APPENDIX A

STRATIGIC PLAN FOR THE INTERDISCIPLINARY GRADUATE PROGRAM OF HYDROLOGIC SCIENCES (HSP)
October 2003

I. BACKGROUND

The Graduate Program of Hydrologic Sciences (HSP) was founded in the early 1960s on the UNR campus to train graduate students in the study of hydrogeology and surface water hydrology. The Program has graduated approximately 316 MS and 7***5*** *Doctoral students.* Since 1961, the year of the first doctoral degree granted at UNR, the Program has been responsible for over 6% of the total number of doctoral degrees at UNR.

The Graduate Program of Hydrologic Sciences is the only graduate program on the UNR campus nationally ranked by *U.S. News and World Report*. Based upon the most recent analysis for the discipline of Hydrogeology, the program is tied for 8th along with MIT and the Univ. of Illinois. No ranking category is available for the more general area of Hydrology, however of the schools ranked in Hydrogeology, our program, along with the University of Arizona (ranked #1), Stanford (#2) and MIT (8th) are the only programs to offer comprehensive programs in both ground and surface water hydrology. Table 1 shows the most recent ranking (1999) from *U.S. News and World Report*.

Ranking	University
1	University of Arizona
2	Stanford University
3	University of Wisconsin–Madison
4	New Mexico Institute of Mining and Technology
5	Penn State University–University Park
6	University of Texas–Austin
7	University of Minnesota–Twin Cities
8	University of Nevada–Reno
8	Massachusetts Institute of Technology
8	University of Illinois–Urbana-Champaign

Table 1. Current ranking of Hydrogeology programs nationwide from 1999 survey.

II. ENVIRONMENTAL CONTEXT

The program is interdisciplinary, with graduate faculty from the Colleges of Agriculture, Biotechnology and Natural Resources, College of Science (Mackay School of Earth Science and Engineering and the Science Departments), College of Engineering, the Desert Research Institute and the U.S. Geological Survey. HSP offers MS and doctoral degrees in 1) Hydrogeology and 2)

Hydrology. Students seeking Hydrogeology or Hydrology degrees share a common foundation core of four courses in Geological Sciences and Environmental and Resource Sciences Depts. The Program discontinued its Hydrology/Hydrogeology MS and doctoral degrees and has 3 students still in this track. The curriculum and courses available are provided in Appendix A-1. The entrance requirements for all degrees include 1 year of chemistry, 1 year of physics and mathematics through differential equations and probability/statistics.

The Program provides access to Doctoral students for faculty in the following departments where no Ph.D. program is available: Natural Resources and Environmental Science, Biology, Applied Economics and Statistics, Nevada Bureau of Mines and Geology, the Desert Research Institute and Mathematics**.** As of September 2001, the HSP has 41 graduate faculty core members (those faculty actively advising students or teaching hydrology related coursework) and an additional 29 collaborating faculty, making it the largest interdisciplinary graduate faculty on the UNR campus. Core faculty are defined as faculty who are or have advised a student in the last year; cooperating faculty have not but wish to participate in the Program. Appendix B-1 describes the contributions and faculty support from the participating Departments and Units.

The HSP does not offer any undergraduate degrees. The University offers a B.S. in Hydrogeology through the Department of Geological Sciences and an option in Watershed Science (within the new degree of Environmental Sciences) in the Department of Natural Resources and Environmental Sciences (formerly known as ERS). Studies are being conducted by faculty in that department to determine if a separate undergraduate major in Watershed Science should be proposed. Both undergraduate degree programs suffer from low enrollment (6-12 in each major or option) and neither has received significant recruiting efforts in the last decade. Undergraduate students have no formal interaction with the graduate students in the Hydrologic Sciences Program although many informal efforts are underway (seminar announcements, field trips, social functions, mentoring, etc.)

III. RECENT TRENDS

1. Research and Societal Needs

HSP began and maintained a focus in hydrogeology through the early 1990's, coincident with a societal focus of ground water availability and ground water pollution. HSP maintains a strong faculty base in traditional ground water hydrology studies, but is relatively weak in the areas of ground water remediation technology when compared to other nationally recognized programs.

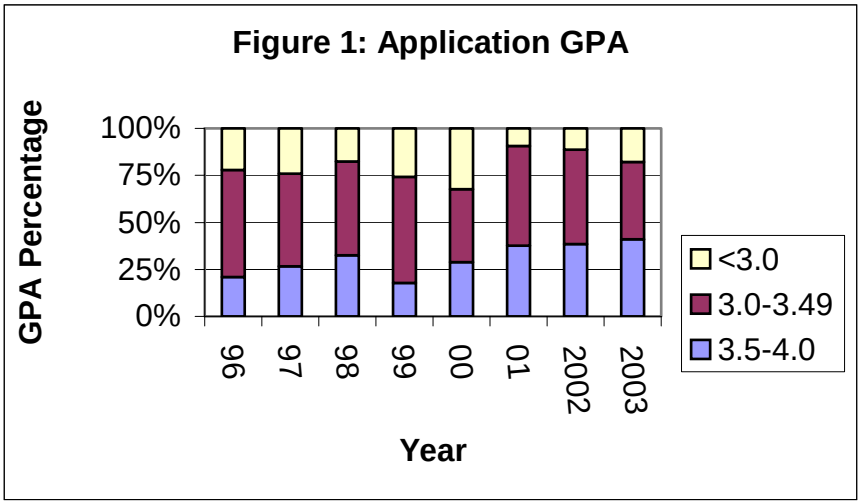
Beginning in the 1990's, the discipline of hydrology has expanded significantly to include surface water and ecologically orientated issues, such as those found in the restoration of Lake Tahoe, and the role of climate change on water resources and water economics/policy. Faculty expertise has grown somewhat in these areas through one hire each in NRES, Geography and Civil Engineering since the mid 1990's. The Hydrology curriculum requirements have been recently revised to produce a student with more skill sets in the area of surface water modeling, water quality assessment and watershed restoration.

The majority (53%) of HSP students enrolled are following the Hydrology curriculum, and 43% are pursuing Hydrogeology degrees. This represents a significant change in enrollment from the last

several decades and indicates that students are adjusting to pressing societal needs. However, the HSP faculty distribution remains weighted more towards groundwater hydrology at this time.

2. Student Applicants

Over the past 3-4 years, the total number of applicants to the program has declined from approximately 80/year to approximately 45/year. However, the applicant quality has significantly improved. Applicants from Tier I and II schools have also dramatically increased In 2003, ~20% of the applicants scored over 1400 in the combined GRE verbal and quantitative, while in 2001, only 10% scored over 1400. Figure 1 shows the distribution of applicant GPA since 1996, showing that since 2001, ~40% of all applicants have GPAs exceeding 3.5.



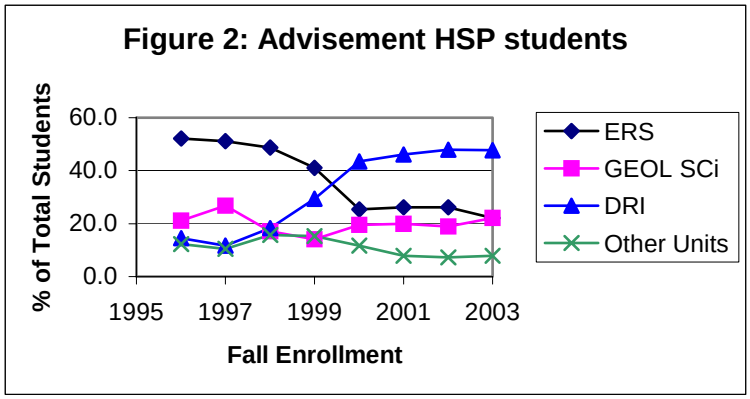
3. Enrollment Trends

Enrollment declined from a high of ~90 students in 1995 to 60 in 2000, although there has been an increasing number of faculty associated with the program. The decline in enrollment is, in large part, the result of the departure and/or retirement of several faculty who carried large numbers of students in the program. Since 2001, enrollment is slowly growing with 63 students (40 MS and 23 Ph.D. in September 2003). The stabilization and slow growth is the result of aggressive recruiting efforts and some faculty replacement.

Currently 43% of these students are pursuing graduate degrees in Hydrogeology and 53% in Hydrology. The geographic distribution of students shows that 28 states and 6 nations are represented in our student admissions between 1996 and 2001, a much larger representation than many graduate programs on the campus.

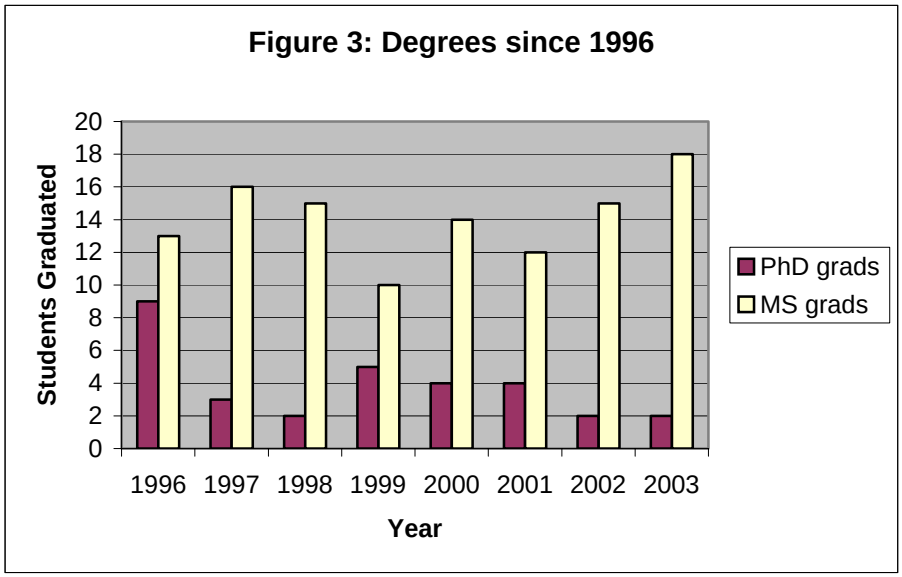
4. Advising, Funding and Graduation Trends

Figure 2 shows the current (Fall 2003) distribution of advisors from contributing departments and units. Desert Research Institute faculty currently advise approximately 50% of the total students enrolled, with NRES and Geological Sciences making up the remaining majority.

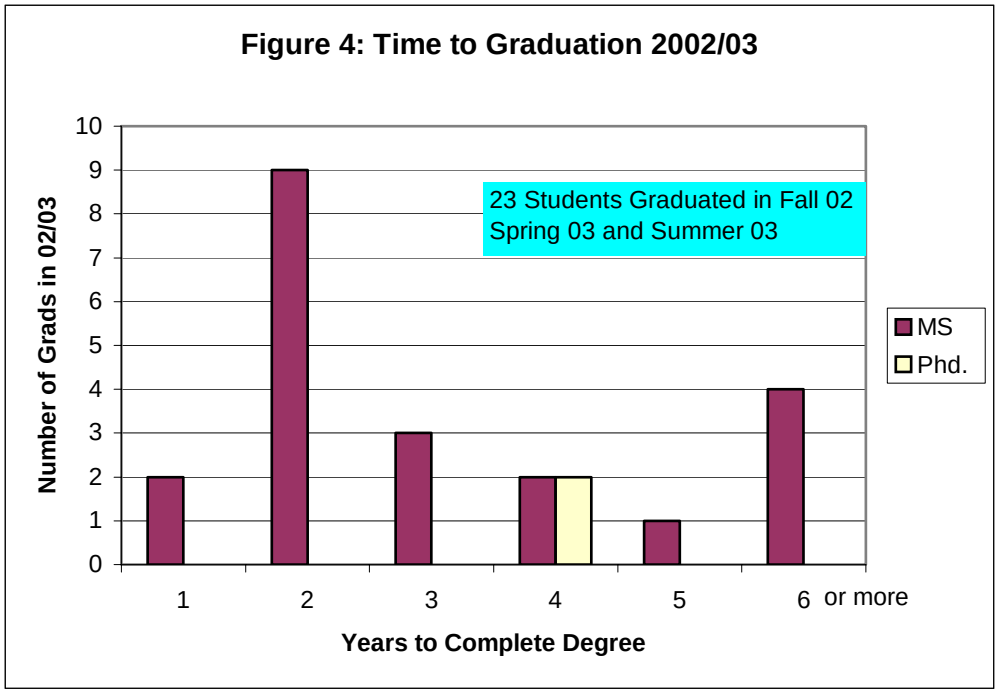


During residence at UNR, HSP students are almost exclusively funded on research grants. In September 2003, 6% of students were funded on research grants, 5% on Teaching Assistantships and 28% were unfunded. The majority of these unfunded students (25% of the 28%) were working full time in the community in the field of hydrology.

Figure 3 shows the number of MS and doctoral degrees granted since 1996. On average, the program graduates 18-20 students per year, with a slight decrease in doctoral degrees granted over the last two years.



The time to graduation has declined in the last several years due primarily to coordinating the curriculum and timing of course offerings. Figure 4 shows the residence time of the most recent year's graduation.



5. **Faculty Distribution**

Since 1999, the graduate faculty has grown from ~50 to 70 faculty. Contributing Departments and Units are described in Appendix B-1. Large increases in graduate faculty have come from the Desert Research Institute and the U.S. Geological Survey. Currently, DRI faculty have their students sign up for thesis/dissertation credits through Geological Sciences. UNR's component of faculty, including new hires since 1990, continue to be focused on subsurface hydrology, with a small but talented group of surface water hydrologists and watershed scientists in NRES and Civil Engineering. DRI senior faculty teach a much larger component of the Hydrology curriculum than the hydrogeology curriculum. The atmospheric component of hydrology (precipitation, climate, etc.) has little representation in the HSP faculty.

In the last two years, four groundwater faculty from the U.S. Geologic Survey District Office in Carson City have joined the graduate faculty in Hydrologic Sciences and the USGS has continued to support and train graduate students. These new faculty represent a significant area for potential new classes, hands-on training for students and short course offerings provided funding and operating agreements can be developed. Collaboration between the USGS and the University of Arizona in the late 1960's led to the development of the top Hydrology school in the United States and is a good model for UNR to follow.

Unfortunately, in spite of enrollment and national trends, the HSP program has not sufficiently strengthened its faculty nor curriculum focus in surface water and watershed science. In addition, a significant portion of the teaching faculty are full professors, with very few assistant professors involved in teaching.

6. Student Placement and Success

Graduates from the program at the MS level routinely enter the private or government sector. In the last 3 years, 100% employment has occurred for all MS graduate students in their chosen field. Only 5% of these graduates were native-Nevadans, yet ~40% of our MS graduates in the last 3 years

obtained hydrology positions in Nevada as their first post graduate job. Many MS graduates from the program have gone on to successfully complete doctoral degrees at other institutions.

At the doctoral level, students from UNR are placed in academic positions (Texas A&M, Oregon State, Ohio State, Univ. of Oklahoma, University of Idaho, University of Nevada, Las Vegas, Univ. of Illinois, University of Missouri, Univ. of Wisconsin-Kenosha, Old Dominion University, Virginia Polytechnic Institute, UNR and the Desert Research Institute), government (U.S. Geological Survey, So. Nevada Water Authority) or the private sector.

IV. PROGRAM VISION AND GOALS

The fundamental goals of the Hydrologic Sciences Graduate Program are simple:

- To produce the highest quality Masters students for professional employment in the private/public sector, and
- To train the highest quality doctoral students for academia and the public/private sector.
- To elevate our national standing to be recognized as one of the top 4 Hydrology Programs in the United States.
- To develop a coherent and viable undergraduate program in the areas of watershed science and hydrogeology.
- To increase collaboration with the related disciplines of Resource Economics, Geography, Environmental Science, Civil/Environmental Engineering, Atmospheric Sciences, and Biology, DRI, the USGS and the Univ. of Nevada, Las Vegas.

V. PROGRESS SINCE THE 2001 STRATEGIC PLAN

1. Curriculum revisions successfully completed for the Hydrology Degree (MS and Ph.D.)
2. Course offering schedule redesigned to improve timeliness and course sequencing.
3. Slight increase in teaching support for DRI
4. Completion of replacement hire of Water Quality Modeler (L. Saito)
5. Addition of 4 adjunct faculty from the U.S. Geological Survey in Carson City
6. Increase in Graduate School support for assistantships and operating budgets through implementation of a student headcount-based funding formula for interdisciplinary programs.
7. Time to complete degree decreased significantly, particularly with respect to Master's degree
8. Student assistantship stipends increased and a schedule of increases is planned.

