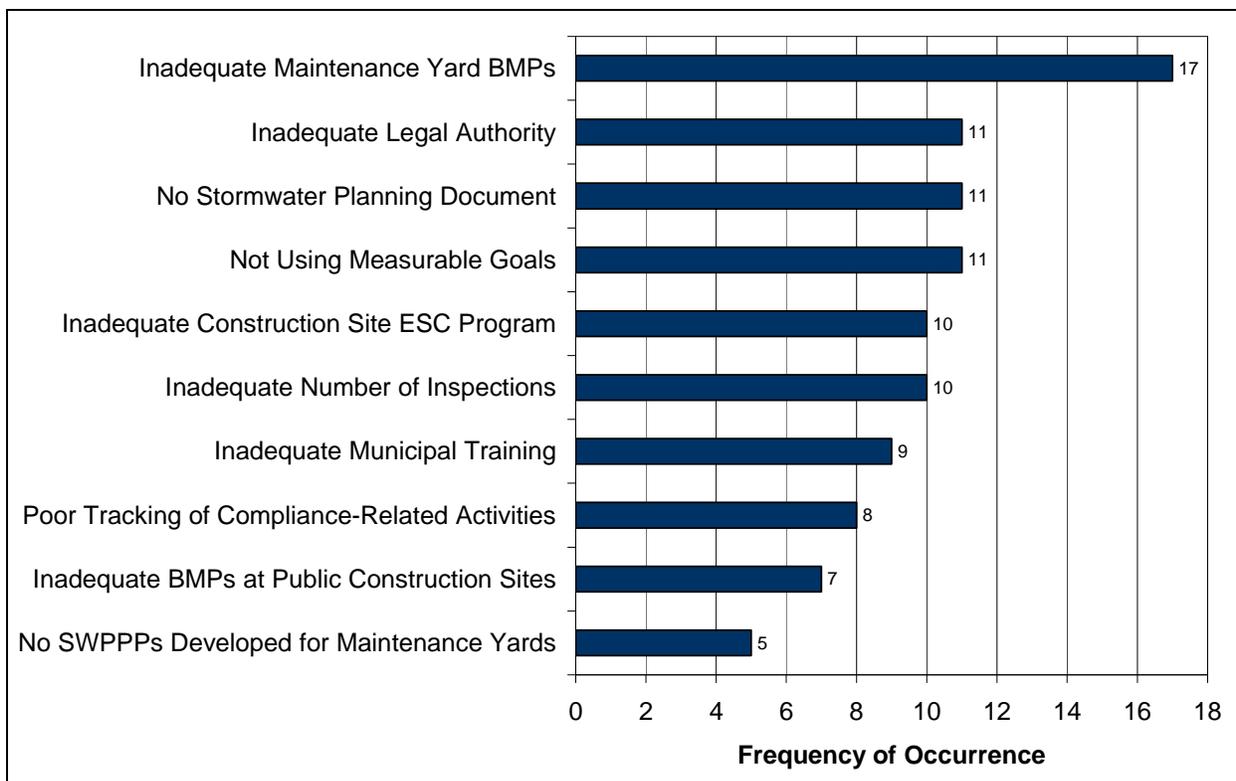
Figure 1. Summary of commonly cited program deficiencies.

Inadequate maintenance yard BMPs

By far the most prevalent program deficiency noted during the audits (17 instances) was the lack of appropriate BMPs at municipally owned and operated facilities, such as corporation or transportation yards. Problems included unprotected storm drains, lack of containment for potentially polluting materials, lack of spill-control measures, and generally poor housekeeping. Often evidence was found of spills that had entered storm drains.

No SWPPPs developed for maintenance yards

Many of the audited permittees had not developed SWPPPs for their corporation yards (5 instances). Typically, these facilities include auto maintenance shops, chemical storage areas, truck-washing facilities, refueling stations, and other facilities and activities that can pose a threat to water quality. Therefore, a plan should be in place that identifies potentially polluting locations and activities, specifies BMPs for each, and outlines spill control and response measures. The SWPPP or similar document should be in place even if the facility is not required to have permit coverage under the industrial stormwater general permit.

