executive summaries

Total water management strategies for utility master planning

Stuart Jeffcoat, Douglas Baughman, and P. Michael Thomas

Increasing demands on water resources and the associated stresses of continued population growth, land-use changes, and climate uncertainty require water managers to use more innovative approaches to long-term water management planning. A total water management (TWM) approach integrates management of the watershed, water supply sources, land-use practices, and related resources to provide sustainable supplies while considering equitable economic and social considerations and promoting a healthy ecosystem. The authors describe a TWM plan implemented by the Clayton County Water Authority in Atlanta, Ga., and examine how this approach has been used successfully to meet long-term water supply and wastewater management needs, even during excessive drought conditions. This article opens the door to further applications of reclaimed water to keep supply reservoirs full even during severe droughts.—MKK

Benefits of shifting fire protection to reclaimed water

Francis A. DiGiano, Christopher C. Weaver, and Daniel A. Okun (deceased)

Health-based regulations drive up the cost of treatment, but about 50% of system design capacity is for irrigation and toilet flushing for which these regulations are irrelevant. Using reclaimed water to eliminate nonpotable demands reduces plant size, and shifting fire protection to reclaimed water keeps water residence time short in the potable lines to the benefit of water quality. In dual distribution systems, pipe diameters and water residence times are reduced in potable water lines, resulting in less deterioration in water quality. A case study community shows the benefits and costs of integrating fire protection into the nonpotable water lines in a dual system. Although the financial barrier to adoption of a dual distribution system is a challenge, this article provides a template to assess the costs and the benefits that will be useful to many water utilities.—MKK

Using the WCM for transient modeling of water distribution networks

Dhandayudhapani Ramalingam, Srinivasa Lingireddy, and Don J. Wood

Utilities rely on transient analysis of large pipe networks to properly assess the potential level of intrusion associated with negative pressure and its effect on disinfectant residual efficiency. However, the computational demand for large pipe networks is significant, and computational effort and accuracy of solution are interdependent.

This research analyzed the numerical accuracy of solution and computational efficiency of two popular methods—the method of characteristics (MOC) and the wave characteristic method (WCM). Results indicated that the WCM is a much more efficient method for modeling transients, without sacrificing accuracy. The WCM constitutes a feasible tool that utilities can use to conduct essential transient analysis and address serious low-pressure transient problems and surge protection issues.

For water providers, transient modeling is a "must do" item to safeguard drinking water quality within their distribution systems. Now transient modeling is also a "can do" task, using the efficient and time-saving method described here.—MPM

Cyclic storage systems optimization: Semidistributed parameter approach

Saeed Alimohammadi, Abbas Afshar, and Miguel A. Mariño

Conjunctive operation of surface water and groundwater systems is a key element in integrated water resource management. The cyclic storage of available water in both surface impoundments and groundwater aquifers reliably maximizes efficient use of available resources with minimum cost. Very large reservoirs are often needed to increase the marginal reliability of the naturally available surface waters. However, this option may result in high costs, extensive evaporation, and increasingly negative effects on the environment. The authors present a semidistributed optimization model for design and operation of a proposed cyclic system. The model includes interacting components of surface water and groundwater subsystems with the objective of minimizing total system costs. A generalized and modified unit response matrix method is developed and embedded into the optimization model. Water suppliers can use this information to develop their own model in order to manage their resources and go even further in banking their water.—MKK

Developing effluent limitations for hardness-based metals considering dynamic variability of effluent and receiving water hardness

Adam Laputz and Steve Saiz

To investigate the effect of hardness variability on implementation of the US Environmental Protection Agency's (USEPA's) hardness-dependent water quality criteria (e.g., metals), the authors superimposed effluent hardness and flow data from two publicly owned treatment plants onto 15 receiving water data sets. Although study results suggest that minimum effluent hardness may be used to develop protective effluent limitations for chronic cadmium, copper, chromium (III), nickel, and zinc, the results also suggest that in some cases significant data are necessary to develop protective effluent hardness–based limitations with 80% confidence.

The study supports USEPA's recommendation that effluent limitations for hardness-dependent metals be developed with consideration for the dynamic conditions seen in effluent and receiving water bodies. The authors provide guidance for implementing USEPA's hardness-based metals criteria based on real effluent and receiving water data sets. This generalized guidance will help water managers and permitting officials understand how to set metals limits that are protective of receiving water quality.—MKK