

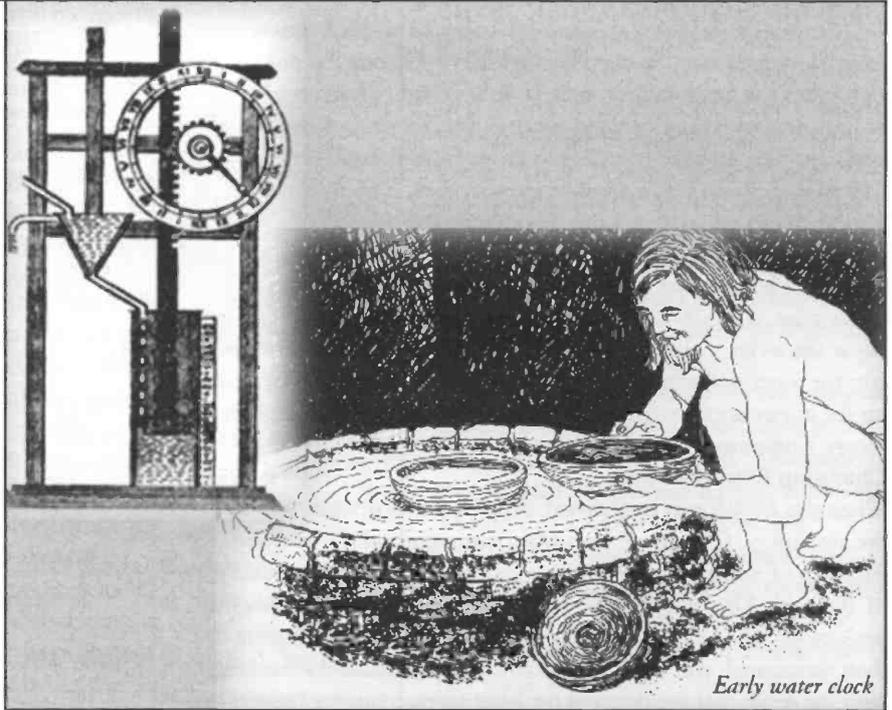


Water Clocks Drip Out The Old Year

Water and time, a suitable note to sound for this end-of-the-year edition of the Arizona Water Resource newsletter, are separate and distinct, yet at some level water and time strike a common chord. For example, rivers often represent the passing of time, with both water and time flowing relentlessly onward. In at least one particular instance, however, the association of water and time is more direct: water clocks.

Water clocks were among the earliest timekeepers not relying on the tracking of celestial bodies. An early bowl-shaped version is seen at right. The bowl when placed in a container of water slowly fills at a constant rate from a hole in the bottom of the vessel. Markings on the inside surface measured the passage of "hours" as the water level reached them. These clocks were handy to determine hours in the dark of night but may also have been used in daytime.

Also shown is a more sophisticated water clock designed in 245 BC by Ctesibius, a Roman living in Alexandria. Water drips at a constant rate from the higher container to the lower container. The rising water level in the lower container causes a float, which is attached to a notched stick, to rise. As the stick rises, the notches turn a gear that moves the hand to point to the time.



Early water clock

Arizona, Nevada Are Partners in Major Water Banking Deal

Nevada gets water; Arizona gets funds, political ally

by Joe Gelt

The Arizona Water Banking Authority was established in 1996 in response to growing concerns about Arizona's Colorado River allocation. At the time, California was using far more than its allocated 4.4 million acre feet of Colorado River water, and Nevada's need for additional water resources was becoming increasingly acute. Meanwhile Arizona was not using its full 2.8 million acre-foot allocation.

Arizona appeared not to be water needy, and officials feared the state's allocation of Colorado River water could be at risk. The AWBA was a strategy to enable the state to take possession of its allocation and ensure the reliability of future supplies. Central Arizona Project water would be "banked" or, in other words, recharged to help ensure secure, dependable long-term water supplies for the state. Accomplishing this was especially important considering CAP's low priority Colorado River allocation.

If the bank had not been available to store water, Arizona might not have used its full Colorado River allocation as early as it did, and the state would have left significant quantities of water in the river. The water bank is doing what banks are supposed to do: save and protect a resource for future use. The AWBA is also authorized to bank on behalf of Nevada and California if water is available.

The AWBA has less water to store and less funding than was originally projected and is involved in negotiating with Nevada an amendment to a 2001 interstate water

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Arizona Water Bank...continued from page 1

banking agreement. The amendment has broad water supply and political implications. Examining the issues involved in the negotiations shows the AWBA taking advantage of changing circumstances to better cope with water shortages and budget deficiencies while encouraging a new spirit of interstate cooperation.

Another view is that Arizona is bowing to political pressure from Nevada to store water on its behalf. If Arizona did not go along with the amendment, some speculate that Nevada might try to negotiate with the Colorado River Indian Tribes to fallow farmlands and free up water supplies to move from Arizona to Nevada. Although this would run afoul of present laws, Nevada might stand a good chance of having Congress change the law. Arizona would prefer that the Law of the River remain intact.

Some believe that the federal government, although not taking direct sides, wants Arizona to accept an amended agreement. Speaking at the recent Arizona Town Hall, Bennett Raley, assistant secretary for water and science, U.S. Department of Interior, commented on the importance of Arizona assisting Nevada build a bridge to secure long-term water supplies.

Changing Circumstances

When the AWBA was established, projections were made about the amount of CAP water available for storage and the likely occurrence of shortages, two prime considerations in the operation of the bank. Drought has called into question some of the original projections. Shortages now seem more likely and more frequent than anticipated, and less CAP water may be available for banking, with the result that the demand for bank storage may be higher than was projected.

Not only have natural conditions limited the AWBA's ability to store water, but bank operations have been set back by a loss of funding. The Arizona Legislature has dipped into the AWBA budget as a source of funds to make up for budget shortfalls in other areas of state government. Also, the Arizona Department of Water Resources has been forced to use AWBA funds to support agency activities due to funding cutbacks. The result has been less AWBA funds available for storing water.

This leaves the AWBA in a difficult position. With the daunting prospect that less water will be available in the future due to high demand and lower than expected inflow, the AWBA might be expected to maximize storage while water supplies are still available. A shortage situation now exists but no cut backs in water deliveries have yet occurred because of substantial storage in the river system. The AWBA, however, does not have the funds to bank the additional water in the face of future shortages. The available but unbanked water represents a lost opportunity.

Correction

The September - October AWR incorrectly quoted Dr. Paul Krausman about the effectiveness of water catchments for wildlife in the desert. He was not in fact being critical of their effectiveness; instead he stated that the importance of catchments to wildlife is a controversial issue. AWR regrets the error.

Nevada Seeks an Amendment

In July 2001 an agreement was worked out between the AWBA and the Southern Nevada Water Authority and the Colorado River Commission of Nevada. Per the agreement, AWBA promised its "best effort" to store sufficient supplies of Colorado River water to enable Nevada to pay for and earn 1.25 million acre feet of long-term storage credits. To ensure the agreement was not burdensome to Arizona water users, AWBA would store only water in excess of the state's needs.

Nevada could then recover those credits at a later date by paying full price to CAP for delivery, storage and recovery of the stored water that would then go to CAP customers. This would entitle Nevada, by exchange, to an additional amount of water from Lake Mead. In effect, AWBA would be storing Arizona's water in Arizona at Nevada's expense. In turn, Nevada would earn the right to withdraw additional supplies from Lake Mead.

Nevada entered into the 2001 agreement anticipating its water needs would be met through 2016 by surplus water made available through the Interim Surplus Guidelines. After 2016, Nevada intended to utilize credits stored on its behalf by AWBA as a "bridge." In other words, the credits would provide a water supply for use in excess of Nevada's 300,000 acre-foot Colorado River allocation while the state developed other long-term supplies.

Drought, however, thwarted these plans. Surpluses under the ISG are no longer available, with Lake Mead's current storage content below the critical threshold established in the ISG. Thus, Nevada needs a new strategy to meet its water needs. Nevada approached Arizona to initiate negotiations to amend the 2001 Agreement.

Nevada's needs, addressed by the 2001 agreement, are now more critical because of drought, growth in demand and threatened water shortages. Negotiations between the AWBA and Nevada offered an opportunity for Arizona to gain some advantages by providing Nevada water banking services.