No stormwater planning document

Tetra Tech found that several permittees (11 instances) had not developed a stormwater management plan (SWMP) or other document that describes the different activities of the program and includes standard operating procedures and other details. Without a master planning document that lays out current program activities and future goals, it will be difficult for permittees to progress the program in a focused manner. This document also provides a detailed description of the program that state regulators can use to assess compliance, especially if the SWMP is a *living document* that is updated with new program elements and procedures.

Not using measurable goals

One important element that is commonly described in the SWMP but was often lacking in programs audited in California was a clear method for evaluating program effectiveness (11 instances). In many cases, permittees implement their programs and individual BMPs without developing measurable goals, monitoring programs, or other methods to track progress over time. One of the ways in which permittees can show progress is to demonstrate effectiveness, for example, that increased frequency of inspection yielded fewer violations or that field screening results showed fewer *hits* for bacteria the year after a focused effort to eliminate improper connections to the storm drain. Without these measures, permittees cannot know whether their activities are having a positive effect on stormwater quality, nor can they gauge which activities provide the most benefit.

Permittees can also measure program progress by comparing a current year's activities to past years' activities. Tracking and evaluating program data can provide insights into where improvements have been and still need to be made. For example, if after 5 years of program implementation there has been no change in the number or type of violations found at construction sites, a new approach might be needed that focuses on education or that includes increased penalties for noncompliance. If, on the other hand, repeated inspections at a sector of commercial businesses never or rarely yield a violation, the permittee might consider using those resources to target a different business type that is more likely to contribute to stormwater pollution.

Inadequate legal authority

Another common finding (11 instances) is that permittees lack adequate legal authority to implement one or more elements of their program. This could have resulted from a number of factors, including

- Lack of political support from elected officials
- Inability of inspectors to obtain code enforcement capabilities
- Lack of an ordinance that prohibits nonstormwater discharges to the MS4
- The permittee is a nontraditional institution that does not have enforcement authority

Because there are several different causes for this lack of legal authority, each instance would need to be addressed on a case-by-case basis in the context of the permittee's municipal structure, organization, and unique constraints.

Inadequate number of inspections

Many permittees were lax in performing inspections and enforcing their stormwater ordinance (10 instances). These permittees had no or few inspectors dedicated to addressing stormwater concerns, and they did not train inspectors in other departments, such as pretreatment, fire safety, or health department inspectors, to look for stormwater violations.

Inadequate construction site erosion and sediment control program

In some cases (10 instances), inspectors were performing inspections inadequately, using *drive by* inspection techniques that would not identify problems with individual BMPs, whether they be design flaws or poor maintenance. As a result, sites can be *in compliance* even though water quality is not being protected adequately. Better training and more careful oversight of inspectors can help to remedy this quality control situation. It is also important that permittees with multiple inspectors foster consistency in terms of inspection protocols, level of stringency, and types of BMPs that are acceptable. Permittees can team inspectors together from time to time to share knowledge and advice, develop a standardized checklist for all inspectors to use, or develop a BMP standards manual that clearly outlines a permittee's expectations for its inspectors and construction sites.

In addition, several programs had inspectors who were knowledgeable and thorough in their inspection technique but were unable to bring facilities into compliance because they lacked adequate authority to levy fines and other sanctions (see "Inadequate Legal Authority" above).

Inadequate BMPs at public construction sites

Many permittees had separate approval and oversight procedures for private construction projects when compared to procedures for public capital improvement projects. In several cases, this division has led to lax implementation of BMPs at publicly owned construction sites (7 instances). Permittees should hold their own project proponents and contractors to the same standards as private construction operators and developers, not only to maintain compliance with the permit and avoid illicit discharges from public construction sites, but also to set a good example for the regulated community.

