

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

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February 1992

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AN ABUNDANCE OF CONVERSATIONS ABOUT WATER

by Robert C. Ward

As I attempt to fully comprehend the magnitude of water education and research activities underway in Colorado, I have been delighted to discover an extremely rich dialogue on water

issues being conducted on the campuses of our highereducation institutions. This issue of *COLORADO WATER* attempts to highlight these discussions by announcing the seminar series that relate to water (see the list of seminars beginning on page 27).

These dialogues often go unnoticed by water professionals outside higher education and, in some cases, by those of us on campus. We tend to participate in our discipline or topicspecific forums which we organize or where we are invited to speak, but it is rare that we see the total, very rich dialogues underway. I encourage all who are interested in water in Colorado to review this abundance of conversations about water and attend those seminars of interest to you. (Please recall that one excellent seminar series at Boulder was printed in the December 1991 issue of *COLORADO WATER*.)

We plan to regularly announce water-related seminar series being held on the campuses of higher education in Colorado. Thus, I encourage anyone organizing such a series for next fall semester to please send us his/her schedule as soon as it is prepared (before July 25, 1992, for publication in the August newsletter).

On another topic, as the Institute works through its process for awarding 1992/93 research projects, I want to point out one dimension of the successes generated by past projects. CWRRI projects, by necessity, are funded at very minimum levels. However, faculty have repeatedly been able to use CWRRI support as seed money to develop larger projects. During the past two years, six investigators, with less than \$100,000 total funds from CWRRI, have attracted an additional 3/4 of a million dollars to support their water research. This indicates: (1) the importance of CWRRI "seed money" in assisting faculty to initiate research on relevant, emerging water problems; and (2) the faculty's initiative in securing additional monies to study water problems important to Colorado.

RESEARCH OPPORTUNITY - EPA

The Environmental Protection Agency requests preproposals under Competitive Cooperative Agreement AERL 9201 on the topic: "Integrated Freshwater Sediment Model for Assessing Sedimentary Contaminant Porewater Exposure to the Benthic Community and Exchange with the Overlying Water Column." Anticipated funding level will be \$225,000 for a three-year project. Contact your Contracts and Grants Office for more information. Deadline: February 28, 1992.

SECOND SOUTH PLATTE CONFERENCE HELD by Craig Woodring

The second, and hopefully annual, South Platte River Basin Conference was held November 19-20 at the Fort Collins University Holiday Inn. Topics included Water Quality, Water Management, Operations, Regional Basin Issues, Water Education, and the South Platte as an Agricultural, Environmental, and Recreational Resource. David Harrison of the Colorado Water Conservation Board and State Senator Don Ament made keynote presentations. A Proceedings of the Conference will be available around March from the Colorado Water Resources Research Institute (303) 491-6308. Conference sponsors included Colorado Division of Wildlife, U.S. Fish and Wildlife Service, Northern Colorado Water Conservancy District, U.S. Environmental Protection Agency, Denver Water Department, and Colorado Water Resources Research Institute.



WATER RESEARCH

WYOMING WATER CENTER ANNOUNCES \$434,000 PROGRAM FOR 1992

Twenty research projects have been approved for fiscal 1992 support by the Wyoming Water Research Center. Included are 11 new one-year projects, six projects continuing from FY1991, and three projects funded by a matching grant from the U.S. Geological Survey (USGS).

Included in the \$238,000 devoted to new research are projects addressing vadose zone monitoring of pesticides; management alternatives during severe drought in the Upper Green River Basin; flow requirements of large rivers necessary to maintain fishery and channel values; and water conservation education.

The \$196,000 devoted to continuing research includes projects addressing water education in Wyoming's elementary schools; development of a plan to transfer water research results to state agencies; modeling groundwater contaminants in aquifers with varied permeability and porosity; microbial transformations of herbicides in Wyoming groundwaters; and long-term investigation of conveyance losses in Wyoming streams and rivers.

For more information about the Wyoming water research program, please contact Steve Gloss at (307)766-2143.

Wyoming Hydrogram, Sept. 1991

INSTITUTIONAL CHANGES COULD IMPROVE WATER ALLOCATION IN THE COLORADO RIVER BASIN

A new research report, <u>Economic Impacts of Alternative Water</u> <u>Allocation Institutions in the Colorado River Basin</u>, by James F. Booker and Robert A. Young, evaluates policies for increasing the beneficial use of water resources in the Colorado River Basin.

Colorado River water is the dominant water supply for much of the southwestern United States, meeting agricultural, municipal, and industrial needs. New demands are increasing pressure to reallocate the already fully utilized basin water. Water transfers would require foregoing some existing uses and would be possible only with significant institutional changes in the set of compacts, state laws, and court decisions currently allocating Colorado River water, according to the investigators. The report evaluates policies for increasing economic returns to basin water resources. The work extends previous efforts on economic allocation of Colorado River water by including all major use sectors in an integrated economic-hydrologic optimization model (HELM). For the first time, alternative water allocation institutions and economic values are formally considered in a full Colorado River basin model. Model solutions are presented using estimates of present and future economic demands under

a river flow level equivalent to estimates of the long-term average and under a flow level simulating serious drought. Present consumptive uses are almost satisfied with the first flow level, but shortfalls occur under other conditions. Within-state transfers are found to be effective for increasing net consumptive use benefits. The authors conclude that continued emphasis on facilitating within-state transfers will have the greatest impact on achieving economic efficiency in basin water use.

The report will soon be available from CWRRI. Completion Report No. 161, *Price: TBA*. The research was funded under the U.S. Geological Survey's Section 105 Matching Grant Program.

DENITRIFICATION PROCESS FOR SMALL COMMUNITIES DEVELOPED

While it is often small communities that must rely on groundwater contaminated with nitrate for drinking water supplies, most nitrate removal processes are unsuitable for water utilities with limited financial resources and few trained personnel. Small communities have been caught in the dilemma of whether to pursue new supply alternatives or the expensive treatment of existing contaminated water supplies.

To help solve the problem, researchers at the University of Colorado have developed a biological denitrification process that reduces nitrate nitrogen from over 13 mg/1 (more than the drinking water standard of 10 mg/1) to less than 5 mg/1. The process is reliable even over a fourfold change in flow (hydraulic loading) rate. It is relatively inexpensive, easy to operate and maintain, and will be especially useful in small/rural communities in Colorado where there is a growing groundwater nitrate contamination problem. Investigators also designed a final polishing process to remove any secondary contaminants introduced during denitrification to ensure production of highquality drinking water.

The CWRRI-sponsored project allowed investigators to study the effect of seasonal changes in water demand on the denitrification process under the challenging conditions of a field study in Brighton, Colorado. The visibility of the field pilot plant at Brighton had the ripple effect of extending the site to several other small Colorado towns, including Gilcrest and Nunn. The work at Nunn was extensive, including sampling and chemical analyses of water and the preparation of a report on nitrate contamination of that town's groundwater. Because of the CWRRI support for the Brighton study, investigators could do the extra work at no cost to Nunn.

Drs. Nevis Cook and JoAnn Silverstein of the Department of Civil, Environmental and Architectural Engineering at the University of Colorado conducted the study. The project completion report, Field Demonstration of Biological 4

Denitrification of Polluted Groundwater and Pilot Scale Field Testing of Biological Denitrification with Widely Varied Hydraulic Loading Rates, is available from CWRRI. Completion Report No. 162, Price: TBA.

(JoAnn Silverstein has received a \$500,000 award from the Environmental Protection Agency to continue her work on the remediation of nitrate contamination in Colorado.)

RIVINT MODEL SIMULATES DROUGHT MANAGEMENT CONTINGENCIES

Selective short-term pumping during drought, rather than largescale pumping on a continuing basis, might be the best way to avoid depletion of groundwater resources in the Denver Basin. Investigators at the Colorado School of Mines, using a previously developed computer model of the Denver Basin (RIVINT), devised simulations of drought alleviation pumping and its effects. Study results show that while the Denver Basin bedrock aquifers cannot <u>fully</u> recover from moderate drought alleviation pumping before the onset of the next drought period, less frequent pumping or smaller pumping rates help decrease the drawdowns.

The CWRRI project was conducted by Dr. Eileen Poeter, Department of Geology and Geological Engineering, Colorado School of Mines. The report, <u>A Modeling Approach for</u> Assessing the Feasibility of Groundwater Withdrawal From the Denver Basin During Periods of Drought, by Sigurd Jaunarajs and Eileen Poeter, includes two program disks. It is available from CWRRI: Completion Report No. 160, *Price:* \$16.00

FOOD SOURCE OF BROWN TROUT SHOWS HIGH CONCENTRATIONS OF HEAVY METALS

Water quality in the Arkansas River downstream from California Gulch, a U.S. Environmental Protection Agency "Superfund" site in Leadville, Colorado, is severely degraded by heavy metals from abandoned mines and mine tailings. This degradation has resulted in a reduced number of species and a shift from metal-sensitive to metal-tolerant organisms, says CSU investigator Will Clements. These organisms include the aquatic insect <u>Salmo</u> trutta, important in the diet of brown trout.

Clements' research found that metal concentrations in organisms collected from impacted sites in the Arkansas River were greatly elevated. This may indicate an important link in the transfer of metals via the food chain of brown trout, according to Clements.

Remediation and restoration activities on the Arkansas River are currently underway, and water treatment facilities will be placed on the Leadville Tunnel and California Gulch, the two primary sources of metals to this system. Clements says it is important to note that these treatment systems must be permanently maintained to restore a healthy and productive brown trout fishery to the Arkansas River system. Background data collected from his CWRRI-sponsored study and other ongoing research conducted by CSU will provide an opportunity to evaluate the success of this remediation. Completion Report No. 163, Fate and Effects of Heavy Metals on the Arkansas River, by William H. Clements, will soon be available from CWRRI. *Price: TBA*.

(William Clements was recently awarded a \$76,000 grant under the U.S. Geological Survey's Section 105 Matching Grant Program to continue his work on heavy metals.)

SAN LUIS VALLEY'S GROUNDWATER SYSTEM VULNERABLE TO CONTAMINATION

CSU researchers have found high levels of nitrates and trace amounts of pesticides in the San Luis Valley's shallow groundwater. Dr. Deanna Durnford, CSU Groundwater Engineer, said there is potential for further groundwater pollution - and although the Valley's groundwater is relatively free of pesticide contamination, immediate steps should be taken to prevent further degradation. Durnford's remarks came at a planning session for the National Water Quality Assessment Program held November 19 in Alamosa.

A shallow, unconfined aquifer system that underlies the San Luis Valley is the source of water for farm irrigation as well as the primary drinking water source for most of the Valley's population. In the summer of 1990 CSU and the Colorado Department of Health sampled 34 irrigation wells around the San Luis Valley during planting and after irrigation ceased in the fall. Over one-third of the irrigation wells exceeded the 10 parts per million federal drinking water standard for nitrates. Most of these wells were located around Center, Colorado. In May 1991 researchers returned for more intensive sampling northeast of Center. Although all information hasn't been processed, preliminary results show that higher levels of contaminants occur at the top of the water table, about nine feet deep, rather than in deeper groundwater. Dr. Durnford hopes 1991 data will help determine how chemicals migrate to groundwater. This information could be used to develop farming practices that have as little impact on the groundwater as possible.

The cooperative efforts of the Colorado Department of Health, Cooperative Extension, the Agricultural Experiment Station, the Colorado Water Resources Research Institute, and many groups and individuals in the San Luis Valley made this study possible.

Completion Report No. 157, <u>Screening Methods for</u> <u>Groundwater Pollution Potential from Pesticide Use in Colorado</u> <u>Agriculture</u>, by Deanna S. Durnford, Kirk R. Thompson, David A. Ellerbroek, Jim C. Loftis, G. Scott Davies and Kenneth W. Knutson, is available from CWRRI. *Price: \$6.00*.

(Deanna Durnford has received an estimated \$164,000 in additional funds and in-kind support for her work in the San Luis Valley from USDA-CSRS, USGS and EPA. CWRRI firstyear funding for this project supported an Honors program student who is from the San Luis Valley and intends to return there after completion of his Masters degree.) San Luis Valley Water Quality Demonstration Project--The San Luis Valley is one of 16 agricultural areas across the country chosen for a water quality demonstration project. The Valley was a prime candidate for the project because of intensive farming, its underlying aquifer with its vulnerability to pollution, demographics, and the variety of crops grown, according to Steve Carcaterra, Cooperative Extension's Agronomy-Water Quality Specialist.

The five-year project combines the talents of the USDA Soil Conservation Service, Colorado State University's Cooperative Extension, the Agricultural Stabilization and Conservation Service and valley growers. It seeks to help the agricultural community take a proactive role in protecting water quality, says Carcaterra, while maintaining agricultural production.

Participants in the demonstration project will work closely with around 30 growers over the next five years to implement yet-tobe developed "best management practices" (BMPs) that focus on nutrient, pesticide and water management.

Partial Source: Valley Courier 11/13/91

URBAN DROUGHT MANAGEMENT STUDY RECEIVES ADDITIONAL FUNDING TO EXPAND

Dr. William H. Bruvold, University of California, Berkeley, has announced that the American Water Works Association Research Foundation has granted \$50,000 to Bruvold's "Urban Drought Management" study. Bruvold's study is currently funded by the University of California Water Resources Center, the Denver Water Department, and the National Science Foundation. Bruvold is collecting data to compare water conservation and rate structures in California's Bay Area and in the Denver Metropolitan Area. The current study continues the research relationship developed with the nine Bay Area Water Districts since 1977. Further research has been done with these districts supported by the University of California Water Resources Center and the University of California at Berkeley Committee on research.

The AWWARF grant will permit the addition of water districts in either Arizona or New Mexico. Bruvold will seek a graduate student in one of those states to assist him in collecting data. Max McGowan, a CWRRI graduate assistant funded by the Denver Water Department, is collecting data from nine Denver Metropolitan water districts on pricing, consumption, and conservation from 1980 to present.

Recent research on municipal water conservation has shown that consumption:

- * is affected by marginal price,
- * may or may not be affected by rate structure,
- is significantly reduced by drought-related use restrictions and conservation education,
- * is dependent on climatic variables,
- * and is directly related to socio-economic variables.

Bruvold describes the response of the water supply industry to these findings by pointing out that:

- * significant increases in marginal price designed to reduce consumption are not politically feasible,
- * inclining block rate structures may not be practical,
- * use restrictions and conservation education are useful in times of acute shortage but cannot be counted upon as reliable long-range demand reduction techniques,
- * there are no arguments with the influence of climatic and socio-economic variables on consumption.

The present research project will use data from the study areas in cross sectional time series analyses designed to:

- * clarify the impact of rate structure on consumption,
- clarify the impact of non-price conservation measures on long term consumption,
- * assess possible interactions between price and non-price
- * conservation program elements on consumption.

Data from the study will be useful in planning programs to promote use reduction during periods of acute shortage, reduce peak demand on hot summer afternoons, and promote long-term use efficiency.

WILL USERS PAY MORE FOR WATER SUPPLY RELIABILITY?

The Institute of Behavioral Science at the University of Colorado at Boulder (UCB), through its Research Program on Environment and Behavior, utilizes the expertise of UCB faculty from all the social and behavioral sciences to address the interactions between humans, our natural resources, and our environment. Typical of the Institute's work in water resources is the December, 1991, report entitled "Incorporating Public Preferences in the Optimization of Urban Water Supply Reliability." Charles W. Howe is senior author of the report and Director of the Program on Environment and Behavior.

Moreau and Little, in a 1989 report published by the North Carolina Water Resources Research Institute (No. 250, pp. 113-115), note that while water utilities are beginning to use explicit risk-based decision procedures for both long-term planning and short-term shortage (drought) management, the majority still use outmoded traditional planning based on meeting the needs of their "drought of record" and are inadequately prepared to deal with drought when it occurs. As Howe et. al. note in the UCB study, the key question is whether or not water users would be willing to pay more (or less) than the storage and capacity costs of avoiding the consequences of a specified shortage event.

Howe et. al. designed mail survey methods to gather information on water user attitudes toward urban water supply reliability and on users' willingness-to-pay for increased reliability (willingness-to-accept compensation for lower reliability). The study presents a framework for including this willingness-to-pay in the design of water supply systems. One last point on the UCB study: there is scant evidence on objective losses to urban areas during drought periods. One classic study from 1970 found low losses of around \$10 per household per year for the extended mid-1960s New England Drought--an event estimated to have a recurrence interval of about 150 years. On the other hand, a 1979 study reports from a California Department of Water Resources survey of Marin County following the 1976-78 drought that landscaping losses per single family dwelling averaged \$570. Certainly further research on quantifying economic and psychological losses from severe drought events is warranted.

Publication of the report is pending. For information contact Charles W. Howe, Institute of Behavioral Sciences, University of Colorado, Boulder, CO 80309.

For three decades, the Institute of Behavioral Science has encouraged interdisciplinary work examining the complexity of social behavior and social life. To best use its resources, the Institute has focussed on four research programs, each interdisciplinary in its faculty and each led by a senior behavioral scientist. The four programs are the Research Program on Population Processes, the Research Program on Political and Economic Change, the Research Program on Environment and Behavior, and the Research Program on Problem Behavior. Professional Staff members are attached to one or more of the Research Programs in addition to their teaching and departmental duties at UCB. The Institute is funded primarily by extramural grants from federal and state agencies, and private foundations. Some of its sources have been the National Science Foundation; several of the National Institutes of Health; the National Institute of Justice; the U.S. Departments of Justice, Labor, Housing and Urban Development; EPA; USGS; CWRRI; the Ford Foundation; the W.T. Grant Foundation; and the MacArthur Foundation.

