

State sticks with 30% nitrogen reduction goal for Neuse Estuary

Based on chlorophyll a predictions from the Neuse Estuary Eutrophication Model (NEEM), the N.C. Department of Environment and Natural Resources (DENR) has recommended to the U.S. EPA no immediate change in the nitrogen reduction goal for the Neuse River Estuary.

However, according to Chris Roessler, who heads up the Division of Water Quality's Neuse total maximum daily load (TMDL) project, recommendations from the recently completed reduction goal assessment will not necessarily form the basis for the phase 2 TMDL assessment that the department is scheduled to complete by March 31, 2001.

As part of an agreement with the U.S. EPA on a TMDL for total nitrogen for the Neuse River Estuary, DENR agreed to revisit its 30% nitrogen reduction goal by July 1, 2000, to demonstrate that the NEEM model has been calibrated and is ready to be applied to the TMDL assessment. But, said Roessler, more stakeholder input, further calibration of the NEEM, and additional modeling tools are needed before a final TMDL and implementation program can be recommended.

According to Roessler, the NEEM model—developed under the Neuse Modeling and Monitoring Program—does not predict sufficiently frequent violations of the State's standard for chlorophyll a in the Neuse Estuary to justify an immediate change in the

nitrogen goal. To be considered impaired for its designated uses, the Neuse Estuary would have to experience violations of the 40 µg/l chlorophyll a standard (the most straightforward measurement of nitrogen impacts) more than 10% of the time—that is more than 10% of all samples taken would have to be in violation of the standard.

Roessler said that insufficient data for modeling is available for periods prior to initiation of the Neuse ModMon Program and that data from June 1997 to December 1998 showed a bare 10% violation of the chlorophyll a standard at only one sampling site. Therefore, the use-support criterion was not exceeded at any site in the Estuary during 1997-1998.

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Director's Forum

Evaluation of the Neuse TMDL for nitrogen

Kenneth H. Reckhow, Director, Water Resources Research Institute

As reported in this issue of the *WRI News*, the N.C. Division of Water Quality has submitted an initial assessment of the reduction goal for nitrogen loading to the Neuse Estuary and found no reason to change the 30% reduction goal at this point. In light of the evidence and analysis to date, this is a reasonable conclusion, but it should not be assumed that changes to the total maximum daily load (TMDL) for total nitrogen in the Neuse Estuary will not occur later in the evaluation process.

Neuse ModMon scientists have been working on a variety of modeling and assessment tasks to provide a scientific basis for the TMDL recommendation. The principal modeling effort to date is the Neuse Estuary Eutrophication Model (NEEM), developed as a modification of the CE-Qual-W2 model at UNC-Charlotte. NEEM is a relatively complex model that is being used to predict the impact of changes in nitrogen loading on chlorophyll and dissolved oxygen in the estuary. A great deal of time and data has been required to prepare NEEM for application to the Neuse; at this point, NEEM yields reasonably reliable predictions of median chlorophyll at various locations in the estuary.

However, water quality standards and public concern in the Neuse reflect extremes (e.g., algal blooms), not average conditions. To address this, we have just begun to examine statistical extensions of NEEM to allow us to reliably predict the frequency of exceedances of the chlorophyll standard. Largely hypothetical calculations describing how this model extension might be used were described in the DWQ report to EPA, but these calculations do not reflect the final model. Two critical additions are need: (1) data from NCSU scientists will allow us to better characterize the near-shore regions of the estuary, and (2) thorough statistical analysis will allow us to

properly extend NEEM to estimate standard exceedances.

In a previous Director's Forum (*WRI News*, May 1999), I noted that ModMon scientists were developing alternative modeling and assessment strategies that will be evaluated and collectively applied for TMDL development. Just as meteorologists depend on multiple models to guide their forecasts, we believe that the application of several

distinct models will enhance our ability to make reliable predictions. Accordingly, ModMon scientists from the UNC Institute of Marine Sciences, East Carolina, and Duke University are independently developing predictive techniques to assess the nitrogen TMDL.

The Duke modeling effort is a probability network model (Neu-BERN) that I discussed in my second *WRI*

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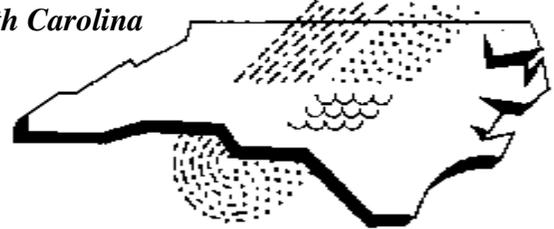
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Director's Forum (*WRRRI News*, July 1996). This model includes uncertainty analysis, which is important because it gives us an explicit measure of reliability. In addition, Neu-BERN is being designed to predict variables of particular interest to stakeholders, such as fish habitat and shellfish viability. Broad public concerns will also be addressed in a new ModMon project leading to stakeholder negotiation of the TMDL nitrogen load allocation responsibility among major sources and geographic regions.

There is still much work to be done before a final TMDL for nitrogen in the Neuse is approved, but we believe that the WRRRI ModMon project has become a model for a university/state/public cooperative effort in environmental planning.

Delaware Sediment & Stormwater Conference 2000

October 24-26, 2000
Clayton Hall
Conference Facility
University of Delaware
Newark

The conference will focus on topics related to erosion, sediment and stormwater management issues, including innovative strategies to meet regulatory challenges and low impact development/nonstructural approaches for stormwater management.

Keynote speaker is Eric Livingston of the Florida Department of Environmental Protection. Closing plenary session speaker is Tom Schueler of the Center for Watershed Protection.

For program and registration information contact
Jeanne Feurer
Conference Coordinator at
(302) 739-4411 or
jfeurer@dnrec.state.de.us

Neuse nitrogen reduction goal continued

Runs of the NEEM model using base loading and 15%, 30% and 45% total nitrogen load reductions (with and without sediment "cleanup") predicted no exceedances of the use-support criterion.

"We're not modeling an impaired time," said Roessler, "but we know from the longer-term record that the chlorophyll a standard is exceeded more than 10% of the time at at least two sites, so we have to continue to work on the modeling."

Roessler said that for the phase 2 assessment, the NEEM model will be recalibrated using 1999 data.

"There were more high chlorophyll a observations in 1999," he said, "so inclusion of this data will help make the model more representative of the impairment."

He said that in addition to recalibrating the NEEM model to include longer-term data, DWQ will consider a statistical analysis that will better identify the likely high and low chlorophyll a concentrations over a year's time.

"The NEEM model does a good job of predicting the average or normal conditions in the Neuse Estuary. Currently it is not as good at predicting the extreme conditions. Statistical modeling will be used to tell us what the extreme conditions might look like."

Roessler said that as the Neuse ModMon Program delivers its other products, including a probability network model, DWQ will investigate a total maximum daily load based on endpoints other than just chlorophyll a, including habitat for fish and shellfish. He said that the probability model may prove useful in predicting fishkills and that NEEM output may be used by biologists to characterize estuary habitat quality under various load reduction scenarios.

EPA's reaction to the nitrogen reduction goal is expected by August 1. The second phase TMDL for nitrogen loading to the Neuse Estuary is scheduled to be ready for public review by March 31, 2001. (See schedule to right.)

The document delivered to EPA, "Initial Reduction Target Assessment for the Neuse River Estuary, North Carolina" has been presented to stakeholders and was scheduled for discussion at a meeting on July 20.

The document is available for download in pdf at <http://h2o.enr.state.nc.us/mtu/> or from Chris Roessler at (919) 733-5083 Extension 506 or chris.roessler@ncmail.net.

Milestone dates for reviewing and revising the Neuse total nitrogen TMDL

April 1, 2000. A CE-QUAL-W2 model (NEEM estuary response model) will be completed to the extent that it will be ready to use as a tool for the completion of the second phase of the TMDL.

