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Water Current

Volume 6 Number 9

September 1974

FROM THE DESK OF THE DIRECTOR . . .

The clock does not have to be turned back many years to the time when local or regional interests in providing more adequate drinking water supplies, greater quantities of flow for irrigation, flood protection or other water related services could assure an orderly succession of planning, design and execution of projects to achieve such objectives. Recently, the value of water resources has been discounted in a national sense and perhaps more significantly, many projects have been delayed or scrapped on the basis of their potential for adverse environmental effects.

At a time when every proposal to develop water or other resources is subjected to intense scrutiny, it becomes more important than ever to have a firm understanding of implications of proposed actions. For each water development project, a reliable estimation of environmental consequences would be of great value to opponents as well as proponents. Environmentalists and others have foreclosed the opportunity for reasonable water development based on emotionalism, often without proof of their convictions and many times with little or questionable data. It is also true that proponents of many projects have not been able to contest the charges of others for lack of information. Some projects should be built, others should not, but the final determination must rest on a factual basis for decisions rather than on the conjecture of special interest groups.

Research on the impact of already constructed projects can be highly instrumental in guiding future decisions. An acceleration of programs to provide an adequate data base for environmental assessment is in order. Researchers in the water resources field should turn their attention to this important topic. Results of such studies would help assure plans of maximum compatibility with all interests.

ON THE HOMEFRONT

DEADLINES FOR RESEARCH PROPOSALS

The deadline for filing annual allotment proposals with the Nebraska Water Resources Research Institute for fiscal year 1976 is December 15, 1974.

Prospective principal investigators should make an appointment to discuss their proposals with the Institute Director before they begin writing. For further information, contact: Dr. Warren Viessman, Jr., Director, Water Resources Research Institute, 212 Ag. Engineering Building, University of Nebraska, Lincoln, Nebraska 68503, (402) 472-3307.

NWRRI HOSTS RESEARCH IN ACTION CONFERENCE

The Nebraska Water Resources Research Institute is conducting a two-day conference entitled "Research in Action - Technology for Implementing Water Research Results" to be held December 5-6, 1974 at the Nebraska Center for Continuing Education. The objective of the conference is to develop techniques for getting quick and effective action from water research results.

Warren A. Hall, Acting Director of the Office of Water Research and Technology, will give the keynote address, "Action from Research." Other topics to be discussed include: The Need for Effective Research Translation, The Importance of Research in State and Federal Water Planning, The University's Role in Research Implementation and Research Applied to National Needs.

For further information and registration form, please contact: Dr. Warren Viessman, Jr., Director, Water Resources Research Institute, 212 Ag. Engineering Building, University of Nebraska, Lincoln, Nebraska 68503 or telephone (402) 472-3307 or 3305.

REGIONAL NEWS

OPENING: RIVER BASIN PLANNER

The Missouri River Basin Commission is seeking an assistant river basin planner with a B.S. or B.A. degree at a salary ranging from \$9,800 to \$12,300. For an associate planner, the requirements are an M.S. or M.A. degree or a B.S. or B.A. degree with one-year's experience at a salary of \$13,000 to \$15,600.

For further information, contact: Nicholas L. Barbarossa, Director of Planning and Technical Services, Missouri River Basin Commission, Suite 403, 10050 Regency Circle, Omaha, Nebraska 68114.

HAL SCHROEDER SPEAKS AT ICE/WRC CONFERENCE

A national conference to achieve integration of natural resources planning was held August 27 and 28, 1974 in Cincinnati, Ohio. The meeting brought together technicians and administrators responsible for many of the water and related land resources programs.

Mr. Hal Schroeder, General Manager of the Lower Platte South Natural Resources District and Chairman of the Nebraska Water Resources Research Advisory Committee, gave a presentation on "Research for Planning Needs."

The following comments highlight his talk:

"In my area, we are greatly concerned about apparent assumptions by some people that water resources development, including structural measures, is inherently bad and that construction of such measures is detrimental to the environment which is assumed to be fragile and inflexible.

