

Water Resources Research Institute

Annual Technical Report

FY 2005

Introduction

This program report provides the required information for projects funded with the 2005 base grant and mandatory non-federal matching funds. Please note that there may be some overlap in information with our 2004 report because data collection is based on a July-June fiscal year rather than the March-February USGS Grant Award period.

The New Mexico Water Resources Research Institute (NMWRRRI) was established in 1963 by the New Mexico State University Board of Regents, becoming one of the first of the 54 state institutes approved nationwide under the authorization of the 1964 Water Resources Research Act. It is considered to be the statewide nucleus for coordinating water resources research. Using the expertise of researchers in a variety of disciplines at state-supported universities, the institute is able to respond to the critical water needs of New Mexico and the region. It operates under the general advice of a Program Development and Review Board, whose membership includes faculty representatives as well as state and federal agency personnel.

The mission of the NMWRRRI is to develop and disseminate knowledge that will assist the state, region, and nation in solving water resources problems. Specifically, the institute 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 informed about 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.

The institute maintains a dynamic program to transfer technical information from the producer to the user and the public. Technical publications, newsletters, conferences, press announcements, and presentations keep practitioners aware of new technology and research advances. The NMWRRRI homepage (wrrri.nmsu.edu) provides on-line information about the institute, newsletters, technical report series, requests for proposals, upcoming conferences and symposia, links to related entities, and the research reference library.

New Mexico is one of the driest states in the nation, averaging no more than 20 inches of precipitation a year, varying from about 6.5 inches in the Four Corners area to more than 30 inches in the high mountains. The relative humidity is low, resulting in a high rate of evaporation. Summer rain accounts for almost half of the annual precipitation other than in the high mountains. Widely varied precipitation contributes as much to a water allocation problem as water scarcity itself. To compound the situation, New Mexico, like much of the West, continues to suffer from the worst drought in 100 years or longer. The winter of 2005-2006 was one of the driest winters in the last 112 years, and in parts of the state, it is the driest year in recorded history. New Mexico's rivers and streams are expected to have extremely low flows because the snowpack conditions are the poorest since 1950. The National Weather Service is predicting that drought conditions [in New Mexico] in the near future are not likely to abate. Snowpack is just 29 percent

of normal, and streams that are in good shape will not even hold half their normal flows during the spring of 2006. The biggest problem remains low reservoir levels. On the Rio Grande, the forecast of flows into Elephant Butte Reservoir, the state's largest reservoir, is 18 percent of normal. Reservoirs are holding anywhere from 6 percent to 89 percent of capacity. Water conservation measures continue to expand in municipalities throughout New Mexico to help ensure adequate public water supplies for residential and industrial use. Drought ordinances are in place in cities across the state, and county and municipal governments are working together to limit water use and reduce demand. The Drought Task Force, established in April 2002 by New Mexico's governor after declaring a state of emergency because of the drought, continues to monitor the situation.

Water problems in New Mexico, like in other western states, continue to revolve around three key issues: quality, quantity, and management. Because water resources are so limited, water quality and water resources management have taken on increasing importance. These concerns are interrelated and sufficiently complex so that the highest quality research is essential to solving them.

Research Program

The primary objective of the New Mexico Water Resources Research Institute is to maintain a balanced program of research that addresses water issues and problems critical to New Mexico, the region, and the nation. In administering this program, the institute relies on financial support from state appropriations, federal and state agencies, and the USGS Water Resources Research Institute Annual Base Program.

To make the best use of limited resources, the institute has targeted four areas as high priority for funding: water conservation, planning and management; atmospheric, surface and groundwater relationships; water quality; and utilization of saline and other impaired waters. During the reporting period, five projects received partial funding with state appropriations and will receive continuation funding from the 2006 Annual Base Program. These projects include two that fit into the water conservation, planning and management category: Development of Geospatial Modeling Tools for Watershed-based Water Resources Management in New Mexico and Estimating Water Use through Satellite Remote Sensing. Two other projects were funded in the utilization of saline and other impaired waters category: Mitigation of Membrane Biofouling by Harnessing Bacterial Cannibalism, and Sustainable Recovery of Potable Water from Saline Waters. One project, A Physically Based Parsimonious Approach for Spatial Disaggregation and Recovery of NEXRAD Precipitation Data in Mountainous Terrains was funded in the atmospheric, surface and groundwater relationships category. Funding from the 2005 USGS 104B program supported the institute's GIS laboratory project, Geographic Information Systems for Water Resources Research Planning, a project focusing on conservation, management, and planning.

