

# **New Graduate Program Approval Request**

## **New Degrees**

New Degrees: Master of Science in Water Science & Management  
Doctor of Philosophy in Water Science & Management

## **Submitted by**

New Mexico State University  
Department of Agricultural Economics and Agricultural Business  
Department of Animal and Range Sciences  
Department of Geography

## **Program Management Committee**

Dr. Karl Wood, Director  
New Mexico Water Resources Research Institute

Dr. Frank Ward, Professor  
Department of Agricultural Economics & Business, College of Agricultural, Consumer, and  
Environmental Sciences

Dr. Alexander Fernald, Associate Professor  
Department of Animal and Range Sciences, College of Agricultural, Consumer, and  
Environmental Sciences

Dr. Christopher Brown, Associate Professor  
Department of Geography, College of Arts and Sciences

## **Administrative Advisory Council**

Dr. James Peach, Regents Professor  
Department of Economics & International Business, College of Business

Dr. Abbas Ghassemi, Director  
Institute for Energy and Environment, College of Engineering

Dr. Jacob Urquidi, Assistant Professor  
Department of Physics, College of Arts and Sciences

Dr. Susan Brown, Director  
Institute for Excellence in Math & Science Education, College of Education

Dr. Steven Arnold, Professor  
Department of Health Science, College of Health and Social Sciences

## **New Graduate Program Approval Request**

Master of Science in Water Science & Management  
Doctor of Philosophy in Water Science & Management

## Table of Contents\*

\*Section and Sub-section numbers correspond to 5 NMAC 5.2

Section	Sub-Section	Section Name	Page
A		Purpose of Program and Mission of the Proposing Institution	1
	(1)	Primary Purpose	1
	(2)	Program Constituency with Role and Scope of NMSU	2
	(3)	Institutions' Priority for the Proposed Program	7
	(4)	Curriculum for the Proposed Program	7
B		Justification for the Program	9
	(1)	Need	9
	(2)	Duplication	12
	(3)	Inter-institutional Collaboration and Cooperation	13
C		Clientele and Projected Enrollment	13
	(1)	Clientele	13
	(2)	Projected Enrollment	14
		Table 1. Projected Student Enrollment	14
		Table 2. Approximate Credit Hour Generation	15
D		Institutional Readiness for the Program	15
	(1)	Teaching Faculty	15
	(2)	Library and Other Academic Support Services	16
	(3)	Physical Facilities	16
	(4)	Equipment and Technology Resources	19
	(5)	Other Operating Resources	19
	(6)	Existing External Facilities	19
E		Projected Costs of the Program	19
	(1)	New Costs for Program Startup	19
	(a)	Faculty	19
	(b)	Library Resources	19
	(c)	Additional Facilities, Equipment, and Technology Resources	19
	(d)	New Graduate Assistantships	19
	(e)	Professional and Administrative Personnel	20
	(2)	State Support	21
	(3)	Other Support	21
F		Quality of the Program	21
G		Assessment of Operations and Impact	22
H		Administrative Responsibility for the Program	22
		Table 3. Internal Approvals Received	23

### **Table of Contents (continued)**

<b>Appendix</b>	<b>Title</b>	<b>Page</b>
A	Graduate Courses Relating to Water Science & Management	25
B	Current Research/Grant Funding	28
C	Letters of Support from NMSU	37
D	Qualifications of Faculty in the Water Science and Education Center	64
E	Curriculum Vitae of Core/Substantive Faculty on Steering Committee of the Water Science and Education Center	66
F	NMSU Support Services	75
G	Library Impact Statement	77
H	References	78
I	Needs Survey Summary	79

## **Proposal for Approval of Master and Doctor of Water Science & Management New Mexico State University**

This proposal has been developed based on the New Mexico Department of Higher Education provisions of 5 NMAC 5.2 that apply to new graduate programs proposed for implementation by a constitutional institution of higher education in New Mexico. Itemization corresponds to 5 NMAC 5-2, Part 5.5.2.9, Requirements for Approved Graduate Programs.

### **A. Purpose of the Program and Mission of the Proposing Institution. The proposed program must have a clear purpose that is consistent with the mission of the proposing institution.**

(1) **The primary purpose** of the proposed master's and doctoral degree programs in Water Science & Management (WSM) at New Mexico State University (NMSU) is to provide graduate education for addressing state, national, and international water issues, training the next generation of water educators, researchers, managers, and professionals; and promoting outreach. Presently graduate degrees with a specialized water emphasis are granted in several departments, indicating a high potential for integrating these specialized areas into a larger comprehensive program. At least 85 faculty members conduct water teaching, research, and outreach at NMSU. Moreover, nearly 100 graduate courses are taught and much water research is conducted across seven of NMSU's colleges and 16 academic departments. To bridge these programs, the Water Science and Education Center was formed 3 years ago as a subcluster in the Natural Resource Sustainability and Renewal Cluster. The proposed WSM program has the potential to greatly expand the number, quality, and range of graduate students in water resources at New Mexico State University. Because the WSM program will foster multidisciplinary research, education, and outreach, it will be able to comprehensively address considerably more challenging water issues of the state, nation, and world.

Why is a new program in water science & management needed? The present generation of water scientists is dominated by people that soon will retire from academia, private industry, consulting and engineering firms, and government agencies. With expanding demands for water, food grown under irrigation, and possible reduced supplies caused by climate change, more scientists are needed. Eilene Zimmerman wrote an article in the March 8, 2009 edition of the New York Times titled, "Hiring in Hydrology Resists the Slump." She says that according to Bureau of Labor Statistics demand for hydrologists has been predicted to grow 24 percent from 2006 to 2016, much faster than the average for all occupations. In the article Matthew C. Larsen, a hydrologist and associate director for water at the U.S. Geological Survey, is referenced as saying, "Most hydrologists did not earn degrees in hydrology; in fact, only a handful of undergraduate and graduate hydrology programs exist across the country. It is far more common for hydrologists to come from a hard science or engineering background. Though it is possible to enter the field with a bachelor's degree — most often as a lab technician — moving up in the career requires an advanced degree." According to the Bureau of Labor Statistics, about 28 percent of hydrologists are employed by the federal government, at the Geological Survey and the Defense Department. An additional 21 percent work for state agencies and state departments

of conservation. Others work in architecture, engineering and for management, scientific and technical consulting firms. Salaries for hydrologists range from an entry level of about \$35,000 to well into six figures for the most senior scientists at consulting firms. Jobs in consulting firms generally pay higher salaries than those with the government.

(2) The **proposed degree program is fully consistent** with the mission and goals of New Mexico State University as expressed in its most recent strategic planning document (“Living the Vision” September 8, 2005, available on the Web at: <http://ltv.nmsu.edu/>). New Mexico State University is the state’s land grant university, serving the educational needs of New Mexico’s diverse population through comprehensive programs of education, research, extension education, and public service.

The Living the Vision document has five primary goals, which will be supported by the proposed degrees.

The goals of the proposed Water Science & Management program include:

1. Foster the discovery and application of knowledge about water resources to promote human well-being and sustainable development
2. Prepare the next generation of water scientists and managers for professional and academic careers at the local, state, national, and international levels
3. Provide graduate students with knowledge in disciplines relevant to water resources including a broad understanding of hydrology and the interplay among the biophysical and social sciences in water management
4. Provide teaching and research opportunities with collaborations, lectures, seminars, and workshops to improve the communication and exchange of knowledge between students, faculty, professionals, and citizens
5. Improve the availability, security, and reliability of human water supplies across all lands

New Mexico State University, which began in 1888 as an agricultural college and preparatory school, is a comprehensive institution dedicated to teaching, research, and service at the graduate and undergraduate levels. It is the only land-grant institution in the United States that is also classified as Hispanic-serving by the federal government and ranked by the Carnegie Foundation in the top research category, Research-Extensive (Carnegie Foundation, 2005). NMSU has extension offices in every county of New Mexico, multiple off-campus research sites, and a rapidly expanding distance education program. Total fall 2008 enrollment for the NMSU system was 30,009. The Las Cruces campus enrollment was 16,726, including 3,321 graduate students. Minority enrollment for the NMSU system was approximately 46.7% percent (39.4 percent Hispanic, 3.1 percent American Indian, 2.9 percent African-American and 1.3 percent Asian-American). There are more than 1,700 faculty members, and almost 4,000 staff. About 1,100 of the faculty and 3,400 staff members are located on the Las Cruces campus. Eighty-one

percent of the full-time faculty hold earned doctoral degrees. NMSU offers 76 bachelor's degrees, 51 master's degrees and 22 doctoral degrees.

(Source: [http://www.nmsu.edu/General/NMSU At a Glance.html](http://www.nmsu.edu/General/NMSU%20At%20a%20Glance.html)).

New Mexico State University has about 85 faculty that conduct water research on and off-campus. This is more than the other five state universities and national labs combined. These faculty members are located in many departments and all the colleges across campus plus the agriculture research centers across the state. For a full listing of faculty involved in the Water Science and Education Center, see <http://research.nmsu.edu/water/waterMembers.html>.

The Water Science and Education Center recently conducted a state-wide survey of more than 624 water entities and found the top issues in New Mexico for future water research, teaching, and service to include:

- Improve existing supply enhancing technologies
- Assess levels of vulnerability of New Mexico aquifers
- Examine cost-effective methods to promote water conservation
- Improve water use efficiency and increase economic returns for water used
- Increase safety of wastewater treated for use as drinking water
- Promote conjunctive use of surface water and groundwater
- Develop better measures for reducing water pollution
- Understand what influences water use by agriculture, municipal, industrial, and environmental users
- Understand effects of land use changes on water pollution

In addition, many faculty members in the Water Science and Education Center SubCluster conduct research, teaching, and service in international water development activities. These include a substantial commitment for the university on projects in Mexico, the Mid-East, and Asia.

NMSU also plays a major role in water development of the region. NMSU has successfully conducted significant basic and applied research to solve water problems in New Mexico and the Paso del Norte region. A significant contributor to this success has been the New Mexico Water Resources Research Institute (NMWRRI). It 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 NMWRRI 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. NMWRRI also houses the New Mexico office of the regional Southwest Consortium for Environmental Research and Policy. It publishes the new Journal of Transboundary Water Resources.

Another important contributor has been the Water, Energy, and Resource Center (WERC), which is a Consortium for Environmental Education and Technology Development. The consortium's mission is to develop the human resources and technologies needed to address environmental issues. WERC has come to be widely recognized for its commitment to the nation's environment and natural resources. WERC's threefold program aims to achieve environmental excellence through education, public outreach and technology development and deployment. Its successes are many, with an active higher education program to support students pursuing environmentally related degrees, an outreach program that reaches thousands of children and hundreds of regional businesses and agencies, and a technology development effort that has resulted in a number of new environmental technologies.

The water related research, teaching, and outreach programs are summarized below for several departments at New Mexico State University.

The **Department of Animal and Range Sciences** has had a program in watershed management since 1979. The program has concentrated on runoff and erosion not only in New Mexico but several foreign countries. Recent research has emphasized irrigation canal and field seepage, changing and use issues, percolation modeling, ground water surface modeling, riparian ecology, and hydrology.

The **Department of Fish, Wildlife, and Conservation Ecology** functions with the New Mexico Cooperative Fish and Wildlife Research Unit as a cooperative unit of the National Biological Service, New Mexico Department of Game and Fish, New Mexico State University, and The Wildlife Management Institute. Research involves understanding the ecological requirements of native aquatic species, the demography and genetics of their populations, aquatic community organization, and how humans modify aquatic ecosystems. Research also includes studies of mercury contamination in fisheries.

The **Department of Agricultural Economics and Agricultural Business** has programs that examine the ways in which human systems and economies interact with water, land, and climatic resources. They also examine the socio-economic impacts from and adaptations to changes in climate and climate variability along with the economic impacts of alternative policy responses to prolonged and severe drought in the Rio Grande Basin, the economic value of water in agriculture, and the economic costs and benefits of instream flow protection for endangered species in an international basin. Water markets are being studied, evaluated, and recommended. This department houses the new Afghanistan Water and Technology Transfer Project.

The **Department of Plant and Environmental Sciences** has programs in dryland and irrigated agriculture, and includes the off-campus science centers. Areas of research include determining the water use-production functions of the primary crops. Flood, sprinkling, and drip irrigation are

available for teaching and research activities. Other research includes climate based irrigation scheduling and movement of water, nutrients, and contaminants through soils. There are programs of geomorphology and paleoclimatology. Turf grasses are studied for application of concentrate disposal from desalination. Land application of other waste waters is also being investigated. This department houses the New Mexico Climate Center.

The **Department of Entomology, Plant Pathology, and Weed Science** works to solve problems in agriculture, meteorology and the environment through the real-time application of satellite remote sensing technology. The department also investigates the fate of pesticides in the environment.

The **Department of Agriculture and Extension Education** provides students a broad base of essential knowledge, skills, and attitudes for functioning effectively in domestic and international, formal and non-formal agricultural and technology education roles. These include water issues. Modules covered may include aquaculture systems, soil and water testing, hydroponics, global positioning systems, robotics, and presentation technologies.

The **Department of Chemical Engineering** is researching membrane distillation for brackish water desalination. This membrane distillation process is being investigated to replace reverse osmosis and thermal distillation for brackish water desalination in New Mexico. Also new adsorbent media and treatment processes are being evaluated or developed for radium, arsenic, perchlorate, iron, and manganese removal from groundwater.

The **Department of Civil Engineering** emphasizes civil, environmental, and agricultural engineering. Programs include wastewater treatment and re-use; arsenic removal; treatment of animal wastes; assessment of solar stills; drainfield performance; constructed wetlands; evaluation of zeolites for filtering; development of well head protection measures; assessment of transboundary aquifers; treatment of oil-field produced waters; energy-efficient, sustainable technologies for desalination; determination of riparian evapotranspiration; determination of lake evaporation; evaluations of well and pump efficiency; erosion and sediment control; surface and groundwater interactions; water use optimization; consumptive use by crops; water resources planning and management; open channel hydraulics; and porous media flow and solute transport modeling.

The **Department of Mechanical Engineering** has research programs relating to water in fluid structure, mechanics, computational dynamics, control, and optimization.

The **Department of Biology** has programs in plant resource use including water use, drought physiology and ecology, mineral nutrition, and photosynthesis as they relate to evolved strategies of resource use. They also research global change biology and extreme events as shaping physiology, ecology, and evolution of plants. In microbiology, the overarching goal is to understand how long microbial pathogens are harbored in environmental reservoirs in between disease outbreaks, and to develop new techniques to detect environmental bioagents. They have developed a new method to simultaneously concentrate bacterial, viral and protozoan pathogens from surface waters and have used this to document prevalent pathogen occurrence in the U.S.-Mexico Rio Grande watershed.



The **Department of Chemistry and Biochemistry** has programs that investigate the chemistry of natural and synthetic phyllosilicates with an emphasis on clays. These clays can be chemically altered to make them have permanent pore sizes of dimensions that make them useful for selective adsorption of water contaminants. The department also has studies of the chemical moieties on the cell walls of plants which are responsible for the selective binding of heavy metal ions from contaminated waters and soils.

The **Department of Geological Sciences** includes research in sedimentation and tectonics, particularly the response of depositional systems and stratigraphy to crustal deformation. It also includes tectonic control on deposition by the ancestral Rio Grande and channel behavior of the historical Rio Grande.

The **Department of Geography** examines the interaction of human activities with the environment. Research also includes geomorphic aspects of landscape ecology, with studies of the spatial edge influences of arroyo channels on ant nesting patterns; remote sensing and geographic information system (GIS) study of semi-arid grassland desertification processes funded by NASA.

The **Department of Health Sciences** has research and education programs relating to waterborne diseases, emergency preparedness, and environmental health. An example is its mosquito-borne disease plan by distributing bilingual promotional material and providing technical assistance. Other diseases such as cholera are found in waters along the U.S.-Mexico border.

The **Department of Economics and International Business** has research and education programs on water research and valuation issues, urban/regional economies, demographics and water demand, and economics and water policy.

The **Department of Government** has research interests in water policy and the environment on the U.S.-Mexico border.

The **Department of Physics** has a research program to study the physics of molecular liquids, particularly water.

NMSU's vision statement reads: "By 2020, New Mexico State University will be a premier university as evidenced by demonstrated and quantifiable excellence in teaching, research, and service relative to its peer institutions." The proposed master and doctoral degrees in water science & management will contribute to NMSU's status as a premier institution. The opportunity for faculty to teach in master and doctoral level programs across departments and colleges should be part of the process for attaining status as a premier institution. Several Carnegie Research Extensive Universities offer master and doctoral programs in water science & management. The presence of master and doctoral students would also allow NMSU faculty to compete more successfully for grants and contracts related to economic development activities.

(3) **Institutional Priority for the Proposed Program:** New Mexico State University has established the goals for scholarly activity: to promote interdisciplinary research, education, and outreach; to promote research and education that is responsible and addresses regional, national,

and global challenges; to promote community involvement and advance outreach; to translate research into economic development for the state and region, to develop tomorrow's visionaries, policy makers, educators, researchers, and leaders; and to create strategic partnerships with government agencies and other educational institutions. In pursuing these goals, NMSU in conjunction with its academic departments has adopted interdisciplinary research clusters to enhance the value of research to the state and nation, while drawing on existing campus-wide strengths and expertise. The five clusters include one called Natural Resource Sustainability and Renewal, which has three subclusters, namely energy, land, and water. This proposal represents the mission and one of the goals of the water subcluster, which is also known as the Water Science and Education Center, as described above.

**(4) Curriculum for the Proposed Program:** Presently, New Mexico State University offers 85 graduate courses in water science & management (Appendix A). It is anticipated that no new courses are needed for implementation of this program.

1. Core Courses

- a. Master's Degree – This degree is designed primarily for students who wish to complement their primary discipline by obtaining scientific, technical, and managerial expertise in water.

i. AG E 475 Water Resource Management and Policy	3
ii. RGSC 518 Watershed Methods and Management or WLSC 465 Advanced Management of Aquatic Systems	3
iii. E ST 505 Statistical Inference I	4
iv. Seminar	1
v. Electives from designated water list	10
vi. Free electives	5
vii. Thesis	6

The Master's degree can be earned with 26 credits of formal course work, plus additional thesis research credits.

- b. Doctoral Degree – This degree is designed to give students a thorough and comprehensive knowledge of water science and hydrology and training in methods of research.

i. AEEC 575 Advanced Water Resource Management and Policy	3
ii. RGSC 518 Watershed Methods and Management or WLSC Advanced Management of Aquatic Systems	3
iii. CE 557 Water Resources Development	3
iv. TOX 523 Environmental Toxicology	3
v. GEOG 481 Fundamentals of Geographic Information Systems or GEOG 521 GIS Applications	3
vi. E ST 505 Statistical Inference I or CE 582 Statistical Hydrology	3-4

- vii. Seminar (Two different departments)
- viii. Electives from designated water list
- ix. Free electives
- x. Dissertation

2

The Ph.D. degree can be earned in about 30-40 credits of formal course work beyond the masters, plus additional dissertation research credits, for a minimum total of 75 credits beyond the B.S. degree.

## 2. Fields of Study

- a. Surface Water Hydrology & Modeling
- b. Ground Water Hydrology & Modeling
- c. Watersheds, and Aquatic and Riparian Wetlands
- d. Water Quality and Treatment
- e. Water Economics, Law, and Policy
- f. Water Infomatics

## 3. Application Deadlines

Students may apply for admission and assistantships at any time with beginning dates being the start of any semester and summer.

