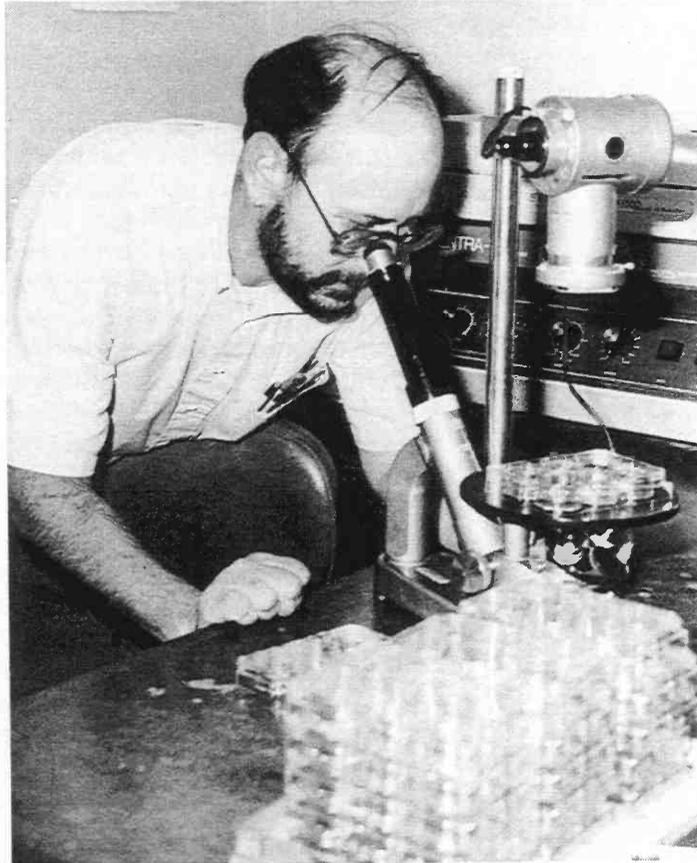


### DWR Proposes CAP Marketing Criteria

Responding to the Town of Payson's sale of its Central Arizona Project (CAP) subcontract to a developer, the Department of Water Resources (DWR) has proposed criteria for approval of future transactions. Payson exchanged its CAP Municipal and Industrial (M&I) subcontract entitlement with North Scottsdale Developers in exchange for money to be used to develop water supplies nearer to Payson. North Scottsdale in turn transferred the subcontract to the City of Scottsdale in lieu of paying the City's water resource development fee for water service to its planned development. The "exchange" was approved unanimously by the Central Arizona Water Conservation District (CAWCD) at its March 11 meeting.

DWR, which had assumed any transactions involving CAP M&I subcontracts would be exchanges for other water supplies, was caught by surprise by the cash-for-contract

*continued on page 2*



*University of Arizona Microbiologist Chuck Gerba searches for water-borne pathogens. Searching for water experts at the three state universities now is easier with the help of the WRRC's computerized expertise directory. Database searches on nearly 200 university employees with water-related expertise can be submitted by phone, FAX, or mail. See AWR, this issue p. 8. (Photo: B. Tellman, WRRC)*

### DWR Mulls Assured Water Supply Comments, Economic Impacts

The Department of Water Resources (DWR) received comments from over 80 individuals and groups on the Draft Assured and Adequate Water Supply (AWS) Rules. DWR anticipates making a number of changes in the proposed rules in response to suggestions and criticisms received.

The 80-plus commentors voiced some 710 separate concerns and questions. Of these, 215 were general comments not directed at any particular section of the proposed rules. The most frequently heard comment (11 occurrences) was that the timing of the AWS rule-making was poor. Pending CAP reallocations, discussions of CAP restructuring, the incomplete state-wide water resource assessment, and insufficient time to review and comment on rules all were mentioned as reasons to slow the process.

Many of the respondents argued the draft rules are unworkable or unconstitutional, with eight comments describing the rules as a taking of water rights and nine comments claiming that the rules cannot be complied with. Another six comments stated that the draft rules destroyed or rendered

*continued on page 2*



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*CAP Marketing cont. from page 1*

transaction. Previously discussed transactions involving CAP exchange contracts involved an "upstream" subcontractor being allowed to divert surface water in exchange for delivery of their CAP allocation to the affected "downstream" water rights holder. While Payson has stated its intent to spend the funds received for its CAP subcontract on water supply development, it is not obliged to do so.

Questions raised by the transaction include: what marketable property right if any does a CAP subcontractor hold? Should costs be imposed on parties holding unused subcontracts so as to discourage speculative hoarding? What incentives can be offered holders of under-utilized subcontracts to market them without raising the specter of profiteering?

DWR has called on CAWCD and the Bureau of Reclamation to develop criteria for evaluating future proposed CAP subcontract sales or leases. DWR is trying to balance the need to act before other holders of exchange subcontracts, such as Prescott, enter into similar agreements, with the desire to avoid hasty policy development in reaction to the Payson transaction. DWR released for comment on April 5 proposed interim criteria which distinguish between exchanges for water supplies and other types of transactions. The criteria acknowledge the need for incentives to voluntarily relinquish under-utilized CAP supplies. They call on the marketing process to be public so that potentially affected parties can comment. If a subcontract is to be exchanged for money, DWR suggests four conditions: 1) the subcontractor must demonstrate it has exhausted all other uses not involving exchange for money; 2) the subcontractor should be encouraged to use the funds to develop new supplies; 3) if funds are not used to develop new supplies, the subcontractor must demonstrate adequate future water supplies; and 4) the recipient of the subcontractor must demonstrate a need and use for the water that is consistent with state water management objectives.

*AWS Comments, Impacts cont. from page 1*

meaningless service area rights.

Ten commentators, nearly all from the Phoenix Active Management Area (AMA), urged DWR not to treat AMAs as single basins but rather to consider local hydrology and basin conditions in determining adequacy of future water supplies. Seven comments from the Tucson AMA, called upon DWR to allocate natural recharge. Another seven comments, mostly from private water companies, urged DWR to better coordinate with the Arizona Corporation Commission.

A number of comments were directed to renewable water supply issues. Nine comments argued that sufficient renewable supplies were unavailable. Six comments called upon DWR to treat effluent differently, such as giving credits for effluent discharges into water courses.

The need for some entity to generate and sell recharge and recovery credits was a common theme. Seven comments stressed the need for a permanent Santa Cruz Valley Water District (SCVWD) in the Tucson AMA and four comments on the need for a Groundwater Replenishment District in the Phoenix AMA.

Not all comments were hostile, or even adversarial. Three comments urged DWR to place more emphasis on water conservation as a method of reducing the need for renewable supplies. Three comments supported the Safe Yield concept. Two comments complimented DWR on its work in drafting the AWS rules.

While DWR internally reviews and discusses each of the comments, it simultaneously is preparing a major cost analysis of the economic impact of the proposed AWS rules. DWR's top priority is completing the economic assessment, followed by considering each individual comment on the AWS Rules in the context of preparing the final draft of the Rules.

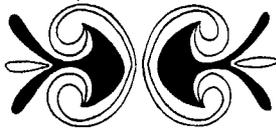
The economic impact analysis is a two-stage process. First, the impact of the Rules on the cost of acquiring and delivering water to consumers and the resulting water price increases has been evaluated by DWR staff for all municipal water providers in the Phoenix and Tucson AMAs. This information was turned over to economic consultants from the University of Arizona and Arizona State University, who modified econometric forecasting models for Maricopa and Pima Counties to determine how increases in water prices impact expenditure patterns, and measured the regional economic impacts of these changes in consumer expenditures. In addition, the study considers the economic impact of possibly foregone development should the AWS Rules prohibit or make economically infeasible certain types of residential development in outlying areas of AMAs (e.g., loss of a retirement-oriented planned community).

The economic assessment compares three scenarios for the time period 1995 through 2025: 1) no AWS rules; 2) AWS rules without any Groundwater Replenishment District (GRD) in the Phoenix AMA or SCVWD in the Tucson AMA; and 3) AWS rules with the Districts. The analysis does not contemplate the existence of a Central Arizona Groundwater Replenishment District.