July 1, 2000. The nitrogen reduction goal (i.e. the total percent reduction necessary to support the estuary's uses) will be completed using the CE-QUAL-W2 model and other data and tools available. The state will provide EPA Region IV with the appropriate information to review by this date.

August 1, 2000. EPA Region IV will approve/disapprove the State's nitrogen reduction goal submitted on July 1, 2000.

March 31, 2001. The State will publish notice for comment on the 2nd phase of the TMDL.

July 31, 2001. The State will submit the 2nd phase TMDL to EPA for approval/disapproval.

August 30, 2001. EPA Region IV will make an approval/disapproval decision on the 2nd phase of the TMDL.

July action of the N.C. Environmental Management Commission

At its July 13 meeting, the N.C. Environmental Management Commission took the following action:

- Reappointed Dr. Donald Francisco, Wayne Bryant and C.L. Gobble and appointed Robert Dodson and Robert Grant O'Dette to the Water Pollution Control Systems Operators Certification Commission.
- Denied a request from the City of Durham to reopen round two of the Jordan Lake water supply allocation process and began a third round of allocations (see article page 6).
- Recertified a reorganized Western N.C. Regional Air Quality Control Agency. Haywood County has withdrawn from the agency.
- Approved holding public hearings on changes to a variety of air quality rules (for more information see the Division of Air Quality website at <http://daq.state.nc.us/Rules/>).
- Adopted a permanent rule exempting ongoing agricultural and ongoing silvicultural activities from wetlands standards at 15A NCAC 2B .0231. The rule was necessary to restore the exemption that existed prior to overturning of certain Corps of Engineers regulations. Environmental groups and DENR had wanted the rule to include a requirement for notifying the department prior to the start of new ditching on sites larger than 50 acres. The notification requirement was seen as a way to allow DENR to identify ditching for commercial purposes under the guise of silviculture. Due to lobbying by the forestry industry and objections from numerous landowners, the notification requirement was not adopted.
- Adopted permanent rules addressing urban stormwater and nutrient management in the Tar-Pamlico River Basin. The Tar-Pam agricultural rule was not adopted because of continued disagreement among stakeholders about appropriate BMPs for grazing. For information on the Tar-Pam rules go to the Division of Water Quality website at <http://h2o.enr.state.nc.us/nps/tarp.htm>.
- Approved the first annual report on the status of the Coastal Habitat Protection Plans (CHPP). The report is to be submitted to the Environmental Review Commission and the Joint Legislative Commission on Seafood and Aquaculture. Information on the CHPP's can be found on the N.C. Marine Fisheries Commission website at <http://www.ncfisheries.net/habitat/chpp1.htm>. The EMC delegated authority to its Water Quality Committee to approve future CHPP reports.
- Reclassified the headwaters of the Green River (Henderson County) and its tributaries upstream of and including Rock Creek to Class B. Trout High Quality Waters (HQW). The HQW classification is meant to protect waters rated as excellent and requires certain management measures in the drainage area. The original request that led to this reclassification had also included a request to reclassify Lake Summit as Outstanding Resources Waters. Monitoring revealed that the lake does not qualify for the classification. During public hearings, concern emerged about possible bacterial contamination of the lake by septic systems. Commissioner Robert Ray asked that additional monitoring be done to investigate whether there is a problem with bacterial contamination in the lake. Commissioner Dan Besse also asked staff to investigate whether

the reclassification needs to be adopted as a temporary rule to help avoid negative impacts of a large development that is planned for the watershed.

- Approved the final Cape Fear River Basinwide Water Quality Plan. A copy of the plan is available from Twanetta Lytle at (919) 733-5083 Extension 360 or Twanetta.Lytle@ncmail.net.
- Approved the final New River Basinwide Water Quality Plan. A copy of the plan is available from Twanetta Lytle at (919) 733-5083 Extension 360 or Twanetta.Lytle@ncmail.net.
- Heard a report on the Governor's Framework for the Conversion of Anaerobic Lagoons and Sprayfields. DENR staffer Michael Shore outlined a "mass balance" approach to the problem of nutrient pollution from swine farms under which total loss of nitrogen from the swine industry would be lowered to 1993 levels. Existing facilities would be allocated decreasing quantities of nitrogen inputs to their operations over a six-year period to reach the 1993 baseline. New facilities would be required to offset 100 percent of their projected ammonia emissions by buying credits from existing facilities. Shore said the department expects to come to the EMC with request to take a draft rule to public hearing in September. Commissioner Robert Cook objected, saying the facts are not clear enough to serve as the basis for such a regulatory program. For information on the plan, contact Shore at (919) 715-2613 or Michael.Shore@ncmail.net.

Water Quality Committee action

At its July 12 meeting, the EMC's Water Quality Committee approved Water Supply Watershed Protection ordinances for the Town of Trinity and Burke County and a revised ordinance for the City of Jamestown.

Environment-related legislation passed by the N.C. General Assembly

The N.C. General Assembly concluded its 2000 short session on July 13. Following are some of the environment-related bills the Legislature passed during the short session. A more complete list along with links to the bill text on the General Assembly web server is available in the web version of this newsletter at the WRRI website: <http://www2.ncsu.edu/ncsu/CIL/WRRI/news/324.html>.

- H 968 An act to modify the procedures concerning final administrative decisions in contested cases heard by the Office of Administrative Hearings, to authorize administrative law judges to award reasonable attorney's fees in certain cases, and to authorize the courts to award reasonable attorney's fees for administrative hearings.
- H 1132 An act to promote the preservation of farmland and to promote small, family-owned farms. Amends *GS 106-744 (c)* to establish new matching provisions for the North Carolina Farmland Preservation Trust Fund. Establishes lower matching requirements for counties that have developed countywide farmland protection plans (including no match for enterprise tier one, two, and three counties). Spells out what countywide farmland protection plans must include.
- H 1218 An act to amend various environmental laws: (1) to promote water conservation by providing for the use of sub-meters in consecutive water systems; (2) related to urban waterfront redevelopment; (3) to provide for variances under the dredge and fill permit program; (4) to clarify the authority of the governor to make appointments to the Environmental Management Commission; (5) to require the Dept. of Environment and Natural Resources to consult with stakeholders prior to developing riparian buffer rules; (6) to prohibit the Marine Fisheries Commission from establishing fees for certain permits and to abolish certain existing permit fees; and (7) to make clarifying, conforming, and technical changes.
- H 1288 An act to recognize metropolitan planning organizations in state law and to provide a process for voluntary evaluation of metropolitan planning organization boundaries, structure, and governance.
- H 1326 An act to designate the state sales tax revenue from dry-cleaning and laundry services to the dry-cleaning solvent cleanup fund, to increase the state sales tax on dry-cleaning solvents, to amend the dry-cleaning cleanup act of 1977 to repeal the requirement of financial responsibility for dry-cleaning facilities and wholesale dry-cleaning solvent distribution facilities, to allow the environmental Management Commission to enter into contracts with private contractors for assessment and remediation activities at dry-cleaning facilities and wholesale dry-cleaning solvent distribution facilities, to direct the secretary of environment and natural resources to study the use of dry-cleaning solvents in North Carolina, and to make other changes in the dry-cleaning Solvent Cleanup Act of 1997. *Provides that 15% of the net State sales and use taxes on dry cleaning services be transferred quarterly to the Dry-Cleaning Solvent Cleanup Fund. Increases the percentage of the Fund that may be used to defray costs incurred by the Department of Environment and Natural Resources and the Attorney General's Office in administering the cleanup program. Makes major changes to the Dry-Cleaning Cleanup Program.*
- H 1577 An act to authorize the addition of Bullhead Mountain State Natural Area to the state parks system, as recommended by the Environmental Review Commission.
- H 1583 An act to provide an incentive for investing in dry-cleaning equipment that does not use hazardous substances and to modify the authorization for investing state funds in rural North Carolina.
- H 1602 An act to clarify that stormwater utility fees may be used to fund all costs of stormwater management programs, as recommended by the Environmental Review Commission. *Clarifies that a county, city, or authority may collect fees or other charges to fund stormwater management programs. Provides that a county's, city's or authority's cost of providing a stormwater management program and a structural and natural stormwater and drainage system includes any costs necessary to assure that all aspects of stormwater quality and quantity are managed in accordance with federal and state laws, regulations, and rules.*
- H 1617 An act to authorize the addition of Lea Island State Natural Area to the State Parks System, as recommended by the Environmental Review Commission/ to transfer state property in Burke County; and to reallocate state land in Wake County to the Department of Cultural Resources for the North Carolina Museum of Art.
- H 1618 An act to extend the de minimis reporting exception to all discharges of petroleum, as recommended by the Environmental Review Commission.
- H 1625 An act to establish a pilot program for the removal of abandoned vessels in the Neuse River Basin.
- H 1638 An act to improve ambient air quality, to provide for the use of on-board diagnostic equipment in the motor vehicle emissions inspection and maintenance program, and to exclude federal congestion mitigation and air quality funds from the distribution formula for funds expended on transportation, as recommended by the Environmental Review Commission.

