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# Water Current

Conservation & Survey  
Division

NOV 6 1984

September/October 1984

University of Nebraska  
**DIRECTOR'S REPORT**

Over the past ten years Nebraska citizens have been concerned about declining water tables and more recently the increased detection of trace amounts of synthetic organic chemicals in groundwater. These concerns led to the need for additional research and education programs by the Institute of Agriculture and Natural Resources (IANR) at the University of Nebraska-Lincoln. It also became apparent that a policy on how IANR should address research and education needs was imperative. Thus, in 1977 the IANR Water Policy Committee was established to advise the Deans and Directors on IANR water programs.

The membership of the Committee is composed of heads of departments and directors of units in IANR having water-related programs. Members include: Vince Dreeszen, Conservation and Survey Division; Darrell Nelson, Agronomy; William Splinter, Agricultural Engineering; William Miller, Agricultural Economics; Norman Rosenberg, Agricultural Meteorology and Climatology; Gary Hergenrader, Forestry, Fisheries and Wildlife; Roger Gold, Environmental Programs; and William Powers, Water Resources Center (chairman).

Responsibilities of the Committee are: (1) to help focus goals and objectives for IANR water programs; (2) to recommend strategies to accomplish IANR goals and missions in the water area, including ways of funding IANR water programs; (3) to assist in coordination of IANR water programs; (4) to promote cooperation among IANR staff and with other agencies in the water area; (5) to suggest program needs and/or redirection for the future; and (6) to serve as a mechanism for providing input from IANR to the Nebraska Water Conference Council. More recently, the Committee has been asked to provide recommendations on needed groundwater quality programs.

This latter charge has involved coordinating the activities of the Nitrate Task Force and the Chemigation Task Force as well as recommending the appointment of other task forces. The Water Policy Committee has recently asked these two task forces to review the draft of the Nebraska Groundwater Protection Strategy and comment on how adoption of such a strategy would affect research and information needs from IANR.

To address the many water issues facing Nebraska and IANR, the meetings of the IANR Water Policy Committee have increased from three or four times a year to monthly. Persons with a topic or idea they believe the Committee should discuss are invited to contact the Director of the Water Resources Center.



NEBRASKA WATER RESOURCES CENTER



## 1984 IRRIGATION TOUR HIGHLIGHTS

Daniel Gibbs, Evanston, Illinois, joined over 200 others on the two-day 11th annual Nebraska Irrigation Tour. Boarding one of the two buses to begin the over 600-mile trip, Gibbs, a professor at DePaul University in Chicago, said, "I heard that if I wanted to learn about irrigation, I had to come to Nebraska."

The focus of the 1984 tour was on water resources in the Elkhorn, Loup and Platte River basins and the three new irrigation projects proposed using Platte River water. The tour was sponsored by the Nebraska Water Conference Council and the Institute of Agriculture and Natural Resources at the University of Nebraska-Lincoln. Tour coordinator was Leslie Sheffield, extension farm management specialist at UNL, and Michael Jess, director of the Nebraska Department of Water Resources, was tour chairman.

At the first stop, General Manager Donald E. Schaufelberger, Nebraska Public Power District headquarters, Columbus, told the group, "Water is the life-blood of agriculture in Nebraska. Some of our state's farmers depend upon NPPD for water to irrigate about 45,000 acres."

Officials of the Loup River Public Power District explained district operations and hydroelectric power. "For the past ten years, 90 percent of homes and commercial buildings in Columbus have been built with electric heat and cooling that helps balance out loads. We have the highest concentration of electric heat of any place in the state," Max Kiburz, LPD general manager, said.

Construction on the Calamus Dam and Reservoir, canal and siphon, near Burwell, which will deliver water to the North Loup Irrigation Project, was explained by Bob Kutz, manager, Nebraska-Kansas Projects Office, U.S. Bureau of Reclamation, Grand Island. "This project is 70 percent completed with one more reservoir to add," Kutz noted. "At 1984 prices, the value on the project is \$314 million with a completion date projected to 1991."

The highest ranking Republic member of the House Appropriations Committee, Virginia Smith, Congresswoman from the Nebraska Third District, told the last-day luncheon audience, "Water is basic and what we do and how we preserve it is going to determine the future of our state." She pointed out that water problems compound as the U.S. uses 18 times the amount of water it did in 1900. She called water "more valuable than gold, oil or any mineral resource."