Preliminary findings indicate that the economic impacts of the rules raising the cost of water are not large, especially in the presence of GRDs. Having a GRD reduces impacts by some 75 percent in Maricopa County and by nearly half in Pima County. Significant impacts do occur if the rules prevent or discourage development in a remote area within an AMA but outside existing service areas, which is considered likely in the absence of GRDs.

A scenario which assumed the rules without Replenishment Districts reduced development by 1,000 residential units per year (a three to five percent reduction over historical construction levels) showed economic impacts that dwarfed the impacts of higher water costs alone, with income and job losses some 25 times greater. Overall, the analysis makes a strong case for the need for GRDs and shows that, in their presence, the costs of AWS rules are relatively modest.

The economic impact assessment is due to be released in June or early July. The public then will have six weeks for review and comment.



## Water Vapors

Exhaustive market research indicates that essentially no one read the Communications section. So, taking a cue from Madison, Avenue, we renamed it! Our readers are a fairly astute group, however, so we altered the format as well. As always, communications to the editor are encouraged.

### Green Card

A few *Arizona Water Resource* readers recently received green postcards in the mail inquiring as to whether they wanted to continue receiving *AWR* and our quarterly publication, *Arroyo*. The balance of our nearly 3,000 subscribers will receive these notices in the near future. ***If you do not fill out and return the postcard to us, you will be dropped from our mailing list.*** Shrinking state and federal resources and a ballooning number of subscribers have forced us to trim deadwood from our mailing list. Those of you returning the card who indicate you wish to continue receiving our publications will continue to enjoy free subscriptions, thanks in part to our sponsors.

The postcards also contain a two-question survey on organizational affiliation and water interests that will allow us to use our new mailing list to target announcements of special water-related events and publications to interested groups. Please return the cards as soon as possible.

### CAP Story Roils Waters

Flood-related news stories have slowed to a trickle, with the collapse of the I-95 bridge over the Gila River the only new report of substantial damage. Discussions continue, however, on the impact of the flood and new Central Arizona Project operating procedures on municipal water quality. The March *AWR* cover story was followed by an *Arizona Republic* story that warned that continued high tur-

bidity levels at Phoenix's Union Hills treatment plant coupled with an early, hot summer might cause water demand to exceed treatment plant capacity, triggering water rationing.

We at *AWR* received considerable feedback on our article from several parties, three of whom were invited to submit Guest Views on the issue of Central Arizona Water Conservation District operating procedures and the quality of delivered water. Two of the parties found the time in the midst of dealing with water treatment problems to eventually respond; their views and comments are on pages 12 and 13.

### Wowing Them in D.C.

Betsy Rieke was one of five Interior Department nominees to appear in confirmation hearings before the Senate Energy and Natural Resources Committee on April 27. Ms. Rieke was enthusiastically endorsed by Senators DeConcini and McCain, and impressed the committee with her articulate responses and command of complex water issues. In response to questions, Ms. Rieke said she favored creative efforts to make interstate compacts like the Colorado River Compact more flexible so that water can be transferred between states. She also stated that the federal government has a responsibility to protect the remaining ecosystems in the United States, restore those that have been damaged, and strive to achieve a balance between the local economy and the environment of affected areas in the West.

### Lawmakers Go Home

The Arizona legislature confounded veteran observers by actually beating their target of adjourning within 100 days. The 97-day session produced relatively few significant pieces of water-related legislation. The most notable exception was S.B. 1425, which creates a Central Arizona Groundwater Replenishment District, along with another ugly acronym, CAGRDR. The bill's import was indicated by comments even before its signing by Governor Symington that it represents only "half a loaf"; already there is talk of major amendments next year.

A description of selected water-related bills and a tabular description of the CAGRDR are contained in Legislation and Law, pp. 6 and 7. The state's hardy band of water attorneys has not been idle while the legislature toiled; next month's issue will update the status of various water-related lawsuits.

### But Where's the Water?

The Northwest Water Alliance has requested the Bureau of Reclamation to amend the Central Arizona Project terminal storage contract and provide for a turnout and reservoir on the northwest side of Tucson. The coalition of water providers, towns and developers is formalizing its organization and selecting a board. Currently, organization members hold only a few thousand acre-feet of CAP contract water, making such a turnout an expensive proposition.



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**Arizona Water Resource Staff**  
 Editor: Joe Gelt  
 Reporter: Todd Sargent  
 Calendar: Nicolle Lahr  
 Publisher: Gary Woodard  
 WRRRC Director: Hanna J. Cortner

**Arizona Water Resource**  
 Water Resources Research Center  
 College of Agriculture  
 The University of Arizona  
 350 North Campbell Avenue  
 Tucson, Arizona 85719  
 602-792-9591; FAX 602-792-8518



## News Briefs

### Tax Incentives Lure Major Water Users

Fort Howard Corporation, a primary target of tax incentives recently passed by the Arizona legislature, has narrowed its choices for a new plant site to Yuma and La Paz Counties. The biggest remaining stumbling block appears to be locating a large, cheap source of water.

The giant sanitary tissue products company, third largest in the U.S. with a 16 percent market share and 1992 revenues of \$1.2 billion, is unique in the industry in using 95 percent recycled materials in its products. A Morgan Stanley limited partnership owns some 80 percent of the closely held firm, which was purchased through a leveraged buyout in 1988. The leveraged buyout left the highly profitable firm operating under heavy debt in excess of \$3 billion.

The Green Bay, Wisconsin-based firm, with plants in Green Bay, Savannah, Georgia, Muskogee, Oklahoma and Manchester, England, plans to spend up to \$1 billion to build its fifth plant employing up to 1,000 employees on a 2 to 3,000-acre site near the Colorado River. Proximity to the Colorado River is dictated by the need for up to 15,000 acre-feet of water per year at buildout.

The City of Yuma, with 50,000 a-f of Colorado River rights and current consumption of about 25,000 a-f, has expressed reluctance to commit the majority of its remaining allocation to the plant. Both the Yuma County Water Users Association with an allocation of 205,000 a-f and the Yuma Mesa Irrigation and Drainage District with approximately 250,000 a-f are potential supply sources, as is the Colorado River Indian Tribes (CRIT). The paper company claims its operation will be environmentally benign, with recycling and evaporation ponds

resulting in little or no discharge back into the Colorado River.

Another potential beneficiary of the state's new tax breaks is Fletcher Challenge, which is considering a site between Bullhead City and Kingman and another near Red Rock for a \$400-million recycled newsprint facility. The Red Rock site may be supplied with treated effluent from Tucson.

### Changes Considered for Stream Gauging Stations

In the aftermath of the flooding in January and February, the U.S. Geological Survey (USGS) is considering some changes in the design of Arizona's streamflow gauging stations. The USGS operates a network of 192 gauges, 168 of which relay data via satellite to a computer in Tucson. Those data then are made available to county, state, and federal agencies, as well as to utility companies and irrigation districts. But this winter's floods damaged or destroyed 35 gauging stations. Emergency repairs kept the network operational, but any interruption in the network is a concern because the data are critical for agencies responsible for flow management and protection of life and property.

To reduce the susceptibility of its flow gauges to damage, the USGS is considering taking advantage of multi-sensor technology and data telemetry systems. In addition, it is evaluating the potential of "temporary gauging stations" that could be used during flood conditions to supplement the existing network of gauges, creating a denser network. This would be particularly useful in gathering data at sites where there is little or no flow for many years, such as downstream from Kelvin on the Gila or downstream from Marana on the Santa Cruz. Operating full-time gauging stations at such sites is considered cost-prohibitive, but the temporary stations could be deployed in anticipation of, or during the early stages of a flood.

The USGS currently is soliciting input on ways to improve the existing network of gauges, and on stream

reaches where emergency flood information would be of particular value. Suggestions should be forwarded to Robert D. MacNish, U.S. Geological Survey, WRD, 375 S. Euclid Ave., Tucson, AZ 85719.

### CAP Advisory Committee, Work Plan Expand

The Governor's Central Arizona Project (CAP) Advisory Committee continues to expand, while its work plan stretches further out into the future. The committee, formed in December to develop recommendations to assure the CAP's long-term viability, has done a tremendous amount of work and produced draft reports on topics including a baseline scenario and issues relating to interstate marketing. The committee reportedly faces considerable additional fact finding before attempting to agree on any recommendations.