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Legislation *continued*

H 1732 An act authorizing the Town of Ocean Isle Beach to protect and regulate erosion control works as a public enterprise.

H 1854 An act to (do a large number of things including) repeal the sunset of the white goods tax and direct the Department of Environment and Natural Resources to study issues related to the scrap tire disposal tax and the white goods disposal tax.

S1082 An act to extend the terms of members of the Structural Pest Control Committee that are appointed by the General Assembly from two years to four years and to require that member recommended by Speaker of the House be actively engaged in pest control industry.

S 1252 An act to create a tax incentive for the redevelopment of brownfields properties, as recommended by the Environmental Review Commission.

S 1275 An act to extend the moratorium on new billboards along a designated section of Interstate 40, as recommended by the Environmental Review Commission. *Extends to July 1, 2001, the moratorium on the issuance of permits for and erection of outdoor advertising along the portion of Interstate 40 from the Orange-Alamance County line to the municipal limits of the City of Wilmington.*

S 1279 An act to provide that certain requirements related to land-use restrictions that apply generally to risk-based environmental cleanups do not apply to cleanups of petroleum from leaking underground storage tanks and to direct the Environmental Review Commission to continue to study the application of land-use restrictions to the cleanup of environmental damage from these tanks through a stakeholder negotiation process, as recommended by the Environmental Review Commission.

S 1311 An act to authorize the addition of the Mountains to Sea State Park Trail to the State Parks system as recommended by the Environmental Review Commission.

S 1328 An act to encourage, support, and accelerate the permanent protection of farmland, forestland, parkland, gameland, wetlands, open space, and conservation lands in North Carolina, as recommended by the Environmental Review Commission. *Sets a state goal of permanently protecting an additional one million acres of farmland, open space, and conservation lands by December 31, 2009. Provides that preservation will be accomplished by acquisition in fee simple or by acquisition of perpetual conservation easements by public conservation organizations or by private entities that are organized to receive and administer lands for conservation purposes.*

S 1329 An act to provide for additional notice of an application for a permit under the Mining Act of 1971, as recommended by the Environmental Review Commission. Establishes new requirements for notification of application for a new or modified mining permit. *Requires that when the Department of Environment and Natural Resources receives an application for a new or modified mining permit that would add land area to the mining operation, the following agencies be notified and given the opportunity to provide written comment: Division of Air Quality, Division of Parks and Recreation, Division of Water Quality, Division of Water Resources, N.C. Geological Survey, Wildlife Resources Commission, N.C. Division of Archives and History, U.S. Fish and Wildlife Service, and any other federal or state agency the department determines to be appropriate.*

S 1341 An act to prevent inappropriate development in the one hundred-year floodplain and to reduce flood hazards. *Designates the channel and the adjoining 100-year floodplain of all State streams as flood hazard areas and sets out restrictions on development in flood hazard areas.*

S 1381 An act to reallocate the proceeds of the Clean Water Bonds.

Schedule approved for round three of Jordan Lake allocations

On July 13, the N.C. Environmental Management Commission approved a schedule for a third round of water supply allocations from the Jordan Reservoir.

Initiation of third-round allocations was prompted by the City of Durham's request for reconsideration of its round-two request for an allocation. The EMC's Water Allocation Committee decided in May not to reconsider round-two allocations—nearing completion—but instead to initiate a new round and instructed staff of the Division of Water Resources to develop a schedule for third-round allocations that would bring allocation recommendations back to the EMC within a year.

Background

B. Everett Jordan Lake is a U.S. Army Corps of Engineers multi-purpose lake on the Haw River in Chatham County. It was filled in 1982. Approximately 45,800 acre-feet is designated for water supply storage. This amount of storage is estimated to furnish about 100 million gallons per day (MGD) even during drought.

Only one round of allocations of water supply has been approved so far. Currently, about one-third or 35 MGD of the 100 MGD water supply pool is allocated, with the lion's share (16 MGD) going to the municipalities of Cary and Apex.

A second round of allocations was initiated in 1996 at the request of the Town of Cary, which—together with Apex—requested an additional 29 MGD. Staff recommendation is that Cary/Apex receive an additional 5 MGD and that Morrisville and RTP South/Wake County, which applied in conjunction with Cary/Apex, receive 2.5 and 1.5 MGD respectively.

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EMC approval of second round allocations awaits certification of interbasin transfer (IBT) for Cary/Apex/Morrisville/RTP South. The Environmental Impact Statement (EIS) prepared by these entities for IBT certification is now under agency review. A public hearing on the EIS was held July 13, and approval of second round allocations is anticipated in February 2001.

If current staff recommendations for allocations are approved, then 44.0 MGD (about 44%) of the available 100 MGD will be committed, with Cary and Apex receiving about half (21 MGD) and about 20.2 MGD being transferred from the Cape Fear Basin to the Neuse Basin until Cary and Apex complete new wastewater treatment facilities that will discharge to the Cape Fear Basin.

Third-round allocations

The schedule approved for third-round allocations will bring allocation recommendations to the EMC in December 2001—a period of 14 months. During this period, the Division of Water Resources will review Jordan Lake operations and hydrology of the Cape Fear River Basin, develop standards for applicants to use to develop demand forecasts and safe yield analyses, and develop a draft Cape Fear River Basin Water Supply Plan. By July 2001, these elements as well as individual applications for water allocations will be ready for public review.

Following public review and comment on the Cape Fear River Basin Water Supply Plan and individual applications for water allocations, the EMC Water Allocation Committee will recommend allocations. Public hearings will be held on allocation recommendations in November 2001, and final recommendations will be approved by the EMC in December.

According to Sydney Miller of the N.C. Division of Water Resources, an allocation for Durham would not likely involve interbasin transfer as the Durham system has the capability to discharge back to the Cape Fear Basin.

Draft State Water Supply Plan available

One hundred sixteen publicly owned water systems in North Carolina are at risk of shortages during periods of peak use and during droughts. By 2020, the number of at-risk publicly owned water systems will increase to 169 unless these systems take steps to increase their water supply. That's according to the draft *North Carolina State Water Supply Plan* recently made available.

The draft *North Carolina State Water Supply Plan* is the first document to be developed pursuant to 1989 legislation requiring a state water supply plan. The legislation requires local governments to develop and submit water supply plans to the N.C. Division of Water Resources and requires the division to analyze the local plans and develop a state plan to address potential problems and conflicts.

The current plan is based on a compilation of more than 500 water supply plans developed by local governments. It does not include private water suppliers.

The main body of the State Water Supply Plan includes general water supply planning information, along with a detailed discussion of the major water supply issues currently affecting North Carolina and considerations for meeting future water supply needs. These discussions are followed by summaries of water supply conditions for the major river basins in the State that have systems that submitted local water supply plans.

The document is available in pdf format at http://www.dwr.ehnr.state.nc.us/wsas/nc_swsp.htm. Comments are being taken on the draft until November.

