

EDITORIAL

## The North Carolina Water Pollution Control Program

The citizens of North Carolina have already invested many millions of dollars in wastewater collection and treatment facilities in communities throughout the state. In the years ahead they will be required to spend many millions of dollars more to meet the needs both of increasing urban populations and increasing requirements for treatment. However, there is strong likelihood that much of this money will be inefficiently used, if not wasted, for three reasons:

1. At present, of every dollar spent for wastewater treatment facilities, 67 cents will be provided by North Carolinians and 33 cents by the U.S. Government. If state funds were available to provide 25 cents of each dollar of construction, then the federal share would increase to 55 cents, leaving only 20 cents to be raised locally. This would represent a saving of 22 cents on every dollar spent by citizens of North Carolina. In order for this to be done, the General Assembly will have to appropriate \$20 million for assistance to municipalities for wastewater treatment plant construction for the biennium as contrasted with only \$4.5 million recommended by the Advisory Budget Commission.

2. When plants are finally built, we have ample evidence that we do not get full value from them because of inadequate operation. We invest less in operation of wastewater treatment facilities per dollar of capital investment than for any other utility. The 1969 General Assembly enacted legislation requiring certification of wastewater treatment plant operators, but funds have not been provided for operator training programs.

3. We can have all of the water pollution control legislation on the books that the Assembly can pass, but it will be virtually meaningless if personnel are not available in the Department of Water and Air Resources to enforce the law. Additional personnel are needed to monitor water quality and to review the operation of treatment facilities. There are many waste treatment plants that have not been visited by regulatory officials for years, and this means that the money invested in these facilities is not bringing a proper return in water quality to the people of North Carolina.

If the water pollution control program, so clearly desired by the people of North Carolina, is to be effective, the tools with which to execute the program must be made available. These tools are represented by increased appropriations for the Department of Water and Air Resources which this General Assembly must be encouraged to provide.

Daniel A. Okun  
Chapel Hill

ADVISORY COMMITTEE MEETING

The Institute Advisory Committee under the chairmanship of Colonel George Pickett, Director of the North Carolina Department of Water and Air Resources, held its annual meeting on March 12 at the downtown Holiday Inn.

Dr. H. Brooks James, Vice President of the University of North Carolina, welcomed the Committee. New members introduced by Board of Directors Chairman, Dr. Ralph E. Fadum, included:

Mr. Irvin Aldridge, Director, N. C. Department of Local Affairs  
Dr. Stephen G. Boyce, Director, Southeastern Forest Experiment Station  
Mr. Harry S. Pedley, Vice-President for Operations and Manager,  
U.S. Plywood Champion Papers, Inc.

After introducing new Associate Institute Director Frederick E. McJunkin, Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill, Dr. Fadum briefly reviewed the five-fold growth of the Institute since its first full year of operation in 1966 and the implications of new federal legislation now before the Congress to increase the annual allotment and authorize new programs for the transfer of research results into practice.

In his preliminary remarks, Colonel Pickett pointed to the cooperative activities now underway between his department and the Institute, together with new arrangements now under consideration.

The morning session was devoted to presentations by University Investigators on various aspects of the program. The value of annual allotment program funding as seed money to encourage the development of new work to be funded by other agencies was very well illustrated by Dr. William M. Crosswhite and Mr. John Macon, Department of Economics, in their discussion of the EPA-WQO demonstration project on water use and waste control in the poultry processing industry. Findings developed under the normative Institute research program of current interest and applicability were presented by four other investigators as follows:

Municipal Sewer Surcharges on Industrial Wastes - Dr. James Seagraves,  
NCSU Department of Economics

Limitations of River Basin Planning in the Piedmont Region of North  
Carolina - Dr. David Moreau, UNC-CH Departments of City and Regional  
Planning and Environmental Sciences and Engineering

Temperature Criteria for North Carolina Estuaries - Dr. B. J. Copeland,  
NCSU Department of Zoology and Pamlico Marine Laboratory

Water Quality Management in the New Hope Reservoir - Dr. Charles M.  
Weiss, UNC-CH Department of Environmental Sciences and Engineering

Dr. Leigh H. Hammond, Deputy Director, State Department of Administration,  
addressed the Committee and assembled faculty at lunch on the subject of the Governor's  
Legislative Program on Environmental Quality.

During the afternoon, Institute Director Howells presented the proposed  
research program for F.Y. 1972 consisting of 20 projects on three campuses. He  
reported that 15 additional projects were approved but could not be supported during  
the coming year because of lack of funds. The tight financial situation was also  
reflected in sharp budget cuts applied to nearly all of the 20 projects scheduled to  
be undertaken.

Howells also discussed a proposed program for the transfer of new research  
results into practice and improved linkage arrangements with state water agencies.  
The former included the minimum level of activity now underway and an expanded program  
in the field of water pollution control for which a demonstration grant proposal has  
been submitted to the Environmental Protection Agency. The Advisory Committee  
unanimously endorsed the proposed new program to encourage the prompt use of new  
research findings and encouraged its implementation.

The meeting adjourned in mid-afternoon, following a brief discussion period.

#### WATER RESOURCE LUNCHEONS

Monthly Water Resource Luncheons are now being regularly scheduled on every  
fourth Thursday at Raleigh and every fourth Friday at Chapel Hill. Both commence  
promptly at twelve noon and conclude at approximately 1:00 p.m. The luncheon at  
Raleigh is held at the NCSU Faculty Club and at the Carolina Inn in Chapel Hill.

The purpose of the luncheons is to provide an opportunity for persons from  
all disciplines--from the public agencies, private industry and the University--to  
meet informally and learn more about each other's work.

Dr. James Gilliam, Department of Soil Science, will discuss his research on  
water contamination from fertilizer nutrients at the Raleigh meeting in March. At  
Chapel Hill, Professor Shirley Weiss and Dr. Ray Burby of the Center for Urban Affairs,  
will review their program dealing with urban development around large reservoirs.

All luncheons are Dutch treat. Reservations must be made a week in advance  
by calling Mrs. McClung at the Institute (Tel. 755-2815).

NEW AWARDS BY OFFICE OF WATER RESOURCES RESEARCH

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The Office of Water Resources Research, U.S. Department of the Interior, has announced the tentative award of \$130,000 in new Fiscal Year 1972 matching grant funds in partial support of five projects. The projects are summarized as follows. They will be reviewed in greater detail in subsequent issues of the News.