## 4. Admission Requirements

General requirements for a graduate degree are set forth in the NMSU Catalog plus:

- Possession of a bachelor's degree for admission to the master's degree program and possession of a master's degree from an accredited university in water or a water related field for admission to the Ph.D. program. Students enrolling for graduate work must have received a bachelor's or masters degree in water resources or one of the allied sciences.
- A bachelor's or master's grade point average of 3.5 or higher on a 4.0 scale. However, students with grade point averages between 3.0 and 3.5 will be given consideration.
- Evidence of professional ability and the potential for professional development. A primary example of professional ability and potential for professional growth will be recommendations from the candidate's current employer. Other evidence might include a master's thesis, a published or non-published professional paper, consulting reports or other creative work.
- A letter of intent that addresses individual professional and personal goals with career interests will be required.
- A brief two-to-three page resume that summarizes the candidate's background.
- Three letters of recommendation directly from persons who know the applicant professionally, including a recommendation from the candidate's employer /sponsor.

Exceptions to any program admission criteria will be considered on an individual basis and are at the discretion of the graduate committee with recommendations to the academic department heads.

**B. Justification for the Program. The proposed program must meet one or more specified needs within the state or region; must not duplicate existing programs unnecessarily or inappropriately; and, to the extent feasible and appropriate, should benefit from cooperative arrangements with other institutions.**

(1) **Need.** The proposed program must meet one or more specified needs within the state or region. Clear and convincing evidence must be provided of the reality and extent of such need.

The need for the proposed master and doctoral of water science & management stems directly from New Mexico's need for more comprehensive and sustained management of its water supplies and water quality.

New Mexico is one of the driest states in the United States, 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 with most of the state receiving closer to 6.5 inches than 30 inches. Widely varied seasonal precipitation contributes as much to a water allocation challenge as water scarcity itself. To compound the situation, New Mexico, like much of the West, continues to suffer from the worst drought in 50 years or longer, and climate change could be a growing issue in the future.

Reservoir levels are rarely full, and it is estimated that above-average precipitation is needed to bring them to full capacity in the next 20 years. Water conservation measures continue to expand in municipalities throughout New Mexico to help ensure adequate 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 due to the drought, continues to monitor the situation. At the other extreme, flooding is a problem in several parts of New Mexico, like Sierra and Dona Ana counties. Although blame is assigned to unusual precipitation events, more physical structures and better land management could help prevent and control the damaging effects.

Toxic elements from natural sources and human activities continue to plague New Mexico's surface and ground waters. Water-borne diseases continue to be a concern.

Success in the water science & management area would allow New Mexico to reduce its public expenditures in such areas as human health care, destroyed housing from flooding, reduced income from low crop yields during droughts, and high costs of water treatment because of high levels of toxicants such as arsenic, salts, fluoride, and uranium. The proposed program would allow New Mexico to capitalize on a new export industry - highly trained water resources professionals who could work in other states and countries. And, unlike many other potential exports, out-of-state students would pay the full cost of their own production process through out-of-state tuition payments.

A needs survey was sent to 624 water employees of government and non-government organizations (excluding academic institutions) in December 2008. About 10% or 59 surveys were returned (Appendix J). Dr. James Peach, a demographer in the College of Business, said this is an adequate sample size to meet survey objectives. The survey suggests that graduates of the proposed program would find numerous employment opportunities. The survey responses indicate that potential demand for the program is strong. Some highlights of the survey response indicate that:

- 79% of respondents agreed or strongly agreed that the proposed program fulfills a need not being met by other graduate programs. Only 2% disagreed.
- 86% of respondents agreed or strongly agreed that they would advise a student to enroll in these graduate programs
- 40 of the 59 respondents agreed or strongly agreed that they would personally or know someone who would likely enroll in these graduate programs
- 68% of the respondents agreed or strongly agreed that they would be interested hiring graduates from these graduate programs
- 71% of respondents agreed or strongly agreed to serve on a Board of Advisors for these graduate programs
- 11 of the respondents agreed or strongly agreed to support these programs by financing professorships, graduate assistantships, or special programs. 61% were neutral or had no opinion.
- 73% of respondents agreed or strongly agreed to offer internships to students in these programs
- 70% of respondents agreed or strongly agreed that the proposed graduate programs are sufficient for development of professional working at the local level
- 72% of respondents agreed or strongly agreed that the proposed graduate programs are sufficient for development of professional working at the state or regional levels
- 59% of respondents agreed or strongly agreed that the proposed graduate programs are sufficient for development of professional working at the international level

Employment of graduates of master and doctoral programs in water science & management are numerous and broad. With an expanding human population and depleted non-replenishing water supplies, greater demands for water will occur. Many employees in these fields will retire

in the next two decades. Replacements are viewed as a critical need with fewer graduates being available than the supply. New Mexico's water problems and challenges are unique so that the State of New Mexico will greatly benefit from educating its own water resources scientists, engineers, and managers, rather than relying on out-of-state and out-of-country workers who lack sensitivity to New Mexico's special culture and needs. Graduates will be qualified to be water resources researchers and managers for federal agencies including the U.S. Geological Survey, Bureau of Reclamation, Army Corps of Engineers, Environmental Protection Agency, International Boundary and Water Commission, Fish and Wildlife Service, Forest Service, Bureau of Land Management, Natural Resources Conservation Service, the Bureau of Indian Affairs, and the Department of Energy including the national laboratories. Graduates will be qualified to be water resources researchers and managers for regional organizations such as the Rio Grande Compact Commission, the New Mexico-Texas Water Commission, and the Paso del Norte Water Task Force.

In state government, graduates will be qualified to be water resources researchers and managers in the Office of the State Engineer; the Environment Department; the Divisions of Forestry, State Parks, and Game and Fish in the Department of Energy, Minerals, and Natural Resources; the Department of Agriculture; the State Land Office; and the Bureau of Geology and Mineral Resources. Graduates will be qualified to be water resources researchers and managers for municipalities and academic institutions. Graduates will be qualified to be water resources researchers and managers for non-government organizations including irrigation districts, consulting firms, mining companies, energy companies, environmental groups, and professional organizations. And, these graduates will be qualified to assist in international water development programs and conflicts sponsored by the U.S. Government, foreign governments, and the United Nations. Finally, these graduates will be in high demand by the private sector including water system suppliers, water utilities, and consulting firms.

The proposed master's and doctoral programs will also place New Mexico and New Mexico State University in the center of water resources development. That is, New Mexico will become even more widely-recognized the place to go for the study and analysis of water resources programs, problem solutions, and issues. D.P. Loucks of Cornell University recently addressed educating future water resources managers in the *Journal of Contemporary Water Research & Education* (June 2008). He stated, "Many universities need to take a look at their curricula more often than they do. It seems much easier to change course contents than the overall plan. Most educators support exposing student to interdisciplinary projects at both graduate and undergraduate levels, so that students learn to participate productively in such projects and recognize the approaches and issues of fields other than their own. Engineers, economists, and ecologists especially need to appreciate each other's approaches to problem solving."

With a reputation as a leader in water science & management programs, New Mexico will also become a highly attractive place for firms and organizations currently residing in other states and nations.

## (2) Duplication

**The proposed program must not duplicate existing programs unnecessarily or inappropriately. A proposal for a program similar to one (or more) that already exist within the state must present clear and convincing evidence that need for the program cannot be met by the existing program(s).**

The proposed master and doctor of water science & management degree program at NMSU would be unique. Such a program is not offered at any other institution in New Mexico.

A master of water resources administration degree program is offered at the University of New Mexico. While the UNM program has been quite successful in achieving its mission, it is a master's level professional degree not designed to prepare students for a Ph.D. degree or a career in teaching, research and outreach. It is a terminal degree that prepares students for careers in water resources administration ([http://www.unm.edu/~wrp/WRP\\_welcome.html](http://www.unm.edu/~wrp/WRP_welcome.html)). A professional degree is a type of academic practitioner's degree designed to prepare the holder for a particular profession by emphasizing practical skills over theory and analysis. These professions are typically licensed or otherwise regulated by a governmental or government-approved body. Areas such as architecture, dentistry, podiatry, audiology, physical therapy, social work, among others, generally require such professional degrees for licensing. This proposed program at NMSU would complement and not compete with the program at UNM. This complementarity would occur because the two programs offer different kinds of degrees. The Master of Science and Doctor of Philosophy degrees require achievement in both scholarship and original research. The degrees are granted chiefly in recognition of the candidate's high attainments and ability in the special field, as shown by work on the required examinations covering both the general and the special fields, and by the preparation of a thesis or dissertation. These degrees expand on research for science, knowledge, and policy not normally linked to or competing with a professional degree.

The New Mexico Institute of Mining and Technology in Socorro offers Master degrees in geochemistry, geology, geophysics, and hydrology. It also offers a Doctor of Philosophy degree in Earth and Environmental Science with a dissertation in geochemistry, geology, geophysics, or hydrology. This university has eight full-time faculty members and offers 16 different courses in hydrology. Some of these courses are similar to some of the 85 graduate courses taught at NMSU. Their courses are strongly deal with subsurface hydrology and atmospheric sciences while courses at NMSU strongly deal with the surface in the hydrology subset of water resources sciences. The water programs of New Mexico Tech and NMSU are viewed as complimentary.

New Mexico Highlands University has a Master of Science in Life Sciences with a concentration in natural resource management. Eastern New Mexico University has a Master of Science in biology with an emphasis in applied ecology. Western New Mexico University has no graduate programs related to water resources. These programs are not viewed as remotely duplicating the water resources program at NMSU.

The potential also exists for this proposed water science & management graduate degree program to expand and include the other state universities in New Mexico, similar to what has been instituted in Arizona.

### **(3) Inter-Institutional Collaboration and Cooperation.**

Presently, New Mexico State University houses the Water Resources Research Institute, but its statutory authority from the New Mexico Legislature states that it will serve all six state universities in New Mexico. It has a history of collaboration that goes back to 1964. The University of New Mexico houses the Utton Transboundary Resources Center in the University of New Mexico School of Law. It supports collaborative natural resource management using multidisciplinary expertise and inclusive, diverse stakeholder involvement. The Utton Center collaborates with other disciplines, such as economics, hydrology, biology, and social science in all state universities. New Mexico Tech houses the Bureau of Geology and Mineral Resources. It distributes information to scientists, decision makers, and the New Mexico public regarding the state's geologic infrastructure, mineral and energy resources, and geohydrology (including water quantity and quality).

The potential exists for this proposed water science & management graduate degree program to expand and include the other state universities in New Mexico, similar to what has been instituted in Arizona between the University of Arizona, Arizona State University, and Northern Arizona University.

The proposed program would allow graduate students enrolled at other universities in New Mexico, the U.S., or foreign countries to take selected distant education courses from this program if it would benefit their program of work at another institution. Since part of the admission process to the proposed program typically involves a bachelor's or master's degree in a related field as a requirement, NMSU anticipates working closely with other New Mexico institutions of higher learning to facilitate that process. It may be appropriate for students in the proposed program to take some courses at another university, but that process must involve approval of courses and transfer credits on an individual basis.

The proposed graduate degree programs may be delivered using WebCT, Centra, ITV (Interactive Television), and other learning technologies to serve students who may not be able to pursue an education through traditional means. Also being considered are site-based programs, which are taught face-to-face at locations throughout New Mexico.

**C. Clientele and Projected Enrollment. The proposal must clearly describe the population of students who will be recruited into the proposed program and must include a detailed projection of enrollment and credit hours anticipated during the first five years.**

#### **(1) Clientele**

Programs similar to the proposed degree program have recently been established at several universities including Texas A&M University, University of California-Davis, University of Florida, University of Minnesota, and Oregon State University. Texas A&M University's program was started in 2005 and has 15 masters and 11 doctoral students. Students come from Texas, India, China, Mexico, Mauritius, Nepal, South Africa, and Egypt. Interestingly, no students are enrolled from neighboring or other U.S. states. Their program generated 1,042 student credit hours in the first 3 years. It is anticipated that the program at NMSU will be as or



more successful than the program at Texas A&M since much of the western U.S. and world has an arid or semi-arid climate which is similar to New Mexico. Therefore, much of the world has water problems which are similar to New Mexico's. For that reason, many students will desire education that are similar and applicable to their home areas.

Demands for the program, in keeping with current university policy, would ensure course availability and guard against cancellation of courses due to low enrollment. We anticipate that our student diversity will parallel that found within NMSU and our current undergraduate and master's programs. Each year, NMSU's enrollment is about 40 percent Hispanic, 4 percent international, and just under 3 percent for both American Indians and Blacks. (NMSU, Office of Institutional Research, Final Enrollment Counts). These statistics are considerably more diverse than the national average in the water science & management profession.

Efforts will be made to attract applicants from ethnically diverse backgrounds. Specific efforts will be made throughout New Mexico through community agencies and professional associations. Additional targeted efforts will be made through the tribes and pueblos, the Southwestern Indian Polytechnic Institute (SIPI), and other organizations to attract Native American students. Given the water science & management needs of Native Americans within the state, we anticipate a strong demand for the proposed degree programs from Native Americans. At NMSU, we aspire to having enrollments to be in parity with the diversity of the state.

## (2) Projected Enrollment

Table 1 contains the projected enrollment of students. Table 2 contains the projected credit hours generated and formula funding generation. The program as proposed can be completed in three academic years.

<b>Table 1. Projected Student Enrollment</b>					
<b>Enrollment Year</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
New Students, Master's	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>
Returning Students, Master's	<b>0</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>
Total Head Count, Master's	<b>10</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>
New Students, Ph.D	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>
Returning Students, Ph.D	<b>0</b>	<b>5</b>	<b>10</b>	<b>10</b>	<b>10</b>
Total Head Count, Ph.D	<b>5</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>15</b>
Graduates	<b>0</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>5</b>

<b>Table 2. Approximate Credit Hour Generation</b>					
<b>Enrollment Year</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Total Headcount, Master	<b>10</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>
Student Credit Hours Generated *	<b>180</b>	<b>360</b>	<b>360</b>	<b>360</b>	<b>360</b>
Formula Funding**	<b>\$130,734</b>	<b>\$261,468</b>	<b>\$261,468</b>	<b>\$261,468</b>	<b>\$261,468</b>
Total Headcount, Ph.D	<b>5</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>15</b>
Student Credit Hours Generated*	<b>90</b>	<b>180</b>	<b>270</b>	<b>270</b>	<b>270</b>
Formula Funding	<b>\$65,367</b>	<b>\$130,734</b>	<b>\$196,101</b>	<b>\$196,101</b>	<b>\$196,101</b>
<b>Total Funding</b>	<b>\$196,101</b>	<b>\$392,202</b>	<b>\$475,569</b>	<b>\$475,569</b>	<b>\$475,569</b>
*Student Credit Hours (SCH) generated assumes 9 credit hours per semester for a total of 18 SCH per academic year					
*The formula funding is based on Tier 2 (\$726.30 per SCH).					

**D. Institutional Readiness for the Program.** The institution should have nearly all of the resources needed to initiate the program. The proposal should include a clear statement of the extent to which the institution is ready to initiate the program, citing the remaining needs and recognized each of those needs in the cost analysis developed pursuant to Section 9.1.5.

**(1) Teaching Faculty**

All faculty members that are needed to teach in the program are in place. It should be noted that the College of Agriculture and Home Economics and the College of Engineering already have endowed chairs in water science & management, and the proposed program should enhance the willingness of other donors to contribute funds for additional endowed chairs. Further, the Cooperative Extension Service has a Water Task Force for outreach, and the College of Education has Project WET (Water Education for Teachers), an international, interdisciplinary, water science and education program for formal and non-formal educators of K-12 student. They facilitate and promote awareness, appreciation, knowledge, and stewardship of water resources through the development and dissemination of classroom ready teaching aids

based on the Project WET Curriculum and Activity Guide, a collection of over 90 innovative, interdisciplinary activities that are hands-on, easy to use and fun.

Typically, graduate assistants are employed within each department for support of teaching and research activities. The Water Science and Education Center with participating academic departments will work with the NMSU Graduate School to increase graduate assistant positions in each department to support those students who are not privately employed or are beginning a new phase of their careers. Further, as externally funded research increases, there should be increased research assistant positions available within the departments. As a result, we anticipate that many new graduate assistantships will be needed. Funding for these will be sought from external funding sources, including the National Science Foundation's Integrated Graduate Education and Research Traineeship (IGERT) program, the New Mexico Department of Higher Education, the New Mexico State Legislature, and private sources.

Appendix E contains the qualifications of the current NMSU faculty members in Water Science and Education Center. The identified faculty members are expected to have significant contact with doctoral students and many have been involved in the development of this proposed program. These faculty, however, have additional teaching, research, and extension responsibilities within their departments are not available for full-time assignment in this program. The vitae of nine faculty members on the steering committee of the Water Science and Education Center (One from each college) are found in Appendix F. These nine individuals will be most directly involved in teaching and administering the proposed degree. Also included are the vitae of the faculty members representing the Department of Agricultural Economics and Business, the Department of Animal and Range Sciences, and the Department of Geography.

The proposed doctoral program will not take resources away from the current baccalaureate, masters, or doctoral programs of any department or college. To implement these proposed graduate programs, additional resources will not be needed for teaching. However, additional resources will be needed for administration of the program and funding graduate student assistantships.

## **(2) Library and Other Academic Support Services**

Current academic support resources are sufficient to initiate the program. A formal assessment of library resources was undertaken by the NMSU Library to determine long-run library resource needs. The program will offer \$27,939 per year to the library for continuation or upgrading of materials needed to support the program.

## **(3) Physical Facilities**

**The Soil, Water, and Agricultural Testing Laboratory (SWAT)** is a group of self-supporting labs at New Mexico State University. It offers chemical testing for water, plants, and soils. SWAT, accredited by the American Association of Laboratory Accreditation (A2LA), is certified by the Drinking Water Bureau of the State of New Mexico Environment Department to

test drinking water. SWAT in addition has a basic microbiological testing service for drinking and waste water testing.

New Mexico State University includes the **Office of State Climatologist**. This office assists the state in understanding and responding to natural and man-induced climate processes and their implications, and cooperates with the federal government in activities relating to climate studies and advisory services. It also promotes and disseminates a general knowledge of the climatology of the state, establishes a state climate program in accordance with the provisions of the federal National Climate Program Act and regulations promulgated pursuant to that act and to receive and utilize grants made available to the state pursuant to the provisions of the federal National Climate Program Act and other grants, gifts, donations or bequests from any source to be used in carrying out its purpose.

The **Spatial Applications and Research Center (SpARC)** provides a variety of services including planning and research, GIS, image processing, modeling and training. Specific software capabilities include the entire suite of ESRI ArcGIS products, including ArcGIS Server, Erdas Imagine, Definiens Professional, and a range of GPS support products. The lab also supports a robust server with expansion capabilities and nightly off site back facilities. The lab was established in 1982 as a contract applied research laboratory for the NMSU Geography Department. The original purpose of the lab was to undertake externally funded projects under the direction of geography faculty and employ students within the department. Twenty-six years and over \$3,000,000 in projects later, the lab continues to do project related work. It has employed more than 100 students, and provided assistance to more than 20 faculty members inside and outside the Geography Department.