WATER RESEARCH AWARDS

A summary of water research awards and projects is given below for those who would like to contact investigators. Direct inquiries to investigator, c/o indicated department and university.

Colorado State University, Fort Collins, CO 80523

National Database Development for Nitrogen Management, William K. Lauenroth, Natural Resources Ecology Lab Central Region Non-Game Stream & Wetland Resources & Management Activities, Stephen A. Flickinger, Fishery & Wildlife Biology Propagation of Colorado Squawfish, Stephen A. Flickinger, Fishery & Wildlife Biology

Hydrologic & Chemical Effects of Rehydrating a Drained Wetland in Central Florida, Lee H. MacDonald and John D. Stednick, Earth Resources

Development of Native Western Turfgrass Cultivars, Robin L. Cuany and Gary L. Thor, Agronomy

Evaluation of Management Regimes for Dryland Western Turfgrass Cultivars, Anthony J. Koski, Horticulture

Monitoring of DEC Stability Sites, Chester C. Watson, Steven R. Abt, and Colin R. Thorne, Civil Engineering

Physiochemical Association of Plutonium in Soil at Rocky Flats, Floyd W. Whicker and Shawki A. Ibrahim, Radiological Health Sciences Deer Research Studies at Rocky Flats, William A. Alldredge, Fishery & Wildlife Biology

Quantification of Federal Reserved Water Rights for National Park Purpose, Thomas G. Sanders, Robert C. Ward, and Stanley L. Ponce, Civil Engineering

Coupling Vegetation Pattern & Ecosystem Process Across Environmental Gradients, Dean L. Urban, Range Science

The Climatological Effects of Convective Cloud Systems, David A. Randall, Atmospheric Science

Blue Ribbon River Fishery Surveys, Eric P. Bergersen, Cooperative Fish & Wildlife Research

1991 - 1992 Mallard Research in the San Luis Valley, David R. Anderson, Cooperative Fish & Wildlife Research

Effects of Heavy Metals on Aquatic Organisms under Laboratory & Field Conditions, William H. Clements and Patrick Davies, Fishery & Wildlife Biology

Climatic Change in the Colorado Rocky Mountains: Bounding Projected Changes in Region, Timothy G.F. Kittel and Roger A. Pielke, CIRA Admin Unit

Rocky Mountain Arsenal Exposure Study, John S. Reif, Environmental Health

Influence of Riparian Vegetation on Stream Channel Processes in Central Rocky Mountains, Kurt D. Fausch, Fishery & Wildlife Biology Analytical Laboratory Analyses for Rocky Mountain Arsenal Pilot Exposure Study, John Domenic Tessari, Environmental Health

Research in Support of a Microwave Precipitation Retrieval Algorithm for TRMM, Graeme L. Stephens and Steven A. Rutledge, Atmospheric Science

Mesoscale Severe Weather Development Under Orographic Influences, Elmar R. Reiter, Civil Engineering

Long-Term Ecological Research into the Effect of Atmospheric Deposition in Rocky Mount..., James H. Gibson and Jill Baron, Natural Resource Ecology Lab

Development of an Ocean Model Based Upon the Reduced System of Equations, Thomas H. Vonderhaar, CIRA Admin Unit

Development of an Advanced Decision Support System (ADSS) for Integrated River Basin., Luis Garcia, Agricultural & Chemical Engineering

Dynamical and Electrical Studies of Mesoscale Precipitation Systems, Steven A. Rutledge, Atmospheric Science

A Modeling and Observational Study of Colorado Front Range Winter Storms, Roger A. Pielke, Atmospheric Science

Constructing Wetlands for Wastewater Treatment, Maurice L. Albertson, Civil Engineering

Effects of Application of Sewage Sludge on High Altitude Range Land in Colorado, Kenneth A. Barbarick, Agronomy Evaluation and Prediction of the Cumulative Hydrologic Effects of Forest Management..., Lee MacDonald, Earth Resources Computer Modeling, Software Development and Documentation for Watershed Hydrology, Jose Salas, Civil Engineering Grassland/Atmosphere Response to Climate Change: Coupling Regional and Local Scales, Michael Coughenour, Natural Resource Ecology Laboratory

Application of Biological Methods for Analysis of Water Quality in National Parks, Gerald Walsh, Biology Minority Institutions Collaboration Program in Water Resources and Environmental Management, Neil Grigg, Civil Engineering Laboratory and Numerical Model Studies of Ice Formation in Clouds, Lewis Grant, Atmospheric Science An Observational and Model Investigation of Orogenic Blocking in the Western US, Tom McKee, Atmospheric Science

University of Colorado, Boulder, CO 80309

Analysis of River-Use Permitting Systems with Focus on Deschutes River in Oregon, Sarah Bates, College of Law Comparative Lithological Mapping Using Multipolarization, Multifrequency Imaging Radar and Multispectral Official Remote Sensing, Fred Kruse and Alexander Goetz, Geological Sciences

Carbon Balance in Global Arid and Semiarid Lands, Carol Wessman, Cooperative Institute for Research in Environmental Sciences (CIRES) Biological Denitrification of Nitrate Contaminated Process Wastes, Nevis Cook and Joann Silverstein, Civil Engineering

Metal Speciation in Urban Stormwater Runoff and Receiving Waters, Gary Amy, Civil Engineering

The Effects of Abrupt Topography on Ocean Currents as Sensed by Satellite Remote Sensing, William Emery and Sedat Biringen

Han River Control System, Phase II. Addition of Dam Break, Hydrologic Forecasting, and Estuary Crossing Modules to the Han River Control System, Pedro Restrepo, Civil Engineering

Field Laboratory and Modeling Studies of Water Infiltration and Runoff in Subfreezing Snow on Regional Scales to Estimate Future Greenhouse-Induced Changes in Sea Level, Tissa Illangasekare, Civil Engineering

Potential Impacts of Global Climate Change on Western River Basin Study, Pedro Restrepo, Civil Engineering

Water Resources Global Climate Change ADSS-River Systems Simulation, Pedro Restrepo, Civil Engineering

Complex River Basin Management in a Changing Climate, William Riebsame, CIRES

Barriers and Incentives to Pollution Prevention, Dale Jamieson, Philosophy

Observations in Support of Remote Sensing and Modeling of Arctic Sea Ice and Atmospheric Conditions, Mark Serreze, (CIRES) Improvement of Winter Research Logistics, Climate Program and Water Facilities at the Mountain Research Station, William D. Bowman,

Environmental, Population and Organismic Biology (EPOB)

Analysis of Rapid and Recent Climate Change, Jonathan Overpeck, Institute of Arctic and Alpine Research

Effects of Environmental Factors on Phytoplankton Emissions of Dimethyl Sulfide: Implications for Climate Change, John Birks, CIRES Biological Hysteresis in Climate Change Models for the Great Plains: Implications for Productivity and Hydrological Cycles, Timothy Seastedt, EPOB

A National Survey of Bromide Ion Concentration in Drinking Water Sources and Related Studies, Gary Amy, Civil Engineering Chemical Aspects of Soil-Aquifer Treatment During Wastewater Reclamation/Reuse: Laboratory and Field Studies, Gary Amy, Civil Engineering

SHORT COURSE PROGRAM INTERNATIONAL INSTITUTE FOR CIVIL ENGINEERING (IICE) March-August 1992 DEPARTMENT OF CIVIL ENGINEERING COLORADO STATE UNIVERSITY

The International Institute for Civil Engineering (IICE) comprises a series of short courses for continuing professional education and academic credit at Colorado State University. IICE answers the need for timely, high-quality instruction on advanced topics in civil engineering. Topic areas include Environmental Engineering, Fluid Mechanics and Wind Engineering, Geotechnical Engineering, Groundwater Engineering, Hydraulic Engineering, Hydrologic Science and Engineering, Structural Engineering and Solid Mechanics, and Water Resources Planning and Management.

For information and a brochure contact: Janet Lee Montera, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Telephone: 303/491-7425 or FAX: 303/491-7727.

FEATURES

YEAR OF THE RIVER COINCIDES WITH YEAR OF CLEAN WATER by Mawreen Maxwell

National Year of Clean Water Proclaimed

President Bush and Congress have proclaimed 1992 the Year of Clean Water, and October 1992 as "Clean Water Month." "This year, the 20th anniversary of the Clean Water Act reminds us that we are all steward of our water resources, and, as such, we are responsible for their preservation and wise use," stated President Bush in his proclamation. He called on all Americans to "join in setting examples of environmental stewardship in our daily lives."

America's Clean Water Foundation reports that while polls show public support for the idea of clean water, personal and public actions to protect clean water have not kept up with the polls. More information is available from the Foundation at: Hall of the States, 444 N. Capitol St., NW, Suite 330, Washington, DC 20001.*

Local Year of the River Celebrates Historical Watershed

In CWRRI's hometown of Ft. Collins, Mayor Susan Kirkpatrick has declared 1992 as Year of the River, coinciding with efforts to have the Cache la Poudre River designated a National Water U.S. Senator Hank Brown (R-CO) has Hcritage Area. introduced the "Cache la Poudre National Heritage Water Rights Act, S. 1174, to declare the Cache la Poudre River a National Water Heritage Area (NWHA). U.S. Rep. Wayne Allard (R-CO) has introduced companion bill H.R. 3468. The bill would authorize \$1 million over five years, to be used by a 15member, locally nominated and Congressionally appointed commission. The commission would help local governments preserve and interpret the river's contribution to the westward expansion of the U.S. The heritage designation includes a minimum of federal involvement: the commission would include one member from the National Park Service whose role would be advisory.



Cache la Poudre River

Senator Brown hopes hearings will be scheduled for March. Mayor Kirkpatrick explained that the Year of the River declaration is not necessarily to create new activities but to provide a framework for river- and water-related activities already planned. She hopes 1992 will be especially significant for achieving the goal of designating the Cache la Poudre River a National Water Heritage Area. However, she pointed out that there are cyclical activities to which the Year of the River may provide a theme and additional community interest. Examples cited by the Mayor included the annual New West Fest, celebrated in August; attempts to excavate the Old Fort near the Cache la Poudre River in downtown Fort Collins; and continuing research in water issues by CSU scholars.



Rather than directing Year of the River activities out of . the City Offices, Mayor Kirkpatrick is expecting a grass roots response to the Year of the River theme. She is meeting with various organizations to alert them to the possibilities of using the Year of the River theme in their planning. She has met with the Convention and Visitor's Bureau, which is planning to structure activities around the theme. The Colorado Municipal

Fort Collins Mayor Susan Kirkpatrick

League will be meeting in Fort Collins during the summer, and Mayor Kirkpatrick hopes it will be an opportunity to stimulate municipal leaders to think about how they can make use of their natural resources and incorporate them into their city planning. The Mayor will also be meeting Fort Collins' 27 boards and commissions to compile a list of items in their plans that fit into the theme.

"One striking feature to me is that it was not an alienating theme to anyone," commented Mayor Kirkpatrick about the Year of the River.

The National Water Heritage Area effort is the outcome of a National Recreation Area Study, mandated in the 1986 Amendments to the Wild and Scenic Rivers Act, which also included a study leading to the designation of 77 miles of the upper Cache la Poudre River as wild or recreational. The NWHA focuses on the history of water management. According to Kari Van Meter Henderson, Senior City Planner, the Cache la Poudre watershed is nationally significant because it is the birthplace of the prior appropriation doctrine. There are no other national heritage areas designated west of the Mississippi.

History Found All Along the River

Local legend claims French fur trappers buried or "cached" extra powder supplies along the river during the late 1830s. "Hide the powder" or "cache la poudre" became the name of the river. Karen McWilliams, Ft. Collins Local History Coordinator, pointed out that differing dates and uncertain references in historical documents throw some doubt on the legend.



Historic sites along the river in Ft. Collins include the Old Power Plant, the Strauss Cabin, the Old Water Works Building, and stopping places along the old Pony Express route. The Old Power Plant was built in 1935 and is an example to 1930s public works architecture know as Art Modern. It operated until 1973, when Ft. Collins shifted all its power demand to US Bureau of Reclamation sources. The two-story log cabin was built by George Strauss in 1864 next to the river east of Ft. Collins. After illness and robbery, Strauss turned back from his trip to California, returning to northern Colorado in 1860. He planted a vegetable garden and sold his produce to the community until his death from exposure during the Cache la Poudre flood in 1904. The oldest part of the Old Water Works Building was built in 1882-1883 as a pump house, according to Ft. Collins resident Doris Greenacre. Prior to that, people took their water directly from the river or from irrigation ditches. The pump house provided the first water purification. The first water delivery pipes were underground wooden pipes.



The Old Water Works Building

*Partial source: Hydata, published by the American Water Resources Association, Vol. 10, No. 5, Sept. 1991.

IS COLORADO BACKING INTO WATER PLANNING?

by David Harrison, Attorney at Law Moses, Wittemyer, Harrison and Woodruff, P.C. Presented at a conference in Fort Collins, Colorado November 19-20, 1991 The South Platte River Basin: Uses, Values, Research and Management -Current and Future

I want to bring you up to date on what the Colorado Water Conservation Board (CWCB) is doing and let you think about how it relates to what is going on in the South Platte and management issues for the South Platte. Let me start by saying something introductory about the CWCB. It was originally created as sort of the planning agency in Colorado. Now, that may be humorous to those of you who know that we don't have water planning in Colorado; in fact, if you know a little more you know that planning is the "P" word in Colorado.

Bruce Babbitt, former Governor of Arizona, is on the speaking circuit now, and when he talks about water planning in the West he says it is not a new idea. Long-range water planning is an institution in the West, according to Babbitt. He described it as finding a very young, electable member of Congress and then keeping him in Congress for a very long term. When he got a lot of seniority, he brought in a lot of water projects. Babbitt commended Colorado for doing reasonably well with Congressman Aspinall, but he was proud to point out that Arizona surpassed Colorado with Hayden and Mo Udall. They were very good at water planning.

For the CWCB, water planning used to mean helping to politic for federal, pork barrel, water projects. Where would the Bureau of Reclamation build, how big would it be, and how do we get the money to get it built? Now to be sure, the CWCB had another important function, and that had to do with interstate relationships: helping to negotiate compacts; helping 10

to defend compacts; or helping to defend, in the United States Supreme Court, on interstate litigation. Now, things have changed. If you are going to view planning as trying to get federal money for big projects, you are not going to be very busy these days. I think everybody has now come to agree that it's over.

There has been another curious problem related to planning, and it has to do with the environment. Regarding the state instream flow program, the opening language in Colorado legislation is: "In order to correlate the activities of man with the protection of the natural environment to a reasonable degree, the Conservation Board shall..." This is the agency that had always been the water development board for the state f Colorado. Now it is supposed to be the "correlation of man and environment board" in addition to being the water development board - a very interesting shift in basic policy. What does all this mean for the CWCB? It is a time of change.

Some things that are happening on the Colorado River may shed some light on this "P" word that we have to deal with today. First of all, let's talk about the instream flow program. An interesting and absolutely earth shattering-application of it is that this past year Senators Brown and Wirth got together on a wilderness bill and introduced legislation on the Senate side. It has now passed the Senate, and it says that there are not going to be any federal wilderness water rights. But in one case of a downstream wilderness area (actually one of a couple of cases), on the Piedra, there would be a CWCB water right. Now that's really strange. If you were to go back and talk to original sponsors of the instream flow program in the early 1970's, you would find that wilderness applications were not part of what was intended. They were thinking about cold water trout streams and minimum flows, basically low flows during the base flow time of year; they weren't thinking about purposes other than fish - trout, to be specific. So the very thought that the CWCB would appropriate water to protect a wilderness area, in who knows what amounts yet, is a very interesting development. CWCB and Forest Service staff have been working under an "MOU" in the field, trying to quantify some of the requirements. The old days of cold-water minimum flow are gone; it is not so simple anymore.

Another question is: What is the CWCB's thinking on other than cold water streams? What about some of the warm water habitats? Is there any movement in that direction? The short answer is, "Not now." But I do believe that we will move on into an era in which the instream flow statute will be applied beyond cold water fish. The trick here is that it is easier to deal with cold water because it is closer to the top of the system and generally above a lot of the uses. But if you put an instream flow on a warm water segment it might be low in the system, and it could tie everything up in a whole basin. It is going to be a lot more complicated to deal with.

The Endangered Fish Program started in the early '80s when the Fish and Wildlife Service issued a draft recovery program for the squawfish and humpback chub in the Colorado River, saying that endangerment of those fish was caused by water development. Therefore the recovery plan was that there would be no more water development. That was the draft plan. It hasn't gone very far in that direction yet. Instead it has spawned a very interesting negotiation among water developers, environmentalists, federal agencies and state agencies to try to come up with an agreed-upon recovery plan. The initial framework has been agreed upon and has been around since 1988. One of the things it calls for is protection of flows necessary for those endangered fish habitats through state water rights. So now we have made an agreement to protect the flow requirements of those habitats through the state instream law to protect the natural environment to a reasonable degree.

The Board has been very cautious about it. Those of you who have talked to the Fish and Wildlife Service may know that there is some frustration on their end that the CWCB hasn't moved more quickly, particularly with respect to the so-called 15-mile reach near Grand Junction. USFWS would like to see a big instream flow there to protect the flow regime that currently exists, but that would be a very interesting problem for the future of any water development in the basin. It would essentially say that Colorado could not realize any of its additional compact entitlement on the main stem of the Colorado River. The CWCB's other objective, beyond protecting the natural environment to a reasonable degree and correlating the activities of mankind, is to promote water development and protect the state's compact entitlement. So that has been delegated, if you will, or perhaps lobbed, into the lap of the . CWCB.