VI. OUTSTANDING ISSUES EMERGING FROM THE 2001 PLAN

1. Department status not achieved, but remains a long term objective.
2. Requested allocation of FTE and increases in DRI teaching FTE not realized. Net loss of ~6K in teaching funds for DRI faculty since 2002 (expiration of 20K startup teaching to director and increase of $14K to DRI teaching pool)
3. As a result of #2 above, course offerings for 2004/2005 will be reduced

4. NFS IGERT proposal submitted to link Hydrologic Sciences and Atmospheric Sciences not funded.
5. No new UNR faculty positions in the Hydrologic Sciences

VII. OBJECTIVES AND STRATEGIES FOR THE FUTURE

1. Insure teaching and research faculty skills match or lead the discipline for the future. To achieve our first three goals, it is critical that new UNR faculty be recruited, hired and retained to a) improve the surface water and watershed science curriculum b) improve the subsurface remediation portion of the Hydrogeology degrees and c) ensure continuity in all programs. This objective can be achieved by one or all of the following strategies:

   - Continued long term focus on the development of a Department of Hydrologic Sciences with three new faculty positions allocated over the next 5 years These positions are focused each in the following areas: 1) Watershed modeling, including potentially a component in GIS and remote sensing analysis, 2) Subsurface remediation including subsurface biogeochemistry and 3) Snow Hydrology/alpine climatology, also with a potential component of remote sensing and GIS skills.
   - Allocation of FTE or partial FTE through the Hydrologic Sciences Graduate Program for joint development of positions with existing UNR departments and/or the Desert Research Institute. Such faculty could have a portion of their duties assigned specifically to support the HSP, as has already been done in other Interdisciplinary degree programs but would also strongly support the missions of the various departments.
   - Development of joint appointments with DRI faculty to insure continuity in teaching.
   - Development of funding and teaching arrangements with the U.S. Geological Survey, both through the Carson City District Office and the Minerals Research Branch co-located on the UNR campus.

2. Insure that appropriate courses and curriculum are offered on a routine schedule. This objective is critical to attaining the program's first three goals. To achieve this, the following strategies are planned.

   - Continued focus on development of a Department of Hydrologic Sciences with three new faculty positions allocated over the next 5 years
   - If department status cannot be attained in the relatively short term, allocation of FTE or partial FTE through the Hydrologic Sciences Graduate Program for development of joint positions with existing UNR departments and/or the Desert Research Institute AND increased DRI teaching support from the current $100K to $120K immediately with both COLA and merit raises provide to this support every year.
   - Addition of $10K/year for the first 2 years for short course offerings through the USGS.
   - Review the system of thesis, dissertation, comp exam and professional paper courses, with the possibility of developing these courses as Hydrologic Science courses, to support those faculty in which no such course exists in their home department.

3. Insure that teaching and research facilities are sufficient for continued success and growth. To accomplish this objective:

- Addition of 2 new graduate student offices immediately and one per year for the next 3 years to meet existing needs and expected growth.
- Procurement of office space for US Geological Survey faculty to use for co-location, during time spent at UNR, or during teaching times.
- Development of a Hydrology student lounge space in LMR 160. Remodeling of this space into student offices and a student lounge will allow students to work more closely together.
- Development of dedicated teaching laboratory space for subsurface hydrology, including soils, vadose zone hydrology and ground water hydrology.
- Equipment needed for the future includes; boat and trailer, geophysical equipment, dedicated computer lab**.**
- Development of an international internship program with student and faculty exchanges.

4. To increase the Program's visibility and national ranking, improvements in recruiting are necessary. To achieve this objective, the following will be done
   - Develop a new Program Web site. The current web site, while highly successful in recruiting, is approximately 7 years old and needs to be completely renovated and modernized.
   - Funding for a recruiting booth at national meetings. In the past, the Hydrologic Sciences Graduate Program has relied upon the generosity of the Mackay School of Mines and the Geological Sciences Department exhibit booth for recruiting. The future of these activities is uncertain, but it is critical that the Program have a strong presence at the Geological Society of American, the American Water Resources Association and the American Geophysical Union's national meetings

5. To improve the undergraduate educational opportunities in the Hydrologic Sciences. The undergraduate programs and degrees that exist have no interaction or optimization of resources. Each operates independently. The Program proposes ALL of the following strategies to improve the existing situation:
   - Development of an undergraduate major in Watershed Science. This is currently under study in the NRES Department and is fully supported by the HSP.
   - Curriculum review of the existing Hydrogeology undergraduate degree and consideration of upgrade to Engineering ABET accreditation, i.e. produce a hydrogeology undergraduate capable of becoming a registered engineer.
   - Consideration of consolidation of both of these degrees under a single Department of Hydrologic Sciences. This would be the optimal arrangement for the long term success and growth of hydrologic sciences on the UNR campus.

6. Develop collaborations, new degree proposals and research projects with other appropriate departments, divisions and universities. Several strategies are available including:
   - Development of joint seminar series

- Exchange of UNR/UNLV faculty for 1 semester course offerings and guest lectures
- Continued discussions with departments interested in water policy and water economics. The Hydrologic Sciences Program initiated discussions with the Dept. of Applied Economics over a new focus in water resources economics, but these have not proceeded sufficiently. Further discussions should also include the Department of Geography and the University of Nevada, Las Vegas.
- Development of joint course offerings between Atmospheric Sciences and Hydrologic Sciences Graduate Programs.
- Maintain strong collaboration with the USGS and DRI.

VIII. RESOURCES

The HSP is administered via line management through the Center for Environmental Science and Engineering (CESE) and on to the Dean of the Graduate School. The Program has a director (stated but not codified in the director's contract documents at 0.25 FTE) and a full time program secretary. The program supplies to the Dept. of Geological Sciences two (2) teaching assistants and one (1) teaching assistant to a course cross-listed between Environmental and Resource Sciences and Geological Sciences. These TA positions are used yearly as recruiting tools. The Program has the following resources in 2003:

- In 2003/2004, the Graduate School budgeted $163,928 for all program activities (exclusive of those below) including secretarial support, TA's, travel, director's stipend and office operations. The majority of these funds are used to support teaching assistantships and research assistantships used in recruiting. In 2003/2004, 9 students received assistantships or partial assistantships from these funds. These funds are NOT used for supporting teaching either through DRI or LOAs, however.
- FTE ($100K in 2003) support DRI faculty in teaching hydrology and hydrogeology courses at UNR. Beginning in 2003, these funds are now directly allocated to the Program. In the past, they had been under the budgeting process of the Mackay School of Mines. These funds are used to teach courses in the following departments: Geological Sciences, Environmental and Resource Sciences and Biology. .
- The CESE has typically supported one additional course by DRI faculty. Support is promised for 2003/2004 but as CESE will no longer exist, no information is available for academic year 2004/2005

IX. TIMELINE FOR IMPLEMENTATION

Fall 2003:	Provide input and guidance to Department-based searches for Aquatic Ecologist (Biology), Aquatic Ecologist (NRES), Climatologist (Geography) to insure that these positions provide support to HSP's teaching and research mission
Fall 2003:	Initiate discussions between UNR and DRI for joint appointments.

Summer 2004:	Complete discussions and sign MOU for HSP/UNR joint appointments
Spring 2004:	Contract for new web site construction and maintenance released
Spring 2004:	Completion of Self-Study and External Review

Appendix A-1
2003 Student Planning Guide

The University of Nevada, Reno (UNR)
Graduate Program of Hydrologic Sciences

Planning Guide (Revised May 2003)

Note that some course numbering and titles may not be reflected in Fall 2003 Schedule of Classes. Please consult the Program Office for updates.

I. INTRODUCTION

Welcome to the University of Nevada, Reno's Graduate Program of Hydrologic Sciences (HSP), one of the nation's top graduate programs in hydrologic sciences! The Graduate Program administers two graduate degrees at both the Masters and Doctoral levels in Hydrology and Hydrogeology, with a shared fundamental core and differing electives. This document has been prepared to assist you and your advisor in planning your coursework and study to best meet your needs. This Planning Guide gives you a complete summary of the degree requirements and an attached listing of related graduate courses and our prediction as to the schedule of class offerings. Additional information about committee guidance and examination procedures can be found in the "Examination Procedures Guidelines" and the UNR General Catalog.

II. MISSION STATEMENT

The Graduate Program of Hydrologic Sciences (HS) is a multi-disciplinary program created to train graduate students, in the diverse field of surface and subsurface aqueous environments. This diversity includes the study of aqueous geochemistry, contaminant transport (surface and subsurface), global climatic change, groundwater hydraulics, plant/water interactions, remote sensing, soil physics, rock physics, water and environmental policy, surface water hydrology, and water resources engineering. The curriculum is designed to guarantee a breadth of experience through a shared foundation core, while leaving ample time for concentration in either Hydrology or Hydrogeology.

III. ENTRANCE REQUIREMENTS and DEFICIENCIES

Students admitted to the Program should have a bachelor of sciences degree or equivalent in engineering, biology, chemistry, physics, geology, natural resources or ecology. Prospective graduate students should have GRE scores exceeding 500 each in verbal and quantitative, undergraduate GPA's above 3.0 and international students should have TOEFL scores exceeding 600.

In addition, the Program requires undergraduate prerequisites of 2 semesters each of physics and chemistry, one semester or probability/statistics and mathematics through differential equations. Students entering with mathematics through Calculus III can fulfill the mathematics requirements with MATH 767 during their first semester of graduate study. Any deficiencies are to be made up

during the first year of graduate students and students are encouraged to consult with their advisors and the Program Office for guidance on the appropriate courses for fulfilling deficiencies.

DEGREES OFFERED

The Graduate Program of Hydrologic Sciences administers two separate degrees (Hydrology and Hydrogeology) at both the M.S. and Ph.D. levels. There is a single, required, foundation core that includes a one-semester credit hour seminar along with one course each in groundwater, hydrologic fluid dynamics, and environmental chemistry. Beyond this foundation core, each degree has separate and additional required coursework. The attached spreadsheet summarizes the selection of graduate courses that fulfill all requirements as well as a listing of other recommended courses for students in the Graduate Program of Hydrologic Sciences.

A non-thesis Masters option is available in both Hydrology and Hydrogeology and is an appropriate alternative for those students with significant experience in project management and report writing, while maintaining the high standards of a Masters of Science Degree. The non-thesis option is generally considered a terminal degree and is not recommended for those students planning to complete a Doctoral degree. The Professional Paper (2 credits) should demonstrate the student's ability to integrate technical state-of-the-art knowledge into a document suitable for professional review and publication. Topics may be of an applied nature and must be approved by the student's Graduate Committee. A ready-to-submit manuscript must be approved by the major advisor prior to the final defense. Suitable outlets for publication include Professional Society Proceedings, Regional/National Symposia and Conferences, Applied Science and Resource Management Journals, and other Journals serving as a Forum for scientific discussion.

Master of Science in Hydrology (31 credits Plan A, 32 credits Plan B)

Student education and research examine the broad area of surface water hydrology, including but not limited to: hydraulics, water quality, limnology, watershed hydrology and rehabilitation and geomorphology. Students follow a shared core of four (4) courses with Hydrogeology degree students aimed at providing the fundamentals of hydrologic fluid mechanics and introductions to ground water hydrology and environmental chemistry as well as a one-credit seminar in Hydrologic Sciences.

Students can pursue a Masters of Science degree either with Plan A (thesis) or Plan B (non-thesis option). Because of the diverse nature of the skill sets needed by students, additional credits beyond the University minimums are required. The Masters of Science Plan A degree in Hydrology require a minimum of 31 credits beyond the Bachelors degree, of which at least 18 credits (including up to 6 credits of thesis) must be at the 700-level. For the non-thesis option (Plan B), a minimum of 32 credits is required; at least 15 of which must be at the 700-level (including 2 credits of Professional Paper). Students should consult with their advisor and the Program Office for guidance on choice of plan options. In general however, the Plan B option should be considered as a terminal degree.

The Master's of Science in Hydrology degree allows flexibility to allow students to follow one or more of the broad areas of surface water hydrology and to allow for specialization. All students

receive a broad underpinning of the hydrologic sciences through the shared core courses. Additional requirements for the degree include a course in watershed hydrology to provide an overview/introduction of surface water processes and one or more specialization courses in surface water hydrology. The Master's of Science in Hydrology degree allows flexibility for students to follow one of two areas of emphasis in surface water hydrology (Hydraulics/Geomorphology or Hydroecology/Water Quality) or to design their own area of emphasis from the available coursework. Students are expected to work with their advisors and committee members to develop a Plan of Study that best matches their research efforts and interests. Students should refer to the course rotation and scheduling guide contained in the Study Guide as some courses are on yearly rotations and others on biannual rotations.

Note that students who have previously taken one or more of the shared core courses may request to waive these requirements. Consult with your advisor and the Hydrologic Sciences Program Office for more information and requirements.

Core requirements and areas of emphasis for the Masters in Hydrology are described below:

SHARED HYDROLOGY AND HYDROGEOLOGY CORE REQUIREMENTS*

A grade of B- or better is required for each of these classes and these classes can only be retaken once.

ERS/GEOL 614	HYDROLOGIC FLUID DYNAMICS (3)+
GE 684	GROUND WATER HYDROLOGY (3)
GEOL 616	ENVIRONMENTAL GEOCHEMISTRY (3)
GEOL/ERS 782	HYDROLOGY/HYDROGEOLOGY SEMINAR (1)

*Students with deficiencies in Mathematics, Physics or Chemistry must make up these deficiencies within their first year of study. Students who have not completed undergraduate math through differential equations and probability/statistics may take MATH 767 to fulfill this deficiency. This must be taken during your first year of graduate study.

+CE 368 Fluid Mechanics Laboratory (1) is highly recommended

ADDITIONAL HYDROLOGY REQUIREMENTS

ERS 682	SMALL WATERSHED HYDROLOGY (4)*

*CE 364 Engineering Hydrology or equivalent may be substituted with consent of your advisor

AND AT LEAST 1 OF THE FOLLOWING COURSES

CE 698	PRINC. OF WATER QUALITY MODELING (3)
CE 610	HYDRAULICS OF OPEN CHANNELS (3)
GEOL 781	ADV. SURF. WATER HYDROLOGY (3)
ERS 785	ADVANCED LIMNOLOGY (4)
GEOL 702J	FLUVIAL GEOMORPHOLOGY (3)

HYDROLOGY AREAS OF EMPHASIS AND APPROPRIATE ADVANCED COURSES

HYDRAULICS AND GEOMORPHOLOGY

Students interested in or pursuing a career track related to fluid mechanics, geomorphic processes and modeling of urbanized and natural surface water systems should consider the electives listed below:

CE 689	WATER RESOURCE ENGINEERING I
CE 690	WATER RESOURCE ENGINEERING II
ERS/GEOL 702Z	FIELD METHODS IN HYDROLOGY
ERS 702D	SNOW HYDROLOGY (*on demand*)
GEOL 641	ADVANCED GEOMORPHOLOGY
GEOG 720	ADVANCED CLIMATOLOGY SEMINAR
GEOL 743	ALLUVIAL FAN HYDRAULICS
GEOL 742	SEDIMENT TRANSPORT
GEOL 702S	STOCHASTIC HYDROLOGY
GEOL 702Z	REMEDIATION TECHNOLOGY
MATH 758	TIME SERIES ANALYSIS

HYDROECOLOGY AND WATER QUALITY

Students interested in or pursuing a career track related to biological and chemical issues of water quality, surface water ecosystem health and management of water quality in watersheds, streams, rivers and lakes should consider the following electives:

BIOL 620	AQUATIC ECOLOGY
CE 756	ENVIRONMENTAL CHEMISTRY
ERS 640	WETLANDS ECOLOGY
ERS 702	SOIL CHEMISTRY
ERS 740	WATER QUALITY MODELING II (*on demand*)
ERS 765	BIOGEOCHEMICAL CYCLING
ERS 7XX	INTERDISCIPLINARY MODELING *(2004)*
GEOL 702Z	REMEDIATION TECHNOLOGY
GEOL 716	LOW TEMP GEOCHEMISTRY
GEOL 742	SEDIMENT TRANSPORT
GEOL 782	ISOTOPE HYDROLOGY
MATH 758	TIME SERIES ANALYSIS
PSC 653	ENVIRONMENTAL LAW

Doctor of Philosophy Degree in Hydrology (72 Credits)

Candidates for the Ph.D. degrees in Hydrology must satisfy all general requirements of the Graduate School. The Doctoral degrees in either Hydrology or Hydrogeology require 73 credits beyond the Bachelors degree, successful completion of a qualifying examination after the first year of study and 1 credit of Comprehensive Examination. The Comprehensive Examination credit may count toward the required 30 credits of 700-level coursework. Note that the Hydrologic Sciences Graduate Program does not generally accept students with only Bachelors degrees directly into the Doctoral degree programs; rather these students are first accepted into the Master's Program and may be considered for the Doctoral degree after one year of study. Students interested in proceeding directly to the Doctoral degree should contact the Program office for further guidance.

