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

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OCTOBER 1997

WATER LEADERS MEET IN GUNNISON FOR 22ND ANNUAL COLORADO WATER WORKSHOP

THIS YEAR'S TOPIC:

WATER PARTNERSHIPS

See Page 12



Fred E. Anderson, Public Affairs Consultant and former State Legislator, was first honoree of the Colorado Water Workshop's new annual series, "Western Water Legends"

UPCOMING MEETINGS

GROW WITH THE FLOW -- 8th Annual South Platte Forum -- see page 43 FLOOD 1997 -- To assess the July 28, 1997 Fort Collins Flood -- see page 43 A RIVER OF DREAMS AND REALITIES -- PAST, PRESENT, FUTURE --4th Annual Arkansas River Basin Water Forum -- see page 42

For a listing of Fall Seminars see page 34



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Western Water's Livit	ng Legends	
Wise Water Stewards	hip Through Partnership	
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COLORADO WATER

Vol. 14, No. 5

October 1997

Editor: Writers: Shirley Miller Maile Ceridon Jennifer Mauch Laurie Schmidt

COLORADO WATER is a publication of the Colorado Water Resources Research Institute. The scope of the newsletter is devoted to enhancing communication between Colorado water users and managers and faculty at the research universities in the state. This newsletter is financed in part by the U.S. Department of the Interior, Geological Survey, through the Colorado Water Resources Research Institute. The contents of this publication do not necessarily reflect the views and policies of the U.S. Department of the Interior, nor does mention of trade names or commercial products constitute their endorsement by the United States Government.

Published by the Colorado Water Resources Research Institute, Colorado State University, Fort Collins, CO 80523.

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Robert C. Ward, Director

(Please note that all 1996 issues of COLORADO WATER should be Vol. 13 and all 1997 issues should be Vol. 14).

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FROM "BEST LAID PLANS" TO LESSONS LEARNED

Editorial by Robert C. Ward, Director

A small creek that runs through the southern part of Fort Collins experienced a flash flood on the evening of July 28, 1997. Over the past ten years, this creek has received considerable stormwater protection improvements from the City of Fort Collins. The devastation experienced by residents and businesses along Spring Creek reminds us of the power of water and of Robert Burns' words, "The best laid schemes o' mice an' men, gang aft agley (often go awry)."

We take our understanding of water, and our understanding of risk, and install the best stormwater protection system we can afford. Then, after a flood like the one Spring Creek experienced on July 28, we ask hard questions about our *true* understanding of water, risk, and economics. As we ask these questions, we hope to learn more about such events in Colorado and to be better prepared for the next occurrence of a flash flood. This need to learn from our failures has been well articulated by Henry Petroski in his book, *To Engineer is Human*.

The Colorado State University (CSU) Water Center, under the direction of Neil Grigg, is organizing a Flood Conference to be held on November 6, 1997, at the Lory Student Center on the CSU campus. The purpose of the conference is to assess and produce a permanent record of the technical, social, and economic consequences of the July 28 flood. At the end of the conference, there will be a session on "lessons learned."

The flood reminds us of the importance of water education, not only for the engineers who design stormwater protection systems, but also for citizens and their elected representatives. Considerable political will is needed to overcome citizen opposition to stormwater protection systems that require the removal of homes, businesses, and public buildings from flood plains. Continuing education efforts are essential to ensuring that flood plain zones are respected during periods of community growth.

We are also reminded of the importance of water research. As the population of Colorado continues to expand, the infrastructure of urban Colorado is increasingly moving into and dominating natural processes, or so we think. We must gain a more comprehensive understanding of the consequences of disrupting natural processes if we are to lighten the human "footprint" we place on the Colorado environment. At the same time, we must reduce the threat that natural processes pose to our "best laid plans."

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RESEARCH OPPORTUNIMES

National Science Foundation

The National Science Foundation is initiating a program, *Science and Technology Centers (STC): Integrative partnerships*, to foster integrative research, education and knowledge transfer. The centers will provide support to bring together diverse expertise and facilities from academia, industry and national laboratories -- an innovative opportunity for conducting world-class research. While there will be a wide range of eligible topics, research at the frontiers of hydrology, watersheds, and geochemistry would offer many opportunities for large, integrated, interdisciplinary inter-university partnership studies. Innovative proposals presenting cutting-edge water research are encouraged. Approximately \$25 million will be awarded annually (ranging from \$1.5 to \$4 million per center) to support 8-10 new centers. Initial commitments are for five years, with potential for 10-year funding. Check the NSF web page for details. Interested teams should expect to submit notices of intent by December 1, 1997, and 15-page preproposals by January 6, 1998. For information contact: Shanna Draheim, Program Manager, Earth Sciences Division, at: sdraheim@nsf.gov.



NRI Competitive Grants Program

The Cooperative State Research, Education, and Extension Service (CSREES) of the U.S. Department of Agriculture is inviting applications for the National Research Initiative Competitive Grants Program for Fiscal Year 1998 in agricultural, forest, and related environmental sciences. Deadlines for submitting proposals range between November 15, 1997 and February 15, 1998. For additional information contact your Contracts and Grants Office or E-mail to: nricgp@reeusda.gov.

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DROUGHT HISTORY PROJECT TAKES SHAPE

by Matt Hildner, Graduate Student Department of History, Colorado State University

In the mid-1970s, a drought hit the state of Colorado and left government officials scrambling to devise a relief plan. State officials logically looked to the past to see what approaches had been used to deal with previous droughts. Unfortunately, their search yielded more frustration than answers. Little organized historical information was available to guide policymakers.

Over the past two decades, Colorado has managed to avoid droughts with consequences as serious as the one that occurred in the late 1970s. For Len Boulas, the current chairman of the state's Drought Task Force, finding historical information about the area's previous droughts retains its importance. In early 1997 CWRRI, in conjunction with the State Drought Response Organization, provided funding to Professor Mark Fiege, an environmental historian at Colorado State University (CSU), to begin a preliminary study on the drought that hit Colorado in the early and mid-1950s. As a graduate student in the Department of History at CSU, I assisted Dr. Fiege in compiling a bibliography of primary and secondary sources relating to this event. Our goals in conducting the study were to aid other researchers in the search for information about the drought and to produce an article or monograph at a later date.

The direction of the study and the decision to begin with the 1950s drought owe much to Boulas' influence. His own efforts to learn about past droughts revealed that there were few studies about the 1950s, despite the era's relevance to present-day concerns and the fact that this was the last time that Colorado experienced a multi-year drought event. Unlike previous dry periods in the 1880s and 1930s, the drought of the 1950s came at a time when urbanization of the Front Range was increasing, and a large network of storage reservoirs had been built to meet the area's needs for water. These circumstances most approximate the situation that future drought managers will face; therefore, the 1950s drought provides an ideal case study.

Research involved trips to libraries, archives, and historical collections throughout the state. Although the bibliography includes summaries of books and articles. the majority of the research focused on the search for primary information: reports, documents, memorandums, notes, and letters of both agencies and individuals that dealt with drought. Federal agencies include the Bureau of Reclamation; the Geological Survey; the Department of Public Works; and the Department of Agriculture's Soil Conservation Service, Economic Research Service, and Agricultural Marketing Service. State and local agencies and organizations include CSU's Cooperative Extension; Department of Game, Fish, and Parks; Department of Natural Resources; Denver Water Board; the Northern Colorado Water Conservancy District, the Great Plains Agricultural Council; and the State Agricultural Commission. The bibliography also includes brief descriptions of the papers of Governors Dan Thornton and Ed Johnson, U.S. Representatives J. Edgar Chenoweth and Wayne Aspinall, and U.S. Senator Gordon Allot.

This represents the first phase of a project that, with further funding, will continue to examine the history of drought in Colorado. Dr. Fiege serves as principal investigator on the project.

If you are interested in obtaining a copy of the bibliography, contact the CWRRI office by phone 970/491-6308, FAX 970/491-2293, or email CWRRI@colostate.edu.

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EVALUATION OF SAMSON FOR USE IN A SOUTH PLATTE DECISION SUPPORT SYSTEM

The following article summarizes a report prepared by John H. Raymond, Research Assistant; Luis A. Garcia, Assistant Professor; and Robert Lange, Research Associate, of the Integrated Decision Support Group (IDS) at Colorado State University; in cooperation with Jon Altenhofen, Northern Colorado Water Conservancy District; Ray Bennett and James R. Hall, State Engineer's Office, Colorado Division of Water Resources; Forest Leaf, Central Colorado Water Conservancy District; and Jack Odor, Groundwater Appropriators of the South Platte.

BACKGROUND

The South Platte River Basin, located mostly in the State of Colorado, has a drainage area of about 24,300 square miles and is one of the main tributaries to the Missouri River. According to the U.S. Geological Survey, the estimated total off-stream water diverted from the South Platte River Basin in 1990 was 12,000 acre-feet per day or 4.4 million acre-feet per year. Of this amount, 71 percent is surface water and 29 percent is groundwater. The principal uses were irrigation (70.8 percent), power generation (14.6 percent), and domestic use (8.4 percent).



Figure 1. Location of the study unit and selected cities and streams in the South Platte River Basin.

The State of Colorado plans to develop a decision support system (DSS) for water management in the South Platte River Basin. Due to the unique characteristics of the basin with its complex interaction of surface and groundwater, the framework of the proposed DSS is expected to be slightly different from other basins in Colorado. The SAMSON (Stream-Aquifer Model for Management by Simulation) Model, developed in the 1980s specifically for the South Platte River Basin, was recommended by Past studies for use in a South Platte DSS.

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The original version of the SAMSON Model was completed in 1987. It was developed over a 15-year period as a river basin model, specifically for the South Platte, to provide daily management information and guidance for long-term planning. This included developing the conjunctive use of water to the fullest extent and understanding how to recharge the aquifer -- even with the complex interactions of water rights, irrigation, pumping diversions, and water reuse. The model depicts stream-aquifer interactions and the effects of pumping for the reach of the South Platte River from Balzac to Julesburg.

CWRRI/IDS SOUTH PLATTE MODEL EVALUATION

To bring together data collection efforts and explore common modeling approaches, the Integrated Decision Support (IDS) Group and a group of representatives from water user organizations cooperated on the CWRRI project, "South Platte Model Evaluation Project." An advisory committee was formed with the following representatives: Jon Altenhofen, NCWCD; Ray Bennett and James Hall, the State Engineer's Office (Denver and Greeley offices); Forrest Leaf, CCWCD; and Jack Odor of GASP.

The South Platte Model Evaluation Advisory Committee met regularly during 1996 and 1997 to evaluate available data, the data needs of basin water users, and modeling strategies for a South Platte DSS. As part of this effort, CSU's Integrated Decision Support group (IDS) evaluated the SAMSON Model to assess what role the model could play in meeting those needs. Four phases were completed to evaluate the model:



Advisory Committee Evaluates Data Needs of South Platte Basin Water Users. From Left: James Hall, Jon Altenhofen, Scott Bartling, Anna Perea, Dave Patterson, Brad Wind, Lori Marchando, Jack Odor and Luis Garcia.

- Phase 1 -- Literature was reviewed to provide an understanding of the basin including water resources, water rights, water management institutions, compacts, water quality, endangered species and the proposed three-state memorandum of agreement.
- Phase 2 -- The SAMSON Model was run to identify its physical constraints and strengths, the data requirements, the data availability for the model, and the model's limitations.
- Phase 3 -- The Advisory Committee met to develop an understanding of the specific needs of the basin and to work on data
 and development of some components.
- Phase 4 -- The original sample data for SAMSON were reformatted to run with the latest version of SAMSON. The data
 were developed to formulate and calibrate the South Platte River Basin from Denver to the Nebraska state line. Some minor
 modifications were made to the code.

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RESULTS OF EVALUATION OF THE SAMSON MODEL

Since the initial development of the SAMSON model, computer speed and availability have revolutionized the modeling process and users expect a much higher degree of interaction with models. Consequently, there have been significant advances in hardware technology and in the philosophy of software development. Modeling philosophy has evolved toward building DSS frameworks composed of small modules rather than a single, very complex model. A modular design allows for the inclusion of models from different sources within a data-centered approach. These systems typically have a relational database with routines for pre and post processing and interchange of data that are generic enough to support multiple models.

The IDS staff and its advisory committee, in its report to CWRRI Director Robert C. Ward, noted the following:



IDS Staff and Advisory Committee for South Platte Model Evaluation Project Discuss Unique Characteristics of the River Basin



Advisory Committee and IDS Staff Review Model Developments

SAMSON was developed during the late 1970s and early 1980s, and was a very valuable tool that proved water resources modeling applications for the South Platte River Basin were both possible and feasible ... At the time of its development, the model could only be run as batch files on a main-frame computer. Multiple runs for different scenarios and user interaction were kept to a minimum since the user would literally have to schedule a model run on a main-frame. Therefore, building the input dataset and reviewing the output were typically one-time events and not interactive. Given the technical limitations of the time, SAMSON provided a general understanding of the interaction of surface and groundwater in the South Platte River Basin and more importantly ... provided a valuable service by proving that surface and groundwater could be modeled as a combined system, even in such a complex system as the South Platte River Basin.

RECOMMENDATIONS OF THE IDS STAFF AND ITS ADVISORY COMMITTEE

When the SAMSON model was originally developed, the modeling philosophy was geared toward a one-time, comprehensive model run, which was standard practice. However, current modeling approaches emphasize building smaller, independent and data-driven components that deal with one task such as consumptive use. Data interchange mechanisms can be used to assemble different components into a DSS framework. Components of SAMSON could be used as part of a future DSS, but these components would need to be separated from the main program and some of the computer code might need to be modified in the light of current modeling approaches.

CURRENT DEVELOPMENT EFFORTS

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The South Platte Advisory Committee has been promoting the idea of doing "modular" development based on a data-centered approach. This means that the data are generic and developed in such a way that all modeling efforts can use the same data. Individual models will be developed that can be part of a larger framework and can be substituted or added with little impact to the overall structure of the system. Currently, the South Platte Water Rights Management System (SPWRMS) has become the first module in this framework. This modeling effort does not include any work with groundwater or consumptive use. Therefore, the committee has recommended that the work being proposed here along with other efforts be undertaken to complement the current work being done with the SPWRMS. All these efforts will eventually be merged into what the State of Colorado hopes will be called the South Platte River Basin Decision Support System or even a more general system for the whole state of Colorado.

There is currently no crop-type coverage considered accurate enough to determine consumptive use for irrigated agriculture. An effort is currently underway to obtain Landsat TM and IRS-1C panchromatic images for the South Platte River Basin. This year's work will concentrate on purchasing Satellite images for Water District 64 (the water district in the lower South Platte River Basin of Colorado stretching from eastern Morgan County to the state line with Nebraska) which is estimated to cost \$12,000. The costs for images along with costs to develop the computer software for processing the images are being funded by a group of water users including: the Ground Water Appropriators of the South Platte, the Northern Colorado Water Conservancy District, the Lower South Platte River Group, Inc., the State Engineer's Office, and the Lower South Platte Water Conservancy District. Satellite images can be used to create accurate field boundary and canal locations. Using established techniques, a preliminary crop-type coverage can be developed. This coverage can be improved with low-altitude aerial photos, and could ultimately be verified by ground-truthing.

CONTINUING MEMBERSHIP

Membership on the advisory committee (CWRRI task force) continues to be:

Luis Garcia, Chemical and Bioresource Engineering Dept. (Chair) Jon Altenhofen, Northern Colorado Water Conservancy District Ray Bennett, State Engineer's Office James R. Hall, State Engineer's Office Forest Leaf, Central Colorado Water Conservancy District Jack Odor, Groundwater Appropriators of the South Platte Brad Wind, Northern Colorado Water Conservancy District Scott Bartling, Northern Colorado Water Conservancy District

BUDGET

Representatives of the supporting organizations have requested that the task force continue during 1997/98 and have agreed to continue their funding support. As a result, CWRRI has agreed to continue providing matching funds.

A copy of Completion Report No. 191, Evaluation of SAMSON for Use in a South Platte Decision Support System, is available at no cost from CWRRI. Contact our office by phone 970/491-6308, FAX 970/491-2293, or email CWRRI@colostate.edu.