"There appears to be a discouraging trend toward reliance on nonstructural measures without having available the necessary controls or authorities to establish or regulate these measures. We must recognize existing legal gaps in land use management. A position of favoring nonstructural programs is often taken by those opposing structural measures.

"Water resource development projects in our sector of the country, whether federally designed and funded, or local projects providing flood control, irrigation water supply, erosion control, fish and wildlife habitat and recreation, are very definite plus factors in an environmental assessment in our opinion. We believe research will confirm this.

"What research is needed?

"To assist water resource development planners in preparing the Environmental Quality Account under the new Principles and Standards research is needed, not on projects in planning status, but on the actual results experienced from projects in place for 10, 20 or more years.

"The research should be directed toward learning whether there has indeed been, as I strongly believe there has, an improvement of water quality, reduced eutrophication of lakes and impoundments and overall landscape beautification.

"Has there been an improvement and increase in wildlife habitat and recreation opportunities and a general enhancement of the environment?

"To my knowledge, research into the economic impacts of projects already built has been done but not on the environmental impacts of completed projects.

"Who should perform this research?

"As the current Chairman of the Advisory Committee of the Nebraska Water Resources Research Institute at the University of Nebraska, I have come to respect the research capabilities of our Institute and of those at other universities. The much needed objectivity as well as technical capability exists at these institutes among the university personnel available to perform the research.

"We are not disputing the fact that some projects in some areas may be detrimental to some forms of life. We seek only, as the Governmental Relations Committee proposes, to increase public understanding, seek closer cooperation and resolve conflicts in water resources development."

In addition to his participating, Mr. Schroeder summarized the important issues discussed at the meeting. These were:

- (1) Implementation of Public Law 92-500, the Water Pollution Control Act, has run into financial and technical problems. A nationwide needs survey based on the criteria of the Act indicates that funds in the order of \$350 billion will be required. With probable reductions in federal appropriations for the program and with the probable inability of states and communities to absorb the financial burden, either the requirements of the law will have to be revised or the schedules and standards will not be met.
- (2) The failure of the current Congress to pass land-use legislation has resulted in new bills being drafted for introduction next session. These bills will probably reduce the participation of the federal government in land-use management and will reduce the conditions imposed on state and other non-federal agencies as a requirement for federal funding. There was great emphasis on the need for state government to establish goals, policies, objectives and provide funds to permit land use planning to be conducted under the principal sponsorship of state government.
- (3) There was general agreement that Water Resources Research Institutes are doing excellent work and the program should receive additional support but that technology transfer needs to be improved, in that much data being published is not being utilized.

\$1.6 BILLION FOR NEBRASKA SEWAGE NEEDS

The Department of Environmental Control said that Nebraska will require \$1,636,247,000 from now until 1990 to satisfy sewage treatment needs. This was the finding of DEC after conducting the 1974 Municipal Wastewater Treatment Survey of Needs. The survey was made from mid-May to July 26 and gathered information from 141 Nebraska communities. A need is determined by the action which must be taken to solve actual or anticipated water quality

problems to meet the goals of the Federal Water Pollution Act Amendments of 1972. The main factors considered were the adequacy of the existing wastewater collection and treatment facilities and storm water treatment.

The results will be used by Congress in determining the allocation of federal funds for collection and treatment facilities in Nebraska for fiscal year 1976.

FEDERAL HIGHLIGHTS

FY 1975 TITLE II PROJECTS ANNOUNCED

The Office of Water Research and Technology has announced the following research projects for fiscal year 1975 water programs authorized under Title II:

Heated Water Problems - State University of New York at Buffalo and Pennsylvania State University;

Water Supply for Energy - University of Wyoming;

Coal and Oil Shale Development - Colorado State University, University of Wyoming, Montana State University and North Dakota State University;

Aquatic Ecosystems - University of Alaska, Cornell University, State University of New York at Plattsburg, University of Kansas and Florida State University;

Water and Land Use Planning - University of Idaho and State University of New York at Binghamton;

Water and Wastewater System Management - University of Nevada, Colorado State University, Systems Control, Inc., Palo Alto, California, University of Texas, Utah State University, Hydrocomp, Inc., Palo Alto, California, University of Colorado and Case Western University;

Water Use Efficiency - Texas Tech University; and

Indian Self-Determination - Colorado State University.

