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## Water Current, Volume 23, June 1991

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# Water Current

Water Center

University of Nebraska

June 1991

## NGF Awards Received by Spaldings at Banquet

The Nebraska Groundwater Foundation, a nonprofit educational foundation, celebrated its sixth anniversary in March with several activities during Nebraska Groundwater Week to promote appreciation of Nebraska's groundwater.

Among them was the annual awards banquet that gave special recognition of contributions to groundwater conservation. The Maurice Kremer Groundwater Achievement Award for 1991 went to Ralph Marlette, a hydrologist and researcher. He taught civil engineering at the University of Nebraska-Lincoln for 39 years.

Hydraulics, groundwater hydrology, and river engineering were included in his class offerings.

His former engineering students staff consulting firms, academic institutions and government agencies in natural resources. "Professor Marlette, a man whose legacy lies in his ability to not only educate, but inspire," was chosen by NGF to receive its highest honor, the Maurice Kremer Groundwater Achievement Award.

### Special Merit Awards

Special Merit Awards were received by Mary Exner Spalding of the UNL Conservation and Survey Division, and Roy Spalding, associate director of the Water Center.

Mary Spalding was cited for "an increased understanding about the process of contamination and levels of concern about groundwater protection statewide." Her nitrate levels research in the Platte Valley was an "excellent example" of this.

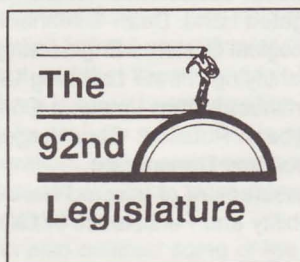
Roy Spalding was chosen because of his research that has contributed to groundwater quality knowledge.

Examples of his recent research include the Burlington Chemigation Project, Vadose Zone Studies, and the Management System Evaluation Area (MSEA).

## Water-Related Action in the 1991 Session of the Nebraska Legislature

by Bob Kuzelka  
Assistant Director, Water Center

105 bills and six resolutions mentioning water have been introduced in the first session of the 92nd Nebraska Legislature. Fewer than that number relate directly to water policy and many fewer will pass and actually set water policy for the State of Nebraska.



At this writing, three water-related bills have gone through all the steps to become law three months after the legislature adjourns, projected to be in early June.

The most interesting of these three enacted bills is LB 772 which eliminates the Water Management Board and the Water Management Fund and repeals the Water Project Revenue Bonding Act.

Another special merit recipient was Congressman Doug Bereuter, for his leadership that has enabled small Nebraska communities to have new groundwater supplies when their wells became contaminated.

During Nebraska Groundwater Week, the Groundwater Foundation promotes activities, including the awards banquet, in appreciation of Nebraska's groundwater heritage. This nonprofit educational foundation is dedicated to educating Nebraskans about groundwater and sponsors Nebraska Groundwater Week that includes a Children's Water Festival for fourth, fifth, and sixth graders. □

These entities were created in 1984 upon the recommendations of a special task force created by Governor Kerrey. Losing them, especially the Water Management Board, leaves some questions about how future water policy in the state will be established. In the next issue of *Water Current* there will be an indepth article on this legislation.

The other two enacted bills are LB 277 which allows permits for release of water for instream recreation or fish and wildlife purposes and LB 278 which causes the applicant to pay for public notice costs in certain types of Department of Water Resources hearings.

### Legislative Framework

The one adopted resolution, LR 27, is confirmation by the Legislature that state actions to date constitute a "legislative framework" for Nebraska waterways and water resources. Such confirmation may be of use in the considerations by the Federal Energy Regulatory Commission in relicensing Lake McConaughy and related facilities.

Four other water policy-related bills have made it out of committee and may have some chance of passage. Three have been designated priority bills. Such designation helps their chance of becoming law this session.

Priority Bill 511 originally was to authorize counties to zone protectively along rivers of their choice. After

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### A LOOK INSIDE

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## FROM THE DIRECTOR

# There's Good News and Bad News

The last few months have produced good news and bad news relative to water-related issues in Nebraska.

First the good news. I attended a highly successful Children's Groundwater Festival at Central Community College in Grand Island. This third annual Festival brought approximately 3,000 fourth, fifth and sixth graders from across the state to Grand Island to learn about our state's water resources in a fun, yet meaningful, way. Sponsored by the Nebraska Groundwater Foundation and supported by many citizens, the Festival points out how we can impact our future leaders on the importance of protecting our water resources. If asked, get involved—the day was long, but fun!

This year's Nebraska Water Conference, held in Kearney for the first time, focused on the river systems in Nebraska, and through an excellent series of presentations gave the audience an overview of our rivers and some details on problems and research now underway. The conference concluded with a lively discussion on uses of the Platte and Niobrara Rivers. Special thanks go to Les Sheffield and Bob Kuzelka for organizing the conference and attracting the outstanding set of presenters.

I was asked to give a talk to the Upper

Missouri United Chamber of Commerce in Niobrara several weeks ago and gladly made the trip to that beautiful part of the state. The Niobrara River itself is well worth seeing; however, the interactions with the community leaders was the highlight of the trip. It is good to discuss the concerns of the communities relative to preserving their water quality.

More good news was recently learned in that UNL faculty were successful in a national competition for United States Department of Agriculture water quality grants. We had three winners this year and in times of decreasing budgets the funds will help research programs. Titles and Principal Investigators of the winning proposals are:

1. Movement of Agricultural Chemicals Beneath Conservation Tilled-Furrow Irrigated Land: Dean Eisenhauer, Biological Systems Engineering
2. Quantifying Nitrate Leaching Under Continuous Corn Versus a Corn-Soybean Rotation: Gary Hergert, Agronomy Department
3. Measurement of Injected Herbicide Mobility and Persistence in Ground



Bob G. Volk

Water: Roy Spalding, Agronomy Department and the Water Center.

I have written before concerning the importance of the Nebraska Research Initiative and its positive effects on research related to water programs in Nebraska. Now that no expansion of funds appear available for the Initiative, we are going to have to work doubly hard to find ways to support water-related research.

Your comments are always welcome. □

## Bob Volk Receives Award

When Berlie Schmidt spoke to the May 1 Water Resources Seminar (see story, page 6) he presented Water Center Director Bob Volk a special certificate of appreciation. Schmidt, of the Cooperative State Research Service (CSRS), U.S. Department of Agriculture, (USDA) said, "Dr. Volk provided a great contribution while he was in Washington, D.C. with the Water Quality Special Research Grant program."

