Storm Water Panel Recommendations to the California State Water Resources Control Board

The Feasibility of Numeric Effluent Limits Applicable to Discharges of Storm Water Associated with Municipal, Industrial and Construction Activities

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Background

The NPDES storm water permit program came into being as a result of the 1987 amendments to the federal Clean Water Act and its implementing regulations. In California, the State Water Resources Control Board (State Water Board) and the nine Regional Water Quality Control Boards (Regional Water Boards) implement the NPDES storm water program.

The Clean Water Act amendments, Section 402(p) require that discharges of storm water from large and medium municipal separate storm sewer systems (MS4s) and discharges of storm water associated with industrial activities be in compliance with NPDES permits. MS4 permits require that the discharge of pollutants be reduced to the maximum extent practicable (MEP). Discharges associated with industrial activities, were required to meet the technology based standards of best available technology economically achievable (BAT) or best conventional pollutant control technology (BCT), and to meet water quality standards.

In 1990, USEPA promulgated regulations (40 CFR Part 122.26) for the NPDES storm water program. These regulations clarified what industrial activities were subject to storm water permit. Construction that resulted in a land disturbance of five or more acres was included as an industrial activity subject to NPDES storm water permit. The regulations also delineated what was to be included in permit applications and the programmatic elements that were to be in a permit and storm water management program for MS4s or storm water pollution prevention plan for industrial activities.

California's Permits

In 1990, MS4 permits were issued to Santa Clara County by the San Francisco Bay Regional Water Board and to Los Angeles County by the Los Angeles Regional Water Board. These permits were appealed to the State Water Board. The primary basis of the appeals was the lack of numeric limits in the permits. The entities that brought the appeals argued that the permits needed to include numeric limits, as the discharges of pollutants must not only be reduced to the MEP, but they must also meet water quality standards. The State Water Board, in hearing these appeals, determined that it was not feasible at the time to develop numeric limits for MS4 permits, and that water quality standards could and should be achieved through the implementation of best management practices (BMPs). Since this ruling, the Regional Water Boards have typically not included numeric limits in storm water permits.

The State Water Board has adopted NPDES General Permits for the Discharge of Storm Water Associated with Industrial Activities and for the Discharge of Storm Water Associated with Construction Activities. Both of these permits contain language stating that developing numeric limitations is infeasible.

Court Decisions

In addition to these actions on MS4 permits at the State level, there have been a number of rulings from the federal courts regarding the NPDES Storm Water program.

One of the most significant is from the federal court, 9th District Court of Appeals from 1999. In its published opinion on Defenders of Wildlife vs. Browner, the Court held that MS4 permits need not require strict compliance with water quality standards. Rather, compliance was to be based upon the MEP standard. However, the permitting authority (the State Water Board/Regional Water Boards for California) could at their option require compliance with standards. The State Water Board through the permit and appeals process has in fact required that the discharges from MS4s meet water quality standards, but has stated that compliance with numeric standards can be achieved through the implementation of BMPs in an iterative fashion.

The Browner decision also found that discharges of storm water associated with industrial activities must be in strict compliance with water quality standards.

In 2004 the State Water Board conducted a public hearing on a draft General Industrial Storm Water permit. This draft permit met with significant opposition from non-government or non-industrial organizations (NGOs) due to the absence of numeric limits. Staff revised the draft permit to include the benchmarks contained in the USEPA multi-sector general permit. This change resulted in strong opposition from the regulated community.

The concerns that have been raised by the NGOs and the regulated community are similar, though they do not necessarily agree on the best way to address them. Both believe that permitting has become overly complex, and that it is extremely difficult, if not impossible to objectively determine if a facility, operation or municipality is in compliance with its permit requirements. The NGOs argue that requiring storm water permittees to comply with numeric effluent limits will result in an easier way to measure compliance. The regulated community agrees, to a degree, but they argue that it is not simply a matter of selecting a number that is suitable for a POTW or industrial waste discharge. Due to the unique nature of storm events and storm water discharges, any numeric limit that is placed in a storm water permit must take into consideration the episodic nature of storm events and be truly representative of storm water discharges. In addition, the regulated community has argued that there are going to be pollutants in storm water discharges that did not originate in the MS4 (run on) or that they do not have the means to control, and therefore should be given special consideration.

In response to these arguments, State Water Board directed staff to convene a panel of storm water experts to examine the feasibility of developing numeric limits for storm water permits. Specifically, this panel of experts was asked to consider the following:

> “Is it technically feasible to establish numeric effluent limitations, or some other quantifiable limit, for inclusion in storm water permits? How would such limitations or criteria be established, and what information and data would be required?”
>
> “The answers should address industrial general permits, construction general permits, and area-wide municipal permits. The answers should also address both technology-based limitations or criteria and water quality-based limitations or criteria. In evaluating establishment of any objective criteria, the panel should address all of the following:
>
> (1) The ability of the State Water Board to establish appropriate objective limitations or criteria; (2) how compliance determinations would be made; (3) the ability of dischargers and inspectors to monitor for compliance; and (4) the technical and financial ability of dischargers to comply with the limitations or criteria.”