DISCOUNT RATE FOR WATER RESOURCES PROJECTS INCREASES

In July 1974, the discount rate for water resources projects was increased from 5-5/8 percent to 5-7/8 percent. The rate would have gone to 6-1/2 percent if not for a provision limiting the yearly change in the rate to 1/4 percent.

If Congress had not changed the discount rate formula in the 1974 Water Resources Development Act, the rate would have increased beyond 7 percent.

The Act, signed last March, also directed the White House to study the discount rate methodology, cost-sharing and project justification criteria. Because of indecisions in OMB and the White House, the study has not begun.

WATER GUN: TOY OR TOOL?

Terraspace, Inc. of Rockville, Maryland has designed an experimental cannon which shoots a one-quart jet of water at the velocity of 9,800 feet per second. The cannon was developed for the Department of Transportation Federal Railway Administration.

When aimed at sandstone, limestone or granite, the rock breaks. At this point in time, it's a one-shot operation. The challenge is to give it a machine-gun capacity for field work. Pressure from the jet reaches 650,000 pounds per square inch. The efficiency is comparable to the best current tunneling methods. The cannon is powered by an oil hydraulic system that compresses nitrogen gas. Upon firing, the gas accelerates a 143-pound, 7-inch diameter piston up to a speed of 140 miles an hour in a distance of one foot. The energy is transferred to the water which is effective out to a range of several inches from the end of the nozzle. The water from the nozzle has a jet pressure nearly four times higher than the pressure against the nozzle walls.

EPA ADMINISTRATOR COMMENTS ON CHLORINE

Speaking before the AWWA's 94th Annual Conference, Russell E. Train, EPA Administrator, said "I have sent letters urging chlorine producers to give priority to serving the demands of cities where shortages of chlorine for water supply and wastewater disinfection may occur." Train reviewed the background of the federal Safe Drinking Water Act. The Administrator also said, "Signs of neglect are beginning to show up in the nation's water supply systems. Both the AWWA and EPA have contributed to the Safe Drinking Water Bill."

On the subject of chlorine, he said that 16 instances of outage or shortage had been reported last spring. Most of these occurred in the eastern states, three involving drinking water and 13 involving wastewater treatment. Train stated, "I have alerted EPA Regional Administrators in our four eastern regions to begin immediately a national reporting system for chlorine problems and to issue a voluntary system of priorities for the use of this chemical. We propose that the priorities begin with drinking water treatment and extend from there to food processing plants and sewage treatment facilities. I have also instructed EPA Regional Administrators in Boston, New York, Philadelphia and Atlanta to invite their state governors to meetings to establish cooperative plans for voluntarily coping with this shortage.

"Legislation is now pending in Congress to provide for the stand-by allocation of chlorine, but this legislation may not be completed in time to help prevent health problems. I believe the measures I have described will enable us to cope with the chlorine shortage over the near-term, and that the new law will enable us to deal with it on a long-term basis."

COMPLETED WATER PROJECTS IGNORED

The Arkansas Basin Development Association filed a statement calling for a system of follow-up studies of the beneficial effects of projects after they are completed and in operation.

Association President, William E. Bender, said project proposals are examined on every detail, but little or no attention is given the completed project. He stated, "This paucity of documentation of completed project benefits has left our water resources programs particularly vulnerable to attack from environmentalists and some economists over the years. The ill-conceived report of the National Water Commission would have been given scant attention had sufficient factual studies of water resources benefits been available."

