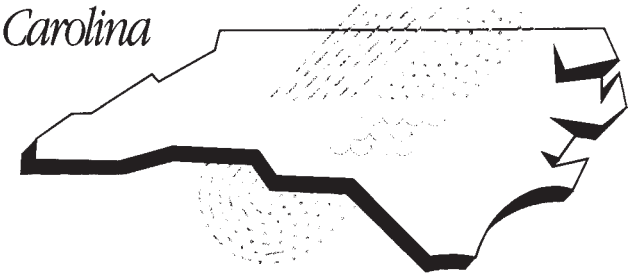
Water Resources Research Institute News
of The University of North Carolina



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State clamps down on sewer overflows

While the U.S. EPA struggles to re-propose sanitary sewer overflow (SSO) regulations proposed in 2001 but withdrawn as a result of the Bush Administration's Regulatory Review Plan, North Carolina continues to move forward with a program that is among the nation's toughest on sewage spills. Historically, the federal Clean Water Act has prohibited untreated wastewater discharges to any waters. Now, in North Carolina all untreated wastewater discharges are prohibited. As of this summer, wastewater systems in North Carolina that cannot show that an SSO was an unpreventable occurrence will face potential enforcement actions that may include anything from a Notice of Violation to civil penalties and a moratorium from the Division of Water Quality (DWQ), depending upont the severity and repetitivenewss of SSOs.

The imposition of increased DWQ review and a more stringent enforcement policy for sanitary sewage spills is the latest in a series of get-tough administrative measures dating back to 1998 and regulatory requirements for wastewater collection systems in the State's Clean Water Act of 1999.

After flooding from Hurricane Fran, finger-pointing by pork producers, and increased emphasis on SSOs by EPA put the spotlight on sewer overflows, DWQ began phasing in new policies responding to SSOs. In 1998 DWQ announced stringent penalties for nonreporting of spills, higher fines for spills, and possible requirements for publishing notice of spills in local news-papers. Enforcement actions were based on a point system that allowed systems to avoid sanctions if they reported and responded to spills quickly and effectively.

At that time, DWQ also required municipalities and other operators to begin evaluating sewer systems and developing plans for correcting maintenance and operational deficiencies. In 1999, DWQ issued a revised enforcement point system that took into account how well systems were following State guidance for operation and maintenance of collection systems in addition to whether they followed reporting requirements.

Concurrent with tougher enforcement actions, DWQ put together a stakeholder group to develop an operation and maintenance-based holistic collection system permit that requires system owners to do systematic preventive and proactive maintenance rather than simply respond to problems. Some 30 municipalities worked with DWQ to determine the proper operation and maintenance requirements for collection systems. The N.C. Clean Water Act of 1999 (House Bill 1160) gave the effort to permit collection systems the force of law, requiring (among other things) that the Environmental Management Commission develop a holistic collection system permit and begin permitting

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Director's Forum

Lessons Learned in Local Stormwater Management

Greg Jennings, Associate Director, Water Resources Research Institute

One of my favorite responsibilities as WRRI Associate Director is working with the North Carolina Urban Water Consortium and its Stormwater Group. The eleven-member Consortium was created in 1985 to support research and technology transfer on critical urban water issues, including water supply, wastewater treatment, and stormwater. Several of the projects highlighted in this year's WRRI Annual Program (inserted in the September/October issue of *WRRI News*) were funded by the Urban Water Consortium. The Stormwater Group is a subcommittee of eight stormwater program managers from Charlotte, Winston-Salem, High Point, Greensboro, Durham, Raleigh, Fayetteville, and Wilmington that meets quarterly to discuss research projects and share program ideas. I have learned four keys to effective local stormwater management from working with the Stormwater Group over the past two years.

First, effective stormwater program managers learn from other communities dealing with the same issues. Six of the Stormwater Group members have been regulated under EPA's NPDES Phase 1 program for the past decade. They have shared experiences about local program funding, monitoring, education, illicit discharge detection, and new stormwater treatment technologies. By rotating meeting locations, members have the opportunity to visit each other's facilities and demonstration projects. During the most recent meeting in October, members toured four sites in Wilmington, including the city's new stormwater best management practice demonstration park.

Second, effective stormwater program managers experiment with new technologies and learn from their experiences. In the past decade, several new best management practices (BMPs) such as constructed wetlands, bioretention areas, permeable pavement, green roofs, and various proprietary treatment devices have been promoted as techniques for improving stormwater quality. Stormwater Group members are at the forefront in experimenting with new technologies and sharing results on their effectiveness and limitations. For example, Charlotte recently provided funding to support a university monitoring project of more than 20 BMPs installed over the past decade.

Third, effective stormwater program managers take advantage of funding opportunities to enhance local program support. Stormwater Group members are actively involved in projects funded by the NC Clean Water Management Trust Fund, NC Wetlands Restoration Program, EPA 319 Nonpoint Source

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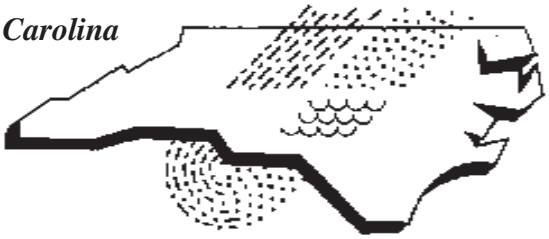

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Program, and other government and private sources. These projects are supporting demonstration and evaluation of stormwater treatment practices, stream and wetland restoration, watershed assessments, and education programs to increase local understanding and involvement in stormwater programs.

Fourth, effective stormwater program managers keep elected officials and the regulated public informed and involved in their programs. It is essential that local citizens and officials see the value of their investment in stormwater management. Tours, media coverage, newsletters, and public meetings are being used to showcase the benefits to water quality and flood prevention resulting from local stormwater programs. Urban residents understand more about stormwater issues than ever before because of the local education programs in North Carolina cities.

Due to changing federal and state regulations, stormwater management is now a major focus of local governments, consultants, researchers, and environmental groups. North Carolina's local stormwater programs are recognized as leaders in the Southeast because of the hard work and dedication of our cities' program managers.

The upcoming conference: "Stormwater: Emerging Issues for Local Communities" scheduled for April 19-22, 2004, in Asheville, North Carolina, will showcase many of their experiences and provide an opportunity for stormwater professionals to learn about current research and to network with other professionals. See the conference web site for more information: http://www.soil.ncsu.edu/swetc/stormwaterconf/main.htm

Call for Abstracts

Water Resources Research Institute
of The University of North Carolina
2004 Annual Conference

Watershed Assessment and Restoration: Lessons Learned and Future Directions
Wednesday, March 31, 2004
Jane S. McKimmon Center, Raleigh, NC

The Water Resources Research Institute of The University of North Carolina (WRRI) requests abstracts for presentations and posters at its 2004 Annual Conference, Watershed Assessment and Restoration: Lessons Learned and Future Directions. We are soliciting for presentations related to the theme and other relevant water issues in North Carolina. Technical session themes will be based on abstracts received. Thirty-six abstracts will be selected for oral presentation in concurrent sessions. Abstracts not accepted for oral presentation may be presented as posters. Abstracts are also solicited for posters. Early response is encouraged, as we may also have to limit the number of posters. Graduate Students are encouraged to submit abstracts. The North Carolina Water Resources Association will be selecting outstanding graduate student posters for recognition at the conference.

The deadline for abstract submission is January 9, 2004.
For abstract format and other information
on submitting abstracts go to web address:
http://www.ncsu.edu/wrri/2004_annual_conference.html
(Conference registration information
will be posted to this site by mid-January.)