Staff invited 10 individuals from the academic and scientific community to participate on the panel. Of the 10, eight agreed to participate. These eight met in a public session on September 14, 2005 and heard presentations from the regulated and NGO communities. They also heard comments from the public at large. They met again on September 15, 2005 to discuss the public comments and to begin to formulate a response. It was also decided at this meeting that they would form sub-committees to address municipal (MS4), industrial and construction discharges separately. These sub-committees worked on drafts statements for each of these, circulating them over the course of a number of months.

The panel met again in private session on April 3 and 4, 2006. The purpose of these meetings was to address unresolved issues and to develop the final response to the State Water Board. It was also decided to combine the three working statements into one Statement of Findings. The following discussion is the panel’s findings and is broken into three program element areas: municipal, construction, and industrial.

Panel's Findings on Feasibility of Numeric Effluent Limits Applicable to Municipal Activities

Municipal Observations

1. The current practice for permitting, designing, and maintaining municipal stormwater treatment facilities (called BMPs herein) on the urban landscape does not lend itself to reliable and efficient performance of the BMPs because:

   - Permitting agencies, including EPA, States, and local governments, have rarely developed BMP design requirements that consider the pollutants and/or parameters of concern, the form(s) that the pollutants or parameters are in, the hydrologic and hydraulic nature of how they pollutants and flow arrive, and then the resulting unit processes (treatment and/or flow management processes) that would be required to address these pollutants or parameters.
   - The permitting agencies generally are not accountable for the performance of the BMP, and thus give much leeway to the developer with respect to the type of BMPs to be constructed, and to the details of the design, although some states do have detailed design standards and have conducted performance tests to identify acceptable devices for their area.
   - The developer is not responsible in most all cases for the performance of the BMP, so the treatment facilities are designed to minimize the cost and/or area of the facility and/or ease of permitting, not maximize the pollutant removal efficiency and/or flow management of the BMP
   - Because BMPs are not held to any, or very few, long-term performance criteria, they are typically not maintained except for aesthetic purposes. Very few stormwater agencies are responsible for BMP maintenance on private property, and public facilities are maintained mostly in response to clogging and/or resultant drainage or aesthetic problems. Even for stormwater agency facilities, maintenance is often limited.

2. The principal reasons for the failure of BMP performance is improper BMP selection, design and/or lack of maintenance.

   - The California BMP Handbooks and other local requirements leave too much of the BMP selection and design to the discretion of the designer, and thus do not address many if not all of the receiving water quality issues

- BMPs need to be *designed to facilitate maintenance*; this is rarely done because it costs the developer money and the BMP designer is rarely responsible for the maintenance.

- Given the amount of debris in urban runoff, and the fact that the hydraulic capacity of many BMPs may be exceeded several to many times per year, BMPs require more maintenance than other types of stormwater control facilities. Since urban BMP maintenance is generally left to untrained homeowner associations and maintenance personnel for commercial properties, inadequate maintenance is a near certainty. Even stormwater agencies often do not have and/or apply the resources necessary to maintain agency owned BMPs.

3. Improvements in the design of municipal BMPs, including residential and commercial as well as municipally owned facilities are necessary to ensure better performance (i.e. sizing, geometry, inlet and outlet design, etc.) and to specifically target receiving water quality issues.

<u>The Problem with Existing Effluent Limit Approaches</u>

Effluent limit approaches usually focus only on conventional water quality constituents that may not be solely or at all responsible for the receiving water beneficial use impairments in urban receiving waters. The important stressors that affect many use impairments can include one or more of the following and may vary in importance from system to system:

- The effect of increased flows and/or volumes (i.e. hydromodification) that can lead to stream channel erosion/sedimentation with resulting habitat destruction

- Sediment contamination (such as enrichment of urban stream sediments with fine-grained heavily polluted particulates; large organic debris masses causing low sediment DO; settled bacteria causing large bacteria gradients with sediment depth etc.)

- Impaired aesthetic value (caused by gross floatables, noxious sediments, etc.)

- Unsafe conditions (caused by dangerous debris, highly fluctuating stream flows and stages, etc.)

- Dissolved and suspended pollutants that are bioavailable in the water column and/or result in downstream sediment contamination

- Elevated temperatures from urban heating effects on runoff and on open conveyances and permanent pool BMPs

It is very difficult to determine specific causative agents or the level of control needed, for a specific beneficial use impairment in a receiving water body. The *Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists, and Engineers* (Burton, G.A. Jr., and R. Pitt, ISBN 0-87371-924-7. CRC Press, Inc., Boca Raton, FL. 2002. 911 pages) was written to be used as a guide for stormwater managers to identify their local receiving water problems and to assist in identifying the causative factors. The methods described would need to be applied to a specific area or region to obtain an understanding of local conditions and problems. Although expensive, comprehensive investigations such as these should be considered an investment to help minimize wasteful expenditures due to the application of inappropriate control practices in a watershed.

Monitoring for enforcement of numeric effluent limits would also be challenging. While spot checks could be made at some of the many outfalls in an area, there is wide variation in stormwater quality from place to place, facility to facility, and storm to storm. Coefficients of variation approaching 1 or higher are not uncommon and there are few factors that can be used to significantly reduce this variation. Analysis of the National Stormwater Quality Database indicates that geographical location and land use are the most important factors affecting stormwater quality for most constituents. Some are also affected by the antecedent dry period before the rain and more highly developed watersheds (containing large fractions of impervious areas) often show elevated “first-flush” concentrations in the first portion of the storms for some, but not all pollutants. Since the storm-to-storm variation at any outfall can be high, it may be unreasonable to expect all events to be below a numeric value. In a similar circumstance, there are a number of storms each year that are sufficiently large in volume and/or intensity, to exceed the design capacity volume or flow rates of most BMPs. Assessing compliance during these larger events represents yet another challenge to regulators and the regulated community.

