

# COLORADO WATER

Newsletter of the Water Center of Colorado State University

June/July 2007 Volume 24, Issue 3

IN THE WEST,  
WHEN YOU TOUCH  
WATER, YOU TOUCH  
EVERYTHING.

— WALTER N. ASPIN

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Water Education**

**Feature Article:  
My Tenure as  
State Engineer,  
Hal Simpson**

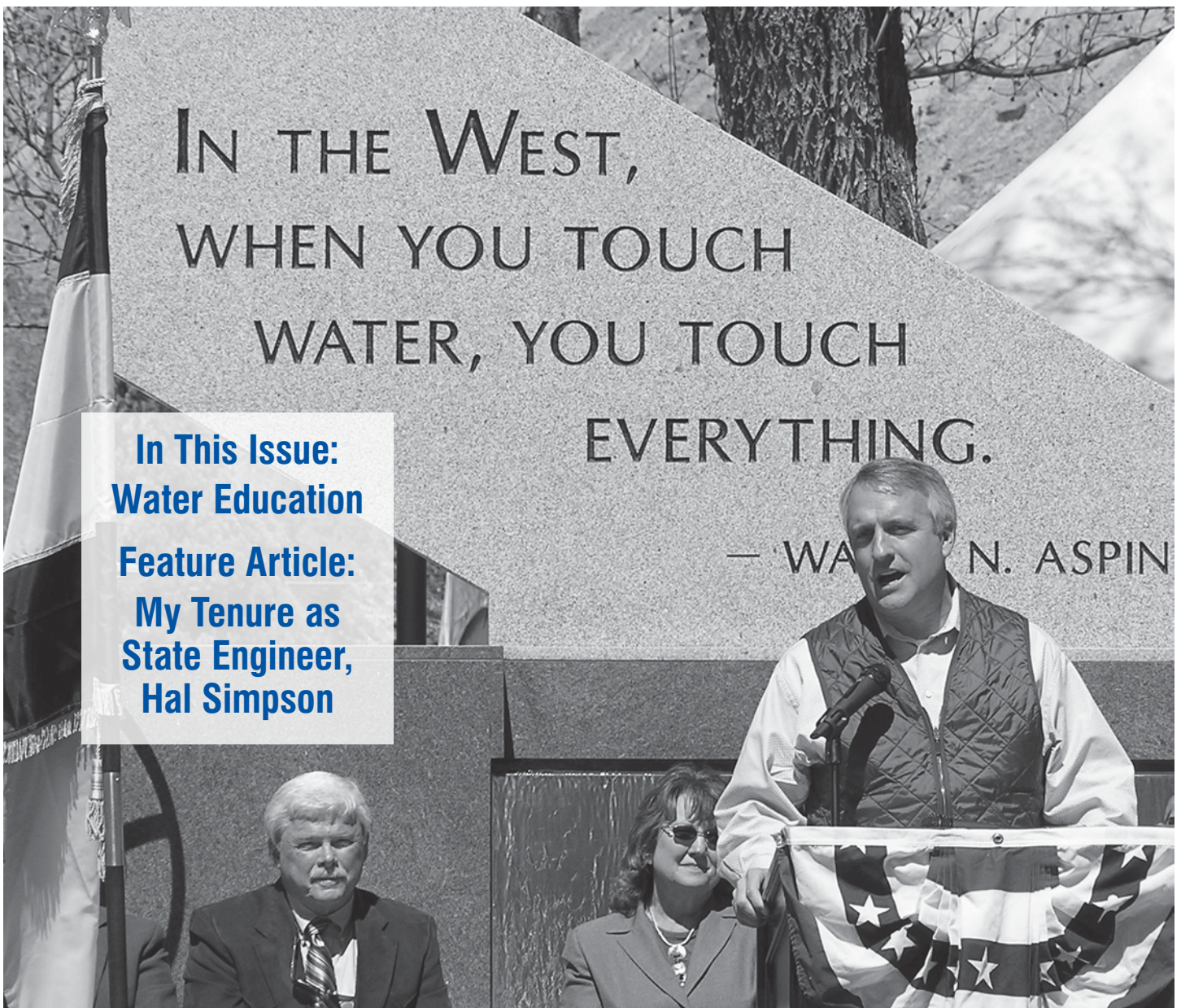


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*Office Manager: Nancy Grice*

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

Published by the Colorado Water Resources Research Institute • Colorado State University, Fort Collins, CO 80523-1033  
 Phone: (970) 491-6308 • FAX: (970) 491-1636 • E-mail: [cwrri@colostate.edu](mailto:cwrri@colostate.edu)

WEB SITES

Colorado Water Resources Research Institute: <http://cwrri.colostate.edu>

CSU Water Center: <http://watercenter.colostate.edu>

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EDITORIAL

Meeting Colorado’s Growing Water Education Needs

by Reagan Waskom, Director, Colorado Water Resources Research Institute

You may recall a recent popular book entitled, *All I Really Need to Know I Learned in Kindergarten*. Someone aptly summed up my reaction to that title by stating, “Only people who die very young learn all they really need to know in kindergarten.” Like all complex subjects, most of us would agree that water education is a lifelong challenge. For those fortunate enough to be in the water business, this lifelong learning is a rich and rewarding process. But what about the vast majority of Coloradans who are not water junkies, who are distracted by the infinite barrage of information thrown at them daily? What do they want and need to know about water and how are we doing in getting this information to them?

Colorado is currently growing at a rate of about a million people every decade, and we already have about four million Coloradans, who have a sparse knowledge of water at best. Most of us who work in this field would agree that the typical high school graduate knows very little about where our water comes from, and most university degree programs do little to rectify this deficiency. Perhaps our school curriculums are providing an appropriate level of water education given the complexity of the information and the relatively few opportunities for most of the public to make critical decisions

about water resources. However, it could be argued that this same public determines our water future as they vote on a variety of ballot issues. As individual citizens, they make daily choices regarding water conservation and water quality protection that ripple far beyond their individual actions. It may be that in the past it was appropriate for a small group of water professionals to make the majority of the public’s decisions about water resources. Clearly, our world has changed, and a more educated citizenry is needed to help our leaders make wise choices about the way we develop and protect Colorado.

The water education community in Colorado faces considerable challenges and increasingly limited financial resources. It is probably safe to say water education is a critical mission, but it is completely decentralized. Recently, CWRRI updated the list of water education providers, and we count over one hundred entities providing water information and education in Colorado. Water conservancy districts; nongovernmental organizations; federal, state, and local agencies; universities; utilities; foundations; and other organizations are targeting specific local and statewide audiences. Coordination of all these efforts is just not possible, as the various providers often have very different agen-

das, messages, and clientele. Perhaps coordination is not what is most needed anyway. One way to look at this is that we have a web of educators and education efforts, and this decentralization provides strength and redundancy that Colorado can build on, particularly if we have some idea what others are doing. The Interbasin Compact Committee (IBCC) recently launched a public education committee as part of the requirements



*Clearly, our world has changed, and a more educated citizenry is needed to help our leaders make wise choices about the way we develop and protect Colorado.*

of HB1177 that is working with the Colorado Foundation for Water Education, the Colorado Water Congress, the Colorado Watershed Assembly, Colorado State University, and others in an attempt to enhance communications among water education providers. In this edition of *Colorado Water* you can read what just a few of these educational providers are currently working on. Please contact me or the authors if you want more information or have feedback about any of these programs.

Nelson Mandela once said, “Education is the most powerful weapon which you can use to change the world.”

I think that Mr. Mandela is correct and that we need to think hard about how we will meet the water information and education needs of this growing state. The ability to think critically, to have some knowledge of the past, and a sense of where we are headed is essential if we as individuals and a collective society are going to craft a vision that guides us to a better future. In Colorado, at least a basic understanding of water and a sense of our shared water future are requisite in our leaders and citizens if we are to sustain the things that make this state a great place to work and live.

## FEATURE ARTICLE

## My Tenure as State Engineer: A Retrospective and a Look Ahead

by Hal D. Simpson, Colorado State Engineer

**M**y tenure as State Engineer began in 1992 with the dismissal of both the State Engineer and Director of Colorado Water Conservation Board (CWCB) on February 14, 1992, for failure to work together. This is referred to as the Valentine's Day Massacre. I was appointed as Acting State Engineer by Governor Romer on that date and was formally appointed as State Engineer on August 7, 1992, along with Daries "Chuck" Lile as the Director of the Colorado Water Conservation Board. Chuck, the former Division Engineer from Division 7, and I were able to work together in many cooperative ways until his untimely death from brain cancer on February 8, 1999.

My career began with the State Engineer's Office (SEO) in December 1972 after three years of duty as an officer with the Army Corps of Engineers and nine months at Wright-McLaughlin Engineers.

### Changes over the Past 34 Years

Over the past 34+ years, I have seen many changes at the State Engineer's Office, and I have highlighted some of them below.

#### *Role of Women in the Workplace*

In 1972, women were primarily in clerical positions with one woman professional engineer (P.E.) and one woman water commissioner. The cultural attitude toward and treatment of women were not acceptable by today's standards. Currently, the SEO has women in leadership, management, professional, and technical positions. We now have the first woman Division Engineer (Erin Light in Division 6), ten other women P.E.s (three as engineers-in-training), many women water commissioners, and many in technical positions. I am proud of the increased diversity and the cultural attitude toward women in the SEO.

#### *Use of Technology to Work More Efficiently*

In 1972, we had access to one computer at CSU for the Colorado Water Data Bank. The clerical staff were excited to have new IBM Selectric typewriters, and copies were made with carbon paper and not copy machines. Over the years, we were able to expand the use of computers and software so that now all staff have PCs and Windows XP operating programs. We have over 20 servers to support our many data, modeling, and internet applications including Hydrobase, which supports our River Decision Support Systems (RDSSs) and related models and programs.

In 1988, the Sutron Corporation with the assistance of SEO staff piloted the Satellite-Linked Water Resources Monitoring System (SMS) in the Arkansas River basin. In 1985, the Water Resources and Power Development Authority granted to the SEO a complete SMS system with a computer, programs, and 150 Data Collection Platforms (DCPs) at key stream gaging sta-

tions throughout the state. The SMS has grown to over 420 DCPs at all major stream gages and canals. The current server and software are much more robust now, and the public can access this data at no cost on our newly improved Web site. Colorado is the only state to have such a large statewide program owned and operated by its talented SEO staff. The support of the CWCB to provide funds for annual replacement of DCPs and maintenance is greatly appreciated.

In 1992, Colorado sought and obtained the support of the Legislature to begin development of the first RDSS by a state. The Colorado DSS was completed in 1998. The Rio Grande DSS was completed in 2004, and the South Platte DSS is to be completed in 2008. Colorado is the only state to have such powerful tools to allow it to better manage its water resources. Again, the ongoing cooperation of the SEO and CWCB personnel has made these RDSSs successful.

#### *Dam Safety Program*

In 1972, the SEO Dam Safety Program consisted of 3 P.E.s and now it consists of 14 P.E.s with 11 engineers located in field offices throughout the state inspecting dams on a regular schedule. Under the direction of Jack Byers, Deputy State Engineer, the program has added many modern and cutting-edge technology changes to the program such as risk-based assessment of a dam and the Extreme Precipitation Analysis Tool, which uses Doppler radar from historical storms to maximize the precipitation in a basin above a dam. These were incorporated in the comprehensive 2006 amendments to the dam safety rules that did not have one objecting party.

#### *Hydrographic Program*

The SEO began its hydrographic program in the 1880s shortly after the office was established in 1881. It was recognized that in order to properly distribute water in over-appropriated basins, such as the Poudre River basin, that streamflow data was needed and gaging stations were installed at critical locations. The program has grown to over 420 stations all equipped with



Colorado State Engineer Hal Simpson



DGPs supported by a staff of 21 engineers and technicians. Colorado is the only state to have its own complete program and does not have to rely on the USGS. The program is nationally recognized as the best state program thanks to Chief Hydrographer, Dr. Thomas Ley. Colorado also operates its program at about one-half the per station cost of the USGS. Other states are looking at the Colorado model to reduce costs of obtaining stream flow information.

### **Water Rights Administration**

The SEO has always had the strongest on-the-river water rights administration program in the West due to the demand of water users for accurate and timely distribution of water. The program has expanded since the 1990s with the addition of 14 staff in the Arkansas River basin to support ground water measurement and use rules implemented to assure compliance with the Arkansas River Compact. We added staff in the Rio Grande River basin (7 FTEs) and South Platte River basin (4 FTEs) in 2006. Since 1992, we have been fortunate to increase the staff for primarily water rights administration and compact compliance from 220 to 265. We are fortunate that the Legislature has recognized this need. With the addition of the SMS, PCs, and programs developed by our excellent IT staff, we are able with much more accuracy and timeliness to distribute water to water users on our many over-appropriated river basins. No other state has this capability, and it is a credit to our water users who have supported our efforts to expand and improve the program.

### **Safe Construction of Water Wells**

In 1972, we had three well inspectors whose positions were eliminated by budget cuts in 1983. In 2003, with the support of the Board of Examiners and Jack Byers (Deputy State Engineer), we were able to obtain approval by the Legislature of a cash-funded program using a new \$40 fee per well permit. These fees fund an inspection program with five well inspectors located throughout the state resulting in over 2,800 inspections per year. This same legislation modernized Article 91 of Title 37 to allow the Board of Examiners to fine contractors up to \$1,000 per violation and to implement a continuing education program for contractors requiring 8 credits per year. All of these changes have resulted in much better quality well construction and pump installation.

## **Major Issues and Challenges**

I have been involved in many major issues and challenges during my tenure as State Engineer, and I have highlighted some of the more important ones below.

### **Leadership Development**

I began an emphasis on leadership development in 1993. I strongly believe that an organization must practice and develop leadership if it is to be truly successful. We have relied on many sources of information, and our favorite is Dr. Stephen Covey, who states, "Leadership can be learned but not taught." Through utilization of principles in Covey's books, including the expectations of honesty, personal integrity, and trustworthiness, we have

improved leadership and trust within the organization. I believe in shared leadership and established a Leadership Team consisting of program managers in Denver and the seven Division Engineers. Shared leadership is not a new concept. King Solomon, one of the wisest men ever, wrote in Proverbs 15:22, "Plans fail for lack of counsel but with many advisors they succeed." The Leadership Team discusses major issues such budget, personnel, strategic planning, legislation and policy. Decisions made through this process result in much greater buy-in by the team and by staff leading to successful implementation of the decision.

