Stormwater Runoff Water Quality Newsletter
Devoted to Urban/Rural Stormwater Runoff
Water Quality Management Issues
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Editor: Anne Jones-Lee, PhD
Contributor to This Issue:
G. Fred Lee, PhD, PE, BCEE

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This issue of the Newsletter is devoted to a review of issues pertinent to application of water quality criteria/standards to urban and highway stormwater runoff. It was prompted by environmental groups' again filing suit to try to get the courts to require that federal and state regulatory agencies apply water quality standards to regulating urban and highway stormwater runoff.

Regulating Water Quality Impacts of Urban and Highway Stormwater Runoff

In early March 2008 the Los Angeles *Times* and the Santa Monica *Daily Press* carried articles on law suits that have been filed by the National Resources Defense Council (NRDC) and other environmental groups against Los Angeles County and the city of Malibu (Weiss, 2008; Daily Press Staff, 2008). According to those reports, concentrations of fecal bacteria, heavy metals, and other pollutants associated with stormwater runoff from Los Angeles and Santa Monica exceed water quality criteria/standards. It appears that the law suit is designed to compel Los Angeles County and the city of Malibu to manage urban stormwater runoff to prevent violations of water quality standards in coastal waters that receive the runoff.

While not involved in that litigation, the authors have been involved in the investigation, assessment, and management of, and in publishing on, water quality impacts of stormwater runoff for more than 40 years. The senior author has spent much of his five-decades-long professional career involved in various aspects of the development, peer-review, application, and site-specific adjustment of water quality criteria and standards both nationally and in numerous states, for the protection of water quality/beneficial uses. This report highlights key technical aspects of regulating water quality impacts from stormwater runoff from urban areas and highways, with particular reference to compliance with water quality standards. It also has applicability to nonpoint source runoff/discharges, such as those from irrigated agriculture. These issues, and recommended approaches for developing appropriate water quality standards for urban and highway stormwater runoff are discussed in greater depth by Lee and Jones-Lee (2000a, 2004, 2005), as well as in numerous other publications, reports, and presentations posted on their website (www.gfredlee.com) in the "Surface Water Quality" section, "Urban Stormwater Runoff" subsection (http://gfredlee.com/pswqual2.htm#runoff). For the past decade the authors have also published an approximately monthly, email-based, "Stormwater Runoff Water Quality Newsletter" that addresses current topics related to the sources, significance, fate, and control of contaminants in urban, rural, and agricultural stormwater runoff. Past issues of those newsletters are archived on their website at http://www.gfredlee.com/newsindex.htm; issues are identified by topics covered at http://www.gfredlee.com/swnews_indexa.pdf.

Water Quality Criteria/Standards for Stormwater Runoff

One of the problems faced by stormwater quality managers and regulatory agencies is the application of numeric worst-case-based water quality criteria and standards to situations beyond those for which they have technically reliable applicability. In 1972, the US Congress mandated that the US EPA develop national water quality criteria that would be protective of the beneficial uses of the Nation's waters. That requirement led to worst-case-based water quality criteria that presume that the all forms of a contaminant to which organisms are exposed are toxic or available to adversely affect beneficial uses of the water, and that organisms receive chronic (long-term or critical life-stage) exposure to the available forms of the contaminants. The use of enforceable standards equivalent to those criteria ignores the fact that most chemicals that are potential pollutants exist in aquatic systems in a variety of chemical forms, only some of which are toxic/available to adversely impact water quality. Further, they do not give adequate consideration to the fact that organisms do not necessarily receive long-term or critical life-stage exposures to contaminants in ambient waters.

US EPA water quality criteria and numeric standards based on them were not developed for the conditions typically encountered with urban and highway stormwater runoff. Those criteria and standards were developed for aquatic life protection under conditions more typical of a continuous discharge of largely available/toxic forms of contaminants (such as from a domestic wastewater treatment facility (POTW)) and that result in longer term (chronic) exposure scenarios for aquatic organisms. Chemical contaminants in urban and highway runoff, by contrast, are typically in largely unavailable, nontoxic forms; organisms in receiving waters generally receive short-term, episodic exposure to those discharges.

