

NEWS

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CONTENTS

Protecting Public Water Supplies: The Evolving State Role.....	Page 1
The Need for An Expanded State Role in Protecting Water Supply Watersheds (Editorial by David H. Howells).....	Page 2
Water Resources Abstract Data Base Available Locally.....	Page 3
Act to Strengthen Sedimentation Rules Takes Effect January 1.....	Page 4
Jordan Lake Water Supply Allocation Plan Goes to Division of Water Resources for Final Recommendations.....	Page 4
SCS on Target to Meet Erosion Provisions of 1985 Farm Bill.....	Page 4
Estuarine Study Program Calls for Research Proposals.....	Page 5
Institute Calls for Research Proposals.....	Page 5
Estuarine Study Program Holds First Annual Review Day.....	Page 5
Regional Council Assists Local Governments Facing Sludge Deadline, Invites Input.....	Page 6
Four New WRI Reports are Available.....	Page 6
Harvard Study Advocates 7-Point Federal Water Policy Agenda.....	Page 8
USGS Report Assesses Quality of Nation's Groundwater.....	Page 8
USGS Estimates of 1985 Water Use Reveal Water-Use Trends.....	Page 9
EPA Science Board Calls for New Focus on Pollution Prevention.....	Page 10
USGS Booklet Addresses Rural Water Problems.....	Page 11
Chesapeake Bay Nonpoint Source Document is Published.....	Page 11
North Carolina Universities Offer Variety of Water-related Courses for the Spring.....	Page 11
Workshop Slated for Review of New Erosion Control Design Manual.....	Page 12
Water Resources Conditions for October.....	Page 13
New Publications Received by the Institute.....	Page 13

PROTECTING PUBLIC WATER SUPPLIES: THE EVOLVING STATE ROLE

(summarized and extracted
from

"Protecting Public Water Supplies
in the South: A Primer on the
State's Role," a report of
Southern Growth Policies Board)

industrial and agricultural production, mining, fisheries,
and tourism. While some uses may not require a high quality
water resource, most, including public supply and many
industrial uses, do, and the need to provide an adequately
pure supply for such uses figures prominently in the
economics of water supply and in a state's overall economic
development strategy.

The cost of providing safe drinking water is becoming an
even greater factor in water supply economics and in states'
development efforts for several reasons.

First, while serious deficiencies remain in our
understanding of the health effects of exposure to many
substances, health risks associated with water contaminants

The protection
of public water
sources is only
one facet of a
state's water
resource policy
because public
water supply is
only one of many
uses for a state's
water resource.
Other important
uses include
power generation,

are now known to be more widespread than previously
acknowledged, and more stringent federal drinking water
standards are being phased in.

Second, it has become evident that current wastewater and
drinking water treatment technologies cannot remove all
potentially harmful substances, and new, more expensive
treatment technologies will have to be developed and
implemented where unpure sources are used for drinking water
supplies--just to reduce risk.

Third, many of the suitable water reservoir sites near
population centers have already been developed. If it
is necessary to develop additional reservoir sites, either
because of greater demand or because of contamination of
sources, those sites "will cost more to acquire,
impoundments will cost more to construct, and water will
cost more to transport from impoundments to treatment plants
and users." (Burby, et al., 1985)

Finally, the elimination of federal funding for wastewater
and water supply projects has increased the financial burden
on state and local governments.

All these factors are combining to make water supply
protection the least costly way of providing the safe public
water supplies which are critical not only to public health
but also to states' and localities' ability to attract and
retain job-generating business and industry. Measures which
prevent contamination of water sources have the added

benefit of accounting for the uncertainties of health risks due to gaps in our knowledge about contaminants and their effects.

State Role Is Increasingly Concerned With Preventing Rather than Solving Water Quality Problems

Under today's economic conditions, the role of states in water supply protection is evolving and is increasingly concerned with examining comprehensive approaches that spend money wisely and prevent water quality problems rather than solve them after risks are discovered.

The traditional role is still vitally important, but supplementing the traditional approach with comprehensive, preventive approaches may be safer and more cost-effective over the long term. Comprehensive, preventive approaches define waters that should receive priority attention, pollution-generating activity that can affect the waters, and critical land areas that feed into the waters. States then implement management techniques that determine how or if pollution-generating activity may operate in critical land areas that affect important waters.

At their heart, approaches to water quality protection are concerned with addressing risk and uncertainty, then determining what segments of society should bear the costs associated with keeping risks at some acceptable level. The traditional approach took a relatively narrow view of risk and corresponding assignment of costs. Standards were set for a relatively few contaminants, and industries and localities were assigned the direct cost of reducing these contaminants in wastewater discharges and in treated water used by the public.

More Groups Now Expected to Share Cost of Protecting Water Quality

Newer approaches recognize that risks are more widespread than previously acknowledged and broaden the responsibility for paying to reduce risk. Increasingly, segments of society not previously subject to some environmental laws such as farmers, small business owners, land developers, and homeowners share directly in the cost of water quality protection through regulation of practices and fees on pollution-generating products and activities.

Although this broadening of responsibility may be necessary to protect public water supplies, states need to work extensively with the newly affected constituencies to demonstrate the wisdom of preventive approaches and to design implementation techniques that are not arbitrary and that retain as much flexibility and local participation as possible.

Water source protection can be complex and costly. But after billions of dollars in construction of water and wastewater treatment facilities, it is clear that technology alone cannot guarantee a safe water supply. The evolving state role in water supply protection, to a large degree, is to incorporate traditional technological solutions into a comprehensive, preventive approach to managing public water supplies.

As much as any topic, protection of public water sources incorporates the history, the conflicts, the opportunities, and the challenges of state natural resource policy. Public water source protection policy must sort out state, local, and federal roles; balance technological approaches with preservationist strategies; recognize the interdependence of land, air, and water; adjust to the transformation in water

quality concerns from a focus on acute health risks from viral disease to chronic health risks from chemical contamination; and address the complexities of risk and uncertainty.

(The report "Protecting Public Water Supplies in the South: A Primer on the State's Role," prepared by John Hodges-Copple, is available at \$3.00 per copy from the Southern Growth Policies Board, P.O. Box 12293, Research Triangle Park, NC 27709)

THE NEED FOR AN EXPANDED STATE ROLE IN PROTECTING WATER SUPPLY WATERSHEDS

An Editorial
by David H. Howells

Professor Emeritus,
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the protection of its Walnut Creek watershed. At that time, water supplies were largely untreated, and the need to protect water sources from contamination by human waste to control water-borne diseases was becoming evident. A leading physician of the time concluded that "zealously" restricting human activity in watersheds was absolutely necessary to prevent contamination of water supplies.

In 1888, protecting the raw water source was the only way of assuring the safety of drinking water. In 1988, watershed protection should still be the first line of defense against exposure to harmful substances in drinking water.

Water Treatment Technologies Alone Are Not Sufficient to Assure Drinking Water Safety

Today, we have come to rely on water treatment technology to purify the water we drink. However, outbreaks of newly recognized diseases, such as Legionnaires Disease, and uncertainty about how well current water treatment technologies control pathogenic viruses remind us that we still have something to learn about water-borne diseases. Moreover, our entry into the chemical age had added to concerns about the safety of water supplies. Uncertainty about the health effects of exposure to chemical contaminants is even greater than uncertainty about water-borne diseases.