- Planning of Regional Water Resource Systems for Urban Needs - Dr. David Moreau, Dept. City and Regional Planning and Env. Sc. and Engr., UNC-CH .....Fed. Grant \$17,738
- Nutrients and Eutrophication in a North Carolina Estuary - Dr. B. J. Copeland, Dept. Zoology and Pamlico Marine Lab, NCSU...Fed. Grant \$36,863
- Contribution of Fertilizers to the Pollution of Waters in North Carolina Coastal Plains - Dr. James Gilliam, Dept. Soil Sciences, NCSU .....Fed. Grant \$14,835
- Effects of Stream Channelization and Drainage on Fish and Wildlife - Dr. F. Eugene Hester, Dept. Zoology, NCSU ..... Fed. Grant \$24,564
- Effects of Authorization for Water Impoundments on Shoreland Transition - Prof. Shirley F. Weiss, Dept. City & Reg. Planning, UNC-CH .....Fed. Grant \$36,000

HYDROLOGIC INFORMATION STORAGE AND RETRIEVAL SYSTEM

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A computerized system for storage, retrieval and routine processing of hydrologic data has been developed by Dr. Edward H. Wiser at N. C. State University with joint support of the Water Resources Research Institute and the N. C. Agricultural Experiment Station. The system is known as HISARS (Hydrologic Information Storage and Retrieval System). Although the system is not yet complete, its modular design permits use in its current form, and a number of useful features are now available. The system is running on the IBM System/360 Model 75 computer at the Triangle Universities Computation Center and can be used at any of the remote terminals scattered around the state.

Data are stored on magnetic disk packs. By making use of an operating system feature known as the indexed sequential access method together with direct access capabilities of the PL/1 language, HISARS can retrieve any one of approximately 350,000 records directly. This makes it possible to determine weather or streamflow characteristics at any location and at any time for which data are available. It is also possible to compare different locations at the same time and to process records through time at a single location.

The following data are now stored by the system:

- 1) STREAMFLOW - Records of daily streamflow have been obtained from the U.S. Geological Survey covering the period from the beginning of record through September 1968. Data are available for all stations in the east coast drainage from the Roanoke

River to the Savannah River, in tributaries of the Tennessee River which drain North Carolina, and in the upper part of the New River. There are 147,000 monthly records in the file.

2) RAINFALL - Records of daily rainfall have been obtained from the National Weather Service for all stations in North Carolina from September 1948 through December 1968. A few longer-term records were also available. As part of the HISARS project, records for about 80 stations have been extended back to the beginning of records. There are 96,000 monthly records in the file.

3) TEMPERATURE - Records of daily maximum and minimum temperatures were also obtained from the National Weather Service for the same stations and period of record given above. A few additional stations in the Coastal Plain have been extended. There are 41,000 monthly records.

4) SNOWFALL - Records of daily snowfall and depth of snow on the ground were also obtained from the National Weather Service as above. There are 18,000 monthly records.

5) EVAPORATION - Records of daily evaporation and wind movement were also obtained from the National Weather Service. Data for only six stations are available. Records for Chapel Hill have been extended back to 1930. There are 1400 monthly records.

6) EVENTS - Some of the observers of the National Weather Service report occurrences of dust, haze, sleet, hail and other miscellaneous phenomena. Such data as were punched by the National Weather Service are included in this file. Although these data are of interest for specific problems, their completeness is very much dependent on the individual observer. There are 14,000 monthly records in which one or more occurrence was reported.

7) HOURLY RAINFALL - Records of hourly rainfall for a number of stations of the Tennessee Valley Authority and the National Weather Service have been punched. There are 28,000 daily records.

8) HYDROGRAPHS - The system makes provision for storing either streamflow or rainfall values at irregular time intervals. This makes it possible to store data for individual storms for detailed processing. The only records now in this file are rainfall records of the Ahoskie Creek project. There are 4000 daily records.

9) PEAK FLOW - It is planned to obtain the flood peak data from the U.S. Geological Survey for the same stations as the streamflow file, since the daily flows are not generally satisfactory for flood frequency analysis.

Separate data files are maintained for each of the elements. In addition, there is an index file associated with each data file. Each record in an index file contains information for each station for which records exist in the associated data



file. This information includes the station name and identification number, the latitude, longitude, elevation, drainage area (streamflow stations only), river basin number, county, geographic location block and period of record. The index file makes it possible when retrieving data from a data file to specify:

- a) The whole state;
- b) An individual station;
- c) All stations in a county;
- d) All stations in a river basin;
- e) All stations in a geographic location block.

Operations in HISARS are divided into three main divisions: Access, Processing, and Management. The Management function exists for the purpose of adding new records and correcting errors in stored records. The Access and Processing functions are described below in more detail.

Under the Access function, the following operations can be carried out:

- 1) LIST INDEX - This lists the index for the element and stations requested.
- 2) LIST MONTHLY - This lists monthly summary information, which is the monthly total for rainfall, streamflow, snowfall and evaporation files and average maximum and minimum for temperature files.

3) LIST DAILY - This lists daily values for the element and stations requested. It is also possible to specify a limited period of record.

4) LIST HOURLY - This lists hourly values from the hourly rainfall file.

5) COPY - Because the data are stored in a form that is not conveniently accessible for languages other than PL/1, the COPY feature may be used to copy specified records into another file for processing by a user-written program.

Under the Processing function, the following programs are now available:

1) DAILY STATISTICS - Standard statistical calculations are made for daily values, separately by month. Results are tabulated.

2) MONTHLY STATISTICS - Standard statistical calculations are made for monthly values, separately by month. Results are tabulated.

3) INTERSTATION CORRELATION - The cross-correlations between daily values for each pair of up to 10 stations are computed, separately by month. A separate table is printed for each month.

4) DAILY FREQUENCY ANALYSIS - In addition to standard statistics, a plot of the cumulative frequency distribution is printed. There is separate output for each month, and also for the entire year.

5) MONTHLY FREQUENCY ANALYSIS - Statistics and a plot of the cumulative frequency distribution are printed for monthly values, separately by month and for the year as a whole.

6) MINIMUM FLOW ANALYSIS - The lowest average discharge is tabulated for each complete climatic year for periods of specified length. Results may be computed as flows or as flows per unit area.

7) MAXIMUM FLOW ANALYSIS - The highest average discharge is tabulated for each complete water year for periods of specified length.

8) MONTHLY MASS FLOW ANALYSIS - There is printed a plot of accumulated flow as a function of time. An option permits plotting of a constant flow rate for storage computations by the Rippl method.

A number of other processing programs will be included in the system. These include flow duration curves, weighted average rainfall, and several watershed models.

Detailed instructions on use of the system are available as User Guides to the Access and Processing Facilities from the Water Resources Research Institute. Comments and suggestions regarding future extension of the system would be appreciated.

Please communicate with Dr. Wiser, Department of Biological and Agricultural Engineering, concerning use of the system. Telephone No: 755-3121.

#### ECONOMIES IN MUNICIPAL WASTE MANAGEMENT

Surcharges based on the amount of pollution discharged by a company will often lead to a reduction in total waste treatment costs, Dr. James A. Seagraves, a North Carolina State University economist, has reported.