The award read:

"The United States Department of Agriculture Cooperative State Research Service proudly presents to Bob Volk this certificate of appreciation for outstanding contributions, particularly the Water Quality Special Research Grant Program, July 1990. Signed: John Patrick Jordan, administrator, Cooperative State Research Service."

Volk, who became Water Center director August 1, 1990, came to the Center from Washington, D.C., where he had been on a temporary, one-year assignment with CSRS, USDA. He had been agronomy department chairman at the University of Missouri before his Washington, D.C. assignment.

## Water Topics Included in New Acquisitions

The Nebraska Water Sciences Research Initiative funding has provided the Water Center funds to enhance library holdings that include books and journals on water-related topics.

Acquisitions received between July 1, 1990 and May 1, 1991 include:

*Carolina Aquaculture News.*

*Aquaculture Advisory Service.*

*CO2 and Climate Change: Impacts on Agriculture: Assessing the Response of Agriculture to the Direct Effects of Increased CO2 and Climate Change.*

Compiled and Edited by M. J. Salinger et al.

*Cost-Benefit Analysis of Irrigation and Drought Proofing.* K. Puttaswamaiah.

*Practical Handbook of Ground-Water Monitoring.* Edited by David M. Nielsen.

*Biomarkers of Environmental Contamination.* Edited by John F. McCarthy, Lee R. Shugart.

*Coastal Alert: Ecosystems, Energy, and Offshore Oil Drilling.* Dwight Holing; Foreword by Ted Danson.

*Demanding Clean Food and Water: The Fight for a Basic Human Right.* Joan Goldstein.

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# All Wells in Basin Should Be Regulated

by Brad Rundquist,  
UNL Conservation and Survey Division

The way some areas of groundwater decline are managed in Nebraska should change because management of such areas does not address the whole groundwater basin, according to a University of Nebraska-Lincoln groundwater researcher.

Ralph K. Davis, speaking to about 150 groundwater scientists and policy experts during the 35th annual fall Midwest Groundwater Conference held in Lincoln, said because groundwater basins act as a unit, management efforts should be aimed at the entire basin, not just the areas experiencing the most decline.

Davis, former manager of the Big Bend Groundwater Management District in Kansas and a graduate student with the UNL geology department, said that typically, management agencies erect an artificial boundary around areas of significant decline and regulate the wells only within that enclosed zone.

But he said research that he and Darryll T. Pederson, research hydrogeologist with the Conservation and Survey Division, Institute of Agriculture and Natural Resources, and UNL professor of geology, have conducted over the past several years has shown that wells outside the zones affect decline within the zone as well.

"Regulating part of the basin helps," Davis said, "but it won't solve the problem. All the wells in a basin that is experiencing decline should be regulated."

Pederson and Davis based their opinion on the circular-island concept, which states that groundwater decline will first be experienced in the center of an island, regardless of the locations of the wells.

## Researchers Modify Concept

They modified that concept to apply to areas of Nebraska and Kansas that are experiencing groundwater-level declines. The center of the island, they said, corresponds to regional groundwater divides, or the areas located between regional rivers. Therefore, they said, the areas showing the greatest decline should be along the divides.

Areas in southwestern Nebraska and the Big Blue River Basin show radial patterns of decline, with the greatest decline along the divides and the least along the rivers.

Davis also presented data generated by a computer model used to

demonstrate their theory. The model showed that groundwater-level decline patterns are similar regardless of the location of the wells.

Davis spoke during the second concurrent session of the conference, which focused on computer applications to groundwater. Two general sessions were held, one on governmental roles in groundwater and another on chemical aspects of groundwater, as well as four concurrent sessions. The other concurrent sessions focused on geophysical applications to groundwater, geographic-information-system/remote-sensing applications to groundwater and the impact of climatic change on groundwater. Speakers came from 10 Midwestern states and from Washington, D.C.

## Keynote From CRS

Jeffrey A. Zinn, a specialist in natural resources policy with the Congressional Research Service in Washington, D.C., gave the keynote address.

In exploring, "Is there a federal groundwater policy?" Zinn said there is no explicit federal groundwater policy at present and that there shouldn't be.

"There is already coordination on many levels," he said. "This is an era of cooperation, and a new coordination mechanism would be more disruptive than helpful."

Zinn also outlined some of the 51 bills relating to groundwater that were in Congress, particularly the new farm bill. Gale Hutton, speaking about state and local government agencies' roles in groundwater, said the primary responsibility for groundwater protection should be vested at the state and local levels.

Hutton, chief of the Water Quality Division of the Nebraska Department of Environmental Control, said the state's responsibility should be to develop comprehensive groundwater-protection programs, to design and more stringently manage areas of high importance and vulnerability to pollution and to develop and coordinate mechanisms to make the most of state and local partnership in groundwater-protection strategies.

The federal government should work to develop new and innovative best management practices, develop sampling, production, and analysis protocols and work to create a national repository of groundwater information, he said.


# News to Use

The following are announcements, that may be of interest.

- Special Supplement "Facts and Figures about Nebraska Rivers," a special supplement for the 1991 Nebraska Water Conference, is available in a limited supply from the Conservation and Survey Division, University of Nebraska-Lincoln. Ray Bental, author of the supplement, is professor emeritus at the Conservation and Survey Division where he has reviewed and edited many publications on geology and water resources as a geohydrologist. Sixteen pages of narrative, 10 tables, and 26 plates, are included in this book from the Division at 113 Nebraska Hall, UNL, Lincoln, NE 68588-0517; phone: (402) 472-3471.
- Technical Report on Drought "Drought Management and Planning," edited by Donald A. Wilhite, Deborah A. Wood, and Paul A. Kay, (IDIC Technical Report Series 91-1, 1191), is available for \$20 from the International Drought Information Center, 241 L.W. Chase Hall, UNL, Lincoln, NE 68583-0728, (402) 472-3679. This book includes 30 papers by scientists and policy makers who attended a drought management and planning seminar in Denver in 1990.
- Demonstration Model Groundwater Flow Demonstration Models are available from the Biological Systems Engineering Department, UNL. This model is used to demonstrate groundwater movement. Several physical and chemical groundwater concepts are demonstrated by the model that is accompanied by a manual that demonstrates 28 concepts. Contact DeLynn R. Hay, 234 L.W. Chase Hall, Biological Systems Engineering, UNL, Lincoln, NE 68583-0726; phone (402) 472-1625 for more information.□

**Register for the 1991  
Nebraska Irrigation Tour  
with form on Page 11.**

**(See story on Page 8.)**

 (see page 8)



# Center Pivot Industry in

Five Nebraska firms that manufacture about 90 percent of the center pivots in the U.S., received 1991 Progress Awards at the 20th annual Nebraska Water Conference Council awards banquet held in Kearney recently. Two persons received awards for recognition of service.