Inadequate municipal training

Lack of training for municipal personnel was another common finding (9 instances). Many times when street or parks maintenance crews were observed working in the field, BMPs were either inadequate or absent, and storm drains were unprotected. Permittees either do not offer training to field crews or only provide minimal training that is not reinforced regularly. Stormwater-related training should be offered to all staff involved with spill response, those handling materials that could enter storm drains, and street crews who can spot spills or illicit discharges while they go about their daily routine in the permit area.

Poor tracking of compliance-related activities

Some permittees fail to track their compliance-related activities (8 instances) and, therefore, are unable to demonstrate that such activities were performed, nor can they document the compliance status of industrial facilities or construction sites. Paperwork might be lacking because it is not part of the permittee's protocols, individual inspectors are lax in filling out paperwork or only partially fill it out, or forms are not filed or entered into a database in such a way as to facilitate data retrieval.

A related problem is that the universe of construction sites or industrial and commercial facilities to be inspected is not updated regularly or systematically. Whether permittees track construction activities on the basis of grading permits issued or requests for engineering inspections or other methods, a list of active sites should be maintained at all times. The same is true for industrial and commercial facilities to be inspected—business licenses can be tracked, windshield surveys of commercial areas can be performed, and so on. Having these site and facility inventories allow inspectors to know where to go and how to schedule inspections and budget their time. It also allows permittees to track progress toward achieving one or more measurable goals in terms of the number or percentage of total sites inspected each year.

5.0 Lessons Learned

Over the past 5 years, a number of patterns have emerged from discussions with both state regulators and municipal stormwater permittees. The following is a set of *lessons learned* that can offer opportunities to streamline and improve both NPDES permits and local stormwater management programs.

5.1 MS4 Permit Language Greatly Affects SWMP Development and Compliance

Tetra Tech has found that programs with more specific permit requirements generally result in more comprehensive and progressive stormwater management programs. For example, the more specific permit requirements in the Los Angeles or San Diego MS4 permits require permittees to be more specific in how they implement their stormwater program. Programs with more general stormwater permit requirements, where the emphasis is on implementation of a stormwater management plan, generally did not have as comprehensive a stormwater program.

5.2 Need for Clear Guidance and Direction from the Water Boards

Beyond the NPDES permit requirements, many MS4s do not have clear guidance or direction from the Water Boards on how they should implement specific aspects of their stormwater program. Some municipal programs have developed guidance for specific topics, such as the C.3 new development requirements in Contra Costa County, or the SUSMP requirements in Los Angeles.

One example of where the Water Boards provided more specific direction on an MS4 program area is the November 2003 Development Planning Program Review Report for Los Angeles developed by Tetra Tech and the LA Water Board. The report included a section on a "development planning program recommended by the Water Board." MS4s were told to consider the recommended program as they implement their new development and SUSMP programs.

Providing this additional guidance is particularly effective in areas such as the LA Board where there are too many permittees for the Water Board to audit on a regular basis.

5.3 Communication Provides Many Benefits

Tetra Tech audit staff believe that almost all municipal stormwater programs want to be in compliance and implement effective programs. However, some municipalities stated they did not receive frequent communication and feedback from their Water Board contacts. The MS4 audits conducted with Water Board participation provide an opportunity for permittees and Water Board staff to spend three days together This often leads to a better understanding of the challenges each face in implementing a stormwater management program and regulating MS4 permit programs.

As an unbiased third party, Tetra Tech can interview staff to clarify program details, while at the same time establish a forum for discussion between the state regulators and permittees. This has been beneficial to the State and to the permittees. Many communities have expressed their appreciation of the feedback that Tetra Tech provides with respect to how their activities measure up to the state's expectations. One city engineer wrote,

> I really appreciate the time you spent with us and the feedback and suggestions you were able to provide. As I am sure you can imagine, from a local program standpoint the term "audit" naturally sparks apprehension and curiosity. I believe we all take this program seriously, but having an objective review for the first time gives us an opportunity to benchmark ourselves against the expectations of the RWQCB and outside experts. I can honestly say that your style and approach to the whole process made it a very enjoyable and enlightening experience. As an auditor it would be easy to be critical and judgmental, but instead you use your experience and insight to be helpful and constructive. I can't tell you how welcome that is from our end.