In a paper delivered before the Advisory Committee of the Water Resources Research Institute of the University of North Carolina on March 12, Dr. Seagraves said surcharges determined by the potency of individual firm's wastes would give industry incentives to reduce wastes and treat sewage in their plants.

The North Carolina economist found industries can usually reduce much of their own wastes at less cost than can a municipal plant. Professor William Crosswhite, another economist reporting to the same Advisory Committee, gave a dramatic example of in-plant waste reduction achieved in a Durham poultry processing plant.

Professors Seagraves and Crosswhite are conducting studies for the Water Resources Research Institute of the University of North Carolina, the U.S. Department of the Interior and the Environmental Protection Agency.

Professor Seagraves said surcharges on industrial sewage could also:

---Insure that industrial users pay in accordance with the cost of treating any pollutants they discharge into municipal systems or streams.

---Slow down the spiraling costs of municipal sewage treatment costs.

State and local governments' waste treatment costs climbed to \$3 billion last year from \$1.3 billion in 1962.

---Provide more efficient use of the nation's water resources. Dr. Seagraves said that encouraging the most efficient ways of handling wastes will make it easier to achieve proper stream standards.

Professor Seagraves found that surcharges on industrial wastes are being levied by one-fourth of the larger U.S. cities. He expects many more cities to adopt this policy as a result of the Environmental Protection Agency's new policy of denying federal grants to municipalities which do not require industries to pretreat their sewage or pay a fair share of their pollution costs.

Cities located on small streams have had the highest required level of treatment and hence the highest treatment cost. Charlotte and Greensboro were the first cities in North Carolina to adopt surcharges--in 1956 and 1963, respectively. They have had no inclination to discontinue these ordinances. Durham, North Carolina, recently instituted a surcharge for wastes stronger than "normal" sewage which has already resulted in some waste reduction by industries discharging wastes to the municipal sewer system.

Surcharges are expected to drastically reduce the wastes discharged in the food processing industries. According to a preliminary study conducted by Dr. Don Ethridge, a former student of Dr. Seagraves, a surcharge of two cents per pound of B.O.D. (bio-chemical oxygen demand) would bring a 75 percent reduction in water-carried wastes. A similar reduction of 32 percent in the wastes discharged by the typical poultry processing plant was thought to be a conservative estimate.

Professor Seagraves urged municipal leaders not to delay the imposition of surcharges because they cannot find a perfectly equitable formula which is easy to administer. "None exist," he said. Cities moving ahead in this area are finding, however, that reasonably simple surcharges are reducing total waste treatment costs plus bringing greater equity to the financing of such costs.

#### NEW INSTITUTE REPORTS

Report No. 43: The Critical Thermal Maximum of Juvenile Spot  
by David W. Bridges  
Department of Zoology  
North Carolina State University at Raleigh

The use of coastal water as a coolant during the production of electricity poses a potential threat to the biology of coastal waters. The concern here was possible harm to organisms passing through generating plants. This study measured the heat tolerance of Juvenile Spot, an estuarine fish, in terms of the Critical Thermal Maximum (CTM)--the temperature above which all organisms will die. Because this test involves a rapid heating of the fish, it simulates the experience of an organism as it passes through the condenser of a generating plant.



It was found that the acclimation temperature was the most important factor affecting the CTM and that larger fish had a higher CTM than smaller fish.

The results imply that the most critical period for the Juvenile Spot is in the summer and early fall. To prevent mortality in power plants, the maximum temperature encountered should not be above 91°F. By early August the Spot in North Carolina are 2 1/2 inches long, and it may be possible to keep them out of intakes with screening.

Report No. 46: A Computer Based Floristic Analysis of Pamlico River  
Phytoplankton

by Dr. Vincent J. Bellis  
Department of Biology  
East Carolina University  
Greenville, North Carolina

Two computer programs for analyzing distribution patterns among estuarine organisms were developed. Each was tested by application to estuarine phytoplankton data provided by the Pamlico Marine Laboratory. The programs were designed to compare relative abundance of up to 150 different organisms among all combinations of up to 150 different collections. Patterns of distribution, based on indices of similarity were described by clustering technique and the results represented graphically in the form of a dendogram.

The investigator reported that the overall phytoplankton pattern in the Pamlico River appears to be based on a core of perennially dominant species (coccolid cyanophytes and microflagellates) highlighted seasonally by the periodic abundance of sub-dominants. He concluded that cyanophyte dominance in estuaries is unusual; otherwise, the alternation of flagellate peaks in warm months with diatom and dinoflagellate peaks at cooler times represents a pattern typical for Atlantic Coast estuaries.

ENVIRONMENTAL IMPACT STATEMENTS - 102 MONITOR

Section 102(2) (C) of the National Environmental Policy Act (P.L. 91-190) or "NEPA" is intended as an "action forcing provision" to make all federal agencies take full account of the environmental aspects of their major actions. In essence it requires that, prior to recommending or reporting on legislation, or taking other major action significantly affecting the environment, the responsible federal official shall prepare an environmental impact statement (a "Section 102" statement). This statement must detail the environmental impact of the proposed action, any adverse effects that cannot be avoided and the alternatives to the proposed action.

Federal agencies with relevant environmental expertise are to be consulted and the views of state and local agencies authorized to develop and enforce environmental standards are also to be invited. Most significantly, the 102 statements and the comments and views of the federal, state and local agencies are to be made available to the public.

The National Environmental Policy Act is an innovative piece of legislation. Fulfillment of its objective will demand vigilance from all branches of government and particularly from concerned members of the public.

In order to facilitate comment on, and participation in this process, the Council will publish the 102 Monitor monthly. In the 102 Monitor all 102 statements (draft or final) that have been received will be listed with the names and telephone numbers of agency contacts from whom copies of these statements and comments thereon may be obtained.

Beginning with the March issue, CEQ plans to focus on different agencies each month, and describe each agency's procedures for handling its 102 statements.

The 102 Monitor is available on request to the Council with preference given to those representing groups with a continuing interest in the 102 process not restricted to a single project, e.g.--conservation and environment protection groups, Congressional staff, news writers specializing in environment news, law school groups, and state and local government officials. A complete set will be maintained at the Institute for review by interested persons.

The 102 Monitor is published by the Council on Environmental Quality, 722 Jackson Place, N.W., Washington, D. C. 20002.

#### POLLUTERS MUST REPORT OIL SPILLS TO FEDERAL GOVERNMENT

All oil spills in fresh water--regardless of the amount of oil involved--must be reported immediately, Frank R. Blaisdell, Acting Regional Director of the Environmental Protection Agency's Office of Water Quality in Charlottesville, has announced.