Three wet labs are devoted to water-related research in the **Department of Fisheries, Wildlife & Conservation Ecology** and one laboratory for aquatics-related teaching. Facilities are available for long-term retention of fish of various species, for phytoplankton studies, and studies on aquatic invertebrates. There is also a small environmental chamber in which climate-controlled studies can be conducted. In addition, a number of ponds, playas, and ranch ponds are available for studies on university-owned lands.

As part of the Department of Fisheries, Wildlife & Conservation Ecology is the **U.S. Geological Survey Cooperative Fish and Wildlife Research Unit**. Their staff members serve as adjunct faculty and are on the NMSU graduate faculty. They operate on campus the A-Mountain Geothermal Fish Culture and Research Facility. Geothermal greenhouses were built at the facility in 1994 by the Southwest Technology Institute, College of Engineering, to capitalize on a renewable resource (heated geothermal aquifer). Geothermal water proved effective in maintaining year-round temperatures for research and extension related studies of plants and fish at New Mexico State University.

In 1999, the Geothermal Aquaculture Production Facility was closed by the Engineering College due to lack of funding. In 2000, the facility was re-opened by Dr. Colleen Caldwell in partnership with New Mexico State University and the U.S. Fish and Wildlife Service to conduct research, provide educational and experiential hands-on opportunities to NMSU's students and assist federal and state agencies with the conservation of the region's threatened native fish species. The facility was renamed the A-Mountain Geothermal Fish Culture and Research

Facility. The facility is 3,000 sq. ft. and operates using water recirculation with treatment of wastewater through a series of filtration systems.

Since 2000, the facility has reared and maintained the federally-endangered Rio Grande silvery minnow. In 2008, the facility will begin rearing for research a new federally endangered species of fish- the Bonytail Chub.

The **Watershed Management Laboratory** is housed in Knox Hall and operated by the Department of Animal and Range Sciences. The lab houses equipment to process and analyze water, soil, and plant samples including: drying ovens for plants and soils; soil crushing, sieving, and sorting equipment; water sample filtration pumps and glassware; centrifuge, water bath, sample and reagent bottles; and other supplies for lab operation. The lab also serves as the hub for watershed management field equipment. Grassland and forest vegetation measurement and sampling equipment; soil and soil bulk density samplers; and water samplers including pumps and balers for surface water and groundwater sampling. Electronic sensors deployed to field sites include automated climate, soil moisture, water flow, and water quality sensors.

The Animal and Range Sciences Department also operates the **Environmental Assessment and Research Laboratory**, which has NSF-funded laboratory equipment for soil and water analysis including: 1) flow through injection analysis and ion chromatograph for automated water quality analysis, 2) carbon nitrogen analyzer for plant and soil samples, 3) laser diffraction particle size analyzer for analysis of soil particle size distribution and texture, and 4) x-ray fluorescence metal analyzer.

Located near Las Cruces and operated by NMSU is the **Chihuahuan Desert Rangeland Research Center**. It includes instrumented riparian hydrology study site with 40 acres of lowland riverside bosque instrumented with wells, piezometers, and recording climate and water level sensors.

The **Corona Range and Livestock Research Center** in central New Mexico is operated by NMSU, and its newly funded research center is slated to include state of the art computerized rangeland monitoring hub with real time links to on the ground water, soil, and climate sensors distributed about the 18,000-acre ranch.

Other remote NMSU water facilities include instrumented water research field sites at the **Alcalde Sustainable Agriculture Research Center** where surface water - groundwater interaction and water balance of irrigated river corridor and rangeland uplands is being studied, field studies on the **Santa Fe Ranch** where pinyon pine and juniper woodland runoff generation and sediment transport is being monitored, field studies near **Cloudcroft** where mixed conifer forest hillslope and watershed hydrology is being studied, and near **Mora** where ponderosa and mixed conifer forest is being evaluated for runoff, sediment transport, and forest floor water balance.

The New Mexico State University College of Engineering recently received a gift of \$1.5 million to establish the Freeport-McMoRan Copper & Gold **Water Quality Laboratory**. The establishment of this new water quality lab represents new, cutting-edge research capability that does not currently exist within the state or the region. The lab will also be an important addition

to the campus wide natural resources research cluster initiative, which supports the development and implementation of strategies that build sustainable water, energy and land resources. The gift will be used for the development of a full-service analytical laboratory at NMSU. The facility will be equipped to identify the chemical and colloidal characteristics of a water/particle system. The college currently houses three small and aging analytical laboratories that are no longer sufficient to support research activities. An estimated \$1 million of the request will be used to acquire analytical equipment to support the laboratory. The remaining \$500,000 will be placed in an endowment with the NMSU Foundation with annual earnings used to support and maintain the laboratory.

#### **(4) Equipment & Technology Resources**

NMSU technology resources, including the electronic communication system, serve as a learning resource to enhance communication with advisors, faculty members, fellow students, and professional colleagues around the globe. Software typically used by doctoral students and many master's degree students includes word processing, spreadsheets, and SAS. Site licenses for SAS are maintained by NMSU. Sufficient quantitative statistical software programs are available through the university server as well as on individual faculty, staff, and graduate student computers and will be available for master and doctoral student learning needs on-campus.

**(5) Other Operating Resources:** All are adequate

**(6) Existing External Facilities:** None will be used

### **E. Projected Costs of the Program. The program must include a clear analysis of the project cost of the proposed program and the sources of funding that will support it.**

#### **(1) New Costs for Program Start-Up**

**(a) Faculty**

One additional faculty position is being requested.

**(b) Library Resources**

Additional library resources are being requested for \$27,000 each year.

**(c) Additional Facilities, Equipment, and Technology Resources**

No additional facilities, equipment, and technology resources are being requested.

**(d) New Graduate Assistantships needed to support the program**

We anticipate that 10 to 20 new graduate assistantships will be needed. Funding for these will be sought from NMSU's Central Administration (See budget detail below), external funding sources, including the National Science Foundation's Integrated Graduate Education and Research Traineeship (IGERT) program, the

New Mexico Department of Higher Education, the New Mexico State Legislature, and private sources. These will be coordinated through the NMSU Graduate School. The total cost of these assistantships is expected to be approximately \$300,000 per year.

(e) **Professional and Administrative Personnel**

One part-time program director and a half-time administrative assistant are being requested from NMSU. The anticipated cost of each is \$30,000 or total of \$60,000.

Budget Detail		
Item/Expense	Amount	Comment
Half-time Administrative Assistant	\$30,000	We request this line from NMSU's Central Administration
Part-time Program Director	\$30,000	This would be an existing NMSU faculty member, and we request support for this from NMSU's Central Administration
Graduate Student Assistantships (10-20/year)	\$300,000	We initially request this from NMSU's Central Administration, but we are also looking to a range of outside sources for these funds <sup>1</sup>
Library	\$27,000	Enhanced support
Faculty Position	\$100,000	NMSU has no teaching faculty in atmospheric sciences

<sup>1</sup>External sources being pursued include the National Science Foundation's Integrated Graduate Education and Research Traineeship (IGERT) program, the New Mexico Department of Higher Education, the New Mexico State Legislature, and private sources.

(2) **State Support**

The approximate amount of state operational formula funding that will flow to the program for each of the first 5 years, based on the projected student credit hours generated and current formula funding factors is provided in Table 2. At current formula funding levels, approximately \$261,468 will be generated annually starting in Year 1 while rising to \$784,404 in Year 3. Costs for the program at Year 3 include graduate assistantships (\$300,000) to be funded by state and other sources.

(3) **Other Support**

All attempts will be made to expose students to a wide variety of water science & management programs, courses, and methods currently being offered at NMSU.

**F. Quality of the Program. The proposed program must be designed to meet high standards of academic quality, considering its instructional curriculum, faculty, student admission standards, and provisions for continual review and improvements of the program.**

It is critical that water science & management professionals within New Mexico, within the United States, and internationally recognize the added value of additional discipline-specific and general education for their water specialists and recognize that the leader in advanced training for the practitioner and water science & management agency is NMSU.

There are some special considerations that can eventually be built into the proposed plan of study. The use of face-to-face courses conducted in off-campus and in nontraditional settings and formats could be highly attractive to currently employed program candidates. Some courses could use weekend, extended class meetings in Albuquerque or other locations to help the working student complete his/her degree. It is anticipated that some classes will be offered online and web-based instructional methods will supplement the face-to-face interaction to fill gaps caused by meeting times and places less regular than the typical college course.

A diverse multicultural, multiethnic, and international master and doctoral student population is anticipated. An outstanding educational environment at NMSU will facilitate master and doctoral student success. The Hispanic Outlook in Higher Education ranked NMSU as one of the nation's top colleges and universities for Hispanic students in May 2003 with an overall rank of 17th for the number of baccalaureate degrees awarded to Hispanic students, 49th for number of master's degrees awarded to Hispanic students, and 315th for the number of doctoral degrees awarded to Hispanic students. This report shows that NMSU does very well at the bachelor degree level, but needs improvement at the graduate levels. This doctoral program will enhance rather than diminish those rankings. All departments involved have successfully educated significant numbers of minority students.

Another student success strategy, faculty and peer support, will be facilitated within all phases of the master and doctoral programs through the use of traditional methods (office visits, faculty 1: 1 mentoring with students) and technology supported methods (chat rooms, email list



serves, email/video discussion groups). Evaluation of student success and satisfaction will be ongoing with adjustments implemented as appropriate.

**G. Assessment of Operations and Impact. The proposal must include a plan by which the proposed program will be assessed for its operation and impact over at least a five-year period.**

Evaluation will address specified measurable outcomes for each of the major objectives of the program (outcome evaluation) and the tasks to be accomplished (process evaluation). The planned evaluation is designed to complement existing NMSU Outcomes Assessment and Process Evaluation Plans. The model uses both quantitative (i.e., course and faculty evaluations) and qualitative (i.e. exit interviews) data collection methods. Program outcomes will be provided to the NMSU Provost annually and to the NMSU Regents and the New Mexico Department on Higher Education as requested.

An advisory board consisting of outside experts, water resources professionals, and academics from other universities will be established. The Advisory board will meet at least annually to provide input regarding the quality and practical content of the proposed program. A number of individuals have already volunteered to serve on the advisory board.

**H. Administrative Responsibility for the Program and Institutional Commitment. There must be clear indication in the proposal that the institution is committed to the success of the proposed program.**

The proposed graduate program will be jointly administered by one faculty member from each of the Departments of Agricultural Economics and Business; Animal and Range Sciences; and Geography, plus the Chair of the Steering Committee of the Water Science and Education Center (WSEC) who is also the Director of the Water Resources Research Institute (WRI). The chairpersonship of the program management committee will rotate across the four members involved on an annual basis. In addition, the existing Steering Committee from the WSEC will comprise an advisory committee to provide technical and policy input to the program management committee.

The program organization chart will be as follows:

Academic Structure

Department of Agricultural Economics  
and Business  
Department of Animal and Range  
Sciences  
Department of Geography  
Chair of the Water Science and  
Education Center

Research Structure

Administrative Advisory Council  
(faculty members from each college  
on the steering committee of the Water  
Science and Education Center)

The Graduate School will continue to provide quality services to students, faculty, and staff. Its personnel will help process applications and oversee the admissions process. They will also process transfer of credit requests, maintain the schedule of oral examinations, provide editorial assistance for candidates preparing theses and dissertations, manage graduate assistantships, employment, certify degree completion, and provide scholarships and grants.

The Department of Agricultural Economics and Business, the Department of Animal and Range Sciences, the Department of Geography, and the Administrative Advisory Council of the Water Science and Education Center (Water Subcluster) will assist the Graduate School in its responsibilities by monitoring course needs, assigning the Center's assistantships, evaluating admission applications, and assuring high quality of the graduate programs.

Statements of administrative support can be found in Appendix C.

<b>Table 3. Internal Approvals Received</b>			
<b>Approving Body</b>	<b>Date Presented</b>	<b>Date Approved</b>	<b>Comments</b>
Water Science & Education Center Steering Committee	10/1/08	10/14/08	
Department of Agricultural Economics and Business	5/1/09	5/14/09	
Department of Animal and Range Sciences	5/1/09	5/14/09	
Dean of Agricultural, Consumer, and Environmental Sciences	5/1/09	5/18/09	
Department of Geography	5/1/09	5/14/09	
Dean of Arts and Sciences	5/1/09	5/20/09	
Vice President for Research, Graduate Studies and International Programs	5/21/09		
NMSU Associate Dean's Academic Council	5/21/09		
NMSU Graduate Dean			
NMSU Faculty Senate			
NMSU Registrar			

NMSU Executive Vice President and Provost			
NMSU Administrative Council			
NMSU President			
NMSU Board of Regents			
New Mexico Council of Graduate Deans			
New Mexico Higher Education Department			
New Mexico State Board of Finance			

## Appendix A

### Graduate Courses Relating to Water Science & Management

<b>Surface Water Hydrology &amp; Modeling</b>		<b>Credits</b>
AGRO 620	Instrumentation in Agronomy	3
GEOG 453	Fluvial and Environmental Geomorphology	3
GEOG 467	Transportation Geography	3
GEOG 552	Landscape Ecology	3
GEOG 553	Applied Geomorphology	3
GPHY 640	Fluid Mechanics in the Earth Sciences	3
A EN 459	Design of Water Wells/Pumping Systems	3
A EN 475	Soil and Water Conservation	3
A EN 476	Conservation Engineering	1
A EN 478	Irrigation and Drainage Engineering	3
A EN 479	Irrigation Systems Design and Management	3
C E 482	Hydraulic Structures	3
C E 483	Surface Water Hydrology	3
C E 485	Design of Earth Dams	3
C E 525	Advanced Analysis of Engineering Systems	3
C E 557	Water Resources Development	3
C E 582	Statistical Hydrology	3
C E 681	Topics in Hydrodynamics I	3
C E 682	Topics in Hydrodynamics II	3
C E 525	Advanced Analysis of Engineering Systems	3
C E 531	Open Channel Hydraulics	3
G EN 485	Earthen Dam Design	3
ME 530	Intermediate Fluid Mechanics	3
ME 533	Computational and Theoretical Fluid Mechanics	3
ME 633	Turbulence and Chaos	3
<b>Groundwater Hydrology &amp; Modeling</b>		
SOIL 456	Irrigation and Drainage	3
SOIL 477	Soil Physics	3
SOIL 477L	Soil Physics Laboratory	1
SOIL 479	Environmental Soil Chemistry	3
SOIL 551	Advanced Soil Chemistry	3
SOIL 552	Advanced Soil Physics	3
GEOL 474	Groundwater Geology	3
GEOL 515	Advanced Principles of Geochemical Equilibria	3
GEOL 560	Geochemistry of Diagenetic and Hydrochemical Systems	3
C E 581	Ground Water Hydrology	3
C E 506	Advanced Soil Mechanics	3

G EN 451	Subsurface Methods	3
G EN 452	Geohydrology	3
G EN 460	Site Investigations	2

### **Watersheds, and Aquatic and Riparian Wetlands**

RGSC 518	Watershed Methods and Management	3
WLSC 458	Ecology of Inland Waters	3
WLSC 458L	Ecology of Inland Waters Laboratory	1
WLSC 465	Advanced Management of Aquatic Systems	3
WLSC 482	Ichthyology	3
WLSC 532	Environmental Biology of Fishes	4
WLSC 565	Advanced Management of Aquatic Systems	4
WLSC 578	Advanced Limnology	3
BIOL 517	Seminar in Physiological Ecology	3
BIOL 533	Environmental Physiology of Plants	3

### **Water Quality & Treatment**

EPWS 520	Environmental Fate of Pesticides	3
WLSC 534	Aquatic Contaminants and Toxicology	4
CHEM 472	Analytical Methods for Toxic Organics and Metal Ions in the Environment	3
TOX 523	Environmental Toxicology	3
ENVE 456	Environmental Engineering Design	3
ENVE 462	Sampling and Analysis of Environmental Contaminants	3
ENVE 551	Unit Process/Operation of Water Treatment	3
ENVE 551L	Unit Process/Operation of Water Treatment Laboratory	1
ENVE 552	Unit Process/Operation of Wastewater Treatment Laboratory	3
ENVE 552L	Unit Process/Operation of Wastewater Treatment Laboratory	1
ENVE 553	Chemical Theories of Environmental Engineering	3
ENVE 554	Microbiological Theories of Environmental Engineering	3
ENVE 557	Water Quality Modeling	3
ENVE 558	Advanced Waste Management	3
ENVE 630	Fate and Transport of Environmental Contaminants	3
ENVE 631	Topics in Environmental Engineering I	3
ENVE 632	Topics in Environmental Engineering II	3
CH E 532	Chemical Engineering Applications to Environmental Cleanup	3
CH E 535	Industrial Waste Treatment and Environmentally Benign Manufacturing	3
CH E 536	Environmental Process Design I	3
CH E 537	Environmental Process Design II	3
CH E 624	Advanced Topics in Reservoir Modeling	3
MPH 554	Environmental Epidemiology	3
BIOL 477	Applied and Environmental Microbiology	4

**Water Economics, Law, & Policy**

AEEC 575	Advanced Water Resource Management and Policy	3
AEEC 580	Natural Resources and Environmental Policy	3
AG E 475	Water Resource Management and Policy	3
PLAN 465	Public Land Analysis	3
ECON 455	Public Utilities Regulation	3
ECON 585	Public Utilities Regulation	3
HL S 452	Environmental Issues in Community Health	3
MPH 550	Environmental Public Health Issues	3
MPH 565	International Health Issues	3
MPH 567	Rural Health Issues	3
MPH 569	U.S.-Mexico Border Health Issues	3
AXED 485	Agriscience and Technology Education Laboratory Applications	2

**Water Infomatics**

GEOG 481	Fundamentals of Geographic Information Systems	4
GEOG 482	Digital Image Processing	3
GEOG 487	GIS Practicum	3
GEOG 521	Geographic Information Science Applications	3
GEOG 581	GIS Modeling and System Design	3
GEOG 585	Advanced Spatial Analysis	3

