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The History of the UNL Water Center from 1964

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The History of the UNL
WATER CENTER

FROM 1964



UNIVERSITY OF NEBRASKA—LINCOLN

**WATER CENTER
SCHOOL OF NATURAL RESOURCES**

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Karen E. Stork
Steven W. Ress

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The History of the UNL

WATER CENTER

FROM 1964

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INTRODUCTION

Water is an integral part of Nebraska's economy and well being in a state that depends on an adequate supply for all uses, including agricultural, municipal, industrial, recreational and wildlife habitat.

Nebraska is fortunate with regard to its water supply, having tremendous groundwater reserves which are estimated to be in excess of two billion acre-feet (an acre-foot being enough water to cover one acre of land with a foot of water, or approximately 325,000 gallons), combined with an estimated annual precipitation of 86 million acre-feet and annual average surface water inflows of 1.7 million acre-feet, give the state adequate supplies of water.

Nebraska has enough groundwater to cover the state to a depth of nearly 40 feet. However, the distribution of these waters as well as economic and other constraints of water utilization, often leave Nebraskans with challenges that make planning and management decisions difficult.

Within this background, the University of Nebraska—Lincoln (UNL) Water Center has facilitated water-related research, trained the next generation of water scientists, lawyers, engineers, economists and managers and assisted in applying research to Nebraska's and the nation's water problems. A primary goal has been to use federal and state resources to coordinate and administer water-related activities within existing units of Nebraska's entire post-secondary educational system.

It has been said that we can't know where we're going until we understand where we've been, so as the Water Center looks to the future and observes its 40th anniversary, it is appropriate to review our beginnings. This report highlights the Water Center's contributions to Nebraska and the nation. It documents why the network of state water resources research institutes was created and reports on some major accomplishments and programs of the Water Center over the past 40 years.

*One note: Because the Water Center has had many different names over the years, it will be referred to as the "**Water Center**" throughout this publication, no matter what its official name was at the time.*

In the western states, *people's perception of water* and its importance is based at least as much on theology and philosophy as it is on hydrology or economics. I have tried to **understand why this is so**, and have concluded that it results, at least in part, from the enormous force, for better or for worse, that water represented in the **life of the early pioneers** and that it continues to be in the *life of Nebraskans today*. In a land where water is scarce, where a year or more may **pass without rain**, where fierce thunderstorms can produce flooded watercourses in a matter of minutes, where hailstones can flatten a year's work in seconds, and where *heat and wind* can suck moisture from the **land and its crops** almost as fast, people are forced to do a lot of **thinking and talking about water**.

Millard W. Hall
Preface to "The Summer in Rained"
1978



VICE CHANCELLOR COMMENTS

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EXECUTIVE SUMMARY

The importance of water to Nebraska and the nation was underscored in 1964 when the U.S. Congress passed the Water Resources Research Act. With this act, Congress pledged that we would always have “Water sufficient in quantity and quality to meet the requirements of an expanding population.”

To fulfill this pledge, Congress authorized creation of water resources research institutes in each state. All were typically established within major land-grant universities and their duties were spelled out in the Act, i.e., to “Conduct competent research, investigations, and experiments of either a basic or practical nature.” In short, the supply of research dollars depended on how well we tackled problems that were of immediate concern to Nebraska.

Through the years, the UNL Water Center has had different names, office locations and directors. However, since the beginning, three primary objectives have been its foundation:

- stimulate and coordinate research, training and educational water-related activities;
- train water scientists by associating students and faculty with water resources research projects, conduct seminars and promote interdisciplinary educational programs; and
- promote graduate education in water resources as a direct compliment to research.

The Platte River near Fremont, Nebraska.

A timeline of historic Water Center dates in the middle of this publication highlights important changes over the years.

Figure 1 shows relative levels of federal, state and other funding. Figure 2 indicates annual federal base grants to the State Water Resources Research Institutes in actual dollars, adjusted for inflation.

The first increase in state funding for the Water Center occurred when the 1975 Nebraska Unicameral made a formal designation of an Area of Excellence in Water Resources Management (WRAE). These funds expanded center activities through hiring additional faculty and staff, both inside and outside of the center.

In the 1990's the Nebraska Research Initiative (NRI) provided another funding increase. One of the project areas funded by NRI, and coordinated by the Water Center, was water science, and NRI funding for this program continued for 10 years. NRI Water Science program activities included: (1) developing a Water Science Laboratory; (2) providing matching or seed monies and support to faculty; (3) strengthening water science research capability through new faculty hires; and (4) purchasing scientific and support equipment to facilitate water sciences research.

The Water Resources Research Initiative (WRRRI) is the most recent complement to water programs at UNL. Begun in 2003, the WRRRI is a multidisciplinary and interdisciplinary collaborative effort that spans several UNL colleges and departments. WRRRI is co-led by Sherilyn Fritz (Geosciences), Sandra Zellmer (College of Law) and Ronald Yoder (Biological Systems Engineering). The initiative promotes greater collaboration among researchers and disciplinary areas and creates the synergy needed to support large-scale externally funded research. Eleven new water faculty have been hired through this initiative.



The Platte River near Bayard, Nebraska.

These and various other funding sources have provided an impetus for the beginning of many important research programs at the University of Nebraska through the years. Various research accomplishments are highlighted throughout this historical account.

Since its inception, the Water Center has been involved in a number of ongoing public service, education/training, and information activities. These

include the Water Current newsletter (in its 40th edition), the annual Nebraska Water Conference, the Spring Seminar Series, and the annual summer Water Tours.

Only funding and imagination may limit the future of the Water Center. The challenge remains to facilitate and coordinate both basic and applied research in the water sciences that will focus on current water issues to continue to benefit Nebraska, the region, and the nation.

Fulfilling a Pledge to Nebraska and the Nation

The importance of water to Nebraska and the nation was underscored in 1964 when the U.S. Congress passed the Water Resources Research Act. With this act, Congress pledged to the nation's citizens that we would always have "Water sufficient in quantity and quality to meet the requirements of an expanding population."

In order to fulfill this pledge, Congress authorized creation of water resources research institutes in each state. As with ours at UNL, all were typically set-up within major land-grant universities. The duty of each institute was spelled out in the Act, i.e., "Conduct competent research, investigations, and experiments of either a basic or practical nature." In short, the supply of research dollars depended on how well we tackled problems of immediate concern to Nebraska.

As early as 1962, faculty and administrators began discussing the merits of forming an interdisciplinary water resources organization and made preliminary plans to create an institute. The Board of Regents at the University of Nebraska established the Nebraska Water Resources Research Institute (NWRRI) in November 1964 to stimulate, sponsor and coordinate research dealing with water resources in Nebraska and the Great Plains.

Primary objectives for the NWRRRI were:

- Develop and conduct a program of basic and problem-oriented research directed towards recognized research ends of the state and nation;
- Identify significant research needs with particular emphasis on Nebraska problems;
- Identify university personnel and other scientists with special competence for water research;
- Stimulate and coordinate research, training, and educational water-related activities;
- Train water scientists by associating students and faculty with water resources research projects, conduct seminars and promote interdisciplinary programs of education;
- Promote graduate education in water resources as a direct complement to the research program; and
- Disseminate information on institute activities to university departments, state and federal agencies, organizations and the public.

The institute began as a program of UNL's Conservation and Survey Division (CSD), and Eugene C. Reed, Director of CSD, was its first part-time director from 1964-1968.

As part of Reed's successful proposal developed for the Federal Office of Water Resources Research

to consider authorizing one of a limited number of national water institutes be located in Nebraska, he emphasized the following:

Nebraska represents a diversified climatic situation in that it extends from an area of subhumid climate, in its eastern part, to an area of semiarid climate, in its western part and is typified by great annual variation in amount and intensity of precipitation. Regional research centers have been established to sample this diversity.

Nebraska is a state with great diversity of water problems – flooding, pollution, deficiencies of supply, lowering of groundwater levels in overdeveloped areas, deterioration of water quality, and many other technical, legal, economic and sociologic problems. The future availability of water for municipal purposes in Omaha and Lincoln is an increasing problem because of accelerated growth in population.

Reed's proposal included a budget of \$75,000; with one month of salary for the director and the following five research projects:

- (1) Groundwater hydrology, flow through porous media
- (2) Surface water hydrology, land treatment, related engineering research
- (3) Biological research, principally crop vegetation and plant-soil-water interactions
- (4) Economics research, pertaining to the northern Great Plains
- (5) Legal analyses, law and water rights



Loading a zodiac on a field trip to gather research data.



1968 - 1975

The Early Years

In 1968 came appointment of the first full-time director, Dr. Warren (“Bud”) Viessman, Jr., and Water Center faculty and staff got a separate office in room 212 L.W. Chase Hall (formerly the Agricultural Engineering Building) on UNL’s East Campus. This marked the beginning of the Nebraska Water Resources Research Institute (NWRRI) as a separate entity reporting to the Chancellor of the University of Nebraska-Lincoln and the starting point of this history.

Viessman began many new programs at the Water Center, including a regular newsletter and spring semester seminar series.

In May, 1969, he began what is now the Water Center’s longest running tradition – the Water Current newsletter – in response to an original objective of the Water Center, which was disseminating information on its activities to other university departments, state and federal agencies, organizations and the public.” Originally called Water Resources News, its title changed to Water Current in March 1974, and thus it has continued, marking 40 years of continuous publication in 2008. From its original mimeographed pages, the newsletter has progressed to a full-color quarterly of 16 to 20 pages that is also available online.

The Missouri River, about 1965.

Viessman also began an innovative new series called the NWRRI Summer Institute, a continuing education program for professionals in water resources-related fields. The annual courses provided engineers, planners, educators and others with necessary background information in various water-related areas and updates in their specific skill areas.

Summer Institute program topics:

- 1970 Applied Mathematical Programming in Water Resources
- 1971 (1) Optimal Analysis of Water Resources Systems, and (2) Simulation of Water Resources Systems
- 1972 Simulation of Water Resources Systems with Special Emphasis on Groundwater,
- 1973 (1) Planning and Management of Urban-Metropolitan Water Systems, and (2) Multiple Objective Water Resources Planning Techniques
- 1974 Quantitative Planning Techniques in Water Resources

An eight-member faculty executive committee helped the director develop policy, research educational and training programs, and comprehensive research approaches to solving significant water resources problems.

Original Executive Committee members were:

- Deon E. Axthelm, Agricultural Engineering and Extension
- Alan Booth, Bureau of Sociological Research
- Adam C. Breckenridge, Political Science
- Donald M. Edwards, Agricultural Engineering
- George P. Hanna, Civil Engineering
- Richard Harnsberger, Law College

Glen Vollmar, Agricultural Economics
 Maurice P. Veatch, Conservation and Survey Division

The Water Center also had an external advisory committee composed primarily of state and federal agency personnel, national and local organization and industry representatives. It was organized to serve as a source of information and advice on water-related problems; provide liaison between the center and state water agencies; suggest research and programming and help coordinate research activities of the Water Center with other agencies.

Members of the first external Advisory Committee:

- Phil Agee, Nebraska Game Commission
- Robert Boecking, Soil Conservation Service
- Carl Chloupek, Environmental Protection Agency
- Alfred Drayton, Farmer
- Bob Epp, Farmer-Irrigator
- Ford K. Jacobsen, Metropolitan Utilities District
- Henry Klosterman, Big Blue River Watershed Planning Board
- Don Long, Central Nebraska Public Power & Irrigation District

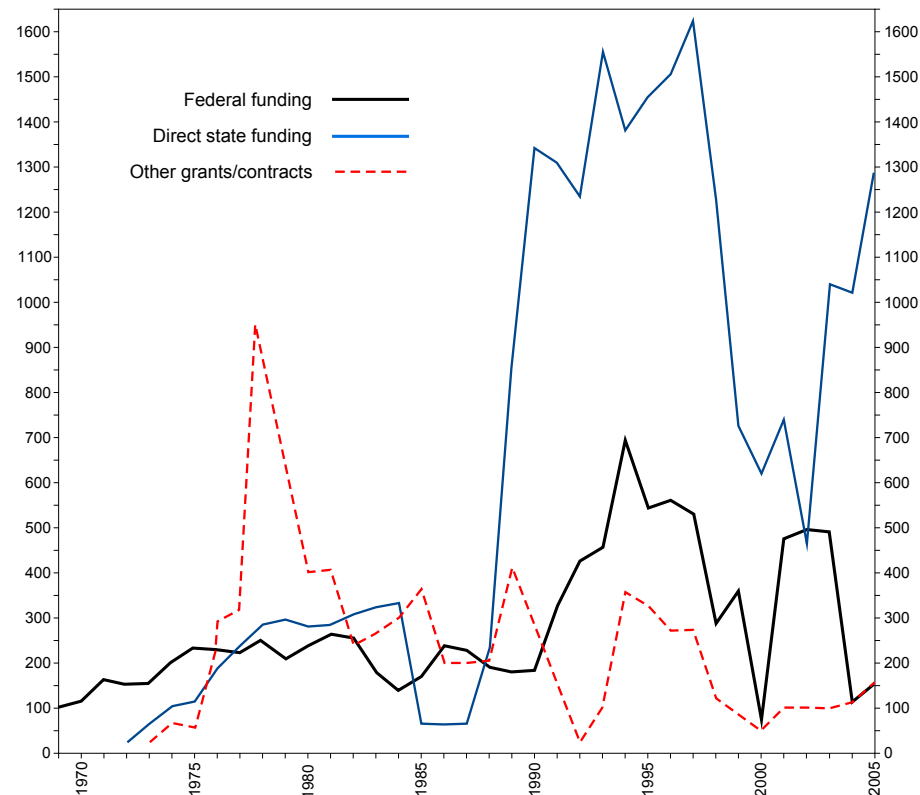


Figure 1. 40-year federal, state and other funding for the Water Center.

Hal Schroeder, Salt Valley Watershed
 Don Thompson, Farmer
 Dayle Williamson, Nebraska Soil & Water
 Conservation Commission
 Richard Adkins, Banker
 Bruce Meier, Kirkham & Michael Associates
 Mrs. Fred Wupper, League of Women Voters
 Dan Jones, Jr., State Department of Water
 Resources

Three early publications of the NWRRRI began in 1969 and continued for at least 15 years:

(1) NWRRRI Publication #1 – Water Resources Research in Nebraska, to communicate information

on current research to active and potential investigators so as to minimize duplication of effort and reveal potential areas for cooperation in research.

(2) NWRRRI Publication #2 – Water Resources Publications in Nebraska, a ready reference list of published works related to the water of Nebraska, a valuable guide to researchers in providing background material for preparation of research proposals.

(3) NWRRRI Publication #3 – Faculty with Competence in Water Resources Research, a listing of University of Nebraska faculty with expertise in

various areas of water resources research, to assist in setting up interdisciplinary research teams.

During these early years, funding for research, through State Water Resources Research Institute legislation, was provided by the federal Office of Water Resources Research (OWRR, later the Office of Water Resources Research and Technology - OWRT) and consisted of an allotment of \$100,000 per year and a matching grant program of competitive research. This allotment covered salaries of Water Center staff and funded a small, basic research program.

Matching grant proposals were larger projects submitted to OWRT for competitive review with projects from all states, and the federal dollars had to be matched with state or local funding. This funding continued at the same level (or slightly higher) until 1995, when the amount dropped to \$78,545. Today, the annual allotment is approximately \$92,000, or near its original level of 40 years ago. In 1985, federal oversight of the State Water Resources Research Institute Program was transferred to the U.S. Geological Survey.

Figure 1 shows the relative levels of federal, state and other funding for the 40-year history of the Water Center. Figure 2 indicates annual federal base grants to the State Water Resources Research Institutes in actual dollars and adjusted for inflation.

The first research project funded by the Water Center was “Energy Sources for Evapotranspiration in the Plains Region,” 1964-1969, by Dr. Norman Rosenberg. With help from this funding, Dr. Rosenberg went on to become a leading researcher

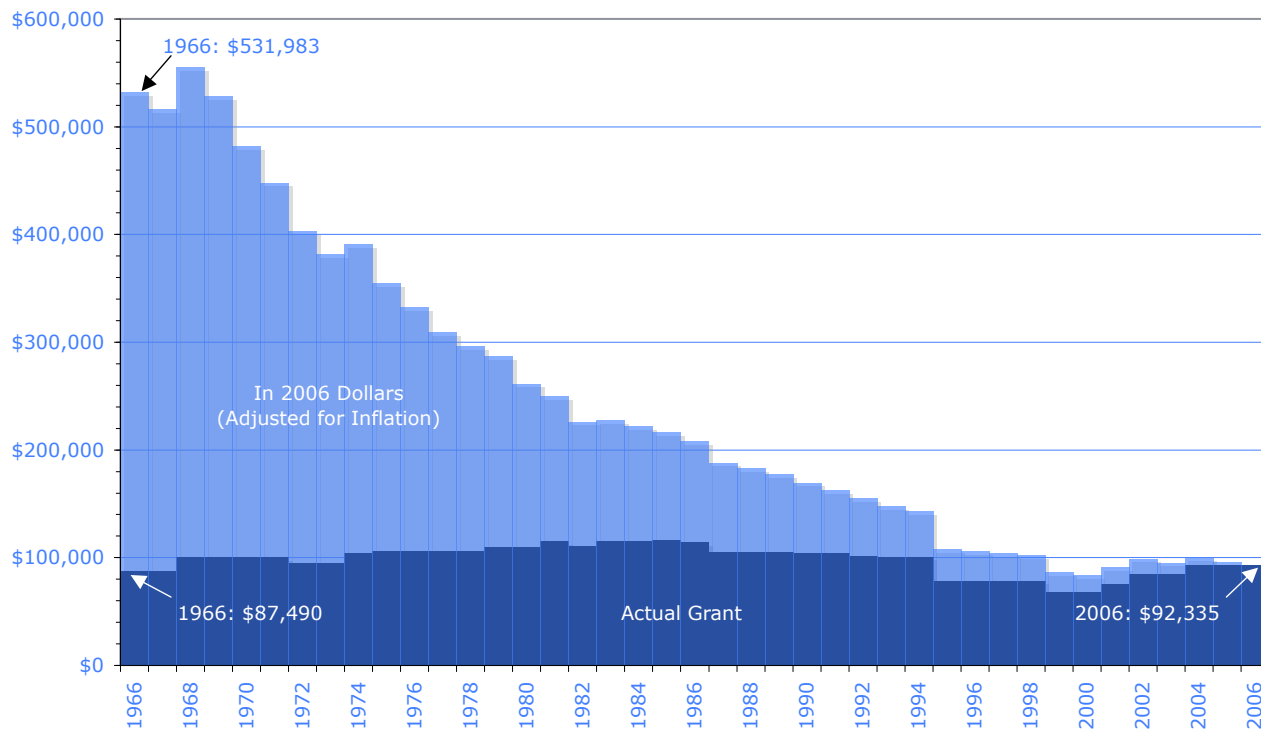


Figure 2. Annual federal base grants.

in the field of water use efficiency and drought preparedness.

