

Prioritizing POCs as the Key to MEP in Urban Watersheds

by

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ABSTRACT

Urban runoff (“stormwater”) discharges are widely known to be significant potential sources of pollutants in urbanized watersheds. Stormwater management agencies are required by the federal Clean Water Act to reduce discharges of pollutants in urban runoff “to the maximum extent practicable”. This fundamental requirement, commonly referred to as “MEP”, drives the planning and design of most municipal stormwater management programs. However, with the broad suite of contaminants commonly found in urban runoff discharges, stormwater managers find it a daunting task to define the meaning of MEP, much less achieve it. Identifying and prioritizing pollutants of concern (POCs) is an effective means of focusing pollution control efforts in urban watersheds, and of working effectively towards implementation of the MEP standard.

Several municipal entities in the Sacramento, California urban area (the County of Sacramento and the Cities of Sacramento, Citrus Heights, Elk Grove, Folsom and Galt) are jointly responsible for stormwater management under the terms of the Sacramento Municipal NPDES Stormwater Permit. These Co-Permittees have designed a comprehensive process of identifying and prioritizing stormwater POCs for the Sacramento urban area. This is part of a comprehensive, multi-stage process designed to ensure that public investment in urban runoff pollution control is applied efficiently and effectively. The process includes the following major stages:

- Identifying and prioritizing POCs
- Identifying significant sources of high-priority POCs
- Identifying effective controls for the significant POC sources
- Integrating implementation of identified controls within the stormwater management program for the urban watershed

The process involves compiling and analyzing a broad range of information on potential POCs, including: local urban runoff discharge monitoring data, receiving water quality data, toxicity study results, causes of impairment cited in CWA Section 303(d) listings for local receiving waters, results from studies showing potential impacts to beneficial uses of local receiving waters, and other public or regulatory issues of concern within the watershed. This POC process is most effective when an extensive array of monitoring and related data are available for evaluation.

A key aspect of this process is the integration of the results of various monitoring programs within the Sacramento area with the information needs of the urban stormwater management program.

The ultimate goal of the process is to develop and implement a POC Reduction Program that will effectively reduce discharges of urban runoff pollutants to the MEP.

INTRODUCTION

Since 1990, the County of Sacramento and the Cities of Sacramento, Folsom and Galt (later joined by the Cities of Citrus Heights and Elk Grove), have been jointly responsible for stormwater management in the Sacramento urban area, under the terms of the Sacramento Municipal NPDES Stormwater Permit. As a key focus of their stormwater management efforts, these Co-Permittees have designed a comprehensive process to reduce discharges of urban runoff pollutants from the Sacramento urban area to the maximum extent practicable. This paper describes the process of identifying and prioritizing pollutants of concern (POCs), within the context of the Sacramento Pollutant Reduction Program.

The POC process outlined herein is described in greater detail in several documents produced for the Sacramento Stormwater Monitoring Program. While this POC reduction process is oriented particularly towards municipal stormwater NPDES permit-holders, the approach could be adapted to a wide range of point and non-point sources.

Defining POCs

In this paper, a “pollutant” is generically defined as any constituent that may cause harm when released into the environment in sufficient quantities. As used in this paper, the term “pollutants of concern” refers to pollutants that have both been identified as constituents in Sacramento area urban runoff, and also have been associated with either a measured exceedance of an in-stream water quality standard or some observable level of environmental impact within the Sacramento region. The Sacramento Stormwater Permittees, who have been working on the issue of identifying and controlling stormwater pollutants since the late 1980’s, formerly referred to “Constituents of Concern” (COCs), and currently use the term “Target Pollutants”. This paper substitutes the more generally-recognized term, POCs.

Purpose: Meeting MEP, Improving Cost-effectiveness

The essential purpose of the POC Reduction Program is to help the Permittees fulfill the most fundamental requirement of the Sacramento NPDES Stormwater Discharge permit: to reduce pollutant discharges to the maximum extent practicable (MEP). Functionally defined in municipal stormwater programs, MEP typically involves 1) developing a stormwater management program based on the best available information, and 2) implementing that program. Because it targets specific key pollutants, and specific sources of those pollutants, the POC Reduction Program has the potential to significantly improve the overall effectiveness of the stormwater management program in reducing pollutant discharges to the MEP.

