

## Annual conference and symposium feature diverse presentations

More than 250 people attended WRRI's 2008 Annual Conference on October 8 and 9 to hear scientists, economists, engineers, and policy specialists from universities; local, state and federal agencies; and private consulting firms share their latest work. Participants chose from 76 technical presentations covering the full spectrum of water-related issues.

Matthew Larsen, Associate Director for Water with the U.S. Geological Survey, kicked off the conference with a keynote address on the "Water for America Initiative." Larsen said that—subject to budget considerations—USGS has plans to intensively study the 21 water resource regions in the United States over the next decade to generate a national water budget. As part of the effort, the agency plans to modernize its 7,400-station stream gage network, map aquifers, and study the effects of past and current water use, land use change, energy demand, and water quality as well as the effects of climate change on water availability.

for the long term. The interim study report is available at <http://www.nicholas.duke.edu/institute/waterallocation.pdf>. Interim recommendations include:

- Improve existing institutions and laws
- Clearly state policy goals to guide administrative and judicial decisions
- Establish a permit for large water withdrawals
- Conform existing laws to each other and to policy goals
- Improve our knowledge base
- Establish proactive, adaptive, river basin water supply planning
- Simplify and integrate water and water-funding information
- Address critical research and study needs
- Improve our supply
- Ensure that water infrastructure is maintained

*continued on page 2*



*Matthew Larsen, Associate Director for Water of the U.S. Geological Survey, was keynote speaker at WRRI's 2008 Annual Conference in October. He discussed the USGS Water for America Initiative, a new national appraisal of water availability that will track changing flow, use, and storage of water, and develop models and predictive tools to guide water management decisions.*

### Some technical session highlights

**Water Allocation.** One of the technical presentations gave participants insight into the statewide water allocation study being conducted under legislative mandate and sponsorship. Bill Holman of the Nicholas Institute at Duke University, one of the study leaders, described an initial set of policy options for making water management in North Carolina more efficient, equitable and sustainable

In this issue	November - December 2008
	Page
November Action of the Environmental Management Commission	3
They paved the way for improved water resources management	5
Lomax named NCSU Vice Chancellor	5
Scientists say greater efforts are needed to protect against microbial contaminants in swine waste	6
Progress Energy Water Resources Seminar review	7
Freeman is new Secretary of Environment and Natural Resources	7
Brewer named chairman of Sedimentation Control Commission	7
Events and Resources	8

## Annual Conference *continued from page 1*



WRRRI Associate Director Upton Hatch (right) and N.C. Water Resources Association President-Elect Trish D'Arconte (far left) congratulate winners of the 2008 NCWRA student poster contest. They are (right to left):

- First Place Winner Leah M. Teuber of UNC-Chapel Hill, for the poster "Mineral Deposition Occurring Behind Waterless Urinals." Principal investigator was Dr. Philip Singer, Department of Environmental Sciences and Engineering.
- Second Place Winner Manuel Reyes of N.C. State University for the poster "River Nitrate Gains Due to Groundwater Discharge at Waste Application Fields, Neuse River, NC." Investigators were Dr. William Showers and Dr. David Genereux, Department of Marine, Earth and Atmospheric Sciences.
- Kristen Rhodes of Elon University, accepting a third place award for herself and Adam Frank, Genevieve Romanello and Brant Touchette for the poster "Phytohormone signaling in emergent freshwater plants during simulated drought conditions."
- Christopher Miller, Brock Strom, and Brant Touchette of Elon University, not pictured, are the winners of another third place award, for the poster "Observed water conservation in a wetland plant, American water willow (*Justicia Americana*), during emerged conditions."

Honorable Mention awards went to Joel Sholtes and Martin Doyle of UNC-Chapel Hill for the poster "Stream Restoration and Flood Attenuation" and Vijaya Gagrani of UNC-Charlotte for the poster "A Long-term Study of Hydrological and Erosion Processes in an Urbanizing Watershed" (Dr. Craig Allan, investigator).