Nevertheless, since the late 1980s, the US EPA has incorporated into NPDES permits for discharges to surface waters (including larger (MS-4) stormwater runoff discharges), the prohibition from violating water quality standards at the point of discharge or at the edge of a defined mixing zone. That requirement, however, has not been enforced for permitted stormwater runoff by the federal and state regulatory agencies. Past court rulings have, in general, concluded that the US EPA has discretion regarding requiring NPDES-permitted stormwater runoff dischargers to manage urban stormwater runoff to prevent violations of water quality standards. The management approach that has typically been followed has been the development of BMPs (Best Management Practices) to work toward compliance with water quality standards, and the reporting of violations of water quality standards by dischargers. The recently filed NRDC lawsuit attempts to eliminate the current exemptions to meeting water quality standards that are being allowed by regulatory agencies.

One of the foremost reasons that the US EPA and state regulatory agencies have not required compliance with water quality standards applied to stormwater runoff is the very high cost of compliance to attain no more than one exceedance by any magnitude in three years, i.e., the conventional NPDES requirements for wastewater discharges. It is estimated that the costs of property acquisition, construct of a collection system, storage facilities, and treatment works, and the operation of the treatment works would translate to several dollars per person per day for the population served by the treatment works. The bulk of the cost is associated with the acquisition of property and the up-sizing of the collection and treatment works to manage the very high stormwater flows that can occur during major stormwater runoff events.

The evaluation and management of urban and highway stormwater runoff to meet US EPA water quality criteria or worst-case numeric standards based on them is, therefore, not technically appropriate and leads to over-regulation of chemical constituents in runoff waters, and establishment of ineffective or unnecessary BMPs. It can also result in the failure to identify real causes of water quality problems and in the overlooking of contaminants that are, in fact, causing water quality problems. (Jones-Lee and Lee (2008) discussed issues that need to be considered in regulating water quality impacts of stormwater runoff; a copy of that paper is appended to these comments.)

The US EPA has developed a procedure, the "water effects ratio," to adjust the national water quality criteria for site-specific conditions in an effort to correct, to some extent, the overregulation of the application of worst-case-based water quality criteria to many waterbodies. Unfortunately, the water effects ratio only partially corrects the overregulation; potential pollutants in some sources such as urban and highway stormwater runoff are in chemical forms that behave differently than the 100%-available forms used in the US EPA water-effects-ratio adjustment. This can cause the adjusted value to also substantially over-regulate contaminants in these types of discharges. Lee and Jones-Lee have developed several reviews on the deficiencies in the monitoring approaches that are typically used by stormwater runoff water quality managers but often required by regulatory agencies (including Lee and Jones, 1991, and Lee, 2002).

"Evaluation Monitoring" for Stormwater Runoff

In the mid-1990s, Lee and Jones-Lee worked with S. Taylor of RBF Consulting in Irvine, CA to evaluate the need for, and appropriateness of, incorporation of conventional BMPs for stormwater management in the development of a proposed toll road in the Upper Newport Bay area of Orange County, California. The primary concern was that the stormwater runoff contained several heavy metals in concentrations above their worst-case-based national water quality criteria. Such violations indicated the potential that the heavy metals could be causing aquatic life toxicity in receiving waters; conventional BMPs would have removed particulates, which contained heavy metals.

Rather than following the conventional monitoring approach of collecting grab samples of stormwater runoff and analyzing them for a suite of potential pollutants such as heavy metals, they obtained permission from the regulatory agencies to shift the emphasis to what they call the "evaluation monitoring" approach described by Jones-Lee and Lee (1998) and Lee and Jones-Lee (1999). The evaluation monitoring employed measurement of toxicity in the runoff instead of the conventional approach of measuring heavy metal concentrations in the runoff and then trying to infer toxicity. This approach evaluates whether the heavy metals, in combination with all other potentially toxic chemicals in the runoff, are present in toxic amounts. It was found that the stormwater runoff was toxic to *Ceriodaphnia*. However, as discussed by Lee and Taylor (2001), contrary to what would have been surmised through conventional chemical analysis, that toxicity was not due to heavy metals. Rather, further investigation revealed that it was caused by pesticides used in urban and agricultural areas of the Upper Newport Bay watershed, but that were not at that time routinely measured in stormwater runoff.

The conventional evaluation approaches would likely have measured total heavy metals, found them to be "excessive" and in need of control, and triggered construction of conventional BMPs such as detention basins or filters to remove particulate heavy metals. This would not have identified or addressed the real problem. The BMPs that were adopted in response to the evaluation monitoring that was conducted included source control on the use of pesticides that become part of the stormwater runoff. Not only did this provide more appropriate pollutant control, it was also more cost-effective. The success of the evaluation monitoring approach in the Upper Newport Bay watershed has caused Lee and Jones-Lee to recommend that stormwater runoff water quality managers and regulatory agencies shift from the conventional monitoring of stormwater runoff to a site-specific, focused effort to define the real, significant water quality impacts of urban area and highway stormwater runoff. This approach could serve as the basis for developing water quality criteria/standards that are appropriate for stormwater runoff.

