

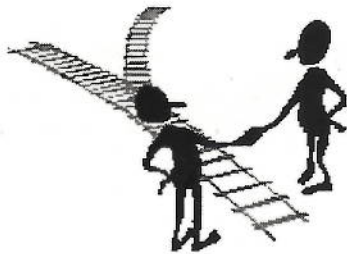


COLORADO WATER

Newsletter of the Water Center of Colorado State University

FEBRUARY 1999

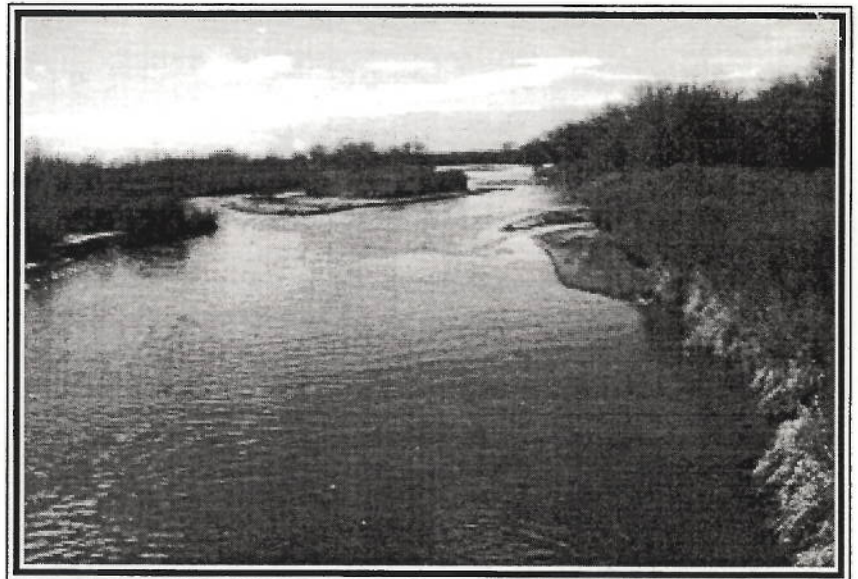
*Administration of CWRRI and The
Water Center of Colorado State
University has merged. See editorial
on page 3.*



ALSO IN THIS ISSUE:

*The South Platte River Basin is the focus
of a cooperative study by CWRRI and
several basin water-user groups*

See page 14



South Platte River near Greeley, Colorado

Co Sponsored by:
Colorado Water Resources Research Institute
Colorado Agricultural Station
Colorado Cooperative Extension
Colorado State Forest Services

**Colorado
State
University**

WATER ITEMS AND ISSUES...

A NEW MISSION ALONG WITH A NEW LOOK, Editorial by Robert C. Ward	3
RESEARCH OPPORTUNITIES	4
CSU AGRICULTURAL EXPERIMENT STATION	5
COOPERATIVE EXTENSION	
<i>Cooperative Extension Programs Impact Water Resources</i>	8
COLORADO STATE FOREST SERVICE	
<i>Forestry Can Help Solve Water Problems</i>	10
COLORADO WATER RESOURCES RESEARCH INSTITUTE	14
<i>An Update on Development of SMAP</i>	14
<i>Irrigation Water Use in the Yampa River Basin</i>	16
<i>CSU, CU, and CSM Water News</i>	17

WATER RESEARCH AWARDS	19
WEB PATHS	22
WATER SUPPLY	22
PUBLICATIONS	23
WATER NEWS DIGEST	24
SEMINARS	32
CALLS FOR PAPERS	33
MEETINGS	34
CALENDAR	36



COLORADO WATER

Vol. 16, No. 1

February 1999

Editor:

Shirley Miller

Writers:

Dave Bartecchi

John Carillo

Jamie Miller

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

Phone: 970/491-6308

FAX: 970/491-2293

E-mail: CWRRI@ColoState.EDU

Internet: <http://www.ColoState.EDU/Depts/CWRRI>

EDITORIAL



A NEW MISSION ALONG WITH A NEW LOOK

Editorial by Robert C. Ward, Director

Over the past 125 years CSU has developed a rich array of multi-disciplinary water expertise that today is comprised of over 100 faculty, in 25 departments, applying their disciplines to water-related topics. In addition to this academic expertise, there are four organizations located on the CSU campus that address water issues related to their missions and are authorized and partially funded by the Colorado legislature (the Agricultural Experiment Station, Cooperative Extension, Colorado State Forest Service and the Colorado Water Resources Research Institute).

The Colorado Water Resources Research Institute (CWRRI) has attempted to support water research on topics of particular interest to Colorado water users and managers; however, swings in federal funding the past three years have greatly restricted such efforts. CWRRI, with financial support from CSU, has maintained a bare minimum of water research, primarily through matching funds from local and state water management organizations. CWRRI has, also with CSU funding, maintained the *Colorado Water* newsletter, encouraged development of water research proposals, co-sponsored Colorado water conferences, and participated in regional and national university-based water research and education organizations.

The Agricultural Experiment Station funds approximately 30 agricultural water-related research projects each year, while Cooperative Extension has 19 specialists providing water-related education and information throughout Colorado. The Colorado State Forest Service increasingly must manage its forests in a manner that respects the integrity of watershed functions.

In the early to mid 1990s, the agencies maintained strong programs in the face of stagnant or declining budgets. However, it was obvious that continued declines in budgets would force changes in programming/staffing if agency missions were to be fulfilled in the future. The CSU Water Center was formed in the mid-1990s to better position the extensive water expertise on the CSU campus to support the research, education and outreach needs of future water management efforts. The challenge was to design and

implement highly effective and efficient programs that are carefully integrated with fellow state organizations. The Water Center's Board of Directors incorporates direction from CSU's academic, research and outreach efforts as well as the state agencies located on campus.

One outcome of the Board's desire to improve the efficiency and effectiveness of CSU's water-related programs was to merge administration of the CSU Water Center and CWRRI. Robert Ward has been appointed director of the CSU Water Center while also serving as Director of CWRRI.

The new cover for *Colorado Water* is a graphic representation of the institutional initiative to better coordinate water programs on the Colorado State University (CSU) campus. You will note that *Colorado Water* is now a publication of the CSU Water Center with co-sponsorship of the four state agencies based at CSU. The water activities of the Agricultural Experiment Station, Cooperative Extension, and the Colorado State Forest Service will now be reported regularly through the pages of *Colorado Water*. Thus, *Colorado Water* will now take on a larger communication role that embodies the efforts of the CSU Water Center to inform Colorado Water readers about the water-related activities of the CSU-based state agencies. CWRRI's traditional reporting on water research activities in higher education and summaries of water research needs in Colorado will continue.

Much of the impetus for this integration of water activities at CSU comes from the changing water research, education and information needs of the citizens of Colorado. The four water-related ballot issues this past fall represent one of the most recent manifestations of the changes in water education, information and research needs taking place. To meet these needs in as efficient a manner as possible, new collaboration and cooperation are necessary.

We hope the 'new' *Colorado Water* will meet your water information needs in a much more integrated fashion. Please let us know your reactions to the new content of *Colorado Water* and, as always, we welcome any input regarding how we can improve the newsletter.

RESEARCH OPPORTUNITIES



**U.S. Geological Survey National Institutes for Water Resources
WATER RESOURCES RESEARCH NATIONAL COMPETITIVE GRANTS PROGRAM
REQUEST FOR PROPOSALS /APPLICATIONS**

Due Date for Applications at CWRRI: Friday, April 16, 1999

This request for applications (RFA) for matching grants to support research on non-point source water pollution and water use is issued by the U.S. Geological Survey in cooperation with the National Institutes for Water Resources and the Nebraska Water Resources Center. \$1 million is being made available for research under this program. At least \$500,000 is to be spent on topics addressing non-point source pollution. The remaining funds are to be focused on research in the area of water use. Any investigator at an institution of higher learning in the United States is eligible to apply for a grant through a Water Research Institute or Center established under the provisions of the Water Resources Research Act (in Colorado, the Colorado Water Resources Research Institute.. Applications may be for projects of 1 to 3 years in duration and shall not request total federal funds exceeding \$250,000 per project. Successful applicants must match each dollar of the federal grant with one dollar from non-federal sources. The USGS and the National Institutes for Water Resources prefer that research supported by this program involve substantial collaboration between the USGS and university scientists, especially on research addressing non-point source pollution. Applicants are encouraged to contact USGS Water Resources Division (WRD) District Chiefs (available on the Internet at <http://water.usgs.gov/staterep.html>), WRD Research Branch Chiefs, and the Office of the Chief of the National Water Quality Assessment program to discuss potential topics and collaborators

RESEARCH PRIORITIES

- A. Research on the following topics: levels of priority are not assigned, and the order of listing does not indicate level of priority.
- Examination of the distribution of organic chemicals and heavy metals in lakes, streams, and ground water and their relationship to multiple potential sources, such as underground storage tanks and motor vehicle use.
 - Urban pesticide and fertilizer use and transport of urban pollutants into ground water and surface water. The effectiveness of methods of controlling such pollution, including regulations and consumer education.
 - Flow modification of small streams and its influence on aquatic habitats and aquatic populations in those streams and in the larger streams and rivers into which they flow.
 - The effect on downstream (downgradient) water quality of nutrients, bacteria, pharmaceuticals, pesticides, growth hormones, and other byproducts of confined animal feeding operations in comparison with other common land-uses in the region.
 - Examination of trends in reservoir water quality, including the effects of sediment buildup on the fate and transport of pollutants.
 - Examination of the effectiveness of Best Management Practices (BMPs) at watershed scales of tens to hundreds of square miles.
- B. Research examining and explaining historical trends in water use in recent decades, as estimated by the USGS
- C. Research on statistical methods for estimating water use at various spatial (national, regional, river basin, local, etc.) and temporal (annual, seasonal, etc.) scales and by types of water use and water users. Research is especially needed on methods of estimating use by self-supplied and unmetered water uses and users.

RFA Guidelines are available at the website <http://ianrwww.unl.edu/ianr/waterctr/usgs/index.html>, from your university's contracts and grants office, or from CWRRI (970/491-6308 or email cwrri@colostate.edu.



AWWA APPROVES FUNDING FOR 39 NEW RESEARCH PROJECTS

The Awwa Research Foundation (AwwaRF), a non-profit organization dedicated to advancing the science of water, announces the selection of 39 new research projects approved for funding in 1999. AwwaRF sponsors practical, applied research for the drinking water community and, since 1986, has managed research projects worth over \$100 million. The new research projects cover topics including utility management, treatment chemistry, customer issues, distribution system water quality, and source water quality and monitoring. Requests for Proposals (RFPs) will be issued for 30 of the new projects and will be available on the AwwaRF web site (<http://www.awwarf.com>) in early March. For additional information, contact AwwaRF at 303-347-6211 or 303-347-6117.



AGRICULTURAL EXPERIMENT STATION



AGRICULTURAL EXPERIMENT STATION PROMOTES UNDERSTANDING OF INTERRELATIONSHIPS BETWEEN AGRICULTURAL AND NATURAL RESOURCE SYSTEMS

by Lee E. Sommers, Director

The Colorado Agricultural Experiment Station (CAES) is an integral part of Colorado State University. The CAES is committed to the land grant mission of addressing the agricultural and environmental needs of the people of Colorado and the region.

The mission of the CAES is to conduct research leading to an agriculture that is economically viable, environmentally sustainable, and socially acceptable. Areas of disciplinary and interdisciplinary research emphasis for the CAES include: a) environmental quality - the interaction of agricultural and natural resource systems; b) improvement of plant and animal resources; c) integrated agricultural systems; d) alternative uses for agricultural commodities; e) food quality and safety; and f) enhancing agricultural and rural economies. These areas of emphasis correspond closely with the priorities established for agriculture and outreach at the 1992 priority setting conferences held throughout Colorado. The CAES supports the concept that agricultural research extends across the entire campus and that colleges within the university must work in concert with each other to solve problems through interdisciplinary effort.

The programs of the CAES include both basic and applied studies essential to maintaining the viability of Colorado's agriculture and its natural resource base. Colorado agriculture benefits in the long term from understanding the interrelationships between agricultural and natural resource systems. Within the area of environmental quality are studies that relate to the compatibility of agriculture, natural resources and the environment; water quality; the availability, conservation and efficient use of water; and understanding the impacts of global environmental change.

The CAES is not a single location; rather it is a statewide system conducting mission-oriented research to meet the needs of Colorado constituents. About 130 research projects are conducted by faculty, staff, and graduate students at both on and off campus locations. Currently, some 22 on-campus departments conduct mission-oriented research supported by the CAES. The CAES program likewise includes research on social and economic aspects of issues as well as research to solve agricultural and natural resource problems that exist in different regions of the state. The Colleges and Departments involved in CAES programs are:

- ◆ **Agricultural Sciences:** Agricultural and Resource Economics, Animal Sciences, Bioagricultural Sciences and Pest Management, Horticulture and Landscape Architecture, Soil and Crop Sciences.
- ◆ **Applied Human Sciences:** Design, Merchandising, and Consumer Sciences, Food Science and Human Nutrition, Human Development and Family Studies
- ◆ **Natural Resources:** Earth Resources, Forest Sciences, Rangeland Ecosystem Sciences, Natural Resources Ecology Lab
- ◆ **Engineering:** Atmospheric Sciences, Chemical and Bioresource Engineering, Civil Engineering
- ◆ **Veterinary Medicine:** Radiology and Radiation Biology, Clinical Sciences, Microbiology, Physiology
- ◆ **Natural Sciences:** Biology, Chemistry, Statistics
- ◆ **Liberal Arts:** Sociology



The CAES also supports 11 off-campus research centers are staffed with professionals dedicated to conducting locally directed, applied research and outreach programs. The names and locations of the off-campus research centers are:

- ◆ *Eastern Colorado, Akron;*
- ◆ *Plainsman, Walsh;*
- ◆ *Arkansas Valley, Rocky Ford;*
- ◆ *San Luis Valley, Center;*
- ◆ *Mountain Meadow, Gunnison;*
- ◆ *San Juan Basin, Hesperus;*
- ◆ *Southwest Colorado, Yellow Jacket;*
- ◆ *Rogers Mesa, Hotchkiss;*
- ◆ *Orchard Mesa, Grand Junction; Fruita; and*
- ◆ *ARDEC, Fort Collins.*

Department	Title	Principal Investigator
Agricultural and Resource Economics	Benefits and Costs of Resource Policies Affecting Public and Private Land	Loomis, J.B.
Agricultural and Resource Economics	Water Quantity and Quality Management and Policy in Western Irrigated Agriculture	Frasier, W.M. Hoag, D.L. Loomis, J.B.
Atmospheric Sciences	Workstation-based Mesoscale Precipitation Prediction to Optimize Agricultural Water Resources	Cotton, W.R.
Atmospheric Sciences	Climate Monitoring and Agricultural Applications for Colorado	McKee, T.B.
Bioagricultural Sciences and Pest Management	Analysis of Agricultural Canal Systems in CO: Maintaining Water Quality Integrity	Kondratieff, B.C.
Chemical and Bioresource Engineering	Microirrigating: Management Practices to Sustain Water Quality and Agricultural Productivity	Broner, I.
Chemical and Bioresource Engineering	Biosensors for Halogenated Pesticides	Reardon, K.F. Murphy, V.G. Henk, L.L.
Chemical and Bioresource Engineering	Investigation of Chemical Application to Sustain Agricultural Production and Protect the Environment	Ayers, P.D. Garcia, L.A. Broner, I.N.
Civil Engineering	Decision Support System for Regional Water Quantity/Quality Evaluation of Best Management Practices	Labadie, J.W. Gates, T.K. Broner, I. Cardon, G.E.
Civil Engineering	Embankment/Dam Breach Predictive Model and Expert System Applications for Agric. Water Distribution	Ruff, J.F. Abt, S.R.
Civil Engineering	Flow Measurement Adjustments for the Cut-Throat Flume	Abt, S.R.
Civil Engineering	Effect of Naturally-Occurring Organic Matter on the Environmental Fate of Pesticides	Sanders, T.G.
Civil Engineering	Conjunctive Use & Management of Surface & Subsurface Waters in the South Platte River Drainage Basin	Durnford, D.S. Marinelli, F.
Civil Engineering	Predictability of Extreme Hydrologic Events Related to Colorado's Agriculture	Salas, J.D. Ramirez, J.A. Warner, J.W.
Forest Sciences	Ecosystem Management: Quantitative Analysis of Spatially and Temporally Explicit Management Models	Grier, C.E. Better, D.R. Dean, D.J.
Forest Sciences	Management Sciences and the Emerging Paradigm of Integrated Forest Ecosystem Management	Better, D.R. Omi, P.N. Rideout, D.B.