The Doctorate of Philosophy in Hydrology allows flexibility to allow students to follow one or more of the broad areas of surface water hydrology and to allow for specialization. All students receive a broad underpinning of the hydrologic sciences through the shared core courses. Additional requirements for the degree include a course in watershed hydrology to provide an overview/introduction of surface water processes and one or more specialization courses in surface water hydrology. The Ph.D. in Hydrology degree allows flexibility for students to follow two general areas of emphasis in surface water hydrology (Hydraulics/Geomorphology or Hydroecology/Water Quality) or to design their own focus area from the available coursework. Students are expected to work with their advisors and committee members to develop a Plan of Study that best matches their research efforts and interests. Students should refer to the course rotation and scheduling guide contained in this Planning Guide as some courses are on yearly rotations and others on biannual rotations.

Note that students who have previously taken one or more of the shared core courses may request to waive these requirements. Consult with your advisor and the Hydrologic Sciences Program Office for more information and requirements. Doctoral degree candidates should consult the "Graduate Program of Hydrologic Sciences Examination Procedures" information package for a review of committee, qualifying and comprehensive examination procedures and scheduling.

Master of Science in Hydrogeology (30 credits Plan A, 32 credits Plan B)

Student education and research examine the occurrence and processes associate with subsurface water transport. Specific areas of emphasis include but are not limited to: ground water contaminant transport, geochemical evolution of ground waters, nutrient transport processes in soils and ground water, vadose zone hydrology and numerical simulation of ground water, geochemistry and reactive transport. Students follow a shared core of four (4) courses with Hydrology degree students aimed at providing the fundamentals of fluid mechanics and introductions to ground water hydrology and environmental chemistry as well as a one-credit seminar in Hydrologic Sciences.

Students can pursue a Masters of Science degree either with Plan A (thesis) or Plan B (non-thesis option). . The Masters of Science Plan A degree in Hydrogeology require a minimum of 30 credits beyond the Bachelors degree, of which at least 18 credits (including up to 6 credits of thesis) must be at the 700-level. For the non-thesis option (Plan B), a minimum of 32 credits is required; at least

15 of which must be at the 700-level (including 2 credits of Professional Paper). Students should consult with their advisor and the Program Office for guidance on choice of plan options. In general however, the Plan B option should be considered as a terminal degree. For more information on credit requirements, students should consult the UNR General Catalog

The Master's of Science in Hydrogeology degree allows flexibility to allow students to follow one or more of the broad areas of subsurface hydrology and to allow for specialization. All students receive a broad underpinning of the hydrologic sciences through the shared core courses. Students are expected to work with their advisors and committee members to develop a Plan of Study that best matches their research efforts and interests. Students should refer to the course rotation and scheduling guide contained in the Study Guide as some courses are on yearly rotations and others on biannual rotations.

Note that students who have previously taken one or more of the shared core courses may request to waive these requirements. Consult with your advisor and the Hydrologic Sciences Program Office for more information and requirements.

Core requirements and areas of emphasis for the Masters in Hydrogeology are described below:

SHARED HYDROLOGY AND HYDROGEOLOGY CORE REQUIREMENTS*

A grade of B- or better is required for each of these classes and these classes can only be retaken once.

ERS/GEOL 614	HYDROLOGIC FLUID DYNAMICS (3)+
GE 684	GROUND WATER HYDROLOGY (3)
GEOL 616	ENVIRONMENTAL GEOCHEMISTRY (3)
GEOL/ERS 782	HYDROLOGY/HYDROGEOLOGY SEMINAR (1)

*Students with deficiencies in Mathematics, Physics or Chemistry must make these deficiencies up within their first year of study. Students who have not completed undergraduate math through differential equations and probability/statistics may take MATH 767 to fulfill this deficiency. This must be taken during your first year of graduate study.

+CE 368 Fluid Mechanics Laboratory (1) is highly recommended

ADDITIONAL HYDROGEOLOGY REQUIREMENTS

Students following the Hydrogeology degree track (either MS or Doctoral) are required to complete two of the following four courses:

GEOL 716---------Low Temperature Aqueous Geochemistry
GEOL 783---------Groundwater Hydraulics
GEOL/ERS 784—Vadose Zone Hydrology*
GEOL 786---------Contaminant Transport in Groundwater Flow Systems

*This course is titled as "Unsaturated Ground Water Flow" in the Fall 2003 schedule

Doctor of Philosophy Degree in Hydrogeology

Candidates for the Ph.D. degrees in Hydrogeology must satisfy all general requirements of the Graduate School. The Doctoral degrees in either Hydrology or Hydrogeology require 72 credits beyond the Bachelors degree, successful completion of a qualifying examination after the first year of study and 1 credit of Comprehensive Examination. The Comprehensive Examination credit may count toward the required 30 credits of 700-level coursework. Note that the Hydrologic Sciences Graduate Program does not generally accept students with only Bachelors degrees directly into the Doctoral degree programs; rather these students are first accepted into the Master's Program and may be considered for the Doctoral degree after one year of study. Students interested in proceeding directly to the Doctoral degree should contact the Program office for further guidance.

The Doctorate of Philosophy in Hydrogeology allows flexibility to allow students to follow one or more of the broad areas of subsurface hydrology and to allow for specialization. All students receive a broad underpinning of the hydrologic sciences through the shared core courses. Students are expected to work with their advisors and committee members to develop a Plan of Study that best matches their research efforts and interests. Students should refer to the course rotation and scheduling guide contained in this Planning Guide as some courses are on yearly rotations and others on biannual rotations.

Note that students who have previously taken one or more of the shared core courses may request to waive these requirements. Consult with your advisor and the Hydrologic Sciences Program Office for more information and requirements. Doctoral degree candidates should consult the "Graduate Program of Hydrologic Sciences Examination Procedures" information package for a review of committee, qualifying and comprehensive examination procedures and scheduling.

EXAMPLE PROGRAMS OF STUDY AND COURSE SEQUENCES

There exists a large body of graduate level courses in the Hydrologic Sciences at the University of Nevada, Reno and students are encouraged to develop, with the guidance of the their advisor and research committee, a Program of Study that best suites their needs and interests. Listed below are several "Example Curricula" for several areas of specialization in the Hydrologic Sciences. These examples have been designed for a Master's candidate entering the Hydrologic Sciences Graduate Program with 1 year of undergraduate Chemistry and Physics, and Mathematics through three semesters of Calculus and allowing completion in 2 years of study. In some cases, previous upper division coursework is assumed. The example Programs of Study satisfies the requirements of the Hydrologic Science Graduate Program and those of UNR's Graduate School.

These Examples are only meant to provide guidance; students and advisors must carefully weigh the needs of the student and the research project. The examples are not meant to serve as a substitute for advisement and students have the responsibility to actively develop their own Program of Study.

HYDROGEOLOGY	
Year 1 Fall	Credits
GE 684 Intro Groundwater Hydrology	3
GEOL 616 Env. Geochemistry	3
MATH 767 Mathematics for Earth Sciences	3
Year 1 Spring	
GEOL 783 Groundwater Hydraulics	3
GEOL 785 Intro. Groundwater Modeling	3
ERS 622 Soil Physics	3
Year 2 Fall	
GEOL 784 Vadose Zone Hydrology	3
GEOL/ERS 782 Hydrology Seminar	1
GEOL 786 Groundwater Contaminant Trans	3
GEOL/ERS 614 Hyd. Fluid Dynamics	3
CE 368 Fluid Mechanics Laboratory	1
Year 2 Spring	
ERS/GEOL/CE 797 Thesis	6
ERS 701D/GEOL 702S Field Methods in Hyd.	3

HYDRAULICS and GEOMORPHOLOGY	
Year 1 Fall	Credits
ERS 682 Small Watershed Hydrology	4
MATH 767 Mathematics for Earth Sciences	3
ERS/GEOL 614 Hyd. Fluid Dynamics	3
CE 368 Fluid Mechanics Laboratory	1
Year 1 Spring	
GEOL 781 Adv. Surface Water Hydrology	3
CE 689 Water Resource Engineering I	3
GEOL 702J Fluvial Geomorphology	3
MATH 758 Time Series Analysis	3
Year 2 Fall	
GEOL/ERS 782 Hydrology Seminar	1
CE 610 Hyd. Of Open Channels	3
GEOl 742 Sediment Transport ***or***	3
GEOL 743 Alluvial Fan Hydrology	3
Year 2 Spring	
ERS/GEOL/CE 797 Thesis	6
ERS 701D/GEOL 702S Field Methods in Hyd.	3

HYDROECOLOGY and WATER QUALITY	
	Credits
Year 1 Fall	
ERS 682 Small Watershed Hydrology	4
GEOL 614 Env. Geochemistry	3
MATH 767 Mathematics for Earth Sciences	3
Year 1 Spring	
CE 698 Princ. Of Water Qual. Modeling	3
ERS 785 Adv. Limnology ***or***	3
ERS 640 Wetland Ecology	3
CE 771 Bioremediation ***or***	3
GEOL 702S Remediation Technology	3
Year 2 Fall	
ERS 740 Water Qual Modeling II ***or***	3
ERS 765 Biogeochemical Cycling	3
ERS/GEOL 614 Hyd. Fluid Dynamics	3
CE 368 Fluid Mechanics Laboratory	1
GE 648 Groundwater Hydrology	3
GEOL/ERS 782 Hydrology Seminar	1
Year 2 Spring	
ERS/GEOL/CE 797 Thesis	6
ERS 701D/GEOL 702S Field Methods in Hyd.	3

HYDROCHEMISTRY	
Year 1 Fall	Credits
GE 648 Groundwater Hydrology	3
MATH 767 Mathematics for Earth Sciences	3
GEOL 614 Env. Geochemistry	3
Year 1 Spring	
CE 698 Princ. Of Water Qual. Modeling	3
GEOL 716 Geochem. Modeling ***or***	3
GEOL 719 Low Temp. Aq. Geochem	3
CE 771 Surface and Colloid Chemistry ***or***	3
CE 771 Bioremediation ***or***	3
GEOL 702S Remediation Technology	3
Year 2 Fall	
ERS/GEOL 614 Hyd. Fluid Dynamics	3
CE 368 Fluid Mechanics Laboratory	1
ERS 765 Biogeochemical Cycling	3
GEOL/ERS 782 Hydrology Seminar	1
GEOl 780 Isotope Hydrology ***or***	3
ERS 702 Soil Chemistry	3
Year 2 Spring	
ERS/GEOL/CE 797 Thesis	6
ERS 701D/GEOL 702S Field Methods in Hyd.	3

COURSE SEQUENCING

The following courses should be considered sequential, i.e. students will be taught fundamentals in the 600 level course and applications and/or more in-depth analysis in the 700 level course that is designed to follow. Students should follow these sequences closely with the only exception being those students have taken the fundamental courses elsewhere. Listed below is a summary of the hydrology sequences in addition to Core Required courses

ERS 682: Small Watershed Hydrology

To be followed by:
GEOL 781: Advanced Surface Water Hydrology

GEOL 641: Advanced Geomorphology

To be followed by
GEOL 702J: Advanced Fluvial Geomorphology

ERS/GEOL 614: Hydrologic Fluid Dynamics

To be followed or concurrently by:
CE 610: Hydraulics of Open Channels
CE 689 Water Resource Engineering I

ERS 614: Hydrologic Fluid Dynamics or CE 610: Hydraulics of Open Channels

To be followed by
GEOL 743: Alluvial Fan Hydrology or
GEOL 743: Sediment Transport

CE 698: Principles of Water Quality Modeling

To be followed by
ERS 740: Water Quality Modeling II

GEOL 783: Ground Water Hydraulics

To be followed by or concurrent with:
GEOL 785: Introduction to Ground Water Modeling
GEOL 786: Contaminant Transport in GW Systems

ERS 622: Soil Physics

To be followed by:
ERS/GEOL 784: Vadose Zone Hydrology

GEOL 616: Environmental Geochemistry

To be followed by:
GEOL 716: Low Temp. Aqueous Geochem or
GEOL 719: Geochemical Modeling or
ERS 702: Soil Chemistry or
GEOL 780: Isotope Hydrology

MATH 767: Advanced Mathematics for Geosciences

To be followed by:
GEOL 702S: Stochastic Hydrology or
MATH 758: Time Series Analysis

CE 659 Hazardous Waste Management

To be followed by
CE 771 Bioremediation or
GEOL 702S Remediation Technology

GE 484, GEOL/ERS 614 and GEOL 614

To be followed by
GEOL 702Z/ERS 701D: Field Methods in Hydrology

BIOL 620 Aquatic Ecology

To be followed by
ERS 785 Advanced Limnology

APPENDIX B-1

CURRENT DEPARTMENT/UNIT CONTRIBUTIONS TO THE HSP

Dept. of Natural Resources and Environmental Sciences: The department contribution to Hydrology focuses on surface water hydrology, watershed sciences and soil science and has 11.5 graduate faculty in the program as well as seminar support Two of the core curriculum courses are cross-listed with Geological Sciences and were taught (until 1999) by ERS faculty. They are now taught by DRI faculty (ERS/GEOL 414/614) and the director (ERS/GEOL 782), who is jointly appointed in ERS. Faculty research is focused on watershed restoration in Lake Tahoe basin, range restoration as it relates to water in the Great Basin, inorganic and microbial pollutants in soil, water and air.

Dept. of Geological Sciences: The department focuses on ground water hydrology, ground water pollution and geochemistry and has 5.5 graduate faculty in the program. Faculty in Geological Sciences offer two of the core curriculum courses. The department supports critical training in ground water hydrology. Faculty research is focused on quantifying pollution transport, arsenic in ground water and the impacts of mining on water quality and nuclear waste disposal.

Desert Research Institute: Faculty from DRI's Division of Hydrologic Sciences and Division of Earth and Ecosystems Sciences contribute to the Hydrologic Sciences Program as well as seminar support. DRI faculty, elected to the HSP graduate faculty teach UNR courses through Geological Sciences, ERS and Biology with an excellent cost/benefit ratio to UNR. DRI faculty have traditionally focused on groundwater research, with increasing emphasis on watershed hydrology, geomorphology and limnology. There are currently 30 graduate faculty from DRI.

U.S. Geological Survey: Researchers the U.S. Geologic Survey serve on the Graduate Faculty as Adjunct faculty. These faculty also provide Research Assistantships (three in 2003) to students in the program and internships. Four faculty from the Carson City District Water Resources Division and one faculty from the Reno Minerals Research Section serve on the faculty and advise 6 students in total. Faculty from the USGS are teaching in the program and wish to increase this role in the future. This strategy was successfully used at the University of Arizona to build the top rated program in the U.S. Encouragement of greater collaboration between UNR and the USGS is a major strategy for the future success of the HSP.

Civil Engineering: The department focuses on surface water hydraulics, sediment transport and water treatment. The department supports a strong Environmental Engineering graduate program focusing on surface water hydraulics, sediment transport, and water and wastewater treatment and water quality. CE faculty advise 1 HSP graduate student at this time. However, critical courses in water quality assessment, aquatic chemistry, hydraulic design, and water and wastewater treatment are available to HSP students and increasingly; HSP students are taking these courses. Currently, there are 5 facu**lty** from Civil Engineering on the Hydrologic Sciences Graduate faculty.

Mathematics: Mathematics currently has three faculty in the HSP and mathematics is fundamental to all hydrologic sciences. The collaboration of math faculty and HSP faculty has led to successful NSF research grants to UNR and the development of a nationally recognized ground water transport group at UNR. The Mathematics Department recently developed a course specifically designed for

Hydrologic Sciences students (MATH 767, Mathematics for Earth Sciences) to serve as alternative to differential equations and probability/statistics. This course will be offered every fall semester for incoming graduate students.

Applied Economics: Applied Economics and Statistics (AES): The department has 3 faculty currently associated with the HSP and contributes to the program in the areas of water policy, water resource economics and natural resource economics.

Nevada Bureau of Mines and Geology (NBMG): NBMG faculty actively advise 1 graduate in the areas of ground water quality. Student numbers in NBMG fluctuate depending upon research grant availability. NBMG offers significant growth possibility, particularly in the area of graduate student funding and research project support.

Mining Engineering: The department has a component of interest in mine water quality, mine dewatering and mine water operations. The department has one faculty on the graduate faculty, with significant collaboration between Mining Engineering faculty and the program director on mine land reclamation.

