Proposed EPA Blending Policy as it Relates to Wet-Weather Management Treatment Alternatives

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On December 21, 2001, the U.S. Environmental Protection Agency (EPA) released a draft policy memorandum titled "*NPDES Requirements for Municipal Wastewater Treatment During Wet Weather Conditions*." The draft memorandum provided guidance for publicly owned treatment works (POTWs) related to wet-weather conditions in three situations:

1) Discharges from emergency overflow structures located within a sanitary sewer collection system.
2) Discharges from physical/chemical treatment systems (such as high rate clarification) used exclusively for treating excess flows within a sanitary sewer collection system.
3) Wet-weather treatment scenarios at POTWs. Specific issues addressed included blending of primary treated effluent with fully treated and disinfected effluent and enforcement discretion for bypass discharges.

The draft memorandum was never acted on, and in May 2002 the EPA separated policy issues by including Items 1 and 2 as a preamble to the Sanitary Sewer Overflow (SSO) regulations and issuing a separate policy on blending. On November 7, 2003, the proposed Blending Policy was published in the *Federal Register* (68 FR 63042-64052).

Proponents of the policy state that blending is an effective peak wet-weather wastewater strategy because it provides flexible, technically sound, and cost-effective treatment and is not a public health risk, since it is typically disinfected and must meet the facility's National Pollutant Discharge Elimination System (NPDES) requirements.

Critics state that the policy would increase the risk to public health posed by effluent discharges, since the policy allows for excess wastewater flows in peak wet weather to be diverted around biological units when flows exceed their capacity.

Much of the criticism is based around the issue that the policy does not specifically require the effluent that is to be blended to be disinfected. Critics also state that studies have shown an increase in the quantity of microbial pathogens found in POTW effluent during blending, as opposed to effluent that had passed through biological treatment.

Why Was the Blending Policy Developed?

Reducing the frequency and volume of sanitary sewer overflows (SSOs) and managing wet-weather flows at POTWs is fast becoming a top priority for municipalities throughout the country. These have been major goals of the EPA's NPDES program since the early 1990s.

Blending of effluents at POTWs during periods of high flow associated with wet weather is a common engineering practice that is used across the country to protect biological treatment processes from damage and to prevent overflows and backups elsewhere in the system. A number of state NPDES authorities, municipal officials, and others have requested clarification of the EPA's NPDES regulations as they relate to blending scenarios.

The EPA developed the proposed Blending Policy to provide clear, nationally consistent guidance to the interpretation of the NPDES regulations as they relate to the practice of blending. Historically, blending at POTWs has been addressed in a variety of ways by state permitting authorities and EPA regional offices.

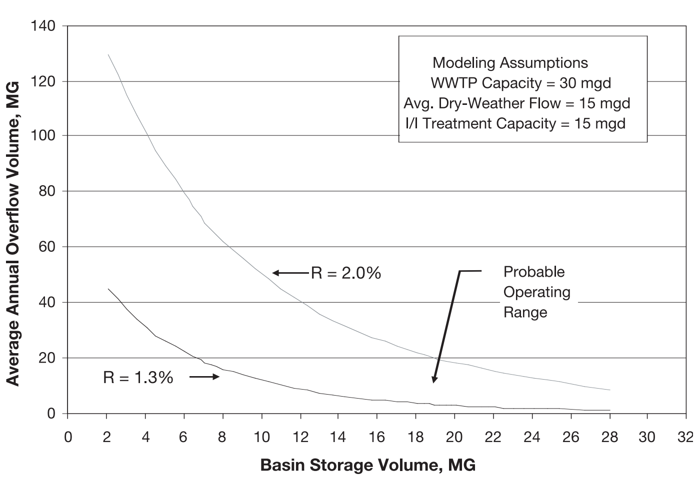

Figure 1

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According to a 2001 survey by the Association of Metropolitan Sewerage Agencies (AMSA), 48 percent of POTWs practice blending during peak-flow conditions. Of these, 70 percent were originally designed to blend and 31 percent had permits that recognized blending.

Because of the lack of clear guidance, many questions have been raised by municipal, state, and EPA officials. The proposed policy seeks to establish clear guidance on the use of blending and to ensure proper management of wet-weather flows, to ensure consistent application of the Clean Water Act technology, and to ensure that blending is protective of human health and the environment.