At the same time, a very serious threat has emerged for Colorado - first, California's drought, and second, completion of the Central Arizona Project - and a realization that the Lower Basin has now fully appropriated its share of Colorado River water and is now utilizing the Upper Basin's share as well. Moreover, it is used not just in a casual way for a little hay now and then, but actually to build Los Angeles. It is very unlikely that once you get a large metropolitan area hooked on a water supply, in excess of its entitlement, that you will ever get it back. This came to a head last summer when California, in the fifth year of drought, started to put pressure on the Bureau of Reclamation for the way it operates the Colorado River - the socalled annual operating plan which is an aspect of the long-term coordinated operating plan. The issue was whether there was a surplus water supply.

You may be aware that last year Governor Romer wrote a letter to the other seven basin states and California suggesting a negotiation wherein Colorado might guarantee that Los Angeles would continue to get its water for some period of time if it began to scale down its dependence on Colorado River water and more specifically, that California would scale down its dependence. California now uses 5.5 million acre-feet a year, but is entitled to 4.4 million acre-feet per year.

In addition, we began to talk about money, a very complicated topic. I want you to know that the environment for this discussion is really charged. It is as if our children's heritage, from the water developer's standpoint, is on the table right now. At the same time, the CWCB is in the process of appropriating large flows in the Piedra and acquiring water rights to appropriate large flows in the endangered fish segments, principally the Yampa, and we are not at all clear what will happen to that Compact entitlement. Maybe we are in the process of shooting ourselves in the foot. Lately, some have written letters to the Governor and to the Conservation Board arguing that we have done exactly that. At the same time that we are trying to protect our Compact share from California, we are appropriating large instream flows to protect the environment. It is clear that before we before we appropriate any of these flows we must know what we have done to the opportunity to develop our Compact entitlement. Are there enough dam sites left? Are there places where water can be developed in Colorado that are compatible with endangered fish recovery, wetlands protection, and other site-specific environmental protection? Can it be done? We will have to figure that out before we make those appropriations.

Now, I do not want to say very much about the "P" word, but I would suggest that when we do all those calculations we will have done something very close to water planning. Now, that is the back door. That, to me, is the clearest example of how we are backing into the whole process of basin-wide water planning.

How might this apply on the South Platte? First of all, my observation is that its more complex on the Platte - not more intense, not harder, but just more complex - with more little pieces. The situation is, in some respects, more subtle. In the Colorado River the issue is: How do we develop and protect endangered fish? If you want to add wetlands, it gets a little more complicated.

On the Platte, you have the question of urban water supply. If Two Forks is down, and I suppose it is, what next? Is Thorton showing us how additional water supplies will be developed, or is there some other plan? How will we protect the water resource base for agriculture? What is agriculture doing to itself in the basin today in terms of salinity on the lower part of the river and in terms of other nonpoint source runoff issues? How will agriculture cope with the regulation of nonpoint source runoff regulation? I think it's inevitable. How will agriculture cope with that? What will be the economic impacts, and who will regulate? Will there be more water development on the Platte? There is a certain amount of entitlement crossing into Nebraska. Will we be able to develop it or will endangered species issues, specifically in Nebraska, preclude that?

There are more issues that are not as well defined on the Platte, but the overall issue is fundamentally the same. How do we back into water planning, given that it is not something that we do upfront in Colorado? I also want to suggest, again, that it is inevitable. You can say, "We are not going to plan in Colorado. We are going to let it run its course." Well, that is a kind of planning. I remember hearing Glenn Saunders often say, "We have a water plan in Colorado. It is called the Prior Appropriation Doctrine." That is the water plan - first come, first served. If you do nothing, that's a form of plan. Today in the Western United States, if you do nothing it is a way of abdicating planning authority to the federal government witness Two Forks. So <u>how</u> we plan is the only issue, not whether we plan.

Now, let me turn to a real nut-and-bolt issue that the CWCB is dealing with, and suggest that therein is how we will face the water planning task in a back-door way on the South Platte. First of all, understand that the CWCB does not have authority to regulate anything; it is not a regulatory board. It does not have authority to regulate wetlands, water development that would impact fish and endangered species, or decide how much water gets allocated from agriculture to municipal. It does not have authority to do what is generally lumped under the heading of basin-of-origin or area-of-origin protection. It has no authority to require mitigation of socio-economic impacts in an area that is impacted by a water rights transfer. It has no authority to regulate anything, nor does any other agency in the state of Colorado, save on the issue of water quality. And with the Water Quality Control Commission, that authority is largely aimed at point source discharge. Nobody has much authority yet over agricultural runoff or other nonpoint sources.

The Construction Fund, which amounts to 90 million dollars, generates about nine or ten million dollars a year. The statute requires that two-thirds of that amount be allocated to developing new projects that will enable Colorado to utilize its compact entitlements. One-third can go to rehabilitation of existing systems and as to other uses. First of all, let me say something more about the Construction Fund. It is a subsidy cheap money, the purpose of which is to subsidize water development. Like any subsidy, its purpose is to stimulate state policy in that area. Remember, there is nothing inherently wrong with a subsidy; it is just a policy decision by the governing entity. You may remember the solar energy subsidies during the Carter era; they were an important expression of government policy. And water subsidies are probably one of the oldest and most tradition-bound forms of policy in the United States. (The federal side of that, however, is over.) Under the old act it was very clear and the state policy was simple: develop the compact entitlement. Now, state policy is more complex. Moreover, the policy of developing the compact entitlement is more complex. Development of new compact entitlement has become virtually impossible because of environmental regulations, economic factors, and socio-economic policy debates in the basin of origin. How can one develop any compact entitlement? Why give two-thirds of the money to something that cannot be done? The CWCB is now recommending a major restructuring of the Construction Fund policies. And that basic restructuring is a way of saying, "We take seriously the job of developing and protecting the state's compact entitlement, and if we are going to do it we need more tools." We would like permission to use the Construction Fund for more tasks that are, in the end, supportive of the basic policy. There are four basic recommendations. We will continue to use money for developing new projects. They will tend to be small projects. They are not going to be federally subsidized, for the most part. This subsidy may be the only

subsidy. New projects will probably require a great deal of local or private participation and cost sharing by private organizations.

The second aspect is something the CWCB has been doing a great deal of but has not talked about a lot, and that is spending its money on the rehabilitation of the existing water infrastructure. If you are interested in environmental protection, this is one of the most important things that can be done. If you are a dam fighter, one of the most effective strategies you can adopt is to get people to rehabilitate what they already have. There are several hundred thousand acre-feet of reservoir capacity in this state that are currently unusable because of hold orders imposed by the state engineer related to dam safety concerns. At the same time, we are trying to find a place and a way to build a new capacity. It is a lot cheaper to recover existing capacity than it is to build new capacity also more environmentally sound. Typically, there is less environmental impact - perhaps no environmental impact in many cases.

The third element is something called "New Management Initiatives." It is a grab bag of things. It includes the recognition that we have to address some very troubling problems in river management as an element of trying to move forward with development. I think one of the best examples is agricultural runoff. That is going to be expensive. There will be best management practices (BMPs) imposed. They need to be designed sensitively and in a way that is both cost effective and compatible with continued operation of farming in this state. The only way I can think of doing that is to have the farmers do it themselves. I think the purpose of this aspect of the fund would be to stimulate, through demonstration projects and actual developments, best management practices. It is not the CWCB's function to regulate water quality, but it may well be its function to try to respond to the water planning problem of how to comply with water regulations.

Another aspect of this third area of new management initiatives will be basin-of-origin protection. We will not regulate protection. I do not think the legislature will get it done very soon. And yet you are going to see a lot of political issues, a lot of concern, a lot of heat generated over things like the Thorton proposal to export water from Water Supply and Storage. There will be local responses, but I think there also will be a cry for some help from the state. I think that can take the form of asking for state money to help out on projects which are benign, such as, for example, dry-year options. A dry-year option, or interruptable supply contract between a city and a farmer, is a win-win situation. It allows the farmer to keep his water nine years out of ten and to be compensated well for selling it the tenth year. It gives the city a firm water supply for that one-in-ten-year drought. I think it is probably the most cost effective and environmentally benign way of approaching additional increments of urban water supply. And accordingly, I think it is a good approach to area-of- origin protection. I think the state ought to subsidize the development of that through the Construction Fund. The issue of water management initiative, I think, is going to be a wide open thing. We want to have the freedom to address and to stimulate development in whatever is proposed that makes sense and that needs to be done.

The fourth aspect of the Construction Fund will be information. We are going to have the temerity to walk into the legislature and ask for money to build models and databases. We will use them to figure out where we can develop our Compact entitlement, where we are going to have to protect the environment in order to be able to move forward as a society, and how we can correlate the activities of man for the protection of the environment to a reasonable degree. That will initially consist of a Colorado River model, we hope. I expect it will be a basin-wide model to put us on equal footing with the other seven states and with the Bureau of Reclamation on the matter of surplus determinations and protecting our compact entitlement. It will also have an intrastate component so that we can decide, for example, if we put an instream flow on the Yampa, on the Piedra, and on the main stem and the Black Canyon of the Gunnison, are we shooting ourselves in the foot or can we still find places and ways compatible with the environment to develop the next increment of water supply? It will be GIS-based. In the long run, we hope to get a beautiful data set from satellite imagery and to know, in a lot better detail, what actual uses are in terms of locations and quantities. This is a significant departure from tradition. It will require the support of all who are sensitive to the importance of water management and the importance of information systems in supporting water management.

These four purposes for the construction fund are in reality not revolutionary changes. They would essentially allow the CWCB to adapt itself to the immediate needs it faces in its traditional role. But it will require information and management decisions to be made, in order to carry out that role. In that way we will have backed squarely into water planning, the original nominal purpose of the CWCB, but a purpose that has been too long neglected.

WATER QUALITY TECHNOLOGY TEAM TO RELOCATE

The National Water Quality Technology Development Staff of the Soil Conservation Service is relocating to Ft. Collins, Colorado, from Fort Worth, Texas. The NWQTDS was created in 1989 to provide national leadership for water quality and quantity technology development for the Soil Conservation Service. The move is expected to be completed by October 1, 1992. The staff will become one of five teams within the Technology Information Systems Division. The Technology Development Staff will continue to focus on water quality technology development, working with the other four TISD teams to bring decision support tools into the Soil Conservation Service computing environment for field and state office use. The NWQTDS will be called the Technology Support Team upon relocation. Heading the NWQTDS is Stephen (Bernie) Owen. Owen was selected as the first member of the NWQTDS in 1989 and has worked with the SCS for 26 years. He has worked in the Kansas, Nevada, and Minnesota SCS state offices as an economist and Planning Staff leader. He has held positions at the South National Technical Center as river basin specialist, remote sensing pilot project manager, and staff head of Planning (Programs) and the National Employee Development Staff. He holds a B.S. in Agricultural Economics from Kansas State University and a masters in Public Administration from Syracuse University (New York). Most of the rest of the NWQTDS will relocate to Ft. Collins by October but final decisions are still pending. *COLORADO WATER* will report staff membership and expertise later in the year.

Available now is the July, 1991, Water Quality Technology Development Status Report, a wide ranging update on developments in this field. The report is part of the continuing implementation of a five year USDA water quality initiative. The goal is to provide information on the best available technology to rural and urban decisionmakers so they can respond to on-farm water quality and quantity concerns and state environmental requirements. The twelve members of the staff represent a wide range of expertise in the sciences, health, environmental, and economics fields. Below are some of the items with which NWQTDS is currently involved.

1. Water Quality Tools Matrices: a set of matrices identifying water quality assessments tools is under development. The tools are grouped into matrices for (1) field assessment tools, (2) field assessment models, (3) hydrologic area models, (4) other tools not yet widely available, (5) tools being developed or not yet available, (6) water resource preferences.

2. Water Quality Model Evaluation: SCS and ARS are involved in an effort to evaluate computer models dealing with water quality. Objectives are to determine (1) what models should be used by SCS, (2) at what organizational level should they be used, (3) what is needed to support model use in SCS.

3. A Soil-Pesticide Water Quality Screening Procedure: a first tier screening procedure has been developed to evaluate the relative loss of pesticides from a field. The GLEAMS model estimates three categories of pesticide loss: leached, absorbed runoff and solution runoff.

4. A Soils Database for Water Quality: a special soils database has been created to assist water quality modeling and other efforts in water quality. A soils database for water quality will be released for each state.

5. Trophic State of Lakes: this Technical Release serves as a screening tool for comparing the impacts of various management practices within a watershed upon some water quality parameters of downstream impoundments. The procedure may be used to target those areas within the watershed potentially having the greatest negative impact upon the water quality of a receiving lake or reservoir.

6. SCS Training Study for Water Quality: the Water Quality Training Design Team is an SCS multi-level (national, regional, state, field) group reviewing water quality training needs by the SCS. The Team has published a draft document identifying training needs priorities, and existing opportunities for accomplishing the training. The Team is in the process of publishing a catalogue of existing training and training materials, and is revising and updating a series of 14 SCS water quality training modules.

7. Water Budget Model: the water budget computer models estimates average monthly : (1) crop evapotranspiration, (2) effective rainfall,)3) net irrigation requirements, (4) excess water. It provides a graphical display of rainfall, crop evapotranspiration, and excess water for the growing season or for an entire year, and can accommodate double cropping and multi-year crops. The SCS method uses the Modified and Food and Agricultural Organization (FAO) version of the Blaney Criddle method for estimating crop ET.

8. Water Quality Technology Notes: this two-page publication by the NWQTDS is published as needed, usually about four times per year. It conveys water quality related information and technology, and reports progress and activities of the NWQTDS.

9. Use of STORET - The EPA Water Quality Information System: STORET is a computer database for the STOrage and RETrieval of data relating to the quality of surface and ground water. It contains information on sampling sites, times and dates, and physical, chemical and biological data for all 50 states, and is accessible using a personal computer and modem.

For further information write or call: National Water Quality Technology Development Staff, USDA Soil Conservation Service, South National Technical Center, 501 Felix Street, P.O. Box 6567, Fort Worth, TX 76115; 817/334-5422

DETERIORATION OF IRAQ'S WATER SYSTEMS CAUSES INTERNATIONAL CONCERN

A September 1992 assessment of Iraq's urban water and wastewater systems showed they were operating at 30 to 70 percent capacity and predicted to approach five to ten percent capacity within weeks or months. Lack of chlorine, spare parts and adequate electric power has caused more problems in water delivery and treatment than collateral damage from the Gulf war. A complete shutdown is possible unless spare parts begin to arrive soon. In early Fall of this year, David Hendricks, CSU Environmental Engineer, went to Iraq as part of a study team to investigate the effects of the Gulf War, the subsequent Civil War, and UN sanctions on Iraq's domestic water and wastewater systems. Hendricks' group, the Water and Sewage Team (WST), was part of a larger effort that included the disciplines of agriculture, electrical and environmental engineering,



Water Quality Technology Notes: this two-page publication the NWQTDS is published as needed, usually about free near pury year. It converge water quality related information rel thrology, and reports progress and activities of the NWQT. environmental sciences, medicine, economics, child psychology, sociology and public health. Eighty-seven persons from the United States, Australia, Jordan, and several countries in Europe including Germany, Norway, Holland and Belgium, took part in the field survey. The study team was organized as the Commission on Civilian Casualties (informally called the "Harvard Study Team"), an ad hoc committee funded by UNICEF, the MacArthur Foundation, the John Merck Fund, and Oxfam-UK.

Once in Iraq, the WST divided into two groups, a North Team of David Hendricks and Mohammed A. Sallam, and a South Team of Don Hernandez and M. Abdul-Wahab. Engineers Mohammed Sallam and Matar Abdul-Wahab are with the Amman, Jordan Water Department. Donald Hernandez is a Consultant to the Oregon Department of Environmental Quality and was formerly WHO Advisor in Baghdad from 1978 to 1982.

The North Team visited water distribution and treatment sites in Baghdad and cities in northern Iraq, and the South Team went to cities south of Baghdad. Both teams reported two common themes for all site visits--lack of spare parts and chlorine rationing. In addition, wastewater treatment plants were limited by an erratic power supply.



Pump shown is not operating because of lack of spare parts. Kurkuk is operating at only 30 percent capacity.



Sewage discharge at Kurkuk is captured for crop irrigation. Several such flows exist in Kurkuk and other northern cities. Vegetables eaten raw from such irrigation are pathway for disease.

The team found that Iraq has an effective organization and a modern physical infrastructure to provide water to its cities. But because Iraq's supply of treated water is not enough to meet distribution system demands, rotation of service is the norm. A common pattern is two days on and two days off, and in Baghdad and other cities, roof tanks are used to provide water during the off period.

For the part of the system without water during the off period, low pressure can cause the cross-connection hazard of back-siphoned flows of nonpotable water. The public health result is an increased risk of water-borne diseases, a problem now greatly exacerbated by post-war conditions.



Sachinar Spring at Sulaymaniyah, about 4 hectares in surface area, treats with chlorine and delivers $64,000 \text{ M}^3/d$, with the Dukan WTP about 65 km from the city supplying the balance. Present operation is about 70 percent of capacity due to lack of spare parts.

The team reported that Iraq north of Baghdad has few wastewater treatment plants, as septic tanks are the rule. In Baghdad and southern Iraqi cities wastewater treatment plants exist, but they were only partially operational due to lack of electric power. Raw sewage was being discharged into receiving waters, causing ecological damage and posing a public health hazard.

