

divining rod

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New Mexico Water Resources Research Institute

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Views from the 37th Annual New Mexico Water Conference

INSTREAM FLOW:
No consensus yet

WATER BANKING:
No legislation needed

This year for the first time in recent years, we held workshop sessions as part of the annual conference. Spirited discussion was held in all three sessions which focused on agricultural conservation, instream flows, and water banking. Here are summaries of the instream flow and water banking sessions—two of the more controversial topics broached during the conference. For those unable to attend the conference, the proceedings will be available after January 15 at a cost of \$5.25 each.

Instream flow continues to be a controversial topic in New Mexico. At the 37th Annual New Mexico Water Conference in Taos, 75 people packed into a small meeting room to discuss the issue during a workshop session. WRRRI Director Tom Bahr described it by saying, "Check your weapons at the door." Forty different issues and concerns were articulated by participants in the workshop session. Here is a sampling of the issues, questions, and positions raised.

- Riparian rights v. the prior appropriation doctrine
- The recognition of instream flows as beneficial use
- Out-of-state interests gaining control of New Mexico's streams
- Lack of money to administer instream flows
- Cultural and biological diversity concerns
- Who truly benefits financially from instream flows?
- Current law doesn't protect acequias and until that has been accomplished, no new beneficial uses should be added
- Would groundwater pumping be curtailed if instream flow was not met by surface water rights?
- Is it unconstitutional for the state to take water from private citizens to meet instream flow demands?

Much time was spent discussing

the use of the words "public welfare" in existing law. The question was raised "Could such recognition of water rights for the public welfare be used to have an instream flow water right curtail groundwater pumping?" Participants recognized that as a possibility and discussion ensued concerning the need for the state engineer and the legislature to codify "public welfare" and ensure that it does not conflict with cultural and social values.

Workshop recorder Peggy Montañó observed that many participants believed that the existing system of laws now provides means to protect instream flows and some slight modifications could be made to further protect instream flows if that is the intended result. In the end, however, no consensus was reached other than the recognition that instream flow legislation was a highly contentious topic. A proposal was made to resolve that no instream flow legislation should be considered by the state legislature either this session or ever because it is a threat to the many cultures and economies of the state. Another suggestion was that instream flow legislation, if adopted at all, should await planning on a local level which is currently underway.

The expressed objective of the water banking workshop was to leave the conference with a

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"Trees, Trout and Bronze Age Culture" kicks off seminar series

Fisher calls the current situation in Somalia an eco-disaster which is tied to deforestation in Ethiopia.

NMSU is one of five universities from around the country belonging to the Arid Lands Consortium along with the U.S.D.A. Forest Service Rocky Mountain Forest and Range Experiment Station at Fort Collins, CO and the Jewish National Fund based in New York City. The Agricultural Experiment Station and Water Resources Research Institute at NMSU are two of the units at NMSU involved in the consortium.

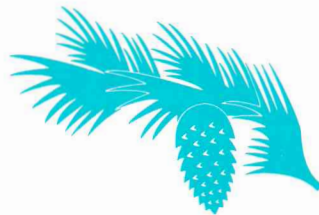
In an effort to help inform the local community about some of the arid lands research which has been ongoing at NMSU for years, and provide food for thought on arid lands issues as well as acquaint people with the consortium, WRRRI and the Ag Experiment Station are sponsoring a series of breakfast seminars featuring NMSU researchers.

The first seminar was held December 9 and featured Dr. Jim Fisher from the Agronomy and Horticulture Department. Dr. Fisher's talk, "Trees, Trout and Bronze Age Culture" provided an excellent kick-off for the series.

What do the Bronze Age and the settlement of North America have in common with the tropical rain forests? Forest overexploitation, according to Fisher. Toward the end of the Bronze Age, bronze was recycled and wood was not used commonly in construction because of wood shortage. Erosion due to over-cutting the forests, coupled with overgrazing, exposed

outcrops of minerals which fed into water supplies, creating salinity problems in fields, thus affecting crop production. A similar pattern occurred in the U.S., but Fisher says it was much less severe. Growth of the cotton industry was one of the primary reasons for deforestation, but shortly after the Civil War, abandoned croplands were eventually reforested.

Why should we be concerned with overexploitation of forests? Highlights from Fisher's talk are given below.