As developed within the Sacramento Comprehensive Stormwater Management Program (CSMP), the POC Reduction Program is intended to be based on POC source identification and control measure identification work specific to the Sacramento urban area. These area-specific investigations then constitute the best available information for the continued development of the CSMP. A key goal of the POC Reduction Program is to improve the cost-effectiveness of the CSMP, by implementing controls for specific pollutant sources within the Sacramento permitted area.

Overview of Process

The POC Reduction Process involves the following major steps:

- 1) Identifying and prioritizing pollutants of concern
- 2) Identifying significant sources of high-priority POCs
- 3) Identifying effective controls for the significant POC sources
- 4) Integrating implementation of identified controls within the stormwater management program

POLLUTANT IDENTIFICATION AND PRIORITIZATION

Step-by-step instructions on how to conduct the POC (Target Pollutant) Identification and Prioritization Procedure were developed by Larry Walker Associates for the Sacramento Stormwater Monitoring Program. The prioritization procedure consists of four main tasks: data preparation, potential target pollutant identification, scoring of constituents identified as potential target pollutants, and ranking of scored constituents. This procedure ultimately produces a list of ranked pollutants that can be further analyzed based on the specific needs of the Sacramento Stormwater Monitoring Program.

The four main tasks of the POC Identification and Prioritization Procedure can be summarized as follows:

1) Data Preparation

- a. Compile, organize and evaluate water quality data for urban runoff and local receiving waters. Summarize this information in a consistent format. Input water quality data into spreadsheet to generate summary statistics.
- b. Summarize information on local CWA Section 303(d)-listed water bodies.
- c. Summarize local toxicity study results, especially toxicity identification evaluation (TIE) data.
- d. Gather local aquatic tissue bioaccumulation data for eventual tabulation once prioritization effort proceeds to Step 3 – Potential Target Pollutant Scoring.

2) Potential POC Identification, Assessment

- a. Identify potential POCs using information compiled from the above-listed sources.
- b. Determine if constituents should be advanced to the scoring/ranking matrix, or alternatively, be listed as a constituent to be considered for additional monitoring.

3) POC Scoring

Score POCs using information compiled from the above-listed sources, according to the score-weighting system developed by Permittees.

4) POC Ranking

Rank POCs according to the weighted scores

Initial Constituent List

The list of constituents under consideration is generated initially from a review of all local urban runoff and receiving water data, and includes all pollutants detected previously, plus any other constituents of concern to the Permittees. The initial constituent list can be amended with additional constituents at such time as deemed appropriate by the Permittees.

Assessment Questions

For each listed constituent, the following six questions are posed:

- **Has the constituent been detected in local urban runoff?**
- **Is the constituent listed as a source of impairment on local Section 303(d) listings?**
- **Has the constituent been demonstrated to cause acute or chronic toxicity in urban runoff or receiving waters?**

- **Does the constituent have the potential to cause or contribute to the exceedance of standards in receiving waters?** This question is addressed by analyzing the measured concentrations of each pollutant in urban runoff and receiving waters in comparison with the prevailing receiving water quality objectives.
- **Has the constituent been demonstrated or implicated to cause or contribute to the impairment of beneficial uses in the permitted area or downstream, including the Sacramento-San Joaquin Delta?** The question should be answered by taking into consideration the following types of beneficial use impairments:
 - a) Demonstrated impacts to aquatic populations (e.g., fish kills) within the area covered by the NPDES stormwater permit;
 - b) Evidence that fish caught within the permitted area are unsuitable for consumption (fish advisories);
 - c) Demonstrated impacts to spawning, reproduction, and/or early development of fish;
 - d) Evidence that levels of the constituent have contributed to additional water treatment levels or health risks associated with area drinking water supplies; and
 - e) Evidence that contact recreation has been affected by surface water microbiological contamination (e.g., beach closures).

