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# COLORADO WATER

Newsletter of the Colorado Water Resources Research Institute, Fort Collins, Colorado 80523

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COLORADO STATE UNIVERSITY

MAY 1989

## TWO FORKS

Editorial by Neil S. Grigg

The Two Forks struggle, however it turns out, can be a disaster for Colorado or a blessing in disguise.

At issue is whether the State can control the future of its water resources, and the economic development and quality-of-life stakes that go along with it, or whether these will be determined by Washington and the courts.

The Two Forks outcome will establish important state water policies. What does this say about the annual debate in Colorado about whether or not we have a water policy?

Actually, the debate over whether states can control their own futures goes beyond water. Jurgen Schmandt, Director of the Center for Growth Studies in Houston, recently wrote that "...the states must find a way to link the heretofore separate agendas of economic development and resource protection, and this can only be done by carefully bringing together information on longer-term trends and problems with the states' policy agenda."

If Colorado has a water policy, it has not been the deciding factor in the Two Forks matter. This shows that water policy is more complex and value-driven than we thought. It is a central concern of government, and a constructive balance is required.

What, other than head for court, do we do now about meeting metro water needs without wasting resources or creating divisions? Colorado needs bold steps, not to throw out our water law but to find a way to link the separate agendas of economic development and resource protection. This is where water policy must go.

Some say that bold steps in policy only result from crisis. I think Colorado can find a way to plan and manage its water resources to promote economic development and resource protection without a crisis. It will take creative leadership. It is a challenge that Jurgen Schmandt called "...governing the scientific state."

## CONFERENCE DRAWS MORE THAN 200 PARTICIPANTS

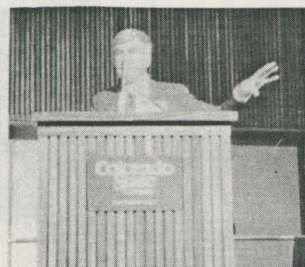


Colorado Water Engineering and Management Conference, February 27-28, 1989

Colorado State's Dean of Engineering Frank Kulacki welcomed attendees at the Colorado Water Engineering and Management Conference by remarking that the use, management and reuse of water will be paramount in planning for the future of all Front Range communities--



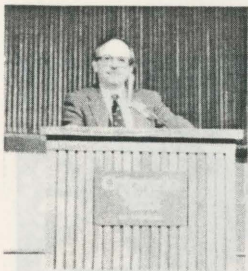
Above: Larry Ford, District Mgr., So. Adams Co. Water & San. Dist.



Left: Jeris Danielson, State Engineer

from Laramie to Las Cruces, New Mexico. He commented, relative to the 100th anniversary of Colorado State University, that water engineering, the environment and water planning have been and will be key fields for the College of Engineering. These areas interrelate with all the other fields of engineering, and the combination of water engineering, planning, regulation and management illustrates the interface of the technology-society debate--the need to mesh the political, social, economic and technical issues.

Dan Luecke  
Environmental Defense Fund



Uli Kappus, Colo. Water Resources & Power Devel. Authority

Geological Survey; Colorado State's Department of Civil Engineering, Department of Agricultural and Chemical Engineering, International School of Water Resources and Colorado Institute for Irrigation Management; the Agricultural Experiment Station, Cooperative Forest Service; and the University of Colorado's Natural Resources Law Center.

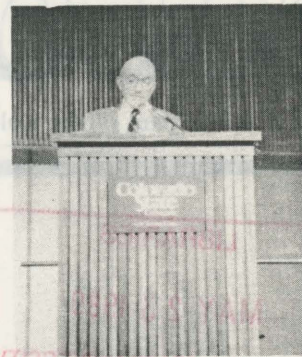


CWRRI Director Neil Grigg told attendees that the focus of the conference was on the use of technical information as a means to solve some of the political and policy problems in water. This is reflected in the list of conference cosponsors:



Cynthia Paulson  
Brown and Caldwell  
Consulting Engineers,  
Denver

See the attachment to this newsletter for a summary of conference plenary sessions.



Charles W. Howe  
University of Colorado

#### STATUS REPORT ON THE DENVER BASIN AQUIFER RECHARGE DEMONSTRATION PROJECT (as of February 22, 1989)

The Denver Basin Aquifer Recharge Demonstration Project (Demonstration Project) is being conducted through an Intergovernmental Agreement between the Willows Water District, the Denver Water Department (DWD), the Parker Water and Sanitation District and the Colorado State Engineer's office (SEO). The Willows Water District is providing the injection facilities, DWD is providing injection water up to 500 acre-feet per year, Parker Water and Sanitation District is providing initial capital financing, and the Colorado SEO is involved based on its regulatory authority relative to underground water rights. John C. Halepaska and Associates, Inc. is providing technical services related to the operation of the project.

The Demonstration Project was undertaken to evaluate the technical feasibility of injecting potable surface water supplies into Denver Basin bedrock aquifers. The physical process of injecting water into the deep bedrock aquifers is meant to facilitate storage of excess surface water supplies when they are available, and other means of storage may not be available, and also to use the bedrock aquifer as a transmission line for these water supplies through the extraction of these waters by remote wells.

The first year of this five-year Demonstration Project is currently under way, using injection rates of 200 to 250 gallons per minute (gpm), and injection-run durations of one to two weeks. It is anticipated that, during the second season of injection, injection rates will increase to the range of 400 gpm, with injection-run durations of approximately one month.

The injection data to date indicate an injection efficiency of approximately 98 percent (volume injected related to volume pumped to clean the well between cycles), and no detrimental effects have been observed related to the aquifer or well hydraulic characteristics.

Pump cycles following the injection cycles typically result in increased sand production in the well, which is most likely related to the reversal of flow in the well and the construction characteristics of the well that is being used for injection. Although sand production during the pumping cycle is expected to some degree as a result of injection, steps are being taken to minimize this sand production before continuing with the project.



Water chemistry of both the source water (Denver Water Department potable water supplies) and water pumped from the well subsequent to injection are being monitored closely during the injection runs and the subsequent pumping cycles. Only limited analytical data are available to date, but the data that are available indicate a very high-quality injection source supply and no degradation in aquifer water quality being pumped from the Arapahoe aquifer.

This first year of the Demonstration Project is designed primarily to evaluate the technical issues related to physically injecting water into the deep bedrock aquifers. It is proposed in subsequent years of the Demonstration Project that other issues related to institutional and legal problems associated with the injection process will be addressed, as well as further evaluating the technical aspects.

by Bruce A. Lytle, Senior Project Engineer and Associate, John C. Halepaska and Associates, Inc., Englewood, CO.

#### SOUTH PLATTE STUDY TEAM CONTINUES WORK ON SAMSON

During the Spring and Summer of 1988 the characteristics of seven different computer models were reviewed by the South Platte Study's Model and Technical Support Subcommittees. On August 9 the Technical Support Subcommittee (TSS) recommended to the Executive Committee that SAMSON be acquired and used. This recommendation was based on analysis of desirable model characteristics; cost of developing, adapting, and acquiring the model; cost of developing a data base to support the model; the means by which the model will be updated and maintained; and the decision by the State Engineer's Office to use this model for various applications related to the South Platte River. On September 13, the Executive Committee voted to accept the recommendation of the TSS regarding SAMSON.

Since September, work to acquire and adapt SAMSON for the basin study has continued. Cooperative efforts with the Colorado State Engineer's Office, which has an interest in utilizing SAMSON for operation and administrative purposes, have been pursued. The goals of this cooperative effort are to eliminate duplication of effort, to assure that models used by the participants and the State Engineer's Office retain similar characteristics, and to pool knowledge and resources to the benefit of the basin's water users.

To make model use more economical for both study participants and the State Engineer's Office, the model was converted from the Cyber super-computer used at Colorado State University to the VAX computer system used by study participants at both the Northern Colorado Water Conservancy District and the U.S. Bureau of Reclamation. The VAX system is also used by the State Engineer's Office. The model is now loaded on the NCWCD computer, and documentation has been provided to the study participants by the CWRRI.

Since September the TSS has explored various means to facilitate both short-term and long-term modifications to SAMSON to make it more compatible with the needs of the study. On March 6 the Executive Committee approved a plan to employ an experienced computer programmer to: (1) review the model's program and document the program's structure; (2) modify the model's code to allow faster and more efficient execution; (3) incorporate modifications to allow input and output data to be entered and displayed in English rather than metric units as in the original

program; and (4) develop a user-friendly, menu-driven IBM-PC compatible graphics package that will allow the display of input and output data. The programmer will work under the direction of the Model Subcommittee.

Source: South Platte Basin Water Management Committee Newsletter, April 1, 1989, Vol. No. 2.