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- Present deforestation in developing countries leads to flood and famine as well as fuelwood shortages. In fact, Fisher calls the current situation in Somalia an eco-disaster which is tied to deforestation in Ethiopia. Fifty years ago Ethiopia's highlands were 30 percent forested; today only 3 percent are forested and erosion has ruined crop and grazing lands. Consequently, in 1978, Ethiopia forbid traditional grazing of Somalian herds and Somalia lost a food source.
 - Countries will lose productivity. Nigeria was a timber-exporting country a decade ago. Now due to overexploitation, it is a net importing country.
 - Rain forests account for six percent of the earth's area but the Amazon contains 50 percent of its plant and animal species. Loss of habitat means a decrease

in North American species as well. For example, species like the meadowlark common to North America migrates to South America, and consequently, such species are decreasing steadily with habitat loss.

- The forests are necessary to maintain the carbon/water balance in our atmosphere. Charles Darwin noted that tropical rain forests returned massive amounts of moisture to the atmosphere. Today we know that parts of other continents are affected when this process is disturbed. Fisher states, however, that silviculture can achieve whatever society wants to achieve with regard to our forests. There have been successful reforestation projects in India, Pakistan and Costa Rica. The most notable ones have restored village communities as well.

For successful reforestation worldwide, Fisher says, "We must begin to view man inside the belljar—man in the biosphere. Educating the public as to our interconnectedness with nature is the biggest task facing us."

The next Arid Lands Consortium breakfast is scheduled for Jan. 20, featuring Dr. Thad Box speaking on "Sustainable Development in the Global Environment." It will begin at 7:00 a.m. at Eddie's Mesilla Valley Inn in Las Cruces. For more information contact Leslie Blair at 646-5367.

Silviculture can achieve whatever our society wants to achieve with regard to our forests.

Eight new WRII reports released

Since the last issue of the *Divining Rod*, WRII has produced eight reports. These may be ordered by calling 505-646-1813 or writing WRII, Box 30001 - Dept. 3167, Las Cruces, NM 88003. All of the reports are free unless a cost is indicated.

Report M15 - New Mexico Water Rights - Written by Linda G. Harris, 1984; updated by Leslie Blair, 1992 (\$3.50 plus \$0.50 handling)

This booklet contains a brief history of water rights administration in New Mexico as well as a discussion of how to apply for a water right and other basic information water users might need.

Report No. 267 - Transfers of Water Use in New Mexico by F. Lee Brown, Charles DuMars, Michelle Minnis, Sue Anderson Smasal, David Kennedy, and Julie A. Urban

This study was part of a comparative examination of the water transfer process of six western states. In addition to a description of the water rights transfer process in New Mexico, the report presents numerical results of a Census of Water Rights Transfers for the period 1975-1987. The issue of public welfare as it has arisen in the context of New Mexico water rights transfers is described and analyzed, and an institutional forum for addressing the issue is proposed.

Report No. 268 - The Effects of Wetting on Transport of Organics in Groundwater by Robert S. Bowman, John L. Wilson, Mike Wei, Roger Huddleston, Daphne Neel, and Peter Burck

The project researchers investigated the effects of altered surface



The updated New Mexico Water Rights discusses how inhabitants of New Mexico have been regulating their water supply for over a thousand years. The above photograph of a waffle garden, irrigated with rainfall or water hauled in buckets, was taken by Jesse L. Nusbaum in 1910 at the Zuni Pueblo. Museum of New Mexico, Negative No. 8742.

chemistries on fluid saturations, flow characteristics, and sorption properties in model porous media. Two distinct lines of inquiry were pursued. The first was to evaluate effects of surface chemistry on wettability and pressure/saturation relationships of chemically modified silica. The second was to modify the surface chemistry of natural zeolite and determine the effects of such modification on sorption of organic chemicals from solution.