In the early 1970s, the Water Center began a long tradition of assisting in identifying major water resources problems of the time. In 1973, the Water Center held a state workshop on regional research planning attended by university faculty and key state and federal agency personnel. Such workshops have continued under the Water Center's direction.

In the 1973 workshop, participants identified the following as critical issues in Nebraska and the Missouri Basin: (1) water use efficiency; (2) nonpoint source pollution; (3) meeting water requirements; (4) energy-water relationships; (5) maintaining environmental quality; and (6) conjunctive management of ground and surface water systems.

On April 1, 1974, the Water Center became one of five divisions of the University of Nebraska's newly formed Institute of Agriculture and Natural Resources (IANR). The other four were: (1) the College of Agriculture, (2) Agricultural Experiment Station, (3) Cooperative Extension Service, and (4) Conservation and Survey Division. State funding for NWRRI, which began in 1972 with a small grant from the NU Board of Regents to study watershed modeling, was now firmly established as part of IANR's budget and covered NWRRI's administrative and operating costs.

Dr. Warren ("Bud") Viessman, Jr.

1968 - 1975



I came to Lincoln in December 1968 as the first permanent director of the Nebraska Water Resources Research Institute (NWRRI) and was also appointed Professor of Civil Engineering. I was given an empty office (with movable office dividers) in the Ag Engineering building, had no staff

and scant records on operation of the institute up to that time. What I did have was the leadership of an institution I believed had enormous untapped potential to support Nebraska's water plans for the future. My first job was to hire a secretary who could do, among other things, establish an accounting system for managing institute funds. This secretary was Jan Stroiike. Karen Stork came on board as secretary (and later administrative assistant) in September 1971.

Next, I set out to devise an agenda for developing a water resources research, technology transfer, training and educational program focused on meeting the water management needs of Nebraska and the U.S. To assist me, I established an advisory committee of state, federal, and local government agency, non-governmental organizations and other stakeholder representatives concerned with state water management. I also established an executive committee for the institute with credentials in eight water-related academic disciplines at UNL and other Nebraska state colleges. The committees helped identify research needs and capabilities for addressing them. The institute also worked to coordinate water-related research in all segments of the University of Nebraska, with other state colleges, and with state and federal agencies such as the U.S. Bureau of Reclamation, Soil Conservation Service, U.S. Environmental Protection Agency and others.

One of my responsibilities was administering funds provided by the Water Resources Research Act of 1964, the State of Nebraska and other granting agencies. I worked

closely with faculty, state and federal agency personnel and others to ensure that the institute's research program targeted state and national concerns. I established priorities for research funding, and monitored the projects funded through the Nebraska institute.

During my tenure, I initiated a special state research program designed to provide quantitative planning techniques for state agencies and Nebraska's Natural Resources Districts. I supervised regional research planning and coordinated Nebraska water research with other states in the Missouri river basin and with the Missouri River Basin Commission. I was personally engaged in research on hydrologic modeling and water resources systems.

A research highlight, for me was heading a project studying development of the Elkhorn river basin (ably assisted by Dr. Gary L. Lewis of UNL's Department of Civil Engineering and Isaac Yomtovian, research associate, NWRRI). The Missouri River Basin Commission authorized NWRRI to study potential development of the 7,000 square-mile Elkhorn river basin in central Nebraska and the charges was to screen options for developing the basin's water resources and identify feasible alternatives. Water uses considered included: irrigation, recreation, water supply, and flood control. The project began in 1973 and finished the following year.

The Missouri River Basin Commission used study results in assessing development options for the Elkhorn river basin. This was a pioneering work, one of the first studies of its kind to incorporate simulation and optimization models simultaneously. At the time, the scale of the model taxed the limits of UNL's mainframe computer. It also required a lot of my staff's time punching thousands of computer cards (a process unknown to many of today's new computer users). The model identified potential sites for development that would generate positive benefits if they were developed.

In my capacity as Professor of Civil Engineering I taught courses on water resources systems analysis and planning. I also developed and conducted seminars and

programs of continuing education relative to water resources problems of concern to Nebraska and was responsible for disseminating information on water resources research to help maximize its usefulness to water resources professionals. I served on the Governor's Advisory Committee on the Natural Resources Data Bank, and was a member of the Technical Advisory Committee to the Nebraska Natural Resources Commission. I was also on the Executive Committee of the National Association of Water Center Directors.

I developed a broadly attended summer institute program dealing with research-related water resources topics such as applied mathematical programming in water resources, optimal analysis of water resource systems, and simulation of water resources systems. We also inaugurated an annual conference series.

In 1971 I was successful in getting UNL selected as the new administrative home for the Universities Council on Water Resources (UCOWR). Having UCOWR co-located with the institute increased our visibility in the academic research community and broadened its horizons significantly. From January 1971 to March 1975, I served as UCOWR's Executive Secretary. In that capacity, I provided information to member universities on current issues in the water field. I also corresponded and visited with university presidents, administrative officers and UCOWR delegates on matters of concern to member universities and kept abreast of federal legislation related to water-resources programs having relevance to the academic community. I also coordinated UCOWR activities with the National Association of State Universities and Land-Grant Colleges (NASULGC), federal water agencies and special commissions.

I resigned my position as institute director in March 1975 to accept the position of Senior Specialist in Engineering and Public Works in the Library of Congress, Washington, D. C.



Gathering a water sample for testing.

Planning and Management

Since its founding in 1964, three primary Objectives have formed the foundation for virtually everything the Water Center does: (1) stimulate and coordinate research, training and other educational water-related activities; (2) train water scientists by associating students and faculty with water resources research projects, conducting seminars and promoting interdisciplinary programs of education; and (3) promote graduate education in water resources as a direct compliment to the research program.

But it wasn't until 1970 that UNL began offering a graduate study program focused on important interdisciplinary aspects of water resources planning and management. At that time, the Water Center's director and executive committee proposed an intra-university graduate program emphasizing water resources planning and management. It was approved by the graduate council in June 1970. This program fostered a team approach to resources planning and encouraged graduate study and research.



Examining a Paddlefish at Natural Resources Hall.



School of Natural Resources students in the field.

This graduate program continues today, offering masters-level students in 15 UNL departments the option to add an emphasis (minor) in water planning and management to their degree program. Participating departments include: Agricultural Economics, Agronomy/Horticulture, Animal Science, Biological Sciences, Biological Systems Engineering, Civil Engineering, Community and Regional Planning, Economics, Geography, Geosciences, Industrial and Management Systems Engineering, Mathematics, Political Science, School of Natural Resources, and Sociology. The option is granted upon graduation and completion of nine credit hours in specified water-related classes. Since 1989, an average of two students per year have qualified for the option on their M.S. degree

Just this year (2008), another aspect was added to the scholarship program, which has been

established honoring the first full-time director of the Water Center. The Warren "Bud" Viessman, Jr. Scholarship Fund will present annual scholarship(s) to regularly enrolled undergraduate students majoring in either environmental restoration or water science in the School of Natural Resources at UNL. Scholarship candidates must express a desire to pursue a career in the area of hydrology, hydraulics or water science following graduation and have a grade point average at or above 3.0.



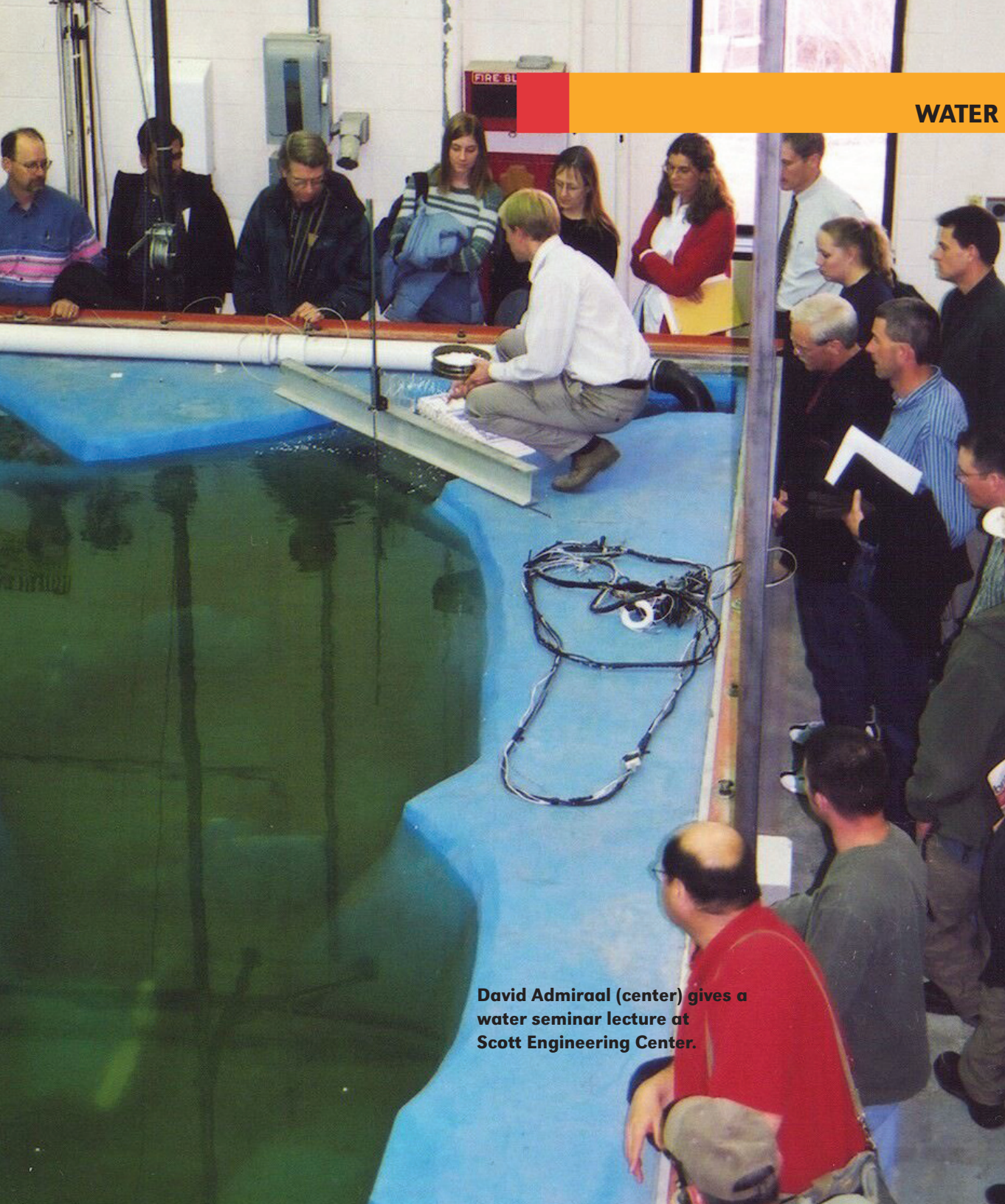
Tadd Barrow (right) with water quality students in the field.

Seminar Series

The Water Center's long-running Water Seminar Series began in 1968 as a spring semester program for students, faculty, water professionals and the public to hear subject-matter experts address current water issues. Students can take the seminar for one hour of credit through the School of Natural Resources and other UNL departments. About 10 to 20 students a year exercise that option and typically, each of the 12 to 14 lectures in the annual series attracts an audience of about 50 to 75, many of whom are seminar regulars.

As part of the seminar, Kremer Memorial Lectures have been presented every year since 1983 in honor of former State Senator Maurice A. Kremer of Aurora. Kremer, known as "Mr. Water," was in the forefront of state water resources planning for more than 20 years and was instrumental in initiating Nebraska's Groundwater Management Act (LB 577), which resulted in the creation of Nebraska's 24 (now 23) natural resources districts in 1972. He also was a staunch and long-standing supporter of higher education. The Kremer Memorial Lectures typically focus on current or future water resources issues affecting Nebraska. Prominent state and national water resources experts are invited to present the lectures.

The purpose of the seminar series is to provide a forum to increase awareness of current and future water issues and for thoughtful discussion of alternatives aimed at the wise management of Nebraska's surface and groundwater resources.



David Admiraal (center) gives a water seminar lecture at Scott Engineering Center.



Matt Joeckel talks about geologic formations near Fremont State Lakes.

Also part of the seminar series since 1994 has been the Williams Memorial Lecture, funded by the Alan G. and Irene Williams Fund, which supports the entire seminar series. A listing of annual Water Seminar topics is provided in **Appendix C**.

Water Tours

Water Tours began in the mid-1970s under the direction of Dr. Leslie Sheffield, a UNL Extension Farm Management Specialist and later outreach programs coordinator for the Water Center/Environmental Programs. The annual event began as an educational activity to highlight water resources projects and irrigated agriculture. The tour visited water resources and irrigation projects in California, Arizona, North Dakota, South Dakota, Colorado, Wyoming, Kansas, Oklahoma, Texas, Oregon, Washington and New Mexico, in addition to virtually every Nebraska county.

The tours were designed to enhance understanding and appreciation for water

management in Nebraska and participants flocked to them from many water-related state and federal agencies, the natural resources districts, from UNL and from farms, ranches and other locales across the state. Tour sponsors and co-planners through the years have included the Nebraska Water Conference Council (the same group that organized the annual Nebraska Water Conferences), UNL Water Center, UNL's Institute of Agriculture and Natural Resources, Kearney Area Chamber of Commerce, Nebraska Association of Resource Districts, Nebraska Public Power District, Central Nebraska Public Power and Irrigation District and several private companies, including banks and irrigation equipment manufacturers.

Sheffield was Executive Secretary of the Water Conference Council for 10 years, from 1972 to 1982, when the Water Center director assumed that position. Nonetheless, Sheffield continued organizing the tours until approximately 1993 when Bob Kuzelka, assistant to the director of the Water Center, stepped into the role. Since approximately 2000, the tours have been organized by current Water Center associate director J. Michael Jess, who has expanded the themes and content of the



Doak Nickerson (center) takes the summer water tour on a hike in the Nebraska National Forest near Chadron, Nebraska.

annual tours to include natural resources issues, as well as water issues. Under his leadership, the tours have returned to sometimes traveling out of the region, as they sometimes did during the Sheffield years.

A listing of some of the annual water tour destinations is provided in **Appendix D**.



Jim Goeke (center) talks to a water group at Swanson Reservoir near Trenton, Nebraska.

Nebraska's Lifeblood

Since the beginning, the Water Center has been a liaison to practitioners needing research to solve problems, agencies interested in initiating water research and scientists capable of doing it. The Water Center helps researchers get financial support for their investigations, administers and coordinates the projects and integrates university water research and training programs with federal, state and local agencies.

Appendix A lists some of the research projects supported by the Water Center.

An early example of this approach's success was the developing irrigation scheduling techniques. In the 1970s, Nebraska was a national leader in irrigation research and irrigation scheduling, or putting the right amount of water on crops at the right time, which improves efficient use of the water. With scheduling, the soil profile is only partially refilled by irrigation water, leaving room for rainfall, should it occur, while maintaining enough moisture to prevent plant stress. Crop water use, soil moisture storage, rainfall and water applied were used to predict proper irrigation scheduling.



Cascading water droplets from a center pivot sparkle like diamonds in the sun.

The Water Center collaborated on many of these projects which demonstrated that proper irrigation scheduling could result in water and energy savings up to 50 percent over large areas of the state, without reducing crop yields. With rising energy costs in the 1970s and local declines in groundwater supplies, these techniques became increasingly popular with the state's irrigators.

These projects also helped train county extension agents and provided funding to publish UNL's first "Irrigation Scheduling Handbook". Additionally, UNL Research and Extension Centers at Clay Center, North Platte, Scottsbluff, Concord and Lincoln received portable computers and other equipment to train consultants and irrigators how to schedule irrigation.

During this decade, the Water Center contributed about 20 percent of the nearly \$2 million invested in UNL irrigation scheduling programs. Funds provided through the Water Center furthered the research and resulted in additional funding from other sources to implement additional irrigation scheduling programs.

Public Service

Public service is an important and ongoing component of the Water Center's mission. Getting information to clientele and the public is vital to the Water Center's public outreach and is accomplished many ways – by partnering and maintaining liaisons with federal, state, regional and local water organizations and individuals, by regularly giving presentations on water-related issues, and through other on-going activities noted below.

Nebraska Water Conferences

Shortly after appointment as Chancellor of the University of Nebraska (the title was changed to President in 1971), Dr. Durward B. Varner noted that Nebraska's water resources represented one of its greatest opportunities for growth and development.

On October 28, 1971 he sent letters to 39 people, selected from various public and private agencies, organizations and interests, asking them to serve as a planning committee to arrange for what he called a "Nebraska Water Resources and Irrigation Development Seminar for the 1970's." All 39 accepted his invitation and the group met for the first time in 1971 and planned the first of what would become the annual Nebraska Water Conference.

At the end of the 1972 seminar, Varner appointed a 25-member Nebraska Water Conference Committee (later a council) to: (1) plan future annual conferences under the title "Nebraska Water Conference" and (2) deal with issues pertaining to irrigation development and to work toward reaching the potential of the state's water and land resources. Over the years, the council has been coordinated by the Water Center and continued developing annual Nebraska Water Conferences.

