

# WATER RESOURCES RESEARCH INSTITUTE

OF THE UNIVERSITY OF NORTH CAROLINA

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### COASTAL AREA MANAGEMENT ACT

The recent General Assembly of North Carolina enacted a "Coastal Area Management Act." Because of the wide interest in this Act, the NEWS has abstracted portions of the 63-page Act that are directly relevant to North Carolina water resources. The June issue of the NEWS will abstract the "Land Policy Act."

### Cooperative State Local Program

Local government shall have the initiative for planning. State government shall establish "areas of environmental concern," set standards, review capacity, and act when local governments do not elect to exercise their initiative. Enforcement is to be a concurrent state-local responsibility.

## Goals

Among the goals are (1) to provide a management system capable of "preserving and managing the natural ecological conditions of the estuarine system, the barrier dune system, and the beaches, so as to safeguard and perpetuate their natural productivity and their biological, economic, and esthetic values," (2) to insure that development proceeds consistent with land and water "capability ... based on ecological considerations," (3) to insure orderly and balanced use and preservation of coastal resources, and (4) to establish policies, guidelines, and standards for economic development, for recreation and tourism, for transportation and navigation, for preservation of historic, cultural, and scientific aspects of the coastal area, for protection of legal rights, and any other purposes deemed necessary or appropriate to effectuate state policies.

## Coastal Area

Counties designated by the Governor in accordance with criteria in the act, are basically those adjoining the Atlantic Ocean; Albemarle, Bogue, Core, Croatan, Currituck, Pamlico, and Roanoke Sounds; and/or tributary rivers within the limits of normal seawater encroachment.

## Development

Development is defined as it relates to structures, excavation, dredging, clearing, or alteration of dunes, shores, banks, or bottoms of surface waters in designated areas of environmental concern. Exempted, under certain conditions are highways, railroads, pipelines, utilities, power lines, agriculture, and forestry. A "grandfather clause" covers pre-existing building and zoning permits.

## Coastal Resources Commission

Within the State Department of Natural and Economic Resources a 15-member commission, appointed by the Governor to staggered 4-year terms, and representative of commercial fishing, wildlife or sportsfishing, marine ecology, agriculture, forestry, land development, marine-related business (other than fishing or wildlife), engineering, a state or national conservation organization, financing, local government, (two members), and three at large members. The Governor has sole discretion in the appointment of three members, the others must come from a list of nominees presented by governing bodies of counties and municipalities from the coastal area. The chairman is appointed by the Governor.

## Coastal Resources Advisory Council

The Advisory Council advises "on matters which may be submitted to it" by the Secretary of Natural and Economic Resources, the Secretary of Administration, or the Commission.

The council consists of not more than 47 members appointed by the Secretaries (3 appts. each) of the State Departments of Natural and Economic Resources, Administration, Transportation and Highway Safety, Human Resources, and the Commissioner of Agriculture; the four COG planning districts in the coastal area (1 appt. each); county boards of commissioners (1 appt. each); 11 members appointed by the Commission, 8 representative of cities; and 3 representatives of marine science or technology; and one local health director appointed by the Commission on recommendation of the State Health Director. The Chairman is elected by the Council.

## Planning Processes

The Commission will propose state guidelines for the coastal area. Staff assistance will be provided by the Secretaries of Natural and Economic Resources and of Administration. Proposed guidelines must be published within 90 days of the effective date of the Act (July 1, 1974). Other agencies and individuals will have the following

60 days to submit written recommendations and suggestions. Within 210 days after July 1, 1974, the Commission must adopt guidelines for the coastal area. Guidelines may be amended by the Commission and a five-year review is compulsory.

Local land use plans within the coastal area "shall be consistent with the State guidelines. No permit shall be issued ... inconsistent with the state guidelines." Acquisition, use, and disposition of land by State agencies must also be consistent with the guidelines.

Within 120 days after July 1, each coastal area county must submit a written statement of its intent to develop or not develop a land use plan. If a county fails to act, the Commission is to prepare and enact a land use plan for the county. Counties shall prepare and adopt a land use plan within 300 days of commission adoption of the guidelines.

County land use plans shall include statements of objectives, policies, and standards, supplemented by maps, and "shall give special attention to the protection and appropriate development of areas of environmental concern."

The county (or the Commission where counties fail to act) may delegate land use planning responsibilities to "the lead regional organization for the region of which the county is a part. Responsibility may also be delegated to a city within the county for those portions of the land use plan within the city's zoning jurisdiction. Cities may ask the Commission to require the land use planning body to delegate plan-making authority to that city for land within its zoning jurisdiction provided that the Commission finds that the city is currently enforcing its zoning ordinance, its subdivision regulations, and the State Building Code within its jurisdiction.

Public hearings are required prior to adoption or amendment of any land use plan. No land use plan can be effected until approved by the Commission. The Commission must act within 45 days of its receipt of a county land use plan. Copies of the plan must be available for public inspection.

Ordinances and local regulations must be consistent with the local land use plan within areas of environmental concern.

#### Area of Environmental Concern

The Commission shall designate certain geographic areas as "areas of environmental concern including coastal wetlands (G.S. 113-230(a)); estuarine waters (G.S. 113-229(n)(2)); renewable resource areas threatened by uncontrolled or incompatible development including public water supply aquifers or watersheds (G.S. 143-214.1); capacity use areas where a generalized condition of water depletion or water or air pollution exists (G.S. 143-215); prime forestry land (sites capable of producing 85 cubic feet of marketable timber per acre-year); fragile or historic areas and other areas containing environmental or natural resources of more than local significance where improper development may result in major damage to important historic, cultural, scientific or scenic values or natural systems, including parks, scenic rivers, streams classified for scientific or research use, wildlife refuges, virgin forests or bogs, rare and endangered species, unique geological areas, historic places, public waterways, dunes, beaches, flood plains, erosion or earthquake prone areas, et al.

The Commission may designate interim areas of environmental concern. Between July 16 and September 13, the Commission must hold public hearings on interim areas in Elizabeth City, Jacksonville, Manteo, Morehead City, Washington, and Wilmington. Any revision of interim areas requires public hearings in the affected county. While interim areas are in effect, developers must give the Commission 60 days notice before initiating construction or other land or water disturbing activity in an interim area.

Public hearings are also required before the Commission can permanently designate areas of environmental concern. Areas must be reviewed at least biennially.

### Permit Letting and Enforcement

The Commission shall adopt and transmit, by August 31, 1975, guidelines and criteria to each coastal area governing body that has filed a letter of intent to act as a permit letting agency. These shall include procedures for local implementation and enforcement, minimum standards, staffing, permit procedures, and priorities.

The governing body of each city and county in the coastal area that files an affirmative letter of intent shall adopt an implementation and enforcement plan by March 1, 1976. These bodies are also required to hold public hearings.

If the Commission determines that local programs are ineffective, it shall recommend corrective action. If the local body fails to act within 90 days, the Commission shall assume enforcement of the program until such time as the local government is willing and able to resume administration and management of the program.

After a date designated by the Secretary of Natural and Economic Resources (but not later than October 1, 1976), every person undertaking development in an area of environmental concern shall obtain a permit (in addition to any other required State or local permit) pursuant to the Act. An expedited procedure is provided for "minor developments." "Major developments" are those requiring permits from the Board of Water and Air Resources, State Board of Health, State Departments of Natural and Economic Resources, Conservation and Development, or Administration, the North Carolina Mining Council, North Carolina Pesticides Board, or the North Carolina Sedimentation Control Board; or which occupies a land or water area exceeding 20 acres; or which contemplates drilling or excavation; or structures with a ground area exceeding 60,000 square feet.

Energy utilities will obtain their permits from the Commission rather than local governments.