Report No. 269 - A Reconstruction of the Water Balance in Western United States Lake Basins to Climatic Change Volumes I and II by Fred M. Phillips, Andrew R. Campbell, Cynthia Kruger, Peggy Johnson, Randall Roberts

and Eric Keyes

The research team reconstructed the surface-area history of two basins in the southwestern United States. At the Plains of San Augustin, New Mexico, they used the oxygen isotope content of ostracode valves to achieve high-resolution reconstruction of the interval 36 to 15 ka (thousand years before present). At Searles Lake, CA they used oxygen isotopes in inorganic carbonate minerals to produce a water-balance history for the period 1,180 to 10 ka. Comparing the Searles record with the marine oxygen isotope chronology shows the single strongest influence on the water balance is global glacial/interglacial cycles; thus water-

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Water conference discussions, continued

consensus on the need and form of legislation to allow water banking in New Mexico. Discussion was focused on:

- The protection of private water rights and private property from acts of forfeiture or condemnation;
- Possible benefits water banking could accrue for the local, regional and state economies and ecosystems;
- Whether or not water banking could contribute to resolving instream flow, riparian management, federal reserved water right and conservation issues; and
- Exploration of legislative language amendments or creation of new language in New Mexico Water Law that would create a "win-win" situation in the battle over water uses.

Workshop participants discussed two distinct definitions of the term "water banking." From a conservation standpoint, water banking means the voluntary suspension of use by a water right holder, in order to recharge an underground aquifer, and by inference could be used to stabilize or augment surface water flows. From the standpoint of water marketing, unused or unappropriated water could be reserved and marketed or deposited by a private or public water right owner into a brokering entity which in turn would market that water for other uses.

Consensus was reached that any attempt to legislate a new water banking entity is, at this time, unnecessary. NMSA 72-12-8(d) established the Pecos Valley Artesian Conservancy District Water Bank. According to Howard Hutchinson, workshop organizer and recorder, participants suggested that an

amendment to this legislation could establish the same type of mechanism for other specific areas of the state.

Consensus also was reached that when there are demonstrated needs for protecting aquatic and riparian systems or underground or surface water sources, there are existing mechanisms to do so within New Mexico water law. It was discussed that during drought conditions, the simple act of discontinuing use of or conserving water can augment natural stream flows. Because the forfeiture of a water right is, at a minimum, a five-year process, individuals or local water authorities have flexibility in regulating flows without resorting to temporary transfers or other mechanisms. It was thought this method insures the greatest degree of local control over designation of water use.



Denver attorney Peggy Montañó, recorder for the instream flow workshop, reports back to the general session at the Annual Water Conference, giving details about the workshop discussion.

Western riparian management conference slated for February in Albuquerque

"Riparian Management: Common Threads and Shared Interests" is a western regional conference designed to explore strategies for managing rivers and riparian areas to maximize benefits for humans and wildlife. Case studies on ways to involve various agencies, user groups, landowners and the general public in decisions about their rivers and topics such as urban-rural issues, science and decision-making, water quality, legal matters and financing riparian protection will be discussed.

The conference will be held February 4-6, 1993 at the Ramada Inn Classic in Albuquerque, and is sponsored and co-sponsored by over 30 agencies and organizations. The cost of the conference is \$135 after January 15. The cost includes two lunches, one dinner and the proceedings. There is a field trip to the Bosque del Apache National Wildlife Refuge scheduled for February 6 for an additional \$20 fee. For more information, contact the Arizona Water Resources Research Center at 602-792-9591.



New reports cover Mesilla Basin, groundwater chemistry near Grants, San Augustine Coal Area, and gravity anomaly maps

The U.S. Geological Survey has released the following New Mexico-related publications since the last issue of the *Divining Rod*. These are available for inspection at the USGS District office in Albuquerque (4501 Indian School Road N.E., Suite 200). The Water Resources Research Institute library also has the reports on file. They may be ordered from the USGS, Federal Center, Box 25425, Denver, CO 80225. You may call 303-236-7476 for price information.

► *Simulation of ground-water flow in the Mesilla Basin, Doña Ana County, New Mexico and El Paso County, Texas, supplement to Open-File Report 88-305* by Peter F. Frenzel (Water-Resources Investigations Report 91-4155) - Because anticipated groundwater withdrawals in the Mesilla Basin may reduce flow in the Rio Grande, a USGS digital, four-layer groundwater flow model was updated and extended from 1975 through 1985. The model assesses the effects of existing groundwater withdrawals on the Rio Grande's flow and aids in the assessment of the effects of future withdrawals. The Mesilla Basin model reflects new definitions for three hydrostratigraphic units in rocks of the Santa Fe Group.