SENATOR DEFENDS CURRENT WATER POLICIES

Any changes in the system of federal sponsorship of large water resources development projects such as the "beneficiary pay" theories set forth by the National Water Commission would likely encounter opposition in the Senate Public Works Committee, whose Chairman, Senator Jennings Randolph (W.V.), strongly defends the current system.

Senator Randolph recalled President T. Roosevelt's 1906 observation: "The national government must play the leading part in securing the largest possible use of our waterways; other agencies can assist and should assist, but the work is essentially national in scope."

Randolph added, "This concept has guided our water resources policy, and it has enabled us, to date, to meet the demands of a constantly expanding industrial technology and a growing population. In meeting these demands, many of our public works programs have succeeded beyond our expectations. Few programs are more essential to the economic and social well-being of our people than wise and comprehensive water resources development."

RAIL-BARGE SYSTEM MAY JOIN HANDS

America's energy crisis has brought the importance of cooperation into sharp focus. The trend toward increased reliance on coal to fuel power plants and basic industries may force the railroads and water carriers to join hands to get this vital commodity from the mines to consumers. Currently, nearly 20 percent of all railborne coal destined for domestic consumption travels

by joint rail-water movement, but this activity pales when compared to future joint routes envisioned in a study published by the National Academy of Engineers. According to the study, by 1985 the nation will demand that eastern rail-barge systems be able to move 650 million tons of coal per year and that new joint systems be able to carry 200 tons per year from opening western fields. These projections represent a 50 percent increase in the tonnage of coal hauled in joint movements in 1973.

URBAN WATER POLLUTION

Study observations commissioned by the Council of Environmental Quality show that storm runoff from a typical moderate-sized U. S. city will discharge as much as 250,000 pounds of lead and up to 30,000 pounds of mercury a year. In addition, the effect of this discharge on a receiving body of water severely depletes oxygen in the water for up to 12 days after the storm and thereby poses a threat to aquatic organisms and overall quality of the water.

Problems of heavy metal pollutants carried in storm runoff are also felt at the sewage treatment plant where they hamper BOD removal by killing bacteria in the activated sludge process. Routine heavy metal analyses are expensive and are not done by the majority of waste treatment plants. Before plans can be made for clean-up of toxic conditions in receiving waters, a system of monitoring the metals in overflows or storm sewers will have to be set up.

The study commissioned by CEQ was designed to gather up-to-date information and analyze data on the effects of storm runoff on water quality. Cities sampled in the study were: Atlanta, Georgia; Bucyrus, Ohio; Cleveland, Ohio; East Bay Municipal Utility District (serving the east side of San Francisco Bay); Roanoke, Virginia; Sacramento, California; San Francisco, California; and Washington, D. C. The Delaware River Estuary was also covered by the investigation.

The practice of separate systems for sewage and storm water conveyance was not found to be effective from an economic or management point of view. In this respect, the researchers report that: "Almost without exception, sewer separation is not a cost-effective approach to the storm water problem. More attractive alternatives provide for the storage of storm water, either in the sewer system itself or in storage lagoons, followed subsequently by treatment." Other aspects of the study worthy of additional investigation by those setting policy for management of this source of polluted water include a view of the federal water pollution program, as one which does not include incentives to municipalities to identify and carry out "the comparatively inexpensive and cost-effective sewer inspection, cleaning and maintenance programs which could significantly reduce the discharge of pollutants." The federal program is one with emphasis on capital grants for the construction of treatment plants. Poor management of storm runoff frequently negates the true water management capability of new facilities.

One source contributing heavily to pollution of runoff was the oily wastes and filth picked up in industrial area runoff. Other pollution contributions are atmospheric fallout of heavy metals, street litter, animal droppings, soil runoff and vehicular oil and dusts.