Sewage systems also were not functioning effectively due to the flat terrain which requires lift stations. When electric power was cut due to the bombing, lift stations ceased operation, sewers developed blockages, and sewage backed up into the low parts of houses and streets. While recovery is proceeding, said Hendricks, without a flow of spare parts the problems will repeat before recovery is fully attained. A complete shutdown within months can be envisioned unless spare parts begin to arrive soon.

In his supplemental notes, Hendricks reports that water distribution systems in some cities sustained collateral damage such as water pipe breaks and direct hits on mains in the vicinity of targets. Most damage, however, was due to looting in both the north and south, and the South Team reported complete devastation in some areas due to the civil war.



Excavation to replace collapsed sewer pipes requires about a month per job. About 470 broken pipes resulted from lift station failures in Baghdad.



On the way to Petra through 3 km canyon.

Iraqi Diary

Hendricks' diary supplements his report with non-technical impressions. Confessing to mixed feelings about the political issues involved, he says: "Certainly the trip to Iraq made me empathetic to the problems and the people there. The engineers and other professionals...were working 'against the tide,' so to speak, in keeping the water systems in operation without spare parts and lacking chlorine and soon, alum."

In a lighter vein, Hendricks describes a side trip to Petra (in Jordan), a city built around the 4th century B.C. This, he says, was his first tourist experience on the trip. The three and one-half hour journey to Petra, on horseback, is described as "...difficult to do justice by camera or description...". Hendricks writes: "Petra is a city built by the Nabataeans, an Arab people from Saudi Arabia, who started the city about 4th Century B.C. The city is in a box canyon that extends some distance, with cliffs 1000 M above the floor...the emergence to the city is dramatic, as ε large Roman-type structure is just opposite the canyon's entrance. The city has many such structures...and huge rooms carved from within the rock mountain.

The canyon shows remnants of a major paved road...with a water

channel located chest high above the road. The city is extensive, with even a classic Roman amphitheater. Our guide took us to one of the 'high places,' 1000 M vertical above the city, reached by steps, carved from the rock or stone blocks, all the way. At the top was a flat area with altar for sacrificing animals for religious ceremonies. We descended by another set of steps down the other side. Petra was taken over by the Romans, then the Byzantines, and after 1350 was a lost city until discovered in 1825 by an English explorer who was shown the city by the Bedouins, who still inhabit the area."

Source: Reports on Study Visit to Iraq With Commission on Civilian Casualties - Vol. I, <u>Water and Wastewater Systems in</u> <u>Iraq</u>, by M. Abdul-Wahab, D. W. Hendricks, D. J. Hernandez and M. A. Sallam; Vol. II, <u>Iraqi Diary</u>, by David Hendricks. (NOTE: National Public Radio announced on January 28 that any lifting of sanctions is unlikely as long as Saddam Hussein remains in power.)

UNIVERSITY WATER NEWS

COOPERATIVE EXTENSION'S WATER PROGRAMS

Colorado State University Cooperative Extension has had a long history of addressing water issues. Extension's mission of disseminating unbiased, research-based information from the Colorado Agricultural Experiment Station and other sources is central to water management issues and causing management practices to change. For most of our history, water quantity has been of more concern than water quality and, therefore, our educational efforts were tailored to meet this need. Extension specialists, working through county Extension agents, have utilized their expertise in irrigation water management for many years. In recent years, new irrigation technologies have emerged and have been a major emphasis.

Some of these new technologies include surge, cablegation and drip irrigation management systems. In certain areas of the state, these systems have been adopted by numerous agricultural producers in an effort to better utilize their water resources. Extension specialists have been able to purchase some of these systems for use on-farm by producers in a demonstration mode. In many instances, because of direct observation, producers have purchased the equipment and revamped their irrigation systems to accommodate these newer irrigation systems. Through demonstration and field trial research, savings of 20 to 30 percent in water usage have been demonstrated by incorporating these new technologies. Extension has worked cooperatively with the Soil Conservation Service, the U.S. Geological Survey and the Bureau of Reclamation to provide assistance to farmers wanting to change their irrigation practices.

In recent years, water quality has emerged as a major initiative for the Cooperative Extension System nationwide. In Colorado, Extension has worked closely with other agencies, i.e., the Environmental Protection Agency, the Colorado Department of Health, and the Colorado Department of Agriculture to provide clientele with educational information about the impacts agricultural practices may have on water quality. A major program effort has been Extension's pesticide applicator training program. This training equips applicators to better understand the impacts of agricultural chemicals on water and assists them in calibrating equipment to better apply appropriate and recommended amounts.

In conjunction with this training, fly-in clinics have been conducted for a number of years to calibrate airplanes applying agricultural chemicals. These highly successful clinics have expanded the number of acres that are impacted by applicators applying chemicals in a more judicious manner.

There is a continuing and growing concern by Colorado residents about their drinking water quality. Interest is building for having wells tested and analyzed and for having drinking water clinics. The importance of water is appreciated and protected by most citizens in Colorado. In February 1990 a major interdisciplinary training, "Food and Water Issues of the Future," was provided to Cooperative Extension agents and specialists.

Also, in recent years Cooperative Extension has been involved in a major effort to reduce the amount of salt entering the Colorado River basin in western Colorado. The primary focus of this effort has been the Grand Valley, although the program has expanded to the Lower Gunnison and McElmo Creek basins. Through improved irrigation management practices Cooperative Extension, in collaboration with the Soil Conservation Service and the Agricultural Stabilization and Conservation Service, has been able to significantly reduce the amount of salt loading into the Colorado River.

The past two years the Cooperative Extension salinity program in the Grand Valley contracted with the Bureau of Reclamation to work with 75 farmers to install surge irrigation units on their farms as a method to reduce salt loading. The recognition by the Bureau of Reclamation of Cooperative Extension's educational role and ability to obtain adoption of this new technology is appreciated and illustrates its mission and the educational role it can play.

Numerous successful water and/or irrigation workshops have been conducted both statewide and regionally. This is another method for fulfilling Extension's mission.

In the future, both water quantity and quality will be important issues to Colorado. Cooperative Extension, utilizing researchbased, unbiased information, will play a lead role in assisting clientele and decisionmakers in the process of better managing water within the state and, as a result, protecting our environment.

To assist the readers of COLORADO WATER in accessing the water resources expertise of Cooperative Extension, the following directory is provided. While Extension staff, individually, handle a wide array of water issues, the directory is organized around water topics in which staff tend to specialize. It should also be pointed out that in some areas of Extension expertise, it is the side effects of practices that are of most concern to water managers in Colorado. For example, when dealing with turf grass management, the movement of nutrients and herbicides may impact groundwater quality. Thus, for this reason such topics are included in the directory.

This directory is our first attempt at highlighting Extension water expertise. As it is further refined, *COLORADO WATER* will publish updates.

COOPERATIVE EXTENSION EXPERTISE IN WATER RESOURCES - KEY CONTACTS

Agricultural Operations/Water Quality Impacts

Pesticides/Herbicides

Bert Bohmont (303) 491-5237 116 Weed Research Building Dept. of Plant Pathology and Weed Science Colorado State University Fort Collins, CO 80523

Reagan Waskom (303) 491-6201 C-09 Plant Science Dept. of Agronomy Colorado State University Fort Collins, CO 80523

Nutrients

Parviz Soltanpour (303) 491-6975 C-126 Plant Science Dept. of Agronomy Colorado State University Fort Collins, CO 80523

(303) 491-6201

(303) 491-6172

C-2 Plant Science Building Dept. of Agronomy Colorado State University Fort Collins, CO 80523

Hunter Follett

Irrigation System Design, Operation and Maintenance

Israel Broner 204 Engineering South Building Dept. of Agric. and Chemical Engr. Colorado State University Fort Collins, CO 80523

Water Management/Water Quality/Salinity Control

Mahbub-ul Alam 690 Industrial Blvd. Delta, CO 81416

Mahdi Al-Kaisi Agricultural Service Center 924 S. Broadway Cortez, CO 81321 (303) 565-8879

(303) 249-8407

(303) 874-5735

Richard Antonio 101 Uncompany Ave. Montrose, CO 81401

Richard Bartholomay 2754 Compass Drive, Suite 170 Grand Junction, CO 81501

(303) 242-4511

Steve Carcaterra 923 First Ave. Monte Vista, CO 81144

Dan Champion 2754 Compass Drive, Suite 170 Grand Junction, CO 81501

Brian Leib Agricultural Service Center 925 S. Broadway Cortez, CO 81321

James Valliant 411 No 10th Street, P.O. Box 190 Rocky Ford, CO 81067

Irrigation/Plant Water Requirements

Wayne Shawcroft P.O. Box 400 Akron, CO 80720 (303) 345-2259

(303) 491-6172

Water Quality Monitoring/Non-point Source Pollution Control

Jim Loftis 205 Engineering South Building Dept. of Agric. and Chemical Engr. Colorado State University Fort Collins, CO 80523

Riparian Zone Management/In-stream Flows/Wetlands

(303) 491-6411

Delwin Benson 109 Wagar Building Dept. of Fisheries and Wildlife Management Colorado State University Fort Collins, CO 80523

Tom Bartlett 202 Natural Resources Building Department of Range Science Colorado State University Fort Collins, CO 80523 (303) 491-7256

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Range Management

Roy Roath 240-D Natural Resources Building Dept. of Range Science Colorado State University Fort Collins, CO 80523 (303) 491-6543

Columnia State

(719) 852-0960

(303) 242-4511

(303) 565-8879

(719) 254-7609

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Conservation Tillage/Soil Surface Disturbance Impacts

Paul Ayers 204 Engineering South Building Dept. of Agric. and Chemical Engr. Colorado State University Fort Collins, CO 80523

Robert Croissant C-14 Plant Science Building Dept. of Agronomy Colorado State University Fort Collins, CO 80523 (303) 491-6201

(303) 491-7070

(303) 491- 6172

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Turf Grass Water Management

Anthony Koski 101-A Shepardson Dept. of Horticulture Colorado State University Fort Collins, CO 80523

Water/Agricultural/Rural Development Policy Programming

Warren Trock	(303) 491-6133
B-326 Clark Building	(303) 491-7307
Dept. of Agric. and Resource Economics	
Colorado State University	
Fort Collins, CO 80523	

On-site Water and Wastewater Treatment

Lloyd Walker 105-B Engineering South Building Dept. of Agric. and Chemical Engr. Colorado State University Fort Collins, CO 80523 (303) 491-6172

(303) 491-7334

Drinking Water Quality

Patricia Kendall 200-B Gifford Building Dept. of Food Science and Human Nutrition Colorado State University Fort Collins, CO 80523

Water Education/4-H Youth Programs

Al Meier 129 Aylesworth Hall, N.W. Colorado State University Fort Collins, CO 80523 (303) 491-6421

(303) 491-6421

Bill Peterson 123 Aylesworth Hall, NW Colorado State University Fort Collins, CO 80523

Nancy Zuschlag 15200 West Sixth Ave. Golden, CO 80401 (303) 271-8980

ASCE STUDENT CHAPTER TO HOST 1992 NATIONAL CONCRETE CANOE COMPETITION by Mary DeMartini

Concrete: A construction material, typically heavy, used primarily in road surfaces and building foundations.

Canoe: A lightweight, slender boat which is pointed at both ends and glides through the water when paddled.

Concrete cance: an apparent oxymoron which has become the challenge for civil engineering students across the nation. For almost 20 years it has been a tradition to design and build concrete cances for regional competition. Only within the last three years has this developed into a national contest where the best twenty schools come together in a clash of engineering excellence, naval strategy and non-stereotypical nerd brawn.

Yes, this event is evidence that engineering students are breaking out of their classical nerd image. They have given up their sliderules, pocket protectors, and taped glasses. They can now be seen racing their own innovative creations in lakes in your area. Engineering students are working together and applying classroom principles creatively to design and construct a concrete cance. This is quite an engineering feat and will help them to develop the skills necessary to improve this nation's infrastructure. Upon first hearing about a concrete canoe, the first words spoken are usually: "Does it float?" If you are picturing a hollowed out chunk of a sidewalk that is only going to race straight for the bottom, erase this image from your mind. Concrete canoes not only float, they float when filled with water. Before the race, the canoes must pass the swamp test to be permitted to race. The best concrete canoes are thin-walled (3/8 inch thick), range from fourteen to eighteen feet in length, and weigh around 100 pounds. According to the rules, the canoes must be made with portland cement as the primary binding material and the reinforcement must be metallic in nature.

When designing the canoe, stability, maneuverability, ability to track well, and speed are desired characteristics which must be considered and prioritized. There are both sprint races and long distance races so it is important for the canoe to have a good combination of these characteristics. Favoring one characteristic may compromise another; for instance, if the canoe's length is increased its potential speed increases but its maneuverability may decrease. A good design and experienced paddlers are both essential to ensure a successful canoe. You can witness this exciting national event here at Colorado State University. CSU was selected as the host of the 1992 ASCE National Concrete Canoe Competition after representatives from ASCE National and Master Builders reviewed the CSU student chapter's proposal and completed a successful site visit in December. The competition will take place June 18-21 and will include presentations and races by the champions of the twenty regional concrete canoe races held each

CCHE AWARD HELPS CSU WATER PROGRAMS

In 1990, the Colorado Commission on Higher Education selected CSU's water resources engineering programs for designation as a "CCHE Program of Excellence." Midway through its first year, the designation has provided a boost for the programs. There are 13 undergraduate students on scholarship, including seven women and minorities.

A foundation grant has been secured to enhance the minority institutions cooperative program and an international conference and workshop is planned for this Summer. Goals are to open up new programs with Hispanic universities and Mexican institutions and enhance the program for Historically Black Colleges and Universities. Graduate assistantships also have Spring across the nation. Over 300 students and faculty are expected to participate in this year's event, which will feature canoe races at City Park Lake in Fort Collins, Colorado. The races will be open to the public, and the canoes will also be on display at CSU. We encourage your attendance and guarantee that you will be impressed with the accomplishments of these civil engineering students.

helped several deserving students, including women and minorities. Support has been provided for computer-based water management capabilities and equipment for water and environnmental laboratories, including individual equipment to some faculty. A special program of excellence lecture by Dr. Vujica Yevjevich, "Water Resources and Civilization," will be given on March 2 in conjunction with the Colorado Water Engineering and Management Conference.

The program will continue in 1992-3 and 1993-4. Additional scholarships will be awarded and laboratories will be further improved.

First Semester of CCHE Water Resources Program of Excellence Scholarship Program Winds Up by Laurel Saito

Thirteen undergraduate engineering students at Colorado State University have completed their first semester as scholarship recipients of the Colorado Commission on Higher Education's (CCHE) Water Resources Program of Excellence. As part of their program, the students participated in three seminars throughout the semester and wrote a paper about a topic in water resources. One seminar featured the *Denver Metro Water Game*, a computerized spreadsheet gaming simulation of the Denver metro area water supply developed by the University of Colorado at Denver. Dr. Neil Grigg spoke to the students about current issues in water resources at another seminar, and the students selected an on-campus seminar of their choice or a conference as their third seminar.

The students selected a variety of interesting paper topics. Junior Scott Andre, Engineering Science major, wrote a paper entitled Groundwater Development of the Denver Basin: Can it be Justified? After noting hydrogeologic and recharge characteristics of the Denver Basin aquifers, Scott concluded that "groundwater development in the Denver Basin is an issue that should be approached with caution and not the mentality of a 'disposable' society where we use up the resource completely without considering the long-term effects of our actions."

Agricultural Engineering sophomore Kirsten Close researched the Estabrook Reservoir, an alternative to the Two Forks Reservoir that was proposed in the <u>Metropolitan Denver Water</u> <u>Supply Environmental Impact Statement</u>. Kirsten highlighted structural features and conservation requirements associated with the Estabrook Reservoir, and then discussed the impacts of the project on the environment, society, and other water projects. Mary DeMartini, a junior Civil Engineering major, investigated the Windy Gap project, detailing its history and major structural components. Mary included a description of the management of Windy Gap water, and discussed recent developments involving the sale of project water. She stated that "the Windy Gap project has become north slope gold which can only become more valuable," but noted that it "may be the last transmountain diversion project to divert water from the West Slope to the Front Range" due to high costs and strict regulatory procedures.

Another Civil Engineering major, senior Brian Foy, discussed major issues regarding the Colorado River in his paper entitled *War on the Colorado*. After relating the development of the Colorado River Compact, Brian outlined potential conflicts between Lower Basin, Upper Basin and Native American interests, stating that the Lower Basin must "begin redistributing agricultural water rights, which account for 80% of the appropriated river water, to its growing cities and industry." He cautioned that "all parties must compromise or the war will never be won peacably."

The controversial purchase of northern Colorado farms and associated water rights by the City of Thornton was the topic of an interesting paper by senior Civil Engineering student **Samara Iodice**. She discussed the history of Thornton's Northern Project, and included a synopsis of a debate on the subject at a recent conference on water and economics in Fort Collins. Thornton interests maintain that "the city has received its much needed water, while coming to the aid of several debt-ridden farmers," while northern water users asserted that "Thornton's dreams for future growth are not sufficient to support the appropriation of water they want." Samara concluded her paper by pointing out that the debate is ongoing and "will most certainly be a continuing battle for many more years. Until the final decision is made, the future of water in the Poudre (Basin) is very uncertain."

