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Water Current

Millard W. Hall, Director
Volume 10, Number 3

Karen E. Stork, Editor
May/June 1978

FROM THE DESK OF THE DIRECTOR . . .

The following is an excerpt of testimony presented by Millard W. Hall, Director of the Nebraska Water Resources Center, at legislative authorization hearings on water resources research conducted by the Subcommittee on Water and Power Resources of the House Committee on Interior and Insular Affairs on April 6, 1978 and at hearings conducted by the Subcommittee on Water Resources of the Senate Committee on Environment and Public Works, April 7, 1978, Washington, D. C.

Many times I have been questioned about what the Office of Water Research and Technology (OWRT) program has produced and what it has meant to the states and to the nation. In considering this, I decided to outline what this program has meant to Nebraska, in the hope that I could illustrate what I consider to be its very favorable positive results.

The Nebraska Water Resources Center began its efforts in 1965 with the \$100,000 per year state institute funding authorized under P. L. 88-379, and one project. Essentially, there was no office and no staff, as the program was administered on a part-time basis by an existing agency. Today the Water Resources Center is a separate agency with eight full-time professional staff members and appropriate technical and clerical support. It currently administers 25 projects having a total annual budget of approximately \$1.7 million. These projects are funded from more than a dozen sources including OWRT, the Old West Regional Commission, the Environmental Protection Agency, the U.S. Bureau of Reclamation, the Nebraska Natural Resources Commission and private concerns. In addition, the Center Director is responsible for the administration of the water-related research projects of the Nebraska Agricultural Experiment Station--some 20 projects with a net annual budget of approximately \$1.5 million.

The mission of the Nebraska Water Resources Center is to foster, coordinate, administer and conduct research, information dissemination, educational and training activities which are responsive to the water resources needs of Nebraska, the surrounding region and the nation. Its major role is in catalytic coordination--to stimulate and guide the efforts of those with interests and responsibilities in water resources research and education and to assist them



in building stronger programs. As such, the Center works with all federal water agencies in the region, with state and local water agencies, with all branches of the University of Nebraska, with other institutions of higher education in the state, and with private interests.

The major thrust of the Center's current program is in the definition of water resources policy alternatives and the development of procedures and methodologies for facilitating decision making on these alternatives. Historically, the Center has played a major role with regard to development of the state's water resources policies and programs. It was involved as a member of the State Water Advisory Team in the effort that produced the state's 1971 Water Planning Framework Study. It was also involved directly in the 1975 "Level B" Planning Study of the Platte River, conducted by the state and the Missouri River Basin Planning Commission.

Center staff have been actively involved in the debate and deliberations concerning the National Water Policy Review. Testimony on aspects of this Review have been offered at various public hearings, and the Center was represented on two major national panels which critiqued the various Water Policy Review Task Force efforts. In addition, the Center was asked to review and comment on a National Water Research Policy Statement prepared by the Office of Science and Technology Policy.

The Center administers a number of efforts directly related to policy considerations. These include the development of surface and groundwater hydrologic models and economic models to be used by decision makers for evaluating alternative water policies, institutions, regulations and management options. The Center is also assisting the State Office of Planning and Programming in using these models to examine the hydrologic and economic effects of Nebraska's Groundwater Control Act.

A major effort is underway with regard to the mechanics and potential of artificial recharge of groundwater. Such information will be very beneficial to those debating the policy question of interbasin transfer of water. Another major study, this one relating to groundwater legislation and institutions in the Missouri River Basin states, is just beginning. This effort should have great impact on the ground water management policies and institutions of each of the Basin states, and indeed, of all states which have to deal with the problem of groundwater allocation.

A third area of technical endeavor is in irrigation scheduling and management. It has been shown that much of the water and energy currently being utilized in irrigation agriculture could be saved with more rigorous management procedures. (See Water Current March/April 1978.) This information is likely to have major impact on future decisions at the national, regional and state levels regarding the use of water for irrigation purposes.