When the results of the surveys made in each of the cities studied were evaluated, it was found that pollution from storm water runoff to receiving waters is about double that of effluent discharged by most sewage treatment plants. "There is little or no sense in requiring sewage treatment plants to improve efficiency when the source of total pollutant load to streams is not considered." The researchers recommended that funding for upgrading sewage treatment should not be limited to treatment expenditures but should include a complete program of regular sewer inspections, cleaning and infiltration repairs.

NEW GENERAL COUNSEL OF WRC

Warren D. Fairchild, Director of the Water Resources Council (WRC) has named Theodore S. Farfaglia as the new General Counsel for WRC. Farfaglia replaces Mr. Ramon J. Powell.

From 1973-1974 Mr. Farfaglia was with the North Carolina Department of Justice where he served as Special Assistant to the Attorney General, Environmental Matters and was responsible for establishing its Environmental Law Division. Prior to employment with the State of North Carolina, he served ten years as Judge-Advocate on active duty with the Air Force.

Mr. Farfaglia graduated from the University of St. Louis with honors in 1963 and is a member of the Missouri and North Carolina State Bar Assoc. He did his undergraduate study at Fordham University including a year in Milan, Italy as a participant of the Fordham's Honors Program.

CONFERENCES

POWER SEMINAR

The American Society of Civil Engineers and the American Water Resources Association (Texas Sections) are sponsoring a seminar entitled, "POWER: Preferred Options in Water and Energy Resources," to be held April 3, 1975 in San Antonio, Texas. Topics to be discussed are: water for power needs in Texas, thermal quality criteria for power, public participation in power plant siting. Complete program details will be available in December.

For further information, contact: Jerry R. Rogers, Associate Professor, Department of Civil Engineering, Cullen College of Engineering, University of Houston, Houston, Texas 77004, (713) 749-4481.

CONFERENCE ON SOIL-WATER PROBLEMS IN COLD REGIONS

On May 6-7, 1975, Calgary, Canada will be the site of a conference sponsored by the Special Task Force on Soil-Water Problems in Cold Regions, Section of Hydrology, American Geophysical Union. The conference will emphasize heat and moisture transfer as it relates to the freezing and thawing of soils. The technical sessions will be held at the Calgary Convention Center and housing of participants will be at the Four Seasons Hotel. Advance registration is \$10. Copies of the proceedings will be presented to all registrants. Information concerning housing facilities and costs will be sent on request.

Contributed papers are solicited and may be offered by sending a title and brief abstract to Dr. James N. Luthin, Department of Water Science and Engineering, University of California, Davis, California 95616.

SECOND ANNUAL RESEARCH, DESIGN AND DEVELOPMENT CONFERENCE

The Environmental Engineering Division of the American Society of Civil Engineers is sponsoring the Second Annual Research, Design and Development Conference on July 21-23, 1975.

Session topics include: control of leachate from landfills, costs of pollution control, ecologic modeling, environmental impacts of transportation systems, eutrophication and lake restoration, integrated environmental quality management, land disposal of municipal waste, removal of toxic substances from water and wastewater, storm water management and urban and rural wastewater treatment.

Papers are invited on these and other topics. Abstracts containing title, authors and affiliation and a 500-word summary of the objectives, results and significant conclusions are to be submitted by November 15, 1974 to Patrick L. Brezonik or James P. Heaney, Department of Environmental Engineering Sciences, University of Florida, Gainesville, Florida 32611.

PUBLICATIONS

SELECTIVE DISSEMINATION OF INFORMATION PROGRAM

The Smithsonian Science Information Exchange has announced a selective dissemination of information program. Monthly compilations of the most recent research project information are available for a fee on an annual basis.

For further information, write: SSIE, Room 300, 1730 "M" Street, N.W., Washington, D. C. 20036.

SELF-SUFFICIENCY - 1980 GOAL

The U.S. Water Resources Council (WRC) has released "Water for Energy Self-Sufficiency," an interagency task force report on current programs relating to the availability of the nation's water for the goal of energy self-sufficiency by the year 1980.