The Commission is empowered to grant variances for land uses otherwise prohibited by the Commission.

The procedures for obtaining permits are sufficiently complex that they should be reviewed in their entirety. They may be obtained from the appropriate local land use governing body or the Secretary of Natural and Economic Resources.

### Protection of Landowner's Rights

Nothing in this Article authorizes any governmental agency to adopt a rule or regulation or issue any order that constitutes a taking of property in violation of the Constitution of this State or of the United States.

### NOTICE: WATER RESOURCES RESEARCH GRANTS

Applications from faculty members of the senior colleges and universities in North Carolina for grants under the Institute's Fiscal Year 1975-76 Matching Grants Program will be accepted until August 30, 1974.

The purpose of the Matching Grants Program is to provide long-term research support (two or three years) for projects directed toward the solution of State-Regional water resources problems. Highest priority will be given to proposals which deal with problems of recognized regional as well as State significance. A report on Water Resources Problems and Research Needs of North Carolina (revised 1974) is available from the Institute upon request. The Institute is currently involved in the analysis of

regional problems in cooperation with other Institutes of the South Atlantic-Gulf Region. Investigators are encouraged to discuss their research interests with the Institute Director or Associate Director to assure that proposals reflect this broader regional interest.

Federal funds are requested from the Office of Water Resources Research (OWRR), U. S. Department of the Interior. The Institute will assume responsibility for non-federal matching funds for projects approved by OWRR. Projects not funded under this program will subsequently be considered under the Institute's Annual Allotment Program.

Particular attention is called to those sections of the proposal dealing with objectives, procedures, and literature review. These are inadequately treated in most proposals and the principal cause of disapproval. Research objectives and procedures must be explicit and sufficiently detailed to give a convincing picture of work to be undertaken. Search of the literature and related discussion must be rigorous enough to satisfy reviewers that investigators are familiar with past and current work and have taken this into consideration in the preparation of proposals. A thorough job in the preparation of proposals greatly enhances probability of approval. Proposals must cover all items included in the Instructions to Applicants.

Instructions to Applicants and Financial Forms can be obtained from the Office of the Director, 124 Riddick Building, North Carolina State University, Raleigh, North Carolina 27607, Telephone Code 919, 737-2815.

DATES TO REMEMBER

June 19 - Regional Conference on Public Participation in Water Resource Planning, Royal Villa Inn, Raleigh.

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|------------------|--|
| 9:00-10:00 a.m.  | Identification of Publics in Water Resources Planning, Dr. Gene E. Willeke, Environmental Resources Center, Georgia Institute of Technology  |
| 10:00-11:00 a.m. | Information Response and Interaction - Dialogue Aspects of Public Participation, Dr. Adam Clarke Davis, Sociology and Anthropology, North Carolina State University                                      |
| 11:00-12:00 noon | Accountability of Public Water Resource Agencies: Alternative Institutions for Citizen Action, Dr. Peter M. Ashton, Water Resources Research Center, Virginia Polytechnic Institute and State University |
| 12:00- 1:30 p.m. | LUNCH  |
| 1:30- 2:30 p.m.  | Education of Planners and Managers for Effective Public Participation, Dr. Benjamin C. Dysart, III, Environmental Systems Engineering, Clemson University  |
| 2:30- 3:30 p.m.  | Education of Publics for Participation in Water Resource Policy and Decision Making, Dr. Peggy J. Ross, Social Science Research Center, Mississippi State University                                     |

3:30- 4:15 p.m. Panel Discussion - All Speakers

4:15 p.m. Adjournment

A second day (June 20) will be devoted to working sessions on problems and research need in public participation. If you would like to be a working member on June 20, please indicate this by contacting James M. Stewart at the Institute.

July 21-25 - Institute Short Course on Environmental Assessment and Impact of Water Resource Development, Continuing Education Center, Appalachian State University, Boone. An excellent staff has been assembled, including representatives from the Environmental Protection Agency, the Army Corps of Engineers, the Department of Natural and Economic Resources, and the University of North Carolina at Chapel Hill. Attendance is by preregistration only. Enrollment will be limited but a few openings yet remain. Please contact F. Eugene McJunkin at the Institute.

September 26-27 - National Symposium on the State of America's Drinking Water at the University of North Carolina at Chapel Hill. Contact F. Eugene McJunkin at the Institute or the University of North Carolina at Chapel Hill.

#### NEW INSTITUTE REPORTS

Report No. 90

Capacity of Water-Based Recreation Systems  
Part I: The State of the Art - A Literature Review

by

Gordon A. Hammon, Harold K. Cordell  
Lewis W. Moncrief, M. Roger Warren, Richard A. Crysedale  
Department of Recreation Resources Administration  
School of Forest Resources

and

John Graham  
Department of Statistics and Biomathematics  
School of Physical and Mathematical Sciences  
North Carolina State University

Recreation capacity is a popular concept, but there is no established rationale or methodology for understanding, measuring, and applying it. This report recognizes the complex and dynamic nature of capacity by reviewing separately the literature which bears on each of five categories of factors which influence capacity: (1) administrative, (2) biological, (3) physical, (4) social, and (5) temporal. The literature is dominated by published reports dealing primarily with the physical factors and secondarily with the social factors. Administrative, biological, and temporal factors have received minor attention in the literature.

The applicability of Leibig's law of the minimum (the occurrence and functioning of an organism is limited by that essential environmental factor, or combination of factors, which is present to the least favorable extent) to the concept of capacity is discussed in some depth. The final section of this report reviews the empirical research effort which has been applied to capacity conceptualization and measurement. To date, this effort has been meager and fragmented.

Report No. 91

Proceedings - Workshop on Land Disposal of Wastewaters

Edited by

Dr. James M. Stewart

Water Resources Research Institute

Eight papers summarize the state of the art including United States and foreign operating experience, regulatory practices, geographical distribution and location of existing land disposal facilities, irrigation practices, land and soil management practices, interaction with soils, health aspects, aerosols, economics of land disposal of and irrigation with wastewaters, and land disposal treatment systems and criteria for animal, agricultural, and municipal wastes.

Report No. 92

Effects of Salt Marsh Impoundments on Mosquito Populations

by

Dr. Richard N. LaSalle and Dr. Kenneth L. Knight

Department of Entomology

School of Agriculture and Life Sciences

North Carolina State University

Four impoundments constructed in irregularly flooded salt marshes in Carteret and Pamlico Counties, North Carolina were studied to determine their effects on mosquito production. The principal species of mosquitoes present were Aedes taeniorhynchus (Weidemann), A. sollicitans (Walker), Anopheles bradleyi King, An. atropos Dyar and Knab and Culex salinarius Coquillett.

Effects of impoundments on vegetation were also observed. Large patches of Distichlis spicata (L.) and Spartina patens (Aiton) interspersed throughout the unimpounded marsh dominated by Juncus roemerianus Scheele (Black needlerush), were often eliminated after the installation of an impoundment. J. roemerianus was, in most cases, also destroyed after flooding, remaining in the impoundment in large dead stands. A large stand of J. roemerianus did continue to thrive in one impoundment. Ruppia maritima L., or widgeon grass was the dominant plant species in the Pamlico County impoundment. Little Ruppia was found in the Carteret County impoundment.

Both Aedes mosquito species, at times exceedingly abundant in the unimpounded marsh sites, especially in Pamlico County, were absent from the impoundments. Only C. salinarius and An. bradleyi, in comparatively low numbers, were present in the impounded marsh. These species were most often collected from those regions of thickest vegetation, such as the few remaining live patches of D. spicata and S. patens near the perimeter of the impoundment, and in combinations of J. roemerianus and R. maritima situated in regions where the water depth was less than one foot. C. salinarius was also collected from muskrat holes on dikes enclosing some impoundments.