During the reporting period, the NMWRRI administered a total of 43 projects dealing primarily with water quality and conservation issues. The total value of these projects was just over \$960,000, including required cost sharing. Awards were made by various federal and state agencies, a private foundation, and from the institute's annual state appropriations. Dollar amounts per project award ranged from \$1,150 to just over \$85,000. During the reporting period, projects were conducted at New Mexico State University, New Mexico Tech, University of New Mexico, New Mexico Highlands University, and Eastern New Mexico University. Faculty members were principal investigators on 32 projects and NMWRRI staff managed 11 projects. The institute maintained frequent contact with its researchers through periodic progress updates, site visits, and expenditure tracking.

Research projects administered by the NMWRRI utilized at least 74 students during the year including 30 undergraduates, 31 masters, and 13 Ph.D. candidates in the disciplines of anthropology, bacteriology, biology, business, chemical engineering, civil engineering, computer science, economics, environmental geology, environmental engineering, earth sciences, geography, hydrology, life sciences, microbiology, and political science. A water resources summer training program provided a broad understanding of water resources to approximately 30 Native American high school students from across the nation.

Projects administered by the NM Water Resources Research Institute during the reporting period that were funded from sources other than the 2005 USGS Annual Base Program are listed below. Note that total award value is shown and includes both agency and cost sharing when appropriate.

Final Deliverables for the Regional Water Plan Mapping Project. NM Interstate Stream Commission \$1,150

Soil Recovery after Herbicide Treatment of Saltcedar Stands and Management Implications. WRI Student Research Grant (Cheryl Rosel, New Mexico State University) \$1,900

Digitizing Geologic Maps. New Mexico Bureau of Geology and Mineral Resources \$2,000

Mycorrhizal Colonization in Cottonwood and Salt Cedar Stands along the Middle Rio Grande: Implications for Water Quality and Water Consumption. WRI Student Research Grant (Jennifer Follstad Shah, University of New Mexico) \$3,000

Groundwater Quality and Well Water Assessment in Las Vegas New Mexico Area. WRI Student Research Grant (Simone-Camille Yelah Tar, New Mexico Highlands University) \$3,482

Mapping Services for Northeast New Mexico - Regional Water Plan Task Order. Professional Services Agreement with the NM Interstate Stream Commission \$3,840

Investigation of Transpiration Water Loss from Pinion-Juniper Forests. WRI Student Research Grant (Sue White, New Mexico Tech) \$4,586

Rapid Detection of Human Fecal Contamination Using sIgA as an Indicator. WRI Student Research Grant (Jessica Hamel, New Mexico State University) \$4,600

Riparian Evapotranspiration Estimates on the Middle Rio Grande Using Remote Sensing. WRI Student Research Grant (Maritza A. Macias-Corral, New Mexico State University) \$5,000

Modeling of Mass and Heat Transport in Membrane Distillation Process for Brackish Water Desalination. WRI Student Research Grant (Prajwal Vikram, New Mexico State University) \$5,000

Numerical Modeling Investigation of Fluid Flow Above and Below Sediment-water Interfaces. WRI Student Research Grant (Meinhard Bayani R. Cardenas, New Mexico Tech) \$5,000

Hydrometeorological Field Studies During the North American Monsoon in the Valles Caldera National Preserve. WRI Student Research Grant (Alex J. Rinehart, New Mexico Tech) \$5,000

Surveying Health Risks Associated with Arsenic in the Gallinas Watershed. WRRRI Student Research Grant (Justin Johns-Kaysing, New Mexico Highlands University) \$5,000

