

**American Water Resources Association**  
**2009 ANNUAL WATER RESOURCES CONFERENCE**  
**November 9-12, 2009**  
Seattle, WA

**Thursday, Nov. 12**

**8:30 AM – 10:00 AM**

**SESSION 58: Watershed Management**

**Natural Background of Indicator Species in Stormwater - Brad Wilson**, University of Alabama, Tuscaloosa, AL (co-author: Robert Pitt)

Sewage-borne pathogen contamination of urban receiving waters constitutes risk to health. Because of difficulties in analyzing specific pathogen content in stormwater discharges to urban receiving waters, risks have traditionally been evaluated on the basis of indicator organisms, microorganisms assumed to have originated from sanitary-sewage contamination of the watershed and assumed to be more persistent than the corresponding sewage-borne pathogens. Research shows that sources other than sewage (e.g., animal feces and soil storage) significantly contribute to indicator-species assemblages in urban stormwater. Accurate assessment of health risk from runoff requires knowledge of these other sources, and of their potential for mobilization by rainfall. This study focuses on the deposition, survivability, storage, and release of microbial indicator organisms, of other than sewage origin, at stormwater source areas in various land uses, and their aggregation into outfall discharge at sub-watershed scales. Preliminary results, focused on dry-weather survivability of indicator species, and on cell-cell and cell-particle associations in wet-weather runoff will be presented. Most Probable Number (MPN) of indicator-species (*E. coli*, total coliforms, and Enterococci) Colony Forming Units (CFU) in runoff are being quantified during controlled laboratory tests and during actual rains at source areas and outfalls. MPN of whole and sieved runoff samples are being determined both for natural and for disaggregated CFU. Watersheds are sampled at their discharge points. Dry-weather survivability of indicator species are being examined by multifactorial culture (pH, temperature, moisture, clay and organic content in soils; temperature, moisture, and UV exposure on impervious surfaces). Analyses Bacterial Count - Most Probable Number (MPN) of Colony Forming Units (CFU) using IDEXX (Enterolert and Colilert) methods, for *E. coli*, total coliforms, and Enterococci. Water-Sample CFU and Particle-Size Association - MPN of water samples is being determined for whole samples and for sieve-separated fractions. Water-Sample Cell-Count and Particle-Size Association - MPN of water samples subjected to (previously optimized) maceration is being determined for whole samples and for sieved fractions. Survival Study - Source-area samples are being incubated in-house to determine dry-weather soil survivability with respect to growth factors over time. Cultured samples are water-suspended, and the MPN of suspended samples determined.

**Leveraging Resources from Multiple Partners to Advance Low Impact Development and Ecological Restoration in the Lockwoods Folly River Watershed - Jason Doll**, Stantec Consulting, Raleigh, NC

Brunswick County, North Carolina is the 29th fastest growing county in the United States, and much of that growth is focused around the County's fragile coastal and estuarine resources. The coastal watershed of the Lockwoods Folly River serves as an acute example of the impacts of rapid coastal development. In 1980, 16% of the estuary was closed to shellfish harvesting, whereas now approximately 55% is closed. The estuary is listed as impaired by USEPA due to the loss of that valuable resource from increasing pathogen loads from on-site septic systems and increasing stormwater runoff. With the support of a USEPA grant, Brunswick County and the North Carolina Coastal Federation organized and convened a Roundtable of local citizens, developers and community leaders for the explicit purpose of developing a slate of recommendations protect and restore Lockwoods Folly. Concurrently, the NC Ecosystem Enhancement Program had selected the watershed for development of a local watershed plan. Shortly after initiation, the two groups saw the opportunity and combined their efforts to avoid duplication, pool resources, and achieve a greater impact. Stantec Consulting was hired to provide technical support for

