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# Water Current

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Guest Editorial

by

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University of Nebraska - Lincoln

In Nebraska, approximately 7 million acres were irrigated in 1977. About 6 million of these acres required energy for pumping water from wells, streams and reservoirs. Of the 6 million acres requiring energy for pumping, 3.5 million acres were irrigated with surface systems, and 2.5 million utilized a sprinkler system. The static pressure required to operate the system, with a lift of 100 feet, results in total lifts of 120 and 275 feet of water for the surface and sprinkler systems, respectively.

The U. S. Geological Survey indicates the average water application of non-scheduled irrigation is 20 inches per year. Without irrigation scheduling, the estimated energy cost of irrigating for Nebraska is about \$130 million. The irrigation water requirements for Nebraska with no irrigation scheduling would be:

$7 \text{ M acres} \times 20 \text{ acre-in/yr} \times 27,154 \text{ gals/acre-in} = 3.8 \text{ billion gallons per year}$

This intensive irrigation has resulted in declining groundwater levels in several locations across the state. Some locations show more than a 20-foot drop. The major declines have occurred in the Blue River Basin (York, Hamilton, Clay and Fillmore counties) and in areas around O'Neill, Alliance and Imperial. The high energy costs and high demand on Nebraska's water resources necessitate a program to more effectively utilize these valuable resources.

Pilot irrigation and irrigation scheduling studies have been conducted in the Blue River Basin since 1969. From 1969 through 1977, an average of 20 inches of water was applied per acre for the non-scheduled fields,

in addition to an average of 13.6 inches of rainfall during the growing season. In contrast, proper irrigation scheduling techniques were applied to certain fields for three seasons, 1975 through 1977--with an average 12.7 inches of water applied per year--resulting in a savings of 7.3 inches per acre per year with no reduction in crop yield. This represents a 37 percent savings in water pumped and a direct energy savings. If irrigation scheduling were extended to all irrigated acres in the state, a reduction in irrigation water used of 1.4 billion gallons and a direct energy savings of \$47 million could result.

Irrigation scheduling involves determination of the "how much" and "when" of water application to the crop. With scheduling, the soil profile (root zone) is only partially refilled by irrigation water, allowing room for rainfall should it occur. However, sufficient moisture is maintained to prevent the plant from being stressed. Crop water use, soil moisture storage, rainfall and water applied are used to predict the proper schedule for irrigation.

In the summer of 1977, the U.S. Bureau of Reclamation awarded \$559,000 to the Department of Agricultural Engineering, through the Water Resources Center, to equip and train county extension agents in Nebraska. The money was also used to write and print the first "Irrigation Scheduling Handbook." In addition, various University of Nebraska regional stations, at Clay Center, North Platte, Scottsbluff, Concord and Lincoln, were equipped with portable computer terminals and other equipment to teach and train consultants and irrigators how to schedule irrigations.

In 1977, these advanced techniques of irrigation water management were applied to 800,000 acres in Nebraska. It has been calculated that this resulted in a savings of \$6.1 million in pumping costs alone--an equivalent of 14.8 million gallons in diesel fuel. Additional savings of approximately \$4.3 million were realized on these lands as a result of lowered fertilizer applications resulting from reduced water application.

However, implementation of advanced irrigation scheduling technology requires highly-trained personnel, skilled in the basics and in the practical aspects of maintaining the proper soil-plant-water relationships in irrigated fields. In Nebraska, such manpower is necessary at several levels, including state and district irrigation extension specialists, computer specialists, technical assistance to these specialists, county extension agents and technical aides to county agents and consultants. Currently, the available manpower is inadequate to the task. For example, one scheduler, plus an assistant, can oversee the operation of about 100 irrigated fields (one irrigation well--approximately 160 acres per field). At this rate, with more than 60,000 irrigation wells and seven million irrigated acres, almost 600 full-time schedulers and additional support personnel will be required for effective irrigation water management. This emphasizes the need for a strong technology transfer program to train Nebraska's irrigators, consultants, county agents, technicians and other support personnel in order that the potential savings of irrigation scheduling may be successfully realized.

## ON THE HOMEFRONT

### GUERNSEY SILT RUN PROJECT

The Director of the Nebraska Water Resources Center has been meeting with researchers of the University of Nebraska Panhandle Station, Scottsbluff, the University of Wyoming, and three Irrigation Districts to discuss research possibilities associated with irrigation in the Bureau of Reclamation built North Platte Project--in Nebraska's Panhandle and adjacent areas in Wyoming.