Note that the above question requires direct evidence of impacts to the beneficial uses specified in the Basin Plan (the five examples listed above are a subset of a larger list of beneficial uses described in the Basin Plan). Also note that indirect evidence of beneficial use impacts, such as exceedances of water quality criteria, toxicity study results using lab test organisms, and CWA Section 303(d) listings, are already covered by other assessment questions.

- **Has the constituent been identified as a significant public, regulatory or Permittee concern that has yet to be adequately or completely addressed by draft or adopted federal, State or local water quality criteria or regulations?** This question should be answered by taking into consideration public, regulatory or Permittee concerns that have been documented via publication in a newspaper, magazine, newsletter, journal, or other public document. This question is meant to take into account evidence regarding a particular constituent that has not already been considered in the answering of the previous questions.

Advancement to Scoring/Ranking Matrix

Evaluation of the answers to the preceding six questions will determine if a constituent should be prioritized (scored and ranked), identified as a constituent requiring additional monitoring (placed on the “Consider for Additional Monitoring” list), or dismissed from consideration in the prioritization process. The following criteria should be used to determine the disposition of each listed constituent:

A. “NO” (Dismiss from further consideration):

If a constituent possesses no “YES” answers or a single “YES” answer and five “no” answers to the six questions, then the constituent need not be scored/ranked.

B. “CAM” (Consider for Additional Monitoring):

If a constituent possesses a single “YES” answer and at least one “unknown” answer to the six questions, then the constituent should be placed on a list of constituents to be considered for additional monitoring (CAM). This list also allows the Permittees to note the reason(s) why a constituent should be considered for additional monitoring.

Additionally, a constituent can possess a single “YES” answer and five “no” answers in the matrix, and still receive a “CAM” answer in Column H when the following scenario occurs: A constituent possesses a single “YES” answer among Columns C through G, but the constituent has not been detected in Sacramento urban runoff (i.e., Column B possesses a “no” answer). A “CAM” answer in Column H under this scenario would allow the Permittees to collect Sacramento urban runoff data for a particular constituent to determine if the constituent is even present in urban runoff.

C. “YES” (Advance to Scoring/Ranking):

If a constituent possesses two or more “YES” answers to the six questions, then the constituent should be advanced to the Potential Target Pollutant Scoring/Ranking Matrix.

Note that the Permittees can choose to dismiss, perform additional monitoring, or advance to scoring/ranking any particular constituent at their own discretion. Any such decision should be documented as part of the prioritization process.

Scoring/Ranking

As a means of determining the relative significance of the potential target pollutants identified in the above procedure, a scoring/ranking scheme was developed. The Target Pollutant Scoring/Ranking Matrix includes eight questions for which a raw score is assigned, based on the available data, and automatically assigns a weighted score based on the relative importance of each question as determined by the Permittees. Finally, a “Composite Score” is automatically calculated for each constituent, and the POCs are ranked in descending order. The year 2000 updated Sacramento POC (Target Pollutant) list is shown as Table 1.

SOURCE ID/CONTROL MEASURE ID

Once the POCs have been scored and ranked, the next steps in the Pollutant Reduction Process involve the identification and prioritization of the sources of the top-ranked POCs, and the identification of applicable controls for the most significant sources of those POCs. To date, extensive work on identification of POC sources and controls has been done by the Sacramento Permittees for diazinon, coliform bacteria (as indicators of human pathogens), copper, and lead.

The extent of controllability of any POC is dependent upon the availability of control methods or practices that could be practicably and cost-effectively implemented for the particular POC in Sacramento urban runoff. Controllability must be considered by the Permittees in the process of selecting controls for particular POC sources. The issue of controllability should include consideration of the following topics:

- What is the urban runoff contribution to problems identified in receiving waters relative to other sources (for constituents with available data)?
- What pollutant sources contribute to urban runoff, but are potentially controlled through other regulatory efforts (e.g., wet and dry air deposition)?
- What is the availability, applicability, cost, and performance of specific BMPs under conditions similar to those found in local urban runoff?