Biology: The Biology Dept. represents a component to link the physical hydrologic sciences and the aquatic ecology. Currently, Biology has one faculty in the HSP. Since 2001/2002, the HSP, in concert with the CESE and Biology have funded the teaching of BIOL 420/620 Aquatic Ecology by DRI faculty. The department has initiated a search for an Aquatic Ecologist.

Physics Dept: The Physics Department currently has one faculty in the HSP focusing upon the physics of fluids in porous rocks and soil. The Physics Department also currently houses the Atmospheric Sciences Graduate Program and represents an excellent opportunity for HSP students to incorporate climate modeling and climate change research in hydrologic studies. To foster this collaboration, the HSP funded the first cross-program course in Hydrometeorology in the fall of 2001.

Geography: The Geography Dept. has a significant focus in GIS, climate change and paleoclimate. Currently, geography has one faculty member in the HSP and is advising one doctoral student. Integration of climate change research with hydrology represents a significant state and national priority and additional exchange with Geography faculty represents a growth area.

Chemical Engineering: The ChemEng department does not currently have faculty or students associated with the HSP. In the last year, HSP students have been encouraged to attend relevant seminars in Chemical Engineering.

APPENDIX B
APPROVED PLAN FOR THE ACADEMY OF THE ENVIRONMENT
Those components relating to HSP are highlighted in yellow
UCCSN NEW ORGANIZATIONAL UNIT
Summary

Campus University of Nevada, Reno

Proposed Center, Institute, Bureau or other organizational unit

Academy for the Environment

Brief description and purpose of unit

The University of Nevada Academy for the Environment (UNAE) will be a cross-college, interdisciplinary unit dedicated to the promotion of the university's environmental programs, the development of multi-disciplinary collaboration and curricular innovation, and the fostering of inter-institutional cooperation with other institutions that address environmental issues in our region. UNAE will function as a facilitator of projects on campus and as a gateway to the university's various programs in environmental science, literature, policy, and engineering. More details are included in the attached proposal.

Estimate of resources needed (personnel, library needs, facilities, equipment)

In addition to the budgetary resources already present in various programs and departments, the university is allocating an operating budget of $200,000 in support of the Academy, with most of those funds budgeted for instructional faculty and student support (see p. 5 of the attached document.

In addition, the university will allocate sufficient space to house the Executive Director of the Academy and a small support staff, with necessary desktop computers and printers to carry out the functions of the Academy.

Projected budget lst year $325,000 4th year $325,000

Note that the projected budget includes funds to support personnel and fringe benefits to administer the Academy. These funds have already been set aside by the university for this purpose.

This proposal has gone through the normal university review process and was endorsed by the Faculty Senate by a vote of 23-0, with one abstention, on April 22, 2004 (Earth Day).

Date approved by Academic Affairs Council_____

(Please attach to proposal)

PROPOSAL FOR NEW UCCSN ORGANIZATIONAL UNIT

Academy for the Environment
University of Nevada, Reno
April, 2004

MISSION AND OBJECTIVES

The mission of the University of Nevada Academy for the Environment (UNAE) is to develop, enhance and coordinate environmental teaching, research and service at the University of Nevada, Reno.

The Academy will:

1) develop innovative courses and provide cross-college connections between various departments and disciplines related to the environment;
2) assist in the development of interdisciplinary undergraduate and graduate degree programs in environmental studies;
3) link the environmental programs of sciences/engineering with those in the arts/humanities;
4) enhance and expand research/scholarship opportunities for environmental faculty;
5) conduct public outreach activities on the environment in collaboration with other UNR units, such as Cooperative Extension, when appropriate;
6) raise the environmental awareness of the campus and provide recommendations to the university administration on how to enhance the environmental quality of the campus and its programs; and
7) publicly promote and advocate for environmentally related programs at the university.

BACKGROUND AND RATIONALE

The University of Nevada has long had many strong environmental programs and faculty working in the engineering and natural sciences as well as in the arts and humanities. However, environmental studies on the campus are widely distributed in various departments, programs, and institutes, with limited coordination and limited visibility. This has led to confusion on students' part, difficulties in defining hiring priorities, reduced efficiency of teaching, decreased retention of faculty and students, and limitations in the faculty's abilities to compete in the nationally-competitive environmental research arena. At the present time, there is no unit or department with campus-wide responsibility to enhance and coordinate environmental programs. Through the creation of an Academy for the Environment, the University of Nevada, Reno can fully realize the immense potential of existing faculty resources to develop new strengths in environmental research and teaching and fulfill its statewide land-grant mission.

The creation of an administrative structure to coordinate environmental research and teaching will enhance the University of Nevada, Reno in several ways. Students, in particular, will benefit from the increased coordination of environmental courses and programs. Currently, the university lags behind national trends by not offering integrated environmental studies programs to students. The Academy for the Environment will not only bring the university's programs up to date— by helping faculty create truly interdisciplinary programs that incorporate the humanities, social sciences, arts as well as the sciences— it will make the university unique among western colleges of similar size.

In performing its land-grant mission, the University of Nevada, Reno seeks to contribute to the advancement and dissemination of knowledge that will help to improve society. Environmental issues dominate the public consciousness in Nevada and are key to the future of our region. The Academy will help develop both an environmentally conscious student body, faculty, and staff through its on-campus programs, and an environmentally informed community through public outreach of its integrated approach to environmental issues. The latter will benefit also from collaborative activities between the Academy and the University of Nevada Cooperative Extension.

The university should ideally serve as a model to the community in demonstrating responsible environmental practice and energy conservation. One goal of the Academy will be to work with existing on campus organizations, such as the Environmental Health and Safety Program, to promote environmentally sound policy and design for the continuing development of the university's physical campus.

The University of Nevada Academy for the Environment (UNAE) builds upon previous attempts to coordinate environmental studies at the university. In 1991, the Center for Environmental Sciences and Engineering (CESE) was created through a partnership between Sierra Pacific Power Company and the university to manage interdisciplinary graduate programs, and coordinate multi-investigator grants.

The Center for Environmental Arts and Humanities (CEAH) was created in 1995 to coordinate interdisciplinary environmental events at the university. Both Centers have reported to the Vice-President for Research, and while both have produced useful programs, they have both lacked the administrative support and adequate resource base to fully capitalize on the university's tremendous potential for coordinating existing environmental programs and fostering innovation for new ones. With a strong financial and administrative commitment from the administration, the proposed Academy for the Environment will incorporate previous efforts while building to meet additional needs.

The current proposal for the UNAE reflects extremely strong, grass-roots support from faculty across the University of Nevada, Reno and the Desert Research Institute. The first proposal, initiated during the first cycle of university strategic planning, attracted the support of over 100 faculty who gave feedback at two meetings in the spring of 2002. The commitment to a truly interdisciplinary Academy is reflected in the diversity of faculty at those and subsequent meetings. Throughout this document, care has been taken to use language that is inclusive of all areas of environmental study, including the arts, humanities, sciences, social sciences, and engineering.

I. ORGANIZATIONAL STRUCTURE

The development of Institutes/Academies at the University of Nevada, Reno is intended to provide assistance for cross-college collaboration and to promote visibility for university programs with common interests and features. As this is the first unit of its type created by the university, it is useful to clarify its relationship to colleges and departments, the more traditional academic units on campus.

Institutes/Academies are not intended to supplant the role of colleges and departments, but to supplement them. Their major purpose is to help the university channel resources appropriately into interdisciplinary efforts, thereby supplementing the resources available to academic units, not

reducing them. As a result, our goal is to create a streamlined administrative structure in which faculty, departments, and colleges willingly assist in pursuit of a mutual benefit.

Faculty members will continue to reside in departments and report to department chairs and college deans, not to the Executive Director of an Institute/Academy. All accounting for student FTE generation will accrue to the department of the instructor and not to an Institute/Academy.

1. Administration

The UNAE will be led by a full-time Executive Director with support staff. The Executive Director, who will represent an area of environmental studies included among those participating in the UNAE, will report to the Provost and sit on the Academic Leadership Council. Because of the needs of the interdisciplinary environmental graduate programs, a close relationship will also exist with the Graduate Dean and Vice-President for Research.

A faculty Steering Committee of the UNAE will be appointed to work with the Director to fulfill the mission and objectives of the Academy. The Executive Director and Steering Committee will develop bylaws and serve as the primary mode for governance of the UNAE. The Steering Committee will be composed of faculty representatives of participating colleges, departments and DRI, and constituted as follows:

- 4 members from the sciences;
- 4 members from the arts, humanities and social sciences;
- 1 member from engineering;
- the Director of Environmental Health and Safety;
- 1 member from Cooperative Extension;
- 1 member from DRI; and
- 1 to 2 additional members at the discretion of the Executive Director.

Prospective members for the Steering Committee will be nominated by the Executive Director and appointed by the Provost.

In addition to the Steering Committee, the UNAE will appoint an external advisory board consisting of community leaders and university alumni with interests in academic environmental programs and research. The advisory board will serve to help the UNAE define and facilitate its public outreach mission, and provide advice on the development of new degree programs that will lead to career opportunities in environmental areas for graduates. The board will also assist the Executive Director in identifying and obtaining appropriate resources for new initiatives in environmental studies.

Through control of budgetary resources, the UNAE Executive Director will work to foster programs across campus and with the Desert Research Institute, primarily by cooperating with existing departments and programs. The Executive Director will also identify areas of need and make hiring recommendations to the Provost in order to solidify and enhance environmentally-related education and research at the university.

As the Academy becomes established, it may become desirable to create additional support positions to further its aims. However, this will have to be determined by the Executive Director, once appointed, in consultation with the Provost. These support positions may be funded through partial reassignment of an affiliated full-time faculty member. In such instances, the instructional

responsibilities of the reassigned faculty member would be replaced by temporary lecturer appointment(s) (LOAs) covered by funds from the Academy budget.

One example of a support position envisioned by the planning group for the UNAE would be a 0.5 FTE position serving as Undergraduate Curriculum Coordinator/Assistant Director. Positions such as this would be joint appointments between the Academy and the faculty member's home department, and annual evaluation would be performed by the academic department with input from the UNAE Executive Director.

The Academy will coordinate interdisciplinary programs across departments, colleges, and with DRI. This dictates its need to remain independent of any colleges and to report directly to the Provost.

2. Space

Upon its inception, the UNAE will require enough space to provide an office for the Executive Director, reception/secretarial area, an office for additional support functions, and a meeting room (approximately 1000-1200 total square feet). This space should ideally be centrally located in order to be accessible to students, and is an immediate need for the start-up (phase I) of the Academy. Ultimately, the UNAE could occupy its own building, showcasing the latest technology in environmentally-friendly resource use.

At present, the Office of the Provost has identified space in the Mackay Science Building on the main quadrangle of the university that could house the Academy for the Environment. This prominent location is near faculty in the environmental literature program as well as those involved in environmental earth and life science programs. It is also convenient to student access.

3. Budget and Resources

Operating Budget. The UNAE will require various resources, including personnel, space, and an operating budget, to successfully carry out its mission. In the previous sections, we have outlined the personnel and space resources that will be provided by the university. Here we focus on the operating budget and the purposes to which it will be dedicated.

A total of $200,000 in new funds has been budgeted initially by the university to cover operating expenses. The operating budget will be allocated to the following purposes, although it should be stipulated that the amounts allocated to these various functions may vary from year-to-year depending on the needs of the Academy:

New Funds

Expense item	*Amount*
Faculty support	
o Research support	$ 20,000
o Program development release time	12,000
o LOA support	50,000
Graduate student support (5 GA positions @ $14,000)	70,000

Fringe benefits (faculty and graduate assistants)	8,000
Student travel support (20 students @ $400/meeting)	8,000
Web site development and maintenance	7,000
Seminars and symposia	18,000
Materials and supplies	4,000
Operating costs (phone, mail, etc.)	3,000
TOTAL	**$ 200,000**

We note that this budget supplements funds already allocated by the university to support operating budgets, graduate assistantships, and DRI faculty teaching in the Atmospheric Sciences (AS), Ecology, Evolution and Conservation Biology (EECB), Environmental Sciences and Health (ES&H) and Hydrologic Sciences (HS) graduate programs, working cooperatively with the Environmental Engineering graduate program. With the formation of the UNAE, the interdisciplinary programs (AS, EECB, ES&H, and HS) would be supervised by the Executive Director but with their present budgets transferring intact.

The various items included in this operating budget are briefly explained below. In most cases, these budget items provide incentives for colleges and departments to collaborate and cooperate with the Academy.

- *Faculty support.* In addition to support provided to DRI and other faculty who teach courses in environmental programs, this item includes some provision for both research support and program development. Research support could include summer salary for seed projects in environmental research and scholarship, or could be allocated as part of a seed grant program supervised by the Academy. The purpose of these allocations would be to help faculty launch new research projects in much the same way that the Junior Faculty Research Grant program, run by the Office of the Vice-President for Research, helps to launch the research programs of young untenured faculty.

  Program development support would provide release time for course development within the various areas of environmental studies. It could also be applied toward 0.5 FTE staffing of environmental curriculum development and oversight.

- *Graduate student support.* These funds, allocated by the Executive Director, would be applied toward teaching assistants needed in the environmental curriculum and could also be used to supplement research support under the supervision of affiliated faculty.

- *Student travel support.* Matching support would be provided by the UNAE, in conjunction with the Office of Research, the Graduate Student Association, the colleges, departments, and faculty research grants, to help students (both undergraduate and graduate) attend conferences and present their work.

- *Web site development and maintenance.* The UNAE will create and maintain a web site that highlights the university's environmental programs, both instructional and research.

These funds will be used to set up the initial web site, then applied toward active maintenance of the site.

- *Seminars and symposia.* The Academy will sponsor an annual seminar series of general interest to the campus community on various environmental issues. These funds might also be used to help faculty host regional and national meetings on environmental topics in the local area.

- *Materials and supplies/Operating costs.* These funds will be used to cover incidental materials and supplies, operating costs, computer supplies, printing, and telephone and mail expenses.

Grant Activities and Indirect Cost Recovery (ICR). The success and growth of the UNAE will require not only a sustained commitment from the university, but will also require revenues from self-generated sources, including grants and private fund raising (see below). The Academy will work with the Vice-President of Research to develop a process to receive annually a percentage of ICR from proposals in the environmental sciences, engineering and humanities that utilize Academy resources in preparation or completion of the grant, as well as a percentage of ICR on grants involving the environment and faculty who participate in the UNAE. As an example of funding sources, the Vice-President for Research has suggested that 5% of the ICR generated on new grants submitted by Academy-affiliated faculty will be returned to the UNAE. This return will **not** be taken from College or Department ICR return, but from that returned to the Office of Research.

In addition, it is expected that the Executive Director, working with affiliated faculty, will seek cross-disciplinary grants to fund new curricular and public outreach programs in environmental studies from both governmental agencies and private foundations. The college and departmental portions of the ICR generated from such granting activity will be retained by the Academy while the participating faculty principal investigators will receive a proportionate share of the PI portion of the ICR funds.

Private fund raising. As indicated in the preceding paragraph, the UNAE Executive Director will work with the UNR Foundation to identify new resources for environmental education, research, and public outreach, and be expected to apply for and receive outside financial support. Strong public interest in environmental issues should support the establishment of an endowment fund through private fund raising. The Executive Director will play an important role in raising public awareness of the university's environmental programs and in soliciting their financial support for the growth of those programs. The UNAE external Advisory Board will also play an important role in this.

The Executive Director will actively forge partnerships with private and government agencies outside of the university community to develop additional revenue for the development of externally-funded interdisciplinary research proposals. Environmental scientists at the university have already been successful in individual investigator awards, EPSCoR and some interdisciplinary awards (NSF/EPA, U.S. DOE, etc). However, significant improvement can be made as evidenced by the recent successes of the DRI in NSF's Biocomplexity programs and the Great Basin Institute's Americorps grant. The Academy will serve to improve coordination of interdisciplinary proposals and to provide a supportive environment for proposal development.

RESPONSIBILITIES AND ACTIVITIES

With the administrative structure and necessary support in place, the newly-formed Academy for the Environment will assume several responsibilities to foster the study of the environment at the university.

Student coordination and recruitment. The Academy will provide a focal point and, when appropriate, advisement for incoming undergraduate students interested in environmental degrees, and will work to ensure that such opportunities are clearly expressed in the course catalog and other promotional materials. The Executive Director and Academy staff will work with the Office of Prospective Students to develop New Student Orientation opportunities. The UNAE will be responsible for maintaining an active and up-to-date directory of all programs related to environmental studies and maintain close working relations with undergraduate advisors in these departments. A series of environmentally related outdoor activities and service-learning opportunities will be planned throughout the year to encourage students to better understand environmental values, science and policy.