In 2000, collaboration began among the Water Center, the UNL College of Law and other UNL departments to sponsor an annual Water Law, Policy and Science Conference. It is something of a hybrid of the former Nebraska Water Conferences and national water resources conferences sponsored by the Water Center in the 1970's. The first of this series of conferences was held in 2004.

A listing of the annual Nebraska Water Conference topics is presented in **Appendix E**.

Other National Water Conferences

For many years, the Water Center hosted national conferences on important water-related issues. Conference proceedings were widely distributed. Topics included:

- 1971 Conference on Water Resources Planning and Public Opinion, March 8-9
- 1972 Technology Transfer in Water Research – the Interface Between Producers and Users, September 25-26
- 1973 The Role of Water in the Energy Crisis, October 23-24

- 1974 Research in Action: Technology for Implementing Water Research Results, December 5-6
- 1976 Water Problems in the Rural Environment – Alternative Solutions for Water Supply and Wastewater Disposal
- 1977 A Question of Values: Decision Making in Water Resources Management, November 29-30

- 1978 Nebraska Water Data – Collection, Storage, Retrieval, use and Needs, sponsored by U.S. Geological Survey and Nebraska Water Data Coordinating Committee and hosted by the Water Center
- 1984 Multi-Objective Optimization and Decision-Making, October 10-12



Dan Snow leads a discussion at a water faculty colloquium.

Below: A Water Law, Policy and Science Conference session.





1975 - 1978

The Middle Years?

Dr. Millard W. (Wayne) Hall became the Water Center's second full time director in 1975, shortly after the Water Center became part of UNL's Institute of Agriculture and Natural Resources (IANR).

At the same time, the Water Center physically moved into Agricultural Hall on UNL's East Campus and the Water Center director became a member of the IANR Deans and Directors Council, which met weekly to review IANR activities and programs.

In July 1977, the name of the NWRRRI was formally changed to the Nebraska Water Resources Center (NWRC), so there would not be one institute (NWRRRI) within another institute (IANR).

State funding for the Water Center improved during Hall's tenure and in recognizing the importance of water to Nebraska, UNL's past high-quality performance in this area and the possibility of even greater returns to Nebraska if excellence could be attained in water resources management; the 1975 Nebraska legislature approved designation of an Area of Excellence in Water Resources Management (WRAE). Along with the Water Center, two other university units involved in this were the Conservation and Survey Division and the Department of Agricultural Economics.

Nebraska crop circles.....the telltale look of fields watered by center pivot.

WRAE program goals were to strengthen and expand the university's water resources management program and make it more responsive to needs. An additional goal was to attain regional, national and international recognition as a center of excellence for water resources management.

WRAE provided the first large-scale infusion of state funds to the Water Center. Area of Excellence funding for fiscal 1975-76 was \$264,000, with the Water Center's budget being \$67,000, and the rest going to the other two university units involved in the program. Additional Water Center funds from this program were \$91,500 (1976-77), and \$144,000 (1977-78). Funding continued for two more years and eventually was incorporated into the NWRC's normal state budget.

This funding enabled the Water Center to hire additional staff, including a part-time faculty position in water resources management with Civil Engineering as well as a water technologist, a research analyst, a water scientist, a faculty technology transfer specialist and a climatology specialist.

When the *well's dry*, we know the **worth of water.**

Poor Richard's Almanac, 1738

Dr. Millard W. (Wayne) Hall

1975 - 1978



It was the green that surprised me. History spoke of The Nebraska Territory as being part of the "Great American Desert;" my expectations did not include green, even on a sunny day in April.

This, my first view of Nebraska, came at the invitation of my friend and colleague, Bud Viessman. He invited me to attend one of the early meetings of what quickly became an important part of the national water management dialogue, the annual Nebraska Water Resources Conference. Under his direction the institute developed into what many recognized as perhaps the best such body in the U.S.

The University recognized this distinction in 1974 by including the Water Institute as one of six components of the Nebraska Institute of Agriculture and Natural Resources, a unit created that year and led by a Vice-Chancellor, to insure that the University's actions were more sharply focused on the state's agricultural enterprises and natural resources.

All this is to say that by March 1975, when Bud resigned as NWRRRI Director, the position was extremely attractive. Bud had long been a good friend, and he proved to be one again in this instance. We first met and worked together at the University of Maine. Over the years he encouraged me to become more involved with state, regional and national water resources policy, planning and management. Now, he threw my name into the hat as a nominee to succeed him as Director of the NWRRRI. Eventually I was offered the job, and after a bit of family agonizing, said yes. In August 1975, my wife, two children, one dog and five cats arrived at our new home in Lincoln.

Bud had developed a first rate, well organized staff. They, Bud's prior planning, and the knowledgeable, enthusiastic and kindly assistance of Interim Director William Splinter (Chair of the Department of Agricultural Engineering) made the transition into the new job an easy one. I just did what I was told.

Bill Splinter is a pilot, and included me on a couple of flights around the state and nearby states soon after my arrival. Having a native son show you Nebraska from a small aircraft quickly gives you a sense of its vastness, its several geographical regions, and its diverse economic enterprises, essential schooling for an easterner seeking to be of service.

My memories of my time at the University of Nebraska are all good ones; good, but blurred, as if the film were being run too fast. I remember;

- Changing the name of the NWRRRI to the Nebraska Water Resources Center, so that everyone could stop referring to an Institute within the Institute.
- Learning about the taste and texture of real beef; steaks at Dresbach's after driving two hours to dinner, prime rib at Misty's after driving across town.
- Appointment to the Governor's Task Force on Drought, as Nebraska endured a years' long, lengthening dry spell. As we were gathering for the first meeting of this imposing group, there was a sudden cloudburst, a real frog floater and trash mover; the drought was over – for a while, at least. Seldom are task forces so successful.
- Trying to establish an interdisciplinary Master's Degree program in Water Resources Management. I think it produced one graduate.
- Learning to make an omelet while attending a meeting of the Nebraska Egg Producers Association.
- Visiting towns around Nebraska where people were

trying hard to hang on to their cultural heritage — Swedish, Danish, Czech, German, Ukrainian, Cowboy.

- Floating down the Niobrara in a canoe my son and I had helped make. Attending a barn dance at the end of the float trip and learning the “two-step.”
- Being surrounded by people, academicians, farmers, ranchers, politicians, public servants, others of many stripes, who had the patience to share with me their hard-won knowledge as I tried to learn my trade.
- Someone suggesting that the NWRC produce a booklet, titled, “The Summer it Rained ” by a Roger Welch; how I was filled with joy years later when I saw Roger’s regular column right there by that of Stephan J. Gould, in the Magazine of the American Museum of Natural History.
- A fall Saturday in Lincoln, the air chill, the light softening, the leaves coloring and starting to fall, and Big Red fans starting to lose their good western calm – actually, their sanity; up for breakfast with fans, pep band, coaches, cheerleaders, on to lunch with a similar crowd, to the stadium and its sea of red. I learned why some people are called fans; as in fanatics, as in loss of reason. A religious experience?

A confession. I loved my whole experience in Nebraska, the culture, the job, the people, and the geography. I have two children with diplomas from East High, one with a degree from the University of Nebraska. I was given a lot of my education in Nebraska; since leaving I have served governments, businesses and other universities in ways that would not have been possible without my experiences in Nebraska.

This expanded staffing led to more interdisciplinary research and programming. WRAE provided a critical mass in water resources management at UNL and was a starting point for cooperation and interaction that have continued through the years for UNL water faculty.

During this period, the Water Center had three interim directors: Dr. William Splinter for a brief time in 1975, and Dr. Gary L. Lewis (professor of Civil Engineering at UNL), and Deon Axthelm (retired Professor of Agricultural Engineering) during 1978 to 1980.



Irrigation center pivot at sunset.



Center pivot near Benkelman, Nebraska.



UNL extension educators place irrigation siphon tubes in the 1960's.

A Growing Challenge

Many research programs begun modestly by the Water Center have gone on to greater national and international importance.

One of these is UNL's drought management and mitigation program begun by Dr. Donald A. Wilhite in 1977 when he became a faculty member in the Water Center through the Area of Excellence Program in Water Resources Management. In 1979, he joined the newly formed Center for Agricultural Meteorology and Climatology, which evolved into the International Drought Information Center in 1988, and then the National Drought Mitigation Center (NDMC) in 1995.

The first Nebraska grant resulting from passage of the Water Resources Research Act of 1964 was used to purchase equipment at the Agricultural Meteorology Research Site at UNL's Mead field lab. Since then the Water Center has assisted in securing more than \$500,000 in research grants to enhance climatology and agricultural meteorology at UNL.

NDMC is a national leader in developing drought management and readiness programs. From the early years of Wilhite's drought research program on climatology of drought and its impacts, program emphasis changed dramatically in the mid-1980s as a result of research on governmental response to drought in the U.S. and internationally.

A prolonged statewide drought that began in the later 1990's shrunk many of Nebraska's rivers, streams, reservoirs and ponds.

He learned that all governments respond to drought by crisis management, an ineffective approach resulting in poor coordination and untimely response. Following organization of an International Symposium and Workshop on Drought at UNL in 1986, his program began to emphasize a pro-active, risk-based management approach. It relies principally on improved drought monitoring and early warning, mitigation measures, preparedness plans, and drought-specific policies.

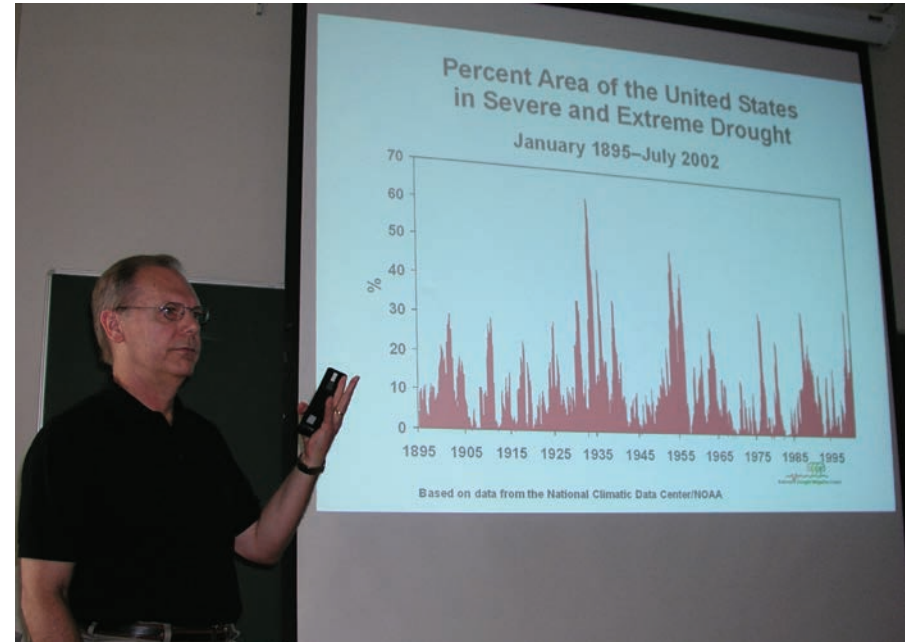
Today Wilhite directs UNL's School of Natural Resources, and Dr. Michael Hayes, a longtime Wilhite protégée, heads the NDMC. Hayes currently is helping guide development of the National Integrated Drought Information System (NIDIS).

“History is a relentless master. It has no present, only the **past rushing** into the **future**. To try to **hold fast** is to be **swept aside.**”

John F. Kennedy

Largely due to Wilhite and Hayes efforts, legislation has been introduced in the U.S. House of Representatives and in the Senate to create NIDIS, which would provide climate and water data to a broad group of users from agricultural producers to policy makers, including water and natural resource managers.

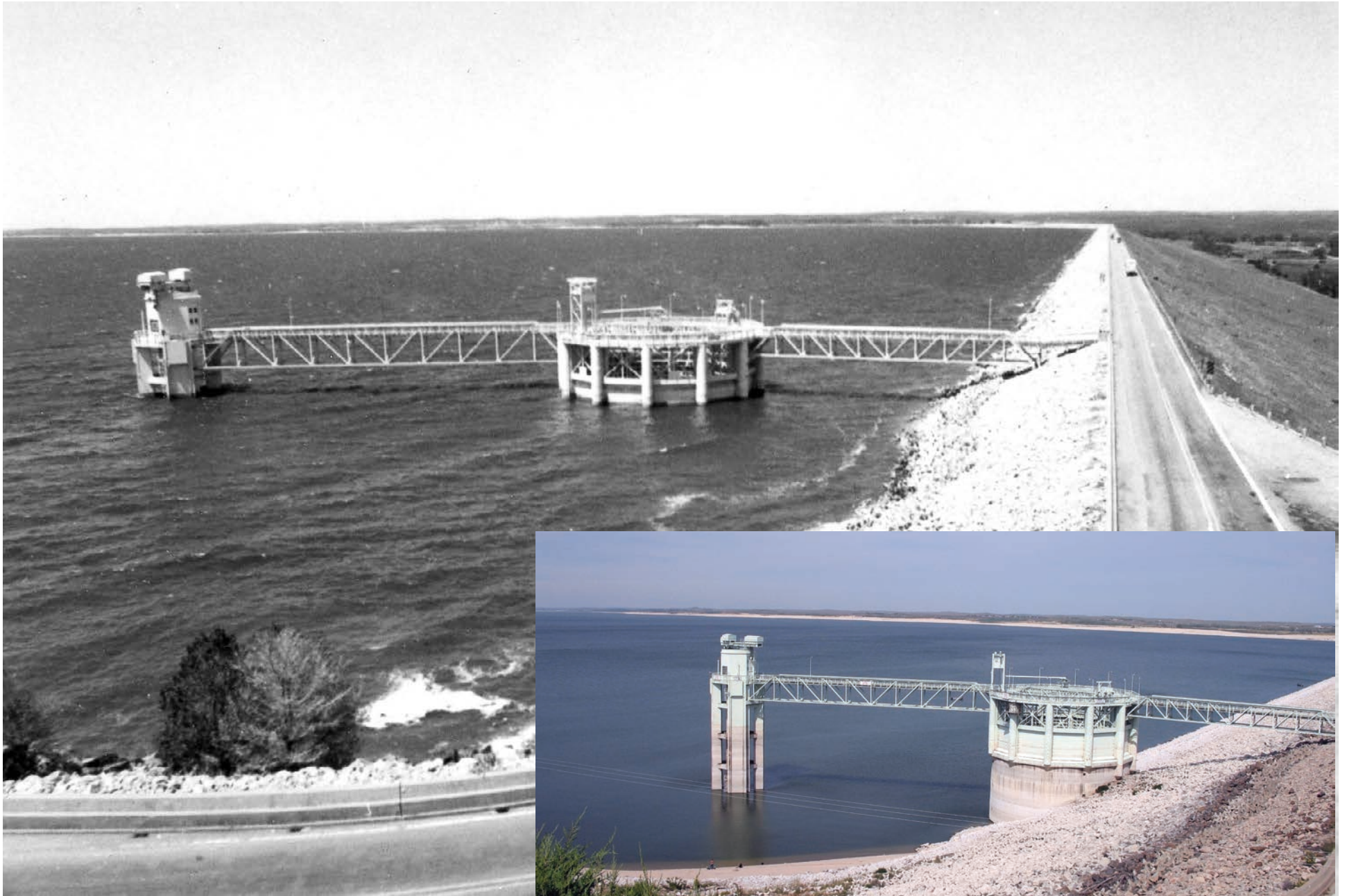
NIDIS would focus primarily on delivery and management of information to improve management and policy decisions. With the information, users could better prepare for drought and reduce its impact, as well as better manage natural resources. The information would help farmers better evaluate risk before planting, for example, based on current and expected climate conditions.



Founding director of the National Drought Mitigation Center and current director of UNL's School of Natural Resources, Don Wilhite.



Lake McConaughy near Ogallala, Nebraska at sunset .



Top Photo: Lake McConaughy in 1970. At Right: A regional drought in the early 2000's significantly shrank massive Lake McConaughy near Ogallala, Nebraska.



Sand, wild flowers and Salt Cedars cover the west end of Lake McConaughy in the early 2000's.

For More Than 30 Years

The Water Center has always measured success many ways: Project results, funding, students graduated, faculty hired and others.

In terms of hiring bright, new faculty members, Water Center funding and collaboration with other departments has often been an incubator in this process.

In the mid-1970s “Area of excellence in water resources management” funding spurred the Water Center’s first major hiring initiative and one of those hired, J. David Aiken, has stayed at UNL as a well-known and universally respected Department of Agricultural Economics professor and water and agricultural law specialist.

After being hired in 1976, he hit the ground running working with the Nebraska legislature’s Public Works Committee (now the Natural Resources Committee) on a variety of emerging water law issues.

The major outcome of this was the “State Water Planning and Review Process,” which published several major reports on pending water policy issues prepared cooperatively by UNL’s Institute of Agriculture and Natural Resources and the Nebraska Natural Resources Commission (now part of the Nebraska Department of Natural Resources).

“The reports on instream flows and the interrelationship between surface water and groundwater both significantly influenced legislation on instream appropriations and hydrologically connected water, respectively,” Aiken said.

After more than 30 years at UNL, Aiken continues as one of a very few faculty members with an academic appointment in all three major areas of emphasis: teaching, research and extension.

He has developed and taught undergraduate courses in agricultural, natural resources and environmental law and water law within UNL’s College of Agriculture Sciences and Natural Resources and is currently considering developing a new undergraduate course in energy law.



Dave Aiken (second from left), Don Blankenau and Mike Jess (right) join a panel discussing water issues at Husker Harvest Days near Grand Island, Nebraska.

“My primary research area has been western groundwater law,” he said. That long cultivated expertise has resulted in numerous published law review articles on western and Nebraska groundwater law and administration, legal protection of instream flows, groundwater quality protection from agricultural chemical use, Platte River endangered species conflicts, the variety of approaches used in western states for legally integrating surface water use and groundwater use, and the implications of the 2005 Nebraska Supreme Court decision that groundwater irrigators could be legally liable for depleting stream flows.

