



DIVINING ROD

NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE

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Spring 1999

Two new water quality projects slated for funding

Assuming New Mexico Governor Gary Johnson signs this year's general government appropriations bill, the New Mexico Water Resources Research Institute will provide funding for at least two new projects through the 1999 WRRRI Seed Money Research Program. Depending on the amount of state appropriations made available to the institute, other projects may be funded later this year.

The first of these projects recognizes that of the estimated 20 billion acre-feet of New Mexico's water stored underground, only about 3 billion acre-feet is potentially recoverable fresh water. The rest is too saline for human consumption. Conventional reverse osmosis—a process used for purifying water whereby pressure is applied to saline water on one side of a semiper-

meable membrane, forcing freshwater through the membrane—has shown promise of providing an economical method of purifying saline and other impaired waters. However, a major limitation is its relatively large waste stream. The waste stream can be as much as 80% of the total volume treated. The high cost of waste disposal severely limits the use of reverse osmosis.

The goal of Dr. T.M. Whitworth's research is to reduce that waste stream to a solid—a reduction in waste volume of up to four orders of magnitude—thus allowing all the water input into the system to be purified.

In a previous WRRRI-funded project, Dr. Whitworth and his research assistant, Gina DeRosa, both of New Mexico Tech, were successful in precipitating

heavy metals including copper, cobalt, and lead, from undersaturated chloride solutions forced through clay membranes—a process referred to as hyperfiltration. Metal chloride solutions are quite soluble, but not as soluble as sodium chloride, a common constituent of almost all waters. If Dr. Whitworth's waste reduction system is to be widely applicable, it must be able to precipitate highly soluble dissolved minerals such as sodium chloride as well as less soluble dissolved minerals.

Theoretical calculations suggest that it is not only possible to precipitate sodium chloride from an initially undersaturated solution passing through a membrane, but that it can be done at fluid pressures of less

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Undergraduate Chris Durrand (left) and Dr. T.M. Whitworth stand next to an experimental hyperfiltration setup.

Make plans to attend the
44th Annual New Mexico
Water Conference
December 2-3, 1999
Santa Fe, NM
La Fonda Hotel

*We'll focus on New Mexico's
obligations under The Rio
Grande Compact and related
issues*



than 400 psi—pressure significantly less than those used in most reverse osmosis systems.

The secret seems to be in the use of an osmotically **inefficient** membrane, that is, one with low, but adequate, separation efficiency and low pressure requirements. Dr. Whitworth will use clay membranes because their osmotic efficiency is related to membrane compaction, which is simple to control experimentally.

Potential uses of the reverse osmosis waste reduction system are many in New Mexico. It could be used in the treatment of both irrigation water and river water to reduce total dissolved solids. Municipalities and individuals could use the system to treat saline and other impaired waters. It is hoped this project will improve the commercial viability of the method so that industrial partners can be attracted to make this process available to users in New Mexico.

Another project to be funded by the WRI continues research under the direction of Dr. Kevin Oshima of New Mexico State University aimed at recovering viruses and *Cryptosporidium* oocysts from water. Although there is growing concern for the potential health risks associated with the presence of pathogens in our water, little data are available to determine how significant are these risks. To identify and quantify waterborne pathogens, methods are needed to reliably concentrate pathogens from drinking, surface and groundwater.

The U.S. Environmental Protection Agency has mandated that large water utilities in the U.S. test their source and product water for viral pathogens from surface and groundwater systems. There are difficulties associated with current methods for concentrating pathogens including time and expense as well as variable

efficiency and consistency of virus and parasite recovery. Further, the use of different methods for detecting viruses, bacteria and protozoan organisms from water increases the complexity and expense.

As part of a previous WRI-funded project, Dr. Oshima's laboratory has optimized two ultrafiltration systems (hollow fiber and tangential flow) to concentrate waterborne viruses under laboratory scale conditions. Now Dr. Oshima will scale-up the systems for use under field conditions and integrate the use of a PCR (Polymerase Chain Reaction) detection system to amplify nucleic acid from enteroviruses and *Cryptosporidium* oocysts to enhance the detection of these pathogens.