Three students chose the Two Forks Reservoir controversy as the topic of their scholarship papers. Junior Civil Engineering student **Todd Lewis** discussed the history of the proposed project in his paper entitled *Two Forks: An Informative Look*. He highlighted major negative impacts of the project, including flooding of the town of Bailey, Colorado; inundation of Cheesman Canyon, the location of a Gold Medal trout hatchery; and the negative environmental impacts on fish and wildlife. Todd concluded with the comment that the"whole debacle dramatically demonstrates just how important a factor water supply is, as well as the difficulty water planners have of trying to provide water to any given population."

Trudy Olin, a senior in Civil Engineering, detailed the Two Forks project from a different viewpoint in her paper entitled *Two Forks: Two Sides to a Controversy.* She focussed on the social and political debate between west and east slope interests, stating that initially the feasibility of Two Forks hinged on a demonstration of sufficient need for the water supply to outweigh environmental impacts and project costs. However, by the time Two Forks was vetoed, Trudy noted that "the political climate towards western water projects had chilled,...Two Forks became the scapegoat in the struggle for determination of water control in Colorado, and perhaps in the nation."

Another senior in Civil Engineering, Richard Pringle, also discussed the Two Forks project. He included descriptions of the structural and hydraulic features of the dam and reservoir, environmental impacts, and mitigation measures. Richard noted the difficulty in addressing mitigation issues, because "those against the project reject most forms of mitigation and prefer to focus on the irreplaceable ecosystem that currently exists...About the only thing proponents and opponents can agree on is that the visual beauty of the area would be forever changed."

Lisa Poppenga, a senior Civil Engineering student, featured the Green Mountain Exchange Project in her paper. She detailed the project location, potential reservoir sites, hydraulic

EDITOR'S IN-BASKET

ST. ELMO TEAM CLEANS UP ABANDONED MINE WASTES

Two miles upstream of the old mining town of St. Elmo, in a glaciated valley of the Sawatch Range east of the Continental Divide, the St. Elmo Nonpoint Source Project Team has completed construction that consolidates and stabilizes 13 acres of mine tailings waste. The project also treated a mine draining tunnel left over form Colorado's gold boom days. The 100-year-old sand, silt and clay mill tailings (crushed ore remaining

capacities, environmental impacts, and estimated project costs. Lisa concluded that "considering the estimated costs and potential environmental concerns the alternative reservoir sites and the pumpback system pose, additional studies will likely be needed before the Green Mountain Exchange Project proceeds to construction now or in the future."

Jennifer Roberts, a sophomore in Engineering Science, researched nonpotable reuse. Jennifer highlighted potential applications for nonpotable water and legal and institutional considerations. She stated that as "water shortages are becoming more and more evident,...increasing the availability of water by reusing wastewater for nonpotable processes poses little threat to the environment, making this an even more desirable option."

The Colorado-Big Thompson Project was the topic of the paper by sophomore Civil Engineering student Carlos Sanchez. Carlos presented a history of the project, a description of its physical features, and a discussion of the economical and political pros and cons of the project. Despite some of the early arguments against the project, Carlos stated that "the Colorado-Big Thompson Project can be credited for part of the prosperity of Northeastern Colorado."

Senior Civil Engineering student Heath Stein described the Williams Fork Gravity Collection System, a proposed system for supplying metropolitan Denver with water from the Williams Fork Basin. Heath described the structural features of the project, including the conveyance pipeline and diversion structures. He then gave a brief history of the Denver Water Department's involvement in the Williams Fork Basin, noting that gravity flow systems have been used since 1940.

Heather Trantham, another senior Civil Engineering student, selected Denver's Potable Reuse Demonstration Plant as the topic of her paper. She related the history of the plant, treatment processes used, and the resulting water quality. Heather described the Advanced Water Treatment Research Institute (AWTRI), created in 1990 to address the future of the plant. Although this future is uncertain, Heather stated that "the reuse plant continues research demonstrating the reliability of the process at hand, generating regulatory agency acceptance, initiating public acceptance, and producing the data necessary for future implementation of a large scale plant."

after mineral extraction) and the draining Golf Tunnel were contributing heavy metals, particularly zinc and cadmium, to Chalk Creek and adversely impacting its water quality and fish habitat. Under the direction of the Colorado Mined Land Reclamation Division, contractors removed approximately 60,000 cuubic yards of mill tailings from four locations, consolidating them with the existing Mary Murphy Mill tailings pile. The consolidated pile, graded to slopes no greater than 3:1, was covered with two feet of rock. To enhance surface stabilization of the pile, four tons per acre of manure and seven tons per acre of native hay mulch were included in the revegetation efforts. Homestake Mining Company contributed material, equipment and manpower to fertilize, hydromulch, and seed the entire 13 acres of affected land with a mixture of subalpine grasses, wildflowers and shrubs. Following earth-moving operations, another contractor prepared the site below the Mary Murphy tailings pile for the creation of a constructed wetland to passively treat the draining Golf Tunnel. Locations from which tailings were removed were also prepared for wetland restoration, thus returning the impacted areas to natural conditions. The "Volunteers for Outdoor Colorado" group organized more than 160 volunteers to transplant native wetland sod plugs and plant 840 Englemann spruce and lodgepole pine saplings in the prepared areas.

Tailings consolidation, stabilization, and mine drainage treatment and the wetland creation/restoration project were completed in less than three months, from July 14 to October 4, 1991. The Colorado Division of Wildlife will monitor post-reclamation water quality at Chalk Creek for three years. The Mined Land Reclamation Division will also inspect the site for three years to assess and implement maintenance requirements.

Total project costs have come to \$400,000, including postreclamation water quality monitoring. The Nonpoint Source Program of the Water Quality Control Division, Colorado Department of Health, authorized the project. Nonpoint source control funding was provided under section 201(g)(1)(B) of the Clean Water Act in the amount of \$76,800. Additional funding and/or "in-kind" contributions to make up the project costs were provided by: Chaffee County; Colorado Division of Wildlife; Colorado Mined Land Reclamation Division; Colorado Soil Conservation Board; Coors Pure Water 2000; Cyprus Minerals Company; Kaess Contracting, Inc.; T.H.E. Consultants; Volunteers for Outdoor Colorado; and the following federal agencies: Bureau of Reclamation, Bureau of Mines, Forest Service, Soil Conservation Service, and the U.S. Environmental Protection Agency.

(For information, contact: Camille Meyer, Colorado Mined Land Reclamation Division, 1313 Sherman Street, Room 215, Denver, CO 80203. Phone: (303) 866-3567. FAX: (303) 832-8106.)

Source: EPA News-Notes, Dec. 1991.

DWD EXTENDS REBATE OFFER

The Denver Water Board has extended through the end of 1992 its offer of \$80 rebates to customers replacing existing toilets with approved ultra-low-volume (ULV) models. However, the Board will stop giving rebates to customers installing ULV toilets for new construction as of February 29, 1992, because a Denver city ordinance requiring ULV models in all new residential and commercial buildings will take effect March 1, 1992.

Eligible customers planning to install ULV toilets in new homes and businesses that want to qualify for a rebate before the deadline must have: 1.) installed the ULV, 2.) a receipt to prove the purchase, and 3.) an appointment for an inspection booked with Denver Water by March 1. Denver's ULV rebates are available only to customers who receive Denver's treated water exclusively and purchase a plumbing industry-approved model. Since January 1990, the Board has paid more than 6,200 rebates totaling \$496,000. The estimated water savings from these 6,200 ULVs is estimated at 130 acre-feet per year.

Ulv toilets use 1.6 gallons per flush--54 percent less water than conventional 3.5-gallon models and 68 percent less than old 5gallon models. For details on approved ULV models, eligibility and how to apply for the rebate, call Denver Water customer services at 893-2444. For more information, contact Kathy Richardson at (o) 628-6700 or (h) 399-8421.

DWD COMPLETES HIGH-ALTITUDE CONSUMPTIVE USE STUDY by Nancy Stowe

In May of 1987 the Denver Water Department began a study of consumptive use in high altitude mountain meadows. From 1987 through 1990, measurements of water consumption by pasture grass were performed along with the corresponding climatological data at two ranches in Grand County; Corral Creek and Lawrence Ranch. Water was measured using constant-head and weighing type lysimeters.

An electronic datalogger was installed in early 1987, to which climatological and soil monitoring instruments were connected. The collected data was utilized in the Blaney-Criddle and Jensen-Haise ET formulas, in addition to developing an overall characterization of the microclimate at the lysimeter sites. The study yielded the following results:

■ Coral Creek Ranch average potential evapotranspiration for the months of May to September was equal to 26.9 inches, while at Lawrence Ranch, it was equal to 24.9 inches for the same time period.

■ A software program from Utah State University entitled REF-ET and a Fortran program written for the Jensen-Haise equation were used to calculate estimates of evapotranspiration by utilizing the climatological data collected at Corral Creek Ranch. The REF-ET program used seven different methods to predict evapotranspiration, which were then evaluated statistically, and ranked based on adjusted standard error of estimates.

■ Crop coefficients were derived using the Blaney-Criddle and Jensen-Haise equations and plotted for the five months of the growing season, and they were found to be very reasonable compared to consumptive use studies performed by others.

■ At Corral Creek Ranch, the Bucket lysimeters consumed an average of 6.39 inches post-harvest, representing actual consumption, compared to the square lysimeters, which consumed an average of 8.54 inches, representing potential consumption.

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■ Coral Creek Ranch pasture grass species included timothy, tufted hair, red top and meadow foxtail, while Lawrence Ranch was dominated by meadow foxtail. Forage yield at Corral Creek averaged 4312 lbs/acre while at Lawrence Ranch, 3400 lbs/acre. For comparison purposes, the Routt County long-term mean yield for pasture grass is 3300 lbs/acre. No relationship between ET and forage yields was apparent.

New consumptive use information for pastures at high altitudes has many applications. Water transfer cases will be more equitable since a better knowledge of historic use is available and irrigation system designs can be approached with empirical data. On a larger scale, conjunctive use managers of surface and ground waters can utilize this consumptive use information to construct better models of their systems. Also, information systems that house consolidated data from around the nation, such as the Geologic Information System (GIS), can be expanded to provide more up-to-date consumptive use and climatological data.

Source: Denver Water Department report, "Evapotranspiration in High Altitude Mountain Meadows," by Norman C. Carlson, Joseph R. Pollara, and Tonhu Le.

FROM THE NATIONAL RESEARCH COUNCIL

New Committee on Environmental Research Formed--Congress has requested the National Research Council (NRC) to undertake a study of the federal coordination, management, and support of environmental research and training in the United States. In response to this request and following discussions with the Assistant to the President for Science and Technology, the Commission on Life Sciences (CLS) has formed a new committee to study these issues. The goal of the study will be to provide recommendations for improving the leadership, focus, coordination, and funding of U.S. environmental research. The study is sponsored by a consortium of federal agencies including EPA, DPE, DOI, and NSF. The Committee on Environmental Research is chaired by Dr. Dale R. Corson, Emeritus President of Cornell University, a member of the National Academy of Engineering, and a recipient of the National Academy of Sciences Public Welfare medal.

WATER SCIENCE AND TECHNOLOGY BOARD

The Water Science and Technology Board of the National Research Council, among its many activities in the general area of water resources, has several underway that directly interact with Colorado. The following news items represent three of these interactions.

Abel Wolman Lecture--The third annual Abel Wolman Distinguished Lecture will be presented be Dr. Jan van Schilfgaarde, Acting Associate Deputy Administrator, Natural Resources, with the Agricultural Research Service (Until last year, Dr. van Schilfgaarde was Associate Area Director for the USDA, ARS, located in Fort Collins). His lecture will focus on the fate of irrigated agriculture worldwide. Dr. van Schilfgaarde is a member of the National Academy of Engineering, former member of the NRC's Board on Agriculture, and former Chairman of the WSTB Committee on Irrigation-Induced Water Quality Problems. The lecture is scheduled for June 29, 1992 in the auditorium of the National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. A reception will follow in the Great Hall. Those interested in attending the event should call Anita Hall at (202) 334-3422 for reservations.

Committee on USGS Water Resources Research--The Committee met in Easton, Maryland on September 22-24. Following a pleasant and informative field trip to the Delmarva Peninsula National Water Quality Assessment Program (NAWQA) Study Area on the 22nd, the meeting focused on issues associated with "national synthesis" aspects of the program. The committee received briefings and had discussions on the Geological Survey's national studies related to NAWOA, which include nutrients and sediments, pesticides, and other topics. The committee, now chaired by Professor George Hornberger of the University of Virginia, will meet next in January 1992 (dates to be determined) in Reston, Virginia. The meeting will feature the use of models and biological approaches in NAWQA; it will also be held in conjunction with a committee-hosted workshop on the USGS stream gaging network. A report focusing on the committee's review of the national synthesis in the NAWOA program is planned for late 1992 or early 1993. (Two NAWQA studies are currently being designed which include parts of Colorado: the South Platte study and the Rio Grande study.)

Committee on Western Water Management--The Committee has completed its study, "Water Transfers in the West: Efficiency, Equity, and the Environment." The study examines pressures for change in water allocation in the West, the range of third party impacts that can accompany transfers, and opportunities at the federal and state level for improving the transfer process. A published volume is expected in February. It includes seven case studies of transfer activity in the Carson-Truckee basin, Nevada; the Arkansas River and Colorado Front Range area; northern New Mexico; the Yakima River, Washington; central Arizona; the Central Valley, California; and the Imperial Valley, California.

To encourage wide discussion of the report and its recommendations, the WSTB is hoping to organize a series of three dissemination workshops. If funding is secured, the workshops would be held in Washington, D.C., Denver, and Irvine, California to provide a forum for committee members to interact with federal and state agency personnel, water managers, congressional staff, the media, and others with an active interest in water transfers. For more information on the workshops, contact Chris Elfring after December 1.

A copy of the report, "Water Transfers in the West" (ISBN#: 4528-2) may be ordered from NATIONAL ACADEMY PRESS, 2101 Constitution Avenue, NW, P.O. Box 285, Washington, DC 20055, for \$29.95.

Source: WSTB NEWSLETTER, Vol. 8, No.4, Oct. 1991.

OF SPECIAL INTEREST - WATER TRANSFERS

In light of the proposed water transfers from the San Luis Valley and the Arkansas Valley, water managers may find the following information of interest. <u>Moving Western Water--At</u> <u>Whose Cost</u>? is a publication of the National Conference of State Legislatures by Larry Morandi. The report looks at water transfers in Arizona, Colorado and New Mexico. For copies of the report contact NCSL, 1560 Broadway, Suite 700, Denver, CO 80202 (303)830-2200.

NSF OPENS NEW ANTARCTIC RESEARCH LABORATORY

Antarctica's role in global change will be studied in a new \$23 million research laboratory that opened November 5, 1991 at McMurdo Station, according to the National Science Foundation (NSF). NSF, through its U.S. Antarctic Program, funds and manages scientific research at McMurdo, two other research stations, and at other remote sites in Antarctica. Dignitaries, scientists, and construction workers assembled to dedicate the 46,500 square foot facility. Dr. Walter E. Massey, director of NSF, was joined at the ceremony by Della M. Newman, U.S. Ambassador to New Zealand; John A. Knauss, director, National Oceanic and Atmospheric Administration; and Dallas L. Peck, director, U.S. Geological Survey. E.U. Curtis Bohlen, who headed the U.S. delegation to the recently completed international negotiations for environmental protection of the Antarctic, represented the Department of State. The lab is named the Albert P. Crary Science and Engineering Center. Crary, who died in 1987, was a prominent geophysicist and glaciologist who was the first person to set foot on both the North and South poles.

UCOWR SEEKS NOMINATIONS FOR AWARD

The Universities Council on Water Resources award recognizes individuals, groups or agencies for significant contributions to increased public awareness of water resources development, use or management. The award consists of a certificate and a letter of commendation. Recipients will be invited to receive their award and make a brief presentation at an appropriate time during the annual meeting. The award recognizes programs or activities beyond ordinary university classroom duties. The activity should have contributed significantly to public awareness in the area of water resources development, use and management, covering any one or a combination of the natural, biological and social sciences concerned with analysis of water resources. Its effects should be of regional if not national scope, and may have private or public sponsorship. Activities may focus on primary or secondary schools, legislative or other public fora or the media. University classroom programs are not eligible.

Nominations should be made by letter of not more than one page, plus supporting materials. Submit to the Chair, Education and Public Service Committee, Universities Council on Water Resources, c/o Dr. Duane D. Baumann, Executive Director, 4543 Faner Hall, Southern Illinois University at Carbondale, Carbondale, IL 62901-4526.

Deadline for nominations is 31 March of each year. The award will be announced at the UCOWR annual meetings. Nominations will be reviewed by the management group of the UCOWR Education and Public Service Committee. No more than two awards shall be given in any year. The committee may choose to make no awards in any year.

WATER SUPPLY CONDITIONS UPDATE

SUMMARY--Precipitation patterns in Colorado have been highly variable thus far during the 1992 water year. After a warm and dry October, the state was pounded by a series of heavy snowstorms during November. Nearly all of the current mountain snowpack accumulated during these storms. December's weather returned to generally dry conditions, contributing to a steady decline in snowpack percentages, to the current levels. With near average reservoir storage, snowpack, and streamflow forecasts, the state's early season water supply conditions appear to be in the best condition since the late 1980's.

SNOWPACK--January 1 surveys show the state's snowpack to be above average in the southern mountains, decreasing to below average in the northern mountains. Near average snowpack has been measured in the Colorado and Gunnison River Basins. Statewide snowpack is currently 101% of last year at this time. Highest snowpack statistics occur in the Arkansas River Basin, with 136% of average snowpack. Other river basin reporting above normal totals include the Rio Grande, at 123% of average; and the San Juan, Animas, Dolores and San Miguel basins, at 109% of average. Dry December weather helped to decrease percentages in the Northern basins to below normal. Lowest readings occur in the North Platte Basin, at 77% of average. Other basins with below normal snowpack accumulations include the Yampa and White River basins, at 86% of average; and the South Platte Basin, at 90% of average.