Additionally, Aiken’s research has spread into topics such as chapter 12 family farmer bankruptcy law, county livestock zoning regulations, state corporate farming restrictions, preferential assessment of agricultural lands for property tax purposes and a historical comparison of Nebraska’s legal responses to agricultural financial crises in the 1930s and the 1980s.

Aiken has presented hundreds of extension programs to thousands of Nebraskans on dozens of water law and agricultural law topics.

The Nebraska native and 1972 Hastings College graduate earned his law degree from the George Washington University, Washington D.C., in 1975. While attending law school he worked in the U.S. Department of Agriculture on a study of western water rights



Jessica Harder (left) on summer water tour in New Mexico.

laws, which would help shape his later research interests.

Aiken is a member of the Nebraska State Bar Association and a past chair of its natural resources section.

In a long and productive academic career, Aiken has published over 100 technical and popular articles and papers on water rights and environmental and agricultural law. Recent law review articles include “The Western Common Law of Tributary Ground Water: Implications for Nebraska,” 83 *Neb. L. Rev.* 541-95 (2004); and “Ground Water, §858 and the Spear T Decision,” 84 *Neb. L. Rev.* 962-996 (2006).

He is equally well known outside the legal community for his agricultural and water law opinions that have appeared in popular articles and columns in such publications as *Nebraska Farmer* magazine.

What goes here?

In 1980, **Dr. William L. Powers** became the third full-time director of the Nebraska Water Resources Center. Prior to his appointment at UNL Powers was at Kansas State University as director of the Kansas Water Resources Research Institute. In 1988 he resigned as UNL Water Center director and returned to teaching as a professor of soil physics in UNL's Department of Agronomy.

The 80's marked a period of transition and major changes for the Water Center, in part due to reductions and reallocations in UNL's budget every year from 1981 through 1986. Ways had to be found to reduce operating costs.

On July 1, 1984, the Water Center merged with UNL's Conservation and Survey Division (CSD) to reduce costs and to strengthen and improve coordination of water programs at the university and provide better focus for public information activities. The Water Center continued as an intact unit in the new division, but the director no longer served as a member of the IANR Deans & Directors Council. Water Center offices moved-in with CSD in Nebraska Hall on UNL's city campus. This arrangement continued until 1988.

What falls are these?

On February 28, 1986, responsibility for the State Water Resources Institute Program was transferred to the U.S. Geological Survey (USGS). Funding provided under this program continued to support research projects, both through an annual allotment program, as well as a nationally competitive matching grant program. State funding provided for salaries of Water Center employees.

In May 1987, a review team lead by the USGS recommended that UNL consider alternative administrative structures restoring the Water Center's independence. After considering this suggestion, university administrators decided to raise the Water Center in the administrative structure by having the center director report directly to the office of the Vice Chancellor of the Institute of Agriculture and Natural Resources.

In 1988, the Water Center moved again to Natural Resources Hall on UNL's East Campus,



A ubiquitous Nebraska center pivot.

Dr. William L. Powers



In the early 1980s, the Water Center was one of six major divisions of UNL's Institute of Agriculture and Natural Resources (IANR) and the director carried the title of Dean/Director of the Nebraska Water Resources Center. These were exciting and rewarding times for the

Water Center and its staff because it was involved in so many of the state's water-related activities.

The Water Center participated in a legislatively mandated State Water Planning and Review Process. Staff were actively involved in several planning task forces, and assumed leadership of the Task Force on Water Use Efficiency. I was a member of the Interagency Water Coordinating Committee, which held monthly meetings chaired by then Governor Charles Thone. I was an advisor to the Nebraska Natural Resources Commission and attended their monthly meetings, and I was a core team leader on the Platte River Forum to Model Stream Flows.

I also chaired IANR's Sand Hills Task Force that was examining effects of the recent expansion of irrigated corn into the Nebraska Sand Hills. This committee examined threats of contamination from agricultural chemicals that moved easily through the sandy soils toward groundwater. Water quality research programs to alleviate the threat were recommended. During the early 1980s, the Water Center had a staff of 12 faculty, technicians and secretaries.

Nationally, I served as executive secretary of the Universities Council on Water Resources (UCOWR) and worked closely with UCOWR's board of directors to plan and conduct the annual meeting, which was attended by delegates from about 50 universities across the U.S.

Along with the rewarding times, there was also disappointment. The Water Resources Research Act of

1980 - 1988

1964 was not renewed in 1981 and federal support for Water Center research activities all but disappeared.

In 1982, the federal Office of Water Research and Technology (OWRT) was created and funding for the center through the federal allotment and matching grant programs was again available. A few years after OWRT was created, it was disbanded and administration of the federal allotment and matching grant programs went to the U.S. Geological Survey (USGS). For several years, funding for this program was not included in the annual USGS budget request.

It was only through concentrated lobbying by the National Association of Water Institute Directors (NAWID) that federal funding for water institutes was restored in the USGS budget. But federal funding for the water institutes began declining by the mid-1980s. Fortunately, IANR allotted an additional \$40,000 of state funds to the Water Center.

On July 1, 1984, the Water Center merged into IANR's Conservation and Survey Division (CSD). Faculty, technicians and some secretarial positions in the center were absorbed by CSD, and one faculty position moved to the Department of Agricultural Meteorology.

The Water Center then ceased to be a "stand alone" IANR unit and became primarily a CSD unit, administering funds of some federal and state water research projects. I served as Assistant Director for Water Research in IANR's Agricultural Research Division and Coordinator of Water Programs in the Cooperative Extension Service. I also chaired IANR's Water Policy Committee and the university's Water Policy Forum. The forum was a group of UNL and UNO water scientists that met annually to coordinate university water research programs.

From 1985 to 1987 the Water Center was a coordination point for national water interests. I still served as UCOWR executive secretary and also NAWID chair.

In spring 1988, I resigned as director and moved to UNL's Department of Agronomy as a professor of soil physics. I retired from UNL in 2005.

and Dr. Roger E. Gold was hired as director, serving in that capacity and as director of Environmental Programs, until 1990.

Dr. Roy Spalding was appointed associate director of the Water Center that same year and CSD faculty member Bob Kuzelka was appointed part-time assistant to the director the following year.

In 1989, a \$4 million Nebraska Research Initiative (NRI) funded by state government began. Also in planning stages at this time was the Water Sciences Laboratory. Much of the initial emphasis of the lab's research programs pertained to groundwater quality, particularly nitrates and pesticides that were suspected of leaching into groundwater aquifers.



Nebraska Hall



MSEA display and brochures in the early 1990's.



Natural Resources Hall



Dr. Martin Massengale, Vice-Chancellor of UNL's Institute of Agriculture and Natural Resources, hired me in 1977. He came to Nebraska two years earlier and asked me to come with him to be director of Environmental Programs-IANR. I

agreed in 1977 and came to Nebraska as Director of Environmental Programs and Associate Professor of Entomology.

Environmental Programs obviously overlapped in some areas with the Water Center, particularly in irrigation and the leaching/back siphoning of pesticides down wells. When I got here I remember looking at an empty office and reception area in what was then the Wildlife Building on East Campus. I was eventually promoted to Professor of Entomology and was asked to serve as head of the Department of Entomology and Director of Environmental Programs. This continued for two years, after which I was appointed director of the Water Center and Environmental Programs.

Why so many changes took place during my employment at UNL was always a bit of an enigma to me, but the Dean asked and I always accepted the challenges. In Texas that is called "Riding the brand", meaning I worked for IANR and did as I was asked. I enjoyed my years in Nebraska for many reasons, but the most important was that I was privileged to work with really dedicated people. It also was a great place to raise children, and further my career. In looking back, those were great years where I really enjoyed my work.

My interest in magic has continued. On several occasions I used it in extension efforts with Water Center programs such as the children's water festivals in Grand Island. One of the main things I remember about my time with the Water Center was "Windshield time," traveling the state attending grower's meetings, talking about best management practices, the need for water conservation and water quality issues. I specifically remember the positive interactions with the Natural Resources Districts and programs they developed, i.e., outreach programs and documentaries we produced such as the Long Pine Creek Project about reducing nitrates, or the Central Platte Project that addressed challenges with leaching agricultural chemicals into groundwater.

During my tenure, brief as it was, we began the \$4 million Nebraska Research Initiative (NRI) funded by state government. There were calls for proposals from across the university and funding was provided in several different colleges, departments and divisions including IANR. The money required annual progress reviews and I remember the challenges associated with approving proposals, hiring new faculty and staff and meeting the requirement of measurable goals in the timeframe mandated by the funding.

The Water Sciences Laboratory was established during this time with Dr. Roy Spalding as founding director. Space was renovated in a separate building behind the Wildlife Building to house it. Much of the initial emphasis of the lab's research involved groundwater resources, particularly nitrates and pesticides that were suspected of leaching into groundwater. We worked closely with the Soil Conservation Service and UNL's Conservation and Survey Division developing best management practices to reduce erosion and address leaching of agricultural chemicals.

In addition to state money, we also received a major grant from industry to evaluate center pivot irrigation and

the consequences of back-siphoning agricultural chemicals into wells. Part of this work correlated with Environmental Programs.

There was also an extension component to the center's programs and many of us worked with producers, chemical companies and the public to bring awareness of the importance of groundwater in Nebraska and the need for conservation of water resources and environmental protection. Certainly one of our most important outreach programs was working with commodity groups and The Groundwater Foundation. Foundation youth programs and 4-H programs were critical to working with the next generation who would assume future leadership roles.

I remained head of the Water Center/Environmental Programs until 1989, when I decided to get back into teaching and research in entomology. I accepted a position as an Endowed Chair and Professor of Entomology, and Director of the Center for Urban and Structural Entomology at Texas A&M University and have been there for 17 years.

Those really were the good ole days. A number of UNL students have joined my programs in Texas as post-doc and graduate students. They have all been outstanding students and individuals and have reflected positively on Nebraska. Being director of the Water Center during a time of expansion was personally rewarding, and I have the faculty and staff that worked in the center to thank for making the programs such a success.

Forum on Water Policy

Beginning in 1985 the Water Center coordinated the “Forum on Water Policy,” to provide an exchange of information and ideas on water resources and water policy issues among university faculty. NU President Ronald Roskins suggested it as a way to better coordinate water issues between NU campuses.

Each campus in the university system appointed delegates to serve on the forum, which had 32 members. Meetings were open to all faculty and consisted of (1) updates on water resources activities within the research community and local, state and federal water agencies; and (2) discussion of potential and existing water policy issues facing Nebraska, the region and the nation.

The forum continues today, in slightly modified form, as a “Water Colloquium” where university water-related faculty meet during fall semester to discuss current water-related topics in a retreat setting.

University Water Forum/Colloquium topics through the years have included:

- 1985 First meeting at which speakers reviewed water-related activities of their agencies
- 1986 Nitrates in Groundwater
- 1987 Water Quality and Hazardous Waste Disposal Siting – How Can We Handle It?
- 1988 Drought Identification and Response: What is it and What are Appropriate Responses
- 1989 University Water-related Programs: Future Directions
- 1990 Water Center: Present and Future
- 1991 Future Water-Related Academic Courses and Activities at the University
- 1993 Getting the Word Out
- 1994 Review of Faculty Water Activities
- 1999 (first since 1994) Water Research at the University of Nebraska in the 21st Century
- 2002 Review and Discussion of University Water Research
- 2004 First annual Water Initiative Research Retreat for University of Nebraska water-related faculty to promote interdisciplinary research initiatives
- 2005 Water Initiative Research Retreat
- 2006 Water Colloquium, funded by WRRRI, featuring presentations on water-related research by university faculty
- 2007 Water Colloquium



Ray Supalla discusses water marketing and banking at a Hardin Hall water forum.



Rain storm in the Sandhills.

The Burlington Northern Project

In 1984, the “Report and Recommendations of the Nebraska 2001 Committee” said Nebraska’s “Unique situation astride the 100th meridian beyond which precipitation and surface water no longer suffice for crop production, and above one of the world’s great underground water sources make water the most critical natural resource.”

An outgrowth of this was that protecting groundwater quality became a priority research objective for the next 20 years and Dr. Roger Gold, then director of the UNL Water Center/ Environmental Programs, noted “Experts estimate that about 40 percent of the more than 27,000 center pivot irrigation systems in Nebraska are used to apply agrichemicals by chemigation, which allows for the potential of widespread contamination (of groundwater resources).”

During fall 1984, the Burlington Northern Railroad Foundation committed \$1 million over five years to study this issue, and the Burlington Northern Foundation Water Quality Project was born. The Water Center provided supplemental funding to complete field operations and assist with post-project soil sampling and analysis, as well as for publishing reports and other publications.

This large, interdisciplinary research and demonstration project included chemigation technology and crop production alternatives to complement best management practices of irrigation, nitrogen and integrated pest management. The objective was preserving groundwater quality and efficient crop production.

The study was designed to assess effects of agricultural chemicals leaching into groundwater through chemigation – the emerging technology of injecting chemicals through center pivot irrigation systems. Nitrate management, irrigation scheduling, conservation tillage and integrated pest management were among the best management practices emphasized.

The are focused on was 11 counties in south central Nebraska on both sides of the Platte River and much of the research was centralized at UNL's South Central Research and Extension Center near Clay Center. That location was central to much of Nebraska's irrigated acres and sprinkler irrigation, and land suitable for much of the planned research was available.

This project provided important data on the reliability of check valves in preventing the backflow of chemicals from the sprinklers into groundwater wells, as well as showing how various groundwater pumping techniques might cleanup an accidental backflow.



Richard Ferguson (right) on a limited irrigation field day.



Richard Ferguson talks about soil fertility and limited irrigation usage.

Project findings generally supported the concept that prevention is the best cure for groundwater contamination. Proper equipment and recommended practices were shown to be essential for preventing groundwater contamination. Chemigation was also found to be an effective way to apply pesticides, and when used properly doesn't contribute significantly to leaching agricultural chemicals into groundwater.

Start-Up Funds

Dr. Mohamed F. Dahab, a respected UNL researcher and teacher and current chair of UNL's Department of Civil Engineering, is an example of the "incubator" effect the Water Center has had on faculty hires at the university over the last 40 years.

Dahab began his UNL career as an assistant professor of civil engineering in 1983. A year later, he received his first research funding from the Water Center's annual USGS allotment and though the amount was fairly modest, Dahab said "This was the only start-up funding I received from UNL for what turned out to be a long-term research program in environmental engineering." His research on removing nitrate from water and wastewater using biological denitrification and managing risk for nitrate-contaminated groundwater supplies today is widely recognized worldwide.

Today Dahab is president of the Water Environment Federation (WEF) and helps direct UNL's Environmental Engineering Program. "WEF's goals and many of UNL's and the Department of Civil Engineering's goals are the same: improving water quality and water availability worldwide," he noted.

Began in 1928, WEF is a not-for-profit technical and educational organization with 32,000 individual members and 76 affiliated member associations representing an additional 50,000 water quality professionals throughout the world. WEF's mission is to preserve and enhance the global water environment. In 1998 Dahab received WEF's prestigious Arthur Sidney Bedell Award.

He considers himself an example of how important it is for the University to invest even small amounts in young faculty members' futures. "I have always advised new faculty in all disciplines that I work with to consider the Water Center a starting point for such funding," he said.

Issues of recurring drought, global warming, energy management, pollution prevention and environmental degradation and developing practical technologies and systems to deal with them give UNL faculty and students limitless possibilities to make meaningful contributions in the future, he said.

Dahab's success illustrates the Water Center's effectiveness in making it a priority to use research funds, available through the USGS as start-up funds, for new faculty. The Water Center has been successful in using this incubator effect to promote increased communication and collaboration between university departments in the water-related research arena.

It is by teaching that *we teach ourselves*, by relating the *we observe*, by affirming that *we examine*, by showing that *we look*, by writing that *we think*, by pumping that *we draw water* into the well.

Henri Frederic Amiel



Mohamed Dahab addressing a WEF conference.

End of the Century

In 1990, **Dr. Bob G. Volk** succeeded Dr. Roger Gold as director of the Water Center. Volk had formerly been chair of the Department of Agronomy at the University of Missouri and had just finished a one-year appointment with the Cooperative State Research Service, Washington, D.C.

During his tenure, Nebraska Research Initiative (NRI) funding continued to increase. NRI began as a five-year funding initiative under Governor Kay Orr the year before Volk came to Nebraska and focused on specific research areas. One of these was developing and inviting collaboration between industry scientists and university researchers.

One of the projects NRI funded for 10 years, and which was coordinated by the Water Center was Water Science. Primary objectives of this NRI Water Sciences program were:

- Developing a Water Science Research Facility/Laboratory, including equipment and technical personnel;
- Providing matching or seed monies and assistantship support to faculty;
- Strengthening water science research capability through new faculty hires; and
- Purchasing scientific and support equipment to facilitate water sciences research.

Also due directly to the increase in NRI funding was the opening of the Water Science Research Facility (WSRF) in 1990 under founding director Dr. Roy Spalding and with a staff that included a field manager, sampling coordinator, laboratory manager, and separations chemist. The new facility was to provide state-of-the-art laboratories and equipment to all faculty to support their environmental and water-related research at the university. The WSRF (later the Water Sciences Laboratory) operated out of the former Wildlife Laboratory Building, adjacent to the Water Center, on UNL's East Campus.



Researchers Steve Comfort and Pat Shea.

Dr. Bob G. Volk

1990 - 1999



My year in Washington D.C. (1989-1990) working with the Cooperative State Research Service while on sabbatical from the University of Missouri had a big impact on my thinking regarding research and the importance of knowing more about

our water resources. I was part of a program granting several millions dollars a year to researchers from across the U.S. on competitive bases. This program introduced me to Nebraska research in water sciences, and it was easy to see how Nebraska would be very competitive for these grants. The faculty wrote very skilled, insightful and superb proposed research that won a number of these grants.