Les Sheffield, secretary of the Nebraska Water Conference Council, said that there have been about 75 to 80 different U.S. firms located in several states which at one time or another since 1953 have manufactured center pivot irrigation systems, today only eight U.S. firms have an appreciable share of the total market.

Sheffield said, "According to a reliable source in the industry, the five major Nebraska center pivot firms also account for about 95 percent of the center pivot irrigation systems which are exported."

He reminisced that the industry dates back only to 1953 when the late Frank Zybach, the inventor obtained his patent in July, 1952, joined with A. E. Trowbridge, an automobile dealer in Columbus, to produce center pivots in a rented machine shop. Zybach lacked the capital needed for production, so in 1953, he sold 49 percent of the patent rights to Trowbridge for \$50,000.

The president of a small short-line manufacturing firm at Valley, Robert B. Daugherty, after hearing about Zybach's invention, negotiated an agreement in 1954 with Zybach and Trowbridge for manufacturing and sales rights that provided for royalty payments for each center pivot that was sold.

"Most irrigation farmers in the 1950s and 1960s believed that you had to have flat land with good deep soils to irrigate crops successfully, because that was the way it had been done for centuries," Sheffield said.

"And then, in the late 1960s, several innovative farmers and land owners in Holt County, Nebraska bought pivot systems for very sandy, shallow soils that were considered marginal cropland, not suitable for irrigation and this new concept of irrigation first began to be accepted."

In Holt County in 1988 there were 1,972 pivot systems and Nebraska had 27,617. Now Nebraska has more than any other state in the U.S., Sheffield reported.

## Awards

The Nebraska center pivot firms that received Progress Awards and special awards recipients are: (Top to Bottom) Lindsay Mfg. Co., Lindsay, NE., Robert Snoozy, vice president of marketing; Reinke Mfg. Co., Deshler, Ron Schardt, chairman; T-L Irrigation Co., Hastings, LeRoy Thom, president; Pioneer Irrigation Award, William E. Splinter, interim vice chancellor for research and graduate studies dean at the University of Nebraska-Lincoln; Lockwood Corporation, Gering, G. Dean Edwards, vice president of sales and marketing; Valmont Irrigation, Valley, James Eiting, vice president of marketing; past chair of Nebraska Water Conference Council, Frank Dragoun, general manager, Central Nebraska Public Power and Irrigation District, Holdrege.

(Photos by Mark Ashman, Kearney State College).

The annual Nebraska Water Conferences are co-sponsored by the Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, the University of Nebraska Water Center, and the Nebraska Water Conference Council.





# Nebraska Recognized with Awards

Although, Sheffield said, some rather U.S. firms entered the center pivot industry, either by acquiring a firm already manufacturing pivots, or starting from scratch, only a few have succeeded and survived. Among these firms were Beatrice Foods, Carborundum Corporation, FMC Corp., and Butler Manufacturing Co.

## Irrigation Researcher, Teacher, Administrator Receives Award

A native of North Platte who learned how to irrigate with a shovel to control irrigation water flows was awarded the 1991 Pioneer Irrigation Award by the Nebraska Water Conference Council at its annual awards banquet.

William E. Splinter, interim vice chancellor for research and dean of graduate studies at the University of Nebraska-Lincoln, received the award for his "exemplary leadership of irrigation-related research, teaching and extension programs while chair of the UNL Department of Agricultural Engineering."

Splinter, who was raised on an irrigated farm just west of North Platte, said 3-day 24-hour per day irrigation runs from the local irrigation district that delivered water to the family farm were not unusual.

"Despite all the manual labor favorable crop yields were made possible by irrigation.

"I never lost my appreciation for what irrigation means to both the viability of farming and also to the economy of Nebraska," Splinter said.

In one of the over 100 articles Splinter has authored, Splinter wrote in the June, 1976, *Scientific American*, "Traveling in orbit around the earth at an altitude of some 270 miles, the Skylab astronauts rotated their spacecraft to establish a bearing on one of their principal check points: a cluster of several hundred round green spots, each half a mile in diameter, arrayed in an orderly pattern on the earth's surface below them.

"What they were viewing was a dense concentration of circular irrigated fields in north-central Nebraska, a pattern easily

identified from space. What was being observed is perhaps the most significant mechanical innovation in agriculture since the replacement of draft animals by the tractor."

Splinter has served as a consultant in several foreign countries including the People's Republic of China, the Soviet Union, Southern Rhodesia, India, Australia, Israel and Morocco.

He was chair of the UNL Department of Agricultural Engineering from 1968 to 1988; from 1984 to 1988 he was the George Holmes Distinguished Professor. From 1972 to 1977, he chaired the Nebraska Water Conference Council's Conference Planning Committee.

Vince Dreeszen, UNL Conservation and Survey Division, and chair of the nominations and awards committee of the Nebraska Water Conference Council, presented the awards for the Council and the UNL Institute of Agriculture and Natural Resources.

# Water Quality Research Site in Nebraska Differs

John Schepers says the Nebraska Management System Evaluation Area (MSEA) at Shelton is different from the others in the President's Initiative on Enhancing Water Quality in Iowa, Minnesota, Missouri and Ohio.

He spoke at the 1991 Water Resources Seminar Series. Schepers, soil scientist, USDA-ARS, at the University of Nebraska-Lincoln agronomy department, said, "Soil, irrigation methods and cropping systems makes the Nebraska site unique." He said the goal of the Nebraska MSEA project is to develop new practices that are economically feasible and the producers will voluntarily adopt to reduce groundwater pollution. "If they were all the same we wouldn't need five sites," Schepers said. "Our strategy here is to say 'well, let's come up with some cropping systems and put these good management practices on the land'."

One of the most difficult challenges facing irrigated corn producers is to determine the appropriate fertilizer nitrogen (N) application rate, especially considering the possibility for N losses by leaching and volatilization before the crop can utilize the fertilizer. Schepers said the problem facing producers everywhere is basically one of synchronizing soil N availability from all N sources with crop N

needs. And we need to evaluate the impact of different systems on groundwater. "It takes a whole cadre of people to do these things," he said.

## MSEA Sites

"If you take a look at all five MSEA sites in general, they have a few things in common: the corn-soybean rotation, evaluation of groundwater, and the socio-economic impacts of alternative management systems, or the reasons why people do things. Each site has a different climate, different soils, and different irrigation," Schepers said.