## Appendix B

### Current Research/Grant Funding

Water Related Awards: FY 06				
Query Run: 09/25/08				
Sponsor/Scheme Name	PI Full Name	PI Dept Name	Project Title	Award Increment Total Sponsor Costs
Cooperative State Research, Education, and Extension Service/Department of Agriculture	JOHN D KEMP	ENTOMOLOGY, PLANT PATHOLOGY, AND WEED SCIENCE	SOUTHWEST CONSORTIUM ON PLANT GENETICS AND WATER RESOURCES	\$348,171.00
New Mexico Interstate Stream Commission	BOBBY J CREEL	WATER RESOURCES RESEARCH INSTITUTE	REGIONAL WATER PLAN MAPPING PROJECT-FINAL DELIVERABLES	\$1,150.00
Noble (Samuel Roberts) Foundation	IAN RAY	PLANT AND ENVIRONMENTAL SCIENCES	IDENTIFYING QTL FOR COMPONENTS OF DROUGHT TOLERANCE AND WATER-USE EFFICIENCY IN ALFALFA	\$12,000.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM	\$2,600.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM	\$2,600.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM	\$2,600.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM	\$2,600.00
Mesa Soil and Water Conservation District	CHRISTOPHER D ALLISON	EXTENSION ANIMAL RESOURCES	CANADIAN RIVER RIPARIAN RESTORATION	\$80,500.00
Bureau of Reclamation/Department of the Interior	COLLEEN A CALDWELL	FISHERY & WILDLIFE SCIENCES	GRANT AGREEMENT FOR MEASURING ATMOSPHERIC DEPOSITION OF MERCURY IN THE CABALLO AND ELEPHANT BUTTE WATERSHEDS	\$11,000.00
Texas A&M University	PAUL GUTIERREZ	COLLEGE OF AGRICULTURE AND HOME ECONOMICS	EFFICIENT IRRIGATION FOR WATER CONSERVATION IN THE RIO GRANDE BASIN	\$450,000.00
Texas A&M University	LEROY A DAUGHERTY	AGRICULTURAL EXPERIMENT STATION (ADMINISTRATION)	EFFICIENT IRRIGATION FOR WATER CONSERVATION	\$450,000.00
Forest Service/Department of Agriculture	THEODORE W SAMMIS	PLANT AND ENVIRONMENTAL SCIENCES	INVESTIGATION OF A MONITORING AND ANALYSIS SYSTEM FOR FOREST HEALTH AND RESTORATION	\$15,000.00
Cooperative Ecosystem Studies Unit/CO Plateau/RECL	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	JOINT INVESTIGATION OF EVAPOTRANSPIRATION DEPLETION OF TREATED AND NON-TREATED SALT CEDAR AT CABALLO, NEW MEXICO	\$53,462.00
Socorro Soil and Water Conservation District	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	SSWC SUPPORT-BOR 05-FC-40-2346	\$60,000.00
U.S. Geological Survey/Department of the Interior	BARRY D STEWART	CARLSBAD ENVIRONMENTAL MONITORING & RESEARCH CENTER	ANALYSIS OF Pu IN SEDIMENT AND WATER SAMPLES	\$3,538.00

Cooperative State Research, Education, and Extension Service/Department of Agriculture	ALEXANDER FERNALD	ANIMAL & RANGE SCIENCES	IRRIGATION SEPAGE EFFECTS ON SHALLOW GROUNDWATER AND RIVER FLOW ALONG THE RIO GRANDE	\$441,000.00
Texas A&M University/WRRI	BOBBY J CREEL	WATER RESOURCES RESEARCH INSTITUTE	MOA BETWEEN TEXAS A&M UNIVERSITY SYSTEM, TEXAS AGRICULTURAL EXPERIMENT STATION AND REGENTS OF NEW MEXICO STATE UNIVERSITY (Awards will be issued in Task Orders)	\$66,211.00
Texas A&M University	CRAIG RUNYAN	EXTENSION PLANT SCIENCES	SOUTHERN REGION WATER QUALITY COORDINATION PROJECT	\$64,997.00
U.S. Fish & Wildlife Service/Department of the Interior	KIRK C MCDANIEL	ANIMAL & RANGE SCIENCES	SALT CEDAR CONTROL ON THE BOSQUE DEL APACHE NATIONAL WILDLIFE REFUGE (NWR)	\$59,400.00
Awwa Research Foundation	ABBAS GHASSEMI	WASTE-MANAGEMENT EDUCATION & RESEARCH CONSORTIUM	WERC ARSENIC WATER TREATMENT PROGRAM	\$675,022.00
Risk Management Agency/Department of Agriculture	ERIN SILVA	PLANT AND ENVIRONMENTAL SCIENCES	RISK MANAGEMENT ASSESSMENT OF DIVERSIFIED VEGETABLE PRODUCTION IN SOUTHERN NM	\$237,000.00
National Turfgrass Evaluation Program (NTEP)	BERNHARD LEINAUER	EXTENSION PLANT SCIENCES	NATIONAL KENTUCKY BLUEGRASS TEST-ANCILLARY STUDY (SALINITY IRRIGATION)	\$15,000.00
Sandia National Laboratories	RICHARD N ARNOLD	NMSU AGRICULTURAL SCIENCE CENTER/FARMINGTON	DESALINATED PRODUCE COAL BED METHANE WATER ON SEEDLINGS IN FOUR CORNERS AREA	\$12,500.00
New Mexico Environment Department	ROBERT W GOTT	WATER UTILITIES TRAINING PROGRAM (SF) - DONA ANA B	WATER UTILITIES TECHNICAL ASSISTANCE PROGRAM	\$124,001.00
New Mexico Water Resources Research Institute	DAVID E COWLEY	FISHERY & WILDLIFE SCIENCES	GRANT AGREEMENT FOR STUDIES RELATED TO FISH PASSAGE AND RIVER CONNECTIVITY AT SAN ACACIA DIVERSION DAM	(\$23,953.00)
City of Las Cruces	J. T MCGUCKIN	ECONOMICS AND INTERNATIONAL BUSINESS	WATER SYSTEM EVALUATION MESA DEVELOPMENT CENTER	\$34,000.00
New Mexico State Engineer's Office	CHRISTOPHER P BROWN	GEOGRAPHY	GPS WATER WELLS IN THE ANIMAS BASIN	\$29,750.00
New Mexico State Engineer's Office	LEEANN S DE MOUCHE	EXTENSION PLANT SCIENCES	WATER CONSERVATION & DROUGHT MANAGEMENT	\$20,000.00
Cotton Incorporated	CHARLES S BUNDY	ENTOMOLOGY, PLANT PATHOLOGY, AND WEED SCIENCE	ESTABLISHMENT OF AN ECONOMIC INJURY LEVEL FOR PLANT BUGS IN NEW MEXICO AND RELATIONSHIP TO WATER STRESS	\$9,000.00
Texas A&M University/WRRI	BOBBY J CREEL	WATER RESOURCES RESEARCH INSTITUTE	MOA BETWEEN TEXAS A&M UNIVERSITY SYSTEM, TEXAS AGRICULTURAL EXPERIMENT STATION AND REGENTS OF NEW MEXICO STATE UNIVERSITY (Awards will be issued in Task Orders)	\$56,000.00
Winrock Intnat. Inst. for Agricultural Development	PAUL GUTIERREZ	COLLEGE OF AGRICULTURE AND HOME ECONOMICS	Winrock International Water Users Association in Central Asia	\$231,002.00
University of New Mexico	ZOHRAB A SAMANI	CIVIL AND GEOLOGICAL ENGINEERING	SCIENTIFIC ASSESSMENT VEGETATION & HYDROLOGIC CONDITIONS IN OUR WATERSHEDS & RIVER SYSTEMS	\$65,147.00
Mesa Soil and Water Conservation District	CHRISTOPHER D ALLISON	EXTENSION ANIMAL RESOURCES	CANADIAN RIVER RIPARIAN RESTORATION	\$19,800.00
Bureau of Reclamation/Department of the	MICHAEL K O'NEILL	NMSU AGRICULTURAL SCIENCE	LOW-TECH MICROIRRIGATION FOR SMALL-SCALE NAVAJO PRODUCERS	\$28,126.00



Interior		CENTER/FARMINGTON		
New Mexico Department of Finance and Administration	ZOHRAB A SAMANI	CIVIL AND GEOLOGICAL ENGINEERING	USING REMOTE SENSING TO DEMONSTRATE WATER SAVING	\$235,217.00
U.S. Geological Survey/Department of the Interior	M. K WOOD	WATER RESOURCES RESEARCH INSTITUTE	WATER RESOURCES RESEARCH INSTITUTE ANNUAL BASE PROGRAM 2006-2008	\$92,335.00
Environmental Protection Agency	ROBERT W GOTT	WATER UTILITIES TRAINING PROGRAM (SF) - DONA ANA B	WPC MANPOWER DEVELOPMENT	\$32,800.00
Los Alamos National Security, LLC	JAMES R MURPHY	ASTRONOMY	EXAMINING MECHANISMS FOR THE LOW-LATITUDE WATER EQUIVALENT HYDROGEN REGIONS ON MARS VIA THE AMES GENERAL CIRCULATION MODEL	\$22,190.00
Bureau of Reclamation/Department of the Interior	ALEXANDER FERNALD	ANIMAL & RANGE SCIENCES	FLOW MEASUREMENT FOR IMPROVED ACEQUIA WATER MANAGEMENT	\$24,880.00
CH2M HILL, Inc.	FRANK A WARD	AGRICULTURAL ECONOMICS & AGRICULTURAL BUSINESS	SUSTAINING WATER CONSERVATION IN IRRIGATED AGRICULTURE	\$73,817.00
Reservoir Fund, The	SHUGUANG DENG	CHEMICAL ENGINEERING	VALIDATION OF SABREX WATER PURIFICATION TECHNOLOGY	\$4,800.00
Bureau of Indian Affairs/Department of the Interior	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	BIA WATER RESOURCES TECHNICIAN TRAINING PROGRAM 2006	\$71,554.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	2006 RESEARCH AND ENGINEERING PROGRAM (REAP)	\$2,600.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	2006 RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM (REAP)	\$2,600.00
U.S. Fish & Wildlife Service/Department of the Interior	KIRK C MCDANIEL	ANIMAL & RANGE SCIENCES	SALT CEDAR CONTROL ON THE BOSQUE DEL APACHE NATIONAL WILDLIFE REFUGE (NWR)	(\$9,923.00)
Texas A&M University/WRRRI	BOBBY J CREEL	WATER RESOURCES RESEARCH INSTITUTE	MOA BETWEEN TEXAS A&M UNIVERSITY SYSTEM, TEXAS AGRICULTURAL EXPERIMENT STATION AND REGENTS OF NEW MEXICO STATE UNIVERSITY (Awards will be issued in Task Orders)	\$5,000.00
Sandia National Laboratories	JAMES P KING	CIVIL AND GEOLOGICAL ENGINEERING	NEW MEXICO STATE UNIVERSITY EXCELLENCE IN ENGINEERING FELLOWSHIP	\$25,000.00
New Mexico State Engineer's Office	LEEANN S DE MOUCHE	EXTENSION PLANT SCIENCES	WATER CONSERVATION & DROUGHT MANAGEMENT	(\$8,000.00)
Competitive Advantage Consulting Ltd.	BERNHARD LEINAUER	EXTENSION PLANT SCIENCES	WIRELESS IRRIGATION SYSTEM	\$38,241.00
Hot Springs Falls	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	GRADUATE STUDENT SUPPORT GRANT	\$4,311.00
Hewlett (William & Flora) Foundation	M. K WOOD	WATER RESOURCES RESEARCH INSTITUTE	U.S. LATIN AMERICAN RELATIONS PROGRAM	\$127,650.00
New Mexico State Engineer's Office	CHRISTOPHER P BROWN	GEOGRAPHY	GPS WATER WELLS IN THE ANIMAS BASIN	\$15,000.00
Bureau of Reclamation/Department of the Interior	COLLEEN A CALDWELL	FISHERY & WILDLIFE SCIENCES	GRANT AGREEMENT FOR MEASURING ATMOSPHERIC DEPOSITION OF MERCURY IN THE CABALLO AND ELEPHANT BUTTE WATERSHEDS	\$15,000.00

Cooperative State Research, Education, and Extension Service/Department of Agriculture	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	A MULTI-INSTITUTIONAL EDUCATIONAL MODEL TO ENHANCE IRRIGATION TEACHING AND TRAINING	\$290,000.00
Cooperative State Research, Education, and Extension Service/Department of Agriculture	JOHN D KEMP	ENTOMOLOGY, PLANT PATHOLOGY, AND WEED SCIENCE	SOUTHWEST CONSORTIUM FOR PLANT GENETICS AND WATER RESOURCES	\$362,294.00
<b>TOTAL:</b>				<b>\$5,086,590.00</b>

Water Related Awards: FY 07				
Query Run: 09/25/08				
Sponsor/Scheme Name	PI Full Name	PI Dept Name	Project Title	Award Increment Total Sponsor Costs
City of Las Cruces	J. T MCGUCKIN	ECONOMICS AND INTERNATIONAL BUSINESS	VAULTION STUDY OF WATER RIGHTS & SERVICE TERRITORY	\$15,834.00
New Mexico Environment Department	JULIE MAITLAND	AGRICULTURAL PROGRAMS & RESOURCES DIVISION NMDA	06/07 WATERSHED GROUP	\$145,130.00
URS Group, Inc.	JAMES P KING	CIVIL AND GEOLOGICAL ENGINEERING	ON-FARM EFFICIENCY INVESTIGATION METHODOLOGY AND ON-FARM EFFICIENCY INVESTIGATION LOCATIONS AND GENERAL INFORMATION	(\$5,000.00)
Sandia National Laboratories	SHUGUANG DENG	CHEMICAL ENGINEERING	SHORT-CUT ANALYSIS AND ANALYTICAL SOLUTION OF ADSORPTION BREAKTHROUGH CURVES	\$9,000.00
Ivanhoe Foundation, The	SHUGUANG DENG	CHEMICAL ENGINEERING	SOLAR DESALINATION OF BRACKISH WATER	\$5,000.00
Texas A&M University	LEROY A DAUGHERTY	AGRICULTURAL EXPERIMENT STATION (ADMINISTRATION)	EFFICIENT IRRIGATION FOR WATER CONSERVATION	\$475,000.00
Reservoir Fund, The	SHUGUANG DENG	CHEMICAL ENGINEERING	VALIDATION OF SABREX WATER PURIFICATION TECHNOLOGY	\$3,250.00
Environmental Protection Agency	ROBERT W GOTT	WATER UTILITIES TRAINING PROGRAM (SF) - DONA ANA B	WPC MANPOWER DEVELOPMENT	\$25,640.00
U.S. Geological Survey/Department of the Interior	M. K WOOD	WATER RESOURCES RESEARCH INSTITUTE	VALIDATION, CALIBRATION, AND IMPROVEMENT OF REMOTE SENSING ET ALGORITHMS IN MOUNTAINOUS REGIONS (PROJ. #2006NM63G, NMT)	\$74,795.00
Sandia National Laboratories	MANOJ SHUKLA	PLANT AND ENVIRONMENTAL SCIENCES	SELF SEALING LINERS FOR DESALINATION EVAPORATION PONDS	\$39,999.00
U.S. Geological Survey/Department of the Interior	BARRY D STEWART	CARLSBAD ENVIRONMENTAL MONITORING & RESEARCH CENTER	ANALYSIS OF Pu IN SEDIMENT AND WATER SAMPLES	(\$2,450.00)
U.S. Geological Survey/Department of the Interior	BARRY D STEWART	CARLSBAD ENVIRONMENTAL MONITORING & RESEARCH CENTER	ANALYSIS OF Pu IN SEDIMENT AND WATER SAMPLES	\$2,450.00

Shaw Environmental, Inc.	ABBAS GHASSEMI	WASTE-MANAGEMENT EDUCATION & RESEARCH CONSORTIUM	TREATMENT OF MTBE CONTAMINATION IN GROUNDWATER USING ADVANCED OXIDATION PROCESSES	\$90,083.00
Texas A&M University/WRRI	BOBBY J CREEL	WATER RESOURCES RESEARCH INSTITUTE	MOA BETWEEN TEXAS A&M UNIVERSITY SYSTEM, TEXAS AGRICULTURAL EXPERIMENT STATION AND REGENTS OF NEW MEXICO STATE UNIVERSITY (Awards will be issued in Task Orders)	\$110,070.00
Canadian River Soil & Water Conservation District	CHRISTOPHER D ALLISON	EXTENSION ANIMAL RESOURCES	MONITORING THE EFFECTS OF SALT CEDAR CONTROL ON THE CANADIAN RIVER	\$80,500.00
Texas A&M University	CRAIG RUNYAN	EXTENSION PLANT SCIENCES	SOUTHERN REGION WATER QUALITY COORDINATION PROJECT	\$60,000.00
USDA/Natural Resources Conservation Service	MARK MARSALIS	AGRICULTURAL EXPERIMENT STATION	SUBSURFACE DRIP IRRIGATION AND GPS TECHNOLOGY FOR WATER CONSERVATION IN THE SOUTHERN HIGH PLAINS	\$75,000.00
Cooperative Ecosystem Studies Unit/CO Plateau/RECL	JOHN W HERNANDEZ	CIVIL AND GEOLOGICAL ENGINEERING	AN APPRAISAL-LEVEL STUDY OF ALTERNATIVE METHODS OF REDUCING CARRIAGE LOSSES FOR CONCHAS CANAL OF THE ARCH HURLEY CONSERVATION DISTRICT	(\$12,802.00)
New Mexico Interstate Stream Commission	M. K WOOD	WATER RESOURCES RESEARCH INSTITUTE	GILA BASIN ACT SCIENCE FORUMS	\$50,000.00
Environmental Protection Agency	SHUGUANG DENG	CHEMICAL ENGINEERING	DRINKING WATER PURIFICATION FOR U.S.A.-MEXICO BORDER REGION	\$10,000.00
Golf Course Superintendents Assc of America Fdn	BERNHARD LEINAUER	EXTENSION PLANT SCIENCES	EFFECT OF PHYSICAL WATER CONDITIONS ON TURFGRASS QUALITY AND IRRIGATION WATER USE	\$8,000.00
New Mexico Interstate Stream Commission	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	MEASURING EVAPORATION LOSSES AT ELEPHANT BUTTE	\$49,993.00
New Mexico Environment Department	ROBERT W GOTT	WATER UTILITIES TRAINING PROGRAM (SF) - DONA ANA B	WATER UTILITIES TECHNICAL ASSISTANCE PROGRAM	\$268,000.00
Texas A&M University	PAUL GUTIERREZ	COLLEGE OF AGRICULTURE AND HOME ECONOMICS	EFFICIENT IRRIGATION FOR WATER CONSERVATION IN THE RIO GRANDE BASIN	\$475,000.00
La Jicarita Enterprise Community, Inc.	ALEXANDER FERNALD	ANIMAL & RANGE SCIENCES	UPPER MORA WATERSHED RESTORATION-PHASE II	\$77,999.00
New Mexico Environment Department	FRANCIS W BOYLE	PLANT AND ENVIRONMENTAL SCIENCES	ANALYSIS OF DRINKING WATER SAMPLES	\$800,000.00
New Mexico Peanut Growers Association (CPPO)	NAVEEN PUPPALA	NMSU AGRICULTURAL SCIENCE CENTER/CLOVIS	DEVELOPMENT OF VALENCIA PEANUT CORE COLLECTION	\$16,130.00
World Wildlife Fund, Inc.	JULIE MAITLAND	AGRICULTURAL PROGRAMS & RESOURCES DIVISION NMDA	06/07 WORLD WILDLIFE FUND PASO DEL NORTE WATERSHED	\$5,000.00
Noble (Samuel Roberts) Foundation	IAN RAY	PLANT AND ENVIRONMENTAL SCIENCES	IDENTIFYING QTL FOR COMPONENTS OF DROUGHT TOLERANCE AND WATER-USE EFFICIENCY IN ALFALFA	\$36,000.00
CH2M HILL, Inc.	FRANK A WARD	AGRICULTURAL ECONOMICS & AGRICULTURAL BUSINESS	SUSTAINING WATER CONSERVATION IN IRRIGATED AGRICULTURE	(\$8,000.00)
Cooperative Ecosystem Studies Unit/CO Plateau/RECL	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	JOINT INVESTIGATION OF EVAPOTRANSPIRATION DEPLETION OF TREATED AND NON-TREATED SALT CEDAR AT CABALLO, NEW MEXICO	\$55,000.00
CH2M HILL, Inc.	FRANK A WARD	AGRICULTURAL ECONOMICS & AGRICULTURAL BUSINESS	SUSTAINING WATER CONSERVATION IN IRRIGATED AGRICULTURE	\$89,895.00

