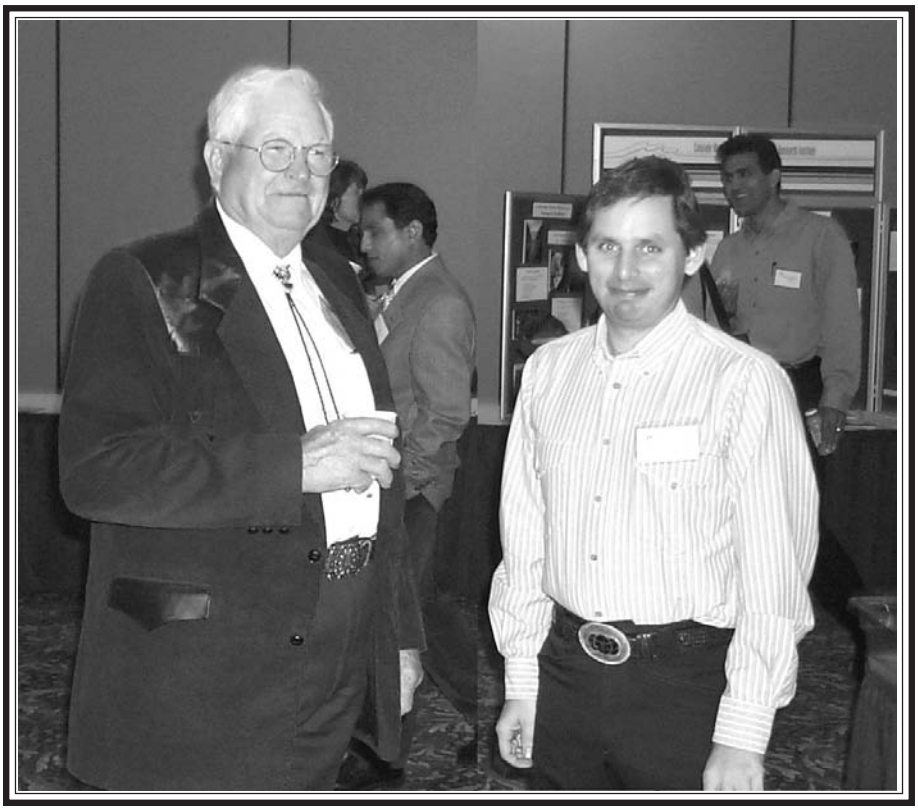
DECEMBER 2000



Right: Tom Pointon, Arkansas Valley producer, and Marshall Frasier enjoy a break at the 11th Annual South Platte Forum held October 24-25 in Longmont.

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WATER ITEMS AND ISSUES . . .

COLORADO WATER

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EDITORIAL

INTEGRATED HISTORY

by Robert C. Ward, Director

One of the advantages of being director of a water institute is working with faculty and water managers from diverse disciplines. For example, hydrologists, biologists, lawyers, economists, sociologists, and creative writers apply their disciplines to water.

In reading the book Irrigated Eden by Mark Fiege (University of Washington Press, 1999), I had an opportunity to examine the interplay of disciplines in the development of irrigated agriculture in the Snake River Valley of Idaho in ways I had not seen documented before. Mark, who is a history professor at Colorado State University, uses his expertise in environmental history to examine a range of human actions, and natural reactions, in the Snake River Valley over the past 140 years.

Disciplinary studies of water often require a simplification of complex issues to make them tractable for analysis. The current and future need to make water management decisions in a more integrated manner is spurring a number of faculty to work together in ways not seen in the past — both across disciplines and in structured teams.

Mark's book goes one step further and explains the interactions of diverse disciplinary factors in the history of the West's water development. The result is a fascinating view of law, biology, hydrology, economics, sociology and literature that describes the formation and nature of the irrigated landscape of the Snake River Valley, specifically, and in the West, in general.

The book begins with the genesis of land and water and the mixing of the two, via irrigation systems, to form what the pioneer irrigators hoped would be an Irrigated Eden. It

continues with a description of the trials and tribulations of the settlers in understanding and addressing the biological reaction to the irrigation systems. Descriptions of water-allocation conflicts among the settlers, and the methods developed to resolve the conflicts, explain how a social/institutional structure evolved to help the people survive in an arid climate. The role of changing commodity prices in shaping the landscape describes people in a productive process that merged nature with another human system, the market.

The book ends with an examination of the thinking of the inhabitants of the Snake River Valley regarding the material reality that surrounded them, as well as their dreams for the future. Fiege uses a rich literature from the valley as well as broader thinking of the times to portray the thoughts, fears and dreams of those attempting to create an irrigated Eden in the Snake River Valley.

As I learn more about the history of water development in Colorado, I realize that each river valley in the state has a history not unlike that of the Snake River Valley in Idaho.

Early Colorado settlers faced huge challenges as nature presented them with a complex set of conditions and reactions to their efforts. Over the years, people living in each valley addressed new challenges to the relationship they had with water and the natural system.

Understanding the history of such challenges, and solutions employed, helps today's citizens appreciate the complex weaving of hydrology, biology, economics, sociology, law and literature that is required to survive in the arid West.

While the book helps explain how irrigated landscapes came to be in the West and why they take on the characteristics we see today, Fiege notes that "the interaction of irrigators with the land wedded artifice and nature in a hybrid landscape whose complexity and irony we have only begun to appreciate."

As Colorado continues to face new water challenges, many of which are beyond the irrigated landscape, the need to better understand the complexity, and irony, grows. CWRRI works with water managers and higher education faculty in efforts to direct applied water research toward understanding these new complexities in an integrated fashion.

CSU UNVEILS STRATEGIC PLAN FOR WATER OUTREACH AND RESEARCH

Colorado State University Cooperative Extension and the Agricultural Experiment Station recently undertook a year-long strategic planning exercise to better focus CSU's water programs. A group of water leaders from around the state and an internal committee of CSU faculty conducted an in-depth evaluation of our current strengths and weaknesses, water education needs of Colorado, key clientele, and major trends affecting water outreach needs in Colorado.

A number of internal needs and potential projects were identified to help strengthen CSU ties to the water community and improve the delivery of water information. Internal changes called for in the strategic plan include recommendations to CSU administration to increase Extension personnel devoted to water outreach and to organize a water working group on campus. A more detailed report of the strategic plan will be included in the next issue of Colorado Water.

Reagan Waskom, the Water Center's newly appointed Extension Water Resources Specialist.

Implementation of the Strategic Plan Begins

Among the needs identified to enhance CSU water outreach efforts was a tighter linkage between water programs of Cooperative Extension, the CSU Water Center, and the Agricultural Experiment Station. To begin improving this linkage, Reagan Waskom will move to the Water Center in January 2001 to serve as an Extension water resources specialist and Dan Smith, Professor of Soil & Crop Sciences, will serve as a liaison from the Agricultural Experiment Station. Robert Ward of the CSU Water Center will serve as the third member of the core team charged with implementing the strategic plan. Troy Bauder will assume responsibility for education and training for the Agricultural Chemicals and Groundwater Protection Program, previously coordinated by Reagan Waskom.

In concert with the strategic planning process, CSU has recently been awarded approximately $500,000/yr for the next 2 years to coordinate regional USDA water quality programming efforts. Lloyd Walker, Extension Agricultural Engineer, leads the project entitled " Coordinated Agricultural Water Quality Programming for EPA Region VIII." Lloyd will serve as the program leader for the 6-state region to coordinate educational activities related to non-point source pollution from agricultural activities. The effort represents a shift in previous USDA water programming activities as it will align USDA-funded programs with the existing EPA regions in order to better coordinate across agencies. It is anticipated that this program will be continued for a number of years, as both USDA and EPA attempt to work with agricultural producers to mitigate non-point source pollution.

This program dovetails with CSU's strategic plans for water as it seeks to forge linkages with the many other partners working on water education in Colorado and the region.

Collaboration Among Water Information Providers Needed

One important outcome of the strategic planning process is an up-to-date inventory of all available water information resources within the state of Colorado. CSU graduate student Darcy Temple compiled this inventory to help determine who was providing water information in Colorado and who were the perceived clientele for this information. Darcy found that there are many excellent sources of water information within the state. The strategic planning committee strongly felt that to meet the growing needs for education on water issues in Colorado, the organizations providing water education in Colorado must better coordinate their efforts. This is especially true as we attempt to inform the general public on how water resources are managed in our state. CSU will seek to enhance these collaborations as we implement the programmatic details of the strategic plan. Contact Reagan Waskom or Robert Ward to provide comments or to obtain a copy of the CSU Strategic Plan for Water Outreach and Research.

REQUEST FOR PROPOSALS
FY2001 National Competitive Grants Program

The National Institutes for Water Resources (NIWR) and the U.S. Geological Survey (USGS) have issued a Request for Proposals for the FY2001 National Competitive Grants Program (authorized under Section 104 of the Water Resources Research Act of 1984). The RFP is available only electronically, for reading and/or downloading, at **http://www.niwr.org/NIWR/app_no/**. Proposals must be submitted on the website at **http://www.niwr.org/**, and may be submitted through this website beginning January 22, 2001. Prospective applicants (PIs) must register at that site prior to submitting an application and may do so now. The deadline for proposals is March 19, 2001. Following that date, the proposals must be reviewed by the CSU Office of Sponsored Programs and CWRRI must approve them for submission to the National Competitive Grants Program no later than March 23, 2001.

Any investigator at an institution of higher education in the U.S. is eligible to apply for a grant through a Water Resources Research Institute established under the provisions of the Water Resources Research Act. A total of $1 million is available 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 areas of water use and water-quality sensors. Proposals may be for projects of 1 to 3 years in duration and shall not request total federal funds exceeding $250,000 per project.

The FY2001 National Competitive Grants Program, funded at a $1 million level, requires a one-to-one match with non-federal funds. University overhead is normally used as one component of the non-federal match.

USDA FELLOWS BEGIN STUDIES AT CSU

by Marian Flanagan

In early 2000, the Cooperative State Research, Education, and Extension Service (CSREES) awarded a $207,000 grant to Jim Loftis, Civil Engineering Department, CSU and Jessica Davis, Soil and Crop Sciences Department, CSU. The award provides fellowships to conduct research on water management issues of critical importance to agriculture in the western U.S. The three Fellows selected for the program are: Garey Fox, Marci Koski, and Colleen Green. The fellowships are administered through the Water Center at CSU, and carry a stipend of $22,000 per year for three years plus a travel allowance to attend two national meetings.

Garey Fox is pursuing his Doctorate Degree in Civil Engineering, specializing in modeling the interactions of surface water and groundwater resources. Having grown up in Godley, Texas, a very small town outside of Fort Worth, he exhibited strengths in math and science and developed an interest in agricultural engineering. As a result of his agricultural involvement in high school, he was awarded the Houston Livestock & Rodeo Scholarship through the FFA (Future Farmers of America) and entered Texas A&M University. It was there that Garey earned his Bachelor of Science degree in Agricultural Engineering and graduated Summa Cum Laude.

He continued at Texas A&M, working on his Master of Science degree in Agricultural Engineering and specializing in Environmental and Natural Resources. Again, he graduated with a 4.0 grade point average. Garey's research integrated remote sensing with surface water models. "I was looking at how I could incorporate remote sensing into those models to improve the calibration and verification of those models, and also the predictability of those models in terms of water quality," he explained. Garey is now looking more at surface water and ground water interaction. He says his research "will involve modeling not only the surface water, but also the interaction with the groundwater and perhaps incorporate the remote sensing together in one package as a more comprehensive model." Garey's long-term goals are to perform research and teach at a University.

Marci Koski

Congratulations, also, to **Marci L. Koski** on her USDA Fellowship. Marci earned her Bachelor of Science degree in Biology, with an emphasis in Ecology, from Westchester University. She is in the process of completing her Masters program in Ecology at CSU, in the Department of Fishery and Wildlife Biology. Marci's Ph.D project will involve looking at food web relationships, tropic dynamics and how they relate to water quality and other aspects of aquatic ecology in western reservoirs. She is interested in the big picture of aquatic ecology and lentic systems.

Marci says, she ". . . would like to educate people about how critical water resources are, especially in the west." "People take it for granted that we have water," she says. "Actually, we're living in a desert." Marci hopes her work ". . . will be part of a publicized effort to distinguish components of our aquatic ecosystem that are really important; that impact water quality and the food web." She would like to help the public understand how fragile the aquatic ecosystem is, and help them appreciate our limited water resources.

Marci enjoys the outdoors, rock climbing, biking, playing classical guitar, traveling, reading and also, her cats.

Colleen Green

Colleen H. Green was awarded a USDA fellowship this year for her PhD work dealing with phosphorus. Colleen will work with phosphorous desorption and sorption modeling, demonstrating how phosphorus moves through vegetative buffer strips. She has a Bachelor of Science degree in Biology and Environmental Science with an emphasis in Water Quality from Metropolitan State College of Denver. Her Masters research at CSU, which she is now completing, studies trace metals in soils from the the Alamosa River Basin Super Fund site below the Summitville gold mine.

Colleen's doctorate work will shift her concentration from the study of trace metals to that of nutrients. Her PhD project will involve runoff and leaching studies with vegetative buffer strips in urban areas verses agricultural areas, where manure has been applied for at least ten years.

Colleen is a dedicated student and well-versed in chemistry. She studied sustainable agriculture and iguana repopulation abroad and says, she ". . . loves working with anything that has to do with protecting the environment." As a graduate teaching assistant at CSU, she teaches the Introduction to Soil Science Lab, and also tutors in statistics and soil science.

Association of State Dam Safety Officials
Announces 2001 Dam Safety Scholarship Program

Scholarships up to $5,000 will be awarded for the 2001/2002 school year. Successful recipients must be U.S. citizens and enrolled at the junior or senior level in an accredited civil engineering program or in a related field as determined by ASDSO, and must demonstrate an interest in pursuing a career in hydraulics, hydrology or geotechnical disciplines, or in another discipline related to the design, construction and operation of dams. Undergraduate students planning to graduate in May/December 2002 will be eligible for the 2001 senior scholarship. Undergraduate students planning to graduate in May/December 2003 will be eligible for the 2001 junior scholarship. Applicants must have a cumulative grade point average of 3.0 for the first two years of college and be recommended by their academic advisor. They must also submit a typewritten essay describing goals and purpose for applying.

Applications are available on ASDSO's web site: http://www.damsafety.org. DEADLINE: February 16, 2001. Send all applications and accompanying materials to: Association of State Dam Safety Officials, 450 Old Vine St., 2nd Floor, Lexington, KY 40507. Phone: 859/257-5140.

RESEARCH

SPMAP PROVIDES COMPREHENSIVE TOOL FOR MAPPING AND ANALYSIS OF SOUTH PLATTE

by Luis Garcia and Bob Lange
Integrated Decision Support Group
Colorado State University

Introduction

Water managers in Colorado are facing competing demands for water: such as, sustaining irrigated food production, providing high quality water to growing populations; mimicking natural flow rhythms to protect aquatic habitats for endangered species; and meeting the growing recreational water uses. The challenges facing modern water managers requires the development of sophisticated, computer-based technology to support decision making so that all needs can be met in the best possible manner. In particular, there is a need to upgrade current technology used to manage the conjunctive use of surface and groundwater resources in the South Platte Basin.

The goal of the project is to enhance water management tools available for the Lower South Platte River Basin, which involves carefully matching data-acquisition system design, modeling, and user interfaces to meet manager's needs. New approaches to water research are being employed, and university researchers are working hand-in-hand with water managers so that the computer tools that are developed aid the managers' decision-making process.

Since 1995, the Integrated Decision Support Group at Colorado State University has been working with a number of local and regional water management organizations along the Lower South Platte River. This work was supported through a Colorado Water Resources Research Institute (CWRRI) project from 1995-1999. In addition, cooperating organizations provided financial support for the project while also providing regular (approximately every six weeks) feedback to researchers on the latest developments. The water managers and university researchers formed a hands-on team that works closely on all aspects of the project.

The result of this close partnership is the development of a set of computer tools that are collectively called SPMAP (South Platte Mapping and Analysis Program. The GIS Component is an ArcView-based tool that allows the user to identify parcels of land, select wells that serve the parcels, access information from weather stations, access crop types etc. This information can be transferred to the Consumptive Use (CU) Model to estimate consumptive use for the selected area. The CU Model estimate of consumptive use can be used in the component SDF View Model to estimate depletion of the South Platte River in the form of Stream Depletion Factors (SDF). The SDF value is used to determine augmentation amounts and timing, according to Colorado law. Surface supplies can be released to the river to replace water removed by groundwater pumping wells that deplete the river by pumping out of the shallow riverine aquifer along the South Platte denoted by the SDF Boundary (Figure 1). Numerous methods, tools and options have been added to the software, in close coordination with advisory committee members, to meet specific modeling needs. For example, the CU Model can import or export data from a spreadsheet or retrieve data on surface water diversions from the statewide database, under development by the State Engineer's Office, called HYDROBASE.

