

Program Guidelines
Academic Year 2004-2005
August 2004
The Master of Water Resources Degree
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Note: These *Program Guidelines* are not a comprehensive collection of the requirements for Master's degrees at UNM. Such information can be found on in the current UNM Catalog. All MWR students should familiarize themselves with UNM's requirements for and regulations governing Master's degrees.

8/31/04

The Master's Degree in Water Resources

MISSION STATEMENT AND INTRODUCTION

The Water Resources Program (WRP) offers the Master of Water Resources (MWR) degree, an interdisciplinary professional degree designed to prepare students for careers in water resources. The program's physical location in the Southwestern USA means that there is a natural emphasis on dry-region region water issues; however, the MWR degree is designed to provide its students a firm grounding in water resources that is applicable to any region. The MWR degree is *not* designed to prepare students for the Ph.D. degree or a career in research. The degree program assumes a basic proficiency in at least one water-related discipline (defined rather broadly) - engineering, sociology, management, public administration, environmental studies, economics, law, chemistry, planning, political science, geology, geography, and biology, among others -- or professional experience in the water field. The program seeks to expand and deepen students' knowledge of their primary disciplines and, at the same time, provide them with an integrated perspective on water in nature and society, improve their capacity to think carefully and comprehensively, and develop their technical and communications skills.

The MWR degree is obtained by following one of two tracks or options: the Hydroscience track or the Policy/Management track. Each track consists of 39 semester credits: 36 credits of coursework plus 3 credits for a professional project. The Hydroscience track is designed primarily for students with technical backgrounds (biology, chemistry, earth/environmental sciences, mathematics, toxicology, physics, physical geography, engineering, etc.) who wish to complement their primary discipline by obtaining expertise in water resources with an emphasis on the scientific/engineering aspects of water. Students without technical backgrounds may select this track but may have more remedial courses. The Policy/Management track is designed for students with diverse backgrounds -- the natural sciences, political science, economics, sociology, management, engineering, geography, psychology, public administration, law, community and regional planning, public health, etc. -- who wish to emphasize those aspects of water dealing with economics, policy, administration, management and planning. The curriculum for each track is flexible, enabling a student, with his/her advisor and committee providing guidance, to design a course of study in accord with his/her career objectives.

The interdisciplinary character and practical orientation of the MWR program reflect the growing complexity of water issues. Over the past several decades, population shifts, industrial developments, changes in water law, and advances in technology have intensified competition for water resources and placed new burdens of decision on the people who manage them. Increasing problems of water pollution, for example, require not only an understanding of water chemistry and transport systems but an appreciation for the short- and long-term implications of water allocation and land-use practices as well as an ability to communicate and work effectively with specialists in various fields, policymakers, and concerned citizens. In short, effective water resource professionals need many competencies. Establishing those competencies is the goal of the MWR degree program.

HISTORY

In 1991, the Master of Water Resources Administration (MWRA) degree was formally initiated at the University of New Mexico in response to the need for well-educated water resources administrators, who could balance competing economic, social, technological, ecological and cultural requirements. This 36 semester-credit professional degree helped organize and package the considerable water expertise of the UNM campus in a manner that made it readily available to students and citizens of New Mexico. The interdisciplinary nature of the degree assured that its graduates were exposed to the issues and conflicts facing today's water managers as well as the solutions being proposed. The core of the degree brought diverse faculty together to present their knowledge in an integrated manner. Without the MWRA degree, this integrated view of water management problems and potential solutions was not possible within highly structured, discipline-focused university departments and traditional degree programs.

In 1995, a Professional Project was initiated in place of the Master's comprehensive exam. No semester credits were given for the project.

In 1998, the highly-structured MWRA degree became the current Master of Water Resources (MWR) degree. The more flexible two-track MWR degree affords students greater options in their coursework program (Policy/Management or Hydroscience) and expands the number of available participating faculty. Three semester credits were given for the Professional Project, bringing the total number of semester credits to 39. The Water Resources Program, the graduate unit responsible for administering the degree, was transferred to UNM's University College, which is rapidly becoming a home for UNM's interdisciplinary programs.

WHAT DO FORMER MWR STUDENTS DO?

Here are the occupations of some of our former students:

- Hydrologist, URS Corporation
- Environmental Scientist, Groundwater Quality Bureau, NM Environment Dept.
- Water Quality Specialist, City of Ontario, CA
- Environmental Consultant, Anchorage, AK
- Civil Engineer, U.S. Army Corps of Engineers
- Senior Water Supply Coordinator, Truckee Meadows Water Authority, NV
- Rural Development Specialist, Rural Community Assistance Corporation
- Environmental Planner, Water Business Group, CH2M-Hill, Inc., CA
- Director, Environmental Sciences Program, College of Santa Fe
- Hydrologist, Hoopa Valley Tribal Fisheries, CA
- Water Resources Manager, Bernalillo County
- Engineer/Economist, Tokyo Engineering Corporation
- Water Attorney, Perkins Coie, Portland, OR
- Department Manager, Benchmark Environmental Corporation
- Water Resource Engineering Specialist, New Mexico Office of the State Engineer
- Project Leader, Water Group, Los Alamos National Laboratory
- District Supervisor, New Mexico Office of the State Engineer
- Water Conservation Officer, City of Rio Rancho

- Water Plan Coordinator and Wetlands Conservation Act Administrator, Clay County Soil and Water Conservation District, MN
- Assistant City Attorney, City of Santa Fe
- Water Quality Specialist, Los Alamos National Laboratory
- Technical Staff Member, Los Alamos National Laboratory
- Environmental Specialist, New Mexico Environment Department
- Hydrologist, Balleau Groundwater, Inc.
- Doctoral Student, Watershed Hydrology, University of Arizona
- Environmental Geologist, Neptune and Company
- Hydrologist, U.S. Forest Service
- Water Resources Engineer, City of Westminster, CO
- Senior Professional Scientist, Loureiro Engineering, Hartford, CT
- Supervisor, Air and Heavy Metals Section, NM State Laboratory
- Water Resources Manager, Pueblo of Santa Ana

CONTACT INFORMATION

The Water Resources Program is housed in the Social Sciences - Economics Building (#57), on Roma Avenue. It is directly north of Zimmerman Library, south of Parish Memorial Library, and east of the University House (you can download a campus map from www.unm.edu/campusmap.html). The WRP office (Administrative Assistant's office) is located in room 1048 (voice: 505-277-7759; fax: 505-277-5226). The WRP Director is Dr. Michael E. Campana (room 1044; voice: 505-277-5249; aquadoc@unm.edu). Questions concerning the WRP and the MWR degree should be addressed to the AA. The mailing address is:

**Water Resources Program
Social Sciences – Economics Bldg. #57
MSC05 3110
1 University of New Mexico
Albuquerque, NM 87131-0001 USA**

The WRP's URL is www.unm.edu/~wrp/ and its e-mail address is wrp@unm.edu.

GOVERNANCE

A Program Committee is responsible for setting policy and establishing the rules and regulations governing the Water Resources Program and its Master of Water Resources degree. The 2004-2005 academic year Program Committee members are: Dr. Michael E Campana (Director, Water Resources Program); Dr. Julia E. Allred Coonrod (Civil Engineering); Dr. Janie Chermak (Economics); Dr. David Gutzler (Earth and Planetary Sciences); Dr. José A. Rivera (Public Administration); Professor G. Emlen Hall (School of Law); Dr. William Fleming (Community and Regional Planning); and Dr. Michele Minnis (Water Resources Program); Mr. Jeffrey L. Peterson (Alumni Representative, Bernalillo County) and Ms. Melanie L. Luna (President, Association of Water Professionals). The Director is responsible for the day-to-day operations of the WRP and the MWR degree program.

The Water Resources Program has also established an external advisory board comprised of MWR alumni and others in the water resources community. Members include: Ms.

Jean Witherspoon, City of Albuquerque; Dr. John W. Shomaker, John W. Shomaker and Associates; Dr. Bob Vocke, Los Alamos National Laboratory; Mr. Mike Hamman, Jicarilla Apache Tribe; Mr. Casey W. Cook, Balleau Groundwater; Ms. Blanca Surgeon, Rural Community Assistance Corporation; Dr. Chris Nunn Garcia; Mr. Erik Galloway, New Mexico Environment Department; and Ms. Linda Weiss, P.E., U.S. Geological Survey.

ASSOCIATION OF WATER PROFESSIONALS

The Association of Water Professionals (AWP) is the official WRP student organization. The AWP arranges talks and social events, engages in outreach, and helps students find employment opportunities. Melanie L. Luna (lunam@unm.edu), Christine Casey (ccasey@unm.edu), Heidi Henderson (hbrown1@unm.edu) and Geoff Klise (gklise@unm.edu) are the President, Vice-President, Secretary, and Treasurer, respectively. The AWP's office is in room 1041; its phone number is 505-277-7431.

FACULTY

The Water Resources Program Faculty is a diverse group of individuals representing just about every aspect of water resources. Membership on the faculty is available to any UNM faculty member who has research, teaching or personal interests in water resources and wishes to be affiliated with the WRP. A list of current WRP faculty according to their primary departmental affiliations follows (asterisks indicate members of the Program Committee).

Art and Art History

Basia Irland, Professor

505-277-9128, basia@unm.edu, <http://www.unm.edu/~finearts/artfac.htm>

M.F.A., University of Massachusetts. Sculpture.

Biology

Clifford N. Dahm, Professor

505-277-2850, cdahm@sevilleta.unm.edu, <http://biology001.unm.edu/Biology/faculty>

Ph.D., Aquatic Ecology, Oregon State University. Aquatic ecology, stream/groundwater interactions, microbial ecology, nutrient cycling, microbial and chemical processes in volcanic environments.

Manuel C. Molles, Jr., Professor

505-277-3050, molles@sevilleta.unm.edu, <http://biology001.unm.edu/Biology/faculty>

Ph.D., Zoology, University of Arizona. Riparian ecology, ecology of desert streams, ecology of exotic species.

James R. Gosz, Professor

505-277-2265, jgosz@sevilleta.unm.edu, <http://biology001.unm.edu/Biology/faculty>

Ph.D., Forest Ecology, University of Idaho. Landscape dynamics, ecology of intrasystem cycling in terrestrial ecosystems, hydrologic-nutrient cycle interactions of terrestrial ecosystems.

Chemical and Nuclear Engineering

H. Eric Nuttall, Professor

505-277-6112, nuttall@unm.edu, <http://www-chne.unm.edu>

Ph.D., University of Arizona. Environmental sciences, waste transport and management, colloid science.

Civil Engineering

Timothy J. Ward, Professor and Chair

505-277-2328, tjward@unm.edu, <http://www.unm.edu/~civil/faculty.htm>

Ph.D., Civil Engineering, Colorado State University. Hydrology, geotechnical and environmental engineering.

Julia E. Allred Coonrod*, Associate Professor

505-277-3233, jcoonrod@unm.edu, <http://www.unm.edu/~civil/faculty.htm>

Ph.D., Environmental and Water Resources, University of Texas at Austin. Water resources, GIS applications.

Bruce M. Thomson, Professor

505-277-4729, bthomson@unm.edu, <http://www.unm.edu/~civil/faculty.htm>

Ph.D., Environmental Science and Engineering, Rice University. Chemical behavior and treatment of radioactive and inorganic water contaminants in both surface and groundwater systems.

James R. Matthews, Associate Professor

505-277-4849, jmatthews@unm.edu, <http://www.unm.edu/~civil/faculty.htm>

Ph.D., Civil Engineering, University of Missouri-Rolla. Registered professional engineer, Missouri. Consultant to UNM on water treatment and energy use, member of ASCE and faculty advisor for the ASCE student chapter.

John C. Stormont, Professor

505-277-6063, jcstorm@unm.edu, <http://www.unm.edu/~civil/staff/index.html>

Ph.D., Geological Engineering with minor in Civil Engineering, University of Arizona. Vadose zone hydrology, geotechnical engineering.

Communication and Journalism

Janice E. Schuetz, Professor

505-277-3949, jschuetz@unm.edu, <http://www.unm.edu/~cjdept/faculty.html>

Ph.D., University of Colorado. Rhetorical theory and criticism, religious and legal communication, communication and aging.

Community and Regional Planning

Claudia B. Isaac, Associate Professor

505-277-5939, cisaac@unm.edu, <http://www.unm.edu/~saap/People/Isaac.html>

Ph.D., University of California-Los Angeles. Community and regional economic development, social theory, gender and development, Latin American studies.

Theodore Jojola, Professor and Director of the CRP Program
505-277-6428, tjojola@unm.edu, <http://www.unm.edu/~saap/People/Jojola.html>
Ph.D., University of Hawaii. Community development, environmental design, indigenous rights, tribal economic development, microcomputer applications in education and planning.

James R. Richardson, Associate Professor
505-277-6460, jrich@unm.edu, <http://www.unm.edu/~saap/People/Richardson.html>
M.Arch./A.S., M.C.P., Massachusetts Institute of Technology. Land-use planning, community development, citizen participation, negotiation and environmental dispute resolution, urban design.

David S. Henkel, Jr., Associate Professor
505-277-1276, cymro@unm.edu, <http://www.unm.edu/~saap/People/Henkel.html>
Ph.D., Cornell University. Cultural aspects of community development, natural resources and regional planning.

William M. Fleming*, Associate Professor
505-277-6455, fleming@la.unm.edu, <http://www.unm.edu/~saap/People/Fleming.html>
Ph.D., University of British Columbia. Watershed management, impacts of land use on water quality.

Min Kantrowitz, Adjunct Associate Professor
505-277-6200, MKAInc@aol.com or minkantr@unm.edu
<http://www.unm.edu/~saap/People/Kantrowitz.html> M.Arch., University of New Mexico, M.A., Wayne State University. Human factors in design, post-occupancy evaluations, energy analysis, case studies.

Earth and Planetary Sciences

Michael E. Campana*, Professor and Director, Water Resources Program, and Albert and Mary Jane Black Professor of Hydrogeology, Department of Earth and Planetary Sciences (see listing under Water Resources)

Laura J. Crossey, Professor
505-277-5349, lcrossey@unm.edu, <http://epswww.unm.edu/faculty.htm>
Ph.D., Geochemistry, University of Wyoming. Clastic diagenesis and organic geochemistry, with emphasis on interaction of organic and inorganic constituents of sedimentary rocks during progressive burial, and diagenetic model development.

Yemane Asmerom, Associate Professor
505-277-4434, asmerom@unm.edu, <http://epswww.unm.edu/faculty.htm>
Ph.D., Geochemistry, University of Arizona. Applications of radiogenic isotopes (U-Series, Nd-Sr-Pb-Hf) to the study of the solid earth, oceans and climate through time.

David S. Gutzler*, Professor
505-277-3328, gutzler@unm.edu, <http://epswww.unm.edu/faculty.htm>
Ph.D., Climatology and Meteorology, Massachusetts Institute of Technology. Data analysis and modeling of interactions between the atmosphere, ocean, and land surfaces and climatic variability of Southwestern North America.