### **Conjunctive Administration of Ground Water and Surface Water Rights**

The implementation of the 1969 Water Rights Determination and Administration Act, which for the first time required the administration of tributary ground water rights with the much more senior surface water rights, was difficult to implement for my predecessors, State Engineers Kuiper and Danielson as well as myself. State Engineer Kuiper was able to promulgate ground water use rules for the South Platte River basin in 1974 but was not successful in the Arkansas River basin or the Rio Grande River basin.

In 1996, I was able to promulgate ground water use rules for the Arkansas River basin. These rules require well owners to replace out-of-priority depletions and depletions to usable state-line flow or not pump. The augmentation must be provided in accordance with plans approved annually by the State Engineer or by a Water Court-approved plan for augmentation.

In 2001, the Supreme Court decision on *Empire Lodge v. Moyers* found that the State Engineer did not have the statutory authority to annually approve substitute water supply plans (SWSPs) for replacing out-of-priority depletions as had been the situation since 1972. This resulted in a series of events to attempt to address the problem created by this decision in the South Platte River basin. The Legislature responded in HB02-1414 by giving the State Engineer authority to approve SWSPs under limited conditions (Section 37-92-308, C.R.S.). I attempted to amend the 1974 South Platte River basin ground water use rules in May 2002 to operate very nearly identical to the successfully promulgated Arkansas River basin ground water use rules. These would have allowed several organizations to continue to operate in a manner similar to the process that had been followed in the basin since 1972 without filing for a Water Court-approved plan until the organization had acquired sufficient water rights to incorporate into a plan for augmentation. These rules were protested, and a legal challenge was filed to the concept of allowing the State Engineer to annually approve a replacement plan. The Colorado Supreme Court found in March 2003 (*Bijou v. Simpson*) that the State Engineer did not have such authority and the rules were rejected. However, the Supreme Court allowed the Arkansas River basin ground water use rules to continue to operate.

The Legislature at the same time approved SB03-73, which allowed those organizations relying on the annual approval of a SWSP such as the Ground Water Appropriators of the South Platte (GASP) and the Central Colorado Water Conservancy

District (CCWCD) three years to file for a plan for augmentation with the Water Court and to obtain annual approval by the State Engineer in the interim. GASP filed a plan for 2003 but went out of business after 2003. CCWCD filed for a plan for augmentation pursuant to HB02-1414. Members of GASP either filed their own plans for augmentation, about 1,000 wells, or were unable to pump due to a lack of replacement water resulting from the drought of 2001 to 2006, the competition for water driving up the price beyond the economic capability of farmers and the loss of the long-term cooperation that had existed prior to this time. As a result, about 2,000 wells were shut down, and the owners are facing difficult times. I deeply regret that the state could not help in preventing this disaster from happening.

### ***Arkansas River Compact Litigation***

My participation began in 1985, when Kansas filed suit in the U.S. Supreme Court alleging three violations of the compact dealing with post-compact (1948) water development. I was in charge of the engineering components of the defense until 1992 and then as State Engineer testifying over 20 days on Colorado's efforts to comply with the compact and with the Special Master's findings. After 12 years and 270 days of trial before Special Master Arthur Littleworth, we have been able to allow post-compact wells to continue to operate if in accordance with the 1996 ground water use rules. The Special Master found in his fourth report in 2004 that Colorado was in compliance beginning in 1997 and that he would evaluate Colorado's compliance after the first ten-year period was completed, which is 1997 to 2006. I am pleased to state that Colorado is in a credit status after this first ten-year period. The exact amount is still under review, but it is at least 3,000 acre-feet.

Many of the undecided technical issues remaining in his fourth report had to be resolved by negotiation or arbitration because the Special Master was not going to conduct any additional trial. At my suggestion to David Pope, Chief Engineer for Kansas, we began in 2005 to negotiate without attorneys present to attempt to resolve as many of these issues as possible. After several intense sessions in Denver and Topeka, we were able to sign nine agreements in September 2005 in the historic Mission Inn in Riverside, California, and present them the same day to the Special Master at his office in Riverside. One issue went to arbitration, and Colorado won on this issue.

### ***Republican River Compact Litigation***

In 1998, Kansas filed suit in the U.S. Supreme Court alleging that Nebraska was violating the Republican River Compact by not limiting new well development and regulating post-compact wells. No allegations were made against Colorado. After Special Master Vincent McKusick found that all well pumping in the basin, if it impacted flows of the Republican River, were subject to the allocations of the compact, Nebraska countersued Colorado in 2000. This placed Colorado in a difficult position, as it was now in a major interstate lawsuit but with a two-year delay in trial preparation. Colorado Attorney General Ken Salazar and then-Governor Bill Owens agreed to attempt to mediate the litigation in the fall of 2001 using a professional mediator. After

a year of intense efforts and many meetings, the states reached agreement and the Settlement Agreement was signed in December 2002. The Colorado negotiation team consisted of Dr. Ken Knox, Chief Deputy State Engineer; Carol Angel, and Pete Ampe of the Attorney General's Office; and me. We were able to negotiate several conditions to improve our ability to comply with the compact. The most favorable was a five-year moving average for determining compact compliance rather than a single year.

### ***Working with Outstanding Staff***

The greatest reward of my tenure has been working with the staff of the SEO, who are without question the most professional and dedicated public servants working in a government agency anywhere. I truly have been amazed at their dedication and work ethic. They recognize the importance of water to the lives of all citizens and make it their goal to help citizens understand water law and water administration. The Water Commissioners have my highest respect, as they are our "water cops" who have to regulate water rights in a fair and consistent manner while at times placing themselves in difficult and contentious situations.

## **Looking Ahead for the Next State Engineer**

The next State Engineer will have to address some recent issues that have come into focus. These are intrastate issues but are also interstate compact-related.

### ***San Luis Valley Aquifer Management***

The State Engineer must continue to encourage the Rio Grande Water Conservation District to implement the provisions of SB04-222, which provides an alternative to the traditional method of augmenting for out-of-priority well depletions through the use of a water management plan approved by the State Engineer and the Water Court. The first step is to create a ground water management subdistrict and then to develop a water management plan. The plan must also address long-term sustainability of the aquifers in the valley and protect compact deliveries. Progress has been slow and difficult with one subdistrict created and a management plan ready to submit. If sufficient progress is not made in the rest of the valley, I believe rules should be promulgated in late 2007 requiring that a management plan be filed with the Water Court by the end of 2008, and if not, wells could not pump in 2009.

### ***Republican River Compact Compliance***

The issues in the Republican River basin are complex, not only dealing with the requirements of the Settlement Agreement made more difficult by the four consecutive dry years, 2003 to 2006, but also responding to the petition by the Pioneer Irrigation District to undesignate a portion of the Northern High Plains Ground Water Basin established in 1966 by the Ground Water Commission (GWC). If the GWC does undesignate some of the basin using the guidance in *Gallegos v. Colorado Ground Water Commission* (2006), the State Engineer may have to promulgate ground water use rules for wells that would become tributary, thus requiring them to augment for out-of-priority depletions or not pump. The ongoing efforts of the Republican

River Water Conservation District to provide an alternative to pumping through an additional CREP program for 30,000 acres of dry-up and other actions must be supported by the State Engineer.

#### ***Arkansas River Compact Compliance***

The State Engineer must implement the final order of the Special Master expected in the next few months. It may be necessary to adjust the presumptive depletion factors in the 1996 ground water use rules to assure that the state remains in a credit status for the next ten-year moving period.

An additional issue has surfaced in recent years resulting from the conversion of flood irrigated lands under some of the canals in the valley to center-pivot sprinkler irrigation. This could result in a violation of Article IV D of the compact, which states, "Improved or prolonged functioning of existing works shall not materially deplete the usable quantity or availability of the waters of the Arkansas River for users in Colorado or Kansas." It is evident for the water short systems that exist in the valley that increased irrigation efficiency will decrease return flows and could result in a violation of Article IV D. I believe rules will need to be promulgated that require the owners of these sprinkler systems to provide proof they are not altering return flows and, if they do, provide a plan to alter irrigation practices to maintain historical return flows. Staff have drafted these rules, and they will be available for public comment this summer.

#### ***Colorado River Basin Rules on Administration of a Compact Curtailment Request***

Depending on future hydrology including the impacts of climate change, a long-term drought could result in a curtailment request from the Upper Colorado River Compact Commission to insure a delivery to the Lower Basin of the 75 million acre-feet over a ten-year moving total, or 82.5 million acre feet if a shortage is determined. It is advisable that the State Engineer promulgate rules in advance on how post-compact water rights would be curtailed in the Colorado River basin and its tributaries in Colorado. Without these rules being in place, Colorado could be subject to litigation or an injunction from the Lower Basin states. It is important to proceed with these rules, as it will take time to get them approved due to the probability that they will be challenged and appealed to the Colorado Supreme Court, which could take several years to resolve. We have been anticipating this and have sought legal guidance from the Attorney General's Office on the legal aspects of this complex rulemaking.

#### **Conclusion**

Finally, I leave office and look forward to assisting the state in future areas as an advisor on many of these issues if I am able to do so. I leave in place a great dedicated staff and a leadership team with a vision, a mission, guiding principles, and a strategic plan ready to support the next State Engineer. Water is their passion, and they are strong leaders ready to move forward. I have been truly blessed and fortunate to serve as State Engineer for over 15 years.

## **AWRA Summer Specialty Conference**

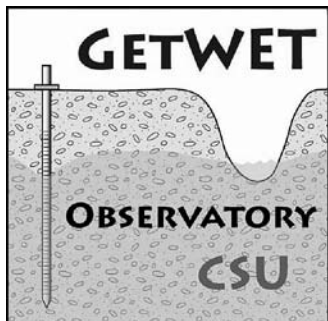
### **Emerging Contaminants of Concern in the Environment: Issues, Investigations, and Solutions**

**June 25 - 27, 2007**  
**Vail, Colorado**

FOR MORE INFORMATION, GO TO [HTTP://WWW.AWRA.ORG/MEETINGS/VAIL2007/INDEX.HTML](http://www.awra.org/meetings/vail2007/index.html)

# GetWET Observatory: A Ground Water Learning and Teaching Facility

by Sara L. Rathburn, William E. Sanford, and Dennis L. Harry, Department of Geosciences; and Andrew C. Warnock, Center for Science, Mathematics, and Technology Education; Colorado State University



Dr. Sara Rathburn

During spring 2006, a ground water well field was installed on CSU's South Campus property (Figure 1) as part of the GetWET Observatory, a Ground Water Learning and Teaching facility. The GetWET consists of six ground water monitoring wells and a surface water monitoring site on Spring Creek, a perennial creek tributary to the Cache la Poudre River. Funding for the GetWET comes from a National Science Foundation Division of Undergraduate Education grant awarded to Sara Rathburn (PI), and co-PIs Warnock, Sanford, and Harry.

Still in its first year of operation, the GetWET has already served as a launching point for fundamental changes in two curricular areas of geology at CSU, including (1) a newly revised undergraduate geology laboratory currently serving over 400 students per year and (2) field-based, interdisciplinary, and process-oriented learning opportunities in surface and ground water hydrology within five undergraduate courses for geology majors. In

addition to the undergraduate educational emphasis, outreach activities at the GetWET provide support for regional K-12 teachers via professional development workshops, ground water well access for their regular classes, TA support, and equipment loans.

Recently, many other exciting and unexpected contributions to and interest in the GetWET Observatory position it as an important outdoor natural laboratory in which to investigate surface water/ground water interactions at Colorado State University. Given the importance of water issues throughout the semi-arid west, effective learning experiences for students are imperative to strengthen their role as citizen scientists, informed voters, and emerging professionals in water resources. This article summarizes the curricular changes, outreach, community support, and future plans for the GetWET Observatory.

## Curricular Changes Within Geosciences

Research on undergraduate education indicates that

field experiences promote the goals of science education reform through inquiry-based, hands-on experimentation and self-discovery (NRC, 1997; Siebert and McIntosh, 2001; AAAS, 2004). The GetWET Observatory is well aligned with these educational goals, giving CSU students the opportunity to learn and directly participate in the process of science through access to real-time water data, experience with advanced water monitoring equipment and analytical techniques, data reduction, and the interpretation and presentation of results.

### Undergraduate Nonmajor Student Activities

During the fall and spring semesters of 2006-2007, over 400 nonmajor students enrolled in GCC121 Introductory Geology Laboratory classes visited the site and completed an analysis of surface water and ground water quantity and quality. Students measure water levels in the wells and Spring Creek; develop a water table map (Figure 2); review core descriptions; calculate gradi-

Figure 1. Aerial photograph showing the location of the GetWET Observatory, east of Centre Drive. Students (right photo) in GCC121 Introductory Geology Laboratory class monitor ground water quality and quantity, Fall 2006. Riparian vegetation along Spring Creek is in the foreground. (View to southeast.)







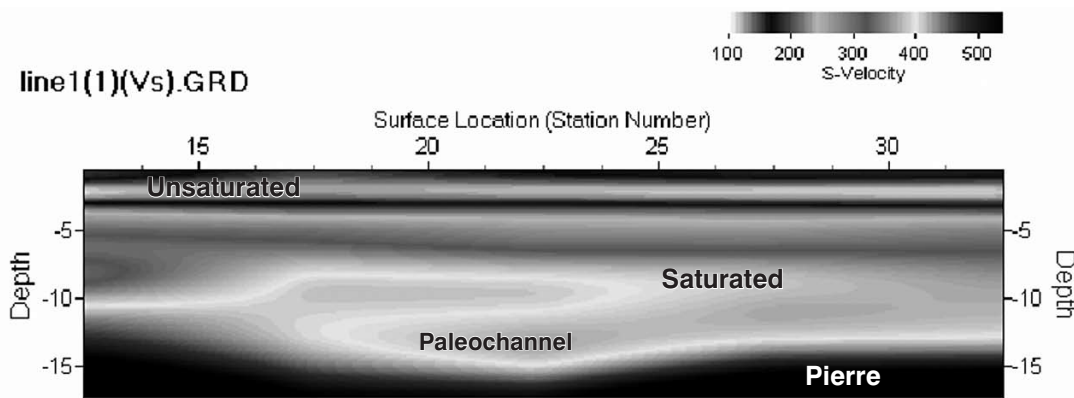


Figure 4. Shear wave velocity structure of the aquifer system at the GetWET collect by students in the G442 Applied Geophysics class. The water table is approximately 3 m deep at this location, and the saturated part of the aquifer has shear wave velocities ( $V_s$ ) between 250-380 m/s. The Pierre Shale aquitard ( $V_s > 480$  m.s.) is located between 13-17 m deep. Note the possible paleochannel incised into the Pierre Shale near the center of the image.

holistic approach to problem solving, with integration and expansion of surface and ground water topics as students move through the curriculum.