<u>Technical Issues</u>

Even for conventional pollutants, there presently is no protocol that enables an engineer to design with certainty a BMP that will produce a desired outflow concentration for a constituent of concern. A possible exception is removal of Total Suspended Solids in extended detention basins, and some types of media filters. The typical approach for evaluating BMP pollutant removal efficiency has been *percent removal*; but observed removal efficiencies vary greatly from facility to facility and it has been demonstrated that percent removal varies directly with the inflow concentration.

Few, if any, BMPs are designed using the first principles laws of physics, chemistry and/or biology for pollutant removal and/or flow-duration control. It will take a substantial research effort, including data gathering on well-designed BMPs, to develop design criteria for the removal of pollutants with confidence intervals that enable us to make reliable estimates of the median and variance of the effluent concentrations to be expected from the various types of BMPs. Until this is done, it will be very difficult to assign legally enforceable numerical effluent limitations to any particular BMP.

Drawing upon the body of knowledge that currently exists regarding pollutant removal efficiency, it is possible to estimate mean effluent concentrations and variances for a number of constituents for different types of BMPs, albeit not in a legally enforceable sense. Effluent concentration distributions for a number of BMPs are available in the International BMP Database (www.bmpdatabase.org) from more then 250 studies throughout the US. The following outlines key issues that have been identified regarding the technical feasibility of setting objective criteria for both existing areas and new or redeveloping areas:

- Effluent concentration estimates could be made for a given constituent and a particular BMP from a larger number of BMPs than available in the BMP Database using literature values of percent removal and local or national data on stormwater runoff EMC data. However, the results from this work would be significantly less reliable then the BMP Database data as it could be biased if the influent concentrations for the studied BMP types did not match general urban runoff.
- Designing the facility more rigorously with respect to the physical, chemical and biological processes (e.g. unit processes) that are active in the BMP would give confidence that the BMP would perform at least as well, if not better than the average performance determined from the literature. A WEF/ASCE task force is currently updating their Urban Runoff Quality Management Manual of Practice; design guidance of BMPS will make better use of the physical, chemical, and biologic processes taking place in the BMP before, during and after a storm event. This manual will build upon recent research efforts employing a unit process based approach for BMP design and selection. These research efforts were supported by the Water Environment Research Foundation (WERF) and the National Cooperative Highway Research Program (NCHRP).
- A BMP *designed* and *constructed* according to a set of criteria described above, could be ***presumed*** to deliver an effluent with a mean constituent concentration and variance similar to the performance numbers developed from the literature ***if it is properly maintained***. Enforcement would comprise periodic inspection of the facility using a checklist of items to be inspected. While not an effluent limit, this seems practical and quantifiable.

- Most all existing development rely on non-structural control measures, making it difficult, if not impossible to set numeric effluent limits for these areas because little is known about the quantity and quality performance of non-structural controls. However, certain development characteristics in some existing development areas that minimize the amounts of impervious areas in a drainage area have been shown to be quite effective in reducing adverse hydromodifications in the receiving waters, and should be encouraged.

Municipal Recommendations

It is not feasible at this time to set enforceable numeric effluent criteria for municipal BMPs and in particular urban discharges. However, it is possible to select and design them much more rigorously with respect to the physical, chemical and/or biological processes that take place within them, providing more confidence that the estimated mean concentrations of constituents in the effluents will be close to the design target. Moreover, with this more rigorous design and an enforceable maintenance program, it can be presumed that these facilities will continue to deliver effluent qualities that are reasonably close to the design effluent concentrations over the life of the facility. And if proper maintenance is performed (enforced), the facilities can be expected to perform throughout their design life at the same or better efficiency as when newly constructed. Depending on the pollutants and parameters of concern and BMP choices, it is very likely that treatment trains of structural BMPs will be required in many cases.

For catchments not treated by a structural or treatment BMP, setting a numeric effluent limit is basically not possible. However, the approach of setting an “upset” value, which is clearly above the normal observed variability, may be an interim approach that would allow “bad actor” catchments to receive additional attention. For the purposes of this document, we are calling this “upset” value an ***Action Level*** because the water quality discharged from such locations are enough of a concern that most all could agree that some action should be taken. Action Levels could be developed using at least three different approaches. These approaches include: 1) consensus based approach; 2) ranked percentile distributions; 3) statistically-based population parameters.

The consensus-based approach would be to agree upon effluent concentrations that all parties feel are not acceptable. For example, most parties would likely agree that an average concentration of dissolved copper above 100 ug/l from an urban catchment would not be acceptable. This would be an Action Level value that would trigger an appropriate management response. This approach may not directly address the issue of establishing numeric effluent criteria and achieving desired effluent quality, but the consensus-based approach would ensure that the “bad actor” watersheds received needed attention.

The ranked percentile approach (also a statistical approach) relies on the average cumulative distribution of water quality data for each constituent developed from many water quality samples taken for many events at many locations. The Action Level would then be defined as those concentrations that consistently exceed some percentage of all water quality events (i.e. the 90^{th} percentile). In this case, action would be required at those locations that were consistently in the outer limit (i.e. uppermost 10^{th} percentile) of the distribution of observed effluent qualities from urban runoff.