The Urbanization of Ocracoke

Reprinted by permission from the May-June 2000 issue of Atlantic CoastWatch

No nook or cranny along the mid-Atlantic seaboard has seemed more isolated, or better protected from the usual ailments of urbanization, than placid Ocracoke on North Carolina's isolated Outer Banks. Guarded on one flank by open water and on the other by public lands belonging to the Cape Hatteras National Seashore, Ocracoke's mere 750 acres of privately held and well buffered land seemed securely destined to remain a bucolic retreat of small inns, restaurants, and cottages.

But in recent years a major flush of tourism has created new problems for the small community: trash and sewage disposal, parking, and traffic congestion from an ever-growing stream of cars and trucks flowing in from Cape Hatteras some 15 miles to the north or debarking in droves from the Cedar Island-Swan Point Ferry. Thomas B. Richter, chief planner in North Carolina's Division of Community Assistance, attended a recent community meeting. "His comments struck me as the most telling of the evening," reported visiting journalist

Irene Nolan in *The Island Breeze*. "I've listened to your problems tonight," Richter said, "and they are urban problems. Ocracoke is not a rural entity any more."

According to Nolan, no proposed solution comes without difficulties. The town cannot secede from Hyde County, on the mainland and indifferent to island problems, without permission from the county which in turn appreciates Ocracoke tax revenues. Incorporation could bring independence, but at a heavy tax cost. Both the National Park Service and some business owners, reports Nolan, oppose the idea of establishing a remote parking area and ferrying visitors into town by shuttle bus.

In the end, Nolan concludes, the "only solution" for Ocracoke and other remote Hatteras communities may be "to incorporate and seize control of the future, no matter what the cost. The alternative may be a loss of the quality of life on these islands that has brought so many visitors here to begin with."

EPA withdraws chloroform goal

When drinking water containing natural organic matter is disinfected with chlorine, a number of "disinfection byproducts," including chloroform, are formed. Many of these DBPs, including chloroform, have been shown to be carcinogenic.

In 1998, the U.S. EPA issued regulations for DBPs that included a Maximum Contaminant Level Goal (MCLG) of zero for chloroform. An MCLG is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. MCLGs are non-enforceable public health goals.

EPA's MCLG for chloroform was challenged by the Chlorine Chemistry Council and the Chemical Manufacturers Association, which asserted that best available scientific evidence suggests chloroform is a threshold carcinogen.

In March, the U.S. Court of Appeals for the District of Columbia Circuit found that EPA had not used the best available, peer-reviewed science to set the MCLG as required by the Safe Drinking Water Act. The Court issued an order vacating the zero MCLG. On May 30, the EPA removed the zero MCLG for chloroform from its National Primary Drinking Water Regulations.

EPA proposes lower arsenic standard for drinking water

In March 1999, the National Academy of Sciences released a report concluding that EPA's current standard for arsenic in drinking water does not protect public health and should be lowered as soon as possible. The study cited evidence that long-term exposure to low concentrations of arsenic in drinking water can lead to

skin, bladder, lung, and prostate cancer as well as cardiovascular disease, diabetes, anemia and reproductive and developmental problems. The Safe Drinking Water Act Amendments of 1996 require EPA to issue a final arsenic standard by January 1, 2001.

In May, EPA proposed to reduce the current arsenic standard from 50 parts per billion (about 50 µg/L) to 5 parts per billion (5 µg/l). The change will largely affect public water systems that use groundwater.

According to a study released by the American Water Works Association Research Foundation (AWWARF), the new arsenic standard will force many groundwater systems that currently perform little treatment of the source water "into the application of full-scale treatment, including some fairly sophisticated technologies." Nationwide, many groundwater systems are expected to have to acquire land and build new treatment facilities. The AWWARF study estimates that an arsenic maximum contaminant level (MCL) of 5 µg/l will impose on public water systems using groundwater capital costs of between \$11.4 billion and \$16.7 billion and annual operating costs of between \$1.1 billion and \$2.1 billion per year.

According to Jessica Miles, Chief of the N.C. Public Water Supply Section, about 400 public water supply systems in North Carolina are expected to have to install or modify treatment processes to comply with the new arsenic standard.

Weakened TMDL rule promulgated in advance of Congressional delay

Acting on orders from President Clinton to head off Congressional action to delay the total maximum daily load (TMDL) rule, EPA Administrator Carol Browner signed the final rule on July 11. The rule was published in the *Federal Register* on July 13.

Changes to the TMDL rule proposed by EPA in August 1999 have been under increasingly vigorous attack by Congress, agricultural interests, and the forestry industry. Even environmental groups were expressing opposition to the rule at one point.

In May, Rep. Sherwood Boehlert, chair of the House Subcommittee on Water Resources and Environment, called on EPA to withdraw the TMDL proposal, saying the agency needs to go back to the drawing board. Earlier, a bill (H.R. 4502) had been introduced to delay implementation of the TMDL revisions and to require a study by the National Academy of Sciences on the scientific basis for and costs of the TMDL program.

Finally, in June Congress passed an emergency military spending bill which contained a rider prohibiting EPA from issuing a "new" TMDL rule or spending money to implement it. President Clinton ordered the pending TMDL rule signed before the July 13 deadline for signing the military spending bill, rendering it an existing rule.

In response to public comment, EPA made significant changes to the proposed rule. The agency dropped provisions that could have required new permits for forestry, livestock, and aquaculture operations; dropped the proposal to require "offsets" before new pollution can be discharged to impaired waters prior to TMDL establishment; dropped the requirement that states list "threatened" waters as well as "impaired" waters; and dropped the requirement that TMDL's include implementation plans.

EPA also upgraded the TMDL rule to "major rule" status which will allow Congress time to review the rule if it chooses and made the effective date for the program coincide with the end of the delay that would have been imposed by the Congressional rider.

EPA maintains that when the rule takes effect, "water pollution problems will be addressed comprehensively on a river-by-river basis for the first time ever." It can be downloaded at <http://www.epa.gov/owow/tmdl/finalrule/>.

DIGEST

Denitrification in small streams.

Results of a recent U.S. Geological Survey study strongly support the theory that nitrogen pollution is naturally removed from water much more rapidly in small streams than in large rivers. According to USGS, the study used data from 374 monitoring stations located on rivers and streams in the United States, including 123 stations in the Mississippi River Basin, to quantify the rates at which nitrogen is removed from channels by denitrification. The results indicate that nitrogen delivery from point and nonpoint sources in a stream drainage basin is not simply a function of the distance between a nitrogen source and a downstream location—such as the Gulf of Mexico—but a function of the amount of time the nitrogen travels through small streams. The report by USGS scientists Richard Alexander, Richard Smith and Gregory Schawarz titled “Effect of stream channel size on the delivery of nitrogen to the Gulf of Mexico” is available in a pdf file at <http://water.usgs.gov/nawqa/sparrow/nature/nature.html>. USGS news release.

Vermicomposting for pathogen

stabilization. Vermicomposting is the practice of using worms to convert solid waste into a soil amendment. A pilot project at the City of Ocoee (FL) wastewater treatment facility had shown that red wigglers reduced four pathogen indicators in wastewater biosolids (sludge): enteric virus, fecal coliform, helminth ova, and Salmonella spp. A full scale project aimed at demonstrating a three- to fourfold reduction of pathogen indicators to produce Class A stabilized biosolids (acceptable to EPA) was undertaken. The results show that earthworms do reduce pathogen indicators and can quickly accomplish the EPA standard of a three- to fourfold decrease. The study also shows that using traditional thermal precomposting to destroy pathogens prior to treatment with earthworms is unnecessary. *Water Environment & Technology* May 2000.