#### USGS ANNOUNCES MATCHING GRANT AWARDS

Three Colorado proposals have been selected for funding in the U.S. Geological Survey FY1989 Matching Grants Program. Colorado State University received one award for research on "Modeling of Seasonal Intermittent Hydrologic Processes." The principal investigator is Jose Salas, Department of Civil Engineering. The University of Colorado received two awards. "Facilitating Volunteer Transfers of Bureau of Reclamation-Supplied Water" will be investigated by Larry MacDonnell, Director of the Natural Resources Law Center. Charles W. Howe and Rob Hamm will examine "Incorporating Public Preferences in the Optimization of Urban Water Supply Reliability: Planning Procedures and Survey Techniques" in the second study. Howe is Director of the Environment and Behavior Program at CU's Institute of Behavioral Science, and Rob Hamm is with the Institute of Cognitive Science at CU.

USGS received 260 proposals for the nationwide water research program, and 35 were selected for awards.

#### WATER SUPPLY OUTLOOK

During March Colorado had unusually dry weather patterns accompanied by warm temperatures, and as a result water supply prospects for this summer have significantly deteriorated, says the Soil Conservation Service. Snowpack figures in Colorado dropped to 87 percent of average on April 1, reflecting a substantial decrease from the March 1 readings of 109 percent of average for the state. These figures, however, remain slightly above last year's measurements on April 1. The highest snowpack in Colorado is in the Upper Rio Grande Basin at 14 percent above normal.

Precipitation at lower elevations was quite variable in March, with the highest amounts observed in the Yampa, White, North Platte and Colorado River Basins. Basins east of the Continental Divide received well below normal March precipitation. The lowest basinwide monthly total was in the South Platte Basin at only 33 percent of average. The Arkansas Basin received only 52 percent of the March average, and has the lowest water-year total in the state at only 78 percent of the October-March total.

Water stored in the state's major irrigation reservoirs continues to remain above normal, with current storage at 31 percent above average statewide.

Streamflow forecasts have decreased significantly at all forecast points in Colorado. Rivers in northern and central Colorado continue to have the lowest forecast volumes. The Yampa, White, Colorado, Gunnison, and North and South Platte River Basins have volume forecasts in the 70-85 percent of average range. Streamflow volume forecasts in the southern river basins have similarly decreased. Only the Rio Grande Basin has a near-normal water year projected for the spring and summer.

Source: USDA, Soil Conservation Service

**CENTER FOR GLOBAL CHANGE RESEARCH**  
**ESTABLISHED AT COLORADO STATE**

Colorado State University has established an interdisciplinary, multi-institutional research center to study the effects of global and regional climatic changes. The center, CADRE, or The Center for Analysis of the Dynamics of Regional Ecosystems, will involve research from five Colorado State colleges, seven universities and several federal and state agencies. Colorado State President Philip Austin called the global change research center a vital service to the region and the world. "Some of the most challenging problems that now confront us do not lie within economic or political arenas but within the arena of global environment," said Austin. "The research produced by this center will go a long way to find solutions to these complex problems."

Colorado State's colleges of Agricultural Sciences; Applied Human Sciences; Engineering; Forestry and Natural Resources; and Natural Sciences will participate in CADRE. The universities of Colorado, New Mexico, Wyoming, Virginia, Denver and New Mexico State also will assist the center. Federal agencies involved include the Forest Service, Department of Agriculture, Park Service, NASA and National Oceanic and Atmospheric Administration.

Robert Woodmansee, on leave from his position as director of the Natural Resources Ecology Laboratory at Colorado State, will serve as director of CADRE.

Source: University Communications, Colorado State University, April 4, 1989.

**FROM COOPERATIVE EXTENSION**

The Soil Conservation Service and Cooperative Extension, with input from several others, have developed a Water Quality Action Plan outlining activities over the next two years. The plan specifies that county offices of SCS and CE will be provided with resource materials to help farmers make environmentally sound management decisions regarding fertilizer and pesticide use. In coming months a pesticide data base and soils data base, with a rating scheme to help farmers compare alternative pesticides in terms of their pollution potential, will be distributed.

Activities planned for 1989 include Safe Drinking Water Clinics and a two-day workshop on pesticide and nutrient movement, tentatively planned for late summer or early fall in Denver. The workshop will include the basics of chemical transport and hands-on experience with simple computer models for estimating groundwater pollution potential. In addition, pilot projects on water and fertilizer management will begin this summer with the goal of reducing nitrate contamination of groundwater.

Extension personnel at Colorado State are preparing a videotape on the risk of pesticides in the food chain, which should be ready for pilot testing this summer. It will be packaged with a brochure and slide set for a variety of applications in Extension programming.

The April issue of WATERWISE describes a new version of the atmometer that was developed recently as a field instrument to determine alfalfa reference evapotranspiration (ET). It was developed to model the transpiration from leaves of a well-watered, growing alfalfa field. Evaluation of the modified atmometer as a tool for irrigation scheduling was done at the Agricultural Engineering Research Center in Fort Collins. For information contact Jon Altenhofen at 223-8196 (Fort Collins).

A computer program that generates tables to manually calculate soil water balance is also being developed, and will be available for Cooperative Extension and Soil Conservation Service personnel use to assist growers in their areas.

Another development is the installation of Low Energy Precision Application (LEPA) systems on the High Plains of Colorado, near the Burlington area. The LEPA system is a modified center pivot or linear move line that works under very low pressure. The center pivot is modified to have a drop nozzle every five feet that extends to the soil surface. Water is applied at a very high application rate under low pressure directly to the soil surface. The LEPA system has some advantages over low-pressure spray nozzles, including higher irrigation efficiency and lower energy consumption. Because of the high application rates of the LEPA system additional tillage may be needed, which may add additional operation costs. The SCS Ogallala team is promoting the use of the LEPA system and helping farmers to make a decision concerning its use.

Sources: Agricultural Engineering News, April 1989, Cooperative Extension, Colorado State University and USDA cooperating.

Waterwise, Cooperative Extension, Department of Agricultural and Chemical Engineering, Colorado Water Resources Research Institute, and Colorado State University and USDA cooperating.

**CU RESEARCHER STUDIES**  
**POLLUTION SEEPAGE THROUGH SOIL**

Inside a sloping glass tank, dyed water filters through transmission oil to the sand and water below. Tissa Illangasekare, Associate Professor of Civil Engineering at the University of Colorado, wants to see how pollutants move through soil after a spill. The tank, funded by a grant from the National Science Foundation, was constructed to allow Illangasekare and his students to simulate the interactions of pollutants and groundwater. Students will also shoot gamma rays through the tank to measure how material moves and is stored in the soil. Later simulated rain will be used to determine how it affects the downstream flow of pollutants. The experiment will be used to form mathematical models to predict how toxic materials move through soil.

Illangasekare, an alumni of Colorado State, received his Ph.D in Civil Engineering and participated in several CWRRI research projects while obtaining his degree.

Source: Rocky Mountain News Boulder Bureau, March 14, 1989.

**WATER INSTITUTE AND COOPERATIVE EXTENSION**  
**WILL COORDINATE PROGRAMS**

The Colorado Water Resources Research Institute (CWRRI) and Cooperative Extension have signed an agreement to cooperate in the field of water quality and quantity.

These CSU-based programs have related missions to provide information, training and technology transfer services to Colorado water agencies and practitioners. CWRRI has studied Colorado water problems and transferred technology for 25 years. Cooperative Extension (CE), a much broader-based program, is entering the water quality

field because of the need to serve agriculture with information about better management practices.

To implement the agreement Jim Loftis, Extension Specialist in the Department of Agricultural and Chemical Engineering, has been named Associate Director of CWRRI for 1989. He will work with CWRRI Director Neil Grigg to develop a coordinated program that includes workshops, conferences and publications.

#### NAWID CELEBRATES 25TH ANNIVERSARY OF STATE WATER INSTITUTES PROGRAM

The Water Resources Research Act was signed by President Lyndon B. Johnson in 1964, authorizing a national water research program to be conducted through a network of state water research institutes located at each state's Land Grant institution. The National Association of Water Institute Directors will celebrate the program's 25th anniversary at its annual meeting in Washington, D.C. April 26-28, 1989. Meeting activities will be covered in the next issue of COLORADO WATER.

#### LEGISLATION INTRODUCED IN CONGRESS TO REAUTHORIZE WATER INSTITUTE PROGRAM

On February 22 California Congressman George Miller introduced legislation to reauthorize the Water Resources Research Act (H.R.1101), the same legislation he sponsored last year. Cosponsors include Colorado Representative Ben Nighthorse Campbell and Representative Richard Cheney of Wyoming.