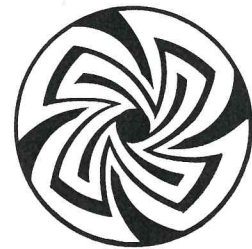
Dr. Oshima and his graduate assistants will attempt to:

- 1) optimize methods to recover viruses under field size (100-1000 L) samples;
- 2) determine the correlation between small and field scale testing for virus recovery;

3) determine the recovery efficiency of *Cryptosporidium parvum* oocysts from environmental water using a small scale hollow fiber ultrafiltration system; and

4) develop and optimize a downstream sample processing procedure leading to the concentration of the sample to less than 1 ml for the field scale samples.

Using ultrafiltration to concentrate viral particles in water was described by Dr. Oshima at last year's WRI water conference. His presentation is contained in the conference proceedings which is available by contacting the WRI at 505-646-4337 or emailing your request to coklett@wrii.nmsu.edu.



Biology graduate student Linda Winona describes the operation of a hollow-fiber ultrafiltration system to be used to concentrate viruses from large volumes of river water.



WRI Reports

43rd Annual Water Conference Proceedings *Water Challenges on the Lower Rio Grande*

All presentations made at last fall's Annual New Mexico Water Conference are contained in the 43rd Annual Water Conference Proceedings, *Water Challenges on the Lower Rio Grande*. Copies of the proceedings will be mailed to conference participants in May. Others interested in obtaining a copy can send a check for \$15.75 to NMWRRI, MSC 3167, Box 30001, Las Cruces, NM 88003.

The following is a list of the papers contained in the proceedings.

Keynote Address: Transfer of Reclamation Project Water from Historic Irrigation to New M&I Uses - Bureau of Reclamation Commissioner **Eluid Martinez**

The Rio Grande Compact: Law of the River - **Chuck DuMars**, UNM School of Law; **Tom Turney**, New Mexico State Engineer; **Jack Hammond**, Texas Rio Grande Compact Commissioner; **Hal D. Simpson**, Colorado State Engineer

Regional Water Planning Update - **Richard Cheney**, Interstate Stream Commission (ISC) Chair and **Mary Helen Follingstad**, ISC staff

The Evolution of the Rio Grande - **Neal Ackerly**, Dos Rios Consultants, Inc.

New Mexico/Texas Water Commission: Update on Commission Activities - **Ed Archuleta**, El Paso Water Utilities

Luncheon Addresses: U.S. Congressman **Joseph Skeen**
Lieutenant Governor **Walter Bradley**

Basin Guidelines and Hydrographic Survey of the Lower Rio Grande - **Calvin Chavez** and **Max Chavez**, Office of the State Engineer

Groundwater Modeling in the Lower Rio Grande - **Peter Balleau**, Balleau Groundwater, Inc.

U.S. Geological Survey Seepage Investigations of the Lower Rio Grande in the Mesilla Valley - **Ed Nickerson**, USGS

The Removal of Arsenic Compounds from Natural Water Sources - **Robert Wingo**, NMSU

Effects of Fire on the Spatial and Temporal Distribution of Mercury in Sediments of an Arid-Lands Reservoir - **Colleen Caldwell**, NMSU

Aquifer Sensitivity Assessment for the Mesilla Valley - **John Kennedy**, WRI

Concentration of Viral Particles from Water by Ultrafiltration - **Kevin Oshima**, NMSU

An Assay for Toxic Chemicals Using Microorganisms - **James Botsford**, NMSU

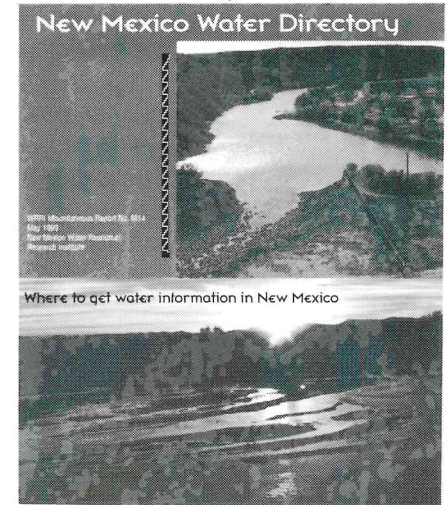
National Water Resources Association Update - **Wayne Cunningham**, NWA

New Mexico First's Recommendations and the State Engineer-ISC Legislative Agenda for 1999 - **John Shomaker**, John Shomaker & Associates, Inc.