- Reward and spread best practices and leadership efforts in water efficiency
- Create more storage

**Dual Water Systems.** Terry Rolan of McKim and Creed Engineering described a new concept for developing dual municipal water systems that could reduce infrastructure costs and encourage more widespread use of reclaimed water. Rolan said that when old water distribution pipes—which are oversized to provide firefighting capabilities—need to be rehabilitated, new and smaller permanent stainless steel pipes for drinking water can be installed in place of temporary bypasses. Then the older pipes can be rehabbed and used to distribute high quality reclaimed water for firefight-

ing and other purposes. An added benefit of such dual systems would be better drinking water quality due to reduced residence times in smaller pipes.

**Drought Toolbox.** Duane Verner of URS Corp., contractor to the N.C. Division of Water Resources, described the Catastrophic Drought Response Measures Toolbox that resulted from an interagency tabletop exercise conducted in May 2008, to identify options for local governments to respond to catastrophic drought. For information about the toolbox, contact Tom Fransen of DWR: Tom.Fransen@ncmail.net.

**Water Budget Myth.** Jeffrey Wilcox

*continued on page 3*



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## Annual Conference

*continued from page 2*

of the UNC-Asheville Department of Environmental Studies described how the “water budget myth” of groundwater sustainability is causing water supply problems in up-scale residential developments in Western North Carolina. The assumption that groundwater use is sustainable if the pumping rate is less than the average recharge rate does not provide a reliable way of calculating minimum lot sizes and maximum housing densities, Wilcox said.



*Tom Schueler was keynote speaker at the NCWRA symposium, “The Billion Dollar Question—How Do We Manage Nutrients in the Built Environment?” held in conjunction with the WRRI Annual Conference. Founder of the Center for Watershed Protection, Schueler is now director of the Chesapeake Stormwater Network.*

## NCWRA symposium on stormwater retrofitting

Jason Doll, president of the N.C. Water Resources Association, introduced afternoon symposium keynoter Tom Schueler by referring to the “Jordan Lake rules,” which, if enacted will require stormwater controls on existing development and drive extensive retrofitting.

## November Action of the Environmental Management Commission

### Water Quality Committee

The N.C. Environmental Management Commission’s Water Quality Committee met November 12, 2008, and took the following action:

- Approved sending drafts of the Broad River and Yadkin-Pee Dee River basinwide plans to the full EMC for consideration. Staff presentations of summaries of the plans showing increased water quality problems in both basins generated concern among committee members. Committee Chair Charles Peterson called contents of the reports “horrifying” and expressed displeasure at the lack of strong recommendations for improvement. Dr. David Moreau said he had the same reaction to the reports and asked “What does the Clean Water Act empower us to do about nonpoint source pollution and TMDLs?” Moreau suggested a working group of staff and commissioners to explore options and next steps. The Yadkin-Pee Dee plan can be accessed at <http://h2o.enr.state.nc.us/basinwide/Neuse/2008/Yadkin2008.htm>. The Broad River plan can be accessed at <http://h2o.enr.state.nc.us/basinwide/Neuse/2008/Broad2008.htm>.

[state.nc.us/basinwide/Neuse/2008/Broad2008.htm](http://state.nc.us/basinwide/Neuse/2008/Broad2008.htm).