Cattails and Ostracodes: An Investigation of Prehistoric Water Management in the Chupadera Arroyo Basin, Central New Mexico. WRRRI Student Research Grant (Monika Enke, Eastern New Mexico University) \$5,000

Water Quality along the Middle Rio Grande of New Mexico. WRRRI Student Research Grant (Lydia Zeglin, University of New Mexico) \$5,000

Human Impacts on Nitrate Dynamics in Hypoheic Sediments Using a Stable Isotope Tracer. (Chelsea Crenshaw, University of New Mexico) \$5,000

GIS Mapping Services for the NMED Project. NM Environment Department \$6,000

Mapping Services Western Hueco Basin. California State University \$6,000

Water Savings and Hydrologic Impacts of the North American Development Bank Canal Lining. Elephant Butte Irrigation District \$6,270

Mapping and GIS Activities Associated with the Enhancement of the Data Portal Capabilities of the Paso del Norte Coordinated Database. Texas A&M, Agricultural Research and Experiment Center at El Paso \$8,074

Predicting Land Use Change and its Effect on Nonpoint Source Pollution. New Mexico state appropriations \$10,000

Enhancement of the Data Portal Capabilities of the Paso del Norte Coordinated Database Project. Texas A&M, Agricultural Research and Experiment Center at El Paso \$18,975

Sustainable Recovery of Potable Water from Saline Waters. New Mexico state appropriations \$19,960

Development of Geospatial Modeling Tools for Watershed-based Water Resources Management in New Mexico. New Mexico state appropriations \$19,991

A Physically Based Parsimonious Approach for Spatial Disaggregation and Recovery of NEXRAD Precipitation Data in Mountainous Terrains. New Mexico state appropriations \$20,000

Estimating Water Use through Satellite Remote Sensing. New Mexico state appropriations \$20,000

Solar Desalination of Brackish Water Using Membrane Distillation Process. New Mexico state appropriations \$20,833

Coordinated Database for Water Related Resources in the Rio Grande Watershed. Texas A&M, Agricultural Research and Experiment Center at El Paso \$21,721

An Appraisal-level Study of Alternative Methods of Reducing Carriage Losses from Conchas Canal for the Arch Hurley Conservancy District: Open-canal construction materials and costs. Bureau of Reclamation \$27,830

Land Application of Industrial Effluent on a Chihuahuan Desert Ecosystem. New Mexico state appropriations \$29,240

Utilization of Saline and Other Impaired Waters for Turfgrass Irrigation. New Mexico state appropriations \$30,000

New Mexico Pesticide Management Plan 2005-2006. Memorandum of Agreement with the New Mexico Department of Agriculture. US Environmental Protection Agency \$30,000

Mitigation of Membrane Biofouling by Harnessing Bacterial Cannibalism. New Mexico state appropriations \$20,000

Development of a Conceptual Model of the Rio Grande Flow Between Elephant Butte Dam and American Dam. Texas A&M, Agricultural Research and Experiment Center at El Paso \$34,618

Development of RiverWare Model of the Rio Grande Flow between Elephant Butte Dam and Fort Quitman. Texas A&M, Agricultural Research and Experiment Center at El Paso \$44,489

An Appraisal-level Study of Alternative Methods of Reducing Carriage Losses from Conchas Canal for the Arch Hurley Conservancy District: Geological Site Studies. Bureau of Reclamation \$49,175

A Joint Investigation of Evapotranspiration Depletion of Treated and Non-Treated Saltcedar at the Caballo Dam, New Mexico. U.S. Bureau of Reclamation \$53,462

An Appraisal-level Study of Alternative Methods of Reducing Carriage Losses from Conchas Canal for the Arch Hurley Conservancy District: Quality Control of Design. Bureau of Reclamation \$53,750

A Joint Investigation of Evapotranspiration Depletion of Treated and Non-Treated Saltcedar at the Elephant Butte Delta, New Mexico. Sierra Soil & Water Conservation District \$60,000