Water Quality on the Lower Rio Grande - **James Davis**, NM Environment Department; **Rodger Ferreira**, USGS; and **Mark Jordan**, TNRCC

Conversion of Water from Agricultural to Municipal Use: How to do it - **John Utton**, Sheehan, Sheehan & Stelzner, P.C.; **Ed Archuleta**, El Paso Water Utilities; **Gary Arnold**, EBID; and **Len Stokes**, Progressive Environmental Systems Inc.

New Mexico Water Directory: Where to get water information in New Mexico



The 1999 edition of the *New Mexico Water Directory* is at the press and should be ready for distribution in early June. WRI staff member Cynthia Rex has spent many hours compiling information on the various water resources agencies and researchers in New Mexico. The directory will assist individuals in locating the best source of information to answer their water-related questions.

The 75-page directory is organized into five chapters: 1) Federal Agencies; 2) State Agencies; 3) Aquia Associations and Irrigation and Conservancy Districts; 4) Water and Professional Organizations; and 5) Universities.

Chapters contain each agency's mission and Internet address. Key personnel are provided with their address, phone number and email address. Staff are further identified by key words describing their areas of expertise. An index by area of expertise is provided along with an alphabetical listing of all individuals contained within the directory.

The latest version of the directory will be available on WRI's home page at <http://wri.nmsu.edu>.



News Briefs

Annual Operating Plan for Elephant Butte and Caballo reservoirs to be discussed

The Bureau of Reclamation will hold two public meetings to discuss its Annual Operating Plan for Elephant Butte and Caballo reservoirs for 1999. On May 18, a public meeting will be held at the NM Dept. of Agriculture located on the NMSU campus at the corner of Espina St. and Gregg St., Las Cruces. On May 19, another public meeting will be held at UTEP, Geological Science building, room 123. Both meetings will begin at 7:00 pm.

As of April 30, 1999, storage in Elephant Butte Reservoir was 1,592,200 acre-feet, and Caballo Reservoir was at 58,260 acre-feet. Due to the poor snowpack in the mountains of northern New Mexico and southern Colorado, dry conditions, high winds, and low runoff forecasts for this spring, Reclamation does not anticipate filling either reservoir this year.

Reclamation will present information concerning storage and lake levels for both reservoirs for 1999 based on present climatic conditions. It also will present a slide show illustrating the history of the Rio Grande Project, including Elephant Butte and Caballo reservoirs.

For further information, contact Filiberto Cortez or Wayne Treers at 915-534-6321.



Ground-water systems book published

William Stone, long-time New Mexico hydrogeologist, has written a book entitled *Hydrogeology in Practice—A Guide to Characterizing Ground-Water Systems*.

The book is designed to fill the gap between the theoretical world of tradi-

tional college courses and the applied world of real-life water studies, with many New Mexico examples and case histories.

This paperback book is available from Prentice Hall Engineering, Science & Math. For more details on the book and to order, check out <http://www.prenhall.com/books/>.



U.S.-Mexico border region web site

Border EcoWeb (BEW) is a newly created web page designed to facilitate community access to information about the environment of the U.S.-Mexican border region. BEW's two main components are its Inventory of Web Pages and Directory of Organizations.

The Inventory page provides brief descriptions and links to various environmental data sets available on the Internet. The Directory of Organizations contains contact information and project descriptions for government agencies, and other groups involved with the border environment.

You may view the website at <http://www.borderecoweb.sdsu.edu>.



Albuquerque releases water conservation report

The City of Albuquerque has released the Water Conservation Program's Annual Report for 1998. The report indicates that while progress was made last year in many areas, the program did not achieve its goal of reducing usage another 3% during 1998.

Instead, the overall percent reduction toward the 30% goal remained essentially level at 18%. While 18% is

admirable for the four years since the program was initiated, the program will refocus the community's awareness on this issue.

To meet this need, Jean Witherspoon, Water Conservation Officer, indicates that the program will work with the media to include irrigation and conservation messages in weather reporting on an ongoing basis. It is hoped this will help revitalize the community's commitment to conservation.

For copies of the report, contact Jean Witherspoon at 505-768-3655 or Relay NM 1-800-659-8331. Copies of the program's newest water resource video, *Tapping the Legacy*, are available by calling 768-3655. For more details on Albuquerque's water conservation program, visit <http://www.cabq.gov/resources/>.