Leslie D. McFadden, Professor and Chair
505-277-6121, lmcfadnm@unm.edu, <http://epswww.unm.edu/faculty.htm>
Ph.D., Quaternary Geology, University of Arizona. Soil development in arid and semiarid regions; applications of soil studies to geomorphology, paleoclimate, environmental research, and geohazard evaluation.

Gary A. Smith, Professor
505-277-2348, gsmith@unm.edu, <http://epswww.unm.edu/faculty.htm>
Ph.D., Sedimentology and Physical Volcanology, Oregon State University.
Sedimentology related to rift tectonics, aquifer heterogeneity, and volcanism, physical volcanology of pyroclastic deposits and composite volcanoes.

Peter J. Fawcett, Associate Professor
505-277-3867, fawcett@unm.edu, <http://epswww.unm.edu/faculty.htm>
Ph.D., Paleoclimatology and Sedimentology, Pennsylvania State University. Long-term evolution of the climate system and patterns of past global change, quaternary paleoclimatology, and climatic influences on sedimentation.

Grant A. Meyer, Associate Professor
505-277-5384, gmeyer@unm.edu. <http://epswww.unm.edu/faculty.htm>
Ph.D., Earth and Planetary Sciences, University of New Mexico. Hillslopes and fluvial systems; climatic, tectonic and environmental geomorphology; Quaternary geology and ecosystem processes.

Louis A. Scuderi, Associate Professor
505-277-2644, tree@unm.edu, <http://epswww.unm.edu/faculty.htm>
Ph.D., Geography, University of California-Los Angeles. Paleoclimatic reconstructions utilizing dendrochronology, climatology, geographic Information Systems (GIS), image processing, global positioning systems (GPS), creation and analysis of historical and paleoclimatic databases.

John W. Shomaker, Adjunct Professor
505-345-3407, jshomaker@shomaker.com
Ph.D., University of Birmingham (England). Hydrogeology, water resources planning and management.

Economics

David S. Brookshire, Professor
505-277-1964, brookshi@unm.edu, <http://www.unm.edu/~econ/faculty/brook.html>
Ph.D., Economics, University of New Mexico. Environmental and resource economics, policy issues associated with endangered species, natural hazards and water resources.

Robert Berrens, Associate Professor
505-277-9004, rberrens@unm.edu, <http://www.unm.edu/~rberrens/berrens.html>
Ph.D., Economics, Oregon State University. Environmental economics, nonmarket valuation, sustainability and ecological economics, environmental equity, institutional economics, riverine and public lands management, survey research.

F. Lee Brown, Professor Emeritus

flbrown@unm.edu

Ph.D., Purdue University. Water resources economics, planning and management.

Janie Chermak*, Associate Professor

505-277-4906, jchermak@unm.edu, <http://www.unm.edu/~econ/faculty/chermak.html>

Ph.D., Economics, Colorado School of Mines. Environmental economics and natural resources, applied microeconomics, empirical testing of the theory of exhaustible resources, exhaustible resource production.

Catherine (Kate) Krause, Associate Professor

505-277-3429, kkrause@unm.edu, <http://www.unm.edu/~econ/faculty/krause.html>

Ph.D., Economics, University of Wisconsin. Public finance, law and economics, experimental and behavioral economics, economic learning and behavior in children, economic issues for children and families, law and economics, sustainable resource use.

Geography

O. Paul Matthews, Professor

505-277-2607, opmatt@unm.edu, <http://mojave.unm.edu/faculty/>

Ph.D., Geography, University of Washington. Water resources management, water law, Federal-state relations.

Law

Charles T. DuMars, Professor Emeritus

ctd@lrpa-usa.com, <http://lawschool.unm.edu>

J.D., University of Arizona. Indian water rights law, water law.

G. Emlen Hall, Professor*. 505-277-2866, hall@law.unm.edu, <http://lawschool.unm.edu>

J.D., Harvard Law School. Property and federal public lands, history of natural resource development in New Mexico.

Political Science

Gregory W. Gleason, Associate Professor

505-277-7391, gleasong@unm.edu, <http://www.unm.edu/~polsci/fac.html>

Ph.D., University of California, Davis. Public policy, federal relations, and international relations.

Public Administration

T. Zane Reeves, Professor

505-277-3312, tzane@unm.edu, <http://www.unm.edu/~spagrad>

Ph.D., University of Southern California. Human resources management, alternative dispute resolution, discipline and grievance handling, collective bargaining.

Santa Falcone, Associate Professor

505-277-4934, falcone@unm.edu, <http://www.unm.edu/~spagrad>

Ph.D., Syracuse University. Administrative behavior, science policy and administrative and environmental issues.

José A. Rivera*, Professor
505-277-2257, jrivera@unm.edu, <http://www.unm.edu/~spagrad>
Ph.D., Brandeis University. Social policy and planning, strategic management, and rural community development in a regional setting.

Mario A. Rivera, Professor
505-277-3312, marivera@unm.edu, <http://www.unm.edu/~spagrad>
Ph.D., University of Notre Dame. Program policy evaluation, and comparative public management systems.

Water Resources

Michael E. Campana*, Professor and Director, Water Resources Program, and Albert and Mary Jane Black Professor of Hydrogeology, Department of Earth and Planetary Sciences 505-277-5249, aquadoc@unm.edu, <http://epswww.unm.edu/faculty.htm>
Ph.D., Hydrology, University of Arizona. Regional hydrogeology, environmental fluid mechanics, environmental isotope hydrology, education in earth/environmental sciences, water resources in lesser-developed nations.

Elena A. Kalinina, Adjunct Assistant Professor
eakalin@sandia.gov
Ph.D., Geology, Moscow State University. Hydrogeology, water resources evaluation, flow and transport modeling, waste management, environmental studies.

Michele Minnis*, Adjunct Professor
505-277-3556, minnis@unm.edu
Ph.D., Developmental Psychology, University of Kansas. Communication, expository writing, psychology and dynamics of interdisciplinary research and collaboration.

Marilyn C. O'Leary, Adjunct Professor of Water Resources and Director, Utton Transboundary Resources Center, UNM School of Law
505-277-3253, oleary@law.unm.edu
J.D., University of New Mexico. Water, utility and environmental law, transboundary resource issues.

Carleton S. White, Adjunct Associate Professor
505-277-8689, cswhite@sevilleta.unm.edu
Ph.D., Biology (Ecology), University of New Mexico. Ecosystems, nutrient and nitrogen cycling, water quality.

ADMISSION

The University uses an admission process called a “Self-Managed Application”. This procedure requires each applicant to compile all the information required by the graduate unit to which she/he is applying and send all materials to the Office of Graduate Studies (OGS) in one packet. Incomplete packets will be returned without processing. Each application packet must contain the following: application form; registration information form; a non-refundable application fee; official transcripts; a letter of intent; and three letters of recommendation. The letters of recommendation may be enclosed in the application packet, or sent directly to the WRP by the recommender(s). Admission deadlines are November 30 for the Spring 2005 semester and July 30 for the Fall 2005

semester. Application packets are available from the WRP Office (Economics Building, room 1048); forms can be also be downloaded from the OGS home page.

Online applications can be submitted at www.unm.edu/~grad/admissions/ogs_admissions.html (or go to the UNM homepage and click on “Apply Online”).

The Office of Graduate Studies may be reached at 505-277-2711 or grad@unm.edu; its URL is www.unm.edu/~grad/

The admission requirements for the MWR degree program are:

- A Bachelor’s degree from an accredited college or university.
- A GPA of at least 3.0 out of 4.0 for the last two years of undergraduate work. A student with a GPA under 3.0 may be admitted if his/her experience/qualifications warrant it.
- Three references from individuals (not friends) qualified to assess the applicant’s academic and/or professional qualifications. *At least one these letters must be from a former professor.* Letters from friends or personal acquaintances are unacceptable.
- A 1-2 page letter of intent describing the student’s background, interests in water resources, experience in the field, objectives, and future plans. This document will be helpful in assessing a particular applicant’s aptitude for the program and in assigning an appropriate temporary advisor. A resume or *curriculum vitae* is helpful, but *does not* supplant the letter of intent. For guidance on what this should entail, see http://www.unm.edu/~grad/admissions/sma_inst.html.
- Successful completion of the MWR prerequisites:

1) Intermediate Microeconomics I (ECON 300 or equivalent).

2) Two semesters of calculus (MATH 162L and 163L or MATH 180 and 181 or equivalents) OR one semester of calculus + one semester of statistics (STAT 245 or equivalent). Students interested in the Hydrosience concentration are strongly urged to select two semesters of calculus, preferably MATH 162L and 163L.

3) Two semesters of introductory college-level science courses, distributed as follows: one semester of introductory chemistry (CHEM 121L or equivalent) AND: one additional semester of introductory chemistry (CHEM 122L or equivalent) OR one semester of introductory biological sciences (BIOL 121L or equivalent) OR one semester of physical geology/environmental science (E&PS 101, ENV SC 101 or equivalents).

Although students should normally satisfy all prerequisites before they can be admitted to the program; however, students missing some of the prerequisites may be admitted on the condition that they complete the prerequisites as soon as possible. Note that a student missing more than two prerequisites may be denied admission. Students satisfying prerequisites while an MWR student must take each course for a letter grade and obtain a grade no lower than B.

The Graduate Record Examination (GRE) is *not* required for admission.

The admission deadlines for the MWR degree program are November 30 for the Spring 2005 semester and July 30 for the Fall 2005 semester. The deadlines for international applicants are August 1 and March 1, respectively. Only former MWR students seeking readmission are admitted for the Summer semester. *Students are urged to apply as soon as possible, as admission to the MWR degree program is becoming increasingly competitive and the WRP may establish a quota on the number of students admitted each semester.*

INTERNATIONAL APPLICANTS

International students (non-U.S. citizens) are welcomed and must apply to the MWR program through the International Admissions Office. Application materials may be requested from the Office of International Admissions, Student Services Building, MSC06 3270, 1 University of New Mexico, Albuquerque, NM 87131-0001 USA. This office also may be reached via phone at 505-277-5829, fax at 505-277-6686 or **goglobal@unm.edu**. Additional information and forms are at **www.unm.edu/preview/na_intlgrad.htm**. Online applications can be submitted at this same URL (or go to the UNM homepage and click on “Apply Online”).

In addition to the completed international application package, an international applicant must include a TOEFL test result of at least 550 on the paper exam or 213 on the computer exam, a certification of financial responsibility form, three copies of their official transcripts and certified English translations (if necessary) with their application package. Deadlines for international applicants for the MWR degree program are August 1, 2004 for the Spring 2005 semester, March 1, 2005 for the Fall 2005 semester, and August 1, 2005 for the Spring 2006 semester.

Amigo International Scholarship information and applications can be found at www.unm.edu/~schol/trans/amigo.html. These scholarships allow international students to attend UNM for resident tuition fees only.

FINANCIAL AID AND HOUSING

The MWR degree program is one of the Western Regional Graduate (also known as the WICHE program) programs which allows graduates from the participating 14 western states to enroll at New Mexico resident tuition rates. Participating states are: AK, AZ, CO, HI, ID, MT, NV, NM, ND, SD, OR, UT, WA and WY. If you are a bona-fide resident of one of these states you can enroll in the MWR degree program at New Mexico resident tuition rates. No application is necessary – just be sure to tell the Director you qualify.

If you take fewer than 7 credits per semester will be charged New Mexico resident tuition rates, *regardless* of your state of residency. Many students who cannot qualify for resident tuition use this approach and apply for New Mexico resident status after one year. The granting of resident status after one year is not guaranteed; consult the criteria for determining residency in the UNM Catalog (go to **www.unm.edu/~unmreg/** and click on “Catalog”).

The **U.S. Department of Agriculture** is providing funding for three internships each year for members of underrepresented groups: Hispanic American, African American, Native American, and others. Under this program, students will be placed with private firms or government agencies where they will work under the mentorship of a water resources professional. Interns will receive a salary and tuition remission. Contact the WRP Office for more information.

The Water Resources Program has no Teaching Assistantships (TAs) assigned to it. However; it does, on occasion, offer Research Assistantships (RAs) to appropriately-qualified MWR students. In addition, the WRP sometimes has fellowships, work-study positions, or internships available. Students are encouraged to keep a brief (2-3 pages) up-to-date *curriculum vitae* in their files in the WRP office so the Director may effectively match them with internship/employment opportunities.

Individual faculty sometimes have hourly-wage positions or RAs available for students who wish to work in their labs, on research projects, etc. Internships are often available with government agencies such as the City of Albuquerque, U.S. Geological Survey (USGS), Bernalillo County, New Mexico Environment Department, Office of the State Engineer, etc. The WRP Office makes every effort to apprise students of these opportunities. Notifications are almost always sent via e-mail, so it is imperative that students read their electronic mail on a regular basis.

Work-study funds are available for qualified students; regular student employment is also available. Information on both programs is at www.unm.edu/~wsestudy/ or the Work-Study and Student Employment (277-3511) Office in Mesa Vista Hall 1040 (wsestudy@unm.edu).

The work-study program provides Federal funds to work on campus; the campus hiring unit provides funding as well, usually 30% or so, with the rest provided by the Federal government. Students must qualify for work-study funds.

There are also University-wide fellowships and other aid programs. The Office of Graduate Studies offers a number of financial aid options, including various fellowships: Challenge Assistantships; Graduate Fellowships; Graduate Scholars Program; and Graduate Tuition Fellowships. Application procedures and deadlines for the aforementioned programs vary; a pamphlet describing these programs is available from the OGS. The WRP Office will endeavor to keep students informed of these opportunities, but students can check with the Office of Graduate Studies Financial Aid Coordinator, Ms. Edwina Chavez-Salazar (505-277-2711; edwinac@unm.edu). Financial aid information can be found at the end of this document and at www.unm.edu/~finaid.

Funding for travel and research related to Professional Projects is available from the Graduate and Professional Student Association (GPSA) through the Student Research Allocations Committee (SRAC) grants, which are competitive. Visit www.unm.edu/~gpsa for more information. The OGS offers Research, Project and Travel (RPT) grants (visit the OGS WWW site for complete information); deadlines for proposals are in late September and January.

Most students live in off-campus housing. A good place to check is the Off-Campus Housing Office at och.unm.edu (och@unm.edu). Information on UNM residence hall housing is at www.unm.edu/~reshalls.

Below is a list of scholarship and funding WWW sites compiled by Jeanine McGann. The first three are very good sites sponsored by graduate departments at UC-Berkeley, NYU and Duke. They are specifically science-related, organized, and include many links. The next seven are specific organizations' web sites that offer scholarships/funding (note that many other professional societies offer scholarships/fellowships: American Water Resources Association, American Geophysical Union, American Society of Civil Engineers, American Society of Agricultural Engineers, Soil Science Society of America, American Society of Limnology and Oceanography, etc.). The last two WWW sites are clearinghouse/scholarship search sites.

www.cnr.berkeley.edu/community_forestry/Funding/funding.html

www.nyu.edu/pages/gsas/GIGS/gsas/science/

www.ors.duke.edu/find/student/grad/index.html

www.wef.org/membershipbenefits/MembershipBenefits/Awards99/scholarship.jhtml

www.aauw.org/fga/fellowships_grants/index.cfm

www.gwis.org/grants/default.htm

www.geosociety.org/grants/gradgrants.htm

www.werf.org/funding/funding_werf.cfm

www.nawc.org/scholarship.html

www.awwa.org/About/scholars/

www.scholarsite.com/

www.back2college.com/library/scholarships.htm

STUDENT RESPONSIBILITIES

Each graduate student is responsible for complying with all regulations and meeting all deadlines of the University and the Department and College or School in which he or she is enrolled. The student is responsible for reading the UNM Catalog and is advised to purchase a copy at the University Bookstore. Desk copies are available for examination in the Office of Graduate Studies, room 107, Humanities Building; a copy is also at www.unm.edu/~unmreg/ (click on "Catalog"). Particular attention should be paid to pages 55 - 79, which pertain to graduate programs. The Catalog also has complete course descriptions; in addition individual departments may have course syllabi on their home pages (go to www.unm.edu and click on "Departments").

