divining rod

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Reaching the Limits: Stretching the Resources of the Lower Rio Grande

Over 300 participants gathered in Las Cruces for the 40th Annual New Mexico Water Conference held on October 26-27, 1995. The conference began early for some participants who took advantage of gorgeous southern New Mexico fall weather and visited Elephant Butte Irrigation District facilities. The response to the tour invitation was so great that the participants were split into two groups: one busload traveled to Elephant Butte Reservoir where Bureau of Reclamation staff led the tour, while the other group visited Caballo, Percha, and Leasburg dams, stopping along the way to listen to Gary Esslinger, manager of the EBID, describe the sites.

The conference kicked off Thursday morning with a keynote address given by Governor Gary Johnson. The Governor spoke on a range of subjects and took questions from a packed house. "Water is the number one priority for the state," asserted the Governor. He said he is formulating a cabinet council on water and feels that it is very important that we quantify New Mexico's water resources. Governor Johnson also noted that the State Engineer Office will require additional resources if it is to computerize its records and run more efficiently.

Tom Bahr, WRRI director, recognized H. Ralph Stucky, the first director of the WRRI and chair of the New Mexico water conference from 1956 through 1971. Dr. Bahr read a proclamation honoring Dr. Stucky for his more than 40 years of serving the water resources community locally as well as nationally. Dr. Stucky, the only participant at this conference who was also present at the first water conference, accepted the award to the enthusiastic applause of the audience.

The mood was upbeat at the Thursday evening banquet where the Quantum Jazz Quintet, all NMSU students, entertained. Lowell Catlett, NMSU professor and entertaining futurist, gave an animated commentary on his view of our technological future.

For the first time, a Water Conservation Poster Contest was held in conjunction with the conference with winners honored at the banquet. Students attending middle schools in the Las Cruces Public School district were invited to submit posters encouraging water conservation. A panel of judges evaluated 130 posters and made three awards. Several additional posters received an honorable mention.

"We were very pleased with the number of entries, and the quality of the students' work. A lot of creative thinking obviously went into these posters," according to Cathy Ortega Klett, conference coordinator.

First place went to Coy Hassell, 7th grader at Picacho Middle School. Coy received a certificate and $100 U.S. Savings Bond. Second and Third Place winners each received $50 savings bonds. Second place was a joint effort by two 6th graders at Lynn Middle School, Angela Buurma and Ashley Smith. Third place went to Derrick Lanning, a 7th grader at Picacho Middle School.

The conference proceedings to be published in early 1996 will contain papers from all speakers as well as comments made by panelists during two panel discussions on the important water issues facing those living in the Lower Rio Grande area. Conference participants will receive a copy of the proceedings at no charge.

Inside

Element found in Kitty Litter helps filter polluted water

From Catherine Lazorko, University Communications, NMSU

A New Mexico State University civil engineering professor has turned an old gas station in downtown Las Cruces into a laboratory for testing a method to clean groundwater.

Fernando Cadena has moved his research to Picacho Avenue where a former gasoline station's underground gasoline tank ruptured and leaked, contaminating the nearby groundwater about 20 years ago. Cadena's research, funded with about $100,000 from the Waste-management Education and Research Consortium and a private oil company consortium, offers a new and potentially inexpensive "pump and treat" method of cleaning groundwater.

A typical gasoline tank holds about 10,000 gallons, but it's not known how many gallons leaked at the study site. Cadena said the spill flow is substantial, stretching many feet from the source and 20 to 30 feet below the surface.

"This problem of leaking underground storage tanks is endemic nationwide, but we have a bigger problem in the Southwest because 90 percent of our communities get water supplies from the ground," Cadena said.

There are 5,800 underground storage tanks in New Mexico, according to Tony Moreland, a geologist with the New Mexico Environment Department. Of those, 916 are leaking. Within Doña Ana County, there are 420 underground storage tanks, and 97 of those leak, he said.

Len Murray, an environmental specialist with the New Mexico Environment Department's Las Cruces district office, said that all leaking tanks are a potential threat to groundwater and hence, drinking water. Several New Mexico communities, including Tatum and Hobbs, have lost municipal drinking water supplies to petroleum-based pollutants flowing from leaking underground tanks, Murray said.

Last year, Murray led efforts to permanently close 125 underground tanks—including some that were not leaking—throughout southwestern New Mexico. Leaking underground storage tanks are responsible for about 45 percent of all known cases of groundwater contamination, according to a February 1993 department report.

Fernando Cadena, NMSU civil engineering professor, and graduate student Jim Sarabia of Gallup stand near the apparatus that cleans polluted groundwater at a former gas station in Las Cruces. (photo by M. Kiernan)

In August 1995, Cadena and graduate student Jim Roberts treated about 1,000 gallons of polluted water below Las Cruces' old downtown station. The first step in Cadena's project was to establish a well to pump the polluted water to the surface. The water then was filtered through a 55-gallon drum lined with organically treated zeolite, a mineral used in Kitty Litter that acts as a pollutant filter to remove hazardous benzene, toluene and xylene found in gasoline and diesel fuels.

"This process removes a good 80 percent of the pollutants," Cadena said. "Then, the same water goes to a reservoir to remove any remaining pollutants."