► *Listings of model-input values for the simulation of groundwater flow in the Mesilla Basin, Doña Ana County, New Mexico and El Paso County, Texas* by Peter F. Frenzel (Open-File Report 91-455) - This report includes two diskettes that contain listings of input values for the four-layer, digital groundwater flow model discussed above. Input values for the steady-state simulation, the

transient simulation, and the Fortran 77 code for an added river package are listed.

► *Geohydrology and potential hydrologic effects of surface and coal mining of the San Augustine coal area and adjacent areas, Catron and Cibola Counties, New Mexico* by Robert G. Myers (Water-Resources Investigations Report 92-4004) - This was a regional study of the aquifers associated with the surface mining of coal in the San Augustine Coal Area. The study found that wells and springs within the excavated area would be destroyed and that mine dewatering or the production of large quantities of water for mining activities could lower water levels in nearby existing wells.

The study also included the Zuni Salt Lake area 18 miles northwest of Quemado, which has been used by Pueblo Indians for religious purposes and for salt production. Coal-mining activities within the subbasins that contribute surface-water runoff to Zuni Salt Lake could decrease the quality of the salt produced, the amount of flow to Smith Spring, and the amount of water in Zuni Salt Lake.

► *Isostatic residual gravity anomalies of New Mexico* by Charles E. Heywood (Water-Resources Investigations Report 91-4065) - The construction of Bouguer and isostatic residual gravity anomaly maps of New Mexico, using approximately 50,000 gravity measurements is the subject of this report. The Bouguer gravity anomaly map indicates a strong regional gradient due to changing crustal thickness, which obscures the anomalies of geologic interest. To

facilitate quantitative modeling of these high-frequency anomalies, a correction was made for the gravitational attraction of the crustal root assuming local Airy isostatic compensation. The resulting isostatic residual gravity anomaly map contains anomalies attributable to density variations from intracrustal sources.

► *Hydrogeology and groundwater chemistry of the San Andres-Glorieta aquifer in the Acoma embayment and eastern Zuni uplift, west-central New Mexico* by Joe A. Baldwin and Scott K. Anderholm (Water-Resources Investigations Report 91-4033) - According to this report, the concentrations of nitrate, chloride and sulfate in groundwater from the San Andres-Glorieta Aquifer near Grants have changed from 1944 to 1981. Hydrologist Scott Anderholm says there not only appear to be changes in the locations of areas where groundwater chemistry has been affected but also differences in the chemical constituents that have changed with time in different areas. These changes in locations and differences in the chemical constituents affected probably are the result of changes in land use in the particular areas.

► *Annual Water-Resources Review, White Sands Missile Range* by Robert G. Myers and Steven C. Sharp (Open-File Report 92-465) - Hydrologic data were collected at the White Sands Missile Range in 1988, indicating a total groundwater withdrawal that year of 628,525,100 gallons. Groundwater withdrawals, chemical analyses, precipitation data, and sewage-influent data are summarized.

WRRI reports, continued

balance changes can be linked directly to global climatic change. However, the researchers found patterns differing from those of the global glacial cycles. They detected unexplained long-term trends of humid and arid water balance with an apparent periodicity of about 400 kyr.

Vol. I is the report itself; Vol. II contains the appendices to the report including the computer models and model inputs. A limited number of Vol. II were printed.

Report 271 - Developing Criteria for Small On-Site Sewage Treatment Systems: Two Case Studies -

J. Phillip King, Ricardo Jacquez, A. W. Blair and Hazem S. Fahmy

Two sites in Doña Ana County, the Lyons Country Estates evapotranspiration bed and the Mesa Village sewage lagoons, were chosen as case study sites for evaluating the design criteria, operation and impacts on groundwater of troubled on-site systems. The evapotranspiration bed studied failed due to inadequate design, while the lagoon system was not built as designed.

Report 272 - Preferential Flow Effects on Chemical Transport and Retardation in Soils - *Kathleen E. Turney and Robert S. Bowman*

The study's objective was to investigate the presence of preferential flow and its effect on the transport of a conservative tracer, m-trifluoromethylbenzoic acid (m-TFMBA), and a mildly retarded tracer, bromacil, through two in situ and two repacked soil columns. Study results lead to three deductions:

- That preferential flow is highly possible in a seemingly structureless

soil profile during steady state-unsaturated flow and intermittent ponding and therefore solute transport may be underestimated using conventional transport models.