Ammonia emissions and ammonium concentrations in precipitation. In an article published in the journal *Atmospheric Environment*, NCSU researchers say that ammonia emissions from swine and poultry operations can cause increases in ammonium concentrations in rain at sites up to 80 kilometers (50 miles) away. The investigators measured weekly ammonium concentrations in precipitation at localities around an intensive swine-growing region in Eastern North Carolina and compared the concentrations with air flow direction for days on which precipitation was measured. They say the analysis shows that ammonia emitted from the swine-growing area is being transported over distances which would allow direct deposition of nitrogen to sensitive coastal and estuarine waters. The article, “Atmospheric transport and wet deposition of ammonium in North Carolina,” by John T. Walker, Viney P. Aneja, and David A. Dickey appears in vol 34 (2000) of the journal. The research was supported by the N.C. Dept. of Environment and Natural Resources and WRR I.

Illness and injury from Hurricane

Floyd. According the Centers for Disease Control and Prevention (CDC), the leading cause of death in North Carolina from Hurricane Floyd was drowning of occupants of motor vehicles. The CDC gathered information from the State Medical Examiner to monitor illness and injury related to Floyd and its subsequent flooding and recently released the data in an article “Morbidity and Mortality Associated with Hurricane Floyd—North Carolina, September-October 1999” (Vol 49, No 17 of *Morbidity and Mortality Weekly Report*). Two-thirds of the 52 deaths attributed to Floyd were drownings, many of which occurred when people attempted to drive through moving water and were swept away. Tracking emergency room visits to 20 hospitals in 18 counties, the CDC found that hypothermia, carbon monoxide poisonings, dog bites, violent crime, diarrhea, and asthma attacks all increased significantly. The CDC suggests public

health intervention strategies that should be followed in future hurricane-related disasters. *Morbidity and Mortality Weekly Report* can be viewed on-line at <http://www.cdc.gov/epo/mmwr>. To go directly to the article on Hurricane Floyd type in <http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/mm4917a3.htm>.—*Natural Hazards Observer* July 2000.

Tiny water purifier. Victims of floods and other natural disasters, soldiers, and backpackers may soon have a convenient way to disinfect water that has been contaminated with microbiological pathogens. A device the size of a felt-tip pen that produces a small electric current which passes through a saltwater solution to produce mixed oxidants is currently being field tested by the military. The device was tested by Mark Sobsey of UNC-Chapel Hill for its ability to purify water contaminated by a variety of viruses and bacteria as well as chlorine-resistant *Cryptosporidium*. The study showed that oxidants produced by the device were able to dramatically reduce all test bacteria and viruses within 10 minutes. Results of the study were reported at the meeting of the American Society of Microbiology in May and picked up by *U.S.A. Today*.

More on carbon sequestration.

“Carbon sequestration” is capturing and securely storing carbon emitted from the global energy system in oceans, geologic formations, soils, and vegetation. It is, according to the U.S. Department of Energy (DOE), the newest concept for managing carbon to reduce buildup of carbon dioxide in the earth’s atmosphere. It is thought that excess carbon dioxide in the atmosphere increases radiation of heat back to earth and traps heat at the earth’s surface, perhaps contributing to global warming. DOE has sponsored major research into the prospects for reducing carbon dioxide buildup by carbon sequestration (see DOE’s carbon sequestration website at http://www.fe.doe.gov/coal_power/sequestration/index.html). Now the Department of

continued page 10

Digest *continued*

Agriculture is getting into the act. The recently passed "Crop Insurance Bill" (H 2559) provides USDA \$15 million to sponsor research "to improve the scientific basis of using land management practices to increase soil carbon sequestration." The money will provide a grant to the Consortium for Agricultural Soils Mitigation of Greenhouse Gases, made up of nine land-grant universities (North Carolina's land-grant universities are not included).

Climate and agriculture. In May the Harvard Medical School's Center for Health and the Global Environment released a report saying that expected warming trends in the United States are likely to create growing uncertainty for U.S. farmers. The report admits that there is still much disagreement about climate change but says: *This much seems clear: if the buildup of greenhouse gases in the atmosphere continues without limit, it is bound, sooner or later, to warm the Earth's surface. Such a warming trend cannot but affect the biophysical processes of photosynthesis and respiration, the regional infestations of weeds, insects, and diseases, and indeed the entire thermal and hydrological regimes governing our agricultural systems.* The report, *Climate Change and U.S. Agriculture: The Impacts of Warming and Extreme Weather Events on Productivity, Plant Diseases, and Pests*, is available on the web at http://www.med.harvard.edu/chge/reports/climate_change_us_ag.pdf.

People

Tom Jones, formerly Neuse Basin Coordinator with the N.C. Division of Soil and Water Conservation, has replaced Rick Dove as Neuse Riverkeeper.

Russ Lea, NC State Associate Vice Chancellor for Research, Outreach and Extension, has been named Interim Associate Vice President for Research and Director of Sponsored Programs for the UNC system.

WRRR reports available

WRRR has recently published peer-reviewed technical completion reports on research projects for which it provided funding. Single copies of WRRR reports are available free to federal/state water resource agencies, state water resources research institutes, and other water research institutions with which exchange agreements have been made. Single copies of publications are available to North Carolina residents at a cost of \$4 per copy prepaid (\$6 per copy if billed) and to nonresidents at a cost of \$8 per copy prepaid (\$10 per copy if billed). Send requests to WRRR, Box 7912, North Carolina State University, Raleigh, NC 27695-7912 or call (919) 515-2815 or email: water_resources@ncsu.edu.

The History of Water Quality in North Carolina Estuarine Waters as Documented in the Stratigraphic Record

Report No. 327 May 2000

*Sherri R. Cooper
Duke University Wetland Center,
Nicholas School of the Environment
Durham, NC*

In this two year study of sediment cores collected from the Pamlico and Neuse River estuaries, the researcher has begun to recreate the history of water quality in these estuaries by dating sediment core samples and analyzing indicators of water quality, nutrient and trace metal flux, diatom assemblages and pollen through time.

Sedimentation rates have generally increased three to 10-fold in the past 50 years over previous sedimentation rates, and metal and sulfur flux to the sediments has increased over the past 50 years. Surface sediments often contain heavy metal concentrations that exceed "Threshold Effects Levels" (TEL) as reported by the U. S. Environmental Protection Agency. Cadmium shows

highest levels in the Pamlico estuary at the core collection site nearest the phosphate mining operations. Most other metals show higher concentrations in the Neuse River estuary.

Diatom and pollen assemblages have changed through time. The most dramatic assemblage changes in the diatoms appear to have occurred in the past 30-50 years in the Pamlico and Neuse estuaries, possibly associated with industrial activity, increasing population, and land-use changes. Recent assemblages are composed of higher abundances of small planktonic taxa that are often found in large blooms in higher nutrient waters. These samples exhibit relatively low species richness and diversity compared to older (pre-1950) samples. Older diatom assemblages are composed of more benthic and epiphytic taxa. Changes likely reflect eutrophication, increased turbidity and sedimentation, and increased freshwater flow to the estuaries, as well as an increase in industrial activities. They may also reflect declines in submerged aquatic vegetation in these estuaries.

Pollen assemblage changes include an increase in ragweed pollen over the past several hundred years, signifying increased land disturbance by humans. Pollen count results also show an increase in nut tree pollen (walnut and pecan) over the last several hundred years and an increase in sweetgum tree pollen in the past 50 years.

The biogenic silica (BSi) results and the determination of diatom valve flux to the sediments both show that more diatom frustules are being deposited to the sediments in recent years. These results indicate higher diatom production, most likely due to increased nutrient inputs to the estuaries. As production increases, dissolved silica in the waters may become limiting, especially if diatoms frustules are preserved in the sediments and not recycled. As silica becomes limiting in the water column, diatoms may be outcompeted by other algal species, including dinoflagellates. Diatoms are generally better food

sources in the estuarine food web than other algal species, so this change could potentially cause problems in higher trophic levels.

The researcher points out that the time frame of water quality changes seen in the Pamlico and Neuse estuaries occurs more recently than similar changes in the Chesapeake Bay. She says that these differences may be due to several factors, including slower population growth, different land use near the estuaries, and the geomorphology of the estuaries. She also says that these conditions may indicate that proper management could reverse trends in water quality changes more quickly for these estuaries than for the Chesapeake Bay.