On April 6 James A. McClure of Idaho introduced a companion bill in the Senate (S.714). Both bills extend the Act's authorization through 1993, and provide a one-to-one matching requirement. The funding authorization level for the State Water Institutes Program remains the same at \$10 million annually, or \$150,000 per Institute. The Act also authorizes an annual \$5 million Institute matching grant competitive program to focus on water problems and issues of a regional or interstate nature beyond those of concern to a single state and which relate to specific program priorities identified jointly by the Secretary of the Interior and the state water institutes. Also authorized is \$20 million annually to continue the Matching Grants Program now administered by the U.S. Geological Survey. The Technology Development section of the act authorizes an additional \$6 million with a cost-share requirement of no more than 1:1 for state water institutes.

#### BRIDGE AND DAM MODELS TESTED WITH CU CENTRIFUGE

CU's new \$2-million centrifuge is being used to test models of bridges, dams and other structures for potential flaws or safety problems. If a structure develops a crack, for example, scientists can construct a small replica of it, including the fracture, and test the scale model in the centrifuge to determine potential effects of the damage. This is the free world's most powerful centrifuge, although the Soviet Union has the largest. It will hold two tons and produce a force of 200 times normal gravity. Engineering Professor Hon-Yim Ko, Director of the CU Center for Geotechnical Research, said a core sample of soil on the site of a proposed skyscraper can be run through the centrifuge to predict how the building's pressure will affect the ground underneath. He said the centrifuge is to civil engineers what a wind tunnel is to designers of jets and other airborne devices.

Source: Denver Post, March 20, 1989.

#### LONGMONT VOTERS APPROVE BOND ISSUE

Longmont voters on March 9 approved the issuance of up to \$7.5 million in bonds for repairs, replacements and improvements to the city's water system. The vote was 1,599 to 986, with only 9.5 percent of the registered voters turning out to vote. The vote does not affect water rates, which were increased December 30 to pay for the improvements. The question decided in the election was whether the projects would be paid as completed, which could take up to 15 years, or to issue bonds to complete the projects by 1993 and pay off the bonds over about 20 years.

Source: Denver Post, March 8, 1989

#### FORT COLLINS TO SPEND \$6.1 MILLION FOR WATER

The city of Fort Collins will buy more than 7,000 acre-feet of water if the City Council approves the purchase. The purchase price is slightly less than \$6.1 million. An \$11.7 million water bond sale would finance the water rights purchase and provide \$5 million to modify the city's water treatment plant to pump an extra 10 million gallons per day to city water users. Mike Smith, water utilities director, said the city is pursuing a water supply policy adopted by the City Council last December. Council members agreed at that time to buy 7,400 acre-feet of water and increase the amount of water developers provide to the city when they build new housing or commercial projects.

Source: Coloradoan, April 18, 1989.

#### EXPERTS SAY DROUGHT WAS 1988'S WORST DISASTER

Agricultural crop losses and indirect loss of human life made the drought of 1988 the nation's worst natural disaster. This is the opinion of a panel of experts who recently met at the annual meeting of the American Association for the Advancement of Sciences in San Francisco. The 1988 drought caused an estimated \$40 billion in agricultural losses, and its related heat wave contributed to some 5,000 to 10,000 heat stress-related deaths. Norman Rosenberg of Resources for the Future, Washington, D.C. added that "A large portion of the country still remains vulnerable. If we have a dry spring, we could have a very serious situation."

Source: U.S. Water News, April, 1989.

#### WIRTH SUGGESTS WILDERNESS WATER RIGHTS COMPROMISE

Colorado Senator Tim Wirth has proposed a set of solutions to resolve the conflict surrounding establishment of new wilderness areas in Colorado. In a letter to Senator William Armstrong, he suggests that an additional 1,200 square miles of federal land in the mountains be designated as wilderness. Wirth proposes a case-by-case effort to resolve questions over water in the protected areas, which includes:

redrawing boundaries to leave certain streams outside the designated areas (for example, the proposed Buffalo Peaks wilderness south of Leadville);

using state law to guarantee that stream flows won't fall below minimum levels (the Piedra area northwest

of Pagosa Springs and Purgatory Flats north of Durango;

and allowing existing upstream diversion to continue, while directing the U.S. Forest Service to file a claim for junior water rights (Service Creek drainage south of Steamboat Springs).

#### BLM DELAYS DECISION ON UPPER ARKANSAS RIVER

Because of protests filed by sportsmen, conservationists, commercial rafting companies and private river users, the U.S. Bureau of Land Management will delay until summer a decision on its management plan for the Upper Arkansas River. The proposed plan would turn management of the river over to the Colorado Division of Parks and Outdoor Recreation and declare a state park along a 150-mile corridor between Leadville and Pueblo Reservoir. Environmentalists contend that the plan favors commercial companies at the expense of wildlife and other resources.

Source: U.S. Water News, March, 1989.

#### WATER RIGHTS APPLICATION MAY COST SAN LUIS VALLEY WATER USERS

American Water Development, Inc. (AWD), claiming a right to water that dates back to an initial land grant, in 1986 filed an application for the right to pump 200,000 acre-feet of groundwater per year from the San Luis Valley. Most of the 112 wells would be located on the Baca Ranch, a Spanish land-grant property owned by one of the firm's principal members. AWD claims the water is "non-tributary groundwater," which under a special state law allows its use to extinction within 100 years. An additional AWD claim is that if the water is proven to be tributary to surface waters under the regular water rights system it won't cause any injuries to other users, so it does not need a plan of augmentation. The State Engineer has determined that the water is tributary to the Rio Grande River system, but this must be proven in court.

The Rio Grande Water Conservancy District is one of 31 parties that formally objected to the application. The Rio Grande District and State Engineer's office are concerned about the effects of pumping on water users throughout the valley. U.S. Bureau of Reclamation officials fear the pumping could ruin the USBR Closed Basin Project, which is designed to intercept shallow groundwater, prevent its evaporation and transfer the water to the Rio Grande.

American Water is a venture started by Maurice Strong, a Canadian petroleum developer.

Source: U.S. Water News, March 1989.

#### COLORADO LOSES 138,000 ACRE-FEET OF WATER TO NEW MEXICO

More than 138,000 acre-feet of excess water was released to New Mexico from Elephant Butte Reservoir last year, and the water may have been worth as much as \$10 million. Jeris Danielson, State Engineer, said the mistake was not discovered until final figures from USBR, which runs the dam at the reservoir, became available. By then it was too late to correct it. Danielson said his agency will consider litigation to recover the lost water.

Source: Coloradoan, April 8, 1989.

#### DRCOG OFFICERS RE-ELECTED FOR 1989

The Denver Regional Council of Governments re-elected Chairman Robert L. Tonsing, Littleton Councilman; Vice Chairman Robert Puckett, Arvada councilman; and Secretary-Treasurer Harold Kite, Adams County commissioner, for their second consecutive one-year terms. As officers, they serve on the DRCOG Executive Committee. The DRCOG Board of Directors also elected Wheat Ridge Councilman, Anthony Fiasco, to replace Mark Bustamante, former Thornton councilman.

#### LOWER SOUTH PLATTE CONSERVANCY DISTRICT NAMES EXECUTIVE DIRECTOR

Chairman Steve Treadway introduced Marian J. Law as the new Executive Director of the LSPCD at the District's April 4 Board of Directors meeting. Ms. Law will attend meetings of other conservancy districts and any other meetings that may concern the District's interests. Among the projects that may be undertaken is a water quality program with the Northern and Central Districts.

#### FEDERAL ATTITUDE ON WATER POLICY MAY CHANGE

The Water Reporter says last summer's drought may cause a political shift of opinion about the federal government's role in improving management of the Nation's water resources. It reported that at a recent area meeting of the American Water Resources Association in Washington, D.C. Trent Norris, legislative aide to Senator Wyche Fowler of Georgia, announced that Fowler would introduce water bills later this year on the following subjects:

- \* water pricing policy
- \* water metering
- \* more efficient irrigation methods
- \* water consumption and conservation technology transfer
- \* research to increase water use efficiency
- \* financing incentives to promote water conservation that would affect municipal bonds
- \* research to promote crops that use less water and/or are drought-resistant.

Norris said the topics would be handled in separate bills to reduce the number of committees involved. He also cited the Delaware River Basin Commission as an example of "amazing profits to gain for regions using the river basin approach."

In other legislation, an expanded version of last year's plumbing performance standards bill was introduced on March 15 (cosponsors Adams-WA and Cranston-CA). The bill would require toilets in new construction that use only 1.6 gallons of water per flush and showerheads that restrict water flow to 2.5 gallons per minute. An identical bill was introduced by Rep. Atkins (MA) on March 1 with 22 cosponsors. Toilets use about 40 percent of a household's total indoor water use, and bathroom showers and sinks use another 35 percent, said the article.