Politics are Paramount

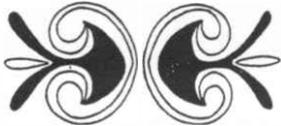
What many view as the big breakthrough promised by the amendment is its strengthening of Arizona-Nevada interstate relations. If drought is demonstrating the advantages of the Colorado River basin states cooperating to plan for and cope with shortages, the amendment is working out details to ensure that at least Arizona and Nevada work together to protect their water interests.

In working out the amendment with Nevada, Arizona gains an ally in negotiations among other basin states to develop guidelines to deal with shortages on the Colorado River. Arizona's prime concern is CAP's junior priority status to Colorado River water. If a shortage is declared, Arizona's CAP water would be the first cut. The amendment gets Nevada on Arizona's side as the state works to gain equal footing with the other states in the event of river shortages.

Some speculate that Nevada may also prove useful as Arizona addresses other concerns. For example, Nevada's support would boost Arizona's arguments for the federal government to begin operations of the Yuma Desalting Plant.

Also, by providing Nevada with a firm water supply, the agree-

Continued on page 12



Water Vapors

Arizona Town Hall Addresses Water Issues

WRRC part of UA team taking part

The 85th Arizona Town Hall, conducted Oct. 31 - Nov. 3 at the Grand Canyon, was titled "Arizona's Water Future: Challenges and Opportunities." The Town Hall is an Arizona institution. A town hall event is conducted twice a year, with organizers inviting prominent people and leaders throughout Arizona to meet and discuss an assigned topic. After several days of discussions, the participants agree on a list of findings and recommendations.

A team from the University of Arizona prepared the background report that provided information to Town Hall participants, some of whom lacked a broad background in water affairs. The seven-member UA team included two members from WRRC: Sharon Megdal, WRRC director and Kathy Jacobs, specialist. The UA team also participated in the discussion sessions.

Any effort that attempts to fully report on two full days of Town Hall discussions involving 170 participants organized into five study groups would face a daunting task. Fortunately information from the Town Hall, both the background document and the final report, are available at the Town Hall web site (<http://www.aztownhall.org/>) and at the WRRC web site (<http://cals.arizona.edu/azwater/>)

There was, however, a Town Hall message beyond the facts, information, findings and recommendations that developed from the sessions. A recurring phrase heard during the discussions was that most citizens' interest in water is generally limited to its availability at the tap. If the tap is turned and water pours out most citizens are not prompted to engage in much more water thinking. Even some of the Town Hall participants admitted to this attitude.

What this means in effect is that most people take water for granted. Any call to action then — and the Town Hall was a call to action — must encourage people to think about water in Arizona: where it

Where the Buffaloes Roam

Among the 170 participants attending the Arizona Town Hall was a small herd of Water Buffaloes. The above badge, along with a knowing aura of water wisdom, set them apart from other Town Hall participants. The origin of the Arizona Water Buffalo species is uncertain. Some say the original Water Buffaloes were the early proponents of the Central Arizona Project. Others say it was a term of abuse for advocates of Orme Dam. Now, however, it seems to refer to an elder statesman, one who has weathered the ups and downs of Arizona water affairs.



comes from, how much there is, its quality and the many associated issues. This was the essential Town Hall message, to encourage Arizonans to become water literate. (See "Public Policy Review," page 11, for fuller discussion of Arizona Town Hall issues.)

News of WRRC's conference, water map, CD-ROM and more...

This issue of the AWR newsletter contains information about the Water Resource Research Center, its plans, projects and activities. In fact, after having worked with various organizations to produce supplements for previous editions of the newsletter, we have reserved this issue's supplement for information about ourselves, the Water Resources Research Center.

Check the supplement for information about the WRRC annual conference to be held in Tucson, April 6, 2005. The conference topic is "Water and the Environment: The Role of Ecosystem Restoration."

The supplement also contains information about an upcoming special event that the WRRC has been working on, "Water Expo - 2005." The event will present current water sustainability efforts now underway in Arizona; the targeted audience includes Arizona State Legislators and Arizona water professionals. The event will be held Jan. 25 on the Senate lawn of the Arizona State Capitol.

Also, see page eight of the newsletter, "Publications," for information about two WRRC products: the Arizona Water Map and the Desert Landscaping CD ROM, Version 2.0, the long-awaited revision of a standard Southwest resource used by thousands of home and professional gardeners.



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News Briefs

Two Cities Consider Land Deals to Obtain Water

Prescott says OK; Flagstaff backs out of its deal

Prescott and Prescott Valley officials have announced plans to buy the JWK Ranch in Big Chino Valley to assure the two cities' future water supplies. Some say the deal has a significance to the area comparable to CAP's importance to Central Arizona, with both projects providing critical water supplies.

An intergovernmental agreement is being drawn up to buy the 4,500-acre JWK Ranch north of Prescott for \$23 million. The governing councils of both municipalities are expected to approve the deal before the end of the year.

Owning the JWK ranch will enable the cities to pump from the Big Chino aquifer that extends beneath the ranch. The two rapidly growing municipalities anticipate they will get about 9,000 acre-feet of water annually, with water expected to begin flowing within three to four years.

Per the agreement, Prescott will own the project and receive 54 percent of the water, with Prescott Valley getting 46 percent. Nearby Chino Valley may also benefit; the agreement may allow it to hook up to the water line at an undetermined date in the future.

The deal has attracted criticism since the aquifer is thought to significantly contribute to the headwaters of the Verde River. There is an ongoing controversy, with the Prescott area on one side and the Salt River Project and towns in the Verde Valley on the other, about the water rights of downriver users.

The Center for Biological Diversity has already fired a volley. The center says

the purchase of the ranch and use of its waters will deplete water in the Verde River and pose a threat to a variety of endangered animals. The center has formally put federal and local officials on notice it will sue unless a plan is worked out to offset the harm it says will result to the endangered animals.

Meanwhile the Flagstaff City Council voted unanimously to back out of a \$15-million deal to purchase the Red Gap Ranch as a water supply source for the city. The city would have obtained 8,500 acres of land directly and received State Land Department leases on about 12,000 acres.

To justify backing out of the deal the motion cited "numerous in-holdings and the present uncertainties regarding the economic feasibility of purchasing Red Gap Ranch." City water officials had previously raised doubts that the land would in fact provide the 10,000-20,000 acre-feet of water each year the owner, Phoenix developer David Leyvas, claimed was available.

Flagstaff now uses about 9,000 acre feet of water annually, with that amount expected to double within 15 years. The \$15 million would only have paid for the land; another \$111 million would be needed to build the necessary infrastructure to transport the water to water users.

Further fueling criticism about the deal was information that Leyvas purchased the property for \$500,000 two years ago. He spent some additional money to install wells and pay for hydrologic studies.

Wastewater's Energy Potential Tapped

A new technology has the potential to further increase the efficiency of a wastewater treatment plant beyond its ability to treat

wastewater to drinking water standards. Called a microbial fuel cell, the new device can not only be used to treat wastewater, but can also provide a clean source of energy.

Similar in design to a hydrogen fuel

cell, the microbial fuel cell captures electrons naturally released by bacteria as they digest organic matter. It then converts the electrons into electrical current.

Researcher Bruce Logan, an environmental engineer at Pennsylvania State University, says "In our system, the two electrodes are separated by a proton exchange membrane, just like in a conventional hydrogen fuel cell. ... It opens the door to using existing hydrogen-gas based stack technologies with bacteria in water." Wastewater flows on one side of the cell and air flows on the other, continuously generating electricity while also removing organic matter from the water.

The technology is developing rapidly, with the cell's generating capacity increasing. Logan and his colleagues have boosted the cell's fuel capacity to 350 watts per square meter. "Two years ago we had 0.1 . . . and now we're in the 100's," he says. "We'd like to get in the range of 500-1000. We're looking for another order of magnitude increase."

Wastewater treatment plants are the most obvious site for the technology, with the cells enabling the plants to be energy self-sufficient as they treat water. The technology would be particularly useful in developing countries. With their smaller treatment facilities, such countries would end up with a surplus of energy for other uses. Logan says, "Even it's only powering a cell phone tower, that would be a reason enough to keep it going."