In reading the UNM Catalog, students should give careful attention to the sections on General Academic Regulations and Master's Degrees and, in particular, the following items from those sections.

Students must maintain a cumulative GPA of at least 3.0 in all courses offered for graduate credit at UNM. After a student has completed 12 hours of graduate credit at UNM, or at the end of the second semester of matriculation, whichever comes first, the student's records will be reviewed by the Office of Graduate Studies. This scrutiny is repeated following each succeeding semester and summer session.

Starting with the Fall 2000 semester, all work applied to a Master's degree, including transfer work from another institution or work taken as a UNM non-degree student, must be completed within a *seven-year period*.

The policy governing Incomplete ("I") grades is covered on pages 64-65 of the 2003-2005 UNM Catalog and should be understood by all students. If an "I" grade is not resolved within a specific time frame, it reverts to an "F".

Students must also be registered for at least one graduate course during the semester in which they complete their degree requirements. This can be any graduate course; if a student has completed all coursework, then he/she can sign up for one credit of Professional Project (WR 598).

The OGS *Program of Study* form for the Master's degree is to be filed with the WRP Office at least four days prior to the end of the semester prior to the one in which the student expects to complete degree requirements (e.g., for graduation in Spring 2005 the Program of Study form must be submitted to the WRP office at least four days before the end of the Fall 2004 semester). This form will not be processed until an approved *Coursework Proposal* form, a WRP internal form, has been submitted to the WRP Office.

In addition to meeting the responsibilities set forth in the UNM Catalog, students in the MWR degree program are encouraged to confer with their advisor at least once a semester regarding their course plan in order to avoid any problems. Students are also advised to pick up a free copy of *The Pathfinder* which covers additional UNM policies and available university services. *The Pathfinder* is available at the Student Activities Center in the Student Union Building. Additional information is available at www.unm.edu/~grad/ and www.unm.edu/~wrp/.

On occasion, students may have a need to seek interpretation or modification of requirements; petitions to the Program Committee or the Office of Graduate Studies may be appropriate. Petitions must be submitted in writing to the WRP office at least two weeks prior to a Program Committee meeting. Consult the OGS homepage for instructions regarding the preparation of petitions. Students are requested to consult with their faculty advisor and the Director before submitting a petition.

All students are eligible for e-mail at UNM. Each MWR student must have his or her own e-mail account, whether through UNM or some other provider, and access it frequently, as the WRP uses e-mail and its WWW site to inform students and faculty of important issues. UNM e-mail can be obtained on-line by visiting www.unm.edu/computing and looking under "E-Mail" or by visiting one of CIRT's (Computer and Information Resources and Technology) computer pods.

A flow chart depicting the sequence of events in moving through the MWR degree program is in the appendices.

FACULTY ADVISOR

Each student will be assigned a temporary faculty advisor upon admission. In most cases, this will be the Director. As the student progresses through the program, he/she will select an advisor and Professional Project committee consistent with his/her interests in the broad field of water resources. A list of WRP faculty was presented earlier. If the student wishes to select a faculty member not on the list, contact the Director.

Each student, in consultation with his/her faculty advisor, should complete a *Coursework Proposal* form (downloadable from the WRP WWW site and at the end of this document) in the second semester in residence (for full-time students) or by the time the student has taken 12 graduate credits. This will be submitted to the WRP Office and serve as a guide for future course selection. It is, of course, subject to change, but it will help the student focus his or her interests.

The role of the faculty advisor is to mentor the student with regard to academic questions relating to the MWR degree (such as identifying appropriate classes or chairing the student's project committee), and to support the student in his/her professional development. At least once each semester, the student should meet with the advisor to review his or her progress, proposed coursework, and to consider future academic and career decisions. A student may change his/her advisor, but must keep the WRP Office informed as to his/her current faculty advisor. Once a student selects a chair for his/her Professional Project committee, that person becomes the student's advisor.

NON-DEGREE AND TRANSFER STUDENTS

Some prospective MWR students may choose to enroll in MWR classes as non-degree students. Non-degree students are limited to a maximum of 9 credit hours per semester. Upon admission to the MWR program, a maximum of 12 graduate credit hours taken under non-degree status may be transferred into the program. Graduate courses taken at another accredited institution may count as much as 50% (18 credits) of the MWR coursework (see pages 68-69 of the 2003-2005 catalog for complete information). This is not automatic; courses must be approved by the WRP. In any case, each course to be transferred or applied, whether taken at UNM or elsewhere, must have been taken for a letter grade with a grade no lower than B. The seven-year rule, which obligates students to complete their Master's degree within seven years, becomes effective with the first class a student takes that is going to be applied to the program's degree requirement, independent of the fact that the class was taken as a non-degree or MWR student.

THE MWR CURRICULUM

Prerequisites

The MWR degree prerequisites are:

- Intermediate Microeconomics I (ECON 300 or equivalent);

- Two semesters of calculus (MATH 162L and 163L or MATH 180 and 181, or equivalents) OR one semester of calculus + one semester of statistics (STAT 245 or equivalent); and
- Two semesters of introductory college-level science courses, distributed as follows: one semester of introductory chemistry (CHEM 121L or equivalent) AND: one additional semester of introductory chemistry (CHEM 122L or equivalent) OR one semester of introductory biological sciences (BIOL 121L or equivalent) OR one semester of physical geology/environmental science (E&PS 101, ENV SC 101 or equivalents).

Students entering the MWR program with deficiencies in the prerequisites must take them as soon as possible. They must be taken for a letter grade, not Pass/Fail or CR/NC. A student who takes the prerequisite courses as an MWR student must receive a grade no lower than B in each course. *Note that students applying to the MWR degree program may not be admitted if they are lacking more than 2 of the above 5 prerequisites.*

Requirements

The MWR degree is a Plan II (non-thesis) degree; there are two formal concentrations: 1) Policy/Management; and 2) Hydrosience. The selection of a concentration should be made as soon as possible after the student enters the Program (normally by the time 12 graduate credits are completed) in consultation with his/her faculty advisor and the Director.

39 credits are required: 36 credits of formal coursework and 3 credits for a professional project. Three of the 36 coursework credits *must* include the PM course Law 547 - Water Law. The 39 credits are distributed as follows:

- 12 credits in the Water Resources interdisciplinary (core) courses: WR 571, WR 572, WR 573.
- 18 credits in the student's concentration (HS or PM) (see following lists of suggested HS and PM courses).
- 6 credits of courses in the other group (HS or PM). If the student's concentration is PM, these six credits must come from the HS group, and vice-versa.
- 3 credits of WR 598 (Professional Project). The student can take more than 3 credits of WR 598, but only 3 credits will count towards the degree.

A student will select courses consistent with his/her professional project and with the advice/consent of the student's advisor/committee. These lists are as broad as possible, allowing quite a bit of latitude in curriculum design. Students may take courses outside these lists with the approval of the Director and their committee. Note that current policy precludes acceptance of *any* 300-level courses for graduate credit towards the MWR degree.

Students taking 400-level courses should ensure that these courses are available for graduate credit and, if so, that they are registered for graduate credit (see the

instructor). Dual-listed (400/500) courses must be taken as the 500 number to receive graduate credit.

A flow chart depicting the sequence of events in moving through the MWR degree program is in the appendices.

Coursework

The following list of courses is *not* exhaustive and is based upon the 2003-2005 UNM Catalog; new courses are continuously being developed and existing courses deleted. Indeed, other courses may be suitable for a particular student's program of study. If you are interested in taking a course not listed here, contact the Director or your advisor/committee chair.

If a course is dual listed as a 400/500 course, you *must* register for the 500-level course to receive graduate credit. 400-level courses available for graduate credit are asterisked in the UNM Catalog.

Main-campus course descriptions and prerequisites are available at www.unm.edu/~unmreg/ (click on "Catalog"). Semester schedules are also at the previous URL (click on "Schedule of Classes"). School of Law courses and schedules are at lawschool.unm.edu/courses/. Detailed syllabi may be available on departmental or instructor homepages.

If you wish detailed information on a certain course, contact the instructor. *Note that some of the courses listed below may have prerequisites beyond those required for the MWR degree. It is up to the students to satisfy these, or seek the instructor's permission to take the course.*

Suggested Hydroscience Courses

Each student takes at least 6 credits from this group, including but not limited to the following list (the number of credit hours for each course is shown in parentheses; "AOA" means "also offered as").

Biology

- 495 Limnology (3)
- 496L Limnology Laboratory (1)
- 507L Bosque Biology (3)
- 514 Ecosystem Studies (3)
- 535 Freshwater Ecosystems (AOA E&PS 535) (3)

Earth and Planetary Sciences

- 515 Geochemistry of Natural Waters (3)
- 535 Freshwater Ecosystems (AOA Biology 535) (3)
- 536 Climate Dynamics (3)
- 555L Computational and GIS Applications in Geomorphology (3)
- 557L Mathematical Modeling in the Geosciences (3)
- 562 Hydrogeology (3)
- 564 Geological Fluid Mechanics (3)
- 570 Physical Climatology (AOA Geography 570) (3)
- 572 Subsurface Fate and Transport Processes (3)

- 574L Hydrogeology Laboratory (1)
- 576 Physical Hydrology (AOA WR 576) (3)
- 580 Advanced Hydrogeology (3)
- 581L Geomorphology and Surficial Geology (4)

Environmental Science

- 530 Advanced Environmental Science (3)

Civil Engineering

- 442 Hydraulic Engineering and Hydrology (3)
- 531 Physical-Chemical Water and Wastewater Treatment (3)
- 532 Advanced Physical-Chemical Water and Wastewater Treatment (3)
- 534 Environmental Engineering Chemistry (3)
- 536 Biological Wastewater Treatment (3)
- 537L Aqueous Environmental Chemistry and Analysis (3)
- 541 Groundwater Engineering (3)
- 542 Intermediate Hydrology (3)
- 543 Introduction to Groundwater and Contaminant Transport Modeling (3)
- 544 Water Resources Engineering (3)
- 545 Open Channel Hydraulics (3)
- 547 GIS in Water Resources Engineering (3)
- 549 Vadose Zone Hydrology (3)

Community and Regional Planning

- 527 Watershed Management (3)
- 570 Seminar - Modeling the Environment (3)

Geography

- 512 Seminar in Climatology (3-6)
- 521 Environmental Modeling and Geographic Information Systems (3-6)
- 553 Energy Balance Climatology (3)
- 556 Microclimatology (3)
- 559 Water Resources and GIS (3)
- 570 Physical Climatology (AOA E&PS 570) (3)
- 587L Intermediate Geographic Information Systems (3)
- 588L Advanced Geographic Information Systems (3)

Water Resources

- 576 Physical Hydrology (AOA E&PS 576) (3)
- 590 Internship (3) (*see following section on “For-Credit Internships” before taking*)
- 595 Topics in Water Resources (1-4) (*offered irregularly; content varies*)

Suggested Policy/Management Courses

Each student takes at least 6 credits from this group (LAW 547 is required) including but not limited the following list (the number of credit hours for each course is shown in parentheses; “AOA” means “also offered as”).

American Studies

- 523 Environmental Justice (3)
- 524 Environmental Conflicts in the U.S. West (3)
- 525 Environmental Theory and Practice (3)

Civil Engineering

- 535 Introduction to Hazardous Waste Risk Assessment (3)
- 538 Introduction to Hazardous Waste Management (3)

Communication and Journalism

- 554 Diffusion of Innovations (3)

Community and Regional Planning

- 515 Natural Resources Field Methods (3)
- 524 Environmental Planning Methods (3)
- 527 Watershed Management (3)
- 564 Foundations of Natural Resources (3)
- 569 Rural Community Development (3)
- 570 Seminar - Natural Resources Methods (3)
- 575 Natural Resource Economics (AOA Pub Ad 575) (3)
- 577 Practice of Policy Development (AOA Pub Ad 577) (3)

Economics

- 442 Topics in Environmental and Natural Resource Economics (3)
- 466 Public Sector Project Analysis (3)
- 535 Evaluation of Public Programs (3)
- 540 Environmental and Natural Resource Modeling (3)
- 541 Sustainable Development (3)
- 542 Environmental and Natural Resource Economics: Survey (3)
- 543 Natural Resource Economics (3)
- 544 Environmental Economics (3)

Geography

- 513 Seminar: Contemporary Issues in Water Resources (3-6)
- 561 Environmental Conservation (3)
- 562 Water Resources Management (3)

Law

- 547 Water Law (3)
- 554 Indian Water Rights (2-3)
- 580 Environmental Law (1-3)
- 605 Advanced Water Law (2-3)
- 630 Environmental Problems (2-3)
- 643 New Mexico Land and Water Law (1-3)

Political Science

- 470 Public Policy Analysis (3)
- 475 Environmental Politics (3)
- 500 Contemporary Public Administration (3)
- 535 Comparative Public Administration (AOA Pub Ad 535) (3)

Public Administration

- 500 Public Management and Policy (3)
- 521 Institutional Development and Behavior (3)
- 524 Intergovernmental Administrative Problems (3)

525 Human Resources Management in the Public Sector (3)
535 Comparative Public Administration (AOA Pol Sc 535) (3)
544 Public Budgeting (3)
546 Public Financial Administration (3)
574 Seminar on Environmental Policy and Administration (3)
575 Natural Resource Economics (AOA CRP 575) (3)
577 Practice of Policy Development (AOA CRP 577) (3)

Water Resources

590 Internship (3) (*see following section on “For-Credit Internships” before taking*)
595 Topics in Water Resources (1-4) (offered irregularly; content varies)

The Water Resources Interdisciplinary Courses

How do the Interdisciplinary (core) courses fit into the curriculum and when should students take them? This section will provide guidance. If questions persist, consult the Director. **To take each core course, the student must have completed all five MWR prerequisite courses.**

WR 571. Water Resources I - Contemporary Issues (4)

Students examine contemporary issues in water resource systems, including water quality; ecosystem health; stakeholder concerns; economics; and water supply, policy, management and allocation. Emphasis on teamwork, cooperation and oral, written and graphic communication. [Fall]

This is the first of the 4-credit interdisciplinary courses and is offered each fall. The structure of the course has varied over the years, but in general, student teams focus on water resource systems (aquifer, river basin, metropolitan area, etc.) and study them in detail, defining water resources issues and suggesting management alternatives. The teams make oral and written presentations throughout the course, culminating in a team-produced final report and oral presentation. Emphasis is on teamwork, cooperation, coordination, issue definition, and communication. This course is normally taken at the start of a student’s program.