A Study of Nitrate Movement to Ground Water at the Neuse River Waste Water Treatment Plant
Special Report Series No. 20 January 2000

Charles W. Welby
 Department of Marine, Earth, and Atmospheric Sciences
 North Carolina State University

Data were collected from September 1990 to March 1996 at two fields of approximately 12 ac each. The fields on which a variety of crops are grown were used by the City of Raleigh to dispose of the biosolids from its Neuse River Wastewater Treatment Plant (NRWWTP). One field (Field 102) has been used since the beginning of the biosolids disposal on the agricultural fields, a period of more than 10 years. The other field (Field 602) first received biosolids after the baseline data were obtained in the fall of 1990. In addition, a short-term study was conducted at a third field (Field 61A) beginning in April 1993 on possible impacts on ground water of the use of commercial chemical fertilizers.

The emphasis of the study has been on acquiring an understanding of how the nitrate in the biosolids affects the shallow ground water beneath the fields in a

Piedmont Province geomorphologic setting. A corollary concern of the study was the possible impact that ground-water discharge from beneath the fields might have on the nitrate-nitrogen ($\text{NO}_3\text{-N}$) concentrations in surface water.

At Field 102 more than ten years of biosolids and cropping have led to nitrate-nitrogen ($\text{NO}_3\text{-N}$) concentrations in the shallow ground water of over five times the national drinking water standard (MCL) of 10 mg/l extending to depths of over 50 ft below the ground surface and in a position, presumably, close to the granitic bedrock. During a two-year long experiment in which no biosolids or other soil amendments were applied on Field 102, the $\text{NO}_3\text{-N}$ concentrations in the ground water continued to increase.

Field 602 was used to examine the effects of biosolids application on ground water and to learn about the relationship between the timing of biosolids application and the appearance of $\text{NO}_3\text{-N}$ in the shallow ground water. Evidence exists in part of the field indicating that the ground water was impacted in less than a year. In other parts of the field it has taken several years for evidence of biosolids application to be recognized in the ground water. Soil moisture studies and examination of the monitoring well hydrographs in conjunction with the time-series graphs of chloride (Cl) and nitrate-nitrogen ($\text{NO}_3\text{-N}$) concentrations indicate that once approximately 2000 lb/ac of biosolids have been applied $\text{NO}_3\text{-N}$ moves to the ground water in a matter of a few weeks, depending upon the amount of precipitation occurring during any particular time interval. Studies at Field 602 have also demonstrated that $\text{NO}_3\text{-N}$ is being contributed to surface water by ground-water discharge to baseflow.

The $\text{NO}_3\text{-N}$ content of soils at all three fields was examined. From this part of the investigation it became evident that fertilizer application can lead to a buildup of $\text{NO}_3\text{-N}$ in the soil and vadose zone. This buildup performs as a reservoir which can supply $\text{NO}_3\text{-N}$ to percolating water which in turn carries $\text{NO}_3\text{-N}$ to the saturated zone.

Preliminary calculations indicate that on the order of three percent of the $\text{NO}_3\text{-N}$ in the total biosolids applied to Field 602 has reached the saturated zone since the completion of the first biosolids application in February 1991. At Field 61A the effects of commercial fertilizer application were detected about a year after the first fertilizer was applied.

Due to the length of this report, the five appendices could not be included. These appendices cover soil descriptions, driller's logs, $\text{NO}_3\text{-N}$ and chloride plots, stiff diagrams, and well hydrographs. If this information is needed, the reader can contact the Water Resources Research Institute to borrow a copy.

Preliminary Announcement
Call for Proposals for Research in
Water Resources

Water Resources Research Institute of
 The University of North Carolina

WRRRI's call for proposals for fiscal year 2002 will be issued on August 1, 2000. Instructions will be available on the WRRRI website at <http://www2.ncsu.edu/ncsu/CIL/WRRRI> or interested investigators may call (919) 515-2815. Proposals will be due by October 6, 2000.

Faculty members of senior colleges and universities in North Carolina are eligible to submit proposals. The purpose of WRRRI's program is to encourage research on water resource problems in North Carolina. Research priorities for the 2002 fiscal year include but are not limited to the following:

- Perennial stream
 - Riparian buffers
 - Aquifer storage and recovery
 - Water reuse
 - Fecal coliform removal
 - Safe yield of cretaceous aquifers
 - Floodplain multiple use
 - Impact of hydrologic changes
 - Relationship of sediment and aquatic habitat
 - Effectiveness of wetland restoration
 - Drought index
-
-

Program keeps eye on Neuse

by Tim Lucas, NCSU News Services
Reprinted from the July 7, 2000, issue of the NC State University Bulletin

Information collected at monitoring platforms in the Neuse River between New Bern and the Pamlico Sound is helping scientists, state agencies and the public keep tabs on fish kills, algae buildup, nutrient dumping and other water-quality problems in that troubled estuary.

The platforms are the backbone of a new environmental research, education and outreach project — the largest of its kind ever attempted on the Neuse estuary — by NC State's Center for Applied Aquatic Ecology, led by Dr. JoAnn M. Burkholder, professor of aquatic botany and marine sciences. There are now four platforms in operation; eventually, 15 will be operational.

Each platform is equipped with automated sensors and sampling devices that collect and analyze data on a wide range of water and weather conditions that play a role in creating favorable environments for fish kills or disease outbreaks.

The data is transmitted to NC State every hour and loaded directly onto the center's free Web site, at www.pfiesteria.org. Once loaded, it is instantly accessible to anyone with an Internet connection. Data remains on the site for a week, and is then archived at the NC State lab.

"With a click of your mouse, you'll be able to call up current conditions at any of the 15 platforms, and track changes in conditions from hour to hour and site to site," Burkholder says.

Data from more than a week ago can be requested through her lab. Data loaded onto the Web will include: water flow; dissolved oxygen levels; salinity; pH; algal biomass; nutrient levels; sediment retention; water temperature and turbidity; light intensity; wind speed; wind direction; water levels; and precipitation. The Web site soon will feature a

Proceedings of Atmospheric Nitrogen Compounds Workshop available

Proceedings of the Workshop on Atmospheric Nitrogen Compounds II: Emissions, Transport, Transformation, Deposition and Assessment held June 7-9, 1999, in Chapel Hill, NC, is available for \$25.00. For information on purchasing the proceedings, contact Dr. Viney P. Aneja, Department of Marine, Earth and Atmospheric Sciences, N.C. State University, Raleigh, NC 27695-8208; (919) 515-7808; viney_aneja@ncsu.edu.

This workshop was an open forum at which scientists, policy makers, industry representatives and others freely shared current knowledge and ideas. It included international, as well as local perspectives. The 554-page+ proceedings

includes a summary of the findings of the workshop, as well as papers presented, and recommendations for future research needs and ways to address nitrogen/ammonia from intensively managed animal agriculture.

The workshop was sponsored by the N.C. Departments of Environment and Natural Resources and Health and Human Services, N.C. State University, WRRRI and others. The table of contents of presentations collected in the proceedings is available in pdf format on the WRRRI website at: <http://www2.ncsu.edu/ncsu/CIL/WRRRI/nitroworktoc.pdf>.

"water quality scale" that rates, from poor to excellent, the overall condition of the water at each site. A "Pfiesteria index," indicating the presence or absence of toxic Pfiesteria at each site, also is planned.

"By having measurements of all the meteorological and hydrological conditions out there, we can better understand what combination of factors leads to Pfiesteria outbreaks and other fish kills, and learn to identify them sooner," Burkholder says.

Stored data from the new monitoring platforms eventually could be used to create computer models that help scientists predict, days in advance, when and where a fish kill is most likely to occur, Burkholder says.

The first four platforms, located in the Neuse at New Bern, Kennel Beach, Carolina Pines and Cherry Point, are now operational and sending back data to the Web site. Three more platforms will soon be up and running between New Bern and Minnesott Beach.