Included is a summary of a recently held task force conference and an inventory of over 100 federal energy and related programs. Also included is a tentative outline of information required and an interim work schedule to develop a report on needed actions to supply enough water for the nation's energy needs.

Copies are available upon request from the Water Resources Council, 2120 "L" Street, N.W., Suite 800, Washington, D. C. 20037.

WRC RELEASES NEW RULES AND REGULATIONS

Warren D. Fairchild, Director of the U.S. Water Resources Council (WRC), has announced the release of new organization rules and regulations for the operation of the Water Resources Council. The new rules and regulations became effective upon publication in the "Federal Register" on June 12, 1974.

In announcing the release Fairchild said, "Experience and events since the 1970 revision of the Council's rules and regulations has indicated the need for further revision in order to make the Council structure more responsive and efficient. I believe these revisions will provide for greater decision-making capability and efficiency."

The new organization rules and regulations will facilitate Council decision-making and management by allowing greater participation by the alternates to the members; by delegating the Director more authority and responsibility to the staff and by giving the Council of Representatives and the Director more flexibility and authority with respect to the Council committee structure.

Copies of the new rules and regulations are available from the Water Resources Council, Washington, D. C. 20037.

CORPS' PROCEEDINGS AVAILABLE

The Corps of Engineers announces the availability of the proceedings of a conference held on March 26-28, 1974 entitled "Analytical Methods in Planning." The publication is free of charge. To obtain a copy write to The Hydrology Engineering Center, U.S. Army Corps of Engineers, 609 Second Street, Davis, California 95616.

WORLD ENVIRONMENTAL DIRECTORY

A one-volume reference encompassing world-wide environmental information is now available. The directory contains 15 sections and is published semi-annually. This edition lists approximately 6,600 companies, agencies, organizations and institutions from more than 60 countries. Complete names, addresses, phone numbers, officers and principals, environmental areas of concern and branch offices are given. The book also contains a personnel index and cross reference.

Copies are available for \$50 from World Environmental Directory, Business Publishers, Inc., P. O. Box 1067, Blair Station, Silver Spring, Maryland 20910.

RESEARCH REVIEW

Project Title: Recharge Simulation Model

Principal Investigator: Deane M. Manbeck, Associate Professor
Department of Agricultural Engineering

The goal of this project is to develop a workable digital simulation model of recharge to groundwater systems for objective planning of Nebraska's irrigation development.

The preliminary model simulating the movement of water from the soil surface to the groundwater was modified during fiscal year 1974. Evapotranspiration and runoff components of the model were expanded to more realistically represent actual conditions. The surface runoff component of the model utilizes Soil Conservation Service methods and data for Nebraska to more adequately represent the amount of precipitation not infiltrating through the soil surface. The evapotranspiration component includes the types, areal extent and normal consumptive use at various stages of growth of the crops being grown in the recharge area, mean air temperature and soil moisture condition. The model generates the amount of water from precipitation and irrigation sources moving vertically downward from one soil layer to the next on a monthly basis for various initial conditions.

Actual data of precipitation, irrigation water applied from surface sources, air temperature and crops from a Nebraska irrigation project have been used in the model to simulate moisture movement through three strata. Annual recharge amounts are not appreciably sensitive to changes in hydraulic conductivity at saturation and field capacity moisture conditions. However, increasing thickness of each stratum tenfold decreased the annual recharge amount to 0.4 percent of the base situation. Also, changing the order of the strata texture affected the annual recharge by 25 to 211 percent.

The adequately developed and verified recharge simulation model will be used to predict the amount of water which may move from the soil surface to the groundwater under various conditions. This prediction of recharge will serve as a guide for selecting sites and methods for augmenting water movement to the groundwater. Research results will be incorporated into overall groundwater hydrology models for dissemination to users. Planning of irrigation development in Nebraska will be assisted by this working tool of predicting artificial recharge.