At this time I was made aware of the open position as Water Center director at the University of Nebraska-Lincoln. I applied for the position and was fortunate to be hired in July 1990. Nebraska was an excellent place to be since the onset of the Nebraska Research Initiative support provided over \$1 million dollars in new research funds to the Water Center. These funds had been used to hire faculty in the Departments of Agronomy; Forestry, Fisheries and Wildlife; Entomology; and Geology. Descriptions were also being written for new faculty in the Departments of Agronomy and Biological Systems Engineering.

One of the greatest joys in administration is the hiring of faculty with the challenges of interviews and then the ultimate hiring. We were fortunate in attracting top individuals for these positions, and I know that outstanding and very productive scientists staff all of the positions established by the NRI.

The Water Center also established a competitive grants program in water sciences, which was widely applauded by faculty throughout not only the Lincoln campus, but also research centers in other locations in the state. We also entertained research proposals from faculty at other state universities. The research proposals were competitive and of very high quality thus making decisions difficult.

One of the most interesting people I had the good fortune to work with was Bob Kuzelka. I mention him because he was most energetic and fun to be around. One of his tasks was to organize and run a water tour every year. This tour took us all over the state and surrounding states to see water resource projects. He was tireless in his quest for excellence and sometimes brought us to argue over what might be best for the Water Center. His advice and council over the years was a real help to me. The water tours gave us all an insight into water problems and opportunities in Nebraska and surrounding states.

The Water Center also published a research report every year with details of research programs and progress on water activities in the state. I was able to initiate major changes in reporting by publishing a water tabloid on a quarterly basis. We printed these as a means to get the word out on what the university was doing with regards to water resources. This was a very popular publication and received many requests from state and local agencies for copies to distribute. The first editor of the paper was a newsperson from a small town in Nebraska. She brought a breath of fresh air to all of us with a perspective we did not have. After she left, I hired a newsperson from Lincoln who performed equally well and was very professional in preparing, writing, and seeing that the tabloid was published on time. Steve Ress was very helpful to the staff and me and was excellent in preparing the tabloid and other special publications.

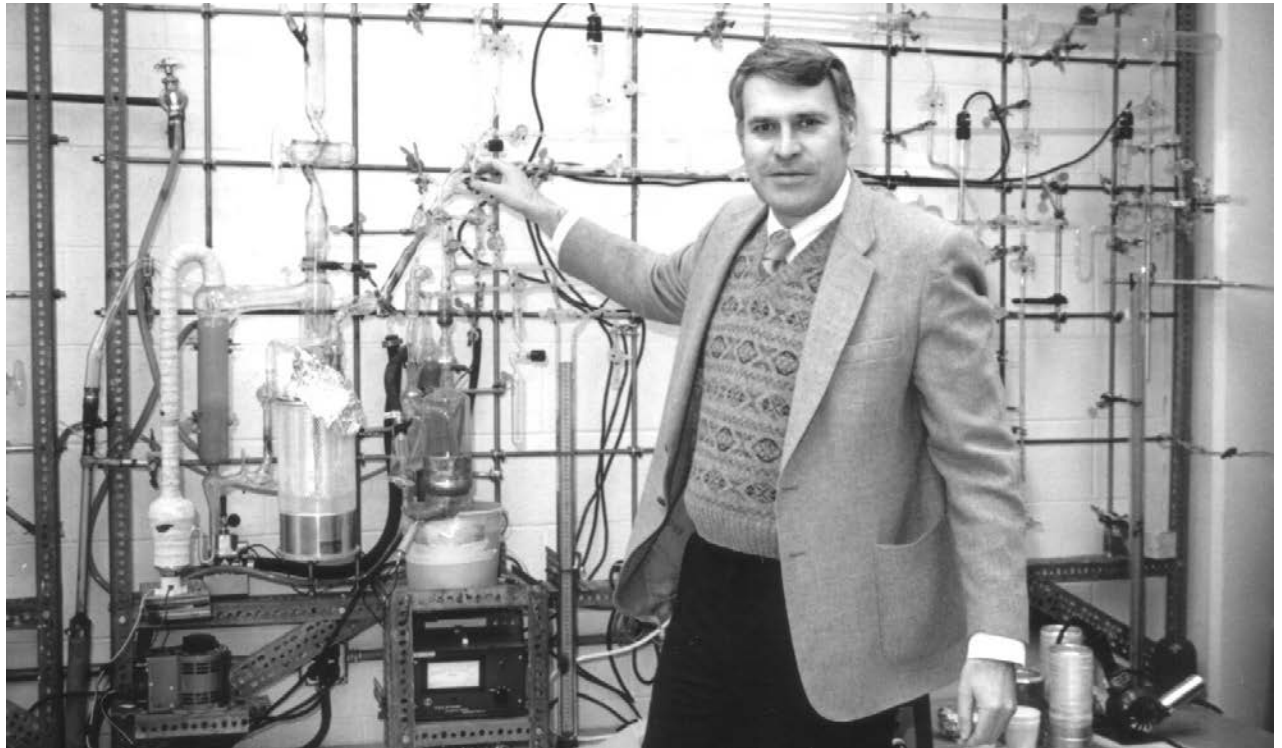
Water is everything to Nebraska agriculture. We have an abundance of groundwater that must be used carefully.

The Platte River and all of its tributaries need special treatment to preserve them as a water source as well as a resource that must be protected for their beauty. Nebraska has an environment that is unique, and only through research and education can our way of life be preserved.

After leaving Nebraska in 1999, I spent several years at the University of Kentucky and then decided that life was too short to be pushing any more paper. I became part of a small missions organization in Wilmore, Ky. called Evangelism Resources where I never had more enjoyment going to work. Following that I became a Foreign Resident Ambassador for Bible Study Fellowship and lived in Budapest, Hungary working as a missionary for several years. I now reside in Omaha.



Bob Volk and Governor Ben Nelson at a conference.



Top Photo: Roy Spalding, founding director of the UNL Water Sciences Laboratory.



Left Photo: Director of Environmental Programs and later interim director of the Water Center Ed Vitzthum (right) with a display on one of the hydrologic unit studies.

NRI also led to hiring additional faculty with teaching appointments in the Departments of Geosciences, Entomology, Biological Sciences, School of Natural Resources and the Eppley Institute for Cancer Research and Allied Diseases at the University of Nebraska Medical Center, Omaha. Under the Water Science portion of the initiative, additional faculty hires included: Tyler Kokjohn, an aquatic microbiologist in the School of Biological Sciences; Steve Comfort, environmental soil chemist

in the Department of Agronomy; and Michael Corbett, agrochemical toxicologist at the Eppley Institute.

Faculty in other UNL departments that received direct salary support from the NRI at that time included: Kyle Hoagland, Department of Forestry, Fisheries and Wildlife; Blair Siegfried, Department of Entomology; Vitaly Zlotnik, Department of

Geosciences; and Spalding, Department of Agronomy.

When Volk left UNL in 1999, after nearly 10 years as the Water Center's director, Dr. Edward F. Vitzthum, who was coordinator of Environmental Programs within the Water Center, was appointed interim director of the Water Center/Environmental Programs.



Selling plants at Festival of Color at UNL's Agricultural Research and Development Center near Mead, Nebraska. The Water Center helped co-sponsor the event.

A Cutting-Edge Analytical Tool for UNL

When the state legislature created the Nebraska Research Initiative (NRI) in the late 1980's to fund basic research science and engineering to help Nebraska business, it would pave the way to what has become one of the finest analytical laboratories in the country.

Because of NRI funding, the Water Center was able to open what was then known as the Water Science Research Facility (WSRF) under founding director Dr. Roy Spalding in 1990. WSRF (later Water Sciences Laboratory, or WSL) is in the former Wildlife Laboratory Building on UNL's East Campus, where it provides state-of-the-art instrumentation to measure organic and inorganic chemicals in the soil, streams and groundwater.

The lab's guiding purpose is to provide analytical capabilities necessary to assess, resolve, and remediate groundwater and surface water contaminants. Its capabilities, in terms of staffing, equipment and methodologies have grown steadily and solidly through the years, making it a research facility that stands alone in both the expertise and technical facilities to provide solutions to water-related problems not only in Nebraska, but nationally and internationally. Lab clients come from within and outside the university, each needing high-level accuracy or sophisticated procedures.

Having the WSL has been an important part of obtaining major research grants by NU and UNL faculty. An early example of this was the Management Systems Evaluation Area (MSEA) project, one of the largest research grants ever received up to that time by UNL's Institute of Agriculture and Natural Resources.

“We do not *inherit* the earth from our ancestors; we *we borrow it* from our children” said Bud Cuca, special counsel for Gov. Kay Orr, in a speech at the 1990 Nebraska Water Conference.

A coalition of more than 20 UNL and U.S. Department of Agriculture – Agricultural Research Service scientists worked on the USDA-funded water quality study throughout the 1990s. Thousands of groundwater samples were analyzed by the WSL for pesticides and nitrate for this project, and others, funded to study pesticide fate and transport. Methodologies developed to analyze herbicides and their degradation products under differing cropping and irrigation practices led to better understanding of how groundwater becomes contaminated and what can be done to minimize or prevent it.

Instrumentation and methods for stable isotope analysis have been a part of the WSL

since it was established. Nitrogen isotope analysis of nitrate and ammonia is always in demand as a “fingerprinting” method for tracing the sources of contaminants. In 1992, the facility acquired a high sensitivity dual inlet stable isotope mass spectrometer that ultimately replaced the outdated systems originally installed. The semi-automated stable isotope mass spectrometer has been used for analyzing hundreds of samples for nitrogen isotopes, as well as for developing a high precision method for measuring what nitrogen gas enrichment does to bacteria denitrification in groundwater.

Two additional stable isotope mass spectrometers were added in 2002 to automate and improve precision of stable isotope analysis of water used as a trace for hydrologic studies. These automated systems can process and analyze samples much faster than using older off-line



Dave Cassada prepares samples at the Water Sciences Laboratory.

methods, thereby reducing costs and increasing the number of projects the methods can be used for.

In 1997, the lab got its first liquid chromatograph-mass spectrometer (LC/MS). This led to developing methods for a whole new group of contaminants including explosives such as RDX (found in groundwater at former ordnance manufacturing plants in eastern and central Nebraska) and pharmaceuticals like tetracyclines, found in livestock waste.

The impact of these and other water-soluble compounds on water quality could not be studied until methods were developed to measure them, as well as other “emerging contaminants” in groundwater and surface water. Research using these methods has been applied to determine how contaminants such as RDX groundwater can be “remediated” or cleaned up using advanced chemical treatment technologies.

The technical staff at the WSL now conducts analysis of samples for water research for a broad range of contaminants and stable isotopes. This unique facility offers an array of analytical services that rival even the most well-equipped university or government research laboratory. The lab continues to develop and apply new methods using state-of-the-art technology to support water research in Nebraska and beyond.

Dr. Daniel D. Snow, who came to the WSL as a hydrochemist when the facility first opened, is now it’s director of services and responsible to the Water Center director for operation of the lab.



Top Photo: Director of laboratory services Dan Snow, UNL Vice Chancellor for Research Prem Paul and Nebraska Third District Congressman Adrian Smith tour the Water Sciences Laboratory.



Right Photo: Dave Cassada (left) guides a public tour of the Water Sciences Laboratory.

Long Pine creek.



The Beginning of a New Millennium

In 2000, **Dr. Kyle D. Hoagland** became the current director of the UNL Water Center. J. Michael Jess served as acting director for two years, from 2000 – 2003, while Hoagland was acting director of the UNL's then fledgling School of Natural Resources Sciences.

In 2003, the Water Center again changed its administrative home when it became part of the School of Natural Resources (SNR), the natural outgrowth of the start-up School of Natural Resource Sciences. SNR combined UNL's School of Natural Resources Sciences (created five years previously from formerly independent departments including Meteorology and Forestry, Fisheries and Wildlife), Conservation and Survey Division and the Water Center. In September 2006, most SNR units moved into the newly renovated Hardin Hall (formerly the Clifford Hardin Center for Continuing Education) at North 33rd and Holdrege Sts at the southwest corner of UNL's sprawling East Campus.

In 2000, the NU's Board of Regents began a process of targeting the highest priority programs on each of NU's four campuses. They established a program of excellence grant fund two years later and the resulting Water Resources Research Initiative (WRRRI) became one of 11 "Programs of Excellence" funded by this source.



A stretch of the Republican River after being treated for invasive species.

The WRRRI is a multidisciplinary and interdisciplinary collaborative effort, coordinated by the Water Center and the Department of Geosciences, which spans several UNL colleges and departments. The initiative promotes greater collaboration among researchers and disciplinary areas, coalesces their efforts around key water issues facing the state, and creates synergy needed to support large-scale externally funded research. The WRRRI also provides federal funds to hire faculty and researchers to fill key gaps in water-related areas. Eleven recent new faculty positions funded by WRRRI are highlighted in **Appendix F**.



Kyle Hoagland, director of the UNL Water Center and Dan Snow, director of services for the UNL Water Sciences Laboratory, detail the lab's analytical equipment and methodologies for Joseph J. Jen, Under Secretary for Research, Education and Economics, U.S. Department of Agriculture.



Dean Eisenhauer adjusts an experimental riparian buffer strip sampler.

One such collaboration is among the Water Center, the UNL College of Law, and other departments, in sponsoring a Water Law, Policy and Science Conference held each spring since 2004 (a continuation of former annual Nebraska Water Conferences) with funding provided by WRRRI.

In 2006, the Water Center reactivated its long dormant advisory board. The Water Resources Advisory Panel (WRAP) was appointed by the UNL Vice Chancellor for Research to share thoughts and opinions on water resources issues facing Nebraska. The goal of the panel is to guide UNL as it continues to invest in water research, education and outreach efforts. The 10 current panel members, who serve one- to three-year staggered terms, are:

Ann Bleed, Nebraska Department of Natural Resources
Eugene Glock, Cedar Bell Farms
Mary Harding, NPPD Board of Directors and formerly Nebraska Environmental Trust
Glenn Johnson, Lower Platte South Natural Resources District
Don Kraus, Central Nebraska Public Power & Irrigation District
Kirk Nelson, Nebraska Game and Parks Commission
Lee Orton, Nebraska Well Drillers Association
Jay Rempe, Nebraska Farm Bureau Federation
Ed Schrock, former Nebraska State Senator
Susan Seacrest, founder and former president, The Groundwater Foundation



A lake restoration project.



Hardin Hall

National Relationships

One of the Water Center's most important connections is involvement in national water-related organizations.

Beginning in 1971, the Water Center served as home of the Universities Council on Water Resources (UCOWR). This organization today is composed of over 90 universities united to encourage research and education in water resources.

UCOWR's main objectives are to: (1) facilitate water-related education at all levels; (2) promote



Mike Jess

meaningful research and technology transfer on contemporary and emerging water resources issues; (3) compile and disseminate information on water problems and solutions; and (4) inform the public about water issues in order to promote informed decisions at all levels of society. An annual meeting is held at one of the member universities. The Water Center continued as UCOWR's home office until 1987.

Another important national organization to which the Water Center belonged was the National Association of Water Institute Directors (NAWID) from about 1966 until 1990. This organization consisted of the directors of all 54 state water



Toxic blue-green algae.

resources institutes, and their mission was to lobby Congress for increased funding for water resources research.

In 1990, NAWID was succeeded by a similar organization, the National Institutes for Water Resources (NIWR), whose purpose is to cooperate closely with other state water institutes and other

organizations to increase their mutual effectiveness and promote regional coordination of activities. An annual meeting is held, usually in Washington, D.C., and Hoagland is the organization's current executive secretary.

Of the Water Center

A 1999 Water Forum enumerated four specific recommendations (italicized) for the future of the Water Center. I discovered these only recently, while in the process of writing this history, which doesn't bode well for committee work in general. It does, however, offer a unique opportunity to reflect on these well considered guides nearly a decade later, without the benefits or limitations of knowing about them in advance. They also serve as a useful starting point for thinking seriously about the future of the UNL Water Center.

“There is a need for aggressive leadership and better coordination of research funding and programming. The Water Center director should facilitate and organize faculty and research as a system-wide center directly under the guidance of the UNL Vice Chancellor for Research, but have no salaried faculty members other than the director. The director’s position should remain full-time.”

The 54 water centers (one in each state, plus Guam, Puerto Rico, Virgin Islands and Washington D.C.) are typically located at Land Grant institutions. They are charged with serving their entire state, particularly in terms of U.S. Geological Survey (USGS) 104b seed grants.

Consequently, this national network is well positioned to help coordinate efforts at local, regional, and national levels.

In Nebraska, water faculty are located at several institutions across the state, including UNL, University of Nebraska–Kearney, University of Nebraska–Omaha, Creighton University and Peru State College. Still, the majority of the more than 130 faculty members who work in water-related fields are at UNL.

Therein lies the challenge that the forum addressed in 1999, which is still pertinent today, namely how does a water center lead, coordinate, facilitate and organize a large, diverse faculty who reside in as many different buildings as the sub-disciplines they represent and who are in no way beholden to the water center director for their academic appointment or tenure? For that matter, what's the point of facilitating research for a diverse group of scientists, engineers, sociologists, economists and others?

The answers lie in the very nature of the basic water challenges that society must presently address. Today's water resources challenges, and those for the foreseeable future, are largely complex environmental issues requiring interdisciplinary teams of water faculty in basic science, applied science, and human dimensions, to have any hopes for finding viable solutions.

More than 30 years after 1972's Clean Water Act was enacted, we continue to struggle with the relationship between science and law in creating environmental policy. This ongoing 'troubled



Beaver dam on the Platte river.

marriage' between water science and law/policy is a result of segregation of water-related fields in academic programs.

Federal granting agencies recognized this need to better integrate water science and human dimensions, for example, the National Science Foundation's Water and Watersheds program and Coupled Natural and Human Systems program (an outgrowth of its Biocomplexity program).

This novel overall approach is designed to investigate complex natural and human systems,

reflecting a new approach to difficult water issues. Resilient aquatic ecosystems are the primary goal that drives this approach to water resources management. Active coordination and facilitation of water faculty research, education and outreach is thus even more important today than in 1999.