- Approved the 2007-2008 Coastal Habitat Protection Plan annual report. The report can be downloaded through the November Water Quality Committee agenda at <http://h2o.enr.state.nc.us/admin/emc/WQC-NOV08AGENDA.htm>.
- Approved asking the EMC to delegate enforcement of the Water Supply Watershed Protection procedures to the director of the Division of Water Quality.
- Heard a progress report on the Neuse and Tar-Pamlico agriculture rules. While the estimated nitrogen reduction (over the 1991-1995 baseline) in the Neuse Basin for crop year 2007 is less than in 2006 because of increased corn production, the reduction still exceeds the mandated 30%. In the Tar-Pam, the 2007 reduction increased 1% over 2006 and exceeds the mandated 30%. The committee also approved appointment of Neuse LAC members.
- Heard a report on a proposal to require mitigation for impacts to *continued on page 4*

### NCWRA Symposium continued

Schueler said that retrofits should be part of a stream recovery plan with clear and achievable goals and objectives that goes from the stream to roof. He said for effective retrofit, managers must find dozens, even hundreds of sites in the right places, with the right owners to cover 3-5% of a subwatershed. Opportunities for retrofit include old ponds, areas below outfalls, road culverts, highway rights-of-way, parking lots, and residential lawns and roofs.

An afternoon panel discussion included a discussion of the Jordan Lake rules. Rich Gannon of the N.C. Division of Water Quality told participants

that the rules would require local governments to develop plans for reducing nutrient loading from existing development and to begin implementing the plans four and one-half years after the effective date of the rules. Bill Hunt of N.C. State University described research on a number of retrofit practices that can prove effective given the right site. He said that pairing level spreaders with vegetated filter strips is a relatively untested practice but may be perfect in small watersheds with high water tables.

Presentation materials for the conference and symposium can be found on the WRRI website: <http://www.ncsu.edu/wrri/>

## November EMC Action *continued from page 3*

intermittent streams. Larry Eaton of the Wetlands Section said that his section has conducted nearly five years of research, funded largely by EPA, into the kinds of aquatic life found in ephemeral, intermittent and perennial streams in the Piedmont, Mountains and Coastal Plains of North Carolina. The research shows that nearly all of the species found in intermittent streams are also found in perennial streams and the same ecological principles and physical/chemical pathways that apply to perennial streams also apply to intermittent streams. Based on this information, DWQ is proposing to require compensatory mitigation through the 401 certification and isolated wetland permit programs for impacts to intermittent streams. A report on the research and details of mitigation requirements can be found at <http://h2o.enr.state.nc.us/ncwetlands/documents/IntermittentStreamMitigationPolicyVersion2.0.pdf>.

- The new policy was noticed by memo on December 4 and comments were taken until January 23. DWQ will review all the comments received and prepare a formal policy for approval by the director. Once that policy is finalized, the public will be notified via posting on the website.]
- Heard a report on DWQ efforts to formulate a statewide approach to address nutrients. The effort is in response to an EPA request that the state establish total nitrogen and total phosphorus standards. The approach will involve adopting region specific, quantitative *chlorophyll a* criteria, which will require rule changes. The North Carolina Nutrient Criteria Implementation Plan can be accessed at <http://h2o.enr.state.nc.us/csu/documents/NC-NutrientCriteriaImplemPlan6-1-04.pdf>.

### Environmental Management Commission

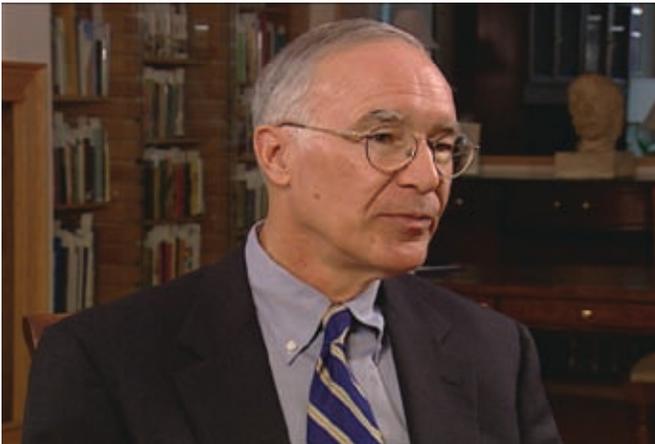
The EMC met on November 13, 2008, and took the following action:

- Approved delegating enforcement of the Water Supply Watershed Protection procedures to the director of DWQ to shorten enforcement time and expedite compliance.
- Approved holding public hearings on heavy-duty vehicle idling restrictions. This air quality rule will, with some exceptions, restrict idling of motor vehicles with a weight rating of 10,001 pounds or more to 5 consecutive minutes per hour.
- Heard report on temporary rules to amend the NOx SIP call rules for 2009 and later and approved changes to various air quality rules.
- Approved performance standards rules for new and expanding swine waste systems. The rules establish what systems must do to (1) eliminate the discharge of animal waste to surface waters and groundwater through direct discharge, seepage, or runoff; (2) substantially eliminate atmospheric emission of ammonia; (3) substantially eliminate the emission of odor detectable beyond the boundaries of the parcel or tract of land on which the swine farm is located; (4) substantially eliminate the release of disease-transmitting vectors and airborne pathogens; and (5) substantially eliminate nutrient and heavy metal contamination of soil and groundwater. A copy of the new rules is available at <http://h2o.enr.state.nc.us/aps/afou/documents/15ANCAC02T.130712-18-2008.pdf>.
- Approved holding public hearings on surface-water monitoring rules for animal operations. The rules were drafted in response to a petition from the Waterkeeper Alliance.

The rules and an analysis are accessible through the EMC November agenda: <http://h2o.enr.state.nc.us/admin/emc/Nov08Agenda.htm>.

- Approved reopening for 60 days the comment period on reclassification of Horespasture River in Jackson and Transylvania counties to Outstanding Resource Water with a special management strategy. Written comments, data or other relevant information may be submitted to Elizabeth Kountis at [Elizabeth.Kountis@ncmail.net](mailto:Elizabeth.Kountis@ncmail.net) by February 13, 2009
- Approved reclassifying a section of the Cape Fear River in Bladen and Cumberland counties to Water Supply IV. The Lower Cape Fear Water and Sewer Authority requested the reclassification so a new intake can be installed to provide water for the Smithfield Packing Company. This move is part of the effort to reduce demand on groundwater called for by the Central Coastal Plain Capacity Use Area rules.
- Approved site-specific water quality management rules for the Goose Creek Watershed in Mecklenburg County. Vice chairman Charles Peterson called the decision “ground-breaking” in that it is the state’s first plan to recover an endangered species, the Carolina heelsplitter mussel. The EMC required the recovery plan as a condition for granting an Interbasin Transfer Certificate to the Charlotte-Mecklenburg Utilities Department for transfer of water from the Catawba and Yadkin-Pee-Dee river basins to the Rocky River in the Yadkin basin. Details of the management plan can be found at <http://h2o.enr.state.nc.us/csu/GooseCreek.html>.
- Once again approved changes in the Jordan Lake nutrient management rules made in response to Rules Review Commission objections.

## They paved the way for improved water resources management



*John Morris retired in June after 28 years as Director of the N.C. Division of Water Resources*



*Terry Brown retired in June after 30 years in water management with the U.S. Army Corps of Engineers*

On June 3, 2008, friends and colleagues of Terry Brown gathered in Wilmington to mark his retirement after 30 years' work in water management for the Wilmington District of the U.S. Army Corps of Engineers. A few weeks later, John Morris accepted accolades after 28 years as Director of the N.C. Division of Water Resources and jetted off to France to celebrate his retirement.

Both men were highly honored for their work: Brown was featured as Tar Heel of the Week in November by the Raleigh News and Observer. Morris was awarded the Order of the Long Leaf Pine, the highest honor the governor can bestow on a citizen. The men were honored with good reason:

both left a legacy of advancement in water resources management that will allow their successors to move more quickly to deal with the huge challenges now emerging.

Oddly enough, while water resources management is a highly technical field, it was not for the technical aspects of their work that these men were most highly regarded. It was for demonstrating the power of cooperation to improve water management—for their patient and skillful efforts to get people with differing interests to work together for the greater good.