The Water Reporter noted that last December the Interior Department issued a policy paper supporting

transfer and profiteering by the sellers of federally-supplied water, as long as state laws are complied with and downstream third parties are not injured. This "Statement of Principles" was in response to a request by the Western Governors Association to clarify federal policy, said the article.

Source: The Water Reporter, Vol. 13, No. 3.

#### MAY 1-7 IS NATIONAL WATER WEEK

A coalition of industry, government, and citizen groups is again sponsoring National Drinking Water Week May 1-7 with the theme, "On Tap for the Future." The National Water Alliance, the lead sponsor among the 15 groups making up the drinking water week coalition, hopes to focus public attention on policy changes that are taking place in the areas of water quality and supply. These changes resulted from passage of the Safe Drinking Water Act Amendments of 1986.

#### LEAGUE OF WOMEN VOTERS UPDATES BEST-SELLING WATER PUBLICATION

COLORADO WATER, a best-selling League of Women Voters publication since 1975, has been revised and the 4th edition is now available. This 32-page, easy-to-read, yet comprehensive publication includes:

- up-to-date figures and laws
- Water in Colorado History
- Water and the Federal Government
- Colorado Water Law
- Colorado Water Management
- Colorado Water Administrators
- Citizens' Choices and Conflicts
- 6 charts, illustrations and maps
- and more--

COLORADO WATER is a valuable resource for teachers, planners, seminar participants, civic officials, water managers, interested citizens and the media.

Contact: League of Women Voters of Colorado, 1600 Race St., Denver, CO 80206 (303)320-8493. Price \$5.00 each plus tax and handling. Quantity discounts available.

#### JAN VAN SCHILFGAARDE ELECTED TO NATIONAL ACADEMY OF ENGINEERING

Jan van Schilfgaarde, Associate Director of the Mountain States Area, Agricultural Research Service, has been selected as a member of the National Academy of Engineering. His accomplishments encompass many aspects of agricultural engineering including drainage design, soil management, water management, watershed engineering and salinity problems.

Born in the Netherlands, van Schilfgaarde came to the United States after completing his high school education. He earned BS and MS degrees in Agricultural Engineering and a Ph.D in Agricultural Engineering and Soil Physics at Iowa State University. He began his career with a joint appointment at North Carolina State University in Agricultural Engineering and with the USDA/ARS as agent (drainage engineer). In 1964 he was appointed Chief Water Management Engineer, Soil and Water Conservation Research Division, ARS, became Associate Director in 1967, and Division Director in 1971 with responsibility for directing a national program of research in the fields of soil management, water management and watershed engineering. He subsequently moved to Riverside, California as Director of the U.S. Salinity Laboratory,

and in 1984 came to Fort Collins as Director of the Mountain States Area.

In recent years his interests have dealt with soil and water conservation needs worldwide, with the interaction between physical and social sciences, and with the urgency of conserving our natural resources. He has served on numerous task forces and committees and received a number of honors, including three outstanding paper awards from ASAE, the Walter J. Humber Research Prize from ASCE, the John Deere Gold Medal from ASAE, election to the Drainage Hall of Fame at Ohio State, and the Royce J. Tipton Award from ASCE.

#### NEW USGS REPORTS AVAILABLE

Arkansas River Basin--The complex interaction between groundwater and surface water in the Arkansas River Basin, and between nature's supply and man's use, make planning and management decisions difficult in the basin. The U.S. Geological Survey, in cooperation with the Southeastern Colorado Water Conservancy District, developed a computer model to aid in that decision process. The monthly time-increment model simulates the quantity and quality of streamflow, groundwater and reservoirs. Water demands of most users are also simulated including direct diversions, reservoir releases, groundwater pumping or transbasin imports. The report, "Calibration and use of an interactive-accounting model to simulate dissolved solids, streamflow, and water-supply operations in the Arkansas River Basin, Colorado," by Alan Burns, is published as Water-Resources Investigations Report 88-4214.

The report is available from the U.S. Geological Survey, Books and Open-File Reports, Federal Center, Box 25425, Denver, CO 80225-0425. Microfiche \$4.00; paper copy \$18.25. Prepayment required, check or money order made payable to U.S. Geological Survey.

Colorado River Basin--A comprehensive USGS study, done in cooperation with the U.S. Bureau of Reclamation, describes the dissolved-solids concentrations and loads at 70 streamflow-gaging stations in the Upper Colorado River Basin. Annual and monthly concentrations and loads of dissolved solids and major constituents were estimated for 70 streamflow-gaging stations in the Upper Colorado River Basin. Trends in streamflow, dissolved-solids concentrations and dissolved-solids loads were identified. Nonparametric trend-analysis techniques were used to determine step trends resulting from human activities upstream and long-term monotonic trends. Results were compared with physical characteristics of the basin and historical water-resource development in the basin to determine source areas of dissolved solids and possible cause of trends. The report is published as U.S. Geological Survey Open-File Report 87-568, and is available at the address given above. Microfiche \$4.75; paper copy \$18.00.

Urban Storm-Runoff--Four linear regression models have been developed from a combined USGS and U.S. Environmental Protection Agency data base that includes about 2,800 storms in 30 metropolitan areas throughout the United States. The models are for use in estimating storm-runoff constituent loads, storm-runoff volumes, storm-runoff mean concentrations of constituents, and mean seasonal or mean annual constituent loads from physical, land-use and climatic characteristics of urban watersheds in the United States. The models can be used at gaged and ungaged urban watersheds by urban planners and engineers to plan for the effects of storm runoff. The report, "Techniques for estimation of storm-runoff

loads, volumes and selected constituent concentrations in urban watersheds in the United States," by Nancy E. Driver and Gary D. Tasker, is published as U.S. Geological Survey Open-File Report 88-191. It is available from the address given above. Microfiche \$4.00, paper copy \$13.25.

#### SCHOLARSHIPS AVAILABLE

**Harlan Erker Scholarship, Colorado Groundwater Association.** Funding: \$1,000 for 1989-1990 academic year. **Qualifications:** (1) enrollment at any accredited public or private college or university; (2) involvement in research or independent study pertaining to hydrology, geology, engineering, hydrogeology, law, economics planning, computer modeling, or other topic concerning groundwater in Colorado. **Applications:** Send abstract to: Chairman, Erker Scholarship Committee CGWA, P.O. Box 15036, Lakewood, CO 80215. **Deadline:** August 1, 1989.

Contact Mark R. Palumbo at 989-2837 for further information.

**J.J. Barr Scholarship Award of the National Association of Water Companies (NAWC).** Each year the association awards a scholarship to a student from an educational institution in the vicinity of the conference city. The 1989 conference will be held in Colorado Springs, Colorado from October 8-12, 1989. This award, a check for \$2,500 and a certificate, is presented annually by NAWC to honor Mr. J. Jack Barr, now deceased, formerly President and Chief Executive Officer of the American Water Works Company. It is made to a junior, senior or graduate to recognize achievement in scholarship, leadership potential, initiative and promise. An additional purpose is to make the student aware of the rewarding career potential in investor-owned water utilities. The scholarship recipient (and spouse if married) will be invited to attend the conference for one day at NAWC expense to receive the award. Scholarship application forms are available from the Institute (491-6308). **Deadline:** May 22, 1989.

#### HEC-2 USERS CONFERENCE PLANNED

A conference for users of HEC-2 will be held in Denver August 10-11, 1989 at the Holiday Inn, I-70 East. The conference will feature speaker-users from the Federal Emergency Management Agency (FEMA), the Corps of Engineers and other government and private users. It will provide the opportunity for HEC-2 users to get together and share their experiences and applications of HEC-2.

The conference is for experienced users of the HEC-2 Model. It will be especially useful for those who have applied the HEC-2 Model to specific applications and have encountered specific problems. Cost of the conference is \$75.00 including coffee breaks, lunches and notebook. It is sponsored by FEMA, the Colorado Section of ASCE, Resource Consultants, Inc. and CWRRI. Contact David Frick at 572-1806 for more information.

#### NATURAL RESOURCES LAW CENTER HOSTS 10TH ANNUAL SUMMER PROGRAM

**Boundaries and Water: Allocation and Use of a Shared Resource** is the topic for the NRLC's 10th annual summer program to be held June 5-7, 1989 at the University of Colorado. This conference will provide a general introduction to the basic legal principles governing the allocation and use of both ground and surface water between different governmental entities. Seven river

basins will be examined to illustrate the types of issues raised in sharing water and the legal and institutional responses that have resulted. Specific issues presented by interstate and interbasin transfers of water will be considered. Finally, opportunities for improved cooperation on a basin-wide basis will be discussed. For information contact: Katherine Taylor, Conference Coordinator, Natural Resources Law Center, Campus Box 401, Boulder, CO 80309-0401. Phone (303)492-1288.