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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

Training & Education for Agricultural Chemicals & Groundwater, Reagan M. Waskom, Soil & Crop Sciences. Sponsor: Colorado Department of Agriculture. Habitat Assessment Project, Roy L. Roath, Rangeland & Ecosystem Science. Sponsor: Colorado Division of Wildlife. SCOP: A System for Conservation, N. Thompson Hobbs, Natural Resource Ecology Lab. Sponsor: Colorado Division of Wildlife. Development of New Information & Education Products/Collaborational Research, Alan P. Covich, Fishery & Wildlife Biology. Sponsor: Colorado Division of Wildlife. Developing Tools to Predict Persistence & Extent of Reintroduced Colorado River Cutthroat Trout, Kurt D. Fausch, Fishery & Wildlife Biology. Sponsor: Colorado Division of Wildlife. Wetlands Data Interpretation, Christopher A. Pague, Fishery & Wildlife Biology. Sponsor: Colorado Department of Natural Resources. Closed Basin Wetlands, Christopher A. Pague, Fishery & Wildlife Biology. Sponsor: Colorado Department of Natural Resources. Rearing & Analysis of Reintroduction Methods for Boreal Toads, Bruce A. Wunder, Biology. Sponsor: Colorado Division of Wildlife. The Willingness of Colorado Anglers to Incur Increased License Fees, Michael J. Manfredo, Natural Resource Recreation & Tourism. Sponsor: Colorado Division of Wildlife. * Human Dimensions in Natural Resources Research Unit, Michael J. Manfredo, Natural Resource Recreation & Tourism. Sponsor: Colorado Division of Wildlife. *Reclamation Plan for Summitville Super Fund Site, Edward F. Redente, Rangeland Ecosystem Science. Sponsor: Colorado Department of Public Health & Environment. *Developing a Classification of Colorado Wetlands..., David J. Cooper, Fishery & Wildlife Biology. Sponsor: Colorado Department of Natural Resources. *Ecological Modeling in Support of County Decision Making -- (GIS), N. Thompson Hobbs, Natural Resource Ecology Lab. Sponsor: Colorado Division of Wildlife. *Air-Sea Interaction Remote Sensing Processes, Thomas H. Vonderhaar, Atmospheric Science. Sponsor: DOC-NOAA-National Oceanic & Atmospheric Administration. *Very High Resolution Gridded Meteorological Forecast Development, Thomas H. Vonderhaar, Atmospheric Science. Sponsor: DOC-NOAA-National Oceanic & Atmospheric Administration. Parameterizing Subgrid-Scale Snow-Cover Heterogeneities for Use in Regional & Global Climate Studies, Roger A. Pielke, Atmospheric Science. Sponsor: DOC-NOAA-National Oceanic & Atmospheric Administration. Long-term Consequences of N Stress on Recovery of Rangelands & Abandoned Croplands, Edward F. Redente, Rangeland Ecosystem Science. Sponsor: USDA-CSRS-Coop. States Research Service. Dynamics of Whirling Disease on the Cache La Poudre River, Eric P. Bergersen, Cooperative Fish & Wildlife Research. Sponsor: Montana State University. *Snow Deposition Studies in Two National Parks of the Rocky Mountain Cordillera, Kevin J. Elder, Earth Resources. Sponsor: DOI-NPS-National Park Service. Peer Review of Vegetation Management Goals for Rocky Mountain National Park, Joyce K. Berry, Forest Sciences. Sponsor: DOI-NPS-National Park Service. Stream Water Quality Modeling Technology Development, Luis Garcia, Chemical & Bioresource Engineering. Sponsor: DOI-Bureau of Reclamation

*Effects of Four Electrofishing Currents on Captive Subadult Colorado Squawfish, Kevin R. Bestgen, Fishery & Wildlife Biology. Sponsor: DOI-Bureau of Reclamation.

Riparian Vegetation Research: 1997, Flaming Gorge Bypass Flow on the Green River, David J. Cooper, Fishery & Wildlife Biology. Sponsor: DOI-Bureau of Reclamation.

Duchesne River: Assessment & Refinement of Instream Flow Needs, Robert T. Muth, Fishery & Wildlife Biology. Sponsor: DOI-Bureau of Reclamation.

Inventory & Characterize Upland Water Resources in Dinosaur National Monument, John D. Stednick, Earth Resources. Sponsor: DOI-NPS-National Park Service.

Lower Sheenjek River Impact Analysis, Public Involvement, & River Management Plan, Jerry J. Vaske, Natural Resource Recreation & Tourism. Sponsor: DOI-NPS-National Park Service.

Contaminants & Endocrine Disruption in Fish, Daniel W. Beyers, Fishery & Wildlife Biology. Sponsor: DOI-USGS-Geological Survey. Summitville Mine Ecological Risk Assessment: Soil, Vegetation & Livestock Exposure..., Thomas J. Stohlgren, Natural Resource

Ecology Lab. Sponsor: DOI-USGS-Geological Survey.

- Summitville Mine/Alamosa River: Livestock Exposure Investigation, Howard S. Ramsdell, Environmental Health. Sponsor: DOI-USGS-Geological Survey.
- Use of Fish & Macroinvertebrates to Assess the Toxicity of Metals in the Animas River, Stephen A. Flickinger, Fishery & Wildlife Biology. DOI-USGS-Geological Survey.

Reconstructing Snow-Depth Distributions Using MODIS Snow-Cover Products..., Glen E. Liston, Atmospheric Science. Sponsor: NASA-Goddard.

*Biosphere-Atmosphere Interactions - A Study of the Energy, Water & Carbon Cycles, David A. Randall, Atmospheric Science. Sponsor: NASA-Goddard.

- Analysis of the Diurnal Cycle of Precipitation & Its Relation to Cloud Forcing..., David A. Randall, Atmospheric Science. Sponsor: National Aeronautics & Space Administration.
- *Upgrading Cropflex to Windows, Israel Broner, Chemical & Bioresource Engineering. Sponsor: USDA-Agricultural Conservation Program.
- *Precision Farming to Protect Water Quality & Conserve Resources, Lee E. Sommers, Soil & Crop Sciences. Sponsor: USDA-ARS Agricultural Research Service.

*Quantifying the Change in Greenhouse Gas Emissions Due to Natural Resource Conservation..., Keith H. Paustian, Natural Resource Ecology Lab. Sponsor: USDA-NRCS-Natural Resources Conservation Service.

Statistical Modeling for Farming Operations, Jennifer A. Hoeting, Statistics. Sponsor: USDA-ARS-Agricultural Research Service. Glenn-Colusa Irrigation District (GCID) Model Study, Steven R. Abt, Civil Engineering. Sponsor: Owen Ayers & Associates.

- *Improving Nexrad-Based Estimates of Precipitation Rates & Hydrometeor Classification, Steven A. Rutledge. Atmospheric Science. Sponsor: NSF-GEO-Geosciences.
- *Coupled Solute Migration Through Clay Barrier Materials, Charles Shackelford, Civil Engineering. Sponsor: National Science Foundation.
- Land Use Change in the East African Savanna: A Case Study of Northern Tanzania, Kathleen Galvin, Natural Resource Ecology Lab. Sponsor: National Science Foundation. Social, Behavioral & Economic Sciences.

Biotic Control of Detrital Processing in Hawaiian Streams, Alan P. Covich, Fishery & Wildlife Biology. Sponsor: National Science Foundation, Biological Centers.

- *Application of Statistical Dynamical Water Balance Model to Regional Scale..., Jorge A. Ramirez, Civil Engineering. Sponsor: Tulane University.
- Dam Foundation Erosion Study, James F. Ruff, Civil Engineering. Sponsor: DOI-Bureau of Reclamation.

Temporal Study of Aquatic Invertebrates in 3 Backwater Habitats on the Lower Green River, Darrel E. Snyder, Fishery & Wildlife Biology. Sponsor: DOI-National Biological Survey.

Boulder Lepidoptera, Christopher A. Pague, Fishery & Wildlife Biology. Sponsor: City of Boulder.

Effects of Fire Disturbance on Watersheds in Bandelier National Monument, William H. Clements, Fishery & Wildlife Biology. Sponsor: Southwest Parks & Monuments Association.

Water Usage of Cottonwoods, William R. Jacobi, Plant Pathology & Weed Science. Sponsor: Denver Water Department.

*A Regional Assessment of Land Use Effect on Ecosystem Structure & Function..., William J. Parton, Natural Resource Ecology Lab. Sponsor: EPA-Environmental Education Grants.

*Cadmium & Arsenic -- Globeville, John D. Tessari, Environmental Health. Sponsor: ENSR Consulting & Engineering.

- Crystalline Plyacrylamide Enhancement of Soil Water Retention & Growth of Row Crops, Grant E. Cardon, Soil & Crop Sciences. Sponsor: McMahon Bioconsulting, Inc.
- *Integrated Research on Hazardous Waste Chemical Mixtures, Raymond H. Yang, Environmental Health. HHS-PHS-Superfund Hazardous Substances.
- *Range-Watershed Training for Native Americans, Ellsworth T. Bartlett, Rangeland Ecosystem Science. Sponsor: USDA-USFS-Rocky Mtn. Experiment Station.

*Water Quality & Ecosystem Studies in Northwest Alaska, Daniel E. Binkley, Forest Sciences. Sponsor: USDA-USFS Forest Research. Ecological Risk Assessment Methodology for the Savannah River Site, Ward F. Whicker, Radiological Health Sciences.

Sponsor: University of Georgia.

The University of Colorado, Boulder, CO 80309

- *A Regional Model of the Arctic Land-Atmosphere System Impacts of Vegetation, Amanda Lynch, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: University of Alaska.
- The Effects of Cortisol on Home-Stream Water Imprinting and Recall in Kokanee Salmon, Richard Jones, Environmental, Population and Organismic Biology. Sponsor: National Science Foundation.
- Differential Access to Irrigation Water and Vulnerability to Flood Hazards in the Punjab: An Analysis of Structure Factors, Geography. Sponsor: National Science Foundation.
- *Direct Measurement of the In-Situ Stress Tensor at Depth in Glacier Ice: A Collaborative Study, Bernard Amadei, Civil, Environmental and Architectural Engineering. Sponsor: National Science Foundation.

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Observations and Modeling of Flow and Fracture Processes Leading to Iceberg Calving, Bernard Amadei, Civil, Environmental And Architectural Engineering. Sponsor: National Science Foundation.

Collaboration on the Development and Validation of the AMSR Snow Water Equivalent Algorithm, Richard Armstrong,

Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: National Aeronautics & Space Administration. *Operation of the Snow and Ice Distributed Active Archive Center, Roger Barry, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: National Aeronautics & Space Administration.

*Impact of Flows and Geomorphology on Food Web Dynamics of the Colorado River Native Fish Community, John Pitlick, Geography. Sponsor: U.S. Fish and Wildlife Service.

*Theoretical and Experimental Studies of Hydrological Properties of Rock Fractures During Active Deformation, Shemin Ge, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: Department of Energy.

*Genetic Stream Standards, Jeffry Mitton, Environmental, Population and Organismic Biology. Sponsor: Colorado Division of Wildlife. Linkage Between Malaria and Hydrology in Africa, Kenneth Strzepek, Civil, Environmental and Architectural Engineering. Sponsor: Arizona State University.

*Ensemble Forecasting of Convective Weather Events Using a Mesoscale Model, Thomas Warner, Program in Atmospheric and Oceanic Sciences. Sponsor: National Science Foundation.

*A Collaborative Study of Atmospheric Dynamics Using Sodium and Rayleigh Lidars at Fort Collins and Alomar, David Fritts, Program in Atmospheric and Oceanic Sciences. Sponsor: National Science Foundation.

*Assessment of Research and Applications of Natural Hazards, Dennis Mileti, Institute of Behavioral Science. Sponsor: National Science Foundation.

*A Clearinghouse on Natural Hazards Research and Applications, Denis Mileti, Institute of Behavioral Science. Sponsor: National Science Foundation.

*An Interdisciplinary Graduate Education and Research Program in Hydrology, V.K. Gupta, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: National Science Foundation.

*Collaborative Research: Scaling Theories of the 3-D Geometry and Flows of River Networks, V.K. Gupta, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: National Science Foundation.

Geostatistical Methods for Determination of Roughness, Topography, and Changes of Antarctic Ice Streams from SAR and Radar Altimeter Data, Ute Herzfeld, Institute of Arctic and Alpine Research. Sponsor: National Aeronautics & Space Administration.

Assessing Future Stability of U.S. High Plains Landcover: Integration of Process Modeling with LANDSAT..., Alexander Goetz, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: National Aeronautics & Space Administration.

Analysis of Nitrogen Losses in a Constructed Wetland, Lesley Smith, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: U.S. Geological Survey.

*The Effects of Anthropogenic Nitrogen Deposition on the Functioning of Alpine and Subalpine Ecosystems: Nitrogen Cycling and Trace Gas Fluxes, Steven Schmidt, Institute of Arctic and Alpine Research. Sponsor: Environmental Protection Agency.

*Nitrogen Dynamics: Interactions Between Snowmelt and Runoff, Steven Schmidt, Institute of Arctic and Alpine Research. Sponsor: National Park Service.

*Establishment of an International Ice Core Data Cooperative, James White, , Institute of Arctic and Alpine Research. Sponsor: National Oceanic and Atmospheric Administration.

*Flow and Sediment Transport in Mountain Streams, John Pitlick, Geography. Sponsor: Department of Agriculture.

*Supplement to existing award.

Call for Papers The Small Flows Journal

Papers are now being accepted for upcoming issues of *The Small Flows Journal*, the only juried technical journal devoted specifically to small community wastewater issues.

Papers in the following categories will be considered for review:

- Technology/research
- Regulations
- Finance

Operation and maintenance Management Public education

For additional information about the journal, manuscript submission guidelines, and publication deadlines, contact Cathleen Falvey, editor, at 1-800-624-8301, ext. 5526, or mail to Editor, *The Small Flows Journal*, National Small Flows Clearinghouse, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064.

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MEETING BRIEFS

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Can Competing Users Cooperate...and Live Happily Ever After? THE 22ND ANNUAL COLORADO WATER WORKSHOP

by Laurie Schmidt



Sarah Duncan, Denver Water (left), and State Representative Lewis Entz (right) share their thoughts with Fred Anderson, Public Affairs Consultant and former State Legislator, prior to his "Western Water's Living Legends" presentation. Western State College in Gunnison, Colorado hosted the 22nd annual Colorado Water Workshop on July 30 – August 1, 1997. The theme of the workshop was "Water Partnerships: Can Competing Users Cooperate to Manage a Vital Resource...and Live Happily Ever After?"

The keynote address, "Building Consensus for Water: Proposition 204," was presented by California State Senator Jim Costa. Other speakers included Don Ament, Colorado State Senator; Hamlet "Chips" Barry, Manager, Denver Board of Water Commissioners; Sarah Duncan, Intergovernmental Affairs Coordinator, Denver Water Department; Gregory J. Hobbs, Colorado Supreme Court Justice; and Uli Kappus, Executive Vice-President, GEI Consultants, Water Resources Services.

This year's Colorado Water Workshop launched a new series called "Western Water's Living Legends," an annual talk to be given each year by a person considered to be a "legend" in the field

of water resources. Fred Anderson, Public Affairs Consultant and former State Legislator, initiated the series this year with his presentation in the Aspinall-Wilson Center at Western State College.

Anderson was a Colorado State Senator from 1967 to 1983, and was President of the Senate from 1974 to 1982. He was also the recipient of the Wayne N. Aspinall "Water Leader of the Year" Award at the annual convention of the Colorado Water Congress in 1994. A summary of his talk is included in this issue of *Colorado Water*.

On the second evening of the workshop, attendees enjoyed an outdoor barbeque dinner and live entertainment at the I-Bar Ranch in Gunnison. Robin Helken, Director of the Colorado Water Workshop, has indicated that next year, she hopes to take advantage of the region's beautiful setting and pleasant summer weather by holding some of the workshop sessions outdoors, in a protected area similar to the I-Bar Ranch setting. Next year's workshop is scheduled to be held in Gunnison on July 29-31, 1998.

Workshop Donors: City of Aurora, Colorado Department of Natural Resources, Colorado River Water Conservation District, Colorado Water Conservation Board, Southwestern Water Conservation District, and Upper Gunnison River Water Conservancy District.

Workshop Sponsors: City of Colorado Springs, City of Grand Junction, City of Gunnison, Denver Water Department, Gunnison County, Colorado Water Resources Research Institute, Northern Colorado Water Conservancy District, and Ute Water Conservancy District.

Workshop Co-Sponsors: Colorado Rural Water Association, U.S. Bureau of Reclamation, and U.S. Environmental Protection Agency.