PUBLICATIONS RECEIVED BY THE INSTITUTE

NWRRI LIBRARY

1. Survey of Economic-Ecologic Impacts of Small Watershed Development, R. M. North, A. S. Johnson, H. O. Hillestad, P. A. R. Maxwell, R. C. Parker, Institute of Natural Resources, The University of Georgia Athens, Georgia, in cooperation with the Environmental Resources Center, Georgia Institute of Technology, Atlanta, Georgia, June 1974.
2. Land Disposal of Wastewater: Processes, Design Criteria, and Planning Considerations, John P. Hartigan, Jr., Environmental Resources Center, Georgia Institute of Technology, Atlanta, Georgia, August 1974.
3. Advanced Concepts and Techniques in the Study of Snow and Ice Resources - An Interdisciplinary Symposium, compiled by Henry S. Santeford, James L. Smith, National Academy of Sciences, Washington, D.C., 1974.
4. Biological Effects in the Hydrological Cycle - Proceedings of Third International Seminar for Hydrology Professors, Department of Agricultural Engineering, Agricultural Experiment Station, Purdue University, West Lafayette, Indiana.
5. International Hydrological Decade Representative and Experimental Basins in the United States: Catalog of Available Data and Results 1965 - 1972, U.S. National Committee for the International Hydrological Decade, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C.
6. Microwaves, A New Tool for Forest and Watershed Management, Bruce R. McLeod, Completion Report, Montana University Joint Water Resources Research Center, Bozeman, Montana, June 1974.
7. Water Resources Development in the Mullica River Basin, James B. Durand, Marvin L. Granstrom, Natelie S. Rudolph, Reprinted from Water Resources Bulletin, American Water Resources Association, Vol. 10, No. 2, April 1974.
8. Water Resources Protection Measures in Land Development - A Handbook, Joachim Tourbier, Richard Westmacott, Water Resources Center, University of Delaware, Newark, Delaware, April 1974.
9. 1974 Annual Report FY 1974 Accomplishments FY 1975 Program, Hydrologic Engineering Center, Corps of Engineers, Davis, California.
10. Effects of Clear Cutting on Water, Discharge and Nutrient Loss, Bitterroot National Forest, Montana, Montana Water Resource Report 52, Tom Bateridge, University of Montana, Department of Geology, Missoula, Montana, July 1, 1974.
11. A Conceptual and Empirical Analysis of Water Pricing in Mississippi Municipalities, Kenneth W. Hollman, Wayne E. Boyet, Water Resources Research Institute, Mississippi State University, Mississippi State, Mississippi, July 1974.
12. Annual Report of the Iowa State Water Resources Research Institute for Fiscal Year 1974, Iowa State Water Resources Research Institute, Iowa State University, Ames, Iowa, July 1974.