The requirements that those who spill oil must report such spills--and take full responsibility for mopping up after a spill--are found in a 1970 federal oil pollution law. The law provides fines of up to \$10,000 and prison sentences of up to one year for anyone spilling oil in water and failing to report the spill immediately. Another fine of up to \$10,000 can be imposed on anyone knowingly discharging oil into water.

Blaisdell said spills occurring in fresh water should be reported to his office in Charlottesville by telephone. The number--to call to report an oil spill--is (703) 296-1290 and will be in operation 24 hours a day.

Similar reports are required to the Coast Guard for oil spills occurring in tidal waters.

"The Office of Water Quality will provide technical assistance in cleaning up oil spills," Blaisdell said, "as well as technical assistance on how to avoid

spills when handling oil. We would rather see the spills prevented and are prepared to inspect oil handling operations and recommend preventive measures that can be taken."

NOTICE OF PUBLIC HEARING - SMITH ISLAND

The application of the Carolina Cape Fear Corporation, High Point, N. C., for an approval of plans for an existing pier in Bald Head Creek at Smith (Bald Head) Island in Brunswick County, N. C., will be considered at a public hearing to be held in the USO Building (Lions Club) at Southport, N. C., at 10:00 a.m., 7 April 1971.

All interested parties are invited to be present or to be represented at the above time and place. They will be given an opportunity to express their views fully and publicly regarding the impact of the structure on the public interest.

Oral statements will be heard, but for the accuracy of the record, all important facts and arguments should be submitted in writing (five copies) as the record of the hearing will be forwarded for consideration by the Department of the Army.

NOTICES OF PUBLIC HEARINGS - FLOOD CONTROL AND NAVIGATION

The Wilmington District, Corps of Engineers, has announced public meetings to consider flood control projects in the Swift Creek and Deep Creek basins in Nash and Edgecombe Counties and navigational improvement of the Little River Inlet as follows:

Swift Creek Basin - 10 a.m., April 20, Community Bldg., Battleboro, N. C.

Deep Creek Basin - 8 p.m., April 19, Ruritan Bldg., Speed, N. C.

Little River Inlet - 7:30 p.m., April 20, Cafetorium, N. Myrtle Beach  
Primary School, N. Myrtle Beach, S.C.

OFFICE OF WATER RESOURCES RESEARCH ISSUES SIXTH ANNUAL REPORT

The 1970 annual report of the Office of Water Resources Research has been transmitted to Congress, Secretary of the Interior Rogers C. B. Morton has announced.

This federal-state program of water research and training is administered at the national level by Interior through the Office of Water Resources Research.

Highlight statements by the state university water research center directors of the 50 states and Puerto Rico constitute an important part of the report. These abbreviated accounts deal, state by state, with major water problems, approaches being taken to solve them, and research plans for the future.

Other parts of the report provide information on research results and their application; manpower, training and public involvements; the Water Resources Scientific

Information center, and other activities of OWRR. Appendices contain fiscal information, lists of research projects and publications, and other data.

Copies of the illustrated 310 page 1970 Annual Report are available from the Office of Water Resources Research, Department of the Interior, Washington, D.C. 20240.

TOLL-FREE WATERWAYS CAUSE "UNECONOMIC DIVERSION OF TRAFFIC TO BARGES," ECONOMIC

ADVISORS TELL PRESIDENT

While D.O.T. and O.M.B. officials were pondering a new waterway tax proposal, it received an endorsement from the prestigious Council of Economic Advisers. In its annual Economic Report to the President last month, the Council stated:

"Even as Government creates new rules and institutions to promote an efficient use of resources, it must constantly examine the utility of its existing institutions. The transportation industry is a case where special care must be taken to assure that Government policies do not promote inefficiency by permitting private costs to diverge unnecessarily from social costs. \*\*\* Inland waterways, for example, are developed out of general tax funds. There is no direct charge levied on the barge operators who use them. Many barge rates consequently fall short of the social cost of such traffic and lead to uneconomic diversion of traffic to barges."

--- Newsletter, National Waterways Conference

MEETINGS OF INTEREST

- 20th Southern Water Conference at Chapel Hill on April 1 and 2
- International Symposium on Livestock Wastes at Columbus, Ohio, on April 19-22
- 1971 Conference on Prevention and Control of Oil Spills at Washington, D.C., on June 15-17
- National Ground Water Quality Symposium at Denver, Colorado, on August 25-27
- Symposium on Man-Made Lakes at Knoxville, Tennessee, on May 3-7
- Symposium on Statistical Hydrology at Tucson, Arizona, on August 31-September 2

FEDERAL AID FOR WATER PROJECTS

<u>Agency</u>	<u>Community</u>	<u>Grant</u>	<u>Project</u>
EPA	Asheboro	\$ 375,730	Interceptor sewer and pumping station
EPA	Wilson	\$ 41,070	Interceptor sewer
EPA	Fayetteville	\$1,295,210	Interceptor sewer and tertiary treatment
EPA	Greensboro	\$ 330,000	Modifications to treatment plant

STATUS OF WATER RESOURCES IN NORTH CAROLINA

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During the month of February the flow of streams throughout the state increased substantially over the flows in January. Flows were above normal at all reporting stations.

Ground-water levels rose in all regions. They remain below average in the eastern Piedmont, but above average in the Mountains and Coastal Plain.

--- U.S. Geological Survey

AVAILABILITY OF PROCEEDINGS OF SOUTHERN WATER RESOURCES AND POLLUTION CONTROL

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CONFERENCES

From its inception in 1952 until 1965 this Conference was called the Southern Industrial and Municipal Waste Conference. Starting with the 14th Conference its name was changed to the Southern Water Resources and Pollution Control Conference. Proceedings from prior Conferences in this series are still available as noted below. Since the Conference locale and responsibility for publication rotates among the sponsoring institutions, orders for specific Proceedings should be addressed to the institution at which each was held.