Also during the luncheon, Leslie F. Sheffield, extension economist-farm management specialist and vice president of the University of Nebraska Foundation, received the Bureau of Reclamation's Citizen award, the Bureau's highest award to a citizen.

The concluding visit to the Neil Grothen farm, Hastings, provided information about the irrigation efficiency contest conducted by the Adams County Extension Service, with the cooperation of the Soil Conservation Service, USDA, Upper Big Blue NRD, the Little Blue NRD and Hastings banks. In 1983 the Grothen farm won the gravity division irrigation efficiency award, and he has entries in the gravity and center-pivot contests this year. Grothen, who bested 15 contest entries, walked off with the \$1,000 first prize in the gated-pipe division by raising 172.5 bushels of corn per acre, using 4,572 gallons for each bushel. He pumped 18 acre-inches. Grothen said, "It wasn't the money that motivated me to enter this contest, but the opportunity to learn how to irrigate efficiently."

Other highlights of the trip included a tour of the Lindsay Manufacturing Company, Lindsay, and the Loup Public Power District's hydroelectric plant, visits to the Doug Thompson Wood River farm, the Ron Hargen farm at Cairo, and the Mormon Island "Crane Meadows" area and observation building constructed by the Platte River Habitat Trust.

Pat Larsen  
Public Information Specialist



## **WATER RESOURCES SEMINAR ANNOUNCED**

The topic for the 1985 Water Resources Seminar Series conducted by the Water Resources Center will be "ASPECTS OF GROUNDWATER QUALITY." The seminar series will be held on Wednesday afternoons at 3:30 p.m. in the EAST CAMPUS UNION beginning on January 16, 1985.

This topic is timely because of recent concerns stemming from the discovery of traces of synthetic organic chemicals in the state's groundwater. The Department of Environmental Control has also recently released a draft of a groundwater protection strategy for the state which has implications for groundwater users.

The Water Resources Seminar Series is offered through the Department of Forestry, Fisheries and Wildlife as FFW 415/815 and is cross listed as Natural Resources 415/815 as well as in the Departments of Geography and Geology (1 hour credit).

Seminar sessions are open to students, faculty and the public. A complete listing of seminar topics and speakers will be available in December.

## **BURLINGTON NORTHERN AWARDS GRANT**

A \$1 million grant from Burlington Northern Foundation in support of a five-year research project on irrigation resource management and groundwater protection in south central Nebraska was recently announced. The grant, through the University of Nebraska Foundation, is the largest single grant by Burlington Northern, and is the first major gift received for implementing recommendations by the Agriculture 2001 Committee appointed by the NU Board of Regents.

The project, to be conducted by the Environmental Programs Office, will be headed by Roger Gold, director of this office. The study is designed to assess the effects of agricultural chemicals leaching into groundwater through chemigation — the injection of chemicals through center-pivot irrigation systems. Focus of the study will be an 11-county area of south central Nebraska on both sides of the Platte River.

Gold said the interdisciplinary research and demonstration project will be centralized at the UNL South Central Extension and Research Center near Clay Center. A \$200,000 annual budget using the grant funds will be provided for personnel, operations, equipment and travel.

NU Foundation officials noted a conclusion of the Agriculture 2001 report that "irrigation is now, and will be over the next 20 years, the largest user of the state's water." The committee had urged improved management of Nebraska's irrigation systems to protect both the quantity and quality of water. Gold noted that fertilizer, insecticides and herbicides are being applied through an estimated 40 percent or more of Nebraska's 22,000-plus center-pivot irrigation systems. And the numbers of irrigators using chemigation are likely to increase.

"Chemical contamination of groundwater is a well-established fact," Gold said. "Non-agricultural chemicals are a key source in many areas of the nation." There is some evidence that groundwater contamination in Nebraska is agriculturally related.

An overall goal of the research project will be to maintain profitable and efficient crop production while preserving the quality of essential groundwater resources. Nitrate management, irrigation scheduling, conservation tillage and integrated pest management are among the best management practices that are being emphasized in this project.