WR 572. Water Resources II - Models (4)

(also offered as Economics 545). Practical aspects of the different technical models used by water resource professionals: hydrological, economic, ecological, etc. Students use models to solve problems. Emphasis on oral, written and graphic communication. Prerequisites: WR 571, Economics 300, and one course in hydrology or hydrogeology (e.g., E&PS 562, WR 576, CE 541, CE 542); or permission of instructor. [Spring].

This is the second interdisciplinary course and is offered each spring. It emphasizes the use of models: hydrological, economic, and other related models. It is not an in-depth exposure to modeling but is designed to give the students an appreciation of the limitations and uses of models. Students are given exercises in using computer models of water resources systems (hydrology, economics, etc.).

This course should be taken only after students have had (at a minimum) ECON 300 and coursework in hydrology or hydrogeology (e.g., E&PS 562, WR 576, CE 542, CE 441); ideally, it is best to take this course about halfway through a student’s program. The course also has a strong communications component.

WR 573. Water Resources III - Field Problems (4)

Intensive experience with a field-based problem or suite of problems. Students work through problem identification and definition, collect/analyze data, propose solutions and present conclusions and recommendations in a appropriate forum. Prerequisites: WR 571 and WR 572; or permission of instructor. [Summer].

This is the last of the interdisciplinary courses and is offered each summer. It is a capstone course in that it represents a culmination of the student's experience in the Program and should be taken near the end of a student's program. In the course, teams of students work on field problems, and use their previous coursework and acquired skills to produce a final written and/or oral report. Again, strong emphasis is placed on communications skills. For the past four summers, WR 573 has been conducted in Honduras; we expect to continue this through 2005. WRP students pay only for the course tuition; the WRP pays the travel expenses.

For-Credit Internships (WR 590)

As a professional degree program, the MWR degree recognizes the value of "real-world" experience. To that end, students may obtain three (3) semester credits of the 39 required by serving an internship with a government agency, private firm or similar, non-UNM organization. The student will be required to provide a deliverable, generally a report, which should be on the scale of a Professional Project report. The topic of the internship should be consistent with the student's concentration (HS or PM).

The student must obtain advance approval from his/her committee (if the student has a committee) and the Director before the semester in which he/she intends to serve an internship. The student must submit a proposal of at least two (2) pages with the following elements:

- where the internship will be served;
- the nature of the tasks to be performed and the problem to be solved;
- how the internship will benefit the student and its relevance to the student's track;
- the student's supervisor; and
- the deliverable.

This proposal must be submitted to the WRP office at least one month prior to the start of the semester during which the student will serve the internship. Once approved, the student will then register for 3 credits of Internship (WR 590). Students may not take WR 590 for any reason other than serving an internship according to the above requirements.

THE PROFESSIONAL PROJECT

Introduction

The Professional Project is the culmination of the student's experience. It is representative of the caliber of professional report work done in a government agency, consulting firm, non-profit organization, etc. The student designs, conducts, analyzes and reports on a particular water-related problem or issue. The choice of the problem is up to the student and his/her committee; if the student is employed, it can be related to job-related responsibilities or internship duties. The end product of the Professional Project is the Professional Project report. The student defends her/his Professional Project in a public forum: the Master's exam/Professional Project defense.

We wish to thank the Community and Regional Planning Program for providing a copy of its Guidelines for Professional Projects: Plan II. We have freely borrowed from that fine document and made modifications where necessary.

In their professional projects and all academic work, students must be conscientious in citing the work of others, being careful to give proper credit. To do otherwise is academic dishonesty – plagiarism, a very serious offense. For definitions and examples of plagiarism, visit www.indiana.edu/~wts/wts/plagiarism.html .

Identifying a Professional Project

Some students enter the program with a good idea of what they would like to do for a Professional Project; these are invariably students who have had academic or professional experience in water resources. However, many students entering the program have little or no academic or professional experience in water resources and are understandably concerned about the Professional Project. “How will I find a suitable project?” is a common question. But these same students often know where their strengths and interests lie. They may have an aptitude and liking for a particular discipline -- economics, engineering, management, biology, etc. That should help them identify a potential professional project area. But what's next? Here are some suggestions:

- Seek out faculty with similar interests. The UNM WWW site (www.unm.edu) is often a good place to start since many departments and individuals maintain home pages (see the faculty list at the beginning of this document).
- Talk to fellow students, especially those who have been in the program for a while.
- Peruse previous Professional Project reports, which can be checked out from the WRP Office or from Zimmerman Library.
- Ask questions in classes.

- Seek out professionals in the water resources field.
- Use the Internet and the library to learn about water resources.
- Become familiar with local water resources issues and problems.

Do not become discouraged if you do not identify a topic right away. Keep your eyes and ears open; sometimes serendipity is a strong factor. However, you should have a professional project topic by the time you have completed 24 graduate credits.

Selecting a Committee and Writing a Proposal

Once a student has identified a topic (or at least narrowed down the list), he/she should contact a faculty member who has expertise in that area and inquire whether he/she would like to chair the student's Professional Project committee. This person may or may not be your faculty advisor (but does become your advisor after agreeing to be chair). At least three members must be on the committee; two of these three, including the chair, must be tenure-stream UNM faculty members. No more than two members can be from the same department. On the WRP faculty list all those listed with the exception of those designated "adjunct" or "emeritus" are tenure-stream faculty.

The third member does not have to be a tenure-stream faculty member; it can even be someone from outside UNM but who has been approved by the Office of Graduate Studies to serve on graduate committees. This person must have at least a Master's degree. Consult the Director for details. Note that adjunct and emeritus faculty can serve as a committee co-chair as long as a tenure-stream faculty member is co-chair as well. If you wish to choose committee members who are UNM tenure-stream faculty members but are not on the WRP faculty list, consult the Director. Some faculty may wish to see a brief summary (1-2 pages) of the proposed work before deciding to be on the committee.

After discussing ideas with the prospective chair and committee members, the student should write a proposal, setting forth the problem to be solved or hypothesis to be tested, its significance, previous work, methodology, anticipated results, resources required (budget, etc.), an outline of the PP report, and a timeline for completion. The committee, especially the chair, can provide guidance. It is not necessary that your proposal be a lengthy tome, but its length will depend upon the nature of the problem and the committee's requirements; the norm is around 4-5 pages. The student and the committee should meet to discuss the proposal and once a final draft is agreed upon, a copy should be submitted to the WRP Office for the student's file. This copy should have a cover page similar to the Professional Project cover page, signed by each committee member.

Examples of Professional Project proposals are included at the end of this document and also at the WRP WWW site.

OGS forms specifically pertaining to graduation (the *Notification of Intent to Graduate* and *Announcement of Examination* forms) will not be signed until an approved Professional Project proposal is on file.

Conducting the Work

After the student and committee agree on the project proposal, the student's task becomes one of completing the project and reporting the results. During this phase, the student should use the committee as a resource -- its members are there to help, and the student should remember that it is the committee who will pass on the quality of the work. The student should adhere to the original proposal as closely as possible, but changes will invariably need to be made.

The student should keep the committee apprised of the project's progress and obtain approval for any changes. Periodic progress reports and committee meetings are beneficial and encouraged.

Funding for travel and research related to Professional Projects is available from the Graduate and Professional Student Association (GPSA) through the Student Research Allocations Committee (SRAC) grants, which are competitive. Visit www.unm.edu/~gpsa for more information. The OGS offers Research, Project and Travel (RPT) grants (visit the OGS WWW site for complete information); deadlines for proposals are in September and January. The WRP also has field equipment available for student use. Items include: a Kodak digital camera, altimeter, GPS units, water level meters, water quality (pH, TDS/EC, nitrate, dissolved oxygen) meters, infiltrometers, two-way radios, rangefinders, a clinometer, tape measures, etc.

The specific format for the written report is up to the student and the committee and should be established by mutual consent before the project is started; however, copies of PowerPoint presentations, etc., are unacceptable. To see what the written report should look like, see previous Professional Project reports, which can be checked out from the WRP Office for guidance. The Office of Graduate Studies publishes *Guidelines for Preparing Thesis and Dissertation Manuscripts* which may provide some assistance even though the professional project report is neither a thesis nor a dissertation.

The Professional Project report should be double-spaced, with 1" (1.50" left-hand) margins, and contain:

- A title page including student name, month and year, and the citation that this document is submitted in partial fulfillment of the requirements for the degree of Master of Water Resources, Water Resources Program, University of New Mexico. A sample title page is included at the end of this document and can be downloaded from our WWW site.
- A signature page, signed by all committee members. The signature page can be found at the end of this document and downloaded from our WWW site.
- A table of contents and separate lists of tables and figures.
- Acknowledgements page.

- An abstract stating the problem or hypothesis, its significance, results, summary and conclusions. The abstract should not exceed two pages.
- An introductory chapter or section identifying the problem/hypothesis, previous work, etc.
- Other chapters or sections, as cited in the table of contents.
- A glossary of terms.
- Appendices (where appropriate).
- Literature cited (references). Because of the diversity of water resources disciplines, citation styles vary. Choose one style that is dominant in the particular field and stick with it. For water resources, the *Journal of the American Water Resources Association* (JAWRA) is a good reference. The student's committee can provide guidance.

The student must take 3 credits of WR 598 while working on the Professional Project. These credits do not have to be taken all in the same semester. If the student needs to remain enrolled while continuing to work on the Professional Project but has taken all 3 credits, he/she can enroll for more credits of WR 598, but only 3 credits will count towards the degree.

It may be necessary to remain enrolled so that access to University facilities, e-mail, etc., can be maintained while the student completes the work.

The Oral Exam/Professional Project Defense

Once the student has finished the report, he/she submits a first draft to the committee for their comments. It is often customary to submit it to the chair before the rest of the committee but this is not a hard rule. The committee may want to see corrections to the first draft prior to scheduling the oral exam. In any case, the student should provide each committee member *at least* two full weeks prior to the oral exam to read the report. At the same time the student must provide a copy to the WRP Office so that others can read the report prior to the exam.

The oral exam is open to the public and must be officially announced two weeks before it occurs. The student and the committee should decide on an acceptable time and date for the examination. Once this is done, the student then requests that the WRP Office secure a room and officially schedule the exam; this request must be made about three weeks before the exam is to be held, as the WRP Office must submit an official *Announcement of Examination* form to the OGS two weeks before the examination takes place. In addition, a student must submit a *Notification of Intent to Graduate* form to the OGS through the WRP Office in the semester in which the student intends to graduate. The OGS must receive this form by October 1 for fall graduation, March 1 for spring graduation, and July 1 for summer graduation. If the student fails to graduate during the particular semester in which the form was submitted, another form must be submitted during the next semester. Note that these two forms are in addition to the *Program of*

Study form, which must be submitted no later than the end of the semester prior to one in which graduation is expected.

During the exam, the student makes a professional-quality presentation, generally lasting no more than 30 minutes, promulgating the results of the project and answering questions from both the committee and the general public.

After the presentation and public questioning, the committee will close the meeting to the public and continue the examination. At the conclusion of the examination the committee and student meet to discuss the results. In some cases changes may be required in the written report. The upshot is: don't assume that the copy the student takes to the oral exam will be the final copy, so don't go the expense of binding it, etc.

On the final exam, the student can receive a grade of "Pass", "Fail", "Pass with Distinction", or "Conditional Pass". The latter is assigned when the committee determines that the written report requires significant changes; it will be removed when the chair of the committee deems the written report to be acceptable and four approved, bound copies are received by the WRP. The "Conditional Pass" will be indicated simply as a "Pass" on the student's transcript.

Final Copies of the Professional Project Report

Four soft-bound copies of the final, committee-approved report will be submitted to WRP Office for filing; two of these will be deposited in the UNM Library. Binding should be permanent (glued or wire spiral); looseleaf or similar binding (plastic "comb" binding) is unacceptable. Glued binding is preferable.

The title page (see the end of this document or the WRP WWW site) is the first page of the report and the signed signature page follows that page. The student may use the title page as the cover or can design his/her own cover, perhaps with a picture or drawing. At a minimum, the cover should display the title, degree name and option, and student's name, with the following at the bottom:

**A Professional Project Report Submitted in Partial Fulfillment of the Requirements
for the Degree of
Master of Water Resources
Hydroscience or Policy/Management Concentration**

**Water Resources Program
The University of New Mexico
Albuquerque, New Mexico
Month Year**

The month and year will be that month (May, August, or December) and year in which the student will *graduate*, not the month in which the student *defended*.

It is customary for the student to provide each committee member with a copy of the final report. Note that graduation will not occur until the WRP Office receives the final copies, signed by all committee members.

Some Common Pitfalls

Below are some of the common problems associated with professional projects.

- Waiting too long to identify a project.
- Poor topic definition or too broad a topic.
- Inadequate skills to complete the task.
- Failure to seek committee help, especially during the initial stages of project development.
- Inadequate data to complete the project.
- Believing one draft will be sufficient.
- Underestimating the amount of time it will take. This is especially true of projects involving a field and/or lab component. In the field or lab, things rarely go as planned; Murphy's Law ("If things can go wrong, they will.") often controls.
- Leaving school before turning in a first draft of the report. Students may leave school before completing all requirements, often to accept a job. Keep in mind that doing so will, in most cases, greatly prolong the amount of time (perhaps by a factor of 3 – 6 times) it will take a student to finish the degree. It is not uncommon for a student to leave, thinking he or she is just a few months away from finishing up and; before one knows it, a year has gone by. The demands of a new job often preclude work on a professional project. If a student must leave before finishing, he/she should endeavor to turn in a first draft of the Professional Project report to his/her committee.

Be aware of the above and ask for help when it is needed. Don't forget to use the Professional Project committee.

PREVIOUS PROFESSIONAL PROJECTS

(Note: professional projects were not required prior to 1995. All those completed after 1999 are in Zimmerman Library.)

A. Kyle Harwood, *The Urban Stormwater Contribution of Dissolved Trace Metals from the North Floodway Channel, Albuquerque, NM, to the Rio Grande*. April 1995.

Tina Marie Sandoval, *Striking A Balance: Potential Legal And Institutional Constraints On The Use Of San Juan-Chama Water and Groundwater As-Needed To Meet Albuquerque's Long-Term Water Demand*. November 1995.

Gretchen Newman, *Erosion Study in Tajique Watershed*. February 1996.

Steven C. Hofstad, *Sediment and Nutrient Loss Following Prescribed Fire in Semiarid Grasslands: the Potential for Water Resource Impairment*. December 1996.

Terry Nelson, *Past and Present Solid Waste Landfills in Bernalillo County, New Mexico*. June 1997.

Bill Hauck, *A Water Audit of Albuquerque Manor Retirement Home: A Potential for Water Savings Study and Economic Analysis*. June 1998.

Tom Krause, *Who Speaks for the Rio Jemez? A Management Plan for the Lower Jemez River Basin*. June 1998.

April Fitzner, *Physical and Legal Aspects of River Rehabilitation, Middle Rio Grande, New Mexico*. December 1998.