Added to the original committee membership are three representatives of environmental groups: Tom Jensen, Executive Director of the Grand Canyon Trust; Andy Laurenzi, Director of Protection for the Nature Conservancy; and Gail Peters, State Director of American Rivers. The Sierra Club also has been offered a seat at the table. Also joining the committee are: John Olsen, Co-Chairman of the Prescott Regional Water Steering Committee; Leo Valdez, Senior Vice President, Alden Capital Markets, and Thomas White, Governor of the Gila River Indian Committee. Resigning from the committee is Lew Murphy, former Mayor of Tucson. The changes bring the committee roster up to 33. (See Dec. 1992/Jan. 1993 *AWR*, p. 6 for initial membership.)

Three working groups have been formed, with former SRP General Manager Jack Pfister chairing the Environmental Issue Working Group. The Financial/Legal Issues Working Group is chaired by Jim Feltham of Rauscher, Pierce, Refnes, and the Indian Working Group is chaired by

Maricopa County Supervisor Jim Bruner.

The committee's original work plan called for an eight-step planning process moving from data collection to analysis and formulation of recommended solutions by May 1993 (see Feb. *AWR*, p. 5). A revised committee schedule calls for working group recommendations to be made by June and final recommendations of the full committee by September. The schedule has had to be reworked because of the enormity and difficulty of the task; in addition, outside pressure appears to have eased, with long-rumored congressional oversight hearings so far failing to materialize.

## Interstate Marketing of CAP Water Considered

The previously taboo subject of leasing or selling a portion of Arizona's Colorado River allocation to California and/or Nevada is being openly discussed. Some groups and individuals, pointing out that the CAP underutilization problem boils down to too much water and not enough money, advocate marketing as the principal component of any solution. Others continue to raise major objections and voice concerns over legal, regulatory and financial aspects of any interstate transaction. What has changed is the increased willingness of involved parties to discuss interstate options, along with a growing consensus that Arizona could do without its full allocation indefinitely.

A draft report dated 21 April from the Governor's Central Arizona Project Advisory Committee on "Marketing Colorado River Water to California or Nevada Users" concludes that the Law of the (Colorado) River does not prohibit interstate marketing, but appears to restrict the form of any such agreement. Identified risks include: leasing water and never having it returned; setting a precedent for interstate marketing that floods the market with low-priced higher-priority Colorado River water from upper basin states; and opening up the Law of the

River to more changes than are originally contemplated or beneficial to the state. The report ends, however, by acknowledging the very real need for additional supplies by southern California water users and Clark County, Nevada.

Meanwhile, pressure to explore marketing options continues to mount. The Tucson City Council, representing the single largest CAP M&I user, adopted a resolution describing the CAP problem as primarily financial in nature and calling for an emphasis on generation of revenue through sales of water and power to all interested parties rather than increasing in-state utilization. At least one "Shadow CAP Committee" is promoting a plan that relies heavily on revenues generated from leasing CAP water to California. Others have stated that permanent sale of some of Arizona's Colorado River allotment would not harm the state.

A major stumbling block to interstate marketing continues to be the incomplete information base upon which such discussions rest, with advocates and opponents making diametrically opposed assumptions about how such a market would work. In the end, many issues and uncertainties may be settled only with the help of 20-20 hindsight.

## Cryptosporidium Considered Minor Threat to Arizona

Cryptosporidium, the gut-wrenching microorganism that invaded Milwaukee's water treatment facilities in April causing hundreds of cases of a flu-like intestinal illness, has been detected in much of the nation's surface water supplies, including several locations in Arizona. The great majority of the population apparently tolerates low levels of the elusive and hard-to-kill pathogen without suffering ill effects. Low levels are suspected of being a risk to immune-compromised individuals. Conditions favorable to outbreaks are rare in Arizona, making major outbreaks fairly unlikely.

A 1988 study led by Chuck Ster-

ling, associate director of biotechnology at the UA's Arizona Research Labs, tested water samples taken from 101 sites across Arizona for cryptosporidium and its better-known cousin, giardia. Cryptosporidium was found in 24 of the samples, including in multiple samples taken from Oak Creek between Sedona and Flagstaff, from the Verde River between Cottonwood and Phoenix, and along the Mexican border between Nogales and Naco. One sample taken near the CAP inlet north of Parker tested positive. More recently, water quality experts at the Metropolitan Water District of Southern California detected very low levels of the protozoan in the Colorado River.

The infectious agent is common in the intestines of mammals and is highly resistant to chlorine. Optimal filtration at treatment plants, however, normally is adequate to protect drinking water quality. (The Milwaukee outbreak may have been triggered by a switch from using alum as a settling agent in the treatment plant to a less-expensive process employing ferric chloride.) EPA-proposed surface water treatment rules will require municipal water providers to test for pathogens including cryptosporidium.

Water quality experts agree that the best treatment strategy for cryptosporidium is preventing the animal-borne pathogen from entering source waters. The relatively low levels of animal activity in most of Arizona and the state's climate both make outbreaks much less likely than in other parts of the United States. Experts agree, however, that microorganism contamination in drinking water supplies continues to be a far greater public health problem than chemical contaminants. An informational brochure on parasites as causative agents of water-borne disease is available free of charge by writing to: Department of Veterinary Science, Building 90, Room 201, The University of Arizona, Tucson, AZ 85721.





## Legislation & Law

*The first session of the 41st Arizona Legislature adjourned sine die on April 17, 1993. Several pieces of legislation were passed that impact water management in Arizona. Some of these are summarized below.*

### S.B. 1053 — Omnibus Water Code Amendments

The annual Omnibus Water Amendments are the result of an ad hoc advisory committee process that reviews items submitted by the Department of Water Resources and other water interests. The items included in the bill clarify Groundwater Code provisions, streamline administrative processes, or address relatively minor issues. The items included in the 1993 legislation are:

- 1) Technical amendments to the Water Conservation Bill of 1992.
- 2) Amendment of the management plan statutes to allow written notice of conservation requirements to be given by first class mail for interim and final notices when the initial notice was sent by registered mail.
- 3) Coordination of well driller registration with the Registrar of Contractors.
- 4) Clarification of language regarding Annual Storage and Recovery by irrigation districts.
- 5) Extending from 1995 to 2000 the expiration date for municipal use of indirect stored water credits to comply with conservation requirements.
- 6) Technical amendments to water exchange language.
- 7) Reconciliation of financial accounting procedures language in the Emergency Dam Repair Fund with language in the Non-Emergency Dam Repair Fund.
- 8) Technical amendments to the Santa Cruz Valley Water District legislation passed in 1992.

### S.B. 1260 — Pinal County Water Augmentation Authority

This bill addressed two issues: creation of an augmentation authority for the Pinal AMA and a revision to the directive to the Department of Water Resources to conduct a study of agricultural water duties.

As proposed by the Pinal County Alliance, S.B. 1260 authorizes the creation of a county augmentation authority to assist the water users of the Pinal AMA in their efforts to better manage their Central Arizona Project, effluent, and surface water supplies. The authority will assist in the meeting requirements of assured water supply rules, developing regional underground storage and recovery projects, and financing of the development of non-groundwater sources.

Late in the session an amendment was added to S.B. 1260 that revises previous legislation directing the Department of Water Resources to evaluate irrigation water duties. The irrigation water duty studies must now evaluate the economic variables that impact whether agriculture will be able to achieve the maximum conservation standard set forth in the second management plans.

### S.B. 1086 — Closed Groundwater Basins

S.B. 1086 limits interbasin transfer of groundwater except for transfers specifically referred to and allowed in the Groundwater Transportation Act of 1991, and those transfers occurring when a city or town provides service in two adjacent basins. This bill protects the economic future of rural Arizona by further restricting the potential for water transfers to deplete the groundwater that may be needed for future economic development.

### S.B. 2040 — Underground Storage Credits

S.B. 2040 amends the Underground Storage and Recovery (US&R) provisions of Title 45. The bill provides that an entity developing a recharge project will be able to receive groundwater storage credits for the water that recharges the aquifer when the natural

channel of a river or stream is used to convey water to a constructed recharge project. Potential benefits from this legislation include: 1) making recharge projects more cost-effective by avoiding construction costs related to building conveyance pipelines or canals; and 2) allowing the water that recharges the aquifer during conveyance to count as part of the recharge project. An additional provision allows the Director of the Department of Water Resources to consider local and land use provisions when determining whether to issue an US&R permit.