Department	Title	Principal Investigators
Horticulture and Landscape Architecture	Turfgrass Water Use, Stress Resistance, and Varietal Evaluation	Koski, A.J. Qian, Y.
Rangeland Ecosystem Science	Rural Land Use Planning and Management Resource Network--Proof of Concept	Woodmansee, R.G.
Rangeland Ecosystem Science	Rangeland and Riparian Health as Affected by Disturbances and Management	Leiringer, W.C. Trlica, M.J. Smith, D.H. Stednick, J.D. Brummer, J. Child, R.D.
Sociology	Municipal and Agricultural Water Exchanges in Colorado: Opportunities & Constraints for the Future	Wilkins-Wells, J.R. Freeman, D.M.
Soil and Crop Sciences	Water Conservation, Competition, and Quality in Western Irrigated Agriculture	Cardon, G.E. Oad, R. Podmore, T. Loomis, J.B. Frasier, M. Hoag, D.L.
Soil and Crop Sciences	Irrigation management and water and soil quality protection in western irrigated agriculture	Cardon, G.E.
Soil and Crop Sciences	Crop, Soil, and Irrigation Research	Berrada, A. Brick, M.A. Peterson, G.A. Westfall, D.G. Quick, J.S. Johnson, D.L.
Soil and Crop Sciences	Crop and Soil Management Systems in Dryland Agroecosystems	Peterson, G.A. Westfall, D.G.
Soil and Crop Sciences	Integrated Crop Production and Soil Management Systems for Irrigated Agriculture in Western Colorado	Pearson, C.H. Golus, H.M. Hammon, R.W.
Soil and Crop Sciences	Soil Fertility Management to Sustain Soil and Environmental Quality	Westfall, D.G. Peterson, G.A.
Soil and Crop Sciences	Manure Management Impacts on Soil, Water and Air Quality	Davis, J.G. Butters, G. Doxtader, K.G.
Soil and Crop Sciences	Forage Water Use in Colorado	Smith, D.H.





COOPERATIVE EXTENSION PROGRAMS IMPACT WATER RESOURCES

by Milan A. Rewerts, Director
 Colorado State University Cooperative Extension

Cooperative Extension is synonymous with university outreach. In fact, our mission is "to provide information and education, and encourage the application of research-based knowledge in response to local, state, and national issues affecting individuals, youth, families, agricultural enterprises, and communities of Colorado." It's a mission we've been committed to since 1914, and we're able to accomplish it in large part because of our county/state/federal partnership. This partnership is fundamental to our success — it's the foundation of our organization.

Another very important partnership is the one we share with colleges, academic departments, agencies, and non-academic units. This unique partnership, which is the very fabric of the land-grant university, makes Colorado State University the "people's university."

In 1996, we launched the Cooperative Extension 2000 initiative, which helped us build on existing partnerships and identify new ones. Such collaboration allowed us to strengthen the structure and function of our organization and our educational programs to serve Colorado more effectively.

The CE 2000 initiative also helped us focus clearly on the critical social, economic and environmental issues in Colorado. As a result, Cooperative Extension developed seven program plans that are tailored to meet the needs of local communities and capitalize on the use of communication technologies, distance learning models, and one-on-one contacts. The programs provide guidance and encourage county, area and regional staff to focus on issues that are unique and particularly relevant to the people they serve locally. The seven program plans are:

- ◆ Engaging communities in transition;
- ◆ Enhancing families and communities;
- ◆ Improving nutrition, food safety and health;
- ◆ Managing small acreages;
- ◆ Partnering for Green Colorado;
- ◆ Strengthening youth development;
- ◆ Sustaining agriculture and the environment.

Under the umbrella of several of the program plans, Cooperative Extension staff throughout the state are addressing a need critical to every person who resides in Colorado — water quality. In the southeastern part of the state, for example, Cooperative Extension programs focus on ways to improve the quality of the Arkansas River. The river, which is the most saline river of its size in the United States, is critical to the agricultural economy of the area.

The following are just a few examples of the impact Extension programs have had in the Arkansas River Valley in recent years.

◆ The Patterson Hollow Hydrologic Unit Area Water Quality Project ensured the installment of \$1,660,730 worth of Best Management Practices. Collaborating with the Natural Resource Conservation Service and the Farm Service Agency, this project positively impacted 35,000 acres spread over 427 participating farms.

◆ Salinity erosion has eaten away at land along the Arkansas River Valley for many years. Through the use of environmentally friendly polyacrylamides or polymers, Cooperative Extension has helped reduce erosion up to 99 percent.

◆ Reduced-tillage studies increased corn yields and returns when rotated with alfalfa. Reduced-tilled corn yielded 198 bushels per acre, with an adjusted return of \$332, or \$24 more per acre than corn grown on traditionally plowed land.



Cooperative Extension's commitment to addressing the water quality issue reaches beyond agriculture to entire communities, and involves youth and adults alike. For example:

◆ In Weld County, 92 youth and 19 adults took 282 water samples and tested 11 different water-quality parameters. They sampled water from the South Platte, Big Thompson and Cache la Poudre rivers. As a result of the 4-H Water Awareness Teamwork Education Research program (4-H W.A.T.E.R.), participants learned about changes in water quality caused by seasonal variations, non-point source pollution and re-use of the water along the river flow.

◆ In Dolores County, the Cooperative Extension director was instrumental in procuring funds and overseeing the successful installation of a rural water system to serve the residents of western Dolores County. Working with the Montezuma Water Company, the county Extension director served as project administrator to design a working water system including storage tanks, pumping stations and 61 miles of mainline. They applied for and received a \$147,000 Community Development Block Grant from the Department of Local Affairs for the two storage tanks. The remaining funds for the project

were provided by the families who personally committed to the purchase of more than 200 water taps worth \$470,000. As a result, 46 percent of the residents in Dolores County now have domestic water.

◆ During the drought years, Cooperative Extension implemented a toll-free drought hotline to help Coloradans make informed decisions about water use and conservation to help maintain their residential properties and agricultural operations.

◆ Colorado State Cooperative Extension, Denver Botanic Gardens and the Green Industries of Colorado recently implemented *Planttalk* Colorado, a 24-hour toll-free automated phone service that provides timely information about water-conserving plant varieties and a variety of other topics.

These are just a few examples of what Cooperative Extension is doing to address the issues of water quality and conservation in Colorado. Recognizing the importance of this issue, Extension will continue to identify needs and work with Colorado State faculty to develop programs that positively impact water and other natural resources. And by combining successful program delivery models from the past with innovative new technologies, Cooperative Extension will remain a relevant source of information Coloradans can trust well into the new millenium.

WATER USE DOWN, SAYS USGS

Newly released statistics on water use by the U.S. Geological Survey (USGS) show that the nation is using less water - 402 billion gallons per day (bgd) for all uses, which is 2 percent less than in 1980, despite a continuous increase in population over that same time period. Freshwater per-capita use also decreased for 1995. Total per-capita use was 1,280 gallons per day (gal/d), compared to 1,380 gal/d in 1990. The USGS has compiled and reported national water-use statistics once every 5 years since 1950.

After continual increases in the nation's total use of surface and ground water for the years reported from 1950 to 1980, water use declined and has remained fairly constant since the mid-1980s according to the USGS report. Long-term concerns remain about the quality of available water, however. Irrigation is the top freshwater category-134 bgd in 1995. When fresh and saline water are combined, more water continues to be withdrawn for thermoelectric power generation (190 bgd, of which 58 bgd is saline) than for any other category.

In a state-by-state comparison, California accounts for the largest total water use (46 bgd), followed by Texas, Illinois and Florida. Two dozen states and Puerto Rico had less water withdrawn during 1995 than during 1990. The USGS water-use report, searchable by county and watershed, along with an expanded section on trends, is available on the World Wide Web at: <http://water.usgs.gov/public/watuse/>.

Single copies of the 71-page report, published as Estimated use of Water in the United States in 1995, (USGS Circular 1200) are available free from the USGS Information Services, Box 25286, Denver Federal Center, Denver, Co, 80225: or FAX (303)202-4693. Specify USGS Circular 1200.



COLORADO STATE FOREST SERVICE

The mission of the Colorado State Forest Service is to achieve stewardship of Colorado's environment through forestry outreach and service and to:

- *Provide for natural resource protection in mountains, plains, and urban settings from damaging effects of fire, insects, disease, wind, water, and people.*
- *Achieve improvement of Colorado's renewable natural resource base for values the public regards as important, while being sensitive to future needs.*
- *Achieve public understanding of forestry's role and value in a healthy environment.*

The Colorado State Forest Service (CSFS) is an organization of active support, rather than a regulatory agency. In recent years, because of rapid population growth, increasing demands for "wild" lands, and growing public interest, CSFS has developed a more holistic approach toward the management of Colorado's natural resources. By taking a stewardship role, CSFS encourages landowners to meet their individual objectives and maintain or improve the overall resource condition while considering all values. The state's forestry function came to Colorado State University in 1955, as the Colorado State Forest Service.



FORESTRY CAN HELP SOLVE WATER PROBLEMS

by Ron Gosnell, Forester

Colorado forests have changed dramatically through the past century. These changes affect everyone's water. This article explains how. It also presents ideas about forestry to improve stream flows and protect water quality.

With respect to forest conditions and water, the hydrologic cycle shown in [Figure 1](#) (see next page) puts water cycle processes in perspective. Almost 90 percent of Colorado's water is from snow melt. Therefore, when you think about forest influences on water flows, think primarily how a forest affects snow-pack accumulation.

As forests grow, the crowns of trees get larger, and eventually branches from adjacent trees touch. A dense, closed, forest canopy forms and precipitation through fall decreases. Instead of reaching the ground to accumulate snow pack, snow lodges in tree crowns.

This airborne snow sublimates moisture back into the atmosphere. Snow pack accumulated on the ground, however, mostly melts eventually. And, most snow melt becomes run-off and storage.

All vegetation stores water in plant tissues and transpires additional water during growth and photosynthesis. Very dense accumulations of vegetation hold and consume more water than does less vegetation. Compared to forest with open space between tree crowns, dense timber:

- ◆ Reduces the amount of water that reaches the soil, and
- ◆ Consumes more of the water stored in the soil.

The overall affect of undisturbed and accumulated forest growth is that a smaller percent of precipitation ends up in streams. The fraction of precipitation that ends up as stream flow is called a forest's water yield. And water yield varies by forest type. A forest type is really a plant community. For example, the Front Range ponderosa pine forest type may include ponderosa growing in association with gamble oak, rocky mountain and common juniper, mountain mahogany, sumac, buck brush, rabbit bush, kinickinic and numerous forbs and grasses.

The difference in what a ponderosa pine forest type yields (about 17 percent of precipitation) and spruce forest yield (about 48 percent of precipitation) is due to differences in temperature, humidity, winds, soils, tree



shapes and arrangements, plant physiology and precipitation characteristics of the differ-

ent forest types. The key factor is SNOW.

In general, higher-elevation forest types yield a higher percentage of water from precipitation. Similarly, there is greater potential to improve water yields with high elevation forest types rather than with lower ones. In addition to the two types mentioned, other forest types that foresters recognize include pinion juniper, aspen, douglas fir, mixed conifer and lodgepole pine.

These plant associations have remained for centuries. However, in a relatively short time period trees have grown very dense, and trees now dominate the plant communities. It can be difficult to recognize forest density changes however because it comes about gradually, with small, annual growth increments. And if one has only seen our forests in their present condition, as is the case for many Colorado newcomers, it is easy to assume that our forests have always looked the way they do today.

With the aid of then-and-now photographs as in Figures 2-3 (see next page) one can better understand the dramatic changes our forests have undergone. Most historical photographs were taken for purposes other than forest comparisons, and yet they serve this purpose well. The changes are most evident if there is a period of 50 to 100 years separating comparison times. Photographs of old mining and railroad scenes, early mountain towns, or schools with hillsides in the background work

Water Storage in the Atmosphere

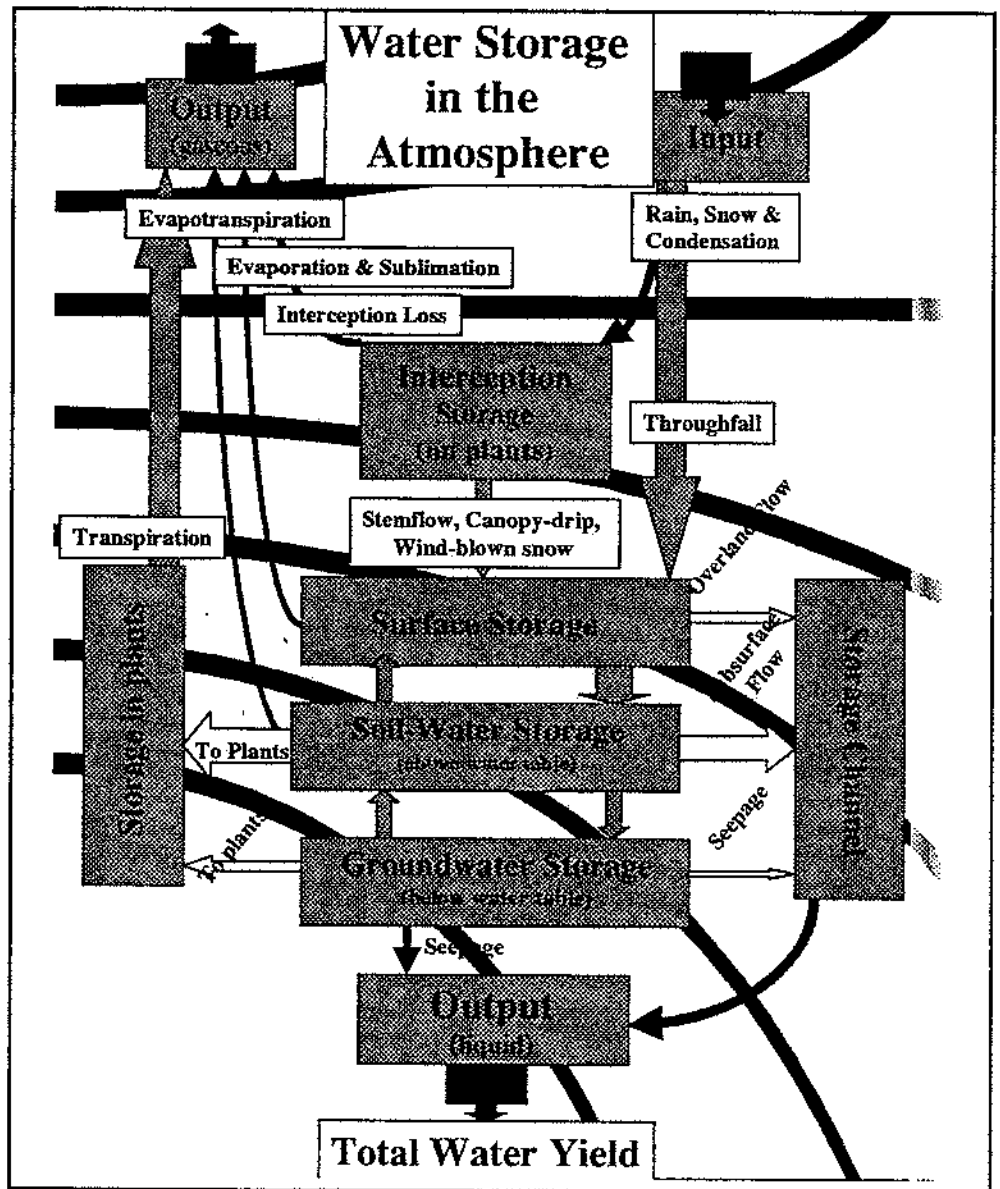


Figure 1. Hydrologic Cycle

well. I recently visited the YMCA Camp at Estes Park. I looked at the 1911 camp photos of buildings and then walked outside to view the same hillsides shown in the background. Wow! What you usually will notice is that trees now occupy previously open space. And this phenomenon is almost universal across Colorado's forested landscape. Keep in mind that the open forest conditions near the turn of the century yielded native stream flows that are the basis of early water rights.



water each year. Why have Colorado forests grown so dense?