Current water cleanup technologies, absorption and air stripping, require passing polluted water through an absorbent such as charcoal to filter the pollutants, or blowing air through the water and stripping off the pollutants. Neither technology completely eliminates the pollutants, Cadena said. With absorption, the filter eventually becomes saturated and must be regenerated or disposed. With air stripping the pollutants become airborne.

Cadena's technique, a hybrid of the two, incorporates both absorption and air stripping. In Cadena's process, the filter can be recycled and is not burned. When the filter becomes clogged, a hair dryer-like device heats and destroys the pollutants. Thus, the filter is reused indefinitely, he said.

After the "pump and treat" process, the water is treated again with the air stripping technique. By the end of the process, the water meets federal drinking water standards, Cadena said.

Cadena has received support through the WRRI for several projects. His most recent project on removing arsenic from wastewaters is described in WRRI technical report #293 (see page 5).

USGS issues reports on groundwater quality, arroyos, geophysical log data, 1995 activities in New Mexico, playas, and nutrients

The U.S. Geological Survey has published the following New Mexico related publications since the last issue of the *Divining Rod*. Copies are available for inspection at the USGS District Office in Albuquerque (4501 Indian School Road NE, Suite 200). The Water Resources Research Institute library also has the reports on file. They may be ordered from the USGS, Federal Center, Box 25286, MS 517, Denver, CO 80225. You may call (303) 236-7476 for price information.

◆ **Ground-water-quality and ground-level data, Bernalillo County, New Mexico, 1990-93** by G.E. Kues and B.M. Garcia (OFR 95-385) - Groundwater quality and groundwater level data were collected in four unincorporated areas of Bernalillo County during 1990-1993, according to this report. Twenty wells in the east mountain area of the county, 11 wells northeast of Albuquerque, 20 wells in the Rio Grande Valley north of Albuquerque, and 30 wells in the Rio Grande Valley south of Albuquerque were sampled.

Unincorporated areas of Bernalillo County, especially those in the Rio Grande Valley and in the eastern quarter of the county, have undergone rapid population growth and expanded development in recent years, increasing the demands on water supplies and also increasing the potential for groundwater contamination. Most homes in these areas use septic systems and County officials have been concerned over the potential for degradation of groundwater quality resulting from sewage disposal.

Monthly monitoring results in the east mountain area of the county are presented in graphical form. Data collected from other areas are presented in tabular form.

◆ **Infiltration and quality of water for two arroyo channels, Albuquerque, New Mexico** by C.L. Thomas (WRIR 95-4070) - Infiltration rates were calculated from instantaneous streamflow-loss rates, wetted channel area, and instantaneous evaporation rates and measured during 1989-92 for selected reaches of Tijeras Arroyo and Grant Line Arroyo in Albuquerque. According to the author, Carole Thomas, "Infiltration rates differed with the location of the reach measured and with the time of day. Differences in intrinsic permeability of the sediments may be the most important factor affecting spatial variations in infiltration. The most important factor affecting temporal variations in infiltration may be the temperature of the water and sediment at the infiltration site."

◆ **Description of geophysical-log data base for boreholes and wells in and adjacent to the Albuquerque Basin, New Mexico** by D.W. Wilkins (OFR 95-360) - Digital geophysical logs for boreholes and wells in and adjacent to the Albuquerque Basin have been entered into a data base. This report describes the data base, the general types of logs available for each borehole or well and their use, and general methods of data collection.

Data base development began in 1987 to provide an easily accessible, central storage location for selected digital geophysical logs. According to the author, D.W. Wilkins, "Geophysical logs in the data base can be grouped into one of four types: electric, nuclear, acoustic, or caliper. These logs provide information about the character of the aquifer, water, borehole, or finished well."

◆ **U.S. Geological Survey activities in New Mexico 1995** by R.K. Livingston (OFR 95-314) - This report provides an overview of the USGS in New Mexico, including activities of the agency's Water Resources, Geologic, and National Mapping divisions. USGS projects in New Mexico have addressed flood discharges, landslides, and land subsidence.

Recent environmental assessments include participation in the Kirtland Air Force Base Installation Restoration Program, designed to delineate and describe sites of possible groundwater, surface water, and soil contamination; erosion on the Zuni Reservation; and groundwater contamination in eastern Bernalillo County. Water availability and water quality studies have focused on groundwater depletion in the Albuquerque Basin, recharge in the Roswell Basin, and the water resources of Taos County. Water quality, bottom sediment, and biota associated with irrigation drainage in the San Juan River area and trace metals in the Rio Grande from San Felipe Pueblo to Los Lunas have been targets of investigations. The National Water Quality Assessment program has two study units that are partly in New Mexico: the Rio Grande Valley and the Southern High Plains.

Energy and mineral resource assessments include gas resources in the San Juan Basin and environmental impacts of mining in the Mimbres Resource Area. The USGS also is determining the extent of areas of suitable habitat for protecting Mexican Spotted Owls in the event of future mineral mining.

The report also includes information on USGS cartographic/thematic products and geographical information systems; surface-water, groundwater, and water-quality data collection networks, and reports published from 1993-1995.