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COLORADO WATER WORKSHOP'S "WESTERN WATER'S LIVING LEGENDS" SERIES 1997 Honoree: Fred E. Anderson

The 1997 Colorado Water Workshop launched a new annual series called "Western Water's Living Legends." Fred E. Anderson, Public Affairs Consultant and former State Legislator, was the series' first honoree this year in Gunnison, Colorado. The following is a transcript of his presentation at Western State College on July 30, 1997:

It is a pleasure for me to be with you for the first annual "Legends of Water" presentation. I am truly sorry that Felix Sparks could not be with you today; he is no doubt a legend in Colorado water history.

I have never thought of myself as a legend. I looked up the dictionary definition of "legend," and the one I liked the best was defined as obsolete: "a story of the life of a saint." I am certain that nobody here would quite go along with that one. But let's work with the first definition, which states that a legend is "a story handed down for generations among a people and popularly believed to have an historic basis, but not necessarily verifiable." This, of course, gives me a great deal of latitude in making this presentation.

The conference title, "Can Competing Users Cooperate to Manage a Vital Resource...and Live Happily Ever After?" may in some ways sound a little "Pollyanna." But I would answer that question with a definite, "Yes, I do think it is possible to cooperate and work things out to the benefit of all the citizens of Colorado." My quote states that, "Things are more like they are today than they ever have been before." Now, you need to think about that a little bit, but let's look at what is going on today compared to the past.

Water is no different now than it was years ago at the time the Constitution was developed. You mention the word "water," and immediately you have a fight on your hands before you say another word. Water wars have been going in Colorado forever. I can remember working with my neighbor in all kinds of situations without any serious problems. For example, there was one time when my dog, along with several others, got into my neighbor's sheep pen and created havoc. All the other dogs ran, but mine stayed. This problem was resolved without any harsh words. The only time there was a difference of opinion between us was when we ran water at the same time and had to split it in the division box. I think that has been the case in Colorado since the year "one."

Water has always been fascinating to me. I can remember

when I was a child back in the '30s, my father and my grandfather were very concerned about and interested in the transmountain diversion that was the proposed Colorado-Big Thompson (CBT) project. In fact, we spent my brother's tenth birthday at a ceremony commencing the CBT.

I grew up in the farming business and even as a boy, I was made aware of the fact that without water, there was no crop. During the '30s, of course, we had a situation where time and time again there was not enough water to finish a crop. Now, here was an idea that promised to solve that problem by providing a supplemental water supply that would allow those in agriculture in eastern Colorado to finish a crop and realize the fruits of their endeavors. Even though there was a lot of consternation about moving water from one slope to another, people were willing to sit down and work all of the problems out. They did not get into a confrontational position, but instead negotiated a plan that would be fair to all interests. If these people were willing to negotiate during that period, why can't we do the same today?

A project of that magnitude created many problems that had never been faced before in Colorado, and both sides felt they were making commitments that would affect the whole future of water development in Colorado. Many of the letters that were exchanged at that time indicate that the negotiators went straight to the issue. For example, in a letter to Mr. Frank Delaney in Glenwood Springs in 1936, the Northern Colorado Water Users Association suggested several solutions to the problems being discussed. One week later, Mr. Delaney gave the following response: "Your letter relative to the use of the Colorado River is at hand. The proposal you set forth is not an acceptable basis of settlement." However, in the same letter, he informed the Water Users that the negotiating team would hold the dates two weeks later to continue negotiations to formulate a plan acceptable to both sides. This was done, and the Grand Junction Sentinel reported the following on June 17, 1937:

The intrastate conflict now apparently ended, the citizens of all Colorado should reunite their powers and influence toward the speedy construction which now hinges on a congressional appropriation. The

reclamation service has put its approval upon the project; Colorado's congressional delegation will unite to secure this appropriation, but there are always eastern foes of reclamation; and anyone cognizant of California's plans easily concludes she is hopefully eyeing the waters and the power facilities of the Colorado that rightfully belong to our state. Procrastination in securing to ourselves the uses of this great stream may easily result in its being lost to us forever. The agreement reached between the eastern and western slopes over the Grand Lake diversion definitely serves notice that the people of Colorado are awake, tho tardily, to the seriousness of this probability, and will unitedly fight to preserve Colorado River waters for Colorado."

This spirit of cooperation was subsequently lost, and Governor McNichols convinced Felix Sparks to take over the directorship of the Colorado Water Conservation Board. This prompted better cooperation within Colorado.

When I was elected to the Colorado State Senate, the Colorado Supreme Court was in the process of deciding Fellhauer v. People (1968), whereby the Court said that the doctrine to be followed in Colorado is one of "maximum utilization." It was

necessary for us in the Legislature to recodify water law in accordance with the direction given us by the Court. This took a period of interim study, which included traveling the state with suggested legislative proposals. This was not an easy process, since many water users wanted no change, and those diverting well water were apprehensive about their position with water rights. Colorado had allowed a whole system of groundwater diversion to develop without any real legislative guidelines. This required a very careful balancing act to keep from creating havoc with an economy that had been

developed over the previous decade. All of this resulted in the adoption of Senate Bill 81, in 1969, which provided the recodification after a long and hard struggle. This law has been amended numerous times and has served the state well.

Glenn Saunders, another "water legend," often quoted the results of the tree ring studies done with bristlecone pine in Arizona. Those results indicate that Colorado could very well be in line for an extended drought period... This does pose the question of whether or not Colorado can handle a drought of a magnitude that led to the disappearance of the Anasazi.

There was never a year that the Legislature did not have to deal with a number of water issues. The 1970s saw the Colorado Water Conservation Construction Fund created, with enough money to begin building small projects and rehabilitating others. Another program that I started was the creation of instream flow water rights. This was a whole new concept that recognized the use of water rights to protect the environment to a reasonable degree by leaving those rights in the stream. Although this program has been challenged on its constitutional basis, the Supreme Court has ruled in its favor. Over the years, a number of amendments have been made to the original act, all of

which, however, were drafted in a manner consistent with and strengthening the original intent of the legislation. Approximately 8,000 miles of stream and 500 natural lakes have been enhanced as a result of this program.

Another major program that was established was the Colorado Water Resources and Power Development Authority. My original intent for this program was to have the ability to lever our state dollars through the bond market in order to be able to fund larger projects. During this period, I felt that we were working as one state to better the interests of the state as a whole.

During the last 30 years, the one question that keeps coming forward is, "Are we doing enough in the

> development of our water resources to be able to meet a drought of major proportions?" Most of you in this room have never had to contend with water supply situations during a drought of more than two years. The major drought in this century occurred in the 1930s, and

there was another dry spell in the early 1950s. Since that time, any shortage has been less than two years in duration. In the 1970s, there were two fairly dry years, during which it would have been difficult to provide water in the CBT system if we had had another year similar to the first two.

Glenn Saunders, another "water legend," often quoted the results of the tree ring studies done with bristlecone pine in

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Arizona. Those results indicate that Colorado could very well be in line for an extended drought period. In the water development business, we often jokingly comment about needing a good hard drought to make people understand the need for more storage, but in truth, we would not wish a drought on anyone. However, this does pose the question of whether or not Colorado can handle a drought of a magnitude that led to the disappearance of the Anasazi.

As I said in the beginning, things are more like they are today than they have ever been before. In the years I have spent working in the water arena, many things have changed; yet, a number of the issues are the same. The work is far from complete, and problems will need solutions, just as they have in the past. One of my major concerns is the effect of term limits in our state legislature, which will create a large numerical turnover in 1998. In the Colorado State Legislature, we will see all of the leadership on both sides of the aisle, as well as a dozen committee chairs, removed from the legislative process. This will remove a great deal of institutional history from the legislative process. I hope that my fears are unfounded and that new people with knowledge and interest in Colorado water will come forward. In the meantime, it puts an additional burden on water users in Colorado to follow the legislative process closely in the coming years.

I have enjoyed talking to you today about the last thirtyplus years of my experience in the water arena. It is hard to be nostalgic when you have trouble remembering things. I would be glad to try and answer your questions.

Q: What is your opinion about the administration and working of the instream flow legislation that you sponsored?

A: In my opinion, it has worked well over the years. I have a sense of regret that we never resolved the question of whether or not inundation of a minimum instream flow segment constituted material injury to the water right. My original intent was to make certain that a minimum amount of water would be available in that stream segment. Inundation of that segment would in no way reduce the amount of water in that segment. There never was any intention on my part to foreclose storage of water through this appropriation process. I believe the law is clear, but it may have to be amended in order to resolve any question. As I have said before, "When trying to fix something, if at first you don't succeed - get a bigger hammer."

The other question tied to instream flow rights, but with much broader implications, is that of conditional water rights. In relationship to instream flow, a compromise was worked out in the last few years which grandfathered the conditional rights to be used in instream flow in a limited way and prohibited the use of conditional rights for instream flows in the future. However, I feel that the whole question of conditional water rights, which do not have as much pressure from due diligence as in the past, needs to be clarified. The Court decisions in this area are not as definitive as I would like them to be. A conditional right is a holder of place in time for the project for which it was filed. If we are to make certain that we follow the sentiments expressed by the *Grand Junction Sentinel*, 1937, this is an issue that needs to be resolved.

In order to maintain a good quality of life in Colorado, from a water point of view, we need to continue working with our legal system as we know it. The doctrine of prior appropriation has served Colorado well since before Colorado was a state. As long as we are flexible and hold true to the doctrine of no injury, I am sure that we will be able to deal with all of our water problems in the future through negotiation. And just remember, things are more like they are today than they have ever been.

WISE WATER STEWARDSHIP THROUGH PARTNERSHIP by Uli Kappus, P.E.

Executive Vice-President, GEI Consultants, Water Resources Services

The following speech was presented at the 22nd annual Colorado Water Workshop, held in Gunnison, Colorado, July 30 – August 1, 1997.

Earlier today I heard someone say, "Be sure and be here for lunch because Uli Kappus is going to talk, and he's going to be very controversial." I always find that interesting

because in the water business, if you have a little bit of a vision, invariably you're branded as "controversial." And I think that says a lot for the water business, in general.

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What I would like to do today is share with you some thoughts about partnerships that have worked and also about some of the partnerships that are

in progress, particularly in the Denver metro area. I believe, as Chips Barry said earlier today, that these partnerships will really form the basis of meeting our obligations to future generations. I've lived in the Denver metro area for about 20 years, and what is really scary to me is that in the last few years, Denver has become a microcosm of Los Angeles. I used to be able to drive to work in 18 minutes, and now it takes me 42 minutes on C-470 in the morning. That is scary when you see that projections indicate that in the next 30 years, the population is going to double again. The question then is, "Where is the new water going to come from?"

I always start my talks with some definitions because it is important to make sure the speaker's definition of terms is clear. As you well know, we in the water field all have a different perspective on nearly everything. After working in the water field for over 32 years, I've come to realize that water is really not a natural resource, it's a political fluid. It's a tough battle, but I believe that battle can be won if some of these projects are structured correctly, and that means getting local support for moving a project ahead.

Stewardship is a term I define as a "long-term perspective of managing the asset with proper regard for the rights of others." The Denver Water Department is one of GEI's clients, and I had never read their mission statement until last week. But the term 'stewardship' is, in fact, in their mission statement. I personally think that Denver has done a good job of balancing the needs of the Denver metro area with some of the other challenges. As you know, in accordance with the newer philosophy of the Board under Chips' direction, they're working very diligently with the

I will go so far as to say that the Endangered Species Act (ESA) is the best tool our neighboring states have in terms of keeping Colorado from developing more of its compact entitlements.

area. That, in fact, includes the fastest growing whitecollar community in the whole country -- Douglas County.

metro area to provide some water they have in times of

plenty to areas in the southern portion of the Denver metro

I define partnership as a "close cooperation between parties having specific and joint rights and responsibilities." Successful partnerships require that stewardship and sharing philosophy be practiced among the parties. That is critical

because, as Fred Anderson said last night, a partnership can't succeed if you're not willing to strike a balance, whether you're in a marriage with your spouse or if you're trying to construct a "marriage" with another water user. If you try to get more than your fair share, it's not going to succeed.

I'm afraid that, in most of the water battles that we've fought in this state, the mentality and the attitude has been, "I want more than my fair share." I do think that as time goes by, the increasing demands for a finite resource are going to cause heightened tensions, not just internally within the state of Colorado, but also with our downbasin compatriots, particularly California. I will go so far as to say that the Endangered Species Act (ESA) is the best tool our neighboring states have in terms of keeping Colorado from developing more of its compact entitlements. I suspect that until we resolve some of these very dicey issues, it will be a very tough row to hoe.

Successful water partnerships minimize the expenditure of public funds. I live in Littleton, and I pay about \$1200 for my half-acre foot per year, which is quite a bit. We get our water from the Denver Water Board, and by the time it's passed through numerous hands, I pay a high price. My water rate has gone up over the years, and it will continue to go up. But every time my water rate goes up, it helps pay for the water engineers (like myself), the attorneys, and a lot of other people that have their finger in the pot. So we need to look at our water rate as nothing more than another de-facto tax that we all pay. And if we don't become more efficient in some of our activities, the rate is going to keep increasing disproportionately to the value we add to that water.

I also believe that in successful water partnerships, you must be willing to yield some control. In the water business, up until very recently, every major water manager has wanted absolute control. He wanted to wear the "water crown." That, of course, doesn't work, especially when

you have whooping cranes, squawfish, and others at the water table. When you look at the ESA from an engineering perspective -- even though I realize some of the attorneys here will argue with me -- it has really made the Prior Appropriation Doctrine subservient to the federal mandate.

Eighteen years ago, I managed the original whooping crane study on the Platte River system, on a little project called Grey Rocks Dam and Reservoir. Having gone through that process, I know the power of the ESA. In that case, the critical habitat in Nebraska wasn't even designated at the time the Laramie River Station power plant was being constructed, and the project participants had invested \$400 million in an \$800 million project. Then, when the critical habitat was designated, Nebraska, in my opinion, saw this

as an opportunity to say, "We don't want Wyoming to evaporate 20,000 acre-feet a year for the cooling towers because that water now flows to us and we get it for nothing." Despite the fact that the water belonged to Wyoming under the compact, Nebraska said, "Ah-Ha, critical habitat is now designated, and you haven't addressed it in an EIS."

Well, of course it hadn't been addressed, because the critical habitat didn't exist when the project was permitted. By the time it was completed, that project came within one day of being terminated by the federal judge. I spent a lot of time, with others, trying to get the ESA amended. After about six months, I told my client, "We're wasting our time and money." The bottom line is that to be in the water business, you've got to abide by the body of law that exists today. For better or for worse, Colorado is blessed with a lot of endangered species. We're also blessed, quite frankly, with being one of the primary playgrounds in the U.S.A. So there are a lot of out-of-state interests here, in addition to our own personal interests, and we need to be cognizant of that.

In a successful partnership, you must also have a balance between the notion of first allocating water for habitat

When you look at the ESA from an engineering perspective -- even though I realize some of the attorneys here will argue with me -- it has really made the Prior Appropriation Doctrine subservient to the federal mandate.

So, one has to be mindful of that, and I'm always fond of saying "Be constructive in your criticism of the bureaucrats, because they have a very rough row to hoe." They're trying to do their job, and if they don't do their job properly, what happens? They get sued and then everything is stopped by a third party, generally the environmental coalitions because they're watching this very carefully also. In partnerships, it's very important to clearly define what the costs will be, who bears what cost, who gets what benefit. Without an honest discussion about the equity, it's not going to work. Again, everybody wants the other guy/gal to pay more than his/her fair share.

Risk control is another important consideration. When you get involved in a major water project, you must make early decisions. Otherwise, you're going to end up throwing

> good money after bad, and then most of these water wars, if I can draw a poor analogy, will end up like Vietnam: -some of the leadership was getting bad information, and we got in deeper and deeper, and it never seemed to end until we lost. That may be an overstatement, but it may also be a good analogy.

Most importantly, you must be part of the solution, not part of the problem. If

you think you can ram something down somebody else's throat, it just won't work, because people tend to be very stubborn. The attachment that I provided in your written material includes an article called, "The Age of Smart Dams." I coined that phrase when I was interviewed by U.S. Water News. They called and asked me about our business of building dams, because right now GEI is working on seven major dams around the country. There are over two dozen dams, that I'm aware of, that are currently in either the permitting, design, or construction phase. So the notion that the dam business is dead is foolish.