Take away all of the trans-mountain water diversions and reservoir releases for developed water since then, and measurements reveal that today's forests yield less. The reduction in native flows is in the hundreds of thousands of acre feet of

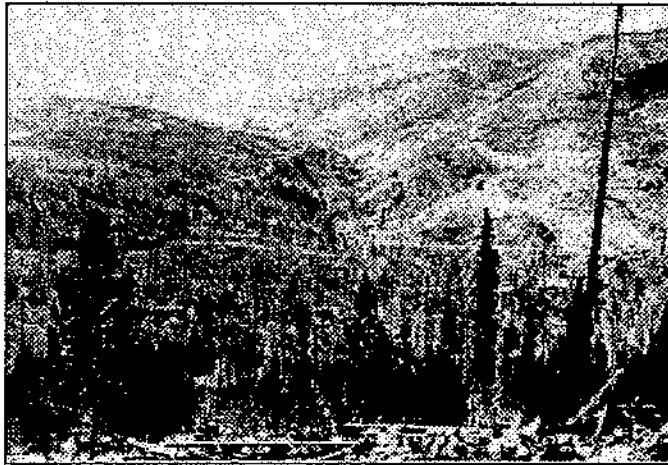


Figure 2. Forest Density Then

Beginning in the early 1900s, changing societal needs and financial necessity led to changes in the way people cared about forests. From the time of the first settlements until the turn of the century, exploitive tree cutting and unchecked forest fires were common. Barren and charred hillsides resulted in unwelcome retribution—floods! Fires were a nuisance, but the floods, which invariably followed fires, destroyed domestic water and irrigation systems and disrupted commerce.

People learned the connection between an adequate and protected forest cover, and favorable water flows. Society no longer tolerated forest abuse. Universities offered studies in forest conservation. Citizens formed the Colorado Forestry Association, which lobbied for National Forest Preserves. The organization that became the USDA-Forest Service was brought into existence.

Orders were sent from Washington D. C. to America's first ever Forest Ranger, William Krueger, who was placed in charge of what became the Pike National

Forest. "Put Out Those Fires!!!" It is interesting to note in Figure 4 that there was a marked drop in the magnitude of Poudre River floods since fire control was initiated in that watershed. Foresters built the best wildland firefighting organization the world had ever seen. Today, that organization includes many federal, state and local agencies including citizens who serve as volunteer fire fighters. Absent the ravages of unchecked fires, and with minimal tree harvesting thereafter, Colo-



Figure 3. Forest Density Now

rado forests accrued phenomenal growth. Gradually, steadily and always staunchly defended, tree growth exceeds mortality many times over.

Today, with mountains blanketed solid, a public mandate to protect trees is stronger than ever. Yet resource managers charged with this responsibility find the job increasingly difficult. With so much accumulated tree growth, though previously manageable, forest fires are difficult to contain, expensive to battle and dangerous. Recently, the Buffalo Creek Fire demonstrated the kind of forest fire that Colorado is likely to experience more of.

At Buffalo Creek, accumulated forest fuel fed an extremely hot wind-driven fire. The fire's extreme heat glazed the soils. Like little glass balls, these hydrophobic soils shed water in torrents. Strontia Springs reservoir is silting in, and with each passing summer thunderstorm erosion-degraded water disrupts Denver's municipal water filtering system. To date, after-the-fire, water



treatment costs are in the millions of dollars. The Buffalo Creek watershed will not heal for decades.

Dense forests are a double whammy for water users. Dense forests reduce water yield. And, when

dense forests burn, they burn so hot that soils are damaged. Vegetation recovery then takes much longer than if fires were not so heavily fueled. Flooding associated with super-hot fires is very expensive, harmful to water quality and can be deadly.

By looking at the results of another disastrous forest fire, one can get a picture of what the forest may have looked like before Colorado's settlement period. The Black Tiger Gulch fire roared out of Boulder Canyon and "chimneyed" up the gulch consuming everything in its path, including homes. The heat here was similar to Buffalo Creek. Yet by nightfall that first day, the fire had laid down and was creeping slowly and diagonally across some hillsides. The cooler night-time fire only killed about half or more of the trees in its path. One can see parts of these "fire-thinned" stands of trees by looking up from Boulder Canyon.

Should society find it acceptable, foresters can restore forest conditions much like the cool, night-time fire did at Black Tiger Gulch. By design, we could have safer forests. Tree-dominated landscapes would give way to greater plant and animal diversity. Crown densities could be restored to something in between the barren and flood-prone hills of yesteryear, and the overcrowded fire and flood disaster-prone hills of today.

Forestry would entail as much of a landscaping art as science-based management. The temporary and necessary disturbances caused by thinning, harvesting and prescribed fire would heal in a matter of years. This compares favorably to decades or more of erosion and

delayed vegetation recovery that follows super-hot wildfires like Buffalo Creek.

Forestry is only possible, however, with an informed citizenry possessing understanding about various affects on forests caused by human endeavors and natural processes. I suspect that if forestry is to become a useful

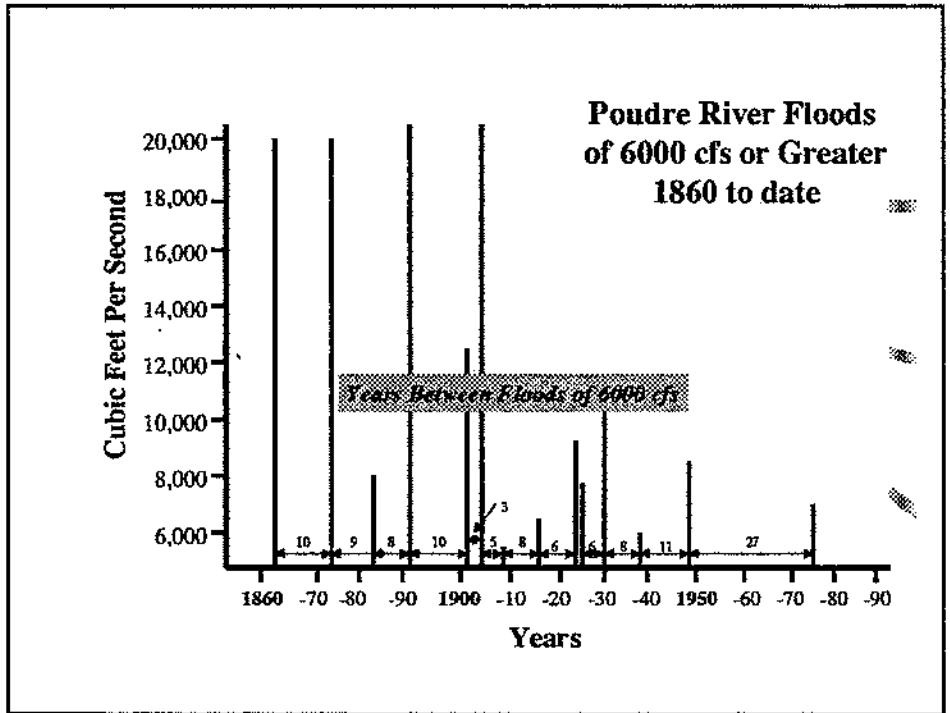


Figure 4. Change in Magnitude of Poudre River Floods

tool to help society meet our water needs into the 21st century, it will be for reasons similar to what stimulated the fire control movement of the early 1900s.

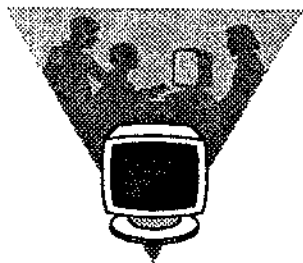
Present forest conditions make it possible that water supplies will suffer from disastrous forest fires, erosion and floods. The costs will hurt. And citizens will demand appropriate forestry action. On the other hand, some research-based knowledge is available now. With citizen support, there can be forestry action to restore forest conditions favorable for water flows.

CWRRI**COLORADO WATER RESOURCES
RESEARCH INSTITUTE**

An Update on the Development of the South Platte Mapping and Analysis Program (SPMAP)

by Luis Garcia and Bob Lange

In the 1970s and 1980s, CWRRI funded basic research to develop mathematical relationships (models) describing interactions between surface and ground water in alluvium aquifers along the South Platte River. Data acquisition and computer technology at the time did not permit integrating the models into data acquisition systems or user-friendly interfaces with decision-makers. The ability to acquire basic resource management data via satellite, combined with the exploding power of the micro-computer (both hardware and software), has brought decision-support technology to a new level. Modern decision support systems employed to enhance water management involve carefully matching data acquisition system design, modeling, and user interfaces to meet manager's needs. New approaches to water research are being employed on this project. University researchers are working hand-in-hand with water managers so that the computer tools are carefully crafted to fit the decisions faced daily by Colorado's water managers.



Since 1995 Dr. Luis Garcia, a faculty member in the Chemical and Bioresource Engineering Department at Colorado State University and Director of the Integrated Decision Support Group (IDS), has been working with a number of local and regional water management organizations

along the South Platte River below Denver. Each of the cooperating organizations financially supports the research while also providing monthly feedback to the researchers on the latest developments. CWRRI has continued to match the water managers' funding. The water managers and university researchers form a 'team' that works closely on all aspects of the research.

As computer technology improves, new tools are being developed for the South Platte Mapping and Analysis

Program (SPMAP). The SPMAP 'team' has been promoting the idea of '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 are being 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.



Due to the modular and data-centered approach, the SPMAP 'team' identified the development of an accurate spatial database and analytical tools for computing farm water budgets and consumptive use (CU) of ground water as two of the most pressing needs for the South Platte River Basin. Out-of-priority impact of ground water well pumping on South Platte River flows must be augmented but this impact needs to be accurately quantified, thus the need for spatial databases and associated analytical tools.

During 1995-96, project efforts focused on spatial data collection and evaluation. A Geographic Information System (GIS) module was developed as an extension to ArcView 3.0a to provide users the capability to view and use spatial data. The GIS module allows the user to view point, line, polygon and image coverages. The current system contains themes for irrigated lands, well locations, stream depletion factors, hydrography, weather stations, county boundaries, roads, and cities.

Since 1997, project efforts have focused on developing a Consumptive Use (CU) model. Satellite images were purchased to determine irrigated land area, as well as field delineation and crop type classifications. A Graphical User Interface (GUI) for the CU model was constructed. The system development has been modular and each component can be operated in a stand-alone mode. The user can employ the GIS module to locate fields and the surface and/or groundwater sources that provide water to them, and this information (along with the crop types grown in

CWRRI

each field and weather station) can then be stored in an ASCII file. The CU model imports the ASCII file and uses it to create an input file which can be used to calculate the CU and any pumping requirements.

The CU output file is then transferred to the SDF model (via an ASCII file again) which then computes the augmentation requirements. This system will help water users better estimate the amount of CU of groundwater and provide a consistent methodology and data to do so.

Current Development Efforts

This year the project is concentrating on developing the final component of the system, installation of the system in the offices of the different water-user groups, and providing technical support. The final component of the system is a model to determine stream depletion factors (SDF) from well pumping and/or recharge sites and projects the impact on the river. The SDF interface will be a stand-alone module that will be used for this project but also will be used by Nebraska and Wyoming as part of the three-state agreement.

The goal this year is to allow users to employ the GIS tools to locate areas where they want to compute the CU and augmentation requirements. This information is then transferred to the CU model (via an ASCII file) which computes the CU for the area.

This year the project is concentrating on developing the final component of the system, installation of the system in the offices of the different water-user groups, and providing technical support.

The SDF interface will be a stand-alone module that will be used for this project but also will be used by Nebraska and Wyoming as part of the three-state agreement.

At the same time, the quality of the spatial data that is available to the users continues to improve. Recently, the project obtained (in digital form) the USGS 7.5" quad sheets for the area. The users can now use them as background for their maps. They can also use satellite images (color and black and white). The locations of the wells continue to be improved, with the State Engineer's office and GASP working on verifying well locations, using differential GPS. As the location of the wells is improved, this will be reflected in new GIS coverages.

The next major step of the development will be the linking of a water supply module to the current system. If funding is available that will start later this year or early next year.



Team Participants

Luis Garcia, Colorado State University
Jon Altenhofen, Northern Colorado Water Conservancy District
Ray Bennett, State Engineer's Office
James Hall, State Engineer's Office
Forrest Leaf, Central Colorado Water Conservancy District
Jack Odor, Groundwater Appropriators of the South Platte
Brent Nation, Groundwater Appropriators of the South Platte
Brad Wind, Northern Colorado Water Conservancy District
Scott Bartling, Northern Colorado Water Conservancy District
Paul Weiss, City of Fort Collins
Tom Donkle, City of Greeley
Todd Bolt, City of Greeley

CWRRI

Irrigation Water Use in the Yampa River Basin

by

*D. H. Smith, R.H. Nichols and F.M. Smith, Colorado State University
and
Kent holt, Division 6, Colorado Division of Water Resources*

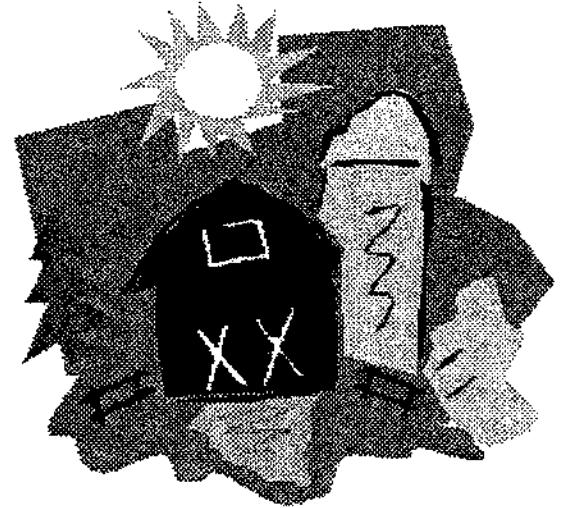
The Yampa River basin encompasses an area of approximately 9,500 square miles in south-central Wyoming and northwestern Colorado. Emphasizing the Colorado portion of the basin, which includes an area of approximately 6,700 square miles, this report provides information on the nature and importance of irrigation water use in the Yampa River basin. The report includes the magnitude and geographical distribution of water use, the timing of water use, and the type of crop production supported by irrigation. The assessment of irrigation water use is based on summaries of actual water use during the period from 1990 to 1994.