South Platte Advisory Committee

Since the focus of any modeling or data development project should be to meet the needs of software users, close coordination with water providers in the basin at all stages of the project was essential to this project's success. To develop a consensus on the tasks needed for this project, an advisory committee was formed. The committee is comprised of representatives from:

- Northern Colorado Water Conservancy District (NCWCD);
- South Platte Lower River Group, Inc. (SPLRG);
- Central Colorado Water Conservancy District (CCWCD);
- Groundwater Appropriators of the South Platte (GASP);
- Colorado State Engineers Office (SEO), Division 1;
- Lower South Platte Water Conservancy District (LSPWCD);
- City of Greeley (Greeley);
- City of Fort Collins (Fort Collins); and
- Colorado Water Resources Research Institute (CWRRI).

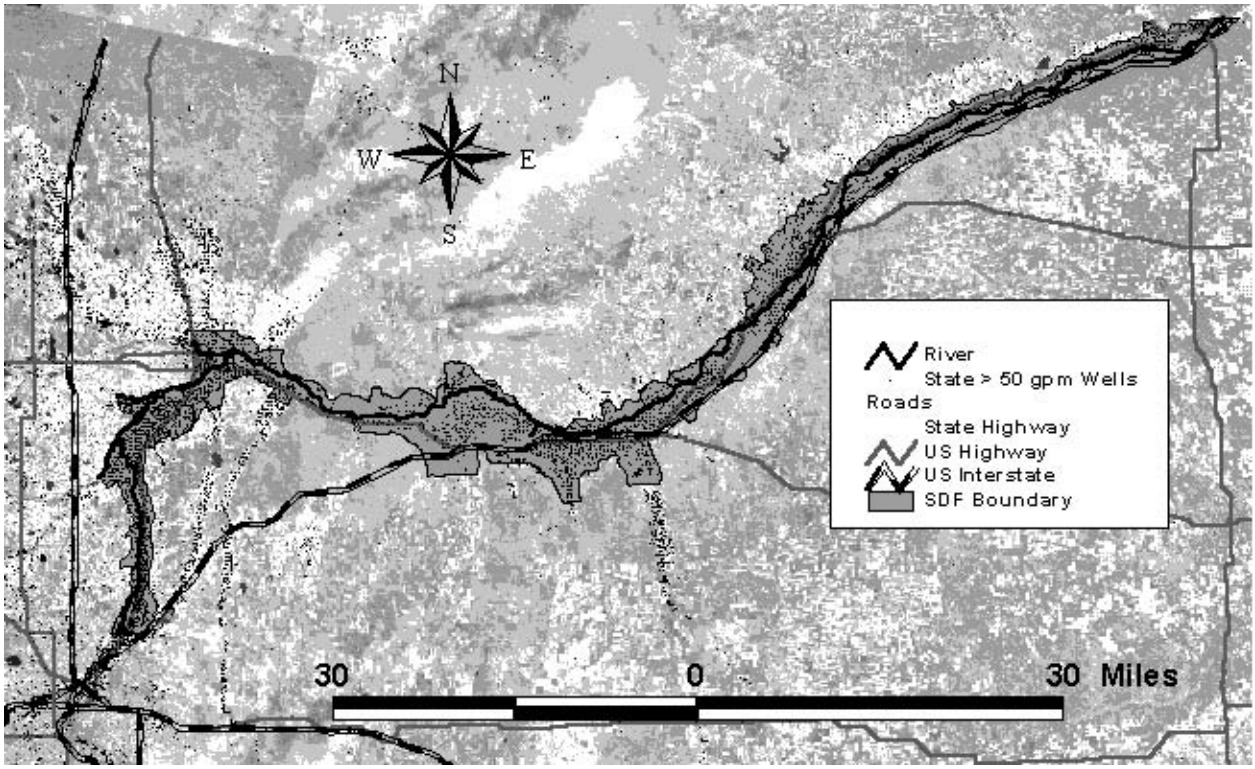

Figure 1: Map of Lower South Platte Region

The data and tools for SPMAP were developed in response to the needs expressed by water providers in the basin and currently are being implemented on a daily basis to make water management decisions. Recently, the committee members were asked to provide feedback for the new stages of the project to determine the usefulness of the software and evaluate the process of creating and distributing it.

Below are a few examples of comments we have received:

> *"The extensive database and the model's inherent flexibility make it ideal for the type of decision making we are faced with."*
>
> ***— Paul Weiss, City of Fort Collins Engineer now with Riverside Technologies Incorporated***

> *"I can honestly say that this effort has been more productive and has provided far more benefits to water users then any previous CSU effort that Central has been involved in."*
>
> ***— Forrest Leaf, CCWCD District Engineer***

> *"The work that you have accomplished at the Colorado Water Resources Research Institute in cooperation with the various water management agencies in the South Platte, has been a very commendable demonstration of what research in conjunction with private and public sector need can accomplish."*
>
> ***— Jack Odor, GASP Manager***

SPMAP Software

The SPMAP software currently is being used to develop augmentation plans and daily needs for managing water on the South Platte. The following three computer-based tools have been developed for this project and are collectively

called SPMAP. The Advisory Committee identified the development of an accurate spatial database and analytical tools for computing farm water budgets and consumptive use (CU) of groundwater as two of the most pressing needs for the South Platte River Basin. Out-of-priority impact of groundwater 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.

SPMAP GIS Component

Water managers use the tools developed by this research effort to determine the amount of water used in the South Platte, the source of the water (surface water or groundwater), and the impacts of this water use on the river. The development of GIS themes for well locations, streamflow depletion factors, satellite images, USGS quad images, and basic data such as county boundaries, roads, and hydrography, etc. have been combined to provide a comprehensive tool for mapping and analysis. ArcView version 3.0+ was selected for the model platform; an extension to ArcView using the Avenue scripting language was developed. This system provides the analysis power of ArcView along with specially designed scripts and customized menus that allow users to view and select data assembled for this project. Specialized tools were also developed in Avenue scripts to perform tasks that lended themselves to automation, such as printing maps that can be used in interviews with farmers to determine more accurate locations of wells.

Geographic Information System (GIS) themes and spatial analysis features of SPMAP can also be used to create input files for the CU Model (Figure 2).

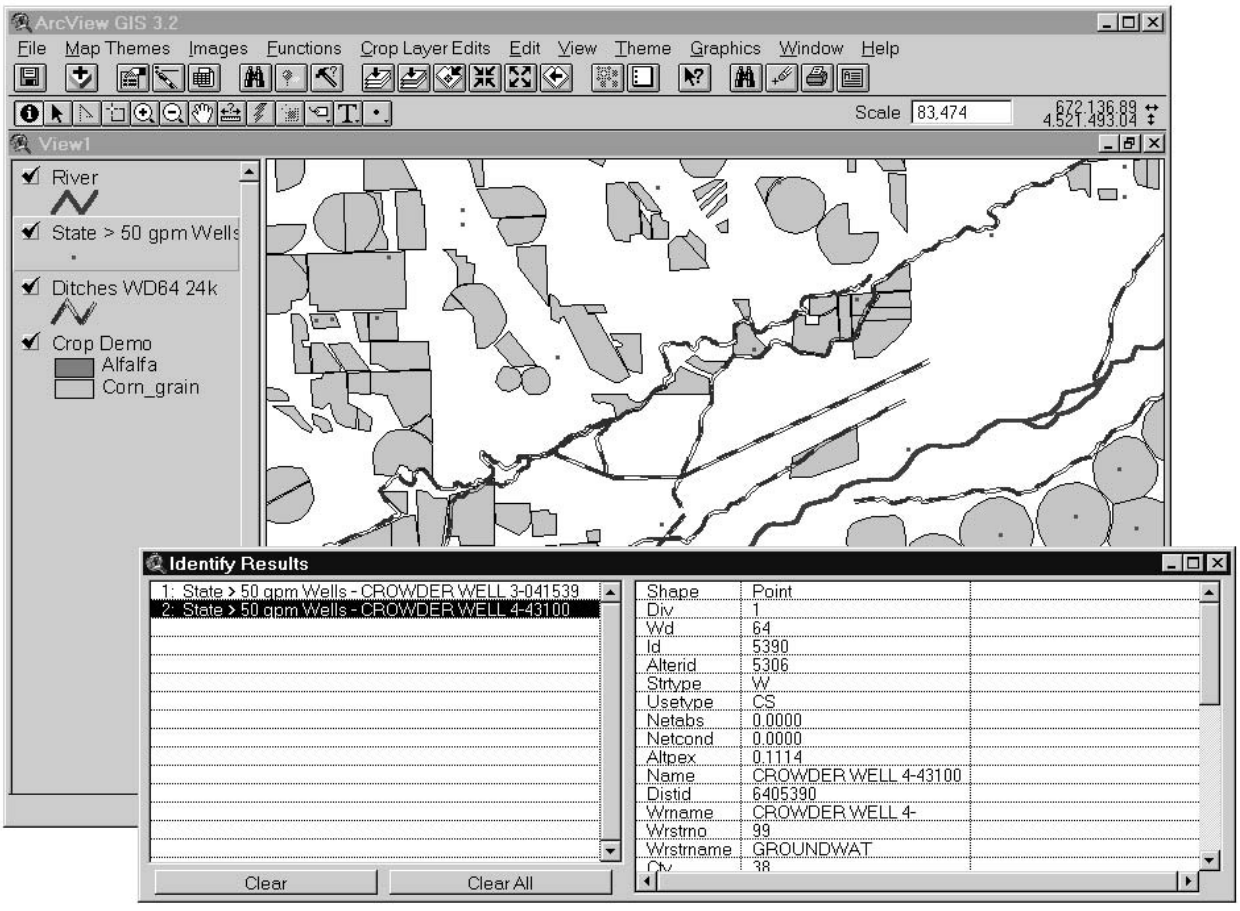

Figure 2: SPMAP GIS Component

South Platte Consumptive Use (CU) Model

Water managers in the South Platte River Basin have needed an efficient process for accurately computing field and farm Consumptive Use (CU). Based on surface-water supplies and consumptive-use estimates, managers can estimate the CU of groundwater, the pumping efficiency of wells, and the river-flow depletions that need augmentation.

Input for the CU Model can be developed through the GIS themes and spatial analysis features of the SPMAP or can be entered directly into the CU Model interface.

The CU model uses the computational program developed by IDS for the Colorado River Decision Support System (CRDSS), and can do monthly calculations using the Blaney-Criddle, calibrated Blaney-Criddle or Kimberly-Penman techniques. The CU Model can also calculate consumptive use using the daily Penman-Monteith technique. The state database HYDROBASE can be accessed to retrieve surface diversion records as well as weather station data. The model can compute the CU for the different CU techniques, and the Graphical User Interface allows the user to compare results from all techniques used. A number of improvements and enhancements to the CU Model were made for its application to the lower South Platte River Basin (i.e., compute pumping requirements and detailed water budget results). Along with improvements in the interface for developing input (including using the spatial abilities of SPMAP), a number of output features have been added to interact with the SDF View and specific to the needs of the water managers in the South Platte (Figure 3).

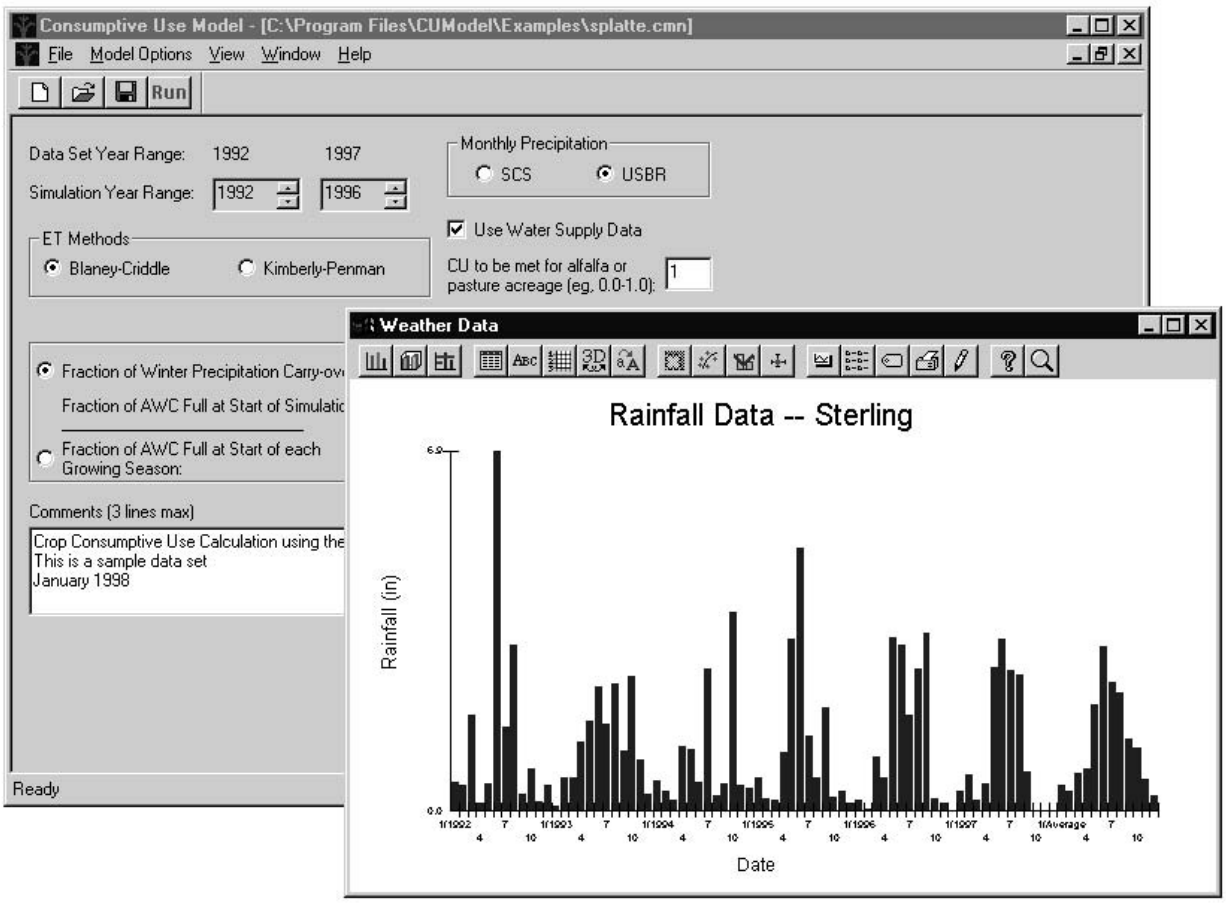

Figure 3: South Platte CU Model

Stream Depletion Factor Model (SDF View)

Water managers use Stream Depletion Factors (SDF) to determine the lag time from when irrigation well water is pumped from, or water is recharged to, an alluvial unconfined aquifer, and when a depletion or accretion happens in the river. The CU Model can create input for the SDF View model, or the user can develop input to the model using the Graphical User Interface. The computational component of SDF View is based on the USGS SDF Model. Additional features have been added to SDF View to allow users to evaluate multiple scenarios such as repeating pumping records or other types of projections. The model creates output showing the impact due to pumping or recharge as well as the net impact to the river (Figure 4).