◆ **Hydrologic and ecologic influence of playa basins in the**

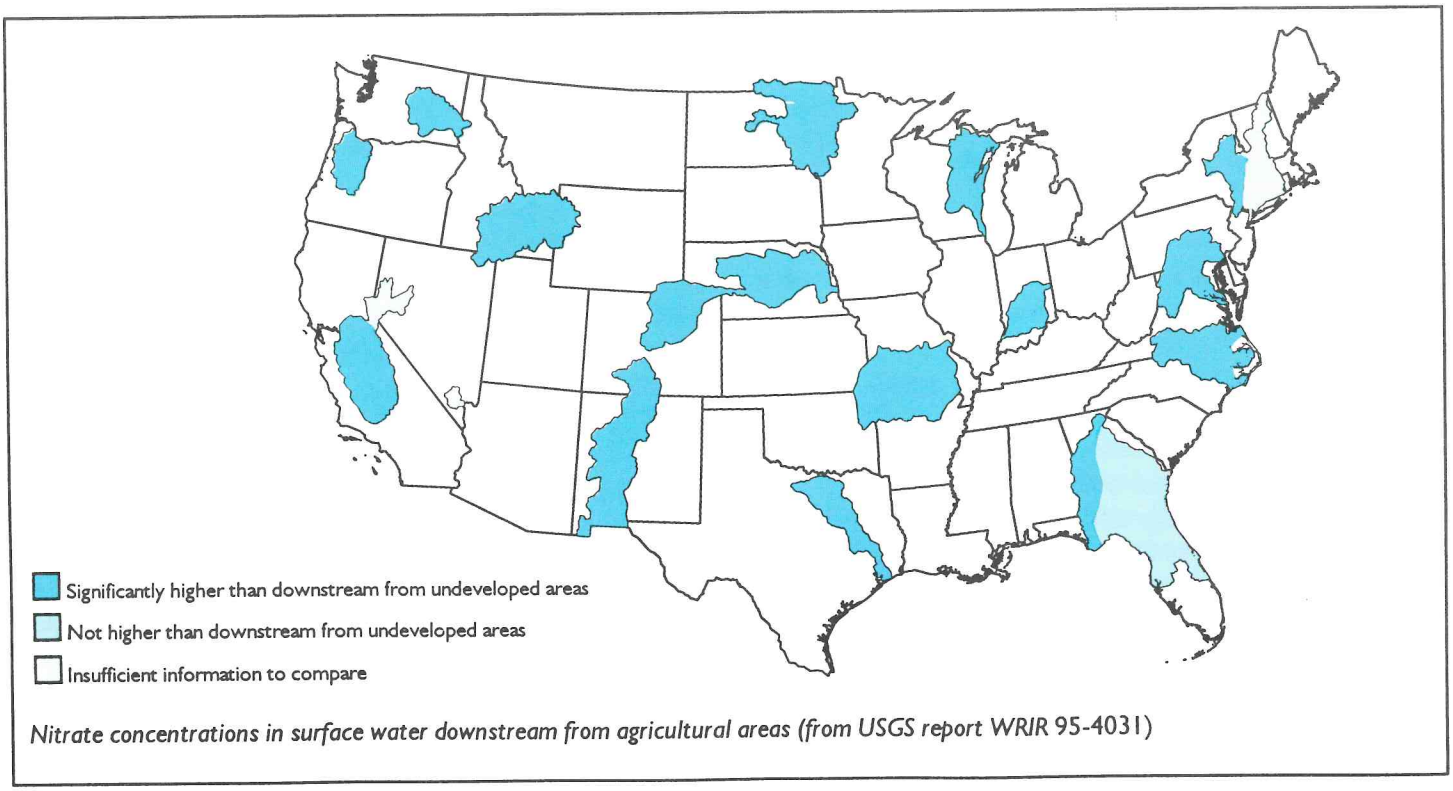
Southern High Plains, Texas and New Mexico by L.M. Bexfield (OFR 94-702) - About 20,000 shallow depressions, called playa basins, mark the Southern High Plains plateau of Texas and New Mexico. These basins periodically accumulate water after heavy rainfall to form ephemeral playa lakes. This report summarizes the important influences of playa lakes and basins on the hydrology and ecology of the Southern High Plains.

◆ **Nutrients in Ground Water and Surface Water of the United States-An Analysis of Data Through 1992** by D.K. Mueller, P.A. Hamilton, D.R. Helsel, K.J. Hitt, and B.C. Ruddy (WRIR 95-4031) - The most extensive study of nutrients in the nation's water resources—12,000 groundwater and 22,000 surface-water samples— found that the drinking water standard for nitrate was exceeded in 21 percent of shallow wells in agricultural areas, according to this report. The study, conducted by the USGS National Water Quality Assessment program, indicates that nitrate levels in ground and surface waters are higher in agricultural areas, indicating patterns of contamination that relate to land use. Nitrate concentrations in surface waters were elevated downstream from agricultural areas, but at significantly lower levels than in groundwater. Concentrations in surface waters rarely exceeded the drinking water standard. Ammonia and phosphorus levels were also elevated downstream from urban areas.