### Outreach Activities at the GetWET

From June 21-23, 2006, 18 K-12 teachers from Northern Colorado attended a teacher training workshop at CSMATE titled “Classroom and Field Strategies for Teaching Key Surface and Ground Water Concepts.” The workshop combined classroom-oriented learning with teacher-directed field exercises related to basic ground water concepts, ground water-surface water interactions, and water quality. As a result of the workshop three classes of high school science students, accompanied by their teacher (a workshop attendee), visited the GetWET during the 2006-2007 school year to collect water samples, measure water levels, and conduct water quality analyses. Teaching materials developed during the workshop are also available on the GetWET Web site

(<http://www.csmate.colostate.edu/getwet/>).

The GetWET was recently designated as an official River Watch monitoring site. River Watch is composed of volunteers who collaborate with the Colorado Watershed Network and the Colorado Division of Wildlife to monitor the surface waters of the state. Monthly surface and ground water samples collected at the GetWET are used by state regulatory agencies for water management decisions. It is noteworthy that the GetWET Observatory is the first River Watch site to monitor ground water quality.

### Community Support and Synergy

In-Situ, Inc., a local company that designs and manufactures leading ground water monitoring equipment, generously donated state-of-the-art water quality sensors, a low-flow sampling system, and a rugged field computer for accessing real-time data and downloading logged data. The donation nicely complements the equipment funded by the NSF. The unsolicited

support and donations from In-Situ are especially appreciated and will allow the geosciences department and CSMATE to maximize students’ educational potential at the GetWET Observatory.

### Future Work

A second teacher-training workshop is scheduled at the GetWET from June 13-15, 2007. Teachers will get the opportunity to use all the new ground water and surface water equipment and plan activities for their students including site visits to the GetWET. Eventually a telemetry system will be installed at the GetWET to provide real-time data access from one well and the surface water monitoring site along Spring

Creek. Data will be available from geoscience classes, River Watch sampling, and teacher workshops and eventually will be added to a database for the GetWET site. Finally, increased interest in the emerging field of hydrogeophysics will be explored with the potential of providing the GetWET as a training site for understanding the geophysical signature of known subsurface materials.

As a last step to complete the necessary field infrastructure of the GetWET, an additional \$10,000 was awarded to Sara Rathburn and Lee MacDonald of the Department of Forest, Range, and Watershed Stewardship as part of the Warner College of Natural Resources Teaching, Research, and Outreach Grants program. The grant will be used to upgrade and modernize the surface water monitoring station at the GetWET to expose students to current surface water monitoring equipment and technology that is on par with the recent purchases and donations from In-Situ, Inc. In this way, students will get experience with the most modern equipment, similar to that they will be using in water-related professions. In addition, the money will fund a wheel-chair accessible ramp and removable bridge across Spring Creek for use during field exercises.

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# USDA-CSREES Northern Plains and Mountains Regional Water Program

## Addressing Shared Water Resource Issues Across the Region

by Matt Neibauer, Reagan Waskom, and Troy Bauder, Colorado State University

In order to address shared water resource concerns across Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming, Colorado State University serves as the host institution for a collaborative program striving to coordinate the education and research activities at these states' land-grant institutions. This program is funded by the United States Department of Agriculture – Cooperative State Research, Education, and Extension Service (USDA-CSREES) and works to research and provide education concerning water issues related to agriculture, energy development, mining, recreation, and tourism within the Northern Plains and Mountains Region (NPM). More specifically, the NPM Regional Water Program utilizes regional collaboration to investigate and share current practices and management techniques to address the availability and quality of water resources needed to meet competing demands from agricultural, municipal, recreational, and ecological uses throughout the region and nationally.

The NPM Regional Water Program facilitates interstate partnerships by building upon the existing state land-grant university network to include federal, regional, state, and local organizations with similar research and educational goals related to water resources. The program create a wide variety of water resources research and education opportunities throughout the region because of the financial and human resource support provided by this network of land-grant institutions, state university water resources centers, soil and water conservation districts, private industry, numerous private landowner partners, and other water/natural resource groups. The program also fosters the development and application of environmentally sustainable water resource management and policy practices. This facilitation is

achieved by providing leadership for water resource research and education to help people, industry, and governments prevent and solve current as well as emerging water quality and quantity problems.

The NPM Water Program has developed four regional initiatives to implement regionally coordinated education, extension, and research programs addressing critical agricultural water quality issues in the region. These initiatives include Watershed Management; Water Conservation and Protection; Drinking Water – Human and Livestock Health; and Production Agriculture Water Quality. The program is actively involved in a variety of research and educational outreach activities and has achieved a number of accomplishments within the six-state region.

### Watershed Management

Currently, the regional project is developing a program designed to monitor, analyze, and interpret water resource data for natural resources management and education. The region is in the process of developing educational program materials concerning watershed and riparian zone management, coal bed methane product water issues, and best management practices for rangelands. Regional team members also hold workshops



Figure 2. Stream monitoring in Montana.

on youth water education, manure management, GIS, and precision farming. Youth water quality education programming such as watershed festivals, 4-H camp presentations, and watershed monitoring is a priority for the program, as is providing K-12 education on watershed functions, links between land use and water quality, teacher training and support, Web site development, and macro invertebrate monitoring. The development of the Stream-Side Science Curriculum for Ninth Grade Earth Systems Science Program and its use in watershed education courses has reached over 14,000 youth and 1,200 teachers learning about water quality and watershed functions.

### Production Agriculture Water Quality

Another regional initiative, Production Agriculture Water Quality, is currently developing a precision farming manual, GIS decision support systems, remote sensing for crop assessment, and a septic tank video. The regional project is also conducting

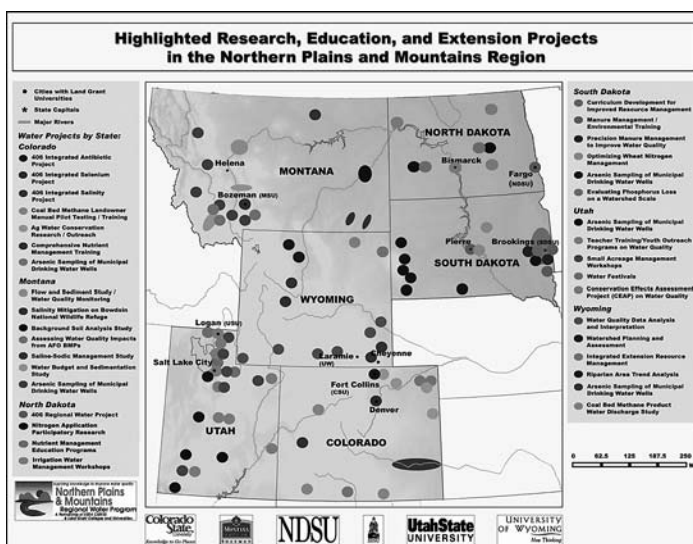


Figure 1. Highlighted regional water program impacts.



Figure 3. Regional team talking with rancher in Wyoming.

research on the fate and transport of agricultural chemicals, as well as implementing educational programs concerning pesticide and fertilizer BMPs.

Another priority of this initiative is the development and implementation of a model that provides flexible nitrogen management strategies that can be adopted without a loss of yield or quality. Furthermore, regional efforts are being made to develop mapping tools to assess aquifer sensitivity, land use and water quality, and impervious area development. The region is also conducting workshops on GPS/GIS, pesticide assessment maps, and pesticide application certification. By collaborating with the Colorado Agricultural Chemicals and Ground Water Protection Program, the regional program has assisted with the testing of wells for 120 private property owners in Colorado. Furthermore, the program has developed and implemented a Comprehensive Nutrient Management Plan (CNMP) workbook for training workshops, influencing 270,000 cattle producing 400,000 tons of manure per year, on the 240 livestock operations that have participated in these workshops.

## Drinking Water – Human and Livestock Health

Drinking water quality and its effects on humans and livestock is a universal issue throughout the region, nation, and world. This is why the NPM Regional Water Program is actively addressing drinking water quality/quantity issues and mitigation of drought impacts. A key component of this initiative is the applied field research investigating the fate and transport mechanisms of P, N, and other emerging contaminants – such as pharmaceuticals and other bioactive substances – as is the development and implementation of water quality testing, interpretation, and treatment programs to improve regional water quality.

Another issue being addressed by this initiative is the development of ways to better manage the water quality of small water bodies. Moreover, the regional program continues to conduct applied research on arsenic, as well as address tribal water quality concerns.



Figure 4. Coal bed methane water discharge in Wyoming.

## Water Conservation and Protection

Water conservation and protection is another issue of significant importance in the Northern Plains and Mountains Region and throughout the Western United States. Therefore, the regional water program is initiating education and research projects related to the urban/agriculture interface, as well as developing workshops to address irrigation water management, conservation, and protection. Ultimately, the NPM Regional Water Program is striving to address issues related to agricultural water policy and develop standards at the request of state legislatures and environmental agencies. Regional team members are also actively involved in addressing drought issues affecting rangeland, livestock management, and grazing on small acreages.

## Regional Water Issues Survey

In order to assist in the development and achievement of its regional initiatives, the NPM Water Team designed and conducted a statistically valid survey for each state in the region. The main goals of the survey were to investigate peoples' attitudes and behaviors toward the environment, water issues, the need to protect and preserve water resources, and water resources education preferences. The survey will help identify future programming needs of the regional program and the state of Colorado.

During the fall of 2004, 309 (51%) of the 600 randomly sampled surveys were completed in Colorado – each identifying the age, gender, education level, occupation, time of residence, and size of community of the Colorado respondents.

The first set of survey questions queried residents' attitudes toward environmental and water issues. The majority (>95%) of Colorado respondents thought clean drinking water, ground water and rivers were extremely important issues, with water for recreation and landscaping rating the least important (see Figure 6). The survey also indicated residents (>75%) recognized better agricultural practices, preservation of agricultural land and open space, and watershed management were important actions to protecting water resources in Colorado.



Figure 5. Resource monitoring workshop in Colorado.

When asked about the quality of their drinking water, 92% of respondents thought their drinking water was safe to drink. Interestingly, only 68% of respondents were satisfied with their drinking water, while 18% were not satisfied. In terms of awareness about which pollutants predominantly affect water quality, Colorado residents identified fertilizers, minerals, and pesticides as the most suspicious or problematic. Surprisingly, many people (38-47%) did not know bacteria, fertilizers, heavy metals, minerals, pesticides, mining waste, salinity, and pharmaceuticals could affect water quality in Colorado. When asked about which societal sector or condition was most responsible for existing water quality problems, residents identified wastes from urban areas (44%), industry (38%), drought (36%), and mining (35%) as the most responsible.

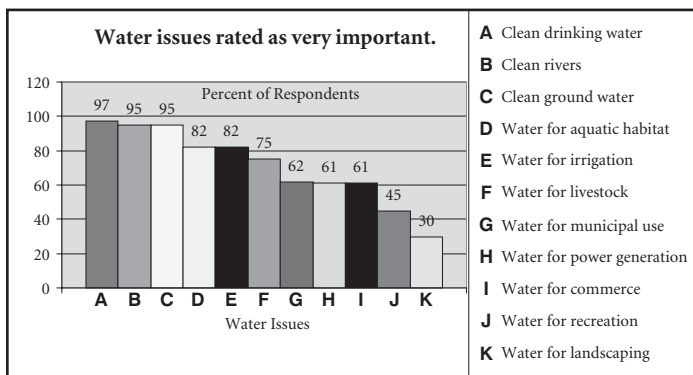


Figure 6. Water issues rated as very important in Colorado.

In considering ways to protect and preserve water resources in Colorado, many respondents stated they have changed their landscaping practices (73%), their home water use (68%), their purchases and installation of water saving devices (68%), or how they wash their vehicles (50%).

On the subject of educational opportunities, Colorado residents preferred to read fact sheets, articles, and/or visit Web sites over all other types of venues (see Figure 7). Residents also indicated they were most interested in learning about protecting drinking water (55%), watershed management (34%), water policy (33%), community actions on water issues (33%), and water needs for fish and wildlife (33%).

Several key programming needs identified by the survey indicate educational opportunities exist concerning the conditions affecting water quality and drinking water in Colorado. Furthermore, the finding that residents were more likely to engage in passive types of educational opportunities (e.g., publications, Web sites), indicates barriers to more active educational settings (e.g., workshops, trainings) need to be addressed by organizations charged with educating Colorado residents about water resources.

### Final Thoughts

The NPM Regional Water Program allows the existing land-grant university network to coordinate water quantity and quality issues on a regional scale. The program's ability to develop and implement effective research and educational activities is enhanced by its ability to form collaborative partnerships with a variety of external organizations. By continually evaluating its priorities and program effectiveness, the NPM Regional Water Program continues to provide citizens throughout the region valuable water resources research and education. For more information, please go to the Northern Plains and Mountains Regional Water Web site: [www.region8water.org](http://www.region8water.org).

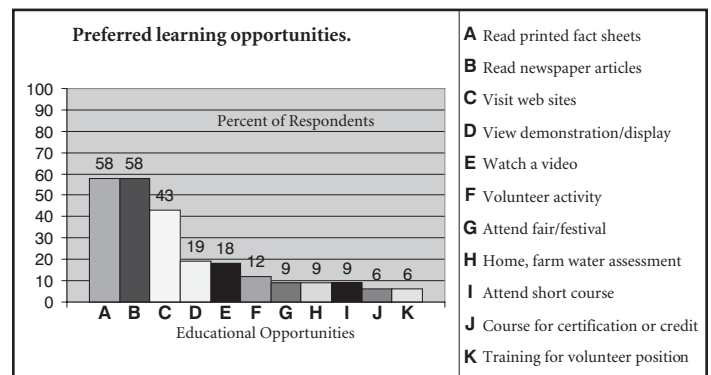


Figure 7. Preferred learning opportunities in Colorado.

# Preventing Ground Water Contamination from Agricultural Chemicals: An Educational Approach

by Troy Bauder, Rob Wawrzynski, and Reagan Waskom

Agricultural receipts from crop and livestock production in Colorado during 2005 generated roughly \$5.4 billion, or about 2 percent of Colorado's general economic output. This revenue was generated on some 30 million of the state's 66 million acres. Approximately 3 million of these acres

are irrigated and intensively farmed for row crops and forages, utilizing inputs of pesticides and commercial fertilizers to achieve high yields. Colorado's aquifers are vulnerable to impairment from these agricultural inputs depending upon hydrogeological properties, chemical properties, and recharge from

is funded by a tonnage tax on fertilizer sales and a product fee for pesticides registered in the state.