At a recent meeting, discussion centered around proposed contractual arrangements between the Universities of Nebraska and Wyoming and the three Irrigation Districts (Gering-Ft. Laramie, Pathfinder and Goshen) most concerned with the discontinuance of the silt run. The Irrigation Districts gave tentative approval to authorizing funds for a Plan of Study and five special research projects concerning the Guernsey Silt Run as follows:

- (1) Impact of a Silt Run Fish and Invertebrates in the North Platte River near Guernsey, Wyoming
- (2) Bank Stability Study
- (3) Effect of Silt on Furrow Irrigation
- (4) Ft. Laramie Canal Records
- (5) Interstate Canal Silt Monitoring

Several scientists from the University of Nebraska and the University of Wyoming will be engaged in these efforts once final approval is received from the Irrigation Districts.

### STAFF ACTIVITIES

Marshall Taylor spoke to the Groundwater Task Force of the South Platte Natural Resources District in Sidney on March 13. The purpose of the meeting was to discuss groundwater management alternatives.

Don Wilhite has been visiting with District V County Extension Agents who are participating in a soil moisture assessment program that is being initiated this spring in southeastern Nebraska. There are currently 12 counties involved in the program which is being jointly sponsored by the Water Resources Center, the Cooperative Extension Service, and the Agricultural Experiment Station. Don Wilhite, Phil Harlan (Agronomy) and Ralph Neild (Horticulture) are co-leaders of the project.

Don Wilhite and Marshall Taylor organized and conducted a discussion of artificial groundwater recharge for the Nebraska Association of Resource Districts. The meeting featured a presentation by Bill Lichtler (USGS) on the project entitled "Mechanics and Potentials of Artificial Groundwater Recharge" which is currently being administered by the Center.

M. L. Quinn attended a meeting in San Francisco in mid-March entitled "Coastal Zone '78" sponsored by the American Society of Civil Engineers and others. The purposes of the Conference were (1) to bring together people from a wide range of disciplines and, (2) to stimulate productive discussion on the leading coastal zone management issues of the day. Both of those objectives were admirably met, and the 1,000 registrants gave a clear indication of interest in the general topic.

Dr. Quinn's attendance was related to previous research work done for the U.S. Army Corps of Engineers' Coastal Engineering Research Center. The product of that research, "The History of the Beach Erosion Board, U.S. Army Corps of Engineers, 1930-1963" was recently published by the Coastal Engineering Research Center, Fort Belvoir, Virginia.

## WATER RESOURCES IN NEBRASKA

### CONSERVATION AND SURVEY PUBLICATION

More on the leaching of nitrates from agricultural lands has just been added by the publication of "Nonpoint Nitrate Contamination of Ground Water in Merrick County, Nebraska," by R. F. Spalding, J. R. Gormly, B. H. Curtiss, and M. E. Exner. All of the authors except Curtiss are staff members of the Conservation and Survey Division. The article appears in the March-April 1978 issue of GROUND WATER pp. 86-95.

On the basis of 293 samples from the groundwater of Merrick County, Nebraska, the authors conclude that where contamination is present, the nitrate-nitrogen concentrations are relatively homogeneous, which indicates large diffuse nonpoint sources.

With the use of SYMAP (gray-scale mapping), they demonstrate good correlation between the irrigated coarse textured soils and the higher nitrate-nitrogen levels. From this they draw the implication that the nitrate-nitrogen levels are directly dependent on the leaching of nitrogenous material dispersed in or on the coarser textured soils.

Their final conclusion is that the widespread use of commercial nitrogen fertilizer on irrigated corn acreages is suspected of being the major contributor of nitrate to the groundwater.

## RECLAMATION INVITES STATE PARTICIPATION IN DAM SAFETY REVIEW

The Bureau of Reclamation will invite State Governments to participate on a regular basis in all formal safety reviews of Reclamation dams.

"Those State agencies having responsibility for the safety of dams will be invited to send specialists along with our technical personnel on field reviews. Their comments and observations will be encouraged," Commissioner of Reclamation R. Keith Higginson said.

"By encouraging their participation in the review process, we do not relinquish our responsibility for the safety of the dams we construct, we merely provide for the involvement of State personnel to ensure further the safety of our structures," he said.

State participation in the Review of Maintenance Program examinations of Reclamation dams will be entirely voluntary and will be at the expense of the State agencies.

A formal program regarding each State's involvement in the review of dams with the Bureau of Reclamation will be established at a later date.

Reclamation's Review of Maintenance Program began in 1948. Under the program, periodic dam inspections supervised by the regional offices are held at intervals of two to three years. The program includes a periodic six-year inspection supervised by the Engineering and Research Center in Denver. Deficiencies in the dams are reported and regional directors report to the Commissioner of Reclamation on the status of the corrective actions every six months until they are completed.

## FEDERAL HIGHLIGHTS

### PRESIDENT COMMENTS ON UNIVERSITY RESEARCH

The following excerpt is taken from remarks, made by the President, at the National Medal of Science presentation on November 22, 1977.

"The quality of scientific equipment has been falling off rapidly in recent years. The number of top-ranked research centers has been falling off in recent years. The percentage of faculty members who are scientists and who are also young has been falling off rapidly in recent years.