### S.B. 1163 — Water Improvement Districts

S.B. 1163 gives a county improvement district the same authority and responsibility as an incorporated city or town under ARS Title 45, Waters. Introduced on behalf of the Metropolitan Domestic Water Improvement District (MDWID) located on the northwest side of Tucson, the bill allows Water Improvement Districts to be treated as cities or towns for Assured Water Supply purposes. MDWID is the first such district formed within an Active Management Area.

### S.B. 1359 — Santa Cruz Valley Water District Amendments

S.B. 1359 amends legislation passed in 1991 allowing formation of the Santa Cruz Valley Water District (SCVWD) by providing that the 12th and 13th members of its board be elected at large from the portions of Pima and Santa Cruz Counties within the Tucson Active Management Area rather than be appointed by the Boards of Supervisors of those counties. The other 11 board members are elected from districts of approximately equal population.

The bill was amended to remove the SCVWD's authority to ask voters to approve an ad valorem tax. The taxing authority was opposed by the City of Tucson and others, and its removal was viewed as enhancing SCVWD's chances of being made permanent.

**S.B. 1425 — Central Arizona Groundwater Replenishment District**

This much-discussed piece of legislation evolved from concerns of the development community over the failure of Maricopa County cities to form a Groundwater Replenishment District (GRD) within the Phoenix Active Management Area (AMA). The development community and private water companies wanted a mechanism to allow small communities and rural development to meet the requirements of the proposed assured water supply rules (see February *AWR*, p. 1).

S.B. 1425 creates a groundwater replenishment authority to be operated by the Central Arizona Water Conser-

vation District. This authority, called the Central Arizona Groundwater Replenishment District (CAGRD), would serve municipal water users in the Phoenix, Pinal and Tucson AMAs. The CAGRD will be responsible for using renewable water supplies to replenish the aquifer to offset excess groundwater pumping by CAGRD members.

Participation in the CAGRD differs from the previously authorized Phoenix AMA GRD in several significant ways (see table below). Membership in the CAGRD is voluntary, and funding of CAGRD activities is through annual replenishment assessments and taxes levied and collected

from members.

The CAGRD will assist water providers in the Phoenix, Pinal and Tucson AMAs in achieving their water management goals, which is widely viewed as a necessary precondition to adoption of Assured Water Supply rules. The ability to combine resources to replenish aquifers with renewable water supplies, such as CAP water, will reduce the cost of replacing over-drafted groundwater supplies.

Water providers in the Tucson AMA would be able to turn to either the CAGRD or the Santa Cruz Valley Water District, if it becomes permanent, for recharge credits needed to satisfy Assured Water Supply rules.

COMPARISON OF GROUNDWATER REPLENISHMENT DISTRICTS		
	Phoenix AMA GRD	Central Arizona GRD
District boundary	Phoenix AMA	Active management areas within Maricopa, Pinal, Pima Counties
Membership	Mandatory for all groundwater pumpers	Voluntary—landowners, municipalities and private water companies may join
Effect of membership	All municipal and industrial water users must recharge groundwater they use in excess of DWR guidelines.	All members seeking designations or certifications of assured water supply based upon groundwater must recharge groundwater they use in excess of DWR guidelines, i.e., any subdivision, water company, city or retirement community deciding to grow must either join or independently find a non-groundwater source of supply for the service area. (In Tucson AMA, options include SCVWD.)
Relationship to assured water supply rules	Assured water supply guidelines and water conservation standards continue to apply. Members still must show access to 100 year supply of well water.	Same, but DWR is affirmatively obligated to adopt assured water supply regulations by 1 January 1995.
Administration	New agency formed to perform duties	Operated by CAWCD
Finance	Ad valorem tax on all property in district (limited to \$.02/\$100). Augmentation tax (up to \$2/AF on all groundwater pumping, including agricultural). Pump tax on excess groundwater used by members.	Pump tax on excess groundwater used by members
Recharge methods	Direct recharge only	Direct and indirect recharge
Treatment of incidental replenishment	Credited against groundwater use. Excess incidental recharge generates credits which may be sold to other members.	No incidental recharge credits
DWR oversight	DWR reviews and approves a preliminary and final plan of operation; no further oversight after final approval.	DWR approves operating plans every 10 years.
Sanctions	If District falls 3 years behind in its recharge functions, no new assured water supplies based on District membership	Same
Estimated Costs	Minimum of \$15/AF (Direct recharge, '93 dollars)	Minimum of \$40/AF (Indirect recharge, '93 dollars)
Use of CAP water	District may use incidental recharge credits and CAWCD recharge demonstration credits for many years without actually recharging any new water.	New use of CAP water will begin immediately on effective date of operations (January 1, 1995) or sooner.



## Special Projects

*The University of Arizona's Water Resources Research Center serves the Arizona water community in various ways. Its mission includes supporting research and conducting information transfer; i.e., distributing water related information. (The Arizona Water Resource is part of WRRC's information transfer program.) Following are descriptions of recent WRRC projects of benefit to Arizona water interests.*

### Water Expertise Database Goes On-line

Have you ever wondered who at the three Arizona state universities is an expert on the politics of water in the Mideast and is willing to give a luncheon talk to your organization? Or have you wondered how to locate a groundwater hydrologist who does research in vadose zone flows and who is fluent in German? Well, wonder no more! The Water Resources Research Center's expertise database is on-line and ready to respond to your queries.

The database contains self-reported information on 164 people at the three universities with expertise in water-related areas, including hydrology, agricultural economics, greywater systems, flood control, water law, groundwater pollution and 47 others. The key word list has almost 300 words to choose from. The database can be searched by researcher, university, general research areas, subjects taught, key words, geographic areas, and language proficiency.

Database queries can be made to the WRRC by phone, FAX or mail. A textual version of the database will be published later this spring (see Nov. 1992 *AWR*, p. 6). In addition, the information may be available in the future on a floppy disk in the form of a compiled search-only database.



### Field Manual for Water Quality Sampling

The Water Resources Research Center is compiling a comprehensive field manual for water quality sampling. Funded in large part by the Arizona Department of Environmental Quality, the project will draw together into one source, suitable for use in the field, protocols and procedures for contaminant sampling in both surface water and groundwater.

The lack of a stand-alone handbook for such purposes can result in inconsistent or incorrect methodology, making comparisons of sample analyses ambiguous and increasing the likelihood of both false positive and false negative testing results.

Currently, water sampling protocols are being collected from federal, state and local agencies and organizations in both the United States and Mexico, with particular emphasis on the U.S. - Mexico border region. A consensus set of protocols will be drafted, and a conference held to discuss sampling techniques with potential user organizations. The conference will serve as both introduction and final review for the handbook.

The water sampling handbook will be translated into Spanish, with both English and Spanish language versions published and widely distributed. Hopefully, the bilingual handbook will assist organizations and agencies with water quality monitoring responsibilities, especially those along the U.S. - Mexico border. It also may serve as the basis for future water sampling training sessions. For more information or to provide input, contact Gary Woodard at WRRC.

### WRRC Small Research Grants Awarded

The Water Resources Research Center has recently completed its selection of projects for the 1993-94 small research grant program. As one of 55 water resources research institutes, the WRRC receives funds from the U.S.

Geological Survey under Section 104 of the Water Resources Research Act to support water-related research in Arizona.

Each year, in October, WRRC announces the availability of this funding and invites proposals from researchers at the three Arizona universities. In November, interested researchers send short, letter-format descriptions of their projects. This year WRRC received 22 letters. Of these, three were received from Arizona State University, one from Northern Arizona University, and the remainder from the University of Arizona. Each year letters are reviewed and projects rated by members of WRRC's External Advisory Committee. The Advisory Committee ranks projects highly that promise to contribute to the solution of critical water resource problems in Arizona. Full proposals are invited for projects that receive a high ranking from the Committee.

WRRC received seven full proposals in 1993. Each of these was sent for peer review to three experts in appropriate specialties. Most of the reviewers are in other western states: California, Nevada, Utah, Colorado, and New Mexico. In general, the proposals were praised by their reviewers, making selection difficult of the few that can be funded. The three most highly rated proposals were selected and are described below.