It was found that at water depths greater than one foot, vegetation was submerged and/or dispersed sufficiently to eliminate the conditions conducive to Anopheles and Culex breeding.

Impoundments were effective in reducing mosquitoes, especially Aedes species, provided proper management of impoundments is practiced including maintenance of minimum depths (12 inches or more), control of emergent vegetation, provision of top water minnows, and maintenance of dikes.

Research Specials

Continuing its series of abbreviated summary reports (6 pp. or less) on special research topics, the Institute announces two additional reports issued this month:

Citizen Awareness and Participation in Water Pollution Control Policy and Decision Making, by Dr. Adam Clarke Davis, Department of Sociology and Anthropology, North Carolina State University.

Evaluation of Water Management Techniques on Salt Marsh Mosquito Control and Salt Marsh Ecology, Part I by Kenneth L. Knight and Richard N. LaSalle, Department of Entomology, North Carolina State University, Part II by Edward J. Kuenzler and Howard L. Marshall, Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill.

## NATIONAL WATER COMMISSION REPORT

Beginning with the June 1973 issue, the NEWS has summarized chapter-by-chapter the more important findings and recommendations of the National Water Commission.

### Chapter 10

#### Better Decision Making in Water Management

This chapter explores the decision-making processes involved in water management. The proper role of water resource planning and the contributions and limitations of public participation are considered. This is followed by the processes used for the evaluation of water resource development proposals. Evaluation is an integral step in the planning process and national economic efficiency has been the traditional basis for justification. Today, there is growing recognition of a need to include other standards of value in deciding what is a good public water resource investment. The use and effects of the discount rate as a policy tool and the procedures through which plans for development are implemented are examined.

Water resource planning by federal agencies evolved as a resource development activity, such as navigation, hydroelectric power, irrigation, drainage, flood protection, reclamation, and similar types of improvements. Planning was designed largely to make the Nation's water resources either more productive, or less destructive. While the need for some additional planning of this kind remains, most economic projects have already been built. The future calls for planning for such purposes as the coordinated management of existing multipurpose water facilities by federal, state, and local governments; for improved water quality; and for better local and non-federal use of water and related land resources.

The most frequently voiced criticisms are that: (1) water planning is not adequately integrated with planning for related land uses; (2) too little effort has been made to relate planning to metropolitan area needs; (3) plans have taken too little account of the environmental consequences and water quality planning has been conducted apart from water planning in general; (4) the interests of the general public are inadequately represented; (5) planning - especially that required of the states - is expensive and time consuming out of proportion to need and benefits; (6) plans tend to

avoid setting of priorities and proceed with early action proposals; (7) in the absence of national priorities, planning leads to development conflicts between regions; (8) planning is too rigid in its adherence to long-range forecasts in a world of rapid social, economic, and technological change; and (9) planning tends to bury in the arithmetic of benefit-cost analysis important issues that must be decided on a non-quantitative and judgmental basis. Among the Commission's recommendations concerning these changes are the following:

1. If Congress enacts legislation to establish a program of federal grants to states for improving state land use planning, it should make adequate provision in that legislation for the coordination of water and land use planning at the state, federal, and local levels, and should encourage the use of coordinating institutions, such as river basin commissions.
2. The Water Resources Planning Act of 1965 should be amended to open the present program of water resources planning grants to local, intrastate planning entities and to provide for the establishment of federal-state-local planning organizations for areas where there is a distinct federal interest and where such organizations may be needed to provide more intensive and continuing attention to the water management needs of smaller basins or metropolitan planning areas.
3. In appropriating funds for future water resources and water quality planning, Congress should provide for coordination with the plans and programs of the established federal-state river basin commissions and the Water Resources Council. Congress should appropriate larger amounts under the Water Resources Planning Act for support of state water planning. Note: Rather than implement the latter recommendation, the Administration appears to be phasing out appropriations to state agencies.
4. The Water Resources Council should:
  - (a) Direct federal water resources planning agencies to adopt procedures and issue appropriate directives and guidelines to provide opportunities for broad public participation in water planning activities from the inception of the planning process.
  - (b) Monitor public participation in interagency planning by reviewing the adequacy of provisions for public participation.
5. As a prerequisite to project authorization, Congress should require federal water resource agencies to report to it on public participation with respect to particular projects, showing compliance with agency public participation procedures, describing the questions considered and the viewpoints expressed, and providing supporting information for the decisions reached on controverted points.
6. Water resources planning agencies should structure their planning procedures so as to proceed promptly to resolution of issues and to conclusions, even though consensus is impossible, by scheduling the timing of public participation and defining the issues to be addressed. Agencies should not place excessive or sole reliance on formal proceedings, but should supplement the formal proceedings both before and after recommendations are made with informal meetings with interests affected by the proposal.
7. Water resources planning agencies should help compensate for the lack of resources of some participating publics by: providing timely, well

publicized information; scheduling at least one public hearing in the area of the proposed project; and making basic data, reports and other background information readily available to public.

8. Federal and state governments should require advance public disclosure as soon as feasible in the prelicense planning of major non-federal projects expected to have an impact on water resources.

9. Where conditions indicate, licensing agencies should seek to develop the interests of all those publics who are affected by agencies' decisions. Where it is determined that some publics are not adequately represented in licensing proceedings, licensing agencies should use independent public advocates to represent such interests, including environmental and consumer groups.

10. The President should approve the substance of the principles and standards of multiple objective planning, as proposed by the Water Resources Council, with certain exceptions. Note: The President has approved the WRC Principles and Standards for Planning Water and Related Land Resources which became effective October 25, 1973.

11. The discount rate for evaluation of water resources projects should be based on the average yield rates of outstanding long-term Treasury obligations. The discount rate should remain constant for a period of five years and then be recomputed.

12. Comprehensive river basin and regional development plans should be used as the basis for authorization and appropriations.

13. Water resource programs and projects which have been authorized for a period of ten years or longer and on which construction starts have not been made, should be deauthorized by Congress. No funds should be appropriated to start any project or program authorized for more than five years until it has been reevaluated and found feasible under principles and standards in force at the time of the proposed appropriation.

#### PUBLIC HEARING ON WASTEWATER PLANNING AREA IN WESTERN NORTH CAROLINA

Section 208 of the Federal Water Pollution Control Act Amendments of 1972 is designed to encourage a long-range comprehensive areawide waste treatment management plan for those areas which the Governor has identified as having substantial water quality control problems. Generally, the plan is to include the identification of the treatment works and collection systems necessary to meet the expected municipal and industrial waste treatment needs over a twenty-year period and the identification and means of control of both point and non-point sources of water pollution within the area designated.

The designated planning agency must within three years from date of designation submit the plan to the Governor for certification and then to the Administrator, Environmental Protection Agency. At that time, the Governor will designate the management agency or agencies responsible for implementing the plan.

At 7:00 p.m., on June 12, 1974, in the Humanities Lecture Hall, University of North Carolina at Asheville, a public hearing will be held to gather public advice on the matter of whether the Governor should designate a planning area and agency to be responsible for preparing an areawide waste treatment management plan for Marshall Township and Mars Hill Township in Madison County, all of Buncombe County that lies within the French Broad River Basin, all of Henderson County that lies within the French Broad River Basin excepting that portion lying within the Pisgah Wildlife Management Area, and those portions of Brevard and Boyd Townships in Transylvania County which lie outside the Pisgah Wildlife Management Area. The agency proposed as the agency responsible for planning within the area is the Region B Commission.