The traditional method of determining whether a water supply is safe for use as drinking water has been to test it using indicator bacteria. This test probably has never been entirely sufficient for non-bacterial microorganisms and is unquestionably irrelevant with respect to chemical pollutants. Further, the traditional technologies for treating raw water are of questionable effectiveness for viruses and are largely ineffective for synthetic organic chemicals. Supplemental treatment by activated carbon adsorption will substantially remove many synthetic organic chemicals--but not all and not with uniform efficiency.

Thus, standard treatment alone is not sufficient to assure a safe drinking water supply where chemicals can enter the source through wastewater discharges, accidents, and stormwater runoff. A protected watershed is absolutely essential to the integrity of public water supplies in the modern era. And, once again, the City of Raleigh and other cities which rely on water supplies from developed watershed

State government
in North Carolina
has been involved
in helping
localities protect
their water
supplies for 100
years. In 1888,
the City of
Raleigh sought and
obtained special
legislation for

areas or watersheds which fall under the jurisdiction of several local governments, as well as communities where the need for watershed protection is not recognized, need help from the State of North Carolina in order to protect the integrity of their water supplies.

State Water Supply Protection Program Relies on Local Incentive, Jurisdictional Cooperation

North Carolina has an innovative water supply protection program which is effective for undeveloped and relatively undeveloped watersheds under jurisdiction of only one or two local governments where officials recognize the need to protect water supplies. The program hinges on surface water classifications.

In predominantly undeveloped watersheds which have requested and received the highest classification, WS-I, by developing and implementing nonpoint source control programs, the Division of Environmental Management (DEM) will not permit point source discharges of any kind. In low to moderately developed watersheds which have requested and received a WS-II classification by developing and implementing nonpoint source control programs, DEM will permit only domestic wastewater or industrial nonprocess cooling water discharges. In watersheds which remain classified WS-III the state places no categorical restrictions on development or discharges.

When the classification program went into effect in 1985, most water supply watersheds were placed into the WS-III classification. Communities with watersheds in the WS-III can obtain a more protective classification for their water supplies only by adopting ordinances and programs for the control of land use and stormwater management adjacent to reservoirs and requesting a new classification.

Land use regulation has long been a local government function, while the regulation of point source wastewater discharges has been a function of State government. In developing the state water supply protection program, it was natural to assume a quid pro quo whereby local government would agree to adopt nonpoint-source control programs if the State would regulate point-source discharges. But, implementation depends upon local understanding of the problem and initiative to seek protective classifications, and the program will be very difficult to apply to larger, multijurisdictional watersheds requiring cooperative agreements amidst competing interests.

Increased State participation in the protection of watersheds is needed. Some State help can come under the existing authority of regulatory commissions and state regulatory programs. But legislative action will be required to provide some needed protection tools, and all efforts to provide stronger watershed protection tools will require additional resources.

Following are recommendations for legislative and executive actions that will help make it possible for surface water supplies across the state of North Carolina to be more adequately protected from contaminants that we cannot depend upon water treatment technologies to remove.

Legislative Action Recommended

- * consolidation of all health and environmental programs in State government to assure cohesive policy and accountability regarding water supply protection

- * resolution of jurisdictional conflicts over watershed land use by establishing new institutional arrangements or expanding roles for existing institutions
- * authorization and funding of an expanded State water supply program to assure future needs for safe drinking water are met
- * adoption of minimum standards for watershed protection by the Environmental Management Commission
- * establishment of a revolving loan fund for advance acquisition of drinking water supply sources by local governments and grants in aid to local governments for the preparation of State-mandated water supply plans

Executive Action Recommended

- * adoption of an Executive Order directing State agencies to avoid actions that could lead to degradation of future water supply resources
- * adoption of a firm policy by the Environmental Management Commission to rigorously enforce regulations affecting watershed protection
- * reaffirmation of a State leadership role in watershed protection--activation of a watershed protection task-force
- * requirement of full disclosure of all chemical and toxic components of wastewater discharges to WS-III waters; assurance that all NPDES and municipal permits under local pretreatment programs fully reflect all toxic components of wastewater discharge
- * strengthening of State and local sedimentation control programs to assure protection of water supply watersheds

WATER RESOURCES ABSTRACT DATA BASE AVAILABLE LOCALLY

The Selected Water
Resources Abstract
(SWRA) data base
is now available

at the D.H. Hill Library at North Carolina State University. The data base, which contains more than 200,000 abstracts, is provided by the U.S. Geological Survey's Water Resources Scientific Information Center. The abstracts describe research done in the United States and several foreign countries and come from about 100 scientific journals.

Searchable fields in each abstract include title words, author name, key words, and abstract words. Once the search request is formulated into a single sentence, the search proceeds fairly quickly. Results may be viewed on the screen and "fine tuned" to remove irrelevant records. The resultant search set can be printed at the library or written to a PC floppy disk for later printing or viewing. Each record consists of complete bibliographic and availability information and an abstract of 200 or more words.

The data base offers information from 1968 (the beginning of SWRA publication) through 1987. The information will be updated yearly.

For more information or to request assistance with a search, contact Lisa Abbott, Documents Librarian, D.H. Hill Library, N.C. State University (919) 737-3280, or James Stewart, Associate Director, Water Resources Research Institute (919) 737-2815.

ACT TO STRENGTHEN SEDIMENTATION RULES TAKES EFFECT JAN. 1

"An Act to Improve
Administration of
the Sedimentation
Pollution Con-
trol Act of 1973,"

which was passed during the 1988 session of the General Assembly, takes effect January 1, 1989. The act provides that:

- * no permit can be issued for construction, demolition, reconstruction, repair, alteration, or removal of a building involving land-disturbing activity unless an erosion control plan has been approved by the Sedimentation Pollution Control Commission or by a local government having a state-approved erosion control ordinance;

- * a draft erosion control plan submitted for approval must contain the applicant's address and, if the applicant is not a resident of North Carolina, must designate a North Carolina agent for the purpose of receiving notice of compliance or noncompliance;

- * any person who fails to submit an erosion control plan as required by the Sedimentation Pollution Control Act shall be subject to a one-time fine of up to \$1,000 in addition to other fines under other provisions of the act;

- * any person injured by a violation of Sedimentation Pollution Control Act rules who brings civil action against the violator and is awarded actual damages of \$5,000 or less shall be awarded costs of litigation including reasonable attorneys fees and expert witness fees.

The 1988 act also directs the Department of Natural Resources and Community Development to study the effect of the new rules and to report to the General Assembly by October 1990 on the advisability of additional rules to give the Department authority to (1) collect plan approval fees, (2) require performance bonds for land disturbing activities, (3) issue stop work orders by field personnel, and (4) increase civil penalties assessed for violations of the Sedimentation Pollution Control Act.

JORDAN LAKE WATER SUPPLY ALLOCATION PLAN GOES TO DIVISION OF WATER RESOURCES FOR FINAL RECOMMENDATIONS

Following a public meeting on November 3, the N.C. Division of Water Resources began reviewing comments in

preparation for making final recommendations for allocating water supply storage in Jordan Lake to local water authorities.

Jordan Lake is a U.S. Army Corps of Engineers project over which the State of North Carolina has water supply allocation control. The State must pay the federal government for the project's 45,800 acre-feet of water supply storage and may transfer to local authorities water supply interest and receive repayment from local governments. In 1988, the N.C. Environmental Management Commission developed an administrative rule to guide the allocation of water supply from Jordan Lake, and last summer local governments were invited to submit applications.