Upcoming meetings

National Ground Water Association, Principles of Ground Water - Flow, Transport and Remediation - June 14-16, Portland, ME

American Water Resources Association, Science into Policy: Water in the Public Realm and Wildland Hydrology - June 30-July 2, Bozeman, MT

National Water Resources Association, Western Water Seminar - August 11-14, Durango, CO

7th Annual New Mexico Water Law Conference - August 26-27, Santa Fe

New Mexico Geological Society 50th Annual Fall Field Conference - September 22-25, 1999, Albuquerque

NM Environmental Health Conference - October 25-27, Albuquerque

New Mexico Water Resources Research Institute's 44th Annual Water Conference - December 2-3, Santa Fe



Are You Being Served?

The mission of the New Mexico Water Resources Research Institute (WRRI) is *to develop and disseminate knowledge that will assist the state, region and nation in solving water resources problems*. Specifically, the WRRI encourages university faculty statewide to pursue critical areas of water resources research while providing training opportunities for students who will become our future water resources scientists, technicians and managers. It provides an outlet for transferring research findings and other related information to keep water managers and the general public apprised of new technology and research advances. In addition, the institute maintains a unique infrastructure that links it with many federal, state, regional and local entities to provide expertise and specialized assistance.

Please let us know how we are doing by completing the following survey.

1. In the last twelve months, have you (or your agency / organization) benefitted from the Institute's...

a. *Research Program?* No _____ Yes _____ If yes, in what way?

b. *Information Transfer Program?* No _____ Yes _____ If yes, in what way?

c. *Public Service Outreach?* No _____ Yes _____ If yes, in what way?

2. In the last twelve months, have you (or your agency / organization)...

a. *Received a copy of the WRRI's Divining Rod newsletter?* No _____ Yes _____

b. *Requested a WRRI publication?* No _____ Yes _____

c. *Requested general or specific information from WRRI staff?* No _____ Yes _____

d. *Visited the WRRI Website (<http://wrri.nmsu.edu>)?* No _____ Yes _____

If you answered yes to any of the above, were you satisfied with the service and/or information you received from the WRRI staff? No _____ Yes _____

Do you have specific comments or suggestions for improvement?

3. What is your affiliation? (please mark any that apply)

_____ *Research/academic* _____ *Research Administrator*

_____ *Research/non-academic* _____ *Student*

_____ *Agency/government* _____ *Other (specify)* _____

We welcome any comments or suggestions. Please complete and return this form to:

Water Resources Research Institute

New Mexico State University

Box 30001, MSC 3167, Las Cruces, New Mexico 88003



WRRI-funded research detects cryptosporidium parvum in water samples *Researcher wins acclaim*

The microorganism *Cryptosporidium parvum* is recognized as a serious public health threat. Infections with this protozoan can lead to acute gastroenteritis and diarrhea that can become life threatening in individuals with weakened immune systems. A highly publicized example of an outbreak occurred in Milwaukee in 1993, in which the microbe infected over 400,000 people and contributed to 104 deaths.

New Mexico State University chemist Joseph Wang received a Seed Money Research grant from the WRRI in 1997 to attempt to develop a reliable, cost-effective, compact bioanalytical device for rapid monitoring of *Cryptosporidium parvum*, based on the combination of highly specific DNA hybridization biosensors and a micro-fabricated PCR (Polymerase Chain Reaction) reactor.

The biosensor hybridization reactions were monitored by Dr. Wang's state-of-the-art miniaturized electrochemical transducers, which by themselves can enable extremely low pathogen detection limits. To push the sensitivity still further, to the striking level of just a few *Cryptosporidium* parasites in a water sample, the biosensors are being integrated with a PCR amplification unit, all on a single chip, in an effort to obtain the advantages of simultaneous in situ amplification and detection eventually in a single hand-held unit.

During the tenure of this project, Dr. Wang and his team of researchers developed several novel electrical detection schemes for detecting DNA sequences specific to *Cryptosporidium parvum*, and have reported their findings in several major international journals. Dr. Wang's WRRI project will end this summer and he will report his findings in a WRRI technical

completion report, which should be ready for distribution the following spring.