Aqua-Phyd	BERNHARD LEINAUER	EXTENSION PLANT SCIENCES	ASSESSING THE USEFULNESS OF WATER AND SOIL CONDITIONING PRODUCTS TO IMPROVE TURFGRASS QUALITY AND REDUCE IRRIGATION WATER USE IN THE SOUTHWEST	\$39,999.00
Awwa Research Foundation	ABBAS GHASSEMI	WASTE-MANAGEMENT EDUCATION & RESEARCH CONSORTIUM	WERC ARSENIC WATER TREATMENT PROGRAM	\$742,500.00
City of Las Cruces Utilities, Board of Commissioners	J. T MCGUCKIN	ECONOMICS AND INTERNATIONAL BUSINESS	TRAINING AND EXPERT ADVICE TO THE BOARD OF COMMISSIONERS FOR THE CITY OF LAS CRUCES	\$34,717.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM	\$2,600.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM	\$2,600.00
CH2M HILL, Inc.	FRANK A WARD	AGRICULTURAL ECONOMICS & AGRICULTURAL BUSINESS	SUSTAINING WATER CONSERVATION IN IRRIGATED AGRICULTURE	(\$11,000.00)
Texas A&M University	CRAIG RUNYAN	EXTENSION PLANT SCIENCES	SOUTHERN REGION WATER QUALITY COORDINATION PROJECT	\$3,318.00
U.S. Geological Survey/Department of the Interior	M. K WOOD	WATER RESOURCES RESEARCH INSTITUTE	WATER RESOURCES RESEARCH INSTITUTE ANNUAL BASE PROGRAM 2006-2008	\$92,335.00
Texas A&M University/WRRI	BOBBY J CREEL	WATER RESOURCES RESEARCH INSTITUTE	MOA BETWEEN TEXAS A&M UNIVERSITY SYSTEM, TEXAS AGRICULTURAL EXPERIMENT STATION AND REGENTS OF NEW MEXICO STATE UNIVERSITY (Awards will be issued in Task Orders)	\$17,055.00
Cooperative Ecosystem Studies Unit/CO Plateau/RECL	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	JOINT INVESTIGATION OF EVAPOTRANSPIRATION DEPLETION OF TREATED AND NON-TREATED SALT CEDAR AT THE ELEPHANT BUTTE DELTA, NEW MEXICO	(\$853.00)
Bureau of Indian Affairs/Department of the Interior	JAMES P KING	CIVIL AND GEOLOGICAL ENGINEERING	FY 2007 BIA WATER RESOURCES TECHNICIAN TRAINING COURSE	\$79,638.00
New Mexico Game and Fish Department	WIEBKE J BOEING	FISHERY & WILDLIFE SCIENCES	MANAGING NATIVE FISH SPECIES AND INVERTEBRATES IN DESERT SINKHOLES	\$6,000.00

**TOTAL: \$4,133,425.00**

## Water Related Awards: FY 08

Query Run: 09/25/08

Sponsor/Scheme Name	PI Full Name	PI Dept Name	Project Title	Award Increment Total Sponsor Costs
Bureau of Reclamation/Department of the Interior	COLLEEN A CALDWELL	FISHERY & WILDLIFE SCIENCES	GRANT AGREEMENT FOR MEASURING ATMOSPHERIC DEPOSITION OF MERCURY IN THE CABALLO AND ELEPHANT BUTTE WATERSHEDS	\$20,000.00
Shaw Environmental, Inc.	ABBAS GHASSEMI	WASTE-MANAGEMENT EDUCATION & RESEARCH CONSORTIUM	TREATMENT OF MTBE CONTAMINATION IN GROUNDWATER USING ADVANCED OXIDATION PROCESSES	\$13,091.00
Bureau of Reclamation/Department of the Interior	ABBAS GHASSEMI	WASTE-MANAGEMENT EDUCATION & RESEARCH CONSORTIUM	WATER STEWARDSHIP EDUCATION PROGRAM	\$11,500.00
Cooperative State Research, Education, and Extension Service/Department of Agriculture	WIEBKE J BOEING	FISHERY & WILDLIFE SCIENCES	IMPACTS OF IRRIGATION PRACTICES ON AQUATIC COMMUNITIES IN DESERT SINKHOLES	\$100,000.00
Cooperative State Research, Education, and Extension Service/Department of Agriculture	SANGAMESH ANGADI	COLLEGE OF AGRICULTURE AND HOME ECONOMICS	WATER CONSERVATION IN FORAGE PRODUCTION SYSTEMS BY SORGHUM-LEGUME INTERCROPPING IN THE SOUTHERN HIGH PLAINS	\$398,109.00
Ute Creek Soil & Water Conservation District	CHRISTOPHER D ALLISON	EXTENSION ANIMAL RESOURCES	PROFESSIONAL SERVICES AGREEMENT BETWEEN THE UTE CREEK SOIL & WATER CONSERVATION DISTRICT AND NMSU FOR THE UTE CREEK WATERSHED RESTORATION & MANAGEMENT PROJECT	\$21,184.00
Cooperative Ecosystem Studies Unit/CO Plateau/RECL	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	JOINT INVESTIGATION OF EVAPOTRANSPIRATION DEPLETION OF TREATED AND NON-TREATED SALT CEDAR AT CABALLO, NEW MEXICO	\$62,146.00
National Science Foundation	JAMES P KING	CIVIL AND GEOLOGICAL ENGINEERING	NILE BASIN HYDROLOGY AND ECOLOGY UNDER EXTREME CLIMATIC CONDITIONS	\$31,702.00
CH2M HILL, Inc.	FRANK A WARD	AGRICULTURAL ECONOMICS & AGRICULTURAL BUSINESS	SUSTAINING WATER CONSERVATION IN IRRIGATED AGRICULTURE	(\$3,000.00)
Environmental Protection Agency	LEEANN S DE MOUCHE	EXTENSION PLANT SCIENCES	TRIBAL MANAGEMENT FOR ON-SITE WASTEWATER TREATMENT SYSTEMS	\$32,750.00
Office of Naval Research	ROBERT J SILVER	AGRICULTURAL EXPERIMENT STATION (ADMINISTRATION)	CURVED NOZZLE TECHNOLOGY FOR REMOVAL OF SUSPENDED MATERIALS FROM WATER	\$3,000.00
Office of Naval Research	ROBERT J SILVER	AGRICULTURAL EXPERIMENT STATION (ADMINISTRATION)	CURVED NOZZLE TECHNOLOGY FOR REMOVAL OF SUSPENDED MATERIALS FROM WATER	\$547,120.00
City of Las Cruces	JAMES P KING	CIVIL AND GEOLOGICAL ENGINEERING	GRAND UNIFIED GROUNDWATER MODEL DEVELOPMENT FOR THE LOWER RIO GRANDE-RINCON	\$31,228.00
National Geospatial-Intelligence Agency	WILLIAM STEIN	PHYSICAL SCIENCE LABORATORY	TOOLS FOR RAPID MONITORING AND PREDICTION OF THE RIO GRANDE BASIN	\$187,991.00
ConocoPhillips Company	SHUGUANG DENG	CHEMICAL ENGINEERING	RECYCLE OF OIL FIELDS PRODUCED WATER FOR ENHANCED OIL RECOVERY THROUGH MEMBRANE DISTILLATION	\$100,000.00

New Mexico Environment Department	ROBERT W GOTT	WATER UTILITIES TRAINING PROGRAM (SF) - DONA ANA B	WATER UTILITIES TECHNICAL ASSISTANCE PROGRAM	(\$22,000.00)
City of Albuquerque	FRANCIS W BOYLE	PLANT AND ENVIRONMENTAL SCIENCES	ALBUQUERQUE WATER TESTING (SWAT)	\$54,960.00
Texas A&M University	CRAIG RUNYAN	EXTENSION PLANT SCIENCES	SOUTHERN REGION WATER QUALITY COORDINATION PROJECT	\$60,000.00
Shaw Environmental, Inc.	ABBAS GHASSEMI	WASTE-MANAGEMENT EDUCATION & RESEARCH CONSORTIUM	TREATMENT OF MTBE CONTAMINATION IN GROUNDWATER USING ADVANCED OXIDATION PROCESSES	(\$13,091.00)
Best Technology Company	BERNHARD LEINAUER	EXTENSION PLANT SCIENCES	ASSESSING THE USEFULNESS OF WATER AND SOIL CONDITIONING PRODUCTS TO IMPROVE TURFGRASS QUALITY AND REDUCE IRRIGATION WATER USE IN THE SOUTHWEST	\$15,214.00
Sandia National Laboratories	IAN H LESLIE	MECHANICAL ENGINEERING	THERMO-ELECTRICALLY DRIVEN SEAWATER PUMPING DEVICE	\$6,000.00
Golf Course Superintendents Assc of America Fdn	BERNHARD LEINAUER	EXTENSION PLANT SCIENCES	EFFECT OF PHYSICAL WATER CONDITIONS ON TURFGRASS QUALITY AND IRRIGATION WATER USE	\$50.00
Sandia National Laboratories	JAMES P KING	CIVIL AND GEOLOGICAL ENGINEERING	NEW MEXICO STATE UNIVERSITY EXCELLENCE IN ENGINEERING FELLOWSHIP	\$25,000.00
Desert Sense Development LLC	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	DEMONSTRATING EFFICIENT LANDSCAPE IRRIGATION IN A DESERT ENVIRONMENT THROUGH SMART WATER APPLICATION TECHNOLOGY	\$15,700.00
Canadian River Soil & Water Conservation District	CHRISTOPHER D ALLISON	EXTENSION ANIMAL RESOURCES	CANADIAN RIVER RIPARIAN RESTORATION PROJECT - MONITORING SALT CEDAR ON CANADIAN RIVER	\$42,000.00
National Geospatial-Intelligence Agency	WILLIAM STEIN	PHYSICAL SCIENCE LABORATORY	TOOLS FOR RAPID MONITORING AND PREDICTION OF THE RIO GRANDE BASIN	\$112,008.00
Environmental Protection Agency	ROBERT W GOTT	WATER UTILITIES TRAINING PROGRAM (SF) - DONA ANA B	WPC MANPOWER DEVELOPMENT	\$25,660.00
New Mexico Environment Department	FRANCIS W BOYLE	PLANT AND ENVIRONMENTAL SCIENCES	ANALYSIS OF DRINKING WATER SAMPLES	\$800,000.00
NationView, LLC	FRANCIS W BOYLE	PLANT AND ENVIRONMENTAL SCIENCES	ANALYSIS OF DRINKING WATER SAMPLES (SWAT)	\$200,000.00
Awwa Research Foundation	GEOFFREY SMITH	BIOLOGY	Microbial Pathogen Survival & Extraction from Point-of-Use Filters	(\$7,467.00)
T & E, Inc.	HEATHER L THROOP	BIOLOGY	XERIC ADAPTED TREES IN MESIC LANDSCAPES: PATTERNS OF WATER USE & ESTABLISHMENT IN RIPARIAN JUNIPERS	\$2,500.00
New Mexico Institute of Mining and Technology	ALEXANDER FERNALD	ANIMAL & RANGE SCIENCES	SACRAMENTO MOUNTAINS WATERSHED STUDY	\$88,164.00
Office of Naval Research	ABBAS GHASSEMI	WASTE-MANAGEMENT EDUCATION & RESEARCH CONSORTIUM	NMSU WATER SECURITY PROGRAM (DESALINATION)	\$929,000.00
Texas A&M University	CRAIG RUNYAN	EXTENSION PLANT SCIENCES	SOUTHERN REGION WATER QUALITY COORDINATION PROJECT	\$10,000.00
U.S. Agency for International Development	TERRY CRAWFORD	AGRICULTURAL ECONOMICS & AGRICULTURAL BUSINESS	NEW MEXICO STATE UNIVERSITY'S AFGHANISTAN WATER, AGRICULTURE AND TECHNOLOGY TRANSFER PROGRAM (AWATT)	\$6,120,000.00

U.S. Geological Survey/Department of the Interior	M. K WOOD	WATER RESOURCES RESEARCH INSTITUTE	WATER RESOURCES RESEARCH INSTITUTE ANNUAL BASE PROGRAM 2006-2008	\$92,335.00
World Wide Water, Inc.	N. N KHANDAN	CIVIL AND GEOLOGICAL ENGINEERING	DESALINATION	\$29,999.00
U.S. Geological Survey/Department of the Interior	BOBBY J CREEL	WATER RESOURCES RESEARCH INSTITUTE	US-MEXICO TRANSBOUNDARY AQUIFER ASSESSMENT PROGRAM-MESILLA AND HUECO BASINS	\$82,000.00
Texas A&M University/WRRRI	BOBBY J CREEL	WATER RESOURCES RESEARCH INSTITUTE	MOA BETWEEN TEXAS A&M UNIVERSITY SYSTEM, TEXAS AGRICULTURAL EXPERIMENT STATION AND REGENTS OF NEW MEXICO STATE UNIVERSITY (Awards will be issued in Task Orders)	\$110,070.00
Bureau of Reclamation/Department of the Interior	COLLEEN A CALDWELL	FISHERY & WILDLIFE SCIENCES	GRANT AGREEMENT FOR MEASURING ATMOSPHERIC DEPOSITION OF MERCURY IN THE CABALLO AND ELEPHANT BUTTE WATERSHEDS	\$15,000.00
Golf Course Superintendents Assc of America Fdn	BERNHARD LEINAUER	EXTENSION PLANT SCIENCES	EFFECT OF PHYSICAL WATER CONDITIONS ON TURFGRASS QUALITY AND IRRIGATION WATER USE	\$16,000.00
Bureau of Indian Affairs/Department of the Interior	A. S BAWAZIR	CIVIL AND GEOLOGICAL ENGINEERING	BIA WATER RESOURCES TECHNICIAN TRAINING PROGRAM	\$79,087.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM	\$2,600.00
Academy of Applied Science	ROLSTON ST HILAIRE	PLANT AND ENVIRONMENTAL SCIENCES	RESEARCH AND ENGINEERING APPRENTICESHIP PROGRAM	\$2,600.00
Mike Matush	THEODORE W SAMMIS	PLANT AND ENVIRONMENTAL SCIENCES	BURROS MOUNTAIN WEATHER STATION	\$5,923.00
New Mexico Game and Fish Department	WIEBKE J BOEING	FISHERY & WILDLIFE SCIENCES	MANAGING NATIVE FISH SPECIES AND INVERTEBRATES IN DESERT SINKHOLES	\$8,000.00
New Mexico Environment Department	ROBERT W GOTT	WATER UTILITIES TRAINING PROGRAM (SF) - DONA ANA B	WATER UTILITIES TECHNICAL ASSISTANCE PROGRAM	\$112,000.00
New Mexico Department of Finance and Administration	JON C BOREN	EXTENSION ANIMAL RESOURCES	SOUTHERN NEW MEXICO DAIRY GREEN WATER RECLAMATION AND REUSE PROJECT	\$500,000.00

**TOTAL: \$11,076,133.00**

## **Appendix C**

### **Letters of Support from NMSU**

**President** Manuel Pacheco

**Provost** Waded Cruzado-Salas

**Vice President of Research** Vimal Chaitanya

**Graduate School Dean** Linda Lacey

#### **College Deans**

Dr. Lowell Catlett, College of Agricultural, Consumer, and Environmental Sciences

Dr. Pam Jansma, College of Arts and Sciences

Dr. Garrey Carruthers, College of Business

Dr. Steve Castillo, College of Engineering

Dr. Virginia Higbie, College of Health and Social Services

Dr. Mike Morehead, College of Education

#### **Department Heads**

Dr. Tony Popp, Economics and International Business

Dr. Terry Crawford, Agricultural Economics and Agricultural Business

Dr. Nancy Baker, Government

Dr. David Thompson, Entomology, Plant Pathology, and Weed Sciences

Dr. Greg Mullins, Plants and Environmental Sciences

Dr. Martha Mitchell, Mechanical Engineering

Dr. Tim Ross, Animal and Range Sciences

Dr. Nancy, McMillan Geology

Dr. Steve Arnold, Health Science

Dr. Raul Valdez, Fishery and Wildlife

Dr. William Gibbs, Physics

Dr. Ricardo Jacquez, Civil Engineering

Dr. Christopher Brown, Geography

Dr. Marvin Bernstein, Biology

Dr. Jack Wright, Geography





## College of Agriculture and Home Economics

Office of the Dean and Chief Administrative Officer

New Mexico State University

MSC 3AG

P.O. Box 30003

Las Cruces, NM 88003-8003

Tel: 575-646-3748 Fax: 575-646-5975

December 16, 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute and  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

Dear Dr. Wood:

I strongly support a new Ph.D. program in Water Resources since so much of what the College of Agricultural, Consumer and Environmental Sciences is involved with in teaching, research and extension concerns water in some way. Numerous classes are already being taught. Countless research projects relate to irrigation and/or saline water issues and much of what the Cooperative Extension Service works on involves water problems or concerns. To say water is at the very core of our college is a massive understatement.

No one program covers all of the important components of water, thus the need for a Ph.D. that puts all of the various parts together in a comprehensive program of study. This type of program will certainly be valuable to the state of New Mexico, but just as importantly, to the nation and the world as water increasingly becomes more of an economic and social driver of change and economic development for many parts of the world.

We pledge our support and resources to helping the program become successful. Thank you for your leadership in getting this new degree moved forward.

Sincerely,

A handwritten signature in black ink, appearing to read "L. Catlett".

Lowell B. Catlett  
Regents Professor/Dean and Chief Administrative Officer



## College of Arts and Sciences

Office of the Dean, MSC 3335

New Mexico State University

P. O. Box 30001

Las Cruces, NM 88003-8001

Phone: 505-646-2001 Fax: 505-646-6096

December 3, 2008  
N022

Dr. M. Karl Wood, Director  
Water Resources and Research Institute &  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

Dear Dr. Wood,

I am delighted to endorse the proposal for new the new degrees of Master of Science and Doctor of Philosophy in Water Resources Management. The issue of water resources is a critical one in the state of New Mexico, one of the driest states in the nation, and throughout the southwest. Furthermore, access to potable water is of grave concern in the developing world. Improper management of water resources has implications for economic vitality and homeland security in addition to environmental degradation and the emergence of water-born diseases. Unfortunately, as with many disciplines, the majority of scientists in the field are nearing retirement. A well-prepared cadre of students trained in the latest techniques and interdisciplinary approaches is necessary to replace them to ensure proper stewardship of this natural resource. New Mexico State University is poised to take on a leadership role in these efforts. The commitment of NMSU to its Land-Grant mission makes it ideally suited to bring the results of its research to the community, the state, and the region.

NMSU has a long tradition in the study of water as a resource with the establishment of the New Mexico Water Resources Research Institute by the Board of Regents in 1963. Currently, seventeen departments and eighty-five faculty members engage in water-related teaching and research. External funding generated by the various research groups totaled in excess of \$10,000,000. The new degree program will bring a synergy to these efforts and provide a vibrant educational environment for the students. The program, unique in the state and one of only a handful in the nation, dovetails well with the Natural Resource Sustainability and Renewal research cluster developed as part of Living the Vision. The interest among students will be high.

I support the proposed degree programs and look forward to seeing them implemented at NMSU.