"In 1968, about 45 percent of the faculty members were young men and women. Now that's dropped off to only about 25 percent, which shows that in the future we have a problem on our hands unless we take strong action to correct these trends."

"I'm assessing each individual agency's budget these days. In many instances the heads of those agencies, the Cabinet members and others, have delegated research and development to a fairly low position of priority. But I directed the Office of Management and Budget to boost those research and development items much higher, and they will be funded accordingly."

For the first time in many years, the Administration has taken a pro-research stand. As the President said in closing remarks, ". . . we want to make sure that the climate for research and development in our country is enhanced." However, he qualified this endorsement by saying, ". . . we are not trying to establish nor to maintain a college aid program."

Hopefully, these remarks indicate a new awareness of the importance of university research in solving many of the nation's problems. It remains to be seen what impact his remarks will have on the future of universities' research programs.

#### HOW DEPENDABLE IS THE NATION'S WATER SUPPLY?

The 1970's have produced both the Nation's wettest and the driest years since the 1930's, according to a U.S. Geological Survey scientist, who said that despite the sharp contrasts of the past five years, the Nation's overall water supply has remained on the average remarkably constant.

The analysis by Walter Langbein, a senior research hydrologist at the USGS National Center is based on a comparison of the charts of annual streamflow published by the USGS covering the past 57 water years--the standard 12-month hydrologic accounting unit that runs from October 1 to September 30 of the following calendar year.

"The 1977 water year (October 1, 1976 - September 30, 1977) averaged 28 percent below normal and was actually one of the driest since 1954, which was also about 28 percent below normal," Langbein said. "Only the 1931 and 1934 water years were drier, in terms of average streamflow. In sharp contrast, the first four months of the 1978 water year have tended to be on the wet side," he said, "and preliminary indications, at least, suggest we may be pulling out of the recent dry trend."

"Despite the sharp contrasts of the past five years, however, the Nation's overall surface-water supply has remained fairly constant," the USGS scientist said. "For example, looking at variations in streamflow in terms of a moving ten-year average--that is, averaging the flow for any particular year for which flow data are available with both the past five and succeeding five years--flows have generally stayed within ten percent of average."

"Such a long-term "ten-year view" also shows that there is no general or persistent downward trend in our surface-water supplies, although recent floods and droughts have produced some rather prominent year-to-year variations," he said.

"The total supply of water in the Nation's streams is derived from rainfall and averages about 1,200 billion gallons per day--several times the current or even prospective withdrawals of water," Langbein said.

"Despite this overall abundance," he said, "parts of the country, particularly in the arid West, are actually consuming or eliminating from reuse more water than is naturally available as stream discharge. Furthermore, some local areas of the country that appear to have adequate quantities of water are beset by water-quality problems that effectively limit the available supply.

"Over the long term, however, the Nation's overall water supply has been and will probably remain both dependable and adequate. What remains to be solved are the short-term and local management and engineering problems of inadequate quantity and quality," he concluded.

#### STUDY ON 160-ACRE LIMITATION

A Department of Agriculture study on the proposed 160-acre limit on federally irrigated lands was recently released soon after a series of developments in the reclamation lands issue. The study is concerned with the Department of Interior's regulations, proposed last August, for enforcing the 1902 Reclamation Act by requiring that farmers own no more than 160 acres per family member of lands irrigated by water from federal reclamation projects. Large landowners and state water associations in the West are opposed to the regulations and contend that small farms are not economically viable. However, environmentalists support the Interior proposal, arguing that it would break up the large capital- and energy-intensive agribusinesses of the West and bring more environmentally sound farming practices.

The Department of Agriculture study found that small family farms can operate profitably, although a strict 160-acre ownership limitation perhaps is not the best way to break up the large farms. It was suggested instead that the size of farms should be determined on a case-by-case basis, depending on the type of soil and growing conditions. Secretary Bergland supports the residency requirement, but would like to see it tightened to include only persons who actually farm the land. The proposed regulations would require landowners to live within 50 miles of the land.

#### DR. H. WILLIAM MENARD, JR., TO DIRECT EXPANDED PROGRAMS AS NEW HEAD OF THE U.S. GEOLOGICAL SURVEY

Dr. H. William Menard, nominated by President Carter to be Director of the U.S. Geological Survey, will assume leadership of the USGS at a time when that scientific agency is expanding its role in natural resources investigations and research, Interior Secretary Cecil D. Andrus said.



Dr. Menard, 57, has been a Professor of Geology at Scripps Institution of Oceanography in San Diego since 1955. In 1965-66 Dr. Menard was a technical advisor in the Office of Science and Technology, Executive Office of the President, responsible for marine science and much of atmospheric and solid earth science.

In 1969 he participated in an NAS study of the impacts of a proposed Everglades Jetport and also in a similar study in 1970 relating to a proposed extension of Kennedy International Airport. He also participated on a White House panel to study the Santa Barbara oil spill of 1969.