Defining the Blending Policy

Although not defined in the Clean Water Act or other regulations, blending is generally recognized to be the practice of diverting a part of peak wet-weather flows at POTWs around biological treatment units and combining effluent from all processes prior to discharge from a permitted outfall. The Blending Policy proposed by the EPA will provide POTWs the flexibility to more effectively manage peak wet-weather flows, protect the biological process and potentially improve the quality of the effluent discharged.

The biggest issue associated with the Blending Policy is the interpretation of blending during wet-weather events under the Clean Water Act under the bypass provision (40 CFR 122.41). Under this provision, bypass is defined as the "intentional diversion of waste streams from any portion of the treatment facility" unless:

- The bypass is unavoidable to prevent loss of life, personal injury, or severe property damage.
- There are no feasible alternatives to the bypass.
- Adequate notice is provided.

The proposed Blending Policy recognizes that diversion of flows around biological processes during peak wet-weather conditions is not considered a *bypass* under the regulations, but incorporates policies and procedures into the NPDES permitting process to include wet-weather treatment scenarios. Any diversion from biological treatment during dry weather, however, would be subject to the bypass provisions.

The proposed Blending Policy contains the following six criteria for blended discharges:

1) The final discharge effluent must meet all NPDES permit discharge requirements, based on secondary treatment regulations (40 CFR Part 133) or more stringent limitations.
2) The treatment scenario for peak-flow management is consistent with generally accepted practices and long-term design criteria.
3) All incoming flow must meet the equivalent of primary clarification.
4) The peak-flow treatment scenario is used only during peak wet weather when the capacity of the biological treatment process and storage/equalization facilities is fully utilized.
5) Sufficient monitoring must be included in the NPDES permit to ensure compliance with applicable water-quality-based effluent limitations and the Clean Water Act.
6) The collection system must be properly operated and maintained.

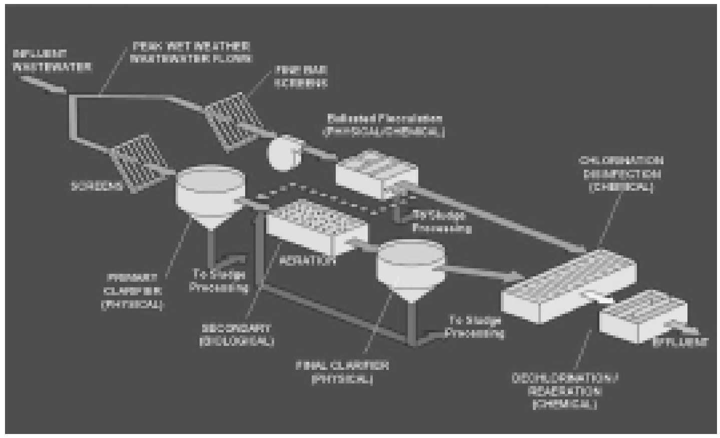

Figure 2
Blending with High Rate Clarification

Wet-Weather Management and Treatment Alternatives

Managing infiltration/inflow and associated wet-weather flows at POTWs is becoming a top priority for many municipalities around the country. There are several alternatives and treatment techniques available to both reduce infiltration/inflow and manage and treat peak wet-weather flows, once they reach a POTW. Some of these alternatives and techniques include:

- Infiltration/Inflow reduction within the collection system
- Equalization storage (both in line and off line)
- Blending at the POTW
- Alternative treatment technologies at the POTW
- Combination of the above

Infiltration/Inflow Reduction and Equalization Storage

To date, the most traditional approach to addressing increased wet-weather treatment capacity has been to reduce infiltration/inflow within the collection system, construct equalization basins, and construct additional primary and secondary biological treatment facilities.

For example, Charlotte Mecklenburg Utilities in North Carolina has taken a three-pronged approach to minimize SSOs and manage wet weather at their wastewater treatment plants (WWTPs). This approach includes sewer-system evaluation and rehabilitation, flow equalization, and trunk sewer capacity improvements. It has been very effective in reducing SSOs and in managing wet-weather flows.