Department of Civil Engineering, (Order from Industrial Extension Service, P. O. Box 5506), North Carolina State University at Raleigh, Raleigh, N. C. 27607:

1st (1952) Out of Print	12th (1963) \$3.00
3rd (1954) \$1.50	15th (1966) \$4.00
6th (1957) \$2.00	18th (1969) \$4.00
9th (1960) \$2.50	

Department of Environmental Sciences and Engineering, The University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27514:

2nd (1953) \$1.00	14th (1965) \$3.50
5th (1956) Out of Print	17th (1968) \$6.50
8th (1959) \$2.50	20th (1971) Price will be announced when published.
11th (1962) \$3.00	

Department of Civil Engineering, Duke University, Durham, N. C. 27706:

4th (1955) \$2.00	13th (1964) \$5.00
7th (1958) \$2.00	16th (1967) \$5.00
10th (1961) \$2.50	19th (1970) \$5.00

WATER RESOURCES LEGISLATION IN THE NORTH CAROLINA LEGISLATURE

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Bills Introduced

- S 167      Regional water revolving funds  
H 273      "To appropriate funds to the Regional Water Supply Planning Revolving Fund." Appropriates from General Fund to Regional Water Supply Planning Revolving Fund in Department of Administration (proposed to be created by S 169 and H 274), to aid local governments in financing comprehensive planning and engineering for regional water systems.
- S 168      Regional water supply planning  
H 272      "To encourage and promote regional water supply systems, and to define the functions of the State Board of Health, the State Department of Water and Air Resources, and the State Department of Administration in relation to planning of regional water supply systems."
- S 169      State staff approp.-reg'l water  
H 274      "To appropriate funds to the State Board of Health and the Department of Water and Air Resources to implement the Regional Water Supply Planning Act of 1971."
- S 187      Limited water diversions  
H 330      "To permit limited diversions of water for public water supply purposes with the approval of the State Board of Water and Air Resources."
- H 275      Tax classification-water companies  
"To classify and designate the real and personal property of certain non-profit water and non-profit sewer corporations as a special class of property under Article V of the North Carolina Constitution and to exclude said property from the property tax base for ad valorem purposes."
- H 276      Tax exemption-water companies  
"To classify and designate the real and personal property of certain non-profit water and non-profit sewer corporations as a special class of property under Article V of the North Carolina Constitution and to exclude said property from the property tax base for ad valorem tax purposes under proposed ad valorem act."
- H 409      Local waste discharge reports  
"To provide for the monitoring of the discharge of industrial and other wastes."

WATER RESOURCES LEGISLATION IN THE CONGRESS

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Bills Introduced

- S. 75      To amend the Federal Water Pollution Control Act, to establish standards and  
H.R. 674      programs to abate and control water pollution by synthetic detergents.



- S. 121 To amend the Water Resources Research Act of 1964 to increase the authori-  
S. 219 zation for water resources research and institutes, and for other purposes.  
H.R. 1400  
H.R. 3835  
H.R. 5413
- S. 498 To authorize the Secretary of Interior to engage in a feasibility study  
of a water resource development.
- S. 523 H.R. 963 To amend the Federal Water Pollution Control Act,  
H.R. 858 H.R. 964 as amended and for other purposes.  
H.R. 859 H.R. 1087  
H.R. 907 H.R. 1426  
H.R. 908 H.R. 1427  
H.R. 934 H.R. 3588  
H.R. 935 H.R. 3591
- S. 573 To amend the Clean Air Act and the Federal Water Pollution Control Act  
S. 927 to provide for standards for the manufacture of certain products to  
H.R. 4378 protect the quality of the Nation's air and navigable waters.
- S. 582 To establish a national policy and develop a national program for the  
management, beneficial use, protection, and development of the land and  
water resources of the Nation's coastal and estuarine zones.
- S. 601 To amend the Federal Water Pollution Control Act, as amended, to provide  
financial assistance for river basin programs.
- S. 745 To protect the public health and welfare and the environment through  
H.R. 4152 improved regulation of pesticides, and for other purposes.
- S. 807 To encourage and promote the establishment and development of National  
Environmental Study Areas.
- S. 991 To authorize the Secretary of the Interior to continue a program of  
H.R. 5334 research, development, and demonstration of processes for the conversion  
of saline and other chemically contaminated water for beneficial use and  
for the treatment of saline and other chemically contaminated waste  
water to maintain or improve the quality of natural waters, and for  
other purposes.
- S. 632 To establish a national land use policy; to authorize the Secretary of  
S. 992 Interior to make grants to encourage and assist the states to prepare  
H.R. 2173 and implement land use programs for the protection of areas of critical  
H.R. 4569 environmental concern and the control and direction of growth and develop-  
H.R. 4332 ment of more than local significance, and for other purposes.  
H.R. 4337  
H.R. 5504
- S. 993 To provide for the cooperation between the Federal Government and the  
states with respect to environmental regulations for mining operations,  
and for other purposes.
- S. 1015 To establish an Environmental Financing Authority to assist in the  
H.R. 338 financing of waste treatment facilities, and for other purposes.  
H.R. 861  
H.R. 932  
H.R. 966

- S. 1025 To establish a Department of Natural Resources and Environment.
- S. 1082 To regulate the discharge of wastes in territorial and international waters until 5 years after the date of enactment of this Act, to prohibit such discharge thereafter, and to authorize research and demonstration projects to determine means of using and disposing of such waste.
- S. 1113  
H.R. 5498 To establish a structure that will provide integrated knowledge and understanding of the ecological, social, and technological problems associated with air pollution, water pollution, solid waste disposal, general pollution, and degradation of the environment, and other related problems.
- H.R. 286 To provide for advance notice to the U.S. Fish and Wildlife Service and certain state agencies before the beginning of any federal program involving the use of pesticides or other chemicals designed for mass biological controls, and for other purposes.
- H.R. 336  
H.R. 548 To require the Council on Environmental Quality to make a full and complete investigation and study of national policy with respect to the discharging of material into the oceans.
- H.R. 337  
H.R. 549 To prohibit the discharge into any of the navigable waters of the U.S. or its international waters of any military material without a certification by the Council on Environmental Quality approving such discharge.
- H.R. 598 To amend the Federal Water Pollution Control Act relating to area acid and other mine water pollution control demonstrations.
- H.R. 654 To consolidate water quality management and pollution control authorities and functions in the Environmental Protection Agency.
- H.R. 659 To provide for compilation by the Secretary of Interior of a national water inventory, and for other purposes.
- H.R. 675 To establish a clean water trust fund, in which federal water use fees shall be deposited and from which shall be expended all amounts for federal water pollution control programs.
- H.R. 676 To amend the Federal Water Pollution Control Act to require persons operating sewage treatment works to be licensed.
- H.R. 677 To amend section 8 (c) of the Federal Water Pollution Control Act, to provide a new formula for allocation of construction grant funds for the fiscal years beginning on or after July 1, 1971.
- H.R. 678 To amend section 8 (c) of the Federal Water Pollution Control Act, relating to reapportionment of unobligated funds.
- H.R. 679 To amend section 138 of title 23 of the U.S. Code, to require certification relating to air and water pollution.
- H.R. 680 To amend section 12 of the Federal Water Pollution Control Act, relating to control of hazardous polluting substances.