Dr. Menard has been a member of the NAS Committee on Science and Public Policy and the NAS Commission on Natural Resources. In 1974, he served as chairman of an NAS Committee to advise the Council on Environmental Quality on the probable impact of developing offshore oil.

Dr. Menard holds a Bachelor's degree in Geology from the California Institute of Technology in Pasadena. He served as a photo interpreter and air intelligence officer in the South Pacific and England During World War II, winning numerous awards. He returned to Caltech after the war and received an M.S. degree in 1947. He was awarded a Ph.D. at Harvard University in 1949.

Dr. Menard's scientific activities have resulted in a hundred papers, including four books. His work is widely cited in scientific literature. He was elected to the National Academy of Sciences in 1968. He also is a member of numerous scientific and professional organizations.

Following favorable Senate action Dr. Menard would become the tenth Director of the 99-year old USGS, succeeding Dr. Vincent E. McKelvey, Director since 1971. Headquartered in Reston, Virginia, the Survey is one of the Interior Department's largest agencies with more than 12,000 employees.

#### FRANK GREGG APPOINTED TO BLM HEAD

After ten years as Chairman of the New England River Basin Commission, Frank Gregg has been appointed Director of the Bureau of Land Management, U.S. Department of the Interior. Following confirmation by the Senate, Gregg's appointment was signed February 13 by President Carter.

The Bureau of Land Management manages nearly 200 million acres of federal land in the 11 Western states for grazing, timber, watershed, recreation, mineral and wilderness preservation. Its jurisdiction includes 280 million acres of land in Alaska. The Bureau also has considerable surveying and record-keeping responsibilities, employs about 8,000 persons and brings nearly \$2 billion annually into the U.S. Treasury. As lessor of all federal mineral rights, the Bureau oversees the sale of oil and gas leases on the Outer Continental Shelf of New England.

During Gregg's chairmanship, beginning in 1967, the New England River Basins Commission developed into the region's primary forum for the study and resolution of water and related land resource problems in New England. A major milestone in the Commission's first decade, according to Gregg, is the fact that NERBC "helped New England state governments to strengthen their capacity to plan and manage their own natural resources." This, he indicated, has been the first priority for the Commission, and the states are now confident about their own abilities to manage these resources and to work with each other and the federal government on natural resources issues.

A successor to Gregg has not yet been named by President Carter.

In the interim, Col. John Chandler, District Engineer for New England, U.S. Army Corps of Engineers, will serve as Alternate Chairman of the Commission.

## CONFERENCES

### OFFSHORE TECHNOLOGY CONFERENCE

The Astrodomain in Houston, Texas will be the site for the May 8-11, 1978 "Offshore Technology Conference."

Over 300 topics will be covered in this four-day meeting, divided into 50 technical sessions. Papers were selected by a 12-member OTC Program Committee and cover such issues as marine geophysics, environmental hazards, ocean mining, platform design, diving activities and support systems.

1,700 leading companies from 16 nations will be displaying their latest equipment, services and supplies for the viewing.

For more information, or to receive an advance registration form, write to: Offshore Technology Conference, 6200 North Central Expressway, Dallas, Texas 75206.

### MISSOURI BASIN GOVERNORS TO MEET IN MONTANA IN MAY

A third Missouri River Basin governor's conference on water will be held May 23-25, 1978 in Great Falls, Montana. Montana Governor Thomas Judge will host the meeting and serve as the conference chairman.

The governors will meet in conjunction with the Missouri River Basin Commission's 24th quarterly meeting at the Heritage Inn in Great Falls.

A steering committee has been formed to develop a theme for the conference and to suggest water policy issues that may be addressed. As in the past, the conference is expected to develop a regional position on questions that may include the developing national water policy and the President's natural resources reorganization study.

### CASE INSTITUTE OF TECHNOLOGY SEVENTH ANNUAL CONFERENCE

From May 22-26, 1978 Case Institute of Technology--Case Western Reserve University--will offer a one-week course in Cleveland on the Hierarchical Approach in Water Resources Planning and Management. The 1978 theme will be Trade-Offs in Water Policy: Efficiency, Environment, Energy and Equity. It is co-sponsored by the International Water Resources Association and the American Geophysical Union, Section of Hydrology.

The cost is \$325.00 which includes one set of notes; one copy of the book, Multiobjective Optimization in Water Resources Systems: The Surrogate Worth Trade-Off Method, by Y. Y. Haimes, W. A. Hall and H. T. Freedman, Elsevier Scientific Publishing Company, The Netherlands, 1975; and one copy of the book, Hierarchical Analyses in Water Resources Systems, by Y. Y. Haimes, published by McGraw-Hill International Book Company, New York, 1977.

Reservations or requests for further information may be sent to Yacov Y. Haimes, Short Course Director, Systems Engineering Department, Case Western Reserve University, Cleveland, Ohio 44106; or call (216) 368-4076.

