

Five projects win USGS funding

The U.S. Geological Survey has awarded \$1.1 million to five New Mexico research projects in the 1988-89 fiscal year. The grants were awarded under the USGS Section 105 Matching Grant program, which requires the state to provide half of the \$1.1 million.

The five were among some 40 projects selected nationwide from a field of 239 proposals. "It speaks well for the quality of New Mexico's water research program when our researchers are able to achieve this level of funding. This is almost 12 percent of the \$4.3 million awarded nationwide," said Bobby J. Creel, WRRRI acting director.

He said the WRRRI submitted 11 proposals from three universities in the state, New Mexico State University, the University of New Mexico,

and New Mexico Institute of Mining and Technology. "Previously, New Mexico had always been successful at winning one or two grants, but five is unheard of, maybe even nationwide," he said.

The selected projects are:

- *The Effects of Wetting on Transport of Organics in Groundwater* -- Robert S. Bowman and John L. Wilson, Geoscience Department, New Mexico Institute of Mining and Technology.

- *Increased Water Use Efficiency in Alfalfa by Selection for Two Key Heritable Physiological Traits* -- Vincent P. Gutschick, Biology Department; Cliff G. Currier, Agronomy and Horticulture Department; and Gary L. Cunningham, Biology Department, New Mexico State University.

- *Institutional Needs and Distribution of Benefits in Use of Hydrologic Criteria to Expedite Changes in Water Use* -- Susan Christopher Nunn, Economics Department, University of New Mexico, and John W. Hernandez, Civil, Agricultural and Geological Engineering Department, New Mexico State University.

- *A Field Study for Model Validation of Multi-dimensional Flow and Transport in the Vadose Zone* -- Daniel B. Stephens, Geoscience Department, New Mexico Institute of Mining and Technology.

- *Groundwater Quality in Pumping Wells Located Near Surface Water Bodies* -- John L. Wilson, Geoscience Department, New Mexico Institute of Mining and Technology.

WRRRI, USGS grant deadlines set for October

Deadlines for the WRRRI allotment and USGS matching grant programs are coming up in October, according to Darlene Reeves, WRRRI project coordinator. "We are encouraging researchers to consider the opportunities as well as the limitations of both programs as they relate to the researcher's area of interest," she said.

The U.S. Geological Survey has set Oct. 14 as its deadline for the Section 105 Matching Grant program. The program is open to proposals submitted by state academic institutions through the WRRRI as well as proposals submitted directly to the USGS by other institutions and organizations. Proposals to be

submitted through the WRRRI must be received no later than Oct. 3 to allow for preparation and mailing.

Between \$1.8 and \$4.3 million in federal monies are expected to be available for research under this nationally competitive program. "This compares to the \$4.3 million that funded some 38 projects last fiscal year," she said.

The deadline for WRRRI Annual Allotment pre-proposals is Oct. 31. To be eligible for funding, she said a project must focus on a water resources problem. Four areas will be given the highest priority in the selection process: 1) water conservation related research, 2) surface-ground water relationships, 3) water

quality research, and 4) saline water research.

The pre-proposals will be screened by the WRRRI Program Development and Review Board, with a decision on the selection made by Nov. 30. Researchers whose pre-proposals are selected for further consideration have until Jan. 31, 1989, to submit a full proposal. Final funding decisions will be made by April 1, 1989.

Copies of the Request for Proposals for both programs are available from the WRRRI. For more information, call Darlene Reeves at 646-1194.

Alfalfa research seeks genetic link

A New Mexico State University researcher has found that some alfalfa plants budget their water use efficiently while others spend their water allowances like "gangbusters." Through genetic selection, biologist Vince Gutschick is hoping to weed out the spendthrifts and breed a new alfalfa variety that can be both water thrifty and productive.