The Academy will promote community involvement of students through a student environmental organization, as well as internships with agencies, organizations and businesses. A focus of this effort will be through the Great Basin Institute/Nevada Conservation Corps, an organization that presently has a highly successful internship program and offers field courses in northern Nevada as well as Mexico.

Faculty and undergraduate curriculum development. In its first year, the UNAE will conduct a series of workshops among faculty to generate an interdisciplinary community of scholars who will exchange ideas and participate in the growth of Academy programs. Coordinated by the interim Executive Director and Academy Steering Committee, these workshops will bring together participants from various colleges and disciplines to read and discuss the theoretical foundations for and potential career paths emanating from new undergraduate degree programs in environmental studies. These efforts will be supported through course-release stipends, research and travel grants, and other support from the first-year operating budget.

There currently exists little opportunity for exchange of ideas and course content other than through the University Courses and Curriculum Committee. The university lacks a truly interdisciplinary institute that can serve to bring faculty together to develop innovative courses on the environment, or ensure that duplication of courses is minimized. By coordinating and funding this series of workshops, the Academy will help to build a community of scholars from disciplines across the university.

The workshops will culminate in faculty recommendations to the incoming Executive Director for the content and rationale of new interdisciplinary curricular programs in environmental studies. In subsequent years, we envision contributing to faculty development by sponsoring smaller workshops, faculty colloquia, offering stipends, research grants, and course development grants on a competitive basis.

Coordination of interdisciplinary environmental graduate programs. The UNAE will coordinate the interdisciplinary environmental graduate programs and their needs for new courses, seminars, faculty appointments and cooperative graduate program development. A coordinated seminar program will be established that allows all of the seminars to be advertised at a central web site, and encourages co-sponsorship of visits of nationally recognized environmental experts to the university. The Executive Director will work with Directors of the

graduate programs to prioritize faculty and program resources needs to provide coordinated advice to the Provost and Vice-President of Research.

Coordination with existing departments and colleges. The success of the Academy will reflect the active cooperation with existing departments and colleges. The Steering Committee, made up of representatives from across campus, Cooperative Extension, and DRI, will provide the forum for continual feedback and communication. As environmental programs have emerged as a priority for the university through strategic planning, college and departmental participation in UNAE programs and activities should enhance departments' growth potential. The Academy will help fund departmentally-based seminars focusing on the environment, workshops, student organization activities, travel, and other activities.

Stable support for programs utilizing Desert Research Institute faculty. Desert Research Institute faculty currently teach a substantial number of important core courses for environmental graduate and undergraduate programs at the university. These faculty, as well as other DRI research collaborators, are a critical component in the success of the university's environmental programs. However, DRI faculty currently teach on a rotating, non-contractual and often inefficient basis.

This system of teaching critical or required classes does not give DRI faculty certainty in support each year, nor does it give our students certainty that critical courses will be offered on a timely basis. Stable funding, program management, and negotiated agreements for longer term teaching support can help to ensure high-quality teaching at both the graduate and undergraduate level and provide significant savings over the current system. The Academy will provide a more formalized structure for the academic linkage between the university and DRI (or other regional institutions) and support greater consistency in teaching, student advisement, and program management.

The Executive Director, in cooperation with a given academic unit at the university and the DRI administration, will negotiate agreements governing joint appointments with an emphasis on long-term stability and quality. If desirable, this may lead to finite-term (for example, 3-5 years) joint appointments for DRI faculty funded through the Academy. Such appointments would necessitate a shared responsibility for the annual evaluation of the affected faculty members by both institutions, the details of which would need to be clarified in any negotiated agreement.

In the start-up phase of the UNAE, the interim Executive Director and Academy Steering Committee will work closely with DRI representatives to establish goals for further developing and strengthening this relationship.

New faculty priorities. The Academy will work together with college deans, the Provost, and individual departments to help set hiring priorities that support and extend environmental education at the university.

Interdisciplinary graduate programs have very limited input into new faculty and faculty replacement positions. Most of the interdisciplinary graduate programs rely solely upon courses taught within departments and therefore only have limited control of their curriculum. Under the current distribution system of faculty lines, interdisciplinary programs, of which those in environmental studies dominate the campus, have little opportunity to have their needs considered. By placing high priority on the development of interdisciplinary research and teaching, the UNAE will help to push the university to the cutting edge of higher education in the nation.

Regional high-profile environmental issues. The UNAE will take a leadership role in coordinating research on regional environmental issues critical to Nevada, in association with academic departments and/or research units on the university campus and Cooperative Extension.

For example, while the university has a strong environmental outreach presence in the Lake Tahoe Basin through Cooperative Extension , there is a lack of coordinated focus for research. While individual PIs have been very successful in the Tahoe basin research arena, the university has been routinely criticized for its lack of focus and point-person designation for Tahoe basin research. The Executive Director will serve as that point-person and participate in critical scientific and policy committees at Lake Tahoe.

Through its activities, the Academy could promote student environmental exchange activities important to the region, including the Tahoe Baikal Institute and Great Basin Institute programs, and other organizations where students can benefit from visiting and learning about environmental management and land stewardship.

Public Outreach. The University of Nevada, Reno has received national recognition for the quality and effectiveness of its public outreach programs on the environment. UNAE will seek to assist and support these successful programs with funding and/or faculty resources when appropriate. It is also anticipated that the university's public outreach entities, such as Cooperative Extension, can play an important role in promoting UNAE throughout Nevada. The potential for a mutually beneficial relationship between UNAE, Cooperative Extension, and other outreach organizations is high. The primary focus of UNAE sponsored public outreach activities will be to conduct campus based programs (for example, environmental conferences, public presentations, and so forth). It is not the intent of UNAE to compete with other environmental outreach programs conducted by the university, but to enhance and supplement them.

Community Relations. The Executive Director of UNAE will actively develop relationships and partnerships with government agencies, educational institutions and non-governmental organizations to expand research and on-campus educational opportunities.

The Executive Director will also work with campus environmental programs to improve the environmental conscience of the campus community and lead by example. This includes advising the university on environmental standards as they apply to the physical plant of the campus and promoting energy and water efficiency in campus buildings and grounds.

Evaluation and Assessment. The Executive Director of UNAE will have responsibility for evaluating personnel supported in full or part by the Academy. In the case of contributing faculty members who receive resource support from the UNAE, the Executive Director will provide input to the faculty member's home department as it performs the annual evaluation. The Executive Director will be evaluated by the Provost.

As per university guidelines, the UNAE will engage in a formal, internal institutional review at the end of its initial three-year term and every five years after that. The UNAE will develop a set of performance indicators that will form the basis of its self-study for institutional review.

ACTIVITIES AND PROGRAMS TO BE INCLUDED UNDER THE UNAE

The CESE and the CEAH will be merged under the umbrella of the new University of Nevada Academy for the Environment, and the activities and support currently assigned to these entities will transfer to the Academy. The Great Basin Institute and the interdisciplinary environmental graduate programs will also be housed within the UNAE. Other university programs are appropriately housed in colleges and departments, but through cooperative activities will be able to benefit from association with the Academy. The UNAE seeks to enhance such programs and would welcome their inclusion within the proposed structure or a more loosely-defined affiliation, depending on each program's wishes and aims.

TIMELINE FOR DEVELOPING THE UNAE

Revitalized by its new prominence within the university, and with a full-time Executive Director and support personnel, the Academy for the Environment will work over the next decade to fulfill its mission to enhance undergraduate and graduate education and research opportunities at the University of Nevada, Reno.

- One-Year Plan: Upon approval by the Board of Regents in 2004, the Provost will appoint a steering committee and an interim Executive Director for the Academy for the Environment. The interim Executive Director will oversee and initiate the start-up tasks to establish the Academy while a national search is conducted for a permanent Executive Director. Some of the start-up tasks include:

    - conducting the searches for and hiring a full-time Executive Director and support staff person;
    - establishing the office for the UNAE in the Mackay Science building;
    - developing the UNAE administrative infrastructure, including a faculty Steering Committee and nominating members for an external Advisory Board made up of representatives from the community;
    - designing and implementing a faculty workshop group that will develop a theoretical framework for new undergraduate interdisciplinary programs in environmental studies for submission to the permanent Executive Director;
    - developing liaisons with agencies and private organizations outside the university;
    - developing and implementing a web site to provide an easily accessible source of information regarding all environmental programs (graduate and undergraduate) at the university;
    - developing and implementing the first stage of a New Student Orientation field experience to market environmental education opportunities to incoming students;
    - participating in the Environmental and Energy Committee to assist in implementing the university's environmental policies;
    - organizing a planning committee for a statewide Nevada Environmental Conference; and
    - writing a one-year program review and annual report to be submitted to the Faculty Senate for review.

- Five-Year Plan: Over the following four years, the Executive Director and faculty Steering Committee of the Academy will continue to develop the programs begun in the first year. Additional efforts will focus on:

    - establishing an external Advisory Board made up of representatives from the community;
    - fundraising through Academy-initiated granting activity and private philanthropy;
    - facilitating student advisement for environmental degree programs;
    - promoting marketing and public relations on campus and within the local, state, and national community;
    - improving the environmental consciousness of students, faculty, and staff on campus
    - coordination of on-campus environmental programs within the university;
    - coordination and development of programs in conjunction with other UCCSN entities, such as TMCC, WNCC, and DRI;
    - developing a public outreach plan on the environment for UNAE that includes an inventory of current university outreach programs, an analysis of how UNAE and existing programs can assist each other, and indentification of opportunities for new efforts to be conducted by UNAE.
    - coordination and communication with outside agencies and private organizations;
    - developing a comprehensive assessment plan for UNAE activities;
    - exploring the demand for undergraduate degree programs in various interdisciplinary areas of environmental studies;
    - developing symposia, conferences, speaker series, and scholarship programs; and
    - providing annual reports to the university (Faculty Senate, Office of the Provost) detailing the activities and accomplishments of the UNAE.

- Ten-Year Plan: After ten years, the UNAE Executive Director, together with the faculty Steering Committee and external Advisory Board, will conduct a self-study program review in order to assess the successes of the program as well as determine its future directions.

Acronym Guide

AS	Atmospheric Sciences
CEAH	Center for Environmental Arts and Humanities
CESE	Center for Environmental Sciences and Engineering
DOE	Department of Energy
DRI	Desert Research Institute
EECB	Ecology, Evolution, and Conservation Biology
EPA	Environmental Protection Agency
EPSCoR	Experimental Program to Stimulate Competitive Research
ES&H	Environmental Science and Health
FTE	full-time equivalent
GA	graduate assistantship
HS	Hydrologic Sciences
ICR	indirect cost recovery
LOA	letter of appointment
NSF	National Science Foundation
PI	principal investigator
TMCC	Truckee Meadows Community College
UNR	University of Nevada, Reno
UNAE	University of Nevada Academy for the Environment
WNCC	Western Nevada Community College

APPENDIX C
DEPARTMENT/UNIT PARTICIPIATION IN HSP

Dept. of Natural Resources and Environmental Sciences: The department contribution to Hydrology focuses on surface water hydrology, watershed sciences and soil science and has 11.5 graduate faculty in the program as well as $250/year for seminar support. Two of the core curriculum courses are cross-listed with Geological Sciences and were taught (until 1999) by NRES faculty. They are now taught by DRI faculty (NRES/GEOL 414/614) and the director (NRES/GEOL 782), who is jointly appointed in NRES. Faculty research is focused on watershed restoration in Lake Tahoe basin, range restoration as it relates to water in the Great Basin, inorganic and microbial pollutants in soil, water and air. There are currently 20 students advised by NRES faculty. The department recently hired an Aquatic Ecologist (Dr. Sudeep Chandra) who has been nominated for graduate faculty status in HSP.

Dept. of Geological Sciences and Engineering: The department focuses on ground water hydrology, ground water pollution and geochemistry and has 5.5 graduate faculty in the program. Faculty in Geological Sciences offer two of the core curriculum courses. The department supports critical training in ground water hydrology. Faculty research is focused on quantifying pollution transport, arsenic in ground water and the impacts of mining on water quality and nuclear waste disposal. Department faculty currently advise 11 HSP students.

Desert Research Institute: Faculty from DRI's Division of Hydrologic Sciences and Division of Earth and Ecosystems Sciences contribute to the Hydrologic Sciences Program as well as seminar support. DRI faculty, elected to the HSP graduate faculty teach UNR courses through Geological Sciences, ERS and Biology with an excellent cost/benefit ratio to UNR. DRI faculty have traditionally focused on groundwater research, with increasing emphasis on watershed hydrology, geomorphology and limnology. There are currently 34 graduate faculty from DRI and three more have applied for graduate faculty status in 2005.

U.S. Geological Survey: Researchers the U.S. Geologic Survey serve on the Graduate Faculty as Adjunct faculty. These faculty also provide Research Assistantships (three in 2003) to students in the program and internships. Four faculty from the Carson City District Water Resources Division and one faculty from the Reno Minerals Research Section serve on the faculty and advise 4 students in total. Faculty from the USGS are interested in teaching in the program. This strategy was successfully used at the University of Arizona to build the top rated program in the U.S. Encouragement of greater collaboration between UNR and the USGS is a major strategy for the future success of the HSP.

Civil Engineering: The department focuses on surface water hydraulics, sediment transport and water treatment. The department supports a strong Environmental Engineering graduate program focusing on surface water hydraulics, sediment transport, and water and wastewater treatment and water quality. CE faculty advise 1 HSP graduate

student at this time. However, critical courses in water quality assessment, aquatic chemistry, hydraulic design, and water and wastewater treatment are available to HSP students and increasingly; HSP students are taking these courses. Currently, there are 5 faculty from Civil Engineering on the Hydrologic Sciences Graduate faculty.

Mathematics and Statistics: Mathematics currently has three faculty in the HSP and mathematics is fundamental to all hydrologic sciences. The collaboration of math faculty and HSP faculty has led to successful NSF research grants to UNR and the development of a nationally recognized ground water transport group at UNR. The Mathematics Department developed a course specifically designed for Hydrologic Sciences students (MATH 767, Mathematics for Earth Sciences) to serve as alternative to differential equations and probability/statistics. The faculty member who developed this course has left UNR, but the department intends to continue to offer this course. There are currently 2 faculty members from the Department in the HSP and one student advised.

Applied Economics: Applied Economics and Statistics (AES): The department has 2 faculty currently associated with the HSP and contributes to the program in the areas of water policy, water resource economics and natural resource economics. There are two students advised by faculty in this department

Nevada Bureau of Mines and Geology (NBMG): NBMG faculty actively advise 1 graduate in the areas of ground water quality. Student numbers in NBMG fluctuate depending upon research grant availability. NBMG offers significant growth possibility, particularly in the area of graduate student funding and research project support.

Mining Engineering: The department has a component of interest in mine water quality, mine dewatering and mine water operations. The department has one faculty on the graduate faculty, with significant collaboration between the Chair of the department and the program director on mine land reclamation.

Biology: The Biology Dept. represents a component to link the physical hydrologic sciences and the aquatic ecology. Currently, Biology has one faculty in the HSP. Since 2001/2002, the HSP, in concert with the CESE and Biology have funded the teaching of BIOL 420/620 Aquatic Ecology by DRI faculty. The department also recently filled a position of aquatic ecologist.

Physics Dept: The Physics Department currently has one faculty in the HSP focusing upon the physics of fluids in porous rocks and soil. The Physics Department also currently houses the Atmospheric Sciences Graduate Program and represents an excellent opportunity for HSP students to incorporate climate modeling and climate change research in hydrologic studies. To foster this collaboration, the HSP funded the first cross-program course in Hydrometeorology in the fall of 2001.

Geography: The Geography Dept. has a significant focus in GIS, climate change and paleoclimate. Currently, geography has one faculty member in the HSP and is co-advising one doctoral student. Integration of climate change research with hydrology

represents a significant state and national priority and additional exchange with Geography faculty represents a growth area.

APPENDIX D
Examination Requirements & Committee Information
Graduate Program of Hydrologic Sciences (HS)

Students are encouraged to consult the UNR General Catalog for additional information regarding university requirements. Where differences exist, the student should follow the guidelines as herein described to ensure the fulfillment of HS Programmatic requirements. All students must notify the Hydrologic Sciences Program Office (Laxalt Mineral Research (LMR) 264, telephone 775-784-6469, or email miller@unr.edu) of the date, time, and location of their defense (both M.S. and Ph.D. candidates) at least two weeks ahead of schedule to allow for proper programmatic announcements. Copies of all student-university correspondence should be provided to the Program Office for efficient record keeping.