Elaine S. Brouillard, *Erosion Potential of the Main Branch of the Piedras Marcadas Watershed, Petroglyph National Monument, New Mexico*. March 1999.

Richard M. Renn, *Assessment and Management of the Arroyo Del Coyote Watershed, Sandia National Laboratories and Environs, New Mexico*. March 1999.

Marquis B. Childs, *Soil Radionuclide Concentrations and Preliminary Stormwater Model Assessment at Material Disposal Area G, Los Alamos National Laboratory*. April 1999.

Jeffrey L. Peterson, *Coordinated Water Resource Planning for the Sandia Basin - A Perspective into Regional Water Planning Needs*. May 1999.

Hiroataka Sato, *Water Pricing Strategy for the City of Albuquerque's Sustainable Water Use*. July 1999.

Linda I. Gordan, *Water Supply Sustainability Through Water Banking*. April 2000.

Christopher T. McLean, *Estimates of Radionuclide Loading to Cochiti Lake from Los Alamos Canyon using Manual and Automated Sampling*. April 2000.

William S. McDonald, *Urbanization of Seven Springs, New Mexico: An Evaluation of Current and Projected Impacts on Ground- and Surface-Water Resources*. June 2000.

Nancy J. Gillard, *An Environmental Analysis of the Drycleaning Industry: A New Mexico Perspective*. July 2000.

Joy K. O'Neil, *Volunteer River Monitoring Plan for the Urban Reach of the Santa Fe Watershed*. July 2000.

Neil W. Gray, *Issues in Managing Erosion: The Spring Timber Sale Case Study, El Rito Ranger District, Carson National Forest, New Mexico*. July 2000.

Robin L. Just, *Modeling Flow and Sediment Transport in the Rio Puerco Using a SWAT/GIS Interface*. September 2000.

Casey W. Cook, *A Mixing Cell Model of the Fernley, Nevada, Groundwater System*. November 2000.

- Katherine A. Smith, *Comparison of Two Riparian Assessment Surveys: Proper Functioning Condition and the New Mexico Watershed Watch Riparian Survey*. November 2000.
- Tobin K. Walters, *PCB Remediation Alternatives on the St. Lawrence River near Massena, New York: Quantitative Impacts to the Industry the Mohawk Indian Nation and the United States Environmental Protection Agency*. November 2000.
- Kelly A. Bitner, *Cost of Compliance with a Lower Arsenic Drinking Water Standard in New Mexico*. January 2001.
- Patricia Vardaro-Charles, *An Evaluation of Water Treatment Technologies Piloted at LANL to Improve Cooling Tower Water Efficiency*. February 2001.
- Andrea Hunter, *Environmental Disturbance of Oligotrophic Bacteria and Effects on Water Quality in Deep Karst Pools*. March 2001.
- T. Jeffery Cotter, *Point-of-Use Arsenic Remediation Using Activated Alumina*. June 2001.
- Debby Mandeville, *Erosion Impacts from Recreation in the Enchanted Tower Climbing Area, New Mexico*. August 2001.
- Claire Kerven, *Benefits and Costs of Diverting 0.2 MGD Influent from Los Alamos County Wastewater System to Los Alamos National Laboratory Sanitary Wastewater System*. November 2001.
- Sherry Evans-Carmichael, *Rancho West Estates Water Distribution System Replacement Funding Project*. November 2001.
- Danielle D. Diehl, *Microbially Mediated Reduction of U(VI) in Groundwater at a Site in Konigstein, Germany*. December 2001.
- Kathy Grassel, *Taking Out the Jacks: Issues of Jetty Jack Removal in Bosque and River Restoration Planning*. April 2002.
- Frederic L. Shean, Jr., *Assessment of Conjunctive-Use Strategies for Water Resources Development in the South Valley Area, Bernalillo County, New Mexico*. July 2002.
- Orlando C. Romero, *A Convective Thunderstorm Case Study in Albuquerque, New Mexico: Does the Urban Heat Island Affect Precipitation?* July 2002.
- Mark Van Eeckhout, *Integrating HEC-RAS and ArcView in Predicting Post-wildfire 100-year Floodplains on the Pajarito Plateau, Los Alamos, New Mexico*. August 2002.
- Joshua S. Nims, *Effects of Summer Climate on Water Demand in Albuquerque, New Mexico*. August 2002.
- Barak Bruerd, *Designing A Village Water Supply System in Papua New Guinea: A Case Study in Third World Development*. May 2003.

Michael M. Gabora, *A $\delta^{18}O$ Calibrated Compartmental Mixing Cell Model of Groundwater Flow in the Roswell Basin, Southeastern New Mexico*. May 2003.

Eric Riebsomer, *Chemistry Variation During Purging of Alluvial Wells at Los Alamos National Laboratory*. May 2003.

Jessica Bentley, *Constructed Surface Flow Wetlands for Oil Refinery Wastewater Treatment in New Mexico*. May 2003.

Lynne M. Paretchan, *Water Resource Management Strategies: Deschutes Basin, Oregon*. August 2003.

Amy Ewing, *Water Quality and Public Health Monitoring of Surface Waters in the Kura-Araks River Basin of Armenia, Azerbaijan and Georgia*. August 2003.

Cody Lee Stropki, *Restoration Treatments in the Middle Rio Grande Bosque: Effects on Soil Compaction*. December 2003.

Kerry Gregg Bassore, *Evaluating Stormwater Best Management Practices in a Small Urban Watershed: A Case Study of the Adobe Acres Drainage Basin in Bernalillo County, New Mexico*. December 2003.

Uday V. Joshi, *Selective Tree Thinning in the Santa Fe Municipal Watershed for Water Yield Augmentation*. May 2004

Stephen M. Kolk, *Assessment and Preliminary Design of a Water Supply Project for the Village of Altos de las Paz, Honduras*. May 2004.

Ron Amato, *Surface Water Quality of the Gallinas River in and around Las Vegas, New Mexico*. August 2004.

Meaghan O'Rourke, *Appropriate Erosion Control Techniques for the Rural Hillsides of Honduras*. August 2004.

IMPORTANT DATES AND FORMS

Prospective Students

Admission Deadlines

For **students who are U.S. citizens** admission deadlines are November 30, 2004 for the Spring 2005 semester and July 30, 2005 for the Fall 2005 semester. For **international students** the deadlines are August 1, 2004 for the Spring 2005 semester, March 1, 2005 for the Fall 2005 semester and August 1, 2005 for the Spring 2006 semester. Students (except those seeking readmission to the MWR degree program) are not admitted for the summer session. Students seeking financial aid should apply as early as possible. For example, financial aid decisions for students entering in fall are generally made by mid-April or so. **Students should apply as soon as possible as the WRP may limit the number of students admitted each semester.**

MWR Students

A flow chart depicting the sequence of events in moving through the MWR degree program is in the appendices. Students should consult it frequently to ensure they are on track for completing all degree requirements.

Coursework Proposal (WRP form)

Submit to the WRP Office by the end of the second semester in residence or by the time the student has completed 12 graduate credits. This is a WRP internal form. OGS *Program of Study* forms **will not be signed** until the aforementioned form is on file.

Approved Professional Project Proposal

The final copy of the proposal should have a cover page similar to the Professional Project cover page, initialed by each committee member. OGS forms specifically pertaining to graduation (the *Notification of Intent to Graduate* and *Announcement of Examination* forms) **will not be signed** until an approved Professional Project proposal is on file.

Program of Study (OGS form)

Due at the OGS by the last day of the semester prior to the one in which the student expects to graduate (sooner if possible). For example, to graduate in Spring 2004 a student must submit this form to OGS by the last day of the Fall 2003 semester. Submit the form to the WRP Office four working days prior to the OGS due date. A student must obtain her/his advisor's signature on this form before submitting it to the WRP Office (unless the advisor is the Director). Please read the instructions for this form before attempting to fill it out.

The following information will be required on the *Program of Study*: the graduate unit is the "Water Resources Program"; the major code is 429; the degree name is "Master of Water Resources" and its abbreviation is "MWR"; it is a Plan II (non-thesis) degree; and there are two formal concentrations: Hydroscience and Policy/Management.

Once a student has submitted the *Program of Study*, s/he must not deviate from the courses listed without his/her advisor's permission and without informing the WRP Office. Unreported deviations could delay a student's graduation when OGS performs its graduation check – checking actual coursework versus what is listed on the Program of Study.

Announcement of Examination (OGS form)

Due at the OGS two weeks before the date of the Professional Project defense. Submit to the WRP office four working days prior to the OGS due date.

Notification of Intent to Graduate (OGS form)

Submit during the semester in which the student expects to graduate. The OGS must receive this form by October 1 for fall graduation, March 1 for spring graduation, and July 1 for summer graduation. The student must make a submission request to the WRP office at least four days prior to the above dates. If the student fails to graduate during the particular semester in which the form was submitted he/she must submit a new form the next semester. Even though MWR students do not write a thesis or dissertation, please complete the second page of this form. Use a tentative title for the Professional Project if need be.

The OGS forms can be obtained at the OGS WWW site or at the OGS Office (107 Humanities Building). The *Coursework Proposal* form can be downloaded from the WRP WWW site.

Note: the OGS is very serious about receiving its forms on time. Failure to submit them on time will likely result in a delay of the student's graduation date. It is the student's responsibility to be cognizant of these dates and to act accordingly.

Graduation Dates

To graduate in a particular semester, all requirements (successful defense of the Professional Project, committee approval of the Professional Project report and submission of four approved, bound copies of the Professional Project report to the WRP Office), except for courses the student may be taking, must be completed by a certain date. These dates are: November 15 for fall graduation; April 15 for spring graduation; and July 15 for summer graduation.

A student can schedule his/her Master's exam after these dates, but the effective graduation date will not be until the end of the next semester. For example, a student who successfully defends her professional project on April 28 would not formally receive her degree until August (the end of the summer session).

SUMMARY OF IMPORTANT DATES FOR THE 2004-2005 ACADEMIC YEAR

Note: All those Office of Graduate Studies (OGS) forms *in bold italics* are submitted to OGS through the Water Resources Program Office. Submit to the WRP Office **four full working days** before they are due in OGS. These forms can be obtained from the WRP Office or downloaded from www.unm.edu/~grad. Students must obtain their advisor's signature on any form requiring it before submission to the WRP Office (unless the Director is your advisor).

The *Announcement of Examination* form must be submitted to OGS two weeks prior to your Professional Project defense and submitted to the WRP Office **four working days** prior to the OGS due date.

Fall 2004

August 1	International students: University application deadline for Spring 2005 admission.
August 23	Classes begin.
September 24	Student Research Allocations Committee (SRAC) grant applications due in GPSA by noon.
September 27	Graduate Research, Project and Travel (RPT) grant applications due in OGS (submit directly to OGS).
October 1	<i>Notification of Intent to Graduate</i> for Fall 2004 due in

OGS.

November 15	Completion of all degree requirements for Fall 2004 graduation (successful Professional Project defense, approval of Professional Project report by committee and submission of four bound copies to WRP Office).
November 30	University application deadline for Spring 2005 admission.
December 10	Readmission applications for Spring 2005 due in OGS.
December 17	<i>Program of Study</i> for Spring 2005 graduation due in OGS (submit to WRP Office by December 13).
Spring 2005	
January 18	Classes begin.
February 4	OGS begins accepting nominations for Graduate Tuition Fellowships and Graduate Fellowships.
March 1	<i>Notification of Intent to Graduate</i> for Spring 2005 due in OGS.
April 15	Completion of all degree requirements for Spring 2005 graduation (successful Professional Project defense, approval of Professional Project report by committee, submission of four bound copies to WRP Office).
May 10	Readmission applications for Summer 2005 due in OGS.
May 13	<i>Program of Study</i> for Summer 2005 graduation due in OGS (submit to WRP Office by May 9).
Summer 2005	
June 6	Classes begin.
July 1	<i>Notification of Intent to Graduate</i> for Summer 2005 due in OGS.
July 15	Completion of all degree requirements for Summer 2005 graduation (successful Professional Project defense, approval of Professional Project report by committee, submission of four bound copies to WRP Office).
July 29	<i>Program of Study</i> for Fall 2005 graduation due in OGS (submit to WRP Office by July 25).

July 30	University application deadline for Fall 2005 admission.
August 1	International students: University application deadline for Spring 2006 admission.
August 10	Readmission applications for Fall 2005 due in OGS.

ANSWERS TO FAQ

Students are often in a quandary about where to submit forms, whom to ask about certain matters, etc. This section will help clear up those issues.

Flow Chart

A flow chart depicting the sequence of events in moving through the MWR degree program is in the appendices and downloadable at the WRP WWW site. Students should consult it frequently to ensure they are on track for completing all degree requirements.

“Nuts and Bolts”

Questions involving deadlines, status of applications (admissions, financial aid, etc.), the scheduling of professional project defenses, all forms, and similar issues should be directed to the Water Resources Program’s Administrative Assistant (Economics Building room 1048; Fax: 277-5226; Voice: 277-7759), who will strive to respond within two business days.

Coursework, Advisement, Program of Study

Questions involving coursework, program of study, etc., (i.e., advisement issues) should be addressed to the Director or the student’s advisor/committee chair (the Director serves as a student’s temporary advisor until the student decides upon a permanent one). A student’s advisor is the same person as the chair of his/her Professional Project committee, i.e., someone who has professional interests similar to the student’s.

For questions about a specific course (prerequisites, what’s covered, etc.) it is best to contact the course instructor (some instructors may have their course syllabi online – check the department’s home page). Courses evolve over time, so the best source of information is the instructor. All main campus UNM course descriptions, including prerequisites, are in the University Catalog, which is online at www.unm.edu/~unmreg/ (click on “University Catalog”). Semester schedules are also at the same URL (click on “Schedule of Classes”). School of Law courses and schedules are at lawschool.unm.edu/courses/. **Note that School of Law classes may have different start/end dates than classes on the Main Campus.**

Professional Project

Questions involving the Professional Project, the Professional Project report, and Professional Project defense should be directed to the chair of the student’s Professional Project committee. The time/date of the Professional Project defense is something the

student and his/her committee agree upon. Once the time and date are set, ask the WRP Office to schedule a room and prepare the proper form.

If a student wishes to examine previous Professional Project reports, contact the WRP Office to check them out. All Professional Projects after 1999 are in Zimmerman Library.

For questions about how to pick a chair/committee or to discuss potential projects, feel free to contact the Director. Please note, however, that the approval of a student's Professional Project topic is between the student and his/her committee, not between the student and the Director.

Forms-R-Us

There are a number of UNM forms that must be submitted on time. All such forms are submitted to OGS through the WRP Office. If an advisor or committee chair's signature is required on the form and it is someone other than the Director, please obtain the signature(s) before submitting it to the WRP Office. Please note that the WRP Office needs to get OGS forms *at least four working days* (sooner if possible) before they are due to OGS the forms are checked for accuracy before securing the Director's signature. If the WRP Office receives a form any later, the student runs the risk that the Director will not be around to sign it or that there will not be time to check it, in which case it will not be submitted on time. The upshot: submit forms as early as possible.