Exhibitor Information

A limited number of spaces for commercial exhibits will be available in the poster/break area at the pre-conference workshop and the Annual Conference. Exhibitors will be provided a ten-foot space with a six-foot skirted table and an electrical connection, if needed. All exhibits must be confined to the assigned space. The exhibit fee is $300 for two days and includes registration for one person. Exhibitor space will be assigned on a first-come, first-served basis. Information for exhibitors is available at http://www.ncsu.edu/wrri/2004_annual_conference.html.

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In conjunction with our Annual Conference WRRI will also sponsor a preconference symposium:
Watershed Management in North Carolina: Successes and Challenges
Tuesday, March 30, 2004
Jane S. McKimmon Center, Raleigh, NC

By mid-January, information on this symposium will also be posted at
http://www.ncsu.edu/wrri/2004_annual_conference.html

Sanitary Sewer Overflows *continued*

systems with a flow larger than 200,000 gallons per day in 2000 and to permit 20 percent of the state's qualifying systems each year over the next five years.

The N.C. Clean Water Act of 1999 also added to reporting requirements related to SSOs. Beginning in 1999 any wastewater treatment system that has an SSO of 1,000 gallons that reaches surface waters of the State is required to issue a press release to general circulation newspapers in the county where the overflow occurs. If an overflow of 15,000 gallons reaches surface waters, the system must publish a "Notice of Discharge of Untreated Sewage" in county newspapers and in newspapers in counties downstream of the discharge that might be "significantly affected." In addition, the law requires wastewater systems to provide their customers an annual report detailing the performance of the system, including any violations of its discharge permit or of federal or state laws.

While collection system permits were being issued and systems were beefing up their operations and maintenance efforts, the point system used to determine enforcement actions that had been issued in 1999 was retained.

With nearly 60 percent of the state's qualifying wastewater collection systems on the way to being permitted and with three years of point-system enforcement behind it, DWQ recently determined that enforcement policy needed to be strengthened. In October, DWQ sent wastewater treatment systems a letter announcing the revised policy.

According to Jeff Poupart, Supervisor of the Non-Discharge Compliance and Enforcement Unit of DWQ, " The point system was generous to violators and was not effective in eliminating chronic situations. Now, each overflow will be judged individually. What we want to see is systems addressing chronic overflows."

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Conditions of North Carolina's System-wide Wastewater Collection System Permit

Following are many of the requirements in North Carolina's collection system permit. North Carolina is the only state to enforce some of these requirements, including the requirement for primary and back-up Operators in Responsible Charge (ORC) who are certified as collection system operators by the N.C. Water Pollution Control System Operators Certification Commission.

- The system must be operated, maintained and managed so that there is no discharge to land or surface waters nor any contamination of groundwater. Any unpermitted discharge requires immediate corrective action.
- Enforcement action may be taken for any discharge that cannot be justified by contemporaneous operating logs that show the discharge was caused by severe natural conditions and that there was no feasible alternative to the discharge or that the discharge was unintentional and could not have been prevented by the exercise of reasonable control.
- The system must have an education and enforcement program designed to reduce grease inputs to the system. The program must target residential and commercial users and must require and enforce operation and maintenance of grease traps.
- The system must have a Capital Improvement Plan to designate funding for reinvestment into the collection system infrastructure.
- Existing overflow piping from manholes and pump stations must be removed or permanently capped.
- The system must have a contingency plan for pump failure at each pump station. Pump stations must have emergency contact information clearly posted, and access to pump stations must be restricted.
- The system must designate and employ a certified operator to be in responsible charge and one or more certified operators to be back-up ORCs. The ORC or back-up must visit the system within 24 hours of knowledge of a spill.
- The system must review all logs and identify recurring problems in the system, then establish a plan for addressing the problems. The system problem review must be scheduled and on-going.
- The system must develop and maintain a schedule for testing emergency and standby equipment and for inspecting and maintaining pump stations.
- At least 10 percent of the collection system—selected by the ORC— must be cleaned each year by hydraulic or mechanical methods.
- The system must have a Response Action Plan for containing and properly disposing of SSOs. An on-site evaluation must be conducted no more than two hours after first knowledge of the overflow. The SSO must be reported to a regional office of DWQ no later than 24 hours after first knowledge of the overflow. System operation must be restored and the surrounding area must be restored and sanitized.
- The system must maintain an up-to-date map of the collection system. If a system does not have a map, it must map 10 percent of the system each year until the map is completed. Records of all modifications and extensions to the system must be maintained.
- The system must be inspected regularly and an inspection log kept. Pump stations not connected to telemetry must be inspected every day. High priority lines (sub-waterway crossing, line contacting surface waters, siphon, line positioned parallel to stream banks subject to erosion) must be inspected at least once every six months.
- Records to document compliance with all conditions must be maintained.

For further information on the collection system permit, please see http://h20.enr.state.nc.us/ndpu. For information on collection system compliance and enforcement policies go to http://h2o.enr.state.nc.us/ndceu.

Sanitary Sewer Overflows
continued

Now, when an SSO occurs, the system must document in detail that it has an aggressive and on-going program to prevent grease clogs, find and remove roots growing into sewer lines, address inflow of stormwater and infiltration of groundwater into sewer lines, prevent pump station failure, provide an alternative power source in case of outage, prevent vandalism, and prevent collection of debris in lines. If a system cannot document to the satisfaction of a DWQ regional supervisor that it has done all it can to prevent overflows at the specific location where an overflow takes place, it could face sanctions including civil penalties, an SOC (Special Order by Consent), and a moratorium on connections.

Poupart said that under the collection system permitting program, DWQ expects to see a decrease in dry-weather SSOs because the permit requires increased preventive maintenance, such as having a fats, oils and grease program and performing routine cleaning and inspection of lines and pump stations. He said the new enforcement policy may or may not result in more enforcement actions.

"What it *will* do is assure that every overflow will have follow up of some kind," he said.

EPA releases strategy for water quality standards and criteria

In response to recent calls for changes to the nation's Water Quality Standards Program (see July/August 2003 *WRRI News*), the U.S. EPA has released its Strategy for Water Quality Standards and Criteria. To help states more accurately assess the condition of their waters and more effectively target efforts to improve water quality, EPA has set milestones for action on ten items of highest priority.

- Publish guidance (1st quarter 2004) and analytical methods for wastewater (final 4th quarter 2005) for implementing the recommended EPA bacteriological criteria (use of E. coli and enterococcus as indicators) for recreational waters.
- Issue final revised pathogen criteria for recreational waters (2nd quarter 2006) and cryptosoporidium criteria for drinking water source water (4th quarter 2007)
- Issue integrated microbiological criteria document (target date undetermined)
- Issue a strategy for development of suspended and bedded sediment criteria (2nd quarter 2004).
- Assist states and tribes in developing and adopting nutrient criteria (2003-2007).
- Assist states in developing and adopting biological criteria (2003-2008).
- Develop a process for selecting emerging contaminants for criteria development (2004).
- Complete consultation on 49 aquatic life water quality criteria with the Fish and Wildlife Service and the National Marine Fisheries Service called for in 2001 MOA regarding EPA obligations under the Endangered Species Act (2004).
- Provide technical support and training to states and tribes on use attainability analyses, tiered aquatic life uses, and other issues related to assigning designated uses (2004).
- Provide support to states and tribes in implementing duration and frequency component of existing water quality criteria and in establishing and applying mixing zone policies in monitoring design, attainment decisions, TMDL development, site-specific conditions, and discharge permit issuance (2005 and ongoing).
- Identify any drinking water source waters whose water quality standards do not protect the use and work with states and tribes to correct any deficient standards (2003-2005).
- Develop a web-based clearinghouse for exchanging information on critical water quality standards issues, beginning with development of state and tribal antidegradation programs (2003-2005).

A fact sheet and the full strategy document are online at: http://www.epa.gov/waterscience/standards/strategy/fs.htm.