### CAP Underutilization Strategies to be Identified

Bonnie Colby and Paul Wilson, of the UA Department of Agricultural and Resource Economics are teamed with Robert Glennon of the College of Law to study the implications of CAP underutilization in Arizona and the Colorado River Basin. A sharp decline in requests for CAP water from the agricultural sector combined with a lower-than-projected use of CAP water in the municipal and industrial sector jeopardizes the financial stability of CAP and raises the specter of water raids by California and Nevada on Arizona's Colorado River entitlement. CAP agriculture faces loan defaults and bankruptcy because of debts incurred

in order to receive CAP water. Other CAP subcontractors face the prospect of paying substantially more for CAP water than expected. Those who still have a choice are likely to continue relying on groundwater thus undermining the goals of the Arizona Groundwater Management Act.

The researchers will be investigating the economic, legal, and policy issues raised by underutilization of CAP water. Their goal is to identify strategies for mitigating the impacts of CAP underutilization and enhancing utilization of CAP water and repayment of CAP debt obligations.

A simple linear programming model will be used to identify the implications of CAP restructuring under various economic scenarios for CAP irrigation districts. An acreage response function will be developed to illustrate the number of acres farmed under alternative water pricing arrangements.

Alternative uses for CAP water will be examined under alternative market structures and pricing policies. Demand for CAP water to accomplish federal, state and tribal water supply objectives will be estimated based on various market factors and non-market valuation studies. A variety of pricing structures for CAP water will be examined for their impacts.

The complicated legal questions raised by CAP underutilization will be addressed through interviews and legal research. Research finding will be applied to federal and state policies, and specific recommendations will be made for improved utilization of CAP water and structuring of repayment.

### Water Needs to Establish Desert Plants Studied

Steven Smith of UA Department of Plant Sciences and Bruce Roundy of the School of Renewable Natural Resources, along with several of their colleagues, will be carrying out the second year of a two-year project to determine the water requirements of desert-adapted plants for use in revegetating abandoned farmland and other disturbed desert lands. A line-source sprinkler gradient irrigation

system was adapted to measure accurately the amount of water needed to establish native plants in a field site located at the USDA-SCS Tucson Plant Materials Center in Pima County.

In the first year of the project, researchers sought to identify and evaluate native plants for their ability to establish and persist under conditions of varying moisture stress. Researchers also were interested in identifying important variables affecting establishment, survival, and productivity of candidate species, including seeding season (July or January) and wet versus dry initial soil profile, as well as varying amounts of irrigation water. Seventeen species of grasses, shrubs and trees were studied. Results indicated that while seedling emergence was highest at the highest level of irrigation, most of the grasses and trees established with only natural precipitation or the lowest irrigation level. The field experiment confirmed that the amount of water required for establishment of desert-adapted plants is substantially less than for crop species.



The generally high level of establishment may have been influenced by the high initial soil-moisture in the first-year field experiments. In the second year, the researchers will test water requirements when the soil profile is initially dry. This will yield information on the minimal irrigation strategies for establishment of the different native species and their relative drought tolerance.

### Effluent Portion of Santa Cruz River Studied

Charles Kreitler, Tom Maddock, and Gray Wilson, all of the UA Department of Hydrology and Water Resources, will be carrying out investigations into surface water-groundwater interactions on the sewage-effluent dominated portion of the Santa Cruz

River in Tucson. This approximately 30-mile-long stretch of the Santa Cruz provides an ideal setting for examining key scientific issues associated with the necessity for balancing disposal of municipal effluent, environmental preservation and conservation, and water quality concerns. The project takes advantage of Tucson's change from groundwater to CAP water, and the consequent change in the effluent's chemical signature, to take a direct measure of the recharge rate in the middle Santa Cruz system.

The rates and processes of recharge through the residual surface layer present in effluent-dominated stream systems and then through an extensive vadose zone beneath the streambed are poorly understood, but they represent areas of great importance in the management of such systems. In the first phase of the research, investigators will explore the suitability of a variety of data collection methods and techniques to determine the most practical field tests.

Investigators will use remote sensing information and effluent and stream flow records for initial characterization of the hydrologic system. They will use field measurements to characterize water movement through the unsaturated section of the water table; field tests and samples will be used to estimate soil parameters. In addition wells will be monitored for water level variation and water samples will be analyzed to determine actual recharge rates. All the information collected will then be aggregated to produce an overall hydrogeologic assessment of the surface water-groundwater interaction in that section of the Santa Cruz River. In addition to describing the Santa Cruz system, this study will provide a protocol for other riparian hydrologic investigations.

Research on these projects will begin in June of 1993 and final reports will be produced in June of 1994. For more information on the projects, contact the individual investigators. For more information on the research grant program, contact Susanna Eden at WRRC.



## Transitions

Key water policy making positions within the Department of Interior continue to be filled (see organizational chart below). Positions still unfilled are Under Secretary, Assistant Secretary for Indian Affairs, and head of the Geological Survey.

As reported in the March issue of *AWR*, Arizonans occupy three key water policy positions, with **Bruce Babbitt** serving as Secretary of Interior, **Betsy Rieke** as Assistant Secretary for Water and Science, and **John Leshy** as Solicitor.

More recent appointments include **Dan Beard**, previously head of the House Interior committee staff under Congressman **George Miller** of California, as head of the Bureau

of Reclamation (BOR). **Bruce Babbitt** often remarked before his appointment that BOR should be abolished; its future continues to be uncertain, with Babbitt continuing to state that the traditional dam-building role of BOR no longer is needed. Its future, if any, appears to lie in creative water management, environmental mitigation and improving project efficiencies.

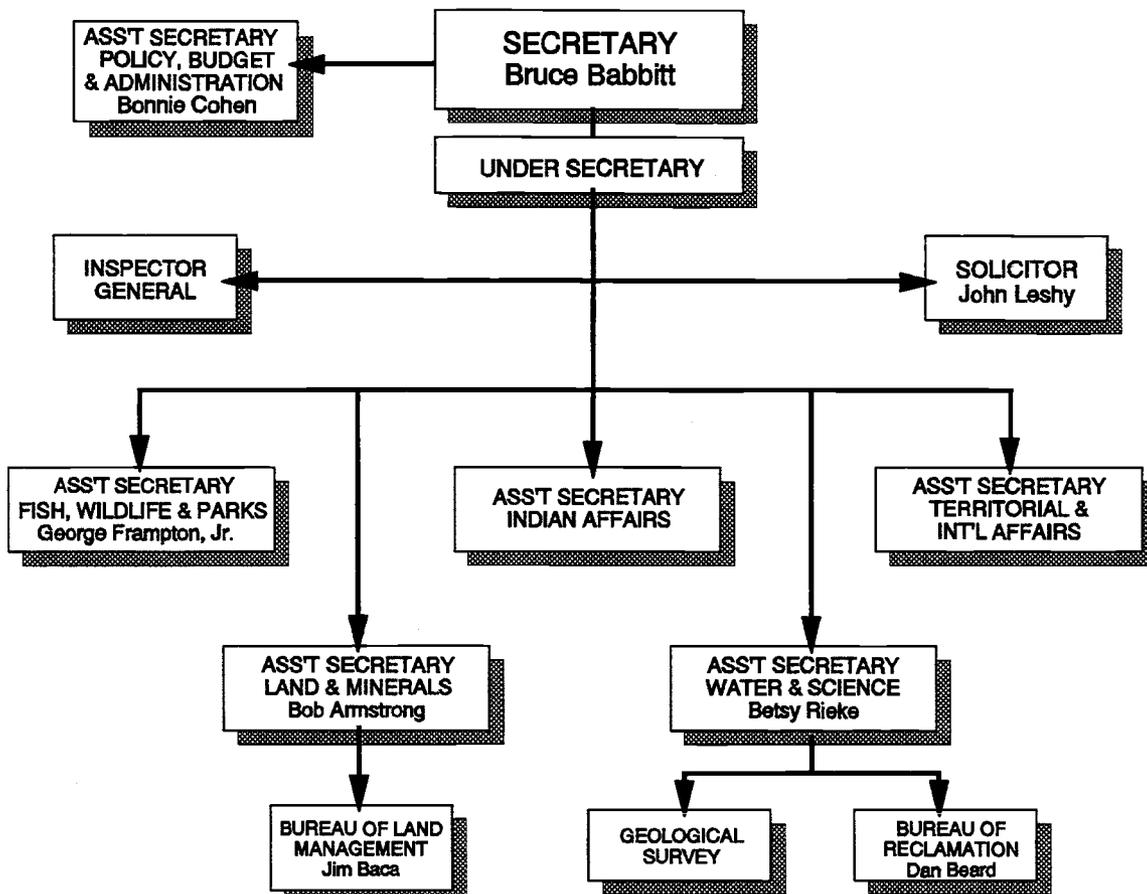
**Bonnie Cohen**, former vice president of the National Trust for Historical Preservation, has been named Assistant Secretary for Policy, Budget and Administration.