#### COLORADO WATER WORKSHOP SCHEDULED

The annual Colorado Water Workshop, held each summer at Western State College, is scheduled for July 24-26. The conference topic will be "Water Quality/Water Quantity Issues." The July issue of COLORADO WATER will provide full information about the conference, or interested parties can contact conference director Tyler Martineau at (303)943-2082.

#### GROUNDWATER QUALITY, PESTICIDES AND FEDERAL FARM POLICIES ARE CONCERNS OF WORKSHOPS

The Environmental and Energy Study Institute, in cooperation with the Environmental and Energy Study Conference, will hold a series of workshops on groundwater contamination, agricultural chemical use and federal farm policies. The series will consist of four two-hour sessions on consecutive Fridays, April 28, May 5, May 12 and May 19, 1989 from 9:30 to 11:30 a.m. in the Dirksen Senate Office Building Auditorium, Washington, D.C. These workshops will try to clarify the problems and identify changes in farming practices and federal policies to prevent groundwater contamination while maintaining farm incomes. Each session will include the opportunity for participants to raise questions and make comments.

#### STREAMBANK EROSION AND FLUVIAL SYSTEM MANAGEMENT SYMPOSIUM PLANNED

This symposium, to be held in Snowmass Colorado July 31-August 2, 1989, is jointly sponsored by the Colorado Soil Conservation Board and Colorado Association of Soil Conservation Districts. Its purpose is to examine low-cost Best Management Practices (BMP) in use in the western United States to control streambank erosion which can be installed by the landowner or landuser. Speakers will include both professionals and landowners. There will be a balance between general sessions, small group discussions, and a field trip along the Roaring Fork River to observe and study BMPs installed and in operation. For further information contact the Colorado State Soil Conservation Board, 1313 Sherman St., Room 420, Denver, CO 80203, or call (303)866-3351. Cosponsors of the symposium include the Bureau of Land Management; Soil and Water Conservation Society of America, Colorado Chapter; Soil Conservation Service; and Colorado Riparian Association.

#### HIGH ALTITUDE REVEGETATION COMMITTEE ANNOUNCES SUMMER FIELD TOUR

The Black Hills of South Dakota, Lead/Deadwood Area, will be the site of the the High Altitude Revegetation Committee 1989 Summer Field Tour. Dates for the tour are July 13 and 14. For information contact Gary Thor, HAR Secretary, Department of Agronomy, Colorado State University, Fort Collins, CO 80523 (303)491-7296.

# COLORADO WATER RESEARCH

A summary of water research awards and projects recently initiated is given below for those who would like to contact the investigators to receive information.

## Colorado State University Fort Collins, CO 80523

- Satellite Remote Sensing, Thomas H. Vonderhaar, CIRA Administrative Unit, Foothills Campus.
- Testing of Hydrologic Model, Daryl B. Simons and Pierre Y. Julien, Civil Engineering Department.
- Bank Erosion Modeling and Assessment Techniques, Colin R. Thorne and Steven R. Abt, Civil Engineering Department.
- Experimental Timber and Concrete/Timber Bridge for Rural Roads, Richard M. Gutkowski, Civil Engineering Department.
- Forecast Product Development for Severe Storm Nowcasting, Thomas H. Vonderhaar and James Purdom, CIRA Administrative Unit, Foothills Campus.
- Hydrologic Modeling Model Analysis, Daryl B. Simons and Pierre Y. Julien, Civil Engineering Department.
- Chronic Metal Impacts to Brown Trout, Eric P. Bergersen, Cooperative Fish & Wildlife Research Unit.
- Floriculture Research, Joe J. Hanan, Horticulture Department.
- Biological Control of Land Atmosphere Exchange: An Ecosystem Approach, David S. Schimel, Natural Resource Ecology Lab.
- The Effects of Base-Level Changes on Fluvial Processes, Sedimentation and Erosion Control, Frank G. Ethridge, Earth Resources Department.
- Numerical Modeling of Cloud and Precipitation Chemistry in Frontal Rainbands, Steven A. Rutledge, Atmospheric Science Department.
- Land Condition/Trend Analysis on U.S. Army Lands, Robert B. Shaw, Range Science Department.
- The Effect of Base-Level Change on Fluvial Processes, Sedimentation and Erosion Control, Stanley A. Schumm, Michael D. Harvey, and Frank G. Ethridge, Earth Resources Department.
- Chalk Creek Project, Eric P. Bergersen, Cooperative Fish & Wildlife Unit.
- Water District History, Daniel Tyler, History Department.
- Current and Forecast Hydrometeorological Conditions, Thomas H. Vonderhaar and Thomas A. Brubaker, Atmospheric Science Department.
- Areal Precipitation Estimates Using Satellites, Thomas H. Vonderhaar and Thomas B. McKee, Atmospheric Science Department.
- Evaluation of Squawfish Introductions in the White River, Colorado, Eric P. Bergersen, Cooperative Fish and Wildlife Research Unit.

## University of Colorado Boulder, CO 80401

- Bacterial Transformations of Selenium Pollutants, R. Ray Fall, Cooperative Institute for Research in Environmental Sciences (CIRES).
- Development and Experimental Verification of Models for Estimation of Uplift Water Pressures in Cracks in Dams, Tissa Illangasekare, Civil Engineering.
- Evaluation of the Airborne Visible-Infrared Imaging Spectrometer for Mapping Subtle Lithological Variation, Fred Kruse, CIRES.
- Artificial Intelligence for Geologic Mapping with Imaging Spectrometers, CIRES.
- Nitrification of the Longmont Wastewater Treatment Plant, Joann Silverstein, Civil Engineering.
- An Advanced Decision-Support System for Groundwater System Management, Kenneth Strzepek, Civil Engineering.

**USCID ANNOUNCES REGIONAL MEETINGS,  
TWO-DAY CONFERENCE**

The U.S. Committee on Irrigation and Drainage (USCID) will sponsor two regional meetings during 1989 on the topic **Planning for Water Shortages**. The first meeting will be held August 24-26 in Boise, Idaho, and will focus on Water Reallocations and Transfers. St. Louis, Missouri will be the site of the second meeting, October 19-21, on the subject of Drought Management.

**Toxic Substances in Agricultural Water Supply and Drainage - An International Environmental Perspective** is the theme of the Second Pan-American Regional Conference of ICID, to be held June 8-9, 1989, in Ottawa, Canada.

For information contact: U.S. Committee on Irrigation and Drainage, P.O. Box 15326, Denver, CO 80215 (303)236-6960.

**NEW INSTITUTE PUBLICATIONS**

Completion Report No. 150--Groundwater Faunas as Indicators of Groundwater Quality: The South Platte River System, by J. V. Ward, Neal J. Voelz and James H. Harvey. Price: \$4.00.

This study, the first of its kind conducted in North America, examined the distribution, structure, and composition of groundwater animals to assess their potential value as indicators of groundwater quality. Phreatic and hyporheic habitats, and surficial bed sediments were sampled at nine locations along the course of the South Platte River, Colorado. Samples were taken with a device procured from Europe that was specifically designed to collect groundwater animals from alluvial aquifers.

Aquatic animals have been widely used as indicators of surface water quality. Because faunal communities integrate past and present environmental conditions, aquatic animals may provide valuable information on water quality that might not be detected by chemical analyses alone. However, to be useful as biomonitors, groundwater animals must be an integral component of riverine aquifers. Results from this study document that a relatively diverse and abundant fauna inhabits the aquifer system of the South Platte River, and data from another western river suggest that groundwater animals will prove to be an integral component of alluvial rivers throughout North America. The responses of aquatic animals to degradation of surface water quality have been extensively investigated at organismic (indicator organism schemes) and community (diversity indices) levels of organization, but such data are not available for groundwater animals. Implementation of biomonitoring as an integrative management tool to protect groundwater resources requires knowledge about the environmental requirements of specific groundwater animals and the responses of community parameters to changes in groundwater quality.

**PARSHALL IRRIGATION RESEARCH  
PAPERS AVAILABLE**

Ralph L. Parshall (1881-1959), developer of the Parshall Flume, was a renowned irrigation pioneer in Colorado during the first part of this century. His basic research has since served as a foundation for irrigation engineering. Parshall's notes and manuscripts, along with those of his colleagues, have been compiled into a collection of 478 envelopes, all indexed by contents. This collection is currently housed at the Colorado State Archives in Denver. An index for this material is now available from the Colorado Water Resources Research

Institute (491-6308) or the Colorado State Archives, 1313 Sherman Street, Denver (866-2055).