The GW Program uses a combination of education, ground water monitoring and regulatory measures to prevent ground water contamination. The focus of this article is on the educational work conducted by the GW Program. Primary components of this educational work include development and distribution of Best Management Practices (BMPs), applied research and field demonstration on BMP effectiveness, and assessing BMP adoption.

on these efforts, crop-specific BMPs, *Barley Management Practices for Colorado* and *Best Management Practices for Colorado Corn* were published to provide producers with useful, growth stage-specific crop production recommendations that also protect water quality. To address NPS pollution concerns from urban users, the GW Program has published a series of fact sheets for home and garden chemical use.

Once BMPs have been developed, providing growers useful tools to aid in their implementation is critical. Recordkeeping is an essential BMP for improved management. Thus, the GW Program publishes and biennially prints pocket-sized *Pesticide Record Books for Private Applicators* and *Irrigated Field Record Books* in cooperation with the CSU Environmental and Pesticide Education Program and the NRCS, respectively. These tools assist growers in properly recording their pesticide and water applications. The pesticide pocketbook also contains water quality and pesticide safety BMPs, sprayer calibration guidelines, and numerous equations and conversions to help private applicators correctly apply the desired rate of pesticide. The irrigation booklet provides equations for determining flow, application depth, soil moisture tables, and crop water use information. These tools have been extremely popular with pesticide applicators and



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irrigation. To mitigate this potential contamination, Colorado has chosen to use a combined effort of regulation, education, and ground water monitoring. This effort was initiated in 1990, when the Colorado Legislature passed Senate Bill 90-126, the Agricultural Chemicals and Ground Water Protection Act. The Colorado Department of Agriculture (CDA), the lead agency, Colorado State University Cooperative Extension (CSUCE), and the Colorado Department of Public Health and Environment (CDPHE) are cooperating agencies in the implementation of this ground water program (GW Program). The GW Program

## BMP Development and Distribution

The GW Program has compiled a broad set of research-based BMPs encompassing nutrient, pest, and water management. In developing these BMPs, the GW Program utilized extensive input from crop and livestock producers, the agricultural industry, the Natural Resources Conservation Service (NRCS), local Extension faculty, water districts, and others. These BMPs were originally published in a notebook form and are updated as needed and expanded to include additional guidelines. Using this notebook as a template, local BMP committees have developed BMPs for the San Luis Valley, the Front Range area of the South Platte Basin, the Western Slope, and the Lower South Platte River Basin. Building

irrigators with roughly 1,000 copies distributed per year.

Increasing development in previously rural outlying areas has created a new water quality audience – the rural small-acreage landowner. While not a major user of agricultural chemicals in terms of total product used, these new rural residents have the potential to impact water quality through their activities. Furthermore, these individuals rely on ground water for their primary drinking water source and utilize septic systems for wastewater treatment. Thus, there is a need for educational activities that inform these residents how to prevent contamination of their own drinking water supplies. In response to this need, *Best Management Practices for Private Well Protection* was revised in 2005 to a more comprehensive publication, *Protecting Your Private Well*.

The BMPs and other outreach and training publications are distributed widely through local outlets, via the Internet ([www.csuwater.info](http://www.csuwater.info)) and other methods. For example, a display booth is utilized at conferences and trade shows to provide local ground water quality monitoring results, publications, and regulatory information. Information has also been presented to the public through radio shows, mass media, press releases, and presentations at meetings throughout the state. CSUCE also offers technical assistance to water conservancy districts, ground water management districts, and other local entities interested in helping these rural residents protect water quality through BMP adoption.

## Applied Research and Demonstration

The GW Program has conducted or sponsored applied research intended to develop, test, or verify BMP effectiveness and practicality. This work is conducted with internal resources as well as external grants. Most work is conducted with collaboration from other CSU faculty as well as USDA/ARS researchers and others. Noteworthy field research projects include reducing nitrate leaching through in-season nitrate and leaf chlorophyll testing; refining nitrogen credit recommendations for irrigation water nitrate; effectiveness of linear polyacrylamide for preventing sediment and nutrient loss; BMP development for corn production; evaluation of atmometers for predicting reference evaporation; ammonia volatilization from sprinkler applied swine effluent; evaluation of runoff water quality from mountain

hay meadows; validation of alternative manure management systems for confined feeding operations; and evaluation of the phosphorus index for predicting phosphorus runoff from irrigated crop fields. Applied research is often integrated with demonstration sites and educational field days to interest producers in techniques or management practices that protect water quality while maintaining or improving profitability.

## BMP Adoption Assessment

Measuring the success of these outreach efforts is valuable in determining the effectiveness of the GW Program's work and in prioritizing resources on areas or topics where adoption is deficient. The GW Program has collected data on BMP adoption in two mailed surveys, one in 1997 and one in 2002. The results from these surveys have shown that

growers are using key BMPs (e.g., soil testing, pest scouting) at a reasonable level for their situation. Adoption rates are typically higher for many BMPs among growers using commercial fertilizer and pesticides, indicating the GW Program is reaching its target audience. As expected, large differences in adoption rates exist among regions of the state and type of producers.

The GW Program has been working with agricultural producers, the agricultural chemical industry and several state and federal agencies to prevent contamination of Colorado's ground water resources from point and nonpoint source pollution for over a decade. This cooperation serves as a good model for other programs working to protect Colorado's water for future generations. BMP adoption results and ground water monitoring data indicate these efforts are working to protect ground water quality in Colorado.

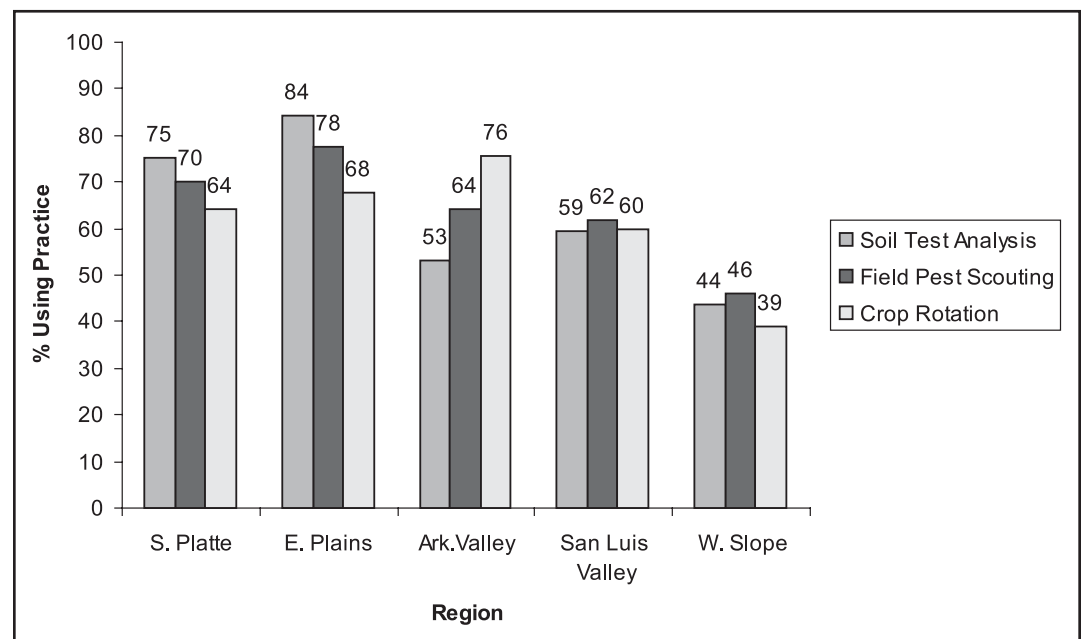


Figure 1. Adoption of key pest and nutrient management BMPs by Colorado irrigating producers. (Bauder et al., 1997)

## Moving Nonpoint Source Outreach to a New Level

by Loretta Lohman, Nonpoint Source Outreach Coordinator, Colorado State University Extension

**N**onpoint source pollution (NPS), like politics, is primarily local.

Colorado's NPS Outreach program recognizes the importance of individual or local actions in remedying nonpoint source pollution. The project is evolving from statewide informational approaches like brochures and advertisements, to local and regional efforts to foster behavioral changes necessary to protect water quality.

This localized activity is building upon three existing assets that will continue to provide the information and awareness basis needed to create local activity. First is a regularly maintained Web page, [www.npscolorado.com](http://www.npscolorado.com), with links to all other activities, NPS projects, videos, and current news.

Another continuing enterprise is the educational program of readers, activity books, CD-ROMs, and interactive Internet materials developed and maintained by the Colorado Foundation for Agriculture for young people. (See [www.growingyourfuture.com](http://www.growingyourfuture.com).)

Finally, a common thread is increasingly being created as H2O Jo and Flo are being adopted as symbols for water quality in Colorado. Jo and Flo were developed and tested to become the Colorado water quality mascots under a NPS grant to the city of Boulder's watershed program. The grant also created a marketing campaign, "Keep It Clean, 'Cause We're All Downstream" strategy and materials.

While traditional in approach, using advertisements, posters, brochures, and other type of handouts, the Keep It Clean campaign tapped into some underlying attitudes as well as quickly becoming a favorite at conferences, water festivals, and other watershed activities.

There are now two H2O Jo inflatable mascots, one available on the Western Slope and one housed in Boulder and used around the Front Range and in several places across the country. The mascot is part of the EPA Nonpoint Source tool kit. A video, a coloring book, and other materials can be downloaded from [www.npscolorado.com](http://www.npscolorado.com).

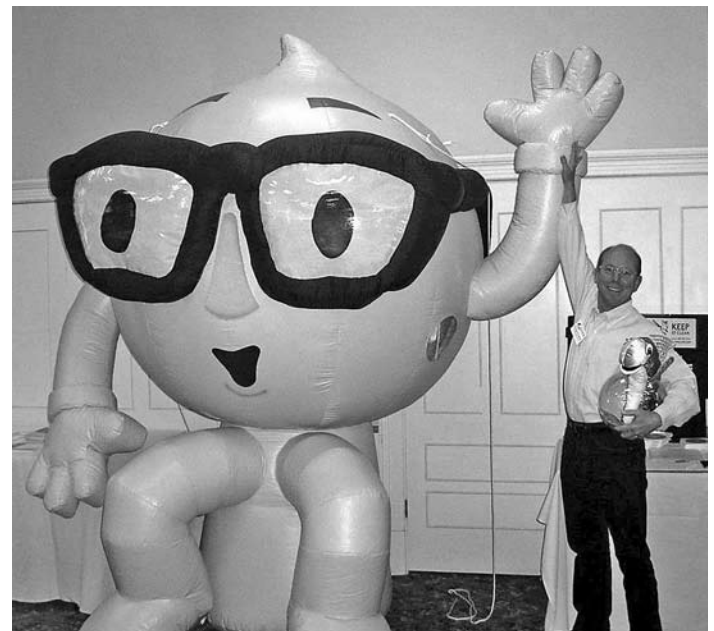
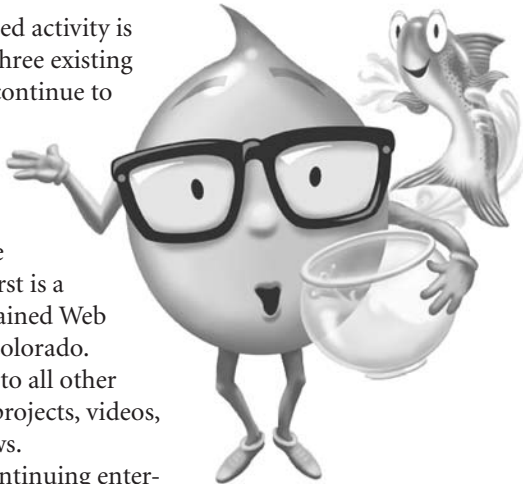
In keeping with the water quality concept that created the mascot, Boulder County has a Keep It Clean Partnership, and Jo has been a featured player in Boulder, Erie, Superior, Louisville, Longmont, Castle Pines, Loveland, Fort Collins, Grand Lake, Denver, Thornton, Westminster, Niwot, Commerce City, Brigh-

ton, Castle Rock, Chicago, and Ohio. On the Western Slope the Keep It Clean Campaign, with Jo and Flo's assistance, encompasses Roaring Fork Conservancy, Mount Sopris Conservation District, Aspen, Colorado River Water Conservation District, Eagle County, Pitkin County, Glenwood Springs, Aspen Center for Environmental Studies, Snowmass Village, Carbondale, and Basalt.

Originally intended to be a draw for children, the mascot equally attracts the attention of adults and helps lay the foundation for more serious information and activities. At a Colorado Water Congress conference, H2O Jo and Flo were instrumental in raising funds for Water for People, a charity founded by the U.S. water and wastewater industry. A number of stormwater entities are using H2O Jo and Flo in their outreach programs, and Denver is undertaking a major campaign using the mascot and some of the campaign strategies.

The success of school education and mascot programs serve to promote awareness and receptivity to the next big challenge in the NPS program. The program has, in the last half year, hosted workshops where Doug McKenzie-Mohr trained attendees in the concepts of community-based social marketing. This is one method that fosters measurable, sustainable behavior change, which is the only way many causes of nonpoint source pollution can be addressed.

Currently, most education campaigns are information-intensive and link attitudes or economic self-interest to behavior. Unfortunately, research does not find this approach very successful. Research and case studies show little or no relationship between knowledge or economic self-interest and sustained behavior change.







**Doug McKenzie-Mohr at workshop.**

In one well-studied example, California annually spends about \$200 million in utility ads promoting energy conservation tips and methods. The program has had little discernable effect. The offer of free in-home energy audit had only a slight effect. Only 6% of the target population requested the audit, and less than half of those took any action to achieve a 2% to 3% energy savings. Doing the math on 2% to 3% of 6% of the population demonstrates that redirecting the education advertisement money

could have retrofitted a many low-income homes with significant energy conservation measures.

There is not a lot of evidence that information-intensive or economic self-interest campaigns work, but we keep taking these two approaches because it seems as if we are doing something. As long as we continue to evaluate outputs (advertisements, presentations, etc.) rather than outcomes, these approaches will continue to be popular. Our failure to measure actual behavior change contributes to continuation of information and economic self-interest approaches that produce few results.