The Center also is actively engaged in technology transfer and information dissemination efforts. These include seminars, institutes and workshops on water problems; speaking to farm groups, Natural Resources Districts and others interested in water resources; publication of various articles for popular use; serving on task forces for state and local agencies; and working with the

Nebraska Unicameral on proposed water-related legislation. A Water Resources Seminar series is conducted during the spring semester each year for students and other interested persons, and the proceedings of this seminar are widely distributed. Annually, the Center sponsors a two-day "Research Overview" outlining its research program. The Center also arranges, at appropriate times, a neutral setting wherein those with divergent views on the state's important water issues may come together and discuss their mutual concerns.

In the area of training, the Center recognizes the need for several kinds of individuals cognizant of water problems and their solutions. We have, of course, been concerned with students of water resources and have involved approximately 220 as research associates and assistants on our projects over the years. In addition, the Center has had a hand in the advanced training of more than 65 faculty members representing 25 departments, through their participation in our research and technology transfer programs. These persons have added materially to the expertise available for solving water resources problems in Nebraska and the nation. Their interest and skill in water resources, in many cases, can be directly attributable to the OWRT program. Furthermore, we have contributed to elevating the technical competence and expertise of countless decision makers in Nebraska who are involved in water resources issues.

All of the activities outlined above are illustrations of the Nebraska Water Resources Center's efforts in meeting water resources research and educational needs. It is expected that these and similar efforts will produce significant payoffs of several kinds, including new knowledge, improved resource management, a strengthened economic base for the state and region, and more comprehensive and equitable state and national water policies.

ON THE HOMEFRONT

JOB OPENINGS

The Nebraska Water Resources Center announces an opening for the position of Water Scientist, available immediately. This is a full-time permanent, non-tenure leading, managerial-professional position.

The person selected will perform independent studies and research as well as provide technical, coordinative and administrative assistance to water-related projects administered by the Center. This will include, but not be limited to, the collection, compilation and analysis of various forms of data; the preparation of research proposals and written reports; the writing of computer programs; and representing the Center at both formal and informal meetings related to the research, training and technology transfer functions of the Center.

Qualified candidates must possess a M.S. degree in either agricultural or civil engineering or related field, or a B.S. degree plus experience related to job responsibilities. Applicants should demonstrate training or experience in one or more of the following areas: (1) hydrology; (2) water quality; (3) water resources management; (4) technology transfer; (5) water resources engineering; (6) water resources development; (7) water resources planning;

(8) water resources data; (9) water resources economics; and (10) water resources policy, laws and institutions. Candidates should possess good written and verbal communication skills.

Interested applicants should send a resume along with the names of three references to: Millard W. Hall, Director, Nebraska Water Resources Center, 310 Agricultural Hall, University of Nebraska, Lincoln, Nebraska 68583. Telephone (402) 472-3305.

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

GRANTSMANSHIP TRAINING PROGRAM PLANNED

The Nebraska Water Resources Center will sponsor a Grantsmanship Training Workshop the week of September 18-22, 1978. The workshop will be taught by a member of the staff of the Grantsmanship Center in Los Angeles.

The Grantsmanship Center is a nonprofit educational organization dedicated to furthering the art of grantsmanship. Since its inception in 1972, it has trained over 5,000 persons in the techniques of grantsmanship, and these alumni have attributed over \$100,000,000 in new grants for their organizations directly to this program. Although the majority of participants have come from nonprofit organizations, there has been considerable representation from state and federal agencies as well as foundation executives.

The week-long workshop will focus on three major areas: (1) program planning; (2) the translation of project goals into funding proposals; and (3) locating and approaching government and private funding sources. The program planning and proposal writing guide which the Center has developed has been adopted by scores of agencies and funding sources, and its circulation now exceeds 250,000 copies.

The tuition for this workshop will be \$325, payable to the Grantsmanship Center. For additional information, please contact Don Wilhite, Nebraska Water Resources Center, (402) 472-3805.

DEE CREEK PROJECT FUNDED

The Water Resources Center has received funding for a continuation of the "Water Quality Study of Runoff from Agricultural Lands (Dee Creek)" Project from the Environmental Protection Agency. This project has been ongoing since July 1974 with primary funding from the Old West Regional Commission. Other support has come from the Center, several federal agencies, the Nebraska Natural Resources Commission, the Lower Platte South NRD and the departments of Civil and Agricultural Engineering at the University of Nebraska. Funding from the Old West Regional Commission expired on July 31, 1977. The tentative starting date for the project has been set at July 1, 1978 with a completion date of September 1, 1979.