**7TH WORKSHOP FOR ON-SITE WASTEWATER TREATMENT  
HELD AT COLORADO STATE**

Participants at the 7th Workshop for On-Site Wastewater Treatment in Colorado reviewed new technology and management developments in on-site wastewater treatment and examined the evolving nature of on-site regulations. An issue of concern that emerged during the workshop's panel discussion was the need for developing a public awareness that homeowners should assume more responsibility for overseeing proper operation and maintenance (O&M) of their systems. Many homeowners tend to view the on-site system as a temporary solution until central sewers reach the home, but lack of money to build central systems will increase the need for better on-site technology for individual systems. Development of a state strategy for on-site technology was suggested as a way to overcome some of the local problems that arise in trying to provide county-by-county management. Participants agreed that, overall, the septage handling, treatment and disposal process in Colorado needs more systematic planning and implementation. And, if on-site technology is to play a larger role in Colorado's wastewater treatment future, its management should also be considered in the context of Colorado's Individual Sewage Disposal System Guidelines.

Approximately 60 persons attended the workshop held March 28 at Colorado State. It was sponsored by the Colorado Environmental Health Organization, Cooperative Extension and CWRRI.

**POSITIONS AVAILABLE**

**Director of the Idaho Water Resources Research Institute**--Includes responsibility for activities supported with funding from Federal Enabling Legislation as of 1984 and other funding and programs as may be administered by or coordinated through the Institute. The Director reports to the Associate Vice President for Research. A Board of Deans and a Policy Advisory Board comprised of members from constituent groups around the state advise the Institute on policy matters. The director will hold a full-time 12 month position. Position requires travel.

Responsibilities include: promoting, encouraging, organizing and coordinating interdisciplinary efforts in water resources research with the University of Idaho, Boise State University, Idaho State University and other cooperative educational institutions; responding to changing state and regional demands on water use including water quality and quantity; interfacing with water user groups (local, state and federal) to identify and initiate research efforts; generating support for the Institute; coordinating preparation and dissemination of reports; and administering operation of a repository of water resources information on Idaho and the Pacific Northwest.

Qualifications: Ph.D and research record in a field related to water resources; experience in obtaining and administering research grants and contracts; ability to work effectively with faculty in a wide range of academic areas as well as university administrators, agency personnel and the public and private sectors; ability to communicate effectively orally and in writing; experience in program initiation, budgeting and personnel management; must be able to qualify as tenured professor in an academic department.

Send detailed resume and the names of three references to Peggy Hammel, Secretary, IWRI Search Committee, 106 Morrill Hall, University of Idaho, Moscow, Idaho 83843 (208)885-6429.

Postdoctoral Research Associateship Program, National Research Council--Global Climate Change and Inland Fisheries Resources. Climate is hypothesized to change significantly over the next century. Increasing temperature and changes in precipitation amount and frequency are two of the most obvious of the expected climatic changes. Inland fisheries resources likely would be dramatically altered if climate changed substantially. There does not currently exist an accepted methodology or procedure to accurately predict changes in inland fisheries resources based on available data. EPA needs to develop this methodology, determine the distribution of sensitive inland fisheries, and predict the changes in these resources under various expected climate change and regulatory scenarios.

For information on this research opportunity, contact:

Robert T. Lackey, Chief  
Terrestrial Branch  
Environmental Research Laboratory  
200 SW 35th Street  
Corvallis, Oregon 97333  
(503)757-4673

For application instructions contact:

Associateship Program - GR430-A  
National Research Council  
401 Constitution Avenue NW  
Washington, DC 20418

Extension Water Quality Specialist, Cooperative Extension Service, Division of Agriculture, Oklahoma State University. Will be responsible for the development, implementation and evaluation of programs relating to water quality, non-point pollution, water use and management as these relate to agricultural production. Qualifications: A Ph.D in an agriculturally related field with emphasis on water/environmental quality. The ability to effectively work with a wide range of audience is essential. Tenure track position, 12-month appointment with 100 percent Cooperative Extension responsibility.

Interested persons should provide a letter of application indicating qualifications and desire for the position; current resume, transcripts of credits and three letters of reference. Send to: Dr. Ray Campbell, Assistant Director, OCES, Oklahoma State University 245 Ag Hall, Oklahoma State University, Stillwater, OK 74078. Deadline: September 1, 1989.

Ph.D Fellowships in Water Science--\$15,000 per year. Oklahoma State University. The USDA Food and Agricultural Sciences National Needs Program is funding two Ph.D Graduate Fellowships in Water Science in the Agricultural Engineering Department at Oklahoma State University. Fellows will start their studies in the 1989-1990 year. Funding will normally continue for three years. Out of state tuition waived. Applications encouraged from U.S. citizens with engineering, hydrology, geology, soil science or related degrees.

For further information contact by phone Drs. C.T. Haan, B.N. Wilson, R.L. Elliott or G.O. Brown at (405)744-5433. Applications in the form of a complete resume including copies of college transcripts and three references should be sent to: Dr. Bruce N. Wilson.

Agricultural Engineering Department, Oklahoma State University, Stillwater, OK 74078-0497.

Student Employment for Summer--The Denver Water Department seeks two students to work full time during the summer on water conservation projects. The jobs will be based in the City and County of Denver, with some office and field work required. One of the jobs will concentrate on East Slope questions and the other on data collection. The focus will be on water consumption of agricultural crops and on urban lawns. The work will concern the Frasier and Blue River Basins. Pay is \$2,000 per month plus overtime. To apply send a resume and application to: Mr. Ed James, Denver Water Department, 1600 West 12th Avenue, Denver, CO 80254.

#### CALLS FOR PAPERS

International & Transboundary Water Resources Issues, Joint Meeting of the American and Canadian Water Resources Associations, April 1-5, 1990, Toronto. Abstracts invited on the following topics: The Great Lakes; Contaminants; Climate Change; Transboundary Flows; The Commerce of Water; Basin Management; Groundwater; North American Experience in Global Water Management. Abstracts of 250 words (three copies) should be sent to address below. Include title, authors' names and their affiliations; on separate page FULL mailing addresses and telephone number for each author. All attendees will be expected to pay registration fee. Deadline: June 1, 1989.

Address: General Editor, Joint AWRA/CWRA Symposium c/o Ken Reid, CAE, Executive Director, AWRA, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192 (301)493-8600.

Third National Irrigation Symposium--"Visions of Irrigation-Technology to Enrich Our Environment", October 28-November 1, 1990, Tucson, AZ. Presentation and Proposal Form available from CWRRI (491-6308) or contact: Dr. C. J. Phene, Soil and Irrigation Scientist, USDA-ARS, WMR, 2021 S. Peach Ave., Fresno, CA 93727, Phone (209)453-3102. Deadline: June 1, 1989.

#### SHORT COURSES

Colorado State's International Institute for Civil Engineering (IICE), Department of Civil Engineering and International School for Water Resources announce 18 short courses in the topic areas of:

- \* Hydraulic Structures and Hydromachinery
- \* Water Resources Impact Assessment
- \* Microcomputers in Irrigation and Water Management
- \* Hydrology and Systems Analysis
- \* Water Quality Engineering
- \* Wind/Environmental Engineering

Individual courses are scheduled throughout the period of January 6, 1989 to August 16, 1989, and will be held at Colorado State University, Fort Collins. For information contact: Janet Lee Montera (IICE), Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Phone: (303)491-7425.

Municipal Water Demand Forecasting, May 22-26, 1989, Austin, Texas. Tuition: \$795 covers all educational materials, labs and refreshments. Lodging and meals not included. Contact: Continuing Engineering Studies, College of Engineering, Cockrell Hall 10.324, University of Texas at Austin, Austin, TX 78712. Phone: (512)471-3506.

