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Water Current

Millard W. Hall, Director
Volume 9, Number 5

Karen E. Stork, Editor
September/October 1977

FROM THE DESK OF THE DIRECTOR . . .

Testifying recently at oversight hearings held by the House Subcommittee on Water and Power Resources, I noted that continued failure to recognize the critical national water problem could produce a situation not unlike that precipitating the energy crisis--too little, too late. Because past national administrations have given insufficient attention to the entire area, we are now confronted with a host of critical national water problems and a lack of sound information and trained persons for dealing with such problems.

I am continually amazed and concerned by the lack of leadership and coordination of the nation's water resources research and educational efforts. Although there are many agencies involved at all governmental levels, there is none that can be said to be minding the store with regard to the overall program. There is a strong need for coordination of individual agency efforts to produce coherent results and reduce overlap, duplication and omission of important areas of research and education.

It is difficult to understand why no single agency has taken the lead in bringing together at least the federal interests and coordinating them to produce more effective results. The Office of Water Research and Technology (OWRT) should be far more aggressive in working in partnership with state institute directors toward more effective program planning and development. There is also a need for OWRT to develop a clear national strategy for its programs.

It is absolutely essential that water resources research and educational efforts be given the high priority they deserve as the use of the nation's fiscal resources is being considered. One need only look at this past summer's drought to recognize that water is a critical natural resource. The importance of water is so pervasive and all inclusive that its study merits a significant level of continuing support.

It is imperative that all levels of government recognize this fact and work together in a coordinated plan to achieve the best results so that this critical resource can be passed on to the next generation in the same condition that it was passed on to us.



NEBRASKA WATER RESOURCES CENTER

ON THE HOMEFRONT

CONFERENCE ON DECISION MAKING IN WATER RESOURCES

The Nebraska Water Resources Center is planning a conference for November 29-30, 1977 at the Villager Motel in Lincoln, Nebraska. The theme of the conference will be "A Question of Values: Decision Making in Water Resources Management."

Topics to be discussed include the following:

- (1) Problems inherent in present water resources decision making.
- (2) Methodologies for evaluating impacts of decision making (national economic development, environmental quality, regional development and social well being). Could these criteria be applied to all decisions in water resources or are there other useful criteria?
- (3) Assessment of values--relative importance of various impacts (normalizing values, public involvement, legislative procedures and assessment of national water policy study).

Speakers will include national and regional authorities, and the conference will include two workshops to give participants a chance to discuss the issues presented. Registration fee will be approximately \$35.

For further information on the conference, contact: Millard W. Hall, Director, Nebraska Water Resources Center, 310 Ag. Hall, University of Nebraska, Lincoln, Nebraska 68583. Telephone: (402) 472-3305.

EXCHANGE PROGRAM COMPLETED

Mr. Stefan Ignar has just completed a one-year training program at the Nebraska Water Resources Center through an exchange program conducted between Goshen College in Indiana and Warsaw Agricultural University in Poland.

Stefan arrived in Lincoln, Nebraska in October 1976 and chose for his topic of study deterministic models in hydrology. During his first few months here, Stefan read literature in this area and began to learn about the basic principles and ideas of the Stanford Watershed Model IV (both the Kentucky and Ohio versions) and about the possibilities for practical use of this model for small watersheds.

Various other activities which Stefan engaged in during his stay in Lincoln included the following: (1) learned Fortran IV programming language; (2) took six credit hours of courses at the University of Nebraska--Advanced Modeling of Small Watersheds, Water Resources Seminar and English for Foreign Students--and audited another course in hydrology; (3) became familiar with the principles and complexities of two mathematical models--USDAHL-74 developed by USDA and ARM (Agricultural Runoff Management) developed by HSP; (4) studied flow modeling and prediction of changes in river channels.

We have thoroughly enjoyed having Stefan with us this year and feel that this association has benefitted both Stefan and the Water Resources Center.