AREA OF EXCELLENCE REVIEW

The Review Committee for the Area of Excellence Program in Water Resources Management recently completed a two-day final review of the program. The visit included a review of six program areas of endeavor: (1) Hydrologic Systems Analysis, including groundwater management, artificial recharge, surface water development alternatives and basic data; (2) Water Use Efficiency, including irrigation efficiency and crop physiology; (3) Water Quality; (4) Drought Strategies; (5) Legal, Institutional and Social Considerations; and (6) Teaching and Training Programs.

This Area of Excellence program originally included funding for three University units -- The Water Resources Center, the Conservation and Survey Division and the Department of Agricultural Economics. Increased legislative appropriations for this program during the past year have now successfully integrated all the major components of the University's water resources management capability, through the addition of important positions which further enhanced this capability in Agronomy, Agricultural Engineering and the Water Resources Center. Fifteen of the 16 new positions created by this program have now been filled. A number of the persons in these positions have begun to demonstrate the additional quality and effectiveness brought to the University through this program.

For example, staff members associated directly with this Area of Excellence program have, in the past year, brought to the University more than \$350,000 in research funds from outside sources. These same persons have helped other staff in obtaining an additional \$750,000 in outside funding for research and extension efforts in water resources.

Such activities illustrate the importance of this program to the University's total effort in meeting the water resources management needs of the state, region and nation. It is expected that these efforts in research, extension and teaching will produce significant payoffs of several kinds including new knowledge, improved resource management and a strengthened economic base for the state.

ODGAARD NEW DIRECTOR OF NWRA

The Nebraska Water Resources Association (NWRA) has announced the hiring of Jack Odgaard, aide to U.S. Senator Carl Curtis, as its new executive director. It is anticipated that Odgaard will move from Washington to Lincoln by late August to assume his new duties.

It was also announced that Mrs. Pat Patitz, NWRA executive director for nearly two years, will remain on the staff.

NWRA is an organization of commercial, industrial, agricultural and individual interests promoting land and water resources conservation and development.

FEDERAL HIGHLIGHTS

NATIONAL WATER POLICY REVEALED

On June 6, 1978 President Carter delivered to Congress his long-awaited message on national water policy. His statement contains four initiatives designed to establish goals and a framework for water policy reform:

- (1) improve planning and efficient management of federal water resources programs to prevent waste and to permit necessary water projects which are cost-effective, safe and environmentally sound to move forward expeditiously;
- (2) provide a new, national emphasis on water conservation;
- (3) enhance federal-state cooperation and improved state water resources planning; and
- (4) increase attention to environmental quality.

None of the initiatives would impose any new federal regulatory program for water management.

Specific initiatives were recommended under each of the above four major areas. To improve federal water resources programs, the President's actions included:

- A directive to the Water Resources Council to improve implementation of the Principles and Standards. The basic objectives of national economic development and environmental quality would be retained and given equal emphasis. Their implementation would be improved by adding water conservation as a specific component of both the economic and environmental objectives and several other specific measures.
- Establishment of economic, conservation, safety, support, cost-sharing and environmental criteria for setting priorities each year among the water projects eligible for funding or authorization, which will form the basis of Presidential decisions on specific water projects.
- Preparation of a two-part legislative proposal for improving cost-sharing for water projects: (1) participation of states in the financing of federal water project construction--states would contribute 10 percent of the costs for project purposes with vendible outputs (such as water supply or hydroelectric power), and for project purposes without vendible outputs (such as flood control), the state financing share would be 5 percent; and (2) equalizing cost-sharing for structural and nonstructural flood control alternatives.
- Approval of and support for retaining the existing legislated discount rate formula.