Staying Enrolled after Completing Coursework

Students sometimes complete their coursework but haven't finished their professional project. If they don't enroll for something, they will lose their UNM privileges (e-mail, library access, etc.) and may be dropped as a graduate student. What they should do is register for at least one credit of Professional Project (WR 598) each semester. It doesn't matter if they've already taken their allotted 3 credits of WR 598 – only 3 will count towards the degree.

Students must also be registered for at least one graduate course during the semester in which they complete their degree requirements (see page 68 of the 2003-2005 catalog). This can be any graduate course; if a student has completed all coursework (including all 3 Professional Project credits), then he/she can sign up for one credit of Professional Project.

If you have not enrolled for three semesters you must apply for readmission to the Program. You will not be assessed another application fee. Fill out both the application and registration information forms and submit both to the WRP Office. Check the deadlines.

Other Stuff – Graduate Units, Catalog, and MWR degrees, etc.

The graduate unit is the "Water Resources Program" and Dr. Campana is the Director. The Program is administratively housed in University College, whose Dean is Dr. Peter L. White (plwhite@unm.edu; 277-9302). The major code is 429. The degree name is "Master of Water Resources" and its abbreviation is "MWR". It is a Plan II (non-thesis) degree; there are two formal concentrations: Hydroscience and Policy/Management The catalog (2003-2005) contains a wealth of information on the Program and the University

in general, including various rules and regulations. Each student should purchase a copy (at the Bookstore) and familiarize himself or herself with the relevant sections, especially *The Graduate Program*. Copies for perusal are available at the libraries and OGS. The entire catalog is online at the Registrar's WWW site.

Computer Lab and Other Resources

The Program has a Computer Lab that all students are welcome to use. It is located in room 1036 of the Economics Building. Students are eligible for keys that will afford them access to the building after hours. The Computer Lab also is equipped with a monitored alarm system. You will receive instructions on how to arm/disarm the system. We currently have three Gateway 2000 computers: two Pentium IIs (one with a Xeon processor) and a Pentium III. We also have a three HP printers: a large-format (11" x 17") inkjet printer; a LaserJet; and a PhotoSmart 1100xi.

We also have an older Dell Pentium interfaced with a LaserJet printer for high-quality black-and-white printing. We have three HP scanners, one of which has an automatic document feeder. A phone is available for student use (505-277-0777).

Please note the WRP computers are for the express use of WRP students, faculty and staff; friends and relatives are not permitted to use them. Please lock the doors and arm the alarm system when you leave.

Next door to the Computer Lab is a student workroom (room 1040) with a microwave oven, coffeemaker, refrigerator, couch and desks.

There is a UNM CIRT Computer Pod in room 1004 of the Economics Building. This is sometimes reserved for Economics classes, but it is available at certain times for general student use. Check the room for open hours. Other CIRT pods are also available.

The Program has also equipment that may be checked out for student work. Items include: a Kodak digital camera, altimeter, GPS units, water level meters, water quality (pH, TDS/EC, nitrate, dissolved oxygen) meters, infiltrometers, two-way radios, rangefinders, a clinometer, tape measures, etc.

E-mail

All students must have an e-mail account and should read it daily. Since MWR students are quite dispersed, this is the only effective way of communicating to so many people in a number of different places. You can use any of the various commercial e-mail providers (e.g., hotmail.com, yahoo.com, aol.com) if you wish.

All UNM students are entitled to free e-mail through UNM. Go to www.unm.edu/computing/ where an e-mail account can be established online, or visit one of the CIRT Computer Pods on the campus. UNM e-mail accounts can be accessed from home computers with modems.

Transfer Courses, Time to Complete Degree, etc.

Some prospective MWR students may choose to enroll in classes as non-degree students. Non-degree students are limited to a maximum of 9 credit hours per semester. Upon

admission to the MWR degree program, a maximum of 12 graduate credit hours taken under non-degree status may be transferred into the program. This 12-credit limit also applies to courses taken at another institution. Graduate courses taken at another accredited institution may count as much as 50% (18 credits) of the MWR course work (see pages 68-69 of the 2003-2005 catalog for complete information). This is not automatic; courses must be approved by the WRP. Each course to be transferred or applied must carry a grade of B or better; this applies to courses taken at UNM or elsewhere. Effective Fall 2000, MWR students have *seven years* to complete their degrees. The seven-year period starts with the first class a student takes that is going to be applied to the program's degree requirement, independent of the fact that the class was taken as a non-degree or MWR student. So the seven-year clock could start ticking *before* a student formally gains admission to the MWR degree program. No extensions will be given to the seven-year time limit.

Incomplete Grades (“I”)

The policy governing Incomplete (“I”) grades is covered on pages 64-65 of the 2003-2005 UNM Catalog and should be understood by all students. If an “I” grade is not resolved within a specific time frame, it reverts to an “F”.

Removing grades of “I” on time is a serious matter; if a student does not remove them according to UNM regulations, the “I” becomes an “F” and *cannot* be removed. A grade of “F” will do wonders for a student's GPA. It is the student's responsibility to ensure the “I” is removed in a timely manner. Graduation cannot occur with an “I” on a transcript.

Lockers

Lockers are available along the wall of the west hall in the Economics Building. If you want a locker for storage of personal items, just put your own lock on an empty locker. No permission is necessary.

WWW Site

The Program's WWW site (www.unm.edu/~wrp/) is a great resource -- links, recent developments, news, speakers, etc. Please check it often.

**Water Resources Program
Master of Water Resources Degree
Coursework Proposal Form**

Name _____ Date _____ Concentration (HS or PM) _____

Semester & Year Entered _____ Expected Graduation (Semester & Year) _____

Prerequisites (for each one: circle course (or equivalent) taken, list semester/year taken)

- 1) Economics 300 _____ 2) Math 162L or 180 _____
 3) Math 163L, 181 or Stat 245 _____ 4) Chem 121L _____
 5) Chem 122L, Biol 121L, E&PS 101 or Env Sc 101 _____

Courses in Concentration (HS or PM) (18 credits minimum; list school if not UNM)
Course (department, number & title) **Semester & Year** **School**

Other HS or PM Water Resources Courses (6 credits minimum; list school if not UNM). If your concentration is HS, these need to be PM courses and vice-versa.

Course (department, number & title) **Semester & Year** **School**

Water Resources Interdisciplinary Courses (12 credits)

Course	Semester & Year
WR 571	
WR 572	
WR 573	

Professional Project (3 credits)	Semester & Year	Advisor
WR 598		

Professional Project Title (tentative) _____

Committee (if you have one; indicate chair) _____

Student Approval _____	Date _____
Advisor/Chair Approval _____	Date _____
Director Approval _____	Date _____

Sample Professional Project Report title page. This is the first page of the report. You can use this as a cover page or you can design your own cover. If you design your own cover, you must include the following information on the cover: title, degree name and option, your name, and, at the bottom of the cover:

Professional Project Report
Water Resources Program
University of New Mexico
Month Year
(month and year of graduation, not defense)

Water Pricing Strategy
for the City of Albuquerque's Sustainable Water Use

by

Hiroataka Sato

Committee

Dr. David S. Brookshire, Chair

Dr. Janie Chermak

Dr. Michael E. Campana

Dr. William M. Fleming

A Professional Project Report Submitted in Partial Fulfillment of the Requirements

for the Degree of

Master of Water Resources

Policy/Management Concentration

Water Resources Program

The University of New Mexico

Albuquerque, New Mexico

August 1999

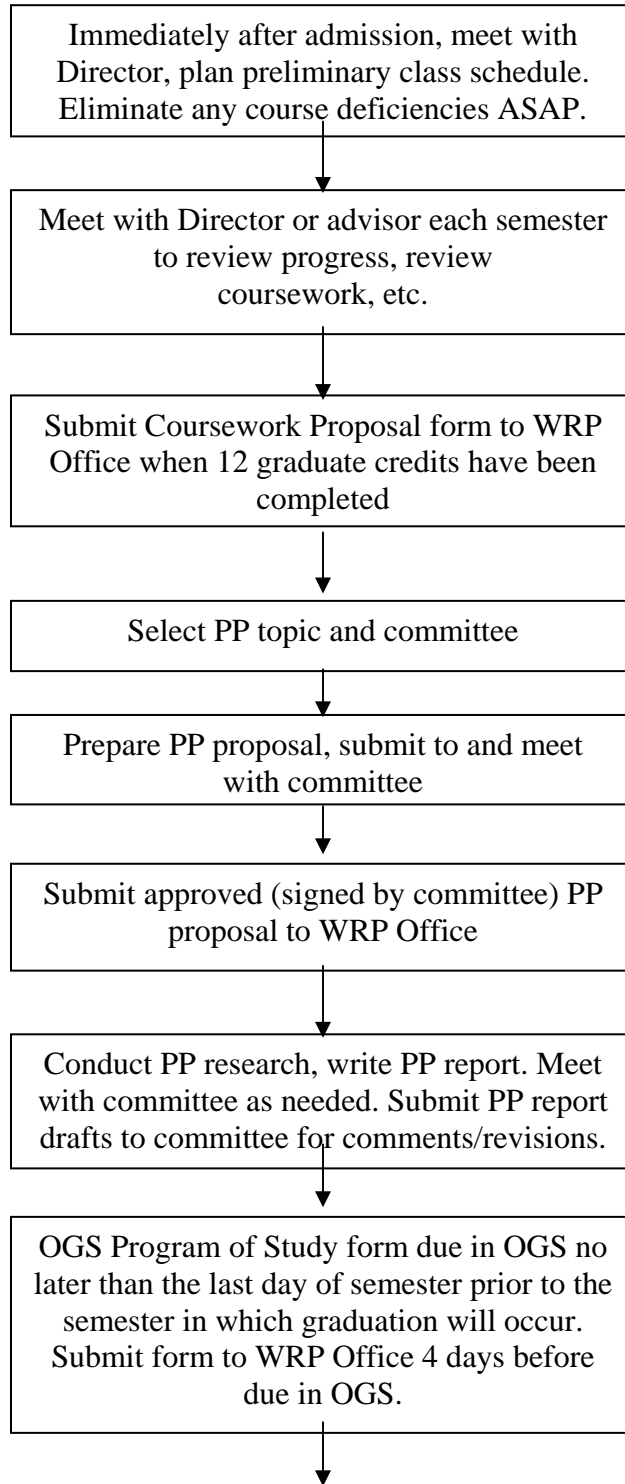
Signature Page. This page follows the title page (please delete this text from your copy).

Committee Approval

The Master of Water Resources Professional Project Report of **Casey W. Cook**
is approved by the committee:

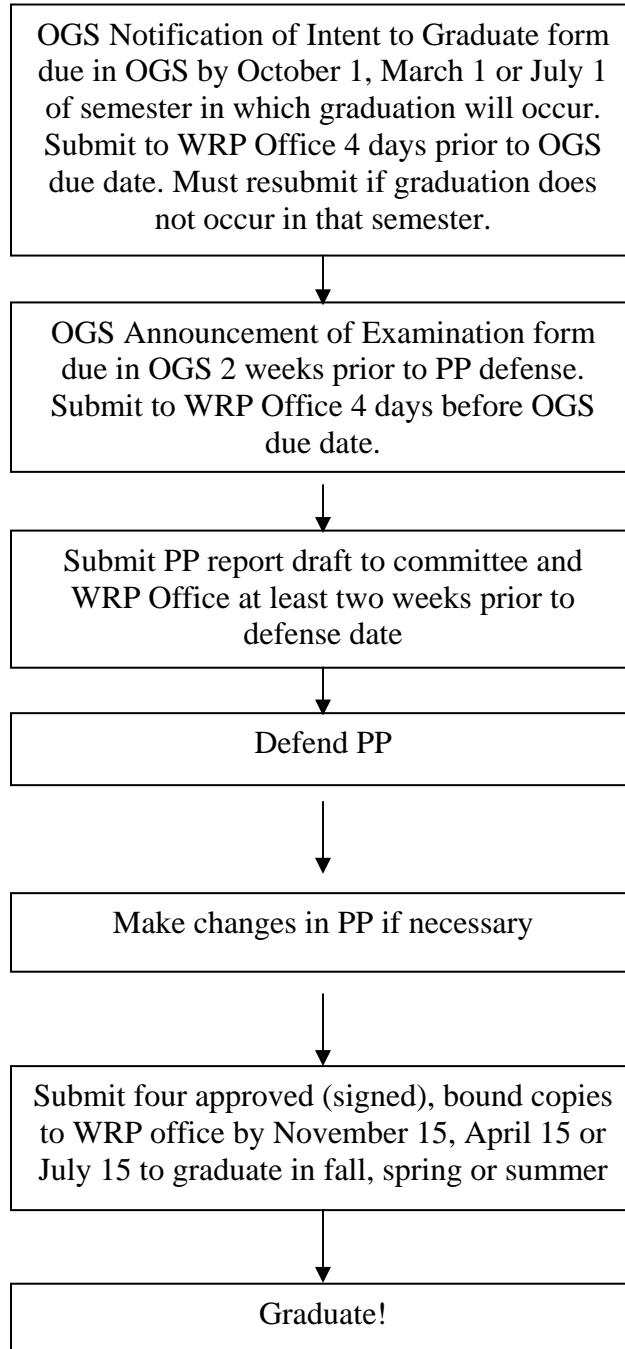
Chair	Date

MWR Degree Flow Chart



Next Page

MWR Degree Flow Chart
(Continued)



Sample Professional Project Proposals

There is no “one-size-fits-all” proposal format. Two excellent proposals are presented here, for quite different projects.

1) Barbara Heemink – very detailed and comprehensive for a field-based project in a lesser-developed country. Her inclusion of a draft PP report outline is an excellent idea, worth emulating.

2) Amy Ewing – well-written, comprehensive, documented, not a field-based project.

An Evaluation of Point Source Contamination at Lake Naivasha, Kenya and its Effect on the Community

by

Barbara Heemink

Committee

Dr. David S. Henkel, Chair
Dr. Janie Chermak
Dr. José A. Rivera

A Professional Project Proposal Submitted in Partial Fulfillment of the Requirements
for the Degree of

Master of Water Resources

Water Resources Program
The University of New Mexico
Albuquerque, New Mexico
April 2003

Committee Approval

The Master of Water Resources Professional Project Proposal of **Barbara Heemink** is approved by the committee:

Chair

Date

OVERVIEW

This document defines my professional project proposal for the acquisition of my Masters of Water Resources degree in the Water Resource Program at the University of New Mexico, Albuquerque, New Mexico. Attachment 1 provides a flowchart that defines the conceptual framework to my professional project.

PURPOSE

I am proposing to complete my professional project at Lake Naivasha, Kenya. The purpose of my professional project is to evaluate the nature and extent of point source contamination at Lake Naivasha, Kenya and its effects on the community. I intend to obtain the community's view on when and what the conditions of the lake were like before and after point source contamination, and determine if the lake water is used as a source of drinking water. I propose to define the economic use of Lake Naivasha in terms of lake water as a required resource for operation and determine the method and costs of current interventions to point source contamination. I will draw upon the analogy of Lake Victoria to Lake Naivasha in terms of point source contamination, economic use, and point source interventions to determine which current interventions at Lake Victoria can be implemented at Lake Naivasha.