5.4 A Well-Written SWMP Plan is Critical for Compliance

MS4s without a document or plan describing stormwater management program components, implementation mechanisms and responsible parties are more apt to be disjointed, disorganized, and vulnerable to noncompliance, especially if staff turnover is high. Permits should include a requirement that a single planning document or a series of component-specific documents be developed that describe implementation procedures, BMPs, schedules, responsibilities, and goals. This SWMP Plan would also allow state regulators to assess a permittee's procedures through document review in lieu of, or in addition to, site visits.

5.5 Measurable Goals Should Be Outcome-Based

Permittees should be required to develop measurable goals based on the desired outcomes of the stormwater program. These goals should be developed on the basis of the pollutant of concern, sources of the pollutant, behaviors associated with the sources, and the indicator most appropriate to demonstrate a change in those behaviors. For example

Pollutant of concern	Sediment
Source	Erosion from construction sites

Behavior	Construction site operators install and maintain BMPs poorly
Goal	Increase the number of operators who are aware of, understand, and comply with the erosion control regulations and plans
Indicators	(1) percent of contractors in the city who have attended a training (to increase as the program progresses); (2) percent of operators who repeatedly violate regulations (to decrease as the program progresses)

5.6 Annual Reports are not Effective Indicators of Program Compliance

Largely due to the lack of specificity in annual reporting requirements, Tetra Tech has found that the annual reports submitted by Phase I MS4s are not always effective indicators of program compliance. Although annual reports are useful to review before an MS4 audit and should be used to spot compliance "red flags," they are usually inadequate determine compliance by themselves. This is because, without specific reporting requirements, municipalities are reluctant to voluntarily report non-compliance.

6.0 Recommendations for Improvements to California's MS4 Stormwater Program

The following brief recommendations, based on Tetra Tech's past experience in the state, are made to help improve the effectiveness of California's MS4 stormwater program:

6.1 Continue MS4 Audits and Conduct Targeted MS4 Audits of Specific Program Components

Some MS4s have not been audited yet. These MS4s could be prioritized for audits, along with MS4s for which the Water Boards will soon be reissuing their NPDES MS4 permit. In cases where the Water Board staff is familiar with the program, the audit could be brief and cover only what has changed since the last permit issuance.

Additionally, the Water Boards could conduct targeted MS4 audits of specific program areas. Tetra Tech has already conducted targeted MS4 audits of the new development, or SUSMP, programs in Los Angeles, Ventura, and San Diego Counties. Additional targeted MS4 audits could be conducted focusing on the illicit discharge, municipal maintenance, or construction components of a permittee's SWMP. Water Boards could select the MS4s and program components to audit based on watershed specific issues, pollutants of concern, TMDLs, or other factors. In addition to determining compliance, the findings from these targeted MS4 audits can also be used to develop guidance from the Water Board on these program components.

6.2 Develop Compliance Tools for Regulators and MS4s

A number of compliance tools should be developed to help MS4s implement the program and help Water Board staff ensure compliance. For example, Tetra Tech has developed an *MS4 Audit Guide* for the state and is currently expanding and revising this guide for U.S. EPA. The *MS4 Audit Guide* will help Water Board staff in conducting MS4 audits, but it also helps MS4 programs conduct a self-assessment to ensure they are complying with their permit requirements.