In a related study, an engineering professor at the University of Toronto is researching the amount of "biogas" produced at wastewater treatment plants. Biogas is methane-rich fuel derived from decomposing organic waste. David Bagley has calculated that the energy potential in wastewater is almost ten times the cost to treat it.

"If we could achieve just one-twentieth of that power, we could break even," Bagley says. "We're confident we're going to be able to do more than that."

A similar technology is being developed by NASA scientists who see an application in manned space missions, to convert astronauts' waste into extra power.

Survey: Development in Rural Areas Should be Linked to Water Supply

Six of ten Arizonans favor laws to prohibit development in rural areas if a developer is unable to prove that a water supply is available to support the project according to a recent survey. The survey found that support was consistent even if such laws served to restrain growth in those rural areas.

The survey expressed the views of a diverse group, with respondents identified with regards to political affiliation and region of residency. Support for such a law was widespread transcending political preferences and even including residents of rural areas of the state. (See table below.)

The above responses likely reflect citizens' concern that a water supply shortage threatens the state, especially in rural areas. The survey measured this concern. It found that 51 percent of respondents say the state as a whole is currently facing shortages, with 11 percent believing the state has plenty of water for future growth. When asked about rural areas of the state, 42 percent say these areas were already experiencing shortages, with 10 percent saying such areas had plenty of water.

Interestingly — and perhaps not unexpectedly — respondents were less likely to believe areas in which they lived were confronting water shortages sufficiently severe to limit growth.

Drought perception was also measured. The survey found that 63 percent considered that major Arizona cities are in serious drought and five percent believed they were not in serious drought; 50 percent said small Arizona cities were in serious drought, with seven percent believing such areas not affected by severe drought. With regards to rural communities, 56 percent said they believed these areas are experiencing the effects of serious drought, with five percent saying they

were not affected by such drought condition.

The survey was conducted by the Behavior Research Center of Arizona as part of its Rocky Mountain Poll series. The center interviewed 705 adult residents across Arizona between Oct. 5 - 14. The complete survey is available at <http://www.brcpolls.com>

The survey has relevance to a recently released Arizona Policy Forum report recommending that developers not be allowed to build in rural areas where a long-term water supply can't be proved and that local governments be given the authority to reject projects. Without those measures, the group warns, the demand for water will produce new conflicts, strain fragile economies and ultimately spawn long-term water shortages.

A. Do you favor or oppose a law which would prevent developers from building in rural areas where they have not proven there is an adequate water supply to support their development...

B. ...if doing so slowed down the rate of growth in those rural areas?

	Question A (%)			Question B (%)		
	Favor	Oppose	Unsure	Favor	Oppose	Unsure
Statewide	61	32	7	59	31	10
Maricopa	62	30	8	61	30	9
Pima	53	36	11	51	33	16
Rural	62	32	6	60	32	8
Republicans	65	26	9	66	24	10
Democrats	66	28	6	62	30	8
Independents	58	39	3	55	40	5
Not Registered	45	35	20	47	36	17

Napolitano Proposes Virtual Water University

Gov. Janet Napolitano's recent proposal to create a "virtual water university" is a strategy to more fully utilize the expertise of faculty at the state's three universities — University of Arizona, Arizona State University and Northern Arizona University. Her plan is to establish the virtual university as a focal point uniting the new and innovative water management work now underway at each university. The campus-less, collaborative institution is expected to become a "super-center of research, community assistance and economic development."

Napolitano announced her proposal at

the recent Arizona Town Hall at the Grand Canyon, saying the center will be the first of its kind in the world. The Governor views it as an interdisciplinary clearing house that will benefit from experts in various fields including engineering, law, geography, geology, biology and history.

The Arizona university system has a rather large pool of water researchers to staff the virtual institution, with over 450 at the three state universities according to Gary Woodard of UA's center for Sustainability of semi-Arid Hydrology and Riparian Areas. He says over two-thirds of them are at the UA.

Napolitano envisions the center as having a broad influence, its groundbreaking

research and long-range planning better enabling the state to secure its water future and also demonstrating to other parts of the world the way a fast-growing region can survive drought in the desert.

The governor expects that funding for the virtual water university would come from private and government sources.

The final report from the recent Arizona Town Hall supported the virtual water university concept adding that the collaborative effort should also include community colleges and other educational institutions.

Officials from each of the universities are presently conferring with the Governor's staff about the proposed center.



Guest View

Tax Credits for Graywater Use Would Boost Conservation

Arizona State Senator Gabrielle Giffords wrote this Guest View assisted by Val Little of Water CASA.

It is common to see newspaper headlines give dire warnings of our drought situation here in Arizona: Can We Weather the Drought?; Wet Week Means Little to Drought; Arizona Farmers Facing Catastrophe; Cities Face Water Limits; We Should Save Water Before Our Future Goes Down the Drain.

From Nogales to Kayenta, the harsh facts behind the bleak headlines make for the stuff of real crises. Arizonans, however, seem to understand neither water's limits nor costs. Responsible policy makers at all levels should constantly be on the hunt for the most effective, efficient and creative ways to save water as well as to educate the people on the limits and costs of this vital resource.

One effort that has tremendous potential for long-term water savings throughout Arizona is the increased reuse of residential graywater. For non-water experts, this is residential "waste" water also defined as water that has been used in the home except water from kitchen sinks and toilets. Most households waste precious drinking water on their lawns, flowers and irrigation when plants can thrive on used water that contain small bits of compost.

According to Oasis Design (<http://www.greywater.net>), other benefits of graywater reuse include:

Less strain on septic tank or treatment plant Graywater use greatly extends the useful life and capacity of septic systems. For municipal treatment systems, decreased wastewater flow means higher treatment effectiveness and lower costs.

Highly effective purification Graywater is purified to a spectacularly high degree in the upper, most biologically active region of the soil. This protects the quality of natural surface and ground waters.

Less energy and chemical use Less energy and fewer chemicals are used due to the reduced amount of both freshwater and wastewater that needs pumping and treatment. For those providing their own water or electricity, the advantage of a reduced burden on the infrastructure is felt directly. Also, treating your wastewater in the soil under your own fruit trees definitely encourages you to dump fewer toxic chemicals down the drain.

Plant growth Graywater enables a landscape to flourish where water may not otherwise be available to support much plant growth.

Reclamation of otherwise wasted nutrients Loss of nutrients through wastewater disposal in rivers or oceans is a subtle, but highly significant form of erosion. Reclaiming nutrients in graywater helps to maintain the fertility of the land.

Increased awareness of and sensitivity to natural cycles Graywater use yields the satisfaction of taking responsibility for the wise husbandry of an important resource.

One way for the Arizona Legislature to encourage the reuse of this water source is to enact a tax incentive for homebuilders and property owners that would either include graywater use equip-

ment into the construction of new homes or for homeowners who want to begin using a graywater system. Such a tax incentive will be proposed this legislative year for homebuilders in the maximum amount of \$200 per housing unit. Homeowners would be credited 25 percent of the hardware costs for their systems, not to exceed \$1,000. Since many houses are not suitable for retrofit at any cost, this tax credit for newly constructed homes would be significantly more affordable and practical.

Drafted legislation would make these incentives temporary, to be in place for no more than five years, with a sunset clause. The idea is to 'prime the pump' so to speak; to get homebuilders used to developing plumbing plans with graywater capture as a routine component and to create a demand for this plumbing feature on the part of home buyers. The hardware to plumb a production home for graywater capture would be no more than \$200 to \$300, and a simple residential graywater system could be less than \$500. Also, the cost to purchase gutters and downspouts for rainwater harvesting to is typically less than \$400.

There are three important factors in Arizona that bring us to this tax policy recommendation. First, the potential for water savings is significant. Up to 40 gallons per person per day; upwards of 140 gallons per family per day is available for landscape irrigation if all sources of residential graywater are utilized. Fifty one thousand gallons of water a year will irrigate a lot of landscape material.

Second, we find ourselves several years into what The U.S. Geological Survey terms "a multi-year drought that now rivals the worst on record for the region." Plenty has been written elsewhere about drought, and few are still in denial about its possible duration and the impacts we each may face in the months and years to come.

Third, Arizona is the second fastest growing state in the nation. As in the last several decades we will continue to grow at a rapid pace, with projected growth from 2000-2005 at 14.2 percent. We will likely exceed 6 million people in 2025 and with this growth comes the need for new housing. In 2003 this amounted to between 75,000 and 80,000 new homes constructed in our state.