The analysis in this report was designed to distill raw data from water records obtained from Water Division 6 of the Division of Water Resources into a document that provides an overview of irrigation water use. Particular emphasis was placed on the magnitude and timing of water use in the basin.

According to previous reports, irrigation represents the single largest use of developed water resources in the Yampa River basin, accounting for 93 percent of the total diversions in the basin and almost 80 percent of the total consumptive use. The number of farm enterprises using irrigation to support crop production is approximately 350, which is about 45 percent of the total farms in the basin.

For some, the most important issue involving irrigation water use in the basin is the impact of current and potential

future irrigation development on the available water resources. From 1989 to 1994, consumptive use of irrigation water averaged only 5.4 percent of available annual water supplies in the basin, even though streamflows averaged only 70 percent of historic flows observed since 1916. The authors conclude that irrigation water use appears to have had minimal impact quantitatively on water resources in the basin, and most likely will not produce further significant effects in the future.



The report includes the following information:

- ◆ Irrigated acreage in the Yampa River basin for various crop categories during selected periods.
- ◆ Irrigated acreage in the Yampa River basin for various crop categories from 1990 to 1994.
- ◆ Monthly and annual historic Yampa River streamflows for 1989 to 1994 and 1916 to 1996 periods and estimated virgin flows.
- ◆ Average annual consumptive water use in the Yampa River basin from 1976 to 1981.
- ◆ Estimated water use in the Yampa River basin under 1985 development conditions.
- ◆ Monthly and total seasonal irrigation water use in relation to streamflows during 1990 to 1994.
- ◆ Average monthly and annual irrigation water diversions and consumptive water use during the period from 1990 to 1994.
- ◆ Water use in relation to irrigated acreage during 1990 to 1994.

The research on which the report is based was financed in part by the U.S. Department of the Interior, Geological Survey, through the Colorado Water Resources Research Institute (Grant No. Project

For a free copy of the report, *Irrigation Water Use in the Yampa River Basin*, Water in the Balance Publication No. 8, November 1998, contact CWRRI by phone at 970/491-6308 or E-mail at cwrri@colostate.edu

CWRRI

CSU Water News



CSU WILL LEAD NASA CLOUD STUDY

\$145 million project is designed to improve weather forecasts, study global warming

Colorado State University will take the lead in a \$145 million study of clouds that could unlock the mysteries of global warming and dramatically improve weather forecasts. NASA's Earth Systems Science Pathfinders program awarded three grants out of 20 proposals, said CSU professor Graeme Stephens, who will direct the project. The cloud study is the only one to be headed by a university. During the five-year project, a radar-equipped satellite called CloudSat will be launched to capture three-dimensional global images of clouds. Stephens said the satellite will probe clouds like a CAT scan or an X-ray. Clouds are the dominant influence on the Earth's heating and cooling: they cool the Earth by deflecting sunlight but heat it by trapping infrared light. But scientists aren't sure whether clouds make things cooler or warmer on a global scale. Much of the technology and theory driving CloudSat were developed at CSU. The two instru-

ments aboard the satellite will be a cloud-profiling radar, which is an antenna about 6 feet long, and an oxygen A-band spectrometer, which is about the size of a 10-inch TV. A second satellite carrying a laser will trail CloudSat so that radar and laser will map the same clouds. CSU will team with the National Atmospheric and Space Administration's Jet Propulsion Laboratory on the project. Ball Aerospace of Boulder will help with the launch of the satellite in 2003. At least 20 CSU graduate students will work on the project, in addition to graduate students from several other universities. Physics and engineering undergraduates at CSU also will play a role. NASA will provide \$119 million for CloudSat, with the rest coming from the Air Force, the U.S. Department of Energy and the Canadian Space Agency. CSU also will provide instruments for another of the three studies, the PICASSO-CENA, which will assess the role of clouds and aerosols on the Earth's heating and cooling.

Rocky Mountain News 12/30/98

CU Water News



WATER IN THE WEST

The University of Colorado at Boulder is organizing a new Western Water Initiative. The purpose of the initiative is to unify, around a regional emphasis, more than 40 faculty members on the Boulder campus with research or teaching interests primarily related to water. The scope of the initiative is defined broadly around the water cycle and includes hydrologic and ecological sciences as well as engineering, social sciences, and law. The initial focus of the Water Initiative will be on climate variability as it affects the hydrologic cycle and water resources in Colorado and adjoining states. Its theme will be the basis for a symposium and

workshop to be held in the summer of 1999. Announcements will be forthcoming. Interested parties can contact William Lewis at the University of Colorado (lewis@spot.colorado.edu). *The Western Water Initiative at CU-Boulder is being organized jointly by the University's Cooperative Institute for Research in Environmental Sciences (Susan Avery, Director) and NOAA's Climate Diagnostic Center (Randall Dole, Director). The initiative will link over a dozen administrative units on the campus that have water-related programs in teaching and research. The initiative is presently being sponsored by NOAA's Office of Global Programs.*

Faculty News

Water Science and Technology Board Member Bill Lewis wins Ecology Medal.—The Societas Internationalis Limnologiae recently awarded William Lewis of the University of Colorado the Einar Naumann-August Thienemann Medal. The award, which was presented to Dr. Lewis in Dublin, IR, honors his extraordinarily comprehensive analysis of the physical, chemical, and biological limnology of tropical rivers and lakes and the regulations of ecosystem functions.

Research by JoAnn Silverstein highlighted in October issue of National Water Research Institute's Briefings.—An innovative nitrate removal project originated by Dr. JoAnn Silverstein was first demonstrated at Wiggins, Colorado in 1996. The process was patented in October, 1997, and a start-up company, NRT, LLC of Golden, Colorado has licensed the patent from the University of Colorado. The first biological denitrification plant for drinking water treatment, designed and built by NRT, was started up this summer in Coyle, Oklahoma. Dr. Silverstein received the Faculty Award for Women Scientists and Engineers from the National Science Foundation in 1991, as well as awards from the Civil, Environmental and Architectural Department at CU. She is a member of the NWRI Research Advisory Board. Dr. Silverstein's Wiggins, Colorado demonstration project was partially funded by CWRRI through the State Water Institutes Program of the U.S. Geological Survey.

CWRRI**CSM Water News**

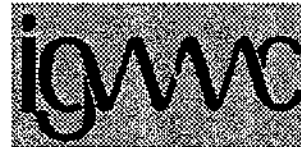
HYDRAULIC AND PURIFICATION PROCESSES IN WASTEWATER INFILTRATION SYSTEMS

Robert Siegrist, Linda Figueroa, Sheila Van Cuyk, Andy Logan, Sarah Masson, Elizabeth Fischer

Current research is being conducted at the Colorado School of Mines, Division of Environmental Science and Engineering, on the hydraulic and purification performance of soil infiltration systems as affected by infiltrative surface character (aggregate-free versus aggregate-laden) and soil depth to ground water. Four 3-D sand-filled tank lysimeters are dosed four times daily with wastewater effluent. This STE and percolate exiting the lysimeters are characterized weekly. Hydraulic performance is evaluated by the relative rate and extent of loss of initial infiltration rate ($\text{cm}^3/\text{cm}^2/\text{day}$). Purification performance is evaluated by relative reduction in concentration and mass of pollutants (BOD, COD, TSS, N, P, and coliform bacteria) during infiltration and percolation. Additional information on soil system performance is gained through multicomponent surrogate/tracer tests. In these tests the applied effluent is amended with a conservative solute (Br), a bacterial tracer (*Pseudomonas* sp.), and two viral tracers (MS-2 and PRD-1 bacteriophages). The break-through and elution curves for these tracers in the lysimeter percolate are observed through extensive sampling and analysis. In addition to laboratory experimentation using 3-D lysimeters, field analysis will be conducted on mature infiltration systems located in a subdivision in Summit County, Colorado.

Correspondence should be directed to: Sheila Van Cuyk, Colorado School of Mines, Golden, CO 80401, Phone 303/384-2002, e-mail svancuyk@mines.edu.

International Ground-Water Modeling Center
Colorado School of Mines
Golden, Colorado, 80401-1887, USA
Fax: (303) 384-2037
Email: igwmc@mines.edu



International Ground-Water Modeling Center 1999 Short Course Schedule

Graphics For Calibrating Ground-Water Models Using Nonlinear Regression	MAR 8	\$ 195	\$245 after 3/1
Calibration And Uncertainty Of Ground-Water Models	MAY 10-13	\$1195	\$1395 after 4/26
Geochemical Modeling of Aqueous Systems	MAY 19-21	\$1095	\$1295 after 5/7
Advanced Groundwater Modeling	JUN 15-18	\$1345	\$1545 after 6/4
Applied Environmental Statistics	JUN 21-25	\$1295	\$1495 after 6/4
PHREEQC: Geochemical and Reaction Transport Modeling	OCT 21-23	\$1095	\$1295 after 10/9
MODFLOW: Introduction to Ground Water Modeling	OCT 20-23	\$1345	\$1545 after 10/9
UCODE - Universal Inversion Code Automated Calibration of "Any" Code	OCT 22-23	\$ 995	\$1195 after 10/10
Subsurface Multiphase Fluid Flow and Remediation Modeling	OCT 28-30	\$1095	\$1295 after 10/15

FOR INFORMATION CALL (303) 273-3103
FOR REGISTRATION CALL (303) 273-3321
VISIT <http://www.mines.edu/igwmc/> FOR MORE INFORMATION


**RESEARCH AWARDS
AT COLORADO UNIVERSITIES**

COLORADO STATE UNIVERSITY
FORT COLLINS, CO 80523

Title	PI	Dept	Sponsor
Agroecosystem Boundaries & C Dynamics with Global Change in the Central United States	Elliott, Edward T	Nat Res Ecology Lab	Univ of Nebraska
Confined Animal Feeding Operations Collaboration Project	Seidl, Andrew F	Agric & Res Econ	CO Counties, Inc.
Flood Forecasting Study Tour & Training Course	Gates, Timothy K	Civil Engineering	Central Water Comm. (India)
Snow Monitoring in the Maule River Basin	Diaz, Gustavo Eugenio	Civil Engineering	Colbun Machicura S.A.
Regional Forest-ABL Coupling: Influence on CO ₂ & Climate	Denning, A Scott	Atmospheric Science	Univ of Minnesota
Land Use & Climate Change Impacts on Carbon Fluxes (LUCCD)	Ojima, Dennis	Nat Res Ecology Lab	Univ of Nebraska
Assessing the Impact of the use of Park Creek Reservoir Water on the Water Quality of Hamilton Reservoir	Carlson, Kenneth H	Civil Engineering	Platte River Power Auth
Devil's Lake Water Quality Review	Fontane, Darrell G	Civil Engineering	COE
Towards a Multisensor Approach to Improve on Current Tropical Rainfall Measurement Mission . . .	Stephens, Graeme L	Atmospheric Science	NASA
Geomorphic Assessment of Lower Mississippi & Atchafalaya Rivers in Vicinity of Old River Complex	Watson, Chester C	Civil Engineering	La Hydroelectric, Ltd.
Interdisciplinary Approaches to Identification & Mitigation of NPS Water Quality Impacts	Stednick, John D	Earth Resources	University of Wy
Regional & Global Estimates of Terrestrial CO ₂ Exchange from National Institute for Global Environmental Change...	Denning, A Scott	Atmospheric Science	Univ CA at Davis
Development of an Ocean Model Based Upon the Reduced System of Equations	Vonderhaar, Thomas H	Cira	DOD-NAVY-ONR
Integrated Modeling & Assessment for Balancing Food Security, Conservation & Ecosys...	Coughenour, Michael B	Nat Res Ecology Lab	Univ of CA at Davis
Reclamation Plan for Summitville Super Fund Site	Redente, Edward F	Rangeland Eco Science	CDPHE
Development of User-Friendly Graphical Interfaces for Ecological Simulation Models	Wall, Diana H	Nat Res Ecology Lab	NM State Univ
The Effects of Remotely-Sensed Data on Modeled Land Surface Atmosphere Interactions; Consequences . . .	Denning, A Scott	Atmospheric Science	NASA
Effects of Biosolids Application on Erosion Control & Ecosystem Recovery	Barbarick, Kenneth	Soil & Crop Sciences	EPA
Tropical Rainfall Measuring Mission Ground Validation	Chandrasekar, V	Electrical Engineering	Univ of Iowa
Application of a Statistical Dynamical Water Balance Model to Regional Scale Integrated Impact Assessment	Ramirez, Jorge A	Civil Engineering	Tulane Univ
Quantitative Determination & Removal of Perfluoroalkylsulfonates and Related Species from Water	Strauss, Steven H	Chemistry	Electrox, Inc.
Platte River Hydraulic Model Study	Abt, Steven R	Civil Engineering	Love & Assoc Inc.
Flower Trial Garden	Klett, James E	Hort & Landscape Arch	Various "Non-Profit"
Develop Updated & Improved Estimates of Recreation Values	Loomis, John B	Agric & Resource Econ	USDA-USFS-RMRS CO
Range-Watershed Training for Native Americans	Bartlett, Ellsworth T	Rangeland Eco Science	USDA-USFS-RMRS CO

Title	PI	Dept	Sponsor
Watershed Erosion Modeling for the Actinide Migration Studies -- Rocky Flats	Julien,Pierre Y	Civil Engineering	Kaiser - Hill Co L.L.C.
Top-down Influences on Water Quality in Front Range Reservoirs	Johnson,Brett M	Fish & Wildlife Biology	N. Fr Range WQ Plan Assoc
Quantification of Federal Reserved Water Rights for National Park Purposes	Sanders,Thomas G	Civil Engineering	NPS
Regional & Global Estimation of Terrestrial CO2 Exchange from NIGEC Flux Data	Denning,A Scott	Atmospheric Science	Tulane Univ
DEC Monitoring Sites 1996-1998	Watson,Chester C	Civil Engineering	COE
NATO Advanced Research Workshop: Decision Support Systems for Integrated River Basin Management & Shared Water ...	Fontane,Darrell G	Civil Engineering	NATO
Design of a Water Quality Monitoring Network for the Big Thompson Watershed	Ward,Robert C	CWRRI	N. Fr Range WQ Plan Assn
Turkey East Anatolia Watershed Rehabilitation	Rittenhouse,Larry R	Rangeland Eco Science	CID
Relation between Risk Management Policy & Natural Resource Use	Swanson,Louis E. Jr	Sociology	Univ of Kentucky
Relationship Between Water Savings & Increased Tree Canopy within Denver, Colorado	Klett,James E	Hort & Landscape Arch	Denver Water
Center for Geosciences/Atmospheric Research Hydro-Meteorology	Julien,Pierre Y	Civil Engineering	DOD-ARMY
USFS Uncompahgre National Forest Biological Survey	Lyon,Margarette J	Fish & Wildlife Biology	USDA-USFS-Forest Research
Relations Between Ice Nuclei and Ice Formation in Clouds	Rogers,David C	Atmospheric Science	NSF
Assessing Values at Risk in the United States from Wildland Fires	Rideout,Douglas B	Forest Sciences	NPS
Dryland Agroecosystems	Peterson,Gary A	Soil & Crop Sciences	USDA-ARS
Developing a Decision Support System for the South Platte Basin	Ward,Robert C	CWRRI	Various "Non-Profit"
Effectiveness Monitoring - Lake Tahoe Basin Watershed Assessment	Noon,Barry R	Fish & Wildlife Biology	USDA -USFS - Tahoe Natl Forest
Ice Formation Processes in Upper Tropospheric Conditions	Demott,Paul J	Atmospheric Science	NSF
A Water Reuse System for Pike's Peak Colorado	Sanders,Thomas G	Civil Engineering	NASA
Bedload Transport Processes in Gravel-Bed Rivers	Abt,Steven R	Civil Engineering	USDA-USFS-RMRS - CO
Snow Distribution & Runoff Forecasting, Kings River Basin, California	Elder,Kevin J	Earth Resources	COE
USARAK Environmental Impact Statement to Withdraw Public Lands	Shaw,Robert B	Forest Sciences	USDA-USFS-RMRS CO
Methodologies for Extrapolating from Local to Regional Ecosystem Scales: Scaling Functions...	Wiens,John A	Biology	EPA
National Conference on Outdoor Recreation Capacity	Haas,Glenn E	Nat Res Recreation & Tourism	USBR
Climate Analysis & Extended Range Seasonal Prediction	Gray,William M	Atmospheric Science	NSF
Herbivore Interactions in Heterogeneous Environments --Role of Context-Dependency and Functional Redundancy	Poff, N. LeRoy	Biology	EPA
Multi-Scaled Ecological Assessment Methods: Prototype Development Within the Columbia River Basin	Poff, N. LeRoy	Biology	EPA