The federal component of the dam business is maybe one exception that I'm aware of. With the exception of the Animas-La Plata project, the big federal dam era is over because the federal government is basically finished

I firmly believe that the U.S. Fish and Wildlife Service, U.S. Forest Service, and other federal agencies have a mission. They have a mandate. They didn't create the ESA: Congress did. So, one has to be mindful of that ...

protection and then providing a reliable water supply for human use, as a secondary priority. I firmly believe that the U.S. Fish and Wildlife Service, U.S. Forest Service, and other federal agencies have a mission. They have a mandate. They didn't create the ESA; Congress did.

providing seed money and incentives to develop water projects. Former Secretary of the Interior, Mr. Ziglar, spoke here some years ago, and he pointed out that the entire federal subsidy for western U.S. water projects is smaller than the subsidy provided to the Washington, D.C. subway system. That sounded outrageous to me at the time, but I checked it out and it's true.

A "smart dam" is simply an off-channel structure, preferably, or a structure on a smaller tributary stream. From a permitting perspective, if you try to dam a major river nowadays, you're not going to succeed. But some of these off-channel structures are huge. For example, California's East Side Reservoir is 800,000 acre feet! Our company was recently part of the team that developed one of the biggest water projects in the country 14 miles outside of San Diego, including a 325-foot high dam at a \$520 million investment. It took us five years to complete the permitting cycle, but we got everybody together at the beginning and, believe it or not, we don't have one threatened lawsuit. So, it can be done. And in my opinion,

have the California Environmental Quality Act, which is tougher than the NEPA (National Environmental Policy Act).

Of the examples of recent partnerships, my favorite is probably the Wolford Mountain project. That project is described in the attached paper entitled, "The Last Dam in the West: Is the Western Water Project Really an Endangered Species?" Obviously, the answer to that question is no, it is not. I believe that

smart dams will continue to be built, and there are some planned by the Northern District, the River District, Parker, and a few others. But I think all of these smart dams also need to be related to conjunctive use opportunities and better use of ground and surface water, which I will address in a minute.

The other project that I would like to mention as a recent partnership is the Platte River Recovery Program. Fifteen years ago, I thought that problem was pretty well solved through the designation of the critical habitat and a \$6.5 million whooping crane maintenance trust fund that was generated from the Grey Rocks Dam and Reservoir project. But we finished that work over 15 years ago, and here it is still being recycled. Somehow, we all have to work harder

Former Secretary of the Interior, Mr. Ziglar, spoke here some years ago, and he pointed out that the entire federal subsidy for western U.S. water projects is smaller than the subsidy provided to the Washington, D.C. subway system. That sounded outrageous to me at the time, but I checked it out and it's true.

to achieve closure on some of these issues, or we're never going to advance very far.

The third item I'd like to comment on briefly is the Denver Water Supply Partnership. When I tell you these numbers, probably none of you will believe them, but they're true. These come from the USGS, which generates very high-

quality data. Under the greater Denver area, there are literally hundreds of millions of acre-feet of untapped, nontributary water. Douglas County, on the south side of Denver, relies on that almost 100 percent. Believe it or not, the greater Denver area has over 400 million acre-feet of water. That's 20 times the storage in Lake Powell. In the five-county Denver metropolitan area alone, there are 150 million acre-feet of water. That water can be developed with no federal permits, it can probably be developed in less than two years; it's immune to drought; it's of high quality; and it's not located 150 miles from home. It's under our feet. I've never understood why the discourse about non-tributary water implies that it's almost immoral to use it. I say, from a permitting perspective, are we any

> better off trying to go 100-150 miles away from home and build big pipelines and tunnels at tremendous expense, rather than first using what we have under our feet?

After seeing what happened at Two Forks, I am of the opinion that maybe we had better look at water not only as the resource we need for future growth, but also as a fully-integrated resource, employing the use of alluvial

water and surface water when it's available, and then nontributary groundwater during a drought or when we have exceptionally high-growth areas. Once you create that hole when you mine the water, it can be developed at \$4,000-5,000 an acre-foot. Building a big dam and pipeline tunnels will cost 2-3 times that amount by today's standards, and there are minimal delivery costs involved in developing non-tributary water. The point of all this is that we need to have a conjunctive program that fully recognizes that potential, because once you mine that water, you've got a hole in it and you can recharge it during wet periods.

When I was with the Water and Power Authority, we actually did the first study of that type in the State of

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California has tougher restrictions than Colorado. They

After seeing what happened at Two Forks, I am of the opinion that maybe we had better look at water not only as the resource we need for future growth, but also as a fully-integrated resource, employing the use of alluvial water and surface water when it's available, and then non-tributary groundwater during a drought or when we have exceptionally high-growth areas.

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Colorado for the City of Parker, and it worked very well. We recharged 50 acre-feet, and it was recovered later. It didn't go anywhere because non-tributary water simply means there is essentially no recharge from the surface. It is very stable, moving less than a foot per year. I believe very strongly that we need to pursue this with a lot more vigor than we have in the past.

In conclusion, I think the whole area of water project development will get a lot more creative --not controversial -- but creative. I also believe that we have to adequately fund the bureaucrats in the state who serve as the "water cops." They have the responsibility of doing a good job of managing the resource. We must have a stronger "winwin" philosophy in terms of what we're trying to do in the water business. We also need to make sure that our water projects are successful and demonstrate characteristics of the five "F" words (which are not what you think). They must be good for farmers, families, fish, fowl and, most importantly, finances. One of the first things I always ask my clients is, "How are you going to pay for the project?" And you'd be amazed at how many clients haven't thought about that. If you don't think about how you're going to pay for it up front, you could be in serious trouble.

Finally, I think it's critical that we negotiate our water partnerships during non-stress times. We've been very lucky in that we haven't had a serious drought in Colorado since the early 1950s. We had one drought, but it only lasted a year and, as you know, a drought has to last 2-3 years to really draw the reservoirs down. But it's coming folks! The tree ring surveys that they've been talking about – that's all real evidence. When I spent time in Saudi Arabia working on water issues, there was an old Bedouin parable that said, "When the water gets low enough, the lions drink with the sheep." You might want to think about what that means.

Thank you for your kind attention.

• WATER MANAGEMENT: THE EQUITABLE SHARING OF A SCARCE RESOURCE

by Hamlet 'Chips' Barry, Manager Denver Board of Water Commissioners

INTRODUCTION

I am pleased to return to the Colorado Water Workshop. I have not been here for the last four or five years, but it is here that I learned the basic counter-intuitive rules involving water in Colorado.

For example, have you ever tried to explain to those from the east (that is East Coast, not East Slope!) that in Colorado water courts, it is possible to file a "statement of opposition in support." Or that we actually have something called "not non-tributary water." Do you think we could bottle water under that label? And that we will all fight over five or ten acre-feet of water, all the while supporting the statutory fiction that certain classes of our many thousand domestic tributary wells have no effect on streamflow, despite a ton of evidence to the contrary.

It is no wonder, therefore, that those outside of these long and troublesome issues believe that we are all nuts.

ASSIGNED TOPIC -- WATER MANAGEMENT

I have struggled to define the topic and figure out what to say. Using a fairly <u>narrow definition</u>, this is an easy topic. Except when Vice President Gore is in town, water is a very predictable and manageable commodity. It generally obeys the laws of physics: it flows downhill regularly, and evaporates on hot days. Unlike customers, the federal government, and water lawyers -- it does what it is commanded to do. Thus -- "management of water" -- once you have it -- is relatively easy. The hard part is, of course, obtaining the water in the first place, and thereafter managing the people and the issues.

Given these thoughts, it would make little sense to talk about "water management" in a narrow context. I think this topic must have been intended as an open-ended invitation to discuss any relevant western water issue that has some relationship to a broader, more inclusive definition of water management. I will therefore discuss some of these larger "water management" issues, and how Denver will approach them.

INTRODUCTION TO TOPICS

The water issues of this season seem to be:

- Transbasin diversions and the "not one more drop" school of thinking. This is not a new topic for Colorado.
- The Upper Colorado River Fish Recovery Program, and the Colorado Water Conservation Board filing for instream flows to protect the fish in the so-called "15-Mile Reach" of the Colorado River. This is a new topic for Colorado.

Some people believe these two topics are related; others believe they are the <u>same topic</u>, at least in a political sense. I think these two topics are clearly separate, deserving different analysis and responding to divergent solutions. However, I understand that the alleged pain of transbasin diversions is exacerbated by the perception and belief that "required" flows for endangered fish further limit the options for future water development and use. Clearly the combination of these two issues is volatile. Both have recently been the subject of intense discussion, analysis and correspondence among water users. My thoughts on these topics follow.

TRANSBASIN DIVERSION

What is the issue with TBDs? There is no agreement on this, of course, but based on the old adage that "where you stand depends upon where you sit," I would like to try some definitions of the issue from various standpoints:

- 1. Demographer: The water is in one place (West Slope) and the people are in another.
- 2. <u>Economist</u>: We have an economically inefficient use of the resource; the marginal value of water east of the Continental Divide is much greater than west of the Divide.
- 3. <u>Constitutional Lawyer</u>: Land use restrictions under House Bill 1041 are an unlawful restriction on the constitutional right to divert, store and use water.
- 4. <u>California</u>: Transbasin diversions from the West Slope to the East Slope cut into the surplus Colorado River water we can use -- and maybe obtain a long-term right to.
- 5. <u>The Grand Junction Chamber of Commerce</u>: Further transbasiin diversions limit or foreclose our future efforts to grow -- especially because the East Slope is growing faster and by the time we are ready, there will be no water left for us.
- 6. <u>The U.S. Fish and Wildlife Service (West Slope Branch)</u>: Transbasin diversions are illegal and contrary to the rights of Colorado River fish under the Endangered Species Act. The fish should get all the rest of the water in the western rivers!
- <u>The U.S. Fish and Wildlife Service (East Slope Branch)</u>: Transbasin diversions are mandated: the return flows from transbasin diversions have added to the flow of the South Platte, and more transbasin diversions would help save birds in Nebraska.
- 8. <u>A Weld or Larimer County Irrigator</u>: Let's stop growing a low-value crop (alfalfa) at 8,000 feet and move the water to the highest economic agriculture use in Larimer, Weld and Morgan Counties.
- <u>A West Slope Environmentalist</u>: The water is best left in the stream where nature put it. It is too bad that Colorado law and natural law disagree.
- <u>A Water Lawyer</u>: From this point of view, TBDs are not an issue -- they are an opportunity. An opportunity to bill more hours and to leverage water court rulings -- either because of TBDs or the lack of them.

All these definitions have some built-in bias, of course. My own definition of the issue is that transbasin diversions are an economic and demographic necessity because, to date at least, they have allowed Colorado relative prosperity without significant social, economic or environmentalist costs. But most importantly, I believe that the problem is <u>not really one of basins</u>; the problem is the <u>inevitable</u> and <u>inequitable</u> effect of the Prior Appropriation Doctrine.

In its most pure form, the Prior Appropriation Doctrine says that if you arrive in Colorado early enough (say 2005 or 2010?) you will have water; if not, you have missed the party. The fear of being left out is a state-wide fear, and it exists in eastern Arapahoe County, northern Douglas County, Grand Junction, Frisco, Fraser, and elsewhere. The fear is heightened because on your way to the party you have heard that the endangered fish, the Forest Service, California, COLORADO WATER

In its most pure form, the Prior Appropriation Doctrine says that if you arrive in Colorado early enough (say 2005 or 2010?) you will have water; if not, you have missed the party. The fear of being left out is a state-wide fear...The fear is heightened because on your way to the party you have heard that the endangered fish, the Forest Service, California, and the Powerful Denver Water Board are already there! You are afraid that by the time you get there, there will not be anything left.

... there is no geographic basis to claim

water in Colorado. A claim of water

based on geography is fundamental,

riparian doctrine, which was rejected

wholly in Colorado beginning in the

middle of the last century. Unless you

have a water right pursuant to state law,

there is no validity to the concept of "our

water based on geography is fundamental, <u>riparian</u> doctrine, which was rejected wholly in Colorado beginning in the middle of the last century. Unless you have a water right pursuant to state law, there is no validity to the concept of "our water." If someone has a valid water right, and the decree allows diversion of the water out of the basin of origin, it is by <u>definition not stealing</u>. A valid appropriation and not theft

transmountain diversion is not theft.

and the Powerful Denver Water Board are already there! You are afraid that by the time you get there, there will not be anything left.

In the end, I don't think the fear of being left without water has anything to do with "basins." Basins are not mentioned and have no special standing under statutory Colorado

water law. However, this issue has everything to do with the economic, social, and political consequences of how we as a society allocate a scarce and valuable resource. The rhetoric surrounding "basins" is only a convenient way to make the debate more politically attractive, but there is no basis in law or fact for a discussion of this issue on the basis of river basins.

Sometimes this discussion is couched in even more volatile terms, such as "not

one more drop," or "they are stealing our water." But the same observations apply to these phrases as well: there is no geographic basis to claim water in Colorado. A claim of

FISH RECOVERY PROGRAM

The questions about TBDs and the anticipated relative scarcity of water would be less evident -- or might not occur at all -without the operation of the Endangered Species Act. The Act has spawned (excuse the pun) the Upper Colorado River Fish Recovery Program which the Fish and Wildlife Service <u>may</u> (or may not) revise to say:

- Releases from Ruedi, Green Mountain, and Wolford should be used to augment flows in the 15-mile reach;
- If these and other flow elements plus additional aspects of the recovery program are diligently pursued, jeopardy
 opinions for historic depletions can be avoided;
- Up to 100,000 acre-feet of new depletions will also be "covered" by the program.

water."

Everyone here knows the theory of prior appropriation, but the pain of its practice is only now becoming clear: it is a tough doctrine, and there are certainly social and economic consequences that result from this less than fully equitable sharing of a scarce resource. But the perceived future

inequity as to how water has been allocated is state-wide, nation-wide (to wit -- Las Vegas, Nevada's complaints), and even world-wide. The issue cannot be defined or solved by talking about "transbasin diversions."

I don't want to leave you with the impression that nothing can or should be done to address this issue. I want to talk about the fish program first, and then discuss

Denver's approach to both issues, because there are <u>common elements</u> in my thinking as to both issues.

I understand that some now say that the recovery program should no longer be supported because all the benefits accrue to the East Slope, and all the burden falls on the West Slope.

I have several thoughts concerning this line of thinking. Non-support of the Recovery Program does not mean the Fish and Wildlife Service will go away. I have tried wishing them away, and it does not work.

• The absence of a region-wide recovery program for all water users means that individual water users will have to undergo difficult, expensive, time-consuming, and frustrating Section 7 Consultations for every water depletion. The time and cost of these reviews is substantial, and favorable results are hardly guaranteed. More than 130 West Slope projects (and no East Slope projects) have received approval from the Fish and Wildlife Service because the recovery program serves as the reasonable and prudent alternative to a jeopardy opinion. In the absence of a recovery program, all 130 projects will have to be revisited and they will almost all receive jeopardy opinions. Ask the Ute Water Conservancy District about how pleasant it is to undergo a Section 7 Consultation on an existing water project.

• Thus far, <u>all</u> the benefits of the recovery program (if benefits are defined to be nonjeopardy opinion) have been for small projects west of the Continental Divide;.

It is true that <u>temporary</u> releases from Ruedi, Green Mountain, and Wolford are being used to augment flows in the 15-mile reach. Denver has contributed, in perpetuity, 2,700 acrefeet of Wolford water for the fish.

If the choice for delivering water to the 15-mile reach were between <u>existing</u> users on the West Slope and <u>existing</u> users on the East Slope, there could be a good and substantive debate about the equities involved. But that is not the choice. The water being used for the benefit of the fish is water that has been available for years on the West Slope, and which has not been used, spoken for, or sold. In other words, it is unused water, and is likely to stay that way for some time. For me, at least, it is no choice at all between West Slope unused available water and East Slope used unavailable water. The claims of hardship suffered by West because of the releases of Ruedi or Green Mountain water are really fears about <u>future</u> shortages.

- The Fish and Wildlife Service has now superimposed a conflicting water allocation scheme (for the 100,000 acre-feet of new depletions) that <u>accelerates</u>, and perhaps magnifies, the inequities in the Prior Appropriation Doctrine.
- Those who imagine great development projects in the future, but have no secure water rights to serve the development, fear being left out -- the same fears as with TBDs. If you understand the Prior Appropriation Doctrine and the workings of the ESA, you know there is legitimacy to this fear.

SO -- WHAT ARE WE DOING ABOUT ALL THIS?