Three applications were received. A joint application from the Towns of Cary and Apex requested a 12-million-gallons-per-day (MGD) short-term allocation and a 13-MGD long-range allocation. An application from the City of Raleigh requested a 20-MGD long-range allocation. A joint application from Chatham County, the Town of Hillsborough, the Orange-Alamance Water System, Inc., Orange County, and the Orange Water and Sewer Authority requested a 4-MGD short-term allocation (for Chatham County) and a 38.3 MGD long-range allocation.

The Division of Water Resources reviewed the applications and prepared a draft allocation plan which was aimed at meeting documented short-term water needs but keeping water supply in reserve to meet future needs as they actually develop. Under this plan, Cary and Apex and the Chatham/Orange group will receive all the water supply they requested to fill immediate need, but most long-range allocations will be deferred.

The Environmental Management Commission (EMC) will review the public hearing results and recommendations by the Division of Water Resources staff. Final action on the first round of allocations could occur at the EMC meeting on December 8.

SCS ON TARGET TO MEET EROSION PROVISIONS OF 1985 FARM BILL

According to a news release from the USDA Soil Conservation

Service, (SCS) conservation plans have been developed for 45 percent of the 1.2 million acres of highly erodible cropland in North Carolina affected by the conservation provisions of the Food Security Act of 1985. Under the act, a farmer who crops highly erodible land must have a conservation plan approved by December 31, 1989, and must implement it fully by December 31, 1994, to remain eligible for USDA program benefits.

The SCS estimates that over 37,000 farmers in North Carolina need a conservation plan in order to comply with the law. According to Bobbye J. Jones, state conservationist, about 18,000 farmers, who account for about 547,000 acres, have completed their plans.

Jones said that the SCS hopes to have 65 percent of the plans completed by the end of 1988 and the remaining 35 percent completed by the end of 1989. He urges farmers to act now if they have highly erodible cropland that needs a conservation plan. He said those who postpone requesting a conservation plan until the last minute may find they have a long wait for the technical help needed to develop it.

According to Jones, North Carolina is a little ahead of the national average in completing plans. Nationally 38 percent of the needed plans--representing 54 million of the nation's 143 million highly erodible acres-- have been completed.

ESTUARINE STUDY PROGRAM CALLS FOR RESEARCH PROPOSALS

The North Carolina
Department of
Natural Resources
and Community

Development (DNRCD) and the Environmental Protection Agency (EPA) announced on November 18, 1988, the third-year Call for Proposals for information needs and public involvement by the Albemarle-Pamlico Estuarine Study. The study is a five-year interagency effort leading to a comprehensive conservation management plan for a large portion of coastal North Carolina.

Available funds for acquiring the needed information and public participation projects this year are expected to be approximately \$1.2 million. Sources of funds come from a 25/75% cost share split between DNRCD and EPA.

The deadline for receipt of proposals by the Albemarle-Pamlico Estuarine Study office in the DNRCD building is by 5 pm on January 13, 1989. No proposals will be accepted after this cut-off date.

For further information about the Call for Proposals, please contact Dr. Robert E. Holman, DNRCD/Albemarle-Pamlico Estuarine Study, 512 N. Salisbury Street, P.O. Box 27687, Raleigh, NC 27611.

INSTITUTE CALLS FOR RESEARCH PROPOSALS

Applications from
faculty members of
senior colleges

and universities in North Carolina for grants under the Institute's Federal Cooperative Program for Fiscal Year 1990 will be accepted until January 20, 1989.

The purpose of the Institute's program is to encourage research on water resource problems in North Carolina.

North Carolina is adding the equivalent of a city of 100,000 people every year, and each job created brings increased water use, increased generation of waste products, and changes in land use--all of which affect the state's water resources. While it would be an overstatement to say that North Carolina faces a crisis in water management, it is fair to say that the state faces an unprecedented demand on its water resources.

The droughts of 1986 and 1988 and the declining quality of the state's valuable estuarine areas are reminders of the critical importance of water to the state's economy and environment. Research and the translation of new knowledge into practice are important elements in the expansion of water management capabilities as the state pursues the goal of enhancing the welfare of its citizens.

Focused problem areas for the Institute's 1990 Federal Cooperative Program include the following:

1) **URBAN WATER MANAGEMENT:** Within this category the topics of special concern are watershed protection, treatment of drinking water and wastewater, management of urban stormwater management, and regional water supply management.

2) **SURFACE WATER:** Three problems in this category in need of special attention are the fate of toxic substances in streams and estuaries and their impacts on aquatic life; evaluation of the impacts of building and operating impoundments on the aquatic

life of small streams and evaluation of policies for maintaining or augmenting low flows in those streams; and the potential effects of climate change on the availability of surface water.

3) **GROUNDWATER:** Priorities in this category are movement of common pesticides in soil types and aquifer conditions in North Carolina where the highest potential for contamination exists, the fates of hydrocarbons in the underground environment and cost-effective methods for cleaning up hydrocarbon contamination; appropriate siting criteria and cost-effective contaminant-containment methods for landfills; and sludge management.

4) **TECHNOLOGY TRANSFER:** This category includes innovative approaches designed to enhance the delivery and acceptance of water technology in the focused problem areas.

More detailed information on these focused areas and copies of instructions for preparation of proposals can be obtained from the Institute by calling or writing the office of the Director, Campus Box 7912, North Carolina State University, Raleigh, NC 27695-7912--Telephone: (919) 737-2815.

ESTUARINE STUDY PROGRAM HOLDS FIRST ANNUAL REVIEW DAY

State and federal
officials,
scientists and
citizens involved
in the Albemarle-

Pamlico Estuarine Study (APES) met in Washington, NC, October 14 and 15 to review progress made by the study program in identifying causes of problems in North Carolina's estuaries and targeting solutions to the problems.

A cooperative program of the North Carolina Department of Natural Resources and Community Development's Division of Environmental Management and the U.S. Environmental Protection Agency's National Estuary Program, the APES has been charged with describing and documenting conditions in North Carolina's estuarine system, identifying the probable causes of water quality and living resource decline, and designing a "management" program that will restore water quality and living resources while allowing as much human use of the estuarine land and water resources as possible.

To that end, the program initiated a research, or technical information gathering phase, in 1987 by funding 45 projects in the broad areas of critical resource areas, information management, fisheries, water quality, public participation, and human environment. The first annual review day provided an opportunity for citizens, officials, and other researchers to learn directly from the principal investigators of the 45 projects what the projects have discovered or accomplished and how the project results may apply to managing natural resources in the estuaries.