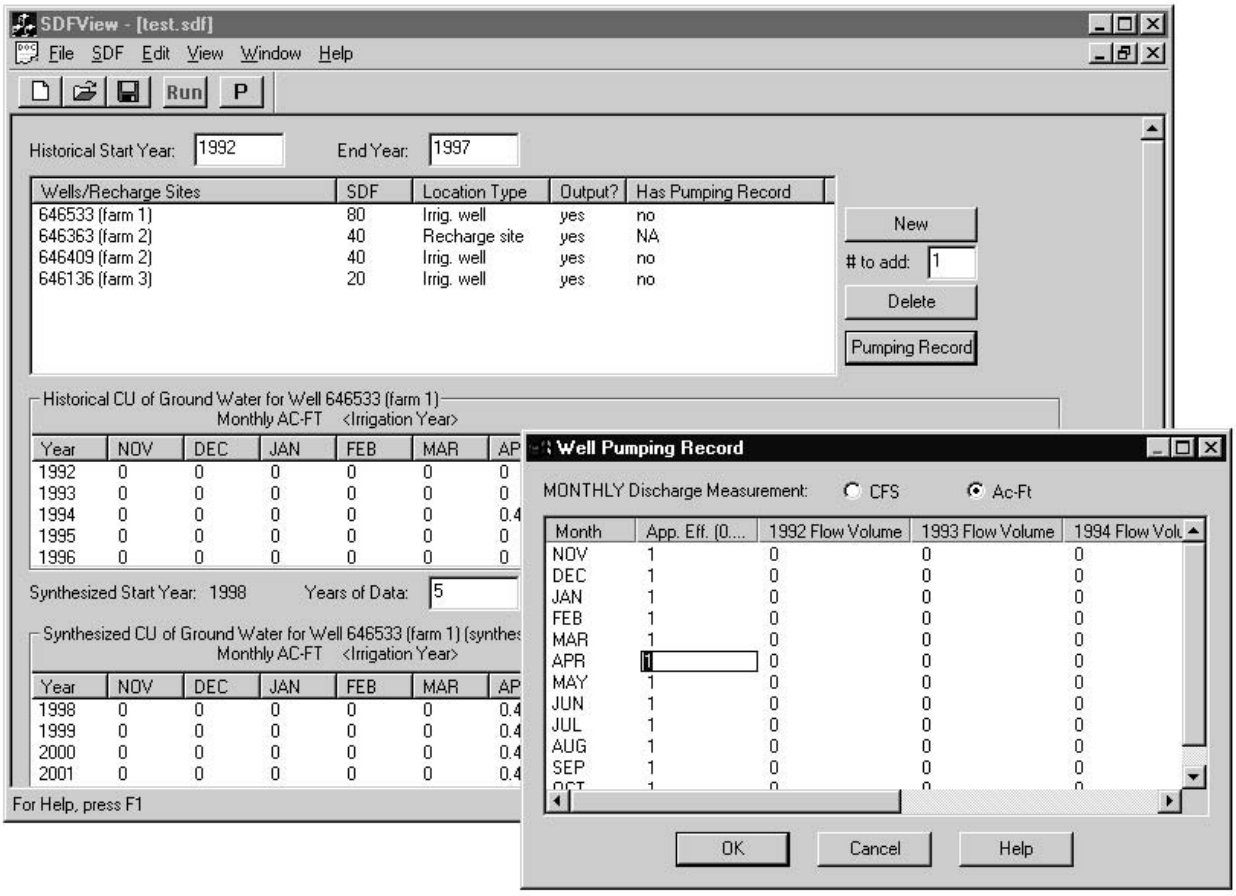

Figure 4: Stream Depletion Factor (SDF) View

Modeling Philosophy

Since the focus of any modeling or data development project should be to meet the needs of software users, close coordination with water providers in the basin at all stages of the project was essential to this project's success. This close coordination was achieved by having regular meetings with the Advisory Committee (every 4-6 weeks) to review the development of the software and identify enhancements. At each stage of development, a version of the component completed was provided to the participating organizations via the World Wide Web along with on-line documentation available from a menu item in the software. Hardcopy documentation can be downloaded and printed from the internet site. Since water providers need these tools, they were put to use almost immediately. This use made clear the identification of bugs and enhancements needed; hence, the quality and practicality of the software developed has been significantly improved.

In addition to meeting the software development needs of users, data collection and modeling projects should use existing models when possible. The CU Model and SDF View make use of computational programs written in standard FORTRAN that were developed for other projects. The CU Model was developed by IDS as part of the Colorado River Decision Support System (CRDSS). Its capabilities were enhanced to include wells, which was not a priority in the CRDSS work. The SDF View computational program was developed by the USGS, and only minor revisions were done for use in this project. To make the programs easier to use and provide new options for building input files and viewing output, Graphical User Interfaces (GUIs) were developed in the C++ programming language and constructed with visual C++. The GIS component is built as an ArcView script and allows for customized analysis options and menu items. The development and user platform is a PC running Windows 95/98/NT. The interface contains on-line help parallel to this documentation, accessed from the Help menu in the interface. The combination of using developed models,

building graphical interfaces, using ArcView scripts, and following a modular and data-centered approach makes this software flexible, specialized, and easy to use.

Project History and Progress

In the 1970s and 1980s, CWRRI funded basic research to develop mathematical relationships (models) describing interactions between surface and groundwater 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 microcomputer (both hardware and software) has provided water managers the ability to further develop decision support technology.

Since 1995 Dr. Luis Garcia, Professor of Civil Engineering at Colorado State University, 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 agreed to financially support the research, while also providing regular (approximately every six weeks) 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 extremely closely on all aspects of the research. 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.

During 1995-96, project efforts focused on spatial data collection and evaluation. A Geographic Information System 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.

During 1997-98, project efforts focused on developing a Consumptive Use (CU) model and an interface for a Stream Depletion Factor (SDF) 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 was modular, and each component can be operated in a stand-alone mode. The user can use the GIS module to locate fields and the surface and/or groundwater sources that provide water to them. This information (along with the crop types grown in each field and weather stations) can then be stored in an ASCII file. The CU model imports the created ASCII file and uses it to create an input file, which then is used to calculate the CU and any pumping requirements.

During 1998-99, efforts focused on the release of the Stream Depletion Factor (SDF) Model interface called SDF View. This interface can be used to estimate the lag time when irrigation well water is pumped from, or water is recharged to, an alluvial unconfined river aquifer and when a depletion or accretion happens in the river. Required input information for SDF View is irrigated consumptive use from well water or net recharge amounts and SDF values for irrigation wells or recharge basins. SDF View is a stand-alone interface for Windows 95/98/NT that has on-line and hard-copy documentation. SDF View was released as part of the Three State Agreement to the State of Nebraska to help manage South Platte groundwater wells in the state.

The focus during the last year of the project (i.e., 2000) was to finish the SPMAP, SDF View and CU Model Interfaces and provide documentation to the satisfaction of the participants. This conclusion provides a well-defined set of deliverables and brings to closure the initial goals of the project. One of the major tasks completed this last year was the development of the CU Model as a stand-alone interface. Although coordination with SPMAP makes the data entry tasks easier and more comprehensive, the CU Model is more flexible, with a stand-alone interface. Additional methods and options have been added to the model. For example the CU Model can retrieve data from the statewide database being developed by the State Engineer's Office called HYDROBASE. A new version of the CU Model complete with documentation is now available.

Conclusions

The South Platte Mapping and Analysis Project illustrates the importance of working closely with local water managers when developing software systems. The Lower South Platte is a critical resource for agricultural production and critical for overall Colorado water policy. The alluvial South Platte aquifer conjunctive use systems (ground and surface water) have a history of use that is unique in the United States. The recent Three-State Agreement illustrates the critical role conjunctive use plays in meeting the water needs of agriculture in Colorado and Colorado's responsibilities to downstream states. SPMAP provides practical tools to help water managers meet future challenges in managing a complex system, and to

meet increasingly complex goals. The software and documentation is provided on the internet at http://www.ids.colostate.edu/projects/spmap.

A new phase of the project will be started this year to further identify data and modeling needs, as well as improving the usefulness of existing tools. This project provides a model of how a framework of diverse users can contribute to the development and use of common tools, benefiting each of the participants. The success of this project would not have been possible without the direct feedback and support of the South Platte Advisory Committee. We extend our thanks to all members of the committee for their input during this project.

For more information contact:

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Web site: **http://www.ids.colostate.edu/projects/spmap**

The project report will be available from CWRRI in early 2001.

PUBLICATIONS

Designing a Report on the State of the Nation's Ecosystems. October 1999. Contact: The H. John Heinz III Center for Science, Economics and the Environment, 1001 Pennsylvania Ave., N.W. Ste 735 So., Washington, D.C. 20004; Phone 202/737-6307, FAX 202/737-6410.

National Park Service, Water Resources Division 1998 Annual Report. Contact: Patty Hennessy at Phone 970/225-3502 or email patricia_hennessy@nps.gov.

Proceedings of the 1999 Ground Water Protection Council Annual Forum held September 19-22, 1999, Newport, RI. Contact the Ground Water Protection Council at Phone 405/516-4972, FAX 405/516-4973, or see the website at http://gwpc.site.net.

Analysis of the Magnitude and Frequency of Floods in Colorado

Regular updates of regression equations are necessary about every ten years, as recommended by the Federal Highway Administration (FHWA) to keep up with the latest improvements in statistical analysis and longer periods of data recorded at stream flow gaging stations over the years. New regression equations and methods for determining floods on unregulated streams were developed in 1994 by the U.S. Geological Survey (USGS), in cooperation with the Colorado Department of Transportation (CDOT) and the Bureau of Land Management (BLM). Stream flow data collected since 1981 through 1993 was used in the latest study presented in a report entitled Analysis of the Magnitude and Frequency of Floods in Colorado. This Water Resources Investigations Report # 99-4190 presents regression equations and methods for determining flood magnitude and frequency on unregulated steams in Colorado and includes data used in previous studies, with as much as 12 years of additional records from each of 64 additional gaging stations, and more.

Copies of this report can be purchased from:

U.S. Geological Survey
Information Services
Box 25286
Federal Center
Denver, CO 80225

For additional information write to:

District Chief
U.S. Geological Survey
Box 25046, Mail Stop 415
Denver Federal Center
Denver, CO 80225-0046

Colorado State University Agricultural Experiment Station

CUTTHROAT FLUME SETTLEMENT RATING ADJUSTMENT

by Steven R. Abt
Professor, Department of Civil Engineering
Colorado State University

Arid and semi-arid regions throughout Colorado and the western United States require the delivery of irrigation waters for crop production and other agricultural-related activities. The extreme value of water in these areas warrants an accurate accounting of the resource. Open channel delivery systems routinely incorporate flumes to provide accurate flow measurement. The cutthroat flume is one alternative flow measurement device used in many of the ditch and lateral distribution networks.

The cutthroat flume was designed to measure flow to an accuracy of ± 3%, provide a simplistic fabrication, allow relatively easy installation in the field, minimize head loss through the structure, enhance self-cleaning, and be cost effective compared to other flow measurement devices . . .

The development of the cutthroat flume is traced to Robinson and Chamberlain (1960), when they demonstrated that flat-bottomed flumes could effectively measure flow for both free-flow and submerged-flow conditions. Subsequently, studies by Ackers and Harrison (1963) and Skogerboe et al. (1967a) provided guidance for the appropriate flume design for inlet and outlet sections. Skogerboe et al. (1967b) made numerous improvements resulting in a durable, reliable and accurate flow measurement instrument that was termed the cutthroat flume.

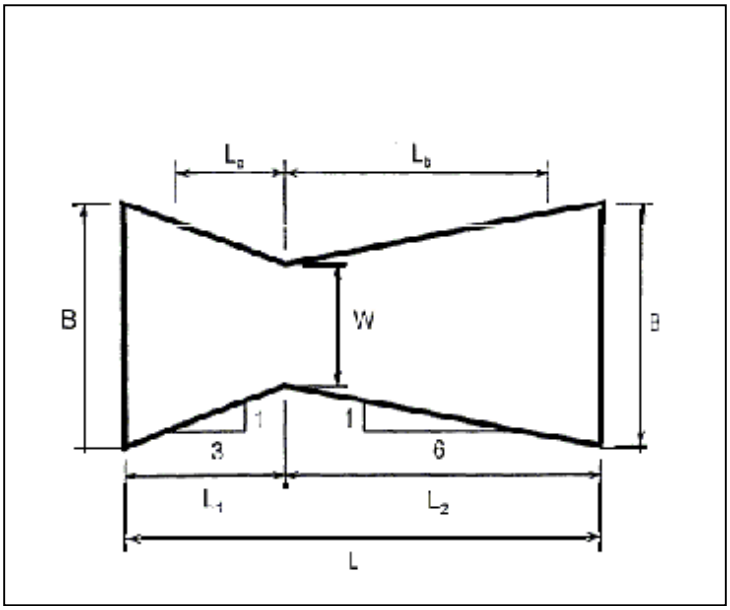

Figure 1. Cutthroat Flume Dimensions (Plan View)

Figure 1 presents a plan view schematic of the cutthroat flume that evolved from Skogerboe et al (1967b). The flume dimensions, as portrayed in Figure 1, are: B = width of both inlet and outlet of the flume; W = throat width; L = length of the flume; La = length from throat of flume to the upstream depth ha; and Lb = length from throat of flume to the downstream depth hb. The upstream depth, ha, is located at 2/3 the length of the convergence section upstream of the throat.

The cutthroat flume was designed to measure flow to an accuracy of ± 3%, provide a simplistic fabrication, allow relatively easy installation in the field, minimize head loss through the structure, enhance self-cleaning, and be cost effective compared to other flow measurement devices (i.e., the Parshall flume). The cutthroat flume, when properly installed, must be level to provide accurate discharge measurements. Should the flume settle due to poor soil or placement conditions, due to soil freezing/thawing or wetting/drying, or due to vibrations from the operation of nearby equipment, significant error may result in flow measurement.

In 1999, Abt and Skowron performed a field assessment of 77 cutthroat flumes located throughout south-central Colorado. The assessment indicated that 47% of the flumes yielded measurement errors exceeding ± 3%, 35% of the flumes yielded measurement errors exceeding ± 5%, and 17 % of the flumes yielded measurement errors exceeding ± 10%.

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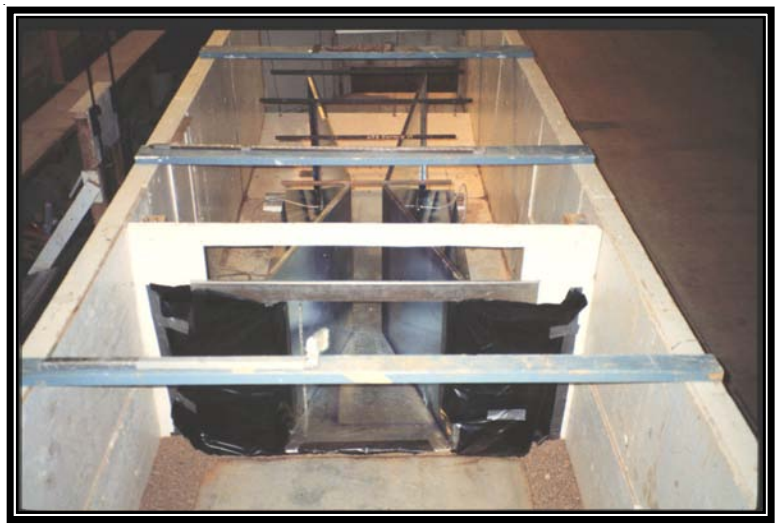
Cutthroat Flume

Further, 55% of the flumes under-estimated the actual discharge. All of the flumes were assessed for integrity and fewer than 20% of the flumes were considered to be in proper operational condition, although the flumes were less than 25 years old.

These findings indicate that the water measurement infrastructure is deteriorating and that the potential measurement discrepancies may portray a false sense of water accountability to water users and water resource managers.



Performing field verification of cutthroat flume tests

It was evident that when properly fabricated, installed and maintained, the cutthroat flume is an effective means for accurately measuring discharge in an open channel network. However, field observations indicated that a significant portion of these flumes has settled/degraded to where measurement accuracy is questionable. Therefore, a means must be found to enable the correction of the flumes with minimal disturbance, or the flumes must be replaced. The objective of Colorado Agricultural Experiment Station Project 1-57151 was to develop a process for adjusting cutthroat flume discharge ratings due to flume settlement while maintaining flow measurement accuracy to ± 3%.

An experimental testing program was conceived and conducted in the Hydraulics Laboratory at Colorado State University (Ruth 1997 and Skowron 1999). Nine commercially available cutthroat flumes (10.2 cm x 0.91 m, 30.5 cm x 1.37 m, 61 cm x 1.37 m, 20.3 cm x 0.46 m, 15.2 cm x 1.37 m, 30.5 cm x 2.74 m, 61 cm x 2.74 m, 15.2 cm x 2.74 m, and 20.3 cm x 0.91 m) were acquired, assembled in accordance with the manufacturer's instructions, and tested in the laboratory test facilities.

A series of 168 tests was performed (9-11 tests per cutthroat flume) to examine settlement effects on the discharge-rating equations for free-flow conditions. The flumes were evaluated under level conditions as well as for lateral and longitudinal floor slopes ranging between - 6% to + 4% to simulate settlement. Lateral (cross) flume settlement was defined as a function of the bottom slope.