Our approach to this challenge over the past ten years has been to: (a) inform faculty of what the other 129 water faculty are doing in each of the challenge areas (via an annual water research colloquium, workshops on cutting-edge topics, and research-based retreats to allow more time to

The key to solving **Nebraska's water problems,** most say, can be **summarized in one word — stewardship.** Stewardship — the use, preservation, development and protection of natural resources — **is critical.**

**Lori Beckman, “Water, the abundance, the menace, the challenge,”
University of Nebraska–Lincoln, College of Journalism,
Depth Report No. 21, May 20, 1990.**

address larger issues.), (b) create a sense of “water community” among faculty (via an expanded faculty directory, and periodic informal social events), and (c) develop research teams to address specific issues and to seek extramural funding to support larger-scale studies and address problems in a more comprehensive way. Thus far, this approach has been effective in facilitating the formation of larger, interdisciplinary faculty teams who are now working on the more complex water resource challenges facing the State and beyond. Learning how to sustain these efforts is an ongoing process.

This is not only a recipe for a water institute to attempt to meet its legislative mandate and address the 1999 Forum’s notion of how a center ought to operate, but is also a formula essential for universities in general to contribute in meaningful ways to the myriad environmental problems that society now faces.

The water centers can even serve as useful models of how universities perhaps should evolve. That faculty are not part of any particular academic unit or at least their affiliations may be more fluid, interdisciplinary teams of faculty may form to address crucial issues, then dissolve as new issues arise, all without “turf” or rigid departmental lines being drawn.

A compelling reason for this model is that the science and engineering disciplines evolve far more rapidly than the university academic departments, centers, schools and colleges that represent them. Since department lines so often don’t keep pace with the science, they may actually hinder progress by inherently discouraging interdisciplinary research.

Water Center director should facilitate both long-term and immediate goals and funding of

water-related research at NU. One of the top priorities would be the allocation of funds to researchers. The director should facilitate lateral interchange between the center and researchers.

This forum recommendation is also aimed at integration of water faculty through the center’s allocation of funds to encourage or even require interchange among researchers. More importantly, this recommendation addresses the critical issue of timescale in addressing research questions, an important element of several federal granting agencies today (e.g., NSF). It’s interesting to note that UNL Water Center funding was declining markedly in 1999, as Nebraska Research Initiative funds were being reallocated campus-wide. As a result, the center lost more than \$500,000 in discretionary funds over a two to three-year period, ending in fiscal 2000. Consequently, allocation of funds was no longer a feasible priority.

Director should facilitate and actively pursue water research funding, as well as disseminate information both to the public and to research faculty, staff and students.

It should be clear by now that the Water Forum took research funding facilitation very seriously! This recommendation took the additional step of identifying outreach education as an important role for the Water Center. This is entirely consistent with the centers’ third Congressional mandate (via the Water Resources Research Act of 1964), “To facilitate water research coordination and the application of research results by means of information dissemination and by technology transfer.”

Water Center should act as a data clearinghouse for researchers and focus on both short- and long-term research and programming.

In 2006, the recently established Water Resources Advisory Panel (WRAP) surveyed specific state water research needs. This was largely prompted by a widely recognized need for UNL research to more closely align with an increasingly long list of water issues Nebraska is facing, particularly water quantity problems exacerbated by a prolonged drought. After a review by university faculty, the following priorities were established by WRAP:

- Assessment of information needs to develop a better understanding between surface water and groundwater resources
- Related topics that impact the water budget, i.e., changes in land use and agricultural practices; impact of riparian vegetation on water use; and groundwater – surface water interaction.
- Determine best management activities/tools to reduce consumptive use and provide the best economic, environmental and social benefits per acre-foot of water consumed.
- Economic impacts of management activities.

As these priorities show, agriculture has long been and will continue to be a basic building block of Nebraska's economy and farming and ranching depend heavily on water. In order to serve those needs and state interests in general, the Water

Center must continue to foster research supporting Nebraska's economy and its communities, large and small.

By necessity, the Water Center's highest priority will continue to be new funding sources needed to carry on its water-related research missions. To that end, a "Top 10" list was compiled based on input from UNL water faculty, WRAP, an ad hoc workshop group of 30 water experts from across Nebraska, and the readership of the Water Center's quarterly newsletter, *Water Current*. The list, while still evolving, represents this collective input:

Top 10 Water Challenges for Nebraska (2007-08)

This listing is *unranked*, also recognizing that several challenges may fit into more than one of the three sub-categories (e.g., challenge #7 - monitoring system, also has immediate water quantity implications, and #8 also poses water quality challenges); K-gray education/outreach are inherent and very important needs inherent in all of these challenges:



The scenic Niobrara River.



Herding cattle to water in Aurthur County.

Water Quantity

1. Effects of water consumption and conservation practices on instream-flows, groundwater recharge and water supplies, including ethanol production; realizing the maximum water use efficiency for irrigation (e.g., changing from gravity flow to center pivot) is a key factor.
2. Invasive exotic species (e.g., purple loosestrife, salt cedar, Phragmites), particularly in riparian buffer strips and in stream channels.
3. Climate change, especially the impacts of global warming and increased climate variability, particularly the frequency and severity of droughts and floods on water availability.

Water Quality

4. Nitrate, uranium, arsenic, and pesticide contamination of drinking water supplies, and nitrate contamination of irrigation sources.
5. Non-point source (NPS) nutrient and sediment inputs in lakes, streams and reservoirs, including toxic algae treatment and prevention, and establishing of Maximum Contaminant Loadings (MCLs) for nutrients in NE.
6. Potential surface and ground water contamination by “emerging” contaminants (including endocrine disrupting compounds), such as steroid hormones, antibiotics, pesticides, surfactants, and disinfectants, from grain and livestock production, biosolids application, biofuel production, and municipal/residential wastewater sources.

Water Institutions

7. Creating and supporting more comprehensive, ongoing, real-time water monitoring, including stream gauging and cyberinfrastructure networks that are linked to predictive models, readily accessible to the public, and coupled with smart decision-support tools. Understanding the connection between surface and ground water is especially important.
8. Aging water infrastructure, including drinking water distribution systems (esp. in small rural communities), wastewater treatment, storm runoff, irrigation systems, dams, levees, and canals.

9. Water economics and water policy, including establishment of water markets and water banking, and recognition and development of water resources as a natural resource amenity for recreational use (incl. greater public access) and wildlife habitat.
10. Creation of effective social systems to influence individual and institutional behavioral change for sustainable management of water resources, including a viable legal framework, ongoing financial support, and an increased focus on collaborative solution development.

An obvious question remains, “How does this list compare to one compiled in 1964 when the Water Center was formed?” or more to the point, “Are we facing the same water challenges today or have some of them been solved over the past 40 years?”

I believe the answers to these questions are critical in assessing the future the Water Center, and water institutes in general. Unfortunately, no such list was compiled in 1964 so far as we know. Observations lead me to believe that (a) many of the same issues that plagued water resources managers in 1964 remain major challenges today, e.g., eutrophication and other problems resulting from non-point source inputs of excess nutrients into waterways; (b) while it appears that no challenges have been entirely removed from the list, it is also true that the level of knowledge that is apparent in the wording of the 2007-08 list clearly reflects the fact that significant progress has been made in addressing these issues; (c) the general category that likely would have received far less attention in

1964 is water institutions, and; (d) there are several challenges on the 2007-08 list that would not have been found on the 1964 list (e.g., global climate change, frequent drought, biofuels concerns and, by definition, emerging contaminants).

If the need for water resources research, education and outreach can be gauged by the number and magnitude of the challenges we face today and if the water institutes can in any way address those needs, then clearly there is a vital future ahead for the Water Center.

First, I would also argue that this list of challenges is in no way unique to Nebraska, rather they represent regional challenges and are similar to those facing the nation, indeed globally.

Second, it is important to point out that despite the fact that most items that presumably would have occurred on a 1964 list are still there today should not be interpreted as a lack of progress. Tremendous strides have been made in many of the areas still listed today, for example in water quality improvements in rivers across the U.S. (significant declines in lead contamination nationwide) and in applications of remote sensing technologies to water resource challenges (e.g., ET estimates, and cyanobacteria mapping and prediction).

If water institutes continue to provide leadership toward quality water resources research, education and outreach, then the outlook for them is indeed bright, because the water challenges we currently face are more critical and challenging than ever before.

A reliable source of clean, safe drinking water and reliable sources of water sufficient for agricultural was almost taken for granted in 1964 (recalling that the first Earth Day was held in 1969), whereas today’s challenges are much better defined.

Solutions are another matter, which will undoubtedly require at least another generation of dedicated, highly trained water scientists, engineers, and water law/policy experts to do what needs to be done to make our aquatic ecosystems resilient and sustainable.

There is much to be done.

— Kyle D. Hoagland,
Director,
UNL Water Center



Water Center Projects

This Appendix lists some of the projects funded through the Water Center since its inception. Most listed in this Appendix were supported by federal funds through the Water Resources Research Act of 1964 and its amendments (unless otherwise noted). Projects are listed by decade, and in most cases the project leader is included (if known). This is not an exhaustive list of Water Center projects, but it does provide an indication of the water issues that were considered important through the years.

Because this listing was developed from various sources and multiple formats, we apologize if all project leaders are not included, are not listed correctly, or their University affiliations are incorrect.

1960s

Energy Sources for Evapotranspiration in the Plains Region, Norman J. Rosenberg, Department of Agricultural Engineering, 1965-69

Engineering Phases of land Treatment Related to Increasing Water Use Efficiency and Storage Efficiency of Rainfall, Howard Wittmuss, Agricultural Engineering, 1966-69

Input-Output Analysis of Water Use for Nebraska Industries, A.W. Epp and Maurice Baker, Department of Agricultural Economics, 1966-70

Internal Water Status of Plants, Jerry Eastin, Charles Sullivan and Kinbacher, Department of Agronomy, 1966-1969

Mechanics of Bank Seepage in Natural Streams During Flood Flows, Sarpkaya, 1966-67

Brackish Water Purification by Biological Fuel Cell-Powered Electrodialysis, William Scheller, Department of Chemical Engineering, 1966-70

Water Quality Practices in Midland Meat Packing Plants, Loyd Fisher and Maurice Baker, Department of Agricultural Economics, 1966-69

Eminent Domain, Richard Harnsberger, College of Law, 1967

Surface Properties of Teflon Film in Saline Water Processes, L.Tao, Department of Chemical Engineering, 1967-68

Utilization of the Storage Potential of River Valley Aquifers, Ralph Marlette, Department of Civil Engineering, 1967-70

Conjunctive Use of Ground and Surface Waters, Richard Harnsberger, College of Law, 1969-70

1970s

Animal Waste Utilization for Pollution Abatement (Technology and Economics), Otis Cross, Department of Agricultural Engineering, 1970-71

Eutrophication of Small Reservoirs in the Great Plains, Gary Hergenrader, Department of Forestry, Fisheries and Wildlife, 1970-72

Physiological and Biochemical Response of Plants to Different Internal Water Potentials, Kinbacher, C. Sullivan, Department of Agronomy, 1970-72

Economic and Technical Aspects of the Use of Mathematical Models in State Water Resources Planning Programs, Warren Viessman, Jr., Water Center, 1970

Evaluation of Methods for Improving Water Use Efficiency Through Simultaneous Determination of Field Evapotranspiration and Photosynthesis, Norman Rosenberg, 1970-72

Nebraska Droughts: A Study of Their Past Chronological and Spatial Extent with Implications for the Future, Merlin Lawson, Department of Geography, 1971

A Survey of the Woody Phreatophytes of the Republican River in Nebraska, P. Rand, Department of Botany, 1971

Influence of Fertilizer Practices on Environmental Quality (Phase I), Robert Olson, Department of Agronomy, 1971-72

Conjunctive Use of Ground and Surface Waters, Richard Harnsberger, College of Law, 1971-72

Ecological Impact of Surface Water Impoundments in the Great Plains Area, Michael Cowan, Department of Biology, 1971-72

Concurrent Growth of Bacteria and Algae in a Closed Vessel, Peter Reilly, Department of Chemistry, 1971-72

A Simulation of the Effects of Dynamic Water Pricing Policies, Marshall Gysi, Department of Civil Engineering, 1971-72

Mobility and Deactivation of Herbicides in Soil-Water Systems, Terry Lavy, Department of Agronomy, 1971-74

Water Quality Models for Urban and Suburban Areas, Dewey Andersen, Department of Civil Engineering, 1971-74

Animal Waste Utilization for Pollution Abatement (Phase II), Otis Cross, Department of Agricultural Engineering, 1971-74

Hydrological Models for Poorly Defined Drainage Areas, Warren Viessman, Jr., Water Center, 1971-73

Aerobic Treatment of Feedlot Runoff Water, Terry McGhee, Department of Civil Engineering, 1972

Dynamic Model for Urban Hydrologic Systems, Alvin Surkan, Department of Computer Sciences, 1972-73

Protection of a Unique Ecological Area Through Improved Irrigation and Fertility Management, Paul Fischbach, Darrell Watts, Department of Agricultural Engineering, 1973

Influence of Fertilizer Practices on Environmental Quality (Phase II), Robert Olson, Department of Agronomy, 1973-74

Practical Treatment of Feedlot Runoff Water, Terry McGhee, Department of Civil Engineering, 1973-74

- Pollution of Irrigation Waters by Plant Pathogenic Organisms, James Steadman, Department of Plant Pathology, 1973-75
- Biological Control of Water Loss, C. Sullivan, Kinbacher and Jerry Eastin, Department of Agronomy, 1973-75
- Recharge Simulation Model, Deane Manbeck, Department of Agricultural Engineering, 1973-75
Disposal of Cattle Feedlot Runoff on Agricultural Land, Howard Wittmuss, Department of Agricultural Engineering, 1973-75
- Biological Control of *Sphaerotilus natans* and Other Related Species in Wastewaters, T. Thompson, Department of Microbiology, 1973-75
- Seasonal Water Use of Irrigated Pasture Grasses Under Permanent-Set Irrigation, James Nichols, 1973-76
- Water Quality Study of Nonpoint Source of Agricultural Runoff, Dewey Andersen, Department of Civil Engineering, 1974-75
- Biological Control of Blue-Green Algae, Eugene Martin, Department of Microbiology, 1974-76
- Alternatives in Area Management of Groundwater, Loyd Fischer, Department of Agricultural Economics, 1974-76
- A Regional Model for Predicting Great Plains Evapotranspiration, Norman Rosenberg, Department of Agricultural Economics, 1974-76
- Improved Water and Fertility Management for Irrigation Systems, Paul Fischbach, Darrell Watts, Department of Agricultural Engineering, 1974-77
- Upflow Filtration of Oxidation Pond Effluent, Terry McGhee, Department of Civil Engineering, 1975
- Investigation of Laser Raman Spectroscopy for Analysis of Water Quality, Frank Ullman, Department of Chemistry, 1975-76
- Detection of a Potential Health Hazard in Recreational and Other Surface Waters, William O'Dell, UNO, 1975-77
- Computer Modeling to Maximize Water Use Efficiency and Reduce Energy in Irrigation, James Gilley, Department of Agricultural Engineering, 1975-77
- Herbicide Transport in Soils Under Center Pivot Irrigation Systems, Terry Lavy, Department of Agronomy, 1975-77
- Validation and Implementation of a Simplified Streamflow Simulator, Alvin Surkan, Department of Computer Sciences, 1975-77
- Mapping Model for Determining Land Suitable for Irrigation, Richard Hoffman, Department of Industrial and Management Systems Engineering, FY 1975-77
- Application of Enzyme Methods to the Determination of Pollutants in Water, Khem Shahani, Department of Food Science, 1975-78
- Irrigation Management – A Mechanism for Saving Energy and Water, Paul Fischbach, Darrell Watts, Department of Agricultural Engineering, 1975-78
- Wastewater Treatment and Reuse by the Soil-Plant System, James Gilley, Department of Agricultural Engineering, 1976-77
- Groundwater Recharge Model and Field Project Implementations, Deane Manbeck, Department of Agricultural Engineering, 1976-77
- Pollution of Irrigation Reuse Water by Plant Pathogens, James Steadman, Department of Plant Pathology, 1976-78
- The Production of Mucilage of Diatoms in McConaughy, Pawnee and Yankee Hill Lakes and the Role of This Material in the Aquatic Environment, James Rosowski, School of Life Sciences, 1976-78
- Physiological Aspects of Plant Water Use Efficiency, Charles Sullivan, Department of Agronomy, 1976-78
- Nitrogen Source Differentiation Through Carbon Isotopes, Roy Spalding, Conservation and Survey Division, 1977
- Nitrogen Losses from Sprinkler-Applied Nitrogen Fertilizer, Gary Hergert, Panhandle Research and Extension Center, 1977-78
- Improved Water and Fertility Management for Irrigation Systems (Phase II), Paul Fischbach, Department of Agricultural Engineering, 1977-79
- Corrosion in Water Distribution Systems, Donald Johnson, College of Engineering, 1977-79

Analysis of Seasonal Persistence of Climate in Nebraska, Merlin Lawson, Department of Geography, 1978

Comparison of Evapotranspiration Rates in the Platte River of Nebraska: 1938 vs 1978, Harold Nagel, University of Nebraska at Kearney, 1978

Surface and Groundwater Study of the White River, Dawes County, Nebraska, Agenbroad, University of Nebraska at Kearney, 1978

Development of a Multi-Objective Screening Model for Water Resources Planning in Nebraska, Jerald Dauer, Department of Mathematics, 1978-79

Region-wide Irrigation Scheduling by Local Evapotranspiration Measurement, Walter Trimmer, Panhandle Research and Extension Center, 1978-79

Impact of an Introduced Fish Species (*Morone americana*) on the Fisheries Resources of Nebraska, Royce Ballinger, E. J. Peters, School of Life Sciences, 1978-79

Remotely Sensed Crop Temperature for Water Resources Management, Blaine Blad, Center for Agricultural Meteorology and Climatology, 1978-80,

Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains, Ray Supalla, Department of Agricultural Economics, 1978-80

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska, J. David Aiken, Department of Agricultural Economics, 1979-80