Bill includes measure to study effects of disposal of desalinization concentrate

In July, U.S. Rep. Ken Calvert (R-CA) and 30 co-sponsors introduced the Water Supply, Reliability and Environmental Improvement Act (H.R. 2828). The bill establishes within the Office of the Secretary of the Interior the Office of Federal Water Resources Coordinator to be responsible for coordinating water resource agencies' activities addressing water desalination (including sea and brackish water), impaired ground water, brine removal, and water reuse projects as well as activities authorized under the bill. It would also create a national performance-based, competitive grant program to help communities implement water desalination, water recycling, and brackish water treatment projects. Included would be grant assistance "to analyze, plan, develop and construct projects on brine management and disposal, including analysis and technology development. Such analysis shall include, but not be limited to, the effects of concentrate disposal and possible mitigation measures." The bill has been marked up by the House Resources Committee Subcommittee on Water and Power and forwarded to the full committee. It is also under consideration by the House Transportation and Infrastructure Committee.

Task force recommends changes to National Environmental Policy Act implementation

In September a federal interagency task force released a report recommending to the White House Council on Environmental Quality (CEQ) "ways to improve National Environmental Policy Act (NEPA) implementation through new technology, best practices, and more information and management systems."

According to CEQ, it along with other federal agencies, will consult with local governments and other interested parties to "consider the Task Force recommendations for ways to advance the Administration's commitment to make the NEPA process more collaborative, more efficient, and timelier."

Background: NEPA

Condensed from "NEPA: Past, Present, and Future" by Alvin L. Alm, EPA Journal - January/February 1988 and "The National Environmental Policy Act - An interview with William Hedeman, Jr.," EPA Journal - November/December 1980.

The National Environmental Policy Act, signed into law on January 1, 1970, was short, simple, and comprehensive. It established a national policy to protect the environment, created a Council on Environmental Quality (CEQ), and required that environmental impact statements (EIS) be prepared for major federal actions having a significant effect on the environment. NEPA has a number of basic goals:

- to maintain conditions in which man and nature can co-exist in productive harmony,
- to involve the public early in the process of government decision-making,
- to effect complete disclosure of the environmental consequences of any proposed action before a decision is made that will affect the environment,
- to effect consideration of as many practicable and appropriate alternatives as may be possible before a decision is made, and
- to try to mitigate the impacts on the environment of governmental decisions.

All of those basic concepts were embodied in the subsequent environmental statutes passed by the Congress.

Following refusal of the U.S. DOT to release comments on one of its EIS's, Congress, in Section 309 of the 1970 Clean Air Act, required that EPA must comment on all environmental impact statements and that EPA's comments must be made public and be transmitted to CEQ for action if the environmental impacts were "environmentally unsatisfactory." Under this Clean Air Act mandate, EPA set up a structured program for reviewing and rating federal agency projects that continues to this day.

Shortly after enaction of NEPA, newly created environmental litigation groups began to sue federal agencies for noncompliance with the law and generally won. The Courts interpreted NEPA to cover not only direct impacts from federal projects and activities but also indirect effects. By the middle of the 1970s, after having projects stopped or delayed by law suits over noncompliance with NEPA, government agencies institutionalized environmental quality concerns in decision-making.

Overall, NEPA has been a quiet but effective success after a turbulent and dynamic beginning. The NEPA process has wrought a major change in the way government deals with environmental issues, and this model has been replicated in whole or in part in 23 states. All in all, NEPA has codified an important national policy commitment and created helpful procedural and organizational tools to further that policy objective.

The NEPA review process

Each federal agency adopts its own procedures to meet the requirements and intent of NEPA. Therefore, agency review processes vary. In general, the NEPA process includes the preparation of an environmental assessment (EA) followed by either a finding of no significant impact (FONSI) or by preparation of an environmental impact statement (EIS).

An EA is done to determine whether an action is a "major federal action significantly affecting the quality of the human environment." The EA is supposed to be "brief but thorough." It contains information about the proposal that the lead agency uses to decide whether to prepare an EIS or a FONSI, including a description of the proposal, a discussion of the proposal's purpose and need, and identification of probable environmental impacts and possible alternatives. In some cases, the EA is circulated for public review and comment before the lead agency issues either a FONSI or an EIS.

A FONSI is a statement by the federal agency that briefly identifies the reasons why a proposal does not require the preparation of an EIS. Some federal agencies circulate the FONSI for public review and comment.

An EIS is a detailed analysis and evaluation of all of the impacts of the proposed project and all reasonable alternatives. This document usually provides more detailed and rigorous analysis than an EA and provides for formal public involvement. An EIS concludes with a decision document, the Record of Decision (ROD) that explains the reasons for selecting a particular action and environmental mitigation associated with that action.

If federal agencies are involved in permitting or licensing state or local actions, or if federal agencies provide sufficient funding that they exercise significant control over a project, then state and local projects may be subject to NEPA review.

continued

Task force recommendations

According to CEQ, the NEPA Task Force was composed of experienced career federal employees who conducted an extensive review of NEPA's implementation with the goal of finding ways to take advantage of technology and management techniques to improve communications and collaboration between federal agencies and the public. The task force makes specific recommendations aimed at the following:

- using information technology to address information management and technology concerns related to the NEPA process, and to enhance the effectiveness and efficiency of the NEPA process;
- promoting better collaboration among agencies by identifying, developing, and sharing methods of engaging tribal, State, and local partners in training designed to educate them about the principles of NEPA, partner agencies' missions, communication skills, and public involvement skills;
- promoting consistent, clear, cost-effective programmatic NEPA analyses, documents, and tiering that meet agency and stakeholder needs;
- convening an adaptive management work group to consider revising existing regulations or establishing new guidance to facilitate agencies' ability to exercise the option of incorporating adaptive management into their NEPA process;
- promoting consistent categorical exclusion development and use, including development of categorical exclusions, where appropriate, based on broadly defined criteria that will provide the agency with sufficient flexibility;
- issuing clarifying guidance on the appropriate content and structure of EIs, FONSIs, and EAs; and
- issuing clarifying guidance explaining that public involvement requirements in an EA should be commensurate with project scale and complexity, required mitigation, and public interest.

While the recommendations are said to be aimed at improving efficiency and collaboration, some environmental organizations look at the task force's work and recommendations as an effort to undermine NEPA review.

In a press release issued the same day the task force report was released, the Natural Resources Defense Council said "While the administration talks about enhancing NEPA, many of its actions are meant to circumvent the process. From logging on national forests to offshore oil drilling to highway projects, the administration seeks to shield from NEPA's requirements federal activities with serious environmental consequences."

Other environmental groups claim that the recommendations would limit public access to "sensitive information," scale back requirements for initial environmental assessments, and expand "categorical exemptions" of activities that require no review.

CEQ is convening regional roundtables to take comment on the NEPA Task Force Report. The Southern Environmental Law Center and The Office of Continuing and Executive Education at Duke University's Nicholas School of the Environment and Earth Sciences will co-host the Southern Regional Roundtable on December 11-12, 2003, in Memphis, TN. Interested members of the public will have an opportunity to express their views. Information on the roundtable can be found at: http://ceq.eh.doe.gov/ntf/southernroundtablepn.html.

The NEPA Task Force report can be read online or downloaded at: http://ceq.eh.doe.gov/ntf/report/index.html

MTBE liability waiver holds up Energy Bill

On November 21, a vote in the U.S. Senate to end debate on the energy bill (H.R. 6, The Energy Policy Act of 2003) failed by a narrow margin following intense lobbying by the American Water Works Association (AWWA) and other organizations representing mayors, local elected leaders, and drinking water providers. In late November a spokesperson for GOP Majority Leader Sen. Bill Frist announced that the Energy Bill would not be considered again before Congress adjourns this year.

Groups representing municipalities and drinking water providers objected to provisions in H.R. 6 that would provide defective product liability immunity ("safe harbor") to producers of gasoline with methyl tertiary butyl ether (MTBE). This provision would eliminate the primary means for communities to have oil producers clean up water supplies contaminated by MTBE.