- Due to the presence of preferential flow and the time interval between ponding events, intermittent ponding can be less effective than steady state-unsaturated flow in flushing surface-applied salts out of a homogeneous soil profile.

- Retardation factors derived from batch isotherm partitioning coefficients are good predictors of mildly retarded bromacil movement during the steady state-unsaturated flow regime.

Report 273 - Proceedings 37th Annual New Mexico Water Conference "Multicultural, Multiuse: Planning for New Mexico's Water Resources Future - *Catherine T. Ortega Klett, Editor (\$5.25)*

This year's annual conference held in Taos focused on the planning process and on some controversial or salient water planning issues. Talks covered water planning in the West and at federal, state, and regional levels. We looked at the Kansas Water Plan, which is one of the model water plans in the nation, and heard from two participants who worked on a regional plan along the Pecos. Other talks looked at water banking, instream flow, agricultural conservation and municipal and industrial conservation. Summaries from three workshop sessions on agricultural conservation, water banking and instream flow also are included in the proceedings.

New groundwater report available

Groundwater in the Great Plains, recently published by the Great Plains Agricultural Council and the Texas Water Resources Institute, provides a great deal of basic information for the general public in 34 pages, much of it displayed graphically. It focuses on groundwater quality and includes information on groundwater flow, types of aquifers, groundwater use, wellhead protection, conservation and contamination and health issues.

Groundwater in the Great Plains may be ordered from Texas Water Resources Institute, Texas A&M University, College Station, TX 77843-2118 (409-845-1851) for \$2.00.

National Geographic Society grants available

The National Geographic Society, through its Committee for Research and Exploration, provides grants-in-aid for basic, original, scientific field research and exploration covering a broad range of disciplines. Particular emphasis is placed on multi-disciplinary projects of an environmental nature.

Investigators with advanced degrees and associated with institutions of higher learning or other scientific and educational nonprofit organizations or museums are eligible to apply. Applications may be submitted at any time.

For more information, address inquiries to: Steven S. Stettes, Secretary; Committee for Research and Exploration; National Geographic Society; 17th and M Streets, N.W.; Washington, D.C. 20036.

Never mind the ozone, CFCs can be used to track groundwater

From U.S. Water News, December 1992 issue

Chlorofluorocarbons (CFCs), judged guilty of ozone depletion and sentenced to die as a refrigerant in air conditioning systems, have been found to have at least one redeeming quality—a unique ability to age-date groundwater and trace the flow of subsurface contamination. Because CFCs were first synthesized in the 1930s concentrations in groundwater can be measured to indicate the rate of recharge during the post-1940 period.

Under ideal conditions, the CFC dating system—initially tested in deep wells of central Oklahoma—can determine groundwater "age" to plus or minus two years, according to Niel Plummer, hydrologist for the U.S. Geological Survey. Plummer has been experimenting with the CFC dating system in conjunction with the Geological Survey's National Water Quality Assessment program. Although CFC concentrations in groundwater are very minute—measured in parts per trillion—they can nonetheless be measured with sufficient accuracy to relate to known atmospheric concentrations of the past 50 years, said Plummer.

While the methodology of dating groundwater with CFCs is not yet commercially available, he pointed out, ages produced by the technique generally agree with age-dating from two radioactive decay methods known as tritium/helium 3 and krypton-85 analyses. In addition, the CFC method usually is cheaper, easier, and faster.

CFC measurements also can be used as a relatively inexpensive pretest for groundwater contamination, said Plummer. Because most contamination originates at the

surface, he explained the presence of CFCs in groundwater usually indicates a hydrologic pathway that moves contaminants downward.

To test the CFC method, Geological Survey researchers tested deep wells in central Oklahoma, expecting to find "old" water free of CFCs. They were surprised to find relatively large concentrations of CFCs in the deep wells, however. Because large quantities of water had been withdrawn from the wells, shallow groundwater had been drawn into the wells along the water from the deeper zones, the researchers theorized. "When water is pumped from wells, it can come from many directions, depending on the pumping rate and hydraulic connections in the ground," said Plummer. "When we find CFCs in water pumped from deep wells, we know there must be a hydraulic connection to shallow water."