Empirically Derived Probability Estimates of Drought Parameters for the Western United States back to 1700 A.D., Merlin Lawson, Department of Geography, 1979-80

Ferrate Ion: Potential Uses in Advanced Wastewater Treatment, James Carr, Department of Chemistry, 1979-81

Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield, Jerry Eastin, et al, Department of Agronomy, 1979-81

Water and Energy Conservation Using Center-Pivot Irrigation and Reduced Tillage Systems, James Gilley, Department of Agricultural Engineering, 1979-81

The Biological Regulation of Bloom-Causing Blue-Green Algae, Eugene Martin, School of Life Sciences, 1979-81

Improvement of Irrigation Scheduling Techniques for Corn with Variable Corn Maturity Range, Plant Population and Water Supply Availability, Darrell Watts, Department of Agricultural Engineering, 1979-80

Public Attitudes of Nebraskans Toward Water Policy, Susan Welch, Department of Political Science, 1979-80

1980s

Measurement of Actual Transpiration of Native Grass Stands as a Component of Nebraska Sandhills Groundwater Hydrology, Ty Harrison, School of Life Sciences, 1980-81

Distribution of Mineral Nitrogen Under Native Range and Cultivated Fields in the Nebraska Sand Hills, Gary Hergert, Panhandle Research and Extension Center, 1980-81

Herbicide Loss From Treated Fields in Water and Sediment Runoff as Affected by Center Pivot Irrigation System and Tillage Treatment, J. R. Leavitt, 1980-81

Reduction in Development of Bloom-Forming Blue-Green Algae by Nutrient Enrichment to Maintain Desirable Pre-Bloom Dominants, James Rosowski, School of Life Sciences, 1980-82

Automation of a Sprinkler Irrigation System by the Utilization of Real Time Weather Information, Albert Weiss, Panhandle Research and Extension Center, 1980-82

Model Quantification of Streamflow-Groundwater Interaction for Complex Aquifer Geometry, Marvin Damm, Department of Civil Engineering, 1980-82

Water Conservation Through Limited Irrigation of Corn and Grain Sorghum in the Great Plains, Darrell Watts, Department of Agricultural Engineering, 1980-82

Evaluation of Hydrologic Effects of Implementing Various Levels of Control on Irrigation Activities (LB577), Marvin Damm, 1980, funded by State Policy Research office

Evaluation of Legal and Institutional Arrangements Associated with Groundwater Allocation in Missouri River Basin States, J. David Aiken and Ray Supalla, Department of Agricultural Economics, 1980-81

Water Quality Study of Runoff from Agricultural Lands (Dee Creek), Marvin Damm and Denis Gilbert, Water Center, 1980-81, funded by the U. S. Environmental Protection Agency

State Water Planning – Policy Issue Analysis, Gary Lewis, Water Center, 1980-81, funded by State Natural Resources Commission

Improved Irrigation Energy Efficiency Through Alternative Irrigation Management Practices, James Gilley, Ray Supalla, 1981-82, funded by Agricultural and Water Research Fund

Tillage Systems for Low Pressure Sprinkler Irrigation on Sloping Soils, Thomas Dorn, Northeast Research and Extension Center, 1981-82, funded by Agricultural and Water Research Fund

Effect of Nitrate on Corrosion of Irrigation Distribution System Components, Donald Johnson, Department of Mechanical Engineering, 1981-82, funded by Agricultural and Water Research Fund

Nebraska Water Law and Administration, Richard Harnsberger, College of Law, 1981-82, funded by Agricultural and Water Research Fund

Scheduling Procedures with Limited Water for Improved Water Use Efficiency for Corn and Soybeans, George Meyer, Paul Fischbach, Department of Agricultural Engineering, 1981-83

Enhancement of Water Quality in Nebraska Farm Ponds by Control of Eutrophication Through Biomanipulation, Gary Hergenrader, Forestry, Fisheries and Wildlife, 1981-83

Parasite Communities as Indicator Systems for Predicting the Effects of Surface Water Management Options on the Biota of Prairie Rivers, John Janovy, Jr., School of Biological Sciences, 1981-83

Increased Water Conservation and Percolation Through Improved Tillage Practices, Howard Wittmuss, Department of Agricultural Engineering, 1982-83

Conservation of Soil, Water and Energy Through Reduced Tillage Systems, Elbert Dickey, Department of Agricultural Engineering, 1982-84

Tillage Practice Effects on Water Conservation and the Efficiency and Management of Surface Irrigation Systems, Dean Eisenhauer, Department of Agricultural Engineering, 1982-84

Mycorrhizae as a Factor in Revegetation of Eroded and Disturbed Soils in Sand Dune Soils, M.G. Boosalis, Department of Life Sciences, 1983-84

Nitrate Removal from Groundwater Supplies Using Biological Denitrification, Mohamed Dahab, Department of Civil Engineering, 1983-84

Predicting Groundwater-Surface Water Interactions and Nitrate Concentrations in Municipal Well Fields Within the Platte River Channel, Martha Gilliland, University of Nebraska at Omaha, 1983-84

Field Measurement of Evaporation and Transpiration for Irrigated Corn, Sorghum and Soybeans, Derrel L. Martin, Department of Agricultural Engineering, 1984-85

Assessment of Accelerated Channel Erosion Following Urbanization of Agricultural Watersheds, Michael E. Nicklin, Department of Civil Engineering, 1984-85

Interpretation of Vegetation Encroachment and Flow Relationships in the Platte River by Use of Remote Sensing Techniques, Jeffrey Peake, M. Peterson, University of Nebraska at Omaha, 1984-86

Thermal Infrared Remote Sensing of Near-Surface Moisture in Deep Sandy Soils, Donald Rundquist, M. Lawson, R. Balling, Conservation and Survey Division, 1984-86

Polishing of Biologically Denitrified Groundwater Supplies to Meet Drinking Water Standards, Mohamed Dahab, Department of Civil Engineering, 1984-85

Assessing Agricultural Drought Impact: The Development of a Crop Specific Index for Winter Wheat, Donald Wilhite, Et al, Center for Agricultural Meteorology and Climatology, 1984-86

Field Measurement of Evaporation and Transpiration for irrigated Corn, Sorghum and Soybeans, Derrell Martin, Department of Agricultural Engineering, 1985-86

Water Policy Making by the Courts in Nebraska, Robert Miewald, Department of Political Science, 1985-86

Identification of a Management Strategy for a Conjunctive Surface-Groundwater System Using Optimization, Michael Nicklin, Department of Civil Engineering, 1985-86

Methodology for Investigating Instream Flows for Maintenance of Wildlife Habitat in Nonequilibrium Alluvial River systems, Ann Bleed, Conservation and Survey Division, 1985-86

Aquifer Recharge-Electrical Resistivity Relationships, William Kelly, Department of Civil Engineering, 1985-88

Irrigation Management Under Limited Water Conditions, Raymond Supalla, Department of Agricultural Economics, 1985-88

Chemical Removal of Nitrates from Drinking Water Using Waste Pickle Liquor, Gary Keefer, Department of Civil Engineering, University of Nebraska at Omaha, 1986

Improvements in Irrigation Efficiency, James Gilley, Department of Agricultural Engineering, 1986-89

Soil Type, Tillage and Precipitation Pattern as Factors Influencing Groundwater Recharge and Surface Water Supplies, Alice Jones, Department of Agronomy, 1987-88

Assessment of the Bacteroides fragilis Group and Their Bacteriophages as Indicators of Human Fecal Pollution of Surface Waters, S. James Booth, University of Nebraska Medical Center, 1986-89

Conservation of Soil and Water Utilizing Interrow Cultivation Techniques, William Kranz and Dean Eisenhauer, Northeast Research and Extension Center, 1987-88

Evaluation and Design of Geophysical, Istvan Bogardi, Department of Civil Engineering, 1987-90

Reducing Nitrate-N Losses to Groundwater by Improving Field Sampling Accuracy of Nitrate-N, Gary Hergert, Panhandle Research and Extension Center, 1987-89

Retention of Toxic Organics as Related to Soil Series and Soil Mapping Unit, Dennis McCallister, Department of Agronomy, 1987-89

Development and Evaluation of Improved Methods of Measuring Chemical Leaching, Darrell Martin and James Gilley, Department of Agricultural Engineering, 1987-89

Risk Management of nitrate-Contaminated Groundwater Supplies, Mohamed Dahab, Department of Civil Engineering, 1988-90

Application of Expert-Systems Technology to the DRASTIC Groundwater-Vulnerability Model, Donald Rundquist, Conservation and Survey Division, 1989-90

Development of a Decision Support System to Aid Decision Makers by Evaluating Groundwater Transfer, Ann Bleed, Conservation and Survey Division, and Istvan Bogardi, Department of Civil Engineering, 1989

Groundwater Contamination Control: Monitoring and Design, Istvan Bogardi, Department of Civil Engineering, 1989-90

The Relation of Pore Size Distribution to the Redistribution of Agrichemicals in the Soil Profile, William Powers, Department of Agronomy, 1989-90

A Non-Weighing Lysimeter Technique for Quantifying Year-Around Leaching Losses in Structured Soil, Norman Klocke and Gary Hergert, West Central Research and Extension Center, 1989-91

Laboratory Evaluation of In-situ Bio-Denitrification for Nitrate Reduction, Mohamed Dahab, Department of Civil Engineering, 1989-91

Surge Irrigation and Furrow Packing for Improving Surface Irrigation Efficiency, C. Dean Yonts, South Central Research and Extension Center, 1989-91

1990s

Anticholinesterase Insecticides in Groundwater: Immunologic Consequences, George Casale, University of Nebraska Medical Center, 1990-92

Identification and Assessment of Alternatives for Management of Reservoir Sedimentation, Rollie Hotchkiss, Department of Civil Engineering, 1991

Characterization of Anisotropy of Hydraulic Conductivity in a Shallow Unconfined Aquifer Under irrigation by Pumping Test and Geophysical Methods, Vitaly Zlotnik, Department of Geosciences, 1991

Biochemical Determinants of Pyrethroid Toxicity to Selected Aquatic Insects, Blair Siegfried, Department of Entomology, 1991-93

Blocked End Furrow Irrigation Management Techniques, Joel Cahoon, Department of Biological Systems Engineering, 1991-92

Slug Test Techniques for Hydraulic Conductivity Measurements in Highly Permeable Shallow Sand and Gravel Aquifers, Vitaly Zlotnik, Department of Geosciences, 1992

Effect of Local Anisotropy of Hydraulic Conductivities on Nonlocal Dispersion in Aquifers, You-Kuan Zhang, Conservation and Survey Division, 1992-93

Synergistic and Chronic Effects of Agricultural Pesticides on Benthic Algal Communities in Nebraska Streams, Kyle Hoagland, Forestry, Fisheries and Wildlife, 1992-94

Chromatographic Automation of Immunoassays for Environmental Analysis, David Hage, Department of Chemistry, 1992-94

Innovative Alternative for Sediment Removal from Reservoirs, Rollie Hotchkiss, Department of Civil Engineering, 1992-94

Initiating a Decision Support System for the Platte River Basin, Rollie Hotchkiss, Department of Civil Engineering, 1993-94

Predicting Pesticide Degradation and Transport Characteristics in the Vadose Zone of the Platte River Valley, Steven Comfort and Pat Shea, Department of Agronomy, 1993-95

A Non-Intrusive Landfill Hazard Ranking System: Application of Geoelectric and Soil Vapor Analysis Methods, Wayne Woldt and David Jones, Department of Biological Systems Engineering (formerly Agricultural Engineering), 1993-94

A Dipole Method of Field Measurement of Transport Parameters in Contaminated Aquifers, Vitaly Zlotnik, 1993-94, funded by National Water Research Institute

Remediating RDX and HMX Contaminated Soil and Water Using Chemical Pretreatments, Steve Comfort, Department of Agronomy, 1993-94, funded by National Water Research Institute

Evaluating New Techniques for Managing Anitrogen in Crops that Follow Sugarbeets, David Baltensperger, Panhandle Research and Extension Center, 1993-94, funded by National Water Research Institute

Effects of Atrazine Metabolites on Freshwater Algae, Kyle Hoagland, Forestry, Fisheries and Wildlife, 1993-94, funded by National Water Research Institute

Irrigation Management Strategies to Reduce Chemical Leaching Potential and Sustain Economic Return, Norman Klocke, West Central Research and Extension Center, 1993-94, funded by National Water Research Institute

Conservation Tillage Effects on Denitrification from Irrigated Corn, Richard Ferguson, South Central Research and Extension Center, 1993-94, funded by National Water Research Institute

Mechanisms of Atrazine Selective Toxicity in Freshwater Algae, Blair Siegfried and S. J. Nissen, Department of Entomology, 1994-95

Measuring Groundwater Quality Impacts from Feedlot Runoff Retention Ponds and Waste Lagoons Using Integrated Geophysical and Bottom Sampling Methods, Dennis Schulte and Wayne Woldt, Department of Biological Systems Engineering, 1994-95

Predicting Pesticide Runoff Losses from Four Tillage-Pesticide Management Practices, Thomas Franti and Steven Comfort, Department of Biological Systems Engineering, 1994-95

Community Structure and Functional Diversity of Microbial Communities in Soils and Underlying Sediments in Response to Atrazine Contamination, Rhae Drijber, Department of Agronomy and Horticulture, 1995

Sulfur-Limestone Autotrophic Denitrification System for Remediation of Nitrate-Contaminated Groundwater, T. Zhang, UNO and Blair Siegfried, Department of Entomology, 1995

Integrated Nitrogen, Water and Pesticide Management Systems to Protect Ground Water Quality, Bob Volk, 1995-2000, funded by U.S. Department of Agriculture

Remediation of Atrazine-Contaminated Water: Column Tests of Enhanced Degradation by Using Zero-Valent Iron, Zongwei Cai, Water Center, 1995-96, funded by National Water Research Institute

Applications of Abiotic Treatments for Remediating Munitions-Contaminated Soil: Pilot-Scale Demonstrations, Steve Comfort, Department of Agronomy, 1995-96, funded by National Water Research Institute

Remediation of Nitrate-Contaminated Water by Sulfur-Limestone Autotrophic Denitrification, Tian Zhang, UNO, 1995-96, funded by National Water Research Institute

Activated Carbon Treatment of s-Triazines and their Metabolites Effects of NOM Fouling, Bruce Dvorak, Department of Civil Engineering and David Hage, Department of Chemistry, 1995-96, funded by National Water Research Institute

Half-Life Determinations of Trichloroethylene Intermediates During Intrinsic Remediation, Mary Exner, Conservation and Survey Division and Daniel Snow, Water Center, 1995-96, funded by National Water Research Institute

Reducing Atrazine Contamination of Interstate Surface Water, Thomas Franti, Department of Biological Systems Engineering, 1996-98

Advanced Assessment for Spot Spraying Plants to Reduce Chemical Input and Improve Water Quality, Thomas Franti and George Meyer, Department of Biological Systems Engineering, 1996-99

Field Verification of the Dipole Flow Test: A New Approach, Vitaly Zlotnik, Department of Geosciences, 1997-98

Site-Specific Management Strategies for Improving Nitrogen Use Efficiency Under Furrow Irrigation, Gary Hergert, West Central Research & Extension Center, 1997-99

Herbicide Effects on Water Quality in the Great Plains: Mechanisms of Selective Toxicity in Freshwater Algae, Kyle Hoagland, Water Center, and Blair Siegfried, Department of Entomology, 1997-99

Nebraska Mandates Management Initiative (NMMI), Bob Volk, 1997-2001, funded by the Nebraska Department of Environmental Quality

Determination of Aquifer and Aquitard Hydraulic Properties and Their Role in Streamflow Depletion, Xun-Hong Chen, Conservation and Survey Division, 1998-2001

Hydraulic Characterization of the Stream-Aquifer Interface: Theory, Field Implementation and Practical Ramifications – A Multi-State Proposal, Vitaly Zlotnik, Department of Geosciences, 1998-2001

Evaluating the Effects of Pesticide Mixtures to Freshwater Algae, Blair Siegfried, Department of Entomology, 1999-2001

A Test of Permeable Zero-Valent Iron Barriers for In-Situ Containment and Remediation of Pesticide Contamination in Unsaturated Soils, Steve Comfort and Patrick Shea, School of Natural Resources, 1999-2000

An Assessment of Factors Indicating Well Vulnerability in Nebraska, Bruce Dvorak and Wayne Woldt, Department of Civil Engineering, 1999-2000

Use of Buffer Strips to Reduce Pesticide, Nitrogen and Sediment Runoff in Clear Creek, NE, Roy Spalding, 1999-2000, funded by Central Platte NRD

2000s

Evaluation of Conductive Properties of the Surficial Aquifer in the Nebraska Sand Hills, Vitaly Zlotnik, Department of Geosciences, 2000-02

Investigation of Directional Hydraulic Conductivities of Streambeds and Their Roles in Stream-Aquifer Interactions, Xun-Hong Chen and James Goeke, Conservation and Survey Division, 2001-03

Investigation of Microbially-Influenced Copper Corrosion in Nebraska Drinking Water Systems, Matthew Morley and Bruce Dvorak, Department of Civil Engineering, 2001-02

Assessment of Thermal-Infrared Imaging as a Tool for Evaluation of Groundwater-Lake Interactions in the Nebraska Sand Hills, Vitaly Zlotnik, Department of Geosciences, and David Gosselin, Conservation and Survey Division, 2001-02

Ecosystems and Economic Models Spatial Dataset Analysis, Kyle Hoagland, Water Center, 2001-04, funded by U.S. Environmental Protection Agency

Development and Implementation of a Comprehensive Lake and Reservoir Strategy for Nebraska as a Model for Agriculturally Dominated Ecosystems, John Holz, Water Center, 2001-04, funded by U.S. Environmental Protection Agency

Assessment of Source of Variation in Copper Concentrations in Nebraska Drinking Water Systems, Bruce Dvorak and Matthew Morley, Department of Civil Engineering, 2002-03