II. Master's Degree Requirements

An advisory committee should be developed as soon as practicable and must have at least three UNR graduate faculty members, with one faculty member being outside of the major professor's (advisor's) UNR department or Desert Research Institute (DRI*)* division. UNR departmental (e.g. Environmental & Resource Science or Geological Sciences) and DRI division (e.g. Hydrologic Sciences or Earth and Ecosystem Sciences) affiliations are different from the interdisciplinary program; therefore a valid committee may consist exclusively of HS faculty. Students are also encouraged to seek committee members from outside the University's Graduate Faculty to bring additional expertise. Requests for outside committee members should be made well in advance of the first committee meeting by the student's advisor through the Program Director and requires University review and approval from the Graduate School. A Program of Study and a thesis proposal should be completed by the student, presented to and approved by the committee, during the first full year of residency. After preliminary drafts have been edited and approved by the advisor, the final written document (thesis for Plan A or professional paper for Plan B) should be distributed to the other committee members at least two weeks prior to the scheduled oral presentation and defense. The defense of the thesis or professional paper will be the primary focus of the final comprehensive examination that is administered by the committee. All committee members are expected to be present for the final oral defense and the defense is open to the public. The HS Program automatically receives a copy of all MS. theses and requires a hard copy of all Plan B professional papers for graduation.

Plan A students must register for six thesis credits, along with at least 24 additional course credits of which at least 12 credits must be at the 700 level, for a minimum total of 30 credits (31 credits in Hydrology). Plan B students must register for professional paper *(two credits),* along with at least 30 additional course credits of which at least 15 credits must be at the 700 level, for a minimum total of 32 credits.

III. Doctoral Degree Requirements

As a general rule students from outside the Hydrologic Sciences program are not admitted directly into a Ph.D. degree program without a Master's degree. However, once a student has been admitted as a Master's level student, it is possible to apply for doctoral admission without first finishing the Master's of Science degree. Regardless of the pathway of entry into the Ph.D. program, the same requirements apply to all.

An advisory committee should be developed as soon as practicable and must have at least five UNR graduate faculty members, with one faculty member being both outside of the major professor's (advisor's) UNR department or DRI *division* as well as outside the Graduate HS Program. Students are also encouraged to seek committee members from outside the University's Graduate Faculty to bring additional expertise. Requests for outside committee members should be made well in advance of the first committee meeting by the student's advisor through the Program Director and requires University review and approval from the Graduate School. Students must register for at least 24 dissertation credits. Students beginning with a Master's degree must take a minimum of 24 additional course credits of which at least 12 credits must be at the 700 levels. Students beginning with a Bachelor's of Science degree must take a minimum of 48 course credits of which at least 30 credits must be at the 700 level. Finally, at least two successive semesters, excluding summer sessions, must be spent in full-time residence on campus at the University of Nevada, Reno (UNR).

Ph.D. Qualification Examination

The Qualification Examination for the doctoral degree consists of three components: 1) an oral proficiency examination designed to demonstrate the student's proficiency in the fundamentals of the hydrologic sciences; 2) presentation and approval of the student's Program of Study; and 3) successful development, presentation and defense of a detailed doctoral research proposal. The student is expected to successfully complete all three components of the qualification examination prior to the end of their first year of residency as a Ph.D. degree-seeking student.

Component 1: Oral Proficiency Examination

Students applying for doctoral candidacy are required to successfully pass an oral examination focusing on the fundamentals of hydrologic science. The Oral Proficiency Examination must be taken within the first year of residency as a Ph.D. degree-seeking student. Oral Proficiency guidelines and example questions can be found in Appendix I. It is the responsibility of the student's academic advisor to schedule the Oral Proficiency Examination with the Hydrologic Sciences Program Office.

The Oral Proficiency Examining Committee is to consist of the student's advisor and two members, chosen at random, from the Hydrologic Sciences Qualifying Examination Committee with at least one member representing faculty teaching one of the Shared Foundation Core Courses.

The examining committee will provide to the student at least one month prior to date of the examination a list of example questions and general study areas. The student will select one question from the example list and prepare a 10-15 minute oral response as their first question in the examination. The examining committee will then proceed to oral questioning to assess the student's knowledge and comprehension of the fundamentals of hydrology, focusing in major part on the subject areas found in the Hydrologic Sciences Shared Foundation Core Courses. The examining committee shall take into consideration in its examination and recommendation, any special needs of the candidate such as non-native English speaker, etc.

The examining committee will provide to the Program Director its written appraisal of the student's qualifications to proceed with his/her doctoral candidacy. The Program Director will circulate this recommendation of the student to the Hydrologic Sciences Core faculty for comment. If no dissenting comments are received within two weeks of circulation to the faculty, the student will be informed in writing from the Program Director stating the decision of the Hydrologic Sciences Faculty, i.e., to proceed with doctoral candidacy or to discontinue doctoral candidacy. If dissenting comments are received during the two-week comment period, a formal vote of the faculty will be made immediately, with a two-thirds majority of those voting required to promulgate the decision.

Component 2: Approval of Program of Study

The Program of Study is developed by the student and his/her advisory committee to fulfill Hydrologic Sciences Program and University requirements, accounting for the student's research area and interests. The Program of Study must be reviewed and approved by all committee members, generally directly following the presentation of the research proposal.

Component 3: Development, presentation, and defense of a detailed doctoral research proposal.

After preliminary drafts have been edited and approved by the advisor, the written research proposal should be distributed to the other advisory committee members at least two weeks prior to scheduling the oral presentation and defense. The written proposal and associated oral presentation should be of adequate detail to allow for rigorous scientific scrutiny. The research proposal must discuss the general format of the dissertation, i.e., traditional thesis or a series of linked manuscripts. All advisory committee members are expected to be present for the oral presentation of the research proposal.

Based upon successful completion of all three components of the Qualifying Examination, the advisory committee will then inform in writing the Program Director that the student has passed the qualification examination and request that the student be allowed to continue forward in their quest for a doctoral degree. The student's signed "Advisory-Examining Committee/Program of Study" form must accompany this written communication. If the student does not successfully complete all three of the qualifying

examination components, the student will not be allowed to proceed towards doctoral candidacy.

Ph.D. Comprehensive Examination

The Comprehensive Examination is outlined in some detail in the UNR Catalog. Doctoral students are to register for Doctoral Examination (e.g. ERS 795, GEOL 795) for 1 credit in the semester they intend to take the examination. The comprehensive examination credit (1) may be counted towards the 700 level degree requirements. If a student does not complete the examination in the semester registered, the student's advisor should contact the Program Director for guidance on grade assignment. The comprehensive examination, covering the breadth of knowledge within the field of hydrology, will be developed and administered by the advisory committee and will consist of:

1) A written portion (either in-class or take home); and

2) An oral examination.

All advisory committee members are expected to participate in both the written and oral portions of the comprehensive examination. Successful completion of the Comprehensive Examination requires submission of the "Doctoral Degree Admission to Candidacy/Comprehensive Examination Report" form to the Program Office and the Graduate School. In the event that two or more advisory committee members cast negative votes, the examination may be repeated once if the committee approves additional study.

Ph.D. Dissertation Defense

After preliminary drafts have been edited and approved by the advisor, the final written dissertation must be distributed to the other advisory committee members at least two weeks prior to the scheduled date of the oral presentation and defense. The dissertation may consist of separate papers integrated into a single document, or be of the more traditional style. All advisory committee members are expected to be present for the final oral defense and are required to sign the dissertation and associated University documentation. The defense is open to the public.

APPENDIX E
HSP SEMINAR SERIES SCHEDULE FOR SPRING 2005
And
RECENT ISSUES OF THE AQUA CLARA
(HARD COPIES)

APPENDIX F
WEB SUMMARIES OF IMPORTANT HSP STUDENT ORGANIZATIONS
(HARD COPIES)

APPENDIX G
LISTING OF ACTIVE HSP STUDENTS AND THEIR ADVISORS

student/advisor				
Last Name	**First Name**	**Advisor**	**email**	**Degree**
Albright	William	Tyler, Scott	billa@dri.edu	PhD
Al-Taani	Ahmed	Tracy	taahiun@hotmail.com	
Arufe	Jorge	Rosen, Michael	jorgea@unr.edu	MS Plan A
Assam	Jason	Stillings, Lisa	jassam@unr.edu	MS Plan A
Baffoe-Twum	Edmund	Ahmed Hassan		
Bansah	Daniel	Thomas, Jim	Daniel.Bansah@dri.edu	MS Plan A
Banta	John (Ryan)	McConnell, Joseph	rbanta@dri.edu	PhD
Bartlett	Justin	Warwick, John	justinb@dri.edu	MS Plan A
Batts	Candace	Arnone, John	candaceb@unr.edu	MS Plan A
Bidart	Robert	Norris, Gary	Bidart11@charter.net	MS Plan B
Botros	Farag	Pohll, Greg	botros@dri.edu	PhD
Breitmeyer	Ron	Cooper, Clay	rbreitmeyer@hotmail.com	MS Plan A
Brown	Scott	Saito, Laurel	browns21@unr.nevada.edu	MS Plan A
Burak	Susan	Dana, Gayle	sburak@psln.com	MS Plan B
Carroll	Rosemary	Warwick, John	rcarroll@dri.edu	
Chen	Dong	Duan, Jennifer	dchen@unr.edu	PhD
Clark	Matthew	Louie, John	xv1100mc@aol.com	MS Plan A
Clark	Ryan	Tempel, Regina	rclark@unr.nevada.edu	MS Plan A
Coleman	Anthony	Benson, David	acoleman@dri.edu	MS Plan A
Considine	Ellen	Wheatcraft, Stephen	ejconsid@unr.edu	MS Plan A
DeRocher	Theodore	Shevenell, Lisa	tderocher@caithnessenergy.com	PhD
Engle	Mark	Gustin, Mae	engle@unr.nevada.edu	PhD
Erwin	John	Narayanan, Rang	jerwin@tmwa.net	PhD
Fenstemaker	Thomas	Tyler, Scott	tomf@unr.edu	PhD
Fosbury	DeEtta	Walker, Mark	dfosbury@unr.nevada.edu	MS Plan A
Foster	Erich	Wheatcraft, Stephen	fostere@unr.edu	MS Plan A
Fritchel	Patrick	Boyle, Doug	pfritchel@sbcglobal.net	PhD
Garner	Christopher	Tyler/Ken McGuire		MS
Gebeyehu	Yonas	Meerschaert, Mark	yonas@unr.edu	PhD
Giffin	Joy	McDonald, Eric	joyg@unr.edu	MS Plan A
Gilliam	Anna(Brooke)	Pohll, Greg	bateya@scsr.nevada.edu	MS Plan A
Glass	Dallas	Johnson, Dale	glassd3@unr.nevada.edu	MS Plan A
Green	Jena	Strobel, Michael	jgreen@unr.edu	MS Plan A
Gunter	Melissa	Thomas, Jim	mgunter@dri.edu	MS Plan A
Harris	Ann Marie	Karlin, Robert	harrisam@mines.unr.edu or harris@bornite.unr.edu	PhD
Harrison	Elizabeth	Johnson, Dale	eharrison@trpa.org	MS Plan B

student/advisor				
Last Name	**First Name**	**Advisor**	**email**	**Degree**
Hartsough	Peter	Thomas, Jim	peterh@dri.edu	PhD
Hershey	Ronald	Miller, Glenn	ronh@dri.edu	PhD
Howcroft	William	Hess, Jack	blhowcroft@sbcglobal.net	PhD
Huntington	Justin	Boyle, Doug	washoezepher@yahoo.com	PhD
Johnson	Jennifer	Tempel, Regina	jennjohn@unr.edu	MS Plan A
Knust	Andrew	Warwick, John	andrewk@unr.edu	MS Plan A
Kozlowski	Don	Swanson, Sherman	kozlows4@unr.nevada.edu	MS Plan A
Latham	Zachary	Warwick/Fritsen	zlatham@hotmail.com	MS Plan A
Loupe	Theresa	Miller, Wally	loupet@unr.nevada.edu	MS Plan A
Lutz	Alexandra	Thomas, Jim	alex@dri.edu	PhD
Makowski	Anna	Pohll, Greg	amakowsk@unr.edu	MS Plan A
McKay	Wallace (Alan)	Warwick, John	alan@dri.edu	PhD
Meadows	Darren	Young, Michael	meadows@unr.nevada.edu	MS Plan A
Meinert	Michael	Walker, Mark	meinert@unr.nevada.edu	MS Plan A
Meyer	Brent	Stillings, Lisa	bmeyer@unr.edu	MS Plan A
Naranjo	Ramon	Boyle, Doug	naranjor@unr.nevada.edu	PhD
Ofosu	Steve	Thomas, Jim	sofosu@dri.edu	MS Plan A
Olsen	Jeffrey	Steve Wheatcraft	jolsen@tmcc.edu	PhD
Otahal	Joan	Tempel, Regina	jotahal@unr.edu	MS Plan A
Peternel	Karin C.	Saito, Laurel	peternel@unr.nevada.edu	MS Plan A
Prudic	David	Tyler, Scott	deprudic@usgs.gov	PhD
Ragavan	Anpalaki	Papelis, Lambis	ragavan@unr.edu	PhD
Rajagopal	Seshadri	Boyle, Doug	esar18@yahoo.com	MS Plan A
Rasmussen	Brian	Tyler, Scott	Brasmussen007@yahoo.com	MS Plan A
Rau	Benjamin	Chambers, Jeanne	dunklebrau@yahoo.com	MS Plan A
Redd	Richard	Tyler, Scott	richredd@hotmail.com	MS Plan A
Reeves	D. Matthew	Benson, David	mreeves@dri.edu	PhD
Rost	Andy	Sada, Donald	Arost@dri.edu	PhD
Rotter	Shane	Duan, Jennifer	srotter@unr.edu	MS Plan A
Royce	Gitane	Tyler, Scott	groyce@unr.edu	MS Plan A
Sawyer	Frederick Emile	Thomas, Jim	aquafir@yahoo.com	MS Plan A
Schmidt	Kurtiss	Swanson, Sherman	KurtissSchmidt@msn.com	PhD
Shope	Christopher	Cooper, Clay	chris.shope@dri.edu	PhD
Skiles	Tom	Walker, Mark	tskiles@unr.edu	MS Plan A
Stein	Chad	Johnson, Dale	cmstein11@hotmail.com	MS Plan A
Stoddard	Shawn	Narayanan, Rang	sstoddard@tmwa.net	PhD
Unger	Kurt	Tracy, John	kunger@dri.edu	PhD
Weaver	Keith	Swanson, Sherman	weaver@unr.nevada.edu	MS Plan A
Weller	Jennifer	Duan, Jennifer	jbweller@unr.edu	MS Plan A
Widmer	Michael	Wheatcraft, Stephen	mwidmer@mail.co.washoe.nv.us	PhD

student/advisor				
Last Name	**First Name**	**Advisor**	**email**	**Degree**
Willard	Pamela	Stillings, Lisa	geopup1@aol.com	MS Plan A
Wright	Mervin, Jr.	Miller, Glenn	mwright@plpt.nsn.us	MS Plan B

APPENDIX H

Graduate Program of Hydrologic Sciences
Thesis/Dissertation Titles 2000-2004

2000

Jeffrey Anderson, M.S., Advisor: John Guitjens: *Hydrodynamic Modeling to Optimize Irrigation Efficiency*

Braimah Apambire, Ph. D., Advisor: Jack Hess: *Geochemical Modeling and Medical Implications of Fluoriferous Groundwaters in the Upper Region of Ghana*

Frank (Chris) Benedict, Ph.D., Advisor: Berry Lyons: *The Interaction of Trivalent Rare Earth Elements with Alluvial Materials from Yucca Flat, Nevada, with Inferences to Actinide Mass Transfer Potential*

Steven Calhoun, M.S., Advisor: Roger Jacobson: *Regional Groundwater Flow at the Nevada Test Site Using Stable Isotope and Trace Chemistry*

Lori Carpenter, M.S. Advisor: Fred Gifford: An *Approach for Delineating Hydrologic Boundaries of Wetlands by Simulating Long Term Hydrologic Conditions*

Thomas Christensen, M.S., Advisor: John Guitjens: *Flood Impact on the Morphology and Riparian Vegetation of the Lower Truckee River*

Harry E. Creech, M.S Advisor: George Danko:*., Measurements of Thermal Conductivity Changes Due to*
Fluid Heat Convection in a Saturated Tuff Using the REKA Probe Method