Another Nebraska presenter, Mike Ellis, of the United States Geological Survey, said central Nebraska

groundwater has been contaminated from long-term use of agricultural chemicals. "The concentrations of agricultural chemicals in the groundwater represent a composite of past and present agricultural practices," Ellis said. He said the primary benefit from the MSEA project will be the establishment of a reliable hydrogeologic basis for the evaluation of the effectiveness of different water and chemical application techniques.

Another scientist at the seminar series, Bill Larson, research coordinator for all MSEA sites, and a soil scientist at the University of Minnesota, reported that all

➞ (see page 6)

## Water Quality Problems?

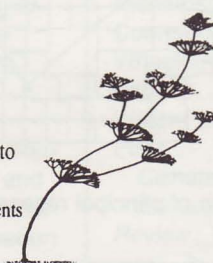
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MSEA sites will be compared: farm management systems between sites, movement of contaminants into the groundwater of each site, high-medium and low-input systems. All MSEA sites are a part of the Presidential Initiative that began in 1990 and will continue for about five years with federal funding of about \$45 million.

Additional seminar presenters were from other MSEA sites. "Farm Management Impacts on Ground and Surface Water Quality," sponsored by the Water Center, and coordinated by Roy Spalding, associate director of the Center, was the 1991 series and is presented each spring semester for class credit and is open to the public. 

## More Emphasis on Water Quality Research — Federal Official

Nebraska is a key state for studying impacts of agriculture on water quality, a U. S. Department of Agriculture soil scientist said.

"Particularly agriculture impacts as they relate to agricultural chemicals — fertilizers, herbicides and other pesticides in our groundwater," Berlie Schmidt, of the Cooperative State Research Service (CSRS), Washington, DC, said. He said it is very suitable that substantial water research be in Nebraska since the state is so dependent on the aquifer system and irrigation systems for agriculture.

"And it's suitable that Nebraska be a key state in terms of water quality research programs," Schmidt said. He said the Management Systems

Evaluation Area (MSEA) at Shelton in the Central Platte Valley, one of five sites in the United States, is important to "put all the pieces of best management practices together."

Schmidt spoke May 1 to the final session of the 1991 Water Resources Seminar Series, sponsored by the Water Center at the University of Nebraska—Lincoln, and coordinated by Roy Spalding, associate director of the Water Center.

Looking ahead to future federal government partnerships with state Agricultural Experiment Stations, land-grant universities and water quality research, Schmidt said the CSRS program has increased funding \$2 million a year for water research since President Bush's 1989 inauguration address. The President pledged federal support for research on water quality and Congress is "supportive."


### Agency Cooperation

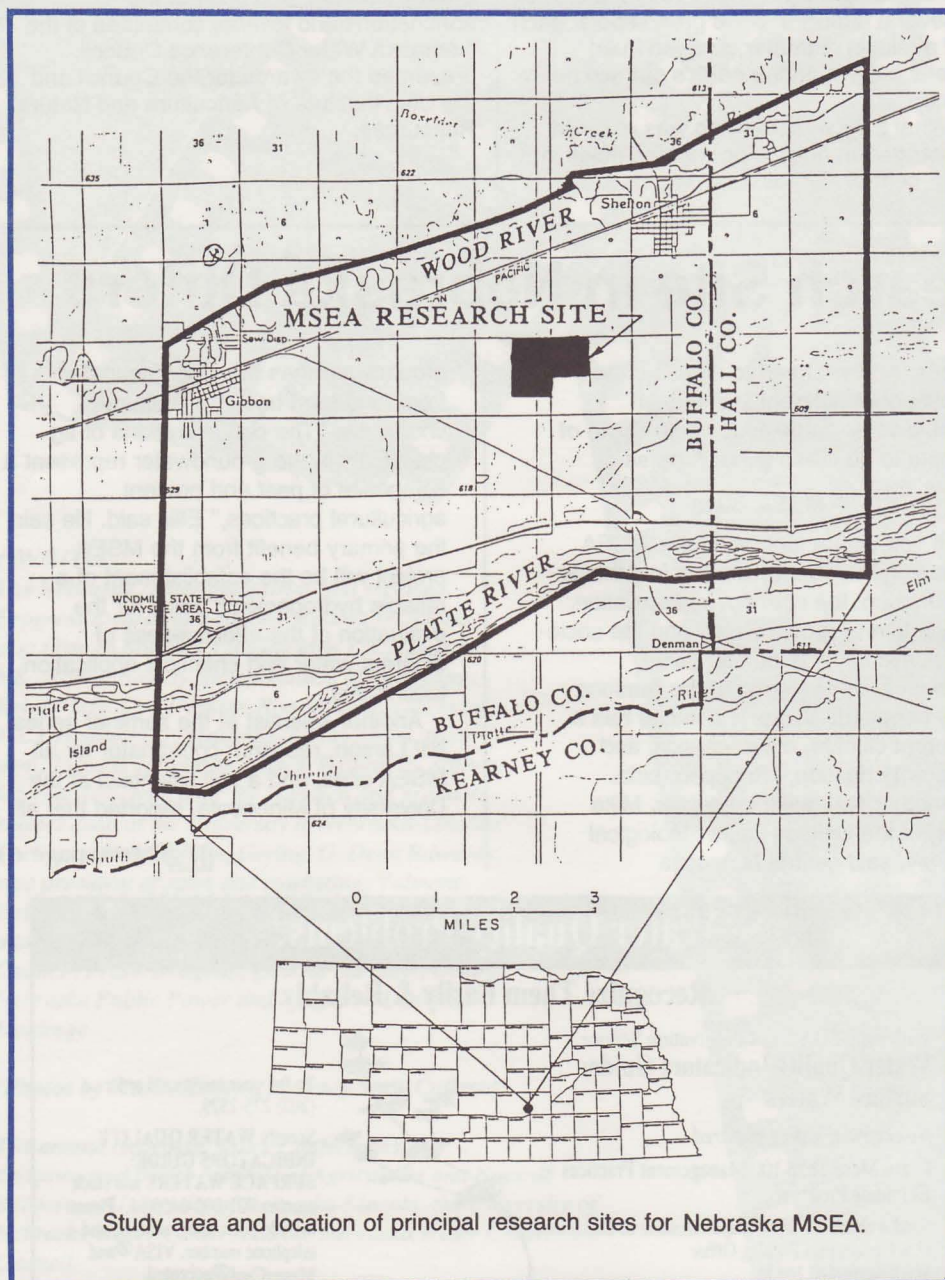
An example of cooperation between all agencies is two major categories of President Bush's Water Quality Initiative that hopefully will answer the question: Which farming practices can be profitable and still not threaten groundwater quality? Schmidt pinpointed the Nebraska MSEA site as pivotal to putting the puzzle pieces together.