A negative lateral slope is when the right side of the flume, looking downstream, is lower than the flume-floor centerline. When the left side of the flume is lower than the flume centerline, looking downstream, the cutthroat flume is considered to have a positive slope. A negative longitudinal settlement is defined where the flume entrance is lowered in relation to the flume toe. When the flume entrance is raised in relation to the flume toe, the longitudinal slope is considered positive. Each cutthroat flume was placed into a fixed, recirculating flume. Flow was conveyed into the test facility and through each cutthroat flume. The measured, or true, discharge through the flume (Qm) was determined by documenting flow through an orifice. The discharge through the cutthroat flume was termed the apparent discharge, or Qa.

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Apparent discharges were attained for each test by measuring ha in the cutthroat flume. Each test consisted of six increments of ha, each increment repreenting a uniquely different discharge. Data collected during each test included measured discharge (orifice), the cutthroat flume discharge, upstream water depth (ha), downstream water depth (hb), and the lateral and/or longitudinal slopes. Flow entering the test facility was measured to within ± 1%.

A rating curve for each cutthroat flume was developed and checked in the horizontal or 0% slope position. The discharge rating curve for the level flume (0% slope) served as the basis from which comparisons were derived. A comparison of the measured (Qm) and apparent (Qa) discharges was performed as a function of the lateral and longitudinal slopes. The maximum lateral slopes that ranged from – 6% to 4% yielded errors of up to ± 11%, while the maximum longitudinal slopes that ranged from – 6% to + 4% resulted in errors of up to ± 23%. Further, for the lateral slope condition, it appeared that the wider the throat, the higher the potential error.

An analysis was performed in which a procedure was developed to adjust the apparent discharge through the cutthroat flume that has settled from the horizontal so as to reflect the actual (true) flow to within ± 3%. A detailed presentation of the discharge correction procedure (process and equations) can be obtained in Abt and Skowron (2001) for free outfall conditions. A cutthroat flume discharge correction procedure for submerged flow conditions is currently in development. Additional information may be obtained by contacting Dr. Abt at 970-491-8203, sabt@engr.colostate.edu, Engineering Research Center, Colorado State University, Fort Collins, CO 80523.

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WATER-WISE GARDENING EDUCATION FOR COLORADO'S MASTER GARDENER

by David E Whiting, Cooperative Extension Consumer Horticulture Specialist, Colorado State University Department of Horticulture & Landscape Architecture

With increasing concerns about water use by home gardeners, the Colorado State University Cooperative Extension Master Gardener Program added a training session on water-wise gardening, focusing on irrigation design and management for home gardeners. Other information covered in the new 3-hour training will re-emphasize routine gardening practices that help home gardeners conserve water, such as the use of a soil mulch, soil amendments, and plant selection and placement.

In the new curriculum, Colorado Master Gardeners will review the three principles of water-wise gardening. Homework from this training includes a check sheet for each student to evaluate their own yard for water-saving gardening techniques they currently incorporate or could incorporate with minimal or significant investment in time or financially. Data from the homework will guide Cooperative Extension in developing other water-saving education programs for the general public.

As part of the curriculum, data from my own yard will help illustrate concepts of irrigation design and management. At my home, the previous homeowner had a local contractor install a landscape irrigation system. With some modifications in management and design, I cut water use by 75 percent.

To begin conserving water, I recognized that all areas of the lawn do not need the same amount of water. The previous owner, like most homeowners, irrigated all areas for the same amount of time (in my case, each irrigation zone received 20 minutes, 3 times a week). By watching the grass and adjusting the irrigation clocks accordingly, I saved a significant amount of water. For example, the front lawn on a southwest-facing slope requires irrigation every three days during summer heat, the back lawn needs irrigation only every 6 days, and a section of lawn in the shade requires watering only every 10 to 14 days. It's easy to see how a minor irrigation timer change results in a major reduction of water use.

Another important water-saving feature came in a design change. The original sprinkler layout had the heads in the center of the lawn shooting out, typical of many yards. With this design, water sprayed onto the driveway, sidewalk and street and was wasted as it ran down the gutter. In the original system layout, water distribution was rather uneven and created a dry area along the driveway. The area required heavy over-watering to keep this spot green, which meant gallons of water not used in other areas of the zone ran into the gutter.

A simple design change corrected the dry spot and prevented excess run-off. Sprinkler heads were lined-out along the sidewalk and driveway, giving head-to-head coverage. It totally corrected the chronic dry spot, kept the street and sidewalk dry, and reduced water usage in this zone by 30 percent.

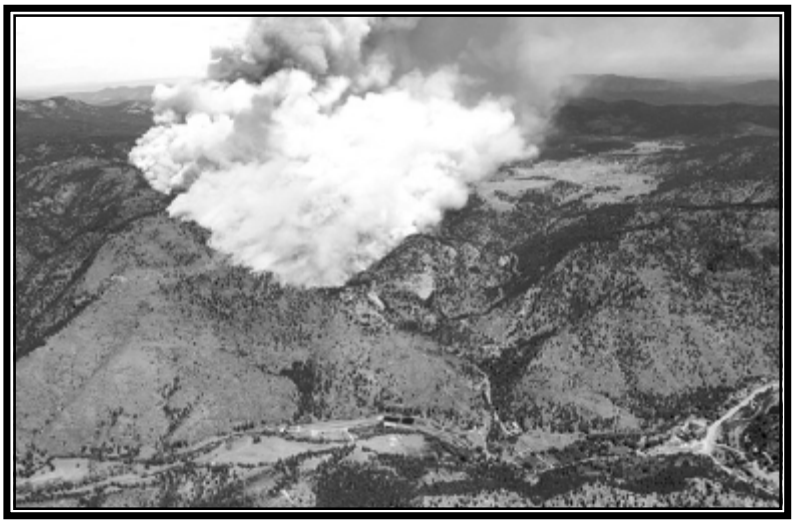
Because of the clay soils found in my neighborhood, most residents have a problem with water running off the lawn into the gutter. Aerating a lawn 2-3 times a year usually corrects the runoff problem.

Examples such as these from my home will make water-conservation relevant to our Master Gardeners and help them teach others in Colorado to conserve such a valuable resource.

2000 WAS A BANNER YEAR FOR COLORADO WILDFIRES

by Katherine Timm
Colorado State Forest Service

The summer of 2000 will go down in history as one of the most significant fire seasons in Colorado history. Of the 2,096 fires reported between Jan. 1 and Nov. 15, 37 were major, burning more than 100 acres each. And these figures only tell part of the story.



Aerial view of Bobcat Gulch Fire in Larimer County, June 2000. Photo taken by Doug Van Reeth.

The current figures reflect only those fires reported to date. "Fire reports from fire departments are submitted on an annual basis and will significantly increase the total number of fires that occurred in 2000," said Rich Homann, fire division supervisor, Colorado State Forest Service.

Although no major fires have occurred in Colorado since October, local, state and federal agencies will be fighting the mounds of paperwork resulting from the fires well into 2001. As of August. 3, the cost to fight Colorado's fires had already totaled more than $25 million — and that figure represents less than 50 percent of the cost to fight the 37 major fires.

So what can we expect in the summer of 2001? It depends on many factors, but forest condition is a reliable prognosticator, and data collected over the past 40 years indicates the risk is significant for major wildfires in 2001 and beyond. Measuring fuels buildups is one way to determine forest condition, and buildups have reached critical levels in the forests of the Central Rockies.

The causes of fuels buildup are many, but perhaps the most significant factors are the custodial care and protection given our forests since the turn of the last century and the increasing number of people moving into the wildland-urban interface areas of Colorado. For the past several decades, forests have been protected from disturbances society found unacceptable, including timber cutting and wildfire. This approach to forest management has allowed shifts in the understory of plant species, the build-up of forest fuels, increased numbers of trees, and less overall forest diversity. These changes, in combination with increased human habitation on or near forested lands, have put today's forests at the edge, or outside the range, of normal conditions.

So what does this mean to Colorado? "The obvious threat is catastrophic wildfire, and the consequences are potential loss of human life and property, as well as degradation of forested land," Homann said. Beyond

Slurry drop at Bobcat Gulch Fire in Larimer County, June 2000. Photo taken by Doug Van Reeth.

that, natural resources managers are concerned that fires as large as the ones that occurred in Colorado this year could have secondary impacts similar to the 1996 Buffalo Creek Fire - degradation of municipal water supplies;erosion that impacts fisheries; and damage to roads, highways and structures due to runoff. In addition, the colsts associated with the secondaty impacts of large fires are passed on to the public through higher water bills and an increase in local and county taxes.

Due to the magnitude ofthe fires this past year, President Clinton identified a team of experts to develop a National Fire Plan. The plan contained recommendations that Congress has funded with a $1.8 billion budget. Forestry experts from the Western United States convened in Salt Lake City Nov. 29-30 to develop strategies to implement the plan in the West commencing in January 2001. The plan focuses on fire preparedness, fire operations, emergency fire contingency, state fire assistance, volunteer fire assistance, forest health manage ment and economic action programs.

...natural resources managers are concerned that fires as large as the ones that occurred in Colorado this year could have secondary impacts similar to the Buffalo Creek fire...

WEB PATHS

Description	Website
TMDL Information -- Contains information about TMDLs, background information, links to EPA sites, state-specific TMDL information, tools for developing TMDLs, and recent congressional hearings.	**http://www.nal.usda.gov/wqic.TMDL.html**
COLORADO WATER CONGRESS	**http://www.cowatercongress.org**
LIP -- Low Intensity Phase of long-term **South Platte River NAWQA Study**. Data acquired as part of field activities are posted under the DATA button on the South Platte NAWQA home page.	**http://webserver.cr.usgs.gov/nawqa/splt/splt_home.html**
RIVER WATCH -- Colorado watershed reports are available at this website.	**http://riverwatch.state.co.us**
National Water-Quality Assessment (**NAWQA**) Program --**High Plains Regional Ground-Water Study** Website -- Has information on the USGS investigation of ground-water resources in the High Plains aquifer system.	**http://co.water.usgs.gov/nawqa/hpgw/HPGW_home.html**
CENTER OF THE AMERICAN WEST -- Univ. of Colorado. The project seeks to establish a better understanding of how "westerners" see themselves and the region in which they live.	**http://www.centerwest.org/westerner**
EPA -- This website contains information about Phase II of the NPDES Storm Water Program.	**http://www.epa.gov/owm/sw/phase2**
EPA -- See this website for information about the Underground Injection Control	**http://www.epa.gov/safewater**
See this website for information about **Colorado's Decision Support Systems**.	**http://cdss.state.co.us**
Newsletter of **The Irrigation Enterprise Management Practice Study**, Colorado State University. For all your irrigation needs, see this website.	**http://socaddr244.soc.colostate.edu/**

NEW FACULTY PROFILES

by Marian Flanagan

Dr. Jared Orsi
Borderlands History
Department of History, CSU

"Water is a good thing to study, because you can watch all of human activity flowing through it…If you watch where it goes and what happens to it …you can learn almost every thing you want to about politics, about social relations, about law, and economic growth or stagnation…you can watch societies rise and fall."

Dr. Jared Orsi has accepted a position at CSU as Assistant Professor of History, namely, Borderlands History (the study of the relationship between US and Mexico focusing on environmental issues).

As a history major at University of California, Davis, Dr. Orsi developed an interest in environmental history. This led to him to research the history of water resource development, focusing in particular on control of floods in Los Angeles, which he later went on to study in graduate school.

He earned his doctoral degree in History from the University of Wisconsin-Madison, in August 1999, majoring in American West and Environment after which, as a Research Fellow, he went to the University of California Humanities Research Institute. His dissertation manuscript, entitled, "Hazardous Metropolis: Flooding and Urban Ecology in Los Angeles" is under submission to the University of California Press for book publication. (The manuscript is a study of flooding in Los Angeles and the development of flood policy.)

Well versed in interdisciplinary studies as they relate history and environmental issues, Dr. Orsi tries to bring his interest in water into the classroom, wherever appropriate. "Water teaches us a lot about other things; economic growth, law, political relationships, things like that," he replied.

His passion, Dr. Orsi says, "is connecting history to the present world, teaching students to look at the world around them and recognize the consequences of historical processes and forces. In environmental history you can see the physical results reflected in the landscape." That's what interests him in environmental history and water history in particular. "When you look at the landscape around you," Dr. Orsi explains, "you can see how past peoples have used that landscape and how their use of it produced the one that we live in today." Through his teaching, he adds, "I hope to teach students, patterns of behavior and skills such as the habit of looking at the physical world around them, asking how did it come to be and what world are they making?" He wants his students to question how their actions are related to the possible consequences of those actions and to be responsible citizens. He also emphasizes the importance of refining writing and communication skills.

Dr. Orsi is learning about Colorado water history, and contemporary society in Colorado. Patterns such as those he observed in his previous studies of flooding in Los Angeles and how over-development relates to flood problems, looms as a likely opportunity for Dr. Orsi to integrate his expertise in our growing Front Range.

Although busy at his new position, he follows baseball intently, enjoys hiking, volunteer community service activities with his wife, such as feeding the hungry. He enjoys volunteer teaching in inner city public schools and also tutoring history.

Dr. Orsi is teaching United States History and Borderlands History this semester and will teach a Modern Latin America class and a class in Historical Methods this spring.

NEW FACULTY PROFILES

by Marian Flanagan

Dr. Alan Dale Bright
Human Dimensions of Natural Resources
Department of Natural Resource Recreation and Tourism, CSU

". . . agencies are realizing they need to address public concerns early on while they're developing ideas and not wait until they are already developed They need to get the public involved sooner. That is really the basis of much of the research we do in Natural Resource Management: getting public attitudes understood earlier in the process of implementing management policy."

Dr. Alan Dale Bright joined the faculty of the Department of Natural Resource Recreation and Tourism in the fall of 2000 as Assistant Professor. His research interests focus on human dimensions of Natural Resource Management (NRM), including the social and psychological aspects of recreation behavior.

Dr. Bright received his PhD from Colorado State University in 1993, and his MBA in 1988 from the University of Illinois. His work is based, in his words, "on social and psychological theory: a lot of work on values, attitudes and their effect on people's behavior in various situations that relate to various Natural Resource Management issues." It is a discipline of social psychology examples and statistics, applicable to any part of the industry.

Regarding NRM, recreation management, and water issues, Dr. Bright said, "In our field there is a lot of water related research because so much outdoor recreation does revolve around water". He referred to issues of crowding and user conflict and the agencies concerned.

One of several projects he is involved in is research through the University of New Hampshire / Maine's Sea Grant program. He is looking at public perceptions of coastal marine aquaculture and the effect information has on the local people's opinions. This includes investigating to what extent the population perceives effects that development may have on recreation along beaches and water, before the construction begins. He is also developing information using a brochure and a video, and comparing the effects that these two types of information have on influencing attitudes toward marine aquaculture in the area. Different angles of his survey will answer questions such as, "Which form of information is more effective," "What factors influence its effectiveness," and "What the different reactions are, based on people's knowledge of aquaculture.

Working with the Forest Service in the northcentral United States as well, he is examining public attitudes with specific forest practices and studying differences in values and perceptions of the local people in that part of the country. In Colorado, he is helping the Park Service in a study of recreation participation, or lack thereof, in Rocky Mountain National Park as it applies to ethnic groups. His interaction with focus groups to develop questionnaires may lead to specific management strategies.

Dr. Bright enjoys being a family man. He and his wife have a four-year old son, and you can't help but notice how his face lights up whenever he talks about his little boy. He also enjoys white-water rafting, mountaineering, and rock climbing.

Classes led by Dr. Bright include RR330, Social Aspects of Natural Resource Management and RR471, Starting and Managing Your Own Tourism Enterprise, for those wanting to start their own tourism venture.

MEETING BRIEFS

FORUM LOOKS AT WATER AND MONEY IN THE SOUTH PLATTE BASIN

The 11th Annual South Platte Forum brought together approximately 140 water users and managers, state and federal agency personnel, academics and students in water-related programs to hear views on **Money Flowing Through the South Platte Basin: The Business of Water**. The meeting took place at the Raintree Plaza in Longmont on October 24th and 25th, 2000.

Keynote speakers were David Robbins of Hill and Robbins on October 24th, and Colorado's former Governor Dick Lamm on October 25th. The forum also included a poster session, and posters were displayed throughout the meeting.

The collage of pictures on the next page includes panelists and presenters, and also provided is Dr. Marshall Frasier's presentation -- a thoughtful examination of rural-urban water issues. Marshall was a panel member for Session 4, Growing Crops or Growing Houses -- Rural v. Urban Water Competition.

WATER WARS OF THE NEW WEST

by Marshall Frasier
Department of Agricultural and Resource Economics
Colorado State University

As an economist, you don't need to expect any answers from me, but what I do hope to do in my talk to you today is to provoke some thinking. Most of us are in a bit of a rut in terms of our thinking about water issues, and I want to challenge some of that thinking. Whichever side of the fence you happen to be on, you are probably missing a good share of the argument, because you have already convinced yourself of the answers. So, we are going to explore some of those arguments this morning.