Among the most critical conditions these platforms will measure is water flow through the upper Neuse estuary, Burkholder says. "Measuring how long it takes water to flush through the estuary;

how much freshwater and saltwater get pushed back into it from the sound; and the extent of sediment and nutrient retention — this is critical to our understanding of the development of conditions favorable for algal growth and Pfiesteria outbreaks," she says.

An additional seven platforms, to be located in lower Neuse estuary between Minnesott Beach and the Pamlico Sound, are planned.

Funding for the project comes from the North Carolina General Assembly, the U.S. Environmental Protection Agency, the UNC Water Resources Research Institute and the Z. Smith Reynolds Foundation. Funding is already in place for the first eight platforms; three more platforms will be funded through pending grants. The remaining four will require new funding.

The average cost per platform is about \$19,000, including equipment. The freestanding platforms are built on 40-foot class-B pylons sunk 10 feet into the riverbed. They are weatherproofed and capable of withstanding hurricane-force winds and surge. To ensure the reliability of collected data, technicians will maintain and calibrate the equipment on each platform every three days.

Publications

The American Society of Agronomy has recently published *Agricultural Drainage* edited by R. Wayne Skaggs and J. van Schilfhaarde. This monograph summarizes the theory and practice of agricultural drainage and introduces new developments in the field since publication of the last ASA monograph on the subject in 1975. The information in this monograph will be useful for understanding how drainage may modify the natural ecosystems and enhance the productivity of the land for agricultural purposes. This monograph also can serve as a guide in formulating water management policies while considering the interrelations that exist between drainage and other natural components, such as wetlands, wildlife, streams, flood plains, nutrient management, and hypoxia. The hardcover, 1,328-page monograph (Agronomy Monograph 38) is available for \$96.00 from ASA, CSSA, SSA, Headquarters Office; Attn: Book Order Department; 677 South Segoe Road; Madison, Wisconsin 53711-1086 or at website <http://www.agronomy.org>.

A new refereed publication titled *Rivers* has been launched to publish studies in the science, policy, and law of instream flow. Authors are invited to submit manuscripts on a number of related topics. Page charges are \$60 for the first 10 pages and \$75 for each additional page. Copyright must be assigned to the publisher. Details are available at website: <http://www.instreamflow.com>.

The U.S. EPA has recently published *Liquid Assets 2000: America's Water Resources at a Turning Point*. The booklet provides a snapshot of the economic value of clean water, the problems we face in the new millennium, and the actions we must take to protect and restore the nation's water resources. It explores the current condition of the nation's water resources and demonstrates the link between clean water and a strong economy. It can be downloaded in pdf format from <http://www.epa.gov/ow/liquidassets.pdf>.

The U.S. Geological Survey has published *Two Months of Flooding in Eastern North Carolina, September-October 1999: Hydrologic, Water-Quality, and Geologic Effects of Hurricanes Dennis, Floyd, and Irene* (WRI Report 00-4093). It can be purchased from U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225

Websites

The N.C. Division of Water Quality's Basinwide Planning Program has created and put online a quiz on the state's river basins. Test your knowledge of the state's rivers and river basins at <http://h2o.enr.state.nc.us/basinwide/Basin%20Quiz.htm>. This site also contains a summary of information about the state's river basins. Go to <http://h2o.enr.state.nc.us/basinwide/index.html> and click on River Basin Statistics. The N.C. Division of Water Quality has also established a website to provide a central point for information on upcoming public hearings, basinwide planning public meetings, and Albemarle-Pamlico National Estuary project (regional councils) meetings. Go to <http://h2o.enr.state.nc.us/admin/calendar.html>. For information on meetings of the N.C. Environmental Management Commission and its committees go to <http://h2o.enr.state.nc.us/admin/emc/>.

Conferences and workshops

The N.C. Chapter of the American Public Works Association will present **Current Issues in Stormwater Regulations, Planning, and Design** September 28-29, 2000, at the Blockade Runner in Wrightsville Beach, NC. For program and registration information contact Leila Goodwin at (919) 462-3846 or lgoodwin@ci.cary.nc.us.

The NCSU Stream Restoration Institute and Appalachian State University will present **Stream Restoration & Protection in North Carolina: Building on Success** August 15-

17, 2000, at the Broyhill Inn and Conference Center in Boone, NC. For program and registration information visit website: <http://www5.bae.ncsu.edu/programs/extension/wqg/sri/Conference/> or call Joni Tanner with the NCSU Soil Science Department at (919) 513-1678.

The NCSU Cooperative Extension Service will present **Stormwater Wetlands Design Workshop** September 7 in Lenoir, NC. PDH's will be offered for professionals. For information contact Patsy Richardson with Cooperative Extension in Caldwell County at (828) 757-1251.

The American Filtration & Separations Society will host **Water & Wastewater Filtration Conference** July 25-26, 2000, at the Hyatt Regency Alicante in Anaheim, CA. For information go to website: <http://bsd.afssociety.org/educational.shtml> or call (205) 333-6111.

The **4th International Conference on Integrating GIS and Environmental Modeling** (GIS/EM4) will be convened September 2-8, 2000, at the Banff Centre for Conferences at Banff, Alberta, Canada. A special conference theme is human-environment interactions, and the role that GIS and modeling have in their improved understanding and prediction. To reserve accommodations and register for the conference, please see the on-line form at the "Desk" page of the conference web site (<http://www.colorado.edu/research/cires/banff/desk/>). For questions, please send messages to gisem4@colorado.edu.

The Sediment and Stormwater Management Program of Delaware's Department of Natural Resources and Environmental Control and the U.S. EPA will present **Delaware Sediment & Stormwater Conference 2000** October 24-26, 2000, at the University of Delaware, Newark. Keynote speaker is Eric Livingston, Florida Department of Environmental Protection. Tom Schueler of the Center for Watershed Protection will address the closing plenary session. Early conference registration fee is \$195.00 (\$235 after September 15). For additional information contact Jeanne Feurer, Conference Coordinator, at (302) 739-4411 or jfeurer@dnrec.state.de.us

Floodplain Manager certification

The Association of State Floodplain Managers has inaugurated a national program to certify floodplain managers. This program will lay the foundation for ensuring that highly qualified individuals are available to meet the challenge of breaking the damage cycle and stopping its negative drain on the nation's human, financial, and natural resources. For more information visit website: <http://www.floods.org/certinfo.htm>.

Drought affecting mountains and Piedmont

According to a June 16 bulletin from the N.C. Drought Monitoring Council, drought is affecting the mountains and Piedmont of North Carolina for the third straight summer. According to the Drought Monitor (see <http://enso.unl.edu/monitor/monitor.html>), a recently developed drought classification system based on numerous drought indices and indicators, the western Piedmont was experiencing "abnormally dry" conditions as of mid-June, but the majority of the mountains and foothills were already experiencing "first-stage drought" conditions.

As a result of abnormally dry and hot conditions, streamflows in early June were normal to below normal in the eastern Piedmont and considerably below normal in the western Piedmont and mountains.

As of mid-June, the National Weather Service was calling for hotter than normal temperatures for the summer along with the possibility of below normal precipitation, with Eastern North Carolina likely to receive additional rainfall due to the anticipated tropical storms.

ENSO Advisory

According to the NOAA Climate Prediction Center's June 12 El Niño/Southern Oscillation Diagnostic Advisory, large-scale oceanic and atmospheric circulation patterns continued at that time to reflect cold episode (La Niña) conditions that influenced North Carolina's weather in 1998 and 1999, bringing below normal precipitation except for that associated with increased hurricane activity. Since March, several indices showed a weakening of La Niña conditions, and some models were predicting further weakening during the summer. However, other models predict a continuation of cold episode conditions through the end of 2000.

Research links air pollution, low rainfall

Extensive analysis of data taken from NASA's Tropical Rainfall Measuring Mission spacecraft shows that smoke from forest fires inhibits rainfall. This research validates earlier studies indicating that urban air pollution can inhibit precipitation.