"There's hardly an academic discipline that doesn't have a place when putting individual pieces of this puzzle together," Schmidt said. "Although the USDA was named the lead agency by the President to coordinate research for solving problems that are caused by agricultural production on groundwater and surface water quality, other agencies are cooperating. And states are coming together in a common effort to help solve groundwater pollution problems."

He said the USDA put together a research plan that included both priority component research, and a demonstration of agricultural systems' impact on groundwater quality, especially as potential pollutants, as they move down through the soil toward the aquifers. Another component of this research includes identification of families of agrichemicals that leach toward aquifers and confirming which management practices increase or decrease vertical movement of these chemicals.

"The second part of the research plan

 (see page 7)



Study area and location of principal research sites for Nebraska MSEA.



numerous amendments, it now gives the Natural Resources Commission the power to identify the river and methods of protection. This bill has advanced to the select file.

#### In Select File

Also in the select file is Priority Bill 413 which clarifies criminal penalty provisions in the Environmental Protection Act. In the general file is Priority Bill 338 which would provide cost share funds for groundwater quality projects undertaken by natural resources districts (NRD).

Not a priority bill, but still advancing, is LB 51 which is in final reading. It would establish consistency in the procedures for handling groundwater quality problems in Special Ground Water Protection Areas (SPA) and Ground Water Management Areas.

Other bills include LB 212 which authorizes a study of conjunctive and integrated use of ground and surface water. Such a study will likely be done by the Legislature's Natural Resources Commission during the interim with, or without the bill's passage. A bill which repeals NRDs' special taxing authority in

SPAs has been bracketed until January 1992.

A wide range of other water-related bills and resolutions are still in committee and will probably see no further action this session. If they are not killed, they will carry over for possible action in the

second session of the 92nd Nebraska Legislature which begins in January of 1992.

The next issue of *Water Current* will carry a summary of water-related actions by the Nebraska Legislature in the current session. □

is called the Midwest Initiative — a long-term, multi-agency program, and a pilot project to pull all components of research together to see how a total farming system operates and affects nutrients and pesticides getting into groundwater," Schmidt explained.

#### Water Quality Research

In 1990 CSRS funded 46 research grants in water quality, a program which began in 1989 with 23 grants. He said CSRS, Agricultural Research Service,

and Agricultural Experiment Stations cooperate in this research. In 1991, from 250 grant proposals, only 44 water quality grants will be funded and three of these will be awarded to Nebraska.

"We have to put a research program together to provide ways for producers to make a profit in agriculture, but to prevent the groundwater from being contaminated," Schmidt said. "We need a systems approach for this. That's really what the Midwest Water Quality Initiative is all about." □

*Dream: Analytical Groundwater Flow Programs.* Bernadine Bonn, Stewart Rounds.

*Drinking Water Microbiology: Progress and Recent Developments.* Gordon A. McFeters, Editor.

*Ground Water in Eastern, Central, and Southern Africa.* United Nations. Dept. of Technical Cooperation for Development.

*Hazardous Waste Minimization Handbook.* Thomas E. Higgins.

*Large-Scale Regional Water Resources Planning: The North Atlantic Regional Study.* By David C. Major and Harry E. Schwarz.

*The Long-Range Atmospheric Transport of Natural and Contaminant Substances: [Proceedings of the NATO Advanced Research Workshop on the Long-Range Atmospheric Transport of Natural and Contaminant Substances from Continent to Ocean and Continent to Continent. St. Georges, Bermuda, January 10-17, 1988].* Edited by Anthony H. Knap.

*NATO Advanced Research Workshop on the Long-Range Atmospheric Transport of Natural and Contaminant Substances from Continent to Ocean and Continent to Continent (1988: Saint*

*George, Bermuda Islands).*

*Management Systems to Reduce Impact of Nitrates.* Edited by J. C. Germon: Assisted by S. Dupain.

*Microbial Water Stress Physiology: Principles and Perspectives.* A. D. Brown.

*Microwave Remote Sensing for Oceanographic and Marine Weather Forecast Models.* Edited by Robin A. Vaughan.

*NATO Advanced Study Institute on Microwave Remote Sensing for Oceanographic and Marine Weather-Forecast Modules (1988: Dundee, Scotland).* Vaughan, R. A. (Robin Antony).

*Organic Acids in Aquatic Ecosystems: Report of the Oahlem Workshop on Organic Acids in Aquatic Ecosystems.* Berlin 1989, May 7-12. E. M. Perdue and E. T. Gjessing, Editors; Rapporteurs, W. H. Glaze et al. Dahlem Workshop on Organic Acids in Aquatic Ecosystems (1989: Berlin, Germany).

*The Rains Model of Acidification: Science and Strategies in Europe.* Edited by Joseph Alcamo, Roderick Shaw, and Leen Hordijk; with Support from National Environmental Protection Board, Sweden et al.

*River Pollution: An Ecological Perspective.* S. M. Haslam; Illustrated by Y. Bower.

*Structure and Function of Biofilms: Report of the Dahlem Workshop on structure and Function of Biofilms, Berlin, 1988, November 27-December 2.* W. G. Characklis and P. A. Wilderer, Editors. Dahlem Workshop on Structure and Function of Biofilms (1988: Berlin, Germany).

*Underground Storage Systems: Leak Detection and Monitoring.* Todd G. Schwendeman, H. Kendall Wilcox; Foreword by Rudolph C. White. *Watershed 89:*

*The Future for Water Quality in Europe: Proceedings of the IAWPRC Conference.* Held in Guildford, U.K., 17-20 April 1989. Editors D. Wheeler, M. Richardson, and J. Bridges. IWAPRC Conference (1989: Guildford, England). Wheeler, D., Richardson, Mervyn, Bridges, J. International Association on Water Pollution Research and Control. E. Price

*Climate Dynamics.* Vol. 5 (1990) only. *Environmental Impact Assessment Review.* □



"Somebody has got to grab the bull by the horns and assure that we have total coordination between all the different arms of federal government that now have some involvement in groundwater," he said. "My big fear is that if we're not awfully careful with all the actors, we're going to start stuttering; we're going to have some redundancy."

### Special Protection Areas

In the same session, Dick Ehrman of the Nebraska Department of Environmental Control talked about the status of Nebraska's Special Protection Areas.

The NDEC can declare an SPA if its studies of an area, done upon the request a local governmental agency, show that nonpoint-source pollution exists or is likely. If an SPA is declared, the local natural resources district must

implement best management practices and education programs to deal with the problem.

After three years of studies, Ehrman said he was able to make several observations concerning the SPA program.