The difficulty of changing behavior is systematically underestimated, and the literature of environmental psychology is not easily accessible. This is one reason McKenzie-Mohr has created a Web site. *Fostering Sustainable Behavior*, <http://www.cbsm.com/>, requires registration so that the site can continuously add materials appropriate to each user. There is a wealth of materials and research available.

An abbreviated description of a social marketing campaign is:

- First, the behaviors in need of change must be selected.
- The barriers or benefits of changing those behaviors need to be identified.
- A program must be designed to overcome the barriers and amplify the benefits.
- The program must be piloted, tested, and piloted again.
- Finally, the program is implemented with thorough and ongoing evaluation.

Selecting behaviors is critical in this process as each suggested change has its own barriers and benefits – this is an incre-

mental process. Only one or another closely related change can be approached in a given program.

Careful observation shows that determining proper tire inflation involves a series of steps. Each step is a behavior that has its own set of barriers. An activity is a series of behaviors. The entire process is a series of steps. A first, small request leads to greater participation and can lead to measurable success.

A critical step is to get a commitment to make a change that is public and visible in the community. A commitment checklist:

- Will not be coercive.
- Will obtain written or public commitment.
- Will actively involve the person.
- Will assist in changing self-perceptions.
- Will facilitate social diffusion and creates a social norm.

Changing behavior involves research, a willingness to prioritize targets, selection of incremental changes that will lead to incorporation of additional changes, and testing and re-testing the program and methods selected.

After 20 years of work in nonpoint source pollution, Colorado has determined that long-term significant changes in preventing increasing amounts of such polluted runoff required a different way of doing many ordinary things – like mowing grass, dealing with weeds, pursuing outdoor recreation, even raking leaves in the fall.

The Colorado NPS Outreach effort will be exploring the best ways to apply the research in fostering sustainable behavior to the problems identified by the NPS program. With the help of H2O Jo identifying the program, it should be an interesting ride.



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# Public Education by Legislative Mandate: The IBCC Public Education, Participation, and Outreach Work Group

by MaryLou Smith, Aqua Engineering Inc.

In 2005, the state legislature passed into law House Bill 05-1177, which was formally named the Colorado Water for the 21st Century Act, but informally came to be known as the 1177 Process. Roundtables in each river basin have been meeting for almost two years, organizing and educating themselves and now tackling the job of making decisions about how to divvy up money available from the legislature for water projects and processes.

The Interbasin Compact Committee (IBCC) is the statewide group set up by the HB05-1177 legislation, and it has similarly been working on organizing and educating itself. The IBCC, working with the Colorado Water Conservation Board, wrote the criteria by which the CWCB decides which projects and processes receive funding.

One group of the IBCC, and indeed the only group within the IBCC written into the legislation, is the Public Education, Participation, and Outreach Work Group. Formed less than a year ago, the Work Group members come from the IBCC itself and from prime water education groups in the state.

**IBCC members on the Work Group are:**

- Rita Crumpton, Orchard Mesa Water Conservancy District
- Jeris Danielson, Colorado State Engineer (retired)
- Carl Trick, North Platte rancher
- Jenny Russell, Telluride water attorney
- Other members of the Work Group are:
- Don Glaser, Colorado Foundation for Water Education
- Jeff Crane, Colorado Watershed Assembly
- Reagan Waskom, Colorado Water Resources Research Institute

**Liaisons to the Work Group are:**

- Eric Hecox, Division of Natural Resources
- Doug Kemper, Colorado Water Congress
- Veva McCaig, Colorado Water Conservation Board

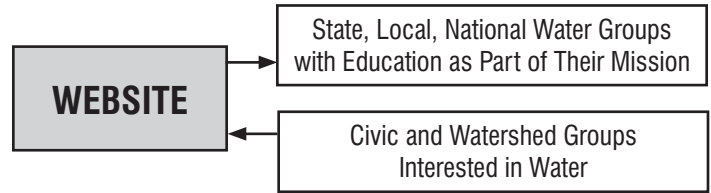
**Facilitator for the Work Group is:**

MaryLou Smith, Aqua Engineering

Harris Sherman, new director of the Colorado Department of Natural Resources, recently listed public education as one of the most important roles of the IBCC and the 1177 Process, and has praised the Work Group for the progress it has made in a short time.

**Here are some of the current projects of the IBCC Public Education, Participation, and Outreach Workgroup:**

- Develop a Web site as a primary means to keep water education and water-interested groups around the state aware of what’s happening in the IBCC and the roundtables and vice versa. The Web site will feature an up-to-date statewide water events calendar and sites for each roundtable in the state to keep in touch with stakeholders.



- Work with Colorado State University Extension and individual roundtables to stage town hall meetings to inform the water-interested public about the 1177 Process and how they can be involved.
- Work with Colorado State University’s Colorado Institute for Public Policy to conduct network analysis surveys of selected roundtables to determine better ways to work together and disseminate information more broadly.
- Work with the Colorado Water Congress to make their Water Almanac and Directory accessible to a wider, more diverse group of stakeholders.

**From Rita Crumpton, Chair of the Work Group:**

*Two years ago when the Water For the 21st Century Act was passed by the legislature, the entire discussion about water in this state changed almost overnight. We began to see people involved in water discussions that had never before participated. We had more people who heretofore had been adversaries actually listening to comments and trying to understand other folks’ point of view. Even though we have barely begun crawling, at this point it seems that the 1177 process is moving things in a productive manner.*

*No one seems to know where this will lead Colorado. We can make a few guesses. We might actually begin to think of the water issues in a statewide manner. We might actually look for solutions other than simply moving water from one place to another by litiga-*



Members of the IBCC Public Education Work Group.

tion. We might actually begin cooperating on a larger scale. Who knows?

As members of the InterBasin Compact Committee (IBCC), the Public Education/Participation/Outreach Work Group (the Work Group) is actually the only one mentioned in the act. We believe it was due to the fact that the people who crafted this bill understood that unless the entire state had the opportunity to contribute and understand, we would go nowhere.

The Work Group's legislative mandate is to create a process to **inform ... and educate** the public on the IBCC's activities and progress regarding interbasin compact negotiations; create a process to ... **involve** the public in the IBCC's activities; and create a mechanism by which **public input and feedback** can be relayed to the IBCC and compact negotiators.

Our first project has been the creation of a Web site, soon to come online, that we hope will begin to answer those directives. We have also become involved in an effort by Colorado State University Extension to hold some town meetings in the near future. We are working on several ideas for workshops that will hopefully assist us

in getting the messages about water out to the entire state. In all of these efforts, we are working closely with the Colorado Foundation for Water Education, the Colorado Watershed Assembly, the Colorado Water Resources Research Institute, the Colorado Water Conservation Board, and the Colorado Water Congress. Why reinvent the wheel? We want to build on what others are doing and make it available to a wider public, especially young folks and those outside the typical "water buffalo" and environmental arenas who have traditionally been involved in water issues in the state. With assistance for a number of folks across the state (ideas and suggestions gladly accepted!), we will be active in providing all the information we possibly can to meet the legislative mandate given us in the Water for the 21st Century Act.

Readers interested in contacting the IBCC Public Education, Participation and Outreach Work Group (especially those with ideas to help us meet our challenging mission) are invited to email us in care of our facilitator, MaryLou Smith, [mlsmith@aquagr.com](mailto:mlsmith@aquagr.com).

## "Walking Through the Water Year" – First Steps

by Nolan Doesken, State Climatologist, Colorado State University

"Walking Through the Water Year" is a water education initiative introduced a few years ago by the Colorado Climate Center at Colorado State University in collaboration with several organizations involved in water monitoring, climate, and education. After getting off to a slow start, WTTWY is about to take its first steps. A pilot project currently being planned could begin this fall. This effort will be funded by the U.S. Bureau of Reclamation in partnership with the Poudre School District in northern Larimer County. Media broadcasts distributed to classrooms, local cable TV, and via Internet streaming video will creatively show how the progression of storms and weather patterns throughout the year delivers water to the region. Students from the school district and interns from CSU will produce these broadcasts with the help of local weather and water experts.

Colorado's water managers, planners, forecasters, and water users traditionally track water resources using the water year calendar that begins October 1 and ends September 30. The beginning of the Water Year coincides with the start of the snow accumulation season in the Colorado high country. It includes the dynamic spring snowmelt period, when the mountain snowpack relinquishes water to tumbling rivers and streams. The year ends with the completion of the summer growing season and irrigation season. Each year follows a common seasonal cycle, but the number, size, intensity, location, and timing of rain and snow storms dictates the amount of water available to Colorado each year. This is modulated by the sequences of warm and cold weather along with variations in wind, sunshine, and humidity that influence evaporation and transpiration.

Water experts, accustomed to tracking weather conditions through the water year, learn through years of experience the intimate connections between weather and water. There is tension and drama each year as weather patterns unfold and our water story is told. Walking Through the Water Year will strive to capture this excitement to bring a greater awareness and appreciation for our limited water resources.

For more information about Walking Through the Water Year or to find out how you or your organization can get involved, please contact:

Nolan Doesken  
Colorado Climate Center  
Department of Atmospheric Science  
Colorado State University  
(970) 491-3690  
[nolan@atmos.colostate.edu](mailto:nolan@atmos.colostate.edu)



Colorado State Climatologist  
Nolan Doesken

**Colorado State University**

AGRICULTURAL EXPERIMENT STATION

# Colorado Watershed Network Celebrates Ten Years

by Jacob Bornstein, Executive Director



CWN Executive Director  
Jacob Bornstein



The Colorado Watershed Network (CWN) is excited to be celebrating its 10th year! Over the past decade, CWN has enjoyed working with partners and in communities to support their local efforts. Not advocating a predetermined viewpoint is core to our mission: *to promote the health of Colorado's watersheds through nonbiased community-based science and support.* CWN conducts its work under three broad and interwoven programs: Research and Monitoring, Education and Outreach, and Conservation and Restoration. CWN's three programs allow for an integrated approach, which is critical to successfully supporting water resource health. CWN produces research with a purpose; education backed up by research and leading to community action; and conservation with the support of watershed science. This article explores CWN's ten years of success and our new K-12 Water Education Program.

## History and Success

### Research and Monitoring

With regard to research and monitoring, many water professionals know CWN for the *River Watch* program, which CWN runs cooperatively with the Colorado Division of Wildlife (CDOW). River Watch is a volunteer water quality monitoring program that started in Colorado schools. Now, not only has CWN reached over 70,000 students, teachers, volunteers, and conservation groups, but it has grown to be

the single largest collector of baseline water quality data for Colorado's rivers and streams each year.

This data is used by the Colorado Water Quality Control Division, CDOW, watershed groups, cities, conservation districts, and many others. River Watch data collection undergoes twice the industry standards of quality control and quality assurance, includes a rigorous training certification program, an annual site visit test with each volunteer entity, and detailed data validation processes. Because of these high standards, River Watch data has helped allow watershed groups to continue their acid mine cleanup despite federal regulations that typically block groups without the necessary liability insurance. River Watch data has been used to help designate both outstanding and impaired waters and has helped engage many youth and volunteers in understanding both the chemistry of Colorado's waters as well as the political process that supports the

state's framework for managing water.

In addition to our River Watch program, CWN has gone on to complete numerous critical studies, ranging from assisting in Colorado's *Environmental Monitoring and Assessment Program* (EMAP) to Mayfly toxicity studies. CWN is also part of the team conducting *nonconsumptive needs assessments* (aquatic life and recreation) for the nine basin roundtables in the state.

### Conservation and Restoration

CWN biologists, in cooperation with the Natural Resources Conservation Service and CDOW have conserved, funded, or restored nearly 30,000 acres for fish and wildlife by making the most of government Farm Bill programs. One recent accomplishment was the 1,300 acres of wetlands conserved under the nationally competitive Wetland Reserve Enhancement Program. CWN biologist, Chanda Garcia, participated in one of five nationally funded projects. This project will protect and restore habitat for the endangered Southwest Willow Flycatcher and is adjacent to the U.S. Fish and Wildlife Service (USFWS) Alamosa National Wildlife Refuge.

CWN is currently in the process of assisting watershed planning in the Culebra Watershed/Costilla County with the Colorado Acequia Association. CWN also supported the Stollsteimer Watershed Planning efforts in matching a 319 Watershed





Planning Grant with a Wildlife Habitat Initiative Program grant so that water quality and wildlife issues can be addressed through the same planning process.

**Education and Outreach**

Research is critically important, but CWN’s philosophy is that for research to be of value it must also be used. One of the best ways research can be used is to inform and inspire a broader audience to care for their local water resources. It’s exciting for CWN’s research and monitoring team to see CWN and other water resource projects used to educate and inform our communities.

CWN has a number of programs that provide for that opportunity. CWN has partnered with the Colorado Watershed Assembly, the Colorado Riparian Association, the Colorado Lakes and Management Association, and AWARE Colorado/League of Women Voters to organize the largest watershed conference in Colorado. This year’s conference, taking place in Breckenridge October 2-4, will be focused on *Making the Water*

*Quality Connections*. The Conference will open with “Balancing Our Water Supply, Quality, and Energy Needs” with state representatives, the new Department of Natural Resources Director, Harris Sherman, and Colorado Department of Public Health and Environment Director, Jim Martin. Other topics will range from the Prairie Waters Project to watershed monitoring in Colorado.

CWN is also assisting the Colorado Water Quality Monitoring Council (CWQMC) in the *Colorado Data Sharing Network (CDSN)*. CWN’s role is to coordinate the building of a statewide database to house water quality, quantity, habitat, and biological information across the state and train data generators and users on how to get data into and out of the system. This system will allow data from monitoring efforts across Colorado to be pooled into a place where they can be collectively assessed.

One of the most exciting aspects of CWN’s education programming is the new grant CWN received from the

Colorado Water Conservation Board to support a state-wide K-12 Water Education Coordinator.

**Youth Focus**

CWN believes in engaging our youth as active stewards of their watersheds, now and in the future. Thanks to a generous grant from the Colorado Water Conservation Board, CWN is proud to be the new home for Project WET in Colorado. Project WET (Water Education for Teachers) is a nationally recognized water education program whose mission is to promote responsible water stewardship through excellent and effective water education. Project WET uses a “train the trainer” model, in which over 150 Project WET facilitators located around



the state reach hundreds of teachers annually. Teachers receive training in the *Project WET Curriculum and Activity Guide*, which boasts over 500 pages of multidisciplinary water-related activities for youth ages 5 through 18 that are hands-on, easy to use, and fun. The activities are written for teachers, by teachers, and are tested in hundreds of



waste water treatment plant operator because River Watch taught her the importance of water quality. Shay Beckman, who went on to get her degree in civil engineering, became part of the engineering team that was open to working with her alma mater high school to design a stormwater plan from the city of Glenwood Springs. Other River Watch participants have gone on to start their own River Watch Programs as teachers, helped communities in Kenya and Vietnam deal with their water quality issues, and compelled their universities to spearhead programs like the Duke University Greening Initiative.