Catherine Davis, M.S., Advisor: Jerry Miller: *Influences of Alluvial Fans on Local Channel Geomorphology, Incision and Vegetation Dynamics in the Toiyabe, Toquima and Monitor Ranges of Central Nevada*

Jeryl Gardner, M.S. Advisor: John Guitjens, *Numerical Modeling of Irrigation Management for Salinity Control*

Peter Hartsough, M.S.Advisor: Scott Tyler, *The Use of Environmental Tracers as Indicators of Paleoclimate and the Paleohydrologic Response*

Michael P. Mann, M.S. Advisor: Greg Pohll, *Use of Geomorphic Information in Extending the Flood Record of the West Walker River, California*

James Maus, M.S. Advisor: John Warwick, *Event Oriented Runoff Modeling of Small Watersheds: A Comparison between PRMS and WMS*

Nancy Moll, M.S Advisor: Steve Wheatcraft., *A Groundwater Flow Model of Eastern Honey Lake Valley, Lassen County, CA and Washoe County, NV*

Ramon Naranjo, M.S.Advisor: John Warwick:, *Overland Flow Simulations of the Upper Burning Grounds Area, Sierra Army Depot, Herlong, California*

Fred Ramsing, M.S. Advisor: Scott Tyler, *Measurement of Groundwater Seepage into Lake Tahoe and Estimation of Nutrent Transport from a Lake Tahoe Watershed*

Matthew Sullivan, M.S. Advisor: John Warwick, *Hydrological Studies Conducted in the Upper Incline Creek Watershed, Nevada*

Richard Susfalk, Ph.D.Advisor: Dale Johnson, *Relationships of Soil-extractable and Plant-available Phosphorus in Forest Soils of the Eastern Sierra Nevada*

Guosheng (Johnny) Zhan, Ph.D.Advisor: George Danko, *Experimental Study of Leach Pad Hydraulics and Transport Behavior During Rinsing*

Thesis/Dissertation Titles
2001

Mitchell Blum, M.S.Advisor: Sherm Swanson, *Using Geographic Information Systems (GIS) to Aid in Watershed Management and Stream Restoration: Steamboat Creek, Nevada*

David Decker, Ph.D Advisor: Scott Tyler., *The Determination of the Hydraulic Flow and Solute Transport Characteristics of Several Heap Leach Materials.*

Larry Feinson, M.S.Advisor: Steve Wheatcraft, *The Effects of Sea Level Rise on Coastal Aquifers*

Danielle Henderson, M.S Advisor: Jean Chambers., *Understanding Relationships Among Climate Stream Channel Dynamics and Riparian Vegetation Establishment During the Past 50 Years in Upland Central Nevada Watersheds*

Matt Herrick, M.S. Advisor: Dave Benson, *Hydraulic Conductivity, Velocity and the Order of the Fractional Dispersion Derivative in a Highly Hetergeneous System*

Hai Huang, Ph.D. Advisor: Bill Hu, *Stochastic Analysis of Contaminant Transport in Structured Porous Media: A Dual-porosity/permeability Approach*

Michael Kellogg, M.S.Advisor: Kyle House, *Paleoflood Hydrology of the Carson River, Nevada and California*

Sean Kosinski, M.S.Advisor: Greg Pohll, *Effective Porosity Estimation from Tracer Testing in Low-Permeability Fractured Rock*

Jason Kuchnicki, M.S. Advisor: Sherm Swanson, *Truckee River Watershed Assesment: Water Quality Indictors and Associated Target Values*

Stacy Langsdale, M.S.Advisor: John Tracy, *A Systems Approach to Modeling the Walker River Basin in Nevada*

Maggy Lengke, Ph.D.Advisor: Gina Temple, *Arsenic Sulfide Oxidation Kinetics*

Richard Niswonger, M.S.Advisor: Greg Pohll, *Assessing Steamflow Processes in Mountain Front Streams Using Surface/Groundwater Modeling*

Jayne' Irene Park, M.S. Advisor: Gina Temple, *Geochemical Evidence for Fluid-Rock Interaction in the Ordovician Vinini Formation at Vinini Creek, Eureka County, Nevada*

Jill Ralston, M.S.Advisor: Greg Pohll, *Influence of Irrigation on the Geochemical Evolution of Groundwater in the Fernley Aquifer System*

John Rupp, M.S.Advisor: Bill Hu, *Applied Monte Carlo Analysis of Chemical Transport Processes*

John Skalbeck, Ph.D. Advisor: Bob Karlin, *Potential Fields Modeling and Hydrogeology of the Steamboat Hills, Nevada*

Michelle Stamates, M.S. Advisor: , *Evaluation of Injection Effects on the Dixie Valley, Nevada, Geothermal Reservoir Through the use of Geochemical Data*

James Sutherland, M.S.Advisor: Steve Wells, *Nineteenth Century Logging and the Geomorphic Response of a Montane Watershed in the Carson Range, Western Nevada*

Woo-Yong Um, Ph.D.Advisor: Lambis Papelis, *Nineteenth Century Logging and the Geomorphic Response of a Montane Watershed in the Carson Range, Western Nevada*

Thesis/Dissertation Titles
2002

Nancy Alvarez, M.S. Advisor: Wally Miller, *Effects of Prescribed Fire on the "Isle of Fertility" in Pinyon-Juniper and Cliffrose Settings*

Tim Bardsley, M.S.Advisor: Joe McConnell, *Investigations Toward Understanding the Spatial Representativeness of SNOTEL Measurements of Snow Water Equivalance*

Charles Denton, M.S. Advisor: Wally Miller, *In-Situ Overland Flow Collection System for Characterization of Interrill Nutrient Discharge From Sierran Watersheds*

Jeff Gamlin, M.S.Advisor: Scott Tyler, *Characterization of Arsenic Transport in Northeastern Honey Lake Basin, Lassen County, California*

Teri Gorham, M.S. Advisor: Doug Boyle, *Application and Evaluation of a Distributed, Physically Based, Hydrologic Model to Improve Streamflow Forecasts in the Upper Rio Grande Basin*

Mark B. Green, M.S.Advisor: Chris Fritsen, *Nutrient Limitation of Periphyton Growth in the Truckee River, California - Nevada*

Stephanie Kampf, M.S.Advisor: Scott Tyler, *Evaporation and Land Surface Energy Budget at the Salar de Atacama, Northern Chile*

Christine Kirick, M.S. Advisor: Joe McConnell, *Trends in Littoral Zone Turbidity at Lake Tahoe, California - Nevada*

Matt Kohlbecker, M.S.Advisor: Steve Wheatcraft, *The Relationship Between Hydraulic Conductivity, Velocity, and Dispersion in Fractional Advection Dispersion*

Becky Mahollond, M.S Advisor: Wally Miller., *Geomorphic Assessment of Natural and Anthropogenic Sediment Sources in an Eastern Sierra Nevada Watershed*

Michael Mercer, M.S.Advisor: Greg Pohll, *Determining Average Basin Rainfall Using the WSR-88D for the Lake Tahoe and Truckee River Watersheds*

Sara Michehl, M.S.Advisor: Waly MIller, *The Importance of Science Based Decision Making to Western Nevada Water Policy*

Brad Morse, M.S.Advisor: Jim Thomas, *Radiocarbon Dating of Groundwater Using Paleoclimatic Constraints and Dissolved Organic Carbon in the Southern Great Basin, Nevada and California*

Daniel Obrist, Ph.D.Advisor: Jay Arnone, *Hydrologic Interactions Between Plants and Soils in Shrub-dominated Arid Ecosystems: Effects of Global Environmental Change*

Rina Schumer Ph.D.Advisor: Dave Benson, *Extension and Refinement of the Owens Lake Groundwater Basin Numerical Simulation.*

Andrew Schwaneflugel, M.S.Advisor: Wally Miller, *Forms of Nitrogen and Phosphorous in Free Draining Pore Water in a Lake Tahoe Soil*

Todd Umstot, M.S.Advisor: Lisa Shevenell, *Estimation of Karst Aquifer Parmeters from Well Hydrograph Data*

Thesis/Dissertation Titles
2003

Khaldoon Al-Qudah, Ph.D.Advisor: Steve Wells, *The Influence of Long-term Landscape Stability on Flood Hydrology and the Geomorphic Evolution of Valley Floor in the Northeastern Badia of Jordan*

Charles Dettling, M.S. Advisor: Dick French, *Use of Remotely Sensed Data to Estimate the Flow of Water to a Playa Lake*

Mark Engle, M.S.Advisor: Gina Temple, *The Mobility of Mercury in Epithermal Mercury Deposits in an Arid Environment*

Richard Felling, M.S.Advisor: Steve Wheatcraft, *A New Transient-Calibrated Groundwater Flow Model to Estimate Future Water Levels and the Effects of Aquifer Injection in the South Truckee Meadows, Washoe County, Nevada*

Patrick Fritchel, M.S.Advisor: Keith Dennett, *Evaluation of Erosion Control Strategies Used for Channel Protection in the Clear Creek Watershed, Eastern Sierra Nevada*

Marija Grabasnjak, M.S.Advisor: Dave Benson, *Flow Velocity, Particle Travel Distance and the Order of the Fractional Dispersion Derivative in a Highly Heterogenous System*

Justin Huntington, M.S. Advisor: Greg Pohll, *A Water Resource Investigation Using GIS and Remote Sensing Methods, Washoe Valley, Washoe County, Nevada.*

Christian Kropf, M.S.Advisor: Scott Tyler, *Capture Zone Analysis Using Standard EPA Methods and Bayesian Uncertainty Analysis in Spanish Springs Valley, Nevada*

Raquel Kutsch, M.S.Advisor: Mark Walker, *Hydrologic Responses to Simulated Small Ranch Conditions of Horse Grazing/Trampling and Flood Irrigation*

Daniel Lahde, M.S. Advisor: Jean Chambers, *Relationships Between Low-Standard Roads and Stream Incision in Central Nevada.*

Justin (Charles) Mayers, M.S.Advisor Brian Andraski/Steve Wheatcraft, *Modeling Tritium Transport Through a Deep Unsaturated Zone, Amargosa Desert Research Site, Nye County, Nevada.*

Sarah Peterson, M.S.Advisor: Greg Pohll, *Modeling Agriculturally Driven Groundwater Nutrients in the Truckee River, Nevada*

Megan Robinson, M.S. Advisor: Chris Fritsen, *The Azolla-Anabaena Symbiosis in the Lower Truckee River, Nevada*

Andy Rost, M.S Advisor: John Tracy., *Predicting Stream Flow Statistics in the Ungaged Watersheds of the Lake Tahoe Basin for Fisheries Habitat Assessment*

William Sicke, M.S.Advisor: Jim Thomas, *Geochemical and Isotopic Evaluation of Pahute Mesa-Oasis Valley Groundwater Flow Paths, Southern Nevada*

Elizabeth Stevick, M.S.Advisor: Greg Pohll, *Simulation of Groundwater Resources in the Fernley and Dodge Flat Hydrographic Basins, Nevada*

Beth Thomas, M.S. Advisor: Mae Gustin, *Characterization of Total and Methyl Mercury in Steamboat Creek, Nevada and Implications for the Truckee River*

Geoffrey Webb, M.S.Advisor: Scott Tyler, *Spatial Variability of Flow in Coarse, Unsaturated Mining Material: Results from Field-Scale Infiltration Experiments*

Thesis/Dissertation Titles
2004

Theresa Jones, M.S., Advisor: Jim Thomas. *Evaluation of Effectiveness of Three Types of Highway Alignment Best Management Practices for Sediment and Nutrient Control*

John (Ryan) Banta, M.S., Advisor: Joseph McConnell *Dating The Upper Siple Dome Ice Core Using Continous High Resolution Chemistry*

Katrina Smolen, M.S., Advisor: Roger Jacobson *Trout Creek Stream Restoration and Wildlife Enhancement Project, Water Quality Monitoring, South Lake Tahoe, CA.*

Kip Allander, M.S., Advisor: Jim Thomas *An Estimate of the Contributions of Streamflow and Nutrients to Trout Creek, South Lake Tahoe, California.*

Jie Xu, Ph.D., Advisor: Bill Hu. *Application of Nonstationary Stochastic Theory to Solute Transport in Fractured Porous Media.*

James Murphy, M.S., Advisor: Dale Johnson. *Soil Chemical Changes Following Wildfire and Prescribed Fire in Sierra Nevada Forest Soils.*

Margaret Shanafield, M.S., Kendrick Taylor. *Influences on Water Clarity Near the Upper Truckee River Outlet in Lake Tahoe, California-Nevada*

Hesham Bekhit, Ph.D., Advisor: Ahmed Hassan. *Contaminant Transport in Porous Media in the Presence of Colloids: Numberical and Experimental Investigations*

Brian Epstein, M.S., Advisor: Greg Pohll. *Analysis and Creation of Ground Water Recharge Models for Nevada's Desert Basins*

Changming He, Ph.D., Advisor: *Using Stochastic and Genetic Method to Study Prediction Uncertainty for Solute Transport in Heterogeneous Media: Evaluation, Conditioning and Optimization*

APPENDIX I
Assessment Plans

Degree: Masters Hydrogeology

Mission Statement

The mission of the UNR Graduate Program of Hydrologic Sciences is to provide training to scientists and engineers in the broad areas of ground water, watershed sciences, water quality and water treatment, restoration methodologies and water resource evaluation. The degrees and tracks within each degree are structured to provide a foundation in water resources and specialization in a student's chosen area or areas. Several tracks are available, including ground water modeling, subsurface contaminant transport, and surface water hydraulics and geomorphology, hydroecology and surface water quality management. Students may also define their own tracks by developing a curriculum from a breadth of graduate courses offered across the campus.

The Hydrogeology Masters degree focuses on the processes of ground water, ground water pollution and the geochemistry of ground water.

Student Learning Outcome

Understanding of the theoretical basis and observational methods for study of water and its interactions with the subsurface.

Student Performance Indicator	Assessment Method
• Descriptive and numerical solutions to exam questions	• Course and graduate exam grades
• Oral presentation in graduate student seminar	• Seminar evaluations by faculty and students
• Student opinions on course content	• Student evaluations of individual courses
• Development of research design and methods	• Evaluation of thesis or professional paper

Student Learning Outcome

Knowledge of the design and use of field instrumentation, computer models, data analysis and laboratory procedures for hydrogeology research and monitoring.

Student Performance Indicator	Assessment Method
• Operation of instrumentation and analysis of data in laboratory, field and computer projects	• Supervisor and instructor evaluations
• Performance in summarizing research methods	• Supervisor and instructor evaluations
• Thesis/professional paper content	• Evaluations from thesis/professional paper review and defense

Student Learning Outcome

Ability to explain ideas and results through written, numerical, graphical, spoken, and computer-based forms of communication.

Student Performance Indicator	Assessment Method
• Narrative essays and numerical solutions on exams	• Exam grades
• Oral presentations	• Faculty and student evaluations in student seminars
• Thesis/professional paper/professional paper structure and content	• Faculty evaluations from thesis/professional paper review and defense

Student Learning Outcome

Adaptability to new avenues of scientific and engineering inquiry that offer interdisciplinary and practical applications to societal needs related to ground water and the environment.

Student Performance Indicator	Assessment Method
• Application of thesis/professional paper results to broader impacts	• Thesis/professional paper review and defense
• Performance in interdisciplinary studies and coursework	• Course grades and project evaluations in interdisciplinary topics
• Employer opinions during pre-graduate internships or post-graduate appointments	• Employer surveys
• Alumni opinions while in post-graduate appointments and other career activities	• Alumni surveys

Use of Results

The Hydrologic Sciences Graduate Faculty will utilize the results of the assessment to develop recommendations on changes or additions to course content, curriculum requirements, and student recruitment and student advisement. The Director will present a summary and recommendations to the Hydrologic Sciences graduate faculty for discussion and action. The Hydrologic Sciences Graduate faculty will also be asked to review and approve a plan for future ongoing assessment activities.

Implementation Plan

Data required for the assessment process (course grades, seminar evaluations, supervisor evaluations of research assistants, thesis/professional paper review, and defense evaluations, etc.) will be requested of the faculty during the coming semesters. The faculty will also be asked to suggest additional performance measures for graduate research projects and interdisciplinary coursework. The Director will undertake the assessment process during the Fall semester and will prepare a report on possible curriculum changes and ongoing assessment methods during the Spring semester. Modifications and additions to the curriculum, recruitment and advisement will be implemented as soon as feasible while continuing to meet the programmatic needs of the students currently working on their degree requirements.