Analysis of the TRMM data, published in the Oct 15th issue of

Geophysical Research Letters, shows that when tropical clouds are polluted with heavy smoke from forest fires, the "warm rain processes" are practically shut off. The "warm rain process" occurs when coalescence or "collision" causes a few cloud drops to get large enough to start falling. As they fall, they pick up the

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North Carolina Precipitation/Water Resources

	May	June
Rainfall (+/- average)		
Asheville	1.27" (-3.16")	2.78"(-1.45")
Charlotte	1.17" (-2.65")	3.48"(+0.09")
Greensboro	2.31" (-1.71")	4.06"(+0.25")
Raleigh	1.23" (-2.69")	2.50"(-1.18")
Wilmington	3.70" (-0.73")	6.26"(+0.28")

Streamflow Index Station (County, Basin)	May mean flow (CFS) (% of long-term median)	June mean flow (CFS) (% of long-term median)
Valley River at Tomotla (Cherokee, Hiwassee)	174 (74%)	130 (81%)
Oconaluftee River at Birdtown (Swain, Tenn)	540 (113%)	360 (90%)
French Broad River at Asheville (Buncombe, FB)	1,500 (67%)	1,000 (53%)
South Fork New near Jefferson (Ashe, New)	293 (60%)	225 (53%)
Elk Creek at Elkville (Wilkes, Yadkin/Pee-Dee)	46 (42%)	31.6 (34%)
Fisher River near Copeland (Surry, Yadkin/Pee-Dee)	100 (46%)	151 (97%)
South Yadkin River near Mocksville (Rowan, Yadkin/PD)	180 (52%)	95.3 (32%)
Rocky River near Norwood (Stanly, Yadkin/Pee-Dee)	271 (53%)	227 (35%)
Deep River near Moncure (Lee, Cape Fear)	585 (61%)	230 (41%)
Black River near Tomahawk (Sampson, Cape Fear)	298 (58%)	484 (116%)
Trent River near Trenton (Jones, Neuse)	164 (162%)	37 (45%)
Lumber River near Boardman (Robeson, Lumber)	612 (60%)	484 (58%)
Little Fishing Creek near White Oak (Halifax, Pamlico)	124 (116%)	90.2 (112%)
Potocasi Creek near Union (Hertford, Chowan)	113 (85%)	131 (146%)

Groundwater Index well (Province)	May depth below surface (ft) (departure from average for month)	June depth below surface (ft) (departure from average for month)
Blantyre (Blue Ridge)	30.81 (-1.23)	32.08(-1.98)
Mocksville (Piedmont)	18.11 (-2.27)	18.96 (-2.56)
Simpson (Coastal Plain)	4.87 (-0.22)	5.53 (-0.36)

Source: U.S. Geological Survey's *Water Resources Conditions in North Carolina*

other cloud drops until they become big enough to fall to Earth as rain drops. With this process in cleaner air, rain can form in small clouds.

Scientists found that in clouds that have been contaminated with smoke, the cloud tops must grow considerably above the freezing level (16,000 feet) in order for the clouds to start producing rain by the alternative mechanism of ice. In this process, ice particles surround by supercooled water grow rapidly as water freezes onto the ice core. These large ice particles fall and eventually melt and become raindrops as they fall toward the warmer surface.

Dr. Daniel Rosenfeld, author of the paper ("TRMM Observed First Direct Evidence of Smoke from Forest Fires Inhibiting Rainfall"), says that scientists have seen evidence of decreased precipitation in clouds contaminated by smoke for some time, but that now they have direct evidence that smoke suppresses precipitation completely from certain clouds. In his paper, Rosenfeld highlighted a 1998 spacecraft pass over Kalimantan, Indonesia. The southeastern portion of the island was engulfed by smoke, while the northwestern portion was relatively smoke free. Radar detected precipitation in smoke-free clouds but almost none in the smoke-plagued clouds.

Scientists are particularly interested in tropical rainfall because it is responsible for about two-thirds of the energy required to power the global atmospheric circulation. When normal precipitation patterns are displaced, atmospheric circulation changes, and global climate can be affected.

For more information about this research and the Tropical Rainfall Measuring Mission visit website: <http://trmm.gsfc.nasa.gov>.

1999-2000 Water Resources Research Seminar Series

Presentations take place in the Ground Floor Hearing Room of the Archdale Building in downtown Raleigh or in Room 1132 of Jordan Hall on the N.C. State University campus. This schedule is also posted on the WRRRI website, and any changes will be posted there (<http://www2.ncsu.edu/ncsu/CIL/WRRRI/2000seminars.html>). For additional information contact Associate Director Robert Holman at (919) 515-2815 or Robert_Holman@ncsu.edu.

Presentations begin at 3 pm.

Tuesday, September 26, 2000
Archdale Building
Development of a Probability Network Approach for the Neuse River Estuary
PhD Candidate Mark Borsuk
Nicholas School of the Environment
Duke University

Tuesday, October 31, 2000
Jordan Hall
The Cost of Watershed Management Policies
Professor David Moreau
Department of City and Regional Planning, UNC-Chapel Hill

Monday, November 20, 2000
Archdale Building
Quantification of Pfiesteria Species
Associate Professor JoAnn Burkholder
Department of Botany
N.C. State University

Tuesday, January 20, 2001
Jordan Hall
Assessment of the North Carolina Water Reuse Regulations
Assistant Professor Helen Hilger
Department of Civil Engineering
UNC-Charlotte

Tuesday, February 27, 2001
Archdale Building
Effectiveness of Multiple Best Management Practices in Agriculture
Professor Carlyle Franklin
Department of Forestry
N.C. State University

Tuesday, March 27, 2001
Jordan Hall
Assessment of Changing Land-use Practices on Basin Sediment Yields
Professor Jerry Miller
Department of Geosciences
Western Carolina University

Tuesday, April 24, 2001
Archdale Building
A Comparative Analysis of Compact and Low-Density Development
Associate Professor Philip Berke
Department of City and Regional Planning, UNC-Chapel Hill

Tuesday, May 22, 2001
Jordan Hall
Technical and Economic Evaluation of Alternative Animal Waste Management
Professor Michael Overcash
Department of Chemical Engineering
N.C. State University

Call for Abstracts
World Water and Environmental Resources Congress 2001
May 20-24, 2001 Orlando, FL
For information on topics and submission requirements visit website: <http://www.asce.org/conferences/wwercongress>
Abstracts are due September 12, 2000.

Call for Papers
NALMS: 10th Annual Southeastern Lakes Management Conference
March 21-23, 2001 Knoxville, TN
For information go to website: <http://www.don-anderson.com/senalms2001/>
Abstracts are due September 30, 2000

N.C. Sedimentation Control Commission Erosion and Sedimentation Control Seminars

September 14-15, 2000
Holiday Inn Select, Hickory

October 24-25, 2000
Sheraton, New Bern

Registration fee: \$100

These seminars are presented to familiarize design professionals with N.C. erosion and sediment control requirements, recent changes to the Sedimentation Pollution Control Act and administrative rules, design applications, and case studies. PDH's will be available to licensed professionals.

For information and registration go to website:
<http://www2.ncsu.edu/ncsu/CIL/WRRRI/escseminars2000.html>
or call Julie Mason at (919) 515-2815.



2000 - 2001 Luncheon and Forum Schedule

September 18, 2000
December 4, 2000
February 5, 2001
April 9, 2001
September 17, 2001
December 3, 2001

Land Use Planning
Endocrine Disrupters in the Environment
Water Reuse
Dam Removals in North Carolina
On-Site Wastewater Issues
Flood Plain Management

All luncheon/forums take place at 11:30 am at the Jane S. McKimmon Center on the N.C. State University campus. For additional information call Robert Holman at WRRRI (919/515-2815).

Luncheon cost for nonmembers will increase to \$20 January 1, 2001. Join NCWRA and save!. Contact WRRRI.

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