Among the projects reported on were the following:

* a study by Ries Collier of the U.S. Fish and Wildlife Service which shows (1) that the trend toward replacing bridges with culverts in the coastal area is blocking

the passage of small "anadromous" fish, such as blueback herring, trying to reach their spawning grounds in upstream areas of coastal rivers and (2) that the existing technology for providing passages around dams to let larger "anadromous" fish, such as striped bass, reach their spawning grounds, is not applicable in this area and needs to be modified for North Carolina use

* a survey by scientists with the National Marine Fisheries Service in Beaufort, NC, which (1) shows that North Carolina has more marine area covered by submerged aquatic plants--a critical component of underwater nurseries--than any southeastern state besides Florida and (2) provides the basis for mapping underwater vegetation so that when applications are submitted to the state for dredge-and-fill related activities, areas of underwater vegetation can be protected from such activity

* a study by Mark Brinson of East Carolina University which, when completed, will identify coastal areas where wetlands are capable of maintaining themselves (migrating inland and sustaining area) and areas where wetlands will erode into uplands as the sea-level rises so that development can be directed toward the latter areas to help preserve wetland resources

* a study by Walter Clark of the UNC Sea Grant College Program which (1) has identified ways in which provisions of the Coastal Area Management Act (CAMA) may be used by local governments to manage water areas, such as estuarine and public-trust waters, as well as land areas, (2) will design a model for identifying a county's water-based resources and managing them using CAMA and local powers (probably in Carteret County), and (3) finally, will provide the management model and details about how it was developed to other coastal counties

According to Dr. Robert E. Holman, APES Project Director, in addition to information being gathered through research projects, information is also being identified and gathered for the estuarine study program by workgroups on toxic substances, endangered species, and water quality monitoring. Holman said that the key to protecting North Carolina's estuarine resources is public involvement and public understanding of the way human activity affects critical natural relationships in the estuarine system.

REGIONAL COUNCIL ASSISTS LOCAL GOVERNMENTS FACING SLUDGE DEADLINES, INVITES INPUT

have disposed of the residue, or sludge, from sewage treatment processes in public landfills. Burying sludge

For many years, wastewater treatment plants operated by local governments in North Carolina

along with garbage in landfills is called "co-disposal," and on March 1, 1989, it becomes illegal. Under a new regulation adopted by the North Carolina Division of Health Services, municipalities must find alternative methods of sludge disposal, and many face the March 1 deadline--an extension from the original deadline--with no alternative in sight.

In an effort to help find alternatives for sludge generators throughout Western North Carolina, the Land of Sky Regional Council (LOSRC) has developed an education and technology transfer program for local governments. Under a 205(j) grant from the N.C. Division of Environmental Management, which regulates sludge disposal, LOSRC is attempting to address immediate disposal needs for municipalities still co-disposing through a project that includes workshops, a decision-making manual, and tours of operating sludge management facilities.

A workshop in September examined land application as a disposal method. Subsequent workshops are planned on incineration, composting, and dedicated landfilling.

LOSRC invites individuals with experience in alternative sludge disposal (successful or otherwise) to share their insights. Contact Tom Elmore or Susan Stevens at Land-of-Sky Regional Council (704) 254-8131.

FOUR NEW WRRI PROJECT REPORTS ARE AVAILABLE

The UNC Water Resources Research Institute has recently published reports on four

research projects for which it provided funding. Free single copies of these reports are available to federal water resource agencies, state water resources research institutes, and other water research institutions with which reciprocal exchange agreements have been made.

Single copies of the reports are free to public agencies, institutions, industries, and private citizens of North Carolina as long as they are in print. Copies of out-of-print publications are available for a \$5 reproduction charge (\$10 if billed). Nonresidents of North Carolina will be charged a prepaid amount of \$8 per copy and \$10 if billed.

The reports may be obtained from:

The Water Resources Research Institute
of The University of North Carolina
Box 7912
North Carolina State University
Raleigh, NC 27695-7912
(919) 737-2815

REPORT NUMBER 239 FORMATION OF HALOGENATED ORGANICS DURING WASTEWATER DISINFECTION

by Philip C. Singer, Richard A. Brown, and Joseph F. Wiseman, Jr., Department of Environmental Sciences and Engineering
University of North Carolina at Chapel Hill

Since the deletion of federally mandated fecal coliform limits from the definition of secondary wastewater treatment in 1976, most states have been reviewing and modifying their requirements concerning wastewater disinfection,

particularly with regard to the use of chlorine. One of the issues involved in this review of disinfection policies has been the discharge of potentially carcinogenic halogenated organic compounds formed during chlorination and their effect on aquatic life and downstream water consumers.

The research described in this report examined the formation of trihalomethanes (THMs) and total organic halides (TOX) during wastewater chlorination at three wastewater treatment plants in the central Piedmont of North Carolina. Secondary effluent samples were collected before and after the addition of chlorine at each of the three treatment facilities; chlorinated samples were taken from various locations within the chlorine contact chambers and at the plant discharge. Water samples were also collected upstream and downstream from two of the plant outfalls to determine the increase and persistence of THMs and TOX below each plant. TOX and THM formation was evaluated in terms of effluent wastewater quality (e.g. residual chemical oxygen demand, total organic carbon and ammonia concentration), chlorine dose, chlorine contacting system, methods of chlorine addition, and chlorine-to-ammonia ratio.

The results showed that TOX was present in the unchlorinated wastewater and that additional TOX was formed immediately after chlorine addition. Small to insignificant amounts of THMs were detected. TOX formation did not increase with increasing contact time, due to the rapid depletion of free chlorine and the formation of combined chlorine in the chlorine contact chamber. Even though the chlorine doses, organic content, and ammonia concentrations were different at the three facilities, the extent of TOX formation was similar. The amount of TOX formed as a result of wastewater chlorination ranged from about 50-150 ug/l at the three plants. Mass balance calculations and in-stream measurements demonstrated that TOX behaves conservatively in the respective receiving streams.

REPORT NUMBER 240
POTENTIAL FOR HYDRILLA DISPERSAL BY SEXUAL MEANS IN NORTH CAROLINA SURFACE WATERS

by K. A. Langeland and C.B. Smith
Department of Crop Science
North Carolina State University

Flowering and seed production of monoecious hydrilla populations in several North Carolina lakes was studied and eleven populations of hydrilla in the United States were karyotyped. Flowering did not occur when plants were maintained in a phytotron for two months under a variety of day lengths and temperatures. Staminate and pistillate floral initiation occurred in the field during early July suggesting a long-short day flowering response. Mature hydrilla seeds were only observed in Lake Wheeler where seed density ranged from 3-30 m⁻² in 1984 and 1985. Seed viability ranged from 30% to 5.0% when seeds were collected in January and October 1986 respectively. Seedling vigor was low compared to hydrilla cloned from the parent population. Only one seedling exhibited apparently normal growth. Somatic cells of hydrilla from all North Carolina populations were found to be triploid (3n=24), and this may be the cause for low seed and seedling viability.

Study results show the potential for hydrilla dispersal by sexual means in North Carolina is very low and research recommends that efforts to manage the plants by minimizing vegetative propagule transportation and using various control methods should continue.

REPORT NUMBER 241
SOIL CHEMISTRY AND PHOSPHORUS RETENTION CAPACITY OF NORTH CAROLINA COASTAL PLAIN SWAMPS RECEIVING SEWAGE EFFLUENT

by Curtis J. Richardson, Mark R. Walbridge, and Alan Burns
School of Forestry and Environmental Studies
Duke University

Several hundred freshwater swamps in North Carolina currently receive municipal wastewater inputs. In this study researchers examined three Coastal Plain wetlands to (1) characterize their soil chemical properties, (2) determine short-term and long-term effects of effluent additions on soil chemistry, (3) estimate the phosphorus sorption capacities of these swamp soils and determine the relationship between P sorption capacity and soil chemistry, and (4) develop a predictive index to evaluate the P sorption potentials of other N.C. Coastal Plain swamps.