Too often, we are bickering. This is not helpful. In the last four or five years, Denver has tried to take a different approach from that taken in the past. In the past, the Denver Water Department paradigm from 1910 through 1980 was more or less as follows:

- File on as many water rights as you could in a variety of locations.
- Design storage projects to store the water for which you had rights; don't tell anybody else what you are doing, and certainly don't cooperate.
- As demand grows, bring additional storage projects on line to meet that demand. Keep your hydrology data and your water rights data as secret as you possibly can.

• Develop your system in isolation from others, defend it against any attack, and attack other systems and plans whose projects, storage, water rights, return flows, etc. might adversely affect you.

The essence of the old strategy was to do everything you could within the boundaries of the Prior Appropriation Doctrine to acquire as much water for your system and its future demands as possible. In the last ten years or so, Denver has tried to take a different approach to both transbasin diversions and the Fish Recovery Program.

- In the first instance, we have tried to behave towards our neighbors as we would expect and hope from them. We have approached problems as if they were common problems, and suggested that we can help solve problems, provided that we do not lose yield in our system.
- In contrast to the past, we have openly shared our data and the results of our computer models indicating water flows, yields, reservoir levels, etc. How can we expect others to understand these systems as we do, if they do not have the same data?
- We put these new principles to task in the 1993 agreements involving Summit County, Grand County, four ski areas, Clinton Reservoir, and the Colorado River District. Without going through these arrangements in detail, we we4re able to fashion a series of agreements that has made more water available for nearly everyone. The Summit County towns get more water from Denver for their domestic needs. The ski areas get more water for snowmaking. Both those entities pay us back only the consumptive use from Clinton Reservoir, which they purchased from Cypress AMAX. The Upper Fraser River area gets additional water from Denver, and we are repaid in part from additional yield made available to us out of Wolford Reservoir, due to a pre-existing "debt" between the River District and the Upper Fraser residents. The River District got financing for its water storage project which could not have been built without our assistance. Denver got permanent, as opposed to temporary, water rights in the newly constructed Wolford Mountain Reservoir. The multiple-party cooperation and benefits could not have happened without a change in attitude, both on behalf of Denver and on behalf of others on the West Slope.
- My personal belief is that there will not be additional reservoirs constructed on the West Slope unless they serve both West Slope and East Slope interests. The East Slope areas, whether they are Colorado Springs, Aurora, Denver, or northern cities, will need additional water storage in western Colorado. The East Slope communities generally have the funds available to construct additional reservoirs. The West Slope entities, particularly the growing destination resorts and ski areas, will need additional water supplies as well. In particular, they will need additional water during the winter, when transbasin diversions are curtailed or at a minimum. Their solution for additional water is, as is the case with the East Slope, additional storage. They will not always have the funds available, or the engineering expertise, or the water rights, to solve the problems. The solutions are joint projects, such as Wolford Reservoir, where East Slope entities paid for most of the project, but received proportionately less of the yield of the project. I believe this same formula, or variants of it, will work in the future for Colorado.
- Finally, I think the same approach needs to be taken with respect to the Fish Recovery Program. With assistance, input, and cooperation from everyone, there is a good chance that the fish can be recovered and removed from the endangered list. Even if the fish are not recovered, a recovery program that serves as the reasonable and prudent alternative for all water users is the only equitable solution to the nettlesome problem of "Section 7" investigations on every existing or new water depletion.

THREE SPECIFIC EXAMPLES OF DENVER ACTIONS OR POLICIES ALONG THESE LINES

Clinton Reservoir/Summit County -- We followed the rule that we would cooperate and help if we did not lose yield in our system.

• We were able to provide water for Copper Mountain, Keystone, and Breckenridge ski areas by allowing them to store water in the form of snow, which then would melt and flow into Dillon Reservoir. The ski areas were required to repay only the evaporative loss, which they repaid from Clinton Reservoir.

- We made available additional water for development in Frisco, Dillon, Silverthorne, and other areas in Summit County, where the same formula applied -- consumptive use was repaid from water stored in Clinton Reservoir.
- In a similar arrangement, we made water available to East Grand County and the Winter Park ski area from our supplies which would have otherwise passed through the Moffat Tunnel to the East Slope. The consumptive use of this water was also repaid from Clinton Reservoir, or from the respective entities' shares in Wolford Reservoir, thereby increasing slightly Denver's yield from Wolford Reservoir.

CONCLUSIONS

Denver cannot solve all the problems or satisfy everyone on the fringe of the discussion involving transbasin diversions or the Fish Recovery Program. But there is plenty of room in the middle for a policy and a practice that will satisfy many people and many interests. The key to a viable solution is to work together to integrate systems, maximize the yield of cooperating agencies and structures, and share data. We need to jointly and mutually approach federal agencies with solutions to their problems as well as ours. We can overcome many of the problems by working together, but we won't get anywhere if we fight among ourselves while the water runs downhill to California.

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COLORADO WATER CONGRESS 1997 SUMMER CONVENTION HELD IN STEAMBOAT SPRINGS, COLORADO

by Laurie Schmidt

The Colorado Water Congress annual summer convention was held in Steamboat Springs, Colorado on August 21-22, 1997. The theme of the conference was "win-win solutions" and finding a common ground among opposing parties in water disputes. Several guest speakers focused on this theme. William Trampe, Upper Gunnison River Water Conservation District, asserted that "We all have a problem with selective hearing, and that's why we can't seem to find a common ground." Eric Wilkinson, General Manager of Northern Colorado Water Conservancy District, stated that there must be mutual understanding and

"reasonableness" among all parties involved in negotiation. Other speakers at the convention included Hamlet "Chips" Barry, Denver Water Department; Daries "Chuck" Lile, Colorado Water Conservation Board; James Martin, Senior Attorney for the Environmental Defense Fund; and Hal Simpson, Colorado State Engineer.

On Thursday afternoon, Tom Cech, Central Colorado Water Conservancy District, led a meeting of the CWC Water Education Committee. The main topic of discussion was the committee's "Proposed Action Plan," the goal of which is to educate government officials, wholesalers, and educators about water resource issues through the mailing of water educational packets. Four meeting attendees volunteered to serve on the committee to coordinate the mailings. In addition, Chris Bridges, Colorado Water Conservation Board, provided a synopsis of water educational materials that are available from a variety of agencies.

John Fetcher receives tribute for his many contributions to the Yampa River District.

A highlight of the convention took place at the

closing luncheon on Friday, August 22, when John Fetcher was honored for his long-standing contribution to the Yampa River

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District. Fetcher was largely responsible for the construction of the Yam Colo and Stagecoach Reservoirs on the Yampa River, both of which have had a major impact on water use in the Yampa Valley. He was also a founder of the Upper Yampa Water Conservancy District and was instrumental in the hands-on development and building of what is now the Steamboat Ski Area. Fetcher was presented with an honorary plaque, and the surprise tribute celebrated the naming of the power plant at Stagecoach Reservoir as the "John R. Fetcher Power Plant." The ceremony included congratulatory remarks to Fetcher by Congressman Scott McInnis, Senators Tilman Bishop and Don Ament, and Representatives Jack Taylor and Lewis Entz.





The water supply conditions during August were excellent throughout the State of Colorado. Above average rainfall was received statewide contributing to above average stream flows which, together with good reservoir storage, boosted the SWSI values. Of note is the large increase in SWSI values in nearly all basins compared to the values last year. The amount and consistency of the rain caused some difficulties for ranchers who wished to hay their fields. The wet weather reduced demand for direct flow irrigation diversions at a time there was abundant stream flow for such diversions. The South Platte River, for example, had no calls for water downstream of Denver, which is a very unusual occurrence during August.

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the U.S.D.A. Natural Resources Conservation Service is used as an indicator of mountain-based water supply conditions in the major river basins of the state. It is based on stream flow, reservoir storage, and precipitation for the summer period (May through October). During the summer period stream flow is the primary component in all basins except the South Platte basin where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven major basins for September 1, 1997 and reflect conditions during the month of August.

Basin	Sept. 1, 1997 SWSI Value	Change From Previous Mo.	Change From Previous Yr.
South Platte	4.0	+1.5	+1.2
Arkansas	2.9	+0.9	+3.4
Rio Grande	2.6	+0.3	+5.1
Gunnison	2.9	+0.6	+3.8
Colorado	3.3	+1.7	+3.4
Yampa/White	3.8	+1.7	+5.2
San Juan/Dolores	3.7	+1.1	+7.2

SCALE

-3	-2	-1	0	+1	+2	+3	+4
Severe	Modera	te	Near Norn	nal	Above Normal	Abundant	
Drought	Drought	t	Supply		Supply	Supply	

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FEATURES



UPDATE ON THE IMPLEMENTATION OF THE AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION ACT (COLORADO SENATE BILL 90-126)

by Reagan Waskom

Colorado Senate Bill 90-126 has been in effect since July 1, 1990, and it seems appropriate to take a look at what this law has accomplished for Colorado water quality protection over the last 7 years. To refresh the readers' memories, the Act concerns the regulation of activities that could result in agricultural chemicals entering the groundwater of Colorado. The implementation of SB 90-126 is funded by a \$0.50 per ton tax on fertilizers and a \$20 per product fee for pesticides registered in the state. Its objectives are to assure that groundwater remains safe for domestic and livestock consumption. Three state agencies are responsible for implementing SB 90-126. They are:

- The Colorado Department of Agriculture, which has overall responsibility for implementation of the Act. This includes identifying problem areas and promulgating rules and regulations as needed.
- Colorado State University Cooperative Extension, which provides education and training in methods designed to reduce groundwater contamination from agricultural chemicals.
- The Colorado Department of Public Health and Environment, which conducts a groundwater monitoring program to assist in identification of problem areas.

SB 90-126 declares that the public policy of Colorado is to protect groundwater and the environment from impairment or degradation due to the improper use of agricultural chemicals, while allowing for their proper and correct use. The Act calls for education and training of agricultural chemical applicators and the general public regarding groundwater protection, agricultural chemical use, and best management practices (BMPs). Agricultural chemicals are defined as commercial fertilizers and all pesticides, including herbicides, insecticides and fungicides.

A three-tiered response is specified by the Act for addressing potential and actual groundwater pollution due to agricultural chemicals. The first level of response is largely preventive and voluntary. These efforts include:

- Implementation of rules and regulations for bulk storage facilities and mixing/loading areas for large agricultural chemical facilities.
- Establishment of voluntary BMPs appropriate to local conditions and type of agriculture.
- Education and training in implementation of BMPs by CSU Cooperative Extension.
- Establishment of a state-wide groundwater monitoring program and an aquifer vulnerability assessment analysis by the Colorado Department of Public Health and Environment.

If prevention efforts fail to remedy a groundwater pollution problem, the Commissioner of Agriculture can adopt rules and regulations that become an Agricultural Management Plan (AMP). If continued groundwater monitoring reveals these plans are not preventing or mitigating the presence of agricultural chemicals, the Water Quality Control Commission may determine the appropriate regulatory response.

Program Accomplishments

GROUNDWATER MONITORING

The Colorado Department of Public Health and Environment began sampling rural domestic wells for the presence of agricultural chemicals under SB 90-126 in 1992. The following regions of the state have been monitored since that time:

1992 South Platte Alluvial aquifer from Denver to Julesburg

1993 San Luis Valley unconfined aquifer

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- 1994 Lower Arkansas Alluvial aquifer from Pueblo to Holly
- 1995 South Platte Alluvial aquifer from Brighton to Kersey
- 1996 Urbanized area of the Front Range
- 1997 Ogallala aquifer

In addition to these studies, the Colorado Department of Health has collaborated with the USGS and other agencies to develop a database of all agricultural chemical detections in Colorado water. Nitrate (NO₃-N) data from a 1990 survey of the West Slope and pesticide data from USGS NAQWA studies are included on the following tables with data collected under the SB 90-126 program. In general, other groundwater studies conducted in the S. Platte and the San Luis Valley have produced similar findings -- very low levels of certain pesticides (primarily triazines) and some NO₃-N contamination.

Nitrate analysis of groundwater has shown that approximately 15 to 20 % of the rural domestic wells tested in agricultural areas exceed the NO₃-N drinking water standard of 10 mg/L (Figure 1). The limited monitoring data collected from urban wells indicates a lower frequency of NO₃-N exceedances. Pesticide analysis has revealed that a number of different chemicals have been detected in surface and ground water (Table 1). However, these detections are relatively infrequent and occur at extremely low concentrations (usually <1ppb). The herbicide atrazine is the most commonly detected pesticide. Only four pesticides detected thus far have exceeded EPA guidelines for drinking water. In general, less than 1% of all rural domestic wells sampled in Colorado have had any pesticide detections that exceed a water quality standard (Figure 2). The SB 90-126 program does not have funding for surface water monitoring, so all surface water data is provided by the USGS and other agencies.



Figure 1. NO₃-N levels in wells sampled by CDPHE from 1990 to 1996.

A long-term monitoring effort was initiated in portions of Weld County overlying the S. Platte alluvial aquifer in 1995 due to identified problems from previous monitoring. Approximately 87 wells between Brighton and Greeley are sampled annually during the irrigation season. Nineteen of the wells are monitoring wells and the rest are irrigation, domestic and stock wells. All wells are analyzed for NO₃-N and atrazine, while monitoring wells are also analyzed for a suite of 46 pesticides. Nitrate analysis has shown that 74% of the monitoring wells and 78% of the irrigation wells tested exceed the NO₃-N drinking water standard of 10 mg/L. As shown in Figure 3, pesticide detections are common, but at levels below human health concerns. None of the three pesticides listed in Figure 3 has been found at levels that exceed a health advisory or maximum contaminant level (MCL) in the Weld County sampling. The MCL established by the EPA for atrazine is 3 ppb, while the health advisory is 70 ppb for metolachlor and 100 ppb for prometone. The detection limit for the analytical methods used the Colorado Dept of Agriculture lab is

10.0

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currently 0.5 ppb for all pesticides. The prevalence of very County suggests non-point sources of contamination, most likely from past agricultural use. An in-depth study of atrazine metabolites in this aquifer is being conducted this year in cooperation with Novartis Crop Protection Inc., the low levels of pesticide throughout the aquifer in Weld primary supplier of atrazine. This study may help us to gain more insight on the age and source of the atrazine in groundwater.

Pesticide	Class	Where	Pesticide	Class	Where
באראיבר, בארבאי לגילור	alt (I weath) the	Detected**	finite USGN	and printing but	Detected
2,4-D	herbicide	s,g	Ethoprop	herbicide	S
2,4,5-T	herbicide	G	HCH	herbicide	S
Alachlor*	herbicide	s,g	Hexazinone	herbicide	g
Aldicarb	herbicide	G	lindane*	insecticide	g
Atrazine*	herbicide	s,g	Linuron	herbicide	S
Benefin	herbicide	G	Malathion	insecticide	S
Bentazon	herbicide	s,g	Metalaxyl	fungicide	g
Bromacil	herbicide	G	Methoxychlor	herbicide	g
Bromoxynil	herbicide	S	Metolachlor	herbicide	s,g
Carbaryl	insecticide	s,g	Metribuzin	herbicide	s,g
Carbofuran	insecticide	s,g	methyl parathion	insecticide	S
Chlordane	insecticide	G	Pebulate	herbicide	S
Chlorothalonil	fungicide	s,g	Pendimethalin	Herbicide	S
Cyanazine	herbicide	s,g	Picloram	Herbicide	g
DCPA	herbicide	s,g	Prometon	Herbicide	s,g
Diazinon	insecticide	s,g	Pronamide	herbicide	S
Dicamba	herbicide	G	Propachlor	herbicide	s
Dieldrin	insecticide	s,g	Propargite	herbicide	S
Diuron	herbicide	s,g	Simazine	herbicide	s,g
EDB*	fumigant	G	Tebuthiuron	herbicide	s,g
Endothall	herbicide	G	Terbacil	herbicide	S
EPTC	Herbicide	s,g	Terbufos	insecticide	S
Ethalflsuralin	Herbicide	S	Trifluralin	herbicide	S

Table 1. Pesticides Detected in Colorado Water as of July 1, 1997.

* One or more detections exceeded MCL for drinking water.

** s = surface water, g = groundwater



Figure 2. Pesticide Detection Frequency in 536 Wells Tested in Colorado (1992-1996).