PRECIPITATION--Precipitation measured at National Weather Service stations across colorado in December were much below average nearly statewide. Totals of less than 70% of average were observed in all basins, except the Rio Grande, which reported much above average totals at many lower elevation stations. The South Platte Basin received the least precipitation during December, with many sites reporting less than 0.10" for the month. For the 1992 water year, the Arkansas and Rio Grande Basins have received much above average totals, while the driest basins include the North and South Platte, Colorado, Yampa, and White River Basins.

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RESERVOIRS--Reservoir storage in the 68 major reservoirs across Colorado is 108% of the 1961-1990 average. However, storage is generally near to below last year's levels, with the exception of the Rio Grande and Colorado Basins, which are reporting 127 and 110% of last year, respectively. The Colorado River Basin is the only basin currently storing below average levels, at 96% of average. The highest storage totals are in the San Juan, Animas, Dolores and San Miguel Basins at 140% of average. STREAMFLOW--Forecasted streamflow volumes for this spring and summer are near average with the majority of the state's rivers projected to see 90-110 percent of average runoff. The lowest percentages are forecast across northwestern Colorado, where the Yampa, Little Snake, Laramie and North Platte Rivers are forecast to produce 70-80 percent of average volumes. The region with the highest streamflow forecasts includes the Sangre De Cristo mountain range, where most of these smaller tributaries are expected to produce volumes greater than 130 percent of average this year.

From: COLORADO WATER SUPPLY OUTLOOK, January 1, 1992 - Issued by William (Bill) Richards, Chief, Soil Conservation Service, U.S. Department of Agriculture; Released by Duane Johnson, State Conservationist, SCS, Lakewood, CO.

WATER PUBLICATIONS

CWRRI RESEARCH REPORTS

The following reports are available from the Colorado State University Bulletin Room, 171 Aylesworth Hall, Colorado State University, Fort Collins, CO 80523. Phone: (303)491-6198.

Completion Report No. 160, <u>A Modeling Approach for Assessing</u> the Feasibility of Groundwater Withdrawal From the Denver Basin <u>During Periods of Drought</u>, by Sigurd Jaunarajs and Eileen Poeter. Price: \$16.00.

Completion Report No. 161, <u>Economic Impacts of Alternative</u> Water Allocation Institutions in the Colorado River Basin, by James F. Booker and Robert A. Young. Price: TBA

Completion Report No. 162, <u>Field Demonstration of Biological</u> Denitrification of Polluted Groundwater and Pilot Scale Field Testing of Biological Denitrification with Widely Varied Hydraulic Loading Rates, by JoAnn Silverstein and Nevis Cook. Price: TBA.

Completion Report No. 163, <u>Fate and Effects of Heavy Metals on</u> the Arkansas River, by William H. Clements. Price: TBA.

Information Series No. 67, <u>Colorado Citizen's Water Law</u> Handbook, Colorado Water: The Next 100 Years, by George Vranesh. Price: \$7.00.

CWRRI MISCELLANEOUS REPORTS

Delph Carpenter Father of Colorado River Treaties

The text of Governor Ralph L. Carr's 1943 salute to Delph Carpenter is presented in this 24-page booklet. Former CWRRI Director Neil S. Grigg consulted Carpenter's son, Judge Donald Carpenter of Greeley, about the publication and says in his introduction:

The July 22, 1991 cover story of *Time Magazine* was entitled "The Colorado - The West's Lifeline is Now America's Most Endangered River." The heading also called it "A fight over liquid gold" and stated: "In a huge portion of the parched West, life would be impossible without the Colorado River. Now the very prosperity that its waters created threatens the river's survival."

The rulebook for the Colorado River is the 1922 Colorado River Compact, a document now nearly 70 years old. Time said, "This critical document facilitated both the astonishing development of the West and the problems that followed as a result." From these statements the enormous significance of the Compact is evident, and a key person in developing this and other compacts was Delph Carpenter, a Greeley lawyer who became an institution in the development of interstate water treaties.

Ralph L. Carr, two-term governor of Colorado, worked with and was a close observer of Delph Carpenter's achievements. Their close association is evident in his moving October 27, 1943 tribute to Carpenter in a speech before the National Reclamation Association. *Free upon request. Call the Institute at (303)491-6308.*

Citizens' Water Law Handbook

This handbook by George Vranesh was developed to help citizens learn the intricacies of Colorado water law and define the role of water engineers. It was prepared for participants of the Colorado Endowment for the Humanities project Colorado Water: The Next 100 Years, a series of programs and discussions held during 1990 in the state's seven water divisions. Barbara Preskorn of Front Range Community College developed the programs. George Vranesh is a natural resources attorney, mining engineer, and author of a three-volume text on Colorado water law. Information Series No. 67, Price: \$7.00.

WESTERN WATER POLICY PAPERS

Two new papers are now available from the Natural Resources Law Center: the first, Using Water Naturally, is by Holmes Rolston III, Professor of Philosophy at Colorado State University. The second, Implementing Winter's Doctrine Indian Reserved Water Rights: Producing Indian Water and Economic Development without Injuring Non-Indian Water Users, is by Reid Payton Chambers and John Echohawk. Contact the Natural Resources Law Center, Campus Box 401, Boulder, CO 80309-0401; Phone: (303)492-1286.

HISTORY OF FLOODS AND DROUGHTS FEATURED IN LATEST NATIONAL WATER SUMMARY

State-by-state summaries of major floods and droughts in the United States are the focus of the sixth volume of the National Water Summary series, released by the U.S. Geological Survey, Department of the Interior. The report covers all 50 states as well as the District of Columbia, Puerto Rico and the U.S. Virgin Islands. Publication of this volume of the National Water Summary coincides with a major international effort to raise the level of awareness of the importance of disaster preparedness. In December 1989, the United States joined with more than 150 other nations in signing a United Nations resolution that established the International Decade for Natural Disaster Reduction. The Summary also includes articles on scientific and societal aspects of floods and droughts and details the cooperative roles of federal agencies and state and local governments in forecasting and mitigation. A chrono- logical listing of 175 water-related events that affected the Nation during 1988 and 1989 is also included.

Copies of the 591-page report, titled "National Water Summary 1988-89 -- Hydrologic Events and Floods and Droughts" and published as USGS Water-Supply Paper 2375, are available for \$39.00 from the U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Bldg. 810, Box 25425, Denver, Colo. 80225-0425, telephone 303-236-7476. Checks and money orders should be payable to the "U.S. Department of the Interior--USGS."

U.S. GEOLOGICAL SURVEY REPORTS

For information about the following reports contact: USGS, Books and Open-File Reports, Federal Center, Box 25425, Denver, CO 80225-0425.

"Water quality of Fountain and Monument Creeks, south-central Colorado, with emphasis on relation of water quality to stream classifications," by Patrick Edelmann, WRIR 88-4132.

"Water-level changes in the High Plains aquifer underlying part of South Dakota, Wyoming, Nebraska, Colorado, Kansas, New Mexico, Oklahoma, and Texas--Predevelopment through nonirrigation season 1988-89," by J.T. Dugan, D.E. Schild, and W.M. Kastner, WRIR 90-4153.

"Sediment discharge in Fortification Creek and the effect of sedimentation rate in the proposed Rampart Reservoir, northwestern Colorado," by L. Butler, Richard O. Hawkinson, and Robert W. Boulger, Jr., WRIR 90-4103.

"Geohydrologic evaluation of the upper part of the Mesa Verde Group, northwestern Colorado," by S.G. Robson and Michael Stewart, WRIR 90-4020.

"Estimates of dissolved solids and major dissolved constituents for 70 streamflow-gaging stations in the Upper Colorado River Basin, Arizona, Colorado, New Mexico, Utah, and Wyoming," by B.D. Nordlund and T.D. Liebermann, Open-File Report 87-547.

"Water-quality and sediment-transport characteristics in Kenney Reservoir, White River basin, northwestern Colorado," by Robert L. Tobin and Caroline P. Hollowed, WRIR 90-4071.

"Regional ground-water flow in upper and middle Paleozoic rocks in southeastern Utah and adjacent parts of Arizona, Colorado, and New Mexico," by Emanuel Weiss, WRIR 90-4079.

"Geophysically estimated porosity of selected paleozoic rocks in the Upper Colorado River Basin, Colorado, Utah, Wyoming, and Arizona," by Gregory A. Wetherbee and William P. Van Liew, WRIR 90-4049.

"Simulation of water quality and the effects of wastewater effluent on the South Platte River from Chatfield Reservoir through Denver, Colorado," by James E. Paschal, Jr., and David K. Mueller, WRIR 91-4016.

"Compilation of water-quality data for Pueblo Reservoir and the upper Arkansas River basin, Colorado, 1985-87," by Patrick Edelmann, Julie Altamore Scaplo, Don Anthony Colalancia, and Brian B. Elson, Open-File Report 91-506.

"Calibration, verification, and use of a steady-state strem waterquality model for Monument and Fountain Creeks, east-central Colorado," by Gerhard Kuhn, WRIR 91-4055.

"Characterization of water quality for streams in the southern Yampa River basin, northwestern Colorado," by R.S. Parker, WRIR 88-4204.

"Effects of land disposal of municipal sewage sludge on soil, streambed sediment, and ground- and surface-water quality at a site near Denver, CO," by Neville G. Gaggiani, WRIR 90-4106.

"Effects of a landslide complex on sediment discharges and loads in the Muddy Creek drainage basin and deposition into Paonia Reservoir, west-central Colorado, 1986-87," by Cynthia L. Appel and David L. Butler, WRIR 90-4173.

NEW PUBLICATIONS FROM ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

"Native fishes in arid lands: a dwindling resource of the desert Southwest, by John N. Rinne and W. L. Minckley, Gen. Tech. Rep. RM- 206. Order No. 34. Fort Collins, CO. RMFRES, 240 W. Prospect Road, Fort Collins, CO 80526.

"Warmwater fisheries symposium 1; 1991 June 4-8; Scottsdale, AZ;" by James L. Cooper and R.H. Hamre, Gen. Tech. Rep. \$M-207. Order No. 35. Same address as above.

POSITIONS AVAILABLE

CHIEF, ILLINOIS STATE WATER SURVEY--The Illinois State Water Survey, a Division of the Illinois Department of Energy and Natural Resources (ENR), seeks qualified candidates for the position of Chief. The Survey is Illinois' primary agency for basic and applied research in water and atmospheric resources and is responsible for certain state-legislated research and service programs. The Survey is located on the campus of the University of Illinois at Urbana-Champaign and is closely affiliated with that institution in matters of research, joint staff, and grant/contract administration.

The Chief has direct administrative responsibility and scientific oversight for a staff of approximately 250 scientists, engineers, support staff, and students. He must interact regularly with representatives of agencies at all levels of government and the general public. The anticipated starting salary for the position (minimum \$80,000) depends on qualifications and experience. Candidate should possess a Ph.D degree or research equivalent experience in any of the disciplines related to water and atmospheric resources and have a substantial record of accomplishment and leadership in scientific research.

To ensure full consideration for the position of Chief of the Illinois State Water Survey, send letter of application and resume (including complete publications record and list of five references) by March 31, 1992, to the address below. Interviews are expected to begin in May 1992. Anticipated starting date for the successful candidate is September 1, 1992.

V.C. Bowersox, Chairperson, Search Committee for the Chief Illinois State Water Survey, P.O. Box 2444 Champaign, Illinois 61825-2444 PHONE: (217) 333-2210 FAX: (217) 333-6540

RESEARCH SCIENTIST/ASSISTANT PROFESSOR, Geology/Hydrogeology, Idaho Water Resources Research Institute-Full-time position with the Department of Geology and Geological Engineering, College of Mines and Earth Resources, University of Idaho. Requires Ph.D. in Hydrogeologic or Geologic Science, or Engineering with an emphasis on ground water hydrogeology. Must have excellent oral and written communication skills, be capable or working without direct supervision and have the ability to interact well with the public. Send a detailed resume and three letters of reference to Dale Ralston, Search Committee, Idaho Water Resources Research Institute, 106 Morrill Hall, University of Idaho, Moscow, Idaho 83843.

Closing Date: Search and selection procedures will be closed when a sufficient number of qualified candidates has been identified, but not earlier than February 14, 1992. Salary commensurate with experience and background.

ASSOCIATE DIRECTOR, National Project WET .- The Western Watercourse, a comprehensive adult and youth water resources education program, and the Western Regional Environmental Education Council (WREEC), the parent organization of Project Lerning Tree and Project WILD, are teaming up to develop Project Water Education for Teachers (WET). This water education program will include instructional guides, creative teaching aids, and water education programming initiatives. Responsible for facilitating the development of Project WET. Will organize and lead the Project WET materials development process. Qualifications--B.S. degree in education, environmental education, natural resources or related field and an advanced degree (MS, MA, Ed.D., Ph.D); teaching experience; environmental education or water resources education program administration experience; superior oral communication skills; extensive written communication skills; computer literacy. Send letter of application; resume; and names and addresses and telephone numbers of three references to:

Dennis Nelson, Director The Western Watercourse/Project WET 335 Culbertson Hall Montana State University Bozeman, Montana 59717

Deadline: February 10, 1992

STUDENT OPPORTUNITIES -- SUMMER POSITIONS

BUREAU OF LAND MANAGEMENT, Idaho State Office, Student Trainee (Hydrology)--Freshmen, Sophomores, first semester/quarter Juniors. BLM is recruiting college students interested in a career in the Federal workforce via the Cooperative Education Program. A student may be converted noncompetitively to a career or career-conditional appointment at the target position within 120 days following completion of educational and work experience requirements.

Applications MUST be received ON OR BEFORE March 16 at the following address:

Personnel Office (953) Bureau of Land Management Idaho State Office 3380 Americana Terrace Boise, Idaho 83706

Contact Nancy Poole, CSU Cooperative Education Program Coordinator, for more information. BRANNON SAND AND GRAVEL COMPANY, Denver-Construction Management Program (Internship Program if desired), Assistant Field Supervisors (indefinite number of positions). Position involves a high degree of civil construction knowledge with interpersoal skills. Will report directly to the field supervisor for day-to-day assignments.

Responsibilities: Become familiar with contract plans and specifications, with emphasis on budget and schedule constraints. Document construction activities, prepare monthly pay estimates, coordinate subcontractors and finalize project. Organize weekly job meetings on-site with all involved parties, and update progress schedule after review with project manager and field supervisor each week.

Deadline: March 2, 1992. Send applications to: The Brannon Sand and Gravel Co., 4800 Brighton Blvd., Denver, CO 80216 c/o Fred Marvel. Interviews will be scheduled at the end of March or the beginning of April.

SEMINAR SERIES

ENVIRONMENTAL ENGINEERING SEMINAR COLORADO STATE UNIVERSITY - SPRING 1992

Date

Topic and Lecturer

- Feb. 10 Rocky Flats Martin Hestmark, Rocky Flats Team Leader, U.S. EPA, Region VIII, Denver.
- Feb. 17 A Passive Mine Drainage Treatment System as a Bioreactor for Removal of Metals and pH Elevation: Challenging the Dogma of Wetland Treatment Systems Dr. Ronald R. Hewitt Cohen, Associate Professor of Environmental Science and Engineering, Colorado School of Mines, Golden.
- Feb. 24 Enhanced Groundwater Remediation Techniques: Vapor Extraction & NAPL Remediation Gary Hecox, Senior Hydrogeologist, International Technology Corporation, Englewood.
- Mar. 2 Pollution Prevention Activities at the Denver International Airport David Duster, U.S. EPA Pollution Prevention Coordinator, Denver.

Mar. 9 Hazardous Waste Land Disposal System - Drew McCoy, President, McCoy & Associates, Inc., Lakewood.

- Mar. 23 Toxic Solvent Replacement: Next Generation Approach Walt Burg, Vice President of Research & Development, RECOM Applied Solutions Inc., Boulder.
- Mar. 30 Fish Habitat Modeling Methodology Terry Waddle, Hydrologist, U.S. Fish and Wildlife Service National Ecology Research Center, Fort Collins.
- Apr. 6 Tooele Army Depot Risk Assessment Planning Charlie Haddox, Senior Hydrogeologist, Ebasco Environmental, Lakewood.
- Apr. 13 Hazardous Waste Management Karen North, Environmental Manager, Oil & Solvent Process Company, Henderson.
- Apr. 20 Case Study of Remediation Activities at a Radioactive Waste Site Tim Rehder, Project Manager, U.S. EPA, Region VIII, Denver.
- Apr. 27 Water and Wastewater Treatment Pilot Plant and Computer Model to Simulate Treatment Laurie Sullivan, Ken Carlson, Ted Zibell, CSU Graduate Students, Civil Engineering Department, Environmental Engineering Program.
- May 4 The Role of Environmental Advocacy Groups in Environmental Issues Dr. Daniel Luecke, P.E., Regional Director, Environmental Defense Fund, Boulder.

Seminars are held in Room 180 of the Lory Student Center, from 12 noon to 1:00 P.M. Everyone is welcome, and should feel free to bring a lunch. Questions should be directed to either Ted Zibell or Michelle May at 491-5448.