UNIVERSITY OF COLORADO
BOULDER, CO 80401

Title	PI	Dept.	Sponsor
Describe the Phylogenetic Relationships Among Populations of Tui Chub (<i>Gila Bicolor</i>) in Nevada	Martin, Andrew	Environ., Population & Organismic Biology	Univ. of Nevada
Conservation Genetics of Devil's Hole Pupfish	Martin, Andrew	Environ., Population & Organismic Biology	Univ. of Nevada
Refinement and Verification of a Climatological Forecast Model of the Loop Current and Associated Eddies	Kantha, Lakshmi	Aerospace Engineering	Marathon Oil Co
Arctic System Science Data Coordination Center at NSIDC	Cross, Matthew	Coop. Inst. For Res. in Environ. Sciences	NSF
Snow and Ice Distributed Active Archive Center	Barry, Roger	Coop. Inst. For Res In Environ. Sciences	NASA
Watershed and River System Management Program -- Decision Support for Yakima Basin Operations and Planning	Zagona, Edith	CADSWES --Civil Environ. & Arch. Engr.	USBR
Western Watershed Initiatives Program: Research, Conference, and Outreach	Kenney, Douglas	Law	USBR
Predicting Sediment Delivery and Stratigraphy on Marginal Slopes and Shelf Basins	Syvitski, James	Inst. of Arctic & Alpine Research	Dept. of Navy
Crusting of Phosphatic Clay Ponds Due to Desiccation -- Laboratory and Field Studies	Znidarcic, Dobroslav	Civil, Environ. & Arch. Engineering	State of Fla.
Deepwater Physical Oceanography Reanalysis and Synthesis of Historical Data	Kantha, Lakshmi	Aerospace Engineering	Texas A&M
A Hydro-Economic Approach to Representing Water Resources Impacts in Integrated Assessment Models	Strzepek, Kenneth	Civil, Environ. & Arch. Engineering	Tufts Univ.
The Influence of Elevated CO ₂ and Climate Warming on Forest Non-Methane Hydrocarbon Emissions and the Lifetime of Methane	Monson, Russell	Environ., Population & Organismic Biology	Tulane Univ.
Littoral Sediment Transport Using Satellite Using Visible-Infrared Imaging Radiometry	Syvitski, James	Inst. of Arctic & Alpine Research	Raytheon System Co.
Watershed Characterization for Purposes of Alpine Basin Sensitivity Analysis: San Miguel	Williams, Mark	Inst. of Arctic & Alpine Research	San Miguel County
Regional Atmosphere/Forest Exchange and Concentrations of Carbon Dioxide	Bakwin, Peter	Coop. Inst. For Research In Environ. Sciences	Indiana Univ.
Collaborative Research: Variations in Circumpolar Frozen Ground Conditions and Model Scenarios of Future Conditions	Barry, Roger	Coop. Inst. For Research In Environ. Sciences	NSF
Implications of Land-Use Legacies in the Duke Forest: Assessing Changes in Land Cover, Forest Productivity and Carbon Budgets in the U.S.	Wessman, Carol	Coop. Inst. for Research In Environ. Sciences	NASA
Hydrology and Water Resources Research	Lynch, Carol	Graduate School	USGS
Center for Drinking Water Optimization	Summers, R. Scott	Civil, Environ. & Arch. Engineering	EPA
Dynamics of Semi-Enclosed and Coastal Seas: Numerical Models and Altimetry	Kantha, Lakshmi	Aerospace Engineering	Dept. of Navy
Halocarbon Atmospheric Sampling	Losleben, Mark	Inst. of Arctic & Alpine Research	NOAA
Carbon Cycle Atmospheric Gas Collection	Losleben, Mark	Inst. of Arctic & Alpine Research	NOAA
Comparison of Three-Dimensional General Circulation Model Simulations of the Desert Aerosol Life Cycle with Satellite Observations	Toon, Owen	Laboratory for Atmospheric and Space Physics	NASA



WEB PATHS

<i>Description</i>	<i>Website</i>
Environmental Science & Technology has the latest peer-reviewed studies and articles 2 to 11 weeks before they appear in print. Published by American Chemical Society.	http://pubs.acs.org
Platte River Endangered Species Partnership — contains minutes from committee meetings. Keep track of the Cooperative Agreement and developing programs.	http://www.Platteriver.org
High Country Citizens' Alliance — founded to protect, restore and enhance natural ecosystems and quality of human life in the Upper Gunnison River Basin.	http://www.sni.net/hcca
Southwestern Water Conservation District, Durango, CO. Contains press clipping summaries, quarterly newsletter, water education materials and other public information services.	http://www.waterinfo.org
The Instream Flow Program's quarterly newsletter, InStream Colorado (Colorado Department of Natural Resources), is on the web at:	http://www.dnr.state.co.us/cwcb/isf.htm



WATER SUPPLY

A general decline in snowpack over the month of December, measured as percent of average water content by the USDA Natural Resources Conservation Service, is believed to be the cause of the reduction in this month's SWSI values from December 1. Statewide, the snowpack averages 77 percent of normal. The lowest snowpack conditions, 65 percent of average, were in the Colorado and Yampa/White River basins while the Rio Grande was the only basin with a value above average, at 105 percent. Wide variations in snowpack conditions are illustrated within the Arkansas basin, which contains a 22 percent of average reading in the Wet Mountain Valley drainage. In spite of the 105 percent of average snowpack value, Rio Grande basin administrator's visual observations indicate a deficiency of snowpack and a concern about conditions. Reports from most basin administrators referred to low December precipitation and low snowpack. Streamflows have been maintaining near normal base flow rates.

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 snowpack, reservoir storage, and precipitation for the winter period (November through April). During the winter period snowpack 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 January 1, 1999 and reflect conditions during the month of December.

Basin	Jan. 1, 1999 SWSI Value	Change From Previous Mo.	Change From Previous Year
South Platte	1.0	-1.2	-2.0
Arkansas	-1.1	-1.5	-1.9
Rio Grande	1.5	-1.5	+2.4
Gunnison	-0.9	-2.0	-0.5
Colorado	-0.6	-0.8	-0.7
Yampa/White	-3.4	-1.6	-0.5
San Juan/Dolores	-0.9	-3.7	-0.6

-4	-3	-2	-1	0	+1	+2	+3	+4
Severe Drought	Moderate Drought		Near Normal Supply		Above Normal Supply		Abundant Supply	



PUBLICATIONS



Colorado Water Resources Research Institute

Irrigation Water Use in the Yampa River Basin, *Water in the Balance* Publication no. 8, November 1998, Colorado Water Resources Research Institute. Free. Contact CWRI by phone 970/491-6308 or E-mail cwri@colostate.edu.



U.S. Geological Survey Publications

Contact the U.S. Geological Survey, Earth Science Information Center, Open-File Reports Section, Box 25286, Mail Stop 517, Denver Federal Center, Denver, CO 80225 or call 303/236-7476 unless another source is provided.

Salinity Trends in Surface Waters of the Upper Colorado River Basin, Colorado, by Nancy J. Bauch and Norman E. Spahr. Published in *J. Environ. Qual.* 27:640-655 (1998).

Dissolved-solids data collected in the Upper Colorado River Basin upstream from Cameo, Colorado, and in the Gunnison River Basin were analyzed for trends in flow-adjusted dissolved-solids concentrations and loads for water years 1970 to 1993, 1980 to 1993, and 1986 to 1993. Trend results for flow-adjusted periodic dissolved-solids concentrations for the Colorado River Basin upstream from Cameo, CO, generally were downward or no trend was indicated. Trends in flow-adjusted monthly and annual dissolved-solids loads primarily were downward or absent. These trend results partly agree with the downward trends reported by a previous investigation for the Colorado River near the Cameo site. In the Gunnison River Basin, trends in flow-adjusted dissolved-solids concentrations and loads were not detected for more than one-half of the site-analysis-period combinations. Of the trends that were present, most indicated decreases in concentrations and loads rather than increases. In both the Colorado River Basin upstream from Cameo, CO, and the Gunnison River Basin, trends in flow-adjusted dissolved-solids concentrations and flow-adjusted monthly and annual dissolved-solids loads may be affected by a variety of factors. These include channel evolution and hydrologic variation, water quality and flow rate of groundwater discharges and springs, sample size and period of record of dissolved-solids data, and changes in land use in the basin.

Quality of Nutrient Data from Streams and Ground Water Sampled During 1993-95 — National Water Quality Assessment Program, by David K. Mueller. USGS Open-File Report 98-276. 1998.

Trace Elements in Streambed Sediment and Fish Liver at Selected Sites in the Upper Colorado River Basin, Colorado, 1995-96, by Jeffrey R. Deacon and Verlin C. Stephens. USGS Water-Resources Investigations Report 98-4124. 1998.

Pesticides in Surface Water in Agricultural and Urban Areas of the South Platte River Basin, from Denver, Colorado, to North Platte, Nebraska, 1993-94, by Robert A. Kimbrough and David W. Litke. USGS Water-Resources Investigations Report 97-4130. 1998.

Water Quality in the Rio Grande Valley, Colorado, New Mexico, and Texas, 1992-95, by Gary W. Levings, Denis F. Healy, Steven F. Richey, and Lisa F. Carter. USGS Circular 1162. 1998.

Water Quality in the South Platte River Basin, Colorado, Nebraska, and Wyoming, 1992-95, by Kevin F. Dennehy, David W. Litke, Cathy M. Tate, Sharon L. Qi, Peter B. McMahon, Breton W. Bruce, Robert A. Kimbrough, and Janet S. Heiny. USGS Circular 1167. 1998.



WATER NEWS DIGEST

AGRICULTURAL WATER CONSERVATION/QUALITY

Pipes may lower irrigation salt

In an effort to reduce levels of salinity and selenium that enter the Uncompahgre River, a \$1.6 million U.S. Bureau of Reclamation (USBR) project will install pipes in 7.5 miles of open ditches near Montrose. If the demonstration project works, it could create a better habitat for endangered species in the river and could also lead to more money to pipe local ditches, said Uncompahgre Valley Water Users Assistant Manager Marc Catlin. "Our ground has a lot of salt in it," Catlin said. "The theory is that by not letting salinity get loose, you can also keep a lot of selenium from getting in the water. Selenium is a trace mineral (that is believed to) interfere with reproduction of endangered species in the river." The laterals being piped are those south and east of Montrose that drain into the Montrose Arroyo. Test wells will be monitored by USBR and Geological Survey (USGS) officials to see if the salt and selenium levels are reduced in water that runs through the pipes. Piped ditches also offer a conservation benefit because less water seeps, leaks, or evaporates out. The demonstration project is being funded by two USBR programs: the National Irrigation Water Quality Program (NIWQP) and Salinity Control Program. The UVWU is providing labor, although that labor is being paid for by the project.

Montrose Daily Press 12/29/98

Water project designed to help Ark Valley irrigation farmers

More efficient use of better quality water is the goal of a cost-share project beginning in eastern Pueblo County and going to the city of La Junta. Local sponsors composed of two soil conservation districts which represent 505 irrigation farmers in Otero County and parts of the eastern edge of Pueblo county formally signed the contracts recently with the Natural Resources Conservation Service (NRCS) here to begin the Highline Breaks PL-566 Watershed Project. The involved farms cover 59,700 acres of irrigated cropland. Key practices to be installed include 31,000 acres with irrigation water management and nutrient management; 190,000 feet of irrigation ditch lining; 310,000 feet of irrigation pipelines; 210,000 feet of gated pipe; and 80 surge pumps. The \$8.7 million-plus project is the fourth such project in the state since 1985, all in the Arkansas Valley. East and West Otero soil conservation districts and the Colorado State Soil Conservation Board are the local sponsors.

The Pueblo Chieftain 12/29/98

Environment-friendly ag projects solicited

The Natural Resources Conservation Service (NRCS) is encouraging Southeastern Colorado farmers and ranchers to sign up for the 1999 Environmental Quality Incentives Program. The signup period is under way and will continue through Feb. 26, 1999. Local field office personnel suggest that ag producers contact them before beginning the process to ask questions and to discuss their conservation proposals. There are 14 priority areas in Colorado that will share 65 percent of the \$5.9 million allocated to NRCS in the state. Those areas include: Lower Gunnison (Montrose), Lower Gunnison (Delta), Grand Valley, Overland Trail, Beaver and Badger Creek, Bijou Flats, South Platte Jumbo, High Plains Pilot Project, Southern Ute/La Plata, Ute Mountain Ute, Central San Luis Valley, North Canon, McElmo Creek, and Fleming Haxtun. The remaining 35 percent is available for EQIP issues addressed in the rest of the state. The five priority issues are water quality, soil erosion on cropland, grassland management, wildlife habitat, and livestock waste management. EQIP was authorized in the 1996 Farm Bill to replace four former soil and water conservation programs. It continues elements found in the former programs and adds emphasis to environmental wildlife concerns. Applications will be ranked and selected on the basis of the environmental benefits offered.

Pueblo Chieftain 12/30/98

DAMSAFETY

Federal, Local and State Agencies plan exercises for flood response

The Bureau of Reclamation is teaming up with state and local agencies to ensure that a water emergency is handled effectively. On Jan. 27, the bureau sponsored the first in a series of exercises with representatives from police and other emergency-response agencies from La Plata County, the Southern Ute Reservation, the San Juan counties of New Mexico and Utah, and the Navajo Nation. The exercise, held at the La Plata County Fairgrounds, was designed to enable the agencies to plan their response to a flood or dam failure at Vallecito, Lemon or Navajo dams. A similar exercise for Jackson Gulch and McPhee reservoirs will be held later in 1999.