Figure 3. Pesticide Detection Frequency in Weld County Groundwater in 1995. (No detections were found above an established drinking water standard)

GROUND WATER VULNERABILITY DETERMINATION

In the initial years of the program, a simple aquifer vulnerability analysis was performed to prioritize groundwater monitoring and education efforts. However, the requirements of the proposed rule for State Management Plans for Pesticides being promulgated by EPA necessitates development of a sensitivity analysis/vulnerability assessment map of the state in a GIS format to determine where to focus education and monitoring activities. Through grant funds from EPA, a sensitivity analysis pilot project was conducted to determine the sensitivity of groundwater to impact by pesticides for the northeastern part of the state. The aquifer sensitivity map for the remainder of the state is scheduled to be completed in the late fall of 1997.

EDUCATION

Best Management Practices (BMPs) have been developed for Colorado agriculture with extensive local input from crop producers. A general BMP notebook for Colorado has been completed and consists of eight subject specific BMP

chapters and one booklet providing an overview of the BMPs. The notebook has been provided to producers, pesticide and fertilizer dealers, CSU Cooperative Extension offices, and all USDA Natural Resources Conservation Service offices. This statewide notebook is being utilized to guide local work groups in developing regionally specific BMPs. Localized BMP development has been accomplished in the San Luis Valley, the South Platte Valley, and the Uncompanyere Valley of the Western Slope.

During February 1997, a survey of producers of irrigated crops throughout Colorado was conducted to determine the adoption level of Best Management Practices. The survey was mailed to 3500 producers and approximately 40% responded. We found that certain practices, such as soil sampling, are widely used by farmers while others need more educational focus. During the summer of 1997, indepth interviews with farmers are being conducted to ascertain the barriers to the adoption of BMPs and to determine where to focus future educational efforts.

The use of pesticides and commercial fertilizers in urban areas also has the possibility to impact groundwater resources and is addressed under SB 90-126. Four fact sheets describing BMPs for urban pesticide and fertilizer have been developed for homeowners. These fact sheets are available from CSU or the Colorado Department of Agriculture.

A program to certify individuals making fertilizer and pesticide recommendations in Colorado has been developed to improve professionalism among crop advisors. Over 200 crop consultants and advisors have passed 2 examinations and proven sufficient experience to be certified as crop advisors in Colorado. These individuals are also required to obtain continuing education units to maintain their certification. This affords an ideal opportunity to provide information concerning pesticides and fertilizers and groundwater protection to those making recommendations to farmers.

PESTICIDE AND FERTILIZER STORAGE REGULATIONS

Rules requiring ag chemical containment became effective September 30, 1994. SB 90-126 requires operators of pesticide facilities to have their facilities in compliance by September 30, 1997 and fertilizer facilities by September

SB 90-126 has been implemented in a team fashion by three state agencies with extensive public input from the affected parties. 1997 marks the beginning of the enforcement phase of the containment regulations and the completion of the initial groundwater monitoring of high priority basins. Future groundwater monitoring efforts will include the West 30, 1999. Numerous facilities have already been completed in Colorado and others are working toward compliance. Generic design plans for small to medium-sized facilities have been developed and are available to the public.

STATE MANAGEMENT PLAN FOR PESTICIDES

The US EPA has developed a program that requires states to produce management plans for pesticides thought to be a significant groundwater hazard. If a state wants to allow continued use of any of the pesticides so identified by the EPA, it must produce an EPA-approved management plan specific to that pesticide.

The SB 90-126 program is developing a generic State Management Plan that can be adapted for different pesticides once EPA formally identifies these compounds. A draft of this plan has been submitted to EPA for review.

One requirement of the State Management Plan is to have county level pesticide use data. This data has never been developed for Colorado. To meet this need, grant funds from EPA have been obtained and the Colorado Agricultural Statistics Service has been contracted to perform a pesticide use survey for Colorado. The survey will take place during the fall and winter of 1997-98.

Future Program Goals

Slope and follow up in agricultural and urban areas of the state. The pesticide and irrigation survey work will be used to refine further educational programming. The Colorado Department of Agriculture and the cooperating agencies desire to keep this program as it was initially conceived - preventative and voluntary.

For more information on the Agricultural Chemicals and Groundwater Protection program contact Mitch Yergert at the Colorado Dept. of Agriculture (303-239-4151), Brad Austin at the Colorado Dept. of Public Health and Environment (303-652-3572), Reagan Waskom at Colorado State University (970-491-6103) or visit

http://www.state.co.us/gov_dir/ag_dir/PlantIndustry/Pesticide/groundwater.html.

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This replaces Page 30, which contains a formatting error.

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The US EPA has developed a program that requires states to produce management plans for pesticides thought to be a significant groundwater hazard. If a state wants to allow continued use of any of the pesticides so identified by the EPA, it must produce an EPA-approved management plan specific to that pesticide.

The SB 90-126 program is developing a generic State Management Plan that can be adapted for different pesticides once EPA formally identifies these compounds. A draft of this plan has been submitted to EPA for review.

One requirement of the State Management Plan is to have county level pesticide use data. This data has never been developed for Colorado. To meet this need, grant funds from EPA have been obtained and the Colorado Agricultural Statistics Service has been contracted to perform a pesticide use survey for Colorado. The survey will take place during the fall and winter of 1997-98.

Future Program Goals

SB 90-126 has been implemented in a team fashion by three state agencies with extensive public input from the affected parties. 1997 marks the beginning of the enforcement phase of the containment regulations and the completion of the initial groundwater monitoring of high priority basins. Future groundwater monitoring efforts will include the West Slope and follow up in agricultural and urban areas of the state. The pesticide and irrigation survey work will be used to refine further educational programming. The Colorado Department of Agriculture and the cooperating agencies desire to keep this program as it was initially conceived - preventative and voluntary.

For more information on the Agricultural Chemicals and Groundwater Protection program contact Mitch Yergert at the Colorado Dept. of Agriculture (303-239-4151), Brad Austin at the Colorado Dept. of Public Health and Environment (303-652-3572), Reagan Waskom at Colorado State University (970-491-6103) or visit

http://www.state.co.us/gov_dir/ag_dir/PlantIndustry/Pesticide/groundwater.html.

COLORADO WATER

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TRENDS IN THE WATER RESOURCES JOB MARKET

by Laurie Schmidt

As part of its mission, CWRRI seeks to provide a link between higher education and water-related industry and government agencies. One of the interfaces where this connection is most direct is the current job market. As a university-affiliated organization, it is important for CWRRI to maintain an on-going examination of how to connect students with the jobs for which they are trained and prepared at the university.

During the summer, CWRRI completed an informal survey of water-related job opportunities. The survey was not intended to be exhaustive, but rather to provide an overview of the current "state-of-the-job-market" in water resources. The sampling procedure consisted of reviewing job listings in professional journals, CSU department bulletin board postings, Career Services listings, Internet job search sites, and ads in *Colorado Jobs* during the period April – June, 1997. A total of 53 job listings were compiled. The listings included jobs from all regions of the U.S. (Table 1) and were grouped into five categories (Table 2).

Table 1.	Geographic Disbursement of
	Job Listings

Region	# of Jobs
North Central	5
Northeast	11
South	13
West	24
Total	53

Table 2. Type of Job Listings

Job Sector	# of Jobs
Conservation and Ecology	6
Fisheries/Endangered Species	4
Hydrology and Engineering	19
Public Works and Utilities	20
Water Planning/Management	4
Total	53

The following trends were observed regarding qualifications desired by employers:

Conservation and Ecology

All of the positions in this category demanded at least a Bachelor of Science degree, and several required a Master's or Ph.D degree. Communications and technical writing abilities were high on the list of required skills for these positions. Knowledge of aquatic and riparian ecosystems, biology, conservation, and computer software applications were also required.

Fisheries/Endangered Species

In this category, two of the listings did not specify degree requirements and two required graduate degrees. One important theme among the listings was the demand for knowledge of federal and state statutes, particularly the Endangered Species Act and the Clean Water Act. Aquatic biology and ecology were also topics with which familiarity was required.

Hydrology and Engineering

Thirty-six percent of the job listings fell into this category. The most common degree requirement was some type of engineering degree - usually civil, environmental, or chemical. However, other types of degrees were also requested in this category, including natural science, agriculture, biology, and even business administration. There was a fairly even distribution between listings that required undergraduate degrees and those that required graduate degrees. The majority of the job listings in this category required some type of professional experience, ranging from two to ten years. The ability to prepare technical reports was also a common requirement.

This category contained the largest number of job listings (38 percent) and included positions such as water company manager, city water works manager, utilities supervisor, district manager, and assistant directors of utilities and public works. Many positions listed in this category required knowledge of water/wastewater treatment and drinking water quality/analysis. Another requirement these listings had in common was leadership skills, specifically managerial and supervisory experience. There were virtually no entry-level positions surveyed. Gaining experience, therefore, is an important part of preparation for a career in public works and utilities.

Water Planning and Management

These listings required a bachelor or master's degree in a variety of fields, including geography, resource management, natural science, and engineering. The common requirement among these listings was knowledge of natural resource management and/or land planning and management. Technical writing skills and the ability to prepare presentations were also common requirements.

Overall Trends

Our informal examination of jobs in water indicates that the majority of available jobs are in the public works and the engineering/hydrology sectors. According to a Geological Society of America publication (*Future Employment Opportunities in the Geological Sciences*), 1,700 of the 3,100 available positions within the U.S. Geological Survey are related to water resources. In addition, the number of hydrology-related federal jobs has been steadily rising, increasing from 2,249 in 1985 to 2,623 in 1993.

Perhaps the two most noteworthy trends among all job listings were the requirements for 1) communications skills and 2) computer software and modeling skills. A full 40 percent of all job listings stated that applicants must possess good communications skills, including the ability to write and edit technical reports and proposals, and prepare lectures and presentations. This highlights the need for educational programs to implement course requirements which train students in the area of communications. According to *Career Opportunities in Water Resources*, a publication by the Universities Council on Water Resources, students entering the water resources field must be well grounded in one of the basic academic disciplines. At the same time, individuals from many disciplines must work together to address the full range of complex, multi-disciplinary, water resource issues. While it is impossible for students to become experts in all water-related disciplines, they need to be able to talk to specialists in other areas. This is where communications skills become essential.

Another significant finding was that 30 percent of all job listings included a requirement for familiarity with computer software and modeling systems. This focuses on the increasing need for students to be trained in the technological aspect of their fields. While research methods were listed as a requirement for the few scientist positions surveyed, knowledge of computer/modeling technology far outweighed research skills when it came to abilities considered most valuable by employers.

Also worth noting is that 79 percent of **all** the job listings required some level of professional experience in the respective field. This is a clear indication of how important it is for students to actively gain experience through internships and part-time jobs while working on their academic degrees. The combination of academic training and "real-world" experience can help make a job-seeker more marketable, thereby giving her/him a competitive edge in the job search.

The following Internet sites may be useful to those interested in the water resources job market:

American Water Resources Association Universities Council on Water Resources Colorado School of Mines Career Center Colorado State University Career Center University of Colorado/Boulder Career Center http://www.awra.org http://uwin.siu.edu/ucowr/careers/ http://magma.mines.edu/stu_life/career/ http://career.sc.colostate.edu http://colorado.edu/careerservices/

COLORADO WATER

UNIVERSITY WATER NEWS -- by Laurie Schmidt

CSU PROFESSOR/DEPARTMENT HEAD TO RECEIVE AWRA'S ICKO IBEN AWARD

Alan P. Covich, Professor and Department Head in the Department of Fishery and Wildlife Biology, has been named the 1997 recipient of the American Water Resources Association's (AWRA) Icko Iben Award. Established in 1971, the Icko Iben Award recognizes persons who have made outstanding contributions in promoting communication among the many disciplines concerned with water resources issues. The award is given in honor of the late Dr. Icko Iben, a cofounder of AWRA, who made extensive contributions toward improving the understanding and communication among those involved in disciplines related to water resources .

Dr. Covich has been in his current position at Colorado State University since 1993. An aquatic ecologist, he previously taught at Washington University and the University of Oklahoma. This year, he participated in an international conference in Holland on ecosystem functioning and biodiversity sponsored by the Scientific Committee on Problems of the Environment. He also represented the National Science Foundation U.S. Long-Term Ecological Research Program at the International Long-Term Ecological Research Symposium for East Asia and Pacific Regions in Japan. Dr. Covich's areas of specialization include effects of disturbance on aquatic foodwebs, assessment of ecological integrity of temperate and tropical riparian communities, and effects of climate change on freshwater habitats. He has more than 50 published articles and book chapters to his credit.



Alan P. Covich



NEW FACULTY IN WATER N. LeRoy Poff, Department of Biology Colorado State University

N. LeRoy Poff has joined the faculty in the Department of Biology at Colorado State University. Dr. Poff received his M.S. in Environmental Sciences from Indiana University and his Ph.D. in Stream Ecology from Colorado State University. From 1990-1997, Dr. Poff was a research scientist at the University of Maryland, where he studied the effects of hydrologic variability and sediment movement on the structure of biological communities in streams. He also served a year as senior scientist at Trout Unlimited's national office in Arlington, Virginia where he developed science-based policies and identified national research needs for the conservation of cold water ecosystems.

Dr. Poff's professional and research interests lie in investigating how ecological processes and patterns in streams are mediated by habitat structure and environmental variability. He is particularly interested in how hydrologic conditions influence species distribution and the flow of energy in stream ecosystems. His present research activities include looking at how mobile invertebrate herbivores and attached algae vary spatially in response to physical habitat structure and stream discharge. He is also involved in collaborative research with the U.S. Forest Service on in-stream flow requirements of trout populations. As assistant professor, Dr. Poff will teach two advanced water-related courses: Stream Biology (Z 441) and Limnology (Z 443).

N. LeRoy Poff

October 1997



COLORADO STATE UNIVERSITY

Water Resources Science and Engineering Fall 1997 Seminar Series

Date & Time	Title	Speaker	Affiliation	Location
Oct. 16 12:10 pm	Groundwater Management Modeling of a Remediation System	Dr. Carlos Tamayo, Research Associate	Groundwater Program, Civil Engineering Department, CSU	LSC208*
Oct. 23 12:10 pm	Two-Dimensional Rainfall- Runoff Modeling	Dr. Darcy Molnar, Water Resources Engineer	Riverside Technology, Inc., Fort Collins	LSC208
Oct. 30 12:10 pm	Distributed Modeling Of The Effects Of Army Maneuvers on Watershed Response in Southeastern Colorado	Dr. Bill Doe, Assistant Director for Graduate and Professional Studies	Center for Ecological Management of Military Lands, CSU	VIRGINIA DALE ROOM, LSC

Nov. 6 -- THE CSU WATER CENTER'S CONFERENCE ON FLOODS (see Meetings)

Nov. 13 12:10 pm	Hydrologic and Model Analysis of Landfill Test Cells in Michigan, Utah, and Delaware	Dr. James C. Ascough, II, Research Hydraulic Engineer	USDA-ARS-NPA, GPSRU, Fort Collins	LSC208
Nov. 20 12:10 pm	Scaling Issues in Hydrology	Dr. Donn Decoursey, Faculty Affiliate	Civil Engineering Department, CSU	LSC208
Dec. 4 12:10 PM	The Ecological Basis of Instream Flow Models	Mr. Claudio I. Meier, Ph.D. student	Hydrologic Science and Engineering Program, Civil Engineering Department, CSU	LSC208

*Lory Student Center Sponsored by: Hydrologic Science and Engineering Program, Civil Engineering Department Groundwater Environmental Hydrogeology Program, Civil Engineering Department Water Resources Planning and Management Program, Civil Engineering Department Hydraulics Program, Civil Engineering Department Agricultural Engineering Program, Chemical and Bioresource Engineering Department Watershed Science Program, Earth Resources Department

For information contact JORGE A. RAMIREZ, Associate Professor, Hydrologic Science and Engineering Program, Phone (970) 491-8650/7621, FAX (970)491-7727, E-mail ramirez@engr.ColoState.edu.