Study results indicate that contamination patterns based on land use are key to determining where water-quality problems may occur. Understanding regional patterns of contamination will be critical to the design of appropriate watershed management strategies.

◆ **Surface-water discharge and evapotranspiration rates for grass and bare soil along a reach of the Rio Grande, Albuquerque, New Mexico, 1989-95** by C.R. Thorn (OFR 95-419) - Two east-west cross sections were established on the Rio Grande in the Albuquerque area to measure surface water entering and exiting the study area. Data for calculating surface-water discharge were collected once every 4-8 weeks from August 1989 through February 1995 from 23 sites on the Rio Grande and all irrigation drains, canals, and ditches along the north and south sections. The data collected will help define the flow system of the Rio Grande floodplain in the Albuquerque area.

◆ **Ground-water hydrographs and 5-year ground-water-level changes, 1984-93, for selected areas in and adjacent to New Mexico** by D.W. Wilkins and B.M. Garcia (OFR 95-434) - This report presents hydrographs of groundwater-level data collected through 1993 from 22 wells equipped with continuous water-level recorders, maps of changes in groundwater levels using water-level data collected at 5-year intervals during 1984-93 in 34 monitoring areas, and hydrographs of 5-year or more frequent water levels measured in selected wells in each monitoring area.



Nitrate concentrations in surface water downstream from agricultural areas (from USGS report WRIR 95-4031)

Five WRRI technical reports published

The following five technical completion reports have been published by the institute in recent months. To receive free copies either write or call WRRI, Box 30001/Dept. 3167, Las Cruces, NM 88003; (505) 646-1813 or place an order thru WRRI's home page at http://wrri.nmsu.edu/

◆ **Report No. 291 - RIOFISH: A Comprehensive Management System Model for New Mexico Sportfisheries** by R.A. Cole, T.J. Ward, F.A. Ward, R.A. Deitner, R.W. Rodden, S.M. Bolton, and K.A. Green-Hammond

For the past 15 years, investigators at New Mexico State University have cooperated with staff from the New Mexico Department of Game and Fish to develop a sportfishery comprehensive management model, RIOFISH. This report is the last in a series documenting the model's evolution and describes the model in text and diagrams, and includes a mathematic appendix.

RIOFISH simulates over 90% of the state fishing at 132 sites. The model has three main components—hydrology, biology, and economics—which may be run separately or integrated. The hydrologic component simulates historic flows or synthetic-forecast flows of water and biologically active material in seven flow categories from extremely low to extremely high runoff.

Output information about flow and material load serves as input for the biologic component, which simulates ecosystem production and food partitioning for up to 24 fish populations. Output information about fish catch, harvest and mean weight serves as input for the economics component, along with habitat surface area from the hydrology component. The economics component simulates angler use, angler economic benefit and regional income from inputs about site quality, substitute site quality, and angler demand.

Model users may modify management and research-related input variables and have access to numerous informative outputs. RIOFISH may be used to compare outputs of reference scenarios and alternative scenarios to determine gains or losses in output values associated with different management practices or research uncertainties.

The model can be run on IBM-compatible desk-top computers. A copy of the user guide and model on diskette are available on request (see below).

◆ **Report No. 292 - User's Guide for RIOFISH: A Comprehensive Management System Model for New Mexico Sportfisheries** by R.A. Cole, K.A. Green-Hammond, F.A. Ward, T.J. Ward, and R.A. Deitner

This guide summarizes the development and structure of the sportfishery management model RIOFISH. Following an introductory background, the guide is designed to be read as the model is run via diskettes for IBM compatible desk-top computers.

The model user is stepped through menus that access background information, scenario setup processes, model running processes, and retrieval of model results. The various model uses are described, with emphasis on comprehensive management planning.

◆ **Report No. 293 - Arsenate Precipitation Using Ferric Iron in Acidic Conditions** by F. Cadena and T.L. Kirk

The most common method for arsenic removal is chemical precipitation with lime and ferric salts, followed by coagulation and filtration processes. Most processes, however, operate at a pH of around 7 to 12, and very little investigation has been done using this method under acidic conditions.

Chemical precipitation using the lime and ferric salt method is very effective, particularly at high initial arsenic concentrations. However, this process produces large quantities of sludge, which makes the process chemically intensive and inefficient from a waste minimization viewpoint.

The technology presented in this report by NMSU researchers addresses the removal of arsenate from industrial wastewaters containing relatively high concentrations of pentavalent arsenic. This methodology may present innovative alternatives to the water treatment industry, where this element typically is found at below the 1.0 mg/L level.

◆ **Report No. 294 - An Expanded Suite of Tracers for Hydrological Investigations** by R. S. Bowman, C.F. Benson and J. Verploegh

Tracers, water-soluble chemicals that are stable and nonreactive, have long been used to follow the movement of water through soils and aquifers.

Currently, the number of useful water tracers is limited. Recently, several fluorinated benzoic acid derivatives have been used effectively as soil and groundwater tracers. This research, under the direction of New Mexico Tech investigator Robert Bowman, provides an expanded pool of effective water tracers which can be readily and economically utilized for hydrological investigations.