Further discussion of the inappropriateness of regulating urban area and highway stormwater runoff through application of the US EPA national water quality criteria is provided by Lee and Jones-Lee (1998, 2000b) and Lee (1998). There is need to develop stormwater runoff water quality criteria that will protect the designated beneficial uses of waterbodies without significant overregulation of chemical constituents in the runoff. While the US EPA has proposed to develop wet-weather water quality criteria to address this need, the agency has not devoted needed resources to this work in part due to opposition to this approach by environmental groups.

Recommendation

There is need to develop wet-weather criteria/standards that properly reflect the coupling between critical concentrations of available forms of potential pollutants and duration of organism exposure that is characteristic of stormwater runoff into receiving waters. To provide the technical foundation for such criteria/standards, stormwater runoff water quality managers and the regulatory agencies need to fund representative, comprehensive, evaluation monitoring studies to define the real, significant impacts of runoff-associated chemical constituents in receiving waters.

Until this approach is formulated and implemented, there will continue to be attempts by some environmental groups to try to get regulatory agencies and/or the courts to force public and private interests to fund stormwater runoff water quality management programs to achieve worst-case-based national water quality criteria/standards. Forcing such compliance will be counterproductive to providing environmental quality protection as it will result in the waste of funds for unnecessary and/or ineffective treatment leaving fewer funds to address real water quality problems. It would far more effective for environmental groups to work with the technical community, stormwater runoff water quality managers, and the public to develop a regulatory approach that will protect the designated beneficial uses of the receiving waters for runoff without significant unnecessary expenditures for chemical constituent control. This should be undertaken under the leadership of an expert panel knowledgeable and experienced in the technical aspects of the nature and behavior of chemical contaminants in urban and highway runoff as it enters receiving waters.

Other Sources of Information

Discussions of Previous Court Rulings. Stormwater Runoff Water Quality Newsletter issues 9-6, 8-4, 5-3, 2-2, 1-5 (designations refer to Volume-Number of the issues found at http://www.gfredlee.com/newsindex.htm) provided background information on discharges of stormwater associated with municipal, industrial, and construction activities, and to some of the past litigation regarding compliance of urban stormwater runoff with water quality standards. Newsletter Volume 2 Number 2, October 16, 1999 summarized the Ninth Circuit Court Ruling on Compliance with Water Quality Standards. Newsletter Volume 5 Number 3, March 5, 2002 summarized the US EPA Appeals Board Decision, Washington, DC, February 2002 Order regarding the need of the District of Columbia's municipal storm sewer system to comply with water quality standards for urban stormwater runoff.

Newsletter Volume 1, Number 5, January 30, 1999, discussed issues affecting the meeting of water quality standards in urban stormwater runoff. Newsletter Volume 9, Number 6, June 27, 2006 reviewed issues that need to be considered in developing water quality criteria/standards for urban area and highway stormwater runoff to control adverse impacts on water quality, and the efficacy of conventional "best management practices" to meet water quality standards. It also provided information on an expert panel report to the California State Water Resources Control Board (SWRCB) entitled, "The Feasibility of Numeric Effluent Limits Applicable to Discharges of Storm Water Associated with Municipal, Industrial and Construction Activities." Several other Lee and Jones-Lee Stormwater Runoff Water Quality Newsletters have included information on the application of water quality criteria/standards to urban stormwater runoff, including Newsletter Volume 8, Number 4, August 12, 2005 that discussed the Clean Water Act, water quality criteria/standards, TMDLs, and weight-of-evidence approaches for regulating water quality.

Additional information on regulating urban area and highway stormwater runoff water quality impacts is available at,

> Lee, G. F., and Jones-Lee, A., "Regulating Water Quality Impacts of Urban and Highway Stormwater Runoff," Report of G. Fred Lee & Associates, El Macero, CA, July 3 (2008). http://www.members.aol.com/GFLEnviroQual/RegulateStormwater.pdf

including a discussion of the importance of incorporating aquatic chemistry into evaluating the water quality impacts of stormwater runoff.

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