Oct. 28 12:10 pm	Brick by Brick: Social Reconstruction in the Former Yugoslavia	Keith Holmes, Documentary Artist,	Visiting Artist, CSU	LSC165
Nov. 4 12:10 pm	Images of India	1997 India Study Tour Pa	rticipants	LSC165
Nov. 11 12:10 pm	World Travel & Career Interests: Water Resources from India to New Zealand	Laurel Saito, CSU PhD Candidate	Civil Engineering	LSC165
Dec. 2 12:10 pm	Water Scarcity in Egypt: Designing Egypt's First Water Conservation Campaign	Dan Hilleman, Professor	Journalism and Technical Communications, CSU	LSC165

COLORADO WATER

Water Resources Seminar -- (A Special Offering of the CSU Water Center) Water Issues and Concerns as Seen by Colorado's Conservancy/Conservation Districts

Oct. 20 4:10 pm	Water Issues and Concerns	Mr. John Porter	SW Water Conservancy District; Dolores Water Conservancy District	A205 Clark
Oct. 27 4:10 pm	Southwest Colorado Water Issues	Dr. Robert Young Dr. Tom McKee Dr. Freeman Smith	Agric. & Res. Econ., CSU Atmospheric Science, CSU Earth Resources, CSU	A205 Clark
Nov. 3 4:10 pm	Water Issues and Concerns	Mr. Dave Merritt	Colorado River Water Conservation District	A205 Clark
Nov. 10 4:10 pm	Water Issues and Concerns	Mr. Dan Birch	Upper Yampa Water Conservancy District	A205 Clark
Nov. 17 4:10 pm	Colorado and Yampa Water Issues	Dr. Dan Tyler Dr. John Loomis Dr. Dan Smith	History, CSU Agric. & Res. Econ., CSU Soil & Crop Sciences, CSU	A205 Clark
Dec. 1 4:10 pm	Future Colorado Water Issues and Concerns	Senator Tom Norton (Invited)	Colorado Senate	A205 Clark
Dec. 8 4:10 pm	Student Team Presentations		and Relation Line Courts	A205 Clark

Natural Resource and Agricultural Economics -- Lunch Time Seminar Series

Nov. 5 12:10-1:00 pm	An Analysis of Drought Response in the San Luis Valley	Dr. Marshall Frasier Mark Sperow	Agric. & Res. Econ., CSU Agric. & Res. Econ., CSU	110 Animal Science
Nov. 12 12:10-1:00 pm	Total Economic Value of T&E Species in the Four Corners Region	Kelly Giraud	Agric. & Res. Econ., CSU	110 Animal Science
Nov. 19 12:10-1:00 pm	Valuing Historic Preservation of Cultural Resources in Fort Collins	Robert Kling	Agric. & Res. Econ., CSU	Marin Ca

UNIVERSITY OF COLORADO AT BOULDER

HOT TOPICS -- A Luncheon Seminar Series

Tuesday, October 28, 1997 -- WESTERN WATER POLICY REVIEW ADVISORY COMMISSION Final Report and Request for Comments

Curt Brown, Project Manager of the Western Water Policy Review Advisory Commission, will discuss the Advisory Commission process and the substance of the draft report (scheduled for release October 1). This program is intended to provide a forum for discussion of the Commission findings and recommendations during the report's official comment period. Douglas Keaney of the Natural Resources Law Center, a contractor with the Commission, will moderate the discussion.

Wednesday, December 3, 1997 -- PUBLIC LANDS LITIGATION SMORGASBORD

Lois G. Witte, Deputy Regional Attorney, Office of the General Counsel, U.S. Department of Agriculture, and Lyle Rising, Senior Attorney, Office of the Solicitor, U.S. Department of the Interior, Rocky Mountain Region, will give perspectives on some of the hottest natural resources litigation affecting public lands. Kathryn Mutz of the Natural Resources Law Center will moderate the panel.

All programs will be held 12:00 noon at Holland & Hart, 555 17th St., 32nd Floor Box lunches are provided -- (Each program offers one hour of General CLE credit (applied for)

October 1997

UNIVERSITY OF COLORADO AT BOULDER FACULTY EXPERTISE IN WATER RESOURCES, 1997/98

The attached inventory of water expertise at the University of Colorado at Boulder is designed to facilitate access of the expertise by Colorado citizens. It is a brief summary; specific details can be obtained by calling or writing the faculty members listed. To further facilitate access, the categories of expertise are identified by current terminology rather than by academic disciplines. Faculty are listed only once under the topic most relevant to their teaching, research and/or service. All addresses can be completed by adding, "University of Colorado, Boulder, Colorado 80309". All phone extensions can be completed by adding (303) 492-xxxx.

Department Abbreviations

ASEN	Aerospace Engineering Sciences	
CADSWES	Center for Advanced Decision Support for Water and Environme	ental Systems
CIRES	Cooperative Institute for Research in Environmental Sciences	
CVEN	Civil, Environmental and Architectural Engineering	
ECON	Economics	
EPOB	Environmental, Population, and Organismic Biology	
GEOG	Geography	
GEOL	Geological Sciences	
INSTAAR	Institute of Arctic and Alpine Research	
LAWS	School of Law	
NRLC	Natural Resource Law Center	

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		WO SHE SHE	
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Charles F. Wilkinson	8262	LAWS, CB 401	

COLORADO WATER

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October 1997



WATER NEWS DIGEST

by Laurie Schmidt and Maile Ceridon

ALLOCATION

Water Cap Placed on Australian River Basin

The historic decision by the Murray-Darling Basin Ministerial Council to cap the amount of water extracted from the Murray-Darling Basin prevents Australian states from extracting more water from the rivers than was taken during 1993-94. Most people who live with the river and its algal blooms, declining fish populations, and carp infestations know that the river is seriously damaged. The first step in restoration is to keep the damage from getting worse, and the cap is a critical part of "holding the line." The cap is designed to prevent a net growth in water diversions from basin rivers. It does not require stopping development. Indeed, the trading and pricing principles imply a marked shift as water moves to higher value crops and land that is more suited to irrigation. This is a major rural re-adjustment mechanism since it allows some irrigators to move out of irrigation with a financial windfall. Their water allocation is then distributed to farmers who, perhaps with better soils, are able to obtain a better return from the investment in this resource. It is important to realize that the cap is a means to an end; the end being a more healthy and useable river that will provide social and economic benefits for everyone who lives in the basin.

The Land, 5/22/97, as reprinted in Resources Policy, June 1997

Golden Prevails in Water War

The City of Golden has saved its main water supply, Clear Creek, from attack by downstream cities. Golden recently won a two-year court battle with Arvada, Westminster, Northglenn, Thornton, and other Clear Creek water users who tried to cap the amount of water Golden could draw from the creek. At stake is water from Clear Creek, a substantial water supply for several of Denver's northern suburbs. Golden's water rights date back to the 1960s and are worth millions of dollars. The water supplies 60 percent of the city's needs during summer months, and if Golden had lost the case, it might have led to shortages during peak times. A loss might also have left the city unable to sell building permits for new development. The case cost Golden \$600,000, and the city intends to ask the losers to pay Golden's attorney's fees. It is likely that Arvada will appeal the judge's August 5 decision, and this will cause Golden's defense costs to go even higher.

Denver Post, 8/15/97



Northern Colorado Water Conservancy District Celebrates 60th Anniversary

The Northern Colorado Water Conservancy District held an informal reception on September 12 to celebrate its 60th birthday. Founded in 1937 by such community leaders as former Colorado State University president Charles Lory, the district partnered with the federal Bureau of Reclamation to complete the Colorado-Big Thompson Project. In the district's lifetime, the seven-county area it serves has grown from 50,000 to more than 530,000 people. The trans-mountain water supply now serves 29 cities and towns, more than 100 ditch reservoir companies, and 620,000 acres of irrigated farmland. Today, the district collects \$4 million in annual property taxes. Most of the money goes to pay for the district's portion of the trans-mountain water project, including operation and maintenance. But at least \$250,000 a year goes to programs aimed at conserving water and keeping it cleaner. The district also maintains demonstration sites at its Loveland office to teach homeowners about the use of fertilizers, mulch, clippings, and sprinkler systems in their yards.

Fort Collins Coloradoan, 9/12/97



Unicameral Moves Quickly on Changes to Instream Appropriations Process with LB877

With near lightning speed, the 95th Nebraska Legislature enacted major changes to the state's instream appropriations process earlier this year. LB877 was introduced on January 22 and signed into law by Governor Ben Nelson on June 12. Prompting introduction of the bill was a pending application for instream appropriations in the Platte River by the Nebraska Game and Parks Commission (NGPC). The following are some of the changes to Nebraska's instream appropriation law made by LB877:

- Requires review of all appropriation permits every 15 years
- Provides that existing or pending instream appropriations be modified to not interfere with applications for certain small and limited
 uses, such as for public water supply and flood and sediment projects
- Increases from 0 percent to 20 percent the time period when the requested stream flow would be available

COLORADO WATER

Requires parties disputing future applications to undergo mediation

The impacts of these changes in statutes could range from creating less controversy over future instream applications to no further applications being filed. The first impacts will undoubtedly be felt by the pending NGPC application. Future impacts might be seen in attempts to implement the recently signed agreement between Nebraska, Colorado, Wyoming, and the U.S. Department of the Interior. This agreement would lead to a Basinwide Recovery Program for the Platte River Watershed.

Water Current, August 1997



Western Water Policy Advisory Commission Prepares Report for Public Review

The Western Water Policy Review Advisory Commission met in Lakewood, Colorado, September 18-20, to approve for public comment a draft report to the President on western water resources. The draft report will be made available for public comment for 60 days beginning in early October. The Commission expects to submit a final report to the President in March 1998. The Commission drew upon a number of sources to develop its draft report and recommendations. It sponsored symposia on the status of aquatic ecosystems, Native American water issues, and on the water programs of the western states (in partnership with the Western States Water Council). In addition, expert reports were commissioned on demographic and economic trends, current and projected water use, climate change, drought management, water quality trends, land us changes, and trends in hydropower regulation. Federal agencies were asked to supply reports about their current water programs and activities to address future water needs. To obtain additional information about the Commission or to receive a copy of the draft report, please contact the Commission office at (303) 236-6211.

Western Water Policy Review Advisory Commission press release, 9/16/97



State of Wyoming Launches Water Planning Project

The Wyoming Water Development Commission (WWDC), the Wyoming State Engineer's Office, and the Wyoming Water Resources Center have begun the process to update the state's framework water plan. About 3,500 Wyoming citizens were sent a preliminary mailing on July 7 to gage willingness to participate in future planning activities. Recipients were also asked to nominate other individuals for inclusion in a major opinion survey to be distributed in early September. According to the WWDC director, over 1,000 responses have been received, indicating a high level of citizen interest in the planning process. The planning schedule calls for the eight-page survey to be distributed to those who indicated an interest in participating. They survey will be mailed out in early September, and recipients will be asked to complete the questionnaire and return it to the Water Development Office by September 30. The WWDC director hopes the results will be compiled before the 1998 legislative session convenes.

Wyoming Water Flow, July-August, 1997

Congressional Hearing Looks at Proposal to Drain Lake Powell

As environmental ideas go, it's one of the biggest and boldest: protect the Grand Canyon's ecosystem by draining Lake Powell, a 252square-mile manmade lake on the Colorado River that attracts 2.5 million tourists a year. Although the idea received a congressional hearing on September 23, lawmakers were anything but supportive, calling it "silly," "monumentally dumb," and "a certifiable nut idea." The Clinton administration said it has no plans to even consider paying for an environmental impact review. The cost of draining the lake, created in the early 1960s by the construction of the Glen Canyon dam, could be in the hundreds of millions of dollars. The dam upriver from the Grand Canyon was built to help harness the unpredictable Colorado River and to generate electricity. But the lake created behind the 710-foot dam has become a recreational success. Supporters point to environmental damage to the Grand Canyon and the rest of the Colorado River caused by nutrient-rich silt backing up on the lake bottom behind the dam. They also say the lake loses too much water to evaporation and to the porous sandstone of Glen Canyon. In addition, they point to the potential instability of the dam. Heavy runoff in 1983 nearly caused the dam to burst. Critics maintain that draining the lake would jeopardize water supplies in six Southwestern states and could cause air pollution if toxic sediment in the lake bed is swept up by winds. Last November, the executive board of the 600,000 member Sierra Club unanimously endorsed the plan. Organized opposition has formed only recently.

Denver Post, 9/22/97, 9/24/97; Fort Collins Coloradoan, 9/19/97, 9/24/97



Walnut Creek Plutonium Levels Prompt Water Re-testing

Water from Walnut Creek, downstream from Rocky Flats, is being re-tested because recent samples showed increased levels of plutonium, according to the company hired to oversee cleanup of the former nuclear weapons plant. The water samples were taken from surface water

and sediments at Walnut Creek near Indiana Street. The standard for water leaving the site is 0.15 picocuries per liter, but the water in the samples tested as high as 0.465 picocuries per liter, for the period from mid-June to early July. The acceptable plutonium standard for water leaving the site is 0.15 picocuries per liter. No contaminated water was found beyond Indiana Street. Although the water is not used for drinking purposes, officials are scrambling to find the cause because previous tests on the water have never shown plutonium levels that high.

Denver Post, Rocky Mountain News, 8/20/97

State Imposes Fine on Pueblo Chemical Depot

The state of Colorado fined the Pueblo Chemical Depot \$500,000 for past groundwater contamination. The fine includes a \$225,000 direct payment and \$275,000 to be spent by the Army for supplemental environmental projects. The fine covers a site on the south end of the 23,000-acre depot.

Pueblo Chieftain, 8/27/97

Movement of Radioactive Isotopes Puzzling

An engineer at the Colorado School of Mines (CSM) recently gave a somewhat disturbing public lecture to the Rocky Flats Citizens Advisory Board. Plutonium and other radioactive isotopes, long thought to be essentially immobile in soil, appear to be moving. According to a project manager for the Environmental Protection Agency, the discovery may mean that Department of Energy officials and their regulators will have to recalculate soil action levels, the contamination level above which cleanup action is required. If particles of plutonium and other radioactive elements move, they can end up in water, resulting in violations of surface water-quality agreements. Researchers have assumed that what little plutonium manages to move through soils does so with water. Therefore, exceedances would be expected to correlate with high rain or runoff periods. However, researchers at CSM found no such correlation.

Boulder Daily Camera, 9/10/97

Clearing up Clear Creek

The Argo, well known historic site visible along I-70 near Idaho Springs, discharges up to 700 pounds of heavy metals into Clear Creek each day. Although the discharge does not harm human health, it poses a threat to fish and other wildlife. By this fall, a water filtration plant will start operations at the Argo Tunnel. The plant has been disguised to blend with the historic structures around it, so it may not be obvious to casual passers-by. But fish, birds, anglers, boaters and nearby residents will likely notice a marked improvement in the stream. The U.S. Environmental Protection Agency identified Clear Creek as a Superfund site and a priority for clean up nearly a decade ago. The start up of the Argo plant illustrates how much progress is being made on the clean up of Clear Creek. Once operating, the plant will allow experts to be able to better determine the other major sources of water pollution in the drainage. The overall job, costing several million dollars, is not finished, however, because the creek's 400 square mile drainage includes more than 1300 old mines and tunnels. Most date from the 19th century, so the old time miners who created the messes are long gone. The state and federal work has been supplemented by local and private efforts. Among the many organizations assisting in the clean up of Clear Creek are Jefferson County, the Coors Company, Colorado Open Space Council, and the Cyprus-Amax company.

Denver Post - 08/15/97

Case Against EPA Cleanup Attracts National Attention

State Senator Ken Chlouber and State Representative Carl Miller are campaigning against the EPA and the cleanup of a local site that has been deemed as a Superfund site near Leadville, CO. The legislators say that the cleanup will destroy the community's mining heritage. Chlouber and Miller say that the project is unnecessary, as no health risk has been proven. They added that the EPA's very presence has prevented Leadville from enjoying the economic boom that the rest of the state has enjoyed. The two legislators have presented their case to several high profile sources including the Colorado General Assembly (who will appeal to Congress), Governor Roy Romer, KUSA Channel 9, U.S. Senator Ben Nighthorse Campbell, and Lake County Commissioner Earl Boeve. Boeve said that he agrees there is no health risk and that the EPA has been in Leadville too long. But he also says that the cleanup has been mandated by the courts and that the cleanup should be done correctly if it must be done. Boeve also stated that the work affects areas that were already disturbed during World War II, and the EPA has agreed to help preserve other undisturbed areas at its expense. The larger issue is whether EPA officials in Washington will accept a trigger level of 3,500 parts per million which will require cleanup of large portions of the country, says Miller. The issue regarding the EPA in Leadville is still under debate.