13. Snow-Air Interactions and Management of Mountain Watershed Snowpack, James R. Meiman, Lewis O. Grant, Environmental Resources Center, Colorado State University, Fort Collins, Colorado, June 1974.
14. Water-Related Aesthetic Preferences of Wyoming Residents - Water Resources Series No. 46, Gary D. Hampe, Verne E. Smith, James P. Mitchell, Water Resources Research Institute, University of Wyoming, Laramie, Wyoming.
15. Proceedings of a Seminar on Analytical Methods in Planning, The Hydrologic Engineering Center, U.S. Army Corps of Engineers, 609 Second Street, Davis, California, March 26-28, 1974.
16. Application of Statistical Techniques to the Selection of an Optimal Pollution Treatment Program, A. B. Whinston, J. R. Marsden, D. E. Pingry, Purdue University, Water Resources Research Center, West Lafayette, Indiana, June 1974.
17. Numerical Properties of Implicit Four-Point Finite Difference Equations of Unsteady Flow, D. L. Fread, Office of Hydrology, Washington, D.C., March 1974.
18. Land and Water Use in Oregon, Seminar Conducted by Oregon State University, Water Resources Research Institute, Spring Quarter 1974, July 1974.
19. Social Dimensions of Urban Flood Control Decisions, Wade H. Andrews, Dennis C. Geertsen, Institute for Social Science Research on Natural Resources, Utah State University, Logan, Utah, January 1974.
20. An Evaluation of Farm Irrigation Practices as a Means to Control the Water Quality of Return Flow, R. J. Hanks, J. C. Andersen, L. G. King, S. W. Childs, J. R. Cannon, Agricultural Experiment Station, Utah State University, Logan, Utah, July 1974.
21. Measurement of Soil Moisture by Use of the Latent Heat of Vaporization, Duane G. Chadwick, Utah Water Research Laboratory, College of Engineering, Utah State University, Logan, Utah, July 1974.
22. Optimal Regionalization of Wastewater Treatment for Water Quality Management, Lewis A. Rossman, Jon C. Liebman, University of Illinois, Water Resources Center, 2535 Hydrosystems Laboratory, Urbana, Illinois, July 1974.
23. Appraisal of Operating Efficiency of Recharge Basins on Long Island, New York, in 1969, Geological Survey Water-Supply Paper 2001-D, U.S. Government Printing Office, Washington, D.C., 1974, D. A. Aronson, G. E. Seaburn.
24. Natural Hazards - Local, National, Global, edited by Gilbert F. White, Oxford University Press, New York, New York.
25. Chemical Analyses of Nebraska Municipal Water Supplies, Nebraska State Department of Health, Division of Environmental Engineering, 1003 'O' Street, Lincoln, Nebraska, January 1973.
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C.Y. THOMPSON LIBRARY

1. The Electrical Process in the Breaking of Dilute Oil-In-Water Emulsions, Clyde Orr, Jr., Edward Y. H. Keng, High Temperature Materials Division, Engineering Experiment Station, in cooperation with Environmental Resources Center, Georgia Institute of Technology, Atlanta, Georgia, June 1974.
2. The Trace Analysis of Water for Selected Metallic Elements Employing Square-Wave Polarography, Peter E. Sturrock, Richard J. Carter, The School of Chemistry, in cooperation with Environmental Resources Center, Georgia Institute of Technology, Atlanta, Georgia, July 1974.
3. Techniques for Determining Amount and Distribution of Precipitation in Mountain Valleys of Idaho, E. Woody Trihey, Water Resources Research Institute, University of Idaho, Moscow, Idaho, June 1974.
4. Wastewater Use in the Production of Food and Fiber--Proceedings, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C., June 1974.
5. Selected Irrigation Return Flow Quality Abstracts, 1972 - 1973, Gaylord V. Skogerboe, Wynn R. Walker, Ray S. Bennett, Betsy J. Zakely, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C., June 1974.
6. Workbook of Thermal Plume Prediction-Volume 2-Surface Discharge, Mostafa A. Shirazi, Lorin R. Davis, National Environmental Research Center, Office of Research and Development, U.S. Environmental Protection Agency, Corvallis, Oregon, May 1974.
7. Land Application of Sewage Effluents and Sludges: Selected Abstracts, Water Quality Control Branch, Robert S. Kerr Environmental Research Lab., Ada, Oklahoma, National Environmental Research Center, Office of Research and Development, U.S. Environmental Protection Agency, Corvallis, Oregon, June 1974.
8. Color Characterization Before and After Lime Treatment, H. S. Dugal, R. M. Leekley, J. W. Swanson, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C., April 1974.
9. Protein Production from Acid Whey Via Fermentation, Sheldon Bernstein, Ph.D., Thomas C. Everson, Ph.D., Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C., May 1974.
10. Analysis of Coprostanol, an Indicator of Fecal Contamination, J. Edward Singley, Cliff J. Kirchmer, Ryosuke Miura, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C., March 1974.
11. Comparison of Germanium Detectors for Neutron Activation Analysis for Mercury, Robert V. Moore, Oliver W. Propheter, National Environmental Research Center, Office of Research and Development, U.S. Environmental Protection Agency, Corvallis, Oregon, June 1974.
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