- H.R. 681 To amend the Federal Water Pollution Control Act, to authorize certain grants for assisting in improved operation of waste treatment plants.
- H.R. 692 To amend the Fish and Wildlife Act of 1956, in order to prevent or minimize injury to fish and wildlife from the use of insecticides, herbicides, fungicides, and pesticides, and for other purposes.  
H.R. 696  
H.R. 4518  
H.R. 4827
- H.R. 693 To amend the Fish and Wildlife Coordination Act, to require certain permits for exploring or mining oil and gas underlying the navigable waters of the U.S.
- H.R. 805 H.R. 1329 To amend the Fish and Wildlife Coordination Act, to provide  
H.R. 807 H.R. 1383 additional protection to marine and wildlife ecology by  
H.R. 808 H.R. 2581 providing for the orderly regulation of dumping in the  
H.R. 983 H.R. 3662 ocean, coastal, and other waters of the U.S.  
H.R. 1095
- H.R. 806 To provide financial assistance for a water pollution abatement program  
H.R. 809 for industrial wastes.  
H.R. 1330
- H.R. 838 To provide a program of pollution control in selected river basins and waterways of the U.S. through comprehensive planning and financial assistance to municipalities and regional management associations for the construction of waste treatment facilities.
- H.R. 933 To amend the Federal Water Pollution Control Act, as amended, to provide  
H.R. 1428 financial assistance for construction of waste treatment facilities, and for other purposes.
- H.R. 898 To authorize the Council on Environmental Quality to conduct studies and make recommendations respecting the reclamation and recycling of material from solid wastes, to extend the provisions of the Solid Waste Disposal Act, and for other purposes.
- H.R. 1083 To amend the Solid Waste Disposal Act in order to establish economic incentives for the return, reuse, and recycling of packaging, to reduce the public costs of packaging and other solid waste disposal, to require national standards for controlling the amount and environmental quality of packaging, and for other purposes.
- H.R. 1088 To amend the Federal Water Pollution Control Act to protect the navigable  
H.R. 2169 waters of the U.S. from further pollution by requiring that synthetic  
H.R. 4465 petroleum-based detergents manufactured in the U.S. or imported into the U.S. be free of phosphorus.
- H.R. 1180 To amend and supplement the federal reclamation laws relating to the  
H.R. 2311 furnishing of water service to excess lands.
- H.R. 1214 To establish the Environmental Protection Act of 1971.
- H.R. 1563 To amend the Act of Aug. 1, 1958, to authorize restrictions and prohibitions on the use of insecticides, herbicides, fungicides, and pesticides which pollute the navigable waters of the U.S.

- H.R. 1609 To provide for regular determinations of the extent of air and water pollution throughout the U.S.
- H.R. 2154 To amend the Federal Water Pollution Control Act, in order to authorize the Secretary of Interior to incur obligations for construction grants under section 8 of such Act, and for other purposes.
- H.R. 2211 To amend the Act of March 3, 1905, relating to the dumping of certain materials into the navigable waters of the U.S.
- H.R. 2522 To amend the Federal Water Pollution Control Act to increase the penalty for pollution of the water by oil.
- H.R. 2563 To authorize the study of certain rivers and river segments for addition to the national wild and scenic rivers system.
- H.R. 3299 To authorize the Secretary of Interior to designate within the Department of the Interior an officer to establish, coordinate and administer programs authorized by this Act, for the reclamation, acquisition, and conservation of lands and water adversely affected by subsurface, strip or surface coal mining operations, and for other purposes.
- H.R. 3312 To authorize the Secretary of Agriculture and the Secretary of Interior to cooperate with states, local agencies, and individuals in the planning and carrying out of practices for water yield improvement, and for other purposes.
- H.R. 3615 To amend the Act of Aug. 3, 1968, relating to the protection and restoration of estuarine areas, to provide for the establishment of a national policy and comprehensive national program for the conservation, management, beneficial use, protection, and development of the land and water resources of the nation's estuarine and coastal zone.
- H.R. 1059 To amend the Federal Water Pollution Control Act to establish health and  
H.R. 1385 welfare standards which must be met by all synthetic detergents and to  
H.R. 3139 ban from detergents all phosphates and those synthetics which fail to  
H.R. 3630 meet the standards by June 30, 1973.  
H.R. 5223  
H.R. 5224
- H.R. 4010 To amend section 8 of the Federal Water Pollution Control Act to increase the federal share for construction grants in certain cases.
- H.R. 4087 To require the Council on Environmental Quality to hold public hearings in which all points of view can be expressed prior to any final action or recommendation by such Council to the President.
- H.R. 4128 To provide for more efficient operation and maintenance of federally supported waste treatment facilities.
- H.R. 4233 To require the establishment of marine sanctuaries and to prohibit the depositing of any harmful materials therein.
- H.R. 4247 To regulate the dumping of material in the oceans, coastal, and other  
H.R. 4359 waters and for other purposes.  
H.R. 4723  
H.R. 5239  
H.R. 5268  
H.R. 5477

- H.R. 4517 To amend the National Environmental Policy Act of 1969 to provide for class actions in the U.S. district courts against persons responsible for creating certain environmental hazards.
- H.R. 4584 To prohibit the discharge into any of the navigable waters of the U.S.  
H.R. 4719 or into international waters of any military or waste material without a certification by EPA and NOAA approving such discharge.
- H.R. 4611 To amend the IRC of 1954 to authorize an incentive tax credit allowable with respect to facilities to control water and air pollution, to encourage the construction of such facilities, and to permit the amortization of the cost of constructing such facilities within a period of from 1 to 5 years.
- H.R. 4631 To amend the Federal Water Pollution Control Act to establish standards and programs to abate and control water pollution by synthetic detergents.
- H.R. 4705 To amend the Land and Water Conservation Fund Act of 1965, as amended.  
H.R. 5599
- H.R. 4911 To provide that state laws or regulations with respect to certain environmental matters shall not be preempted or nullified by federal law until such time as regulations in lieu of such state laws or regulations are put into effect by or pursuant to federal law.
- H.R. 4985 To reduce pollution which is caused by litter composed of soft drink and beer containers, and to eliminate the threat to the nation's health, safety, and welfare which is caused by such litter by banning such containers when they are sold in interstate commerce on a no-deposit, no-return basis.
- H.R. 5049 To regulate the discharges of wastes in territorial and international waters.
- H.R. 5277 To assure protection of environmental values while facilitating construction of needed electric power supply facilities, and for other purposes.
- H. Con. Res. 146 Expressing the sense of the Congress with respect to the pollution  
" " " 147 of waters all over the world and the necessity for coordinated  
" " " 148 international action to prevent such pollution.  
" " " 176

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Water Resources Planning

"Computer Simulation of Water Resource Systems at Utah State University," by J. P. Riley, Utah Water Res. Lab., College of Eng., Utah State Univ., Logan 84321, Aug. 1970.