AUDIENCE

My primary audience will be the Lake Naivasha Riparian Association (LNRA) with my secondary audience being community members residing at Lake Naivasha, Kenyan regulatory agencies, and non-governmental agencies.

RESEARCH OBJECTIVES

I have defined my research into six primary objectives within which there are secondary objectives. The primary objectives provide the basis of my research. The secondary objectives define the content of my primary objectives.

The following is a summary overview of my primary and secondary objectives:

Primary: Characterize Point Source Contamination at Lake Naivasha

Secondary:

Define the nature, extent, and cause of point source contamination at Lake Naivasha.
Develop a "pre and post" baseline for determining point source contamination at Lake Naivasha.
Determine when point source contamination became critical.
Define how point source contamination is affecting water quality.

Primary: Describe Lake Naivasha as a Source of Drinking Water

Secondary:

Determine use of lake water as a source of drinking water.
Define methods of extraction and by whom.

Determine if water is treated prior to consumption and how.

Primary: Identify LNRA and Community Connection to Lake Naivasha

Secondary:

Define the role of the LNRA as primary stakeholders.

Define the community as secondary stakeholder.

Define the connection between the LNRA to Lake Naivasha.

Define the connection between the community to Lake Naivasha.

Define the LNRA's and the community's awareness of point source contamination to Lake Naivasha.

Determine the LNRA's and the community's concerns regarding point source contamination to Lake Naivasha.

Determine how the point source contamination at Lake Naivasha is effecting the community.

Determine how the community and LNRA foresee the future of Lake Naivasha if point source contamination is not further addressed.

Primary: Evaluate Economic Use of Lake Naivasha Defined by Water as a Requisite Resource

Secondary:

Determine which industries require their location to be a Lake Naivasha due to water as a resource.

Determine which industries have brought members to the community to the Lake Naivasha region for employment purposes.

Determine which industries would be disabled if Lake Naivasha could not longer be used as a source of water.

Determine any current and future economic constraints.

Primary: Identify Current Interventions

Secondary:

Determine what interventions are being currently implemented to address point source contamination.

Define the effectiveness of those interventions.

Determine the costs of those interventions.

Determine who is implementing those interventions.

Assess any proposed interventions.

Primary: Draw a Lake Victoria Comparison to Lake Naivasha

Secondary:

Determine the correlation between Lake Victoria and Lake Naivasha in terms of point source contamination, economic use and purpose, and interventions.

Determine which intervention activities are in affect at Lake Victoria that could be implemented at Lake Naivasha.

ISSUES OF CONCERN

The following research objectives have concerns that need to be addressed:

Point source contamination to Lake Naivasha.
Use of Lake Naivasha as a source of drinking water.
Connection between stakeholders to Lake Naivasha.
Economic use of Lake Naivasha in terms of livelihood based on Lake Naivasha as a water resource.

There are many activities causing environmental degradation to the lake that are due to non-point source contamination. In addressing point source contamination, it is important to understand the causes of non-point source contamination in order to distinguish the differences and similarities between the two in terms of environmental degradation results. The following provides an overview of some non-point source contamination occurring at the Lake:

Increased sediment and nutrient load from deforestation and habitat destruction.
Negative impact on the lakes' ecosystem from overfishing, alien fish species, excessive water hyacinth and extraction of papyrus.
Livestock dipping.
Soil erosion from poor farming techniques and overgrazing.
Inflow of potentially contaminated groundwater from pit latrines and infiltrated pesticides, fertilizers, and herbicides.
Surface runoff of municipal wastewater and pesticides, fertilizers, and herbicides.
Excessive surface water extraction.

Often the physical results of point source and non-point source contamination are the same, such as in vegetation stress, degraded water quality, negative effects on the wetland ecosystem, and negative effects on the health of humans and wildlife. To narrow my research in addressing the physical results of point source contamination to the environment, I will only be addressing lake water. In addition, it may be necessary, due to the interrelationship between point source and non-point source contamination, to define the limits of identifying lake water quality degradation to solely point source contamination.

Per my literature review, groundwater flow direction is to the south-southwest. In determining Lake Naivasha as a source of drinking water, I will not only address surface water extraction, but potentially shallow well water extraction from wells located bordering the lake to the south-southwest. Due to limitations in technical data on water quality, much of my research acquisition will be based on visual observation and community interaction.

The community surrounding Lake Naivasha encompasses a variety of inhabitants. These inhabitants include, but are not limited to the Maasai, residents of the town of Naivasha, industrial/commercial land owners, tourism operators, and the LNRA.

The LNRA are my primary stakeholders due to their association to Lake Naivasha as designated custodians by the Kenyan government and their active involvement in addressing lake health. They represent varying members of the community, particularly those who are industrial/commercial land owners. Their analysis and technical documents are vital in understanding point source contamination to the lake as well as the effects point source contamination may have on the community. However, equally important are the view points of members of the community separate from that of the LNRA. There may be limitations in actual communication with these members in terms of language and comprehension of the nature of my research.

Economic use of Lake Naivasha as a source of livelihood due to water as a resource is one of my primary objectives. Not only is it important to understand which industrial/commercial land owners are causing point source contamination but also to understand the economic cost point source contamination is having on the community. These economic costs can be defined as employment, future outlook if point source contamination is not addressed, and the cost to industry when Lake Naivasha can no longer be used as a source of water. Based on literature review, it may be difficult in obtaining direct information from industry owners as well as photographic documentation on privately owned land.

ANTICIPATED RESULTS

The following defines my anticipated results:

Qualitative data based on primary data collection methodology.

Quantitative data based on secondary data collection methodology.

An analysis of the nature, extent and source of point source contamination at Lake Naivasha.

An analysis of the use of Lake Naivasha as a source of drinking water.

An analysis of the connection between primary and secondary stakeholders to Lake Naivasha.

An analysis of the economic use of Lake Naivasha whose livelihood is dependent on water as a resource.

An analysis of the point source interventions used to enhance lake water quality at Lake Naivasha.

A comparative analysis of profiles between Lake Naivasha and Lake Naivasha based on point source contamination, economic use with water as a requisite resource, and point source interventions.

Determination of the varying point source interventions implemented at Lake Victoria that can be implemented at Lake Naivasha.

Determination of limitations to data acquisition.

Recommendations.

DATA COLLECTION

I have separated my data collection process into research time frame and methodology. The research time frame is divided into pre-fieldwork, fieldwork, and post-fieldwork data collection. The methodology defines the methods, tools, and equipment that will be used in obtaining my research data.

Research Time Frame

My research time frame for the completion of my professional project commenced in September 2002 and is anticipated to be finalized by October 2003. The following defines the sequence of events by which research data will be obtained.

Pre-Fieldwork

Pre-fieldwork data collection has commenced since September 2002 and consists of the collection of information sufficient to define my purpose, audience, primary and secondary research objectives, issues of concern, and anticipated results. In addition, it has provided the tools to commence the actual fieldwork necessary for the completion of the professional project report.

Field Work

I am planning on completing my fieldwork at Lake Naivasha. The timeline for my fieldwork will be from May 22, 2003 to July 31, 2003. A field planning schedule is provided in Attachment 2 and defines the activities that will be completed during my stay at Lake Naivasha.

Post-Fieldwork

My post-fieldwork will include final acquisition of data, data compilation, data interpretation, and report development. At this time, it is unknown how long these activities will require, but I am anticipating a time frame of August to October 2003.

Methodology

The following defines the methods, tools, and equipment that will be used in my research data acquisition.

Methods

The methods by which I will be collecting data are both primary and secondary. My primary method of data collection, which will be utilized during my fieldwork at Lake Naivasha, is as follows:

Landscape Mapping

Visual Appraisal of Site Area

Transect Walks with LNRA and Community Members

Non-structured, Open-Ended Interviews with LNRA and Members of the Community (Stakeholders)

Focus Groups, Oral Histories, Time Line Variations

GPS Coordinate Collection of Direct Effluent Locations

Measurements of Direct Effluent Objects Photographic Documentation

Landscape mapping will allow for members of the community to draw the landscape surrounding Lake Naivasha based on their viewpoint on how the lake looked like before and after the inception of point source contamination.

This exercise is an important component in allowing members of the community to express themselves in a way that may provide additional information that a verbal dialogue may not achieve. A visual appraisal of the site area will allow me to ascertain the current physical conditions of the lake, note locations of direct point source effluent and structures relating to point source contamination. In addition, direct visual appraisal will allow me to confirm data provided in the literature. Transect walks portray the interactions between the stakeholders and the physical environment. This is another method by which stakeholders can provide information regarding point source contamination activities that may not have been thought of during a formal interview. Transect walks will primarily consist on walking along the lake boundary and allowing the interviewee to provide information on current and historical conditions of the lake.

Non-structure, open-ended interviews will be conducted with the LNRA and members of the community. Certain interview questions have been developed to obtain certain key data, but most of the information from interviews will be derived from information obtained from landscape mapping, a visual appraisal, and transect walks. Focus groups allow for outsiders to better describe the range of perspectives in a community or local organization through small group discussions. Oral histories often provide a way to understand the foundation and long-term trends of issues that people contend with in the present. Time line variations are a way to note the important historical events of a community. For the purpose of this professional project, focus groups, oral histories, and time line variations are methods that will be used to obtain information of pre and post point source contamination, economic use of the lake by stakeholders, and understanding the connection between the stakeholders and Lake Naivasha.

GPS coordinates of locations where direct point source effluent is occurring will be collected. Field measurements of the structures and other physical conditions of the effluents will be collected. The premise behind these methods is to provide accurate and documented data of point source contamination. Photographic documentation will be obtained of anything that is related to my professional project for documentation purposes.

My secondary method of data collection will be through:

- Literature review
- Review of technical documents
- Expert opinion
- Media
- Landsat/GIS documents
- Documented Maps and Figures

Previous work has been completed at Lake Naivasha by the Lake Naivasha Riparian Association (LNRA), graduate students from varying Universities, NGOs, and professional specialists in the field of ecology, biology, botany, hydrology, geology, and agriculture and pesticide assessment.

Of importance are environmental management plans that have been developed for both Lake Naivasha and Lake Victoria and Landsat and GIS data that has been compiled and developed for the Lake Naivasha region.

Tools

The tools that will be used for my primary data collection are as follows:

Personally drafted graphics based on visual appraisal

Preliminary questions to be asked in the non-structured, open-ended interviews with stakeholders

Field Notes

Transcribed interviews from field notes and audio tape recordings

Drawings by members of the community

The tools that will be used for my secondary data collection are as follows:

Library

Internet

Newspapers

Documents provided by stakeholders and technical specialists

Equipment

Equipment use for my primary data collection will be as follows:

Field Notebooks

Drawing Material

Tape Recorder

GPS Unit

Digital and manual cameras

100' Tape Measure

Flag Stakes

Research Material

DATA COMPILATION

Upon completion of the primary and secondary data collection, I plan on compiling the data by order of research objective in preparation for data interpretation.

DATA INTERPRETATION

Data interpretation of the information collected will determine that the research objectives have been met, provide a comparison to pre-determined anticipated results, and will provide the basis for recommendations.

DRAFT REPORT OUTLINE

I have developed a draft report outline, which is provided as Attachment 3.

REPORT DEVELOPMENT

Report development will incorporate the draft report outline and any other unanticipated changes. It will comprise of the development of tables, graphs, figures, photographs, appendices, and references for the final development of a rough draft report.

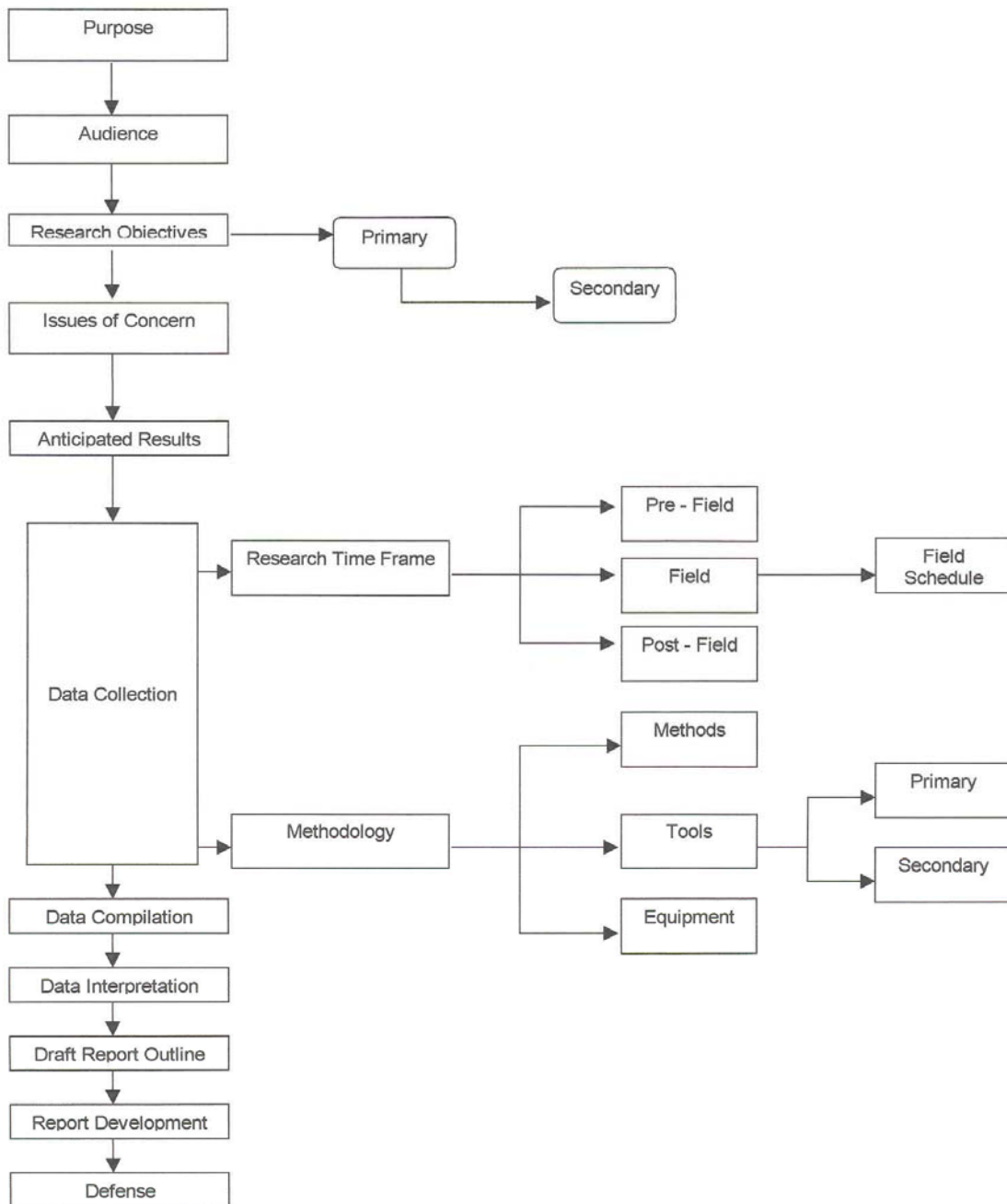
PROFESSIONAL PROJECT DEFENSE

Following approval of the draft report content by members of my committee, I will define a time for my professional project defense. I am anticipating on defending mid-October 2003.