According to AWWA, MTBE has contaminated thousands of drinking water sources across the United States, and spreading MTBE contamination will cause more and more wells to be shut down. Where contamination has occurred, cleanup costs range from a few million dollars to more than $200 million per utility.

In a letter to members of Congress, the coalition of agencies and associations said that providing immunity from liability for MTBE contamination puts "a $29 billion bailout on the backs of local taxpayers and drinking water consumers."

In addition to providing oil companies "safe harbor," H.R. 6 would provide federal grants for "merchant producer conversion assistance" for producers making a transition from MTBE to other fuel additives as MTBE is eliminated from fuels. It also mandates a review of the use of MTBE by the National Academy of Sciences.

Express permitting available in Raleigh and Wilmington regions of DENR

Permit processing time may be reduced 30 percent to 50 percent for projects that use a new One Stop Express Permitting Program within the NC Department of Environment and Natural Resources (DENR). During the last legislative session, the NC General Assembly authorized $500,000 to fund a pilot program to provide express permit and certification reviews. Participation is voluntary and higher fees will be charged for permits reviewed under this program.

The legislation states that the program may be applied to any or all permits, approvals or certifications in the erosion and sedimentation control, water quality, and coastal management programs. Initially the one stop express review process will include: state stormwater permits, water quality wetland certifications, stream origin determinations, erosion and sedimentation control plans, and permits under the Coastal Area Management Act. Other permitting programs such as the water quality non-discharge permit are being considered as future candidates.

A developer or project manager may request to participate in the One Stop Express Permitting Program. Projects with critical economic impact or projects needing multiple environmental permits will be given priority. The higher fees charged for projects that participate in the program will go to support the One Stop Express Permitting program.

The pilot effort will cover the 23 counties in the north central and southeastern portions of the state, currently served by the DENR's Raleigh and Wilmington Regional Offices. The Wilmington Regional Office serves Brunswick, Carteret, Columbus, Duplin, New Hanover, Onslow, and Pender Counties. The Raleigh Office serves Chatham, Durham, Edgecombe, Franklin, Granville, Halifax, Johnston, Lee, Nash, Northampton, Orange, Person, Vance, Wake, Warren, and Wilson counties. Areas outside these pilot counties will be considered on a case-by-case basis.

"This is a logical extension of the one stop permit coordination and assistance program established by the department in 2000," said Edythe McKinney, director of DENR's Customer Service Center and contact for the One Stop Express Permitting Program. She said that the one stop coordination program provides early identification of environmental permits or requirements that might be needed for projects. The permit coordinator, working with the permitting agencies, then sets up pre-application conferences, tracks permit decisions, and remains a point of contact through project development. The express permitting program allows the hiring of additional staff to review the permit applications or make site visits as necessary.

"This should be a win-win situation for all," said McKinney. "Clients obtain quicker turn-around time for permit decisions, but no corners are cut in the review process. State permitting rules, statutes and documentation still apply,"

McKinney said that the key to the expedited process is the submission of a high quality complete application, with all the supporting documents included in the original package so site visits and technical evaluation can move forward in a timely matter. The quicker review is possible because additional engineers and environmental specialists will be hired, using express permitting fees, to review permits, plans and certifications under this program.

The amount of time for review and fees charged varies depending on the permits or certifications needed. For example, if a developer wants an erosion and sedimentation plan under the express permit program, a fee of $250 for projects of less than eight acres and $2000 for larger projects would be charged. These fees would be in addition to the normal $50 an acre charge for erosion and sedimentation plan review. For these additional costs, it is estimated that plan reviews would be completed in three to four days, compared to the 25 to 30 day normal process time.

For more information on the one stop express permit program, contact Edythe McKinney at 1-877-623-6748 or email: edythe.mckinney@ncmail.net

—NC DENR Customer Service Center

Harmful algal bloom research bill moves forward

In July, the U.S. House Science Committee approved the Harmful Algal Bloom and Hypoxia Research Amendments Act of 2003 (H.R. 1856). In introducing the bill in April, Rep. Vernon J. Ehlers (R MI) said: "Scientists have recently observed an increase of harmful algal blooms and hypoxia in the Great Lakes, a growing concern for residents in my home state of Michigan and in other Great Lakes states." [See Studies, page 12]

The Harmful Algal Bloom and Hypoxia Research and Control Act was passed by Congress in 1998. The act created a task force to study the causes of harmful algal blooms and authorized $19 million annually for research and monitoring activities. Last March, the Environment, Technology and Standards Subcommittee of the House Science Committee held a hearing on harmful algal blooms and hypoxia and, based on comments received at that hearing, developed H.R. 1856 to reauthorize the 1998 Act. The bill has 22 co-sponsors. It updates the authorization levels to $30 million annually. The bill also requires the task force to complete an assessment of harmful algal blooms in freshwaters and estuaries of the United States and a separate assessment of blooms in marine waters within 24 months of bill passage.

WRRI reports available

Single copies of WRRI 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 WRRI, Box 7912, North Carolina State University, Raleigh, NC 27695-7912 or call (919) 515-2815.

Lumped Parameter Models for Predicting Nitrogen Loading from Lower Coastal Plain Watersheds (Report No 347 December 2003)

D.M. Amatya, U.S. Forest Service Center for Forested Wetlands Research; G.M. Chescheir, G.P. Fernandez, R.W. Skaggs, F. Birgand, Department of Biological and Agricultural Engineering, NC State University; and J.W. Gilliam, Department of Soil Science, NC State University

In recent years physically based comprehensive distributed watershed scale hydrologic/water quality models have been developed and applied to evaluate cumulative effects of land and water management practices on receiving waters. Although these complex physically based models are capable of simulating the impacts of these changes in large watersheds, they are often prohibitive for regular applications because of excessive input data requirements and because of uncertainties in both the model processes and input data. Nevertheless, important decisions need to be made with regard to nutrient and water management practices at the field and watershed scales.

Through research conducted in the coastal plain soils over many years researchers have determined both the magnitude and the factors affecting nutrient losses from agricultural and forested soils. They have also researched the use of riparian buffers and controlled drainage to reduce nitrogen (N) and phosphorus (P) losses to drainage waters and have developed models for predicting effects of land use and management practices on nutrient losses at the field edge. However, these models cannot be directly applied to predict nutrient loading at the watershed scale. Because of in-stream processes, N and P loads at the watershed outlet are usually substantially less than the cumu-lative loads at the field edge. Watershed scale models that will consider these in-stream processes are needed to assess proposed methods for reducing nutrient loads to coastal streams and estuaries.

The researchers on this project hypothesized that variations in N loading at the watershed outlet is most affected by hydrology and hydraulics. They believed that methods developed in their previous research could be used to simulate the hydrologic and hydraulic processes with reasonable levels of certainty, since these processes are well understood and the parameters controlling them can be reasonably quantified. On the other hand processes controlling nitrogen transformations are much more complex, numerous, and difficult to quantify. Many of these processes involve cycling of N between different organic and inorganic states, which may not significantly affect loading rates at the watershed outlet. Although it may affect receiving water reactivity, the processes could still be reasonably lumped into simple empirical relationships quantifying net change of N in the stream system. The scientists believed that by developing lumped parameter models for determining net in-stream attenuation of N and coupling these models with existing mechanistic hydrologic and hydraulics models, they could predict N loading at the watershed outlet with reasonable accuracy.