Implementing flow equalization facilities at Charlotte-Mecklenburg Utilities' Irwin Creek WWTP, along with relief sewer improvements, has reduced wet-weather overflows by 94 percent, as shown in **Figure 1**, and has allowed for greater operational flexibility in managing wet-weather flows at the WWTP.

Although these conventional methods are effective in reducing SSOs and managing wet-weather flows, such comprehensive rehabilitation/ replacement programs require significant capital investment and are often limited by the lack of available space. Cost can be increasingly significant, in light of the amount of time these additional facilities are actually on line – primarily during wet-weather events, which typically occur infrequently throughout the year and last for relatively short periods. As a result, municipalities are looking for more cost-effective alternatives to meet permit requirements during wet-weather events without a large capital investment.

Blending with High-Rate Clarification

Blending at POTWs provides an alternative, cost-effective approach to managing wet-weather flows and reducing SSOs. Blending can be accomplished with or without additional treatment, but most often some additional treatment is needed in order for the blended effluent to meet the current NPDES requirements.

The use of high-rate clarification (HRC) within the blended effluent routed around the biological process provides a viable and economical alternative for wet-weather treatment. An example of HRC utilizing the ballasted flocculation process for blending is shown in **Figure 2**.

Ballasted flocculation (a type of HRC) is a high-rate, physical/chemical clarification process that involves the fixing of suspended solids onto a ballast (micro-sand) with the aid of a polymer. Using a combination of a metal salt coagulant, micro-sand, and enhanced clarifier features, the process increases settling velocities by a factor of 10. A schematic of the ballasted flocculation process is shown in **Figures 3 and 4**.

Coagulant is combined with screened sewage ahead of a flash mixing tank, where polymer and micro-sand are added to the process. The coagulant destabilizes suspended solids present in the wastewater, which bind together via polymer bridges. Micro-sand particles are enmeshed in the flocs, resulting in particles with specific gravities ranging from 2.8 to 2.9. Further mixing and detention time are provided in the maturation zone, where flocs increase in size and density, settling faster

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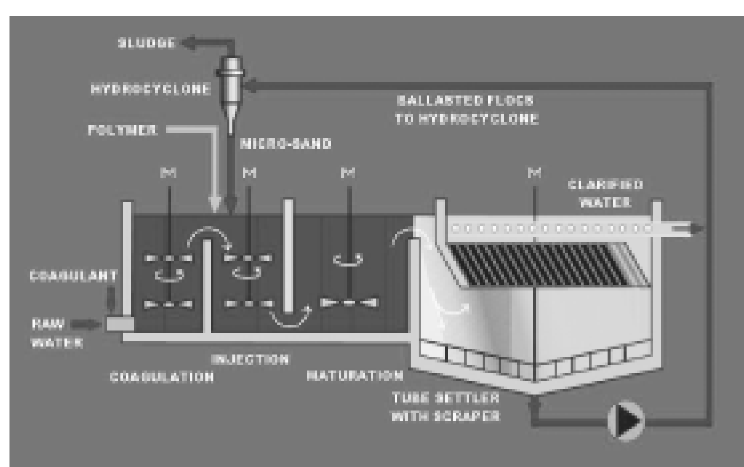

Figure 3
Ballasted Flocculation Process

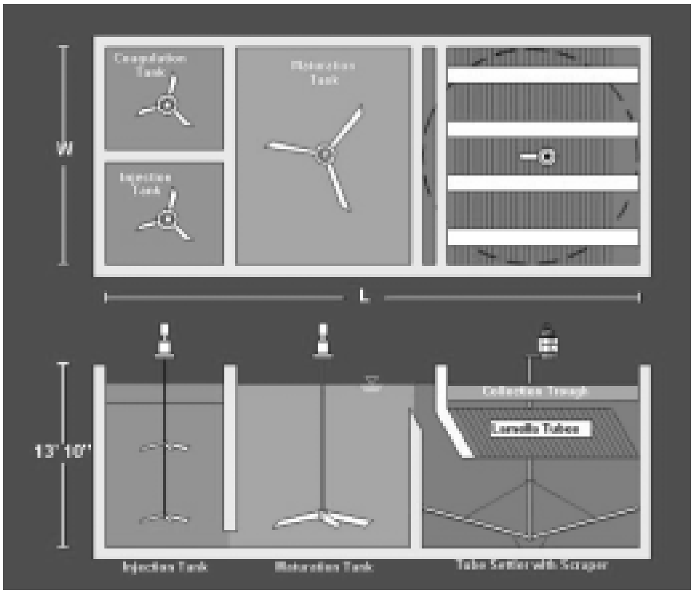

Figure 4
Ballasted Flocculation Process

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in the sedimentation tank.