Following are some questions the research project will attempt to answer:

- Are pesticides equally effective when applied by chemigation in comparison with conventional methods?
- How much dislodgeable pesticide residue is left by chemigation as compared to conventional application methods?
- How much chemical residue does chemigation leave on or in the grain as compared to conventional methods?
- What is the impact of chemigation on wildlife and other non-target species?
- What can be done to compensate for the increased potential for leaching in chemigation as compared to conventional methods?
- Is the technology developed and implemented in the nitrogen and irrigation management programs transferable to other soil types?

Pat Larsen  
Public Information Specialist



## DEC GROUNDWATER STRATEGY

A groundwater protection strategy that would emphasize prevention of pollution and create a state "superfund" to finance the cleanup of aquifers was recently released by the state Department of Environmental Control (DEC).

Because the state's groundwater quality remains relatively high and because of the extreme expense of restoring a polluted aquifer, DEC's strategy is based on prevention. According to the strategy, prevention will be achieved by registration of pollution sources — fuel storage tanks, pesticide users, solid waste sites and industrial sites — and monitoring of those sites through inspections and testing. If pollution should occur, the strategy would establish liability and restoration requirements.

The proposal would study the health effects of nitrate pollution and how to prevent further contamination by fertilizers. Nitrates are the most widespread pollutant of Nebraska's groundwater. Areas particularly susceptible to groundwater pollution, because of soil types, agricultural activity or waste sites, or which need to be closely monitored to protect drinking water supplies, would be included in the strategy's "Intensive Groundwater Quality Protection Areas" (IPA's). The IPA's could be designated by the state Environmental Control Council and operated by local entities (such as natural resources districts) to protect groundwater quality much the same way that NRD's now operate protection areas for groundwater quantity.

DEC plans to discuss the strategy in a series of meetings this fall and will hear from the public before the final strategy is drafted. The Institute of Agriculture and Natural Resources Water Policy Committee at UNL is presently examining research and educational needs to assist DEC in the implementation of the strategy.

## CONGRESS PASSES H.R. 71

The U.S. House of Representatives recently approved and sent to President Reagan for his signature legislation sponsored by Rep. Douglas Bereuter (R-Neb) to provide \$20.5 million for development of groundwater supplies in Nebraska and other Great Plains states.

The Senate has already approved the legislation which authorizes \$500,000 for a one-year study of technology that can be used to recharge groundwater supplies. Once that study is completed, the Bureau of Reclamation will be authorized to spend \$20 million on 21 projects demonstrating the technology involved in groundwater recharge.

Bereuter expects at least one and possibly two of the demonstration projects to be in Nebraska. The legislation authorizes expenditures over five years.

Bereuter's staff visited with a number of University and Water Center personnel in preparing this legislation.

## NATIONAL WATER RESOURCES RESEARCH CONFERENCE

A National Conference on Water Resources Research will be held February 4-6, 1985 at the National 4-H Center in Chevy Chase, Maryland. The conference is sponsored by the Universities Council on Water Resources and organized by a planning committee composed of a number of universities and water agencies, with the assistance of the UNL Water Resources Center. The objectives of the conference are: (1) to seek a renewed effort to re-establish a national water resources research agenda; (2) to re-state research priorities; and (3) to develop alternative working arrangements of the research community, including federal, state, university and private sector interests.

A working conference is planned with active participation by attendees. Draft papers on the conference topics will be prepared and distributed in workbooks prior to the conference. These papers will provide the basis for conference workshops and discussions.

Registration for the conference is \$35. To obtain a copy of the conference program and registration form, contact the Nebraska Water Resources Center, 310 Agricultural Hall, University of Nebraska, Lincoln, NE 68583-0710.



## RESEARCH REVIEW

Project Title: *Groundwater Management Using Control Analysis and Multiple Objective Techniques*

Principal Investigator: *Jerald P. Dauer, Professor, Department of Mathematics and Statistics, UNL*

The problems associated with groundwater management are well known—land subsidence, salt water intrusion, reduced flow of surface streams, increased energy consumption, social and economic disruption. However, effective groundwater management requires technology that can aid in the analysis of the systems. This technology should provide a mechanism for comparing management alternatives, generate new control policies, and determine system structures that are optimal for specified management goals or objectives.

The overall objective of this project was to develop mathematical optimization techniques, theory and models which are applicable in the management of groundwater systems. The motivation for this research was to improve the analytical techniques that can be used in solving certain groundwater problems. A primary objective of the project was to analyze mathematical systems using a control theoretic approach and multiple-objective techniques.