Despite similarities in vegetative cover, North Carolina Coastal Plain swamps were found to vary in soil characteristics and P sorption capacity, due to both natural and anthropogenic factors. Within a particular wetland, soil chemical properties related to P sorption may also exhibit spatial heterogeneity. Determination of the maximum P sorption potential of a particular wetland must be based on accurate assessment of the chemical properties of the wetland soil and their spatial variability. Both the effective absorbing surface area and the retention time must be considered when estimating the P removal potential of a wetland.

Maximum utilization of wetlands for phosphate removal from wastewater with minimum ecosystem impact can be achieved only under conditions which maximize retention time and the effective surface area of the wetland and minimize the average impact per unit area. This could be achieved by adding acidified wastewater using a well-designed diffusion system, rather than using a point discharge.

REPORT NUMBER 242
METHODOLOGY FOR ASSESSMENT OF CONTAMINATION OF THE UNSATURATED ZONE BY LEAKING UNDERGROUND STORAGE TANKS

by Francis A. DiGiano, Cass T. Miller, Anne C. Roche,
and Edward D. Wallingford
Department of Environmental Sciences and Engineering
University of North Carolina at Chapel Hill

The groundwater resources in North Carolina and the United States have been contaminated by a variety of volatile organic pollutants that include solvents, petroleum products, and pesticides. Groundwater monitoring and renovation must be founded on the measurement of a contaminant concentration distribution in the subsurface environment. Many common volatile organic contaminants typically exist in several phases of the subsurface environment: as a nonaqueous phase liquid, as a solute dissolved in the aqueous phase, as a solute volatilized in the vapor phase, and as solute sorbed to a solid phase. Determination of a contaminant distribution in the subsurface environment requires measurement of theoretical computation of the concentration in each phase--or some combination of the two approaches.

This work focused on the investigation of three methods for measuring a contaminant distribution in the subsurface: an ultrasonic, mixed-solvent, solid-core extraction methods; a nitrogen-purge, solid-core extraction method; and a driveable ground-probe, vapor-phase sampling method. Laboratory results demonstrate the theoretical basis and performance of each method, while an investigation at a Camp

Lejeune site provided a field trial. Method development and testing are presented in detail for all methods. The best results in the field were obtained with the ultrasonic, mixed-solvent, solid-core extraction method and the driveable ground-probe, vapor-phase sampling method. Field data results show that concentrations in each phase may be roughly predicted by assuming equilibrium among all phases.

HARVARD STUDY ADVOCATES 7-POINT FEDERAL WATER POLICY AGENDA

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from The Water Reporter

Eighteen federal agencies in seven departments and seven independent agencies exercise authority over water programs. These

number at least 25, funded by no less than 70 separate congressional appropriations accounts. Prior to 1971, more than \$338 billion was spent both publicly and privately to develop the nation's water resources. It is estimated that another \$300 billion will be needed by the end of this century. This summer's drought dramatized the nation's water dilemma--we still have plenty, but our management, or policy, is "confused and disorganized."

So says the Harvard Water Policy Project, which issued its findings in Washington, DC, August 30. The study, "Federal Water Policy: Toward an Agenda for Action," was produced at the Energy and Environmental Policy Center of the John F. Kennedy School of Government, Harvard University, under the leadership of Peter P. Rogers and Charles H.W. Foster. Rogers is the Gordon McKay Professor of Environmental Engineering and a professor of city planning. Foster is an adjunct research fellow at the Kennedy School of Government. Although its criticism of the current water policy scene is hardly new--the study reviews all the post-World War II water policy examinations--it notes that they all separated policy considerations from "the frontline water resource agencies themselves." [David C. Harrison's mostly ignored work, "Do WE Need a National Water Policy Process?" published in 1981 by the National Academy of Public Administration, probed this politically sensitive but highly germane area.] The Harvard study also stressed that although "the concept of a single, national water policy has a nice ring to it, national policy, in reality, is only the sum total of a number of individual federal, state, and regional policies." Thus the study focused on federal policy.

The seven initiatives the study advocates for the "first 100 days of the new administration" are:

1. Appointment of a President's Water Council under an independent chairperson. Its function would be to coordinate, assess, and facilitate water resources.
2. Formation of similar regional councils for parts of the country suffering water problems. Such largely autonomous councils would help avoid water disputes through consensus-building and offer financial and technical assistance to state and local agencies.
3. Creation of a national water information program to improve access to existing data.
4. Revision of the national water resources research program, to include a national water extension service to encourage more transfers of information and technology.

5. Speed-up of water resource public education, with the holding of regional water resource forums as a first step to establish program priorities and improve communications between federal administrators and local water interests.

6. Application of modern marketing and pricing techniques to all federally produced water. Federal agencies should reallocate water currently in storage and redevelop existing federal projects.

7. Creation of a national water trust fund to finance federal water programs through revenues such as user fees rather than general tax revenues.

The study was produced by faculty and graduate students with grant assistance from Resources of the Future of Washington, DC, and advice from 10 outside experts: Daniel P. Beard, House Interior and Insular Affairs Subcommittee on Energy and Water staff director; Henry P. Caulfield, Jr., Colorado State University professor emeritus; Robert K. Dawson, Office of Management and Budget associate director; Anthony S. Earl, former governor of Wisconsin; Madge O. Ertel, U.S. Geological Survey state liaison; Lawrence J. Jensen, EPA assistant administrator for water; Theodore R. Schad, National Water Commission director; Kyle Schilling, Army Corps of Engineers Institute for Water Resources policy studies chief; Gerald D. Seinwill, Soil Conservation Service information resources management director, and Warren Viessman, Jr., University of Florida Environmental Engineering Sciences chairman.

USGS REPORT ASSESSES QUALITY OF NATION'S GROUNDWATER

The overall quality of the nation's groundwater is good, but management and

protection of groundwater resources remain major challenges, according to a the U.S. Geological Survey's fourth National Water Summary released in October.

As the nation's largest water-science and water-information agency, USGS each year measures groundwater levels at about 30,000 wells, determines water quality at 9,000 wells and conducts hundreds of groundwater investigations. According to James W. Ziglar, assistant secretary of the Interior for water and science, the 560-page report is based on data collected by USGS as well as a variety of other data on groundwater quality conditions in each state. He said that state summaries in the report are compilations of much needed information scattered throughout state and federal reports and files which touch upon every aspect of groundwater quality.

"From the information collected by the USGS in cooperation with more than 950 other federal, state, and local agencies, there is a sound base of data and research on which the states can continue to build strong groundwater management and protection efforts," said Ziglar in releasing the report.

Ziglar said the state summaries show groundwater quality conditions vary widely from state to state, depending on such factors as geology, climate, and human activities. Groundwater quality is affected by naturally occurring bacteria, heavy metals, dissolved solids, iron, and manganese, each of which can impair some uses of water. Human-induced sources of contamination most frequently mentioned in the USGS report include landfills, septic systems, underground storage tanks, agricultural use of fertilizers and pesticides, surface impoundments, and accidental spills. All states report some impairment of

groundwater use due to natural conditions and some contamination from human activities, but only a small percentage of the total volume of fresh groundwater is contaminated enough to impair use, and most of that is at shallow depths.

The report points out that costs of detecting and cleaning up groundwater contamination are staggering and that, in some cases, complete removal of pollutants from groundwater in the vicinity of some waste sites may not be technically feasible. For those reasons, efficient and effective groundwater protection is the most successful and least costly approach to the problem of groundwater contamination.