Durango Herald 1/1/99

Solutions to 'unsafe' status of Cherry Creek Dam prompt protests

The Army Corps of Engineers is quietly considering seven sites for a new dam in the Cherry Creek watershed of Douglas County. The corps acknowledges it is considering neighboring valleys in northeastern Douglas County for a \$140 million "dry dam. The earthen structure, which would alternate between empty and full depending on rainfall, would be an alternative to raising the Cherry Creek Dam. The corps in 1993 deemed the 50-year-old dam southeast of Denver unsafe, saying it would crumble under a massive rain. Residents maintain that affected property owners were not notified. The Douglas County Board of Commissioners said it learned "third-hand" of a public corps meeting a few days before it was held. Commissioners also contend they were never notified of two other meetings. Notices indicated discussions would address problems with Cherry Creek Dam but never mentioned dams in Douglas County, Commissioner Sullivan said. The corps' 1993 report says the Cherry Creek Dam would collapse if 29 inches of rain fell in three days over the watershed. "If the dam were to fail ... there is the potential for loss of life and potential flood damages have been estimated at nearly \$3 billion," the corps said in the report. The corps acknowledges there is only a one in 1 billion chance of such a storm. About 138,000 people live in the flood plain, downstream from the dam. The alternative to an upstream dam, the corps says, is raising the Cherry Creek Dam 9 feet and adding another spillway. Greenwood Village opposes raising the dam because the size of the reservoir would increase and would flood some homes. Colorado Sen. Wayne Allard is investigating the complaints.

Rocky Mountain News 12/30/98

♦ ♦ FISHERIES AND WHIRLING DISEASE

Hatcheries updated as part of \$10M DOW project

Research by the Colorado Division of Wildlife confirms that whirling disease has killed up to 90 percent of young rainbow trout in sections of the state's premier fishing rivers. The disease, which poses no threat to humans, also has invaded 12 of the state's 15 trout hatcheries. The state has allocated about \$13 million to clean up the hatcheries and conduct research into the incurable disease, which has killed millions of fish. The disease jeopardizes the state's \$1.3 billion annual sport fishing industry.

The Finger Rock Hatchery near Yampa is being modernized as part of a \$10 million war the Colorado Division of Wildlife is waging on whirling disease and other disease threats to its hatcheries, said Divisions Hatchery Chief Eric Hughes. The money is being spent to modernize the hatcheries, which primarily involves protecting hatchery groundwater sources such as wells and springs from surface water — the most likely source of whirling disease organisms. And the effort is paying off. Hughes said one hatchery has been certified WD-negative by PCR testing and two more have initially tested negative for the disease. The division also is moving forward with additional research that should provide a complete management package within the next several years. Steps include DNA testing to identify extremely low levels of infection, investigating the possibility of developing a vaccine to prevent the disease, using drugs to treat the disease and developing whirling disease resistant brood stocks. But the best chance to produce disease-free fish may be through construction of secure groundwater supplies for as many fish production units as possible, Hughes said. To accomplish this, the division committed \$10 million in fiscal year 1997-98 to hatchery modernization, which involves cutting off river and surface water supplies to the hatcheries, while protecting well-, ground- and spring-water sources. So far, three former WD-positive hatcheries — Mt. Ouray near Salida, Bellvue near Fort Collins and the Durango Hatchery — have had their water supplies protected and been disinfected. Mt. Ouray has been determined to be WD-negative by DNA testing, and preliminary tests at Durango and Bellvue are negative, Hughes said. In addition, work at Buena Vista has helped make its water supply more secure.

If facility improvements proceed on schedule and testing remains WD-negative, these hatcheries could collectively be producing 1.9 million WD-negative, catchable-sized trout by late 2002, Hughes said. The DOW's hatchery modernization plans include:

— **Finger Rock** — Plans are to install perforated spring collection lines to secure the existing groundwater system from potential irrigation-water contamination and to cover the concrete raceways to protect the water from birds, which may carry spores from infected fish they have eaten. Construction is scheduled to be completed by January 1999. Catchable-sized trout should be available 18 months later. Projected capacity is 300,000 fish per year.

— **Rifle Gap** — Protecting the water sources for the hatchery at Rifle Gap presents the biggest challenge to the modernization project because many of the springs are situated in the walls of a narrow canyon that has a road paralleling Rifle Creek. Some of the springs are below the creek level. Plans are to dig a trench along the base of the canyon wall, bury a collection pipe and line the side of the trench closest to the creek with plastic to prevent creek water from infiltrating the trench. The trench will be capped with rock and gravel. Tentative plans are to begin work on the trench in early 1999 and work until summer tourist season begins, move work crews to the hatchery during the summer, and to finish the trench work in the fall. Rifle Gap Hatchery is projected to produce 800,000 catchable sized fish by mid-2001.

At the DOW's Durango Fish Hatchery, construction of a new pump gallery and recirculation system is under way. It will include a system of screens and oxygen injection systems to help improve water quality.

The *Salida Mountain Mail* reports that the Collegiate Peaks Chapter of Trout Unlimited has granted an award of \$7,500 to the Whirling Disease Foundation of Bozeman, Montana, to fund the development and distribution of standardized protocols for the aquatic worm which acts as an alternate host for the whirling disease parasite. For more information, contact the Whirling Disease Foundation at P.O. Box 327, Bozeman, Montana 59771-0327 or at 406-585-0686. On the web, send e-mail to whirling@mcn.net or visit the organization's web site at www.whirling-disease.org.

Steamboat Pilot 12/31/98, *Rocky Mountain News*, *Salida Mountain Mail* 12/23/98

♦ ♦ LITIGATION

Dispute over water supply goes back to court

After arbitration meetings failed to produce a settlement in a dispute between Lafayette and the New Anderson Ditch Co., attorneys and city officials are headed back to court. The dispute, over Anderson's termination of a contract to deliver water through the ditch to the Baseline Reservoir, is estimated to have cost both cities at least \$700,000 in the last two years. Lafayette, which filed the suit, owns 70 percent of the reservoir, and Boulder owns 63 percent of the ditch company's shares. How much water flows through the ditch, which branches off from Boulder Creek, has been one obstacle to reaching an agreement in the dispute.

Boulder Daily Camera 1/7/99

♦ ♦ MISCELLANEOUS

CRWCD expands small-grant program

Last year, the Colorado River Water Conservation District (CRWCD) awarded more than \$89,000 to 11 entities. This year, it appropriated \$150,000 to increase the program. The grants are awarded to water resource projects that are within the district's boundaries and involve the beneficial use of water for agricultural, municipal, industrial and other purposes. The district also will consider projects for watershed management activities, water quality enhancement projects, and water conservation and efficiency projects. Applicants may be governmental, private organizations and individuals. Last year, among other recipients, Palisade, Kremmling and the Grand Junction Kiwanis received grants between \$1,650 and \$13,500 for water supply projects. The Upper Yampa Water Conservation District was awarded \$20,000 for diversion research, and the Uncompahgre Valley Water Users Association \$13,500 for a water quality project making use of a polymer sealant to seal canal leaks. Two local projects also received \$13,500 — Basalt, to stabilize the Roaring Fork River bank where flooding occurred several years ago, and Colorado Rocky Mountain School in Carbondale, for its garden project. Requests for this year's grants must be submitted to the district by Feb. 15. Awards will be made in April by the district board at its quarterly meeting. For more information and an application form, call the district office at 945-8522 or 1-800-626-3479.

The Glenwood Post 1/11/99

♦ ♦ PEOPLE

Governor Owens Announces Cabinet Appointments

In January, newly-elected Governor Bill Owens announced the following cabinet appointments: to head the Department of Agriculture, **Don Ament**. Ament is a farmer/rancher, former Colorado State Representative and State Senator, and served as chairman of the Senate Agriculture and Natural Resources Committee. **Jane Norton** was appointed Director of the Colorado Department of Public Health and Environment. Norton's experience includes serving as Regional Director of the U.S. Dept. of Health and Human Services and as an executive with the Medical Group Management Association of Englewood. She was appointed to fill an unexpired term in the Colorado Legislature, 1986-87. **Greg Walcher** was named to head the Colorado Department of Natural Resources. Walcher served as President of Club 20, a Western Slope advocacy group, since 1989; as a staff member for then-U.S. Sen. Bill Armstrong (R-CO) from 1979 to 1989. Owens' other cabinet appointments include: Bob Brooks, Department of Local Affairs; Bill Moloney, Department of Education; Tom Norton, Department of Transportation; Tim Foster, Colorado Commission on Higher Education; and Michael Cooke, Department of Regulatory Agencies.

Denver Post 1/10/99

♣♣♣ RECYCLING

Recycling water for city irrigation saves groundwater

Aurora plans a \$21.5 million expansion of its water recycling plant to provide water to irrigate parks and golf courses. The plan to divert water from the Metro Wastewater Reclamation District was approved last month. Funds are expected to be from a loan from the State Revolving Fund made available by the Clean Water Act. If all goes according to plan, the expansion should be up and running by the spring of 2001. The city now recycles about 10 percent of its wastewater at the Aurora Water Recycling Plant, formerly the Sand Creek Wastewater Reclamation Facility. Aurora obtains all of its water for human and residential consumption from transmountain sources. City officials don't want to deplete groundwater in the face of rapid growth. Denver Water also has started a water reclamation project. The city plans to build a water-reuse plant in the northeast part of the district to treat water from the Metro Wastewater Reclamation Plant for irrigation and industrial uses. Westminster, Broomfield and Colorado Springs also have reclamation facilities.

Rocky Mountain News 12/8/98

♣♣♣ WATER QUALITY

American Soda requests special permit to begin mining operation

The former Unocal oil shale processing facility, about three miles north of Parachute, may soon be sold to American Soda, L.L.P. for use as a processing site for the mineral nahcolite. American Soda, L.L.P. has filed a request for a special use permit from Garfield County to start a mining operation in the Piceance Creek Basin near Parachute. This time nahcolite, a naturally-occurring sodium bicarbonate found near oil shale, is the object of the mining operation, not the oil shale itself. When processed, nahcolite is used to make baking powder, antacids, paper pulp and detergent. Unocal has been actively negotiating the sale to American Soda of its 1,000-acre oil shale processing facility, which it shut down in the early 1980s after the oil shale market collapsed, about three miles north of Parachute. Because of local concerns about heavy truck traffic on county roads in the Parachute area, the company decided to use a hot-water extraction system that will pump the liquefied mineral through a 45-mile pipe line to an evaporation facility and rail spur. To minimize the environmental impacts of the operation, the extraction pipe-line will form a closed loop, so that water can be recirculated for reuse. The 10 to 12 inch in diameter, dual insulated pipe will be laid along an existing gas pipeline so no new environmental disturbance will occur. American Soda held two open house public briefings about the proposed project for area residents to gather information and ask questions. In addition, Garfield County will hold public hearings on the special use permit and the BLM will hold public hearings on an Environmental Impact Statement.

The Glenwood Post 12/27/98

Monitoring project proposed for Fruitland outcrop

The Colorado Oil and Gas Conservation Commission (COGCC), in conjunction with La Plata County, industry and other governments, has proposed a \$1.8 million well-monitoring system along the outcrop – the line where coal in the Fruitland formation comes to the earth's surface. It is called the San Juan Basin 3M Project – for monitoring, mapping and modeling. The goal of the project is to monitor water levels within the coalbed and to form an informational model. From that model, officials will predict the impacts of future wells on the Fruitland outcrop. Officials have speculated that an increase in the number of production wells along the outcrop – and the subsequent removal of water associated with the methane extraction process – has increased the number of gas seeps in the county and could spark more underground coal fires. The COGCC has proposed nine monitoring sites along the outcrop, stretching from Basin Creek about five miles south of Durango eastward to Beaver Creek about eight miles northeast of Bayfield. There will be an average of three monitoring wells per site. The COGCC's seven-member governing board Dec. 3 passed its staff's recommendation to support the 3M Project. The COGCC plans to fund half the project's costs from severance tax funds that must be appropriated by the state Legislature.

Durango Herald Dec. 11, 1998

Penalties few in San Luis Valley mine pollution

After three years of criminal court proceedings and a \$160 million cleanup bill, "The decision has been made not to further pursue the Summitville investigation criminally," says U.S. Attorney Linda McMahan. Beginning in the 1980s, the Summitville Consolidated Mining Co. stripped 10 million tons of ore from the face of South Mountain, then chemically extracted gold from it. Toxic water from the mine site, poisoned with heavy metals including silver and copper, was discharged into nearby creeks. It killed all life in 17 miles of the Alamosa River system. Water used for irrigation also was affected. Elevated levels of metals since have been found in crops and livestock in the area. High acidity in the water has damaged irrigation pipes. In 1992, facing collapse of a dam that was supposed to contain some of the toxic water at the mine site, the operators abandoned the mine and declared bankruptcy. That left the polluted site to the state and federal governments. Cleanup is still under way. Summitville Consolidated Mining Co., its former general manager, and

and former environmental manager were indicted in 1995 and 1996. No one else ever was charged. Summitville Consolidated Mining Co. pleaded guilty to 40 federal felony charges in 1996 and agreed to pay \$20 million in fines. However, the company by then was bankrupt and had only \$750,000 in assets. The U.S. Attorney's Office has a civil lawsuit in Denver U.S. District Court against Robert Friedland, founder and a top official of the defunct Gallactic Resources. Gallactic was the parent company of Summitville Consolidated. A multimillionaire and a Canadian citizen, Friedland fled the country after the Summitville disaster and has been reported living in Asia and Australia. He has denied responsibility for the pollution. U.S. officials seized \$150 million of Friedland's assets in 1996, but a Canadian judge gave the money back to Friedland and scolded the United States lawyers for presenting a weak case. The identities of other targets in the investigation have not been disclosed. During a sentencing hearing for the two Summitville employees, the prosecution recommended that they get lighter sentences for their cooperation. Both men went to work for Summitville in 1988 - years after the environmental damage began at the open pit gold mine.

Rocky Mountain News 12/19/98

WATER RATES

Denver defends its water rates, right to charge more for heavy residential use

The Denver Water Board has chosen to promote conservation through higher rates for residential customers who use larger amounts of water, and it successfully defended its choice in a 1996 court case. Now, unfortunately, it will have to go back and do it again, as the Colorado Court of Appeals has ruled that a case Denver Water won by summary judgment in 1997 must instead go to trial. At issue is whether Denver Water's conservation rates are sufficiently related to its costs to satisfy the city charter's provision for rates that are "uniform as far as practicable" but also "related to the service furnished or the volume of water used" in a fair and equitable manner. To the water board, the rate system is justified because it reflects residential consumers' pattern of use. Households' peak demand - typically for outdoor watering in the summer - is often several times higher than indoor winter use. The system has to be able to handle peak demand, so a pricing system that flattens the peaks reduces the need to acquire additional capacity. The argument is important, because it is needed to establish that Denver Water's rate schedule is consistent with its charter obligations, as well as with its goal of water conservation. Judge Sandra Rothenberg wrote, "Municipalities have the right to use a reasonable classification for consumers and to establish different rates based on such factors as the cost of service, amount or quantity received, character of the service provided, time of use, or any other factor constituting a substantial difference." However, she sees a need for a trial to establish whether the specifics of Denver Water's rate schedule conform to the charter.

Rocky Mountain News 12/05/1998

Castle Rock council approves plan to raise water revenue with one-time increase

The Castle Rock Town Council has approved a plan that will raise residential water rates by as much as 154 percent next year. Officials said the plan will raise revenues by 58 percent. The money is needed for water system operational costs, they said. The plan given final approval by the Town Council Thursday would raise rates to:

- * \$2.27 per 1,000 gallons for the first 5,000 gallons, up from \$1.
- * \$3.18 per 1,000 gallons for the next 10,000 gallons, up from \$1.50.
- * \$5.09 per 1,000 gallons above that, up from \$2, a 154 percent hike.