Joint Investigation of Evapotranspiration Depletion of Treated and Non-Treated Saltcedar at the Elephant Butte Delta, New Mexico. Bureau of Reclamation \$61,507

Grand Unified Groundwater Model Development for the Lower Rio Grande. Lower Rio Grande Water Users Association \$63,576

U.S.-Latin American Relations Program Mapping Project. Hewlett Foundation \$75,000

Water Resources Training Program for Native American Students 2005. US Bureau of Indian Affairs \$85,092

Geographic Information System for Water Resources Research Planning

Basic Information

Title:	Geographic Information System for Water Resources Research Planning
Project Number:	2002NM1B
Start Date:	3/1/2002
End Date:	2/28/2006
Funding Source:	104B
Congressional District:	Second
Research Category:	Not Applicable
Focus Category:	Management and Planning, Conservation, Water Quality
Descriptors:	
Principal Investigators:	Bobby J. Creel

Publication

1. Hawley, J.W. and J.F. Kennedy. 2004 (2005), Creation of a Digital Hydrogeologic Framework Model of the Mesilla Basin and Southern Jornada del Muerto Basin. New Mexico Water Resources Research Institute; prepared for Lower Rio Grande Water Users Organization; Technical Completion Report 332, 105 p., with plates and appendix on CD ROM (including June 2005 Addendum extending model into Rincon Valley and adjacent areas).
2. King, J.P., J.W. Hawley, J.W. Hernandez, J.F. Kennedy and E.L. Martinez. 2006. Study of Potential Water Salvage on the Tucumcari Project Arch Hurley Conservancy District: Phase I. A pre-appraisal-level study of the potential amount of saved-water and the costs of alternative methods of reducing carriage losses from district canals. New Mexico Water Resources Research Institute, Technical Completion Report No. 335, with plates and appendices on CD ROM.
3. Hawley, J.W., J.F. Kennedy, and M. Ortiz. 2005. Digital hydrogeologic-framework model of the western Hueco Bolson area, Texas and Chihuahua. New Mexico Water Resources Research Institute, New Mexico State University. Project Completion Report, prepared for California State University-Los Angeles (CSULA Purchase Order CGA46120/NMSU Acct # 20050644), 45 p., 2 plates.

GIS Project

Problem and Research Objectives

The New Mexico Water Resources Research Institute has become the focal point for geographic information system (GIS) data and information concerning water resources in New Mexico. It combines database management with digital mapping into spatial-tabular data models. These models are powerful tools for representing and manipulating earth-science information.

As use of Geographic Information Systems has grown and presented new opportunities, it also has raised a number of new issues and problems. Of increasing concern is the management of a growing collection of spatial data sets and applications programs. These data sets and programs are very expensive to produce but relatively easy to share, so there is a great incentive to avoid duplicating production efforts. The trend clearly is toward managing these elements in distributed spatial libraries.

The primary objective of the project is to increase availability and accessibility of water resource information to support water resource planning and management in the state. The first task provides spatial data library accessibility. This task maintains arrangements and establishes those necessary to provide access to spatial data maintained by other agencies and organizations. The second task, spatial data development, evaluates needs, establishes priorities, and undertakes development of spatial data that is otherwise unavailable. These efforts will be coordinated with cooperating agencies and organizations to ensure no duplication of effort and to establish guidelines for coverages and priorities. The principal investigators maintain, update as necessary, and make the data available to cooperating agencies and organizations through both formal and informal arrangements to facilitate water resource planning activities.

Methodology

A number of cooperative data sharing agreements have been entered into with state, federal, and local agencies and organizations to facilitate access and to develop spatial data. Others will be pursued as necessary. Research funded by the NMWRRRI in many cases results in the development of data that can be represented in a spatial form and thus can contribute to the state data pool. Projects that have such a potential are adjusted as necessary to meet this secondary purpose.

The NMWRRRI maintains a GIS laboratory consisting of computer workstations; data storage devices; input/output devices (color plotter, digitizer, etc.); software for mapping and analysis (ARC/Info); database development and visualization; and network systems. The laboratory is connected via fiber to the New Mexico State University computer network, and thereby to the Internet. The NMWRRRI also maintains an Internet web server site through which both spatial and tabular water resource data can be provided.