### THIRD MID-AMERICA ENVIRONMENTAL ENGINEERING DESIGN CONFERENCE

The Third Mid-America Environmental Engineering Conference will be held June 1-2, 1978 at the Adventureland Inn, Des Moines, Iowa. The topic for the first day will be The Design of Filtration Systems for Water and Wastewater Treatment, and the topic for the following day will be The Design of Sludge Processing Systems for Water and Wastewater Treatment. Co-sponsors of this Conference are the University of Iowa and Iowa State University.

Program topics will be both timely and useful to engineers and designers of water and wastewater treatment facilities. More specific program and conference details will be announced later.

For additional information, contact Stephen E. Jones at (515) 294-4975, or write 493 Town Engineering Building, Iowa State University, Ames, Iowa 50011.

### INTERNATIONAL SYMPOSIUM ON RISK & RELIABILITY IN WATER RESOURCES

Approximately 70 papers will be presented at the Waterloo Symposium to be held at the University of Waterloo, June 26-28, 1978. The themes of the papers are within the general topic of risk and reliability in water resources. Because of the importance of this topic in almost all fields of water resources, the paper presentations will be concerned with many interesting research studies. In particular, the major subdivisions of the paper presentations are: (1) distribution and analysis of extreme events and their influence on design; (2) use and development of stochastic, deterministic and hybrid models in risk and reliability analyses; (3) socio-economic and political considerations in risk and reliability; and (4) decision theory techniques for use in risk and reliability.

The Symposium should be of interest to consulting engineers, water quality scientists, hydrologists, hydraulics experts and other professional personnel.

A final circular that will outline the exact program, accommodations and registration will be available in April 1978. If you are not currently on the mailing list and you wish further information, please write to: Organizing Committee, International Symposium on Risk and Reliability in Water Resources, Department of Civil Engineering, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G1, or phone (519) 885-1211 and ask for Dr. Keith W. Hipel (Ext. 3113); Dr. E. A. McBean (Ext. 3349); or Dr. T. E. Unny (Ext. 2870).

#### WATER RESOURCES MANAGEMENT: A SYSTEMS APPROACH

A videotape course and workshop on the systems approach to water resources management will be held July 5-14, 1978 at Colorado State University. A 30-lecture, full color videotape course developed at CSU will be shown, with each lecture followed by discussion and workshop sessions using computer programs and numerical examples.

There are actually two courses available: Course A runs from July 5-7 and is oriented towards water managers interested in some of the broader aspects of systems analysis as applied to water management. Course B (July 5-14) includes the material from Course A, but delves more deeply into technical aspects and computer models.

The discussion and workshop leaders include Neil S. Grigg, Warren A. Hall, John W. Labadie, Robert A. Longenbaugh, and George L. Smith. The videotape course is available for purchase. For more information, contact the course manager: J. W. Labadie, Engineering Research Center, Colorado State University, Fort Collins, Colorado, 80523, Phone (303) 491-8596.

#### MANAGEMENT OF GROUNDWATER RESOURCES

A special two-week summer program is being offered by the Department of Civil Engineering at Massachusetts Institute of Technology to be held July 10-21, 1978.

The Program is designed for civil and agricultural engineers, geologists, hydrologists and planners.

Based on the underlying concepts of groundwater hydraulics, the program is directed toward the development of a conceptual model of the groundwater forecasting problem for water quantity and quality. Through numerical finite difference and finite element techniques this model is translated into expected effects, which are utilized in management models to suggest optimal decision strategies. Monitoring strategies and parameter identification are also examined.

For further information, please contact: Director of the Summer Session, Room E19-356, MIT, Cambridge, Massachusetts 02139.

### COMPUTER WORKSHOP IN STATISTICAL HYDROLOGY

A workshop on the use of computers and statistics in hydrology will be held July 17-21, 1978 at Colorado State University, Fort Collins, Colorado. The major objective of the workshop is to provide participants with statistical methods and procedures, as well as corresponding computer programs designed for the analysis and synthesis of hydrologic data. It is intended for hydrologists, hydraulic engineers, water resources specialists, engineers and scientists interested in using computer and statistical techniques in hydrology. Space is limited and advanced registration is suggested.

Lecturers are Vujica Yevjevich, John C. Schaake, Jr., Jack Delleur, Thomas E. Croley II, Jose D. Salas, Duane C. Boes and E. Benzedden.

For more information, contact the workshop coordinator: Jose D. Salas, Engineering Research Center, Colorado State University, Fort Collins, Colorado 80523, or phone (303) 491-8460.

### ENVIRONMENTAL CHEMISTRY-FATE MODELING

The American Society for Testing and Materials (ASTM) has recently initiated expanded activity in the area of environmental chemistry-fate modeling of new and expanded-use chemicals.