The specific major accomplishments of the research are as follows:

(1) A multiple objective waste disposal model was developed and analyzed. The model is a modification of the single objective waste disposal model of Alley, Aguado and Remson. The solution structure was obtained using the method of constraints so that dual variables (shadow prices) are available with the solutions. This model proved to be significantly better for analyzing the system than previous models.

(2) An analysis of the objective space for a multiple objective linear program was completed with the development of an algorithm for determining the non-dominated objective values that are extreme points. Since not all extreme points (nor edges) of the constraint space map to extreme points (edges) of objective space, this algorithm analyzes a simpler structure than that analyzed by algorithms based on the extreme points of the constraint space. Thus, this technique proves to be very powerful in analyzing large, multi-objective systems.

(3) A number of questions arising in the design of state feedback controls for dynamical systems were answered. These results were algebraic in nature and included results on positive definite solutions to Lyapunov's equation and on the rotation of switching surfaces and attractive surfaces for min-max controls. Applications of these results to uncertain control systems were developed.

## CALL FOR PAPERS

"Clean Water Through Controlling Nonpoint Sources" is the theme of a National Conference on Nonpoint Source Pollution planned for May 19-23, 1985 in Kansas City, MO.

Papers are being sought for the following technical sessions on nonpoint sources: (1) Monitoring and Assessment Techniques; (2) Groundwater Quality; (3) Lake Quality; (4) Wet Weather Criteria and Standards; (5) Institutional/Financial Aspects; (6) Making Point/Nonpoint Source Abatement Tradeoffs; (7) Eutrophication and Nonpoint Source Control; and (8) Legal Aspects of Control.

Papers should contain information drawn from practical experience, including specifically designed and monitored demonstration projects. Speakers are encouraged to present technical information but should keep in mind the meeting is not a research conference. Only original, unpublished work is sought; substantial updating or synthesis of previous work is permissible.

Abstracts of 150 words or less are due by NOVEMBER 15, 1984. Papers, not to exceed 15 double-spaced pages, are due by March 15, 1985. Abstracts should be sent to the North American Lake Management Society, 1815 "H" Street, N.W., Suite 1000, Washington, D. C. 20006.



## MEETINGS AND CONFERENCES

- Nov. 11-16, 1984      Conference on "Groundwater Contamination" sponsored by the Engineering Foundation and co-sponsored by UCOWR will be held at Santa Barbara, CA. The conference fee, which includes registration, accommodations and meals from dinner on Sunday through lunch on Friday, is \$500 for single occupancy room. For further information, contact the Engineering Foundation, 345 East 47th St., New York, N.Y. 10017. Telephone: (212) 705-7835.
- Dec. 3-5, 1984      Short Course on "Ground Water and Unsaturated Zone Monitoring and Sampling" to be held in Phoenix, Arizona. Course fee is \$395 for NWWA members and \$445 for nonmembers. For additional information, contact Monitoring Short Course, National Water Well Assoc., 500 West Wilson Bridge Road, Worthington, OH 43085.
- Dec. 3-7, 1984      Annual Fall Meeting of American Geophysical Union will be held in San Francisco, CA. For complete program, contact Meetings, AGU, 2000 Florida Avenue, N.W., Washington, D. C. 20009.
- Dec. 10-11, 1984      National Symposium on Erosion and Soil Productivity to be held in New Orleans, Louisiana. Registration fee will be in the range of \$80-\$100. For additional information contact Erosion Symposium, American Society of Agricultural Engineers, 2950 Niles Road, St. Joseph, MI 49085-9659. Telephone: (616) 429-0300.
- May 26-30, 1985      International Conference on Food and Water with the theme "Water and Water Policy in World Food Supplies" will be held at Texas A&M University in College Station, TX. Four registration, lodging and meal plans are available. For additional information, contact Jack L. Cross, Program Coordinator, Int'l Conference on Food and Water, Texas A&M University, College Station, TX 77843.

## NEW BOOK AVAILABLE

*Water Management: Technology and Institutions*, by Warren Viessman, Jr. and Claire Welty, was recently published by Harper and Row. The book is designed for undergraduate and graduate studies as well as for professional use. *Water Management* combines the best elements of technology with the practical realities of contemporary political and social systems. The subject matter of the book is organized so that, with appropriate selection, it can be used for courses in: water resources engineering, planning and management; environmental science; natural resources management; geography; urban and regional planning; resource economics; earth sciences; and geology.