Principal Findings and Significance

Various research activities are supported by the system for water resources planning in the state. The New Mexico Interstate Stream Commission provides grants to regional groups to support water resources planning. NMWRRRI continues to be utilized by the NM Interstate Stream Commission to provide GIS mapping products for use in their plans and in public outreach. NMWRRRI has helped many regional groups with GIS mapping products for use in their plans and in public outreach efforts.

Additionally, support has been given to the New Mexico/Texas Water Commission and various public entities of southern New Mexico for their planning activities. GIS mapping support is also provided to the Lower Rio Grande Water Users Organization.

Presentations utilizing the products of the database management system were given at the Annual Environmental Science Conference in Pasadena, CA on April 6, 2005; the 2005 New Mexico Water Research Symposium on August 16, 2005; and the CEA-CREST/SAHRA/EPWU Hueco Bolson Workshop 3 in El Paso TX on August 19, 2005. A report entitled "Digital Hydrogeologic-Framework Model of the Western Hueco Bolson Area, Texas and Chihuahua" was prepared for a project supported by California State University-Los Angeles.

Marquita Ortiz, a graduate student at New Mexico State University and WRRI's GIS Technician received an NMSU Cluster Mini-Grant award for her project entitled, *The Impacts of Land Use Change on Water Resources and Traditional Acequia Culture in North Central New Mexico*. She will work with co-investigators from several departments to examine and interpret land use changes in the Black Mesa Reach of the Rio Grande in northern New Mexico. Marquita will employ GIS, remote sensing, and aerial photography to study the land use changes.

This sophisticated mapping and geo-spatial database management system, originally designed to support WRRI-funded research activities, is now being used for external research grants (e.g., Creation of a Digital Hydrogeologic Framework Model of the Mesilla Basin and Southern Jornada del Muerto Basin; creation of maps for the purpose of water planning funded by the New Mexico Interstate Stream Commission; and pesticide management planning in the state funded by the New Mexico Department of Agriculture) by water resources management and planning agencies in the state. A research grant resulted in the creation of a regional geographic information system to support water planning in the Paso del Norte borderland area of the southwestern United States.

This is an ongoing project with new data continually being added to the database and assistance being given to produce specific GIS products upon request. Continued funding is anticipated from annual state appropriations, as well as pending agency awards.

Information Transfer Program

The New Mexico Water Resources Research Institute maintains an active program to transfer technical information from the producer to the user and the public. Technical publications, newsletters, conferences, symposia, press announcements, and presentations keep practitioners aware of new technology and research advances. The WRRRI homepage (wrrri.nmsu.edu) provides on-line information about the institute's newsletters, technical report series, requests for proposals, upcoming conferences and symposia, and the research reference library. Starting with the 31st Annual New Mexico Water Conference Proceedings, all papers have full-text viewing via the institute's homepage. Other federal and state servers, such as the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, USGS, and National Weather Service are linked to the WRRRI homepage.

Information Transfer Program

Basic Information

Title:	Information Transfer Program
Project Number:	2002NM3B
Start Date:	3/1/2002
End Date:	2/28/2006
Funding Source:	104B
Congressional District:	Second
Research Category:	Not Applicable
Focus Category:	Education, None, None
Descriptors:	None
Principal Investigators:	Bobby J. Creel, Cathy T. Ortega Klett

Publication

1. Cowley, D.E., J. Alleman, R.R. McShane, and P.D. Shirey, and R. Sallenave. 2005. Effects of Salinity and Suspended Sediment on Physical Properties of the Egg of the Rio Grande Silvery Minnow (*Hybognathus amarus*). New Mexico Water Resources Research Institute, Technical Completion Report No. 334, New Mexico State University, Las Cruces, New Mexico.
2. Ortega Klett, C.T., 2005, Proceedings of the 49th Annual New Mexico Water Conference, Water Desalination and Reuse Strategies for New Mexico. New Mexico Water Resources Research Institute, Technical Completion Report No. 336, New Mexico State University, Las Cruces, New Mexico.