### Education Model

CWN is looking to engender a synergy with River Watch and Project WET to create the best model for water education in the country. CWN is now coordinating Project WET, the best regarded water curricula and teacher training program in the country. For Colorado as well as River Watch, it is perhaps the best example of a statewide program that engages students in stewardship by going out every month and monitoring their streams. CWN hopes to support the progression from teacher training to engaging students as stewards of their watersheds. By working with the CWCB, water supply utilities working on conservation plans, and stormwater permit holders (MS4s), we can partner to ensure that training teachers in curricula is just

the first step. We also want to connect teachers with other resources and researched processes that will get their students:

1. Informed about local water issues.
2. Exploring Colorado's precious water resources.
3. Inspired about water resource professions.
4. Taking action to improve their watershed or conducting a science project like River Watch, wetland plantings, marking storm drains, or saving water through household practices.

CWN isn't just about ensuring that there is enough clean water for people, the environment, and agriculture. CWN is also about supporting communities and people through an integrated approach that connects science, education, and stewardship.

This will not be an easy task, and CWN and Colorado has a long way to go. But here at CWN, supported by research and monitoring and larger conservation and restoration projects, we believe that it is the model for success. It is the model needed to help bring in partners and resources, and it is a model that will require friends like you.

For more information about CWN's projects, programs and events, please visit [www.coloradowatershed.org](http://www.coloradowatershed.org) or call executive director, Jacob Bornstein directly at (303) 291-7437.

classrooms around the nation. According to a 1999 survey, over 95% of teachers felt Project WET had a positive impact on students' interest in water issues. CWN is able to build off Project WET's past success and hopes to provide locally focused resources to even more teachers across the state. CWN is now poised to act as a catalyst propelling the state forward to become a leader in water education.

Over the last decade, CWN has heard countless success stories from our previous River Watch students. Bill Challis was a classic case of a high school student with attention deficit disorder. Many of his high school teachers predicted he wouldn't graduate Glenwood Springs High School. He found River Watch to be so grounding and rewarding that he graduated and now works in youth conservation and is a forestry surveyor. Candy Burbage from Nucla High School south of Telluride is now a

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*CWN isn't just about ensuring that there is enough clean water for people, the environment, and agriculture. CWN is also about supporting communities and people through an integrated approach that connects science, education, and stewardship.*

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## AWARE Colorado

### *Helping Local Officials and Their Communities Protect Water Quality*

*by Laurie DiBattista, AWARE Colorado Media Specialist*



**AWARE Project Director  
Cynthia Peterson**

**A**WARE Colorado has traveled much of the state in the last 2 ½ years to inform local decision makers about the effect their land use choices have on protecting water quality.

Not only does the AWARE (Addressing Water and Natural Resource Education) Colorado program help communities make the connection between land use and water quality, it also informs them of strategies to protect water and natural resources from polluted runoff.

Many of AWARE’s educational messages deal with ways to reduce such impervious surfaces as asphalt, cement, roofing and even compacted soil – anything that prevents rain and snowmelt from infiltrating the ground.

The program provides strategies that utilize planning and zoning tools such as buffers and setbacks; innovative street and parking lot design; porous pavers and other permeable materials; natural landscaping and tree cover; model ordinances; and many other approaches.

“AWARE Colorado is all about helping communities understand the impacts their decisions have on water quality,” said Reagan Waskom, director of the Colorado Water Resources Research Institute at Colorado State University and a member of AWARE’s advisory committee.

“In a state as dry as Colorado, protecting water quality is critical to preserving the precious water we do have.



AWARE is working with many stakeholders around the state to provide information and tools to help communities make better decisions regarding land use and water quality. Colorado State University and CSU Cooperative Extension are pleased to have this partner in community-based water quality education,” he said.

Denver-based AWARE is an initiative of the League of Women Voters of Colorado Education Fund, a nonprofit and nonadvocacy education and research organization. AWARE is funded by the Colorado Department of Public Health and Environment (CDPHE) through grants from the U.S. Environmental Protection Agency.

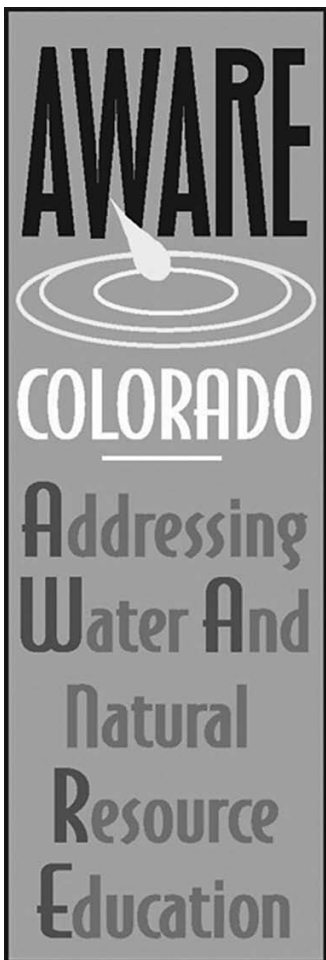
AWARE is a charter member of the National Nonpoint Education for Municipal Officials (NEMO) Network. The network helps communities across much of the country better protect natural resources while accommodating growth.

### Community Dialogues

AWARE program director Cynthia Peterson has visited many of the state’s small- to large-sized communities to give presentations and talk with them about why effective water quality management starts with strategic planning at the local level – even before any dirt is moved.

Peterson has met with planning commissions, city councils, visioning task forces, county commissioners, home-builders, and others. “It’s been rewarding for our team to develop the AWARE program, with help from our technical advisory committee, and then take the messages across the state.”

“The results of our post-presentation evaluation surveys are very encouraging. I believe it’s because AWARE’s program is based on findings from a questionnaire we sent to select land use decision makers when our team began to design the program,” she said.






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*“AWARE Colorado is all about helping communities understand the impacts their decisions have on water quality.”*

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At the presentations, Peterson distributes AWARE’s *Water Protection Toolkit for Local Officials*, one of the program’s centerpieces. Last year, the toolkits were also sent to every municipality and county in the state thanks to a grant from Coors Brewing Co.

The booklets give communities ideas about ways to protect water quality; suggested resources for learning more (including links to numerous Web sites); and proven management strategies and practices appropriate for Colorado. The toolkits can be viewed or downloaded at [awarecolorado.org](http://awarecolorado.org).

The toolkits can play a key role in ongoing community discussions about preventing pollution through wise planning.

According to Michelle DeLaria, Jefferson County’s stormwater quality coordinator, who also serves on AWARE’s advisory committee, “Planning with water quality and quantity in mind encourages a community to think about the elements that will help ensure long-term environmental and economic success. Understanding these effects is the beginning of a community dialogue on how to minimize those effects.”

### Moving Toward a Focus on Watersheds

As the CDPHE’s Water Quality Control Division continues to move toward a more watershed-oriented focus, AWARE is incorporating that approach, starting with the Big Thompson Watershed Forum.

“Decision makers in our watershed and surrounding communities face a daunting task of protecting the quality of our water resources while preserving traditional uses and enabling healthy growth,” says Rob Buirgy, the forum’s executive director.

“This balancing act requires the creative application of a wide variety of management tools, both old and new. By partnering with AWARE, our forum has been able to provide the high quality, focused information these leaders need to accomplish their work. AWARE provides concise information supported by well documented strategies for controlling and treating nonpoint source pollution.”

Another way that AWARE has become more involved with watersheds is its role as a cosponsor of the second annual Sustaining Colorado’s

Watershed conference, which will be held October 2-4 in Breckenridge. Peterson will be a presenter at conference, whose theme is Making the Water Quality Connections.

The watershed conference will explore the connections between water quality and land use, water supply, energy development, wildlife, and other related issues. It will also feature information about emerging issues and recent developments in water quality monitoring. Other co-sponsors include the Colorado Watershed Network, the Colorado Lakes and Reservoir Management Association, the Colorado Watershed Assembly (CWA), and the Colorado Riparian Association.

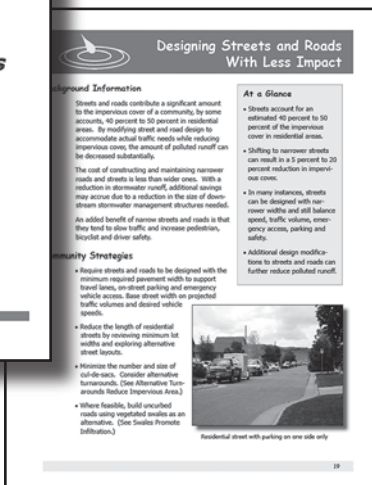
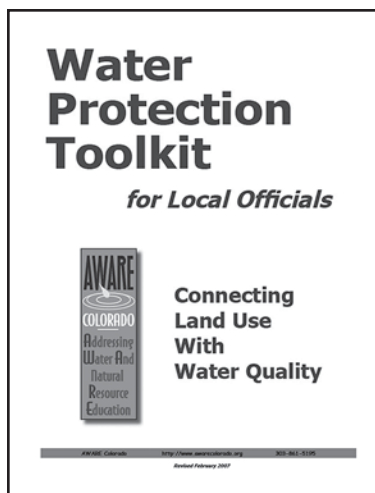
### Outreach on Many Fronts

From the start, those involved in shaping AWARE’s new program knew it would be critical to effectively connect with Colorado’s communities – to let them know about the program and to keep the line of communications open.

It wasn’t the first foray into an environmental education campaign for AWARE’s program director and staff, who previously worked on the Colorado Water Protection Project. That five-year project was geared to inform the public about nonpoint source pollution and simple ways residents can reduce polluted runoff around their homes. Its messages were delivered using TV and radio ads, a Web site and newsletter, CDs, brochures, on-air interviews, and newspaper articles.

With that experience, AWARE was well equipped to spread the word about its new





program to land use decision makers, community members, and other professionals like planners, homebuilders, developers, and engineers.

After developing a logic model with a short-, mid-, and long-term plans, the program introduced itself on the Web in 2005. A section was soon added to the site where interested communities could learn more about AWARE's community presentations. Updates, helpful links and resources and the toolkit publication also appear on the site. In a recent six-month period, about 4,450 visitors logged on.

To stay in touch with its target audience, AWARE regularly sends a free e-newsletter to about 300 subscribers, updating them about news, new resources, and articles that have appeared in the media, along with upcoming events that deal with water quality protection.

Information about AWARE has appeared in newsletters such as *Colorado Planners and Colorado Counties* and the *Colorado NPS Connection* and on

the Colorado Department of Local Affairs and CWA listservs.

When Peterson receives inquiries for more information about a topic, the answers or helpful resources are likely found in the AWARE database.

With funding from a state Supplemental Environmental Projects (SEP) grant, AWARE is giving in-depth educational programs in the southern part of the state.

"AWARE has provided needed educational opportunities for public officials, staff and other interested parties in the Pueblo area," said Dennis Maroney, stormwater utility director for the city of Pueblo. "(AWARE) presentations provide an overview of sources of stormwater pollution, structural and nonstructural best management practices, and examples of opportunities for local officials to facilitate improved stormwater practices," he added.

## Tapping into Community-Based Social Marketing

AWARE is in the process of adding a new component that fits with Colorado's nonpoint source program: community-based social marketing (CBSM).

How does a CBSM approach work? It creates behavior changes by removing barriers to desired activities, at the same time enhancing the activities' benefits.

AWARE staff attended CBSM training and plans to pilot a project using the method in the South Platte Watershed, where they will use barriers and benefits research to enhance the AWARE program. The modified AWARE program will be evaluated as a model for other programs conducting water-related education efforts.

"We look forward to building on what we learned from our experience and incorporating CBSM strate-

gies to make the program even better," Peterson said.

Meanwhile, AWARE will also carry on with its current efforts.

As David Merritt, chief engineer of the Colorado River Water Conservation District and mayor pro-tem of the city of Glenwood Springs, sees it, "AWARE provides an opportunity to get public officials, elected and appointed, thinking about the impacts of their land use decisions on water quality.

"In most cases, when making development or zoning issues, we focus solely on the human use issues such as density, traffic, solar shading, and related impacts to neighbors," he said. "By becoming more cognizant of our ability to minimize water quality impacts with minor adjustments, we can improve our communities and our environment."

For more information, visit [awarecolorado.org](http://awarecolorado.org) or call Peterson at (303) 861-5195.

## NWRA Western Water Seminar

July 25-27, 2007  
Monterey, California

FOR MORE INFORMATION, VISIT [WWW.NWRA.ORG](http://WWW.NWRA.ORG)

## Colorado Foundation for Water Education

by Don Glaser, Executive Director

Created in 2002 by the Colorado General Assembly, the Colorado Foundation for Water Education is Colorado's only statewide nonprofit, nonadvocacy organization providing water resource information and education. This mission is accomplished through publications, events, and training opportunities that take place throughout the state of Colorado.

*Headwaters* magazine is the signature publication of the Foundation. Each quarterly publication explores current water issues and their human impact. One issue every year highlights a single river basin and provides insight on the current issues that the basin water users face. The *Citizen's Guide* series explores enduring issues in more depth. Each full-color guide is approximately 32 pages in length. The most popular is the *Citizen's Guide to Colorado Water Law* by Justice Greg Hobbs. This guide provides the reader with an understandable look at the complex system of laws that govern water use in the state. Currently, there are approximately 17,000 copies of this guide in circulation. The *Citizen's Guide to Colorado's Environmental Era* features the photography of John Fielder with essays from prominent historians and scholars regarding the evolution of water use in Colorado since the early 1970s. This series also includes *Citizen's Guide to Colorado Water Conservation*, *Citizen's Guide to Colorado Water Heritage*, *Citizen's Guide to Colorado Water Quality Protection*, and *Citizen's Guide to Where Your Water Comes From*.