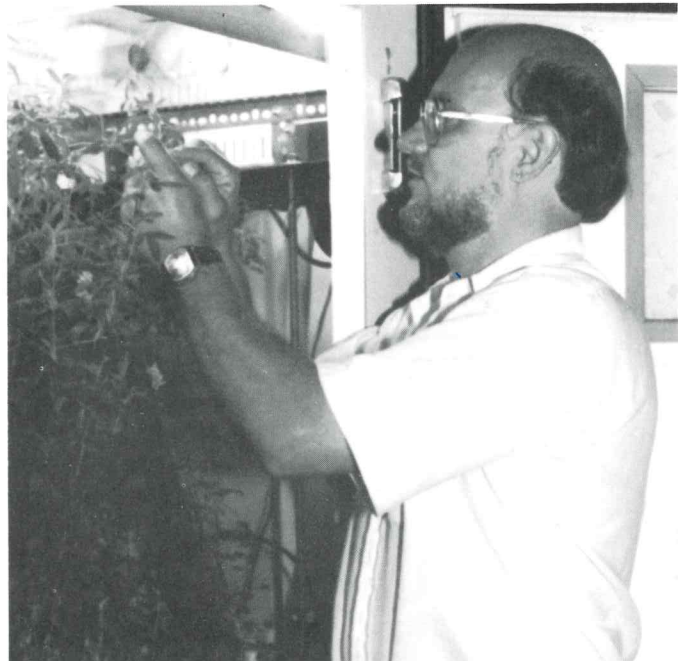
Gutschick's work confirms earlier research which showed that such thrift is found only in those plants that keep their stomata, or pores, more tightly closed. By allowing less water to transpire through the pores into the atmosphere, these plants efficiently use the conserved water to produce plant material.

Using a computer model, he can predict which plants will be more water efficient by measuring the carbon dioxide level in the alfalfa leaf. He predicted, for example, that a plant registering a 9 percent decrease in carbon dioxide and a 20 percent increase in leaf thickness could raise the plant's water use efficiency 28 percent while decreasing yield only 5 percent. "The trick," he said, "is finding the combination that allows the least penalty in yield."

Using carbon dioxide levels to track water use efficient plants is a faster, simpler selection technique than looking for plants that are simply water use efficient. More importantly, low carbon dioxide levels and water use efficiency are heritable traits.

Gutschick chose alfalfa for his research because of its importance as a forage crop not only in New Mexico, but worldwide. In New Mexico, alfalfa ranks first in acreage, income and water use. In 1986, the most recent year of record, the state's alfalfa hay production was valued at \$100 million. Its prominence in New Mexico agriculture and high water use made it an obvious candidate for his research.

Gutschick began his alfalfa research almost as soon as he came to NMSU three years ago. He conducted his first experiments through small grants from the New Mexico Water Resources Research Institute and NMSU's Plant Genetics Engineering Laboratory.



Vince Gutschick checks his growth chamber alfalfa crop to see if it's ready for harvesting.

The experiments were designed to determine if water use efficiency and yield are controlled by the two leaf traits as he had speculated. These studies were conducted in a growth chamber where he could control light, temperature and humidity. Using a separate device, he measured the leaf carbon dioxide levels. "We saw a lot of variability in breeding traits, but we also saw that these traits affected yield and water use just as the model had predicted," he said.

He recently received a \$320,000 grant from U.S. Geological Survey and state funds to continue the research in the field under varying environmental conditions. It is in the field where he, NMSU agronomist

Cliff Currier, and fellow biologist Gary Cunningham will test Gutschick's compound hypothesis that the two heritable traits of carbon dioxide level and leaf mass are linked to two measures of performance -- water use efficiency and yield.

During this next phase of research, he will test his growth chamber model against field results. His work on the model, he said, combined the intellectual challenge of hard science with the excitement of producing results that could reap direct benefits. "We can use models to explore what's possible, and to find out how we can improve things," he said.

New reports include Town Hall

To order the following publications, write the New Mexico Water Resources Research Institute, Box 30001, Dept. 3167, Las Cruces, NM 88003-0001.

M18 -- *Water Supply and Demand for New Mexico: 1985-2030 Resource Data Base.* Lansford, R.R., J.W. Hernandez, G. Bruner, C. Lightfoot, J. Costello and B.J. Creel.

M19 -- *Water: Lifeblood of New Mexico.* Creel, B.J., L.G. Harris, G.L. Bruner, C.T. DuMars, J.W. Hernandez and R.R. Lansford.

M20 -- *Laboratory Planning for Water and Wastewater Analysis.* Clark, D.W.

#230 -- *Mechanisms of Salt Tolerance in Plants Relevant to Closed System Agriculture in Desert Environments.* Cunningham, G., H. Neufeld, and M. Zeroni.