CONFERENCES

- May 3-5 WESTERN SURFACE COAL MINING CONFERENCE, Gillette, WY. Contact: Society of Mining Engineers, Box 625002, Littleton, CO 80162. (303)973-9550.
- May 10-11 PROFITING FROM WATER, Business and Investment Opportunities for the 1990s. Santa Monica, CA. Contact: Water Research Associates, 12233 W. Olympic Blvd., Suite 152, Los Angeles, CA 90064. Call Lou Olmos at (213)207-8277.
- May 21-25 WATER RESOURCES FOR THE FUTURE; THE MANAGEMENT CHALLENGE. 16th Ann. Spec. Conf. ASCE Water Resources Planning and Management Div., Sacramento, CA. Contact: Darell D. Zimbelman, NCWCD, P.O. Box 679, Loveland, CO 80537.
- May 22-25 PARTNERSHIPS, EFFECTIVE FLOOD HAZARD MANAGEMENT, ASSOCIATION OF STATE FLOODPLAIN MANAGERS 13TH ANNUAL CONFERENCE, Scottsdale, AZ. Contact: Rebecca Hughes, Maryland Water Resources Administration, Tawes State Office Bldg. D-3, Annapolis, MD 21401.
- June 7-9 INTERNATIONAL SYMPOSIUM ON DESIGN OF WATER QUALITY INFORMATION SYSTEMS, Ft. Collins, CO. Contact: Robert Ward or Jim Loftis, Agric. & Chem. Engr. Dept., Colorado State University, Ft. Collins, CO 80523. (303)491-5252.
- June 8 WESTERN WATER POLICY IN TRANSITION; EMERGING TRENDS IN LAW, ECONOMICS, AND FINANCE. Santa Fe, NM. Contact: Lincoln Institute of Land Policy, ATTN: Conference Registrar, 26 Trowbridge St., Cambridge, MA 02138. (617)-661-3016.
- June 8-9 TOXIC SUBSTANCES IN AGRICULTURAL WATER SUPPLY AND DRAINAGE - AN INTERNATIONAL ENVIRONMENTAL PERSPECTIVE. 2nd Pan-American Regional Conference of ICID, Ottawa, Canada. Contact: USCID, P.O. Box 15326, Denver, CO 80215. (303)236-6960.
- June 26-29 INTERNATIONAL SYMPOSIUM ON DESIGN OF HYDRAULIC STRUCTURES, Ft. Collins, CO. Contact: Janet Lee Montera, Civil Engr. Dept., Colorado State University, Ft. Collins, CO 80523. (303)491-7425.
- June 27-30 SYMPOSIA ON HEADWATERS HYDROLOGY AND INDIAN WATER RIGHTS AND WATER RESOURCES MANAGEMENT, Missoula, MT. Contact: William W. Woessner, Dept. of Geology, University of Montana, Missoula, MT 59812. (406)243-5698.
- July 18-20 1989 NATIONAL WATER CONFERENCE AND LIFE SYMPOSIUM OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, Newark, DE. Contact: William F. Ritter, Agricultural Engr. Dept., University of Delaware, Newark, DE 19717-1303. (302)451-2468.
- Aug. 4-5 WATER RESOURCES MANAGEMENT; ISSUES AND OPPORTUNITIES, The Honor Society of Phi Kappa Phi First National Summer Seminar, Salt Lake City, UT. Contact: Esther Radinger, Phi Kappa Phi Summer Seminar, Building 124, University of Utah, Salt Lake City, UT 84112. (Nonmembers are invited).
- Aug. 8-11 UCOWR '89, FACING THE WATER PROBLEMS OF THE NINETIES, Minneapolis, MN. Contact: Water Resources Research Center, 866 BioSciences Center, University of Minnesota, St. Paul, MN 55108. For questions regarding registration call Liz Espointour at (612)624-9282 or Margery Robinson at (618)536-7571.
- Aug. 24-26 PLANNING FOR WATER SHORTAGES--WATER REALLOCATIONS AND TRANSFERS, Boise, ID. Contact: USCID, P.O. Box 15326, Denver, CO 80215.

SUMMARY OF PLENARY SESSIONS  
COLORADO WATER ENGINEERING AND MANAGEMENT CONFERENCE

February 27-28, 1989

by

Loretta C. Lohman, Chapman Research Group, Inc., Littleton, Colorado and Neil S. Grigg

LARRY SIMPSON, GENERAL MANAGER OF THE NORTHERN COLORADO WATER CONSERVANCY DISTRICT, MODERATOR:

The water policy of the State of Colorado is a body of thought developed through combinations of law, political action, public opinion and economic need--the various forces that bring together a direction for the development, conservation and management of water supplies for public benefit in the State of Colorado. Developed over the last 150 years, the policy is a dynamic force. However, the time is coming when conservation--the capture of water in wet periods for distribution in drier times--will have to take place in the high country rather than in more accessible areas. Also, water will have to be used and reused through industrial, municipal and agricultural communities in such a way that the agricultural base as well as environmental aesthetics can be maintained into the future. This type of conservation--retention and multiple-use of our water resources--is the primary water policy of Colorado and should continue to be so.

S. LEE GRAY, CHAIRMAN, AGRICULTURAL AND RESOURCE ECONOMICS DEPARTMENT, COLORADO STATE UNIVERSITY: "WATER AND COLORADO'S ECONOMY"

Estimates of Colorado agricultural water withdrawals range from 5.6 to 6.6 million acre-feet annually, with consumptive use from 60 to 65 percent. Our economic model seems to show that such agricultural water is not always efficiently used. For example, when water withdrawals are compared to value of output for hay and pasture, 4,000 gallons of water are required for every dollar of output. For food and feed-grain crops each dollar of output requires 950 gallons of water. In contrast, livestock uses 5.3 gallons for each dollar of output. These descriptive figures seem to indicate that substantial amounts of water could be transferred from certain types of agriculture with only minimum economic disruption.

However, you can't wipe out agriculture and have negligible impacts on Colorado's economy. Other values resulting from this water use--the aesthetics of high-country meadows, for example, or the economies of farm-dependent counties--must be examined. The role of agriculture as it contributes to overall economic activity must be considered.

It is clear that the direct and indirect water requirement necessary to sustain the sale of one million dollars worth of agricultural output to final demand is 926 acre-feet. However, water multipliers, employment multipliers, and input and business multipliers should be used to isolate the truly marginal agricultural sectors before any change of use is contemplated. The output multiplier indicates that agriculture is one of the more important sectors in the State's economy, although including the other relevant multipliers does indicate that hay and pasture could be classified as a marginal sector within agriculture. A reduction of hay and pasture by one-half of one percent of the value of sales to final demand would free 73,000 acre-feet of water for other uses. The loss would be about 14 jobs and a reduction in the final value of output of about \$1.3 million. This input-output technique may identify the truly marginal agricultural sectors in which a dollar value could be attached to the water used and the water fairly reallocated. It is imperative that this be done before any changes in water policy allocation are made.

CHARLES W. HOWE, PROFESSOR OF ECONOMICS, UNIVERSITY OF COLORADO: "WATER TRANSFERS IN COLORADO"

Water transfers mean changing uses--moving a water supply that already exists from one use to another. The factors in favor of such transfers include the increasing costs of new physical works, new storage, and new transmission facilities. There really are two kinds of water transfers: small ones which take place rather effortlessly and at small overall cost, and larger ones which involve senior water being transferred, often out of the area-of-origin.

There are many marginal uses of water in the agricultural sector from an economic point of view. The costs of agricultural water transfers include a reduction in agricultural output. Determining which outputs are affected is very important in determining the true negative effects. A reduction of 50,000 acres may not affect the Nation or the state, but it can affect significantly a local or regional economy.

For example, the Arkansas Valley will have very few opportunities to replace agricultural activity with other income-producing activities. There is unlikely to be a reinvestment of the proceeds of the water sale and there will be problems in declining infrastructure, lower tax base and rates, and a reduction in social services and quality of life.

ED RUETZ, DIRECTOR OF COMMUNITY AFFAIRS, DENVER WATER DEPARTMENT: "METRO WATER SUPPLY ISSUES"

Denver, and much of the metropolitan area, has just been through one of the most elaborate water-supply planning exercises known to man, consuming seven years and close to \$40 million. All of this activity is taking place because of a recognition of the need to develop and maintain adequate water supplies for the Denver metropolitan area. While the recent economic downturn has slowed the rate of growth and the edge of urgency, the need for Two Forks is firmly established.

Two Forks could be required as early as 1999 with nominal conservation and by 2006 with comprehensive conservation. Both dates assume development of wells as interim supply sources. If the Denver Water Department service area is considered separately, Two Forks could still be required as early as 2010 or as late as 2021, depending on the level and

success of a conservation program. Even using Denver's modest surplus to meet demands outside the service area, Two Forks would be needed between 1999 and 2005.

Major assumptions used to project future water demand include interim supplies, conservation, development and redevelopment of wells, improvements to existing reservoirs, South Platte and Blue River exchanges, the lease of Muddy Creek water, the Straight Creek project, and additional and transfer rights. The conservation savings will come from universal metering, expansion of the evapotranspiration and electronic leak-detection programs, plumbing-code changes, encouragement of xeriscape landscaping, and a system of recycled water use for public open-space irrigation.