The overall objective of this expanded activity is to develop a mathematical model that can be used to provide the information needed by industry and governmental agencies to predict the environmental concentrations and the fate of new or expanded-use chemicals and their transformation products with a sufficient degree of reliability to determine whether any of them could accumulate in some part of the terrestrial or aquatic environment in sufficient concentrations to have an adverse effect on environmental quality and/or man.

A meeting of this ASTM section was held in Cleveland in early November 1977; the next meeting is scheduled for New Orleans, October 17-20, 1978.

Those interested in becoming involved in the ASTM activities devoted to environmental chemistry-fate modeling should contact Professor G. Fred Lee, Environmental Chemistry, The University of Dallas at Texas, Dallas, Texas.

### CALL FOR PAPERS: NATIONAL SYMPOSIUM

A symposium on Hydrometeorological and Climatological Characteristics of Precipitation: Excessives and Deficiencies will be held in conjunction with the National Fall Meeting of the American Geophysical Union in San Francisco, California, on December 4-8, 1978. The Conference is being arranged by the Precipitation Committee of the Section of Hydrology of AGU.

The symposium is planned as a forum for discussion of the hydro-meteorological and climatological characteristics of droughts and floods. The recent experiences of droughts and floods in the United States has emphasized the need for adequately describing and modeling such extreme hydrometeorological events.

The one-day symposium will include both invited and contributed papers. Only papers dealing with the hydrometeorological and climatological characteristics of extended dry and excessive precipitation occurrences will be considered for the symposium.

Authors should submit titles and abstracts (200 words) by August 1, 1978, to Dr. David M. Hershfield, Program Chairman, Hydrograph Laboratory, BARCW, Building 007, Beltsville, Maryland 20705. Authors will be notified by August 15 as to the selection of papers.

## PUBLICATIONS

### USGS 1977 YEARBOOK AVAILABLE

A yearbook providing a comprehensive description of the accomplishments of the U.S. Geological Survey during fiscal year 1977 is available for purchase by the public.

The 229-page well illustrated report summarizes the progress of the federal government's principal earth science agency in such activities as: identifying the nation's land, water, energy, and mineral resources; classifying federally owned mineral land and water power sites; regulating the exploration and development of energy and mineral resources on federal lands, including the Outer Continental Shelf (OCS); exploring and appraising the petroleum potential of the National Petroleum Reserve in Alaska; developing methods to delineate and mitigate hazards associated with earthquakes, volcanic eruptions, landslides, land subsidence, and floods.

As a report to Congress and the public, the Yearbook also includes a series of "Perspectives"--concise earth science essays which address national issues. Subjects covered by Perspectives include: river quality assessment, radioactive waste disposal, shut-in wells on the OCS, volcanic monitoring, planetary exploration, and submarine landslides.

Copies of "United States Geological Survey Yearbook Fiscal Year 1977" may be purchased from the USGS Branch of Distribution, 1200 South Eads Street, Arlington, Virginia 22202, for \$4.75 per copy (prepaid; checks or money orders payable to the U.S. Geological Survey).

### PROFESSIONAL ENGINEER (CIVIL) STATE BOARD EXAMINATION REVIEW

A group of practicing professional engineers has collaborated to provide this review and guide to solving practical problems for those preparing to take State Professional Civil Engineering Examinations. The book covers eight major subject areas ranging from Sanitary and Environmental Engineering to Hydraulics. Each subject area includes a primer on the subject and a large number of problems and solutions typical of those found on examinations.

The book is intended for aspiring registrants, practicing engineers and students. The large number of practical problems should be of potential value for use in Civil Engineering Curricula.

(Ed. by Murland R. Packer. ARCO Publishing Company Inc., New York, New York 1977. 752 pages. \$15.00).

### WATER RESOURCE FILM AVAILABLE

A color sound motion picture on water resource investigations has been produced for the U.S. Geological Survey, Department of the Interior, and is now available for public viewing.

The 28-minute film explains how the USGS, the nation's largest water resources investigating agency, appraises the quantity, quality, distribution, and occurrence of surface and groundwater.

The film focuses on how the USGS, through its Water Resources Division, monitors and evaluates water resources through a nationwide hydrologic network, and how such data and research are used by local, state, and federal agencies to help solve a wide range of complex water problems.

The subjects discussed and visualized include techniques for monitoring and analyzing water supplies, droughts, flood-mapping, underground waste disposal problems, water use and consumption, and the need for water to meet a variety of industrial, domestic and agricultural demands.

The film, titled "The Subject of Water," is expected to be useful to educational, institutional, industrial, and other groups with special interests in environmental and natural resource activities. The film was produced for the USGS by Jerry Warner and Associates, Westlake Village, California. Copies of the film may be obtained on loan for viewing by contacting the U.S. Geological Survey's Branch of Visual Services, 303 National Center, Reston, Virginia 22092.