INTEGRATION WITH THE STORMWATER MANAGEMENT PROGRAM

To be useful, the development of the POC Reduction Program must involve integration with existing and planned stormwater management activities. Stormwater program managers must ask the following questions:

- In a practical sense, how can stormwater permit-holders best make use of the POC Source ID and Control Measure ID information?
- How can emerging POC information be used to modify or add to the implementation of existing management programs?

The results of the POC Reduction Program should be integrated into the stormwater management program, through the identification and implementation of control measures designed to reduce discharges of specific sources of priority POCs. Integration with other, related programs, such as municipal recycling or hazardous waste management programs, also should be considered. This requires the coordinated efforts of the various Stormwater Co-Permittee agencies, as well as the cooperation of other, non-stormwater agencies.

Once the POC Reduction Program is in place, these questions should be addressed annually, as part of an annual integration effort, and coordinated with an annual review and update of POC information. The annual integration/update should include a means for cross-referencing and integrating new monitoring data, POC source information, and control measure effectiveness information with other previous work on POCs. Provision also should be made to address sources or control measures that do not neatly fit into existing management program elements.

Generally, the most practical use of the POC program information is likely to be in the context of existing stormwater management program activities. For each POC, the sources and control measures identified in the POC Reduction Program should be used by stormwater program managers to select BMPs for implementation or emphasis. Where necessary to address major POC sources, new control measures or BMPs could be added to existing programs, based on the results of the POC Source ID and Control Measure ID work.

Pollutant Reduction Goals

Perhaps the most difficult task relating to the implementation of the POC Reduction Program involves defining pollutant reduction goals. Current technical knowledge of pollutant removal effectiveness is lacking for many stormwater controls. Because it is not yet known what pollutant reductions are feasible due to implementation of various combinations of controls, setting numerical pollutant discharge goals is problematic. This has implications for TMDLs, whereby stormwater agencies may be required to implement specific reductions in pollutant loadings. There is currently great uncertainty regarding the feasibility of achieving specific load reductions for urban runoff discharges.

As progress is made in our understanding of the relative magnitudes of the sources of POCs, and as we gain knowledge of the pollutant reduction effectiveness of specific controls, stormwater modeling work may provide useful analytical tools to project reasonable numerical pollutant reduction goals.

Table 1.

**Sacramento Stormwater Monitoring Program
Target Pollutant Prioritization, 2000**

Rank	Constituent	Composite Ranking Value
1	Diazinon	67.9
2	Chlorpyrifos	59.8
3	Mercury, Total	43.1
4	Carbon, Total Organic	16.5
5	Carbon, Dissolved Organic	14.2
6	Copper, Dissolved	14.0
7	Zinc, Dissolved	10.7
8	Coliform, Fecal	10.3
9	Coliform, Total	10.2
10	Solids, Total Dissolved	5.8
11	Lead, Dissolved	5.2
12	Bis2(ethylhexyl)phthalate	5.1
13	Cadmium, Dissolved	3.1
14	Solids, Total Suspended (surrogate for sediment)	3.0
15	Pentachlorophenol	2.2
16	Benzo(b)fluoranthene	1.4
17	Chrysene	1.1
18	Methyl Tertiary Butyl Ether	1.0
19	Trash	1.0
20	Malathion	0.8
21	Simazine	0.8
22	Benzo(k)fluoranthene	0.6
23	Iron, Dissolved	0.4
24	2,4-Dinitrotoluene	0.3
25	Benzo(a)anthracene	0.3

Author Notes:

This work represents the efforts of many individuals over a period of over ten years, including notably the listed authors of this paper. Principal author Armand Ruby, a senior Associate with Larry Walker Associates of Davis, California, has been professionally active in the water quality field for 24 years, and has served as a consultant for the Sacramento Stormwater Monitoring Program since 1992.