Additional tools could include a BMP selection guide MS4s would need to use to ensure they were in compliance with the MEP standard. The guide would also be used by Water Board staff to evaluate the adequacy and effectiveness of BMP programs and determine compliance with permit requirements. The guide could include:

- Minimum requirements for BMP siting, sizing and design standards, and operation and maintenance specifications,
- Assessment tools, methods to measure effectiveness, an surveillance and monitoring requirements for each BMP that must be implemented by the permittee to demonstrate compliance, and
- Minimum recording and reporting requirements.

6.3 Develop a Consistent Format for MS4 Permit Language

Presently, the State develops permits on a regional basis, and the level of specificity and individual requirements vary widely. Some permits detail individual BMPs that should be implemented for each program area and include guidance on how and to what extent they should be implemented. This specificity can assist the permittees in knowing how best to meet permit requirements and reduces ambiguity. However, this can result in municipalities implementing substantially similar programs but with significantly different details and requirements.

One factor for the state to consider when writing permit language is to be clear enough to set appropriate standards and establish required outcomes, but still allow permittees to be creative and innovate solutions to stormwater management that are appropriate for their situations. The audits of the past 5 years have shown that each permittee approaches implementation from its own unique perspective and with unique attributes and constraints that sometimes facilitate and other times confound implementation. The *one size fits all* mantra does not apply to MS4 stormwater programs because the ways in which they are implemented depend on each permittee's organizational structure, staff availability, and budget, along with legal constraints and more- or less-favorable political climates. Each MS4 may develop and work toward different measurable goals, but still be able to achieve the required outcome.

However, a consistent format to the MS4 permit and the basic requirements in the permit will provide some statewide consistency to the stormwater program and allow programs to share resources more easily. This consistent format will also require MS4s to be on more of a level playing field as they implement their programs.

6.4 Provide Guidance on Annual Reporting

Often annual reports are the only official communication from year to year between the permittee and the state, so it is important that the report be informative and relevant. Many times

permittees tend to send too much information, and, as a result, state regulators receive huge binders full of hard copy forms and outreach materials that do not provide useful information to assess compliance. Because of the time involved in preparing such large documents, less time could be spent preparing summary information and compiling data that would be useful to assess compliance.

To remedy this, the state could develop a set of guidelines that clearly describe the information they would like included in the report. For example, the following program information is necessary when assessing construction inspection programs:

- Number of active construction sites a permittee needs to inspect
- Number of staff are performing inspections
- Frequency of inspections
- Total number of inspections performed
- Number of violations found and follow-up actions performed

This information allows state regulators to determine if staffing levels are adequate, if inspections are being performed, and if enforcement activities are occurring. Other information, such as a list of "bad actor" operators with violation frequency and other summarized tracking data maintained by the permittee, could be helpful to provide a clearer picture of the permittee's procedures. Submission of materials such as individual forms or notices of violation would be burdensome for both the permittee and the reviewer and should be discouraged in the guidelines. The information included in the annual report should clearly demonstrate progress towards reaching measurable goals, and therefore may vary by permittee.

6.5 Provide Guidance on Developing Measurable Goals

The state should include guidance on how permittees can develop measurable goals and performance standards so they can track their own progress and share this information as part of the annual report. Permittees will need to tailor their measurable goals to their specific pollutant sources, behaviors, activities, and protocols; therefore, the state should provide examples of the types of quantifiable goals they would consider acceptable in different kinds of situations. For example, the state might want to know how effectively the permittee has been advertising household hazardous waste collection events. The permittee could track attendance at the event from year to year and, if their methods are effective, expect to see a steady increase in first-time attendees (10 percent, for example) over time. Permittees have in the past described measurable goals in non-numeric terms, such as "track the number of first-time attendees at events," but it is important that there be a numeric target or rate of change incorporated into each goal. This is particularly important for Phase II MS4s under the general permit.

EPA has issued guidance on developing measurable goals that could be referenced by the Water Boards or serve as the starting point for a new guidance (see http://cfpub.epa.gov/npdes/stormwater/measurablegoals/index.cfm).