The Foundation hosts three events annually. A favorite event is the annual Headwaters Tour. Every summer, the Foundation puts together this two-day tour to explore water issues and water features in a river basin. This year, the Gunnison River will be the focus of the tour held on June 25 and 26. Beginning in the beautiful city of Gunnison, the tour will travel up to Taylor Reservoir and down the Aspinall Unit; explore the Uncompahgre Valley,

the North Fork of the Gunnison River, and the Black Canyon National Park; and return to Gunnison. Another favorite event is the CFWE golf tournament. For the Foundation's Second Annual Golf Tournament (see page 32), we will be returning to the beautiful Arrowhead Golf Course in Littleton, Colorado. The best ball scramble format tournament will begin with a shotgun start at 7:30 a.m. on July 20. The third event the Foundation presents is the President's Award Presentation and Reception. This award is presented to individuals who have provided exceptional service to the water community. In 2006, the Foundation was pleased to give the First Annual President's Award to Mr. John Fetcher of Steamboat Springs.

Providing training for Colorado citizens interested in water resource issues is central to the mission of the Foundation. Therefore, the Foundation also conducts the annual Water Leader's Course. This highly regarded development training offers 12 emerging water leaders the opportunity to enhance their leadership potential with a focus on water resources issues. This yearlong program will provide leadership training, including self-assessment opportunities, training in conflict resolution, communication, negotiation, and other leadership skills necessary to participants' future success. Participants receive opportunities to shadow major water leaders, participate in coaching sessions with trained executive coaches, and attend several of the state's major water conferences, tours, and symposia.

The Colorado Foundation for Water Education is a 501(c)3 corporation funded by grants, sponsorships, and memberships from individuals and corporations. Citizen's guides, posters, and memberships can be purchased from our online store at [www.cfwe.org](http://www.cfwe.org).

## AWWA 125th Annual Conference and Exposition: Explore the Future of Safe Water at World's Water Event

June 24-28, 2007

Toronto, Ontario, Canada

FOR MORE INFORMATION AND/OR TO REGISTER VISIT [HTTP://WWW.AWWA.ORG/](http://www.awwa.org/)

## Learning from a Water Educator

by Patricia J. Rettig, Head Archivist, Water Resources Archive, Colorado State University Libraries

Having become an expert in several areas of engineering during his career, Robert Glover put this expertise to use by teaching at Colorado State University, helping the institution become a leader in water education. Signing on in 1956 following his retirement from a 30-year career with the U. S. Bureau of Reclamation, Glover made significant contributions to CSU's civil engineering education program over the next 25 years.

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*“At the present time CSU is probably the only school in the United States which offers an outright course in transient ground water hydraulics. We seem to be generally recognized as a leader in this field.*

*I hope we can retain this position.”*

*– Robert E. Glover, October 18, 1968*

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Glover's own education was received at the University of Nebraska, on either side of service in World War I. He then put his undergraduate degree in civil engineering to use at the U.S. Bureau of Reclamation (the U. S. Reclamation Service at the time), where his knowledge contributed to the construction of some of the Bureau's largest and most famous dams. He contributed concrete and design studies to Gibson Dam in Montana, Owyhee Dam in Oregon, and Hoover Dam in Nevada/Arizona. His concrete cooling studies, enabling Hoover Dam to be built quickly and efficiently, earned his name a place on the dam's recognition plaque.

Among his other accomplishments at the Bureau, Glover developed the trial-load method of designing arch dams as well as a penstock analysis, a water-hammer analysis, and the stiffener design. The Department of the Interior recognized Glover's valuable contributions by giving him both the Silver and Gold Medals for outstanding service.

During his years at the Bureau, Glover pursued further education by completing a professional degree in civil engineering at the University of Nebraska in 1936 and a master's degree in applied mathematics from the University of Colorado in 1950.

Retirement from the Bureau in 1954 at age 58 enabled Glover to explore other opportunities. He briefly worked for Boeing and then joined the U.S. Geological Survey on a contract basis and Colorado State University (Colorado A&M at the time) on a half-time basis. This work involved both research and teaching. The University utilized his expertise by having him teach such courses as Design of Concrete Dams, Flow in Porous Media, Mathematics of Ground Water Movement, and Studies in Ground Water.

For these courses and others, Glover's course outlines, lecture notes, assignments, and grade books are available in the col-

lection of his papers at CSU's Water Resources Archive. These and other materials give a detailed look into CSU's engineering education during the 1960s and 1970s. Not only do Glover's personal materials reveal what he was teaching and how, but they also contain correspondence between Glover, his colleagues, and administrators regarding bigger-picture issues of water-related engineering education.

Also beyond the usual course materials that one would expect to find, there are some less common documents that Glover created.

His reports on class field trips reflect on student learning, showing how engaged students were with first-hand looks at irrigation wells in operation, thus translating their classroom experience to practical application. Lists of references that Glover used for his classes show the resources from which students were learning. Some of this was either so new or so sparse that Glover created his own. A compilation by Glover and Morton W. Bittinger called "Source Material for a Course in Transient Ground Water Hydraulics" (1959) was frequently requested by others who heard about it. Eventually Glover transformed this into a textbook, *Transient Ground Water Hydraulics* (1974), which was used around the world.

The materials in the collection also demonstrate other influences and trends in higher education. The evolution of computer use during the 1960s and 1970s is clearly evident, as is the significant presence of international students at CSU. Also, course materials intermingled with Glover's ground water research at CSU shows the influence of current research on education.

Some of Glover's students are still around today, and some are even well-known state government employees. Thus, Glover's legacy lives on in those students and the people they influenced in turn, as well as through research in publications throughout the world and in the personal papers his family donated to CSU.

The papers of water educators can be an ongoing source of education for the future. Other similar collections in the Water Resources Archive include those of Daryl B. Simons and Maurice L. Albertson. For more information about these collections – or if you know of similar collections that should be saved – visit the Water Resources Archive Web site at <http://lib.colostate.edu/archives/water>.



**Robert E. Glover – engineer, educator, and all-around water enthusiast – in his boat, “Sedimental U.” (From the Glover Papers, Water Resources Archive, CSU.)**

## Aspinall Memorial Unveiled in Palisade

Former Mesa County Commissioner Tillie Bishop was joined by Gov. Bill Ritter, Sen. Ken Salazar, Aspinall family members, a number of local elected officials and dignitaries, and about 250 others on April 14 for the unveiling of a memorial to former Colorado Congressman Wayne N. Aspinall in his hometown of Palisade.

The granite memorial, placed prominently in Palisade Town Park, was nine years in the making and required significant effort and sacrifice from a local committee and many donors. It includes a bust of Aspinall facing the Colorado River, which he loved. A granite dam structure with a copper spillway is flanked by a stand pipe and headgate that serves as a fountain. One of Aspinall's most famous quotes is prominently chiseled into granite: "In the West, when you touch water, you touch everything."

Aspinall was known as "Mr. Chairman" for his 14 years of service as the powerful Chairman of the House Committee on Interior and Insular Affairs. In this role he shaped Colorado and the West's natural resource development by championing the approval of some of the region's greatest water projects, including the Glen Canyon Dam, the Central Arizona Project,



and the three reservoirs of the Aspinall Unit on the Gunnison River. Aspinall set the standard for public service and leadership in Colorado, beginning his public service in 1920 on the local school board, becoming a town trustee in 1928 before moving to the Colorado House in 1931. He served 10 years in the Colorado Senate from 1939 to 1949 before moving on to the US House of Representatives.

The memorial is a fitting tribute to a man from the peach orchards of Palisade, who served in two world wars and ably represented the Colorado Fourth District for 24 years in the US Congress. Next time you are on I70 east of Grand Junction, turn off at Palisade for an inspiring lesson in Colorado history.



Top Left: Master of Ceremonies Tilly Bishop. Top right: Sen. Ken Salazar, Mesa County Commissioner Steve Aquafresca, Rep. Bernie Buescher, and Ken Johnson, former publisher of the *Grand Junction Daily Sentinel*. Above: Mr. Chairman. Right: Water and local dignitaries at the unveiling ceremony.

## Colorado Section – American Water Resources Association 2007 Annual Symposium

### *Colorado Water Supply Issues: Cooperation Before Crisis*



**Jerry Galloway, National President of the AWRA, addresses the conference.**

**J**erry Galloway, national AWRA president, kicked off the annual AWRA conference on a snowy Friday the 13th at the Mt. Vernon Country Club west of Denver. Dr. Galloway reviewed the failures of Hurricane Katrina and stated that Katrina should be a wake-up call for all of us, as it underscores the lack of attention paid to water in the United States. He believes this is a national problem, as Sacramento and other large U.S. cities are at as great a risk of flooding as New Orleans. Dr. Galloway called for a National Water Policy to address vulnerabilities and risks we face in water supply, water quality, flooding, and drought, particularly in light of the continued rapid growth on our coastlines. He stated that our entire federal water budget is only \$6 billion to \$10 billion per year, while there are an estimated 3,500 unsafe dams around the country and many other infrastructure issues. In his opinion, we are using yesterday's infrastructure to deal with today's water problems. We are missing a national vision for water, yet we are living today on the vision of our forefathers.

Don Glaser, Executive Director of Colorado Foundation for Water Education, spoke on the theme of Cooperation Before Crisis. He outlined the evolution of water development in the West and noted that the new type of projects that are emerging to meet water supplies fit in the current paradigm of water conservation and environ-



**State Engineer Hal Simpson receives recognition for outstanding service from Colorado AWRA President Mike McHugh.**

ment protection. However, as we continue moving to the margins of our water supply we take what flexibility is left out of system, leaving little ability to respond to threats, much less plan for the long-term future.

The planning horizon for multi-use, environmentally sustainable projects is very long – in the neighborhood of decades. Thus, today we need to be planning and implementing the projects that will be needed in 20 years. Vision, leadership, and discipline will be required to get us there.

Four breakout sessions covered cooperative water efforts, new projects, and new information by a variety of speakers. The day ended with a panel discussion on Western Slope issues and a reception.

The highlight of the conference was a luncheon address by State Engineer Hal Simpson, reflecting on his career, the challenges he has faced, and the challenges the next SEO will face (see article on page 2). He received

recognition from AWRA with a lifetime membership to the Colorado Section. For more information on AWRA, go to <http://www.awra.org/state/colorado>.



**Kelly DiNatale, CDM, and others visit at the conference reception.**

## FACULTY PROFILE

## Dr. Jeff Niemann, Department of Civil and Environmental Engineering



Dr. Jeff Niemann

Jeffrey Niemann joined the Department of Civil and Environmental Engineering as an assistant professor in August 2003. He is the first person to hold the Faoro Professorship of Water Resources. Previously, Dr. Niemann was a faculty member at The Pennsylvania State University. He earned M.S. and Ph.D. degrees from the Massachusetts Institute of Technology in civil and environmental engineering and earned a B.S. with High Distinction in civil engineering from the University of Colorado at Boulder. His professional career includes serving as a consultant for the U.S. Environmental Protection Agency in Nepal and Bangladesh and as a research assistant for the International Institute for Applied Systems Analysis in Austria and the Center for Advanced Decision Support for Water and Environmental Systems in Boulder. He is a licensed professional engineer in Colorado and Pennsylvania.

Dr. Niemann's research interests are in hydrology and geomorphology. His research focuses on the interaction of water and topography at both short and long time scales. At short time scales, topography controls the collection of runoff into streamflow, which is used for human consumption, industrial processes, and agricultural irrigation. Dr. Niemann has developed methods to analyze and estimate soil moisture patterns including

their dependence on topography, and he has developed numerical models for simulating soil moisture dynamics and their role in regional water balance. Dr. Niemann has also examined the interaction of water and topography at long time scales. Water shapes river basin topography into complex dendritic patterns that exhibit scaling invariance and fractality. Dr. Niemann has studied the fractal properties of topography and has developed statistical conditions that help explain the origins of these properties. He has developed methods to classify river network platforms based on these characteristics. He has also examined the dynamic evolution of river basin topography and improved the descriptions of hydrologic processes in landscape evolution models. Dr. Niemann was awarded the Presidential Early Career Award for Scientists and Engineers for his research in hydrology and geomorphology at the White House in 2002.

Dr. Niemann has taught nine different courses during his academic career. At the undergraduate level, his courses have included Numerical Modeling and Risk Analysis, Fluid Mechanics, Basic Hydrology, and Engineering Hydrology. At the graduate level he has taught Physical Hydrology, Surface Hydrology, Water Engineering for International Development, River Basin Morphol-

ogy, and Fractal River Basins. He developed all of the graduate courses except Physical Hydrology. Dr. Niemann's teaching style emphasizes problem-based learning. His undergraduate courses frequently include real-world projects that encompass the course's subject matter. At the graduate level, Dr. Niemann emphasizes a collegial approach where students learn from each other. Students present progress reports on their semester projects in class to obtain recommendations from other students, and class periods are used to discuss recent journal articles.

Dr. Niemann's service activities include memberships in the American Geophysical Union, the American Society of Civil Engineers, and the American Society of Engineering Education. He has participated in numerous departmental committees, chaired the University's International Development Studies Board, and has served as a representative to the national Consortium of Universities for Hydrologic Sciences, Inc. He has convened and chaired a session at a national American Geophysical Union meeting. He has also contributed to a project to improve the drinking water, irrigation, and wastewater systems for a rural orphanage in Guatemala and Engineers Without Borders projects to improve drinking water systems for villages in El Salvador.

## STAFF PROFILE

**Congratulations, Jamie Woodworth**

**J**amie Woodworth has worked for the Colorado Water Resources Research Institute and the Water Center at Colorado State University since May 2006. Jamie has been responsible for accounting duties and other various jobs within the office. Jamie had always believed she had an awareness of water related issues, but since working for the CWRI Office, she has developed a heightened awareness of water conservation.

Jamie is a Colorado native, born in Glenwood Springs, Colorado, and grew up in Eagle, Colorado. She has a son, Jackson, who is 6 months old, and a dog, Daisy.

Jamie's interests include the outdoors, hiking and snowboarding. She is graduating with a degree in criminology and criminal justice from Colorado State University and will be moving to Hawaii to pursue a career in real estate.

We are very proud of Jamie. She has been an outstanding employee, and we wish her the very best of luck!