Sincerely,

Pamela Jansma  
Dean



## College of Business

Office of the Dean, MSC 3AD  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003-8001  
Tel: 505-646-2821  
Fax: 505-646-6155  
<http://business.nmsu.edu>

December 3, 2008

Karl Wood, Ph.D.  
Director  
Water Resources Research Institute  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, New Mexico

Dear Dr. Wood,

I have reviewed your proposal to offer two new degrees at New Mexico State University: (1) a Master of Science in Water Resources Management, and (2) a Doctor of Philosophy in Water Resources Management. I am supportive of this proposal with the caveat that you seek approval of both degrees at one time but reflect in the proposal that the Masters Degree would be offered first and, given sufficient market interest, the Ph.D. Degree would then be introduced. My support is based upon:

- The quality and status of the faculty members associated with the proposal,
- The program being an extension of the ongoing water cluster research and development program at NMSU,
- The commitment that most, if not all, of the courses are currently available and there appears to be sufficient faculty resources to begin the Masters Degree offering,
- The reality that water resources management is one of the promising areas of research, education and policy development for New Mexico, the Southwest and many semi arid countries,
- The program and degrees should be very compatible with natural resource policy development interests in the Domenici Public Policy Institute,
- And the proper management of water resources will, in some part, dictate the economic development activities in New Mexico.

My casual observation is that depending upon state operational formula funding to finance the program ignores the possibility that there may not be a one to one correlation between what the formula yields and what the administration invests in. Formula

Karl Wood, Ph.D.  
Page Two

funding, to my knowledge, has never been earmarked by program at NMSU. You should strengthen the financing of the program by committing some of the current expenditures on water management to the M.S. and Ph.D. programs.

Sincerely,

A handwritten signature in black ink, appearing to read 'Garrey Carruthers', with a long horizontal flourish extending to the right.

Garrey Carruthers, Ph.D.  
Dean and Professor of Economics  
Vice President for Economic Development



## College of Engineering

Office of the Dean, MSC 3449  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003-8001  
Tel: 575-646-7234  
Fax: 575-646-3549

December 16, 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute  
And  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

Dear Dr. Wood:

I am very pleased to provide you with this letter in support of the proposal for new Ph.D. and M.S. interdisciplinary degree program in water resources management at New Mexico State University (NMSU). I was very pleased to see this proposal being prepared and submitted to you by a strong, broad interdisciplinary team of outstanding faculty here at NMSU.

Water is the life blood of New Mexico. It is necessary for drinking, industry and agriculture. The scarcity of water in New Mexico together with its importance presents an extraordinary array of challenges and issues that remain to be addressed and solved by our research community. No university in New Mexico is better equipped and prepared to move forward in water research than NMSU. Classes and research related to water are being conducted in all colleges and in our extension service. Our push towards establishing NMSU as a premier institution in water issues in inland arid regions is well along the path to success. It is only natural to implement graduate degree programs in this extremely important area as a complement to our ongoing research and education programs.

In summary, I give the proposal to establish Ph.D. and M.S. degree programs in water resources management my strongest support.

Regards,

A handwritten signature in black ink, appearing to read "Steven P. Castillo".

Steven P. Castillo  
Dean and NMSU Regents' Professor

SPC:vcn



**College of Health and Social Services**

Office of the Dean  
MSC 3446  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003-8001  
Tel: 575-646-3526  
Fax: 575-646-6166

November 5, 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute  
New Mexico State University

Dear Dr. Wood:

This letter is writing to express the full support of the administration and faculty of the College of Health and Social Services for the initiation and approval of the proposed graduate degree programs in Water Resources Management. Our college has a mission statement that clearly aligns our academic efforts with the health, safety and welfare of the people of New Mexico and beyond. Your efforts will focus much needed attention on the often overlooked relationship between the availability and quality of water and the spread of disease here in New Mexico as well as across the world.

Additionally, as our population grows, the need for professionals in water resources management will increase proportionately. There are very few areas in our state and in the surrounding territories that are not impacted by the reality of water shortages or the prevalent threat of water-borne diseases. It becomes necessary sooner rather than later to prepare for shortages and infestation control before these problems have a serious impact upon the quality of life for everyone. I believe that New Mexico State University as the state land-grant university has an obligation to prepare water resource specialists as part of our mission to address these potentially harmful conditions.

I can foresee the majors in our college finding opportunities for study within your degree programs to enrich their understanding of the relationship of the quantity and quality of water to the maintenance of public health and safety.

Sincerely,

A handwritten signature in cursive script that reads "Virginia C. Higbie".

Virginia C. Higbie, Ph.D. Interim Dean



## College of Education

Dean's Office  
MSC 3AC  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003-8001  
Tel: 575-646-5858  
Fax: 575-646-6032

November 11, 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute  
And  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

Dear Dr. Wood:

Water education, research, and outreach programs are essential to New Mexico because of the regions need for water development and research. New Mexico and the Paso del Norte region have significant water challenges. Senator Domenici's website shares information on water problems in New Mexico, including the fact that water is a vital resource for New Mexico; consequently, it is a significant issue facing New Mexicans. There are many pressures on this invaluable resource, from growing populations, protecting endangered species, to the prolonged drought.

The proposed programs will enhance the study of this important topic, allowing New Mexico State University to become a national leader in this area, and can be done for minimal cost. The manner in which the programs are planned allows for extensive collaboration, across department research, and efficient use of tax payers dollars.

I strongly support the proposed master and doctorate degrees in Water Resources Management.

Sincerely,

A handwritten signature in dark ink, appearing to read "Michael Morehead".

Dr. Michael Morehead  
Interim Dean  
College of Education  
New Mexico State University



**College of Business**

Department of Economics and International Business  
University Statistics Center  
MSC 3CQ  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003-8001  
Tel: 575-646-2113  
Fax: 575-646-1915

Dr. M. Karl Wood, Director  
Water Resources Research Institute and  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

December 12, 2008

Dr. Wood:

It is a pleasure for me to write a letter of support for the proposed new master's and doctorate level degrees in Water Resource Management. The proposed degrees address a topic that is of utmost importance to New Mexico, the United States and the world community.

The importance of water and its uses is reflected by the many academic departments involved in the issue. The use of water has implications for economic development, aquatic species, endangered species, agriculture and overall environmental health. Not only is research needed in the use of available water, but in the reuse and quality of that water. This means that the technical aspects of the transportation and reuse of water must be understood. Many researchers today claim that it is not energy that will be the limiting factor in the development of economies but the level and quality of water available for use.


The management of water resources is particularly important to New Mexico, one of the driest states in the nation. Economic development priorities are being challenged by the need to protect the environment and support of threatened and endangered species. What is learned in New Mexico is applicable to all the other semi arid regions around the world. This is evident by the work that is already being done by researchers at NMSU. Results from water management research will become increasingly important as the effects of global warming are felt throughout the United States and the world.

There is no doubt in my mind the water resource management specialists will be in great demand in the future. They are needed now but the need is not fully recognized. That will change.



You and your team have put together a solid proposal for these degrees. I fully support the implementation of these degrees at NMSU.

Respectfully,

  
Anthony V. Popp  
Professor and Department Head  
Department of Economics and International Business  
College of Business  
New Mexico State University  
[apopp@nmsu.edu](mailto:apopp@nmsu.edu)



## College of Agriculture and Home Economics

Department of Agricultural Economics and Agricultural Business

MSC 3169

New Mexico State University

P.O. Box 30003

Las Cruces, NM 88003-8003

505-646-3215

505-646-3808

December 5, 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute And  
Water Science and Education Center Sub Cluster  
MSC 3167  
New Mexico State University  
P. O. Box 30001  
Las Cruces, NM 88003

Dear Dr. Wood:

In an arid land such as New Mexico, as in much of the world, it is critical in today's environment with growing population pressures on water resources, to have a vigorous effort at water education, research, and outreach programs for New Mexico. Our water supply is relatively fixed. Since the last major storage project was completed on the San Juan River, New Mexico's population has more than doubled, industrial activity has increased, and agricultural uses have intensified. Populations in our downstream neighboring states have grown even faster than in New Mexico, placing a premium on efficient and wise use of water.

The proposed graduate programs (M.S., and Ph.D.) in Water Resources Management would promote sustainable development in regards to water use and increased economic benefits to our residents. It would prepare the next generation of scientists and water managers for careers at the local, state and national levels. It would further our understanding of hydrological issues in the region and how these issues relate to the biophysical and social science in managing water. The knowledge gained from these programs can be applied to improve the availability, security and reliability of water supplies across the region for human, agricultural and industrial uses.

The Department of Agricultural Economics and Agricultural Business of the College of Agriculture and Home Economics supports the establishment of these degree programs because of the interest of our faculty and the possible coordination with our new undergraduate major in Natural Resources and Policy.

Sincerely,

A handwritten signature in cursive script, reading "Terry L. Crawford".

Terry L. Crawford  
Interim Head of Department

rml



College of Agricultural, Consumer and  
Environmental Sciences  
Department of Agricultural Economics and Agricultural Business  
MSC 3169  
New Mexico State University  
P.O. Box 30003  
Las Cruces, NM 88003-8003  
575-646-3215, fax: 575-646-3808

**Dr. Karl Wood, Director**  
Water Resources Research Institute and  
Water Science and Education Center Sub-cluster  
New Mexico State University  
Las Cruces, NM 88003

May 18, 2009

Dear Dr. Wood:

I'd like to take this opportunity to express my enthusiastic support to establish a master's and doctorate degree in water resource science and management at NMSU. Water scarcity and the debates of how to manage that scarcity are essential characteristics of New Mexico. I am confident that establishing comprehensive advanced degrees on the conservation, development, management, allocation, and use of water will support the needs of New Mexico's people. Growing population, climate change, and economic development all have the potential to create water shortages and quality issues. Producing graduates that can address these issues in a unified and objective way will be a major contribution to the state's sustainable future.

The agricultural economics and agricultural business department stands ready to join this enterprise and participate in its design, implementation, and administration. We want to contribute our part in building a professional and respected water resources science and management program at NMSU.

Sincerely,

A handwritten signature in black ink, reading "Terry L. Crawford". The signature is written in a cursive, flowing style with a long horizontal line extending from the end.

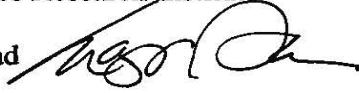
Terry L. Crawford,  
College Professor and Interim Head  
Department of Agricultural Economics and Agricultural Business

# Department of Government New Mexico State University

Date: December 4, 2008

To: Dr. Karl Wood, Director,  
New Mexico Water Resources Research Institute

From: Nancy Baker, Academic Head  
Government Department



Re: Proposed M.S. and Ph.D. in Water Resources Management

This memo is in support of the proposed new degrees: a Master of Science and a Ph.D. in Water Resources Management. Clearly these programs will serve the state and region by providing technical skills, advanced research, and outreach related to our scarce water resources. Both of these programs are more technically oriented than our Masters of Public Administration, where students study public policy (including environmental policy) and public management. For this reason, neither program duplicates what we offer in the Department of Government. In fact, they could be attractive professional degree options for students completing coursework in Government.



**College of Agriculture and Home Economics**

Department of Entomology, Plant Pathology and Weed Science,  
New Mexico State University  
MSC 3BE, Box 30003  
Las Cruces, NM 88003-8003  
Phone: (575) 646-3225  
Fax: (575) 646-8087

December 10, 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute and  
Water Science and Education Center Subcluster  
New Mexico State University  
MSC 3167, Box 30001  
Las Cruces, NM 88003

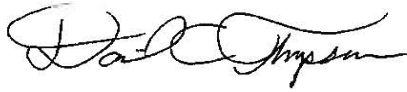
Dear Karl:

The Department of Entomology, Plant Pathology and Weed Science supports the proposal for the new Interdisciplinary Graduate Programs in Water Resources Management. There is a definite place for an interdisciplinary program that will allow students to concentrate on the importance of water to their individual research interests. The arid/semi-arid environments near New Mexico State University provide an ideal location to work on the influence of water management on the biology and control of pest populations influencing crops and animals in New Mexico and other locations around the world with similar climates.

The program will allow students flexibility in their choice of a MS or PhD program. In the past, interdisciplinary efforts have floundered because advisers were reluctant to push these programs because students were not considered part of a home department; however, the changing philosophy proposed in this document in which graduate student credit is recorded in the department of the major professor makes these programs very appealing. Additionally, we do not have a PhD program and this program would provide another mechanism to recruit and retain good graduate students to New Mexico State University and the department.

Please let me know what my faculty or I can do to support your efforts at making these programs a reality.

Sincerely,

A handwritten signature in black ink, appearing to read "David Thompson". The signature is fluid and cursive, with the first name "David" and last name "Thompson" clearly distinguishable.

Dr. David C. Thompson  
voice: 646-2740 email: dathomps@NMSU.edu

COLLEGE OF AGRICULTURE AND HOME ECONOMICS

Department of Plant & Environmental Sciences, MSC 3Q  
New Mexico State University  
P.O. Box 30003  
Las Cruces, NM 88003-8003  
Telephone: (505) 646-3405  
FAX: (505) 646-6041  
Email: [gmullins@nmsu.edu](mailto:gmullins@nmsu.edu)



December 3, 2008  
Dr. M. Karl Wood, Director  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003  
Dear Dr. Wood:

With this letter I would like to express my full support for establishing a Master of Science degree in Water Resources Management and a Doctor of Philosophy degree in Water Resources Management at New Mexico State University. The establishment of these two degree programs (in my opinion) would support the mission of my department, the College of Agriculture and Home Economics, and New Mexico State University. They would be very beneficial to the state of New Mexico and the southwestern United States.

Water is a critical natural resource for each and every citizen in the state of New Mexico and the Southwest. Every day, we all depend on a safe and reliable source of drinking water. In addition water is also critical to various industries in the state, including agriculture. Currently, approximately 76% of the water used in New Mexico goes into irrigated agriculture. In order to protect our limited water supplies for future generations and increase the efficiency of water use by all sectors in the state and the Southwest, it will be critical for New Mexico State University to train students that are able to conduct research as well extension & education programs that can protect our water supplies and increase the efficiency of water use in our state and the region. These degree programs should increase our ability to train/prepare graduates to be future leaders in these areas in New Mexico as well as the Southwest.

In 2006, cash receipts for all Agricultural Commodities Produced in New Mexico totaled \$2,463,526,000, which included \$602,427,000 for all crops. A primary goal of my department is to conduct research and educate students that will serve as future leaders in maintaining a strong, vibrant and sustainable (crop production) agricultural industry throughout the United States.

One final point is that my department regularly has several international M.S. and Ph. D. students. So, these two degrees should increase NMSU's ability to train future leaders on an international scale when these international students return to their respective countries.

Sincerely,

A handwritten signature in black ink, appearing to read "Gregory L. Mullins".

Gregory L. Mullins  
Department Head.



COLLEGE OF ENGINEERING  
DEPARTMENT OF CHEMICAL ENGINEERING, MSC 3805  
NEW MEXICO STATE UNIVERSITY  
P.O. BOX 30001  
LAS CRUCES, NM 88003-8801  
TELEPHONE: (575) 646-1214  
FAX: (575) 646-7706

December 1, 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute  
And  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

Re: Support for new programs of study: M.S. in Water Resources Management and Ph.D. in Water Resource Management

Dear Dr. Wood,

The state of New Mexico has acute needs with respect to water quality and water quantity. Our citizens need cost-effective and energy efficient technologies to produce water for human, agricultural and industrial uses. Water is a precious resource. The Department of Chemical Engineering at New Mexico State is involved in projects to purify drinking water by removing arsenic and other heavy metals, as well as to desalinate the brackish water found in the Tularosa Basin.

The M.S. and Ph.D. degrees in Water Resources Management would codify the extensive activity in water research being done at NMSU into programs of study that would allow students to demonstrate their emphasis on water resource management. These programs will not require any new classes or faculty, but will take advantage of the extensive activity already occurring at NMSU. The success of the water subcluster is indicative of the strong infrastructure already existing at NMSU supporting water research. Following up on this proposal for new programs with an NSF IGERT proposal is an excellent idea.

The Department of Chemical Engineering supports the proposal for new M.S. and Ph.D. programs in Water Resources Management.

Sincerely,

A handwritten signature in black ink, appearing to read "Martha C. Mitchell". The signature is fluid and cursive, with a long horizontal stroke at the end.

Martha C. Mitchell, Ph.D.  
Professor and Dept. Head  
Chemical Engineering  
New Mexico State University

CC: Steven Castillo, Dean, College of Engineering, New Mexico State University





**College of Agriculture and Home Economics**

Department of Animal and Range Sciences, MSC 3-I

New Mexico State University

P.O. Box 30003

Las Cruces, NM 88003-8003

Tel: 575-646-2514, fax: 575-646-5441

November 17, 2008

Dr. Karl Wood, Director  
Water Resources Research Institute and  
Water Science and Education Sub-cluster  
MSC 3167  
New Mexico State University  
PO Box 30001  
Las Cruces, NM 88003

Dear Dr. Wood:

The Department of Animal & Range Sciences supports the development of a Master and Doctoral program in Water Resources Management at New Mexico State University.

Water is the life blood of the agricultural industry. Livestock makes up about 75% of the agriculture commodities in New Mexico. Water is of greatest importance to the success of the dairy, beef, sheep and equine industries in our state. New Mexico is one of the driest states in the U.S. and has recently experienced a drought that has imposed many hardships to our range livestock producers and the dairy industry. However, quantity of water is not the only problem. Water quality is also a problem experienced by the livestock industry. Water quality issues not only impact livestock performance and health, but also impact the quality of life of those people living in the rural ranching communities of New Mexico.

New Mexico State University currently addresses many water issues. However, these efforts are spread over several colleges and departments. A graduate program in water resource management will provide a means to organize these programs into a cohesive program that can train the water resource administrators and scientists of the future.

New Mexico State University has the opportunity to be the front runner in providing the expertise to address the water issues of the future. I recommend we take the logical step in that direction by approving the Master and Doctoral Programs in Water Resource Management.

Respectfully,

A handwritten signature in black ink, appearing to read "Tim Ross", with a stylized flourish extending from the end.

Tim Ross  
Interim Department Head

**Geological Sciences**

New Mexico State University

MSC 3AB, Box 30001

Las Cruces, NM 88003-8001

Phone: (575) 646-2708

Fax: (575) 646-1056

<http://www.nmsu.edu/~geology/>

19 November 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
PO Box 30001  
Las Cruces, NM 88003

Dear Karl:

The Department of Geological Sciences here at NMSU is excited about the proposed Master and Doctoral Degrees in Water Resources Management. It is difficult to think of a topic that will be more important in the future to New Mexico, the nation, and the global economy. Water issues will far outstrip even petroleum issues in the next few decades. Few people recognize that some of the world's fastest growing population centers on our planet occur in some of the most water-starved deserts! Certainly, as New Mexico continues to grow and attract high-tech businesses, water issues will become foremost on political, economic, and education agendas. The time is overdue that NMSU provides graduate degrees in water resources management.

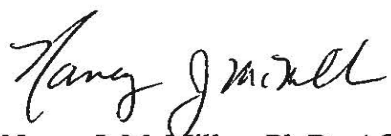
The proposed graduate degrees are significant because they build on an interdisciplinary base of scientific, engineering, and technical expertise at NMSU. To rigorously approach water problems, one must understand the geologic, chemical, physical, economic, and anthropologic aspects of the issue. All of these are complexly intertwined. Thus, the proposed degrees, in which all colleges and many departments will participate, are built on this foundation of interdisciplinary scholarship.