The research focused on:

- testing a new series of fluorobenzoic acid (FBA) derivatives for suitability as soil and groundwater tracers;
- developing analytical methodologies to measure new and existing FBA tracers simultaneously in natural water samples; and

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Scenes from a v

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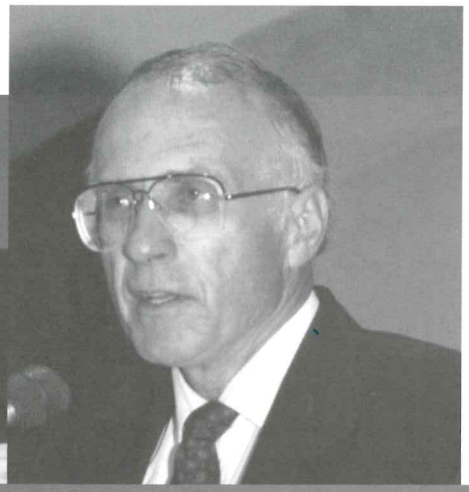

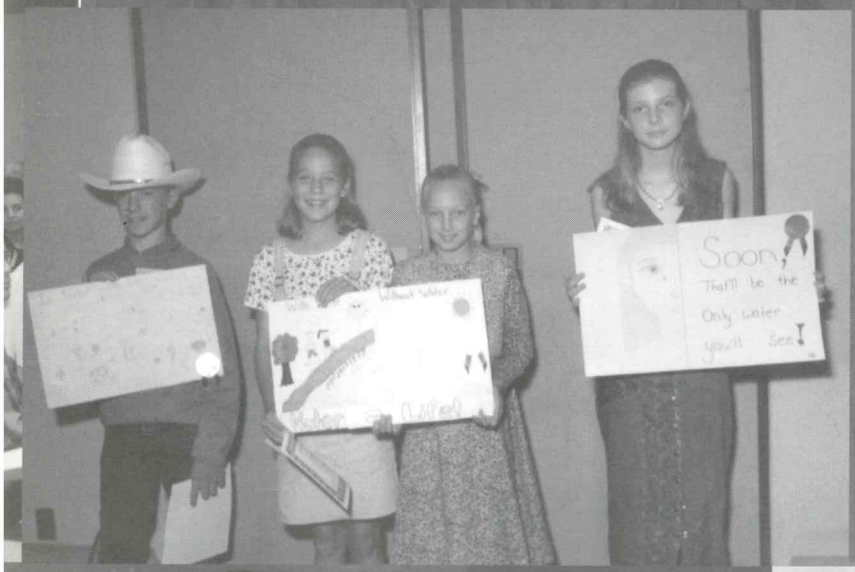

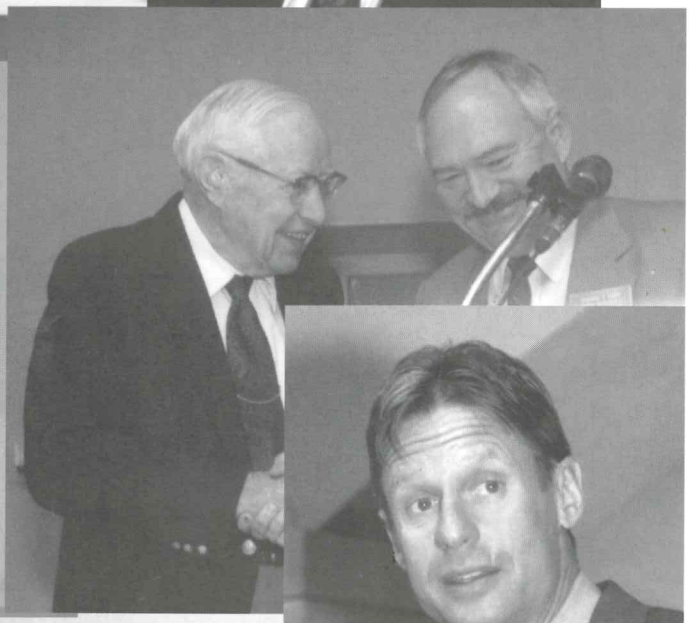

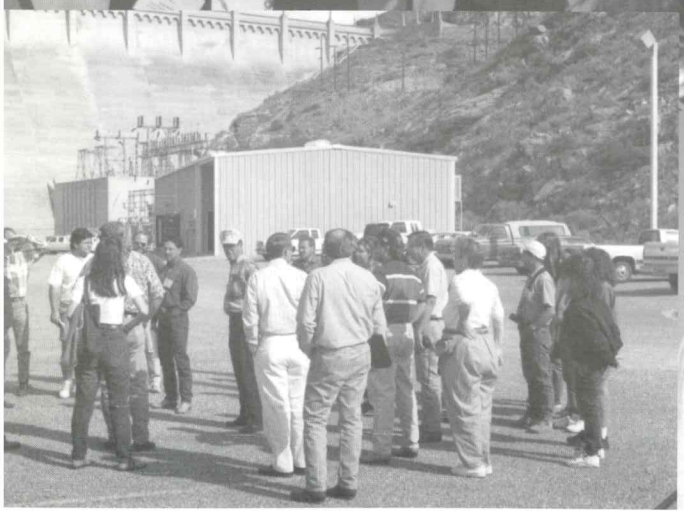

New Xeriscape Brochure Offers Handy and Colorful Water Conservation Tips

"Enchanted" and "xeriscape" may not be words that most New Mexicans use to describe the same landscape. But a new brochure from the New Mexico State Engineer Office is designed to change the way we think about xeriscaping by showing just how colorful and beautiful water conserving landscapes can be.