In the area of water conservation, President Carter's initiatives included:

- Directives to all federal agencies with programs which affect water supply or consumption to encourage water conservation.
- A directive to the Secretary of the Interior to improve the implementation of irrigation repayment and water service contract procedures under existing authorities of the Bureau of Reclamation.
- Preparation of legislation to allow states the option of requiring higher prices for municipal and industrial water supplies from federal projects in order to promote conservation, provided that state revenue in excess of federal costs would be returned to municipalities or other public water supply entities for use in water conservation or rehabilitation of water supply systems.

On the subject of enhanced federal-state cooperation, the President's statement included:

- Proposing a substantial annual increase from \$3 million to \$25 million in the funding of state water planning under the existing 50%-50% matching program administered by the Water Resources Council. State water planning would integrate water management and implementation programs which emphasize water conservation and are tailored to each state's needs.
- Preparation of legislation to provide \$25 million annually in 50%-50% matching grant assistance to states, counties and cities to implement water conservation technical assistance programs. This program would be administered by the Water Resources Council in conjunction with matching grants for water resources planning.
- Working with state governors to create a task force of federal, state, county, city and other local officials to continue to address water-related problems.
- An instruction to federal agencies to work promptly and expeditiously to inventory and quantify federal reserved and Indian water rights.

Concerning environmental protection, President Carter's initiatives included:

- A directive to the Secretary of the Interior and other federal agency heads to implement vigorously the Fish and Wildlife Coordination Act, the Historic Preservation Act and other environmental statutes. Affected agencies will prepare reports on compliance with environmental statutes on a project-by-project basis for inclusion in annual submissions to the Office of Management and Budget.

- A directive to agency heads requiring them to include designated funds for environmental mitigation in water project appropriation requests to provide for concurrent and proportionate expenditure of mitigation funds.
- Accelerated implementation of the former Executive Order No. 11988 on flood plain management.
- A directive to several agency Secretaries to help reduce flood damages by acquisition of land and property.
- A directive to the Secretary of Agriculture to encourage more effective soil and water conservation through watershed programs of the Soil Conservation Service.
- A directive to federal agency heads to provide increased cooperation with states and leadership in maintaining instream flows and protecting groundwater through joint assessment of needs, increased assistance in the gathering and sharing of data, appropriate design and operation of federal water facilities, and other means.

A complete copy of the President's message on national water policy is available at the Water Resources Center, 310 Agricultural Hall, University of Nebraska, Lincoln, Nebraska 68583.

OWRT APPROPRIATIONS

The House Appropriations Subcommittee responsible for the Office of Water Research and Technology appropriations, recently completed its markup on this year's bill. Essential and important actions relating to university research programs included the following:

- (1) State Water Institutes (Annual Allotment) -- No change in amount requested, i.e., \$110,000 for each of the 54 Institutes.
- (2) State Water Institutes (Technology Transfer) -- The \$750,000 requested was deleted in its entirety.
- (3) Matching Grants -- The \$4,000,000 requested was changed to \$5,960,000, an increase of \$1,960,000. However, half of this amount will be opened up to private industry and consulting firms on a matching basis as well as universities.
- (4) Water Resources Research (Water Reuse Research and Water Resources Planning and Management Research) -- The \$3,200,000 requested was changed to \$2,800,000, a reduction of \$400,000.

The Senate Appropriations Subcommittee dealing with this matter has not yet met, but they are scheduled to take up this bill in approximately four weeks. After the Senate Appropriations Subcommittee has met, if their proposed bill differs from the House version, a Conference Committee of both House and Senate members will be formed to iron out the differences.

CONFERENCES

NATIONAL SPECIALTY CONFERENCE

The Water Resources Planning and Management Division and the Irrigation and Drainage Division of ASCE are jointly sponsoring a Specialty Conference with the theme "Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management. The conference will be held at Virginia Polytechnic Institute and State University in Blacksburg, Virginia, July 26-28, 1978, with the cooperation of the Virginia Water Resources Research Center.

Session topics will include: (1) 208 Studies: Institutional and Legal Constraints; (2) Water Law and Technology; (3) Institutions in Water Policy; (4) A View of Eastern Water Law; (5) Models as a Viable Management Tool; (6) Water Allocation and/or Water Use Efficiency; (7) Interesting Aspects of Western Water Law; (8) Legal Aspects of Conjunctive Use; (9) New Constraints on Irrigation and Drainage; (10) Institutions for Management; (11) Water Management in Developing Countries; (12) Water Law, Policy and the Federal Government; and (13) Water Resources Management.