He said the program has been successful in improving relations between the state and NRDs and making the people of Nebraska more aware of groundwater-quality problems.

But, he said, current levels of funding for the program do not allow for improvement of the program, such as the implementation of better study techniques. He also said the funding in scarcely-populated NRDs and the one-year time frame for SPA studies are inadequate.

The Midwest Groundwater Conference was set up in 1956 to promote the

exchange of ideas between state-supported groundwater professionals working in Midwestern states. This year's Midwest Groundwater Conference was sponsored by the Conservation and Survey Division, the University of Nebraska Water Center, and the Agriculture Research Division, all of the IANR; the UNL Department of Geology; the Nebraska Groundwater Foundation; and the Nebraska district office of the Water Resources Division of the U.S. Geological Survey.

The conference rotates among the states of North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Arkansas, Michigan, Wisconsin, Illinois, Indiana, Ohio and Kentucky. □

**(Editors note: Although this conference was last fall, we ran out of space in the last Water Current.)**

## Colorado, Wyoming, Nebraska Irrigation Tour Destinations

Management of the North and South Platte Rivers in Wyoming, Colorado and Nebraska is the focus for the 20th annual Nebraska Irrigation Tour July 22-26, according to the tour director.

Les Sheffield, University of Nebraska Extension farm management specialist, said, "We believe the 1991 tour will be the best tour ever because of the intense interest in water-use of these two rivers in the three states."

He said it's all new tour stops and the information provided on the tours will be "timely."

The tour goes all the way to the Alva B. Adams Tunnel and pumping plant where water is lifted over the Continental Divide to the East Slope of the Rocky Mountains with stops on the way that include:

- A luncheon presentation on "Current Status of FERC Relicensing of Hydro Plants" at the UNL West Central Research and Extension Center at North Platte;

- Lake McConaughy and Kingsley Dam and hydro plant;

- Lake Minatare and Lake Alice with narration about conflicts with Wyoming over the water supply;

- Tri-State Diversion Dam, Farmers Irrigation District, Scottsbluff;

- Bus narration of the Mitchell Canal Diversion structure on the Wyoming-Nebraska state line about National Guard mobilization in the 1930s after water was

diverted downstream in the North Platte River;

- Interstate Canal Diversion Dam in Wyoming;

- Narration about Laramie River Power Plant at Wheatland;

- Guernsey Dam and Reservoir near Guernsey, Wyo.;

- Glendo Dam and Reservoir in Wyoming;

- Bus narration while traveling in the Glenrock, Wyo., area about Wyoming-Nebraska dispute over water supply in the North Platte River;

- Alcova Dam and Reservoir and Pathfinder Dam and Reservoir;


- Seminole Dam and Reservoir

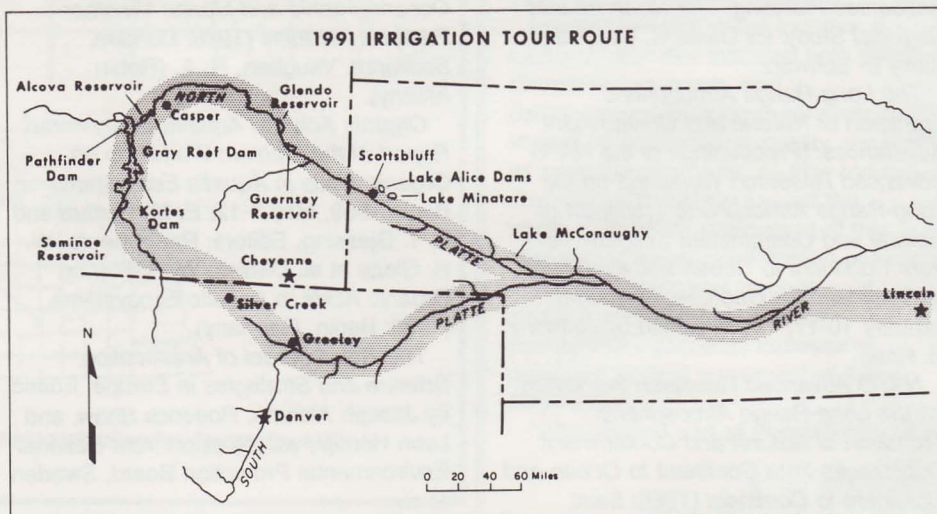
following lunch at scenic Miracle Mile near Kortess Dam in Wyoming;

- Lake Granby Pumping Plant that is operated 10 stories underground by Northern Colorado Water Conservancy District at Loveland, Colo.; and


- Rocky Mountain National Park with travel over scenic Trail Ridge Drive to Loveland, Colo. Bus narration will be about water diverted from the Western Slope to the eastern Slope, or agricultural vs urban water use.

Sheffield said this year's two tour buses are limited to 80 persons with registrations on a first-come first-served

 (see page 9)






(Colorado, Wyoming p. 8) 

basis. Registrations are due July 10 with a variety of options included. Buses will stop along the route to pick up participants and others may drive the route.

Dayle E. Williamson, Nebraska Natural Resources Commission, is the tour chairman. These tours are sponsored by the Nebraska Water Conference Council, the University of Nebraska Water Center, and the UNL Institute of Agriculture and Natural Resources.

See registration form on page 11.

Call Sheffield at (402) 472-1773 for more information. 

## Projects Funded Here With USGS Grants

The Water Center has announced awards for five research projects under the USGS, section 104, annual funding. Projects begin June 1, 1991 with a proposed completions date of May 31, 1992. Research and scientists are as follows:


"Identification and Assessment of Alternatives for Management of Reservoir Sedimentation," Rollin H. Hotchkiss;

"Anticholinesterase Insecticides in Groundwater: Immunologic

Consequences," George P. Casale;

"Characterization of Anisotropy of Hydraulic Conductivity in a Shallow Unconfined Aquifer under Irrigation by Pumping Test and Geophysical Methods," Vitaly Zlotnik;

"Biochemical Determinants of Pyrethroid Toxicity to Selected Aquatic Insects," Blair D. Siegfried; and

"Blocked End Furrow Irrigation Management Techniques," Joel Cahoon. 

## Nearly 4,500 Chemigation Applicators Certified in Two Years

Crop producer response and acceptance to mandatory certification of chemigation applicators have been excellent, according to state chemigation program specialists.

Training sessions for chemigators have been conducted by the University of Nebraska Cooperative Extension Service. In 1987, 90 training sessions were held and 4,193 chemigators were certified.

In 1988 at 16 sessions, 291 chemigators were additionally certified. A 50-question test follows the three-hour training with certification issued by the Nebraska DEC.