Rocky Mountain News 12/15/98

WATER SUPPLY, DEVELOPMENT, AND PLANNING

Douglas County outlines improvements to accommodate growth

Douglas County has retained its title as the United States' fastest-growing county for the fourth straight year. Perhaps the Douglas County Board of County Commissioners' most significant decision this year was its approval of new water supply standards. The regulations, approved unanimously by the board Aug. 12, require developers to show an adequate, physical supply of water to sustain future developments. The standards include a host of new water supply requirements. Well tests to show evidence of water availability are required in western portions of the county. And all groundwater under any future development must be preserved in perpetuity, unless an exemption is granted by the board. And the Preble's meadow jumping mouse's listing on the federal Endangered Species Act continues to have far-reaching effects in the county. Secretary of the Interior Bruce Babbitt came to Douglas County in May to announce the mouse's threatened status. The listing has placed restrictions on any future activity within the mouse's habitat areas, which include several Douglas County creeks.

Douglas County New Press 12/30/98

Water issues high on Montrose city agenda

Montrose city officials have concerns about making sure various classes of utility customers are paying their proportionate share. For example, should high-volume industrial customers pay the same rate as low-volume residential users? However, the issue is complicated because the city is in a unique situation — “We have the unusual circumstance that rather than needing to conserve water, we have an abundant supply that comes with a price tag as a result of the Dallas Water Project,” Says Montrose City Manager Ted Barkley. “At this point, for some uses, encouraging businesses and industries to use more water actually keeps the price down” for people who use less water. It’s unusual because we are required to have conservation efforts in place, yet we would benefit most by selling more water.” Barkley expects other water issues to arise as the city boundaries increase and service areas currently occupied by water companies start to bump up against each other. “I expect to see a lot of discussion between the Menoken Water District, Chipeta Water Company, Tri-County Water Conservancy District and the city,” he said. “With the growth that is occurring, there are areas where one of the entities may have built a lot of infrastructure to serve the area,” yet the city has grown into that area and would have jurisdiction. “We need to sort the overlaps and gaps, and come to some kind of agreement,” he said.

Montrose Daily Press 1/6/99

Clear Creek dam plan dropped

Proposed plans for a new 100,000-acre dam for Clear Creek Reservoir and the dam for East Tennessee Creek in the upper Arkansas River Basin have been eliminated, according to the final water storage needs assessment report released by the Southeastern Colorado Water Conservancy District (SECWCD) on Dec. 10. The report projects that Arkansas River basin cities and farmers will need more than 173,100 acre-feet of additional water storage capacity to meet demands for water into the year 2040. According to Steve Arveschoug, SECWCD Manager, enlargements and better use of present facilities will be studied to meet the demands of growth in the valley. The water-storage projects listed for enlargement are Turquoise Lake and Pueblo and Meredith reservoirs, according to Arveschoug. The report projects growth in the nine-county service areas of as much as one million people over the next 40 years. Anticipated storage needs include: 40,000 acre-feet of permanent space for the Winter Water Storage Program, 20,000 acre-feet for the Board of Water Works of Pueblo, 45,000 acre-feet for the City of Colorado Springs, 26,000 acre-feet to regulate replacement water for well pumping, 5,500 acre-feet for Pueblo West, and 6,000 acre-feet for towns west of Pueblo. Depending on how the alternative storage options are combined, total costs to develop 173,000 AF of additional storage could range from \$41 to \$199 million, according to the report. The district, through its water and storage needs assessment enterprise, will conduct further studies and public meetings to establish a consensus plan for the development of the needed water storage capacity. The continued study will include a more thorough evaluation of the various environmental, recreational, financial and operational issues associated with the recommended storage alternatives.

Salida Mountain Mail 12/23/98, 12/29/98

Durango to push for recreation in A-LP plan

City of Durango water commissioners say that the Durango City Council should put pressure on the Clinton administration to include recreation facilities in the latest proposal of the Animas-La Plata water project. Commissioners said not building recreation facilities at Ridges Basin — the reservoir slated to be built south of Durango — is senseless. Commissioner Fred Kroeger said “(The federal government) has built recreation facilities on every other project they’ve done; they should do it here, too.” Under the plan dubbed A-LP Ultra-Lite — to build a smaller reservoir near the Animas River to serve three Indian tribes in Colorado and New Mexico — the A-LP Water Conservancy District would receive 2,600 acre-feet of water per year for domestic use by the city. The proposal does not include recreation facilities or water for irrigation. City councilors asked commissioners in December to study the proposal and recommend whether the city should write to the Department of the Interior and take a position on Ultra-Lite. Commissioners said it could cost the city more to pump water from Ridges Basin than it would if the city built its own reservoir in Horse Gulch. They are urging councilors to keep open its options to build the reservoir. Under the Ultra-Lite plan, drawing water from Ridges Basin could be more expensive because the plan is to store only 90,000 acre-feet of water in the reservoir — a third of the original amount. Earlier versions of A-LP designs had the pipeline stationed below the reservoir level and gravity would have allowed water to flow into the river for the city to use. But because the reservoir level will be lower and the pipeline position unchanged, the city would have to build a pumping station, pay for power and incur other capital costs to move the water, city Public Works Director Jack Rogers said. Rogers said the city would have to pump water over a hill to the Animas River. Commissioners also said they want city councilors to continue working on acquiring property in Horse Gulch, a potential site for a reservoir. Rogers said building a reservoir in Horse Gulch, which is in the city’s capital improvement plan for 2015, would be about \$6.5 million. He said that figure is using 1998 dollars.

Durango Herald 1/12/99

Animas La Plata — Utes’ 1868 water claims called invalid

The anti-Animas-La Plata Citizens Progressive Alliance says that the Southern Ute Tribe’s 1868 senior water rights on the Animas and La Plata rivers are invalid. A Denver water lawyer hired by the group spent six months investigating the claims, and has detailed the

group's case in a 15-page memo released to the *Herald* in January. Opponents of A-LP say the memo is filled with legal arguments that prove the tribe should be given a very junior 1938 priority date for its water claims. They will press these arguments at public meetings in February when the Interior Department will seek comment on the A-LP Project. The 1868 date is important because it precedes all other claims on the two rivers, putting the tribes first in line to use water in the Animas and La Plata rivers. It later became the basis for the 1988 Colorado Ute Water Rights Settlement Act, of which A-LP is the cornerstone. A 1938 water priority date, a very junior right, would entitle the tribes to significantly less water. Opponents dismiss the Ute Mountain Ute's 1868 claims on the two rivers outright because neither the Animas nor the La Plata border cross the tribe's reservation. A-LP supporters say opponents are basing their legal argument against the Southern Ute Tribe on land claim cases, not water cases. In 1880, riding a wave of anti-Indian sentiment, Congress passed an act that terminated Ute ownership of reservation lands, which then occupied roughly the western third of Colorado. A-LP opponents say the tribe's 1868 reserved water rights never survived the elimination of the reservation in 1880. Following the 1880 Act, the Utes remained without a home until 1938, when Congress created the present-day Southern Ute reservation in southern La Plata County. The tribal attorney maintains that when lands severed from a reservation are later reacquired by the tribe, those lands continue "to carry a priority date for reserved water based on the original date of the reservation."

Durango Herald 1/17/99

Flow increase plan at Navajo Dam scrapped

A plan to pass more water through the Navajo Dam next spring has been canceled. A biology committee working to recover endangered native fish while allowing for some water development in the San Juan Basin said Tuesday that it has withdrawn its request of the U.S. Bureau of Reclamation to increase releases from the Navajo Reservoir to 6,000 cubic feet per second. The plan is too costly and potentially damaging, said the committee chairman. He said the committee can meet its goals without increasing the flows from this year's level of 5,000 cfs. The committee, which includes fish biologists from federal, state and tribal agencies, makes up the San Juan Recovery Implementation Program. The program began in 1991 to determine what the Colorado squawfish and razorback suckers needed to bounce back from the brink of extinction and to reproduce naturally in the San Juan River, while allowing water development, including the Animas-La Plata Project, to proceed. The committee initially thought that a flow of 6,000 cfs was needed for the fish to flourish and to also allow for water development. "Right now we can meet what we need for the fish and for some water development," the chairman said.

Durango Herald 12/23/98

County opposes water 'exports'

A second Gunnison County jurisdiction has taken a stand against a yet-to-be worded state bill believed to threaten the water of the Upper Gunnison River locally and the regulatory power of counties statewide. County Commissioners Fred Field and Marlene Zanetell voted to circulate a letter written by County Manager John DeVore stating the county's objections to the current version of the Water Resources Act being formulated by state lawmakers. Along with the letter will go an analysis performed by the county attorney delineating the county's objections to the WRA. With that action the commissioners aligned the county with the Upper Gunnison River Water Conservancy District which voted 6-3 at its last meeting to oppose the WRA in its draft form. The county's letter will be sent to all 14 Colorado River Basin counties, the Denver Water Board and the bill's author, Rep. Matt Smith (R-Mesa, Delta counties), who sponsored last year's version of a similar proposal, HB 1288. However, one commissioner warned that up-front opposition to the WRA may isolate Gunnison County and eliminate the opportunity to provide useful input during the crafting of the language of the bill. That bill was opposed by many jurisdictions on the Front Range and the West Slope including the county and the UGRWCD. The analysis points out that all versions of the WRA propose using state funds to study statewide water needs, all require the identification of water projects in each of the state's major river basins by local planning groups, the make-up of the planning groups is poorly defined, and the bill will allocate state money to build water projects for regional beneficiaries. The analysis maintains that if the state identifies a water project as being in its interest, county 1041 powers - which allow counties regulatory oversight on major projects within their boundaries - will be usurped. Finally, all versions of the bill include language supporting water "exportation." That is seen by opponents as transmountain diversion. Former Upper Gunnison director Butch Clark urged the commissioners to include with its letter and analysis a proposal called CARP - Colorado Aqueduct Return Project. Clark's project envisions a reservoir being built near the Utah border with a piping network back to the headwaters region near the Continental Divide for use by the Front Range or Western Slope as needed. "We need to offer the state an alternative (to headwater diversion)," Clark said. "CARP offers that."

Gunnison Country Times 1/8/99

Get your taps now!

Vallecito Water Co. officials are under pressure to double the sale of water taps near Oxford and Grandview, the first areas in southeastern La Plata County to be served by a proposed rural water system. A \$5 million U.S. Department of Agriculture Rural Development loan for the domestic water system requires that the Vallecito Water Co. have at least 700 tap commitments within the "initial service area" before the loan money becomes available. The cost of a tap, due 90 days prior to construction, is \$3,500, plus the cost to install a

meter pit. On March 1, the tap cost will increase to \$4,500. Once the company secures the 700 taps, it will begin preparing plans and designs and acquiring rights-of-way. That could take more than a year, after which construction can begin. The \$17 million project, proposed by the Pine River Irrigation District through the Vallecito Water Co. it formed, would annually take 2,000 acre-feet of agricultural water from Vallecito Reservoir and make it available for household and commercial use. Initial plans to construct a water treatment plant on Bureau of Reclamation land just below the reservoir have been scrapped. Instead, water company officials want to build a treatment plant on land in Bayfield, probably south of Joe Stephenson Memorial Park. The site was changed both because it will allow the water company to serve more households and because of difficulties reaching an agreement with the Bureau of Reclamation.

Durango Herald 1/20/99

Utes, Ignacio close to water agreement

Officials from the town of Ignacio and the Southern Ute Tribe say they are close to completing a water service agreement between the two. Since 1972, the tribe has been providing water to the town, which in turn distributes the water to its residents. The 10-year service agreement, which expired in December 1997, has been extended until the new one is agreed on by the governing bodies of the tribe and the town. The tribe and town are trying to reach an understanding on a paragraph about bulk water rates. Under the version passed by the Tribal Council, the tribe reserves the right to sell water to bulk buyers at a discount rate; the town would like to be eligible to receive that rate as well. Ignacio water bills will remain largely unaffected by the water agreement. Since July, the town has been charging its residents \$3.12 per 1,000 gallons up to a 6,000 gallon cap. After they reach the cap, the price of each additional 1,000 gallons increases to \$3.33.

Durango Herald 1/20/99

22 Counties take ACTION

Colorado's rural political clout has doubled with the official creation of ACTION 22, a coalition of 22 southeastern counties patterned after a similar coalition of Western Slope counties known as Club 20. At a charter convention in Pueblo, 91 county and city governments, individuals, business and nonprofit organizations paid their dues to become charter members. The convention drew nearly 250 participants.

Together, Club 20 and ACTION 22 represents nearly three-fourths of the states' counties. Unlike Colorado Counties Inc., which tends to give more clout to the more heavily populated counties, ACTION 22 and Club 20 allow only one vote per county. U.S. Rep. Scott McInnis, whose district encompasses 36 counties in ACTION 22 and Club 20, urged convention participants to emphasize issues affecting rural Colorado, not just southeastern Colorado or the Western Slope. An active participant in Club 20, he said that partnership is known for studying the issues, remaining bipartisan and representing all members.... ACTION 22's charter membership drive will continue through April 15, followed by county's board representative Standing committees will be created at the first elected board meeting in June and meet throughout the summer.

Denver Post 1/14/99

Y2K

Y2K — No one knows what computers will do

Y2K — the problem is that most computers — and perhaps many millions of embedded microchips — have been programmed to read dates only by the last two digits. The big unknown is how they will cope with the figures "00" — some may correctly read that as 2000, some may see it as 1900 and others may simply become confused and stop functioning properly. The scope of any possible computer-generated problems may cause general disruption of such services as telephones, power and water supplies, banking and transport. Boulder County has been described as one of the most progressive counties in the country in terms of awareness and preparedness.

The infamous Y2K may not be such a problem in Douglas County. By the first quarter of 1999, all Metro Districts computers should be Y2K compatible. The Centennial Water and Sanitation District also has stockpiled enough fuel and chemicals to run wastewater facilities on generators should there be a problem.

When Pueblo County bought new computers in the early 1990s, it had an eye on the new millennium. The county has been Y2K compliant since 1992. The staff "rolled the clocks forward" on the county network during a weekend test in November and it worked properly.