Advanced registration fee is \$45 before July 1 and \$55 after July 1. Fee includes all conference sessions, refreshment breaks, and a copy of the published proceedings.

For additional information concerning the conference, contact Dr. William R. Walker, Director, Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, 617 North Main Street, Blacksburg, Virginia 24060. Telephone (703) 951-5624.

CONFERENCE ON HIGH PLAINS IRRIGATION

The Mid-Continent Research and Development Council will hold a conference on the "Impacts of High Plains Irrigation" at Colorado State University, Fort Collins, Colorado, August 10-11, 1978.

Emphasis at the conference will be on impacts of irrigation from groundwater in the High Plains. Attention will be given in the first session to the history of High Plains irrigation, including the impact of technology (particularly the center pivot system) and to the background of a proposed federal-state study of High Plains irrigation.

In the second session, emphasis will be on physical aspects, including the effects of pumping on groundwater levels, the legal restrictions to pumping, potential other supplies and the control of wind erosion.

The third session will include socio-economic and environmental aspects, including papers on energy economics, economic impacts of irrigation, sociological problems and environmental considerations.

A scenic tour of the East Slope facilities of the Colorado-Big Thompson Project will be conducted for those interested following the third session. Efforts will be made to accommodate families, with special provisions for wives and children during the conference and on the tour.

Registration fee for Members of Mid-Continent R&D prior to August 1 is \$50, and registration for non-members is \$55. After August 1, registration fees will increase \$5 for each category.

For further information, contact Victor A. Koelzer, Program Chairman, Department of Civil Engineering, Colorado State University, Fort Collins, Colorado 80521.

ASCE CALL FOR PAPERS

The Committee on Research and Information of the Water Resources Planning and Management Division of the American Society of Civil Engineers (ASCE) is sponsoring a session at the February 26-28, 1979 Specialty Conference in Houston. Persons interested in presenting papers on "The Optimal Structure of a National Water Resources Research Program" should submit abstracts of 250 words or less by August 19, 1978 to Dr. Gary L. Lewis, Water Resources Center, University of Nebraska, 310 Agricultural Hall, Lincoln, Nebraska 68583.

This session will consist of five or six papers dealing with the local, regional and national institutional structure of water resources research. At least one paper will describe the history of federal and other programs in research and will bring the audience up to date on the existing institutional research structure. The remaining papers will argue the ills and advantages of the existing structure, and each author will be asked to advance and discuss suggestions for improvements and efficiencies in developing water research programs which will provide timely and effective solutions to water issues.

Papers from members of other divisions of ASCE, and papers from non-members and non-engineers, are welcome.

A CALL FOR PAPERS

The American Water Works Association Research Foundation is organizing an International Water Reuse Symposium under the principal sponsorship of the Office of Water Research and Technology (U.S. Department of the Interior) and U.S. Army Medical BioEngineering Research and Development Laboratory. The Symposium will be held in Washington, D.C. March 25-29, 1979. With the theme of "Water Reuse - From Research to Application", it will be the first week-long effort devoted entirely to renovation and reuse of wastewaters. Subjects to be covered include pertinent case histories, new water recycling research and practical community applications. Selected papers will emphasize innovative approaches, new or unreported system design and performance data and future water reuse plans.

Technology transfer will be paramount from formal papers at plenary and concurrent sessions, sub-group workshops, and special poster presentations designed to optimize one-to-one communication.

The program is directed to individuals from water/wastewater utilities, consulting firms, federal and state research/regulatory agencies, research divisions of manufacturers, universities and other water research organizations. Interested authors are invited to submit qualification information and a detailed 500 word abstract of their papers by September 15, 1978 to: Richard D. Heaton, Conference Organizing Committee, AWWA Research Foundation, 6666 West Quincy Avenue, Denver, Colorado 80235, (303) 794-7711.