Managing several large multi-purpose reservoirs gave Brown many opportunities to cultivate patience and the ability to work through differ-

ences. During the recent "historic" drought, it was his job to work with stakeholders throughout the Neuse River Basin to manage releases from Falls Lake. Through careful listening and open discussion, he was able to get stakeholders to understand each others' needs, even as it appeared that Raleigh might run out of water.

Chief among Morris's successes in eliciting cooperation was the Central Coastal Plain Capacity Use Area plan. Getting municipal and county governments in 15 Coastal Plain counties to agree to restrictions on groundwater use—with all the economic implications of those restrictions—required exceptional patience and persistence. But the plan is in place and evidence is that it will soon lead to recovering groundwater levels.

When they departed, both Brown and Morris took with them a huge store of institutional memory and long years of observations that can still be mined for new insights. Brown will consult with the Corps on some special studies and "put down on paper" his experiences and recommendations for reservoir management. Morris said he expects to find ways to speak and write about water management issues in North Carolina.

### Lomax named NCSU Vice Chancellor for Research and Graduate Studies

On January 7, 2009, N.C. State University Chancellor James Oblinger announced the appointment of Dr. Terri Lomax as Vice Chancellor for Research and Graduate Studies. WRRRI falls in Lomax's area of supervision. Lomax, who has been the interim vice chancellor since June 2008, replaces John Gilligan, who left his post last year to return to teaching. Prior to becoming the interim vice chancellor, Lomax had been dean of N.C. State's Graduate School. She also spent 3 1/2 years at NASA in Washington, D.C., serving as an administrator and a senior policy analyst. She joined NASA from Oregon State University, where she was a professor of botany for more than 16 years. A biologist by trade, Lomax earned a bachelor's degree from the University of Washington, a master's from San Diego State University and a doctorate from Stanford University.

## Scientist says greater efforts are needed to protect against microbial contaminants in swine waste

Dr. Mark Sobsey, Distinguished Kenan Professor of Environmental Sciences and Engineering at UNC-Chapel Hill, says that while conventional lagoons and alternative treatments he studied reduce microbial pathogens in swine waste significantly, none achieves the reduction necessary to completely protect groundwater, surface waters, edible crops and humans from potential contamination.

### Background

Pathogens that can infect humans, including the bacteria *Salmonella*, *Yersinia* and *Leptospira* and the protozoans *Cryptosporidium parvum* and *Giardia lamblia*, are found in high concentrations in swine waste. In addition, there are growing concerns about the presence in swine waste of antibiotic-resistant bacteria and recently discovered animal pathogens, such as the swine hepatitis E virus and influenza viruses, that might be able to infect humans.

Per capita fecal production by swine far exceeds that of humans, and concentrations of pathogens occur at levels of millions to billions per gram of wet weight. Housing thousands to tens of thousands of animals in small areas creates huge amounts of waste and poses significant risk to humans.

Researchers have documented numerous ways in which pathogens from animal waste can move off farms: when animals themselves are moved, when treated waste is moved off-farm as fertilizer, when pathogens are transported by runoff or by air in dust or aerosols from barns and land-application sites, when various vectors (rats, geese) come into contact with wastes, when contaminated workers transmit pathogens to families and other contacts, and when produce is irrigated with effluent. In addition, waterborne outbreaks of *E. coli* illness in humans in several loca-

tions have been linked to groundwater contamination by animal manures.

### The Research

The investigator collected multiple samples of influent and effluent from (1) single-stage anaerobic lagoons at several kinds of swine facilities, (2) a two-lagoon system, (3) an anaerobic digester with a 7-million-gallon in-ground reactor, (4) a two-cell constructed wetland planted with bur-reed and cattails, (5) a "marl-gravel" media filter, (6) an overland flow cell, (7) a two-stage aerobic biofilter preceded by a solids separator, (8) an aerated solids recovery biological treatment system consisting of a "solids ecoreactor, three "bioreactors," and a temporary liquid storage area.