Further Information concerning this hearing may be obtained by writing or calling:

Mr. A. F. McRorie, Assistant Chief  
Water Quality Division  
Office of Water and Air Resources, NCDNER  
P. O. Box 27687  
Raleigh, North Carolina 27611 (phone: 919: 829-4740)

#### UNIVERSITY POSITIONS IN WATER RESOURCES

##### Positions Available in Groundwater & Hydrology and Fluid Mechanics & Hydrology

Two postdoctoral positions are available at Michigan State University for the 1974-75 academic year, jointly sponsored by the Department of Civil and Sanitary Engineering, and the Institute of Water Research. The research will be concerned with groundwater flow and surface hydrology in relation to wastewater recharge. Additional research opportunities exist in areas of watershed analysis and management.

The Department of Civil and Sanitary Engineering at Michigan State University is seeking a person to teach and conduct research in fluid mechanics and hydrology for the 1974-75 academic year. Teaching duties will include undergraduate hydraulics and hydrology, and selected courses on the graduate level. The research assignment will be a project involving the hydrological aspects of waste water recharge, supported by the Institute of Water Research located on the campus. Projects already underway include prediction of groundwater movement and contamination, and surface hydrology. Additional research opportunities exist in areas of watershed management. Qualified persons are encouraged to phone or write to: Dr. William C. Taylor, Chairman, Dept. of Civil & Sanitary Engineering, Michigan St. University, East Lansing, Michigan 48824, Phone: 517- 355-5107.

##### Faculty Position (II) Available in Parametric and General Hydrology

The Department of Hydrology and Water Resources, University of Arizona, solicits applications for a faculty position, rank and salary depending on qualifications. The position requires teaching and research, including undergraduate and graduate level courses in parametric and general hydrology, supervision of graduate student research, and hydrologic research, in particular, field-oriented research and analysis.

Applications should be made to:

University of Arizona  
College of Earth Sciences  
Department of Hydrology & Water Resources  
Tucson, Arizona 85721  
Telephone (602) 884-1855

Faculty Position in Operations Research and Hydrology

The Department of Hydrology and Water Resources, University of Arizona, solicits applications for a faculty position, rank and salary depending on qualifications. The position requires teaching and research including applications of operations research techniques to water resources problems and the practice of water resources administration in U.S. agencies, participation in educational group tutorials with multidisciplinary faculty teams and interdisciplinary graduate student teams, and development of proposals for educational and research funding and execution of research projects.

Applications should be made to:

University of Arizona  
College of Earth Sciences  
Department of Hydrology & Water Resources  
Tucson, Arizona 85721  
Telephone: (602) 884-1855

Overseas Research Post and Educational Opportunity in Hydrology/Water Resources

The Hydrological Research Unit at the University of the Witwatersrand, Johannesburg, South Africa invites applications for the post of Junior Research Officer. The Unit concentrates on the solution of practical local problems in the fields of engineering hydrology and water resources. The work of the Director and the reports of the Unit have been well received, nationally and internationally. Copies of research reports and publications will gladly be forwarded to any prospective applicants, on request.

The Unit maintains a catalogue of proposed research projects, and priorities. They cover a wide range in the fields of deterministic and stochastic hydrology, water resources and the application of mathematical models to hydrological and water resources systems. The successful applicant will be expected to select one of the high-priority projects as his personal research topic. He will be expected to register for a higher degree and submit a dissertation based on this research work.

Applicants should hold a B.Sc. or M.Sc. degree with a large component of subjects relevant to hydrological research (e.g. civil engineering, agriculture, forestry, geology, mathematical modeling, water quality, statistics and/or stochastic processes). In addition, competence in the use of computers (especially the IBM 360 and 370 systems) will be a recommendation. A capacity for independent thought and work is essential.

For further information write to: The Director  
Hydrological Research Unit  
University of the Witwatersrand  
Jan Smuts Avenue  
Johannesburg, South Africa  
2001.

GROWTH CONTROL ORDINANCE HELD ILLEGAL

A California city's attempt to limit its growth to 500 housing units per year is an unconstitutional violation of the right to travel, the U. S. District Court for the Northern District of California ruled April 26 (Construction Industry Association v. City of Petaluma, No. C-73 663 LHB).

Judge Lloyd H. Burke's written findings of fact and conclusions of law expanded his oral decision that was handed down in January.

Burke characterized the growth limitation ordinance enacted by Petaluma, California, as an "effort to avoid the problems that accompany contemporary trends in population growth." Such a growth limitation, Burke said, may be upheld only if it furthers a compelling state interest.

Burke ruled that the ordinance was not supported by the city's contention that its sewage treatment plant capacity is inadequate to serve an uncontrolled population. Burke found Petaluma's treatment facilities fully capable of meeting the demands of a growing population. Even if the treatment facilities become inadequate, Burke said, a more reasonable alternative would be to increase the capacity of existing plants, not limit population growth.

Burke also rejected the city's contention that it has an inherent right to control its own rate of growth in order to preserve a "small town character." A municipality capable of supporting a natural population expansion, Burke said, may not limit growth "simply because it does not prefer to grow at the rate which would be dictated by prevailing market demand."

.... Environmental Reporter

NOAA PUBLISHES RULES SETTING FORTH AVAILABILITY OF ENVIRONMENTAL DATA

Environmental data and information that may be obtained from the National Oceanic and Atmospheric Administration were set forth in regulations (15 CFR 950) published by the Agency on April 16 (39 FR 13626).

Through the Environmental Data Service, NOAA collects, stores, and distributes information and data on the oceans, the atmosphere, the earth, the sun, and the weather. The Data Service operates the National Climatic Center; the National Oceanographic Data

Center; the National Geophysical and Solar-Terrestrial Data Center; the Center for Experiment, Design, and Data Analysis; and the Environmental Science Information Center.

National Climatic Center

The Climatic Center makes available meteorological information collected from ocean and land stations, radar observations, and satellite operations. The center provides maps and charts, computer tabulations, and basic research data. Queries for such materials should be made to the center, NOAA, Asheville, N.C. 28801; telephone (704) 254-0765.

National Oceanographic Data Center

The Oceanographic Center collects and distributes information about the oceans, including data on temperature, salinity, oxygen, and other chemical constituents of the seas recorded at various depths, surface currents, and biological analyses. Questions should be addressed to the center, NOAA, Washington, D. C. 20235; telephone (202) 343-8921.

National Geophysical Center

Solid earth, marine geophysical, ionospheric, solar, and other space environment data may be obtained from the National Geophysical and Solar-Terrestrial Data Center. Inquiries should be sent to Marine Geology and Geophysics Group, NOAA, Washington, D. C. 20235; telephone (202) 343-7368.

Center for Experiment

The Center for Experiment, Design, and Data Analysis currently is involved in the Barbados Oceanographic and Meteorological Experiment, the International Field Year for the Great Lakes, and the Global Atmospheric Research Project Atlantic Tropical Experiment. Information may be obtained from the center, NOAA, Washington, D. C. 20235; telephone (202) 343-6281.

Science Information Center

The Environmental Science Information Center provides editorial and publishing services to NOAA, develops automated information systems, and operates NOAA libraries. Requests for information should be sent to the center, NOAA, Washington, D. C. 20235; telephone (202) 343-6454.

EPA FEEDLOT PERMITS

The Environmental Protection Agency should define specifically those feedlot operations required to apply for National Pollutant Discharge Elimination System (NPDES) permits, according to a report approved by the House Government Operations Committee April 23. (House Rpt. 93-1012)

Prepared by the Government Operations Conservation Subcommittee, the report recommended that EPA survey the feedlot industry and define in terms of the number of animals handled in those operations that constitute "concentrated animal feeding operations." Section 502 (14) of the Federal Water Pollution Control Act stipulated that such operations be subject to the NPDES permit program.