## POSITIONS AVAILABLE

### CAREER OPPORTUNITY

The University of Wyoming announces an opening for an Aquatic Biologist with the Water Resources Research Institute. The responsibilities of this position include continuation of ongoing research projects in the areas of instream flow requirements for salmonids and the impacts of surface mining on aquatic habitat and biota. The incumbent will also be expected to develop new research programs in the field of aquatic biology.

The position requires an M.S. degree, minimum, with a Ph.D. preferred (major emphasis in aquatic ecology or fisheries biology, minor emphasis in hydrology or water resource management). Salary competitive and negotiable, dependent upon education and experience. Successful applicant will be selected by April 15, 1978, with employment starting July 1, 1978.

Individuals who wish to be considered for this position should submit a letter of application, vitae, undergraduate and graduate transcripts, an example of scientific writing ability (e.g. reprints of published journal articles, etc.), and three letters of recommendation to: Paul A. Rechard, Director, Water Resources Research Institute, University of Wyoming, P.O. Box 3067, University Station, Laramie, Wyoming 82071.

### ENVIRONMENTAL ENGINEERING/WATER RESOURCES

Three faculty positions at ranks through full Professor are available at Wayne State University depending upon qualifications. Candidates should possess background in one or more of the following: waste water treatment, industrial waste treatment, water quality, water resources and solid waste disposal. A Ph.D. and at least one degree in Civil Engineering is required. A BSCE is preferred. Undergraduate and graduate teaching is included. Development of externally funded research programs is essential.

Interested persons should send resumes to: John H. Lamb, Chairman, Department of Civil Engineering, Wayne State University, 667 Merrick, Detroit, Michigan 48202. Wayne State University is an Equal Opportunity/Affirmative Action Employer.

### DIRECTOR, STATE OF WASHINGTON WATER RESEARCH CENTER

There is an immediate opening for the position of Director, State of Washington Water Research Center. The Center is a joint entity of the University of Washington and Washington State University and is located on the Washington State University campus in Pullman, Washington. The Director is responsible for the program of the Center. The focus of the Center's activities is on state and regional water resources problems with funding derived largely from federal and state agencies.



The Director is a faculty member of Washington State University and holds an appropriate rank in a department or program of his or her professional discipline. A Ph.D. in a relevant discipline is required. Candidates must have significant experience of demonstrated technical competence and administrative ability in an area related to water resources. Five years or more experience is preferred. Salary is open depending upon qualifications and experience.

Recommendations, applications, requests for detailed position description and all inquiries should be sent to: C. J. Nyman, Dean, The Graduate School, Washington State University, Pullman, Washington 99164. A completed application must include a resume of education and professional experience and the names of three references.

Washington State University is an Equal Opportunity/Affirmative Action Employer. Women, minorities and handicapped are encouraged to apply.

#### DIRECTOR SOUGHT FOR DWQRC

Florida International University is seeking a Director for the Drinking Water Quality Research Center (DWQRC). The Director will be responsible for planning, organizing and supervising DWQRC personnel and laboratories to accomplish its objectives of water-related research, education and service.

The Director should be a recognized leader in an appropriate academic discipline; have participated in related research endeavors; have appropriate administrative experience; be able to represent the Center and the University during interactions with the community, governmental agencies, granting agencies, private businesses, industries, and the general public; and be able to provide dynamic leadership for the current research level and future growth. Academic qualifications should enable a concurrent tenure earning appointment as an associate or full professor in the College of Arts and Sciences or the School of Technology. This is a 12-month appointment with salary up to \$35,000 depending on experience and qualifications. The position is available July 1, 1978.

Inquiries, nominations and applications should be forwarded by May 1, 1978 to: Dr. Robert W. Ellis, Jr., Dean, School of Technology, Florida International University, Miami, Florida 33199.

Florida International University is an Equal Opportunity/Affirmative Action Employer.

#### RESEARCH ASSISTANT PROFESSOR

The Department of Civil Engineering at the University of Washington announces an opening for a Research Assistant Professor to be filled by October 1, 1978. The person selected will conduct research in the general area of water resources engineering with emphasis on combining stochastic hydrology and optimum reservoir operation and design techniques. Skills in network design and advanced time series analysis methods with applications to environmental assessment are desired.

The position will also involve assisting in supervising graduate students and serving on student committees. The initial appointment and re-appointment will depend on research fund generation.

Interested applicants should send resume, undergraduate and graduate transcripts, three references and details of research interests by May 1, 1978 to: Stephen J. Burges, Associate Professor of Civil Engineering, FX-10, University of Washington, Seattle, Washington 98195.

The University of Washington is an Affirmative Action, Equal Opportunity Employer.

#### ASSISTANT PROFESSOR OPENING

The Department of Environmental Sciences and Engineering of the University of North Carolina at Chapel Hill has an opening in Water Resources Engineering for a faculty member at the Assistant Professor level. Applicants should have a Ph.D. in applied fluid mechanics and be interested in research and graduate teaching in flow phenomena pertinent to water supply, water and wastewater treatment, wastewater discharge, or natural aquatic systems.