Here in Geological Sciences, we discuss water issues in every class we teach; the distribution of water in our planet and its effects on the chemical and physical properties of Earth materials are fundamental to understanding most geologic processes. Because of this, all six of our faculty members can contribute in some way to graduate research in the new degree programs. Dr. Greg Mack, for instance, is a nationally-recognized expert in the stratigraphy of the sands and gravel deposits that constitute the Mesilla Valley aquifers. I have an interdisciplinary research project with Dr. Michael Johnson, Chemistry and Biochemistry,

comparing natural and synthetic iron oxides and oxyhydroxides for removal of As from drinking water. We are eager to participate on graduate student research projects, and to have graduate students from our department earn Water Resources degrees.

I support this effort whole-heartedly!

Sincerely,

A handwritten signature in black ink, reading "Nancy J. McMillan". The signature is written in a cursive, flowing style.

Nancy J. McMillan, Ph.D., AOJN  
Professor of Geology  
Academic Department Head, Geological Sciences



## College of Health & Social Services

Department of Health Science  
MSC 3HLS  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003-8001  
Tel: 575-646-4300, fax: 575-646-4343  
[www.nmsu.edu/~hlthdpt](http://www.nmsu.edu/~hlthdpt)

November 5, 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute, and  
Water Science and Education Center Sub-cluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

Dr. Wood:

I write in full support of the proposed M.S. and Ph.D. degree programs in Water Resources Management.

It is difficult to think of a topic that has greater importance in the arid region of the Southwest portion of the United States, and beyond.

Given that the U.S. population has now exceeded 300 million, and it is predicted to surpass 400 million within the next 35 years; and given that only 1% of all water on this earth exists as fresh drinking water (1/5 of which exists as surface water in lakes and rivers while 4/5 exists as groundwater); the logical conclusion is that we as a people have an urgent responsibility to manage our existing water resources with the utmost care.

Few degrees prepare students adequately in water resources management. Thus, there is a distinct shortage of innovative experts and leaders in this area, and yet the need is overwhelming.

We as a society in New Mexico have the responsibility to provide educated water resource professionals to work with policy makers, communities, the agricultural industry, manufacturers in industry, and more. All of these needs extend well beyond New Mexico to include the entire U.S. and our fellow countries throughout the world.

Sincerely,

A handwritten signature in cursive script that reads "Stephen D. Arnold".

Stephen D. Arnold, Ph.D.  
Professor and Interim academic Department Head



**College of Agriculture and Home Economics**

Department of Fish, Wildlife and Conservation Ecology

MSC 4901

New Mexico State University

P.O. Box 30003

Las Cruces, NM 88003-8003

Tel: 575-646-1544, fax: 575-646-1281

E-mail: fwce@nmsu.edu

cahe.nmsu.edu/academics/fws

4 November 2008

Dr. M. Karl Wood, Director  
Water Resources Research Institute and  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

Dear Dr. Wood:

Water is clearly one of the most important natural resources in New Mexico, the Chihuahuan Desert, and adjoining arid regions of the southwestern United States and Mexico. Not only is water critical for human occupation of arid environments, it is equally critical to the persistence of endemic fish and wildlife species.

The Department of Fish, Wildlife & Conservation Ecology enthusiastically supports water education, research and outreach programs. The proposed Master's and Doctoral degree programs in Water Resources Management will provide desperately needed training for future management of water resources and they will raise awareness among water professionals of the important tenets of sustainable development. The proposed degree programs will integrate a highly interdisciplinary focus in the degree program and will help alleviate a serious shortfall amongst water managers to address simultaneously human social, cultural, and economic needs for water with those of threatened and endangered fish and wildlife species that equally depend on sound water management and the natural habitats so highly valued by Society.

We endorse without reservation these new degree programs and stand ready to help train Tomorrow's leaders in water resources management.

Sincerely,

A handwritten signature in black ink, appearing to read "Raul Valdez".

Raul Valdez, Professor and Department Head

December 18, 2008

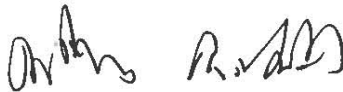
Dr. M. Karl Wood, Director  
Water Resources Research Institute  
And  
Water Science and Education Center Subcluster  
MSC 3167  
New Mexico State University  
P.O. Box 30001  
Las Cruces, NM 88003

The need to understand our water resources is very evident. While the amount of water available is limited, the needs, with increasing population, are not. Aside from simply enabling the conservation of the water that is available and implementing its efficient dispersal, major health issues are also associated with our ability to understand all aspects of water. Aside from the overall lack of water, our country, including New Mexico, suffers from floods every year. The ability to regulate so as to have minimal waste of the flood water is also important.

Water, common and essential as it is, is a very complex substance. Research in this area is likely to bear fruit in the furthering of our understanding of this precious liquid. Of course the results of such studies need to be communicated to students and, eventually, to the population at large.

Such a program would be well carried out through graduate education at New Mexico State University. It seems entirely appropriate that the state's land grant college would be the one to take the lead in this effort. The agriculture sector is generally the first to feel the effects of drought or poor water management. The best way to advance these studies is by creating a degree program. Graduates from this program will be qualified to be researchers and managers in the many oversight agencies of the state and federal governments. The degree program would also help to promote New Mexico State University as center of excellence where national and international researchers can come to study and participate in the understanding of water and its control.

In summary, I wish to support strongly the creation of the Master's and Doctoral programs in Water Resources Management at New Mexico State University. They will serve the University, the state and the country well.



William R. Gibbs

Interim Department Head, Department of Physics

COLLEGE OF ENGINEERING  
Civil Engineering Department  
MSC-3CE, P.O. Box 30001  
New Mexico State University  
Las Cruces, NM 88003-8001  
Telephone: (505) 646-3801  
FAX: (505) 646-6049



December 19, 2008

To: Dr. Karl Wood  
Director, New Mexico Water Resources Research Institute  
and Chair of the NMSU Water Resources Subcluster

From: Dr. Ricardo Jacquez, P.E. *[Signature]* for RBJ  
Interim Department Head, Civil Engineering Department

Cc: Dr. N. Khandan, Dr. A. T. Hanson, Dr. Z. Samani, Dr. A. S. Bawazir, Dr. J. P. King

Re: MS and Ph.D. programs in Water Resources Management

Karl,

The faculty of the Civil Engineering Department support the interdepartmental Masters and Doctorate programs proposed by the Water Resources Subcluster. We have a long tradition of Water Resources Engineering, and we believe that these programs have the potential to raise the overall capacity and reputation of NMSU in the broader fields of Water Resources.

Our faculty members of the Water Resources Subcluster look forward to working with you to move forward with the development of the programs.

DEPARTMENT OF GEOGRAPHY

Breland Hall 107  
New Mexico State University  
MSC MAP / P.O. Box 30001  
Las Cruces, New Mexico 88003-8001

(505) 646-3509 Voice  
(505) 646-7430 FAX  
URL: <http://www.nmsu/~geoweb/>



Dr. Karl Wood, Director  
Water Resources Research Institute and  
Water Science and Education Center Subcluster  
New Mexico State University  
Las Cruces, NM 88003

22 December 2008

Dear Dr. Wood,

It is with considerable interest that I recently reviewed the proposal you and others at New Mexico State University (NMSU) have developed for an M.S. and Ph.D. in Water Resources Management. New Mexico and other states in the arid southwestern U.S. face a range of water resource management issues at present, and these are likely to increase in severity in the coming years. Increasing population levels are intersecting with the inherent aridity of the region to generate major water supply issues, and these challenges are likely to increase as climate change impacts the region. Water quality issues related to a range of human uses will also become increasingly serious.

The proposal you and others have developed speaks very well to these challenges, and your team has developed a well thought out approach to advance education of students at the Masters and Ph.D. levels that will effectively inform these students of the challenges we face and the tools needed to meet them. The goals you outline for these degree programs support this approach very well and are also very consistent with the long range planning NMSU is doing under the Living the Vision plan. You have assembled a very strong team of faculty from many departments across several colleges, and this will insure a strong interdisciplinary approach to both research and education.

The professionals you will train in these degree programs will be well suited to help meet the water resource challenges noted above, and this capability will greatly benefit economic development and the social welfare of people living in New Mexico and other parts of the arid southwestern U.S. This is a most timely proposal in an area of major importance to the State of New Mexico with considerable potential. I strongly endorse the proposal you have developed and wish you well in advancing this effort that will train the next generation of water resource managers in New Mexico.

Best regards,

A handwritten signature in black ink, appearing to read 'Christopher Brown'.

Dr. Christopher Brown, Associate Professor  
Director of the NMSU Spatial Applications Research Center





## College of Arts and Sciences

Department of Biology

New Mexico State University

MSC 3AF, P.O. Box 30001

Las Cruces, NM 88003-8001

505-646-3611, fax: 505-646-5665

<http://biology-web.nmsu.edu/>

January 4, 2009

Dr. M. Karl Wood, Director

Water Resources Research Institute and Water Science and Education Center Subcluster

New Mexico State University MSC 3167

Las Cruces, NM 88003

Dear Dr. Wood:

It is a pleasure to write to you on behalf of the Department of Biology to endorse and support your proposal to initiate masters and doctoral degree programs in water resource management at NMSU. In addition to increasing interaction and collaboration among the 85 NMSU faculty members doing water-related research, these degree programs will provide improved opportunities for training graduate students working with them. It will also dramatically increase recruitment of excellent new graduate students. Research and student-training opportunities are likely to grow as well, through funding opportunities for which only graduate degree programs are eligible. The new degree programs will also bring focus and coordination to the nearly 200 undergraduate and graduate courses related to water at NMSU, and those courses in turn will attract more students.

We live at a time of increasing demands for water and of decreasing supplies. This is due to growth in New Mexico's population, industry, and agriculture, compounded by rapidly accelerating climate change. As the state's land-grant institution, NMSU must take the lead in providing the professional expertise and leadership to carefully manage New Mexico's water and, through outreach, help the state's water users use their water efficiently. The most important contribution of the new degree programs, therefore, will be the training of qualified individuals to take on these tasks throughout the 21<sup>st</sup> Century.

NMSU can and must become a beacon, especially to arid and drought-stricken lands throughout the U.S. and the entire world, in training professionals to do research on water issues and in showing people how to manage their water resources. Because of the fundamental importance of water to life, these tasks are critical to every biologist studying any organism in any ecosystem. I therefore pledge the support and participation of the NMSU Department of Biology in the development of these new degree programs.

Sincerely,

A handwritten signature in black ink, appearing to read "Marvin H. Bernstein".

Marvin H. Bernstein, Ph.D.

Regents Professor and Interim Department Head

DEPARTMENT OF GEOGRAPHY

Breland Hall 107  
New Mexico State University  
MSC MAP / P.O. Box 30001  
Las Cruces, New Mexico 88003-8001

(505) 646-3509 Voice  
(505) 646-7430 FAX  
URL: <http://www.nmsu/~geoweb/>



Dr. Karl Wood, Director  
Water Resources Research Institute and  
Water Science and Education Center Subcluster  
New Mexico State University  
Las Cruces, NM 88003

May 15<sup>th</sup>, 2009

RE: Support for M.S. and Ph.D. in Water Resources Management

Dear Dr. Wood:

As Head of the Department of Geography, I strongly support the proposal to create M.S. and Ph.D. graduate degree program in Water Resources Management at NMSU. Aridity is the essential defining trait of New Mexico and the Southwest. Offering advanced degrees focused on water quantity, quality, policy, and management is extremely relevant and sensible. Population pressures are placing great challenges as we seek a balance between agriculture, urban uses, and natural systems. Water supply is the most pressing subject faced by New Mexico as we grow.

I am impressed by the proposal that you and other colleagues at NMSU have prepared. The Geography Department stands ready to join this effort and participate in its implementation. We have strong skills in natural resources, land use planning, and geospatial analysis that will be of significant help in building a professional and respected Water Resources Management program at NMSU.

We strongly support your proposal and look forward to being of assistance in the future.

Sincerely,

A handwritten signature in dark ink, appearing to read 'John Wright', with a long horizontal flourish extending to the right.

Dr. John Wright, Head  
Department of Geography  
575-646-4806  
[jowright@nmsu.edu](mailto:jowright@nmsu.edu)

## Appendix D

### Qualifications of Faculty in The Water Science and Education Center

Faculty members that are members of the Water Science and Education Center and are conducting water teaching and research are listed below. A one-page vitae for each of them can be found at: <http://research.nmsu.edu/water/waterMembers.html>

Arnold, N., Richard (Revegetation with produced water)  
Arnold, Stephen (Environmental health)  
Baker, T., Red (Riparian & forest ecology and management)  
Bawazir, Salim A. (Evapotranspiration/Irrigation and drainage)  
Bleiweiss, Max (Remote sensing)  
Boeing Wiebke (Aquatic ecology)  
Boyle Jr., Bill (Water testing and analysis)  
Brinegar, Hillary (Economics and policy)  
Brown, Chris (GIS applications and binational water research)  
Brown, Susan (Water education)  
Caldwell, Colleen A. (Aquatic contaminants and toxicology)  
Camacho, Lucy Mar (Groundwater contamination and remediation)  
Cowley, David (Aquatic ecology)  
Creel, Bobby J. (Economics and policy)  
DeMers, Michael N. (Geographic information systems)  
DeMouche, Leeann (Economics and policy)  
Deng, Shuguang (Water treatment technology)  
Dugas, Daniel (Geomorphology)  
Falk, Constance (Organic horticulture production)  
Fernald, Sam (Water quality hydrology)  
Garcia, Z., Jose (Water policy on the U.S./ Mexico border)  
Ghassemi, Abbas (Energy and water management)  
Goss, Ryan (Irrigation of turfgrass)  
Gould, Bill (Statistical analysis)  
Guldan, Steven (Acequia irrigation systems)  
Hadjigeorgails, Ereny (Water markets and economics)  
Hanson, Adrian T. (Small community water and wastewater systems)  
Herrick, Jeffrey (Ecosystem disturbance ecology and monitoring)  
Hurd, Brian (Economics and policy)  
Johnson, Michael (Environmental applications of ferrate ion,  $\text{FeO}_4^{2-}$ ; arsenic, selenium and antimony remediation from ground water)  
Khandan, Nirmala (Desalination, produced water treatment, sustainable technologies)  
King, James Philip (Surface water hydrology)  
Lara, Antonio S. (Water quality and arsenic removal)  
Lawton, Tim (Sedimentation and tectonics)  
Leinauer, Bernd (Irrigation water conservation, irrigation of turfgrass with saline and potable water)  
Lindemann, C., William (Soil microbiology and environmental contamination)  
Loya, James M. (Desalination and water education)

Mack, H., Greg (River deposition and channel behavior)  
Maitland, Julie (Water policy and law)  
McGuckin, Thomas (Economics and policy)  
Mexal, John (Land application of wastewater)  
Mimbela, Luz Elena Y.  
Mitchell, Martha (Water quality and arsenic removal)  
Monger, Curtis (Geomorphology and paleoclimatology)  
O'Neill, Mick (Microirrigation and water management)  
Peach, Jim (Demographics and water demand)  
Phillips, Rich (Hydrology and forest regeneration)  
Picchioni, Geno (Plant physiology and water stress)  
Popp, Anthony (Water policy and public finance)  
Rango, Albert (Snow hydrology, climate change, and remote sensing)  
Remmenga, Marta (Statistical modeling)  
Rockstraw, David (Water treatment technology)  
Runyan, Craig (Agricultural water use, Extension outreach, Project management)  
Samani, Zohrab A. (Water resource development)  
Sallenave, Rossanna (Aquatic research)  
Sanderson, Robert (Geographic Information Systems modeling)  
Schmugge, Thomas (Remote sensing and soil moisture & evapotranspiration)  
Schroeder, Jill (Water use by plants)  
Shukla, Manoj (Chemical fate and transport in soils)  
Skaggs, Rhonda (Irrigation economics and water policy)  
Smeal, Daniel (Consumptive-use of agricultural and horticultural crops)  
Smith, Curis (Urban horticulture and irrigation efficiency)  
Smith, Geoffrey Battle (Environmental microbiology)  
Smits, Robert (Stochastic transport of chemicals and biological mechanisms in porous media)  
St. Hilaire, Rolston (Environmental stress physiology)  
Starbuck, Maghan (Environmental and natural resource issues)  
Stringam, Blair L. (Irrigation, Open Channel Flow Measurement, Sensor Applications)  
Kenny Stevens (Solar water distillation and groundwater hydrology)  
Tartowski, Sandy (Collaborator, USDA-ARS Jornada Experimental Range)  
Thompson, Roseann (Groundwater hydrology)  
Ulery, April (Poor quality water for irrigation)  
Unc, Adrian (Organic waste management)  
Urquidi, Jacob (Physics of molecular liquids (water in particular) and amorphous materials)  
Vilchis, Hugo (Water borne diseases and community health)  
Ward, Erin (U.S.-Mexico Border environmental policy)  
Ward, Frank (Economics and policy)  
Widner, Benjamin (Urban and regional economics)  
Wood, Karl (Runoff and erosion)  
Watkins, Cindy (Agriculture and life sciences librarian)

## **Appendix E**

### **Curriculum Vitae of Core/Substantive Faculty on Steering Committee of the Water Science and Education Center**

#### **Dr. M. Karl Wood**

##### **Director New Mexico Water Resources Research Institute**

New Mexico State University

Las Cruces, NM 88003-8001

P.O. Box 30001, MSC 3167

Office: 575-646-4337

Fax: 575-646-6418

Email: [kwood@wrri.nmsu.edu](mailto:kwood@wrri.nmsu.edu)

##### **Education**

1974 B.S. Forestry and Range Management, University of Nevada at Reno

1976 M.S. Range Soils, University of Nevada at Reno

1979 Ph.D. Rangeland Watershed Management, Texas A&M University

##### **Professional Experience**

1979-2000 Assistant Professor, Associate Professor, and Professor of Watershed Management, Department of Animal and Range Sciences and Member of the Range Improvement Task Forces, New Mexico State University

2000 to present Director of the New Mexico Water Resources Research Institute

##### **Primary Research Interests**

Watershed Management, Surface Hydrology, Erosion Processes, Water Law and Policy

##### **Professional Activities and Honors (last 6 years)**

Current Chair of the Lower Rio Grande Water User's Organization

Co-Chair of the New Mexico-Texas Water Commission

Past Chair of the Paso del Norte Water Task Force

Past President of the Universities Council on Water Resources

Past President of the New Mexico Section of the Society for Range Management

## **Dr. Frank A. Ward**

### **Professor Agricultural Economics and Agricultural Business**

New Mexico State University

Las Cruces, NM 88003-8001

P.O. Box 30001, MSC 3169

Office: 575-646-1220

Fax: 575-646-3522

Email: [fward@nmsu.edu](mailto:fward@nmsu.edu)

### **Education**

1978 Ph.D Economics, Colorado State University

1975 M.S. Economics, Colorado State University

1970 B.S. Economics, Colorado State University

### **Professional Experience**

1978-1983 Assistant Professor, Natural Resource Economics, New Mexico State University

1983-1988 Associate Professor, Natural Resource Economics, New Mexico State University

1988-present Professor, Natural Resource Economics, New Mexico State University

### **Primary Research Interests**

Water Resource Economics and Policy

### **Professional Activities and Honors (last 6 years)**

Publication of numerous papers in refereed journals and two books

Numerous contracts and grants

## **Dr. Abbas Ghassemi**

Professor, Chemical Engineering  
Director, Institute for Energy & Environment  
New Mexico State University  
P.O. Box 30001, MSC WERC  
Las Cruces, NM 88003-8001  
Office: 575 646-2357  
Email: [aghassem@nmsu.edu](mailto:aghassem@nmsu.edu)

### **Education**

1979 B.S. Chemical Engineering, Minor in Mathematics, University of Oklahoma  
1989 M.S. Chemical Engineering, Minor in Experimental Statistics, New Mexico State University  
1990 Ph.D. Chemical Engineering, Minor in Experimental Statistics, New Mexico State University

### **Professional Experience**

2006-present Institute for Energy & Environment Director  
1999-present WERC Executive Director  
1996-1999 WERC, Director of Research and Professor of Chemical Engineering  
1989-1996 WERC, Director Special Projects and Technology Transfer  
1990-1992 GMA Inc., Environmental Engineering Manager  
1983-1990 G&H Corporation, Partial Owner and Managing Director  
1977-1988 Monsanto/Fisher Controls, Intl.