- "Downtown: An Economic Environmental Simulation Game," by W. H. Long, Inst. for Res. on Land and Water Res., Penn State Univ., Univ. Park, Pa., 16802, 1970.
- "A Sample Design for Investigating the Effects of Stream Pollution on Water Based Recreation Expenditures," by W. H. Long, Inst. for Res. on Land and Water Res. Penn State Univ., Univ. Park, Pa., 16802, 1969.
- "Projected Irrigation Water Requirements for Northeast North Carolina Above Cape Look-out for the Year 2020," by R. E. Sneed, Dept. of Bio. & Ag. Engr., NCSU, Raleigh, N. C. 27602, 1971.
- "Legal Aspects of Water Storage for Flow Augmentation," by V.P.I., USGPO, Wash., D. C. 20402, Price: \$1.75, Aug. 1970.
- "The National Water Commission," Interim Report No. 2, by Commissioners, Supt. of Doc., USGPO, Wash., D. C. 20402 - Price \$.30.
- "North Carolina Water Plan Progress Report, Chap. I, Water Policy and Law," (Draft) by N. C. State Bd. of WAR, P. O. Box 27048, Raleigh, N. C. 27611, Feb. 1971.
- "Papers Presented at N. C. Nuclear Environmental Workshop," Pinehurst, N. C., October 16-17, 1970, by Dept. of Nuclear Engr., Div. of Cont. Ed., NCSU, Raleigh, N. C. 27607.
- "An Assessment of Optimization Techniques as Applied to Water Resource Systems," by J. A. Dracup, et al, Nat. Tech. Inf. Service (NTIS), U.S. Doc., Springfield, Va. 22151, Price \$3, Aug. 1970.
- "Recreational Impact of Reclamation Reservoirs," by J. G. Milliken, et al, (Ind. Economics Div., Univ. of Denver), USGPO, Wash., D. C. 20240, March 1969.
- "Estimating Recreation Use at Visitor Information Centers," by H. K. Cordell, et al, SEFES, Asheville, N. C., USDA - Forest Service 28801
- "Selective Withdrawal From a Stratified Reservoir," by J. Imberger, et al, USGPO, Wash., D. C. 20402 - Price: \$1, Dec. 1970
- "Socio-Economic Study of Multiple-Use Water Supply Reservoirs," by Ralph Stone & Co., Inc., OWRR, USDI, Wash., D. C. 20240.
- "Systems Analysis for Urban Water Management," by Urban Water Res. Res. Program, Amer. Soc. of C. Eng. - Water Res. Eng., Inc., Walnut Creek, Cal., Sept. 1970.
- "Water and Related Land Resources Management, The Challenge Ahead," Feb. 2-4, 1971, Sheraton Gibson Hotel, Cinn., Ohio - Seminar Summary, U.S. WRC, Suite 900, 1025 Vt. Ave., N.W., Wash., D. C. 20005.
- "Water Resources Planning Conference," November 4-5, 1969, by The New England Council of Water Center Directors and the New England River Basins Commission, 55 Court St., Boston, Mass. 02108.
- "Water Res. Problems in Pennsylvania," by S. M. Leadley, et al, Inst. for Res. on Land and Water Res., Penn State Univ., Univ. Park, Pa. 16802.

#### Water Quality Management

- "Treatment of Acid Mine Drainage," by Horizons, Inc., for FWQA, USGPO, Wash., D. C. 20402 - Price: \$1, Dec. 1970.
- "Determination of the Feasibility of Removal of Algal Nutrients in Lake Water by Ion Exchange," by O. T. Zajicek, Univ. of Mass., Amherst, Mass. 01002.



- "Disposal of Brines Produced in Renovation of Municipal Wastewater," by Burns & Roe, Inc. (Oradel, N. J.), USGPO, Wash., D. C. 20402 - Price: \$1.25, May 1970.
- "Cannery Waste Treatment Kehr Activated Sludge," by Env. Eng. Dept. of FMC Corp., (Santa Clara, Cal.), USGPO, Wash., D. C. 20402, Price: \$.70, Sept. 1970.
- "Carbonate Bonding of Coal Refuse," by Black, Sivalls, & Bryson, Inc., USGPO, Wash., D. C. 20402, Price: \$.60, Feb. 1971.
- "Combined Sewer Temporary Underwater Storage Facility," by Melpar, for FWQA, USGPO, Wash., D. C. 20402, Price: \$1.75, Oct. 1970.
- "Preliminary Report Effect of Cooling Tower Effluents on Atmospheric Conditions in Northeastern Illinois," by F. A. Huff, et al, Ill. State Water Survey, Urbana, Ill. 61801, 1971.
- "Kinetic Studies of the Oxidative Degradation of Detergent and Related Species in Aqueous Solution," by M. J. Ripin, et al, Univ. of Maryland, College Park, Md., 20740, Sept. 1970.
- "Electroosmotic Pumping for Dewatering Sewage Sludge," by J. Grayson, for FWQA, Supt. of Doc., USGPO, Wash., D. C. 20402, Price: \$.65, July 1970.
- "The Role of Aquatic Vascular Plants in the Eutrophication of Selected Lakes in Western Massachusetts," by R. B. Livingston, et al, Univ. of Mass, Amherst, Mass. 01002.
- "A New Prospect: Preventing Eutrophication of our Lakes and Streams," by L. T. Kardos, Inst. for Res. on Land & Water Res., Penn State Univ., Univ. Park, Pa. 16802, March 1970.
- "TVA Activities Related to Study and Control of Eutrophication in the Tenn. Valley," by G. E. Smith, National Fertilizer Develop. Center, Muscle Shoals, Ala. 35660 April 29-30, 1970.
- "Report of Investigation of Fish Kills, Hyde County, N. C.," Aug. 2 - Sept. 2, 1970, by N. C. Bd. of WAR, WQD, Dept. of WAR, Raleigh, N. C. (Prepared by J. S. Melvin).
- "First National Symposium on Food Processing Wastes Proceedings," by Pacific Northwest Water Lab., April 6-8, 1970, at Portland, Ore., USGPO, Wash., D. C. 20402, Price: \$3 (Cont'd by USA Western Reg. Res. Lab, Nat'l Cannery Assoc., Northwest Food Processors Assoc.).
- "Control of Spillage of Hazardous Polluting Substances," by G. W. Dawson, et al, USGPO, Wash., D. C. 20402, Price: \$3, Nov. 1970.
- "Application of Hyperfiltration to Treatment of Municipal Sewage Effluents," by K. A. Kraus, USGPO, Wash., D. C. 20402, Price \$.70, Jan. 1970.
- "A Study of Nitrification and Denitrification," by B. J. Mechals, et al, USGPO, Wash., D. C. 20402, Price: \$1, July 1970.
- "Biological Fixation and Transformation of Nitrogen in Small Impoundments," by D. W. Toetz, The Oklahoma WRI, Okla. State Univ., Stillwater, Okla. 74074.
- "Santa Barbara Oil Pollution 1969," by The Univ. of Cal.-Santa Barbara, USGPO, Wash., D. C. 20402, Price: \$.55.
- "Effects of Oil Pollution on Waterfowl--A Study of Salvage Methods," by L. A. Griner USGPO, Wash., D. C. 20402, Price: \$.50, Dec. 1970.
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- "Reverse Osmosis Renovation of Municipal Wastewater," by Env. Systems Div., Aerojet-General Corp., USGPO, Wash., D. C. 20402, Price: \$1.50.