## PUBLICATIONS

The following publications have been received by the Water Resources Center during September and October 1984. They have been forwarded to C.Y. Thompson Library on UNL's East Campus for cataloging. Persons on campus may obtain the publications through UNL's library system. Others are encouraged to request copies they desire from the organization issuing the publication.

1. *Investigation of Strategies For Reducing Agricultural NonPoint Sources In The Chowan River Basin*, Project No. A-110-NC, Water Resources Institute of The University of North Carolina, 225 Page Hall, North Carolina State Univ., Box 7912, Raleigh, N.C. 27695-7912, September 1984.
2. *Groundwater Contamination* by the Geophysics Study Committee, Geophysics Research Forum, Commission on Physical Sciences, Mathematics and Resources, National Research Council, National Academy Press, Washington, D.C. 1984.



3. *Policies and Procedures for Land Treatment of Wastewater*, Report No. 1, Land Treatment Series, Project No. B-123-NC, Water Resources Research Institute of The University of North Carolina, 124 Riddick Building, North Carolina State Univ., Raleigh, N.C. 27650, August 1983.
4. *General Guidelines for Land Treatment of Wastewater*, Report No. 2, Land Treatment Series, Project No. B-123-NC, Water Resources Research Inst. of The University of North Carolina, 124 Riddick Bldg., North Carolina State Univ., Raleigh, N.C. 27650, August 1983.
5. *General Guidelines for Land Treatment of Sludge*, Report No. 3, Land Treatment Series, Project No. B-123-NC, Water Resources Research Inst. of The University of North Carolina, 124 Riddick Bldg., North Carolina State Univ., Raleigh, N.C. 27650, August 1983.
6. *General Guidelines for Subsurface Treatment of Wastewater*, Report No. 4, Land Treatment Series, Project No. B-123-NC, Water Resources Research Inst. of the University of North Carolina, 124 Riddick Bldg., North Carolina State Univ., Raleigh, N.C. 27650, August 1983.
7. *Application of Wastewater to Wetlands*, Report No. 5, Land Treatment Series, Project No. B-123-NC, Water Resources Research Inst. of The University of North Carolina, 124 Riddick Bldg., North Carolina State Univ., Raleigh, N.C., 27650, August 1983.
8. *An Integrated Methodology For Instream Flow Strategies*, Project No. A-130-NC, Dept. of Civil and Environmental Engineering, School of Engineering, Duke University, Water Resources Research Institute of The Univ. of North Carolina, Raleigh, N.C. 27695-7912, September 1984.
9. *Institutional Framework for Rural Water Supply in North Carolina, and Virginia*, Bulletin 142, Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, VA 24060.
10. *Effect of Length of Fallow Period on Water Storage and Drainage*, The Kansas Water Resources Research Institute, Kansas State University, Manhattan, Kansas 66506, August 1983.
11. *Quantity and Quality Considerations for Water Use Efficiency in Irrigation*, Department of Plant and Soil Sciences, Texas Tech University, Lubbock, TX, August, 1977.
12. *Problem Oriented Evaluation of Institutional Decision Making and Improvement of Models Used in Regional Urban Runoff Management Application to Indiana*, Water Resources Research Center, Purdue University, West Lafayette, IN, May 1984.
13. *Measured Evaporation in High Rainfall Areas*, Technical Report No. 156, Water Resources Research Center, University of Hawaii-Manoa, October 1983.
14. *Response of Algal Populations To Changes in Stream Water Quality*, Center for Coastal and Environmental Studies, Division of Water Resources, Rutgers - The State University, New Brunswick, N.J. 08903, February 1984.
15. *Floodplain Management: The TVA Experience*, December, 1983, Tennessee Valley Authority, Division of Economic and Community Development, Knoxville, Tennessee.
16. *Developing the Resource Potential of a Shallow Water Table*, Water Resources Center, University of California, 2102 Wickson Hall, Davis, CA 95616, August 1984.
17. *Environmental Effects of Land Use and Intensive Range Management: A Northern California Example*, Water Resources Center, University of California, Davis, CA 95616, July 1984.



## WATER CURRENT

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