EPA's regulations on the permit program and effluent limitations guidelines initially required the smallest feedlots to control discharges, but finally exempted

all but the largest operations from the standards, Subcommittee Chairman Henry S. Reuss (D-Wis) said, "EPA's vacillation between these extremes has largely disregarded both the statutory requirements and the pollution potential of many feedlots," he added.

The report further recommended that the Agriculture Department allocate \$8 million for the development of feedlot waste control practices. The report suggested that the Department participate in a cost-sharing program for the development of methods for producing fertilizer from animal wastes. The report also recommended that the Interior Department should support research and pilot plant development to convert animal wastes to oil and other fuels.

#### RESEARCH TRIANGLE AREA PILOTS NEW U.S. GRANT PROGRAM

The first of a new series of Federal planning grants to help metropolitan areas solve complex water pollution problems has been awarded to the Raleigh-Durham-Chapel Hill area. The new program is designed to encourage metropolitan areas to develop regional systems to control water pollution, rather than on a city-by-city basis. (Section 208 of the Federal Water Pollution Control Act of 1972).

Russell E. Train, administrator of the Environmental Protection Agency, made the announcement in Raleigh on April 11. The grant will be \$947,500. Train said the Triangle area was chosen as the pilot area for the program because of its potential pollution problems and the apparent willingness of local officials to work at solving them.

Governor James E. Holshouser, Jr. joined Train for the announcement. The grant emphasizes that North Carolina is in the forefront in solving pollution problems, the Governor said. Holshouser said the funds will go to coordinating sewer systems in Wake, Durham, Orange, and parts of Johnston and Chatham Counties.

#### SMOKING AND ENERGY

According to a recent campus memorandum on energy conservation by North Carolina State University Chancellor John T. Caldwell, "when occupants of a room are smoking, the requirement for air circulation to remove odors and polluted air is eight times greater than when occupants don't smoke. This means removal of excessive amounts of warm air in the winter and excessive amounts of cool air in the summer. It is estimated that energy loss is about 25 per cent on the average. Conclusion: If you must smoke, make every effort to do it outside and save energy."

WATER RESOURCES CONDITIONS IN NORTH CAROLINA FOR APRIL 1974

Heavy rains on April 3-5, with amounts from 2 to 5 inches, caused minor flooding on many streams in the mountains and western Piedmont. Also on the 3rd, tornadoes, which accompanied the rains, caused severe damages in the western counties of Burke, Cherokee, and Graham. Streamflow during the month was above normal in the mountains and western Piedmont and slightly below normal in the remaining eastern part of the State. Flows at the U.S. Geological Survey index gaging stations ranged from 1-3/4 times normal flow at the French Broad River at Asheville to only 3/4 of the normal April flow at Neuse River near Clayton. Flows receded toward the end of the month. On April 30 streamflow in western North Carolina was only about 3/4 normal and near 1/4 normal in the Coastal Plain.

Ground-water levels rose slightly in the mountains and Piedmont during the month. In the Coastal Plain, water levels in the shallow water-table wells declined but most levels in the deeper artesian wells either remained steady or rose slightly. Except for several heavily pumped areas in the Coastal Plain, ground-water levels generally remained above the long-term averages for the month.

———— U. S. Geological Survey

EPA SEWAGE TREATMENT PLANT AND SEWER CONSTRUCTION COST INDEX (1957-1959=100)

FOR MARCH 1974

<u>Location</u>	<u>Plant</u>			<u>Sewer Cost Index</u>		
	<u>Values</u> <u>Mar.1974</u>	<u>% Change</u> <u>Mar.1973</u>	<u>% Change</u> <u>Dec.1973</u>	<u>Values</u> <u>Mar.1974</u>	<u>% Change</u> <u>Mar.1973</u>	<u>% Change</u> <u>Dec.1973</u>
Atlanta	173.81	3.7	2.6	190.00	6.8	4.6
National	190.97	5.9	1.8	210.49	7.5	2.2

ENVIRONMENTAL RECONNAISSANCE INVENTORY OF NORTH CAROLINA

The U. S. Army Corps of Engineers has recently published an Environmental Reconnaissance Inventory of the State of North Carolina. This atlas represents an effort to provide a reference source of environmental information for planners in the U. S. Army Corps of Engineers and should be useful to others involved in any activity affecting land and water resources. This atlas was prepared by the Engineer Agency for Resources Inventories, Office of the Chief of Engineers, with assistance and contributions from many in and out of government. Any future revision or updating of the atlas will be accomplished by the Wilmington District.

The Atlas may be inspected at the Institute Office.

PROCEEDINGS OF GOVERNOR'S CONFERENCE ON SEDIMENTATION

The Institute has a limited supply of Proceedings of the Governor's Conference on Sedimentation held in Raleigh on April 25, 1974. Prepared for the North Carolina Sedimentation Control Commission by the North Carolina Environmental Education Program, single copies are available to North Carolina residents without charge while the supply lasts.

EPA PUBLISHES GUIDELINES TO ASSIST PREPARATION ON SEWER SYSTEM EVALUATION

Guidelines to assist engineers, municipalities, and regulatory control agencies in preparation of sewer system evaluations were published by the Environmental Protection Agency.

The document, dated March 1974, said a logical and systematic evaluation of the sewer was necessary to determine the cost-effectiveness of any rehabilitation program to eliminate infiltration/inflow. The Federal Water Pollution Control Act Amendments of 1972 required that after July 1, 1973, all applicants for treatment works grants must demonstrate that each sewer system discharging into the treatment works was not subject to excessive infiltration/inflow.

The guidelines said the infiltration/inflow analysis should provide information necessary to establish the nonexistence or possible existence of excessive infiltration/inflow in the sewer system and to justify any proposed sewer system evaluation survey.

The document provided an approach to the sewer system evaluation survey which was designed to avoid overstudy of the infiltration/inflow problem. Information and directions were given for the survey's five phases, the physical survey, rainfall simulation, preparatory cleaning, internal inspection, and survey report. It noted instances when the cleaning and internal inspection phases could be eliminated.

Copies of "Sewer System Evaluation" may be obtained from EPA regional offices.

NEW MANUAL AVAILABLE ON START-UP OF MUNICIPAL WASTEWATER TREATMENT FACILITIES

A new Environmental Protection Agency manual, "Start-up of Municipal Wastewater Treatment Facilities," (EPA-430/9-74-008), provides guidance for putting into initial operation a new municipal wastewater treatment plant, a new addition to an existing treatment plant, or a change in the mode of a treatment plant's operation. Proper operation of the treatment plant or process will ensure that the wastewater is treated in compliance with the specific conditions and limitations established for each treatment facility.

Information is provided on preparing for actual treatment plant start-up. Preparation for start-up includes; staffing the plant; developing standard operating procedures; conducting dry- and wet-run testing of equipment; providing on-site operator training; conducting safety training; and establishing procedures when construction is continued during start-up. The manual describes start-up procedures for some of the more common pretreatment and primary treatment units; for the specific secondary treatment processes of activated sludge, trickling filters, stabilization ponds and aerated lagoons; and for sludge handling units and the anaerobic digestion process. The start-up procedures for advanced wastewater treatment units and processes are not within the scope of this manual.

The manual can be purchased from the U.S. Government Printing Office for \$1.40 per copy. Checks may be made payable to the Superintendent of Documents.

NEW MANUAL AVAILABLE ON MAINTENANCE MANAGEMENT SYSTEMS FOR MUNICIPAL  
WASTEWATER FACILITIES

A new Environmental Protection Agency manual, "Maintenance Management Systems for Municipal Wastewater Facilities," (EPA-430/9-74-004), contains recommendations on the basic elements required to develop an effective maintenance management system. The recommendations are not intended as a rigid format, but should be tailored to specific equipment and plant type. Procedures are comprehensive and complete and designed to assist in development of an effective system and implement recommendations for maintenance of specific facilities.