The WRRI would like to congratulate Dr. Wang on being selected by the American Chemical Society's Division of Analytical Chemistry as the 1999 winner of its Chemical Instrumentation



Dr. Joseph Wang has developed a "lab-on-a-chip," a control unit including a compact, battery-operated analyzer that can record data and operate unattended. (Photo by Alison Sawyer)

Award. This award is given only to one chemist each year, and will be presented at the ACS meeting in August. A two-day analytical chemistry symposium in Wang's honor, featuring presentations by 12 of the leading scientists in the field, will be held as part of the ACS conference.

Besides detecting microorganisms in water, Dr. Wang's hand-held sensors can be used for a variety of other purposes such as the detection of lead in blood and the measurement of glucose levels in diabetics.

Dr. Wang's prolific career includes six patents, five books, 15 chapters and more than 450 research papers. He has presented more than 100 invited lectures at major international conferences. Since 1980, 15 doctoral students, 30 research associates and 20 visiting professors from around the world have studied with Wang and worked in his NMSU laboratory.

"Dr. Wang has been one of the giants in the New Mexico State University research effort for quite some time, and this fact is well known by his colleagues on campus," said Rene Casillas, dean of arts and sciences at NMSU. "This prestigious award, the American Chemical Society's highest award for analytical chemists, signifies that the international community has long recognized his important contributions."



Dr. Joseph Wang's research team includes Jianyan Wang (left), Joseph Wang, and doctoral students Baomin Tian and Jianmin Lu. (Photo by Alison Sawyer)



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generations of kids from New Mexico farm families.

Although Ralph was an able administrator, that was not his major contribution to agriculture—it was the annual Water Conference. Ralph called the first water conference in 1956 and it was a success! This past fall the WRRRI held its 43rd annual meeting and, like those Dr. Stucky chaired, it was a success.

The topics of these annual conferences run from water law to agricultural use to people's needs, and from there to watersheds and saline water. Sounds fine, but what made the sessions so successful? It was the people whom Ralph got together: Steve Reynolds, the State Engineer; Dennis Harris of the Farm Bureau; W.H. Gary, a farmer from Hatch and a member of the Interstate Stream Commission; Delmar Roberts from Anthony and a member of the Board of Regents; Claud Tharp a cotton leader; Bill Hale of the U.S. Geological Survey; Roland Fife of the Bureau of Reclamation; Fred Moxey of the Oil & Gas Association; Robert Clark from UNM's Law School;

Roger Corbett and Gerald Thomas, presidents of NMSU; Governor Jack Campbell; and all sorts of other folks from all sides of the fence.

Somehow Ralph could bring together these people to listen to each other and to talk about something they would normally fight about—water! Ralph Stucky made his greatest contribution to agriculture, not through his research, but through his ability to get people to work together, and of course, because of his stick-to-itiveness, or was it sticky-to-itiveness?

In early 1978, shortly after Tom Bahr became Director of the New Mexico WRRRI, Dr. Stucky stopped by the WRRRI and gave Tom a draft of a manuscript he was working on which documented the early history of the WRRRI. A long conversation followed in which the past, present and future of the Institute was discussed. It was evident that Ralph Stucky had a clear sense of New Mexico's water future, the problems New Mexico would face and how research could help solve water problems.

By examining the speeches Ralph Stucky gave in the 1950s and 60s, it is very clear that he was truly a man of vision. For example, nearly 50 years ago he sensed the need for municipalities along the Rio Grande to begin considering the use of river water for urban use in order to conserve valuable groundwater resources. That vision has become reality for the City of El Paso and the two largest New Mexico cities on the Rio Grande, Albuquerque and Las Cruces, in that these cities are now developing plans for municipal use of river water.

Dr. Stucky was preceded in death by his wife of 67 years, Frances, and is survived by his daughter Creta Ann Stucky McGuire and family, and son John Thomas Stucky and family.

Dr. John Hernández, NMSU
Dr. Tom Bahr, WRRRI

For copies of Dr. Stucky's 1978 report, "A History of the New Mexico Water Resources Research Institute, 1963-1978" contact the WRRRI at 505-646-4337.

USGS Reports

Below we list two new New Mexico related papers published by the U.S. Geological Survey since the last issue of the *Divining Rod*. Copies are available for inspection at the USGS District Office in Albuquerque (5338 Montgomery Blvd NE, Suite 400; 505-830-7900). The Water Resources Research Institute library also has the reports on file. They also may be ordered from the USGS, Federal Center, Box 25286, MS 517, Denver, CO 80225. You may call 303-202-4210 for price information.