Nominated as Assistant Secretary for Fish, Wildlife and Parks is **George Frampton, Jr.**, president of the Wilderness Society.

Other recent appointments include **Robert Armstrong** as Assistant Secretary of Land and Minerals Management. Armstrong previously served as special advisor on energy and minerals to Texas Governor **Ann Richards**.

Appointed to head the Bureau of Land Management is **Jim Baca**, previously New Mexico Land Commissioner.

ORGANIZATIONAL CHART FOR DEPARTMENT OF INTERIOR  
Emphasizing Key Water Policy Making Positions





## Publications

### *Governor's CAP Advisory Committee Description of the Central Arizona Project April 1993.*

An excellent summary of CAP system components and legal framework designed to facilitate discussion of repayment restructuring options. Copies available from the Arizona Department of Water Resources, Public Information Division, 15 South 15th Avenue, Phoenix, AZ 85007; 602-542-1553. \$10 per copy for requests in excess of one.

### *The RATEBASE Report*

This report describes in detail water pricing and rate structures for some 210 water pricing structures used by 138 water utilities in the west and midwest. The 215-page report, which is updated quarterly, also ranks western water utilities by relative levels of monthly billings (The RANKING Report) and summarizes the "style" of each of the 210 rate schedules in the database (The PROFILE Report). These reports provide useful information for structuring or analyzing water conservation pricing incentives. Available as an annual subscription. \$25 for Ranking Report, \$40 for Profile Report, and \$100 for full Ratebase Report. Contact: Ben Mason, Water Conservation Studies, P.O. Box 1468, Santa Teresa, NM 88008; 505-589-1291.

### *Groundwater Education in America's Schools*

This is a catalog of groundwater resource materials for elementary and secondary education professionals. Contact: The American Groundwater Trust, 6375 Riverside Drive, Dublin, OH 43017; 614-761-2215.

### *A Citizen's Guide to Clean Water*

This guide is published by The Izaak Walton League of America, 1401 Wilson Blvd., Level B, Arlington, VA 22209; 703-528-1818. \$5.00 for a photocopy.

### *Groundwater: Managing the Unseen Resource*

This World Wildlife Fund booklet summarizes recent developments in groundwater protection. Contact: WWF Publications, P.O. Box 4866, Hampden Post Office, Baltimore, MD 21211; 410-516-6951.

### *Estimated Use of Water in the United States in 1990*

This national report provides water-use information by state, with description of each water-use category, the sources of data, and the methods used to estimate water use for each category. The report is the latest in a series of national estimates compiled by the USGS every five years. Copies of the report are available free from Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 24286, Denver, CO 80225.

### *Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy*

This committee report outlines a national strategy for aquatic restoration, with practical recommendations and case studies of aquatic restoration activities around the country. The committee examines: key concepts and techniques used in restoration; common factors in successful restoration efforts; threats to the health of the nation's aquatic ecosystems; approaches to evaluation before, during, and after a restoration project; and, the emerging specialties of restoration and landscape ecology.

Copies are available for \$39.95 plus \$4 shipping. National Academy Press, 2101 Constitution Avenue NW, Box 285, Washington, D.C. 20055; 202-334-3313.

### *1992 River Conservation Directory*

The Directory, developed by American Rivers and the National Park Service's Rivers, Trails and Conservation Assistance Program, includes agencies and organizations, both public and nonprofit, whose missions directly involve river conservation. The 150-page document is organized by federal agencies, national organizations, multi-state organizations, and state agencies and organizations. It also includes an index. This is an excellent resource for anyone involved in river conservation.

Copies are available for \$10.00 from U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, D.C. 20402-9328; 202-783-3238. Request the Directory by its title and stock number, 024 005 01104 8.

### *How-To Manual for Groundwater Protection Projects*

This manual describing use of volunteers to identify potential sources of groundwater contamination is available from National Association of RSVP Directors, Inc. Contact: Dave Terry, Texas Water Commission, 512-463-8266; or RSVP of El Paso 915-541-4374.

*Arizona Water Resource* is financed in part by sponsoring agencies, including:

Arizona Department of Environmental Quality  
 Arizona Department of Water Resources  
 Arizona Municipal Water Users Association  
 Central Arizona Water Conservation District  
 Salt River Project  
 Santa Cruz Valley Water District  
 Tucson Water  
 USGS Water Resources Division  
 Water Utilities Association of Arizona

Their contributions help make continued publication of this newsletter possible.



## Guest Views

**CAWCD is facing a number of new operating challenges. The latest challenge concerns maintaining the quality of water delivered to municipal contractors. The record-breaking precipitation in January and February produced tremendous amounts of sediment-laden runoff. Also, New Waddell Dam is complete, thereby altering operations of the CAP system (see March AWR, p. 1). As a result, municipal water providers have struggled to treat adequate quantities of water to potable standards, and concerns have been raised about the impacts of operating decisions on future CAP water quality. These Guest Views are an attempt to enhance the dialogue between CAWCD and CAP water users so that all parties can work together in the best interests of Arizona's residents. The following was transcribed by Joe Gelt from conversations with Grant Ward and Rich Rupert of the Central Arizona Water Conservation District.**

It almost could have been expected that the floods of this past winter — the most significant in Arizona's recorded history — would result in increased sediment in CAP water. Floods of this magnitude are unusual, but when they occur the heavy runoff will include increased levels of TDS, at least in this part of the United States. Except for increased turbidity, however, CAP water quality was not affected by the recent floods.

Storm events such as major floods, however, can cause water quality problems, with the nature of the problem depending upon the section of the country in which it occurs. In Arizona, excessive runoff mostly will increase sediment because of the buildup of sand and silt in normally dry river beds. Other regions confront other conditions. For example, Milwaukee's much publicized water quality problem is believed to have resulted from runoff into Lake Michigan.

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***Major runoffs always have required additional treatment to filter sediment from water.***

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The sediment in CAP water mainly came from two sources: the Bill Williams River and the Agua Fria. The project pumping plant is located next to the Bill Williams River which carries a heavy sediment load during flood events. Sediment also came from the Agua Fria which spills into New Waddell Dam, the reservoir that supplies water to the canal. The Agua Fria is now clear, with the sediment settled, and normal operations are resumed. February water quality tests indicated normal conditions. Any water quality problems from flooding therefore are temporary.

Normal runoff during a normal year will not create any problems. Rains would not be so heavy and frequent, and snow melt generally is regular and steady. Neither would significantly increase sedimentation.

Major runoffs always have required additional treatment to filter sediment from water. For example, Phoenix has had to treat the Salt and Verde rivers for increased sediment during heavy flows. Sediment in CAP water represents the same condition.

Cities have different strategies to deal with sediment from increased runoff. Some cities increase their consumption of groundwater. Such procedures are in place and are available to deal with CAP turbidity problems.

Another factor to consider is that January and February floods occur at a time when municipal water demand is low. As a result, municipalities are not expected to experience the full impact of increased sedimentation from these flood events.

Also as the water flows through CAP canals further settlement occurs behind check structures. As canal distances increase, the sediment problem decreases. Tucson, located at the end of the line, will be less affected by increased levels of sedimentation in its CAP water than cities up canal.

Additional CAWCD expenses may result from unusual flooding. Sediment buildup in the canal will have to be removed more often than was projected. This is to be expected however by any operation maintaining canals. The Salt River Project regularly drains its canals to remove sand and sediment that builds up behind various check structures.