### **Primary Research Interests**

Risk-based decision making; pollution prevention and energy efficiency; multiphase flow and process control, management, and modification; waste management and environmental restoration;

## **Dr. Stephen D. Arnold**

Professor, Department of Health Science  
P.O. Box 30001, MSC 3HLS  
New Mexico State University  
Las Cruces, NM 88003  
Office: 575-646-4160  
Fax: 575-646-4343  
Email: [sarnold@nmsu.edu](mailto:sarnold@nmsu.edu)  
Website: <http://web.nmsu.edu/~sarnold/>

### **Education**

1984 B.S. Biology and Chemistry, New Mexico State University  
1989 Ph.D. Environmental Health and Industrial Hygiene, Colorado State University

### **Professional Experience**

1998-present Professor, Associate Professor, Academic Department Head, Graduate Program Coordinator, Visiting Associate Professor, New Mexico State University  
1990-1998 Associate Professor, Assistant Professor, Environmental Health Program Director, Professional Practice Coordinator, Private Industrial Hygiene Consultant, Illinois State University  
1989-1990 Postdoctoral Research Fellowship in Industrial Hygiene Toxicology

### **Primary Research Interests**

Environmental health, occupational health, and industrial hygiene

### **Professional Activities and Honors (last 6 years)**

2000 Donald C. Roush Award for Teaching Excellence, NMSU  
2000 Outstanding Student Mentor in NMSU WERC Undergraduate Fellowship Program  
2003-2004 Executive of the Year, Mesilla Valley Chapter of the International Association of Administrative Professionals



## **Dr. James T. Peach**

Regents Professor, Department of Economics and International Business,  
Co-director, Office of Policy Analysis, Arrowhead Center  
New Mexico State University  
P.O. Box 30001, MSC 3CQ  
Las Cruces, NM 88003  
Office: 575-646-3113 or 575-646-2112  
Fax: 575-646-1915  
Email: [jpeach@nmsu.edu](mailto:jpeach@nmsu.edu)

### **Education**

1967 B.A. Mathematics, University of Texas at Austin  
1978 Ph.D. Economics, University of Texas at Austin

### **Professional Experience**

2002-present Regents Professor of Economics, New Mexico State University  
1999-2002 Robert O. Anderson Distinguished Professor, New Mexico State University  
1994-1999 Professor of Economics, New Mexico State University  
1984-1994 Associate Professor of Economics, New Mexico State University  
1980-1984 Assistant Professor of Economics, New Mexico State University  
1978-1980 President, Simulation Systems, Inc., Austin, Texas  
1979-1980 Assistant Professor, Department of Management, Marketing, and General Business,  
Southwest Texas State University  
1976-1979 Economic Consultant, United States Agency for International Development, Dacca,  
Bangladesh  
1973-1976 Research Assistant, Computer Based Education Project, at The University of Texas at  
Austin  
1975-1976 Teaching Assistant, Department of Economics, The University of Texas at Austin  
1973 Systems Analyst, General Land Office of the State of Texas  
1969-1972 Computer programmer-analyst, U.S. Air Force, Kelly Air Force Base, San Antonio,  
Texas  
1967-1969 Mathematician, University of Oklahoma Research Institute, Field Artillery Research  
Office, Ft. Sill, Oklahoma

### **Primary Research Interests**

Economic development (including water issues)  
Population economics (including implications for Water Demand)  
U.S.-Mexico economic relations  
Income distribution

### **Professional Activities and Honors (last 6 years)**

2002 NMSU Regents Professorship  
1999-2002 Robert O. Anderson Distinguished Professorship, NMSU College of Business

## **Dr. Susan W. Brown**

Director, STEM Projects  
College of Education  
P.O. Box 30001, MSC 3R  
New Mexico State University  
Las Cruces, NM 88003-8001  
Office: 575-646-1397  
FAX: 575-646-7710  
Email: [susanbro@nmsu.edu](mailto:susanbro@nmsu.edu)

### **Education**

2000 Ph.D. Curriculum and Instruction, New Mexico State University  
1988 Elementary Certification, Curriculum and Instruction, New Mexico State University  
1981 M.A. Education, Curriculum and Instruction, New Mexico State University  
1970 B.A. New Mexico Highlands University

### **Professional Experience**

2004-Present NASA Aerospace Education Specialist  
2004-Present MathStar, Mathematically Connected Communities, ENLACE, Evaluator  
2001-Present Southern New Mexico Science, Engineering, Mathematics, and Aerospace Academy, Project Director  
2002-Present MAXIMA, Pathways for Excellence, HP University and K-12 Connection, HP and Math 115, 185, Project Director  
1999-Present New Mexico Collaborative for Excellence in Teacher Preparation, SNMSEMAA, New Mexico State University, Program Curriculum Coordinator, Project Director  
1994-Present Instructor of Science and Math Methods for Early Childhood, Elementary and Secondary Teachers, EMD How to Write Grants, New Mexico State University

### **Primary Research Interests**

Science Education, Science for All Students, Engaging Science Curriculum

### **Professional Activities and Honors (last 6 years)**

2004 New Mexico State University Research Award  
2004 NASA Partnership and Sustainability Award  
2003 Presidential Star Award, New Mexico State University  
2000 Larus Award, Outstanding Research Presentation at the AAAS meeting

## **Dr. Jacob Urquidi**

Professor  
Department of Physics  
New Mexico State University  
P.O. Box 30001, MSC 3D  
Las Cruces, NM 880003-004  
Office: 575-646-5199  
Fax: 575-646-1934  
Email: [jurquidi@nmsu.edu](mailto:jurquidi@nmsu.edu) or [jurquidi@lanl.gov](mailto:jurquidi@lanl.gov)

### **Education**

2001 Ph.D. Physical Chemistry, Texas Tech University  
2000 M.S. Physical Chemistry, Texas Tech University  
1994 B.S. Chemistry with a minor in Physics, University of Texas at El Paso

### **Professional Experience**

2003-present New Mexico State LANSCE Professor of Physics, New Mexico State University and Los Alamos Neutron Scattering Center (LANSCE), Lujan Center, Los Alamos National Laboratory  
2001-2003 Postdoctoral Research Scientist on disordered materials at the Intense Pulsed Neutron Source (IPNS), Argonne National Laboratory  
2000-2001 Chemistry Faculty, Assistant Professor, South Plains Junior College  
1996-2001 Research Assistant, SPQR Labs, Dept. of Chemistry and Biochemistry, Texas Tech University

### **Primary Research Interests**

Molecular liquids (water in particular) and amorphous materials (e.g., high and low density amorphous ice and optically relevant glasses) through the use of neutron and high energy X-ray diffraction techniques combined with molecular dynamics (MD) and reverse Monte Carlo (RMC) simulations as aids in data interpretation; the use of plants in remediation of areas contaminated with heavy metals; microheterogeneity in water/alcohol systems and how this may shed light on the hydrophobic

## **Dr. Alexander Fernald**

Assistant Professor of Watershed Management  
Department of Animal and Range Sciences  
New Mexico State University  
Las Cruces, New Mexico 88003  
Office: 505-646-1041  
Email: fernald@nmsu.edu

### **Education**

1997 Ph.D. Watershed Science, Colorado State University  
1993 M.E.M. Water and Air Resources, Duke University  
1987 B.A. International Relations, Stanford University

### **Professional Experience**

2001-Present Assistant Professor, Watershed Management, Department of Animal and Range Science, New Mexico State University  
2001 Extension Natural Resource Specialist, College of Agriculture and Home Economics, New Mexico State University  
2000 Fulbright Scholar, University of Concepción, Concepción, Chile  
1997-2000 National Research Council Postdoctoral Associate, U.S. EPA

### **Primary Research Interests**

Water quality hydrology; land use effects on infiltration, runoff, sediment yield, and nonpoint source pollution; effects of surface water/groundwater exchange on water availability and water quality

## **Dr. Christopher Brown**

Associate Professor, Department of Geography,  
New Mexico State University, Las Cruces, New Mexico, 88003  
Director, Spatial Applications and Research Center  
Office: 505-646-1892  
Fax: 505-646-7430  
Email: brownchr@nmsu.edu

### **Education**

1998 Ph.D. Geography, San Diego State University/ University of California at Santa Barbara  
1991 MA Geography, Michigan State University  
1986 BA Economics, San Diego State University (honors)

### **Professional Experience**

2005-Present Associate Professor of Geography, Director of Spatial Applications and Research Center, New Mexico State University  
2000-2005 Assistant Professor of Geography, New Mexico State University  
1997-2000 Assistant Professor of Geography and Planning, West Chester University  
1999 Ford Foundation/Udall Center Fellow, Udall Center for Studies in Public Policy, The University of Arizona  
1993-1997 Ph.D. Research Associate, Department of Geography, San Diego State University  
1991-1992 Research Specialist, Institute of Water Research and Center for Remote Sensing, Michigan State University  
1990-1992 GEMNET Coordinator  
1988-1989 Research Assistant, Michigan Department of Natural Resources, Michigan Resource Information System

### **Primary Research Interests**

U.S./Mexico border water resource issues; U.S./Mexico border environmental management

## **Appendix F**

### **NMSU Support Services**

#### **THE UNIVERSITY**

New Mexico State University (NMSU) is a thriving center of higher education deeply rooted in the multicultural tradition of the Southwest. Situated at the gateway to Mexico, the university's 6,250-acre campus is among the largest in the world. It was founded in 1888 as Las Cruces College. The university was established the next year as a land-grant college by an act of the Legislative Assembly of the Territory of New Mexico in accordance with provisions of the Morrill Act. During that time, NMSU became known as New Mexico College of Agriculture and Mechanic Arts. The institution grew steadily over the next 71 years, fulfilling its purpose as a nonsectarian center of learning in the broadest possible service to the state and nation. The growth and maturity of the institution was formally recognized in 1960 when the constitution of New Mexico was amended to change the name to New Mexico State University. Today, the university's students can major in 77 areas of undergraduate study in six undergraduate colleges. The Graduate School offers 50 areas of study on the master's level, 3 areas on the specialist in education level, and 24 on the doctoral level. The university offers degrees through the doctorate and is accredited by The Higher Learning Commission of the North Central Association of Colleges and Schools (NCA). In addition, many departments and colleges are further accredited by organizations serving their special fields.

New Mexico State University is the state's land-grant university, serving the educational needs of New Mexico's diverse population through comprehensive programs in education, agriculture, engineering, and public service. In its growth and expansion, the university has achieved distinction in many special fields. It has on its campus one of the three full-time planetary observatories in the nation, as well as one of the largest computer centers in the Southwest. NMSU ranks in the top two percent of institutions in the nation for providing access to personal computers for students. The Department of Journalism and Mass Communication initiated the state's first student-operated AM station, and staff and student-operated FM and TV stations. In its ratings of universities, the Carnegie Foundation for the Advancement of Teaching has placed NMSU in the category of Doctoral/Research University Extensive. Only 150 other institutions were granted this recognition. NMSU has over \$181.1 million in total sponsored program expenditures and ranks 108th of 601 institutions in research and development expenditures. The university's central campus is located at the southernmost interchange of the Pan American Highway, Interstate 25, in southern New Mexico. Also bordering the campus is Interstate 10, the principal east-west route across the southern United States. The university is adjacent to Las Cruces, New Mexico.

#### **THE GRADUATE SCHOOL**

A number of academic departments of the university have a long history of providing formal graduate study. The first master's degree was awarded in 1896. In 1921, an organization was established to supervise graduate study when the president appointed a committee to supervise the work. The Graduate School, formally established in 1956 with a full-time dean, is one of the

fastest growing divisions of the university. In 1956, 57 master's degrees were awarded. From 2005-2006, the following were awarded: 6 specialists in education degrees, 835 master's degrees; and 79 doctoral degrees. The Graduate School currently enrolls 3,205 students pursuing advanced degrees with about 626 pursuing the doctorate.

Fellowships, assistantships, and special loan programs are available in growing numbers and value for students who have achieved good academic records in their undergraduate and/or graduate programs. With the rapidly expanding facilities, laboratories, and library holdings, the Graduate School of New Mexico State University offers unique programs of high quality graduate study. The graduate faculty consists of 592 professors and adjunct professors. The Graduate School mission is to facilitate the exchange of ideas and the creation of knowledge, while fostering academic excellence. The Graduate School promotes a high quality-learning environment that embraces diversity. New Mexico State University is one of the few research extensive universities that reflect Hispanic, Native American, other American cultures and cultures of the world. Our international students from Latin American, Asian, African, and European countries add to the richness of our diversity. The quality of life for our students is of critical importance to the Graduate School and NMSU. It cultivates the marriage of academic, professional, and personal skills while helping students graduate in a timely manner. The Graduate School strives to provide quality services to students, faculty and staff. It processes applications and oversee the admissions process among departments; process transfer of credit requests; maintain the schedule of oral examinations; provide editorial assistance for candidates preparing theses and dissertations; manage graduate assistant employment; certify degree completion and provide scholarships and grants. Professional development workshops are offered for students on a range of topics. To ensure that students receive the best advice from faculty, academic advising workshops are offered to faculty and staff.

The Graduate School ensures the quality of graduate programs by carefully reviewing and approving new graduate programs and by periodic review of existing programs. It ensures the quality of faculty by overseeing their appointment to and reappointment as members of the graduate faculty.

## Appendix G

### Library Impact Statement

#### Summary

The NMSU Library's monographic collection supports many graduate programs in the sciences and some in the social sciences. When taking the broader subject view, the collection has strengths in many areas of potential relevance to interdisciplinary study of water science and management. The Library's federal government documents collection and archives collections also offer strong support for advanced study in this area.

When focusing on the 14 subject areas that are core to this field, however, both the University of Arizona (7,425) and the University of Wyoming (3,424) have more titles than NMSU with the University of Arizona having more than twice as many titles. Although our collection is a decent size and is relatively current, without ongoing, external funding, water-related collections will not continue to flourish as they have for the past 10 to 20 years. The funding source (PNM Foundation) that has provided significant support for some more recent acquisitions is no longer available.

The Library offers excellent coverage of research literature related to water science and management through databases such as *Science Citation Index*, *CAB Abstracts*, and through important database packages such as *Environmental Sciences and Pollution Management*. The Library subscribes to the subject specific database *Water Resources Abstracts* which provides significant research assistance. Adding the open source databases will enhance our collection.

This report recommends that a total of \$27,939.00 be allocated to bring Library collections up to the level of comparable peers. Specifically, we recommend that the Library receive at least \$12,439.00 in external start up funding for periodical subscriptions. We also recommend that for ongoing funding the total amount of \$15,500.00 be divided between monographs (\$1,500) and the 5 core periodical subscriptions (\$14,000. incl. inflation costs). Library collections designed to support programs at the post baccalaureate level require continuous funding streams, allowing these newly developed collections to grow in their support of the program. A one-time infusion of money will not support ongoing needs for materials required for graduate-level research.

In summary, the Library's current collection is significant but not totally adequate for graduate programs in this area. The collection is in need of further development in both the monographic and periodical subscription areas, with particular need for additional periodical subscriptions.

The complete Library Resources Analysis Report is on file at the Water Resources Research Institute and is available upon request.



## Appendix H

### References

Carnegie Foundation. (2005). "Classifications"

<http://www.carnegiefoundation.org/classifications/sub.asp?key=62&subkey=127>

New Mexico Department of Higher Education (2005), *5 NMAC 5.2 POST-SECONDARY EDUCATION CHAPTER 5 POST-SECONDARY EDUCATIONAL PROGRAMS PART 2: APPROVAL OF NEW GRADUATE PROGRAMS*

<http://www.nmcpr.state.nm.us/nmac/parts/title05/05.005.0002.htm>

New Mexico State University, Office of the President, (July 2, 2005) "Living the Vision"

<http://ltv.nmsu.edu/>

New Mexico State University, (September 2005), "NMSU at a Glance"

[http://www.nmsu.edu/General/NMSU At a Glance.html](http://www.nmsu.edu/General/NMSU%20At%20a%20Glance.html).

University of New Mexico Water Resources Program (Oct 2008)

[http://www.unm.edu/~wrp/WRP\\_welcome.html](http://www.unm.edu/~wrp/WRP_welcome.html)

Loucks, D.P. 2008. Educating future water resources managers. *Journal of Contemporary Water Research & Education* 139: 17-22

## Appendix I

### Needs Survey Summary

# Master and Doctorate in Water Science & Management

## New Mexico State University

After reading the email letter regarding the proposed Master and Doctorate Degrees in Water science & management, please respond to the statements below. Send to [kwood@wrri.nmsu.edu](mailto:kwood@wrri.nmsu.edu) by pressing the "Submit by Email" button at the top of the page or sending by fax to 575-646-4337. Thank you!

<b>Name</b>	SUMMARY					
<b>Address</b>						
<b>E-mail</b>						
<b>Phone</b>						
<b>Position</b>						
<i>Please check only one response per row.</i>						
	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>	<b>No Opinion</b>
The proposed Master and Doctorate degree programs in water science & management would help fill a need that is not currently being completely filled by other graduate programs.	37%	42%	15%	2%	0%	3%
I would advise a qualified and interested student to apply to the Master or Doctorate degree programs.	37	49	8	0	2	3
Given the opportunity, I or someone I know would likely enroll in the Master or Doctorate degree programs.	19	31	31	8	0	12
I (or my organization) would be interested in hiring one or more graduates from the Master or Doctorate degree programs in water science & management.	29	39	14	7	0	12
I (or someone in my organization) would be willing to support this program by serving on a Board of Advisors or similar group.	34	37	15	2	0	12
I (or my organization) would be willing to support this program by financing professorships, graduate assistantships, or special programs.	3	15	34	19	2	27

I (or my organization) would be willing to offer internship opportunities to students in the Master or Doctorate degree programs.	20	53	10	3	0	14
The proposed training/experience provided in the Master or Doctorate degree programs in water science & management is sufficient for development of professionals working at the local level (city and county for example).	36	34	12	7	3	8
The proposed training/experience provided in the Master or Doctorate degree programs in water science & management is sufficient for development of professionals working at the state or regional level (Colorado or Appalachian region for example).	36	36	14	5	2	8
The proposed training/experience provided in the Master or Doctorate degree programs in water science & management is sufficient for development professionals working at the international level.	27	32	17	8	3	12
<p><b>Additional comments:</b></p> <p>See following page</p> <p><b>How many water management professionals are already employed by your organization?</b></p> <p><b>If you know someone else who would have an opinion on this topic, please provide his/her name and e-mail address and we will send him/her a survey form. Thank you.</b></p>						