SYMPOSIUM ON ROLE OF GROUNDWATER SYSTEMS IN DROUGHT OF MID 70'S

A symposium on the role of groundwater systems in the drought of the mid 70's will be held as part of the Spring Annual meeting of the American Geophysical Union in April 1979. The Symposium is planned for a full-day session and is sponsored by the AGU Committee on Groundwater, Section of Hydrology.

The symposium program will direct its attention to the broad aspects of the role of groundwater systems in moderating the effects of the drought as well as the effects of the drought on groundwater systems. Emphasis will be placed on management aspects, short- and long-term hydrologic problems of local and regional nature associated with increased withdrawals, drought related mining of groundwater, changes in water quality, conflicts in water use, data needs, use of groundwater systems as alternate sources of supply, conjunctive use, and research related to these problems.

Papers for the symposium will be selected from contributors responding to this announcement. Contributors should submit a preliminary abstract of about 500 words to the symposium chairman by November 15, 1978. These abstracts will be used only for selection of papers for the symposium program, and authors will be notified in time to prepare official abstracts required by AGU. Preliminary abstracts should be submitted to: J.S. Rosenshein, U.S. Geological Survey, WRD, 1950 Avenue A--Campus West, University of Kansas, Lawrence, Kansas 66045.

PUBLICATIONS

WATER FOR ENERGY DEVELOPMENT

The case-bound book entitled "Water for Energy Development" contains a 400-page collection of papers and discussions that were presented at a recent conference sponsored by the Engineering Foundation and the U.S. Water Resources Council. Copies are \$25 each, including postage and handling, and may be obtained from (prepayment is requested and checks should be made payable to Northwestern University): Dr. Raymond J. Krizek, Department of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Illinois 60201.

POSITIONS AVAILABLE

WRC SOLICITS NOMINATIONS FOR ONE-YEAR ASSIGNMENTS

The Water Resources Council (WRC) is soliciting nominations for two one-year assignments with the Council in Washington, D.C., in order to obtain skilled manpower on a short-term basis under the authority of the Intergovernmental Personnel Act. Work assignments will be in one or more areas of Council programs and at a level commensurate with the employee's experience and qualifications.

The following information concerning the IPA Program is provided for the benefit of universities which may be interested in nominating an employee for this assignment.

- For purposes of this program, State agency also means public and private institutions of higher education.
- An assignment solely for training is not intended. However, the gaining of experience and understanding of operations at a different level of government will undoubtedly improve the employee's effectiveness in his or her regular assignment.
- The employee selected, his or her agency, and the Council will be parties to a written agreement.
- The assignment must be agreed to by the employee.
- The assignment will be by detail, with the employee remaining on the rolls of the State agency during the term of the assignment.
- The employee is expected to return to his or her agency at the end of the assignment and will not be encouraged to seek employment in the Council or other Federal organizations.
- Full reimbursement of the employee's salary and benefits will be made to the State agency by the Council during the assignment on a monthly or quarterly basis, as desired. The State agency may wish to consider supplemental pay or a temporary raise for the employee during the assignment in consideration of the level of work to be performed during the assignment.
- The Council will make direct reimbursement or advance payment to the employee for his or her travel and expenses to and from the assignment including immediate family and transportation of household goods and personal effects with the proviso that the total weight of goods and effects allowed will be subject to negotiation. All official travel during the assignment will be paid by the Council.
- The employee must agree to serve the entire period of his or her assignment (1 year) unless the assignment is terminated for reasons beyond his or her control. Otherwise, the travel and moving expenses are recoverable as a debt due the United States, although the Council may waive the recovery if justified.

- Consistent with the terms of the agreement, the assignment may be terminated at any time at the option of the Council or the State agency.
- The Federal tort claims statute, other Federal tort liability statutes, and a number of provisions of law governing the ethical and other conduct of Federal employees, will apply to the State employee during the assignment.

Nominations should include in addition to a personal endorsement, a resume of the employee showing, as a minimum, current and past employment (stressing, for teaching assignments, how the particular discipline taught, e.g., economics, geography, etc, related to the water resources field), inclusive dates for each employment, duties and accomplishments in each employment, education, current salary, and any anticipated salary increases during the next year. Each State agency is requested to submit only one nomination.