The State of Arizona, both urban and rural, is facing a "perfect storm" concerning our long-term water supply and all levels of government need to explore and implement conservation measures to ensure our quality of life. The combination of these three realities brings us to advocate for something new, something well reasoned and appealing to all water managers, political decision-makers and to the public.

Enacted legislation to allow for limited graywater tax credits in Arizona would provide us with a practical and low-cost solution to one of our greatest looming problems, even in a limited budget year. This is a forward-thinking opportunity that could significantly improve our long-term water problems, particularly in fast growing urban areas. To track this legislation, do not hesitate to contact your state legislator or visit our website at <http://azleg.state.az.us> 



Water Resources Research Center

College of Agriculture and Life Sciences

The University of Arizona

UA Water Resources Research Center Grows, Connects

This year marks the 40th anniversary of the Water Resources Research Act. The act established the national state water institute program, providing funds to support a water institute in each state.

One of the themes in the history of the University of Arizona's Water Resources Research Center, evident from its beginnings, is reaching out and making connections — to other Arizona universities, water researchers, government agencies, lawmakers and other water professionals. At the same time, the needs of citizens interested in water affairs have not been neglected. WRRC has reached out and made connections through research, education and public service.

The 40th anniversary of the legislation is marked by WRRC building closer connections, this time by working more formally with other UA water centers. Four water centers are housed at the UA, each with a different mission and purpose, although at the same time they cover some common ground. The other UA water centers are the Engineering Research Center for Environmentally Benign Semiconductor Manufacturing, the Water Quality Center and the center for Sustainability of semi-Arid Hydrology and Riparian Areas. The centers are working closely with water researchers throughout campus, especially those researching water policy and social science issues.



The University of Arizona's Water Resources Research Center serves the people of Arizona, providing news, information and outreach to encourage understanding and awareness of the many and varied water issues of importance to the state. Graphic by Gabriel Leake

WRRC recently received positive results of a five-year review of its activities. The review panel especially noted WRRC's success at attracting university and state support.

The impetus that recently drew the four water centers into a closer working relationship was the administration of the Technology and Research Initiative Fund. This was funding derived from a voter-approved sales tax increase to be devoted to education. A UA TRIF priority was support of water research. The four UA water centers work together to coordinate the Water Sustainability Pro-

gram as part of their TRIF duties. (WSP information is available at www.uawater.arizona.edu)

Further WRRC connections now are in the making, beyond a single campus. Governor Napolitano is proposing the establishment of a virtual water university, to combine the resources of the three state universities: UA, Arizona State University and Northern Arizona University. WRRC already has responsibilities to coordinate its activities with other universities in the state, but Napolitano's proposal goes beyond this. The proposed virtual water university will be without a campus and will unite academic researchers to help focus their work on state water problems. WRRC is involved in preliminary discussions regarding the virtual water university.

WRRC recently received positive results of a five-year review of its activities. The review panel especially noted WRRC's success at attracting university and state support.

Whatever its other accomplishments — and this supplement describes some of them — WRRC's history has been marked by building bridges or connecting with other interests in the state: the Arizona water community, other UA water programs and other Arizona state universities. WRRC's history has been onward and outward. (Check <http://ag.arizona.edu/azwater/>)

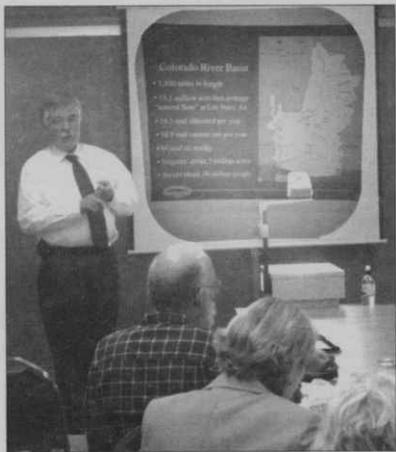
WRRC Plans Statewide Conference

Planning is underway for the next Water Resources Research Center annual conference. The conference topic will be "Water and the Environment: The Role of Ecosystem Restoration" and will be conducted in Tucson, April 6, 2005. The full-day program will feature a mix of keynote speakers, panel discussions and commentary. Speakers were invited who have field experience in the state, and the development of environmental enhancement projects will be featured. Conference topics have been identified, and speakers are being confirmed. Session topics include ongoing efforts in the Verde Watershed; the legal system as a tool for effecting environmental policy; and the Colorado River Multi-species Conservation Plan. The draft conference agenda will be posted on the WRRC web site in January. Contact us at wrrc@ag.arizona.edu to have your name added to the conference email list and receive updates as plans are worked out.

The Tucson conference is the latest in a series of annual WRRC conference. The topic of last year's conference, held in Casa Grande, was the "Future of Agricultural Water Use in Arizona."

Water Expo - 2005 Shows Arizona Lawmakers Sustainability Projects

Water sustainability is the big water issue of the day, and Water Expo - 2005 is an event to inform and educate Arizona lawmakers about projects now underway in the state to achieve water sustainability. The Water Expo theme is: Current efforts toward water sustainability in Arizona.



The Water Resources Research Center conducts a "brown bag" lecture series, with individuals and organizations invited to make lunch-time presentations. Above is Bob Johnson, Lower Colorado Regional director for the Bureau of Reclamation, discussing Colorado River issues at a Nov. 12 brown-bag session. Photo: Joe Gelt

The University of Arizona's Water Sustainability Program, with support from the Central Arizona Project and the Salt River Project, is coordinating the Water Expo, scheduled for Jan. 25, which will feature various exhibits and displays set up on the Senate lawn of the Arizona State Capitol.

Dana Flowers, who is organizing the event, says, "Much time is spent talking about the current drought situation and trying to figure

out what needs to be done . . . (Water Expo) is to make people aware there are things happening now, that there are great advances going on."

Organizations that are involved with projects reflecting the Water Expo theme were invited to exhibit. Water Expo presenters include municipalities from around the state, consultants, non-governmental organizations, tribal governments, state agencies and water companies. Northern Arizona University, Arizona State University and UA will also have displays. About 45 presenters are expected to participate.

The principle audience of the Water Expo are the Arizona State Legislators and water professionals from around Arizona.

WRRC Newsletter Gets Around

The *Arizona Water Resource* newsletter mailing list includes over 2500 names. Readers are from 42 states and 14 foreign countries.

New Book Informs Public About Water Treatment Devices



Arizona: Know Your Water, a Consumer's Guide to Water Sources, Quality, Regulations and Home Water Treatment Options. A collaboration of Janick Artiola, the Dept. of Soil, Water and Environmental Science, with Kitt Farrell-Poe, Dept. of Agricultural and Biosystems Engineering; Jackie Moxley, program coordinator at the Water Resources Research Center, assisted with production. Funded by University of Arizona, Technology and Research Initiative Fund (TRIF), Water Sustainability Grants Program.

This volume offers a wealth of information to help consumers make informed choices about the need and use of home water treatment devices. The information is organized into six sections and includes specific references to Arizona.

The water treatment section is the focus of the booklet. Deciding whether a home treatment device is needed is the first consideration. Six different treatment options are reviewed: particle and microfiltration; activated carbon filters; reverse osmosis; distillation; ion exchange water softening; and disinfection methods. There are illustrations, descriptions, an outline of the principles of the technology, types of models, operation and maintenance, and costs for each of the options. The two different types of installations for treatment devices: point-of-entry into the household to treat all water and point-of-use are covered. A list of questions to ask when purchasing water treatment equipment guides consumers in making the right choice.

Copies will be available free of charge at county extension offices, libraries, the Water Resources Research Center and on-line through CALSmart at <http://ag.arizona.edu/calsmart/> (shipping and handling charges will apply). An electronic down loadable version will be posted on the Water Sustainability Program web site <http://uawater.arizona.edu>



Water Education for Teachers

In a world where waterborne disease is responsible for 2 to 5 million deaths each year, people need to understand the importance of clean water in their lives. In a region where no end to the current drought has been forecast, people need to know what a drought is, where their water supply comes from, and how it is managed for their use. In a state in which the Governor has called for a water conservation plan and curriculum, people need to know what their options are to save water.