WATER RESOURCES SCIENCE AND ENGINEERING SEMINAR COLORADO STATE UNIVERSITY - SPRING 1992

- Feb. 6 DSS for Conjunctive Stream-Aquifer Management Jeff Fredericks
- Feb. 13 Two Dimensional Runoff Modelling with Radar Data Fred Ogden
- Feb. 20 Spatial Heterogeneity and its Influence on Watershed Response -Bahram Saghafian
- Feb. 27 DSS for Design and Analysis of Water Distribution Systems Saud Taher
- Mar. 5 Use of MPARMA Models for Modelling Seasonal Time Series Magdy Abdelmohsen
- Mar. 12 Optimal Stochastic Operation of Aswan High Dam Hanan Abdelkader
- Mar. 19 Spring Vacation Recess. No Seminar.

Mar. 26 Influence of River Channel Properties on Flood Frequency - Gary Wolff

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Date	Topic and Lecturer	
Apr. 2	GIS Approaches for Estimating Irrigation Demand - Monsoor Hashmi	
Apr. 9	A Hybrid Hydrodynamic and Statistical Flood Routing Method - Hussam Fahmy	
Apr. 16	State Space approach and Kalman Filtering in Hydrology - Momcilo Markus	
Apr. 23	Watershed Response Sensitivity to Global Change - Dan Epstein	
Apr. 30	Real-time Automation and Control of Irrigation Systems - Flavio Albuquerque	
May 7	Estimation of Flow Hydrographs for Ungaged Watersheds - Gamal Allam	

The Hydrologic Science and Engineering program and the Water Resources Planning and Management program jointly organize the Spring Seminar Series on Water Resources Science and Engineering - this is a preliminary schedule. The series will be organized as an independent study course, CE 695CV, in which students will have the opportunity to present and discuss their work, emphasizing the research aspects of a graduate education in water related areas at CSU. The series is also open to the public. Seminars are held in Room 208 of the Lory Student Center, from 12:10 to 1:00 p.m. For information, contact Jorge A. Ramirez at 491-8650 or John W. Labadie at 491-8596.

AGRICULTURAL ENGINEERING GRADUATE SEMINAR COLORADO STATE UNIVERSITY - SPRING 1992

- Feb. 7 An Ice-Coring Study of Atmospheric Deposition on the Fremont Glacier, Wyoming Cheryl Miller, Agricultural and Chemical Engineering and USGS and David Naftz, USGS
- Feb. 14 Decision Support Systems for Water Resources Management Luis Garcia, Agricultural and Chemical Engineering
- Feb. 28 U.S. Agriculture: A Viable Industry? James Welsh, Research Director USDA-ARS, Natural Resources Research Center
- Apr. 10 Monitoring Agricultural Chemical Transport in the San Luis Valley, Colorado David Ellerbroek, Agricultural and Chemical Engineering
- Apr. 17 Monitoring Field Sprayer Performance Khalid Algaadi, Agricultural and Chemical Engineering
- Apr. 24 Modeling Spatial Variability of Solute Transport in Soils Tom Nolan, USGS and Agricultural and Chemical Engineering

Most seminars begin with refreshments at 3:15 pm and end by 4:30. The usual meeting room is 203-205 in the Lory Student Center. Call Jim Loftis at 303/491-5252 for more details.

FLUID MECHANICS, HYDRAULICS AND WIND ENGINEERING PROGRAMS COLORADO STATE UNIVERSITY - SPRING 1992

- *Feb. 12 Models of Intermittent Bursting in a Turbulent Boundary Layer Emily Stone, Visiting Scholar, Department of Mathematics
- *Feb. 19 On Forward-In-Time Differencing for Fluids Piotr K. Smolarkiewicz, Meteorologist, NCAR-MMM, Boulder, CO
- *Feb. 26 Solving Fluid Problems with LDA Systems Brent W. Mefford, Head, Hydraulic Structures Section, Div. of Research, Bureau of Reclamation, Denver, CO
- **Mar. 11 An Ensemble of Fluid Models of Geophysical Phenomena Al Bedard, Physicist, Adjunct Professor, University of Colorado, NOAA Wave Propagation Laboratory, Boulder, CO
- *Apr. 1 Man-Induced Drought in Egypt Due to Climate Change in the Congo Al Stevens, Consultant, Boulder, CO
- *Apr. 15 Water Resource Problems in Colorado's Future Robert Longenbaugh, Water Resource Engineering Consultant, Lakewood, CO
- *Apr. 22 Mathematical Modeling of Rivers Using Streamtubes: Aluvial River Simulation Albert J. Molinas, Asst. Prof., Civil Engineering, CSU

Date

Topic and Lecturer

*Apr. 29 Turbulence: Measurements and Modeling - Peter Bradshaw, Prof., Mechanical Engineering, ASME Distinguished Lecturer, Stanford University, California

* Room 230, Lory Student Center **Room 203-205, Lory Student Center Refreshments at 3:45 p.m.; Seminar: 4:00 p.m. Call Dr. R.N. Meroney, Professor and Director, Fluid Dynamics and Diffusion Lab, 303/491-8574.

ENVIRONMENTAL HEALTH SEMINAR COLORADO STATE UNIVERSITY - SPRING 1992

Feb. 10 A Case-Control Study of Bladder Cancer and Drinking Water Disinfection - Mike McGeehin, Ph.D Candidate

Apr. 6 A Microbial Indicator System to Differentiate Fecal Pollution in Aquatic Systems - Barbara Stevens, Ph.D Candidate

Apr. 13 Overview of Activities in the Environmental and Occupational Toxicology Division - Dave Villenueve, Div. of Environmental and Occupational Toxicology, Health and Welfare, Canada

Held at Noon, Microbiology Bldg. A108. For more information contact Professor Ray Yang (303/491-7038.

REMOTE SENSING & GIS SEMINAR COLORADO STATE UNIVERSITY - SPRING 1992

- Feb. 10 The Realities of Building a GIS Data Base Lynne Bridgeford, U.S. Forest Service
- Feb. 17 The Integration of Visitor Use, Environmental Data, and Site Development for GIS Applications in Recreation Planning, William J. Gribb, Dept. of Geography & Recreation, University of Wyoming
- Mar. 2 The Integration of GIS and Hydrologic Modeling William Doe, Dept. of Civil Engineering, CSU
- Mar. 9 Applications of GIS for Northern Spotted Owl Habitat Assessment Barbara White, U.S. Fish & Wildlife Service
- Mar. 16 Spring Break
- Mar. 30 Remote Sensing & GIS Applications in the Western U.S. With Emphasis on the Grand Canyon Project, Lee Werth, Bureau of Reclamation
- Apr. 6 DEM Data: Pitfalls and Promises Susan Stitt, National Park Service
- Apr. 20 Wetland Delineation: Combining Field Evaluations with Remote Sensing Don Schrupp, Colorado Division of Wildlife and David Cooper, CSU
- Apr. 27 Physical Erosion Models, GIS Interface, and Watershed Analysis Jacek Blaszczynski, Bureau of Land Management

May 4 Tracking Rain Storms with Radar - Lynn Johnson, Dept. of Civil Engineering, University of Colorado at Denver

Meetings are held 4:10-5:00 Monday, Room 109, Natural Resources Bldg., CSU

GRADUATE-FACULTY SEMINAR COLORADO STATE UNIVERSITY - SPRING 1992

Jan. 31 Oxidation of the Fish Toxicant Antimycin in a High-Gradient Stream - Ken Tiffan, Dept. of Fishery and Wildlife Biology, CSU

- Mar. 6 Comparison of Marking and Siting Population Estimators Gary White, Dept. of Fishery and Wildlife Biology, CSU
- Mar. 13 An Overview of Instream Flow Incremental Methodology Jenny McGraw, Dept. of Fishery and Wildlife Biology
- Mar. 27 Experimental Analysis of Microhabitat Features Selected by Juvenile Coho Salmon and Steelhead in a British Columbia Stream - Kurt Fausch, Dept. of Fishery and Wildlife Biology; and Age and Growth of the Endangered Colorado Squawfish -John Hawkins, Dept. of Fishery and Wildlife Biology

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Date

Topic and Lecturer

Apr. 3 Effects of Heavy Metals on Aquatic Communities - William Clements and Peter Kiffney, Dept. of Fishery and Wildlife Biology

Apr. 10 Determining the Future of Bighorn Sheep in Wilderness Areas - James Bailey, Dept. of Fishery and Wildlife Biology

- Apr. 24 Toxicity of Carbaryl and Malathion to Fishes and Aquatic Invertebrates Dan Beyers, Dept. of Fishery and Wildlife Biology; and Avian Ecotoxicology - Jane Adams, Dept. of Fishery and Wildlife Biology
- May 8 Indirect Effects of Heavy Metals on Brown Trout David Rees, Dept. of Fishery and Wildlife Biology; and The Professional Role of Wildlife Rehabilitation - Liz Molacek, Dept. of Fishery and Wildlife Biology

Meets in Room 132 of the J.V.K. Wagar Bldg. on the CSU campus at 3:10 p.m. on Fridays. For information, contact C.A. Carlson, 303/491-5089.

HOT TOPICS IN NATURAL RESOURCES UNIVERSITY OF COLORADO, NATURAL RESOURCES LAW CENTER - SPRING 1992

Mar. 12 Political Oversight of Public Land Management: What Are the Boundaries?

Apr. 7 Oil and Gas Leasing in the National Forests

May 19 The 1992 Earth Summit in Brazil: Can It Succeed?

The "Hot Topics" luncheon meetings are held at the United Bank Center, 17th and Lincoln, Hershner Room, Denver. For information contact the Natural Resources Law Center at 303/492-1286.

ADDITIONAL SEMINAR SERIES COLORADO STATE UNIVERSITY

Program for Alternatives in Sustainable Agriculture

Fall 1991 Seminar Series had them of "Water in Agriculture." Spring series currently being scheduled. For information contact Ed Sparling (303/491-6946) or Jack Fenwick (303/491-6907)

Range Science Seminar Currently being organized by Prof. W. K. Lauenroth (303/491-7581)

Agricultural and Resource Economics Department Seminar currently being organized by Prof. S. Lee Gray (303/491-6955)

Earth Resources Seminar currently being organized by Ellen Wohl (303/491-5298)

WORKSHOPS, SHORT COURSES, CAMPUS CONFERENCES AND SPECIAL PROGRAMS

COLORADO STATE UNIVERSITY

CONSTRUCTED WETLANDS FOR WASTEWATER TREATMENT, NATIONAL SCIENCE FOUNDATION UNDERGRADUATE FACULTY ENHANCEMENT PROGRAM - COLORADO STATE UNIVERSITY - July 20-31, 1992. Will introduce participants to the rapidly evolving and relatively new technology of designing and constructing wetlands. Will include the topics of Wetlands, Wastewater Treatment Systems, Unit Operation in Wastewater Treatment, Regulatory Opportunities and Difficulties, Models, Community Reactions, Economic Factors and Case Histories. Program followup includes a quarterly newsletter and a second workshop in July 1993 for participant progress reports and discussions. For information contact: Maurice L. Albertson, Project Director, Dept. of Civil Engr., Weber Bldg., Colorado State University, Fort Collins, CO 80523. Phone 303/491-5753; FAX 303/491-7727.

RIVER TOUR SERIES--Platte River Tour - Tour No. 1, June 15-19, 1992; Tour No. 2, July 13-17, 1992; Tour No. 3, Aug. 10-14, 1992. Western Water Issues, including: Operation of River Systems, Endangered Species and Instream Flows, Relicensing Hydroelectric Plants, Cities vs. Agriculture, Water Quality, New Water Projects. Limited Enrollment. Organized and presented by Department of Civil Engineering, CSU. Contact: Janet Lee Montera, Civil Engineering Dept., Colorado State University, Fort Collins, CO 80521-9900. Telephone: 303/491-7425; FAX: 303/491-7727.

12th Annual Hydrology Days, CSU/AGU - March 31-April 2, Lory Student Center, CSU. Call H.J. Morel-Seytoux at 303/491-6762 for more details.

Design of Water Quality Monitoring Networks Short Course, June 8-12; and Activated Sludge Process Control Short Course, June 22-26, Fort Collins, CO. Contact: Office of Conference Services, CSU, 303/491-6222.

CALL FOR PAPERS - RESOURCES AND ENVIRONMENT: EDUCATION, TRAINING AND RESEARCH -July 13-17, 1992, Colorado State University, Fort Collins, CO. Deadline: February 14, 1992. Contact: Neil Grigg or Janet Montera, Civil Engineering Dept., Colorado State University, Fort Collins, CO 80523. Telephone: 303/491-7425 and FAX 303/491-7727.

COLORADO SCHOOL OF MINES

Applied Ground Water Modeling - March 18-22, 1922 and April 20-24, 1992 - International Ground Water Modeling Center. Contact Director Paul K.M. van der Heijde (303/273-3103; FAX: (303/273-3278.

Stormwater Regulations and Permitting - February 13-14, 1992, Dr. G. Mattney Cole, Department of Chemistry and Geochemistry (303/273-3651.

XIVth International Seminar in Piping Design and Pipe Stress Analysis - April 27-May 1, 1992, Dr. Mogens Henriksen, Dean of Engr., Univ. of North Dakota, School of Engr. and Mines (701/777-3412).

Transport and Fate of Petroleum Hydrocarbons and Organic Solvents in Environmental Systems - Summer 1992, Dr. Helen Dawson, Asst. Professor, Dept. of Environmental Science and Engineering (303/273-3402)

UNIVERSITY OF COLORADO

The Greater Yellowstone Ecosystem: Grizzlies, Wolves, Logging, and Mining - Natural Resources Law Center - Public address by NRLC Distinguished Visitor Ed Lewis, 7:30 p.m. CU School of Law. March 12, 1992. Call 492-1286.

Environmental Law Program - Natural Resources Law Center/Boulder Bar. Held at CU School of Law in Boulder April 25. Call 492-1286 for details.

Trends in Natural Resources Law and Policy: A Symposium Celebrating the Tenth Anniversary of the Natural Resources Law Center (with anniversary Dinner). June 13, 1992. CU School of Law. Call 492-1286 for details.

Uncovering the Hidden Resource: Groundwater Law, Hydrology and Policy in the 1990s - in conjunction with the Rocky Mountain Groundwater Association. June 15-17, 1992. University Memorial Center, Univ. of Colorado. Call 492-1286 for information.

MEETINGS

PRELIMINARY PROGRAM

COLORADO WATER ENGINEERING AND MANAGEMENT CONFERENCE Including AWRA, COLORADO SECTION SYMPOSIUM

and Program of Excellence Distinguished Lecture "Water and Civilization"

MARCH 2-3, 1992

HOLIDAY INN DENVER SOUTHEAST, 3200 SOUTH PARKER ROAD, AURORA, COLORADO

Monday, March 2, 1992

8:00-10:00	Coffee and Ed	ucational Displays {Main Lobby}
10:00-10:20	Opening Sessi	Daw-Day Registration Hun 4 @ 5100 = 5
	Welcome:	Neil S. Grigg, Head, Department of Civil Engineering, Colorado State University
	Welcome:	Jeris Danielson, State Engineer
	Remarks:	Judson Harper, Vice-President for Research, Colorado State University

10:20-12:00 N Session 1: (Plenary) - Moderator: Neil Grigg

8:00-10:00 AM Registration (Main Lobby)

Colorado's Environment - Ken Salazar (invited); Environmental Issues - Speaker TBA; Wetlands Issues and Federal Regulations -Gene Reetz, USEPA, Region VIII; Wilderness and Water - Hank Brown's Staff (invited)

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12:00-1:30 P	M Lunch	neon (S	peaker TBA) I	Moderator: TBA	Lony Stud	h 31-April 2				
1:30-3:00	Session 2A:	Surfa	ce Water Issu	ies and Water	Rights - Mo	derator: TBA				
1:30-3:00	Session 2B:	Climat	te Change, Di	oughts and W	atersheds -	Moderator:	IBA			
1:30-3:00	Session 2C:	Comp	uting Innovat	ions in Water	Resources -	Moderator:	IBA			
3:00-3:30	Break With	Educati	onal Displays							
3:30-5:00	Session 3A:	Wate	r Quality Issu	es - Moderator	: TBA					
3:30-5:00	Session 3B:	Dam S	afety and PM	IP Issues - Mo	derator: TB	A				
3:30-5:00	Session 3C:	Decis	ion Support S	ystems - Mode	erator: TBA					
5:00-6:30	Reception V	Vith Edu	ucational Disp	lays		A bea \$591				
6:30 PM	Dinner and	Progran	n of Excellenc	e Distinguished	Lecture - D	r. Vujica Yev	jevich - "WA	TER AND CIVILIZ	ATION"	
				Tue	sday, March	3, 1992				
7:30-8:30 AN	A Regist	ration {	Main Lobby}							
8:30-10:00	AWRA, Co	lorado	Section Annu	al Meeting and	d Session 4:	(Plenary) M	Aoderator: Ev	an Elá		ANVIX
	Water Qual	ity Issu	es in Colorad	o - David Holm,	Director of V	Water Quality	Control Divi	sion; Julie Krause,	State Engineer'	's Office
10:00-10:30	Break With	Educati	onal Displays							
10.30 12.00	Section EA.	Crown	dwater Quali	ty Moderator	TDA					
10.30-12.00	Session 5R:	Fcon	uwater Quan	Water Desour	IDA	ator TRA				
10:30-12:00	Session 5C:	Confli	ote and Mana	water Resour	Moderator	TDA				
10.30-12.00	Session 5D:	Hydra	ulics and Riv	er System Mar	- Moderator.	Moderator: T	RA			
10.50-12.00	Session SD.	nyura	and and Kiv	er oystem mar	lagement - 1	wouchator. 1	uniterini			
12:00-1:30 PI	M Lunch	eon (Sj	peaker TBA) -	Moderator: TI	BA - Middle	e East Water	Issues	ug OCT Jawas I Shi		
1:30-3:00	Session 6A:	Agricu	Itural Impact	ts on Water Qu	uality and V	VQ Assessme	ent Program	- Moderator: TBA	ana J Interaction	
1:30-3:00	Session 6B:	Conta	minant Evalu	ation and Tre	atment - Mo	oderator: TBA	4			
1:30-3:00	Session 6C:	Grou	ndwater Man	agement - Mod	lerator: TBA					
1:30-3:00	Session 6D:	Water	r Rights and	Water Manage	ement - Mod	erator: TBA				
3:00-3:30	Break	With E	ducational Dis	plays						
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3:30-5:00	Session 7A:	Storm	water and No	onpoint Source	es - Moderato	or: TBA				
3:30-5:00	Session 7B:	Hydra	ulics and Irri	gation Issues -	Moderator: '	TBA				-
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WATER NEWS DIGEST

WATER TRANSFER

Governor Requests Delay in Largest Water Purchase in Region's History

Colorado Governor Roy Romer has requested a delay in a plan by Colorado Water Supply Co. to buy 48,000 acre-feet of water from the Fort Lyon Canal for use by Front Range cities. Gov. Romer believes such transfers threaten the future of Colorado agriculture. He acknowledged the right of farmers to sell their water rights but requested that the farmers be given until Feb. 28 to decide whether to sell, rather than the Jan. 13 deadline given by the purchaser. Colorado Water Supply Co. is an affiliate of Colorado Interstate Gas Co. and is considering buying the water and building a pipeline system to transport it to Front Range users. Under the proposed deal, CIG would receive about 16 billion gallons of water per year from the Fort Lyon Canal. The transfer would eliminate about 48,000 to 50,000 acres of irrigated farmland in the lower Arkansas Valley.