Statement of Critical Water Problem:

The New Mexico Water Resources Research Institute's Information Transfer Program is designed to bring the results of its research projects to the public and to educate New Mexicans on the critical water issues of the state, region, and nation. Different sectors of the public are targeted for each of its activities.

Statement of Results and Benefits:

The program goal is to provide people with water information appropriate to their level of training and interest. Information transfer activities are funded primarily from non-federal sources. Responsibilities for different segments of the program have been assigned to various professional and support staff at the institute.

Nature, Scope and Objectives:

The primary methods for information transfer are conferences, publications, audio/visual presentations, and available information on the institute's website. For the past 50 years, the NMWRRI has sponsored the Annual New Mexico Water Conference focusing on a topic of importance to the New Mexico water community. The annual conference is held in different locations around the state, usually in the fall. Most of the conference participants are water resources practitioners working for state, federal, or local agencies, although some members of the general public and of academia also attend. Average attendance ranges between 200 and 350, depending on the location and topic of the conference.

Publications include technical completion reports resulting from NMWRRI sponsored projects, special in-house publications, and conference proceedings. The institute has published more than 360 technical and miscellaneous reports. The peer reviewed technical completion reports are directed toward water professionals working in disciplines related to the research projects. Since about 2000, technical reports are available via the NMWRRI web site in full text. Those interested in a particular report are able to print off the Internet instead of ordering a hard copy of the report.

The institute averages over 500 requests on-line each month for its publications and 10 requests for hard copies of specific publications each month. As reports have become available on-line in the past few years, the institute has been receiving fewer requests for hard copies. Requests on-line have more than doubled in the past three years.

A quarterly newsletter, *The Divining Rod*, focuses on research and current water issues. It is distributed to approximately 2,300 readers and is available on the WRRI homepage.

A reference room, housed at the institute, contains over 10,000 documents and is used frequently by faculty, students, and others. A complete catalog of holdings can be searched through the NMWRRI home page on the Internet, along with an extensive water resources and information system database and other information about the institute. Several hundred inquires per month are recorded on the web page.

The institute director and associate director are invited frequently to speak at local, regional, and national conferences and workshops in addition to serving on a number of committees that focus on water resources. The institute director is currently the past-president of the national organization, Universities Council of Water Resources, and is an active member of the National Institute of Water Resources. The NMWRRI staff also regularly provides expertise for solving specific problems and general concerns. They play a central role in planning for the water future of the region by cooperating with a host of water resources entities throughout the state and region, particularly in the Paso del Norte area.

Accomplishments:

The 50th Annual New Mexico Water Conference was held in October at Corbett Center on the New Mexico State University campus in Las Cruces. NMSU was the host site for the first 25 annual New Mexico water conferences. The past 50 conferences have been held at different sites around the state. This year's milestone conference, "New Mexico Water: Past, Present, and Future or Guns, Lawyers, and Money" drew over 300 participants including 50 students. A pre-conference tour of Elephant Butte Dam was hosted by the U.S. Bureau of Reclamation in conjunction with the 100th anniversary of the Rio Grande Project. UNM School of Law Professor Emeritus Chuck DuMars gave the 2005 Utton Memorial Water Lecture, "Prior Appropriation

Law and Future Water Allocation: Preserving Water for Future Generations.” A full proceedings of the conference was produced and is available on the WRRI website. All conference participants received a copy on CD.

The NMWRRI coordinated the 2005 Water Research Symposium held on the campus of New Mexico Tech, in Socorro, New Mexico. The one-day “2005 New Mexico Water Research Symposium – Advances in Hydrology: Methods and Instruments” was co-sponsored by Sandia National Laboratories, Los Alamos National Laboratory, New Mexico’s three state universities, the Office of the State Engineer, New Mexico Interstate Stream Commission, and the AWRA-New Mexico section. Thirty-two presentations were given and 30 posters displayed. Over 180 participants from throughout New Mexico, Arizona, and west Texas attended.