Education is the key! Opening the door to information is the goal of a statewide, comprehensive, teacher-tested water education program available to Arizona educators. The Arizona Project WET Water Education for Teachers program offers engaging, understandable, interdisciplinary, and hands-on lessons for teaching K-12 students about water.

Content & Teaching Methodology

The cornerstone of this program is the "Project WET Curriculum and Activity Guide." Teachers and scientists participated in work-



shops where 500 lessons were developed by 350 brains working together! Of the 500 lessons, 91 were chosen and tested by classroom teachers with 35,000 students. Fully correlated to all articulated Arizona Academic Standards, the lessons are con-

structivist and inquiry-based and help teachers meet testing requirements and improvement guidelines.

Water is always a relevant subject! The Project WET curriculum is comprehensive covering the physical and chemical properties of water, water in life systems, water in earth systems, water as a natural resource, water management and water as a part of social

AZ Project WET Provides Key to Water Education

history and cultural constructs. Additional guides provide in-depth coverage of specific water topics including the "Conserve Water Educators Guide," "Discover a Watershed: The Colorado" and "Healthy Water Healthy People Water Quality Educators Guide." Hands-on teaching tools are available to teachers at four locations across the state to facilitate an understanding of groundwater, watersheds, nonpoint source pollution, water history and conservation.

Delivery Network

Yet water education guides, lessons and materials don't make effective water education a reality. In Arizona, a unique statewide delivery network consisting of state coordinators, community partners, and facilitators enables us to deliver water education to teachers and students. Community partners and state coordinators work together developing local water education programs that meet the needs of that community. Community partners often work at city conservation offices or the University of Arizona's Cooperative Extension and share the common goal of water education outreach.



Facilitators are trained to conduct teacher workshops in their areas. Facilitators are active teachers and district administrators, professionals from city conservation offices, federal and state agencies, extension offices, universities, state and county parks, Indian tribes, private consulting firms, and they include retired teachers. They come from wide-ranging Arizona communities, from Williams to Sierra Vista, from the Navajo Nation to Yuma.

Teachers participate in engaging 8-to-16-hour workshops held throughout the state. Districts and individual schools can request a workshop at no charge thanks to program sponsorship. Since January 2000, 1,913 teachers and educators have participated in workshops, and they reported reaching 93,639 students annually.

Statewide Collaboration

A true statewide collaboration is responsible for the success and continued growth of this water education program. Federal, state and city governments, private companies, universities, tribal governments, civic organizations and interested citizens sponsor programs with funding, in-kind donations and/or volunteer hours. With everyone working together, we have a strong foundation for producing effective water education in the state (see Water Festival sidebar). "Drought" and "Waters of Arizona," both 16-page Kids in Discovery booklets, are due out in spring 2005 thanks to the efforts of our state sponsors. Join us in promoting water education in Arizona: <http://ag.arizona.edu/azwater/wet/>

Project WET's Water Festivals Celebrate Water

What do thousands of elementary students, hundreds of volunteers, and countless gallons of water have in common? They are the essential ingredients in the Arizona Make a Splash with Project WET Water Festivals! Designed to teach 4th and 5th grade students about groundwater, watersheds, the hydrologic cycle, the value of water and more, water festivals are structured enjoyable hands-on learning experiences. Collaborating with sponsors and community partners, the Arizona Project WET program supported five water festivals at locations all over Arizona reaching 2,600 students.

Water Festivals are growing in popularity! A Future Water Festival Committee meets regularly to explore ways to reach more students and develop a network of support and funding. A business plan was completed summer 2004 to address the expansion of the water festival effort while maintaining the effectiveness of the learning experience. With a program coordinator now in place at the WRRC, the program is looking for long-term sponsors, community partners and local coordinators in all areas of the state. Contact: Chrissy Mance at cmance@ag.arizona.edu or 520.792.9591 ext. 63.

WRRC Staff's Varied Roles Include Water Researcher

Research has been a key Water Resources Research Center activity since the program's inception. WRRC administers a federal grants program (see sidebar), and staff members are involved in various research projects. Following are brief descriptions of some staff research projects.

Environmental Enhancement Studied

WRRC Director Sharon Megdal is working on two projects related to environmental enhancement in Arizona. The first, funded by the U.S. Army Corps of Engineers, focuses on ecosystem restoration projects in Pima and Maricopa counties. The second project, funded by the U.S. Bureau of Reclamation, is examining a broader array of environmental enhancement projects in terms of project partners, project location and project funding. The determination of projects to be included in the latter study is under way. Two meetings were

held in late October to gather input on projects. These may range from projects developed by private landowners to large projects developed by local, state, federal and/or tribal entities.

Depending on the nature of and funding for the environmental enhancement projects, these efforts are typically called environmental preservation, environmental



Ed Pastor Kino Environmental Restoration Project

restoration or environmental mitigation. The studies are designed to understand the purposes of the projects, their design, including their water requirements and any water quality improvements, and their long-term viability and public benefits.

Research Assistant Jennifer Jones, a student in the School of Landscape Architecture, has been assisting Dr. Megdal.

Using Climate Info to Manage Colorado River Basin

An interdisciplinary team of UA researchers has initiated a two-year project to examine the use of climate information in the management of the Colorado River basin. Kathy Jacobs of the WRRC is project manager, supported by Dustin Garrick, a graduate student in the UA Geography Department. The UA and the Bureau of Reclamation have provided support for the project. Titled, "Enhancing Water Supply Reliability Through Improved Predictive Capacity and Response," the project addresses four primary objectives aimed at integrating climate information into management of Colorado

River water supplies.

Project objectives include assessing current Reclamation use of climate information in water resources modeling; identifying strategies to better utilize paleoclimatology, climate forecasts, and climate change predictions to improve water supply predictive capacity for the lower Colorado River and the Central Arizona Project; evaluating existing management tools to translate improved predictive capacity into enhanced supply reliability for water users; and developing practical supply reliability strategies for use by municipalities, irrigation districts and other stakeholders. Other PIs are Bonnie Colby, Dept. of Agricultural and Resource Economics; Dave Meko, Tree Ring Lab; and Bart Nijssen, Dept. of Hydrology and Civil Engineering.

Paleoflood Hydrology Reveals Flood Danger

The South Boulder Creek (SBC) watershed is of critical concern to the citizens of Boulder, Colorado. Aside from the year-round water supply provided by the Gross Reservoir, the SBC has a long history of producing disastrous floods. A new study was commissioned to understand the dangers posed by this watershed; one requirement of this study was that it utilize a new way of studying ancient floods known as "paleoflood hydrology."

Drs. Justin Ferris of the WRRC and Bob Jarrett of the U.S. Geological Survey conducted the paleoflood study. It involved analyzing all the tributaries within the SBC watershed for evidence of past flood peaks, recorded in the heights and orientations of rocks and sediment, as well as scars left upon old trees and rocky channel walls. The magnitude of these ancient floods is then reconstructed by computer simulation, and the results were startling.

While it may be sufficient for water storage and supply, it now seems that the Gross Reservoir was not well situated for flood control purposes. There exists just below the Gross Reservoir a key hydroclimatic regime: an area where orographic factors and steep slopes conspire to produce large, fast floods and landslides.

Managing Effluent in Ambos Nogales

Senior WRRC Research Associate Terry Sprouse, with Fulbright Grant funding, has been researching issues related to management of Mexican effluent in Nogales, Arizona and Nogales, Sonora (Ambos Nogales). He is examining possible new mechanisms for management and how these new developments may present opportunities for an agreement between Mexico and the United States.

Effluent is an increasingly important renewable water resource in Ambos Nogales. A problem lies in the uncertainty that surrounds the effluent, both in Mexico and in Arizona. While the effluent currently is discharged and utilized exclusively in Arizona, Arizona law restricts its use because it belongs to Mexico, making its long-term availability uncertain. Mexico retains the legal right to use its portion of the effluent, even though it is treated in Arizona. Mexico's uncertainty lies in the fact that it is both losing its water and incurring a cost for treating the water, and there is presently no group or agency in Arizona to compensate Mexico for the effluent. With more cooperation, better management of shared water resources would result as well as an improved capacity to anticipate and cope with systemic stresses such as drought, which affect both communities. ■

WRRC Administers Grant Program

WRRC administers the federal Water Resources Research Act, Section 104b program. This funds water research at Arizona's three state universities, enabling researchers to address critical state water concerns. WRRC received 11 proposals for the next round of 104b funding: 7 from the UA, 3 from Arizona State University and 1 from Northern Arizona University. The deadline for proposals was November 22, with awards announced prior to January 15.