In this project, they developed and tested lumped parameter watershed scale water quality models of various levels of complexities for predicting N loading from lower coastal plain watersheds. These models are based upon DRAINMOD, a field scale hydrologic water management model for poorly drained high water table conditions that has been successfully tested for varying geographical and climatological conditions. The watershed scale models have in-stream hydraulic and quality transport submodels linked to DRAINMOD. Models were simplified and a lumped parameter approach used to describe in-stream water quality processes. The models were tested with both water quantity and quality (concentrations and loadings) of N collected over a three-year (1996-1999) period on several subwatersheds across an intensively monitored 10,000 ha lower coastal plain watershed. Model testing involved only minimal calibration that used data available in the literature as input to the model. Given the complexity of the model and limited data, predictions of daily and annual outflows at the outlets of all the subwatersheds ranged from acceptable to excellent. The model performed better for a uniform managed forest than for an agricultural watershed, which was more heterogeneous with respect to soils, crops, and water management practices. The degree of accuracy of predictions of seasonal and annual loads of N varied widely depending upon the season and the level of complexity chosen in lumping the transport processes.

A spreadsheet-based export coefficient model, which used average annual velocity for estimating travel time in the delivery ratio, was as good as using a day-by-day velocity simulated by the complex watershed scale hydraulics model. A GIS-based lumped parameter model was developed based on an export coefficient-delivery ratio (DR) concept, with the DR dependent on time of travel from field to the watershed outlet. The GIS model can be used to quantify the seasonal and annual N loads at the watershed outlet. Research is underway to include an uncertainty analysis component with this lumped parameter water quality model so that N loading predictions can be described as a probabilistic distribution.

WRRI reports available *continued*

An Assessment of the North Carolina Water Reuse Regulations: Their Application to a New Reclamation Facility and Their Key Features Compared to National Water Reuse Regulation Trends (Report No. 346 November 2003)

Helene A. Hilger, Department of Civil Engineering, UNC-Charlotte and Mark D. Sobsey, Department of Environmental Sciences and Engineering, UNC-Chapel Hill

There are no federal regulations governing reclaimed water use, and standards have developed state by state. A review of state regulations reveals that under a variety of influences, water reuse standards or guidelines among the states have evolved to be quite different. The North Carolina water reuse regulations were promulgated in 1996 in response to growing municipal interest in water reuse (Section 15A NCAC 2H.0200 of the N.C. code governing "waste not discharged to surface waters"). The regulations were drafted by an expert committee seeking to obtain a sensible integration of regulations used in other states with those recommended in federal documents such as Guidelines for Water Reuse. However, the regulations were written without benefit of any North Carolina pilot or demonstration project data, since none were available.

The first full-scale municipal water reclamation facility in North Carolina began operating under the new state regulations in late summer 2000. The Charlotte-Mecklenburg Mallard Creek Water Reclamation Facility (MCWRF) has the capacity to deliver up to 200,000 gallons per day (gpd) to the nearby Tradition Golf Course and the Mallard Creek Park. This research was undertaken to review the state reuse regulations as they applied to this new plant and specifically to assess whether the regulations are generally acceptable and adequate to protect human health. Some of the specific concerns that were to be addressed in the review were the fecal coliform limits and the set-back distance requirements in areas where public access is permitted.

In order to make the assessment, the following activities were undertaken: (a) monitoring data from the plant was collected and reviewed; (b) monthly reconnaissance sampling of effluent at the plant and from the irrigation site was conducted, and samples were assayed for organics, nutrients, and bacterial and viral indicator organisms; (c) a review of recent and pertinent literature on microbiological contaminants associated with reclaimed water was undertaken; (d) a water balance model was developed to predict changes in fecal coliform loadings in runoff flow with various setback distance requirements; and (e) state regulations from all other states with water reuse regulations or guidelines permitting use of reclaimed water in areas of public access were collected, compiled, and reviewed.

The plant experienced numerous difficulties during the first year of operation that resulted in frequent shutdowns of the system. Much of the difficulty was likely due to the confounding effects of on-going construction at the site. The shutdowns, combined with seasonal reductions in customer need for reuse water, resulted in few productive sampling months for the field study. Plant monitoring data indicated there was difficulty staying within permit limits for several parameters, although it is believed that some of the violations were likely due to sample contamination. Field sampling at the distribution site showed there was variation in the water quality from month-to-month, but generally the samples of irrigation spray contained acceptable levels of organic material and nutrients. The fecal coliform counts were negligible, and the coliphage used as viral indicators were also at very low concentrations in the irrigation spray. It is important to note, however, that this plant is operating under coliform limits that are even more stringent than those stipulated in the regulations. The permit is written to allow a narrower buffer region with lower coliform limits. The grass sampled from beneath the irrigation headers did show significant viable coliphage accumulation (but negligible fecal counts) on some sampling occasions, while grass from the buffer region and the control site did not. The coliphage accumulation did not persist beyond the first two months of field sampling, so it may have been an anomaly associated with plant start-up. It was beyond the scope of this study to evaluate the risk associated with the accumulations observed.

The survey of other states' regulations and guidelines revealed that many states apply and adapt their land application of treated wastewater regulations for water reclamation projects. Only a subset of states, including North Carolina, have regulations written specifically to encourage and direct wastewater reclamation aimed at augmenting potable water supplies. North Carolina regulations are among the more comprehensive of these. States like California and Florida (and a few states that have adopted California regulations), with long histories of water reuse, have regulations that are significantly more detailed to encompass a wider range of use options and some additional reporting. Also other western states, with some of the earliest pressures for supplementary water supplies, have broad and detailed regulations. It was evident during the data collection for this report that there is a resurgence of interest among the states to develop or improve dedicated water reclamation legislation.

When the North Carolina reuse regulations are compared to those of other states, it is clear that North Carolina treatment requirements are few, with reliance on the water quality limits to drive proper treatment. Among the water

continued

quality limits, North Carolina requires that the monthly geometric mean fecal coliform level be less than 14 cfu/100 mL, with the daily maximum not to exceed 25 cfu/100 mL. Although direct comparisons are difficult because of variations in the tests and statistical parameters required state-to-state, it is clear that these levels fall about mid-way in the range of coliform limits allowed by different states.

Despite the wide variation in allowable coliform limits among the states, there is no evidence of illness related to contact with water from a properly operated wastewater reclamation facility. Nevertheless, in the absence of any codified way to set microbiological water quality limits, there is something to be said for following the course of states with the longest history of reclaimed wastewater use, since presumably their limits have been subject to the most iteration and refinement based on historical experience. However, incremental lowering of the allowable coliform limits should not be done capriciously, because it significantly increases the challenge to plant operators to reliably meet treatment limits, and an appreciation of this difficulty may serve as a disincentive to municipalities considering water reuse projects.

The other water quality parameters related to microbiological water quality are turbidity and total suspended solids. While North Carolina requires continuous turbidity monitoring, and while a specific maximum turbidity limit was specified for the plant monitored in this study, there is no stated required average or maximum daily turbidity limit in the North Carolina regulations. Instead, like Florida, North Carolina uses total suspended solids as a marker for particulates. Among the states that do use turbidity, many require that certain turbidity limits be met before filtration, so that disinfection is optimized. By setting solids limits for the post-disinfection product, an opportunity for a multiple barrier approach to regulation is sacrificed.

The setback distances cited in the North Carolina regulations are not unusual or excessive compared to other states with buffer requirements. North Carolina requires a setback distance of 100 ft from shellfish waters and 25 ft from surface water. Iowa, Maryland, Massachusetts, Missouri, Ohio, Texas, and Wyoming all impose setbacks from surface waters, ranging from 30-300 ft. North Carolina setbacks from wells and property lines are also consistent with many other states, although there are differences with whether setbacks are designated from property lines or just from residences. Like the microbiological limits, it is difficult to anchor setback distances to experimental data, because aerosol transport and pathogen scouring from vegetation and soil are not well characterized. Climate factors such as wind conditions and rainfall also contribute to differences state-to-state. Several states rely on case-by-case buffer distances so that site and situational variations can be taken into account.