"Ninety-four percent of those taking the test have been certified for the four-year certificate period," Larry Schulze, UNL extension specialist-pesticide training, said.

"Nearly all chemigation has been with center pivot irrigation systems," Gary Buttermore, Nebraska Department of Environmental Control (DEC), said. He said more than a fourth of the 27,000 center pivots in Nebraska in 1987 received permits.

"There were a large number of new permits in 1988," he said, "due to changes in farmed acres because of farm programs, a general increase in compliance and crop changes."

Since LB 284, the Chemigation Act of 1986, became effective Jan. 1, 1986, all chemigators must be certified and their irrigation systems must be inspected by Natural Resources District for permits.

In 1987 there were 7,164 permits issued; in 1988, 1,501 new chemigation renewals, Buttermore reported.

Each chemigation system must be inspected before a new permit can be issued.

"However," he said, "there is no specific requirement for inspection of

renewals." So inspection programs vary considerably among Natural Resource Districts (NRDs), he said.

For example, the Upper Republican NRD inspected nearly all renewals while the Upper Niobrara-White didn't inspect renewals, but plans to inspect each system every other year.


Equipment problems have been noted, according to Buttermore.

"Chemical injection check valves have been the biggest problem," Buttermore said. He said that at a September conference of NRDs, concern was expressed that 90 percent of the systems inspected by the Upper Republican NRD had equipment problems. The injection check valve was often "fouled or not working properly and had to be cleaned, repaired or replaced."

Another problem reported is the failure of the low pressure drain to close. However, specific records haven't been kept from inspections to document equipment problems.

According to the 1988 renewal permit applications, fertilizer and 33 different pesticides were applied in 1987. Roughly 8 percent of the 7.9 million irrigated acres, or 647,000 acres, were chemigated in Nebraska, the Nebraska Department of Agriculture estimates. Buttermore cautions that these figures are the chemigators' best estimates of applications by chemigation in 1987 and are "simply a general idea of chemigation use."

Although a few violators have been discovered by aerial observation, previously permitted systems, spotting equipment from the road and observing chemical deliveries, inspection stickers provided by DEC assists some chemical

 (see page 10)

## York Recharge Project Dedicated by Dignitaries and Guests

The first of 21 projects in the U.S. of the High Plains Water Recharge demonstration project was dedicated May 3. This demonstration project legislation of 1983 was introduced by First District Rep. Doug Bereuter.

The \$1.93 million research project and recreational area has been operating since January and was open to the public March 1. The area will serve as a research center to recharge surface water into the aquifer beneath and will also be a natural educational field laboratory for area students, according to Bereuter.

The High Plains Ogallala Aquifer study showed that with no modification, groundwater practices in the area will expand and groundwater levels will continue to decline. Irrigation pumping for the past 34 years in the Big Blue basin has caused a 5 foot water level decline below the predevelopment water levels in this 1.73 million irrigated acres area, the study showed.


Bereuter said, "Groundwater management is a key of the new focus toward water conservation, water quality and environmental protection." Learning how to recharge the groundwater is an

important element of that emphasis, he said.

The three recharge methods tested in the York Groundwater Recharge Demonstration Project are:

Seepage from a reservoir with 310 acre-feet of permanent storage;

Seepage from two spreading basins; and

Direct injection into the aquifer through an injection well, after the water has been treated to drinking water quality at 100 gallons a minute. 



# Nitrate-Groundwater Contamination a Complicated Issue

(Courtesy of UNL Information Office)

There's an old story that, in the ecological picture, if you pull something here, then ultimately you affect something somewhere else.

Zoltan Kerekes, director of water quality for Omaha's Metropolitan Utilities District, used this explanation to explain the complexity of nitrate-groundwater contamination, which is a concern worldwide.

Kerekes was among the participants and observers at the North Atlantic Treaty Organization (NATO) Advanced Research Workshop on Nitrate Contamination of Groundwater, organized by the Water Center.

Its purpose was to bring together 46 researchers from 17 NATO and non-NATO countries, to present and discuss their work regarding nitrate contamination of groundwater. The concern over nitrate contamination stems from the fact that nitrates have been linked with infant methemoglobinemia, which depletes the infants' oxygen supply, and the possible formation of potent carcinogens in the digestive tract.

## Uniform Standards

In the final panel discussion, the scientists informally concurred that the 10 parts per million (or 50 milligrams per liter) standard adopted by the U.S. and most countries worldwide is a valid standard for the safe nitrate concentration level in water.

In the meantime, decision makers have to rely on formulas which incorporate available information with mathematical and decision-making models, including a model which considers the geophysical, human, and control systems as well as a model which incorporates uncertainties.

Michael Dourson, with the U.S. Environmental Protection Agency in Cincinnati, Ohio, defined a model based on an acceptable Reference Dose (RfD) and the No Observed Adverse Effect Level (NOAEL).

While there have been no good studies

or mathematical models that could be used to answer this question, Dourson said studies have shown that increased bacterial contamination seems to increase the probability of nitrate-related deaths when contamination is above the accepted standard. Medical scientists at the workshop explained that this could be because stomachs which are distressed by higher levels of bacteria produce more nitrates from the same amount of nitrates than do stomachs without the higher levels of bacteria.

Mathematical and other decision making models are used at all levels of dealing with the nitrate contamination issue, from the standards set by the Environmental Protection Agency to what type of treatment system should be used to remove nitrates from water supplies. Chemical precipitation, distillation, ion-exchange, reverse osmosis, electrodialysis, and biological denitrification were among the processes explained.

## Natural Methods

Also presented were natural means of removing nitrates, including the use of non agricultural (and thus non-fertilized) plantings in areas adjacent to stream and river banks. Louis Schipper, with the Forest Research Institute in Rotorua, New Zealand, said the conversion of nitrate to nitrogen gases by denitrification has been shown to be highly active in riparian (river-bank) zone organic soils. Utilizing the renovative capacity of these soils has tended to reduce nonpoint source nitrate pollution of streams and lakes.

U.S. communities facing nitrate contamination above the accepted level are required by EPA rules to provide bottled water to infants under six months of age and to comply with other guidelines, explained Tim Amsden with EPA's Region 7 office in Kansas City, Kansas. One of those guidelines is to study how nitrate contamination could be controlled at the site of a private well or municipal well.

## Guidelines Reviewed

While such guidelines indicate a well-structured system, it is one which is continually being reviewed, EPA officials indicated. European scientists commended the U.S. for its continued review of acceptable nitrate levels.

The growth of the nitrate problem in developing countries was also discussed.