Legislation and Law

Arizona Seeks to Change CAP's Junior Colorado River Allocation

With drought continuing and water supplies tightening, Arizona is considering options to ensure adequate water resources. One option being considered is getting its Central Arizona Project allocation upgraded from its present junior priority status to a category to ensure a more equitable allocation of Colorado River water during times of water shortages.

In effect, Arizona's junior status means if a shortage is declared on the Lower Colorado River the state would be at a disadvantage compared to other lower basin states. CAP could possibly have its entire 1.5 million acre-feet allocation cut before California loses a drop.

This has been a longstanding issue that drought has brought to the foreground. Obtaining Congressional approval for CAP in 1968 resulted in Arizona having to accept limitations to its Colorado River entitlement. California had exerted its political muscle. No limitation; no CAP. The result: Arizona ended up with a junior priority status. Should shortages occur on the Lower Colorado River — and shortages may be on the horizon — CAP is stuck with the lowest priority.

What Arizona wants is a more equitable system for sharing shortages, with the other lower basins also bearing some of the effects. Yet the state would seem to be at a distinct disadvantage in negotiating its cause. It is actually to California's advantage for Arizona to lose its full 1.5 CAP allocation before California suffers any cutback. Nor would it seem at first that Nevada's self-interest is necessarily served by supporting Arizona's position.

These, however, are unusual times. Drought stalks the land, and states are taking action to cope with water shortages and their effects. Does the current state of affairs provide Arizona any leverage to press its case?

One situation that may work in Arizona's favor is management of its water bank. The state is now banking part of its CAP allocation by taking water from the river and pumping it underground for future use. If instead of banking the water, Arizona left it in the river the supply would help maintain reservoir levels that are dropping due to drought.

California and especially Nevada would prefer that the reservoir levels not drop too drastically. Las Vegas pumps water directly from Lake Mead, and dropping reservoir levels threaten the city's water supply. One concern is that the reservoir level will drop below the level of the city's intake, at about 1050 feet.

Dropping reservoir levels also threaten power supplies. A depleted reservoir, with little or no water to release, lacks generating capacity. Water Arizona is now banking could, if left in the reservoir, be used to turn turbines and generate power for Nevada and California.

California and Nevada prefer that Arizona top water bank. In effect, this means Arizona, instead of banking its water underground, would leave it in the river to be withdrawn at a later date.

What, if any concessions Arizona can gain negotiating its water

bank operations remains to be seen. Perhaps other possibilities are more likely to work to Arizona's advantage and result in the state having its junior status reduced or removed. One such possibility has to do with the political implications of enforcing the state's junior status.

Although the legal authority exists for cutting off Arizona's CAP allocation in the event of shortage, this is an action the Secretary of the Interior would not likely want to take. To penalize so significantly a single state would be a very difficult political decision to uphold. It would be a decision fraught with political complexities.

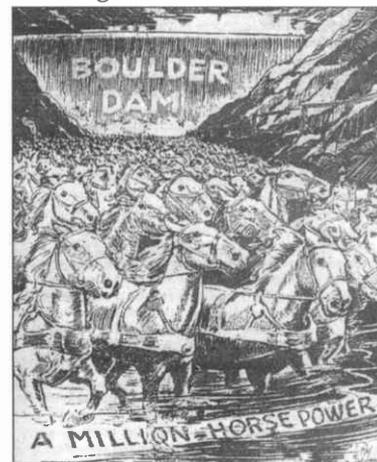
Consider also the internal politics of the state. It is CAP that has junior rights, not necessarily other Arizona water users along the Colorado River. The state's actual Colorado River allocation is 2.8 maf, with Colorado River communities getting 1.3 maf and CAP 1.5 maf. A declared shortage will result in CAP taking a hit, not necessarily the water users along the river. Tucson and Phoenix area citizens might be forced to give up water supplies so that Yuma and Wellton-Mohawk could get their full allocation. This situation would not sit well with many state leaders.

Another development that might work in Arizona's favor is the spirit of concern now shared by the lower basin states. A present priority among the states is to agree on plans to share water shortages lest the federal government steps in and makes decisions for the states. Possibly this we-are-all-in-this-together attitude will result in an opportunity for Arizona's junior status to be reconsidered.

Larry Dozier, CAP deputy general manager believes that if this were to occur all lower basin states would benefit since smoother and more productive negotiations would then result. He says, "If we are all at a level playing field, better resource management decisions could be made."

Dozier, however, realizes that changing Arizona's junior status is a difficult task. He says, "We're going to have to wait for the moon and stars to get into the right alignment as well as the congressional delegation. ... This is a really sensitive issue in need of a tremendous breakthrough ... or a coup in Congress."

The recent Arizona Town Hall also addressed the issue. One of its recommendations is that the state continue its efforts to upgrade its CAP's junior level for Colorado River water. ■



Above is a 1926 cartoon from the Los Angeles Examiner promoting the building of Boulder Dam with its power generating capacity. Drought now threatens the dam's generating potential.



Publications & On-Line Resources

WRRC Offers Water Map, Announces New Version of Desert Landscaping CD



Version 2.0 of the **Desert Landscaping CD ROM**, Desert Landscaping CD ROM, a Water Resources Research Center's project to encourage appropriate desert plant selection, will be available in the spring. Desert Landscaping is a valuable tool for desert gardening needs, whether identifying the right plant for a container or choosing low water-use vegetation to landscape yard or patio.

It has become a standard Southwest resource, used by thousands of home and professional gardeners. Over 10,000 copies of the first version were sold. The Desert Landscaping CD-ROM will be available at nurseries and bookshops. The CD also is available directly from the Water Resources Research Center for \$30, including shipping.



Every state deserves a water map, and the Water Resources Research Center is the proud producer of the **Arizona Water Map**. The map was first published in 1994, and its presence on the walls of offices, classrooms and libraries attests to its popularity and usefulness. Over 7,000 copies of the map were distributed. A new of the Arizona Water Map was published in 2002. Like the original map, this completed

revised version was designed to be attractive and informative; in other words, to please the eye and engage the mind. Copies are available for \$8.00 from the WRRC. Proceeds from the map are earmarked to support water related educational activities and for future reprinting costs.

Freshwater Resources: Managing the Risks Facing the Private Sector

Jason Morrison and Peter Gleick

A recent Pacific Institute report outlining the effects of water scarcity on businesses warns that water shortages could threaten corporate health. The report identifies a range of worrisome trends that impact businesses but also recommends ten steps companies can take to address water-related issues. Steps include measuring current water use and establishing water * with specific goals and performance targets. The report also gives examples of companies using these strategies. The report is available at http://www.pacinst.org/reports/business_risks_of_water/business_risks_of_water.pdf

Confronting the Nation's Water Problems: The Role of Research

Committee on Assessment of Water Resources, The National Academies Press, \$47 paperback, \$42.30 if purchased online at <http://books.nap.edu/catalog/11031.html>. Also it can be read free online.

This congressionally mandated report calls for a new U.S. commitment to water resource research. An identified priority is for a new strategy to coordinate water research currently fragmented among nearly 20 federal agencies. According to the committee, various developments — competition for water among farmers, communities, aquatic ecosystems and other users, climate change and the threat of waterborne diseases — justify that an additional \$70 million in federal funding be annually allocated to water research. Areas identified in special need of research include water demand and use and water supply augmentation. The report notes that overall real-term federal funding for water research has been stagnant for the past 30 years, with the portion dedicated to research on water use and social science topics actually having declined considerably.