The manual can be purchased from the U.S. Governmental Printing Office for \$1.60 per copy. Checks may be made payable to the Superintendent of Documents.

WATER RESOURCES LEGISLATION IN THE CONGRESS

Bills Introduced

House

H.R. 14393 To amend the National Flood Insurance Act of 1968 to continue the present federally subsidized floor insurance program in any locality where construction of an adequate flood protection system has begun, and to eliminate the compulsory features added to such program by the Flood Disaster Protection Act of 1973.

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 organizations issuing the publication. The addresses are provided by the News for this purpose.)

Abbreviations used throughout as follows:

ASCE	- Amer. Soc. of Civil Engr.	USDA	- U. S. Dept. of Agric.
EPA	- Env. Protection Agency	USDC	- U. S. Dept. of Commerce
NCDNER	- N.C. Dept. Nat'l. & Econ. Res.	USDI	- U. S. Dept. of the Interior
NSF	- Nat'l. Science Foundation	USGPO	- U. S. Gov. Printing Office
NTIS	- Nat'l. Tech. Information Serv.	WPC	- Water Pollution Control
NWC	- Nat'l. Water Commission	WQS	- Water Quality Standards
OWAR	- Off. of Water & Air Resources	WRC	- Water Res. Center
OWP	- Office of Water Programs	WRR	- Water Resources Res. Institute
OWRR	- Office of Water Res. Research	WRSIC	- Water Res. Sci. Infor. Center

Water Resources Planning

- "Guidelines for Evaluating Coastal Wetland Developments," Jan. 1974, Marine Res. Div., SC Wildlife & Marine Res. Dept., Charleston, SC 29412.
- "Application of DDDP in Water Resources Planning," (Res. Rpt. #78), Jan. 1974, by V. T. Chow, et al, U. of IL, WRC, 2535 Hydrosystems Lab., Urbana, IL 61801.
- "Planning a Domestic Groundwater Supply System," (ISWS-73-CIR116), 1973, by J. P. Gibb, Dept. of Reg. and Educ., IL St. Water Survey, Urbana, IL 61801.
- "Effects of Economic Development Upon Water Resources (An Interindustry Approach to Modeling Economic-Environmental Systems)," (Tech. Rpt. #18), Dec. 1972, by J. H. Cumberland, et al, WRRRC, U. of MD, College Park, MD 20742.
- "Economic Evaluation of the Effect of Selected Crop Practices on Nonagricultural Uses of Water," (Res. Rpt. #79), Mar. 1974, by H. Onishi, et al, U. of IL, WRC, 2535 Hydrosystems Laboratory, Urbana, IL 61801.
- "The Delaware Estuary System, Environmental Impacts and Socio-Economic Effects, Environmental Quality and Its Evaluation," Jan. 1974, by W. Whipple, Jr., for NSF RANN Prog., avail. from WRR, Rutgers U., New Brunswick, NJ 08903.
- "Fundamentals of Comprehensive Environmental Planning," Jan. 1974, by D. A. Bella, Repr. from Engineering Issues, ASCE, 345 E. 47th St., NY, NY 10017.
- "Environmental Reconnaissance Inventory of the State of North Carolina," Dec. 1973, by Eng. Agency for Res. Inventories, avail. from Dept. of Army, Wilmington Dist., Corps of Engrs., P. O. Box 1890, Wilmington, NC 28401.
- "Final Environmental Statement, Falls Lake, Neuse River Basin, North Carolina," (Revised), Mar. 1974, Army Eng. Dist., Corps of Eng., Wilmington, NC 28401.
- "Evaluation of New Communities, Selected Preliminary Findings," Proceedings of a Seminar held at the NSF, Wash., DC, Mar. 5, 1974, avail. from New Towns Res. Series, Cntr. for Urban and Reg. Studies, UNC, Evergreen House, Chapel Hill, NC 27514, Price \$3.
- "Some Aspects of International Fishery Law," (UNC-SG-74-01), Mar. 1974, by S. W. Wurfel, UNC Sea Grant Prog., 1235 Burlington Lab., NCSU, Raleigh, NC 27607.

- "The Use of Questionnaires in Collecting Information for Urban Flood Control Planning," (ERC-0274), Feb. 1974, by L. D. James, Env. Res. Cntr., GA Inst. of Tech., Atlanta, GA 30332.
- "Criteria for Identification of Areas of Particular Public Concern," (Second Draft), Apr. 1974, by the Interagency Task Force on Env. and Land Use Planning, NCDNER, P. O. Box 27687, Raleigh, NC 27611.
- "A Selected Annotated Bibliography on Land Resource Inventory and Analysis for Planning," Feb. 1974, by E. B. MacDougall, et al, for Dept. of Env. Res., Commonwealth of PA, avail. from Dept. of Property and Supplies, State Bookstore, 10th and Market Streets, Harrisburg, PA 17125.
- "Potential for Marginal Cost Pricing in Water Resource Management," (Repr. from Water Res. Research, Vol. 9, No. 4), Aug. 1974, by S. H. Hanke, et al, Dept. of Geog. & Env. Eng., Johns Hopkins U., Baltimore, MD 21218.
- "A Completion Report on Techniques for Identifying & Evaluating Market Benefits & Costs of Water Resource Systems," June 1973, TX Water Dev. Bd., P. O. Box 13087, Austin, TX 78711.
- "Economic Optimization and Simulation Techniques for Management of Regional Water Resource Systems," (Rpt. 179), Feb. 1974, TX Water Dev. Bd., P. O. Box 13087, Austin, TX 78711.
- "The Political Economy of Water Resources Development," 1973, by S. H. Hanke, Repr. from Transactions of 38th N. Amer. Wildlife & Nat. Res. Conf., Wildlife Management Inst., Wire Bldg., Wash., DC 20005.
- "Water Quality Strategy Paper, A Statement of Policy for Implementing the Requirements of the 1972 Federal Water Pollution Control Act Amendments and Certain Requirements of the 1972 Marine Protection, Research, and Sanctuaries Act," (Second Edition), Mar. 15, 1974, EPA, Wash., DC 20460.
- "User Charges and Industrial Cost Recovery Denver SMSA," (Cont. #68-01-1864), Jan. 1974, by G. H. Aull, Jr., et al, for EPA, Region VIII, Wilbur Smith and Associates, Denver, CO 80222.
- "Survey of Oregon's Water Laws," (WRRRI-18), Mar. 1974, by C. D. Clark, WRRRI, OR St. U., Corvallis, OR 97331.
- "A Summary of Viewpoints, Water Development and the Environment, Issues of Water Policy in California," (Rpt. #27), Feb. 1974, ed. by R. H. Coppock, WRC, U. of CA, Davis, CA 95616.
- "Water Resources Management for Metropolitan Washington: Analysis of the Joint Interactions of Water and Sewer Service, Public Policy, and Land Development Patterns in an Expanding Metropolitan Area," Dec. 1973, by J. Promise, et al, Metropolitan Washington Council of Governments, 1225 Connecticut Ave., NW, Wash., DC 20036, Price \$3.50.
- "Analytical Techniques for Planning Complex Water Resource Systems," (Rpt. 183), Apr. 1974, by TX Water Dev. Bd., P. O. Box 13087, Austin, TX 78711.
- "Conventional and Unconventional Alternatives for Water Supply Management," Repr. from Water Resources Research, Vol. 9, No. 4), Aug. 1973, by R. K. Davis, et al, Dept. of Geog. & Env. Eng., Johns Hopkins U., Baltimore, MD 21218.

Water Quality Management

- "Activated Sludge Treatment Systems with Oxygen," (EPA-670/2-73-073), Sept. 1973, by J. B. Stamberg, et al, for EPA, avail. from USGPO, Wash., DC 20402, Price 90¢.