Samples were analyzed for the bacterial pathogen *Salmonella* and a suite of 6 microbial indicators: fecal coliforms, *Escherichia coli*, enterococci (fecal bacterial indicators); somatic coliphages and F-specific coliphages (viral indicators); and *C. perfringens* spores (indicator for protozoans), as well as total suspended solids, chemical oxygen demand, and pH.

### Results

The analyses showed the following:

- The one-stage lagoons and the anaerobic digester appreciably reduced enteric microbe concentrations, except for the indicator organism for protozoans. However, relatively high concentrations, including *Salmonella*, remained. In the two-lagoon system, the second lagoon accomplished appreciable further reduction in concentrations.
- Constructed wetlands, aerobic biofiltration and aerobic solids recovery biological treatment reduced *Salmonella* and enteric microbial indicators as well as lagoons and

the anaerobic digester.

- The aerobic biofilter system reduced *Salmonella* and enteric microbial indicators (except for the indicators of protozoans) somewhat better than the single-stage lagoons and in less time. However, backwash from the biofilter system contained high concentrations of enteric microbes and would require additional treatment.
- The aerated solids recovery biological treatment system achieved high microbe reductions (except for the indicator of protozoans), and concentrations fell more after storage in the temporary storage area (a former primary lagoon).
- The constructed wetland system was the only treatment that reduced indicator organisms for protozoans at the same level as other enteric microbes.
- The marl-gravel media filter and overland flow system developed for nitrification did not reduce pathogen concentrations as well as other treatment systems.
- None of the treatment systems produced a final effluent that would meet the limits for *Salmonella* and fecal indicator bacteria required for land application of domestic or municipal wastewater.

Because secondary lagoons further reduce microbe concentrations, Sobsey says they should be considered for greater pathogen reduction. In addition, he says, it is likely that a third lagoon in series would accomplish even greater reductions. Using former lagoons for temporary storage of effluent is a beneficial and cost-effective way to use existing structures.

Sobsey also says that using one of three alternative treatments stud-

*continued on page 7*

## Swine Waste

*continued from page 6*

ied—constructed wetlands, aerobic biofilter and aerated solids recovery biological treatment—might reduce the risk of environmental contamination. These systems reduce pathogens as well as lagoons but more quickly and with less volume than lagoons require, so system failures or events such as flooding would not be as catastrophic.

Finally, Sobsey says that because none of the systems studied eliminate the risk of contamination by pathogens in swine waste, the extent of contamination of groundwater, surface waters and edible crops should be studied.

## Freeman is new Secretary of Environment and Natural Resources

On January 7, 2009, then Governor-elect Beverly Purdue announced her selection of Dee Freeman to lead the N.C. Department of Environment and Natural Resources. Freeman, who had been executive director of the Triangle J Council of Governments in Raleigh since August 2000, has more than thirty-four years of local government and regional management experience. As TJ-COG executive director he worked closely with local governing boards to address transportation needs, growth management issues, environmental issues, and a variety of regional planning interests. Freeman received a BS from N.C. State University and a Master of Public Administration from Appalachian State University and is a graduate of the Municipal Administration Program of the UNC-CH Institute of Government.

### *Progress Energy Water Resources Seminar*

## Price-based methods are more cost-effective for reducing water demand

At the Progress Energy seminar in November, Yale economist Sheila Olmstead told attendees that while demand for water is relatively inelastic, it is not unresponsive, and response is stronger under higher prices. Moreover, she said, demand in the residential sector is inelastic because, in most cases, prices are too low—well below the long-run marginal cost of supply.