Guía para la Conservación de las Aguas Grises

by Val Little

Translators: Cesar García and Jason Cole; Editor: Guillermo García

This is the Spanish version of "Graywater Guidelines," a booklet written for the novice or layperson. It clarifies graywater issues in a simple and straightforward manner and includes helpful illustrations. The text will help readers decide if graywater is suitable for them and provides guidelines on a variety of appropriate materials and methods of system installation. The booklet is a publication of Water CASA (Water Conservation Alliance of Southern Arizona). Check the Water CASA web site for information about the obtaining a copy. (<http://www.watercasa.org>)

Surveillance for Waterborne-Disease Outbreaks Associated with Drinking Water

Brian G. Blackburn

Fewer Americans have become sick from drinking tap water in 2001-2002 than the previous two-year period, according to a new study. Just published in the Centers for Disease Control and Prevention's "Morbidity and Mortality Weekly Report," the report looks at 31 waterborne disease outbreaks (WBDO) that were reported in 19 states. To obtain this study, go to <http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5308a4.htm>



Special Projects

ASU Center Will Study Water Resource Decision-Making

Arizona State University's new \$6.9 million Decision Center for a Desert City will use Phoenix as a laboratory to study concerns common to all developing desert cities. To address one of the most critical concerns of such cities — planning and managing growth with limited water resources — DCDC will study water resource decision making in the Phoenix area.

Funded by the National Science Foundation, the center aims to produce new knowledge, information and tools to promote informed decision-making. The program's primary focus will be to investigate human decision-making under climatic uncertainty, and it will take into account short-term climate variability and long-term climate change.

The project is a response to the growing awareness that even a reliance on the best available science will not significantly reduce uncertainty about global climate warming and the climate cycles that cause droughts, floods and other severe weather events.

Patricia Gober, professor of geography and project co-director says, "Society must learn to make better decisions in the face of uncertainty. Our theme is the creation of partnerships between scientists and decision makers to study and understand the complex relationships between rapidly growing population, finite water resources and climatic variability."

The program is a cooperative venture, involving various academic disciplines and community agencies. Gober says, "Our team of scientists from geography, anthropology, sociology, management, psychology, math, computer science and public affairs will work with our community partners (City of Phoenix, Salt River Project, Arizona Department of Water Resources, Maricopa County Flood Control District and the U.S. Bureau of Reclamation) to enhance the region's adaptive capacity to make informed decisions about water management given these climatic uncertainties."

Along with Gobers, other principal investigators are Charles Redman, director of ASU's Center for Environmental Studies, Grady Gammage, senior fellow at ASU's Morrison Institute, Robert Bolin, a sociology professor and Thomas Taylor, an associate professor of math and statistics.

Gammage says they have been discussing a series of possible projects to kick off the program. One possibility is to develop an integrated water supply-demand model for the Phoenix metro area. Another possibility involves determining how much water is actually saved when xeriscape is mandated in new Phoenix subdivisions. Also being considered is an analysis of the impact on the heat-island effect when green vegetation is removed.

Another possibility is to conduct drought vulnerability analysis of particular neighborhoods to determine the effect of different drought responses, such as rate increases or rationing, on the neighborhoods. This would raise socioeconomic and social equity questions. DCDC also might contribute to the on-going efforts of the Governor's Drought Task Force.

ASU views DCDC as a long-term program extending beyond

the initial NSF-funded five years. It is expected to complement ASU's research efforts that look at urban growth and the environment, with an emphasis on creating a sustainable community.

DCDC will have access to a valuable research tool with ASU's Decision Theatre. This three-dimensional "immersive environment" allows researchers to use computer modeling, analytic techniques and simulations to analyze the real-world effects of policy decisions. DCDC researchers will be able to use real information and scientific data to create "what if" scenarios showing how decisions about water use and growth affect a desert city.

DCDC is the third major NSF-funded center in Arizona to address water issues. The agency also funds two centers at the University of Arizona: the Sustainability of semi-Arid Hydrology and Riparian Areas which promotes sustainable management of water resources in semi-arid regions and the Water Quality Center which conducts research to evaluate physical, chemical, and microbial processes affecting drinking water. ■

ASU Project to Study Nanomaterials in Drinking Water

The U.S. Environmental Protection Agency recently announced funding for an Arizona State University project to study the fate, transport, transformation and toxicity of manufactured nanomaterials in drinking water.

Nanotechnology is the ability to work at the molecular level, atom by atom, to create materials and structures with fundamentally new functions and characteristics that give them unique properties. Currently there is limited scientific information about the implications of manufactured nanomaterials on human health and the environment. The concentration of nanomaterials in the environment is not thought to be a current problem. With decreasing manufacturing costs and the discovery of new applications, this could change.

The objectives of the three-year project are: 1) to characterize the fundamental properties of nanomaterials in aquatic environments; 2) to examine the interactions between nanomaterials and toxic organic pollutants and pathogens (viruses); 3) to evaluate the removal efficiency of nanomaterials by drinking water unit processes; and 4) to test the toxicity of nanomaterials in drinking water using cell culture model system of the epithelium.

Intended program results are to provide essential information to support policy and decision-making regarding handling, disposal, and management of nanoscale materials in commerce, manufacturing and the environment.

The project's principal investigators are Paul Westerhoff, Yongsheng Chen, John C. Crittenden, Department of Environmental Engineering; David Capco, Department of Biology.



Announcements

AWRA National Water Resource Dialogue in Tucson

The 2nd National Water Resources Policy Dialogue will be held in Tucson Feb. 14 and 15. Convened by the American Water Resources Association and sponsored by 11 federal water agencies, the conference will include three keynote addresses and panel discussions on three key issues: infrastructure management, water resources supply and demand, and environmental quality. Speakers and panelists will be drawn from all levels of government, academia and the private sector. While key issues will be national in scope, within each key issue, western concerns will be addressed. Check the AWRA website (<http://www.awra.org>) for additional information.

Xeriscape Conference in Albuquerque

The Xeriscape Council of New Mexico is sponsoring the 10th Xeriscape Conference and Exhibits Feb. 24-26 at the Albuquerque Convention Center. Key speakers include Robert Glennon, Shlomo Aronson, Randall Arendt, Gary Nabhan, David Salman and Art Ludwig.

The 2-day conference will be followed by a free-and-open-to-the-public day of seminars and exhibits on Feb. 26. The over 120 exhibitors will include nurseries, irrigation companies, landscape architects and designers, gravel/mulch companies, rain barrel companies, landscape art, etc. Online registration is available at: <http://www.xeriscapenm.com>

WQA Hosts Exhibit, Conference

The Water Quality Association is holding an exhibition and conference in Las Vegas, with the conference scheduled Mar. 29 - April 2 and the exhibition Mar. 30 - April 1. Titled WQA Aquatech USA 2005, the event will bring together a diverse group of water-related industries including process water, drinking water, ultrapure and wastewater for household, commercial and industrial uses. Lectures on water management will be provided, focusing on topics such as business operations and marketing. There will also be technical seminars available for key installation and maintenance visitors. Aquatech USA aims to provide a one-stop event that connects technologies, know-how, education, networking, and business opportunities to multiple water industries. For more information, check <http://www.wqa.org>.

WaterReuse Symposium Call for Papers

The WaterReuse Association issued a call for papers for the 2005 WaterReuse Symposium to be held in Denver, Sept. 18 - 21, 2005. Sponsored by the American Water Works Association and the Water Environment Federation, the WaterReuse Symposium is devoted to water reuse and desalination. The Symposium theme is "Water Reuse & Desalination: Mile-High Opportunities." Abstract instructions, including submittal form and water reuse and desalination

subject areas, can be downloaded from the WaterReuse Association's website at www.WaterReuse.org. Abstracts must be received by Feb. 9.

Membrane Tech Conference in Phoenix

Membrane technology, a process of purifying water, will be the topic of a conference in Phoenix on March 6-9. The Membrane Technology Conference and Exposition, co-sponsored by the American Water Works Association, the International Water Association and the European Desalination Society will showcase the newest applications and developments in the fast-growing field. Areas of focus will be regulatory and operational issues, membrane cost modeling, advances in technology, the latest research in the field and more. The conference will provide an opportunity for engineers, researchers and many others to gain new insights, share solutions and network with industry peers. For more information, visit <http://www.awwa.org/conferences/membrane/>

RFP: Water Resources Research Act, 104(g)

The U.S. Geological Survey in cooperation with the National Institutes for Water Resources requests proposals for the National Competitive Grants Program (Section 104 G of the Water Resources Research Act), to support research on the topics of water supply and water availability. Researchers at Arizona state universities are eligible to apply and must submit their applications through the University of Arizona's Water Resources Research Center. Proposals can be for projects of 1 to 3 years in duration and may request up to \$250,000 in federal funds, with successful applicants required to match federal grant funds with non-federal sources.