#231 -- *Growth of Channel Catfish in Saline Groundwaters of the Pecos Valley of New Mexico.* Turner, P.R.

#232 -- *A History of New Mexico State University's Well Development and Ground Water Use.* Lashway, C.



WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY GROUND-WATER STUDIES IN NEW MEXICO

GROUND-WATER ISSUES

Ground-water resources supplied 41 percent of water used in New Mexico during 1985. About 86 percent (1.6 billion gallons per day) of all ground water pumped was used for irrigation. Water demands in the drainage basins of the Rio Grande and the San Juan, Gila, Canadian, and Pecos Rivers in New Mexico are met by conjunctive use of surface and ground water. Water demands in the eastern High Plains, the southwestern intermontane basins, and west-central parts of New Mexico are primarily met by ground water. Some major ground-water issues in New Mexico are:

- Interstate transfer of water;
- Ground-water use and depletion;
- Federal and Indian water rights;
- Hazardous-waste disposal and ground-water pollution; and
- Development of saline ground-water resources.

U.S. GEOLOGICAL SURVEY PROGRAMS

The U.S. Geological Survey (USGS), established in 1879, is the principal source of scientific and technical expertise in earth sciences within the Federal government. USGS activities include research and services in the fields of geology, hydrology, and cartography. The mission of the Water Resources Division of the USGS is to develop and disseminate scientific information on the Nation's water resources. The activities of the Water Resources Division in New Mexico are conducted by scientists, technicians, and support staff in offices in Albuquerque, Santa Fe, Las Cruces, and Carlsbad.

Hydrologic-data stations are maintained at selected locations throughout New Mexico to record data on stream discharge and stage, reservoir and lake storage, ground-water levels, well and spring discharge, and the quality of surface and ground water. Water-resources data are stored in the USGS National Water Data Storage and Retrieval System data base. These data are used by water planners and others involved in decisions that affect New Mexico's water resources.




During 1987, the USGS maintained a network of about 1,200 observation wells in New Mexico in cooperation with Federal, State, and local agencies. Water-level measurements from wells are used to monitor ground-water trends; however, they need to be integrated with other observations and ground-water investigations to be most useful.

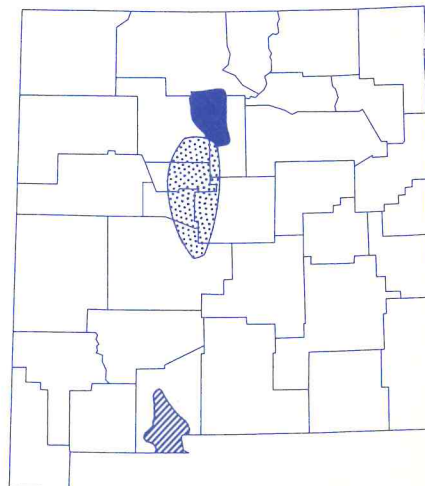
The USGS has conducted more than 300 hydrologic investigations in New Mexico. During 1987, the USGS entered into agreements with 36 Federal, State, and local agencies involving 41 hydrologic investigations in New Mexico; 24 of these investigations were directed toward ground-water quantity and quality. Three examples of ground-water studies by the USGS that address specific ground-water issues in New Mexico are discussed in the following sections.

Depletion and Contamination in the Albuquerque Basin

Public-supply, industrial, and military water requirements in the Albuquerque area primarily are met by ground water from the sediments in the Albuquerque basin. Population growth in the Albuquerque area has increased rapidly in the last decade, and declines in ground-water levels are significant on the east side of the Rio Grande valley where most of the population is located. Recent population growth is to the west. Also, the Rio Grande valley is susceptible to toxic-waste contamination owing to shallow ground-water levels. Water-planning agencies need geohydrologic information for development of long-term water plans and implementation of ground-water-contamination monitoring programs. Since 1978, the USGS, in cooperation with the city of Albuquerque, Kirtland Air Force Base, Bernalillo County, and the New Mexico State Environmental Improvement Division, has conducted studies regarding the availability and quality of water in the basin-fill aquifer. Test wells have been drilled to determine aquifer properties. Water-level data, borehole-geophysical data, and water-chemistry data have been compiled and about 72 wells are used to provide long-term water-level data. The USGS has identified organic-compound contamination of ground water in Albuquerque's South Valley.