The ammonia limit set by North Carolina is one that few other states have for reclaimed water. Presumably it was set to minimize damage to vegetation. It also minimizes the risk of ammonia conversion to nitrification, which would yield nitrate that could readily leach to groundwater.

The site constraints in the North Carolina regulations cover most of the same issues as states with lengthier sections on these topics. The key areas of contractual agreements and public input, awareness, and education are covered. A review of stipulations made by other states (offered in the Appendix) offers some ideas for additional site-related safeguards that could be included in future legislation, especially since some reclaimed water irrigation sites are in residential housing units in North Carolina.

The literature review of recent studies related to safe microbiological water quality requirements, combined with the monitoring results reported here do suggest that viral contaminants may persist even where bacterial indicators are not found. Yet the review also makes clear that there is insufficient data to reliably determine the risks associated with viral indicator organisms, and more study is needed before risk analyses could be used to set limits for coliforms or alternate indicator organisms.

The computer model, which was developed to predict the likely stormwater fecal coliform loadings to the receiving stream under different grassed buffer conditions, showed that there is the potential for substantial fecal coliform loadings under the current allowable coliform limits. However, there is limited information about how likely coliforms in the spray will remain at the surface; how long a coliform on the surface will remain viable; how readily a coliform attached to surface soil or grass will become dislodged by storm water flow; and how readily a dislodged coliform will be retained in a vegetated buffer. Clearly, additional, and in some cases site-specific, research will be necessary. However, with more information about these topics, the model could be used to evaluate buffer requirements under a variety of fecal coliform limits. It is possible that with the lower limits used in some states, a vegetated buffer would prove unnecessary. The model did not assess transport of fecal coliforms in airborne particles, but with the low allowable limits of coliforms in the spray irrigation water, it can be assumed that the small percentage that would be carried in aerosol spray blown from the site would be negligible.

Summaries of state water reuse guidelines are available on Dr. Hilger's website at: http://www.coe.uncc.edu/~hhilger/#research

Studies

Controlling harmful algal blooms requires understanding adaptive abilities

In a lengthy review of the state of knowledge of harmful freshwater algal blooms*, UNC-CH researcher Hans W. Paerl and co-authors explore the complex of physical, chemical, and biotic factors that contribute to the development, proliferation, and expansion of noxious blue-green algae (cynaobacteria). The review makes it clear that the potential for expansion of freshwater nitrogen-fixing (diazotrophic) species beyond their traditional geographic distribution into estuarine environments such as the Neuse River Estuary is real.

Algae, or phytoplankton, use light, carbon dioxide, and a range of inorganic and organic nutrients to photosynthetically produce organic matter that supports food webs in freshwater ecosystems. In most water bodies, a fine balance of adequate light and nutrients determines the rate of production of phytoplankton biomass, or primary productivity. Grazing by algae eaters limits how much "net" production takes place. Physical factors—such as vertical mixing and residence time in a water body—also influence how much phytoplankton production and consumption take place over time and space. Under optimal growth conditions, high rates of primary productivity take place. If consumption does not keep pace with production, excess phytoplankton accumulates. Accumulations that discolor water (yellow, green, blue-green, red or brown) are called "blooms." High nutrient loading and long water residence time that support high growth, along with relatively low grazing lead to optimal bloom conditions.

Blue-green algae—particularly harmful toxic, surface-dwelling, scum-forming genera—are adept at exploiting nutrient-enriched waters because they can rapidly migrate between light-rich surface waters and nutrient-rich bottom waters. Many of these species are tolerant of extreme environmental conditions, including very high light levels, high temperatures, various degrees of desiccation, and periodic nutrient deprivation. Some of the most noxious genera can fix atmospheric nitrogen and therefore dominate under nitrogen-limited conditions.

Blooms may rapidly deplete nutrients, increase turbidity (and therefore decrease transparency), and exhaust inorganic carbon supplies and other essential resources. Under these conditions, a sudden decline in biomass—called a "crash"—occurs, causing a decaying, foul-smelling, unsightly scum. Scums can harbor a variety of microbial pathogens and can rob the underlying waters of oxygen, causing hypoxia, anoxia, release of toxic hydrogen sulfide and accelerated release of nutrients from sediments, which further aggravates eutrophication and blooms. Some bloom-forming species also produce compounds that are toxic to zooplankton, finfish, shellfish, and vertebrate consumers of drinking water, including humans. Since these conditions are noxious from water use, recreational and health perspectives, the bloom-forming species are called "harmful."

Historically, the most notorious cyanobacteria have been confined to heavily nutrient-enriched impoundments. However, global expansion into more recently nutrient-impacted waters is underway. In the United States, blue-greens are expanding in large riverine, estuarine and coastal ecosystems (Lake Pontchartrain, LA; St. Johns River Estuary and Florida Bay, FL; tributaries of the Albemarle-Pamlico Sound system, NC; Potomac River-Chesapeake Bay, MD-VA). Documented toxin producing genera are becoming problematic in aquaculture operations, including fresh-to-brackish catfish, shrimp, and striped bass operations and euhaline salmon net-pen cultures. A nitrogen-fixing blue-green has recently been documented in the open waters of Lake Michigan, and molecular methodology has identified the genetic potential for nitrogen fixation in the Neuse River from the freshwater portion to the mesohaline mouth.

Factors involved in expansion of blue-green species

A number of environmental factors are related to expansion of cyanobacterial bloom expansion. These factors must be considered in strategies to control cyanobacterial growth and dominance.

Nitrogen and Phosphorus: On an ecosystem scale, nitrogen and phosphorus are usually in short supply relative to plant growth needs. When waters are enriched with one or both of these nutrients, primary productivity is stimulated. If the rate of primary production exceeds the rate at which it is utilized by consumers, blooms occur. Blooms can magnify into more serious, long-term water quality and habitat degradation problems. Hypoxia and anoxia, which result when blooms decay, are prime causes of shellfish and finfish mortality. Oxygen depletion also stresses oxygen-requiring higher animals, increasing susceptibility to disease and parasitism. Excessive phosphorus is a chief cause of freshwater eutrophication. Waters having a nitrogen-to-phosphorus molar ratio of less than 15 are susceptible to nitrogen-fixing blue-green dominance. Waters having molar nitrogen-to-phosphorus ratios above 20 are likely to be dominated by non-nitrogen fixing taxa. In hypereutrophic systems with both excessive nitrogen and phosphorus, other factors (light, vertical mixing, residence time, conductivity) may dictate algal community composition. In contrast to most freshwater systems, primary production in marine waters is generally nitrogen-limited. Some estuaries exhibit nitrogen and phosphorus co-limitation. In shallow water estuarine and near-shore shelf systems, phosphorus is efficiently cycled between sediments and the water column, ensuring a readily available source of regenerated phosphorus to support productivity. In the Neuse River Estuary, a cap on nitrogen may result in shifts in the nitrogen-to-phosphorus ratio and alterations in the aquatic communities, including possible selection for species adapted to growth in waters with reduced nitrogen-to-phosphorus ratios. Nitrogen-fixing species have been observed in brackish estuarine, lagoonal, and coastal waters, showing that there is the potential for expansion into estuarine ecosystems.

Organic Matter: Dissolved organic matter may directly stimulate microalgal growth if the organisms possess appropriate uptake and assimilatory enzymes,

which many species of cyanobacteria apparently do. Dissolved organic matter may also indirectly benefit microalgae by providing energy and nutrition for bacteria that help algae grow.

Iron and trace elements: Iron and a number of trace elements are necessary for algal growth. Iron can play a role as a limiting nutrient in some freshwater systems, but iron limitation has not yet been shown for estuarine systems. Under anoxic conditions, iron may be released from sediments in a bio-available reduced form, so periodic anoxia may enhance iron availability. Since blooms can cause anoxic bottom waters, algae may at times control their own iron supplies. Iron availability is also mediated by dissolved organic matter that can form metal chelates. In comparison to high phosphorus loading and low nitrogen-to-phosphorus ratios, iron limitation likely plays a secondary role in determining the distributions and magnitudes of blue-green blooms.