The statistically based population approach would once again rely on the average distribution of measured water quality values developed from many water quality samples taken for many events at many locations. In this case, however, the Action Level would be defined by the central tendency and variance estimates from the population of data. For example, the Action Level could be set as two standard deviations above the mean, i.e. if measured concentrations are consistently higher than two standard deviations above the mean, an Action situation would be triggered. Other population based estimators of central tendency could be used (i.e. geomean, median, etc.) or estimates of variance (i.e. prediction intervals, etc.). Regardless of which population-based estimators are used (or percentile from above), the idea would be to identify the [statistically-derived] point at which managers feel concentrations are significantly beyond the norm.

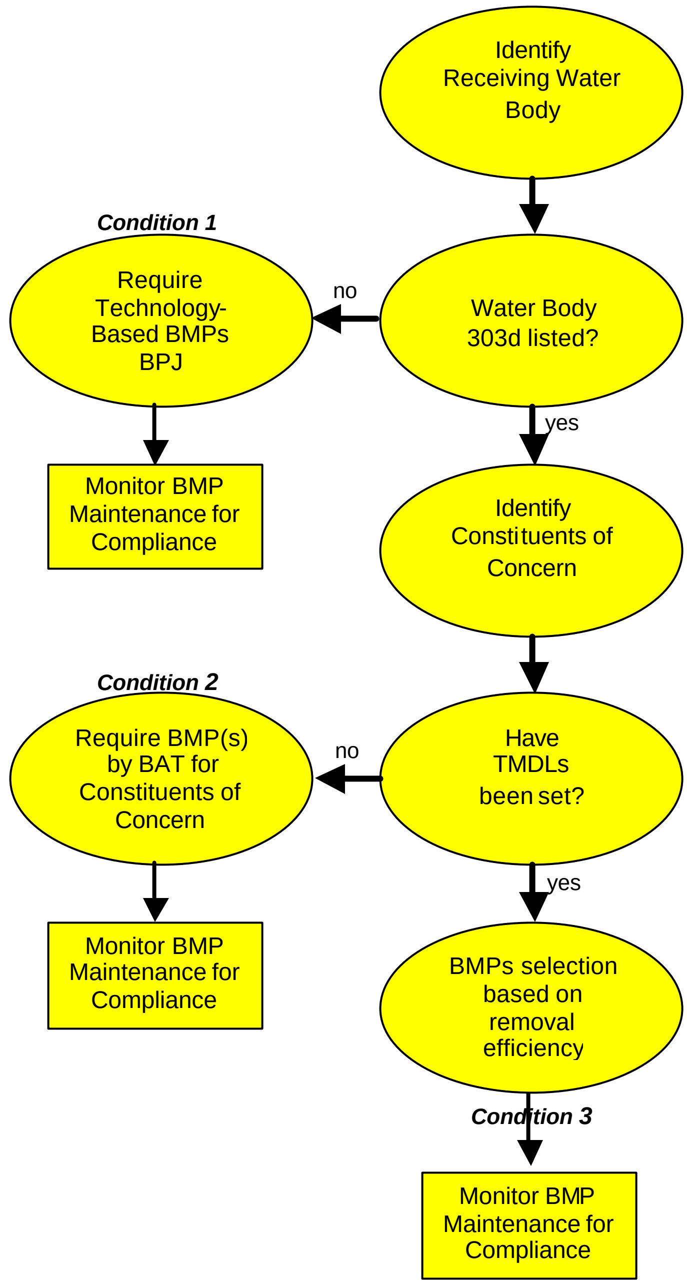
The ranked percentile and population-based estimators are highly dependent upon the data sets used to calculate them. There are a number of options that were considered by the Panel, but ultimately they were broken into two distinct categories. The first category was for new development/redevelopment and the second was for built out urban environments. For new development/redevelopment, the panel recommends using the data set associated with the international BMP database (www.bmpdatabase.org). This data set represents the variety of water quality from the most up to date, best conducted and reported BMP studies. The database effort does not limit itself to BMPs types or designs; it focuses on technically sound monitoring studies and reporting information. Therefore there could be some screening of studies to those thought to be well designed BMPs to then develop effluent quality distributions and statistics on performance. Certainly, there is no expectation that urban stormwater managers could improve water quality beyond what would be reported in this dataset.

In built-out urbanized environments, there are greater opportunities to examine various data sets for setting Action Levels. For the Panel, these opportunities were a function of spatial scale. The first opportunity would be at the local scale. Some urban stormwater monitoring programs have been in existence for 10 years or longer. Examples include the Los Angeles County Department of Public Works, City of Sacramento, Orange County, San Diego County, amongst others. Using permit specific data sets may make sense if issues of climatic variability or localized geomorphology are important. The next scale would be to combine these California municipal permit monitoring data sets, especially if lack of data for specific constituents of concern in any one location or region is an important issue. The largest scale would be the National Stormwater Quality Database (NSQD) from municipal monitoring programs across the nation (http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/Mainms4paper.html). This data set includes monitoring data from urban areas such as residential, commercial, industrial, freeway, institutional, and mixed use which is especially useful if small sample size limits the use of local data. One advantage of using smaller (and local), rather than larger, spatial scales is the ability to update data sets for revising Action Levels. The NSQD may not be updated for quite some time, but local data sets can be updated periodically (annual amendments, 10-year rolling averages, every permit cycle, etc). Ultimately, Action Levels would be expected to become lower as outliers are removed from data sets and as improved water quality data are collected through targeted management actions. It may be appropriate to eliminate older data sets as well over time.