Parts per . . .

Over the past 25 years, advances in analytical techniques have enabled scientists to detect contaminants in smaller and smaller amounts. Many regulatory standards are expressed in parts per million or parts per billion.

One part per million is equivalent to dissolving one pound of sugar into 120,000 gallons of lemonade. One part per billion means there is one pound of substance dissolved in a billion pounds or 120 million gallons of water. Now scientists can measure amounts as small as parts per trillion (as in the CFC story left) or parts per quadrillion. Trying to find a part per quadrillion has been compared

Adopt a waterway

New Mexico has about 6,000 miles of year-round rivers and about 150,000 acres of lakes in the state. Yet the Environment Department's Surface Water Quality Bureau has less than 15 staff members who do field work to cover the whole state.

To help monitor the state's surface water, NMED has started an adoption program where individuals or groups can choose a waterway to observe on a frequent basis. Those adopting a waterway don't have to have technical expertise; simple information such as the following is useful:

- Is there trash in the waterway or adjacent arroyos?
- Are fish dying or do fish have an unpalatable flavor?
- Are there unusual odors, colors, or is there a sheen on the water?
- Is there excessive sediment on the river bottom?
- Is there machinery in the water or an activity taking place which is stirring up a lot of sediment?
- Is there a large buildup of algae?

For more information about the program contact Bonney Hughes, Surface Water Quality Bureau, P.O. Box 26110, Santa Fe, NM 87502; 827-2796.

to finding a postage stamp in an area as big as the states of New Mexico, Nebraska, and South Dakota combined.

Tech researchers use subsurface temperature to monitor groundwater flow

By Leann M. Giebler, NM Tech Public Information Office

Shirley Wade, a hydrology graduate student at New Mexico Tech, and Dr. Marshall Reiter, senior geophysicist at the New Mexico Bureau of Mines and Mineral Resources, are studying groundwater flow in the Rio Grande/Canutillo area in south-central New Mexico by modeling subsurface temperature data. The study sponsored by the Water Resources Research Institute should reveal flow direction of groundwater and may also help reconstruct old flow patterns in the area south of Las Cruces.

Wade explains that determining the direction of vertical flow has practical significance because it can be used to help define recharge and discharge areas. Such data may be used in contaminate flow analysis and potential water supply analysis.

Wade and Reiter say they often can tell the vertical direction of groundwater flow by measuring the temperature in wells at different depths. Upward flow tends to warm shallower depths whereas down-

ward flow tends to cool shallower depths.

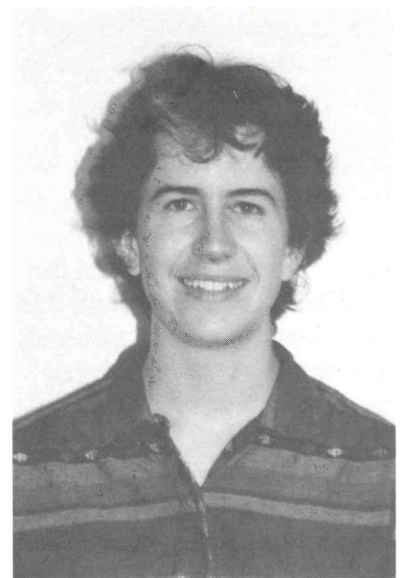
Wade and Reiter can often tell the vertical direction of groundwater flow by measuring the temperature in wells at different depths.

Wade says that she is performing tests on the rock through which the water flows to determine its thermal conductivity. "I have to be sure that the recorded temperatures are demonstrating water flow and not changes in thermal conductivity," she notes.

"Water well pumping from the deep aquifer began in the Rio Grande/Canutillo area in 1957. Using more recent logs performed by the U.S. Geological Survey, we may be able to model how the groundwater moved before pumping began," says Wade. These models should help researchers relate the effects that pumping may have had

on the amount and direction of groundwater flow.

According to Wade, in the Rio Grande/Canutillo area the deep groundwater has been flowing upward, while the groundwater near the surface appears to be flowing downward. The direction of groundwater flow may change in the deep aquifer as pumping conditions change.



Tech hydrology graduate student Shirley Wade

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