NEUBERGER APPOINTED TO WATER POST

Nebraska Governor J. James Exon has named John W. Neuberger as Director of the Nebraska Department of Water Resources. Neuberger was formerly chairman of the ten-state Missouri River Basin Commission, a post he has held for over five years, after being named to the job by former President Richard Nixon. Neuberger has submitted his resignation from his federal post effective October 26 and will assume his new position on November 1. He will succeed Marion Ball, who is retiring.

Neuberger, 41, is a South Dakota native. Following graduation from South Dakota State University, he served as hydraulic engineer in Wyoming and South Dakota. In 1963, he joined the University of Nebraska as assistant professor of Agricultural Extension. In 1964, he was named manager of the Papio Watershed in Omaha. Neuberger was appointed deputy assistant secretary for water and power resources of the U.S. Department of Interior in 1969, and accepted the job as chairman of the Missouri River Basin Commission in 1972.

WATER RESOURCES IN NEBRASKA

SHORT COURSE IN HYDROLOGY

The Conservation and Survey Division of the University of Nebraska-Lincoln, in coordination with the University Division of Continuing Studies and in cooperation with the Nebraska Chapter of the Sierra Club and Nebraska Wildlife Federation, is conducting a one-day Short Course in Hydrology for members of Conservation and Environmental organizations in Nebraska, to be held Saturday, October 29, from 9:00 a.m. to 4:00 p.m. at the Nebraska Center for Continuing Education, 33rd and Holdrege Streets, Lincoln, Nebraska.

This is the first such course to be designed by the University specifically for persons whose desire to understand basic groundwater geology, surface and groundwater hydrology and water management tools stems largely from concern for fish and wildlife habitat, recreation, ecological diversity, water quality and other public values which are affected by water resource management in Nebraska.

FEDERAL HIGHLIGHTS

GARY COBB NAMED DIRECTOR OF OWRT

Gary D. Cobb has been appointed Director of the Department of Interior's Office of Water Research and Technology (OWRT). For the past year, Cobb has served as Acting Director of the U.S. Water Resources Council (WRC) and was Deputy Director of the WRC from November 1974 to September 1976.

Cobb has a broad background in water resources planning, policy analysis and research oversight and management. From 1966 to 1969 he was one of five budget examiners with the Office of Management and Budget (OMB) responsible for reviewing all aspects of the Civil Works Program of the Army Corps of Engineers. During that period, Cobb was a staff observer from OMB to the Interagency Committee on Water Resources Research.

Cobb joined the WRC in 1969 as Senior Staff Specialist. One of his major assignments was development of the Council's "Principles and Standards for Planning Water and Related Resources." He led the Council's interagency field test in testing the principles and standards. Appointed WRC's Assistant Director for Policy and Procedures in January 1973, Cobb was responsible for implementing the principles and standards. In addition to his other assignments, he was Chairman of the Council's Policy Committee

Cobb is a graduate economist with a degree in agricultural economics from Colorado State University. His government career includes service with the Bureau of Reclamation at Grand Island, Nebraska and Pueblo, Colorado and with Reclamation's Planning Division in Washington.

NEW DIRECTOR FOR WATER RESOURCES COUNCIL

Secretary of Interior, Cecil D. Andrus, as Chairman of the U.S. Water Resources Council (WRC), has appointed Dr. Leo M. Eisel, Director of the Council. Dr. Eisel was formerly Director of the Illinois Environmental Protection Agency in Springfield.

Eisel will serve under Secretary Andrus and his Alternate, Guy Martin, Assistant Secretary of the Interior for Land and Water Resources, and will be responsible for administering the functions of the Council that were established by P.L. 89-80 in 1965, and for managing the Council's staff.

The Council is composed of the Secretaries of Interior, Agriculture, Army, Commerce, Housing and Urban Development and Transportation; Director, Office of Management and Budget; Attorney General; Administrators of the Environmental Protection Agency, Federal Energy Administration and Tennessee Valley Authority; Chairman, Council on Environmental Quality; Chairmen and Vice-Chairmen of the River Basin Commissions; and Chairmen of Interagency Committees.