As we look at water wars, you will recall that in the water wars of years past the weapons of choice were mostly shovels and shotguns. These days, the weapon of choice has become the dollar. We are looking at a battle of money as we look at the new wars today.

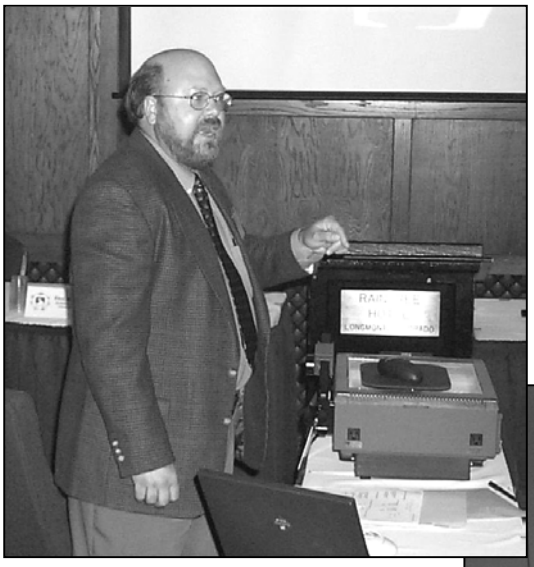
I tried to come up with a catchy title that seemed to fit, and the more I thought about it, the more I really liked the way that this did fit. We are really in an age of water wars in the New West. Bill made some comments in his opening remarks about the fighting over water these days. As we look at water wars, you will recall that in the water wars of years past the weapons of choice were mostly shovels and shotguns. These days, the weapon of choice has become the dollar. We are looking at a battle of money as we look at the new wars today. As we look at the primary players in the game, we are looking at agriculture vs. municipal use. These are the primary players that we see in Colorado.

There are many reasons to conclude that these are the two primary players. One comes through examining consumptive use. Recent statistics show that about 90 percent of the water that is consumed in the state of Colorado is consumed by irrigated agriculture while municipalities consume only about seven percent. We talk about value, and many folks that I work with say, "Well, you are the economist; you can determine the value." No, economists don't determine the value. We observe and try to explain why people attach value to different things, but that is all we do. We don't ascribe any value to the water itself.

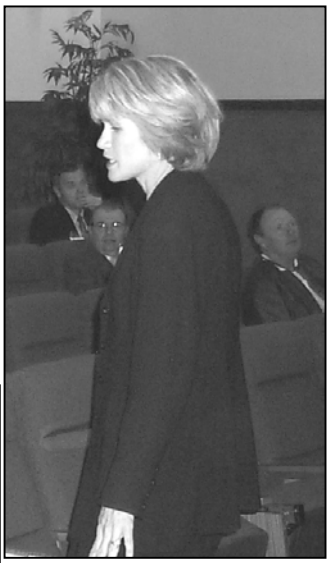
As we look at irrigated grain and hay production in the State of Colorado, values of ag water tend to be well under $100 per acre-foot. This isn't a permanent right; it is just for one acre-foot—43,560 cubic feet—of water applied to a fielding a given season. Frequently cited values hover around $50, give or take. In a municipal setting, we see that the cities are willing to pay well in excess of $1,000 for that same unit of water. This was confirmed in the previous presentation citing the astronomical prices for water in Left Hand Ditch. CBT water is selling for in the neighborhood of $20,000 a unit; that is only 7/10 of an acre-foot. That is for a permanent right; you get that amount each and every year, but when you put that back on an annual

11TH ANNUAL
SOUTH PLATTE FORUM
October 24-25, 2000
Raintree Plaza
Longmont, Colorado

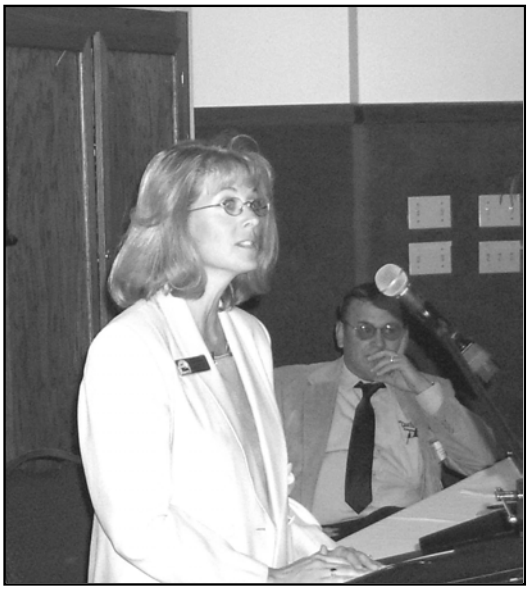
MONEY FLOWING THROUGH THE SOUTH PLATTE BASIN: THE BUSINESS OF WATER



Steve Boand, HydroLogic Technology, described replacement of the sustainable water supply deficit in the South Denver Metropolitan area.



Marie Livingston, University of Northern Colorado Professor, presented an economist's view of competition for water in the South Platte Basin.



Above: Ramchand Oad, Professor of Civil Engineering,CSU, and Denver Water's Sara Duncan discuss water issues presented at the Forum.

Left: Barbara Kirkmeyer, Weld County Commissioner, participated in the panel on Growing Crops or Growing Houses…

Right: Eric Wilkinson, Manager, Northern Colorado Water Conservancy District, presented an overview of South Platte Basin supply issues.

basis, you are talking about several thousand dollars for an acre-foot of water.

We have many ways to evaluate this problem, but the one thing you cannot ignore, no matter how you look at it, is that there is huge potential for gains from trade. We have farmers who are holding water, using water, and are generating less than $100 per acre-foot. In a municipality, we can use the water where we are getting $1,000 of benefit per acre-foot. That is a pretty big gap, isn't it? The gains to both buyer and seller can be great.

As a society, there are many things that we can talk about in terms of whether this is a good thing or a bad thing. Barbara Kirkmeyer posed the idea that farmers are thinking that they can't afford to farm anymore. It is almost posed as a bad thing. Is it bad to look at this and say, "I just can't afford to farm anymore"? Flip it around. Let's say, "I am going to farm. They are not going to take the water." As a society, is that something we want to see happen? As a society, we benefit from this. The values derived in the municipalities are a reflection of how we weight the value of water in that use. The value derived in agriculture is a reflection of the value, as a society, that we place on the goods that are grown with that water.

Now, that comes off as sounding anti-ag, doesn't it? Well, I am not anti-ag at all. We will talk the other side of this issue later. For those of you who are died-in-the-wool ag supporters, saying, "Ag is the only way and we have to shut these municipalities down," you cannot ignore this. Let's think about the potential here of water transfers. Think first of the perspectives of the buyer and of the seller. To them, it is a voluntary transaction. You can't hold that against people. People should have a choice as to what they want to do.

That is one of the nice things about our market setup with water allocation. That big difference between the agricultural use and the municipal use—economists call that surplus—the buyer and the seller get to decide how it will be divided. Suppose that the city is willing to pay $1,000; the water is only worth $100 to the farmer, so they have $900 to negotiate with. It is not very hard to see that you can make that a win-win situation. One opportunity is to just split it evenly at a sale price of $550 – the city pays $450 less than what customers would be willing to pay. The farmer receives $450 more than he has been getting out of it. Of course, cities generally have a much stronger bargaining position, so the price will tend to be closer to the farmer's value and result in more surplus to the city.

But that is not the end of the story. If it were, we would not be sitting here today and this would not be an issue. The issue is that we have other people who are affected by these transactions – those we call third parties, or those who are outside the sale. Let's talk about these people.

There are several classes of third parties that I'd like to address. First, we have other water appropriators. It is pretty convenient for us that our ancestors were quite forward thinking about water transfers. They said, "If you move water around, that can have a pretty significant impact on other people who use water. So, guess what? We will let you transfer water only to the extent that you do not damage other water appropriators." That is why we have a water court system: to protect and assure that other water appropriators are not damaged through this transfer. So, as we are moving water around, other people have all the water that they have always had before.

Is anyone else affected? There are impacts on neighbors. People who are local to the seller are affected — people who relied upon the revenue you generated; people who relied upon you to buy and sell goods in the community; and if you sell out and leave, you are no longer part of that economy. If one or two go, what is the big problem? But when you see half, three-quarters, 90 percent of the agriculture in your region go and you are an ag-dependent community, it makes some pretty significant impacts.

We have those that are local to the buyer as well: certainly, as we talk about issues of urban sprawl, as we are transferring water into areas and promoting growth there will be impacts – some positive, some negative. That is one of the things we see: as we take water out of one economy and put it in another. For example, the tax roll – as you take a unit of water from ag you certainly lose some tax base, but I would guess that is frequently offset by the development that took place under the new use. So, there are pluses and minuses: we don't know, necessarily, which will dominate.

Finally, we also can have some pretty significant instream flow impacts if we move the point-of-diversion in the change case that we are considering. If we have an instream flow right and it is protected, then it will be amongst the group in the first category. But if you don't have a right, as in rafting, for example, there is no protection under law at this point.
Let's talk about the perspective of the economist on this. First, economists always get a bad rap that all we care about is money. There is a lot more to this than dollars and cents. So, it is a smaller effort for us to get everything in commensurate terms if we can monetize those things that typically are not ranked. Those of you who were here yesterday heard John Loomis talk about some techniques that we use to try and monetize things that are not valued in a marketplace.

There is nothing sacred about money. We could use a common metric of plucked chickens, if you wanted to, although it would

be tough. It is a lot easier to think of it in terms of dollars and cents. It allows us to identify the tradeoffs so that we can strike a balance between the benefits and costs. Certainly, some of my economist brethren have not done our discipline any favor by implying, "It is hard to monetize that, so we will just ignore it." That is flat wrong. The first fundamental principle in conducting a benefit-cost analysis is that ALL impacts must be considered in some fashion or another.

I don't want to get into a full-fledged discussion of the merits and demerits of the economist's role, or I'll keep you well past the time that I'm allotted. Suffice it to say that the discipline has a great deal to contribute to the dialog of water transfers.

Our greatest fears surround the large-scale water transfers. In Colorado today, this usually means drying up agriculturally productive lands so that the water may be used in another setting.

As we grapple with the issues of water transfers, we are generally not troubled by any given sale of water between two private parties. As a market transaction, it is a voluntary agreement between the buyer and seller and, typically, the third party impacts are very low. Our greatest fears surround the large-scale water transfers. In Colorado today, this usually means drying up agriculturally productive lands so that the water may be used in another setting.

A number of arguments have been employed in challenge of large-scale transfers. Some legitimate, others less so. This is one of the places I'd like to "challenge your thinking". Seemingly any time that anything threatens agriculture, the issue of food security is raised. The argument is that if we don't do something to stop this atrocity, we will all starve to death. While food security is an important issue, water transfers in Colorado have very little impact in a national sense. Irrigated production in Colorado accounts for only a few percent of total U.S. production and any given transfer only affects a fraction of Colorado production. Clearly, water transfers within Colorado do not pose a serious threat to food security.

One valid argument does stand as to why we might not want to see large-scale water transfers. That is the "drying" of local economies.

Often a retort to that argument is, "Yeah, maybe not today, but what about the future? As other lands are taken from production nationwide, our irrigated lands may well be critical in the future." This counter argument implies that the water transfer is irreversible. I would argue that this is not true. Unlike paving or building on a field where crops were produced, the physical cost of restoring the land to its former potential is very low for water transfer. Over time, infrastructure may fall into disrepair, but should generally be repairable at low cost. The major cost will be regaining the right to the water.

In today's environment, it would be difficult to obtain water from a city for ag uses. However, we've already seen the tremendous gains from the trade going the other way. If the roles were reversed ($100/AF for cities, $1,000/AF for agriculture), then you would expect that the rights would be migrating in this direction. Relative values of these magnitudes in these uses are not within our experience, but you can see that IF water became much more valued in agricultural production than in the cities, you would expect the market to work in reallocating in the opposite direction of that we see today. The condition would be that water would have to be more valued in irrigation than municipal use.

To this point, my arguments seem to favor the continued transfer of water from agriculture to the cities. One valid argument does stand as to why we might not want to see large scale water transfers. That is the "drying" of local economies. As mentioned previously, employment of water in a given use generates indirect, but real, benefits to others in the local economy. Large-scale transfers tend to draw from fairly concentrated areas, as costs of the transaction for the buyer are generally less when concentrated. When a high proportion of the water is transferred out of an agriculturally dependent community, the ramifications can be significant. Unfortunately, neither the buyer nor the seller faces this cost, so it is generally not fully considered when their decision is made of whether or not the transaction should take place. In some cases, direct benefits to the buyer and seller can be more than offset by the cost imposed on the local community, resulting in outcomes that are not socially desirable.

Unfortunately, the public debate squares off between fairly polar views. One side espouses the virtues of the market system and the sanctity of private property rights, claiming "The market works, let it be!" The other side points out the injustices for those outside of the market transaction and vilifies the prior appropriation doctrine claiming "The market's broke, scrap it for a system that is more just!" The truth probably lies somewhere in between.

On another front is a viewpoint that there are answers to the problem beyond water transfer. Alternatives frequently cited include developing new supplies, curtailing demand, and (my favorite) conservation. Most of you here today realize the difficulties in obtaining new supplies of water. Even if it were easier to obtain these supplies, would it make sense to do so if the water could be purchased for less than the cost of developing the new supplies? Generally not, and if cheaper supplies

did exist, they'd likely be developed for other uses already (which they have).

Conservation and curtailment of demand are generally cited hand-in-hand. Many suggest that we just need to educate these city folks so they don't use so much water. Whether it be through conservation (whatever that is) or simply curtailing demand, this comes at some cost. If the cost of education and the reduction of benefits are less than the value of water in other uses, this makes a lot of sense. However, if we impose great costs to perpetuate the use of water where it is of low value, one must begin to question this practice. This is really an empirical question.

Conservation by agriculture is also cited as a source for water to meet our expanding municipal demand. As an economist I hesitate to speak as a hydrologist, but this is an issue that I continually find that most people do not understand, so pardon me while I climb up on my soapbox.

Frequently people will comment on the low rates of application efficiency that we see in old, unimproved gravity irrigation systems throughout the South Platte basin… .Unfortunately, what they don't realize is that the "wasted" water from the low-efficiency systems returns to the stream-aquifer system and is available to be used by other appropriators downstream.

Frequently people will comment on the low rates of application efficiency that we see in old, unimproved gravity irrigation systems throughout the South Platte basin. It seems to many of them that all we'd have to do is improve efficiency through the installation of sprinkler systems or some other means and we would have more than enough water to meet all of our expanding needs.
Unfortunately, what they don't realize is that "wasted" water from the low-efficiency systems returns to the stream-aquifer system and is available to be used by other appropriators downstream. Improving application efficiency would leave more water instream, at the time and point of diversion, but would result in no more water further downstream. If this water that was "saved" through more efficient application was allowed to be used elsewhere, there would be less water available downstream and other water appropriators would be wrongly injured. In terms of providing additional water for other uses, improving application efficiency will not yield additional water for diversion in a conjunctive stream-aquifer setting.

[Detailed discussion of a numerical ag water conservation example omitted.]

I see that Reagan Waskom is itching a bit because I'm standing up here torpedoing improved irrigation technologies. Let me be very clear—from the standpoint of the total amount of water flowing downstream, improved application efficiencies will not have the desired impact. However, there are many other benefits that come from these improvements, particularly in the realm of water quality. Less water moving through the soil profile means less constituent leaching to an underlying aquifer. Widespread changes in application efficiency can also change the timing of when flows occur down stream. For some demands, such as endangered species, this becomes an important consideration.

I'll hop off my soapbox now and return more directly to the topic that I was asked to address. In my opening comments, I promised that I'd prod your thinking. At this point, I hope you'll agree with me that the third-party impacts in local economies are by far the greatest concern with large-scale water transfers. I have a few water policy options that I'd like you to think about in that context. Undoubtedly for each of these there will be someone in the audience who will find it objectionable, and with good reason. The reason that I pose these is that I think they focus on the real problems that we face in water transfers. Rather than clouding the issue in a convoluted mess, I'd just as soon we get it right out in the open where we all can see what's happening so we can fairly weigh the relative strengths and weaknesses of the alternatives.