One element to consider when comparing monitoring data to Action Levels is the concept of a design volume for water quality (also known as the Water Quality Capture Volume – WQCV, WEF #23 and ASCE publication #87, 1998) or a design flow rate. The WERF and NCHRP efforts mentioned above include recommendations regarding design sizing using continuous simulation techniques for both volume-based and rate-based BMPs. The Panel acknowledged that several to more times each year, the runoff volume or flow rate from a storm will exceed the design volume or rate capacity of the BMP. Stormwater agencies should not be held accountable for pollutant removal from storms beyond the size for which a BMP is designed.

<u>A Technically Sound and Pragmatically Enforceable BMP Design and the Permit Process</u>

The diagram below provides guidance for determining what BMPs are required in a newly developing watershed. Under ***Condition 1*** where the receiving water quality is not impaired, determination of the appropriate BMP would be by Best Professional Judgment (BPJ). Any of the "state approved" BMPs could be used. The permittee would be required to design the treatment facilities in accordance with the California BMP Handbook, ***which should be revised as a criteria manual***, rather than a guidance manual *and include more physiobiochemically based design criteria designed to address an agreed upon set of "Pollutants and Parameters of Concern" based upon knowledge of the pollutants and parameters that generally are of concern in urban runoff, with perhaps some differences on receiving water type.*



A detailed maintenance plan and schedule would be required that includes:

1. Actions to be taken and when,
2. Designation of the party legally accountable for the facility maintenance, and
3. A whole-life cost estimate for the facility that include maintenance.

Compliance with the design criteria and the maintenance plan and schedule would constitute achievement of the design effluent criteria. In the event of failure by the responsible party to perform the required maintenance and/or to perform it to the required level of quality, the whole-life cost schedule could be used to determine the consideration that the defaulting responsible party would pay to the new responsible party that takes over the maintenance.

Under ***Condition 2*** where water quality impairment exists but a TMDL has not yet been performed, BAT would be required, which means applying the BMPs that can practicably (to be defined) be employed to produce the lowest effluent concentrations (e.g. the lower grouping of BMP effluent quality) of the constituent(s) of concern. Several types of BMPs may fulfill the BAT standard if these BMPs have performance that is not statistically or practically differentiable. This case will allow flexibility in choosing among that sets of BMPs that demonstrate superior performance. As in the case of C*ondition 1,* compliance with the maintenance plan and schedule would constitute compliance with the design effluent criteria.

Condition 3, which occurs when a TMDL has been specified for the BMP or for the tributary watershed, may (or may not be) actually be less stringent that *Condition 2* if the TMDL allows for a higher effluent concentration of the constituents of concern than that discharged by a BAT facility. The same requirements would apply for the design criteria, and the maintenance plan and schedule would constitute the guarantee of design effluent concentrations from the BMP.

<u>Strategies for Stormwater Management to Protect Urban Water Environments</u>

Stormwater effluent limits can become very complex if all the issues are to be directly addressed. If complex, they are not likely to be workable. However, too much simplification can also lead to ineffective programs. Therefore, a reasonable first step is needed, based on local data. Compliance monitoring (e.g. BMP inspections) is also needed to ensure that the goals are likely to be met. Most likely goals will have to be revised over time. The overall strategy should contain these objectives:

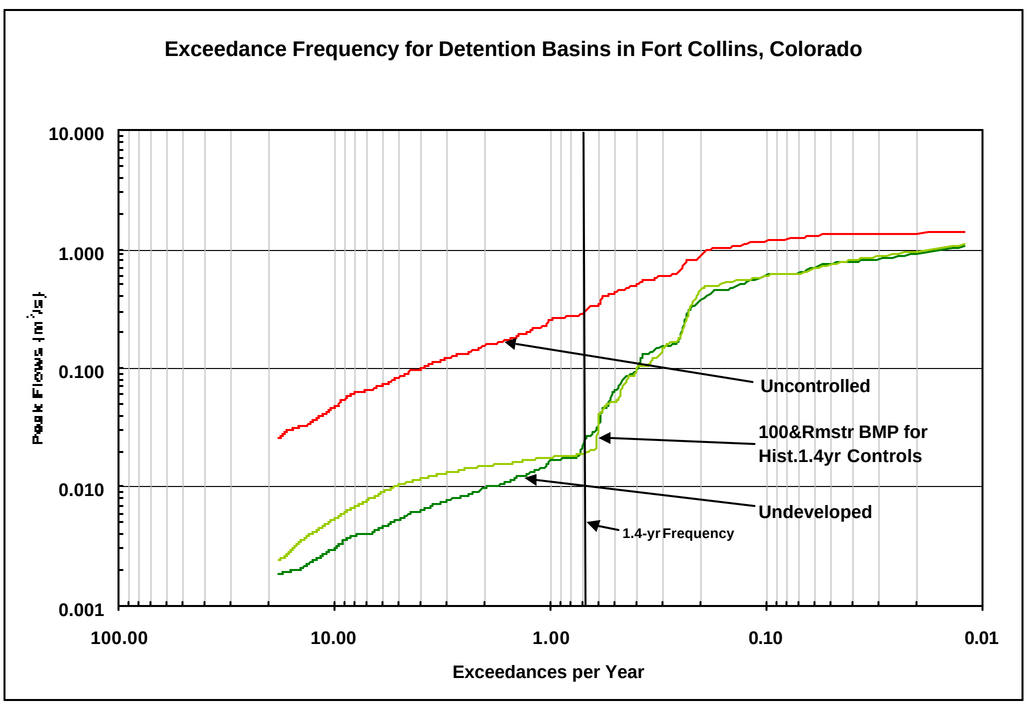
- Effectiveness
- Affordability
- Enforceability, and
- Flexibility