From 1973 to 1977 Dr. Eisel was Director of the Illinois Division of Water Resources. In February 1977 he became Director of the Illinois Environmental Protection Agency which was responsible for control of water, air, noise and land pollution and implementation of a public water program in Illinois.

INTERIOR PROPOSES NEW RULES FOR DISPOSAL OF "EXCESS" IRRIGATED LANDS

Secretary of the Interior, Cecil D. Andrus has proposed new regulations to ensure that subsidized irrigation water from Bureau of Reclamation projects be used by family farms rather than large absentee-owned ventures. The proposed new rules establish policies and procedures to tighten up implementation of the laws that define Bureau of Reclamation policy on excess lands. They would apply throughout the 17 Western States served by the Bureau.

"Congress designed the Reclamation program primarily to place small farmers on the land," Secretary Andrus said. "These proposed regulations are an attempt to carry out that Congressional directive. Because we are proposing important changes, we will study carefully the comments we receive to ensure that the final version of these rules fully and fairly carry out the letter and spirit of the Reclamation laws with a minimum of disruption," Andrus said. "It will not interfere with legitimate farmers who have retired or those that are not living directly on the land yet qualify as family farmers."

Comments on the proposed regulations are invited until November 23, 1977 and should be addressed to: Commissioner, Bureau of Reclamation, Department of the Interior, 19th and "C" Streets, N.W., Washington, D.C. 20240. Attention: Code 410. Requests for hearings may be made to any of the Bureau's regional headquarters in the West.

Reclamation laws limit the amount of land which an individual owner may irrigate with water from a project to 160 acres, or 320 acres for a husband and wife.

One of the major changes proposed for inclusion in the new rules is a provision that all future purchasers of excess lands must reside on, or in the neighborhood of, the land they wish to buy. A neighborhood is generally defined as being within a maximum radius of 50 miles.

The proposed rules would also make the following principal changes:

- (1) Sale prices of excess land must be approved by the Secretary to prevent windfall profits--not only on the original sale from excess to nonexcess status, as presently required, but on all subsequent sales for 10 years after the original sale. From that time until one-half the total project construction costs allocated to irrigation have been repaid (typically, 20 to 25 years after first delivery of water to the area involved), the Secretary would monitor any further resales to prevent "unreasonable" profits.
- (2) No person nor corporation can lease more than 160 acres of land.
- (3) The seller of excess land cannot lease it back from the buyer.
- (4) No person or corporation may receive Reclamation water for land owned in excess of 160 acres anywhere within the 17 Western States served by the Bureau. Present practice is to allow delivery of water to 160 acres in each district served by Reclamation. Owners of land now receiving water in more than one district would be allowed one year to sign recordable contracts agreeing to dispose of their excess lands within five years.
- (5) All new recordable contracts will require disposal of excess lands within five years instead of the present ten years.
- (6) Buyers of excess land will be selected by the Bureau of Reclamation, by lottery or other means. Currently, the owners of excess land receiving water from Federal projects have been allowed to sell to an eligible buyer of their choice, at a price approved by Reclamation, if they offer to sell before the expiration of their ten-year contract.
- (7) Sales of more than 160 acres into multiple ownership (partnerships, trusts, corporations) will be approved only when there is a family relationship among all owners.

"The Bureau of Reclamation has in the past been required to follow legal interpretations and policy that this Administration is not in complete accord with, and we are therefore changing the policy to aid and benefit the small farmer," Andrus concluded.

USGS DIRECTOR McKELVEY TO LEAVE POST JANUARY 1

Interior Secretary Cecil D. Andrus has announced the resignation of Dr. Vincent E. McKelvey as Director of the U.S. Geological Survey, effective January 1, 1978. "Dr. McKelvey has made a significant contribution to the Nation's scientific advancement while serving as Director of the Survey since 1971," Secretary Andrus said. "I am pleased that Dr. McKelvey has expressed a desire to remain in the Interior Department and to return to his work as a research scientist after a new Director is selected."