The options can be thought of as falling under "share the pain" or "share the gain." Under "share the pain," I am suggesting that we consider limiting water transfers in some manner. The problem that we seek to avoid is the abandonment of agriculture in a region. By limiting the proportion of water permanently transferred from an area one can assure that the agricultural industry will persist. This could be accomplished limiting the number of rights sold or allowing only temporary transfer but limiting the frequency of those transfers. The upside to this class of options is that it could maintain a viable agricultural base while allowing some water to be transferred. Those that currently own the water rights would have less opportunity than they currently have to sell their rights. The major difficulty in this option is determining the optimal amount of water to be allowed for transfer.

Realizing that there is a large amount of surplus to be divided among the buyers and sellers in these transfers, the "share the gain" option allows the water to be transferred. Some mechanism could be used to redistribute some of the "windfall" gain to those in the region who were adversely affected by the transfer. The benefit is that the water moves to its highest valued use and all affected parties benefit from the transfer. The problems with this approach include setting the proper rate of

revenue sharing and identifying the third parties and their relative injury for compensation.

I would like to leave you with a parting thought. It applies to areas far beyond water allocation issues, but seems particularly appropriate as I wrap up this little stroll through topics in water resource policy. I wish that I could take credit for this notion, but I can't. Some time ago, a local editorial columnist in the Fort Collins newspaper made a poignant observation regarding how our national politics and our society in general seems to have evolved from one of dialog to one of debate. The distinction between the two terms focuses on the objective. Through dialog we seek to better understand an issue so that we may make a decision that provides a fair outcome. It implies give and take. In debate, each side presents their case and tries to discredit the opposing view. The objective simply is to win.

In my experience, it seems that we spend far too much time "debating" issues in water resource problems and too little time in "dialog" of trying to understand all sides of the issue. Today I've talked about a lot of implications on both sided of the water transfer issue. Of all the sides that are taken in water issues, it appears that everyone could gain a great deal from a little more dialog with those representing the opposing view. As each of you return to your daily lives after this forum, I challenge you to do your part to infuse a little more dialog and a little less debate into the issues that you encounter.

WATER SUPPLY

During October, the first month of the 2001 water year, stream flows dropped to their winter base flows. The Rio Grande and San Juan/Dolores basins, and various other individual areas throughout the state, continue to suffer from below normal stream flows. Irrigation reservoirs in the South Platte, Rio Grande, and San Juan/Dolores basins contain below normal amounts, while municipal reservoirs in the South Platte basin and almost all reservoirs in the Arkansas basin asre above normal amounts. While precipitation, including early winter snow, has fallen in many areas, including the Rio Grande and San Juan-Dolores basins where it is especially needed, it is too early to predict how the coming winter's snowpack will develop.

The surface Water Supply Index (SWSI) developed by this office and the USDA Natural Resources Conservation Service is used as an indicator of mountain-based water supply conditions in the major river basins of the state. It is based on stream flow, reservoir storage, and precipitation for the summer period (May through October). During the summer period, stream flow is the primary component in all basins except the South Platte basin, where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven major basins for November 1, 2000, and reflect conditions during the month of October.

Basin	11/1/00 SWSI Value	Change from the Previous Month	Change from the Previous Year
South Platte	1.4	-1.1	-2.1
Arkansas	0.4	+0.3	-1.7
Rio Grande	-1.0	+1.4	-3.0
Gunnison	-1.7	+0.3	-3.2
Colorado	-0.3	-1.1	-2.9
Yampa/White	-1.0	-1.8	-1.0
San Juan/Dolores	-0.6	+1.0	-1.4

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

2000 WATER YEAR DRIEST IN 23 YEARS

by Nolan Doesken, Assistant State Climatologist
Department of Atmospheric Science, Colorado State University

Colorado statewide precipitation for the 2000 water year (October 1, 1999 - September 30, 2000) ended up at 87 percent of average (average for the 1961-1990 period). This is based on data provided from more than 200 National Weather Service cooperative weather stations representing all counties of Colorado. This is the driest year in Colorado since 1977 when less than 80 percent of average fell. 1989 was a close second with just under 90 percent of average water-year precipitation. Overall, precipitation has been above average in all but 6 years since the 1977 drought. This period since 1977 has been the wettest in recorded history since the 25-year wet spell from 1905-1929. Last year (1999 water year) was one of the wettest individual years with 134 percent of the long-term average. For comparison, Colorado's driest years of the 20th century such as 1934, 1939, 1954 and 1956 each received less than 70 percent of average statewide with some individual stations reporting less than 50 percent.

STUDENT WATER SYMPOSIUM LOOKS AT CHALLENGES RELATED TO WATER IN THE NEW CENTURY

by Margaret Matter, Symposium Chairman

The fourth annual Colorado State University Student Water Symposium was held November 8-10, 2000. The encompassing theme of the event highlighted challenges of the new century, and their relation to historical developments. This year's Water Symposium featured over 40 water-related presentations, including both poster and oral presentations, given by students representing about 10 different departments at CSU. Presentations included topics in:

Phytoremediation
Technological advances
- GIS applications
- decision support systems
- artificial neural networks
- application of infrared spectoscopy in pollutant detection
- laser turbidimetry

Water and global warming
Underwater video mapping of fish habitat
Water salvaging
Sediment transport
Fluvial geomorphology
Non-point source pollution
Water quality monitoring
Terrestrial restoration techniques
Recovery of native and endangered fish species and
Sociological impacts of natural resource development.

Sara Rathburn, Graduate Student in Earth Resources, Freeman Smith, Professor of Earth Resources, and Bill Riebsame, Keynote Speaker

In addition to a full program of student presentations, the Water Symposium hosted eleven guest speakers in two individual keynote addresses and two panel discussions.

On Wednesday evening, November 8th, Dr. William Riebsame, professor of geography at the University of Colorado in Boulder and editor of Atlas of the New West: Portrait of a Changing Region, provided the opening keynote address, **People, Land and Water in the New West: A Look to the Future**.

Mr. Josh Korman , a systems ecologist and modeler, provided the second keynote speech for Dr. Carl Walters at noon on Thursday, and it was titled, **Challenges in Adaptive Management of Riparian Ecosystems**.

Left: Josh Korman.

Right clockwise: Stan Schumm, Tim Randall, LeRoy Poff., David Wegner and Ed Redente.

Mr. Korman's presentation was followed on Thursday by the panel discussion, **DAM REMOVAL: TOWARD AN ECOLOGICAL, ENGINEERING, AND SOCIETAL BALANCE**, and the panel members and their topics were:

Mr. David Wegner — **Dams and the Environment: Our Changing Perspective of Rivers and Ecosystems**
Dr. Stan Schumm — **Rehabilitating Downstream Channels for River Restoration**
Dr. Ed Redente — **Considerations and Approaches in Restoring Former Reservoir Sites**
Mr. Tim Randle — **Elwha River Restoration and Sediment Management, and**
Dr. LeRoy Poff — **Potential for Riverine Ecosystem Restoration Following Dam Removal.**

From left: Larry Shiao, Western Area Power Administration, Loveland; Ripley Heintz, Director of High Plains Ecological Center, Boulder; Marie Livinston, University of Northern Colorado; and Betsy Rieke, Area Manager, Lahonton Area Office, USBR, Carson City, Nevada

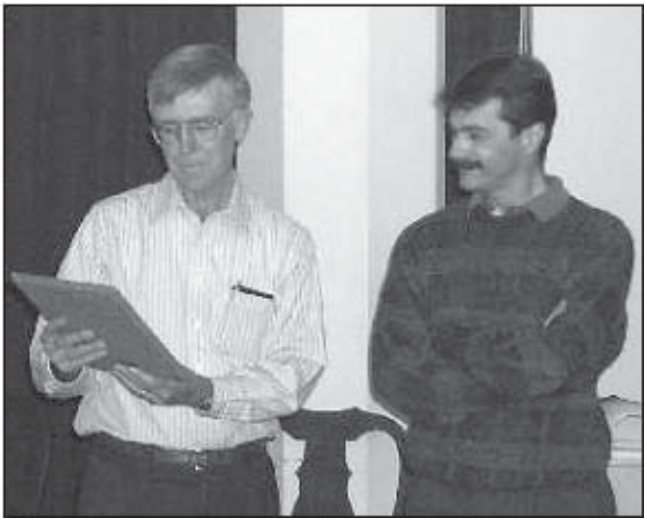
INFLUENCE OF WATER POLICY EVOLUTION ON CHALLENGES FACED AND SOLUTION OPTIONS IN WATER RESOURCES was the final panel discussion, held on Friday, November 10th, and the panel members and their discussion topics were:

Betsy Rieke — **Native American Water Use: Years of Neglect and Current Conflicts,**
Ripley Heintz — **Water Resources and the Modern Suburbitat: A Pattern for Conservation and Sustainable Development,**
Marie Livingston — **Water Policy and Markets: the Likelihood of Solving Future Problems with Current Institutions**, and
Larry Shiao — **Cumulative Effects of Dam Reoperations On Hydropower Production**.

The Water Symposium also was honored to receive special manuscript contributions for the proceedings by Dr. Robert Young, Dr. Gilbert White, Governor Richard Lamm, and Dr. Henry Caulfield. The symposium closed with the Awards Ceremony and Reception held Friday evening, November 10th, for student presenters, faculty, sponsors, and committee members.

JORGE RAMIREZ RECEIVES WATER CENTER AWARD

Dr. Robert Ward, CWRRI Director, presented the Water Center Award to Dr. Jorge Ramirez of Colorado State's Civil Engineering Department. The award recognizes CSU "water" faculty who have made significant contributions to interdisciplinary water education, research and outreach activities in Colorado. In addition to his teaching and advising responsibilities, Jorge took on the job of organizing the annual AGU-Hydrology Days at CSU upon the retirement of Dr. Hubert Morel-Seytoux last year. He also took the initiative to submit a National Science Foundation proposal for Research for Undergraduates, and when approved and funded by the NSF, was the program manager. Jorge organized and administered an interdisciplinary seminar series in water resources science and engineering. Jorge serves as principal investigator for another NSF preproposal titled, "WATER: The Water, Atmosphere, and Terrestrial-Ecosystems Education and Research Program at Colorado State University. This program would involve many units at CSU and provide students with a unique interdisciplinary graduate education and research training program emphasizing an integrated approach to water resources science and engineering. Jorge's letter of nomination included the observation that he ". . . deserves recognition both for outstanding scholarship and for extraordinary interdisciplinary leadership in professional activities related to water."



Robert Ward (left) reads plaque given to Jorge Ramirez (right) for "significant contributions to interdisciplinary water education, research and outreach activities."

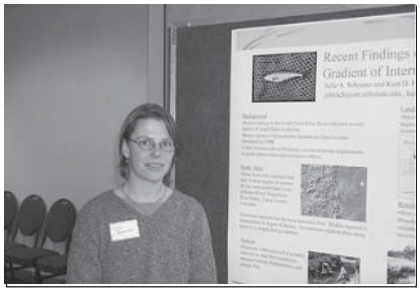
Co-chairpersons for the 2000 Student Water Symposium were Margaret Matter, Department of Civil Engineering, and J.B. Bryant, Department of Earth Resources. Financial support for this year's Water Symposium came from a record sixteen departments at CSU that include water-related issues in their programs, the CSU Water Center, ASCSU, and the Water Resources Division of the National Park Service. Awards and prize donations were provided by Teledyne Waterpik in Fort Collins and the U.S. Bureau of Reclamation, Water Resources Services Group, Technical Service Center in Lakewood

From left: J.B. Bryant and Margaret Matter, co-chairs of the 2000 Student Water Symposium, toast Annie Epperson, who will chair the 2001 symposium

Left: Laurel Saito, Bob Lange and Ty Mull enjoy social event at the Student Water Symposium.

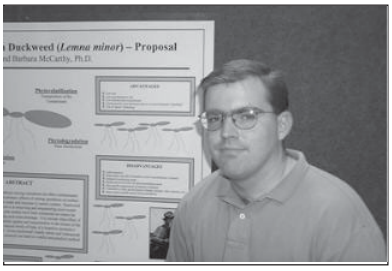
Right: Erich Stroheim, Graduate Student in Sociology, chats with Don Klein, Professor of Microbiology.

Below: Julie Scheurer, Fishery & Wildlife Biology, with her poster titled Recent Findings on Habitat Use by State-threatened Brassy Minnow . . .

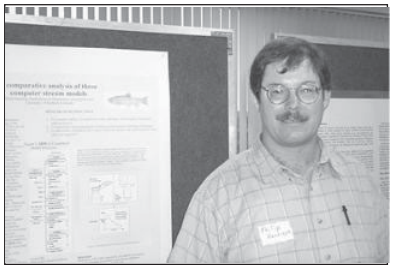


Above: Jennifer Lee, Civil Engr., with her poster titled Reclaimed Water and Greywater: Answer to a Sustainable Supply?

Below: Anthony Johnson, Earth Resources, with his poster titled Effect of pH on Metal Sequestration in Duckweed



Below: Philip Harrison, Earth Sciences, with his poster titled Trout Stream Habitat Models



Above: Gigi Richard, Civil Engr., with poster titled Historic Geomorphic Analysis – Cochiti

Below: Scott Cooney, Fishery & Wildlife Biology, With his poster titled How Water Can Eliminate

CWRRI
Colorado Water Resources Research Institute
CSM WATER NEWS

Call for Papers

MODFLOW 2001 and OTHER MODELING ODYSSEYS
An International Ground Water Modeling Conference and Workshops
Colorado School of Mines
September 11-14, 2001

The IGWMC, in cooperation with the Office of Special Programs and Continuing Education of the Colorado School of Mines, is organizing a three-day conference on MODFLOW and other models important to the ground-water community. The purpose of this conference is to bring together the users and developers of MODFLOW, related modeling programs and alternative modeling programs to present the latest innovations in model applications, discuss the capabilities and limitations of MODFLOW, and to explore the needs and directions for future developments. The conference will feature a series of keynote speeches on a wide range of topics. The conference provides a forum for demonstration of the latest MODFLOW related software products. Attendees can participate in workshops offered in conjunction with the conference.

Since the initial release by the U. S. Geological Survey in the early 1980s, MODFLOW, the modular three-dimensional finite-difference ground-water flow model, has come as close to being an international standard as any other code in the brief history of ground-water modeling. The popularity and wide acceptance of MODFLOW has spurred the development of a large number of MODFLOW compatible programs for contaminant transport modeling, parameter estimation, uncertainty analysis, management optimization, graphical interfaces and visualization packages. Today, MODFLOW, along with MODFLOW compatible models, is used for a majority of industrial applications, and as such, it plays a key role in shaping the future directions of ground-water modeling. The conference MODFLOW'98 was held at the International Ground Water Modeling Center (IGWMC) in 1998. Now the USGS has released MODLFOW-2000, and it is time again for MODFLOW users and developers to gather and exchange ideas and information. While MODFLOW is featured in this conference, the modeling "journeys" of other codes and tools will also be explored.

Topics—The conference will include keynote speakers, contributed oral presentations and poster sessions (papers will be published in a proceedings volume), exhibitors, workshops, and software demonstrations. The conference will address issues of model development, applications, code testing/performance, and graphics related to MODFLOW. Topics include:

MODFLOW-2000, latest developConnections to MODFLOW for simulating processes not included in MODFLOW
MODFLOW limitations and directions for future development
Typical problems encountered in modeling and their solutions
New innovations in data collection for modeling purposes
Model calibration and parameter estimation
Constraining ground-water models using hydrogeologic information
Uncertainty analysis and risk assessment
Sochastic approaches and applications
Modeling of surface-water/ground-water interaction
Modeling in fractured environments
New approaches and innovations in contaminant transport modeling
Coupling flow and reactive transport modeling

Location—The Conference will be held on the Colorado School of Mines Campus in Golden, Colorado, U.S.A. September 11-14, 2001. There are many hotels in the nearby Golden and Denver areas in which reservations can be made. Golden, Colorado is located at the foot of Lookout Mountain, 13 miles west of downtown Denver, on the majestic Front Range of the Colorado Rockies.

Call for Papers—Those interested in presenting a paper or poster should submit an approximately 200-word abstract via http://www.mines.edu/igwmc/conferences/mf2001/abstract no later than January 15, 2001. Abstracts must include sufficient detail to permit a thorough review by the Technical Committee. If the abstract is accepted for an oral or poster presentation, the author is required to submit a paper for publication in the proceedings by May 15, 2001. IGWMC will sponsor travel and registration for the student submitting the abstract judged to be the best. Format information for papers will be sent with the abstract acceptance notice.

