Treatment BMP Performance Standards

Prepared for the Ventura Countywide Stormwater Quality Management Program

by

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I have been asked to comment on the proposed treatment BMP performance standards incorporated in Provision 4.A.3 and Attachment C of the April 29, 2008 draft Ventura County MS4 permit. These standards were developed by the Regional Board based on an analysis of the information contained in the International BMP Database. I recently completed an extensive analysis BMP performance using this same dataset for the Water Environment Research Foundation (WERF). This analysis is contained in the publication, *Performance and Whole Life Costs of Best Management Practices and Sustainable Urban Drainage Systems* (Lampe et al., 2005). The findings have also been approved for publication in a special stormwater issue of the ASCE Journal of Irrigation and Drainage (Barrett, in press). WERF is now the primary funding organization for the database and I currently serve on their project oversight committee, so I continue to remain abreast of database updates. I am also very familiar with stormwater issues in California, having assisted with the Caltrans stormwater program for over 10 years and, in addition, worked on projects for San Diego and Orange Counties. Finally, I am the author of the design guidelines for structural BMPs contained in the California BMP Handbooks. Consequently, I am uniquely qualified to comment on the proposed performance standards.

In general, the adoption of performance standards for stormwater treatment systems is an improvement over requirements that specify little more than the water quality volume. However, there are several issues related to the proposed numerical standards in the draft Ventura permit, which include:

1. The analysis used by the Board to establish numerical objectives based on performance by pollutant results in a situation where a BMP that doesn't meet every single criterion is eliminated from consideration.

2. The BMP categories used in the analysis grouped together many devices that are not that similar.

3. The use of effluent concentrations ignores the benefit of ancillary infiltration that occurs in a variety of low impact development techniques.

4. The use of effluent discharge concentrations overcomes some of the problems associated with characterizing pollutant reduction as a percent removal; however, there are a number of other significant problems with this approach.

5. It will likely be very difficult to administer an effluent standard for BMP performance.

The Board developed their performance criteria based on the top performing BMPs for each pollutant category. Unfortunately, this results in a situation where some of the better performing BMPs and those appropriate for the climate in the Ventura area are excluded from consideration. Excluded BMPs include media filters (total copper), extended detention basins (total nitrogen, total copper, total lead), biofilters (total phosphorus, total copper), and hydrodynamic separators

(total copper). A better approach would be to identify a list of appropriate BMPs and require that they be designed to meet the median discharge quality for that type of BMP.

It is important that the BMP toolbox for Ventura County include of a variety of BMPs, because site specific conditions can make implementation of many BMPs infeasible. For, instance, infiltration is a useful tool for helping to maintain the predevelopment hydrology, but its appropriateness can be severely restricted in areas with low permeability soils, high groundwater levels (Simi Valley), or slope stability issues. In addition, high failure rates have been experienced in areas where conditions were not optimal for their installation. Sand filters require a substantial amount of hydraulic head and are subject to rapid failure if there are any disturbed areas within the watershed. In addition, wet ponds are likely not widely applicable because of the extended dry season, vector concerns, and the need for supplemental water for systems serving small, highly impervious watersheds.

Another consideration associated with the data used to generate Table 3 in Attachment C, is that a variety of BMPs have been grouped together under a common name. For instance, biofilters include both swales and vegetated buffers. The performance of these two BMPs is substantially different, with buffer strips being far more robust and exhibiting much better performance. Media filters include both Austin style sand filters and proprietary devices such as Contech's StormFilter, which uses a much coarser media and has substantially less pollutant removal ability at the flow rates advertised. In addition, some increasingly popular low impact development strategies, such as bioretention, are not included at all, so it is not clear whether they would meet all the treatment goals or be considered for inclusion.

The focus on achieving numerical discharge concentrations also tends to ignore other benefits that can be achieved using BMPs, such as swales that may only have modest concentration reduction, but also infiltrate a substantial amount of runoff. A Caltrans study of BMP performance in southern California (Caltrans, 2004) found that the load reduction achieved by swales was often better than that of sand filters, because so much of the runoff volume was lost to infiltration. This is particularly true for dissolved constituents.