An expanded role for the Survey, including additional responsibilities for environmental protection, energy development and mineral leasing, makes a change in leadership desirable for the years ahead, Secretary Andrus said.

The selection process for a new Director is under way. The Interior Department has requested the National Academy of Sciences to identify a panel of outstanding candidates for the position, according to Assistant Secretary for Energy and Minerals, Joan M. Davenport.

McKelvey, 61, has been a career scientist with the USGS since 1941 and stepped up from Chief Geologist in 1971 to become the ninth Director of the Survey, succeeding the late William T. Pecora. Created in 1879, the USGS today employs nearly 12,000 scientific, engineering, technical and administrative personnel in support of a wide range of natural resource and environmental missions and responsibilities.

CONFERENCES

FLOOD PLAIN PLANNING SHORT COURSE

Oklahoma State University is sponsoring a Short Course on Flood Plain Planning November 15-17, 1977 at Stillwater, Oklahoma. The course will consist of workshops and lectures encompassing open channel flow, water surface profiles, flood plain determination and flood plain insurance studies. Major emphasis will be placed on the utilization of the computer program HEC-2 developed by the Hydrologic Engineering Center of the Corps of Engineers.

For further information, contact: Engineering Extension, 301 Engineering North, Oklahoma State University, Stillwater, Oklahoma 74074.

PANEL DISCUSSION ON GROUND WATER AND THE WESTERN DROUGHT

A panel of experts will discuss Ground Water and the Western Drought during the week of December 5, 1977, in association with the American Geophysical Union's Annual Fall Meeting in San Francisco.

This half-day timely session will highlight the more significant drought effects, covering short and long-term effects of low recharge and increased pumping on ground water and ground water basins, and discuss the role of ground water in stabilizing a highly variable surface supply.

For further details, contact: H. J. Peters, AGU Ground Water Committee, California Department of Water Resources, P.O. Box 388, Sacramento, California 95814.

SYMPOSIUM ON GROUND WATER EFFECTS ON POWER PRODUCTION

A Symposium on the Ground Water Effects of Power Production Activities will be held during the week of April 17, 1978, in association with the American Geophysical Union's Annual Spring Meeting in Miami Beach, Florida. The symposium is sponsored by the Ground Water and Water Quality Committees, Section of Hydrology, AGU.

The half-day session will consist of eight to ten papers, including several invited papers. The remaining papers will be selected from those offered on the subject.

The symposium will concentrate on the effects on ground water caused by, or which could potentially be caused by, power production activities. Included are those caused by disposal of radioactive wastes, and disposal of cooling tower brines from fossil fuel plants and treatment or solutions to contaminant problems.

Anyone interested in offering a paper for this symposium should prepare an abstract in standard AGU format and send it by December 15, 1977 to: Jack Robertson, AGU Ground Water Committee, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, California 94025.

7th ANNUAL UNIVERSITIES FORUM

The Association of Environmental Engineering Professors is calling for papers for the 7th Annual Universities Forum to be held during the AWWA Annual Conference in Atlantic City, New Jersey, June 25-30, 1978.

Papers should be 15 minutes in length and will be followed by a five-minute discussion period. All papers should be related to municipal, agricultural or industrial supply problems including water treatment, water supply quality control, and water resource development and management. Water contamination should be linked clearly to water supply and water treatment problems.

If a university travel subsidy is not available, students should contact their local AWWA sections.

Five copies of a two-page abstract (about 500 words) preferably with figures and tables, should be submitted by December 15, 1977 to: Dr. Roger A. Minear, 73-B Perkins Hall, Department of Civil Engineering, The University of Tennessee, Knoxville, Tennessee 37916.

ASCE SPECIALTY CONFERENCE

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

Session topics may include such areas as competition for water resources in metropolitan areas, legal problems in developing and utilizing water supplies, enhancement of the environment in land and water development, legal problems involved in associated surface and ground water resources--in short, a wide range of topics that consider the integration of social, legal and institutional consideration with the technical and engineering factors.