the local watershed planning effort, and was able provide a strong scientific basis for the Roundtable Recommendations. Using the USEPA-supported PLOAD framework, a watershed model was developed to examine nonpoint source pollutant loads of nutrients, sediment and fecal coliform under both existing and future landuse conditions. The modeling analysis predicted four-fold increases in pathogen loading under future conditions with existing land use plans and management scenarios. The Roundtable advanced a set of strategies including the implementation of low impact development (LID) methods, stream and wetland restoration, targeted preservation and stormwater BMP retrofits to reduce and prevent further degradation of Lockwoods Folly. Through simulation of various “what if” management scenarios, the model predicted significant pollutant load reductions from some of the Roundtable Strategies, but clearly illustrated that no one approach alone would achieve the desired level of reductions. Rather, an aggressive and comprehensive pursuit of all the strategies would be required to prevent further degradation of Lockwoods Folly and restore some shellfishing opportunities.

**Recast of Computer Model in Water Clarity Simulation for Management Decision - Ping Wang,**  
UMCES, Annapolis, MD (co-authors: Lewis C. Linker, Richard A. Batiuck)

The Chesapeake Bay Water Quality and Sediment Transport Model (WQSTM) has been used to assess the responses of the Bay’s water quality to nutrient and sediment loads. The Chesapeake numeric water quality standards of dissolved oxygen, chlorophyll-a, and water clarity are designed to protect and restore living resources, and the estimated nutrient and sediment reductions needed to achieve these standards are assessed by the WQSTM. Accurate simulation of water quality under different management scenarios is important, since a small deviation of model estimates of DO, chlorophyll, or clarity could lead to incorrect conclusions on whether the water quality standards are achieved or not. Numeric standards are difficult to assess with water quality models, as these models are representations of the ecosystems that are adept at generating relative differences in water quality responses, but may be inaccurate to adequately represent achievement or non-achievement of the Chesapeake numeric water quality standards. To take advantage of the representational strength of the models and the more than two decades of monitoring data collected by the Bay Program, an approach was developed using the observed data of light attenuation as the primary basis to project relative changes in light attenuation estimated by the model. The use of this “scenarioed data” provides the best approach for assessing the nutrient and sediment reductions needed to achieve the clarity/SAV numeric standard. Application of this method faces challenges, due to, 1) the water quality monitoring in the Chesapeake estuary is mainly along the center channels of the mainstem Bay and its tidal tributaries, and not at the nearshore areas where underwater sea grasses grow and the water clarity standard is enforced; 2) the model and the monitoring emphasize different components in the water clarity calculations.

**Evaluating Future Policies Using A Proactive Basin Management Tool - Jennifer Benaman,** Anchor  
QEA, Glens Falls, NY (co-authors: Emily Chen, Jim Patek, Harry Zahakos, In Cooperation with the Lower  
Colorado River Authority )

Lake Travis, Texas is a run-of-the-river reservoir located in the heart of the Texas Hill Country. This lake, which is one of the most pristine impoundments in the state, currently has basin-level policies in place to protect its water quality. Pending state-set nutrient criteria could potentially create the need to reset (or set new) permit limits for nitrogen and/or phosphorus constituents for existing dischargers, as well as potentially impact the assessment of Lake Travis in the 305(b) biennial Clean Water Act review of designated waters within the state. The Lower Colorado River Authority (LCRA), who manages the lake, has a vested interest in understanding the implications of policy changes in the basin, as well as the impact of continued growth in the watershed. The LCRA is committed to maintaining the quality of Lake Travis, a drinking water source, and ensuring that the water body will not be negatively impacted by growth. There is also a challenge on how to manage any potential policy changes, such as a lifting of the state-levied point source discharge ban. Consequently, the LCRA contracted and was intimately involved with the development of a combined watershed/water quality modeling framework to actively manage this precious resource. This presentation will overview the current policies that are in place in this basin and specifically focus on the point source discharge ban and non-point source ordinance. An overview of the basin-management tools that have been developed, including a combined watershed-water quality model will be discussed. A specific focus of the talk will be what could potentially happen to Lake Travis if the

state lifted the point source discharge ban and allowed discharges into the lake. Issues such determining reasonable permit limits for new point sources will be overviewed to show how this tool, when used proactively, can guide the state and LCRA on appropriate policy decisions, while maintaining the high water quality of the Lake.