- "Hydrogen Peroxide Cures Filamentous Growth in Activated Sludge," (EPA-670/2-73-033), Oct. 1973, by C. A. Cole, et al, for EPA, avail. from USGPO, Wash., DC 20402, Price 65¢.
- "Aerial Spill Prevention Surveillance During Sub-Optimum Weather," (EPA-R2-73-243), Sept. 1973, by R. I. Welch, et al, Earth Satellite Corp. for EPA, avail. from USGPO, Wash., DC 20402, Price \$1.40.
- "Ammonia-Nitrogen Removal by Breakpoint Chlorination," (EPA-670/2-73-058), Sept. 1973, by T. A. Pressley, et al, for EPA, avail. from USGPO, Wash., DC 20402, Price 95¢.
- "Buffer Capacity in Aquatic Ecosystems," (ERC-0474), Mar. 1974, by F. G. Pohland, et al, Env. Res. Cntr., GA Inst. of Tech., Atlanta, GA 30332.
- "Factors Controlling the Dynamics of Non-Ionic Synthetic Organic Chemicals in Aquatic Environments," (Tech. Rpt. #44), Dec. 1973, by J. L. Hamelink, et al, WRRRC, Pardue U., Lafayette, IN 47906.
- "Survival of Intestinal Bacteria in Oligotrophic Waters," (Rpt. #14), July 1973, by D. L. Johnston, et al, WRC, WA St. U., Pullman, WA 99163.
- "Chemical and Physical Character of Surface Waters of North Carolina, 1970-71," (Bul. I, Vol. XIV), 1973, NCDNER, OWAR, Water Quality Div., P. O. Box 27687, Raleigh, NC 27611.
- "Design and Performance of Chlorine Contact Tanks," (ISWS-74-CIR119), 1974, by V. Kothandaraman, et al, Dept. of Reg. and Educ., IL St. Water Survey, Urbana, IL 61801.
- "Regeneration of Chromated Aluminum Deoxidizers," (EPA-660/2-73-023), Dec. 1973, by H. C. Hicks, et al, Boeing Comm. Airplane Co. for EPA, avail. from USGPO, Wash., DC 20402, Price \$1.95.
- "Technical and Economic Evaluations of Cooling Systems Blowdown Control Techniques," (EPA-660/2-73-026), Nov. 1973, by D. B. Boies, et al, Wapora, Inc. for EPA, avail. from USGPO, Wash., DC 20402, Price \$1.20.
- "Denitrification as a Pathway for Nitrate Removal in Aquatic Systems," (Tech. Rpt. #42), Dec. 1973, by D. W. Nelson, et al, WRRRC, Pardue U., West Lafayette, IN 47906.
- "Feasibility Study on Desalting Brackish Water From the Mt. Simon Aquifer in Northeastern Illinois," 1973, IL St. Water Survey, U. of IL, Urbana, IL 61801.
- "An Investigation into the Extent and Cause of Eutrophication in Canyon Ferry Reservoir, Montana," (Rpt. #50), by J. C. Wright, et al, MT U. Joint WRRRC, Bozeman, MT 58715.
- "Determination of the Fate of Polynuclear Aromatic Hydrocarbons in Natural Water Systems," (Res. Rpt. #80), Mar. 1974, by P. R. McGinnes, et al, U. of IL, WRC, 2535 Hydrosystems Laboratory, Urbana, IL 61801.
- "Water Quality and Treatment of Domestic Groundwater Supplies," (ISWS-73-CIR119), 1973, by J. P. Gibb, Dept. of Reg. and Educ., IL St. Water Survey, Urbana, IL 61801.
- "Outline of Groundwater Quality Management and Monitoring Program for North Carolina," Mar. 1974, Groundwater Div., OWAR, NCDNER, Raleigh, NC 27611.
- "Subsurface Heating and Irrigation of Soils: Its Effect on Temperature and Water Content and on Plant Growth," (WRRRI-23), Mar. 1974, by E. W. R. Barlow, et al, WRRRI, OR St. U., Corvallis, OR 97331.
- "Water Transport of Heavy Metals in Solution and by Different Sizes of Particulate Solids," (Res. Rpt. 32), Mar. 1974, by R. M. Perhac, WRRRC, The U. of TN, Knoxville, TN 37916.

- "Sensitivity of Vertebrate Embryos to Heavy Metals as a Criterion of Water Quality Phase I," (Res. Rpt. #71), 1974, by W. J. Birge, et al, WRRRI, U. of KY, Lexington, KY 40506.
- "Irrigation of Citrus with Citrus Processing Waste Water," (Pub. #28), Mar. 1974, by R. C. J. Koo, WRRRC, U. of FL, Gainesville, FL 32601.
- "Capsule Report, First Progress Report: Limestone Wet-Scrubbing Test Results at the EPA Alkali Scrubbing Test Facility," (4), Technology Transfer, EPA, Wash., DC 20460.
- "Analysis of Liquid-Waste Injection Wells in Illinois by Mathematical Models," (Res. Rpt. #77), Jan. 1974, by M. Heidari, et al, U. of IL, WRC, 2535 Hydrosystems Lab., Urbana, IL 61801.
- "Mathematical Model for Barged Ocean Disposal of Wastes," (EPA-660/2-73-029), Dec. 1973, by R. C. Y. Koh, et al, for EPA, avail. from USGPO, Wash., DC 20402, Price \$4.85.
- "Upgrading Meat Packing Facilities to Reduce Pollution," Oct 1973, Technology Transfer, EPA, Wash., DC 20460, publications as follows:
1. "In Process Modifications and Pretreatment," by A. J. Steffen, et al.
  2. "Waste Treatment," by W. James Wells, Jr., et al.
  3. "Choosing the Optimum Financial Strategy," by U. M. Patankar, et al.
- "Modular Wastewater Treatment System Demonstration for the Textile Maintenance Industry," (EPA-660/2-73-037), Jan. 1974, by G. Douglas, Linen Supply Assoc. of Amer. for EPA, avail. from USGPO, Wash., DC 20402, Price \$3.45.
- "Distribution of Autotrophic Nitrifying Bacteria in a Polluted Stream," Feb. 1974, by M. S. Finstein, et al, WRRRI, Rutgers U., New Brunswick, NJ 08903.
- "Nitrogen Removal by Ammonia Stripping," (EPA-670/2-73-040), Sept. 1973, by T. P. O'Farrell, et al, for EPA, avail. from USGPO, Wash., DC 20402, Price 65¢.
- "An Oil Recovery System Utilizing Polyurethane Foam -- A Feasibility Study," (EPA-670/2-73-084), Oct. 1973, by R. A. Cockran, et al, Shell Dev. Co. for EPA, avail. from USGPO, Wash., DC 20402, Price \$2.35.
- "Effects of Crude Oil and Some of Its Components on Young Coho and Sockeye Salmon," (EPA-660/3-73-018), Jan. 1974, by J. E. Morrow, U. of Alaska for EPA, avail. from USGPO, Wash., DC 20402, Price 85¢.
- "Oxidation of Organic Matter in Sediments," (EPA-660/3-73-005), Sept. 1973, by M. M. Pamatmat, et al, U. of Wash. for EPA, avail. from USGPO, Wash., DC 20402, Price \$1.30.
- "Process Control Model for Oxygen Regeneration of Polluted Rivers, Phases IV and V," Jan. 1974, by B. Davidson, WRRRI, Rutgers U., New Brunswick, NJ 08903.
- "Laboratory Ozonation of Municipal Wastewaters," (EPA-670/2-73-075), Sept. 1973, by S. G. Roan, et al, for EPA, avail. from USGPO, Wash., DC 20402, Price 85¢.
- "Ozone in Water and Waste Water Treatment, A Bibliography," (WRSIC 74-204), Apr. 1974, WRSIC, OWRR, USDI, Wash., DC 20240.
- "Physical-Chemical Treatment of Raw Municipal Wastewater," (EPA-670/2-73-070), Sept. 1973, by D. F. Bishop, et al, for EPA, avail. from USGPO, Wash., DC 20402, Price \$1.05.
- "Unrecorded Pollution and Dynamics of Biochemical Oxygen Demand," Mar. 1974, by W. Wipple, Jr., et al, WRRRI, Rutgers U., New Brunswick, NJ 08903.
- "Pretreatment of Pollutants Introduced into Publicly Owned Treatment Works," (Fed. Guidelines), Oct. 1973, U. S. EPA, Off. of Water Prog. Operations, Wash., DC 20460.