The Enchanted Xeriscape is a full-color brochure which provides plenty of hands-on information about water-wise landscaping in New Mexico. It features color photographs of xeriscapes from throughout the state, plus photographs of specific low-water use plants. In addition, a list of specific plants and their water use requirements is included for each of New Mexico's three xeriscape climate areas - north/mountain, central and south.

"Our intention with *The Enchanted Xeriscape* is to provide an introduction to the principles of water-wise landscaping," said Alice Darilek, Water Conservation Program Coordinator, State Engineer Office. "As a semiarid state, New Mexico has limited water resources. Promoting wise water use in outdoor landscaping can help ensure that our water supplies meet current and future demands."

The Enchanted Xeriscape is the second residential water conservation brochure produced by the State Engineer Office. The first, entitled *Agua Action*, offers an overview of water saving tips plus interesting water facts. Both brochures can be displayed as wall posters.

Free copies of *The Enchanted Xeriscape* and *Agua Action* are available by calling the State Engineer Office's Water Conservation Program at (505) 827-3879 or 1-800-WATER-NM. Prices for large-quantity orders for municipal or commercial distribution are also available.

Bilingual Water Quality Sampling Handbook Available

Monitoring water quality along the U.S.-Mexico border should be more consistent and uniform with the publication of a bilingual handbook describing proper sampling techniques. The *Field Manual for Water Quality Sampling/Manual de Campo para el Muestreo de la Calidad del Agua* presents a sampling protocol consistent with the practices of Mexican and U.S. federal and state agencies.

The Water Resources Research Center at the University of Arizona, in cooperation with the Arizona Department of Environmental Quality, developed the publication in response to growing concern about public health and environmental conditions along the border.

The manual outlines a step-by-step process, from siting a water sampling station to shipping collected samples to analytical laboratories. Beginning with a section on safeguarding samplers' health and safety, the manual covers planning stages, including selecting and establishing sampling stations, and making preparations prior to going into the field.

Most of the handbook is devoted to describing correct procedures for sampling both groundwater and surface water for nearly all types of potential contaminants. Illustrations, check lists, and step-by-step instructions are provided as well as post-sampling instructions, reference and glossary information and a full index.

The field manual is designed for use in the field under rugged conditions. Sized to fit in a back pocket, the manual is printed in indelible ink on water-proof, tear-proof paper. Nearly indestructible, it also floats.

For further information on the bilingual field manual, contact Gary Woodard at the University of Arizona's WRRC, (520) 792-9591; those with access to the World Wide Web will find field manual information on the WRRC's home page at http://ag.arizona.edu/AZWATER/.

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HTTP://WRRI.NMSU.EDU/

Día del Río celebrates basin's rich diversity

The Rio Grande/Río Bravo Basin Coalition held the first annual Día del Río on Saturday, October 21, 1995. The event was held to improve the quality of the Rio Grande basin, while building international cooperation among the United States, Mexico and Native American pueblos through public awareness activities.

Día del Río was both a call to action and a celebration of the basin's rich diversity. It drew public attention to the critical state of the basin's rivers, riparian habitat and groundwater, according to its organizers. It also demonstrated the commitment by citizens in the basin to improve the quality of life.

Día del Río was envisioned as a volunteer event which would occur simultaneously throughout the basin with the aim to raise awareness through public talks, tree planting, river cleanups and youth activities.

Nearly 50 organizations in Mexico and the United States were partners in Día del Río. These organizations helped plan, promote and execute events in their respective areas. For example, at the headwaters of the Rio Grande in southern Colorado, the Citizens for San Luis Valley Water painted murals and held a number of cultural events in celebration of the river and its biodiversity.

The Rio de las Gallinas Acequia Association in Las Vegas, New Mexico hosted a two-day seminar in support of sustainable development in northern New Mexico. The theme of the seminar was legal and historical issues surrounding acequias and water adjudication. Topics included regional planning, sustainable agricultural development, and management of the Gallinas watershed. At the close of the seminar, each participant received a tree to plant on their land.

In the corridor from Taos to Socorro, New Mexico a number of events took place to celebrate Día del Río. In Taos, volunteers helped remove salt cedars at Orilla Verde Recreation Area. Native trees were planted and a "Gathering of Waters" ceremony took place.

Día del Río events included cleanup projects, nature hikes, tree plantings and educational talks.

Albuquerque activities included a South Valley Bosque cleanup and nature hike, a tour of the Albuquerque constructed wetlands pilot facility, a river curriculum and hands-on activities for teachers at the Rio Grande Nature Center presented by the Albuquerque Science Teachers Association and river/water explorations at the Coronado State Park.

Socorro hosted a Bosque Education service training activity at the Bosque del Apache National Wildlife Refuge as well as the dedication of the new Nature Center at the Bosque del Apache National Wildlife Refuge.