Table 1 - Effects of Urbanization on Hydrologic Regime in Colorado and Georgia

Location	Annual Precipitation	Mean Storm Depth*	Runoff Events per Year		Annual Runoff (mm)	
	Millimeters per Year	Millimeters	Undeveloped	Developed	Undeveloped	Developed
Fort Collins, CO	335	11	27	47	12	124
Atlanta, GA	1262	18	48	78	36	500
* Values obtained from Fig. 5.3 ASCE MOP (1998)						

Runoff volume and peak flows have been recognized as two of the most important stormwater factors needing control. **Table 1** (Roesner and Nehrke) shows that urbanization dramatically changes the hydrologic regime of urban waterways. In both Atlanta (a higher rainfall area) and Fort Collins (a semiarid area), the number of runoff events per year on developed land increases by a factor of 2 times the number of runoff events that occur in the undeveloped state; and the runoff volume increases by a factor of ten! The peak flows also increase dramatically as shown in **Figure 1** below, but as also seen on the figure, the peak flow frequency curve can be adjusted back to its predevelopment character by the proper application of runoff controls. But while these controls restore the peak flow frequency to its natural regime, the duration of flows at the low end (but still channel "working") of the flow frequency curve is greatly increased, which raises potential for channel scour in stream channels with erosive soils.

Figure 1 - Exceedance Frequencies for Detention Basins in Fort Collins, Colorado



Since many of the stormwater pollutants are strongly associated with particulates, stormwater particulate control is also often a component of stormwater control programs. Therefore, an effective stormwater control strategy that could be encouraged is a combination of several practices, listed below in the order of increasing events:

- On-site stormwater reuse, evapotranspiration and infiltration for the smallest storms and up to specific targeted events, depending on site limitations (soil characteristics and groundwater contamination potential) (usually by conservation design emphasizing infiltration, disconnecting paved areas, etc.)
- Treatment of excess runoff that cannot be infiltrated, again, up to a specific targeted runoff volume (usually by sedimentation or filtration) For pollutants of concern, it should be demonstrated that the BMP(s) need to include the physical, biological, and/or chemical treatment processes that address the typical pollutants of concern and/or specific pollutants in the case of 303D listed water bodies or those with established TMDLs.
- Control of energy discharges for the channel forming events (such as through storage-release, focusing on flow-duration analyses and peak flow frequency analyses). To be most effective, this should to be completed under a watershed management plan and not site-by-site.
- Provide safe drainage for damaging events (conventional drainage, plus secondary drainage systems)
- In watersheds that are already experiencing damaging flow impacts to streams, it could be in many circumstances much more cost-effective (and effective period) to develop through a watershed plan a natural stream stabilization approach that could address both the existing development and the remaining smaller infill or otherwise smaller new development. In these cases, requiring the remaining new development to implement flow-duration control would not solve the issue in a measurable way and resources would be better spent restoring the functions of the creek with instream enhancements.

Panel's Findings on Feasibility of Numeric Effluent Limits Applicable to Construction Activities

Construction Observations

Regarding the question of the technical feasibility of Numeric Limits for stormwater discharges from construction activities, the Panel bases its recommendations on the following observations.

1. Limited field studies indicate that traditional erosion and sediment controls are highly variable in performance, resulting in highly variable turbidity levels in the site discharge.
2. Site-to-site variability in runoff turbidity from undeveloped sites can also be quite large in many areas of California, particularly in more arid regions with less natural vegetative cover and steep slopes.
3. Active treatment technologies involving the use of polymers with relatively large storage systems now exist that can provide much more consistent and very low discharge turbidity. However, these technologies have as yet only been applied to larger construction sites, generally five acres or greater. Furthermore, toxicity has been observed at some locations, although at the vast majority of sites, toxicity has not occurred. There is also the potential for an accidental large release of such chemicals with their use
4. To date most of the construction permits have focused on TSS and turbidity, but have not addressed other, potentially significant pollutants such as phosphorus and an assortment of chemicals used at construction sites.
5. Currently, there is no required training or certification program for contractors, preparers of soil erosion and sediment control Stormwater Pollution Prevention Plans, or field inspectors.
6. The quality of stormwater discharges from construction sites that effectively employ BMPs likely varies due to site conditions such as climate, soil, and topography.
7. The States of Oregon and Washington have recently adopted similar concepts to the Action Levels described earlier.