Underground Storage Tanks, Waste Disposal Sites Most Often Responsible for N.C. Groundwater Contamination

In North Carolina, where about 55 percent of the population relies on groundwater for its drinking water supply, the most common naturally occurring groundwater quality problem is the presence of saltwater in all aquifers in the eastern part of the state. Human-induced water-quality problems in North Carolina's aquifers most commonly result from contamination by leachate from landfills and seepage from waste lagoons, underground storage tanks, septic tanks, and accidental spills of chemicals. An estimated 68 public and 690 private wells are known to have been contaminated in the state.

Groundwater contamination has been confirmed at 33 of 35 sites where monitoring is required under the Resources Conservation and Recovery Act, which regulates hazardous waste. An additional six sites have been included in EPA's National Priorities List of hazardous waste sites under "Superfund" cleanup legislation, and two more are being considered for the "Superfund" cleanup list. The Department of Defense has identified 51 sites in North Carolina where the potential for contamination of groundwater by hazardous waste exists. The potential for contamination at nine of these sites at one facility was considered significant enough to warrant remedial action.

Pesticides have been detected in water from 202 private wells and one public-supply well. Although many of the wells that yield contaminated water are near agricultural lands where pesticides have been applied, some of the wells seem to have been contaminated by spills that occurred during the preparation, mixing, or handling of the chemicals before application, or from infiltration of rinse water used to clean application equipment or tanks.

One-third of the sites where groundwater contamination has been confirmed are publicly owned. Of these, 23 percent are municipal or county landfills.

Contamination of water supplies by septic-disposal systems near public or private supply wells is a problem of unknown magnitude, according to the report. However, 30 percent of the homes in Graham, Haywood, Jackson, and Macon Counties had drinking water supplies that were bacteriologically contaminated (though not necessarily unfit for use), at least partly because of onsite sewage-treatment problems.

According to the report, the greatest threats to groundwater in the state are posed by aging underground storage tanks, particularly in the Sand Hills area, and the cumulative effects of some agricultural practices, particularly the trend toward minimum-tillage and increased reliance on herbicides and chemirrigation.

USGS ESTIMATES OF 1985 WATER USE REVEAL WATER-USE TRENDS

According to a report recently released by the U.S. Geological Survey, (USGS)

Americans withdrew about 10 percent less water from streams and groundwater aquifers to use in homes, fields and farms, businesses, and industries than they did in 1980. The decrease in estimated water use between 1980 and 1985 is the first decline since USGS began making five-year estimates in 1950, but, according to the report, the decrease confirms a general trend that began in 1970 when the rate of increase in water use began to slow.

Nationwide, per capita freshwater use for all purposes in 1985 was 1,400 gallons per day. In North Carolina, per capita use was 1,260.

Commercial, Industrial, and Mining Water Withdrawals Drop to Lowest Level Reported Since 1950

The largest decline in withdrawals came in a category called "self-supplied industrial, commercial, and mining." This category includes several types of users that withdraw water from streams or groundwater aquifers rather than, or in addition to, using public water supplies. Included in this category are (1) institutions such as universities and prisons, military installations, and businesses such as motels and restaurants which withdraw and treat their own water; (2) industries which withdraw water for purposes such as processing, washing, and cooling; and (3) mining operations that withdraw water for dewatering, milling and other preparations. Withdrawals in this category dropped 33 percent to the lowest level reported since 1950.

The report says that some of the apparent decrease in the industrial, commercial, and mining category may be attributable to reporting methods but that an actual decline in water withdrawals by business, industry and mining did occur along with an increase in consumptive use--that is use which does not return used water to the water source. The authors of the report speculate that these two facts taken together may indicate increased plant efficiencies (conservation) and an increased reuse (recycling) of water but may also reflect a decline in production due to an economic slowdown.

The survey also revealed a significant decline over the five-year period in water withdrawals for both thermoelectric power use and hydroelectric power generation.

Thermoelectric plants, which generate electricity by burning fossil fuels or using geothermal or nuclear energy, use water mainly to cool condensers and reactors. This use category accounts for the largest water withdrawals for offstream use and represents 47 percent of total fresh and saline withdrawals for all offstream categories. Over the survey period total withdrawals in this category declined 13 percent.

Hydroelectric power generation is classified as an "instream use," a term which refers to the use of falling water to drive turbine generators. Between 1980 and 1985, use of water for this purpose declined seven percent. At the same time, hydroelectric power generation increased seven percent.

The final major offstream use category showing a decline in withdrawals was irrigation, which decreased six percent. This category includes all water artificially applied to farm and horticultural crops as well as water used to

irrigate public and private golf courses. Lower requirements for irrigation may have resulted from depressed commodity prices and a consequent drop in crop production; however, plentiful rainfall in 1985 could also have reduced the need to irrigate in some areas.

Reported Water Withdrawals for Livestock Use Doubled during Survey Period

While most major water use categories saw a decline between 1980 and 1985, there were increases in two categories. Withdrawals by public water supply systems were up seven percent, basically reflecting the increased demand generated by population growth of six percent during the five-year survey period.

Water withdrawals for a category called "rural domestic and livestock use" were up 39 percent. The survey estimated that 42.5 million people, or 18 percent of the nation's total population, supplied their own water for household, or domestic, uses in 1985 and that withdrawals (largely groundwater) for this purpose declined four percent. However, withdrawals for stock watering, feed lots, dairy operations, fish farming and other on-farm needs doubled between 1980 and 1985. The report attributes the huge increase to an increase in fish farming in several states, including Arkansas, Idaho, and Mississippi and to the fact that fish farming had previously been reported as an industrial use by some states.

The report, "Estimated Use of Water in the United States in 1985" (USGS Circular 1004), is available free from the Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25425, Denver, CO 80225.

EPA SCIENCE BOARD CALLS FOR NEW FOCUS ON POLLUTION PREVENTION

In a report
delivered to U.S.
Environmental
Protection Agency
Administrator Lee

Thomas in September, the EPA Science Advisory Board recommended that the agency shift its research emphasis from end-of-pipe regulation and clean-up to pollution prevention.

Thomas asked the Science Advisory Board in 1987 to establish a special committee to provide an independent, objective assessment of the agency's long-term research needs and to advise him on how to incorporate those needs into the research planning process. The Research Strategies Committee was created in response and is composed of scientists, engineers, and managers with broad experience in environmental research.

In its report, "Future Risk: Research Strategies for the 1990s," the committee said that while there is a continuing need for mandated pollution control, the end-of-pipe strategy EPA has emphasized over the first 18 years of its existence, is no longer in itself sufficient to protect the environment.

A new approach to environmental protection is needed because

(1) some of the most threatening forms of pollution and environmental contamination, such as chlorofluorocarbons in the stratosphere and run-off from farms and city streets, cannot be traced to the end of any single pipe, but are "linked to thousands--if not millions--of small sources of pollution,"

(2) traditional controls do not eliminate pollution but simply move it from one environmental medium (water, air) to another (land),

(3) in spite of past control efforts, some pollutant loadings are too high and are beginning to overwhelm the capacity of the environment to assimilate them, and

(4) some environmental problems, such as ozone depletion and carbon dioxide buildup in the upper atmosphere, are not as reversible as past forms of air and water pollution.