STUDY AREAS

-  Albuquerque Basin
-  Mesilla Basin
-  Santa Fe - Espanola Basin



Results from the studies are used by Federal, State, and local agencies to develop long-term water-use plans and to preserve the area's water resources.

Ground-Water Resources in the Mesilla Basin

Urban development along the Rio Grande in southern New Mexico and El Paso, Texas, has increased the demand for water from basin-fill aquifers of the Mesilla basin. Further urban development will affect fully-appropriated surface-water supplies owing to the close relation between surface- and ground-water systems in the basin. Water-planning agencies need information about the relation between aquifers and the Rio Grande to plan for orderly ground-water development in the Mesilla basin. The USGS studied the geohydrology of the Mesilla basin from 1971 to 1987 in cooperation at various times with the New Mexico State Engineer Office (NMSEO), city of El Paso, city of Las Cruces, Elephant Butte Irrigation District, New Mexico Water Resources Research Institute, U.S. Bureau of Reclamation, and the International Boundary and Water Commission, U.S. Section. During this period, the USGS collected data from about 1,200 wells, drilled 105 test holes, and collected surface-geophysical data at 140 sites. Maps were prepared showing water quality and aquifer properties. A computer model was developed to simulate ground-water flow. Aquifer-test data, streamflow data, and water-level data from three hydrologic sections were used to define the relation between the Rio Grande and ground-water flow systems. Results of these studies are used by Federal, State, and local water management agencies to plan ground-water development in the Mesilla basin.

Ground Water in the Santa Fe-Espanola Basin

Indian, municipal, and other water needs in the Santa Fe-Espanola basin have long been met through conjunctive use of surface and ground water. Urban development has resulted in increased pumpage from water-bearing volcanic and fluvial deposits. Ground-water pumpage affects fully-appropriated surface-water supplies owing to the relation between the surface- and ground-water systems. Federal, State, and local water planners need information about ground-water availability, aquifer properties, stream-aquifer relations, recharge mechanisms, and ground-water quality to plan for ground-water development and to aid in adjudication of Indian water rights. Since 1971, the USGS has conducted studies of the aquifer system in cooperation with the NMSEO, Santa Fe Metropolitan Water Board (SFMWB), and the U.S. Bureau of Indian Affairs (BIA). Geohydrologic data have been collected from approximately 2,100 wells. More than 60 test wells have been drilled to determine aquifer characteristics. A ground-water-monitoring program has been initiated to measure water-level and water-quality fluctuations. Maps have been prepared that describe the thickness and availability of freshwater in the aquifer, and a computer model of ground-water flow has been prepared. Study results are used by the NMSEO, SFMWB, BIA, and Pojoaque and Tesuque Tribes to aid in orderly water development and in the adjudication of Indian water rights.

GROUND-WATER MANAGEMENT

The principal State agencies responsible for ground-water management are the New Mexico State Engineer Office and the Environmental Improvement Division of the Health and Environmental Department. The New Mexico State Engineer Office is responsible for administration of water law and the Environmental Improvement Division coordinates efforts to protect the quality of the State's water resources. Both agencies

use ground-water data and results of ground-water studies provided by the USGS. During 1987-88, the following Federal, State, and local agencies entered into interagency or cooperative cost-sharing agreements with the USGS to conduct ground-water investigations in New Mexico:

Bernalillo County
Cities of Alamogordo, Albuquerque, El Paso, Las Cruces,
and Santa Rosa
International Boundary and Water Commission, U.S. Section
Navajo Indian Nation
New Mexico Bureau of Mines and Mineral Resources
New Mexico Environmental Improvement Division
New Mexico Interstate Stream Commission
New Mexico State Engineer Office
Pecos River Commission
Pueblos of Acoma, Laguna, and Zuni
Santa Fe Metropolitan Water Board
U.S. Air Force
U.S. Army
Corps of Engineers
White Sands Missile Range
U.S. Department of Energy
U.S. Department of the Interior
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation

SELECTED REFERENCES

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- Hearne, G.A., 1985, Mathematical model of the Tesuque aquifer system near Pojoaque, New Mexico: U.S. Geological Survey Water-Supply Paper 2205, 75 p.
- Kernodle, J.M., and Scott, W.B., 1986, Three-dimensional simulation of steady-state ground-water flow in the Albuquerque-Belen Basin, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 84-4353, 58 p.
- Knutilla, R.L., compiler, 1986, Water-resources activities of the U.S. Geological Survey in New Mexico—Fiscal Year 1986: U.S. Geological Survey Open-File Report 86-141, 83 p.
- U.S. Geological Survey, 1984, National water summary 1983—Hydrologic events and issues: U.S. Geological Survey Water-Supply Paper 2250, 243 p.
- , 1985, National water summary 1984—Hydrologic events, selected water-quality trends, and ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, 467 p.
- Wilkins, D.W., 1986, Geohydrology of the southwest alluvial basins, regional aquifer-systems analysis, parts of Colorado, New Mexico, and Texas: U.S. Geological Survey Water-Resources Investigations Report 84-4224, 61 p.
- Wilson, Brian, 1986, Water use in New Mexico in 1985: New Mexico State Engineer Technical Report 46, 84 p.
- Wilson, C.A., White, R.R., Orr, B.R., and Roybal, R.G., 1981, Water resources of the Rincon and Mesilla valleys and adjacent areas, New Mexico: New Mexico State Engineer Technical Report 43, 514 p.

Information on technical reports and data related to ground water in New Mexico can be obtained from:

District Chief
U.S. Geological Survey
Water Resources Division
Pinetree Office Park
4501 Indian School Rd. NE, Suite 200
Albuquerque, New Mexico 87110-3929

Director
New Mexico Water Resources Research Institute
New Mexico State University
Box 30001, Dept. 3167
Las Cruces, New Mexico 88003-0001

Aiming for irrigation efficiency

A new irrigation efficiency program now underway in southern New Mexico could save New Mexico agricultural producers up to one third of the energy used for irrigation pumping and up to 50 percent in water use. The program, which eventually will be conducted throughout the state, is being administered by the New Mexico Water Resources Research Institute (WRRI).

"The program is an ideal opportunity not only to look at ways to save energy but also ways to save water," said Bobby Creel, WRRI acting director. Previous research, he said, evaluated the feasibility of using pump testing and irrigation management as a means of water and energy savings. "This program allows us to take the research information into the field where it can be put into practice."

The irrigation efficiency program will provide a number of energy services ranging from irrigation system efficiency tests to training courses for New Mexico farmers. The first phase of the program, which consisted primarily of pump testing and irrigation management, is complete in the Deming and Lordsburg areas. The program now moves on to Farmington, Clayton, Clovis, Portales and Roswell.

The program is a cooperative effort of New Mexico State University (NMSU), Black Range Resource Conservation and Development Inc. (RC&D), and the WRRI. Funding for the \$123,168 program is being provided by the New Mexico Energy, Minerals and Natural Resources Department.

The bulk of the pump testing and evaluation phase was conducted this past summer under the direction of Al Blair, an irrigation engineer with NMSU's Civil, Agricultural and Geological Engineering Department. "The program," he said, "not only addresses the engineering side of irrigation but also the economic end results." He said the economic analysis will tell the producer how long it will take for improvements such as pump repairs or the installation of new equipment to pay off.

The field work will include testing of about 80 irrigation pumps and



Measuring the irrigation pumping rate at a farm south of Deming are (left to right) John Meetze, soil conservationist, Soil Conservation Service; and Salim Bawazir and James Head, both engineers with New Mexico State University.

repairing selected pumps that show significant potential for energy efficiency improvement. Blair is preparing a field techniques and economic evaluation manual for use by Cooperative Extension Service personnel and agricultural producers. Publication is expected in the spring of 1989.

This past May, Blair and other NMSU faculty members conducted an on-farm irrigation system evaluation training course for those involved in managing or designing agricultural irrigation systems. A training course on irrigation system management techniques designed for agricultural producers will be held in December in Clovis. That course will cover irrigation scheduling and the economics of various irrigation management systems.

According to Stan Bulsterbaum, coordinator, Black Range RC&D, the irrigation water management component of the program builds on earlier efforts of the Soil Conservation Service (SCS), which has been conducting pump tests since May 1987. "In the current program, the SCS will provide land owners technical assistance such as measuring water delivery, water absorption in the root zone, and moisture requirements for different stages of crop growth," Bulsterbaum said.