Proposals must be filed on the Internet <http://www.niwr.org> by February 22, 2005. The WRRC then has until March 4, 2005 to review proposals and submit them to the National Competitive Grants Program. The RFP is available at https://niwr.org/2005_104G_RFP or <https://niwr.org/>

There has not yet been a FY 2005 appropriation of funds for this program, but the amount available for research under this program is anticipated to be \$1,000,000.

This is a highly competitive funding source. Last year, however, Shlomo Neuman of the UA Department of Hydrology and Water Resources received \$131,976 to study "Forward and Inverse Transient Analytic Element Models of Groundwater Flow," and, David Quanrud of UA Arid Lands Studies received \$152,926 to study "Pharmaceutically Active Compounds: Fate in Sludges and Biosolids Derived from Wastewater Treatment."



Public Policy Review

by Sharon Megdal

Past, Present AZ Town Halls Raise Water Issues Needing Attention



In 1997, I attended my first Arizona Town Hall. The topic was water. This fall, I had the privilege of attending the 85th Town Hall, entitled "Arizona's Water Future: Challenges and Opportunities," in a dual role. Because I served as one of the authors of the background research report, I served as a resource consultant to one of the panels. But

I also was a participant involved in the panel's discussions and deliberations. This was the largest Town Hall ever. Almost 180 people participated. It was a stimulating few days!

To me, there were some marked differences between the atmosphere of this most recent Town Hall and the one several years ago. Seven years ago, a major concern was the formation of new Active Management Areas. I recall the strength of the opposition to the concept of extending state regulation of groundwater beyond existing AMA boundaries. The 1997 Town Hall was very clear on this. The Report concluded that "the AMA model is not the appropriate mechanism for local problem-solving and development of long-term water planning." The recent Town Hall accepted this conclusion as a given. The focus this time was more on how to meet the informational and financial needs of local and regional efforts to develop and implement water resource plans.

In 1997, the Arizona Department of Environmental Quality was beset by difficulties and its viability as a state water agency was questioned. The report recommended "consideration be given to merging some of ADEQ's water quality programs into ADWR to ensure continuity in water management. ... One agency should be responsible for coordinating and managing water quantity and quality." Now on firmer ground, ADEQ wasn't focused on this year.

Instead, the importance of providing resources to enable the Arizona Department of Water Resources to carry out a much-expanded mission was the focus of much discussion. The importance of this issue can be gauged from a motion unanimously adopted during the plenary session: "The primary recommendation from this Town Hall is that dedicated and secure funding sources be created to finance Arizona's critical water management, planning and infrastructure needs. Without such secure funding, the other recommendations of this report are not achievable."

Other recommendations included that ADWR be responsible for collecting and disseminating information about water supplies and demand, particularly in non-AMA areas. It was also concluded that ADWR should be responsible for coordinating long-range, statewide water planning. The report stated: "ADWR must play a central leadership and advocacy role. The Agency's statewide mission should be expanded and strengthened in the areas of policy development, planning and data collection. ADWR's strategic plan should be implemented by local policymakers on a regional basis. Town Hall recommends that a primary objective in any planning

process is for ADWR to collect comprehensive hydrologic data on all Arizona water resources, including water quality in conjunction with ADEQ, and disseminate such information throughout the state. It also should lead in the statewide conservation campaign."

Town Hall's front-and-center attention to ADWR is appropriate. The state agency would be responsible for carrying out many of the recommendations, if implemented. Fulfilling these new functions would require considerable financial resources and talent, and the agency already is in financial straits, unable to perform its current mission. The Town Hall recommended that ADWR receive additional resources to help it meet the challenge of assisting in the resolution of Arizona's current and future water challenges.

In addition to increased general fund appropriations, it was recommended that "costs caused by growth should be funded by growth" and new funding mechanisms be explored. The funding mechanisms specifically mentioned included bonding (which is really a method of financing), exempt well fees, federal programs such as Water 2025, surcharges, permit and impact fees, private sector donations coupled with tax credits or deductions, property taxes, and user taxes. This is quite an inclusive list, but perhaps the most important part of the primary recommendation is the inclusion of the word "secure." This acknowledges that it would not do much good if increased revenues generated by new funding sources were used to replace existing general fund revenues.

The serious drought conditions and their implications were covered in the Town Hall background report and reflected in the report adopted at the closing plenary session. Although continuing to grow at a rapid pace, many of the state's communities have not quantified the water resources needed for expected growth. Town Hall participants questioned whether the general public understands the critical nature of Arizona's water issues. The Report stated, "In the short term, all Arizonans must be educated about the severity of the [drought] issue, supply limitations and potential solutions." The Town Hall called for increased water literacy.

The importance of education at all levels was highlighted, with the report emphasizing development of a conservation ethic and recommending that Arizona "take a national leadership role in developing and implementing a new K-12 conservation curriculum that is aligned to the state educational standards." We at the Water Resources Research Center already are assuming a leadership role. Arizona Project WET, as well as other programs and individuals, have been working on aligning water resource curricula with state standards. We can attest to strong community and water company support for conservation and general water stewardship curricula. Additional resources will enable us to train teachers to integrate water into their instruction and generate the financial resources to support delivery of water education to all Arizona schools.

This was the fifth Arizona Town Hall to address water issues. Let's see if we can resolve some of these critical water issues prior to the sixth. We have our work cut out for us! 🏗️

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ment is seen to promote more effective and productive Colorado River discussions among the basin states. Nevada's acute water needs would be an issue to complicate whatever negotiations might occur.

Terms of the Agreement

The amendment provides advantages to both states. Some terms within the amendment are the same as what was included in 2001 agreement. For Nevada, the crux of whatever deal is worked out is obtaining critically needed water supplies, and the amendment still ensures Nevada's access to 1.25 million acre feet of excess CAP water. Further, Nevada would continue to bear the full cost of storing and later recovering the water.

The amendment also includes some significant changes to the agreement. Per the original agreement, AWBA promised its "best effort" to store sufficient supplies of Colorado River water to enable Nevada to pay for and earn 1.25 million acre-feet of long-term storage credits. The amendment changes "best effort" to "guarantee" of specific annual delivery amounts. Some officials are nervous with the word change. It is argued in response that although a guarantee creates some risks for shorting Arizona, the amendment's financial and political advantages make it a risk worth taking.

Also the amendment reduces the annual recovery obligation. Under the 2001 agreement, Nevada could request recovery up to 100,000 acre feet in any given year. The amended agreement's upper limit is only 40,000 acre feet except during shortage years.

The amendment also differs from the agreement by paying Arizona \$100 million up front in January 2005. The funds are to assist Arizona acquire alternative supplies in the event its obligation to Nevada cannot be met with CAP water. Discussions about possible options for developing alternative water supplies include paying willing partners to fallow land and purchasing a water ranch. According to AWBA and CAP calculations, however, such a situation

is unlikely, with studies indicating that sufficient water will be available to bank to meet the 1.25 million acre-foot obligation even after all Arizona water needs are met.

Along with the \$100 million Arizona also will receive ten annual payments of \$23 million beginning January 2009 to pay for storage. Recovery of that water would accelerate the development of needed water-recovery plans and help pay for required infrastructure.

A further advantage is that an interstate water banking arrangement provides revenues to Arizona to fund environmental programs. Excess CAP water delivered for interstate water banking purposes includes a fee collected in lieu of the ad valorem property tax currently levied within the CAP service area. With this property tax equivalency component set at \$20 per acre foot in 2004, developing 1.25 million acre feet of credits would ring up revenues in excess of \$24 million.

Both the original agreement and the amendment provide this benefit, but the amended agreement provides the funds up front, thus allowing a more flexible use of them. The funds could be used to support the Arizona Water Protection Fund and Arizona's portion of the Multi-species Conservation Program.

Lest the AWBA's budget again tempt raiders, steps are being taken to protect funds obtained through the amendment. Plans call for the money to be deposited in an interest bearing account with strict controls on its use. The AWBA Commission will provide oversight of expenditures that would occur only after public input. The expenditures would then be detailed in the AWBA annual plan of operation which is subject to public review and comment prior to its approval.

The Central Arizona Water Conservation District approved the amendment at its Dec. 2 meeting, and the AWBA Commission followed suit at its Dec. 9 meeting. The Southern Nevada Water Authority is scheduled to meet Dec. 16 to discuss the amendment. Its approval is expected. ■



Arizona Water
Resource

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