The report concludes, "A strategic shift in emphasis from control and clean-up to anticipation and prevention is absolutely essential to our future physical, environmental, and economic health," the report asserts.

While EPA is commonly understood to be a regulatory agency, the report says, it is, in fact, a multifaceted agency, responsible for research that defines the nature of and possible solutions to environmental problems as well as for technology transfer and public education, and that, as such, the agency needs to reshape its R&D program to support a wide range of activities that reach individuals, communities, industry, and state government programs. Among these activities must be pollution prevention strategies that will

- * educate individuals about actions they can take in their daily lives to reduce pollution,

- * aid communities and community groups in promoting pollution prevention and in providing the facilities and technologies for such pollution prevention activities as recycling,

- * aid industry in pollution prevention through research and technology transfer,

- * promote the practice of pollution prevention at the federal and state levels by banning the use of certain materials and supporting the use of recycled products.

The report lists 10 recommendations which, it says, if implemented would facilitate the strong environmental research program needed to reduce future risk. Following are the committee's recommendations:

- * EPA should shift the focus of its environmental protection strategy from end-of-pipe controls to preventing the generation of pollution. EPA should use a hierarchy of policy tools that support national efforts to (1) minimize the amount of wastes generated; (2) recycle or reuse the wastes that are generated; (3) control the wastes that cannot be recycled or reused; and (4) minimize human and environmental exposures to any remaining wastes.

- * To support this new strategy, EPA should plan, implement, and sustain a long-term research program.

* EPA needs to establish better mechanisms to ensure that a coherent, balanced R&D strategy is planned and implemented.

*EPA must improve its capability to anticipate environmental problems.

* EPA should provide Federal leadership for a national program of ecological research by establishing and funding an Environmental Research Institute.

* EPA should expand its efforts to understand how and to what extent humans are exposed to pollutants in the real world.

* EPA should initiate a strong program of epidemiological research.

* EPA should expand its efforts to assist all those parts of society that must act to prevent/reduce environmental risk.

* EPA needs to increase the numbers and sharpen the skills of the scientists and engineers who conduct environmental research.

* EPA's R&D budget should be doubled over the next five years.

Recently, EPA has begun to incorporate pollution prevention approaches into its programs. In 1987, a waste-minimization staff was established in the Office of Solid Waste (OSW), and OSW has released policy statements outlining strategies for hazardous waste reduction in industry and for reduction of household and other nonhazardous solid wastes. In addition, the agency has created by directive an Office of Pollution Prevention within the Office of the Assistant Administrator for Policy Planning and Evaluation to promote multimedia waste reduction by industry and to coordinate source reduction efforts in all of its regulatory units.

USGS BOOKLET ADDRESSES RURAL WATER PROBLEMS

With a little knowledge rural homeowners can avoid some

pitfalls that often go with wells and septic tanks, according to a booklet available from the U.S. Geological Survey.

Titled "Ground Water and the Rural Homeowner," the 37-page booklet describes and illustrates the fundamentals of groundwater occurrence, the common types of household wells and methods of preventing or solving common well-water and septic-system problems.

According to Assistant Secretary of the Interior James W. Ziglar, the increasing number of American who buy rural homes away from municipal water supplies are not always aware of the problems of water quantity and quality they may encounter. The booklet is designed to prepare current and potential rural homeowners to anticipate such problems and deal with them.

The booklet deals not only with familiar problems of shallow wells going dry and contamination from septic systems but also with concerns such as wells near former chemical dump sites and wells on property that has been subjected to prolonged use of agricultural chemicals.

Also discussed in the booklet are problems associated with a falling or rising water table and possible solutions to such problems, potential problems near oil and gas fields, and problems related to land subsidence and sinkholes.

Tables at the end of the booklet list the common problems with rural domestic water supplies, along with their probable causes and remedies, and sources of further information on the subject.

Single copies of the booklet are available free of charge by writing the U.S. Geological Survey, Books and Open-File Reports Section, Box 25425, Denver, CO 80225

CHESAPEAKE BAY NONPOINT SOURCE DOCUMENT IS PUBLISHED

A report titled "Chesapeake Bay Nonpoint Source Programs" was

prepared as a cooperative effort by EPA's Region III Chesapeake Bay Liaison Office in Annapolis, MD, with assistance from EPA's Nonpoint Sources Branch. The report provides a comprehensive review of state and federal activities to curb pollution from nonpoint sources in the Chesapeake Bay drainage basin by describing the current programs to ameliorate nonpoint sources of pollution to the Bay; the achievements in terms of pollutant removal; and recommendations for future directions of the nonpoint source programs over the next several years. It is hoped that this report will be useful to other states as they develop and refine their state NPS Management Programs. Copies of the report may be obtained free from the: Chesapeake Bay Program, 410 Severn Ave., Annapolis, MD 21408 (301) 266-6873. A review copy is available at the UNC Water Resources Research Institute, 219 Oberlin Road, NCSU Campus, Raleigh, NC.

NORTH CAROLINA UNIVERSITIES OFFER VARIETY OF WATER-RELATED COURSES FOR THE SPRING

Individuals interested in educational opportunities related to water resources

management will find a variety of courses available this spring at North Carolina universities. Following is a list of courses which focus specifically on water sciences, water systems engineering, and water resources planning and management.

These universities also offer a number of other courses, such as political and life sciences courses, which are related in some way to water resources. University catalogues provide a complete listing of courses and should be requested by those interested in other aspects of water resources.

UNC- Chapel Hill

Department of City and Regional Planning (PLAN)

PLAN 233 - Natural Resources Law & Policy

Department of Environmental Sciences
and Engineering (ENVR)

ENVR 132 - Limnology and Water Pollution

ENVR 222 - Special Topics in Water Chemistry II
 ENVR 174 - Water and Wastes Treatment Processes
 ENVR 272 - Design of Water Systems
 ENVR 275 - Advanced Water and Wastes Treatment Processes II
 ENVR 281 - Modeling Groundwater Systems
 ENVR 370 - Investigations in Water Resources Engineering

Those wishing to take courses at UNC-Chapel Hill should request admission information from the Evening College, which also serves those who want to enroll in regular courses as part-time students. The Evening college is headquartered in Abernethy Hall on the Chapel Hill campus (919/962-1134/1135)

N.C. State University

Department of Marine, Earth, and Atmospheric Sciences (MEAS)

MEA 565 - Hydrogeology
 MEA 569 - Physical Dynamics of Estuaries

Civil Engineering (CE)

CE 382 - Hydraulics
 CE 383 - Hydrology & Urban Water Systems
 CE 480 - Water Resources Engineering Project
 CE 484 - Water Supply and Waste Water system
 CE 644 - Groundwater Engineering
 CE 674 - Stream Sanitation
 CE 671 - Advanced Water Management Systems

Department of Biological and Agricultural Engineering (BAE)

BAE 674 - Theory of Drainage - Unsaturated Flow

Department of Forestry (FOR)

FOR 472 - Renewable Resource Policy and Management

Adults who wish to take regular courses at North Carolina State University should make application through the Division of Lifelong Education headquartered in the Jane S. McKimmon Center on Western Boulevard in Raleigh (919/737-2261 for noncredit courses; 919/737-2265 for credit courses)

UNC-Charlotte

Department of Civil Engineering (graduate courses)

CEGR 5090 - Environmental Chemodynamics
 CEGR 5090 - Industrial Wastes

At UNC-Charlotte, adults holding bachelor's degrees and satisfying prerequisites may take graduate level courses as post baccalaureate students. For further admission information contact the Office of Admissions, UNC-Charlotte, UNCC Station, Charlotte, NC 28223, (704/597-2211)

Duke University

Department of Civil and Environmental Engineering

CE 123 - Water Resources Engineering
 CE 227 - Groundwater Hydrology
 CE 243 - Water Treatment
 CE 246 - Water Supply Engineering Design

School of Forestry and Environmental Studies (FES)

FES 312 - Wetlands Ecology
 FES 333 - Hydrology of Groundwater
 FES 398 - Seminar in Water & Air Resource Prog.
 FES 237 - Watershed and Water Quality Modeling

Adults over the age of 25 who wish to take regular semester courses as nondegree students at Duke should apply through Duke's Office of Continuing Education.