The Mountain Mail-Salida - 08/27/97

COLORADO WATER

WILDERNESS

American Heritage Rivers Initiative Sparks Controversy

During his annual State of the Union address last February, President Clinton announced the launching of the American Heritage Rivers Initiative, an initiative to support the revitalization of local rivers. Designated rivers will receive and enhanced federal program support and services, and private sector support will be encouraged. The Clinton administration plans to use \$5 million of already authorized funds in the first year to advise communities on where to build local parks and flood control projects and set priorities for cleaning up riverbanks. Boosters of the initiative, including Denver's Mayor Wellington Webb, say the program will be a boon to urban areas with tight budgets that have been slow to clean up polluted waterways. But some are questioning how much a say communities will really have. Some Western members of Congress are attacking the idea, branding it an attempt to dictate water and land-use policies. Rep. Bob Schaffer, a freshman Republican from Fort Collins, says the initiative could trample on private property owners' rights. Part of these uneasy feelings are linked to the White House's election-year decision to designate the Grand Staircase-Escalante National Monument in Utah, over the opposition of that state's congressional delegation in 1996. In response to these concerns, Kathleen McGinty, chair of the Council on Environmental Quality, noted that nominations are voluntary, no new rules are imposed, communities may choose to terminate the designation, and foreign governments and international organizations will have no role in the program. This month, in a victory for President Clinton, the Senate voted 57-42 to kill an amendment by Tim Hutchinson (R-AR) that would have stopped the president's plan to designate the 10 American Heritage Rivers. Sixteen Republican senators joined with 41 Democrats to support the plan. The GOP senators' strong support for the program makes it nearly impossible for House opponents to stop the initiative, despite efforts by Rep. Helen Chenoweth (R-ID).

American Rivers, Spring 1997; Fort Collins Coloradoan, 9/19/97; Denver Post, 9/8/97; Western States Water, 8/8/97

South Platte River Corridor Project Wins 1997 National Urban Rivers Gold Award

The South Platte River Commission was one of 17 river conservation groups that received gold and silver awards at the third American Rivers' National Urban Rivers Symposium, held on June 12-14. The awards were presented for achievement in river education, environmental justice, conservation leadership, grassroots activism, special partnerships, science and engineering, and river stewardship. The Commission has developed six major restoration projects and acquired nearly 80 acres of riverfront park lands in its efforts to restore the damaged river corridor. Once neglected, the South Platte River in Denver today is the key to the area's economic renaissance.

American Rivers, Summer 1997

Flood Toll Reaches \$200 Million



Preliminary estimates of the devastating flooding on July 28 approached \$200 million. The Colorado Office of Emergency Management provided the following breakdown of damage to homes and property:

- Larimer County: 108 homes destroyed, 86 severely damaged, 209 with minor damage, 100 others affected. The estimate for damage to
 public infrastructure, not including CSU, was \$2.5 million.
- Logan County: No homes destroyed, 30 with major damage, 105 with minor damage, and 13 affected. The damage estimate for public infrastructure was \$800,000 to \$900,000.
- Morgan County: No homes destroyed, 13 with major damage, 19 with minor damage, and 16 affected. Public infrastructure damage
 was estimated at \$1.7 million.

Al Yates, president of Colorado State University, estimated the flood damage to the university at upward of \$135 million, with the damage estimate for the campus library alone totaling \$40 million. The Federal Emergency Management Agency (FEMA) is expected to pick up as much as 75 percent of the cost, with the state covering the rest. Eighteen teams from FEMA toured Fort Collins and Colorado State University the weekend following the flood to assess damage in the wake of President Clinton's declaration that Larimer, Logan, and Morgan Counties would qualify for federal disaster aid.

Fort Collins Coloradoan, 8/3/97, 8/10/97

Rio Grande Study Started

The Colorado Water Conservation Board has begun a process in cooperation with the State Engineer to evaluate the feasibility of developing a Rio Grande River decision support system. The first public meeting was held on August 6 in Alamosa and included representatives from federal, state, county, and local governments, and non-profit entities. Issues that need to be addressed in the Rio Grande basin include collection of quality data for compact administration, utilization of the Closed Basin Project, water storage, daily river administration, snowmelt and rainfall forecasting, groundwater and its interaction with natural streams, and management of available water supplies within the compact allocations. The Rio Grande system will be similar to the Colorado River decision support system, which enables decision-makers to use computer modeling to evaluate options for water administration and policy development.

Natural Resource News, September 1997

October 1997

CALLS FOR PAPERS

HYDROLOGY DAYS -- March 30 - April 3, 1998 Colorado State University, Fort Collins, Colorado

HYDROLOGY DAYS will be held March 30 - April 3, 1998, at Colorado State University, Fort Collins, Colorado. Hydrology Days 1998 is dedicated to pioneers in the development of numerical techniques for ground water modeling: Dick COOLEY and Lennie KONIKOW, U.S. Geological Survey; George PINDER, University of Vermont; and Tom PRICKETT, Thomas A. Prickett & Associates, Inc.

Included will be special sessions on "Historical Perspectives and Modern Approaches to Development and Application of Numerical Models: Simulation, Calibration, Management, Optimization, Accounting for Uncertainty," and on "Floods: Flash, Small and Large-Scale." The City of Fort Collins and the Colorado State University campus were not spared from the worst storm to ever hit Fort Collins. Papers on all aspects of floods are welcome. Other sessions will include "Use of Modern Tools in Hydrology: GIS, Internet WWW Data Access, Remote Sensing, and Object-Oriented Programming." Awards and prizes will be presented for the best student papers as <u>oral or poster</u> presentation in the categories of B.S., M.S. and Ph.D.

Send <u>three</u> hard copies (original plus two) of single-page abstract(s) without a specific format and include: title, author's

name, affiliation, full mailing address, telephone, fax, e-mail, and indication of student status (MS, PhD), if applicable. Include a cover letter indicating presentation preference of oral or poster. Indicate your special audio-visual needs. Abstracts are due by January 9, 1998 to:

Professor H.J. Morel-Seytoux, HYDROLOGY DAYS, 57 Selby Lane, Atherton, CA 94027-3926. Phone and Fax: (650) 365-4080; E-mail: morelsey@usgs.gov.

The preliminary program, final program and registration information on the AGU Meeting are available at: http://www.lance.colostate.edu/depts/ce/netscape/wnew.html. or contact: Janet Lee Montera, Civil Engineering Department, Colorado State University, Fort Collins, CO 80523-1372. Phone: 970/491-7425 -- FAX 970/491-7727; E-mail: jmontera@engr.colostate.edu

COSPONSORS -- American Geophysical Union (AGU) Hydrology Section and the Front Range Branch; American Society of Civil Engineers (ASCE), Water Resources Engineering Division, and the Colorado Section, American Water Resources Association.

MINING IN COLORADO: WATER ISSUES AND OPPORTUNITIES March 13, 1998 -- Mount Vernon Country Club, Golden, Colorado

As we approach the end of this century, we face a myriad of challenges related to mine water at abandoned mines, at currently active operating mines, and at proposed future mine sites. This one-day symposium will address all aspects of mine water issues and opportunities, including pre-mining water rights, water quality of mine discharge, and utilization of existing mines as water storage reservoirs. You are invited to submit a 1-page abstract. Approximately 20 minutes will be allowed for each presentation and discussion. Send abstract to: AWRA, P.O. BOX 9881, DENVER, CO 80209-0881. For further information contact Isobel McGowan at 303/477-5338.

A RIVER OF DREAMS AND REALITIES -- PAST, PRESENT, FUTURE 4th Annual Arkansas River Basin Water Forum February 4-5, 1998 -- La Junta, Colorado

The Arkansas River Basin Water Forum will continue to provide an opportunity to share ideas and methods of addressing the various needs for the water flowing through the Arkansas River. A panel discussion on historic successes and failures will set the background for further debate on future development and regulation. Special group sessions on such issues as channel maintenance, water quality, wetlands concerns, and farming methods will provide technical information as well as opportunity for general discussion. The forum is designed to accommodate all individuals interested in the recreational, agricultural, municipal, and/or environmental concerns of Colorado water, especially in the Arkansas River drainage basin. Please visit our web site for year-round participation in Forum activities. The web site address is <http://www.uscolo.edu/arkriver. For more information please contact: Joe Kelley, City of La Junta, P.O. Box 489, LaJunta, CO 81050; Phone 719/384-7358, FAX 719/384-8412.

COLORADO WATER

C GROW WITH THE FLOW: Growth and Water in the South Platte Basin The 8th Annual South Platte Forum -- October 29-30, 1997 Raintree Plaza Conference Center, Longmont, Colorado

The South Platte Forum continues its tradition of presenting multi-disciplinary dialogue on timely resource issues in 1997 with a forum addressing growth and water issues in the South Platte Basin, covering the past history, present happenings and future projections. The conference will include the following sessions and presenters:

SESSION	PRESENTERS
SHOW ME THE MONEY	David Carlson, Colorado Department of Agriculture; Dick Wolfe, former Fort Lupton Mayor; Barbara Kirkmeyer, Weld County Commissioner; Bart Woodward, Superintendent, Riverside Irrigation District
LAND OF PLENTY	Lee Rozaklis, Chief Engineer, Hydrosphere; Jim Sullivan, Douglas County Commissioner
LAND OF DEPLETION	Max Dodson, Assistant Regional Administrator, U.S. Environmental Protection Agency; Marcia Hughes, P.C., Metro Water Suppliers Wild & Scenic Task Force; Dan Luecke, Environmental Defense Fund
OF MINNOWS, MICE AND MEN	Kevin Bestgen, Larval Fish Laboratory, Colorado State University; Lee Carlson, Colorado Field Supervisor, U.S. Fish and Wildlife Service; Deb Freeman, Trout and Raley, P.C.
VISIONS OF THE FUTURE	Buford Rice, Executive Vice President, Colorado Farm Bureau; Neil Grigg, Water Center, Colorado State University; Mike Besson, Wyoming Water Development Commission; Betsy Rieke, Natural Resources Law Center, University of Colorado, Boulder; Rick Cables, Forest Supervisor, Pike and San Isabel National Forest.
WHAT'S AFOOT WITH THE HEADWATERS?	Gary Nichols and Cathy Kindquist, Park County Tourism Office; Mike McHugh, Project Manager, South Park Conjunctive Use Project, City of Aurora; Steven Spann, President, Upper South Park Water Conservancy District
SPECIAL HISTORICAL PRESENTATION	Paul McIver, U.S. Environmental Protection Agency

Invited Keynote Speakers are U.S. Senator Hank Brown, Mark Schaefer, Deputy Assistant of Water and Science, Department of the Interior; Department of Natural Resources Executive Director Jim Lochhead; and Senator Don Ament. In addition to the speaker sessions, there will also be a poster session. For information about the conference, contact Jennifer Mauch, CWRRI, 410 University Services Center, Colorado State University, Fort Collins, CO 80523-2018. Phone 970/491-2657; FAX 970/491-2293.

FLOOD 1997 -- A Conference to Assess the July 28, 1997 Flood in Fort Collins, Colorado November 6, 1997 -- North Ballroom, Lory Student Center, Colorado State University

The Water Center will host a "Flood 1997" conference at Colorado State University on November 6, 1997. The conference will assess the technical, social, and economic consequences of the July 28 flood and produce a permanent record of the flood and its consequences. It will also help the city and university community understand all facets of the event and lay the foundation for faculty and students to study the flood in more depth. Attendance at the conference will be free. Tentatively, the program will begin at 8:30 a.m. with introductory remarks by university and city officials. Then, presentations about the storm, the flood itself, and the response and recovery will follow. Federal officials will provide a further overview of the hydrology and scientific aspects of the event.

In the afternoon, presentations will also be made on the history of flooding, the emotional impact of the flood and on how the media handled it. Finally, a panel will discuss the lessons learned from the flood. There will also be opportunities for poster presentations and for attendance at a lunch where a national authority on urban flooding will speak. There will be a charge for lunch and attendance will be limited and on a first come, first serve basis. For further information about the conference, contact Janet Montera (970/491-7425), Marilee Rowe (970-491-5247) or Neil Grigg (970/491-5048).

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October 1997

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	CALENDAR 1997
Oct. 22-24	MUNICIPAL STORMWATER MANAGEMENT, Salt Lake City, UT. Contact: Contact American Society of Civil Engineers, phone 1-800-548-2723, FAX 703/295-6444, or E-mail conted@asce.org.
Oct. 26-29	SYMPOSIUM ON CLIMATE VARIABILITY, CLIMATE CHANGE AND WATER RESOURCE MANAGEMENT, Colorado Springs, CO. Contact: Betty Neal, Hagler Bailly Services, Inc., P.O. Box 3524, Eagle, CO 81631. Web Site: http://civil.colorado.edu/climate.
Oct. 29-30	NPDES STORMWATER PERMIT COMPLIANCE, Denver, CO. Contact: American Society of Civil Engineers, phone 1-800- 548-2723, FAX 703/295-6444, or see Web Site at confed@asce.org.
Nov. 6-7	2ND ANNUAL CONFERENCE, CLEAN WATER ACT Key Permitting and Implementation Issues, Denver, CO. For information call (800)873-7130 or access on the Internet at http://www.cleinternational.com.
Nov. 16-18	NASULGC 110TH ANNUAL MEETING, Washington, DC. Contact: National Assoc. of State Universities and Land Grant Colleges, One Dupont Circle, N.W., Suite 710, Washington, DC 20036-1191, Phone 202/778-0818, FAX 202/296-6456.
Nov. 16-19	INTERNATIONAL CONFERENCE ON ADVANCES IN GROUNDWATER HYDROLOGY, Tampa, FL. Contact: Andy Smith, So. Florida Water Mgmt. Dist., 2379 Broad St., Brookville, FL 34609, Phone 352/796-7211, ext 4235.
Nov. 17-19	PLANNING FOR THE NEXT DROUGHT, Salt Lake City, UT. Contact: National Drought Mitigation Center at phone 402/472- 6707, FAX 402/472-6614, E-mail ndmc@enso.unl.edu.
Dec. 2-6	17TH INTERNATIONAL SYMPOSIUM, NORTH AMERICAN LAKE MANAGEMENT SOCIETY, Houston, TX. Contact NALMS at phone 303/781-8287 or FAX 303/781-6538.
Dec. 8-12	1997 FALL MEETING, AMERICAN GEOPHYSICAL UNION, San Francisco, CA. Contact: Ron Zwickl at phone 303/497- 3029, FAX 303/497-3645, E-mail zwickl@sel.noaa.gov. AGU Web Site: http://www.agu.prg.

	CALENDAR 1998
Jan. 26-29	CONFERENCE ON TAILINGS AND MINE WASTE 98, Fort Collins, CO. Contact: Linda Hinshaw, Dept. of Civil Engineering, Colorado State University, Fort Collins, CO 80523-1372, Phone 970/491-6081, FAX 970/491-3584/7727.
Mar. 20-29	WETLANDS ENGINEERING & RIVER RESTORATION CONFERENCE, Denver. CO. Contact: American Society of Civil Engineers, Phone 703/295-6029; FAX 703/295-6144, or visit ASCE Web Site at http://www.asce.org.
Apr. 19-23	FIRST FEDERAL INTERAGENCY HYDROLOGIC MODELING CONFERENCE, Las Vegas, NV. Contact: Don Frevert or Jim Thomas, Phone 303/236-0123 x235; FAX 303/236-0199; or E-mail <u>dfrevert@do.usbr.gov</u> or jthomas@do.usbr.gov.
Apr. 26-28	WATER DISTRIBUTION SYSTEM DISINFECTION RESIDUALS WORKSHOP, Philadelphia, PA. Complete information is available on the Internet at http://www.awwa.org/tande/dsdrw.htm.
Apr. 28-30	SOURCE WATER PROTECTION INTERNATIONAL 98, Dallas, TX. Contact: National Water Research Institute, 10500 Ellis Ave., PO Box 20865, Fountain Valley, CA 92728-0865, FAX 714/378-3375, E-mail NWRI-1@worldnet.att.net.
May 3-6	WATERSHED '98 WATERSHED MANAGEMENT: MOVING FROM THEORY TO IMPLEMENTATION, Denver. CO. Contact: Water Environment Federation at 800/666-0206 or E-mail confinfo@wef.org.
Sept. 27- Oct. 2	GAMBLING WITH GROUNDWATER, Physical, Chemical, and Biological Aspects of Aquifer-Stream Relations, Las Vegas, NV. Contact: IAH/AIH Conference Las Vegas Conference Headquarters, Attn: Helen Klose, 2499 Rice St., Suite 135, St. Paul, MN 55113-3724, Phone 612/484-8169, FAX 612/484-8357, e-mail AIHydro@aol.com.

40th Annual Convention -- COLORADO WATER CONGRESS Northglenn, Colorado -- January 29-30, 1998 For information contact the CWC office at 303/837-0812

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