The El Paso/Ciudad Juárez/Las Cruces area hosted a series of activities which sought to promote the importance of saving and protecting water resources. Among these activities was an essay competition for 6, 7, and 8th graders in the region. Students were asked to write on the theme of "Why is it important to conserve and protect our water resources?" Prizes were given to the top respondents. Ten groups in Cd. Juarez were commissioned to paint murals. Each group received a small honorarium. Mural locations are spread around the city and will serve as a continual reminder to residents of the importance of water resources.

Día del Río was organized by the Rio Grande/Río Bravo Sustainable Development Initiative. The Initiative is a nongovernmental, nonpartisan program made up of citizen-based working groups in the basin. For more information on the program, contact Daniel Sisbarro, Program Director, Center for Global Studies, 4800 Research Forest Drive, The Woodlands, TX 77381, (713) 363-7913.

USGS SECTION 105 COMPLETION REPORTS AVAILABLE

The U.S. Geological Survey has announced the publication of recently completed Section 105 Water Resources Research Completion Reports. The reports will be available sometime in 1996 from the National Technical Information Service, USDC, Springfield, VA, 22161. A partial list of completed reports follows.

Turbulence Measurements in a Straight Flume with a Transversely Sloping Bed and in a Meandering Laboratory Channel (G1732) by K.-L. Lee, E.R. Holley, and Z. Weizhun - University of Texas

Management of Conserved Water: Market Development, Efficiency Gains, and Distributive Consequences (G1751) by B.G. Colby, D. Cory, and H. Ayer - University of Arizona

Institutional Change in Water Management: Consequences of State Trust Land Claims and Participation (G1891) by S.K. Fairfax - University of California at Berkeley

Coping with Severe, Sustained Drought in the Southwestern United States (G1892) by D.S. Bowles and W.B. Lord - Utah State University

Microbial Degradation of Soil-Associated Organics (G1902) by J.T. Novak - Virginia Polytechnic Institute and State University

Predicting Water Flow and Kinetic Equilibrium Sorption Effects of Pesticides in Soil (G1906) by R.J. Wagenet and J.L. Hutson - Cornell University

Nucleophilic Reagent Effect on Mutagenic, Chlorinated Drinking Water (G1912) by R.T. LaLonde - State University of New York

Spreading and Mixing of Soluble Contaminant Plumes in Self-Similar Porous Media (G1916) by M.W. Kemblowski, E.U. Gilberto, C.-M. Chang, Y. Ma, and J.-C. Wen - Utah State University

Transport of Gases to Groundwater under Constant and Fluctuating Water Table Conditions (G1917) by R.L. Johnson and P.L. Toccalino - Oregon Graduate Institute

Scale Variations in Groundwater-Surface Water Interactions (G1920) by K.L. Prestegaard - University of Maryland

Agricultural Practices and Groundwater Quality in the High Plains: Impacts of States, Regional and National Policies (G2082) by D.J. Bernardo and R.L. Elliott - Oklahoma State University

Regional Modelling and Economic Incentives for Water Quality and Quantity Control (G2084) by R. Howitt - University of California at Davis

Effects of Agricultural Practices on Surface Water Quality (G2085) by T.O. Randhir, J.G. Lee, and R.D. Lacewell - Purdue University and Texas A&M University

An Investigation into the Literature Used by the Water Resources Research Community (G2087) by R.D. Walker and M.L. Ahn - University of Wisconsin at Madison

Using Public Preferences to Identify Options for Watershed Management: Economic Assessment Using a Contingent Choice Survey (G2088) by L.A. Smith, S.K. Swallow, T.F. Weaver, and R.J. Johnson - University of Rhode Island

Volatilization of Organic Solutes (G2089) by G.O. Brown - Oklahoma State University

Transport of Non-Indigenous Bacteria in Groundwater for the Initiation of In-Situ Bioremediation of Organic Contaminants (G2091) by A.S. Weber - University of Buffalo

Enhancement of Photodegradation of Pesticides in Soil by Transport Upward in Evaporating Water (G2094) by S.G. Donaldson - University of Nevada at Reno

Ionic Binding and Its Effect on the Conformation and Sorptivity of Natural Organic Matter (G2096) by W. Fish and B. Bonn - Oregon Graduate Institute

Structural and Functional Responses of Benthic Communities to Heavy Metals: Variation along Longitudinal Stream Gradients (G2099) by W.H. Clements, P.M. Kiffney, and C.N. Medley - Colorado State University

The Impact of Cyanobacterial Metabolites on Water Quality (G2101) by J.J. Sasner - University of New Hampshire

Hydrometeorological Modeling for Climate Studies (G2107) by J.A. Smith - Princeton University

A Spatially Distributed Water Balance Based on Physical, Isotopic and Remotely Sensed Data (G2110) by C.M. Neale, D.G. Tarboton, J.J. McDonnell, T. Jackson, and G.A. Artan - Utah State University

A Study of Cool, Warm, and Wet Episodes in the Western United States (G2113) by S.-C. Chen and J.O. Roads - University of California at San Diego

Develop and Test Vulnerability and Toxicity Indices for Classifying Karst Aquifer Pollution Potential (G2157) by D.A. Kurtz and R.R. Parizek - Pennsylvania State University

Simulation of Effects of Climate Change on Surface Water Balances of Agricultural Lands (G2158) by J.L. Heilman and M.J. McFarland - Texas A&M University

Using Water Banks to Promote More Flexible Water Use (G2253) by L.J. MacDonnell - University of Colorado

An Analysis of Water Quality Enforcement Strategies and Their Effectiveness in Achieving Water Quality Standards (G2254) by S. Hunter - West Virginia University

(continued from page 5)

- developing methods to lower FBA tracer detection limits in natural water samples.