Montrose Daily Press 12/17/91, Rocky Mountain News 12/25/91

Greeley to Buy Water Rights

The Greeley City Council has agreed to issue \$6.6 million in bonds to buy rights to 2.1 billion gallons of water from Greeley-Loveland Irrigation Co. stockholders. The purchase secures Greeley's future water supply and protects the water rights from other Front Range cities looking for new water sources.

Montrose Daily Press 11/21/91

Drought-ridden California Tries Some Solutions, Debates Others

As California enters its sixth year of drought legislators are seeking water supply solutions, and the benefits and problems of water marketing are being debated. California Governor Pete Wilson has signed several new water laws passed by the legislature in 1991 and more will be considered in 1992. Legislation authorizes water suppliers during 1991, and 1992 if necessary, to sell water to the state drought water bank. Transfers are authorized whether or not the water is surplus to the needs of the supplier's service area. Although the water bank was a success, many are wary of future transfers if they mean that water will be treated as a free-market commodity.

On Dec. 11, more than 100 California utilities and public interest organizations signed an agreement to work together to protect California's water supply. The statewide Urban Water Conservation Charter contains 16 "Best Management Practices" (BMPs) designed to deliver annual savings equaling the amount of water used by 2.5 to 5 million Californians each year. These include indoor and outdoor water audits, installation of water-efficient plumbing such as low-flow shower heads and ultra low-flush toilets, leak detection programs, and landscape water conservation ordinances.

Owens County Water Reporter 12/22/91

WATER ALLOCATION

Conservation Board Adopts New Stream Flow Policy

The Colorado Water Conservation Board has adopted a new policy allowing river water, originally planned to be held in reservoirs, to be converted into stream flows. Three years ago, The Nature Conservancy sought to donate some senior Gunnison River water rights to the Board, provided those rights were converted to instream flows through the Black Canyon of the Gunnison. Water developers worried that if many of the dam-building water rights held by private groups were converted to instream flows, there would be so much water legally dedicated to stream flows that no new dams could be built. In November, the Conservation Board gave initial approval to a compromise policy that would allow the state to convert dam-building rights into stream flows if the acquisition poses no "significant negative effects" to future water development in the state. The Board has since accepted the donation from The Nature Conservancy, marking the first time the state has converted a water right for a dam into an instream-flow water right.

In a related move, the Conservancy Board reversed an earlier decision and is now backing Gunnison Basin water users in their efforts to protect instream flow rights against Front Range claims. The Upper Gunnison Water Conservancy District is seeking to have those rights affirmed by the Colorado Supreme Court. Arapahoe County wants to divert water from the Gunnison Basin, while the district wants to refill Taylor Reservoir and release the water for fisheries and recreation.

In addition, the US Department of Interior has announced plans to give fish and wildlife priority in formal negotiations aimed at securing a formal contract to use water stored in Blue Mesa Reservoir to improve and protect Gunnison River streamflows. The plan for public negotiations between federal and state agencies clears the way for passage of a wild and scenic river bill for the Gunnison River and a final decision on the AB Lateral hydropower project. The talks will be between the US Bureau of Reclamation, Bureau of Land Management, National Park Service, Fish and Wildlife Service, and the Colorado Water Conservation Board.

Denver Post 12/16/91, 1/23/92; Grand Junction Daily Sentinel 11/21/91, Ft. Collins Coloradoan 12/20/91

NATIVE AMERICAN WATER RIGHTS

Decree Settles Southwest Colorado Water Case

The Ute Mountain Ute and Southern Ute tribes filed a consent decree last month settling a 15-year-old water case involving 11 rivers. The tribes initially claimed water rights dating back to formation of the Ute reservation in 1868. The decree represents negotiated agreements between the two tribes, the state of Colorado and water users. Part of the decree gives the tribes water through the Animas-La Plata water project. According to the settlement, \$5 million appropriated by Colorado in 1981 to litigate the case will be used to build a pipeline from Cortez to Towaoc to provide the Ute Mountain Utes with their first drinking-quality water.

Montrose Daily Press 12/20/91, Ft. Collins Coloradoan 12/6/91

Tension Grows Between Native Americans and Environmentalists

The Ute Indians in southwest Colorado face a threatened court battle with environmentalists, who have vowed to stop the Animas-La Plata project. Environmentalists cite peril to the endangered Colorado squawfish and the razorback sucker. Native Americans point out that they were put on reservations where it is nearly impossible to make a living, and are now facing restrictions on use of their land. The Animas-La Plata project would bring jobs to the two Ute tribes in southwest Colorado, where federal statistics say 35 percent of the Utes are unemployed, and tribal leaders say unemployment is closer to 60 percent. Similar lines are drawn in other areas of conflict, such as the Pacific Northwest, where Native Americans who fish for salmon support hatcheries, but environmentalist oppose them, concerned that artificial breeding saps the vitality of the species. Navajos in Arizona are also concerned that environmental restrictions could affect jobs in the coal mines, which are the largest employers in the Navajo Nation.

Denver Post 1/5/92

WATER PROJECTS

Controversial Project Receives BuRec Approval

The US Bureau of Reclamation has recommended approval of the AB Lateral Project in western Colorado although it would nearly double the volume of water diversion from the Gunnison River above the Black Canyon of the Gunnison National Monument. The Bureau's record of decision established certain conditions that the sponsors of the project must meet to protect streamflows through the Black Canyon. The Uncompandere Valley Water Users Association and Montrose Partners, sponsors of the project, can now consider the conditions and determine if they wish to proceed with the project. Originally approval was put off until the National Park Service could quantify the national monument's water right, but the Bureau went ahead because of an agreement by the sponsors to sign a contract requiring them to protect canyon streamflows.

Ft. Collins Coloradoan 12/22/91

Animas-La Plata Still Stalled

A threatened lawsuit has put the Animas La-Plata water project on hold, although federal officials say that construction would not have begun in winter anyway. A 60-day notice of intent to sue was served in October by the Sierra Club Legal Defense Fund for the Taxpayers for the Animas River, the Four Corners Action Coalition, the Sierra Club, the Colorado Wildlife Federation, the National Wildlife Federation and the Southern Utah Wilderness Alliance. They claim the project has changed enough to require new environmental studies from the Bureau of Reclamation. The first Animas-La Plata contract, for archaeological artifacts recovery from the Ridges Basin Reservoir site, most likely would not be awarded until April. Other contracts for construction are being prepared inhouse to ensure environmental compliance.

Montrose Daily Press 1/3/92

Wolford Mountain Reservoir Approved

The Wolford Mountain Reservoir has received final approval from the US Department of Interior. The project will be built north of Kremmling to provide water for Denver and the Western Slope. The agreement calls for Denver to buy 15,000 acre-feet of water a year from Wolford Mountain, to make up for additional diversions from Dillon Reservoir, leaving 7,000 acre-feet a year for Western Slope water users and endangered fish in the Grand Valley.

Grand Junction Daily Sentinel 1/2/91

San Juan Water Commission to Apply for Water

San Juan, New Mexico, water commissioners plan to seek all the water available to the commission under the proposed Animas-La Plata water project. The Commission will apply to the state engineer for all the water in case the project is never built. If the commission does not hold the water allocated under the project, the water would revert to public domain under state statutes. The commission's request will be done in concert with an application made earlier this fall by the city of Aztec for all the water to which it is entitled. The commission represents San Juan County, the San Juan Rural Domestic Water Users Association, and the cities of Aztec, Bloomfield and Farmington.

Montrose Daily Press 12/4/91

Bill Seeks Deauthorization of Unbuilt Water Projects

Colorado water officials and politicians are looking for ways to block a bill introduced by U.S. Representative George Miller (D-CA) to deauthorize Colorado water projects that have been on the books for years but have not been built. H.R. 429, an omnibus reclamation bill, contains a section by Miller requiring the Secretary of the Interior to report on all unfinished projects of the Colorado River Storage Project. The report would include economic analyses of each project, and recommendations whether the authorization for each project should be terminated. Among the projects are the West Divide Project near Silt, the San Miguel Project near Norwood, the Savery-Pothook project in northwestern Colorado on the Wyoming border and Fruitland Mesa near Crawford.

The bill originally called for immediate deauthorization of the projects in a complicated trade for more funding for the Central Utah Project. U.S. Rep. Ben Nighthorse Campbell (D-CO) proposed a study instead of the immediate deauthorization. His idea is to help Colorado still tap some of the power revenues earmarked to build the four projects, but to use them on other projects.

Grand Junction Daily Sentinel 12/9/91

Agreement Reached on Water Pipeline

Fort Lupton and the Northern Colorado Water Conservancy District have reached an agreement to provide mountain water through a water pipeline project. The project would add a pipeline to one currently being built from Carter Lake to Broomfield and would service the communities of Fort Lupton, Platteville and Hudson.

Montrose Daily Press 1/10/92

Reservoir Proposal Revived

Western States Water & Power has filed a preliminary application with the Federal Energy Regulatory Agency for a 750,000-acre-foot reservoir and a 2,5000-megawatt hydroelectric generating plant. The project would be built on the Gunnison River between Delta and Grand Junction. The U.S. Bureau of Reclamation originally planned to build the Dominguez Reservoir but abandoned the project nearly a decade ago, saying it was not economically feasible. WSW&P has redesigned the project, originally a water project, to be an energy project.

The Colorado Environmental Coalition, on behalf of nine other environmental groups, has filed a petition with FERC to stop construction, arguing that the project would inundate 30 miles of the Gunnison River and several thousand acres of the Dominguez Canyon Wilderness Study Area, which the BLM has recommended for permanent wilderness protection.

Grand Junction Daily Sentinel 11/22/91, 1/17/92

WATER QUALITY

Drinking Water Escapes Contamination

Radioactive runoff into Clear Creek never reached area drinking water supplies, according to EPA officials. A main burst on Colorado School of Mines campus in Golden, sending water containing uranium and heavy metals from an instructional mine into an old tailings pond. Stream water from Clear Creek was diverted before it reached metro area water supplies.

Denver Post 1/27/92

Suit Threatened on Lead in Water

The Sierra Club Legal Defense Fund plans to sue the state of Colorado if it does not start providing day-care centers with information on lead contamination in drinking water. The federal Safe Drinking Water Act requires states to provide information about lead contamination to both schools and day-care centers. EPA guidelines explain the hazard and tell schools how to identify and eliminate it. Colorado has distributed the EPA guidelines to primary and secondary schools, but the Legal Defense Fund plans to file suit if the state does not provide the same information to day-care centers within 60 days.

Denver Post 1/17/92

Duckweed May Help Reduce Nonpoint Source Pollution

Duckweed, a tiny floating plant in the Lemna family, may be an effective and cost-efficient method of treating nonpoint source nutrients. These plants are among the fastest growing on earth and can assimilate large quantities of nutrients and pollutants from water. A biological process was developed to use these attributes and has been applied to wastewater treatment of domestic and industrial wastes. A project underway by the Denver Regional Council of Governments, the Chatfield Basin Authority, and the Lemna Corporation will evaluate this technology on Plum Creek in Chatfield. Using water from Plum Creek, plants will be grown and harvested and the treated water will be returned to Plum Creek, thereby reducing the load of phosphorus entering Chatfield Reservoir. Duckweed can be harvested and used as animal fodder or as a phosphorus-recycling compost. The reservoir has been identified as a eutrophic waterbody not meeting its beneficial uses as defined by the Water Quality Control Commission. If the duckweed project is successful, the Chatfield Basin Authority will have an affordable best management practice for nonpoint source control.

Interview with Russell N. Clayschulte, DRCOG, 2/3/92; The Colorado Conservator 12/91

Hopi Reservation is Focus of Water Quality Study

A grant from the EPA has helped bring about an agreement between the Hopi tribe and Northern Arizona University to monitor water quality and supply problems on the reservation. The Hopis will give the university a portion of the grant to evaluate water quality. Initial studies will examine possible contamination of water from uranium mill tailings, wastewater facilities, and coal mining. A team of university researchers will collect water samples throughout the reservation as well as make assessments of groundwater availability. In addition, the university will hire and train between eight and ten undergraduate and graduate Native American students to work on the project.

U.S. Water News 12/91

WILDERNESS

Controversy Surrounds Federal Wilderness Water Proposal

Water developers and environmental groups have criticized a federal river protection plan aimed at ending the decade-long impasse over the designation of new Colorado wilderness areas. The U.S. Forest Service released the plan in an attempt to persuade the Colorado Water Conservation Board to guarantee streamflows through a 15-mile stretch of the Piedra River in southwesterm Colorado. The Forest Service proposal would require all natural springtime flood flows to remain in the Piedra in some wet years. In drier years, about 15 percent of peak springtime river flows could be diverted by future water developers. Developers also would be allowed to take more than half of the natural streamflows cause by major late summer rainstorms.

The Piedra proposal is a key test for the wilderness compromise last year between U.S. Senators Tim Wirth and Hank Brown of Colorado, giving the state control over wilderness streamflows. Some Congressional leaders have doubted the state's willingness to protect wild rivers in federal areas. The Wirth-Brown wilderness bill passed the Senate but awaits action in the House of Representatives.

Denver Post 1/24/92

NATIONAL WATER POLICY ROUNDTABLE, Interstate Council on Water Policy, Washington, DC. Contact: Amy Middleton, Freshwater Foundation at Spring Hill Center, 725 County Road Six, Wayzata, MN 55391. Phone: (612)449-0092; FAX: (612)449-0592.
SUSTAINABLE AGRICULTURE CONFERENCE - PRINCIPLES, POLICIES AND PRACTICES, k Northglenn, CO. Contact: Lauren May at (303)491-6432 or Fred EchoHawk at (303)654-0425.
FOURTH ASCE WATER RESOURCES OPERATIONS MANAGEMENT WORKSHOP, Mobile, AL. Contact: ASCE, 345 E. 47th St., New York, NY 10017-2398. Phone: 1-800-548-ASCE or (212)705-7139. FAX: (212)980-4681.
AWRA NATIONAL SYMPOSIUM ON AVAILABILITY OF GROUNDWATER RESOURCES, Raleigh, NC. Contact: AWRA, Michael C. Fink, 5410 Grosvenor Lane, Ste 220, Bethesda, MD. Phone: (301)493-8600; FAX: (301)493-5844.
AGRICULTURAL WATER QUALITY PRIORITIES, A TEAM APPROACH TO CONSERVING NATURAL RESOURCES, Beitsville, MD. Contact: Ms. V. Hupfer at (301)504-8112; Dr. Timothy J. Gish (301)504-83788; or Dr. Ali Sadeghi (301)505- 6693.
WATER RESOURCES AND ENVIRONMENT: EDUCATION, TRAINING AND RESEARCH, Fort Collins, CO. Contact: Neil Grigg or Janet Montera, Civil Engr. Dept., Colorado State University, Fort Collins, CO 80523. Telephone 303/491-7425; FAX 303/491-7727.
ADVANCES IN PLANNING, DESIGN AND MANAGEMENT OF IRRIGATION SYSTEMS AS RELATED TO SUSTAINABLE LAND USE, Leuven, Belgium. Contact: Conference Secretariat, Center for Irrigation Engr., Vital Decosterstraat 102, 3000 Leuven, Belgium. Phone: +32-16-23 13 81; FAX: +32-16-23-06 07.
DAM SAFETY, OPERATION AND MAINTENANCE (An International Technical Seminar and Study Tour - Colorado, Nevada, Arizona). Contact: American Water Foundation, 1616 17th St., Denver, CO 80202. Phone: (303)628-5516; FAX: (303)628-5469.
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Colorado Water Resources Research Institute Colorado State University Fort Collins, CO 80523

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Dancer Post 1/34/92

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Denver Past UE1/92

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