Conductivity and salinity: Salinity and ironic strength (conductivity) of waters have been considered potential regulators of carbon dioxide and nitrogen fixation by blue-green algae. However, recent research has shown that there are species of freshwater blue-greens, including nitrogen fixers, that can tolerate 0 to above 30 psu salinity, indicating a potential for expansion beyond their current geographic ranges.

Turbulence: Cyanobacteria are sensitive to water column stability, including vertical stratification. Low-level turbulence promotes localized nutrient cycling, alleviates certain forms of nutrient limitation, and enhances growth. Moderate turbulence inhibits photosynthetic and nitrogen-fixing activities and growth. High-level turbulence causes disaggregation, cell and filament damage, and crashes among many genera. Larger-scale (mesoscale) wind and tide-induced mixing can overcome the ability of cyanobacteria to maintain optimal vertical positioning. Physical forcing of this kind plays an important role in shaping phytoplankton light and nutrient competition, community composition, and succession. Shear stress common to large lake, estuarine, and coastal surface waters might control nitrogen fixation in bloom-forming genera, and thus present a potential barrier to their expansion.

Biotic interactions: Bloom-forming cyanobacteria form close associations with other microorganisms, including eubacteria, fungi, phytoflagellates, and ciliated and amoeboid protozoans. Cyanobacteria excrete organic compounds, including organic and amino acids, peptides, alkaloids, carbohydrates, and lipopolysaccharides that attract and support the growth of associated bacteria. Culturable cyanobacterial bloom species from North Carolina coastal rivers have not been successfully grown free of bacteria. Specific growth factors (e.g. vitamins) produced by associated bacteria may aid cyanobacterial growth. Associated bacteria may also detoxify cyanobacterial extracellular metal chelates potentially autotoxic to the host. It is difficult to explain why certain bloom-forming strains produce substances that are toxic to mammals, fish, birds, and invertebrates since these organisms are not natural consumers of cyanobacterial. Cyanobacterial toxin production may serve to select for and maintain mutualistic symbiotic microbial relationships by deterring protozoan and metazoan grazing and viral and bacterial lysis, with mammalian and fish toxicity being coincidental. What humans perceive to be toxins may, in fact, be chemical mediators of microbial interactions, bloom dynamics, and—inadvertently— water quality and health impacts.

While cyanobacterial toxins may mediate microbial interactions, they may also inhibit their competitors and consumers, including other phytoplankton, vascular aquatic plants, and protozoans. There is considerable evidence that cyanobacteria can have deleterious effects on grazing zooplankton and that large cladocerans (water fleas) are most adversely affected. Cyanobacterial toxins can cause rapid mortality of herbivorous zooplankton, as well as long-term chronic effects on zooplankton growth and reproduction. However, some zooplankton are resistant to cyanobacterial toxins and some do not eat cyanobacteria and so are not affected.

Effects on fish and the food chain

Cyanobacterial toxins may affect fish and other animals higher on the food chain through (1) direct exposure to toxins, (2) bioaccumulation of toxins in the food chain, and (3) alterations to aquatic food chain structure. Cyanobacterial toxins can kill fish. Cyanobacterial toxins can accumulate in primary consumers, including freshwater clams, crayfish, zooplankton, and gastropods. This indicates potential transfer to higher trophic levels. Blue-green toxins could shift zooplankton composition from large *Daphnia* to smaller and more evasive cladocerans, rotifers, and copepods and thus reduce the feeding success of young-of-the-year and other planktivorous fish. If blue-green blooms exclude more nutritious algae, even zooplankton that are resistant to their toxins could dramatically decrease in abundance, potentially leading to fish recruitment failures.

Harmful bloom management

To successfully control nuisance blooms, consideration must be given to co-occurring physical, chemical, and biotic factors that act to control nitrogen fixation, photosynthesis, and growth and reproductive potential. Widely used control measures include (1) use of algicides, (2) nutrient input reduction and manipulation (e.g. N:P ratios), (3) vertical destratification through mechanical mixing or bubbling, (4) enhanced water flushing to reduce retention time, and (5) biological control (that is changing the aquatic food web to increase grazing pressure or reduce recycling of nutrients). Each measure has its appropriate use in specific impoundments or ecosystems. In general, option 2 remains the most practical and economically feasible choice. However, to assure long-term control of harmful algae research must continue to understand the ecological and physiological adaptations that some species possess to circumvent certain controls.

Paerl, H.W., R.S. Fulton, III, P.H. Moisander, and J. Dyble. 2001. Harmful freshwater algal blooms with an emphasis on cyanobacteria. *TheScientificWorld* 2001(1):76-113.

TheScientificWorld is a peer-reviewed journal. This review was funded by NSF, USDA, US EPA, NOAA, and the St. Johns Water Management District, FL.

Publications

The following technology transfer products are among many developed by EPA's National Risk Management Research Laboratory. The products can be ordered free of charge at the Office of Research and Development website: www.epa.gov/ord.

- Environmental Curricula Handbook: Tools in your Schools (EPA 625/R-02/009; CD ROM: EPA 625/C-02/009)
- Ozone Monitoring, Mapping and Public Outreach: Delivering Real-Time Ozone Information to Your Community (EPA 625/R-99/007; CD ROM: 625/C-99/002)
- Retrofit Opportunities for Water Resource Protection in Urban Environments (EPA 625/R-99/002 CD ROM: 625/C-99/001)
- Environmental Planning for Communities: A Guide to the Environmental Visioning Process Using a Geographical Information System (GIS) (EPA 625/R-98/003)

The Department of Housing and Urban Development (HUD) recently released **The Practice of Low Impact Development.** The publication can be downloaded in pdf format at: http://www.huduser.org/publications/destech/lowimpactdevl.html

People

Pat Davis, formerly water resources manager with Triangle J Council of Governments, has been named the first Sustainability Administrator for the Orange Water and Sewer Authority. Davis will manage projects related to reuse of highly treated wastewater for appropriate non-drinking purposes, water conservation initiatives and energy conservation and will evaluate the efficiency and effectiveness of OWASA's services and programs.

Meredith College offers Land and Wildlife Conservation in North Carolina

In nine 7-9 pm Monday classes January 26 through March 29, you can earn 1.8 CEUs and learn about the unique natural heritage resources of North Carolina, the public agencies and private conservation organizations that attempt to save special natural areas and wildlife habitats, and the methods used for protection and stewardship of NC's natural heritage. An overview is provided of NC's natural heritage resources, the conservation movement, public policy, recent initiatives, and current trends in environmental resource protection. Focus is on public and private programs active in land and wildlife conservation in NC, with several guest speakers and assigned student interviews of key environmental leaders. Cost: $360, Instructor: Charles E. Roe. To register, call 760-8450 or register online at http://www.meredith.edu/professional/environmental.htm.