Registration—The Conference registration fee is $595 (US), which includes the conference proceedings, evening receptions, lunches, and breaks. A reduced fee will apply for students registered for a degree. Address questions about the conference to IGWMC at 303/273-3103, fax 303/384-2037, e-mail: igwmc@mines.edu. For registration, contact: Colorado School of Mines, Office of Special Programs and Continuing Education at 303/273-3321, fax 303/273-3314, e-mail: space@mines.edu. Opportunities exist for exhibit/information booths as well as for corporate support of conference events. Such participation will be publicly acknowledged. Please direct inquiries to IGWMC.

RESEARCH AWARDS

A summary of research awards and projects is given below for those who would like to contact investigators. Direct inquiries to investigators c/o indicated department and university. The list includes new projects and supplements to existing awards. The new projects are highlighted in bold type.

COLORADO STATE UNIVERSITY
FORT COLLINS, CO 80523

Title	PI	Dept	Sponsor
Park County Biological Assessment	**Spackman, Susan**	**FWB**	**CDOW**
Assessing Surface Water Sensitivity to Atmospheric	**Baron, Jill**	**Natural**	**USDA**
Wetland/Seep/Spring/Biological Inventories in Several Colorado Counties	**Culver, Denise**	**FWB**	**BLM**
Joint Research Studies on Earth-Atmospheric Problems	Stephens, Graeme	Atmos. Sci.	NASA
Comparative Trout Production & Distribution Costs of Colorado Division of Wildlife & Fish Hatcheries	**Loomis, John**	**DARE**	**CDOW**
Technical Assistance to the State for Wetland Conservation and Protection	**Culver, Denise**	**FWB**	**CDOW**
Dynamical Studies in Hurricane Intensity Change	Montgomery, Michael	Atmos. Sci.	DOD
Investigations of Spacebased Doppler Lidar Propagation Through Simulated Cloud/Storm Systems	**Cotton, William**	**Atmos. Sci.**	**UCAR-NCAR**
Inventorying & Monitoring Natural Resources Status & Trends	Loftis, Jim	Civil Engr.	NPS
Land Development Over Time & Space: Economic & Hydrologic/Geomorphic Drivers of Ecological Structure	**Poff, N. Leroy**	**Biology**	**Maryland Univ.**
Fort Bend & Beaver/Badger Watershed Plans	**Smith, Freeman**	**Earth Res.**	**USDA-NRCS**
Investigation of Boundary Conditions and Numerical Methods for Littoral Flows	**Browning, Gerald**	**CIRA**	**DOD**
Interdisciplinary Approaches to Identification & Mitigation of NPS Water Quality Impacts	Stednick, John	Earth Res.	Univ. of Wyo.
Numerical Simulation & Analysis of Mesoscale Convective Systems & Severe Storms	Cotton, William	Atmos. Sci.	NSF
BedloadChange Transport in Gravel-bed Rivers & Channel	**Abt, Steven**	**Civil Engr.**	**USDA-USFS-RMRS**

FEDERAL SPONSORS: BLM-Bureau of Land Management, COE-Corps of Engineers, DOA-Department of the Army, DOE-Department of Energy, DON-Department of the Navy, DOT-Department of Transportation, EPA-Environmental Protection Agency, HHS-PHS-Public Health Service, NASA-National Aeronautics & Space Administration, NBS-National Biological Survey, NOAA-National Oceanic & Atmospheric Admin., NPS-National Park Service, NRCS-Natural Resources Conservation Service, NSF-National Science Foundation, , USBR-US Bureau of Reclamation, USDA/ARS-Department of Agriculture, Agricultural Research Service, USDA/NRS-Department of Agriculture, Natural Resources Service, USFS-US Forest Service, USDA-USFS-RMRS-Rocky Mountain Research Station, USFWS-US Fish & Wildlife Service.

STATE/LOCAL SPONSORS: CDA-Colorado Department of Agriculture, CDNR-Colorado Department of Natural Resources, CDPHE-Colorado Department of Public Health and the Environment, CDOW-Colorado Division of Wildlife, NCWCD-Northern Colorado Water Conservancy District.

UNIVERSITY DEPARTMENTS, INSTITUTES AND CENTERS: Colorado State: BSPM-Bioagricultural Sciences & Pest Management, CBE-Chemical & Bioresource Engr., CIRA-Cooperative Inst. for Research in the Atmosphere, DARE-Dept. of Agric. & Resource Economics, FWB-Fishery & Wildlife Biology, HLA-Horticulture & Landscape Architecture, NREL-Natural Resource Ecology Lab, NRRT-Nat. Resources Recreation & Tourism, RES-Rangeland Ecosystem Science. University of Colorado: ACAR-Aero-Colorado Center for Astrodynamic Research, AOS-Atmospheric & Oceanic Sciences, CADSWES-Center for Advanced Decision Support for Water and Environmental Systems, CEAE-Civil, Environmental, and Architectural Engineering, CIRES-Cooperative Institute for Research in Environmental Sciences, EPOB-Environmental, Population & Organismic Biology, IAAR-Institute for Arctic & Alpine Research, IBS-Institute of Behavioral Science, ITP-Interdisciplinary Telecommunication Program, LASP-Lab. For Atmos. And Space Physics, PAOS-Program in Atmospheric and Oceanic Sciences.

UNIVERSITY OF COLORADO
BOULDER, COLORADO 80309

Title	PI	Dept	Sponsor
International Research Workshop on Integrating GIS and Environmental Modeling: Problems, Prospects, and Research Needs	**Parks, Bradley**	**CIRES**	**USDA**
Center for Drinking Water Optimization	Summers, R. Scott	CEAE	EPA
Improving the Simulation of Sea Ice Lead Conditions and Turbulent Fluxes Using RGPS Products and Merged RADARSAT, AVHRR, AND MODIS Data	**Maslanik, James**	**CIRES**	**NASA**
Validation Studies and Sensitivity Analysis for Retrievals of Snow Albedo and Snow-Covered Area from EOS AM-1 Instruments	Nolin, Anne	CIRES	NASA
Global Land Ice Measurements from Space	Scharfen, Gregory	CIRES	NASA
Snow and Ice Distributed Active Archive Center	Barry, Roger	CIRES	NASA
Satellite Gravity and Large-Scale Hydrology	**Wahr, John**	**CIRES**	**NASA**
The Mobilization and Transport of Particles and Particle-Associated Contaminants in the Unsaturated Zone	**Ryan, Joseph**	**CEAE**	**NSF**
Spatial Analysis and Calibration of Glacier-Climate	**Manley, William**	**IAAR**	**NSF**
Reconstruction of Drought and Streamflow Over the Coterminous United States from Tree Rings, with Extensions into Mexico and Canada	**Woodhouse, Connie**	**IAAR**	**NSF**
Temperature for the Last Four Glacial Cycles in Sediments	**Lehman, Scott**	**IAAR**	**NSF**
Landscapes and Seascapes: Linkages Between Marine and Terrestrial Environments and Human Populations in the North Atlantic	**Ogilvie, Astrid**	**IAAR**	**NSF**
Observations and Modeling of Flow and Fracture Processes Leading to Iceberg Calving	Pfeffer, Tad	IAAR	NSF
Static and Dynamic Safety Investigation of Concrete Dams: A Fracture Mechanics Approach	**Saduma, Victor**	**CEAE**	**Tokyo Elec. Co.**
Cooperative Agreement for Decision Support for Watershed and River Systems Management	Zagona, Edith	CADSWES	USBR
Lagrangian Modeling of Plume Dispersal in the Urban Boundary Layer	**Weil, Jeffrey**	**CIRES**	**EPA**
Linking LANDSAT TM Data and Evapotranspiration in	**Asner, Gregory**	**Geological Sci.**	**NASA**
Land-Atmosphere Interactions in Beringia Over the Last 21	**Lynch, Amanda**	**CIRES**	**NSF**
Scaling and Allometry in River Networks: Coupling Rainfall, Topography and Vegetation with Hydrological Extremes	**Gupta, V.K.**	**CIRES**	**NSF**
Patagonian Lake Drilling Project	Markgraf, Vera	IAAR	NSF
Issue and Cost Associated with Treatment Process Integration for Arsenic Removal	**Hernandez, Mark**	**CEAE**	**Malcolm Pirnie**
The Influence of Aerosol-Cloud Interactions on Climate	Pinto, James	CIRES	Univ. of Alaska
Study of Antarctic Permafrost and Periglacial Geology	Mellon, Michael	LASP	Univ. of Washington

WATER NEWS DIGEST

CLOUD SEEDING

Purgatory reaps rewards of cloud seeding

Durango Mountain Resort is happy with the cloud-seeding program Larry Hjermstad runs for the ski area. Hjermstad, who lives in Durango, has been in the cloud-seeding business since 1965 and in the Four Corners since 1971. Vail has been a customer for 23 years. Hjermstad has a permit for his cloud-seeding programs through the Colorado Water Conservation Board. Purgatory ski resort participated in the program in the late 1970s through 1985. Snowfall at that time was 120 percent to 160 percent of normal. The program's cost – $42,000 – is split between the ski resort and the Southwestern Water Conservation District, which hopes increased precipitation will result in more water for irrigators. The program will run through Jan. 31. Success of the cloud seeding will be determined at the end of the season by comparing snowfall at the ski area to surrounding weather stations which are not in the targeted areas. The Telluride ski area is a partner with the water district in a separate cloud-seeding program for the San Miguel drainage. Last year precipitation at Telluride was 25 percent greater than nearby Lizard Head and Red Mountain passes.

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Durango Herald, 11/14/00

DAM SAFETY/FLOODS

CWCB OKs $405,000 Riverside loan for diversion structure

The Colorado Water Conservation Board has executed a $405,000 loan contract with the Riverside Reservoir and Land Co. (RRLC) for a $450,000 project to rehabilitate a diversion structure damaged during flooding. The project will ensure Riverside's ability to continue to divert water from the South Platte River and provide water to 100 shareholders in the Fort Morgan area. The work is expected to take four months and to be completed by next February. The CWCB makes loans to help finance the engineering and construction costs of raw water projects. Small grants are available for project planning. Projects determined to be feasible by the CWCB are recommended to the General Assembly for funding through an annual bill. Borrowers need to apply by early fall to have funds available by the following June. For information, contact John Van Sciver at 303-866-3441 ext. 306, the CWCB website at http://cwcb.state.co.us.

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Fort Morgan Times, 11/15/00

Creek's flood options studied

A 300-page draft study details the potential for flooding on South Boulder Creek in and near Boulder, listing 1,300 homes in the creek's 100-year flood plain. Four years ago, a study of the flood plain along South Boulder Creek projected a more widespread path of destruction in the event of a 100-year flood than previously thought possible, also covering a quarter of the 308-acre South Campus property owned by CU. The new study weighed options that the city, CU, the county and the flood control district had been discussing for months. Over the next 90 days, officials will review the draft and public comment will be taken. The governments are expected to pick a course of action — options range from doing nothing to spending millions to alleviate the flooding danger. The study favors a $136 million plan to spread floodwater in retention ponds, replace culverts under Colo. 93 and U.S. 36 with wider ones, build a 4-foot berm near Colo. 93 and enlarge Boulder's storm-water runoff system in parts of east Boulder. The study suggests that the most controversial flood-control option— a dam built along Colo. 93 as tall as 70 feet — be pulled from consideration until other options are ruled out, despite calling it effective and the cheapest alternative.

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Boulder Daily Camera, 11/2/00

DRINKING WATER

Ark Valley pipeline discussion resurfaces

Water officials from several Lower Arkansas Valley communities are discussing building a drinking water pipeline from Lake Pueblo to as far east as Holly. Plans for the pipeline, known as the Arkansas Valley Conduit, have been around since the 1950s as part of the Fryingpan-Arkansas Project, but the conduit never was built because eastern communities said they couldn't afford the cost. Talk of reviving the pipeline started after Aurora began its proposed purchase of water rights in the Rocky Ford Ditch last year. County officials realized that the sale will shrink the amount of agriculture in the area and decided that the county will need some other industry to replace it, but economic development is hard for towns like Rocky Ford and La Junta, where the water tastes bad and corrodes pipes. The conduit, if built as planned 50 years ago, would begin at Pueblo Dam and run east along U.S. 50 as far as is needed. The pipeline's original plans called for extending parts of the pipeline north to Crowley County and Eads. A feasibility study of the pipeline will cost as much as $200,000. Otero County and the South-eastern Colorado Water Conservancy District each will donate $20,000 for the study, and planners will ask the Colorado Water Conservation Board for $100,000. The rest of the money would be collected from communities that want to support the study, and later, the pipeline. Depending on how it is built, the pipeline could cost an estimated $150 million to $230 million. The group plans to ask the federal government to help pay for it. The pipeline would help small cities and towns meet the increasingly stringent federal drinking-water regulations,

according to Joe Kelley, La Junta's water and waste-water director. Water in the conduit could be treated for drinking either at a large plant near the reservoir or at smaller local plants. Either way, treating Lake Pueblo water will be simpler and cost less than treating the local ground water and river water that the communities use now. La Junta plans to built a newer treatment plant using reverse-osmosis technology, but Kelley said the city's new plant could treat a lot more of the better-quality Pueblo water if the conduit is built, and possibly pipe it to surrounding communities. While the Arkansas Valley Conduit never was built, a similar pipeline was built to Colorado Springs. The Fountain Valley pipeline also starts at the Pueblo Dam, and El Paso County cities plan to build a second pipeline to provide more water. The St. Charles Mesa Water Association was one of the entities that wanted the original valley conduit. The association gets its water from several sources, but needs to store it or pump more from the river to maintain a supply during the winter. Many of the region's cities and towns would have to back the pipeline for it to become a reality. Kelley said La Junta and Otero County themselves couldn't afford to build the project, but if all of the region's entities participated, it might become feasible.

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Pueblo Chieftain, 11/15/00

ENDANGERED SPECIES

Brook trout removal helps cutthroats

Removal of brook trout from a stream that is historic habitat for pure Rio Grande cutthroat trout may help to upgrade the stream's native fish population's status from declining to stable, followed by periodic control. Colorado Division of Wildlife biologists captured an estimated 2,300 brookies in the middle section of West Indian Creek on the Forbes Trincheria Ranch over a three-day period in early August. Last year, 3,000 non-native trout species were removed from the lower section of the river, said a CDOW biologist. Brookies are a threat to cutthroat trout because they proliferate quickly and compete with cutthroats for space and food. They hatch fry two to three months ahead of cutthroats, which spawn in the spring. Research has shown that brook trout fry may then prey upon the smaller cutthroat fry. The Forbes Trincheria Ranch has been a refuge for the cutthroats and has cooperated with DOW conservation efforts for 25 years. Twenty-six streams on private land have Rio Grande cutthroat populations, which are important to the subspecies' protection because they control over-harvest and land-use impacts.

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Rifle Citizen Telegram, 10/25/00

GOCO grants DOW species funds

On Oct. 12, the Great Outdoors Colorado Board approved the Division of Wildlife's FYO2 funding proposal for $10.4 million on a 9-6 vote during a meeting in Pueblo. The DOW will match the proposal with $6.3 million in wildlife cash funds. The proposal highlights a few key points:

- To date more than 65 percent of the GOCO wildlife quadrant funds have been spent on habitat protection. To balance priorities, the DOW needed to place greater emphasis on species protection.
- The DOW needed to move away from fee acquisitions placing greater emphasis on easements, leases and landowner incentives.
- Due to increased conflicts and concerns about declining and listed species, the agency needed to urgently increase support for species programs.

The funds will be spent in one fiscal year beginning July 1, 2001 and ending June 30, 2002. The FYO2 Funding Proposal allocates 41 percent of the GOCO funds toward species protection, 38 percent to habitat protection, 13 percent to wildlife education and six percent to watchable wildlife.

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Rifle Citizen Telegram, 11/8/00

RECREATION

John Martin recreation talks continue

Talks are continuing between Colorado State Parks and the Army Corps of Engineers about the state acquiring a recreational lease for a substantial portion of John Martin Reservoir. Steven Hall, public information specialist for Colorado State Parks, said, the parks division will be able to access certain types of government funding that will allow the upgrading of reservoir facilities. Hall said tentative plans include adding 175 campsites, a visitors' center and historic trails. Hall said the corps still will manage reservoir operations.

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Pueblo Chieftain, 11/8/00

Tubers, fishers agree on compromise plan

As of next summer, commercial tubing on the Yampa may move downriver for at least a year. In a compromise between commercial tubing companies, the Yampa Valley Fly Fishers and the City of Steamboat Springs, Director of Parks and Recreation Chris Wilson has proposed pushing the tubing companies down below Fifth Street for a one-year test. The plan also includes a river management study and river improvements that the city will fund.. The study would assess the impacts on the river from its various uses, including everything from tubing to commercial development.