- "Sediment Problems in Urban Areas," by H. P. Guy, USGS, Wash., D. C. 20242, 1970.
- "Disposal of Wastes from Swine Feeding Floors to Minimize Stream Pollution," by W. F. Schwiesow, et al, Univ. of Maryland, Agr. Exp. Sta., College Park, Md. 20740, Jan. 1970.
- "Treatment of Sole Leather Vegetable Tannery Wastes," by D. Eye, USGPO, Wash., D. C. 20402, Price: \$1.25, Sept. 1970.
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- "Phenolic Waste Reuse by Diatomite Filtration," by Johns-Manville Products Corp., USGPO, Wash., D. C. 20402, Price: \$1.25, Sept. 1970.
- "The Case for Better Waste Treatment," by J. M. Rademacher, et al, U.S. Env. Prot. Agency, 911 Walnut St., Room 702, Kansas City, Mo. 64106, Jan. 1971.
- "Water Quality Criteria for Selected Recreational Uses," by D. W. Bishop, et al, U.S. Doc., Springfield, Va. 22151, Sept. 1970.
- "Complex Systems Analysis of Water Quality Dynamics: The Feedback Systems Structure," by J. E. Knight, et al, WRC, Inst. of Tech., Atlanta, Ga. 30304, Sept. 1970.

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- "Effects of Simulated Cloud Seeding on Streamflow of Selected Watersheds in Pennsylvania," by W. E. Sopper, Inst. for Res. on Land & Water Res., Penn State Univ., Univ. Park, Pa. 16802, 1970.
- "Theoretical Probability Distributions for Flood Peaks," by E. Zelenhasic, Hydrology Papers, Colorado State Univ., Ft. Collins, Colo. 80521, Nov. 1970.
- "Flood Routing Through Storm Drains," (Parts I - IV as follows) by V Yevjevich, et al, Hydrology Papers, Colo. State Univ., Ft. Collins, Colo. 80521, Nov. 1970:
- Part I - "Solution or Problems of Unsteady Free Surface Flow in Storm Drains"
  - Part II - "Physical Facilities and Experiments"
  - Part III - "Evaluation of Geometric and Hydraulic Parameters"
  - Part IV - "Numerical Computer Methods of Solution"
- "Hydraulic Geometry of 12 Selected Stream Systems of the United States," by J. B. Stall, et al, Univ. of Ill., WRC, 2535 Hydrosystems Lab., Urbana, Ill. 61801, July 1970.
- "Hydrology of Limestone Terranes," by J. L. Sonderegger, et al, Parts B and C, Geol. Survey of Ala., Div. of Water Res., Univ. of Ala., Auburn 36830.
- "Instrumentation Development of Techniques to Measure & Evaluate Meteorological Problems Important to Hydrology," by D. G. Chadwick, Utah Water Res. Lab., Coll. of Engr., Utah State Univ., Logan, Utah 84321, Nov. 1970.
- "Electrical Effects and the Movement of Water in Soils," by D. Swartzendruber, et al, Dept. of Ag., Purdue Univ., Lafayette, Ind. 47907, July 1970.
- "Evaporation Losses in Sprinkler Irrigation," by J. M. Myers, et al, Fla. WRRC, 220 Env. Eng. Bldg., Univ. of Fla., Gainesville, Fla. 32601, Dec. 31, 1970.
- "Open Channel Expansion," by L. H. Austin, et al, Utah Water Res. Lab., College of Eng., Utah State Univ., Logan, Utah 84321, Aug. 1970.
- "Design Procedures for Rainfall-Duration-Frequency in Pennsylvania," by B. M. Reich, et al, Inst. for Res. on Land & Water Res., Pa. State Univ., Univ. Park, Pa. 16802, Aug. 1970.

- "Joint Probabilities in The Rainfall-Runoff Relation," by A. V. Hiemstra, Inst. for Res. on Land & Water Res., Penn State Univ., Univ. Park, Pa. 16802, 1969.
- "Subcritical Flow at Open Channel Structures, Bridge Constrictions," by G. V. Skogerboe, et al, Utah Water Res. Lab., Coll. of Eng., Utah State Univ., Logan, Utah 84321, Sept. 1970.
- "Lithologic Controls on the Development of Solution Porosity in Carbonate Aquifers," by H. W. Rauch, et al, Inst. for Res. on Land & Water Res., Penn State Univ., Univ. Park, Pa. 16802, 1970.
- "Finite Element Solution of Steady State Potential Flow Problems," by U.S. Army Eng. Dist., Sacramento, 609 Second Street, Davis, Cal. 95616, Nov. 1970.
- "Selected Urban Storm Water Runoff Abstracts," by Sci. Inf. Ser. Dept., The Franklin Inst. Res. Lab., USGPO, Wash., D. C. 20402, Price: \$2.75, July 1970.
- "Synthetic Generation of Seasonal Precipitation," by L. A. V. Hiemstra, et al, Inst. for Res. on Land & Water Res., The Penn State Univ., Univ. Park, Pa. 16802, 1970.
- "Mathematical Simulation of Hydrologic Events of Ungaged Watersheds," by L. F. Huggins, et al, Purdue Univ., WRRRC, Lafayette, Ind. 47908, March 1970.
- "A History of the Cooperative Water Yield Procedures Study Project," by A. L. Sharp, et al, SCS (USDA), Bu. of Reclam. (USDI) SWCRD (USDA), Wash., D. C. 20240.

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- "Resources for the Future, Inc.," Annual Report ending Sept. 30, 1970, 1755 Mass. Ave., N.W., Wash., D. C. 20036, Dec. 1970.
- "Publications Listing," Univ. of Wisconsin, Hydraulics and Sanitary Lab., Madison, Wisconsin 53706, Jan. 1971.
- "Publications of the Southeastern Forest Experiment Station--1964-1968," by M. P. McSwain, Forest Ser., USDA, Southeastern Forest Exp. Sta., P. O. Box 2570, Asheville, N. C. 28802.
- "Research Reports supported by Office of Water Resources Research," July - Dec. 1970, USDI, (WRSIC), Wash., D. C. 20240.
- "Water Resources Research Catalog," Vol. 6, Parts 1 and 2, USDI, OWRR, WRSIC, USGPO, Wash., D. C. 20402, Price: \$12.25 (per set of 2 vol.), Dec. 1970.

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