Nominations should be submitted no later than July 12, 1978 to:
Gerald D. Seinwill, Deputy Director, U.S. Water Resources Council, Suite 800,
2120 "L" Street, N.W., Washington, D.C. 20037.

TEMPORARY OPENING FOR AQUATIC BIOLOGIST

The Department of Biology of the University of Nebraska at Omaha is seeking an assistant professor of biology. This is a one-year appointment for the nine-month academic year beginning August 23, 1978. Teaching responsibilities will probably include portions of limnology and general biology plus a seminar course in the candidate's specialty.

Qualifications include a Ph.D., aquatic biologist, and emphasis in phycology is desirable. Salary will be paid over twelve months and is dependent on training and experience.

A curriculum vitae and three letters of reference should be received no later than August 1, 1978. Interested applicants should send credentials to Dr. Richard H. Stasiak, Search Committee Chairman, Department of Biology, University of Nebraska at Omaha, Box 688, Omaha, Nebraska 68101.

The University of Nebraska at Omaha is an Equal Opportunity/Affirmative Action employer. Minority, female and handicapped applicants are invited to identify themselves.

POSITION IN SANITARY ENGINEERING

Iowa State University announces the availability of a 9-month or one-year visiting appointment in sanitary engineering at the Assistant, Associate, or full Professor level depending upon the individual's qualifications. The appointment would be for half-time teaching and half-time research. A post-doctoral appointment for a recent Ph.D. recipient with a thesis in some fundamental aspect of biological waste treatment will also be considered.

The teaching duties would include one graduate course in the Fundamentals of Biological Waste Treatment offered in the fall quarter, plus undergraduate courses in water and wastewater treatment and water and sewerage systems.

Interested individuals should submit resumes to: Dr. E.R. Baumann, 496 Town Engineering Building, Iowa State University, Ames, Iowa 50011, (515) 294-4975.

Iowa State University is an Equal Opportunities Employer.

JOB OPENING AT COLORADO STATE

Assistant, Associate or Full Professor: The Department of Earth Resources at Colorado State University is seeking a Ph.D. in Forest Hydrology, Watershed Science or related field for a teaching/research position in snow hydrology. The position is a full time academic faculty. Duties include undergraduate/graduate teaching, advising and research. Rank and salary commensurate with training and experience.

Interested applicants should send a complete resume, three letters of reference and other supporting materials by August 1, 1978 to: Dr. S.L. Ponce, Department of Earth Resources, Colorado State University, Fort Collins, Colorado 80523. Anticipated appointment date is August 20, 1978.

Colorado State University is an equal opportunity employer and complies with title IX requirements. Complaints should be filed with the office of Equal Opportunity, Student Services Building.

FACULTY POSITIONS IN ENVIRONMENTAL ENGINEERING

The Department of Civil and Environmental Engineering at Washington State University has two tenure track positions at assistant and associate professor levels, available in September, 1978. Both positions require teaching and research responsibilities in the area of water quality engineering. One position is in mathematical and physical modeling of aquatic and wastewater systems. Another position is in water and wastewater treatment. Preference will be given to candidates who in addition to the above-mentioned areas possess background in systems analysis, advanced treatment systems, land disposal and/or toxic materials, and have strong proven teaching and research capability or potential. Earned Ph.D. and B.S. degrees in engineering required.

Interested persons should send a current resume, a transcript of graduate and undergraduate courses taken, and four professional references (including names, titles, addresses, telephone numbers, etc.) to: Dr. Alan F. Babb, Department of Civil and Environmental Engineering, Washington State University, Pullman, Washington 99164, phone: (509) 335-4546.

Applications will be received through June 30, 1978, or until the positions are filled. An equal opportunity/affirmative action employer.

VISITING PROFESSOR (SEPTEMBER 1, 1978 to JUNE OR AUGUST 1979)

The Division of Environmental Engineering at Utah State University is seeking a visiting professor or a professor on sabbatical leave to assist with teaching and research during the coming academic year. A post-doctoral student would also be considered for the position.

The level of appointment will depend on the individual's qualifications. Responsibilities will include half-time teaching of graduate and some upper division undergraduate environmental engineering courses and half-time research on funded projects. The nature of the courses and research can be arranged to be compatible with the individual's interests and background.