RESOURCES REQUIRED

Due to the location of my professional project site area and subject matter of my research, the type of resources required are not extensive, but are costly. The following defines my budget requirements and provides the timeline for my research completion.

**MASTER OF WATER RESOURCES – PROFESSIONAL PROJECT PROPOSAL FOR
BARBARA HEEMINK
ATTACHMENT 1 – FLOWCHART**



**MASTER OF WATER RESOURCES – PROFESSIONAL PROJECT PROPOSAL FOR
BARBARA HEEMINK**

ATTACHMENT 2 – FIELD PLANNING SCHEDULE

RESEARCH QUESTION	SUB – OBJECTIVES	FIELD PLANNING SCHEDULE	STAKEHOLDER INTERVIEW	NON-INTERVIEW DATA COLLECTION METHODS	DATA RECORDING TOOLS/ EQUIPMENT
What is the nature and extent of point source contamination at Lake Naivasha?	<input type="checkbox"/> Current source, nature and extent <input type="checkbox"/> Pre –Post Baseline <input type="checkbox"/> Critical Point <input type="checkbox"/> Effects to Water Quality	May 28 – July 27	LNRA	Primary <input type="checkbox"/> Visual Appraisal of Site Area <input type="checkbox"/> Non-structured, Open-Ended Interviews with LNRA and members of the Community (Stakeholders) <input type="checkbox"/> Transect Walks with LNRA and Community Members <input type="checkbox"/> GPS Coordinate Collection of Direct Effluent Locations <input type="checkbox"/> Photographic Documentation <input type="checkbox"/> Measurements of Direct Effluent Objects	Tools <input type="checkbox"/> Personally drafted graphics based on visual appraisal <input type="checkbox"/> Preliminary questions to be asked in the non-structured, open-ended interviews with stakeholders <input type="checkbox"/> Field Notes <input type="checkbox"/> Transcribed interviews from field notes and audio tape recordings <input type="checkbox"/> Drawings by members of the community
		May 28 – June 10	<input type="checkbox"/> Naivasha Residents <input type="checkbox"/> Fisherman <input type="checkbox"/> Boating Tourism		
Is Lake Naivasha a source of drinking water and by whom?	<input type="checkbox"/> Municipal and Non-Municipal <input type="checkbox"/> Method of Extraction <input type="checkbox"/> Treated	May 28 – July 27	LNRA	Secondary <input type="checkbox"/> Literature review <input type="checkbox"/> Review of technical documents <input type="checkbox"/> Expert opinion <input type="checkbox"/> Media <input type="checkbox"/> Landsat/GIS documents <input type="checkbox"/> Documented Maps and Figures	Equipment <input type="checkbox"/> Field Notebooks <input type="checkbox"/> Drawing Material <input type="checkbox"/> Tape Recorder <input type="checkbox"/> GPS Unit <input type="checkbox"/> Digital and manual cameras <input type="checkbox"/> 100' Tape Measure <input type="checkbox"/> Flag Stakes <input type="checkbox"/> Research Material
		May 28 – June 10	<input type="checkbox"/> Naivasha Residents <input type="checkbox"/> Naivasha Municipal Waste Water Treatment		
What is the stakeholder (LNRA and community) connection to Lake Naivasha?	<input type="checkbox"/> Define Primary (LNRA) and Secondary (Community) Stakeholders <input type="checkbox"/> Define Connection Stakeholder Awareness <input type="checkbox"/> Stakeholder Concern <input type="checkbox"/> Effects on Community <input type="checkbox"/> Future Outlook	May 28 – July 27	LNRA	<input type="checkbox"/> Literature review <input type="checkbox"/> Review of technical documents <input type="checkbox"/> Expert opinion <input type="checkbox"/> Media <input type="checkbox"/> Landsat/GIS documents <input type="checkbox"/> Documented Maps and Figures	Equipment <input type="checkbox"/> Field Notebooks <input type="checkbox"/> Drawing Material <input type="checkbox"/> Tape Recorder <input type="checkbox"/> GPS Unit <input type="checkbox"/> Digital and manual cameras <input type="checkbox"/> 100' Tape Measure <input type="checkbox"/> Flag Stakes <input type="checkbox"/> Research Material
		June 11 – July 1	<input type="checkbox"/> Naivasha Residents <input type="checkbox"/> Commercial Industry		
What is the economic use of Lake Naivasha with Water as a Requisite Resource?	<input type="checkbox"/> Types of Industries <input type="checkbox"/> Employment Factor <input type="checkbox"/> Economic Constraints	May 28 – July 27	LNRA	<input type="checkbox"/> Literature review <input type="checkbox"/> Review of technical documents <input type="checkbox"/> Expert opinion <input type="checkbox"/> Media <input type="checkbox"/> Landsat/GIS documents <input type="checkbox"/> Documented Maps and Figures	Equipment <input type="checkbox"/> Field Notebooks <input type="checkbox"/> Drawing Material <input type="checkbox"/> Tape Recorder <input type="checkbox"/> GPS Unit <input type="checkbox"/> Digital and manual cameras <input type="checkbox"/> 100' Tape Measure <input type="checkbox"/> Flag Stakes <input type="checkbox"/> Research Material
		June 11 – July 1	<input type="checkbox"/> Naivasha Residents <input type="checkbox"/> Commercial Industry		
What interventions are being implemented at Lake Naivasha addressing point source contamination and by whom?	<input type="checkbox"/> Current/Future Methods <input type="checkbox"/> Costs <input type="checkbox"/> Stakeholders, NGOs, Government	May 28 – July 27	LNRA	<input type="checkbox"/> Literature review <input type="checkbox"/> Review of technical documents <input type="checkbox"/> Expert opinion <input type="checkbox"/> Media <input type="checkbox"/> Landsat/GIS documents <input type="checkbox"/> Documented Maps and Figures	Equipment <input type="checkbox"/> Field Notebooks <input type="checkbox"/> Drawing Material <input type="checkbox"/> Tape Recorder <input type="checkbox"/> GPS Unit <input type="checkbox"/> Digital and manual cameras <input type="checkbox"/> 100' Tape Measure <input type="checkbox"/> Flag Stakes <input type="checkbox"/> Research Material
		July 1 – July 15	<input type="checkbox"/> Naivasha Waste Water Treatment Facility <input type="checkbox"/> Flower and Aggie Farms		
In what ways is Lake Naivasha analogous to Lake Victoria in terms of point source contamination, economic use, and intervention implementation?	----	----	----		----
Are there activities that have been completed at Lake Victoria that can be implemented at Lake Naivasha in addressing and remediating point source contamination?	----	----	----		----

**MASTER OF WATER RESOURCES – PROFESSIONAL PROJECT PROPOSAL FOR
BARBARA HEEMINK
ATTACHMENT 3 – DRAFT REPORT OUTLINE**

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Abstract
List of Tables, Figures, Appendices
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- 2 Purpose
- 3 Research Objectives
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**Water Quality and Public Health Monitoring of
Surface Waters in the Kura-Araks River Basin of
Armenia, Azerbaijan and Georgia**

by

Amy Ewing

Committee

Dr. Michael E. Campana, Chair

Dr. William M. Fleming

Dr. Gregory Gleason

A Professional Project Proposal Submitted in Partial Fulfillment of the Requirements
for the Degree of

Master of Water Resources

Water Resources Program

The University of New Mexico

Albuquerque, New Mexico

March 2003

Committee Approval

The Master of Water Resources Professional Project Proposal of Amy Ewing
is approved by the committee:

Chair

Date

Professional Project Proposal
University of New Mexico
Masters of Water Resources Program

Amy Ewing
March 24, 2003

Introduction

The focus of this project is the Kura-Araks River Basin, an international river basin located in the South Caucasus. The watershed includes Turkey, Iran, Armenia, Georgia, and Azerbaijan, although the analysis of this project will be constrained to the three lower basin states of Georgia, Armenia, and Azerbaijan. The total area of the watershed is approximately 188,500 km², with the percent of total area for each of the countries as follows: 18% Georgia, 16% Armenia, 31% Azerbaijan, and 35% for Iran and Turkey combined (USAID, 2002). The Kura River originates in Turkey, and flows southeast through Georgia into Azerbaijan (USAID, 2002). The headwaters of the Araks River are in Turkey, and it flows east through Turkey to the border with Armenia. The Araks marks the borders between Turkey and Armenia, and then Iran and Armenia, before flowing into Azerbaijan. The confluence of the Kura and Araks Rivers is in Azerbaijan, near the town of Sabirabad (USAID, 2002). The population of the basin exceeds 8 million people (European Commission, 2002), and there are currently no treaties between these countries concerning water rights or water quality in the basin (Wolf, 2003).

My interest in the Kura-Araks Basin stems from a NATO proposal entitled the South Caucasus River Monitoring Project, for which Michael Campana is the NATO representative. This NATO funded project aims to set in place a monitoring program developed and maintained by these countries, and will collect water discharge and quality parameter data monthly and quarterly, analyzing for a score of contaminants. The monitoring is scheduled to begin in the fall of 2003, and the project is planned to operate for a period of 3 years (NATO, 2002). This NATO project is exciting because scientists from Armenia, Azerbaijan, and Georgia are coming together in an effort to document a baseline of current basin conditions, with a look into the future at how best to manage the shared water resource.

The governments are aware of this project, but they are not involved in it. Scientists will brainstorm a transboundary management plan as a part of this project, with possible future implementation by governments who have historically been in conflict.

Other new monitoring programs are proposed in the basin, including one by the European Commission, and there are lists and lists of existing (or previously existing) monitoring stations available. During the Soviet era, water resource monitoring data was collected by region, and forwarded to Moscow at the end of each year. This practice stopped in 1989, and since then, former Soviet Republics have been developing monitoring programs of their own (DAI, 2002). There is very little actual water quality data available, which may perhaps be just as well, as the accuracy of laboratories is called into question in the project proposals of current date. Laboratory accuracy is an issue that is being dealt with currently, so as to validate the data to be collected by the NATO project beginning this fall.

Water Use and Quality

Water use along the river is fairly well constrained, including municipal, agricultural, industrial, and mining uses. In Georgia there is a surplus of water, and surface water from the Kura River is used primarily for agriculture. In Armenia, there are shortages some of the time, however, they are primarily induced by the water resource management methods (European Commission, 2002). In Armenia, the primary use of surface water from the Araks River is for agriculture and industry, while further downstream in Azerbaijan, the Kura-Araks River is relied upon for drinking water as well as for agriculture and industry (European Commission, 2002). Azerbaijan is short on water, only allowing an average use of 1000 m³ per person per year, which is one of the lowest rankings in the world (USAID, 2002).

The list of contaminants present in the river is also fairly well constrained. Over 8 million people live in the basin, and with little or no treatment for the municipal sewage, there is a great amount of contamination from coliform bacteria, and infectious diseases. Industry is diverse in the region, with copper mining common to all three countries. Heavy metal contamination includes copper, zinc, manganese, lead, mercury, and cadmium (European Commission, 2002). Chemicals are also a result of industry in the area – primarily phenols and carbon hydrates.

Runoff from agriculture yields nitrate contamination, and the introduction of pesticides into the river – most notably, DDT (European Commission, 2002).

Contaminant Exposure and Effects

With the list of contaminants so well constrained, the potential risks to human health can also be evaluated. We know what the primary uses of water are for each country, and as Azerbaijan is the only one of the three that relies on surface water from the Kura-Araks for drinking water, it is there that the most serious impacts on human health are expected. The effects of these contaminants are well known in the medical community, and as I am interested in the effects of water quality on public health in this basin, I am researching their effects. I am interested in taking the list of known contaminants, and quantifying the amounts of each necessary to pose a threat to the regional public health (particularly in Azerbaijan, the country furthest downstream). Such an analysis could easily be applied to the data that will be collected in the future, with such analyses pointing out the water quality issues that if adequately addressed could eliminate threats to human health. Exposure effects applicable to the Kura-Araks River Basin include the effects of coliform bacteria and infectious disease from the lack of treatment for municipal waste, heavy metal contamination as a result of mining and industrial use, as well as chemical and pesticide introduction from industrial and agricultural runoff.

Public health monitoring is something that is not included in either the NATO monitoring project, or that proposed by the European Commission; however, I feel that it is an important aspect of defining baseline water quality. I expect for overall life expectancy to be lowered by the lack of infrastructure and water treatment, and for the rates of cancer to be high as a result of exposure to many of these contaminants. Life expectancy and cancer rates are difficult to quantify, as the number of people who would have to be monitored to accurately define these would be too great. It would be useful, however, to monitor any neurological effects present as a result of exposure to heavy metals, as well as the health of pregnant women and babies looking for increased infant mortality, birth defects, and developmental delays as a correlation to exposure to chemicals and pesticides such as DDT. A list of recommended public health monitoring could be better constrained after the exposure effects are more clearly understood.

By establishing a public health baseline, and by combining this information with the known effects of exposure to certain contaminants, a plan could then be formulated for the order in which contaminants might best be addressed, yielding the greatest impact on

the betterment of the public health in the basin. Such an order could be applied in this basin, and in other basins around the world.

This area lacks money with which to address these issues; however, the international community is heavily involved in the funding of projects it sees as having potential, including those that will monitor water quality. I have no reason to expect that a project potentially limiting exposure to certain contaminants with known detrimental effects on public health would not elicit both international interest and financial backing.

Objectives

My interest in this area originates with early work I was involved in just after college on the Aral Sea, and the effect its shrinkage has had on local climatology. I came into the water resource program with an interest in international water issues, and that interest has flourished. I wrote a paper on the Aral Sea myself as a part of this program, and it was from this research that I developed an interest in public health issues, especially as they relate to water quality. The issues of water quality are great in the former Soviet Republics of Central Asia, as well as those republics that together form the South Caucasus.

The purpose of this project is to identify and list the contaminants that are present in the Kura-Araks River Basin, identify the routes of exposure to each as well as the populations affected, and evaluate the effects of exposure to each of the known contaminants. The analysis will quantify the amount of each contaminant that is a risk to human health for easy application to the results of monitoring that will come from the NATO South Caucasus River Monitoring Project. In addition, I intend to design a more extensive monitoring project both with respect to lists of monitoring stations, and water quality parameters in need of monitoring (i.e. are not a part of a current monitoring program). In summary, this project will define a list of known contaminants and their effects on human health, and also will develop a public health based water quality monitoring plan. An implementation of this monitoring plan, followed by actions resulting in a reduction in exposure to those contaminants with the most significant impacts would have a positive impact on the health of the people in this basin.

Timeline

March 27, 2003	Proposal to be approved and signed by full committee
March 27, 2003	Turn in OGS Notice of Intent to Graduate Form (summer 2003)

May 5, 2003 Paper draft to Bill Fleming, Greg Gleason, and Michael Campana
week of May 5 Turn in OGS Announcement of Examination Form
week of May 19 Project Defense
May 29, 2003 Paper turned in

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