The institute maintains an active program to transfer technical information from the producer to the user and the public. Technical publications, newsletters, conferences, press announcements, and presentations keep practitioners aware of new technology and research advances. The NMWRRI’s homepage (wri.nmsu.edu) provides on-line information about the institute’s newsletters, technical report series, student grants, requests for proposals, upcoming conferences, and the research reference library. Starting with the 31st Annual New Mexico Water Conference Proceedings, all conference papers have full-text viewing on the institute’s homepage.

The institute’s publications for the period included one technical report entitled, “Effects of Salinity and Suspended Sediment on Physical Properties of the Egg of the Rio Grande Silvery Minnow (*Hybognathus amarus*).” The 49th Annual New Mexico Water Conference proceedings was produced in hardcopy and on CD. NMWRRI technical completion reports are available at no charge while supplies last. A copy charge is assessed if the report is out of print or has been reprinted. Water conference proceedings and miscellaneous reports can be purchased for a small charge. All technical report abstracts can be viewed via the NMWRRI homepage, and publications may be ordered at wri.nmsu.edu.

The institute’s quarterly newsletter, *The Divining Rod*, is an eight- to sixteen-page newsletter that focuses on research projects administered by the NMWRRI and on current water issues in New Mexico. It provides information on upcoming conferences, seminars, and workshops; describes new grants and newly released publications; and provides general information on new developments in water resources research and management. Each issue is available on the NMWRRI’s homepage. Hard copies of the newsletter are distributed to approximately 2,300 readers. During the reporting period, the institute published two 8-page issues and two 12-page issues of *The Divining Rod*.

The Information Transfer Program is an ongoing program with no particular timelines.

Student Support

Student Support					
Category	Section 104 Base Grant	Section 104 NCGP Award	NIWR-USGS Internship	Supplemental Awards	Total
Undergraduate	0	0	0	0	0
Masters	1	0	0	0	1
Ph.D.	0	0	0	0	0
Post-Doc.	0	0	0	0	0
Total	1	0	0	0	1

Notable Awards and Achievements

John W. Hawley, WRRI senior hydrogeologist, received the Geological Society of America's 2005 Engineering Geology Division Distinguished Practice Award presented in honor of a long and distinguished career practicing environmental and engineering geology in the public interest. The award was made at the Society's annual meeting in Salt Lake City, Utah, on October 17, 2005. At the award ceremony, Dr. Hawley was noted for his important contributions to our understanding of soil geomorphology and basin-fill aquifer systems in the American Southwest. He helped to guide the evaluation of potential waste disposal sites and geologic hazards, served as a respected and pragmatic expert on regional geology, and unselfishly mentored countless young geologists.

Project 2001 B-03 NM1421 Geographic Information System for Water Resources Planning: Several presentations were made by researchers supported by the GIS project including the following:

CEA-CREST 6th Annual Environmental Science Conference, Pasadena, CA (4/6/2005): Hawley, J.W. and J.F. Kennedy. Digital hydrogeologic-framework model of the binational western Hueco Bolson area, Texas and Chihuahua.

NMWRRIEPA QA/QC Review, Las Cruces, NM (6/30/2005): Hawley, J.W. Power-Point presentation on development of digital hydrogeologic-framework models of the Mesilla and southern Jornada Basins, Rincon Valley and western Hueco Bolson, New Mexico, Texas and Chihuahua.

2005 New Mexico Water Research Symposium (8/16/2005): Hawley, J.W., J.F. Kennedy, M. Ortiz, and S. Carrasco. Digital hydrogeologic-framework model of basin-fill aquifer systems in south-central New Mexico, and adjacent parts of Trans-Pecos Texas and Chihuahua.

CEA-CREST/SAHRA/EPWU Hueco Bolson Workshop 3, El Paso, TX (8/19/2005): Hawley, J.W., J.F. Kennedy and M. Ortiz. Digital hydrogeologic-framework model of the western Hueco Bolson area, Texas and Chihuahua.