WORKSHOP SLATED FOR REVIEW OF NEW EROSION CONTROL DESIGN MANUAL

Engineers,
architects,
surveyors, and
other pro-

fessionals who develop erosion and sediment control plans will have the opportunity to become familiar with a new North Carolina Erosion and Sediment Control Planning and Design Manual at a workshop December 5.

The North Carolina Erosion and Sediment Control Planning and Design Manual represents a major revision of the state's 1976 erosion control guide.

"It is designed to put the best technical information available into the hands of professionals," said Bob Jessup, one of the principal authors of the manual. The manual emphasizes planning considerations and provides design specifications for a large number of practices so that those who use the manual will be able to match practices to site conditions more closely than in the past. Sample design problems included in the manual will help users cut delays in getting plans approved by providing more clear-cut guidance on how to prepare and submit plans, according to Jessup.

The first half of the workshop will include a general review of the manual. The second half will feature concurrent sessions on vegetative stabilization, channel and basin design and construction, and plan preparation.

The 572-page manual was developed by the North Carolina State University Water Quality Group, a cooperative program of the Department of Biological and Agricultural Engineering and the North Carolina Agricultural Extension Service. The project was funded by the North Carolina Sedimentation Control Commission, which oversees the state's erosion control law. The workshop is sponsored by the North Carolina Sedimentation Control Commission, the North Carolina Department of Natural Resources and Community Development, Division of Land Resources, Land Quality Section, and The University of North Carolina Water Resources Research Institute. Cosponsors include several technical and professional associations. The workshop will be held at the McKimmon Center on the North Carolina State University Campus in Raleigh.

As of November 9, more than 400 people had registered for this workshop. No additional registrations can be accepted. Another workshop is anticipated. See the next NEWS for details.

WATER RESOURCES CONDITIONS FOR OCTOBER

Streamflow de-
clined in October
throughout the
northern Blue

Ridge, northern Piedmont, and central and southern Coastal Plain and rose significantly only in the southern Blue Ridge

and the southern Piedmont. An area of normal flow conditions that covered most of the Blue Ridge during September contracted during October leaving most of the Blue Ridge in the below-normal range of flow. Several streams in the province have been in the below-normal range for nine consecutive months. Mean flows were also below normal in most of the Piedmont, except in the extreme northeastern and southeastern sections. The area of below-normal flows also extends into the central and northeastern Coastal Plain. October was the fourth consecutive month of below-normal mean flows in the northern section of that province.

On October 28, index reservoirs in the Piedmont had a combined volume of 76 percent of capacity as compared to the

long-term September average of 76 percent. By comparison, this volume is two percent of capacity less than during the 1986 drought.

Groundwater levels in unconfined (water-table) aquifers at month's end (as determined at three index wells) continued to decline in the Blue Ridge but rose in the Piedmont and Coastal Plain. Water levels were below average for the month in the Blue Ridge and Coastal Plain but were above average in the Piedmont.

---U.S. Geological Survey

NEW PUBLICATIONS RECEIVED BY THE INSTITUTE

(Residents of North Carolina may borrow these from the Institute for a two-week period. Where individual copies are desired, readers are encouraged to request copies from the organization issuing the publication. The addresses are provided by the NEWS for this purpose.)

Water Quality Management

"Groundwater Quality--State Activities to Guard Against Contaminants (Report to the Chairman, Subcommittee on Hazardous Wastes and Toxic Substances, Committee on Environment and Public Works, US Senate)," (GAO/PEMD-88-5), 2/88, avail. from GAO, POB 6015, Gaithersburg, MD 20877. (04B)

"Research Program Description--Ground-Water Research," (EPA/600/9-88/005), 1/88, avail. from Office of R&D, Off. of Env. Engr. & Technology Demonstration, USEPA, Washington, DC 20460. (04B)

"Effects of pH on Locomotor Activity and Drift of Stream Insects," (#50), 12/87, by J.F. Haney, et al., avail. from WRRRC, Univ. of NH, Durham, NH 03824. (05C)

"Hydrogeologic Setting, Water Levels, and Quality of Water From Supply Wells at the U.S. Marine Corps Air Station, Cherry Point, North Carolina," (88-4034), 1988, by O.B. Lloyd, Jr., et al. avail. from USGS, Water Resources Div., POB 2857, Raleigh, NC 27602. (USGS)

"Tillage Effects on Runoff Water Quality from Sludge-Amended Soils," (#162), 1988, by S. Mostaghimi, et al., avail. from WRRRC, VPI&SU, 460 N. Main St., Blacksburg, VA 24061. (05B Nonpoint Runoff)

"Waste Minimization Opportunity Assessment Manual," (EPA/625/7-88/003), 7/88, avail. from Hazardous Waste Engr. Research Lab., Office of R&D, USEA, Cincinnati, OH 45268. (05B)

"Technical Assessment of Low-Pressure Pipe Wastewater Injection Systems," (PB88-107222), 9/87, by D.L. Hargett, avail. from USDC, NTIS, Springfield, VA 22161. (05D)

"Water Quality Progress in North Carolina--1986-1987/305B Report," (88-2), 7/88, by and avail. from NCDNRCD, DEM, Water Quality Sec., POB 27687, Raleigh, NC 27611. (05G)

Water Quantity Management

"Eno River Area Capacity Use Investigation--Executive Summary Report, Main Report, and Appendix," 9/87, by NRCD, POB 27687, Raleigh, NC 27611.

Miscellaneous

"Aquatic Plant Control Research Program," (Proceedings, 22nd Annual Meeting, Aquatic Plant Control Research Program), 6/88, by Env. Lab., US Army Engr. Waterways Experiment Station, POB 631, Vicksburg, MS 39180-0631. (02I Aquatic Weeds)

"A Summary of Experiments with a Model of the Eastern Scheldt," 6/88, by J.J. Leendertse, avail. from The RAND Corporation, 1700 Main St., POB 2138, Santa Monica, CA 90406-2138. (02L)

"National Water Summary 1986," (Water-Supply Paper 2325), 1988, by USGS, avail. from Books & Open-File Reports, USGS, Fed. Center, Box 25425, Denver, CO 80225, price - \$36.00 (prepaid). (USGS)

"Northwest Wetlands--What Are They? For Whom? For What?," (Conference Proceedings), 1987, ed. by P. Dyer, avail. from Inst. of Env. Studies, Univ. of Washington, Seattle, WA 98195. (02H-1)

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