**USCID Fourth International Conference  
on Irrigation and Drainage:  
Role of Irrigation and Drainage  
in a Sustainable Future**

**September 30 - October 5, 2007  
Sacramento, California**

FOR MORE INFORMATION ABOUT CONFERENCE AND CALL FOR PAPERS GO TO [HTTP://WWW.USCID.ORG/](http://www.uscid.org/)

# 100 Years of San Luis Valley Reservoirs

July 23-25, 2007

Monte Vista and Alamosa

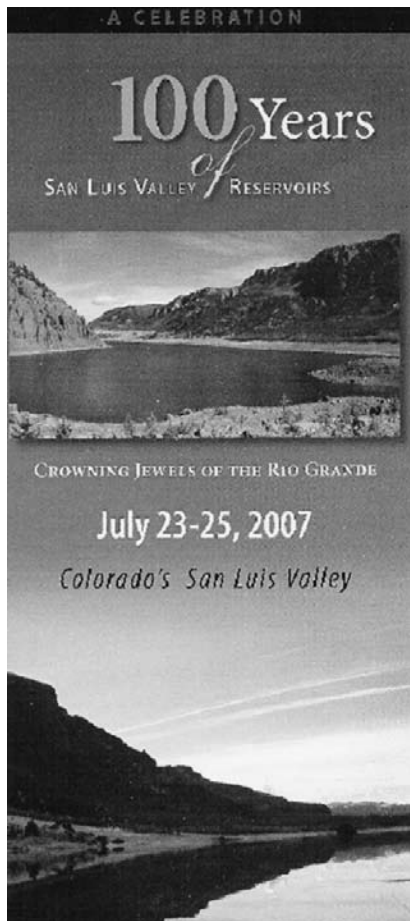
~ Reservoir Tours ~

~ Symposium titled “Water Storage in the Rio Grande Basin:  
The Past, the Present, and the Future”

~ Fun Family Activities ~

*All are welcome ~ No fees or registration required*

**For detailed schedule, see  
[www.100yrSLVreservoirs.org](http://www.100yrSLVreservoirs.org)**



### Speakers Include:

Rod Kuharich, Director of CWCB

#### Attorneys

David Robbins

Bill Paddock

David Harrison

#### Historians

Dr. Douglas Littlefield

Dr. Daniel Tyler

#### Rio Grande Compact Commissioners

Hal Simpson, Colorado

John D'Antonio, New Mexico

Patrick Gordon, Texas

#### Water Experts

Justice Gregory Hobbs, Colorado Supreme Court

Russell George, former director, Colorado DNR

Tom Harbour, Central Arizona Project

#### DOW Representative

Glen Hinshaw

#### San Luis Valley Water Officials

Mike Sullivan, Division 3 Engineer

Travis Smith, CWCB President

Allen Davey, RGWater Conservation District Engineer

Reservoir Officials

#### Poetry and Art Contests

Maria Morales McConnell, poet

David Guerrero, artist

**For more information, call (719) 852-3188 or e-mail [mecagetz@fone.net](mailto:mecagetz@fone.net)**



## RESEARCH AWARDS

## Colorado State University, Fort Collins, Colorado Awards for March 2007 to May 2007

**Bastian, Dawn**, Morgan Library – National Endowment for the Humanities. *The Western Waters Digital Library: The Foundations of American Water Policy*. \$338,444.

**Carlson, Kenneth H.**, Civil Engineering – CH2M Hill. *Aquifer Recharge and Recovery (ARR) Testing*. \$30,000.

**Christensen, Dana K.**, Horticulture and Landscape Architecture – Golf Association/U.S. Green Section. *Development of Stress Tolerant, Turf-Type Saltgrass Varieties*. \$26,274.

**Cooper, David Jonathan**, Forest, Rangeland and Watershed Stewardship – DOI-National Park Service. *Wetland Protocol Development*. \$55,231.

**Cotton, William R.**, Atmospheric Science – DOC-National Oceanic and Atmospheric Administration. *Sensitivity of the North American Monsoon to Soil Moisture, and Vegetation, and Its Telecommunication Mechanisms into*. \$70,000.

**Cotton, William R.**, Atmospheric Science – National Science Foundation. *Prediction of MCS Hazards and Simulations of Aerosol Influences on Severe Convective Storms*. \$194,492.

**Douglas, Marlis R.**, Fish, Wildlife and Conservation Biology – Turner Enterprises, Inc. *Introgression in Rio Grande Cutthroat Trout*. \$9,649.

**Fausch, Kurt D.**, Fish, Wildlife, and Conservation Biology – USDA-USFS, Forest Research. *Field Test of Riparian Vegetation Elements Needed to Support Trout Populations in Southern and Central Rocky Mountains*. \$25,000.

**Fausch, Kurt D.**, Fish, Wildlife, and Conservation Biology – DOI-Bureau of Land Management. *Field Evaluation of Trout Populations Under Different Cattle Grazing Regimes*. \$5,000.

**Garcia, Luis**, Civil Engineering – DOI-Bureau of Reclamation. *Multi-Temporal High-Resolution GIS-Based Spatial Evapotranspiration*. \$43,000.

**Garcia, Luis**, Civil Engineering – DOI-Bureau of Reclamation. *Calculation of Moist Soil-Plant Evapotranspiration (ET) Using Remote Sensing*. \$8,996.

**Gates, Timothy K.**, Civil Engineering – DOI-Bureau of Reclamation. *Identification, Public Awareness, and Solution of Waterlogging and Salinity in the Arkansas River Valley*. \$50,000.

**Gilbert, David M.**, Civil Engineering – S M Stoller Corporation. *Follow-On Treatability Studies for Solar Ponds Plume at Rocky Flats*. \$98,344.

**Jacobi, William R.**, Bioagricultural Sciences and Pest Management – Larimer County. *Effects of Chloride Salts on Roadside Vegetation and Water*. \$2,600.

**Kalkhan, Mohammed**, Natural Resource Ecology Lab – DOI-US Geological Survey. *Invasive Species Survey and Report*. \$36,975.

**Labadie, John W.**, Civil Engineering – Davids Engineering, Inc. *IID Efficiency Conservation Definite Plane*. \$13,622.

**L'Ecuyer, Tristan S.**, Atmospheric Science – National Aeronautics and Space Administration. *New Satellite Energy*

*Balance and Water Cycle Products for the Study of Interactions Between Atmospheric Hydrology*. \$168,333.

**L'Ecuyer, Tristan S.**, Atmospheric Science – National Aeronautics and Space Administration. *New Satellite Energy Balance and Water Cycle Products for the Study of Interactions Between Atmospheric Hydrology*. \$50,000.

**Liston, Glen E.**, Cooperative Institute for Research in the Atmosphere – National Science Foundation-IPY. *Collaborative Research: A Prototype Network for Measuring Arctic Winter Precipitation and Snow Cover (Snow-Net)*. \$78,000.

**Lyon, Margarete J.**, Fish, Wildlife, and Conservation Biology – Pagosa Skyrocket Conservation (CO). *National Fish and Wildlife Foundation*. \$5,025.

**McKay, John K.**, Bioagricultural Sciences and Pest Management – National Science Foundation. *Arabidopsis 2010: Collaborative Research: Physiological and Genetical Genomics of Drought Adaptation*. \$163,457.

**Neid, Stephanie**, Fish, Wildlife and Conservation Biology – DOI-Bureau of Land Management. *Survey of Critical Wetlands in Hinsdale County on Bureau of Land Management*. \$10,000.

**Niemann, Jeffrey D.**, Civil Engineering – DOI-US Geological Survey. *Characterizing Non-Beneficial Evaporative Upflux from Shallow Ground Water Under Uncultivated Land*. \$15,000.

**Pilon-Smits, Elizabeth A.H.**, Biology – National Science Foundation. *Evolutionary and Ecological Aspects of Plant Selenium Hyperaccumulation*. \$159,031.

**Qian, Yaling**, Horticulture and Landscape Architecture – Golf Association/U. S. Green Section. *Multiple Stress Tolerance, Seed Dormancy Breaking, and Establishment of Seeded Saltgrass*. \$22,852.

**Ramirez, Jorge A.**, Civil Engineering – NSF-GEO-Geosciences. *Quantifying the Complex Hydrologic Response of an Ephemeral System*. \$35,467.

**Ramirez, Jorge A.**, Civil Engineering – NSF-Education and Human Resources. *REU Site: Research Experiences for Undergraduates: Program in Water Research at Colorado State University*. \$105,520.

**Reising, Steven C.**, Electrical and Computer Engineering – National Science Foundation. *CAREER: Three-Dimensional Measurements of Atmospheric Water Vapor Using Miniaturized Microwave Radiometers*. \$80,000.

**Rocca, Monique E.**, Forest, Rangeland, and Watershed Stewardship – Boulder County Parks and Open Spaces. *Effects of Mechanical Forest Thinning on Understory Communities in a Ponderosa Pine Forest, Boulder County*. \$5,000.

**Roesner, Larry A.**, Civil Engineering – Water Environment Research Foundation. *Linking Stormwater BMP Systems Performance to Receiving Water Protection to Improve BMP Selection and Design*. \$59,496.

**Rohrer, Christine**, Civil Engineering – Urban Drainage and Flood Control District. *Whole Life Cost Assessment Report for BMPs*. \$39,981.

**Shaw, Robert B.**, Center for Environmental Management of Military Lands – USDA-USFS-Rocky Mountain Research Station, CO. *Stormwater and Wastewater Inspection Databases and Compliance Study for US Army Garrison, Hawaii*. \$18,207.

**Smith, Frederick W.**, Forest, Rangeland, and Watershed Stewardship – USFS-Rocky Mountain Research Station – CO. *Best Management Practices for use of Prescribed Fire in Ponderosa Pine Forests*. \$20,000.

**Stednick, John D.**, Forest, Rangeland, and Watershed Stewardship – DOI-US Geological Survey. *Effects of Pine Beetle Infestations on Water Yield and Water Quality at the Watershed Scale in Northern Colorado*. \$15,000.

**Swift, Curtis E.**, Cooperative Extension – DOI-Bureau of Reclamation. *Irrigation Audit Project for the Grand Valley of Western Colorado*. \$10,000.

**Thornton, Christopher I.**, Civil Engineering – DOI-Bureau of Reclamation. *Investigation of Alphabet Wiers*. \$20,000.

**Wall, Diana H.**, Biology – Ohio State University. *The Interactions of Ecosystem Legacy on Contemporary McMurdo Dry Valley Biodiversity and Function*. \$137,767.

**Waskom, Reagan M.**, Colorado Water Resources Research Institute – DOI-US Geological Survey. *Technology Transfer and Information Dissemination*. \$52,335.

**Westra, Philip**, Bioagricultural Sciences and Pest Management – Monsanto. *Field Production of Tissues and Grain from Drought Tolerant Corn During 2007*. \$26,460.

**Wickramasinghe, Sumith Ranil**, Chemical Engineering – National Science Foundation. *New Generation Responsive Membranes for Water Treatment*. \$350,000.

**Wickramasinghe, Sumith Ranil**, Chemical Engineering – Clemson University. *Inverted Colloidal Crystal Membranes*. \$172,785.

**Willson, Bryan D.**, Mechanical Engineering – Solix Biofuels, Inc. *Algae to Biodiesel – Phase One; Lab and Reactor Development*. \$200,000.

**Winkelman, Dana**, Cooperative Fish and Wildlife Research – Montana State University. *Investigating Competition Among Lineages of *T. Tubifex* and the Potential for Biological Control of Whirling Disease*. \$2,500.

**Yang, Chih Ted**, Civil Engineering – DOI-Bureau of Reclamation. *Taiwan River Restoration and Sedimentation Studies*. \$75,000.

**Zimbrick, John D.**, Environmental and Radiological Health Sciences – US Department of Energy. *Transgenerational Effects of Chronic Low-Dose Irradiation in a Medaka Fish Model System*. \$340,847.

## Second Annual CFWE Golf Tournament

The Colorado Foundation for Water Education is pleased to announce its Second Annual Golf Tournament on Friday, July 20, 2007. Returning to beautiful Arrowhead Golf Club in Littleton, the tournament will follow a Best Ball Scramble format beginning with a shotgun start at 7:30 a.m. Individuals may participate in the tournament for \$150, teams of four for \$600.



Robert Trent Jones, Jr. designed the Arrowhead Golf Club to show off the beautiful sandstone rock formations of Roxborough State Park. This formation is part of the stunning vista at the golf club's signature 13th hole.

**For more information or to sign up for the tournament, go to [www.cfwe.org](http://www.cfwe.org) or call Jeannine Tompkins, CFWE Office Manager, at (303) 377-4433.**

Participants in the 2006 tournament putt among the Ponderosa Pines and sandstone formations at Arrowhead Golf Club.

## 2007 CALENDAR

- May 18-22 **River Networks 2007 National River Rally.** Stevenson, Washington. For more information about the rally, visit [www.rivernetwork.org/rally](http://www.rivernetwork.org/rally).
- May 22-24 **Colorado Water Workshop: A Watershed Wide Look at Colorado River Controversies.** Gunnison, Colo. For more information online, visit <http://www.western.edu/water>. Information by e-mail, please contact Peter Lavigne (Director Colorado Water Workshop) at [plavigne@western.edu](mailto:plavigne@western.edu) or [pete@igc.org](mailto:pete@igc.org). Contact by phone: (970) 641-2579.
- June 6-9 **USCID Second Conference on SCADA and Related Technologies for Irrigation System Modernization.** Denver, Colo. For more information or to register, visit [www.uscid.org/07scada.html](http://www.uscid.org/07scada.html).
- June 24-28 **AWWA 125th Annual Conference and Exposition: Explore the Future of Safe Water at World's Water Event.** Toronto, Ontario, Canada. For more information and/or to register, visit <http://www.awwa.org>.
- June 25-27 **AWRA Summer Specialty Conference: Emerging Contaminants of Concern in the Environment: Issues, Investigations, and Solutions.** Vail, Colo. For more information, go to <http://www.awra.org/meetings/Vail2007/index.html>.
- July 24-26 **2007 UCOWR/NIWR Conference: Hazards in Water Resources.** Boise, Idaho. For more information, visit <http://www.ucowr.siu.edu>.
- July 25-27 **NWRA Western Water Seminar.** Monterey, Calif. For more information visit [www.nwra.org](http://www.nwra.org).
- August 23-24 **Colorado Water Congress 2007 Summer Convention.** Steamboat Springs, Colo. For more information, visit [www.cowatercongress.org](http://www.cowatercongress.org) or call (303) 837-0812.
- Sept. 30-Oct. 5 **USCID Fourth International Conference on Irrigation and Drainage: Role of Irrigation and Drainage in a Sustainable Future.** Sacramento, Calif. For more information about conference and call for papers, go to <http://www.uscid.org>.
- October 24-25 **South Platte Forum 2007.** Longmont, Colo. For more information, visit <http://www.southplatteforum.org>.
- November 7-9 **NWRA Annual Conference.** Albuquerque, N.M. For more information, visit [www.nwra.org](http://www.nwra.org).



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