Interested persons should send resumes to: Dr. James J. Reynolds, Head, Division of Environmental Engineering, UMC 41, Utah State University, Logan, Utah 84322. Telephone: (801) 752-4100 Extension 7744.

Utah State University is an equal opportunity employer.

ASSISTANT DIRECTOR FOR PUBLICATIONS

Virginia Water Resources Research Center at Virginia Polytechnic Institute and State University announces an opening for the position of Assistant Director for Publications.

The Assistant Director will be responsible for directing and implementing the total information dissemination program for the Virginia Water Resources Research Center. Specifically, he will identify clientele or targets to receive information, develop a comprehensive program for collecting and analyzing information relating to water resources problems in Virginia, evaluate the cost effectiveness of various techniques or combinations of techniques for reaching clientele, and coordinate the information program with the activities of the Extension Division and the VPI&SU Division of Information Services. The Assistant Director also will edit material prepared by other members of the Water Center staff.

A Master's or Ph.D. degree in journalism, with extensive experience and a proven work record in technical writing and some writing experience in the political, social, economic, and legal fields is required. Applicant must have the creative writing ability to determine the form that information must take to be easily understood and applied by various user groups. In addition, the applicant must be able to adapt research reports to the needs of users. Material must be prepared in a format that will facilitate its use in the resolution of complex water problems.

Faculty position. Rank and salary commensurate with formal training, experience, and expertise.

All applications and inquiries should be directed to: William R. Walker, Director, Water Resources Research Center, 617 North Main Street, Blacksburg, Virginia 24060. Written inquiries must be received by August 1, 1978.

An equal opportunity employer.

RESEARCH REVIEW

PROJECT TITLE: Region-Wide Irrigation Scheduling by Local Evapotranspiration Measurement

PRINCIPAL INVESTIGATOR: Walter L. Trimmer
Panhandle Station

Irrigation scheduling requires some sort of estimate of evapotranspiration (ET) to estimate the amount of water the crop has used. The measurements involved in the estimate are temperature, humidity, solar radiation, and wind and are used in the modified Penman equation to produce the estimate of ET. Since weather stations required for such information are both expensive to install and operate, it is a good idea to have as few as possible. This project is designed to determine the criteria to be used for spacing limitations, limits on how the information should be used, and expected errors from the instruments being used under ordinary conditions.

The first step was to establish three stations located about 50-60 miles apart in the Nebraska Panhandle at Scottsbluff, Sidney, and Alliance as control stations. A network of weather stations set up by various agencies is also available for comparison, but the level of skill in managing some of these stations make them questionable for comparison.

Comparing these three stations statistically with a paired t test showed about fifty percent confidence interval that the records were the same during the first year. While this may appear unacceptable at first sight, the three day averages would appear to be nearly interchangeable if used for most irrigation scheduling methods where other errors involved in measurement of irrigation water and soil moisture will be much larger and more significant.

The error analysis of the modified Penman equation involved using a sensitivity analysis of the various parameters used in the equation. A sensitivity analysis yields a coefficient that reflects the relative change of ET with a change in the parameter being tested for sensitivity. The result of the analysis show that ET is sensitive to wind and solar radiation, but also sensitive to maximum temperature. This would indicate some promise in developing a new ET estimator using primarily temperature and skirting the spacing problem of expensive weather stations.

More data will be collected and analyzed to see if the results of one year are repeatable. Also the information collected will be used as a basis to use other agencies' measurements to see how the ET varies over a very wide area. This analysis may produce the best results for comparing locations of ET measurements.

There are many questions that remain, however, such as expected error and distance effects that can change that assessment. There are errors in the estimate of ET, errors in the instruments that yield the estimate, and errors associated with moving the information off the local site. These combinations of errors may show it infeasible to use this information without significant backup at each location using the information.

It is apparent that the information can already be used with suitable back up for irrigation scheduling. What is not as readily apparent is that the back up measure themselves must be kept to a minimum if irrigation scheduling is to be widely accepted. This research will attempt to establish a concrete method of comparison between the conflicting requirements of the various methods.

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