Construction Recommendations

It is the consensus of the Panel that active treatment technologies make Numeric Limits technically feasible for pollutants commonly associated with stormwater discharges from construction sites (e.g. TSS and turbidity) for larger construction sites. Technical practicalities and cost-effectiveness may make these technologies less feasible for smaller sites, including small drainages within a larger site, as these technologies have seen limited use at small construction sites. If chemical addition is not permitted, then Numeric Limits are not likely feasible. Whether the use of Numeric Limits is prudent, practical or necessary to more effectively achieve nonpoint pollution control is a separate question that needs to be answered, but is outside the scope of this Panel. However, Action Levels are likely to be more commonly feasible. For small sites or smaller drainages within larger sites, or where chemicals cannot be used, the Panel recommends that Action Levels be specified.

Advanced systems lend themselves to Numeric Limits because of historically reliable treatment, while non-active controls are less predictable. Advanced systems have been in use in some form since the mid-1990s. At this time, there are two general types of systems. With each general system the stormwater is retained on-site, treated, and released more slowly. One system employs polymer coagulation and sedimentation. The second system employs polymer coagulation with direct filtration. Both types of systems are considered reliable, and can consistently produce a discharge less than 10 NTU. These systems have been used successfully at many sites in several states since 1995 to reduce turbidity to very low levels. Non-active erosion and sediment control BMPs, while effective when applied and adequately maintained, produce more highly variable in effluent quality, making setting Numeric Limits difficult, if not impossible.

An important consideration in setting Numeric Limits or Action Levels is that in many locations in California the natural background turbidity and/or TSS levels in stormwater runoff are quite high. This is particularly true in semi-arid or arid regions, which tend to have less vegetative cover. For example, natural runoff concentrations in Emerald Creek, on the Newport Coast, above any developed areas have been over 5,000 mg/l during runoff events. The Los Angeles County Monitoring Data sets included an open land use watershed that also showed TSS levels significantly above other types of urban land uses. Therefore, it is important to consider natural background levels of turbidity or TSS in setting Numerical Limits or Action Levels for construction activities. The difficulty in determining natural background concentrations/levels for all areas of the state could make the setting of Numeric Limits or Action Levels impractical from an agency resource perspective.

While the Panel concludes that Numeric Limits or Action Levels are technically feasible, the Panel has several reservations and concerns.

1. The active treatment systems have generally been employed on sites five acres or larger. While the systems are technically feasible for sites of any size, including sites or drainages as small as an acre or less, the cost may be prohibitive. The cost-effectiveness of active treatment systems is greatly enhanced for large drainage areas, at which construction occurs for an extended period of time, over one or more wet season. There is also a more "passive" active system that is employed in New Zealand that uses captured rainfall to release the chemical into flows entering a detention system that requires less instrumentation and flow measurement infrastructure. Even more passive systems such as the use of polymer

logs and filter bags are currently under development for small sites. Regardless, the Panel recommends that the Board give particular attention to improving the application of cost-effective source controls to small construction sites.

2. In considering widespread use of active treatment systems, full consideration must be given to whether issues related to toxicity or other environmental effects of the use of chemicals has been fully answered. Consideration should be given to longer-term effects of chemical use, including operational and equipment failures or other accidental excess releases.
3. Consideration should be given to the seasonality of applying Numerical Limits. There may be sites where summer only construction that complies with Action Levels may be preferred to year-round that sites that include winter construction that complies with Numeric Limits. In such cases, applying Numeric Limits to summer construction may be a disincentive to scheduling active grading during dry periods. Allowing summer only construction sites to comply with action levels would discourage winter construction activities.
4. Consideration should be given to whether Numeric Limits would apply to all construction sites or only those with significant disturbed soil areas (e.g. active grading, un-vegetated and/or un-stabilized soils). A site could meet certain conditions to be considered “Stabilized” for the runoff season.
5. Where Numeric Limits are not feasible or where they would not apply during designated seasons or site conditions, the Panel recommends that the Board consider the concept of Action Levels for sites where only traditional erosion and sediment controls are applied or construction sites that are considered “stabilized” for the runoff season. An Action Level indicates a failure of BMPs (within some storm size limits).
6. The Board should consider Numeric Limits or Action Levels for other pollutants of relevance to construction sites, but in particular pH. It is of particular concern where fresh concrete or wash water from cement mixers/equipment is exposed to stormwater.
7. The Board should consider the phased implementation of Numeric Limits and Action Levels, commensurate with the capacity of the dischargers and support industry to respond.
8. The Panel recommends that a Numeric Limit or Action Level should be compared to the average discharge concentration. The minimum number of individual samples required to represent the average discharge concentration for a storm will need to be defined.
9. The Board should set different Action Levels that consider the site’s climate region, soil condition, and slopes, and natural background conditions (e.g. vegetative cover) as appropriate and as data is available. With active treatment systems, discharge quality is relatively independent of these conditions. In fact, active treatment systems could result in turbidity and TSS levels well below natural levels, which can also be a problem for receiving waters.

10. The Board should consider whether the Numeric Limits or Action Levels should differ between receiving waters that are water quality limited with respect to turbidity, sediment or other pollutants associated with construction, from those water bodies that are not water quality limited.
11. The Panel recommends that Numeric Limits and Action Levels not apply to storms of unusual event size and/or pattern (e.g. flood events). The determination of Water Quality Capture Volume should consider the differing climate regions to specify these events.
12. The Board should set Numeric Limits and Action Levels to encourage loading reductions as appropriate as opposed to only numeric concentrations. Examples include phased construction (e.g. limited exposed soil areas or their duration), infiltration, and spraying captured runoff in vegetated areas as means to reduce loading.
13. The Panel is concerned that the monitoring of discharges to meet either the Action Levels or Numeric Limits may be costly. The Panel recommends that the Board consider this aspect.