Dr. Olmstead said that her conclusion from research she conducted with Robert Stavins of Harvard is that using prices to manage water demand is more cost-effective than implementing non-price conservation programs such as restrictions on outdoor use or rebates for efficient fixtures. In addition, she said, price-based approaches to water conservation are easier and less expensive to monitor and enforce, while

non-price approaches can create political liabilities in the form of water utility budget deficits.

Why, then do the vast majority of water systems use non-price methods to manage demand? Because low water prices are popular and politically difficult to change. Educating customers about the real cost of water might make rate increases more acceptable, she says, but, if elected officials choose to have their communities bear the costs of inefficient water pricing, they should at least measure the tradeoffs and make them explicit to customers.

The report on Dr. Olmstead's research is accessible at <http://www.ncsu.edu/wrri/events/progressenergyseminars/> or at [http://pantheon.yale.edu/~smc77/Olmstead\\_Stavins\\_water\\_price\\_non-price\\_final.pdf](http://pantheon.yale.edu/~smc77/Olmstead_Stavins_water_price_non-price_final.pdf)

## Brewer named chairman of Sedimentation Control Commission

Donnie W. Brewer has been appointed chairman of the 12-member North Carolina Sedimentation Control Commission (SCC). Brewer has been a member of the N.C. Environmental Management Commission (EMC) since 2002 and has represented the

EMC on the SCC since 2004.

Brewer received a bachelor's degree in mathematics from the University of North Carolina at Chapel Hill and a civil engineering degree from NC State University.

## Upcoming Events

**February 9-12, 2009**

IECA Annual Conference

Reno Convention Center and Atlantis Casino  
Hotel, Reno, Nevada

<http://www.ieca.org>

**February 25-26, 2009**

2009 Spring Erosion and Sedimentation Control  
Workshop

McKimmon Center, NC State University

<http://www.ncsu.edu/wrri/erosionworkshops.html>

**February 26-27, 2009**

14th International Water Conservation &  
Xeriscape Conference

Marriott Pyramid Hotel

Albuquerque, New Mexico

<http://waterconservationconference.org>

**May 12-13, 2009**

2009 IECA Southeast Chapter

Muddy Water Blues

Asheville, NC

<http://guest.cvent.com/EVENTS/Info/Summary.aspx?i=ad0c0576-a14b-4480-8334-45a4a4f21fd2>



## NCWRA Luncheon

11:30 am, February 16, 2009

McKimmon Center

NC State University

**“The Grass Is Always Greener  
Under the Water Sprinkler:  
The Role of Water Reuse in an Integrated  
Water Resource Management Approach”**

*Speaker: Don Safrit, Technical Specialist,  
McKim & Creed, P.A.*

Population growth and climate change will have a dramatic effect on future use of North Carolina’s water resources. Water conservation and water efficiency can play a major role in ensuring a sustainable water supply but many communities must begin to plan in earnest for alternative water supplies for future demands. The presentation will discuss the current role of water reuse in North Carolina and the benefits, drivers, and impediments to implementing water reuse as part of an integrated water resource management approach.

This forum will provide 1 PDH (professional development hours) for professional engineers and surveyors, authorized by the NC Board of Examiners for Engineers and Surveyors.

Download a registration brochure (pdf):  
[http://www.ncsu.edu/wrri/events/ncwra/NCWRA\\_Feb2009.pdf](http://www.ncsu.edu/wrri/events/ncwra/NCWRA_Feb2009.pdf)

### Resources

## Interactive Real-Time Data Retrieval Map

The USGS North Carolina Water Science Center has developed a new interactive map application which can be used to access all of the agency’s real-time data. The map is accessible at <http://nc.water.usgs.gov/realtime/index.html>

The entire state can be displayed, or individual subbasins can be selected. The default setting is to display all four types of data: precipitation, surface water (streamflow and stage), ground water, and water quality. Appropriate boxes can be checked or unchecked to choose the types of data for display. Once a station is selected by clicking on the site icon, the most current readings for that station are displayed in a pop-up window.