For more information on the conference, contact: William R. Walker, Director, Virginia Water Resources Research Center, VPI & SU, Blacksburg, Virginia 24061. Virginia travel information is also available upon request.

INTERNATIONAL SYMPOSIUM ON URBAN STORM WATER MANAGEMENT

The Fifth International Symposium on Urban Storm Water Management is being planned for July 24-27, 1978 at the University of Kentucky in Lexington. Authors are invited to submit indicative abstracts (250 words or less) of papers for presentation at the symposium. Papers giving research results, design and analysis techniques and/or case studies on the following topics are invited: (1) quantifying rainfall, runoff, non-point water quality and/or sediment production in urban areas; (2) economic trade-off and legal implication associated with urban storm water management; (3) techniques and case studies of innovative systems for managing urban storm water runoff and sediment; (4) hydraulics of urban drainage facilities; and (5) application of remote sensing techniques to urban storm water management.

The symposium is specifically designed to provide practicing engineers with information useable by them in storm water management work. A limited number of more theoretical papers will be accepted. The subject of wastewater treatment will not be included in this symposium.

Initial paper selection will be based upon review of the abstracts. The final acceptance will be based on content of paper and how well it meets the description of the abstract. The following deadlines must be adhered to:

Receipt of 250 word abstract	January 4, 1978
Paper invitation - based on abstract	January 15, 1978
Receipt of photo-ready manuscript	March 15, 1978
Notification of acceptance	April 1, 1978

Mail abstracts and papers to: Ms. Elizabeth Haden, Symposium Coordinator, Office of Continuing Education, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. Telephone (606) 258-4881.

PUBLICATIONS

NEW FROM PERGAMON PRESS

Two new publications are available from Pergamon Press. Water Supply and Management is an international journal for the rapid publication of research results and their practical applications in the field of water supply and management. The editor-in-chief is Asit K. Biswas of Ottawa, Canada.

Some of the subjects to be covered in this journal include: resources and needs; assessments of the world and regional water situation; appropriate technology--potential and limitations; policy options and proposed action at national and international levels; the current and prospective supply and demand situations for water; the gravity of actual and potential water shortages; and current and future demands for food, energy, sanitation and pollution management as they affect use of water.

The annual subscription rate is \$106 which includes postage and insurance. There is a special reduced rate to individuals whose library subscribes. A free specimen copy of the journal is available on request.

The second publication available from Pergamon Press is a new book series--Water Development and Management. Volume 1 consists of the complete proceedings of the United Nations Water Conference; Volume 2 is a summary of the main documents of the U.N. Water Conference; Volume 3 is "Arid Land Irrigation in Developing Countries--Environmental Problems and Effects;" and Volume 4 is "Water and Environment."

For further details on either publication, contact: Miss P. Millar, Pergamon Press, Ltd., Headington Hill Hall, Oxford OX3 0BW, England.

OGALLALA WATER RECHARGE PROJECT PUBLICATION AVAILABLE

The International Center for Arid and Semi-Arid Studies (ICASALS) announces the availability of a new publication entitled, "Ogallala Water Recharge Project," by Philip Johnson, Duane Crawford and Artis Davis. This is ICASALS publication No. 76-2.

Copies may be obtained by writing: ICASALS, Texas Tech University, Lubbock, Texas 79409.

POSITIONS AVAILABLE

POSITION AVAILABLE - UNIVERSITY OF ARIZONA

The Water Resources Research Center at the University of Arizona announces a job opening which involves assisting on a project relating to the monitoring of groundwater quality in a coal strip-mining area in Wyoming and on oil shale tracts in Utah. Headquarters will be in Tucson, Arizona with the Water Resources Research Center. The individual hired will be expected to assist in the field when necessary, in preparing reports, and in guiding the activities of student assistants.