Panel's Findings on Feasibility of Numeric Effluent Limits Applicable to Industrial Activities

Industrial Observations

The Panel believes that Numeric Limits are feasible for some industrial categories. Industries have control over their facilities. They control access, construction practices, product substitution to affect pollution prevention and the types of treatment systems to be used to mitigate stormwater runoff. There are many treatment systems or prevention practices that have been in place for lengthy periods, extending back to the 1980s in many cases. For example, there is much known today about construction materials, such as roofing materials (roofing composition, gutters, paints and coatings, products that abrade or tend to create solids or litter, etc). Other examples include development of pervious surfaces, or infiltration methods.

The decision for the value of Numeric Limits should be made in one of two ways. When there is a TMDL that defines the permissible load for a watershed, the Numeric Limits should be set to meet the TMDL. Consideration must be given for both the pollutant concentration as well as the volume of runoff, since both contribute to the impacts that required the TMDL to be implemented.

When there is no TMDL, the Numeric Limits should be based upon sound and established practices for storm water pollution prevention and treatment, using an approach analogous to that used in the NPDES wastewater process in the 1970s. In this approach phased, Numeric Limits were first set that were based upon the use of best currently available technology, and permittees were given a defined period for compliance. Permits were established based upon industry types or categories, with the recognition that each industry has its own specific problems and financial viability.

To establish Numeric Limits for industrial sites requires a reliable database, describing current emissions by industry types or categories, and performance of existing BMPs. The current industrial permit has not produced such a database for most industrial categories because of inconsistencies in monitoring or compliance with monitoring requirements. The Board needs to reexamine the existing data sources, collect new data as required and for additional water quality parameters (the current permit requires only pH, conductivity, total suspended solids, and either total organic carbon or oil and grease) to establish practical and achievable Numeric Limits.

In cases where the industrial activity is similar to activities covered by the MS4 permit (roofs, parking lots, etc), the approach or limits for industries should be the same as for MS4 permittees. In cases where the industrial activity is similar to land disturbance activities (e.g. landfills, gravel mines, etc.), there exists data and design experience with runoff control, capture and advanced treatments systems (e.g. systems using polymer to enhance total suspended solids removal – see the construction section) that may make Numeric Limits feasible for new facilities, and the approach and limits should be the same as for construction permittees. The same conditions and issues related to active treatment discussed in the construction section apply here.

In cases where there is less certainty in the data for both stormwater characterization or BMP performance to establish Numeric Limits, there maybe sufficient data to establish Action Levels. Action Levels set for industrial sites that discharge to MS4s should not exceed those set for MS4 permittees.

The Panel recognizes that existing and new facilities may have to be treated differently and recommends the approach in **Table 2**.

Table 2- Approach to Establish Numeric Limits or Action Levels at Existing or New Facilities

		Numeric Limits	**Action Levels**	**Notes**
Existing Facility	Indoor	No	Yes, similar to MS4	
	Outdoor	Yes if data are adequate for the specific industrial activity and BMP	Yes, using industrial database	Action Levels should approach MS4 action levels.
New Facility	Indoor	Yes – BMP Database		Technology based, similar to MS4 New Development
	Outdoor	No, unless sufficient data exist for the specific industrial activity and BMP	Yes when sufficient data are available	

Industrial Recommendations

The Panel has several reservations and concerns:

- The Panel recognizes the inadequacy of current monitoring data sets and recommends improved monitoring to collect data useful for establishing Numeric Limits and Action Levels.
- Required parameters for future monitoring should be consistent with the type of industrial activity instead of the current parameters (i.e., monitor for heavy metals when there is reasonable expectation that the industrial activity will cause greater heavy metals concentrations in the storm water).
- Insofar as possible, the Panel prefers the use of California data (or National data if it can be shown to be applicable to CA) in setting Numeric Limits and Action Levels.
- The Panel recognizes that economies of scale exist for large facilities and large groups of single facilities.
- Industrial facilities that do not discharge to MS4s should have to implement BMPs for their non-industrial exposure (e.g., parking lots, roof runoff) similar to commercial facilities in MS4 jurisdictions.
- Regardless of Action Levels or Numeric Limits, the permittees should implement a suite of minimum BMPs – good housekeeping, employee training, preventing materials from exposure to rain, etc.
- SIC categories are not a satisfactory way of identifying industrial activities at any given site. The Board should develop a better method of characterizing industrial activities that can impact storm water.
- The Panel recognizes this is a large task and recommends prioritizing the implementation of this approach to achieve the greatest reduction of pollutants statewide.
- Increasingly, a number of industries have moved industrial activities indoors, preventing storm water pollution. The Panel recognizes that these facilities should be granted some sort of regulatory relief from industrial Numeric Limits or action levels, but should still be required to comply with MS4 permit requirements.

The Panel recognizes the need to make progress in monitoring and reducing storm water discharge from industrial facilities, but urges the Board to consider the total economic impact and not unduly penalize California industries with respect to industries outside of California.