- **Summary of the Southwest Alluvial Basins Regional Aquifer-System Analysis in parts of Colorado, New Mexico, and Texas** by D.W. Wilkins (Professional Paper 1407-A). The main purposes of the SWAB study were to enhance the understanding of the regional hydrology of alluvial basins that serve as major groundwater reservoirs, and to study the hydrologic effects of stresses on the system. The report summarizes studies of 22 selected alluvial basins

and discusses water quality, groundwater flow systems, and water use in the study area as a whole. Geology, groundwater flow, groundwater geochemistry, groundwater recharge, and aquifer characteristics were studied, and digital flow models of the groundwater systems were developed for three basins.

- **Detailed study of selenium and selected constituents in water, bottom sediment, soil, and biota associated with irrigation drainage in the San Juan River area, New Mexico, 1991-95** by Carole L. Thomas, R. Mark Wilson, Joel D. Lusk, and R. Sky Bristol (USGS Water-Resources Investigations Report 98-4213). In response to increasing concern about the quality of irrigation drainage and its potential effects on fish, wildlife, and human health, scientists from the USGS, U.S. Fish and Wildlife Service, Bureau of Reclamation, and Bureau of Indian Affairs collected water, bottom-sediment, soil, and biological samples at 61 sites in the San Juan River area during 1993-94. Supplemental data collected in 1991-1995 by the Bureau of Indian Affairs extended the time period and sampling sites available for analysis.

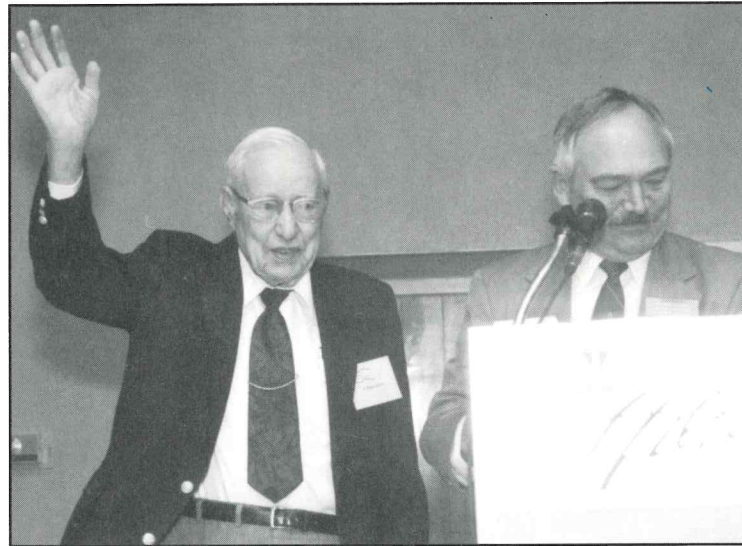


H. Ralph Stucky 1904 - 1999

*New Mexico WRRRI Director
1964-1971*

Dr. H. Ralph Stucky, first director of the New Mexico Water Resources Research Institute, passed away on March 9, 1999 at the age of 94. Dr. Stucky chaired the first Annual New Mexico Water Conference in 1956 and continued to serve as chairman through 1971. At the 40th Annual Water Conference in 1996, he was honored for “a lifetime of unselfish devotion to the causes of water research and development.”

What was it that made Ralph Stucky such an unusual man that he would be remembered at a memorial service at his church, at the Good Samaritan Village, at the Las Cruces Rotary Club, and by his colleagues around the West in water-resources management? One reason was that Ralph Stucky was a natural leader who could get people from different poles to work together, and to accomplish his as well as their goals. Folks who worked with Ralph always thought they were doing what they wanted to do, but in



Dr. H. Ralph Stucky (left) was honored for a lifetime of contributions to the water resources community at the 40th Annual New Mexico Water Conference. WRRRI Director Tom Bahr presented the award.

the end, the results also clearly reflected his vision. Another reason he got things done was that he just never gave up. Some who knew him well say he was just stubborn, ‘cause Stucky always stuck.’

Ralph Stucky was an agricultural economist who came to New Mexico State University in the early 1950s and

soon became concerned with the management and use of the limited water supply available in the arid Southwest. He wrote over 70 papers on the economics of water use, and he taught his professional views to two

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