Another problem associated with a ranking of BMPs by effluent discharge quality achieved is that for many constituents the effluent quality is correlated with influent quality. A common misconception among those that examine the performance data in the BMP database is that BMPs that have better than average discharge quality have been designed or maintained better than those with higher discharge concentrations. This is not necessarily the case, since BMPs located in relatively clean watersheds may have low discharge concentrations without substantially improving the water quality. For instance, wetland basins are apparently among the three best performing BMPs for many constituents, but the difference between influent and effluent concentrations is not significantly different for total suspended solids, total phosphorus, nitrate, TKN, and lead. This indicates that the influent concentrations at the monitored locations

were already at very low levels. The effect of influent concentrations on discharge quality have been analyzed in several published studies (Barrett 2003, 2004, 2005). Consequently, one cannot assume that a well designed BMP will achieve the numerical target without some knowledge of the influent concentrations.

An additional issue with the proposed numerical standards is administration of the requirement. One would not want to monitor every single BMP that is constructed to determine whether it met discharge standards since over time that could amount to thousands of facilities. Given that as many as one half of the types of facilities in the database did not achieve the required discharge quality, specific design guidelines need to be adopted, so that all facilities would be presumed to comply with the requirements.

Regulatory agencies in many parts of the US have effectively adopted performance standards and this has been done in two principle ways. One method is a simple performance threshold, such as an 80% reduction in total suspended solids (TSS). This has the effect of eliminating most of the poorer performing BMPs from consideration; however, it also eliminates extended detention as an option. Extended detention has proven especially popular in areas with low rainfall such as the Denver, Colorado area. In addition, percent reduction is also fraught with difficulties because it is strongly influenced by the quality of the untreated runoff, with high removal efficiencies calculated when the influent has higher solids concentrations.

The second approach used by regulatory agencies in some areas is to identify a list of approved BMPs and providing design guidelines to ensure that each type of BMP achieves its maximum potential pollutant removal performance. In general, these lists do not include many, if any, proprietary products such as, swirl concentrators or drain inlet inserts. A list of appropriate BMPs for the Ventura area might include:

Sand Filters
Extended Detention
Swales
Infiltration facilities (basins, trenches, porous pavement)
Wet Ponds/Wetlands
Vegetated Buffer Strips
Bioretention

Another common misconception about the database is that the facilities that are included are "well designed." Actually, the basis for inclusion is that each site has sufficient documentation of the design and monitoring program. At this time there are not enough BMPs in the International BMP Database with varied designs to evaluate all of the criteria that might affect the pollutant removal. For instance, the time to drain from basin full conditions is considered an important factor in extended detention basin performance. However, until very recently the database only

contained sites with greater than 70 hour draw downs (all Caltrans sites) and a few sites with less than 10 hour drain times, so there was not a single site in the database designed to drain in the 24 to 48 hour period commonly recommended in guidance manuals. Therefore, it is not currently possible to make a detailed evaluation of the exact influence of drain time on pollutant removal. Nevertheless, if one designs a BMP using criteria similar to those of a site that was previously monitored, one can expect to achieve roughly the same pollutant removal performance.

There are many sources of design guidelines for stormwater controls, including the California BMP Handbooks (http://www.cabmphandbooks.org). Even though there may be uncertainty about the precise design standards needed to ensure optimum performance, the state of current knowledge is sufficient to provide a reasonable certainty that performance goals can be met, with some uncertainty since each potential location may receive runoff with somewhat different particle size distributions, particle densities, and dissolved/particulate partitioning. As our knowledge increases based on the availability of new information, these guidelines could be modified as necessary so that improvements in performance could be achieved.

Some of the stakeholders have discussed an approach similar to that used by the Board's staff, but using water quality requirements associated with the median of each BMP type rather than pollutant category. It is likely that BMPs designed using information from the California Handbooks or other sources would achieve the median discharge quality if one recognizes the uncertainty in that value and that different BMP types have been lumped together in the database analysis.

One goal, of whatever approach is adopted by the Board, should include ensuring that there are a sufficient number of approved devices to provide developers with the flexibility to select a system appropriate for site specific constraints. In addition, the regulated community needs some degree of confidence that the stormwater management plan developed and approved for a particular project will meet the water quality requirements of the Board and the County, without an open ended liability associated with invalidating their entire stormwater management plan based on data collected post-development. The Board should also consider how any adopted standard would be administered by the County without undue monitoring requirements.

I applaud the move by the Board staff to ensure a higher level of stormwater treatment than is required under the current permit. However, I urge the Board to reconsider the approach contained in the Ventura draft permit and adopt an approach that provides a larger BMP toolbox to address site specific constraints, that can be administered by the County in an efficient and cost-effective manner, and that provides the development community some degree of certainty that their project stormwater management plans will meet all regulatory requirements.

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