Appendix A. MS4 Audits Conducted by Tetra Tech in California, July 2001 – July 2006

Location	MS4 Audited	Date of Audit
Alameda	Cities of Dublin, Fremont, Hayward, Livermore, and Oakland	November, 2001
American Canyon	City of American Canyon	June, 2005
Bakersfield	City of Bakersfield and Kern County	November, 2002
Caltrans	District 5	July, 2002
Contra Costa	Cities of Antioch, Brentwood, and Oakley	March, 2005
Contra Costa	Cities of Concord, Pinole, Pittsburg, Richmond, and San Pablo	September, 2004
Contra Costa	Cities of Hercules and Pittsburg, Walnut Creek, and Concord, Contra Costa County, and Contra Costa Clean Water Program	May, 2003
Elk Grove	City of Elk Grove	April, 2005
Fresno	Cities of Fresno and Clovis, and the Fresno Metropolitan Flood Control District	January, 2005
Lake Tahoe	City of South Lake Tahoe, El Dorado County and Placer County	June, 2002
Long Beach	City of Long Beach	August, 2001
Los Angeles	LA County and Cities of Glendale, Los Angeles, and Santa Monica. Review of Standard Urban Stormwater Mitigation Plan (SUSMP) requirements.	March, 2003
Los Angeles	Cities of Calabasas, Carson, Glendora, Pomona and Santa Clarita. Review of city's construction program	June, 2004
Modesto	City of Modesto	February, 2004
Napa	City of Napa	June, 2005
Orange County	Cities of Laguna Beach, Laguna Hills, Lake Forest, Rancho Santa Margarita	May, 2005
Orange County	Orange County and Cities of Mission Viejo, San Clemente, and San Juan Capistrano	June, 2003
Petaluma	City of Petaluma	June, 2005
Riverside	Cities of Corona, Moreno Valley and Riverside	May, 2004
Sacramento	County of Sacramento and the Cities of Folsom, Galt, and Sacramento	March, 2002
Salinas	City of Salinas	July, 2003
San Bernardino	Cities of Fontana and Redlands and San Bernardino County	October, 2004
Santa Clara	Cities of Milpitas, Palo Alto, Santa Clara, and Santa Clara County	April, 2005

Location	MS4 Audited	Date of Audit
Santa Clara	City of San Jose and County of Santa Clara	December, 2003
San Diego	Cities of Carlsbad, Chula Vista, and El Cajon	May, 2002
San Diego	Cities of Encinitas, Lemon Grove, Poway, and Santee	April, 2004
San Diego	Cities of Escondido, National City, Oceanside	February, 2003
San Diego	Cities of Imperial Beach, La Mesa, San Marcos, and Vista	October, 2003
San Diego	City of San Diego, County of San Diego	October, 2002
San Diego SUSMP	Cities of San Diego, Carlsbad, Lemon Grove, Chula Vista, Oceanside, National City, Poway, El Cajon, Escondido and San Diego County. Review of Standard Urban Stormwater Management Plans (SUSMPs)	March, 2005
San Diego	Cities of Solana Beach, Coronado, and Del Mar and Port of San Diego	November, 2004
San Mateo	County of San Mateo and Cities of South San Francisco, Foster City, Pacifica, Redwood City, and San Mateo	August, 2002
Santa Rosa	City of Santa Rosa, Sonoma County, and the Sonoma County Water Agency	March, 2002
Stockton	City of Stockton and San Joaquin County	December, 2002
Ventura	Ventura County Flood Control District and the Cities of Ojai, Oxnard, Santa Paula, and Simi Valley	October, 2001
Ventura SQUIMP	Cities of Fillmore, Moorpark, Port Hueneme, Ojai, Oxnard, Santa Paula, Simi Valley, the County of Ventura, and the Ventura County Watershed Protection District. Review of Stormwater Quality Urban Impact Mitigation Plan (SQUIMP) requirements	August, 2004