The resulting sludge and micro-sand mixture is collected at the bottom of the sedimentation basin and pumped to hydrocyclones. The high-energy hydrocyclones separate the high-density micro-sand from the lighter flocs (sludge). The residual solids are sent through the conventional sludge processing system, and the recovered micro-sand is recycled as ballast to newly formed flocs.

The ballasted flocculation process is an attractive alternative for municipalities faced with increasing demands from wet-weather inflows to their collection systems and yields significant benefits. It is attractive to municipalities with limited space because of its compact size, with a footprint that is 5 to 15 percent the size of conventional treatment trains.

The quick startup of the process makes it suitable for treating storm-induced peak wet-weather flows with a peak efficiency obtained in less than 20 minutes. In addition, pilot study results indicate that the process produces highly clarified effluent in terms of turbidity and total suspended solids (TSS). It can remove more than 85 percent TSS and 65 percent biological oxygen demand (BOD).

Published reports also demonstrate that the process can remove up to 90 percent phosphorus and 25 to 35 percent nitrogen. Additionally, unlike conventional biological treatment trains that are sensitive to large increases in flow, the ballasted flocculation process has the ability to treat a wide range of flows without reducing pollutant removal efficiencies.

During dry-weather flows, the process can be used as a chemically-enhanced primary clarifier or for flow maintenance during construction periods at the head of the plant. Other potential wastewater treatment applications include phosphorus removal and high-rate primary clarification for conventional plant expansions, particularly when space constraints are critical.

An example of using ballasted flocculation for both wet-weather and tertiary treatment (phosphorus removal) is shown in **Figure 5**. One of the reasons that ballasted flocculation is an attractive option is because capital costs are relatively low and operational costs are incurred only during peak-flow events.

Fort Worth, Texas, HRC Case Study

The city of Fort Worth, Texas, needed a management strategy to control overflows from its wastewater collection and treatment system during wet-weather events, in compliance with an EPA administrative order. Expanding the conventional treatment process at the city's 144-million-gallons-per-day Village Creek WWTP was estimated to cost $50 million. Instead, CDM and the city investigated and succeeded in permitting the HRC process, saving 70 percent of the estimated cost of a conventional expansion.

CDM initially conducted pilot studies that demonstrated more than 85 percent removal of TSS and 65 percent removal of BOD. The process also removed 80-90 percent phosphorus and 20-30 percent nitrogen. The results of these tests helped Fort Worth obtain the first NPDES permit to send excess influent wastewater to the HRC process during peak wet-weather flows.

CDM then coordinated a pilot study at the Village Creek WWTP to evaluate the performance of four HRC process equipment alternatives at various overflow rates ranging from 10-70 gallons per minute per square foot (gpm/ft^2). Results revealed optimum coagulant dosages and ballast sand concentrations, and established startup procedures for full-scale facilities.

Based on the pilot studies, the EPA included the HRC process on the list of acceptable "technology options" for the treatment of wet-weather flows as part of the agency's SSO control program. The recognition of the HRC process as a viable treatment option offers municipalities a cost-effective alternative for managing infiltration/inflow challenges associated with wet-weather flows.

St. Bernard Parish, Louisiana, Case Study

The addition of an HRC system at the Munster WWTP provides St. Bernard Parish, Louisiana, with an opportunity to establish a cost-effective wastewater consolidation program. Three of the parish's aging facilities and the collection system require more than $70 million in upgrades to comply with the impending SSO regulations. CDM recommended a two-phased approach that would accommodate daily flows, as well as frequent wet-weather peak flows and avoid the costs of rehabilitating aging plants.

The HRC process serves as the central component of the consolidation program, with the upgraded Munster WWTP managing 7.5 mgd average daily flow and 20 mgd of peak flow. The HRC technology alleviated the need for costly parallel treatment trains to accommodate wet-weather flows, while still achieving permit requirement compliance. Additionally, the HRC unit's small footprint provided an ideal match for the facility's limited site and difficult soil conditions.