An M.S. in hydrogeology, geology or soil science is required, along with an interest in water quality. Salary is negotiable, depending upon experience, up to a total of \$16,000 per year.

The position is open immediately, with support through June 30, 1978. Renewal of the position beyond this date is contingent upon additional project funding.

Interested applicants should contact: L.G. Wilson, Hydrologist, Water Resources Center, University of Arizona, Tucson, Arizona 85721. Telephone: (602) 884-2321.

POSITION SOUGHT FOR POLISH PROFESSOR

Goshen College in Goshen, Indiana is trying to locate a position for Dr. Andrzej Ciepielowski, a visiting Polish professor. He received his Ph.D. in 1972 from Warsaw Agricultural University. Dr. Ciepielowski is a hydrologist and has worked mainly with calculation methods of high water flow in small catchment areas, calculation methods of water flow in rivers, and flood control.

Dr. Ciepielowski's areas of interest include: (1) research done in experimental hydrological basins in general; (2) work in hydraulic laboratories; (3) mathematical modeling of small watersheds of an agricultural nature; and (4) empirical methods of calculating characteristic flow in ungauged catchment areas.

Dr. Ciepielowski has just completed a six-week intensive English course and speaks and understands English quite well. He will be in the States until July 1978.

Regarding compensation, Dr. Ciepielowski would need a stipend similar to a post doctoral fellowship or graduate assistantship, as he would need to pay his living expenses from his salary.

Interested schools should contact Mary Liechty, Assistant in International Education, Goshen College, Goshen, Indiana 46526. Telephone (219) 533-3161, ext. 218.

DIRECTOR SOUGHT FOR WATER RESOURCES CENTER

The Water Resources Research Center for the District of Columbia announces an opening for Director at the University of the District of Columbia, Van Ness Campus, Washington, D.C.

Job responsibilities include: (1) developing and implementing conjunctive water resource and land use research programs for the District of Columbia and the metropolitan Washington area; (2) preparing program plans for the Center's annual allotment and matching grant programs; (3) coordinating and monitoring research programs at the Center and participating universities in the District of Columbia; (4) working with local and regional councils of governments, community leaders and the Office of Water Research and Technology of the Department of Interior; and (5) a part-time teaching assignment (water quality management) in the Department of Environmental Sciences.

Qualifications include a Ph.D. degree with training and experience in a water resources related field with recognized competency in water resources research and related areas. Demonstrated ability for clear written and oral expression are also essential. Salary is commensurate with education and experience.

Interested applicants should forward resume, college transcripts and at least three references to: Dr. Robert R. Bradford, Dean of Natural Resources, UDC/Van Ness Campus, 4100 Connecticut Avenue, N.W., Washington, D.C. 20008.

The University of the District of Columbia is an Equal Opportunity Employer.

DIRECTOR, NORTH DAKOTA REGIONAL ENVIRONMENTAL ASSESSMENT PROGRAM (REAP)

The North Dakota Legislative Council is seeking a director for the North Dakota Regional Environmental Assessment Program (REAP) in Bismarck, North Dakota. REAP is a computer-oriented resource information and analysis program designed to provide a comprehensive system for environmental, socioeconomic and sociological data acquisition, monitoring and analysis. It was established in 1975 to provide decisionmakers with an accurate and coordinated information and forecasting tool.

The director should have a natural, social science, or engineering background and be capable of administering a highly skilled technical staff and dealing on the policy-making level of government. Salary is negotiable. Applications must include a complete resume, the names and addresses of three to five professional references and at least two personal or character references, and a list of publications and oral presentations.

Application deadline is October 14, 1977. Send applications to: Mr. John A. Graham, Director, North Dakota Legislative Council, State Capitol, Bismarck, North Dakota 58505.