In the absence of a metropolitan water authority Denver may not be able to share these interim supplies, because the City Charter mandates maintaining adequate reserves to protect the City's supplies and interests. Denver has entered into discussions with area governments to create a water authority responsible for development of raw water resources, which would leave other community water systems intact.

The no-action alternative of the EIS would likely lead to a chaotic set of conditions, including an assault on water resources throughout the state, a pattern of hopscotch urban development, and a proliferation of special districts. The price of land and water would be adversely affected.

DAN LUECKE, SENIOR SCIENTIST, ENVIRONMENTAL DEFENSE FUND: "COLORADO ENVIRONMENTAL ISSUES"

Water will not be the constraining factor in area growth. Air is more likely to be a constraining resource--our ability to manage and deal with it.

While working on the cross-Florida barge canal for the Army Corps of Engineers, a canal approximately four times as long as the Panama Canal constructed to avoid a journey around the isthmus of Florida, it became clear that we're getting to the point where our desire to create infrastructure may have run beyond the point where it is in any way useful. This is particularly true if you consider the fact of diminishing returns.

For example, if you want to deliver a mean riverflow on a firm basis, you must have infinite storage capacity. Taken further by Langbein, a storage vessel eventually gets to the point of diminishing return. He suggested that the annual mean runoff in the Colorado was past the mean (for storage) about the mid-1950s, before Glen Canyon was on the line.

There is a great deal of rhetoric in our discussion of water that is dissociated from reality; for example, the allocation of the water resource given its relative value. If the relative value of water in one application versus another differs by an order of magnitude, there's a lot of room to bargain. With this room there is the possibility of constructing an "insurance system" and a system structure which would allow irrigation to be in business an average of nine out of ten years or fourteen out of fifteen years, with the other year being used to supply municipal shortfalls.

The Greenhouse Effect may have a relationship to water storage. The water storage vessel reduces variance but also reduces the mean. We don't really understand the phenomenon sufficiently to conclude that one means of addressing the Greenhouse Effect should be to provide more water storage. We certainly don't know enough to "put all of our eggs in a storage vessel."

MARSHALL KAPLAN, DEAN OF THE GRADUATE SCHOOL OF PUBLIC AFFAIRS, UNIVERSITY OF COLORADO: "COOPERATION AS A METHOD TO SOLVE STATE WATER PROBLEMS"

The efforts of the Metro Cooperation Group--the seven larger cities and three counties that make up the Denver metropolitan area--have been going on for three years. The group has been trying to figure out what cooperation means and trying to solve some real problems.

There are several public policy models which could be used by this "Gang of Ten." First is the right-left model: the right says that there are very few choices or control over public policy because of economic events, variable factors, etc.; the left finds that the grand economic sweep of history really does determine how we act. The second model, the group model, suggests that public policy is made by the petition of groups on government areas. Third, the institutional model, says that public policy is the creation of the cities, states, other local governments, and the federal government--that certain types of institutions behave in different ways. The fourth model, rational, states that we evaluate benefits and cost, predict and anticipate, and collect all data to optimize the choice. Finally, there is the "muddling-through model" which states that policy functions incrementally and that there is never enough data.

Water policy in the metropolitan area is very complex and tough to deal with, in part because there are no strong overview organizations able to create a consensus. There is also the federal government, represented by more than one agency, involved in many of the major decisions--and federal agencies don't manage to cooperate any better than the metropolitan-area entities.

Probably the biggest variable, despite all the studies, is a genuine absence of knowledge. The "facts" of the EIS are challengeable and we have an absence of knowledge about water scarcity, its relationship to demography and its impact on the environment. A good metaphor is provided by Minneapolis-St. Paul, which has good metropolitan cooperation. The mayor during the 1960s, Art Naftalin, says this is because there are so many Norwegians there. This is a sharing-community culture. It's a lot easier to achieve cooperation in that kind of culture than it is in a "frontier," individualistic context.

With so many players, with the lack of a community-sharing culture, and with the basic absence of knowledge, the problem of water comes down to intuition and the playing out of legitimate democratic politics.

J. WILLIAM McDONALD, DIRECTOR, COLORADO WATER CONSERVATION BOARD: "STATE WATER POLICY ISSUES"

The current major issue in Colorado is whether, how and when to account for uses of water rights not now recognized by Colorado law. Other issues are:

\*The state policy to preserve instream flow--a duty and right limited to the Water Conservation Board, but such rights are very junior in priority.

\*Compensatory storage for transbasin diversions--now required on a selected and limited basis, but only for conservancy districts.

\*Increased regulatory authority through land-use control--this has been used effectively to determine the fate or direction of water development (H.B. 1041, 1974).

\*The growth of federal regulation--this is such that the State may lose control of its destiny.

The impact of all of the above issues on existing interstate compacts may also affect the State's ability to move forward.

MARVIN JENSEN, DIRECTOR, COLORADO INSTITUTE FOR IRRIGATION MANAGEMENT, COLORADO STATE UNIVERSITY: "EVALUATING IRRIGATION EFFICIENCY"

A discussion of evaluating water use efficiency requires a clear definition of terms that are used. Water use is either a consumptive or one-time use, a non-consumptive use, or a combination of these uses. Irrigation and conveyance efficiencies are used extensively by engineers in designing and operating water distribution and farm irrigation systems. Agriculturalists use an index called "water use efficiency" which is the production of marketable crop per unit of water consumed. This term can be used to evaluate the overall value of various agricultural water uses.

All uses of water affect the value of water. A water use either consumes the resource or affects its intrinsic value. Evaluating water use efficiency within a river basin may be a very complex process, but there are relatively simple cost effective ways to assess the relative value of alternative water uses or management practices. These indices can be used to monitor the effects of changes in policies and practices and to assess how effectively available water is being managed in a river basin.

JERIS DANIELSON, STATE ENGINEER, COLORADO DIVISION OF WATER RESOURCES: "WATER MANAGEMENT ISSUES IN COLORADO"

Three trends affecting water management in Colorado need close examination. First, demand and competition for water are certain to grow. Second, the Government lacks the resources to apply traditional fixes to improve this situation. Third, environmental considerations will loom much larger. In order to deal with these, one of the most urgent needs is baseline data.

There are many opportunities for improving water management, such as the opportunity to provide Windy Gap water to Thornton. The call of the Shoshone power plant on the Colorado River is a challenge. Surely there is a way to get more power and improve water management at the same time. In the San Luis Valley there are two million acre-feet of water which we need to determine how to use.

To implement management improvements we need to get together. Look at our approach to California. We sue and California uses our water. We need to learn how to better use our technical tools. We need to better educate the public and professionals. There is a role for each group in improving water management. This includes the State agencies, conservancy districts and special districts.

ULI KAPPUS, EXECUTIVE DIRECTOR, COLORADO WATER RESOURCES AND POWER DEVELOPMENT AUTHORITY: "THE CWRPD AUTHORITY FINANCING RESPONSIBILITIES"

The Colorado Water Resources and Power Development Authority has important planning and financing roles. There are attractive water development opportunities in Colorado if the plans and development can be implemented. The Authority maintained a major role in the Animas-La Plata negotiations, and has committed \$30 million to the construction of the project. It has funded a statewide \$2 million satellite link stream-monitoring system and issued \$6.8 million of revenue bonds to partially finance the Stagecoach water and power project. In 1988 the Colorado General Assembly authorized the Authority to participate in the financing of wastewater treatment works and to aid in the creation of the water pollution control revolving fund.

NEIL S. GRIGG, DIRECTOR, COLORADO WATER RESOURCES RESEARCH INSTITUTE, COLORADO STATE UNIVERSITY: "WATER RESEARCH AND MANAGEMENT NEEDS"

Needs expressed at the conference for research and management are in the areas of water policy, water transfers, and planning and management.

\*Water policy--how to reflect public values in the market system for water and improved decision-making in federal programs that value nonmarket uses. How to increase cooperation and develop joint planning for water resources.

\*Water transfers--the need to study low-value versus high-value uses of water. What are the effects of water transfers? The need to determine how to move water in the short-term from agricultural to municipal uses. How to increase and facilitate transfers within water management districts.

\*Planning and management--How to change to mixture of agricultural production to improve the use of water. What the Greenhouse Effect may mean. What the effects of changing crops and patterns on water development will be. How to substitute management technology for water development. How to improve record-keeping in water management. How the State can act as an information source to facilitate water management. The need to study basinwide water use efficiency. The need to use technical tools better for water management.

Plans of the CWRRI for the next year include a groundwater conference in 1990, focused workshops on subjects of interest to water practitioners, a new round of research projects for 1989-90, the development of better support for models, and continuing activities including the newsletter and monthly Water Issues Forum luncheons.

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