Vitae, references and pertinent publications should be sent to: Dr. Philip C. Singer, Department of Environmental Sciences and Engineering, School of Public Health, 201H, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27514.

The University of North Carolina is an Equal Opportunity/Affirmative Action Employer.

#### SABBATICAL RESEARCH OPPORTUNITIES IN HYDROLOGY AND WATER RESOURCES

The USDA-ARS Hydrograph Laboratory provides opportunities for faculty members to spend their sabbatical leaves conducting full-time research in hydrology and water resources. The Hydrograph Laboratory is located at the Agricultural Research Center in Beltsville, Maryland. The Lab has excellent computer and library facilities and is located in the Washington, D.C. area near many other federal and educational institutions involved in water resources.

The areas of study that would complement the Lab's ongoing program include general hydrology, hydrologic modeling, non-point source pollution, soil physics, groundwater hydrology, applied meteorology, remote sensing, and reservoir sedimentation. Under certain conditions, the Hydrograph Lab can possibly pay travel expenses and part or full salary.

Those interested in this opportunity who would like more information, please contact: Dr. Edwin T. Engman, Chief, USDA-ARS, Hydrograph Laboratory, Room 139, Building 007, BARC-West, Beltsville, Maryland 20705.

## RESEARCH REVIEW

PROJECT TITLE: Evaluate Hydrologic Effects of Implementing Various Levels of Control on Irrigation Activities

PRINCIPLE INVESTIGATOR: Marvin V. Damm  
Associate Professor, Department of Civil Engineering  
Research Associate, Nebraska Water Resources Center  
University of Nebraska - Lincoln

It has been recognized for a number of years that groundwater levels are declining at a significant rate in several areas of Nebraska. Because of this fact and the recognition of the importance of groundwater to Nebraska, the Legislature established the Nebraska Ground Water Management Act (L.B. 577) in 1975. This legislation provides an administrative mechanism for protecting the available groundwater supplies from excessive usage. The Act provides for the establishment of a "control area" in any area where "there is an inadequate groundwater supply to meet present or reasonably foreseeable needs for beneficial use of such water supply." Once a control area has been established there are several types of regulations on groundwater usage that may be instituted. They are:

- (a) Specification of the permissible groundwater withdrawal and allocation of such withdrawal among users in the control area;
- (b) Rotation of use of groundwater;
- (c) Adoption of more restrictive well-spacing requirements than specified in other legislation;
- (d) Adoption of other reasonable regulations; and
- (e) Closing portions or all of the area to issuance of well permits (therefore, effectively placing a moratorium on new well construction in the area.)

As of the date of this writing, two areas of Nebraska have been designated as control areas. They are within the Upper Republican and Upper Big Blue Natural Resources Districts. These districts are currently formulating rules and regulations related to the use of groundwater in their areas.

The purpose of the current research is to determine the hydrologic effects associated with control (a), above. A measure of the hydrologic effects can be represented by the differences between groundwater level elevations that would result over a number of years of operating with the controls in comparison with that expected without controls. In order to estimate the future water levels, use will be made of computer models and projections of expected land use.

Because of surface runoff, the use of water by plants, evaporation, geologic factors, and other considerations, the inputs of water at the land surface do not necessarily appear as recharge to the groundwater body from which wells pump water. Therefore, a model (a computer program) is being developed to account for the additions and depletions of water

between the land surface zone and the groundwater body. This model will provide the necessary water recharge inputs to an existing groundwater model. A sequence of irrigation development for a test area will be selected by judgement. The computer models along with the judgemental development sequence will then provide estimated future groundwater level elevations for different allocation specifications. The future hydrologic responses will be determined for the following: (a) no regulation of groundwater withdrawals, (b) a high allocation level, and (c) a substantial reduction in groundwater allocation. Comparisons of the reduced allocation groundwater elevations with that calculated for the no-control program will provide a first step in evaluating the hydrologic implications of the Ground Water Management Act.

Work on this phase of the project is scheduled for completion in June 1978. In order to study the hydrologic implications of the remaining control options included in the Act, additional research efforts are being proposed for fiscal year 1978-79.

#### NEWSLETTER ITEMS SOLICITED

The Water Current Newsletter will publish, without charge, announcements, programs for up-coming conferences, employment opportunities or other newsworthy items on hydrology, water resources or related topics. We will be happy to help advertise any water-related job openings in this newsletter. Please send any job openings you would like to have published to the editor, and we will see that they are advertised.

#### QUESTIONS AND INQUIRIES

Newsletter items and inquiries should be sent to: Editor, Nebraska Water Resources Center, 310 Ag. Hall - 7C, University of Nebraska - East Campus, Lincoln, Nebraska 68583; or phone (402) 472-3307.