**"Now just hold your horses, everyone. . . . Let's let it run for a minute or so and see if it gets any colder."**

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*The city perspective is offered by Bing Brown, APR, Public Information Officer, Water Services Dept., City of Phoenix.*

Throughout the Central Arizona Project's planning stages, experts evaluated the water from the Colorado River. It was clean, clear and just about perfect to augment the water supplies of Arizona cities.

For more than six years, Phoenix has processed that high-quality water at the Union Hills Water Treatment Plant. In fact, things were going so well that last Spring the city doubled the size of the plant (see July/August *AWR*, p. 4), bringing its capacity to 160 million gallons per day.

Enter the infamous Murphy and his equally infamous law (Anything that can go wrong, will). This time, he had an accomplice, Mother Nature. Between the two, the clear blue water in the CAP canal turned an ugly brown.

The fierce storms of January and February scoured dirt from the sides of mountains; rivers, such as the Bill Williams and Agua Fria, roared muddy torrents. Operators at the Union Hills plant encountered a meteoric rise in turbidity units. Accustomed to dealing with an average of 3 units in CAP water, they suddenly had to contend with numbers more than 50 times greater than average.

Time and again the thicker brew clogged filters at the treatment plant, reducing the quantity of water which could be processed. Also, more chemicals were needed to treat the water, causing treatment costs 10 times greater than normal.

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### *Cities receiving CAP water would like CAWCD to give equal weight to quantity and quality.*

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But the issue now facing Phoenix is not so much a question of cost, as a question of supply.

As summer approaches, higher temperatures herald the coming of the peak usage season. That's when it's important to make sure resources are in place to meet the demand.

With that in mind, Phoenix and other cities receiving CAP water would like CAWCD to modify its operational objectives to give equal weight to quantity and quality. In other words, the cities want water of consistent and high quality, such as that which flowed through the canal during its first six years of operation.

Questions being asked include: Must so much water come from the Bill Williams River? Must so much come from Lake Pleasant?

As those short rivers roil down from the mountains, they carry tons of dirt — dirt which clogs the city's filters — dirt which slows the treatment process — dirt which increases the cost of treating the water.

The cities understand that with such unprecedented storms, it is impossible not to experience some increase in turbidity. However, as large and dependable customers, the cities are asking CAWCD to do all it can to continue to supply the high-quality product it has delivered for six years.



## *Announcements*

### **Calls for Papers**

A call for papers has been issued for the Rocky Mountain Ground Water Conference, to be held October 27-29, 1993 in Albuquerque, NM. Papers are requested on all aspects of subsurface water science and engineering. Four copies of a camera-ready abstract are to be submitted by May 28. For additional information contact William J. Stone, Technical Chair, NMED-Ground Water, P.O. Box 26110, Santa Fe, NM 87502-6110; 505-827-2434. Exhibitors contact the Exhibits Chair, Douglas Earp, City of Albuquerque, Environmental Health Department, P.O. Box 1293, Albuquerque, NM 87103; 505-768-2600.

The Arizona Hydrological Society is accepting abstracts for its Sixth Annual Symposium, "Emerging Critical Issues in Water Resources of Arizona and the Southwest," September 23-24, 1993 in Casa Grande, AZ. Symposium topics include water management, CAP issues, water quality programs, wells, and hydrologic studies. Three copies of an abstract are to be sent by May 28 to Mr. Peter Livingston, CH2M Hill, Inc., 5210 E. Williams Circle, Suite 550, Tucson, AZ 85711-4486; 602-748-9144, FAX 602-748-1316.

Abstracts are being accepted for the 1994 Pacific Northwest/Oceania Conference, "Assessment of Models for Groundwater Resources Analysis and Management," March 21-23, 1994, Honolulu, HI. Some topics include: new modeling approaches, post-audit modeling studies, and economic issues in groundwater development, protection and use. Submit abstracts of 300 words or less to Dr. Aly I. El-Kadi, Dept. of Geology and Geophysics & WRRC, Univ. of Hawaii at Manoa, 2525 Correa Rd., HIG 411, Honolulu, HI 96822; 808-956-6331 by June 30.

### **Western Water Organizations is Program Topic**

The University of Colorado Natural Resources Law Center presents "Water Organizations in a Changing West," July 14-16 in Boulder, CO. The program will focus on the broad array of organizations that meet western water needs. Speakers will discuss issues and strategies to meet emerging concerns and requirements, and the growing role of non-traditional interests in water supply and management will be described. Contact the Natural Resources Law Center, Campus Box 401, Boulder, CO 80309-0401; 303-492-1288.



# Calendar of Events



## RECURRING



**Arizona Hydrological Society.** 2nd Tuesday of the month, Meetings held at WRRC, 350 N. Campbell Ave., Tucson. Contact: Lori Wirt 602-670-6231.

**Arizona Water Resources Advisory Board.** No meeting set at this time. ADWR, BO44, 15 South 15th Ave., Phoenix. Contact: Beverly Beddow 602-542-1553.

**Casa Del Agua.** Hourly tours, Sundays noon to 4:00 p.m., 4366 North Stanley, Tucson. Contact: 602-791-4331.

**Central Arizona Water Conservation District.** 1st Thursday of the month, 12:30 p.m. CAP Board Room, 23636 N. 7th St., Phoenix. Contact: 602-870-2333.

**City of Tucson Citizens Water Advisory Committee.** 1st Tuesday of the month, 7:00 a.m. 310 W. Alameda, Tucson. Contact: Trish Williamson 602-791-4331.

**Phoenix AMA, GUAC.** 11 May, 9:30 a.m. ADWR, Phoenix AMA Conference Room #134, 15 S. 15th Ave., Phoenix. Contact: Mark Frank 602-542-1512.

**Pima Association of Governments / Water Quality Subcommittee.** 177 N. Church Ave., Tucson. Contact: Gail Kushner 602-792-1093.

**Pima County Flood Control District.** 3rd Wednesday of the month, 7:30-9:30 a.m. Public Works Bldg., 201 N. Stone, Tucson. Contact: Carla Danforth 602-740-6350.

**Pinal AMA, GUAC.** 20 May, 7:00 p.m. Pinal AMA Office, 1000 E. Racine, Conference Room, Casa Grande. Contact: Dennis Kimberlin 602-836-4857.

**Prescott AMA, GUAC.** 19 May, 10:00 a.m. Prescott City Council Chambers, 201 S. Cortez, Prescott. Contact: Phil Foster 602-778-7202.

**Santa Cruz Valley Water District.** 2nd Friday of the month, 7:30 a.m. Meetings held at the Water Resources Research Center, 350 N. Campbell Ave., Tucson. Contact: Warren Tenney 602-326-8999.

**Tucson AMA, GUAC.** 21 May, 9:00 a.m. Tucson AMA offices, 400 W. Congress, Suite 518, Tucson. Contact: Linda Stitzer 602-628-6758.

**Yavapai County Flood Control District.** 1st Monday of the month in Prescott; 4th Monday of the month in Camp Verde. Contact: YCFCD, 255 E. Gurley, Prescott, 86301.

## MAY



**8 (Sat) Spring Water Smart Workshop: Drip Irrigation Workshop.** 8-10 a.m., Udall Recreation Center, 7200 E. Tanque Verde, Tucson. Contact: Melaney Seacat, Tucson Water 602-791-4331.

**8 (Sat) National Drinking Water Week Open House.** 10:00 a.m.-12:00 p.m. Tucson Water Treatment Facility. Contact: Tucson Water 602-791-4331.

**10-12 (Mon-Wed) Wetlands and Watershed (Water Resources) Management.** Sparks, NV. U.S. Environmental Protection Agency-Wetland Division. Contact: The Association of State Wetland Managers, P.O. Box 2463, Berne, NY 12023-9746; 518-872-1804.

**11-13 (Tue-Thu) Planning and Implementing Effective Groundwater Sampling Programs.** Denver, CO. Contact: Geoff Petersen, Environmental Education Enterprises Institute, 2764 Sawbury Blvd., Columbus, OH 43235; 614-792-0005.

**11-13 (Tue-Thu) National Groundwater Association's Principle of Ground Water Hydrology.** San Antonio, TX. Contact: 800-551-7379.

**12-14 (Wed-Fri) Central California Tour.** Water Education Foundation Tours focuses on the San Joaquin Valley. Contact: Valerie Holcomb 916-444-6240.