Relating Landscape Scale Characteristics with Phosphorus Loss Potential to Surface Waters, Martha Mamo and Dennis McCallister, Department of Agronomy and Horticulture, 2002-03

Defining Dynamic Crop-Water-Stress-Index Baselines to Schedule Irrigation Using Infrared Thermometers, Jose Payero, Panhandle Research & Extension Center, 2003-04

Assessing the Occurrence of Arsenic in Groundwater: Implications for Small Water Supply Systems in Nebraska, David Gosselin and F. Edwin Harvey, Conservation and Survey Division 2003-04

Biodegradation of Dual-Contaminant Mixtures in Groundwater: Chlorinated Solvents and High Explosives, Matthew Morley, Department of Civil Engineering, 2003-04

Remediation of PCB-Contaminated Soils and Sediment using Zero-Valent Iron and Surfactants, Steve Comfort, School of Natural Resources, 2004-05

Investigation of Groundwater Interactions with Surface Hydrologic Systems in River Valleys – Using Modeling and Field Approaches, Xun-Hong Chen and James Goeke, Conservation and Survey Division, 2004-05

Low-Cost Flow Estimation for Storm Water Quality BMP Monitoring, David Admiraal, Department of Civil Engineering, 2004-05

Hydrogeological Controls of Salinity Patterns in the Sand Hills Lakes, Nebraska, Vitaly Zlotnik, Department of Geosciences, 2004-05

Quantification of Stream-Aquifer Connection and Its Implication for Modeling Surface Water-Groundwater Interactions, Xun-Hong Chen, Conservation and Survey Division, 2005-07

Growth Promoters in Nebraska Rivers: Detection and Toxicity, Alan Kolok, University of Nebraska at Omaha, and Daniel Snow, Water Science Laboratory, 2005-06

Beaver in Agricultural Watersheds: Potential for Mitigating Degraded Midwestern Streams, Dean Eisenhauer, et al, Department of Biological Systems Engineering, 2005-07

The Impact of Rural Water Supply Systems on Property Values, Steven Shultz, University of Nebraska at Omaha, 2005-07

Use of Remotely Sensed Data for Improved Quantification of Evapotranspiration for Water Management in Nebraska, Ayse Irmak, et al, Department of Biological Systems Engineering, 2006-07

Determination of Appropriate Lake Water Quality Expectations in Agriculturally Dominated Ecosystems. Phase I: Defining Nebraska's Hydroecoregions, Aris Holz, School of Natural Resources, 2006-07

Water Quantity and Quality within the Great Plains: Model Development Within a Nebraska Basin, Erkan Istanbuluoglu, Department of Geosciences, 2006-07

Hydrazine Derivatives of Pesticides and Pharmaceuticals During Disinfection of Drinking Water and Wastewater, Patrick Shea, School of Natural Resources, 2007-08

Detection of Episodic Low-Level Concentrations of Emerging Contaminants in Drinking Water, Bruce Dvorak, Department of Civil Engineering, 2007-08

Improving Estimates of the Value of Irrigated Land in the Republican Watershed, Steven Shultz and Roger Sindt, UNO, 2007-08



Elkhorn River at Neligh, Nebraska.

Water Center Staff

Following is a list of Water Center staff through the years, with approximate years of service. In some cases, the years of service were estimated from old University telephone books. We apologize for any omissions and any errors made.

**Dr. Warren Viessman,
Director, 1968-1975**

Jan Stroike, Secretary, 1969-1972

Nyla Thomsen, Secretary, 1970 - 1979

Jeanne Enevoldsen, Secretary, 1971 - 1975

Karen Stork, Administrative Assistant, 1971 - 1985

Isaac Yomtovian, Research Associate, 1973 - 1978

**Dr. M. Wayne Hall,
Director, 1975 - 1978**

Carol Robinson, Research Technologist, 1974 - 1978

Mary Ann Ellsworth, Systems Analyst, 1975 - 1979

Barbara Mitchell (Noble), UCOWR Secretary,
1976 - 1982

Marshall Taylor, Research Technologist, 1976 - 1979

Cathy Wilken, 1976-1979

Mary-Louise Quinn, Water Resources Specialist,
1977 - 1984

Ruth Dickinson, Research Analyst, 1977 - 1980

Donald Wilhite, Water Management Specialist,
1977 - 1979

Susie Ferguson, Secretary, 1978 - 1982

Denis Gilbert, Water Scientist, 1978 - 1982

Theresa Bull, Secretary, 1978 - 1979

Evon Meyer, Secretary, 1978 - 1980
Danita Bright, Secretary, 1979 - 1980
Mary Piccolo, Part-time Secretary, 1978 - 1983
Marvin Damm, Research Associate and Civil Engineering, 1976 - 1980
Mike Nicklin, Research Associate and Civil Engineering, 1976 - 1980
Gary Lewis, Assistant Director (and Asst. Professor of Civil Engineering), 1975-80

Acting Directors Dr. Gary Lewis and Mr. Deon Axthelm, 1978-1980

Dr. William L. Powers, Director, 1980 - 1988

Robert E. Burns, Water Resources Specialist, 1979 - 1983
Susan Miller, Water Resources Specialist, 1980 - 1988
Donn Rodekohr, Water Research Technologist, 1980 - 1990
Daniel Sobashinski, Water Scientist, 1980 - 1982
Daniel Himsworth, Editor, 1981 - 1982
Daryoush Razavian, Water Scientist, 1981 - 1988
A.J. Brandt, UCOWR Secretary, 1982 - 1984
Ann Bleed, Assistant Professor, 1982 - 1988
Vicki Halstrom, part-time Secretary, 1982 - 1985
Terri Short, Computer Technician, 1984 - 1988
Cindy LeGrande, Office Manager, 1986 - 1995
Eileen Miller, UCOWR Secretary, 1984 - 1986
Pat Larsen, Communications Assistant, 1985 - 1992

Dr. Roger Gold, Director, 1988 - 1990

Bob Kuzelka, Assistant to the Director, 1989 - 2000
Audrey Schardt, Secretary, 1988 - 1992

Dr. Bob G. Volk, Director, 1990 - 1999

Wilma Daddario, Bookkeeper, 1990 - 1991
Jean Klasna, Accounting Technician, 1991 - 1995
Bettina Heinz Hurst, Communications Specialist, 1993 - 1997
Tricia Liedle, Project Manager, 1995 - present
Steve Ress, Communications Coordinator, 1996 - present
Ed Vitzhum, Associate Director and Interim Director 1999-2001

Dr. Kyle D. Hoagland, Director, 2000 - present

J. Michael Jess, Senior Lecturer, Associate Director, Acting Director - 2000 - present
John C. Holz, Assistant Director, 2005 - 2007
Lorrie Benson, Deputy Program Manager and Assistant Director, 2006 - present
Jessica Harder, Water Outreach Associate, 2006 - 2007

Water Sciences Laboratory

Dr. Roy Spalding, Associate Director and Water Science Lab Director, 1988 - 2002

Mark Burbach, Project/Field Coordinator, 1989-2003
Daniel Snow, Laboratory Manager/Services Director, 1990 - present
David Cassada, Separations Chemist/Scientist, 1990 - present
Mike Fults, Research Technician, 1990 - 1992
Shelly Unger, Project, 1990-94
Jeff Toavs, Research Technician, 1990 - 2002

Glen Martin, Research Associate/Isotope Chemist, 1990-2006
Lyn Underwood, Research Technician, 1992 - 1995
Steve Monson, Research Technologist, 1992-2002
Tom Papernik, Database Manager, 1992-1996
Zongwei Cai, Postdoctoral Research Associate, 1994 - 1995
Lesley Weir, Research Technician, 1994 - 1998
Sandy Seybold, Project Assistant, 1995 - ??
Patrick Larsen, Database Manager, 1996-1998
Julie Chapin, Research Technician, 1996 - 1999
Lorraine Moon, Project Assistant, 1996-2002
Li Ma, Postdoctoral Research Associate, 1997 - 1998
Anita Sisco, Research Technician, 1998 - 2002
Junhua Zhu, Postdoctoral Research Associate, 1999 - 2000
Dottie Harrell, Database Manager, 1999 - 2002
Andrea Hollar, Research Technician, 2000 - 2001
Mike Benjamin, Research Technician, 2002 - ??
Roger Ladd, Research Technician, 2002 - 2003
Teyona Damon, Research Technologist, 2003 - present
Mike Meyer, Research Technician, 2004 - 2005
Beena Raman, Research Technologist, 2004 - 2005
Aaron Shultis, Research Technologist/Isotoper Scientist, 2005 - present
Monica Hollrah, Research Technician/Technologist, 2005 - present

Annual Water Seminar Series Topics

Following are annual topics of the Water Seminar Series, which began in 1968. Presented during spring semester, these seminars provide students, faculty, staff water professionals and the public with an opportunity to hear experts address pertinent water issues.

In recent years, with the merger of the Water Center into the School of Natural Resources, the focus on the seminar series has returned to a more generalized focus on current water, environmental and natural resources issues.

- 1970** Impacts of Large-Scale Water Resource Developments
- 1971** Water Resources Development and the Ecosystem
- 1972** The Sandhills of Nebraska
- 1973** Regional Planning for Natural Resources with Special Emphasis on the Missouri River Basin
- 1974** Energy, Water, Food, and the Environment
- 1976** Water Resources Policy

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|-------------|--|-------------|---|--------------------|---|
| 1977 | Water Resources Planning and Management Issues | 1989 | Water Quality in Nebraska | 2000 | Cooperation and Tension: The History, Reality and Future of Nebraska's Interstate Agreements |
| 1978 | National Water Policy Review and Its Impacts | 1990 | The Platte River: Analysis and Policy | 2001 | Social Sciences Affect on Allocation of Water and Natural Resources |
| 1979 | Current Water Resources Planning and Management Issues | 1991 | Farm Management Impacts on Ground and Surface Water Quality | 2002 | Current Water Issues in Nebraska (partial funding from the Williams Trust began this year) |
| 1980 | Surface and Groundwater Quality in Nebraska | 1992 | Cancer and Water Quality | 2003 | Nebraska's Drought Conditions and Other Current Water Issues |
| 1981 | Water Resources Research at the University of Nebraska | 1993 | Global Perspectives on Water and the Environment | 2004 – 2008 | No specific annual themes. Typically current Nebraska/regional water and environmental issues |
| 1982 | Current Water Issues in Nebraska | 1994 | Flatwater: The History of Nebraska and its Water | | |
| 1983 | Water Law and Policy in the Great Plains | 1995 | Water Quality and Waste Management | | |
| 1984 | The Sandhills of Nebraska – Yesterday, Today & Tomorrow | 1996 | Platte River Management Goals | | |
| 1985 | Aspects of Groundwater Quality | 1997 | When the Rains Don't Come: Drought, Climate Change and Water Management | | |
| 1986 | Current Water Issues in Nebraska | 1998 | Interrelationships of Water, Native Grasslands and Wetlands | | |
| 1987 | Wildlife Habitat and Competing Water Demands | 1999 | Three Water Perspectives: (1) Creating a Significant Water Research Program; (2) Using the Findings from Water Research; and (3) Exploring Current Water Research | | |
| 1988 | Discussion of Various Water Topics – Water Quality, Hazardous Wastes, Leaking Underground Storage Tanks and Agricultural Chemicals | | | | |

Annual Water Tours

Following is a listing of some of the annual water tour destinations and focus topics through the years:

- 1982** August 11-13 – Tour of water developments in South Dakota and large irrigated farms
- 1983** August 17-20 – Southwest Nebraska and Northeast Colorado, rural, municipal and state water development projects in both states
- 1984** August 16-17 – Tour of Central and Northeast Nebraska including NPPD, The Calamus Dam and Reservoir, Twin Loup Irrigation and Platte River Habitat Trust
- 1985** September 8-13 – Tour of California, Salad Bowl of the Nation and tour of specialized farms and ranches
- 1985** October – Tour of Nebraska’s Rainwater Basin in order to share knowledge and develop a common understanding of the Rainwater Basin area among researchers, policy makers and resource managers.
- 1986** August – Alliance, Chadron, Crawford and Douglas, WY



Cattle at the water tank in the Sandhills.

- 1987** February 8-13 – Water Irrigation Tour to Lake Havasu City, AZ, also visit the first U.S. Bureau of Reclamation project, the Salt River Project, the Central Arizona Project, Univ. Of Arizona Maricopa Agricultural Center, Paloma Ranch and Red Mountain Farms.
- 1987** August 11-13 – South-central and Southwest Nebraska (co-sponsored by Four State Irrigation Council), included stops at Central Nebraska Public Power & Irrigation Dist., Johnson Lake, site of a proposed dam on Plum Creek, and various farms.
- 1988** July 14-15 – Lower Platte South, Lower Big Blue, Nemaha, and Papio NRDs
September 10-17 (17th Annual Tour) – Tour of Pacific Northwest (Oregon and Washington) including irrigation districts, farms, reservoirs and Bonneville and Grand Coulee Dams
- 1989** August – Management, Resources and Conservation in the Sandhills, including Calamus Dam and Reservoir, Upper Big Blue NRD, Nebraska National Forest
- 1990** August 5-11 – Kansas, Oklahoma and Texas, featuring water conservation techniques of drip irrigation and a weather modification project
- 1991** July 22-26 - Management of the North and South Platte Rivers in Wyoming, Colorado and Nebraska
- 1992** July 19-24 – 2,000 mile-long tour of North and South Dakota in the Missouri River Basin, focusing on surface water management
- 1993** July 21-23 – Groundwater recharge projects, irrigated farms and wildlife sites in central and south-central Nebraska
- 1994** July 25-28 – Missouri River tour focused on flood recovery efforts, including water construction activities, flood prevention construction and flood damage.
- 1995** July 18-19 – Grand Island and Central Nebraska, including a variable rate application technology site, Mid-NE Water Quality Demonstration site and the U.S. Meat Animal Research Center at Clay Center
- 1996** July 22-24 – Republican River Basin Tour, including groundwater and surface water management projects
- 1997** No individual tour; Four States Irrigation Council Tour to Colorado
- 1998** August 11-13 – Arkansas and Republican River Basin Tours into Kansas and Eastern Colorado
- 1999** July 19-21 – Northeast and North Central Nebraska, including Loup Public Power District hydro-generating plant, flood control projects, Ted Turner Ranch
- 2000** July 24–26 – Water Transfer and Marketing Tour in Nebraska and Colorado, including Colorado water conservancy districts, Upper Republican NRD
- 2001** June 18-20 – Urban Water Quality and Quantity Concerns, including visits to flood control projects, urban natural resources districts and the U.S. Environmental Protection Agency offices in Kansas City, MO
- 2002** July 22-25 – Following the North Platte River in Nebraska, Colorado and Wyoming
- 2003** July 21-12 – Republican River Water Issues, including visiting facilities directly related to compliance with terms of the lawsuit settlement
- 2004** June 7-9 – Competing Uses for Platte River Water and Basin Development
- 2005** June 28-30 – Irrigation and Natural Resources Issues in the Sandhills and Pine Ridge Area and Local Response to LB 962.
- 2006** July 18-20 – Tour of Northeast Nebraska and the Missouri River, including Gavins Point Dam, Lower Platte River Corridor Alliance, and Lewis & Clark Rural Water System
- 2007** June 4-7 – New Mexico’s Pecos River Basin (compare and contrast with Nebraska’s Republican River Valley Compact)

Annual Water Conference Topics

Following are some of the annual Nebraska Water Conference topics through the years:

- 1973** Water Resources Development in Nebraska
- 1975** Land and Water Use Planning – A Case Study
- 1976** Do We Need a State Water Management Policy?
- 1979** Water – Our Diminishing Resource
- 1980** Second Conference on Water Data Programs and Needs, co-sponsored by U.S. Geological Survey and Governor’s Water Data Coordination Committee
- 1982** The Changing Platte River
- 1983** Moving Forward With Water Management
- 1984** The Future of Water Management in Nebraska: Developing a Consensus
- 1985** Water Management Implementation
- 1986** Profit in Agriculture Through Soil and Water Conservation
- 1987** Water Marketing

Snake River Falls in Cherry County Nebraska.

- 1988** Challenges in Developing and Managing Nebraska's Water Supplies in Light of Emerging World Policies and Production
- 1989** The Sandhills of Nebraska
- 1990** Perspectives on the Water Quality Outlook for the 1990s
- 1991** Two Rivers of Nebraska: Character, Conflicts and Cooperation
- 1992** Living With Wetland Policies and Politics
- 1993** A Centennial Observance of Irrigation in Nebraska (UNL publication of Flat Water: A History of Nebraska and Its Water, by Robert D. Kuzelka and Charles A. Flowerday)
- 1994** Conjunctive Use: Sharing the Resource
- 1995** Water: Understanding a Resource (Water-related Policies on Local, State and Federal Levels)
- 1996** The Mighty Missouri: Past and Future
- 1997** The Great Plains Symposium 1997: The Ogallala Aquifer – Managing for Drought and Climate Change
- 1998** Nebraska Water 2000: Information for the Future
- 1999** Nebraska Water 2000: Planning for the Future

- 2000** Nebraska Water 2000: Management for the Future
- 2001** Groundwater Quality Monitoring Workshop
- 2002** No Water Conference held. Joined with Nebraska Water Resources Association and Nebraska State Irrigation Association in sponsoring annual NWRA/NSIA Conference entitled "Changing Times/ Changing Attitudes."
- 2004** First Annual Water Law, Policy and Science Conference: Solutions to Multi-Jurisdictional Water Conflicts

This is the first in a new series of conferences co-sponsored by the College of Law, the Water Center,

- the Water Resources Research Initiative (WRRRI) and others.
- 2005** Second Annual Water Law, Policy and Science Conference: Water Management and Policy in the Great Plains: Implications of Drought and Climate Change
- 2006** Third Annual Water Law, Policy and Science Conference: Adaptive Management for Resilient Water Resources, Nebraska City
- 2007** Fourth Annual Water Law, Policy and Science Conference: Future of Water Use in Agriculture
- 2008** Fifth Annual Water Law, Policy and Science Conference:



Platte River near Ashland, Nebraska.