ASSOCIATE DIRECTOR (PHYSICAL SCIENCES) POSITION

The Institute of Natural Resources is an interdisciplinary unit with programs designed to encompass both basic and applied research relating to problems in development, management, utilization and conservation of natural resources. This position is for a middle or senior level person with a background and interest in ENVIRONMENTAL ENGINEERING. The candidate must be willing to work with biologists, economists, lawyers, public and private sector officials and others on Institute projects. The candidate will be expected to provide leadership for the engineering aspects of projects, especially those related to mineral and energy resources. A doctorate is required. Academic position in an appropriate department and salary commensurate with experience and qualifications will be negotiated.

Candidates please send a vita, statement of interests and three references before October 30, 1977 to: Ronald M. North, Director, Institute of Natural Resources, Ecology Building, the University of Georgia, Athens, Georgia 30602.

SENIOR HYDROGEOLOGIST SOUGHT

Metcalf & Eddy, Inc. (engineers, architects and consultants) are seeking a senior hydrogeologist in Boston, Massachusetts. This is a permanent position requiring an advanced degree, ten years consulting experience and knowledge of common groundwater techniques. Good health and willingness to travel are essential.

Interested applicants should contact: Personnel Manager, Metcalf & Eddy, Inc., 50 Staniford Street, Boston, Massachusetts 02114. Telephone: (617) 523-1900.

RESEARCH REVIEW

PROJECT TITLE: Mechanics and Potentials of Artificial Groundwater Recharge

PRINCIPAL INVESTIGATOR: William F. Lichtler
U.S. Geological Survey

Groundwater levels are progressively declining in many areas of Nebraska due to extensive withdrawal for irrigation. If depleted groundwater resources necessitate a return to dry land farming in the future, it would be a large economic loss to the state. Artificial groundwater recharge may be able to help alleviate the problem.

The objectives of this project are: (1) document and evaluate existing recharge systems; (2) determine the amount of water moving from the surface to the aquifer through methods of impounded water, recharge wells and flowing water in canals; (3) set up a monitoring system to determine changes in recharge due to changes in surface conditions; (4) develop selection criteria to determine areas potentially suitable for recharge; (5) survey areas of Nebraska and the region to delineate areas potentially suitable for artificial recharge; and (6) demonstrate the practicality of recharge in selected areas.

A well recharge system was completed in early 1977. This system consists of a well near the Platte River which withdraws Platte River water that has been purified by natural filtration through the ground, a three-mile pipeline, and a recharge well in the Blue River basin where water levels are progressively declining. Also included are observation wells at different distances from the recharge well and provision to monitor the chemical quality, the sediment content and the bacteria content of the injection water and the mixed water in the aquifer. Several tests, up to ten days in length, have been made with encouraging results. Buildup of water levels in the recharge well after ten days of injecting water at 750 gal/min was only 12 feet. The static water level is nearly 100 feet below land surface; therefore, it appears that water could be injected at a substantially higher rate. (A 60-day test is in progress.)

Installation of a surface recharge facility is complete and will be tested in the near future. Background information on the zone above the water table was collected. This consists of: (1) neutron scatter logs and analysis of cores to determine moisture content; (2) sampling of porous cups to determine the quality of the water at different levels of the unsaturated zone; and (3) measurement of the relation of barometric pressure at different levels in the unsaturated zone to changes in barometric pressure at the land surface. This indicates the air permeability of the various soil layers in a totally undisturbed condition. The air permeability will be converted to water permeability through use of a computer program. Laboratory analyses are being made on relatively undisturbed cores to determine moisture retention curves, unsaturated hydraulic conductivity-tension curves, and particle-size distributions for materials above the water table.

An exceptionally high nitrate content was found in the groundwater at the well recharge site (330 mg/l N). Two nests of observation wells, consisting of wells at the top, middle and bottom of the aquifer, will be used to sample water in different parts of the aquifer and to determine the vertical interconnection. Samples from undisturbed cores had different nitrate contents at nearly all locations. All data is being used in a mathematical model simulating flow in the unsaturated and saturated zone.

The second phase of this project will concentrate on recharge via seepage from pits, canals and streams and to a lesser degree on seepage from various surface impoundments.