While flows treated by the HRC unit are
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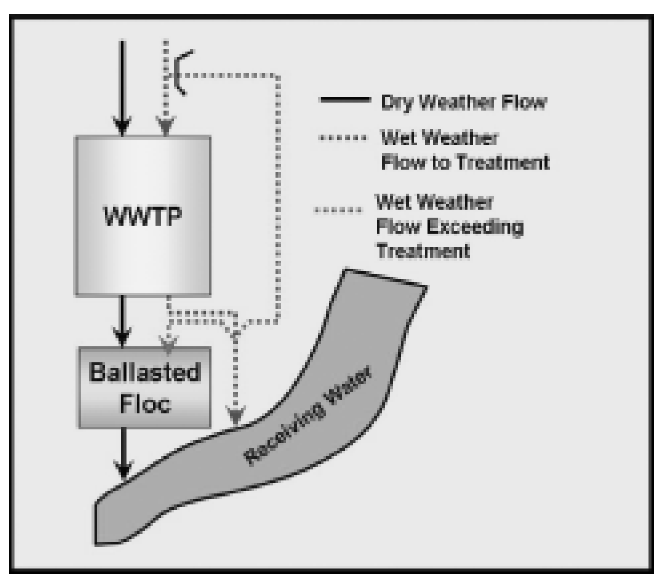

Figure 5
Ballasted Flocculation for Tertiary and Wet-Weather Treatment

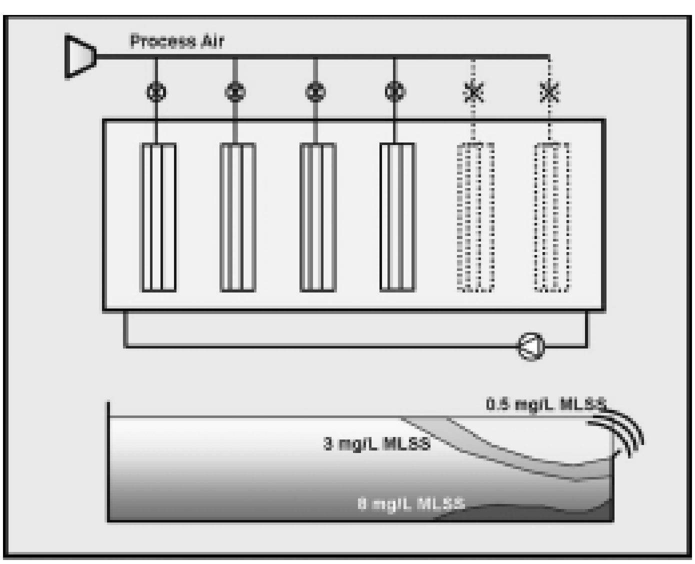

Figure 6
Aeration Tank Settling

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routed to biological treatment, the unit's demonstrated performance is enabling St. Bernard Parish to pursue permit changes that would allow treatment solely by the HRC unit. The parish anticipates that future peak-flow increases at the Munster WWTP could exceed 40 mgd of peak flow. The SSO program will require the parish to make collection system upgrades, but the HRC unit will accommodate the expected capacity increases while still complying with impending regulations.

Alternative Treatment Technologies

Other treatment technologies are available and have been utilized as wet-weather treatment options. These include advanced primary treatment technologies such as chemically enhanced primary treatment (CEPT), operation of the biological process in the step feed/contact stabilization modes, and aeration tank settling (ATS).

ATS can be a very effective wet-weather treatment alternative and is used by many operators as a last resort, but seldom acknowledged. Essentially, ATS is the process of shutting off the air on the most downstream portion of the biological process to allow settling of the biomass during peak wet-weather flows. This practice reduces the loss of biomass from the biological process, thereby preventing solids washout and solids overloading of the final clarifiers. A schematic of ATS is shown in **Figure 6**.

Current Blending Policy Status

Many municipalities face the critical need to manage and treat peak flows during wet-weather events. The EPA's draft Blending Policy, issued in 2003, was to be followed by a final policy to be published in August 2004; however, publication has been delayed because of numerous issues that have been raised in the nearly 100,000 comments the EPA has received since the draft policy was published. As of this writing, the final policy has yet to be issued.