Publications from Prior Projects

1. 2000NM7G ("Institutional Adjustments for Coping with Prolonged and Severe Drought in the Rio Grande Basin") - Articles in Refereed Scientific Journals - Ward, F.A., B.H. Hurd, T. Rahmani, and N. Gollehon. 2006. Economic impacts of federal policy responses to drought in the Rio Grande Basin, *Water Resources Research*. 42;W03420 (doi:10.1029/2005WR004427).
2. 2000NM7G ("Institutional Adjustments for Coping with Prolonged and Severe Drought in the Rio Grande Basin") - Articles in Refereed Scientific Journals - Ward, F.A., J.F. Booker, and A.M. Michelsen. Forthcoming. Integrated Economic, Hydrologic and Institutional Analysis of Policy Responses to Mitigate Drought Impacts in the Rio Grande Basin. *Journal of Water Resources Planning and Management*.
3. 2000NM7G ("Institutional Adjustments for Coping with Prolonged and Severe Drought in the Rio Grande Basin") - Articles in Refereed Scientific Journals - Ward, F.A. and J.F. Booker. 2006. Economic Impacts of Instream Flow Protection for the Rio Grande Silvery Minnow in the Rio Grande Basin. *Reviews in Fisheries Science*. 14:1-2:January-March 2006.
4. 2000NM7G ("Institutional Adjustments for Coping with Prolonged and Severe Drought in the Rio Grande Basin") - Articles in Refereed Scientific Journals - Booker, J.F., A.M. Michelsen, and F.A. Ward. 2005. Economic impact of alternative policy responses to prolonged and severe drought in the Rio Grande Basin. *Water Resources Research*. 41: W02026 (doi:10.1029/2004WR003486).
5. 2000NM7G ("Institutional Adjustments for Coping with Prolonged and Severe Drought in the Rio Grande Basin") - Conference Proceedings - Ward, F.A., J.F. Booker, and A.M. Michelsen. 2004. Institutional Innovations for Coping with Severe and Sustained Drought in an International Basin. *World Water Congress 2004, Critical Transitions in Water and Environmental Resources Management, World Water and Environmental Resources Congress 2004*, G. Sehlke, D.F. Hayes, D.K. Stevens (eds), June 27 - July 1, 2004, Salt Lake City, Utah, USA.
6. 2000NM6B ("Hyperfiltration-Induced Precipitation of Sodium Chloride") - Articles in Refereed Scientific Journals - Saindon, R. and T.M. Whitworth. 2006. Reverse osmosis properties of bentonite/glass bead mixtures at low compaction pressures. *Applied Clay Science*. 31:1-2:90-95.
7. 2000NM6B ("Hyperfiltration-Induced Precipitation of Sodium Chloride") - Articles in Refereed Scientific Journals - Hart, M. and T.M. Whitworth. 2005. Hyperfiltration of potassium nitrate through clay membranes under relatively low-head conditions. *Geochimica et cosmochimica acta*. 69:20:4817-4823
8. 2000NM6B ("Hyperfiltration-Induced Precipitation of Sodium Chloride") - Articles in Refereed Scientific Journals - Oduor, P.G. and T.M. Whitworth. 2005. Mechanistic interpretation of ionic azo dye flux decline through compacted Na-montmorillonite membrane. *Journal of Membrane Science*. 265:1-2:85-93.
9. 2000NM6B ("Hyperfiltration-Induced Precipitation of Sodium Chloride") - Articles in Refereed Scientific Journals - Saindon, R. and T.M. Whitworth. 2005. Hyperfiltration of NaCl Solutions Using a Simulated Clay/Sand Mixture at Low Compaction Pressures. *Aquatic Geochemistry*. 11:4:433-444.
10. 2000NM6B ("Hyperfiltration-Induced Precipitation of Sodium Chloride") - Articles in Refereed Scientific Journals - Fang, J. B. Deng, and T.M. Whitworth. 2005. Arsenic removal from drinking water using clay membranes. *American Chemical Society, ACS symposium series*. 915:294-305.
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