- "Evaluation of Methods of Pumping Test Analyses for Application to Hawaiian Aquifers," (Tech. Rpt. #70), July 1973, by J. A. Williams, et al, WRRRC, U. of HI, Honolulu, HI 96825.
- "Baseline Quality Data for Kalihi Stream," (Tech. Rpt. 71), June 1973, by G. K. Matsushita, et al, WRRRC, U. of HI, Honolulu, HI 96825.
- "Management of Saline Water," (Rpt. #29), Mar. 1974, by C. V. Moore, et al, WRC, U. of CA, Davis, CA 95616.
- "Relict Sediment Deposits in a Major Transgressive Coastal System," (UNC-SG-74-04), Jan. 1974, by S. R. Riggs, et al, UNC Sea Grant Prog., 1235 Burlington Labs., NCSU, Raleigh, NC 27607.
- "Infrared Fourier Transform Spectrometry of Gas Chromatography Effluents," (EPA-660/2-73-034), Jan. 1974, by L. V. Azarraga, et al, SE Env. Res. Lab for NERC, EPA, Corvallis, OR, avail. from USGPO, Wash., DC 20402, Price \$1.10.
- "Stormwater Runoff Quality for Urban and Semi-Urban/Rural Watersheds," (Tech. Rpt.#43), Feb. 1974, by F. T. R. McElroy, III, et al, WRRRC, Pardue U., West Lafayette, IN 47906.
- "Quality of Surface Water in Illinois, 1966-1971," (ISWS-73-BUL56), 1973, by R. H. Harmeson, et al, Dept. of Reg. and Educ., IL St. Water Survey, Urbana, IL 61801.
- "Prediction of Dew Point Temperature, Solar Radiation and Wind Movement Data for Simulation and Operations Research Models," Apr. 1974, by D. D. Franz, Hydrocomp, Inc. for OWRR, USDI, Wash., DC 20240.
- "Evaluation of Microwave-Induced Plasma Spectrometer for Trace Analysis," (EPA-660/2-73-009), Jan. 1974, by W. R. Seitz, for EPA, avail from USGPO, Wash., DC 20402, Price 65¢.
- "Utilization of Trickling Filters for Dual Treatment of Dry and Wet Weather Flows," (EPA-670/2-73-071), Sept. 1973, by P. Homack, et al, Elson T. Kalman Assocs., Inc. for EPA, avail. from USGPO, Wash., DC 20402, Price \$1.50.
- "On Site Waste Water Disposal for Homes in Unsewered Areas," (R2533), Sept. 1973, Out-of-State Purchasers: Agric. Bulletin Bldg., 1535 Observatory Dr., Madison, WI 53706, Price 20¢ plus postage.
- "Seasonal Changes in Water Quality and Primary Productivity in Doe Valley Lake," (Res. Rpt. #72), 1974, by E. J. Bacon, et al, U. of KY, WRRRI, Lexington, KY 40506.

#### Water Quantity Management

- "Design of Small Canal Structures," 1974, by A. J. Aisenbrey, Jr., et al, USDI, Bureau of Reclamation, avail. from USGPO, Wash., DC 20402, Price \$8.65.
- "Optimum Drilling Sites for Ground-Water Development on The East Coast of Lanai Island," (Tech. Rpt. #68), July 1973, by W. M. Adams, et al, WRRRC, U. of HI, Honolulu, HI 96825.
- "Some Application of Statistical Methods to Ground-Water Flow System Analysis," (Pub. #14), Apr. 1973, by R. L. Cooley, et al, WRRRC, Desert Res. Inst., U. of NV, Reno, NV 89507.
- "The Effects of Diminished Groundwater Supplies on Selected New Hampshire Industries: An Economic and Legal Evaluation," (Bul. 5), June 1973, by R. H. Forste, WRRRC, U. of NH, Durham, NH 03824.
- "Network Analysis of Conjunctively Operated Ground Water-Surface Water Systems," (Res. Rpt. #76), Jan. 1974, by A. S. Hamdan, et al, U. of IL, WRC, 2535 Hydrosystems Lab., Urbana, IL 61801.

- "Hydrologic Models of the Great Lakes," (Res. Rpt. #81), Apr. 1974, by D. D. Meredith, U. of IL, WRC, 2535 Hydrosystems Lab., Urbana, IL 61801.
- "The 7-Day 10-Year Low Flows of Illinois Streams," (ISWS-73-BUL57), 1973, by K. P. Singh, et al, Dept. of Reg. and Educ., IL St. Water Survey, Urbana, IL 61801.
- "Transient Response of a Layered, Sloping Soil to Natural Rainfall in the Presence of a Shallow Water Table: Experimental Results," (ARS-NE-30), Feb. 1974, USDA, Agric. Res. Service, Hyattsville, MD 20782.
- "Engineering, Legal and Economic Aspects of Storm Sewer Assessment," Oct. 1973, by J. Barnard, et al, for OWRR, USDI, avail. from U. of IA, Iowa City, IA 52242.
- "Sensitivity of Surface Runoff to Variations of Watershed Parameters in Small Urban Areas - A Kinematic Model," (C.E. Rpt. 74-02), Jan. 1974, by C. L. Yen, et al, Dept. of CE, Howard U., Wash., DC 20001.
- "Wells and Pumping Systems for Domestic Water Supplies," (ISWS-73-CIR117), 1973, by J. P. Gibb, Dept. of Reg. and Educ., IL St. Water Survey, Urbana, IL 61801.
- "Three-Dimensional Zone Model Log Interpretation," (Tech. Rpt. #69), Sept. 1973, by L. J. Shamey, et al, WRRRC, U. of HI, Honolulu, HI 96825.

Miscellaneous

Annual Reports: State Water Resources Research Institutes

California  
Virginia  
Maryland

- "Washington State's Water, a 1974 Report," (Annual Report), by D. C. Flaherty, avail. from WRC, WA St. U., Pullman, WA 99163.
- "A Report on the Sea Grant Program for Jan. 1 - Dec. 31, 1972," (Annual Report) Florida Sea Grant Prog., U. of FL, Gainesville, FL 32611, Price 40¢.
- "Publications List of the Idaho Water Resources Research Institute," Apr. 1974, WRRRC, U. of ID, Moscow, ID 83843.
- "Second Report to Congress, Resource Recovery and Source Reduction," (SW-122), 1974, by Off. of Solid Waste Management Prog., avail. from USGPO, Wash., DC 20402, Price \$1.65.
- "Geomorphology, Hydrology, and Soils in Karst, Southern Indiana, Field Conference, April 24-25, 1974," by J. L. Bassett, et al, WRRRC, IN U., Bloomington, IN 47401.
- "Plant Phenology in Eastern and Central North America, II. Phenological Observations on Lilac 'Red Rothomagenses'," (Bul. 678), Dec. 1973, by R. J. Hopp, et al, Agri. Exp. Sta., U. of VT, Burlington, VT 05401.

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