North Carolina Precipitation/Water Resources

Rainfall (+/- average)	September	October
Asheville	3.01" (-0.71")	2.33" (-0.84")
Charlotte	2.69" (-1.14")	1.43" (-2.23")
Elizabeth City	7.58" (+2.51")	3.77" (+0.91")
Greensboro	7.90" (+3.60")	1.72" (-1.55")
Raleigh	4.47" (+0.21")	2.62" (-0.56")
Wilmington	4.69" (-2.93")	9.58" (+6.37")

Streamflow Index Station (County, Basin)	September mean flow (CFS) (% of long-term median)	October mean flow (CFS) (% of long-term median)
Valley River at Tomotla (Cherokee, Hiwassee)	142 (190%)	96.4 (113%)
Oconaluftee River at Birdtown (Swain, Tenn)	291 (116%)	183 (76%)
French Broad River at Asheville (Buncombe, FB)	2,141 (195%)	1,620 (126%)
South Fork New near Jefferson (Ashe, New)	403 (165%)	323 (114%)
Elk Creek at Elkville (Wilkes, Yadkin/Pee-Dee)	110 (254%)	70 (140%)
Fisher River near Copeland (Surry, Yadkin/Pee-Dee)	236 (229%)	160 (147%)
South Yadkin River near Mocksville (Rowan, Yadkin/PD)	296 (150%)	206 (114%)
Rocky River near Norwood (Stanly, Yadkin/Pee-Dee)	488 (161%)	285 (65%)
Deep River near Moncure (Lee, Cape Fear)	1,839 (492%)	490 (147%)
Black River near Tomahawk (Sampson, Cape Fear)	479 (120%)	332 (127%)
Trent River near Trenton (Jones, Neuse)	94.7 (159%)	360 (733%)
Lumber River near Boardman (Robeson, Lumber)	1,630 (242%)	1,625 (325%)
Little Fishing Creek near White Oak (Halifax, Pamlico)	406 (1,230%)	103 (324%)
Potecasi Creek near Union (Hertford, Chowan)	933 (6,262%)	176 (1,214%)

Groundwater Index well (Province)	September monthly mean water level (ft) (Percent of long-term median)	October monthly mean water level (ft) (Percent of long-term median)
Blantyre (Blue Ridge)	28.22 (92%)	29.47 (92%)
Mocksville (Piedmont)	15.75 (91%)	16.31 (96%)
Simpson (Coastal Plain)	3.96 (75%)	3.56 (63%)

Source: U.S. Geological Survey's *Water Resources Conditions in North Carolina http://nc.water.usgs.gov/monthly/*

Conferences and workshops

Sediment and Erosion Control Solutions for the Southeast. March 17-19, 2004, Charlotte, NC. Information and registration at: http://www.soil.ncsu.edu/swetc/ieca/main.htm.

The NCSU Industrial Extension Service will present an 8-Hour **HAZWOPER Refresher for Environmental Professionals** January 23, 2004, from 8 am to 5 pm on the NCSU Centennial Campus. Eight (8) Engineering Professional Development Hours are awarded for completion of the course. For information visit the IES website: http://www.ies.ncsu.edu/ and click on Environmental or contact Michael_Pirrello @ncsu.edu.

Stormwater: Emerging Issues for Local Communities, April 19-22, 2004, The Grove Park Inn, Asheville, NC. Information at http://www.soil.ncsu.edu/swetc/stormwaterconf/main.htm.

Stormwater Program Institute, April 19-22, 2004, Asheville, NC. NCSU is pleased to announce the first Stormwater Program Institute (SPI) by the Center for Watershed Protection. This is a certificate program offered as a specialized track during Stormwater: Emerging Issues for Local Communities. Information at :http://www.soil.ncsu.edu/swetc/stormwaterconf/institute.htm.

Sediment & Erosion Control: Latest Information with Hands-On Demonstrations, May 7, 2004, Sediment & Erosion Control Research & Education Facility, NCSU, Raleigh, NC. Information at http://www.soil.ncsu.edu/swetc/sediment2/main2.htm.

Delineation of Piedmont and Coastal Plain Jurisdictional Wetlands, May 24-28, 2004, Raleigh and New Bern, NC. NCSU Forestry Education and Outreach Program. Information at http://www.ces.ncsu.edu/nreos/forest/feop/programs.html.

Putting the LID on Stormwater Management. September 21-23, 2004, in College Park, Maryland. The 2-1/2-day conference will highlight innovative low impact design/development techniques designed to mitigate the effects of urbanization and development at the watershed level. Information at: http://www.mwcog.org/environment/lidconference/

Southeastern Regional Conference on Stream Restoration, June 21-24, 2004, Winston- Salem, NC. This conference will showcase stream and wetland restoration efforts from Maryland to Florida. Professionals from the southeastern US and beyond will have an opportunity to present and discuss topics related to the field of restoration. Research and results will be the primary focus of this four-day event, including topics such as sediment transport, in-stream structures, and monitoring and evaluation. Habitat issues, ecosystem assessments, mitigation, funding sources as well as other topics associated with restoration will also be highlighted. For information go to: http://www.bae.ncsu.edu/programs/extension/wqg/sri/2004_conference/index.html

Other resources

Urban Watershed Restoration Manual: The Center for Watershed Protection has spent the better part of the year developing the Urban Watershed Restoration Manual (WURM), a practitioner's guide to restoring urban watersheds. Presented in a series of modules, WURM introduces an integrated framework for urban watershed restoration, outlines effective techniques for assessing urban watersheds, and provides a comprehensive review of watershed restoration techniques. A provisional table of contents for the series can be viewed at http://cwp.org/RR12_WURM_TOC.pdf

Eleven modules in total, WURM will be organized to present practical and useful information on the actual techniques of watershed restoration that can be conveniently accessed and used by planners, engineers, stream biologists and municipal officials. Each part will be profusely illustrated, and will present detailed field methods, practice specifications, costs, applicability and tips on implementation. Expect WURM to appear as 11 stand-alone virtual publications in pdf format in spring 2004.

Cleaning Up Contaminated Properties for Reuse and REVitalization: Effective TECHnical Approaches and Tools Conference - After Action Information. The goal of the RevTech conference was to showcase smart strategies for assessment and cleanup to advance reuse and land revitalization programs. The audience included: Local, State and Federal Cleanup and Development Officials; regulators; developers; the financial community; and technology vendors, service providers, and consultants. The after-action information includes the final agenda with presentations; the lists of poster presentations, exhibitors, and technology fair vendors; and abstracts and bio-sketches. For access to this information, see: http://www.brownfieldstsc.org/revtech/index.html

EPA Science Inventory: On November 18, the US EPA launched its publicly accessible Science Inventory to make EPA's science available to researchers and all citizens. The Science Inventory is a searchable database of 4,000 scientific and technical work products from across the agency. It provides information such as project descriptions (abstracts), contacts for additional information, and electronic links to final reports and related research. Users can search by keyword or within nine topics: aging initiative, contaminated sediments, ecological assessment tools, genomics, tribal science, children's health, cumulative risk, environmental justice, and non-indigenous species. The Science Inventory is available at http://www.epa.gov/si.

Publication Available

Safe Drinking Water Guide
for owners of non-transient, non-community
Public Water Systems using groundwater
in North Carolina,
including child day care centers, adult day care
centers, schools, factories, and businesses

Produced by WRRI under a grant from the U.S. EPA through the Southeastern Regional Small Drinking Water Technical Assistance Center in cooperation with the Public Water Supply Section of the N.C. Division of Environmental Health.

This publication is meant to be a general guide on broad areas of responsibility and core principles of safe system operation for prospective and current owners of non-transient, non-community Public Water Systems that use groundwater. It can be downloaded in pdf format at http://www2.ncsu.edu/ncsu/CIL/WRRI/NTNCguide.pdf. Hard copies can be obtained by calling WRRI at (919) 515-2815.

NCWRA
North Carolina Water Resources Association

2003
Luncheon and Forum Schedule

Feb 2, 2004
Morgan Creek and Little Creeks
Local Planning Initiative
Bonnie Duncan, N.C. Wetlands Restoration Program

JANUARY IS THE TIME TO RENEW YOUR MEMBERSHIP OR JOIN NCWRA AND SAVE ON LUNCHEON COST. FOR MEMBERSHIP INFORMATION CALL JULIE MASON AT (919) 515-2815.

Please note new meeting location.
All luncheon/forums take place at 11:30 am
at the College of Textiles Building on Centennial Campus
N.C. State University. For directions, go to website:
http://centennial.ncsu.edu/howtogethere/htgh.htm

For information about NCWRA visit the website:
http://www.ncsu.edu/waterquality/ncwra/home.htm

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