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Steamboat Pilot, 11/14/00

WATER QUALITY

Sierra Club, Tri-State continue negotiations

The company that owns the Craig power plant and the Sierra Club have agreed to continue negotiations instead of going to court to argue if the power plant broke environmental laws in the '90s. In 1997, U.S. Geological Survey scientists concluded in a study that acid deposition was killing aquatic life in the wilderness area, located seven miles northeast of Steamboat Springs. The study said the power plants in Hayden and Craig were contributors to the problem. However, the two sides agreed to continue negotiating to try to reach a settlement.

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Steamboat Pilot, 11/1600

American Soda up and running

American Soda L.L.P. has started turning out its products. Injection wells at Piceance Creek Basin pump pressurized hot water deep into oil shale fissures, dissolving the sodium mineral nacholite. The liquid is recovered and processed into soda ash brine at the Piceance Creek Basin plant. The hot soda ash brine is then pumped 44-miles by pipeline to the Parachute plant, where it is processed, dried and stored for shipment. Soda ash, the primary product, is used in producing of a wide variety of materials, mainly detergents and glass. The Rocky Mountain Chapter of the Sierra Club and a competing mining company, IMC Chemical, recently requested that the Interior Department immediately consider an appeal of American Soda's federal environmental approvals. They said the BLM did not properly follow its own procedures and alleged that the hot-water injection mining could pollute water tables overlying the sodium mineral.

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Glenwood Post, 11/700

Gas leases yanked near Piedra River

The U.S. Forest Service has withdrawn plans to let energy companies tap methane gas from coal beds in the San Juan National Forest after conservation groups said the agency studies of the area were outdated. USFS had planned to lease 2,000 acres to extract methane for gas-fired electrical power plants. Although the Forest Service owns the land in the San Juan National Forest, the Bureau of Land Management administers the leases on oil, gas and other minerals. Coal-bed methane is released from fractures inside coal beds by pumping off overlying water. The Wilderness Society, the Land and Water Fund of the Rockies, the Citizens Oil and Gas Support Center and the San Juan Citizens Alliance said that can lower water tables, affect drinking wells, contaminate aquifers and kill large swaths of vegetation. The leases would have allowed for oil, gas and mineral development to occur without complete and current environmental impacts studies, they say. Both the San Juan Citizen's Alliance and the Southern Ute Grassroots Organization sued the BLM in February to stop it from approving oil and gas drilling in the area until the agency completes an environmental impact statement on the effects of the proposed drilling. The suit is pending.

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Durango Herald, 11/13/00

Environmental group tries to block renewing Umetco license

A local environmental group is contesting state renewal of an operating license for Umetco Minerals Corp.'s hazardous waste disposal site near Uravan. The Western Colorado Congress has asked the state Department of Public Health and Environment not to renew the Grand Junction company's operating license due to alleged health and environmental risks. WCC is also concerned that a potential merger under negotiation between Umetco parent company Union Carbide and Dow Chemical may bring waste to Uravan from chemical plants across the country. Umetco has agreed not to accept out-of-state commercial waste, but it can dispose of company waste there, Hamrick said. In 1997, it disposed of materials from a Union Carbide cleanup project in Ohio. The main WCC concerns include ammonia loading in the nearby San Miguel River and stability of Umetco's existing waste piles, said Jake Jacobi, program manager for the state radiation services division. State water samples from the river do not show a problem with ammonia loading, Jacobi said.

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Grand Junction Daily Sentinel, 11/15/00

Summitville cleanup in dispute

The Alamosa Riverkeepers, a coalition of Alamosa River valley farmers and ranchers, disputes a recent state report declaring the Alamosa River clean enough for fish. On Oct. 25 state officials placed 150 rainbow trout in several cages in Terrace Reservoir and the Alamosa River, which was sterilized by Summitville Mine runoff in 1993. All the fish survived and were released on Oct. 29. Critics contend that the study is not comprehensive and does not address all possible environmental conditions in the reservoir.

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Denver Post, 11/5/00

WATERSHED/HABITAT RESTORATION

Box Creek Watershed restoration set for spring

The Bureau of Land Management and the U.S. Forest Service are studying landscape conditions in the Box Creek Watershed in the Twin Lakes area, and expect to propose restoration projects for federal land in the watershed this spring. The project area is on the west side of the Arkansas River between Twin Lakes and Half Moon Creek, and takes in 10,466 acres. The Box Creek Restoration Project is a cooperative

effort of the BLM, Forest Service, Colorado Division of Wildlife and the U.S. Fish and Wildlife Service, and is designed to improve forest health, wildlife habitat and the sustainability of fire-adapted ecosystems and their natural resources. A video is being produced that will give an overview of the project. It can be viewed at BLM or forest service offices, or a copy can be requested. Information about the restoration project also will be mailed to the public. Call Cecilia McNicoll, project leader, at (719) 486-0749 or write to her at the Leadville Ranger District, 2015 N. Poplar, Leadville 80461.

Pueblo Chieftain, 11/8/00

Habitat restoration project narrows and deepens river

The Rio Blanco River just south of Pagosa Springs has been diverted for almost 30 years to meet irrigation and drinking needs. Silt and gravel that used to wash out under a fast current now slowly fill the riverbed depths, pushing the water up and widening the flow. The Rio Blanco flows into the San Juan River and eventually the Colorado River. Congress approved 17 miles of tunnels in the 1950s to divert 70 percent of the Rio Blanco's headwaters to the Rio Grande River basin for irrigation, and ultimately, for drinking water in Albuquerque. The Rio Blanco was diverted before federal environmental laws were enacted. The tunnels were completed in 1970, pipes were opened in 1971, and 93,677 acre feet of water each year no longer went downstream. The Bureau of Reclamation, which built the project, began dumping sediment downstream from the diversion point, effectively clogging the river. As the river spread out, the shallow water was heated by the sun. Fish began to die. In one test during 1973, fish transplanted to the river died within 24 hours. Lawsuits in the 1970s stopped USBR from dumping the silt and gravel downstream, but it took a grant from EPA in 1996 for things to begin to improve. The goal of the San Juan Water Conservancy District, various federal agencies, a homeowners association, the states of Colorado and New Mexico, and the public was to see if narrowing the river would create faster current to wash out the sludge and sediment that had built up over the decades. The $96,000 EPA grant – with an additional $114,000 of matching funds from local groups – proved it would. The banks of the 1.1-mile demonstration project were squeezed to deepen the channels and bring back the deeper pools. Instead of inches deep, the pools are 6-7 feet in depth. Ultimately, the goal is to restore a 8-mile section of the Rio Blanco between Colorado Highway 84 and the confluence with the San Juan River by 2005. Almost $500,000 in federal, state and matching funds is being sought for the next three miles of the river. Preliminary studies show water temperatures in the demonstration section have dropped by almost 3 degrees. Fish counts, crustacean and amphibious counts, and water quality sampling are ongoing.

Durango Herald, 11/16/00

San Miguel River getting facelift

The San Miguel River is undergoing a major makeover that will result in a river resembling much what it was like more than a century ago. Environmentalists, Telluride town planners, parks and recreation board members and representatives from open-space groups turned their attention to fixing the river in 1997. The group won a $532,000 grant that had been placed in a cleanup fund by Idarado Mining Co., the Town of Telluride put in another $132,000, and Great Outdoors Colorado added a $100,300 grant for parks and trails along the river.

Denver Post, 10/31/00

WATER SUPPLY/DEVELOPMENT

Broomfield plans to buy water

Broomfield city leaders are expected to approve an $8 million bond to buy 665 units of Colorado-Big Thompson (CB-T) water, expected to cover Broomfield's anticipated growth for the next three to four years. Broomfield will buy a total of 1,000 units from the C-BT water supply, which also serves Boulder, Fort Collins, Greeley and several other municipalities. The current purchase price is $12,000 to $15,000 per unit, and in some cases has risen to $17,000 per unit. (Each unit sold for about $2,000 when Broomfield began purchasing the water in 1995. Water is expected to increase to up to $50,000 per unit in 20 years.) City leaders predict all C-BT units will be sold within the next 7 to 8 years, and they want to guarantee water to Broomfield, whose population is expected to increase from 39,000 to 67,000, by 2020. Since 1995, Broomfield has purchased 7,776 units from the C-BT watershed.

Broomfield News, 9/26/00

Court rejects Arapahoe water storage project

The state Supreme Court ruled against Arapahoe County commissioners Nov. 20, agreeing with a water court that denied the application for conditional water rights for the Union Park Reservoir project. The water court concluded that there was insufficient water available for the project. Arapahoe commissioner Marie Mackenzie said the decision means that "We have anywhere from one-half million acre-feet of water leaving the state to move to California, Nevada and other downstream states." But Colorado Attorney General Ken Salazar said he was happy with the decision, which should put an end to the 14-year fight that has cost more than $6 million.

Denver Post, 11/21/00

MEETINGS

COLORADO WATER CONSERVATION BOARD BASIN MEETINGS

The Colorado Water Conservation Board (CWCB) has held a series of open house meetings in locations throughout the state covering each of Colorado's eight major river basins. Two meetings scheduled for the Rio Grande Basin will both be held on Thursday, December 21; the Monte Vista meeting will be held at the Monte Vista Elks Club at 1:30 p.m., and the La Jara meeting will be held at Centauri High School at 7:00 p.m. The Greater Denver meeting will be held January 16, 6:00 p.m., at the Renaissance Hotel in Denver, with a reception at 5:00 p.m. Further information on the meetings will be posted on the CWCB web site as it becomes available. The Basin Fact Sheets are also available on the web site at **http://cwcb.state.co.u**s.

WATERSHED ASSEMBLY SETS SECOND MEETING DATE

A second meeting of the Watershed Assembly is scheduled for February 2, 2001, at the Keystone Center. It will be an all-day meeting where attendees will select those services that are most essential to support the efforts of Colorado's watershed community and discuss a proposal for ways to make these services available. The list of services as presently identified is:

- Organize and present annual watershed conference for Colorado's watershed community.
- Prepare and disseminate periodic newsletter for Colorado's watershed community.
- Organize and present training workshops as needed.
- Compile and maintain information about funding sources for watershed efforts.
- Provide fundraising assistance to local watershed initiatives.
- Provide facilitation assistance to local watershed initiatives.
- Provide watershed planning assistance to local watershed initiatives.
- Compile and maintain information about relevant federal programs.
- Compile and maintain information about relevant state programs.
- Make available information about legislation/laws relevant to watershed efforts.
- Provide strategic planning assistance to local watershed initiatives.
- Provide assistance with membership outreach for local watershed initiatives.
- Provide assistance in working with media for local watershed initiatives.
- Provide water quality monitoring assistance to local watershed initiatives.
- Help coordinate federal and state agency efforts related to watersheds
- Compile and maintain information about sources of technical assistance for watershed efforts.

For information contact: Lawrence J. MacDonnell at ljmpc@quest.net.

COLORADO WATER CONGRESS 43RD ANNUAL CONVENTION

JANUARY 25-26, 2001

For details and registration forms see the Colorado Water Congress website at http://www.cowatercongress.org or contact the Colorado Water Congress at 303/837-0812

CALLS FOR PAPERS

Joint AWRA/UCOWR Summer Specialty Conference
"Decision Support Systems for Water Resources Management"
ANNOUNCEMENT & CALL FOR PAPERS
June 27-30, 2001 -- Snowbird, Utah

This specialty conference will provide a stimulating environment for water resources specialists to focus on available and future technologies for providing information for identifying and solving the problems of water supply and management. The conference will emphasize the generation, display, interpretation, and use of information to facilitate the complex multidisciplinary approaches required for decision making in the development and implementation of planning and management procedures for a broad spectrum of water resources issues and problems. Discussions will also address the needs of water resources education to meet the challenge presented by new information technologies and advance the state-of-the-art through research and development. Oral presentations, posters, and discussion sessions will focus on diverse applications involving the provision of decision-relevant information and analysis of interdisciplinary tradeoffs in the solution of problems in such areas as:

Integrated Watershed and River Basin Management
Water Conservation and Reuse
Water Supply
Water Quality
Flood Warning/Flood Control
Hydropower Generation
Urban Storm Water Management
Recreation
Environmental and Endangered Species Issues

The proposed paper or poster presentations should address the development, application, and utility of specific decision support systems including issues of why some systems have failed in topics such as those in the following list in relation to one (or more) of the areas described above.

Integrating public policy in decision making
Educating the public on water resources management
Use of real-time weather data in predicting and regulating water demand and use
Systems for controlling water use in residential and rural areas
The application of supervisory control and data acquisition systems (SCADA) to water supply and management
Application of system analysis techniques to water system planning and management
Water quality management
TMDL development and application
GIS applications to integrate and display information on social, institutional, economic, ecological, and engineering tradeoffs
Use of the WWW to provide information to decision makers and diverse stake holders
Water conservation technology
Information technologies for the real-time control of water systems for flood control, watershed management, TMDL definition, water supply, and so forth
Integrating social, institutional, legal, economic, biological, and engineering issues into decision making for water resources management
Water rights issues, including transfers, protection, conflict resolution
Land use planning issues, such as establishing and maintaining green-belts
Issues relating to private property versus public domain?Compliance with various laws, such as the Safe Drinking Water, the Endangered Species, and the Clean Water Acts

The conference will be held at the Snowbird Conference Center and Resort. The Resort is just 40 minutes from the Salt Lake City International Airport. For complete conference information and instructions for abstract submittal see the following web site:

http://www.awra.org/meetings/Utah2001/

CALENDAR

Jan. 10-12	FOUR STATES IRRIGATION COUNCIL ANNUAL CONVENTION, 2001: A WATER ODYSSEY, Fort Collins, CO. Contact: Brian Werner at 970/622-2229 or Mary Rhodes at 970/622-2261. FAX 970/663-6907.
Jan. 15-18	CONFERENCE ON TAILINGS AND MINE WASTE '01, Fort Collins, CO. Contact: Linda Hinshaw, Dept. of Civil Engr., CSU at Phone 970/491-6081, FAX 970/491-3584, email lhinshaw@engr.colostate.edu.
Jan. 23-24	WATER RIGHTS, COLORADO RIVER ALLOCATION, AND THE ROLE OF HOOVER DAM, Las Vegas, NV. Contact: Univ. of Nevada Las Vegas, Division of Continuing Education, 4505 Maryland Pkwy., Box 451019, Las Vegas, NV 89154-1019, Phone 702/895-3394, FAX 702/895-4195.
Jan. 25-26	COLORADO WATER CONGRESS 43RD ANNUAL CONVENTION, Holiday Inn - Northglenn, CO. Contact: Colorado Water Congress, Phone 303/837-0812, FAX 303/837-1607, Website http://www.cowatercongress.org.
Jan. 25-26	SYMPOSIUM ON SPATIAL METHODS FOR SOLUTION OF ENVIRONMENTAL AND HYDROLOGIC PROBLEMS, Reno, NV. Contact A. Ivan Johnson, 7474 Upham Court, Arvada, CO 80003-2758, Phone 303/425-5610, Fax 303/425-5655.
Mar. 22-23	ARKANSAS RIVER BASIN WATER FORUM, Lamar, CO. Contact: Tom Pointon at 719/456-0413.
Apr. 30-May 2	AWRA ANNUAL SPRING SPECIALTY CONFERENCE, WATER QUALITY, MONITORING, & MODELING, San Antonio, TX. Contact: Michael J. Kowalski, AWRA Director of Operations, AWRA, 4 W. Federal St., PO Box 1626, Middleburg, VA 20118-1626, Phone 540/687-8390, FAX 540/687-8395, e-mail: mike@awra.org.
June 27-30	JOINT AWRA/UCOWR SUMMER SPECIALTY CONFERENCE, DECISION SUPPORT SYSTEMS FOR WATER RESOURCES MANAGEMENT. Snowbird, UT. Contact: Direct inquiries as follows: Technical Program Chairperson Donald F. Hayes, Civil and Environmental Engr., Univ. of Utah, 122 So. Central Campus Dr., Ste 104, Salt Lake City, UT 84112, Phone 801/581-7110, FAX 801/585-5477, e-mail: hayes@civil.utah.edu. Conference General Co-Chairperson Mac McKee, Utah Water Research Lab, Utah State Univ., UMC8200, Logan, UT 84322-8200, Phone 435/797-3188, FAX 435/797-3663, e-mail: mmckee@cc.usu.edu.
Aug. 19-24	LINKING STORMWATER BMP DESIGNS AND PERFORMANCE TO RECEIVING WATER IMPACTS MITIGATION, Snowmass, CO. Contact: Ben Urbonas at 303/455-6277; 303/455-7880, Email burbonas@udfcd.org.

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