**14-15 (Fri-Sat) Arizona State Environmental Technology Training Center's Basic Wastewater Treatment Seminar.** Tucson, AZ. Contact: 602-722-7872.

**15 (Sat) Spring Water Smart Workshop: Drip Irrigation Workshop.** 9-11 a.m., Tucson Parks and Recreation Dept., Therapeutics Center, Multi-purpose Room, 1000 S. Randolph Way, Randolph Park, Tucson. Contact: Melaney Seacat, Tucson Water 602-791-4331.

**16-20 (Sun-Thu) Second USA/USSR Joint Conference on Environmental Hydrology and Hydrogeology.** Washington D.C. Contact: Secretariat, Second USA/USSR Conference, American Institute of Hydrology, 3416 University Avenue, S.E., Minneapolis, MN; 612-379-1030.

**17-21 (Mon-Fri) National Inter-Agency Wilderness Conference.** Westward Look Resort, Tucson, AZ. Contact: Society of American Foresters, Wilderness Conference May '93, 5400 Grosvenor Lane, Bethesda, MD 20814.



19-21 (Wed-Fri) **The 6th Symposium on Artificial Recharge of Groundwater—Purpose, Problems, and Progress.** Phoenix. Contact: Technical Committee, 1993 ARGS, Water Resources Research Center, The University of Arizona, 350 N. Campbell Ave., Tucson, AZ 85721; 602-792-9591.

21-22 (Fri-Sat) **Arizona State Environmental Technology Training Center's Basic Waste/Wastewater Pump and Motor Maintenance Seminar.** Tucson, AZ. Contact: 602-722-7872.

25-27 (Tue-Thu) **Seventh National Outdoor Action Conference on Aquifer Restoration, Groundwater Monitoring, and Geophysical Methods.** Las Vegas, NV. National Ground Water Association. Contact: Chris Miller, NGWA, 6375 Riverside Dr., Dublin, OH 43017; 800-551-7379.

## UPCOMING



4-5 June (Fri-Sat) **Arizona State Environmental Technology Training Center's Advanced Wastewater Treatment Seminar.** Tucson, AZ. Contact: 602-722-7872.

5 June (Sat) **Spring Water Smart Workshop: Drip Irrigation Workshop.** 9-11 a.m., Tohono Chul Park, 7366 N. Paseo Del Norte, Tucson. Contact: Melaney Seacat, Tucson Water 602-791-4331.

6-10 June (Sun-Thu) **American Water Works Association Annual Conference and Exposition.** San Antonio, TX. Contact: AWWA, 6666 W. Quincy Ave., Denver, CO 80235.

6-13 June (Sun-Sun) **1st Annual Arizona Educators Academy for Environmental Education.** Prescott, AZ. Contact: Dr. Tina Allen, Dept. of Education, 1535 W. Jefferson, Phoenix, AZ 85007.

9-10 June (Wed-Thu) **Arizona State Environmental Technology Training Center's Basic Waste/Wastewater Operational Laboratory Skills Seminar.** Tucson, AZ. Contact: 602-722-7872.

9-12 June (Wed-Sat) **1993 Groundwater Modeling Conference.** Golden, CO. Contact: 1993 GW Modeling Conference, IGWMC, Colorado School of Mines, Golden, CO 80401-1887; 303-273-3103.

12 June (Sat) **Spring Water Smart Workshop: Irrigation Timers and How to Use Them.** 9-11 a.m., Tohono Chul Park, 7366 N. Paseo Del Norte. Contact: Melaney Seacat, Tucson Water 602-791-4331.



14-16 July (Mon-Wed) **Water Organizations in a Changing West.** Boulder, CO. Contact: Katherine Taylor, Conference Coordinator, Campus Box 401, Boulder, CO 80309-0401; 303-492-1288.

15-19 June (Tue-Sat) **International Wetland Symposium: Improving Wetland Public Outreach, Training, and Education, Interpretation.** Madison, WI. Contact: The Association of Wetland Managers, Inc., P.O. Box 2463, Berne, NY 12023-9746; 518-872-1804.

26-29 June (Sat-Tue) **AWRA Annual Summer Symposium, "Effects of Human-Induced Changes on Hydrologic Systems."** Jackson Hole, WY. Contact: American Water Resources Association, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192; 301-493-8600.

27-30 June (Sun-Wed) **Water Resources Education: A Lifetime of Learning and Changing Roles in Water Resources Management and Policy.** Bellevue, WA. Contact: AWRA, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192; 301-493-8600.

12-15 July (Mon-Thu) **Conference on Sustainable Ecological Systems: Implementing an Ecological Approach to Land Management.** Flagstaff, AZ. Contact: Conference on Sustainable Ecological Systems, c/o duBois Center P.O. Box 15003, Flagstaff, AZ 86011-5003; 602-523-7502.

12-16 July (Mon-Fri) **Groundwater Pollution and Hydrology.** San Francisco, CA. Contact: Princeton Groundwater, P.O. Box 263033, Tampa, FL 33685; 813-855-6898.

3-6 August (Tue-Fri) **Universities Council on Water Resources Annual Meeting and Conference: U.S. and International Water Resources Education.** San Francisco, CA. Contact: Margery Robinson, UCOWR Executive Director's Office, 4543 Faner Hall, Southern Illinois University at Carbondale, Carbondale, IL 62901; 618-536-7571.

12-13 August (Thu-Fri) **Texas Synergistic Conference on Constructed Wetlands.** Nacogdoches, Texas. Contact: American Water Foundation, 1616 17th Street, Suite 376, Denver, CO 80202; 303-628-5516.

29 August - 2 September (Sun-Thu) **American Water Resources Association 29th Annual Conference and Symposium, "Innovations in Ground Water Management" and "Effluent Use Management."** El Conquistador Resort, Tucson. Contact: AWRA, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192; 301-493-8600.

30 August - 3 September (Mon-Fri) **Fundamentals of Bioremediation of Hazardous Waste Contaminated Soils.** Logan, UT. Contact: Ivonne Harris, Registration Services, Utah Water Research Laboratory, Utah State University, Logan, UT 84322-8200; 801-750-3693.

*Announcements cont. from page 13*

## American Water Foundation Fellowships

The AWF Executive Board is offering fellowships to outstanding undergraduate and graduate students in agriculture, geology, law, economics, and political science. Three or more research fellowships will be awarded in the range of \$200-\$1000. Applicants must be enrolled as full-time students in a recognized program and must not be more than 35 years old. Funds may be used for books, supplies, computer time, equipment, or other special needs. Awards may be made to individuals or institutions for the student's use. Deadline for submission 10 July 1993. For more information contact: American Water Foundation, 1616 17th St., Suite #371, Denver, CO 80202.

## AHS to Award Scholarships

The Arizona Hydrological Society will award three \$500 student scholarships in 1993 to full-time juniors, seniors, and graduate students in hydrology, hydrogeology, or any water-related discipline at any Arizona university or college. Applications must be submitted by June 30, 1993 to Dr. Aregai Teclé, Northern Arizona University, School of Forestry, P.O. Box 4098, Flagstaff, AZ 86001.

## ADEQ Seeks Advice on Monitoring Sites

The Arizona Department of Environmental Quality (ADEQ) is in the process of modifying its monitoring plan by changing sites, parametric coverage, and sampling frequencies. The modified plan is for water year 1994 to begin in October 1993. The agency invites suggestions for possible surface water sites for monitoring. A June 1 deadline is set. A priority monitoring list will be established. Mail responses to ADEQ, Attn: Melinda K. Longworth, 400 West Congress St., Suite 433, Tucson, AZ 85701, or call for information: 602-628-6740.

## Foundation Money Available

FishAmerica Foundation provides grants of up to \$10,000 for the following: advancing fish populations and preserving and enhancing water ways; developing conservation programs promoting fish habitat, water quality, and waterway clean-up; encouraging personal conservation measures; and presenting workshops and seminars designed to inform and encourage private and public sector involvement in key fisheries and water quality issues. There are no grant deadlines. For more information contact: Christina Altman, Grants Administrator, 1010 Massachusetts Ave. NW, Suite 320, Washington, D.C. 20001; 202-898-0869.

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