Irrigation designs also will be used to improve irrigation efficiency by decreasing the amount of time and water required for irrigation. He explained that reducing the hours of irrigation pump operation also reduces the total consumption of energy and conserves water resources.

Information from both components of the irrigation efficiency program will be used to evaluate the potential for energy and water savings. In turn, those findings will be used in developing a plan for regional on-farm energy and water conservation.

Use of the energy savings techniques resulting from the program will be promoted through educational materials such as video tapes, brochures and demonstrations. Training courses and technical assistance also will be available for agricultural producers and others associated with irrigation management.

For more information about the program, contact the New Mexico Water Resources Research Institute, Box 30001, Dept. 3167, Las Cruces, NM 88003-0001, (505) 646-1813. Information is also available from the Black Range RC&D office in Deming and the SCS offices in Deming and Lordsburg.

Water planning is conference theme

The 33rd Annual New Mexico Water Conference will be held Oct. 27-28 at the Hilton Hotel in Santa Fe, New Mexico. The conference, with the theme "Water Planning from the Town Up," is sponsored by the New Mexico Water Resources Research Institute.

"New Mexico has been actively involved in water planning throughout the state, especially at the local level," said Bobby J. Creel, WRRRI acting director. He said the New Mexico legislature also has encouraged water planning at the regional and state levels. "The conference will be an excellent forum for bringing together these groups to discuss their water planning efforts," he said.

The first session Oct. 27 will cover planning at the local level. John Folk-Williams, president of Western Network, will discuss the importance of public participation in water planning. New Mexico Economic Development and Tourism Secretary John Dendahl will talk about water planning and economic development. The effects of water transfers on rural communities will be discussed by Helen Ingram, professor of political science at the University of Arizona.

The Oct. 27 second session will focus on planning at the regional, state and federal levels. The first speaker will be Cliff Barrett,

regional director of the U.S. Bureau of Reclamation. He will discuss the bureau's water planning efforts. Then, Al Utton, professor of law at the University of New Mexico, will outline the regional water planning efforts of the Interstate Stream Commission. Lee Tillman, executive director of the Eastern Plains Council of Governments, will talk about the progress in water planning in New Mexico's eastern High Plains. Santa Fe County's water plan will be presented by Tony Mayne, executive director of the Santa Fe Metropolitan Water Board. Closing that session will be Art Waskey and John Tysseling of the New Mexico State Land Office who will discuss water planning for state trust lands.

New Mexico Governor Garrey Carruthers will open the Oct. 28 session with a brief look at the

status of water planning in the state. Following his talk, Ann Sorensen, assistant director of the Natural and Environmental Resources Division of the American Farm Federation, will discuss reconciling agricultural demands and water quality. Then, Robert R. Lansford, professor of agricultural economics at New Mexico State University, will present the results of a recent study on projecting water demands in the state.

The conference will close with a panel discussion on the special interests in water planning. Panelists include Tom Davis, Carlsbad Irrigation District; Phil Wallin, River Network; Maxine Goad, New Mexico Environmental Improvement Division; Cleve Matthews, Sandia Peak Tram Co.; Herbert Becker, Office of the U.S. Attorney in Albuquerque; Vickie L. Gabin, New Mexico State Engineer Office; and Wilfred Gutierrez, a farmer from Velarde, New Mexico. Other invited speakers include Indian representatives of Pueblo Indian and non-Pueblo Indian tribes.

The cost of the conference is \$50, which includes the conference proceedings. The student fee is \$15. Registration after Oct. 17 will be an additional \$10. The Thursday evening banquet is \$20. For more information, write the WRRRI at Box 30001, Dept. 3167, Las Cruces, NM 88003-0001, or call (505) 646-4337.

33rd Annual New Mexico
Water Conference
Banquet
Oct. 27, 1988, 7:00 p.m.
Santa Fe Hilton

*Public Trust: Implications
for Water Planning*

Roderick E. Walston
Senior Deputy Attorney General
State of California

Bob J. Creel, acting director, New Mexico Water Resources Research Institute
Linda G. Harris, editor

the divining rod

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