Boulder Daily Camera 1/21/99, Douglas County New Press 12/30/98, Pueblo chieftain 1/3/99

SEMINARS

COLORADO STATE UNIVERSITY
INTERNATIONAL CONNECTIONS
 A Brown Bag Lecture Series — Free and Open to the Public
 12:15 p.m. to 1:00 p.m. Lory Student Center, Room 165

Date	Title	Speaker
Apr. 13	Economic Issues of Groundwater Management in India -- Some Policy Options	Nareppa Nagaraj, Professor, Agricultural & Resource Economics CSU
Apr. 27	Biodiversity Conservation on the Yucatan Peninsula: Strategies in the Non-Profit Sector	Sonja Macys, Wildlands Course Assistant, Forestry CSU
4-May	Perceptions of SE Asia -- Vietnam, Thailand, Brunei, Malaysia	Dave Cismoski, Manager, CIRA, CSU

COLORADO STATE UNIVERSITY
DEPARTMENT OF EARTH RESOURCES
 SEMINAR SCHEDULE, SPRING 1999

Date	Title	Speaker
Feb. 23	NGWA Darcy Lecture -- Ground-Water Recharge in Arid Regions	Scott Tyler, Desert Research Institute
Mar. 1	Active Deformation of an Accretionary Wedge Margin Determined by Fluvial Terraces, Olympic Mountains, WA	Frank Pazzaglia, University of New Mexico University Distinguished Speaker
Mar. 22	GSA Birdsall Lecture -- Faults and Fluids	Stuart Rojstazer, Duke University
Mar. 24, Wed., 12: 10 p.m.	The Big Stretch in the Basin and Range	Mark Anderson, Columbia University
Apr. 5	Floods and Mass Wasting in the Nepal Himalaya and Effects in the Lowlands: Whose Fault is it?	Dick Marsten, University of Wyoming

COLORADO STATE UNIVERSITY
SPRING 1999 LUNCHTIME SEMINAR SERIES
NATURAL RESOURCE AND AGRICULTURAL ECONOMICS
 WHEN: Wednesdays — 12:10 to 1:00 WHERE: 110 Animal Sciences

Date	Title	Speaker
Feb. 24	Do Conjoint Ranking and Ratings Give the Same Marginal Values of Forest Health Attributes?	Michelle Haefele, CSU
Mar. 3	The Effects of Transactions Costs on Trading Behavior: Theory & Application to CA Water Markets	Janis Carey, CSM
Mar. 17	A Multi-Objective Evaluation of Policies for Managing a Coastal Aquifer in Mexico	Robert Young, Professor Emeritus, CSU
Mar. 24	Evaluating Multi-Attribute Trade-Offs in Irrigated Agriculture	Dana Hoag and Shauna Page, CSU
Mar. 31	Recreation & Existence Values from Removing Dams on the Lower Snake River for Salmon	John Loomis, CSU
Apr. 7	Community Impacts of Confined Animal Feeding Operations: Dollars and Scents	Andy Seidl, CSU
Apr. 14	Do Demand Revealing Incentives Matter in CVM: A Case Study of Boulder County Open Space	Patty Champ, USFS, Nick Flores, Tom Brown
Apr. 21	A Socio-Economic Description of Larimer & Weld Counties: Implications for Long-Range Planning	Steve Davies & Harvey Cutler, CSU
Apr. 28	Modeling Rural Land Use Change Using GIS	David Theobald, Nat. Res. Ecology Lab

CALLS FOR PAPERS



19th ANNUAL HYDROLOGY DAYS August 16-20, 1999 Colorado State University — Fort Collins, CO

The objective of the Annual Hydrology Days is to provide a forum for hydrologists and hydrology students to get acquainted and to share problems, analyses, and solutions. Papers are welcome on all topics in hydrology and hydrologic engineering. Hydrology Days 1999 will be dedicated to the former students and worldwide professional colleagues of Hubert Morel-Seytoux. This will be the last year that Professor Morel-Seytoux will be the primary organizer of the group. The conference provides an opportunity for students to present papers in a friendly atmosphere, within the structures of a fully professional conference. The five-day program will include volunteered papers, invited papers, student papers, and a poster session. Awards and prizes will be given for the best student papers as oral or poster presentations in the following categories: B.S., M.S. and Ph.D.

Papers are welcome on all topics in hydrology and hydrology engineering. Sessions are under consideration with the following titles:

- ◆Future of surface water and groundwater modeling.
- ◆River flow forecasting and reservoir operations management.
- ◆Optimization of water resources in integrated catchment management.
- ◆Hydrologic models calibration and validation.
- ◆Applications of geospatial technology in hydrology and water resources.
- ◆Mountains and hill-slope hydrology, soil water processes, and snow hydrology in alpine and sub-alpine areas.
- ◆Human impacts on hydrology.
- ◆Links between hydrologic models and water quality models.
- ◆Use of (large-scale) hydrologic and water quality models for integrated (multi-use) watershed management.
- ◆Measurements and estimation of aquifer recharge in small to large-scale basins.
- ◆Estimation of hydraulic properties of porous media.
- ◆Multi-phase flow in heterogeneous porous media; infiltration, redistribution and contamination.
- ◆Hydraulics of flow through waste impoundment covers, capillary barrier effects and design of waste landfills.
- ◆New methodological developments in stochastic hydrology.

Send three hard copies (original plus two) of abstract(s) on a single page without a specific format, but font 12 minimum, and include: title, author name, affiliation, full mailing address, telephone, fax, e-mail, and indication of student status (M.S., Ph.D.), if applicable. Include a cover letter indicating presentation preference of oral or poster. Indicate special audio-visual needs. Abstracts submitted early will be given priority for oral presentation if accompanied by payment of a \$30 abstract fee or a full registration. The \$30 abstract fee will be refunded to full-time students at the time of the conference. Late abstracts will be considered according to availability of space within the program. For abstract/program information and registration forms contact H.J. Morel-Seytoux at HYDROLOGY DAYS, 57 Selby Lane, Atherton, CA 94027-3926; Phone and FAX 650/365-4080; or e-mail hydroprose@batnet.com. For registration/general information contact: Ms. Marilee Rowe (Hydrology Days), Dept. of Civil Engr., Colorado State University, Fort Collins, CO 80523-1372; Phone 970/491-5247; FAX 970/491-6787; e-mail mrowe@enr.colostate.edu. REGISTRATION FEES: \$240 by June 30, 1999; \$270 after June 30, 1999. Registration includes technical sessions, exhibits, posters, two lunches, refreshment breaks and two copies of the proceedings. One-day packages are available. **ABSTRACT DEADLINE: May 3, 1999.** Website: <http://www.enr.colostate.edu/depts/ce/>.



DAM SAFETY '99

Sponsored by Association of State Dam Safety Officials
Hyatt Regency, St. Louis, MO
October 10-13, 1999

ASDSO invites all persons interested in safety of dams to submit abstracts of papers to be considered for presentation at its 16th annual conference. Authors may choose from, but are not limited to, the following general subject areas: **Hydrology and Hydraulics, Geotechnical Issues, Emergency Preparedness, Dam Design and Rehabilitation, Dam Inspections, Removal of Dams, Dam Safety Regulatory Programs, Dam Owner Issues, Dam Construction, and General Information/Multi-Category** (computer applications, current technical research, and model testing). Submit one-page, single-spaced abstract to: Association of State Dam Safety Officials, Inc., 450 Old Vine, 2nd Floor, Lexington, KY 40507. Phone 606/257-5140; FAX 606/323-1958; e-mail damsafety@aol.com. **ABSTRACT DEADLINE: March 1, 1999.**

**FOURTH USA/CIS JOINT CONFERENCE ON ENVIRONMENTAL
HYDROLOGY AND HYDROGEOLOGY**

Sponsored by American Institute of Hydrology (AIH)
San Francisco, California
November 7-10, 1999

The conference is a continuation of joint meetings on the problems and solutions of mutual interest in environmental hydrology and hydrogeology in the USA and CIS (formerly USSR) organized by AIH in cooperation with major governmental agencies, scientific institutions and private organizations. Contact: AIH, Phone 651/484-8169, FAX 651/484-8357, E-mail AIHydro@aol.com, Webster: aihydro@org. ABSTRACT DEADLINE: February 28, 1999.

MEETINGS

1999 Distinguished Darcy Lecture Series

Sponsored by the National Ground Water Association

"Ground-Water Recharge in Arid Regions: Questions about Today and the Past?"

**Dr. Scott W. Tyler, Desert Research Institute and the University of Nevada
Reno, Reno, Nevada USA**

February 25, 1999

Lecture at Colorado School of Mines

Hosted by the Department of Geology and Geological Engineering

Green Center, Metals Hall Auditorium

4 pm refreshments. 4:30 pm lecture

For information contact Dr. John McCray, Dept. of Geology and Geological Engr., Colorado School of Mines. Phone 303/384-2181, FAX 303/273-3859, e-mail mccray@mines.edu.

5TH ARKANSAS RIVER BASIN WATER FORUM

Canon City, CO — April 23-24, 1999

The 5th Arkansas River Basin Water Forum will be held April 23-24, 1999 in Canon City at the Canon Inn. The Forum will start April 23 with registration at 8:30 a.m. The first day's session, "Watershed Information and Orientation to the Issues," will feature Water Needs and Storage Assessment as affected by water rights, biological, recreational and social issues. The Lake County Initiative will show how citizens, politicians and agencies working together are making a difference. Saturday beginning at 8:30 a.m., will feature the session, "Current Opportunities in Our Watershed to Influence Decisions With Informed Opinions. It will have breakout sessions on Water Law, Health of our Watershed, Lower Arkansas Water Quality Issues, Water Exchanges and the Planning and Zoning Initiatives. The Forum will end with a luncheon presentation, "How Can We Participate in Our Watershed's Future. Registration is \$35 for "early bird" or \$40 at the door. For information on the Forum, contact David Cockrell at 719/549-2469, Larry Handy at 719/783-2481, Steve Reesc at 719/539-7289 or Jim Valliant at 719/254-7608, or see the Forum website at <http://www.uscolo.edu/arkriver>.

NATURAL RESOURCES LAW CENTER

**STRATEGIES IN WESTERN WATER LAW AND POLICY:
COURTS, COERCION AND COLLABORATION**

PUBLIC PROGRAM ON WWPRAC, JUNE 8TH – CONFERENCE, JUNE 9TH – 11TH

The Natural Resources Law Center, University of Colorado at Boulder, will focus its 20th summer conference on the principal problem-solving strategies in Western water law and policy: Courts, Coercion and Collaboration. The program will address Colorado courts, the public trust, the Snake River and other basin-wide adjudications, ESA, TMDL Implementation, the Clean Water Action Plan, and CALFED. The June 11th program, "Collaboration in Western Water," will be available for separate registration and will include an analysis of collaborative processes in the Platte River Watershed. The conference will be preceded, Tuesday evening, June 8th with a free public program on the Western Water Policy Review Advisory Commission Report. For more information, contact Donna Peavy: call 303-492-1288; fax 303-492-1297; e-mail nrlc@colorado.edu or <http://www.colorado.edu/Law/NRLC>.



NEWS FROM THE COLORADO WATER WORKSHOP

at Western State College in Gunnison

FOR ALL THOSE WATER FOLK WHO LOVE E-MAIL, Robin Helken, Director of the Colorado Water Workshop, is pleased to announce her new e-mail address: water@western.edu. Feel free to contact her for updates on the 1999 Water Workshop or to share your thoughts about what you'd like to hear about at the next conference. The general topic will be decided by early March. If you have suggestions about concurrent session topics, please e-mail her by March 5th.

MARK YOUR CALENDAR: *The dates for next summer's Water Workshop are July 28-30, 1999.* The schedule for the 3-day conference on western water issues will be similar to that of last year's session, and will be held (as usual) on the Western State College campus in Gunnison, Colorado.

VIDEO TAPES OF FLOYD DOMINY'S 1998 WATER WORKSHOP SPEECH are now available through the Water Workshop office for just \$20 each. Here's a rare opportunity to see and hear the inimitable former Bureau of Reclamation Commissioner as he shares his views and experiences in western water development with unforgettable style! An added bonus: Aspinall award winner JOHN FETCHER'S appearance as part of the "Living Legends in Western Water" series. Make your check payable to Colorado Water Workshop, Western State College and mail to:

Robin Helken, Director
Colorado Water Workshop
1181 County Road 20
Gunnison, Colorado 81230

We regret we cannot accept credit card orders for the tapes. *Please allow 2-3 weeks for delivery from the date you place your order.* Proceeds from the tapes will be used to help fund future Water Workshop events.

WATER WORKSHOP WEBSITE! Information and updates on the Colorado Water Workshop will be available on the World Wide Web this spring at <http://www.waterinfo.org/workshop.html> thanks to the kind cooperation of the Water Information Program (WIP) in Durango.

DID YOU HAVE TO CALL OR FAX US LAST YEAR TO GET A WATER WORKSHOP REGISTRATION BROCHURE...OR HAS YOUR ADDRESS CHANGED RECENTLY? Please help us keep our records updated! It only takes a minute to e-mail (water@western.edu), fax (970-641-6219) or call in (970-641-6215) your new address. Please include your name, title/company, NEW mailing address, phone,

The Colorado Section of the American Water Resources Association (AWRA)
In conjunction with
The Colorado Groundwater Association
And
The Colorado Section of the American Society of Civil Engineers
Announces a Symposium

URBAN WATER SUPPLY DEVELOPMENT IN COLORADO
March 19, 1999 — Mount Vernon Country Club, Golden, CO

We know the population in Colorado is growing, and growing, and growing. So where is the water coming from for all these new people? What is being studied and proposed? Who is doing what? Of course, the problem is that every sector already needs all the water it has, and more, and more. This one-day symposium will give us all a mega status report on this fascinating reallocation process. For information contact: AWRA - Colorado Section, P.O. Box 9881, Denver, CO 80209-0881. Phone 303/526-0616.

CALENDAR

March 10-13	BENCHMARKING IRRIGATION SYSTEM PERFORMANCE USING WATER MEASUREMENT AND WATER BALANCES, San Luis Obispo, CA. Contact Larry D. Stephens, USCID, Phone 303/628-5430, FAX 303/628-5431, E-mail stephens@uscid.org . The USCID web page can be found at www.uscid.org/~uscid .
April 10-14	7TH MULTIDISCIPLINARY CONFERENCE ON SINKHOLES AND THE ENGINEERING AND ENVIRONMENTAL IMPACTS OF KARST, Harrisburg/Hershey, PA. Contact Gayle Herring, P.E. LaMoreaux & Assoc., Inc., Phone 423/483-7483, FAX 423/483-7639, E-mail pelaon@usit.net . Web page: ww.uakron.edu/geology/karstwaters/7th.html .
May 10-12	POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE TO WATER RESOURCES OF THE UNITED STATES, AWRA Spring Specialty Conference, Atlanta, GA. Contact: Michael J. Sale, Phone 423/574-7305, FAX 423/576-8543, e-mail jon@orni.gov .
June 2-5	FIFTH BENCHMARK WORKSHOP ON NUMERICAL ANALYSIS OF DAMS, Denver, CO. For information contact Pasquale Palumbo, Technical Secretariat, Via Pastrengo, 9, 24068 Seriate (BG), Italy. Phone 39-35-307-111, FAX 39-35-302-999, E-mail ppalumbo@ismes.it . See the U.S. Committee on Large Dams web page at www.uscold.org/~uscold .
June 13-15	2ND NATIONAL MITIGATION BANKING CONFERENCE, Atlanta, GA. Contact Terrene Institute, 4 Herbert St., Alexandria VA 22305. Phone 703/548-5473, FAX 703/548-6299.
June 20-24	INTERNATIONAL CONFERENCE ON THE CHALLENGES FACING IRRIGATION AND DRAINAGE IN THE NEW MILLENNIUM, Sponsored by U.S. Committee on Irrigation and Drainage, Colorado State University, Fort Collins, CO. See the USCID web site -- www.uscid.org/~uscid , or Phone 303/628-5430, FAX 303/628-5431, E-mail: stephens@uscid.org .
June 30-July 2	SUMMER SPECIALTY CONFERENCE, AWRA -- Two tracks: Science Into Policy: Water in the Public Realm -- contact Vivian Drake, Phone 406/447-1668, FAX 406/447-1665, e-mail: drake@co.lewis-clark.mt.us . Wildland Hydrology: Contact Darren Olsen, Phone 801/752-4202, FAX 801/752-0507, e-mail: dolsen@bio-west.com .
July 7-9	WATERPOWER '99 -- Hydro's Future: Technology, Markets and Policy Las Vegas, Nevada. Contact Liz Sigler at Phone 800/548-ASCE, ext. 6078 or 703/295-6078, FAX 703/295-6144, or E-mail lsigler@asce.org . Waterpower home page: www.waterpower.org .



XTH WORLD WATER CONGRESS, 11-17 MARCH 2000 — CALL FOR PAPERS

The date for abstracts has been extended to 3 May 1999. For further information and submission of abstracts, please contact the Congress Secretariat - Ms Lisa McNaught, Ph 61 3 9682 0244; Fax 61 3 9682 0288; email: worldwater@icms.com.au. Abstracts may also be submitted on-line Internet: <http://www.icms.com.au/worldwater>