The scientists acknowledged that as these countries increased use of agricultural fertilizers and other chemicals, nitrate levels in their water supplies also increased. However, they also noted that greater agricultural production was helping to reduce a greater risk in these countries—hunger.

"We need to put together the little pieces of knowledge to add to the great amount of uncertainty," said Andras Bardossy, the West Germany scientist who had presented the decision-making model which included uncertainty as a factor to be considered. □

## Vitamin C a Safeguard Against Nitrate-Related Cancer

(Courtesy of UNL Information Office)

Sidney Mirvish of the University of Nebraska's Eppley Institute for Cancer Research wasn't the first person to say that orange juice was good for you, but 18 years ago he headed a group which offered evidence that the vitamin C it contains can inhibit certain kinds of cancer.


Mirvish presented a paper at the North Atlantic Treaty Organization (NATO) Advanced Research Workshop where he detailed his methods for establishing the scope of vitamin C as a cancer inhibitor.

"Consumption of fresh fruits and vegetables, especially those with high vitamin C levels, is negatively correlated with the incidence of cancer of the stomach, esophagus, mouth, larynx and cervix," Mirvish said. "This suggests that these cancers are caused by N-nitroso compounds and that their formation is inhibited by vitamin C."

## Vitamin C Safeguard

Vitamin C could be a safeguard against cancer and other diseases associated with nitrate contamination of ground water, according to a British scientist speaking at the workshop. S. Leach of the PHLS-Centre for Applied Microbiology and Research, Porton Down, Salisbury, England, said he has also found vitamin C to be a safeguard against certain kinds of cancer.

"We have shown that vitamin C is a potent inhibitor," Leach said. "Thus the intake of this dietary constituent will be likely to protect against nitrosation reactions that result in N-nitroso compounds."

(Nearly 4,500 p. 9) 

dealers as they will not deliver to non-permitted chemigators.

In the past two years, five chemigation system accidents have been reported. "However, none have resulted in contamination of the water source," Buttermore said. □



**Tour Reply Form For 1991 Nebraska Irrigation Tour  
To Western Nebraska, Eastern Wyoming and Colorado  
July 22-26, 1991**

*Sponsored By*

**The Nebraska Water Conference Council**

**University of Nebraska—Lincoln Institute of Agriculture and Natural Resources**

**The University of Nebraska Water Center**

(Call 402-472-1773 or 402-472-1742 if you need information)

**Return Form To:**

Les Sheffield  
304-B Filley Hall  
University of Nebraska—Lincoln  
Lincoln, NE 68583-0922

- ☐ I plan to participate in the 1991 Nebraska Irrigation Tour
- ☐ I will ride on the buses and I will get on the bus at \_\_\_\_\_  
and I will get off the bus at \_\_\_\_\_.
- ☐ No, I will drive my own car and meet the Tour at \_\_\_\_\_  
and I will leave the Tour at \_\_\_\_\_.

**Please Check All Appropriate Boxes Below (Costs are on Per Person Basis):**

- ☐ Registration Fee to cover mailing costs, name tags, etc. \$ 10.00
- ☐ Chartered Bus Fee (To cover Bus Charter Costs) \$180.00

<b>Lodging Accommodations (Per Person Rates)</b>	<b>Single</b>	<b>King</b>	<b>Double</b>	
<input type="checkbox"/> Mon., July 22, Scottsbluff Inn, Scottsbluff	\$ 45.50	\$ 30.00	\$ 28.00	\$ _____
<input type="checkbox"/> Tues., July 23, Holiday Inn, Casper, WY	\$ 37.00	\$ 25.00	\$ 21.00	\$ _____
<input type="checkbox"/> Wed., July 24, The Inn, Silver Creek, CO	\$ 50.00	\$ 40.00	\$ 47.00	\$ _____
<input type="checkbox"/> Thur., July 25, Ramkota Inn, Greeley, CO	\$ 50.00	\$ 30.00	\$ 30.00	\$ _____
Subtotal, Lodging Accommodations	\$182.50	\$125.00	\$126.00	\$ _____
(If Double Room, I will share room with _____)				

**Meals During Tour: (Per Person Basis)**

- ☐ Mon., July 22, Orange Juice, Coffee & Doughnuts on Buses..... N.C.
- ☐ Mon., July 22, Lunch at UNL West Central Res. & Ext. Center, N.P..... \$ 6.50
- ☐ Mon., July 22, Dinner at Oregon Trail Wagon Train, Bayard, NE ..... \$ 17.00
- ☐ Tues., July 23, Breakfast at Scottsbluff Inn, Scottsbluff, NE ..... \$ 6.50
- ☐ Tues., July 23, Lunch at Morrill City Park, Morrill, NE ..... \$ 6.50
- ☐ Tues., July 23, Dinner at Holiday Inn, Casper, WY ..... \$ 16.00
- ☐ Wed., July 24, Breakfast at Holiday Inn, Casper, WY ..... \$ 7.00
- ☐ Wed., July 24, Box Lunch at Miracle Mile near Kortess Dam, WY ..... \$ 6.50
- ☐ Wed., July 24, Dinner at The Inn at Silver Creek, CO..... \$ 17.00
- ☐ Thur., July 25, Breakfast at The Inn at Silver Creek, CO ..... \$ 7.50
- ☐ Thur., July 25, Catered Lunch at Park in Big Thompson Canyon..... \$ 6.50
- ☐ Thur., July 25, Dinner at Best Western Ramkota Inn, Greeley, CO ..... \$ 17.00
- ☐ Fri., July 26, Breakfast at Best Western Ramkota Inn, Greeley, CO ..... \$ 7.50
- ☐ Fri., July 26, Lunch at Holiday Inn, North Platte, NE ..... \$ 8.00
- Subtotal, Meals During Tour..... \$129.00

**SUMMARY OF COSTS:**

- ☐ Full Tour, Ride on Buses, Single Room 1 Person \$502.00
- ☐ Full Tour, Ride on Buses, King Bed Room, 2 Persons, ea. \$444.50
- ☐ Full Tour, Ride on Buses, 2 Persons, 2 Beds \$445.59

**MAKE CHECKS PAYABLE TO: Nebraska Water Conference Council**

Enclosed is my check payable to the Nebr. Water Conf. Council for \$ \_\_\_\_\_

Name: \_\_\_\_\_ Mailing Address: \_\_\_\_\_

Title: \_\_\_\_\_ Firm or Agency: \_\_\_\_\_

Town: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

Office Phone: (\_\_\_\_\_) \_\_\_\_\_ Res. Phone: (\_\_\_\_\_) \_\_\_\_\_

Remarks or Special Requests: (Non smoking room etc.) \_\_\_\_\_







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