◆ **Report No. 295 - Economic Optimization of River Management Using Genetic Algorithms** by J. P. King, F.A. Ward, H.S. Fahmy and M.W. Wentzel

In this research, NMSU investigators studied the potential of a genetic algorithm-based technique to optimize the operation of a complex water resources problem. Current approaches to this problem represent a tradeoff between model accuracy and optimization capability.

Both a dynamic programming and a genetic algorithm approach were applied to a simple water resources exercise. As the exercise grew in complexity, the calculation time for the dynamic programming model increased rapidly. In contrast, the genetic algorithm implementation experienced a much smaller increase in calculation time.

The genetic algorithm approach was then applied to the problem of optimizing the operation of a complex simulation model of the Rio Grande Project in southern New Mexico. Although it did not model the behavior of the Project with complete accuracy, it was able to guide the search to better operating strategies, demonstrating the potential of genetic algorithms to optimize the operation of realistic system models when they are available.

Rio Grande Compact Commission 1994 Report Issued

The New Mexico Interstate Stream Commission (ISC) has issued the 1994 Report of the Rio Grande Compact Commission to the Governors of Colorado, New Mexico and Texas. The report was prepared by the U.S. Geological Survey and contains water-supply data provided by various federal and state agencies.

At its 56th Annual Meeting of the Rio Grande Compact Commission on March 23, 1995, the Commission found that:

✔ deliveries of water at the Colorado-New Mexico state line by Colorado amounted to 286,600 acre-feet in 1994 and the scheduled delivery for the year was 277,600 acre-feet. The accrued credit of Colorado was 44,200 acre-feet on January 1, 1995. The decrease in storage in 1994 in reservoirs in Colorado constructed after 1937 aggregated 1,200 acre-feet.

✔ deliveries of water into Elephant Butte Reservoir by New Mexico...amounted to 950,300 acre-feet in 1994 and the scheduled delivery for the year was 834,600 acre-feet. The accrued credit of New Mexico was 106,900 acre-feet on January 1, 1995. The decrease in storage in 1994 in reservoirs in New Mexico above San Marcial constructed after 1929 aggregated 31,400 acre-feet.

✔ release of usable water in 1994 from Project Storage amounted to 884,100 acre-feet. The accrued departure from normal release on January 1, 1995, was zero. Actual spill of credit water from Project Storage amounted to 10,000 acre-feet in 1994.

A limited number of copies of the report is available from Mike Roark, USGS, (505) 262-5354. Copies are available for inspection at most libraries around the state.

Budget Update

As we go to press with this issue of the *Divining Rod*, federal funding for the Water Resources Research Institutes program has cleared most Congressional hurdles. However, the overall Interior Appropriation Bill for FY96, which provides funding to the Institutes through the U.S. Geological Survey, is still on hold in the House-Senate Conference Committee.

The House and Senate have agreed on continued funding for the Institutes at last year's level ($80,000 per Institute) but they still must reach agreement on other Interior Department funding issues. It is expected that when the final funding bill is passed, new procedures will be required by the U.S. Geological Survey to introduce additional competition into the Institutes program. Until the funding bill is passed and new guidelines issued by the USGS, we will have to delay our normal request for proposals announcement.

The Congressional authorization of the Water Resources Research Act expired September 30, 1995. A new reauthorization bill (H.R. 1743), cosponsored by Congressman Joe Skeen, was introduced and passed the full House last month. The bill must now pass the Senate, and when signed into law, would extend the authorization another five years.

Hydroexplorer Runs Colorado River Rapids

A second version of the *Hydroexplorer* computer game, "The Colorado River Run," is now available from the Water Education Foundation.

The new *Hydroexplorer* explores the Colorado River and its tributaries, from Colorado to the Gulf of California. Designed for grades 7-12, it is a fun way to introduce students to western water issues. Development of the game was funded through a cooperative agreement with the Bureau of Reclamation's Lower Colorado Regional Water Conservation Center.

Players "board" *Hydroexplorer*, a freshwater submarine and choose one of the river's tributaries to begin their journey. Once on the river, players explore several national parks, float past the Colorado's many dams, and end the journey in Mexico. Along the way, "Mission Control" sends urgent messages requesting information about the geology and geography of the seven Colorado River states, the water delivery system and major uses of the water—farming, urban, industrial and environmental. Players can use the sub's "periscope" to research the questions and retrieve information.

The *Colorado Hydroexplorer* computer is available for $25 in either an IBM or Macintosh version. Contact the Water Education Foundation at (916) 444-6240 for an order form or more information.

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