Questionnaire related to fulfillment of learning outcomes as demonstrated by the HYDROGEOLOGY MS thesis or Professional Paper and defense (To be completed by Advisor)

Note: The 'learning outcome' and 'performance indicator' terms are used by UNR's Program Assessment initiative, in which the Graduate Program of Hydrologic Sciences is required to participate. This questionnaire is one of the modes by which we can obtain results for our internal assessment process.

Name of Student _____

For each Learning Outcome, indicate your level of agreement that the student has met the associated Performance Indicator. Also provide any comments you wish regarding student performance on specific elements of the learning outcomes.

1. Learning Outcome: Understanding of the theoretical basis and observational methods for study of water and its interactions with the subsurface

Performance Indicator: The thesis or Professional Paper and defense demonstrate that the student was successful at using and describing research methodologies for study of hydrologic processes, showing an understanding of both theoretical and observational principles.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

2. Learning Outcome: Knowledge of the design and use of field instrumentation, computer models, data analysis and laboratory procedures for hydrologic research and monitoring. .

Performance Indicator: The thesis or Professional Paper and defense adequately describe the instrumentation, analytical methods and other technology utilized during conduct of the reported research.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

3. Learning Outcome: Ability to explain ideas and results through written, numerical, graphical, spoken, and computer-based forms of communication.

Performance Indicator: The thesis or Professional Paper and defense provide evidence of the student's knowledge of how to convey the process and results of their work using all forms of communication.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

4. Learning Outcome: Adaptability to new avenues of scientific and engineering inquiry that offer interdisciplinary and practical applications to societal needs related to ground water and the environment.

Performance Indicator: The thesis or Professional Paper and defense include information showing the student's ability to interpret their research results with consideration of broader impacts and interdisciplinary applications.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

Assessment Plan

Degree: Ph.D. Hydrogeology

Mission Statement

The mission of the UNR Graduate Program of Hydrologic Sciences is to provide training to scientists and engineers in the broad areas of ground water, watershed sciences, water quality and water treatment, restoration methodologies and water resource evaluation. The degrees and tracks within each degree are structured to provide a foundation in water resources and specialization in a student's chosen area or areas. Several tracks are available, including ground water modeling, subsurface contaminant transport, and surface water hydraulics and geomorphology, hydroecology and surface water quality management. Students may also define their own tracks by developing a curriculum from a breadth of graduate courses offered across the campus.

The Hydrogeology Masters degree focuses on the processes of ground water, ground water pollution and the geochemistry of ground water.

Student Learning Outcome

Understanding of the theoretical basis and observational methods for study of water and its interactions with the subsurface.

Student Performance Indicator	Assessment Method
• Descriptive and numerical solutions to exam questions	• Course, Qualifying exam and graduate exam grades
• Oral presentation in graduate student seminar	• Seminar evaluations by faculty and students
• Student opinions on course content	• Student evaluations of individual courses
• Development of research design and methods	• Evaluation of dissertation

Student Learning Outcome

Knowledge of the design and use of field instrumentation, computer models, data analysis and laboratory procedures for hydrogeology research and monitoring.

Student Performance Indicator	Assessment Method
• Operation of instrumentation and analysis of data in laboratory, field and computer projects	• Supervisor and instructor evaluations
• Performance in summarizing research methods	• Supervisor and instructor evaluations
• Dissertation content	• Evaluations from dissertation review and defense

Student Learning Outcome

Ability to explain ideas and results through written, numerical, graphical, spoken, and computer-based forms of communication.

Student Performance Indicator	Assessment Method
• Narrative essays and numerical solutions on exams	• Exam grades
• Oral presentations	• Faculty and student evaluations in student seminars
• Dissertation structure and content	• Faculty evaluations from dissertation review and defense

Student Learning Outcome

Adaptability to new avenues of scientific and engineering inquiry that offer interdisciplinary and practical applications to societal needs related to ground water and the environment.

Student Performance Indicator	Assessment Method
• Application of dissertation results to broader impacts	• Dissertation review and defense
• Performance in interdisciplinary studies and coursework	• Course grades and project evaluations in interdisciplinary topics
• Employer opinions during pre-graduate internships or post-graduate appointments	• Employer surveys
• Alumni opinions while in post-graduate appointments and other career activities	• Alumni surveys

Use of Results

The Hydrologic Sciences Graduate Faculty will utilize the results of the assessment to develop recommendations on changes or additions to course content, curriculum requirements, and student recruitment and student advisement. The Director will present a summary and recommendations to the Hydrologic Sciences graduate faculty for discussion and action. The Hydrologic Sciences Graduate faculty will also be asked to review and approve a plan for future ongoing assessment activities.

Implementation Plan

Data required for the assessment process (course grades, seminar evaluations, supervisor evaluations of research assistants, dissertation review, and defense evaluations, etc.) will be requested of the faculty during the coming semesters. The faculty will also be asked to suggest additional performance measures for graduate research projects and interdisciplinary coursework. The Director will undertake the assessment process during the Fall semester and will prepare a report on possible curriculum changes and ongoing assessment methods during the Spring semester. Modifications and additions to the curriculum, recruitment and advisement will be implemented as soon as feasible while continuing to meet the programmatic needs of the students currently working on their degree requirements.

Questionnaire related to fulfillment of learning outcomes as demonstrated by the HYDROGEOLOGY Ph.D. Dissertation and defense
(To be completed by Advisor)

Note: The 'learning outcome' and 'performance indicator' terms are used by UNR's Program Assessment initiative, in which the Graduate Program of Hydrologic Sciences is required to participate. This questionnaire is one of the modes by which we can obtain results for our internal assessment process.

Name of Student _____

For each Learning Outcome, indicate your level of agreement that the student has met the associated Performance Indicator. Also provide any comments you wish regarding student performance on specific elements of the learning outcomes.

2. Learning Outcome: Understanding of the theoretical basis and observational methods for study of water and its interactions with the subsurface

Performance Indicator: The dissertation and defense demonstrate that the student was successful at using and describing research methodologies for study of hydrologic processes, showing an understanding of both theoretical and observational principles.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

3. Learning Outcome: Knowledge of the design and use of field instrumentation, computer models, data analysis and laboratory procedures for hydrologic research and monitoring. .

Performance Indicator: The dissertation and defense adequately describe the instrumentation, analytical methods and other technology utilized during conduct of the reported research.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

4. Learning Outcome: Ability to explain ideas and results through written, numerical, graphical, spoken, and computer-based forms of communication.

Performance Indicator: The dissertation and defense provide evidence of the student's knowledge of how to convey the process and results of their work using all forms of communication.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

5. Learning Outcome: Adaptability to new avenues of scientific and engineering inquiry that offer interdisciplinary and practical applications to societal needs related to ground water and the environment.

Performance Indicator: The dissertation and defense include information showing the student's ability to interpret their research results with consideration of broader impacts and interdisciplinary applications.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

Assessment Plan

Degree: Masters Hydrology

Mission Statement

The mission of the UNR Graduate Program of Hydrologic Sciences is to provide training to scientists and engineers in the broad areas of ground water, watershed sciences, water quality and water treatment, restoration methodologies and water resource evaluation. The degrees and tracks within each degree are structured to provide a foundation in water resources and specialization in a student's chosen area or areas. Several tracks are available, including ground water modeling, subsurface contaminant transport, and surface water hydraulics and geomorphology, hydroecology and surface water quality management. Students may also define their own tracks by developing a curriculum from a breadth of graduate courses offered across the campus.

The Hydrology Masters degree focuses on interactions between water, the land surface and biota. Areas of emphasis include surface water hydraulics, surface water quality and watershed hydrology.

Student Learning Outcome

Understanding of the theoretical basis and observational methods for study of water and its interactions with the land surface, biota and climate.

Student Performance Indicator	Assessment Method
• Descriptive and numerical solutions to exam questions	• Course and graduate exam grades
• Oral presentation in graduate student seminar	• Seminar evaluations by faculty and students
• Student opinions on course content	• Student evaluations of individual courses
• Development of research design and methods	• Evaluation of thesis or professional paper

Student Learning Outcome

Knowledge of the design and use of field instrumentation, computer models, data analysis and laboratory procedures for hydrologic research and monitoring.

Student Performance Indicator	Assessment Method
• Operation of instrumentation and analysis of data in laboratory, field and computer projects	• Supervisor and instructor evaluations
• Performance in summarizing research methods	• Supervisor and instructor evaluations
• Thesis/professional paper content	• Evaluations from thesis/professional paper review and defense

Student Learning Outcome

Ability to explain ideas and results through written, numerical, graphical, spoken, and computer-based forms of communication.

Student Performance Indicator	Assessment Method

• Narrative essays and numerical solutions on exams	• Exam grades
• Oral presentations	• Faculty and student evaluations in student seminars
• Thesis/professional paper/professional paper structure and content	• Faculty evaluations from thesis/professional paper review and defense

Student Learning Outcome

Adaptability to new avenues of scientific and engineering inquiry that offer interdisciplinary and practical applications to societal needs related to water and the environment.

Student Performance Indicator	**Assessment Method**
• Application of thesis/professional paper results to broader impacts	• Thesis/professional paper review and defense
• Performance in interdisciplinary studies and coursework	• Course grades and project evaluations in interdisciplinary topics
• Employer opinions during pre-graduate internships or post-graduate appointments	• Employer surveys
• Alumni opinions while in post-graduate appointments and other career activities	• Alumni surveys

Use of Results

The Hydrologic Sciences Graduate Faculty will utilize the results of the assessment to develop recommendations on changes or additions to course content, curriculum requirements, and student recruitment and student advisement. The Director will present a summary and recommendations to the Hydrologic Sciences graduate faculty for discussion and action. The Hydrologic Sciences Graduate faculty will also be asked to review and approve a plan for future ongoing assessment activities.

Implementation Plan

Data required for the assessment process (course grades, seminar evaluations, supervisor evaluations of research assistants, thesis/professional paper review, and defense evaluations, etc.) will be requested of the faculty during the coming semesters. The faculty will also be asked to suggest additional performance measures for graduate research projects and interdisciplinary coursework. The Director will undertake the assessment process during the Fall semester and will prepare a report on possible curriculum changes and ongoing assessment methods during the Spring semester. Modifications and additions to the curriculum, recruitment and advisement will be implemented as soon as feasible while continuing to meet the programmatic needs of the students currently working on their degree requirements.

Questionnaire related to fulfillment of learning outcomes as demonstrated by the HYDROLOGY MS thesis or Professional Paper and defense (to be completed by Advisor)

Note: The 'learning outcome' and 'performance indicator' terms are used by UNR's Program Assessment initiative, in which the Graduate Program of Hydrologic Sciences is required to

participate. This questionnaire is one of the modes by which we can obtain results for our internal assessment process.

Name of Student _____

For each Learning Outcome, indicate your level of agreement that the student has met the associated Performance Indicator. Also provide any comments you wish regarding student performance on specific elements of the learning outcomes.

5. Learning Outcome: Understanding of the theoretical basis and observational methods for study of water and its interactions with the land surface, biota and climate

Performance Indicator: The thesis or Professional Paper and defense demonstrate that the student was successful at using and describing research methodologies for study of hydrologic processes, showing an understanding of both theoretical and observational principles.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

6. Learning Outcome: Knowledge of the design and use of field instrumentation, computer models, data analysis and laboratory procedures for hydrologic research and monitoring. .

Performance Indicator: The thesis or Professional Paper and defense adequately describe the instrumentation, analytical methods and other technology utilized during conduct of the reported research.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

7. Learning Outcome: Ability to explain ideas and results through written, numerical, graphical, spoken, and computer-based forms of communication.

Performance Indicator: The thesis or Professional Paper and defense provide evidence of the student's knowledge of how to convey the process and results of their work using all forms of communication.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

8. Learning Outcome: Adaptability to new avenues of scientific and engineering inquiry that offer interdisciplinary and practical applications to societal needs related to water and the environment.

Performance Indicator: The thesis or Professional Paper and defense include information showing the student's ability to interpret their research results with consideration of broader impacts and interdisciplinary applications.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

Assessment Plan

Degree: Ph.D. Hydrology

Mission Statement

The mission of the UNR Graduate Program of Hydrologic Sciences is to provide training to scientists and engineers in the broad areas of ground water, watershed sciences, water quality and water treatment, restoration methodologies and water resource evaluation. The degrees and tracks within each degree are structured to provide a foundation in water resources and specialization in a student's chosen area or areas. Several tracks are available, including ground water modeling, subsurface contaminant transport, and surface water hydraulics and geomorphology, hydroecology and surface water quality management. Students may also define their own tracks by developing a curriculum from a breadth of graduate courses offered across the campus.

The Hydrology Ph.D. degree focuses on interactions between water, the land surface and biota. Areas of emphasis include surface water hydraulics, surface water quality and watershed hydrology.

Student Learning Outcome

Understanding of the theoretical basis and observational methods for study of water and its interactions with the land surface, biota and climate.

Student Performance Indicator	Assessment Method
• Descriptive and numerical solutions to exam questions	• Course, qualifying/comp exan and graduate exam grades
• Oral presentation in graduate student seminar	• Seminar evaluations by faculty and students
• Student opinions on course content	• Student evaluations of individual courses
• Development of research design and methods	• Evaluation of dissertation

Student Learning Outcome

Knowledge of the design and use of field instrumentation, computer models, data analysis and laboratory procedures for hydrologic research and monitoring.

Student Performance Indicator	Assessment Method
• Operation of instrumentation and analysis of data in laboratory, field and computer projects	• Supervisor and instructor evaluations
• Performance in summarizing research methods	• Supervisor and instructor evaluations
• Dissertation content	• Evaluations from dissertation review and defense

Student Learning Outcome

Ability to explain ideas and results through written, numerical, graphical, spoken, and computer-based forms of communication.

Student Performance Indicator	Assessment Method

• Narrative essays and numerical solutions on exams	• Exam grades
• Oral presentations	• Faculty and student evaluations in student seminars
• Dissertation structure and content	• Faculty evaluations from dissertation review and defense

Student Learning Outcome

Adaptability to new avenues of scientific and engineering inquiry that offer interdisciplinary and practical applications to societal needs related to water and the environment.

Student Performance Indicator	Assessment Method
• Application of dissertation results to broader impacts	• Dissertation review and defense
• Performance in interdisciplinary studies and coursework	• Course grades and project evaluations in interdisciplinary topics
• Employer opinions during pre-graduate internships or post-graduate appointments	• Employer surveys
• Alumni opinions while in post-graduate appointments and other career activities	• Alumni surveys

Use of Results

The Hydrologic Sciences Graduate Faculty will utilize the results of the assessment to develop recommendations on changes or additions to course content, curriculum requirements, and student recruitment and student advisement. The Director will present a summary and recommendations to the Hydrologic Sciences graduate faculty for discussion and action. The Hydrologic Sciences Graduate faculty will also be asked to review and approve a plan for future ongoing assessment activities.

Implementation Plan

Data required for the assessment process (course grades, seminar evaluations, supervisor evaluations of research assistants, dissertation review, and defense evaluations, etc.) will be requested of the faculty during the coming semesters. The faculty will also be asked to suggest additional performance measures for graduate research projects and interdisciplinary coursework. The Director will undertake the assessment process during the Fall semester and will prepare a report on possible curriculum changes and ongoing assessment methods during the Spring semester. Modifications and additions to the curriculum, recruitment and advisement will be implemented as soon as feasible while continuing to meet the programmatic needs of the students currently working on their degree requirements.

Questionnaire related to fulfillment of learning outcomes as demonstrated by the HYDROLOGY Ph.D. dissertation and defense (to be completed by advisor)

Note: The 'learning outcome' and 'performance indicator' terms are used by UNR's Program Assessment initiative, in which the Graduate Program of Hydrologic Sciences is required to participate. This questionnaire is one of the modes by which we can obtain results for our internal assessment process.

Name of Student _____

For each Learning Outcome, indicate your level of agreement that the student has met the associated Performance Indicator. Also provide any comments you wish regarding student performance on specific elements of the learning outcomes.

1. Learning Outcome: Understanding of the theoretical basis and observational methods for study of water and its interactions with the land surface, biota and climate

Performance Indicator: The disseration and defense demonstrate that the student was successful at using and describing research methodologies for study of hydrologic processes, showing an understanding of both theoretical and observational principles.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

2. Learning Outcome: Knowledge of the design and use of field instrumentation, computer models, data analysis and laboratory procedures for hydrologic research and monitoring. .

Performance Indicator: The dissertation and defense adequately describe the instrumentation, analytical methods and other technology utilized during conduct of the reported research.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

3. Learning Outcome: Ability to explain ideas and results through written, numerical, graphical, spoken, and computer-based forms of communication.

Performance Indicator: The dissertation and defense provide evidence of the student's knowledge of how to convey the process and results of their work using all forms of communication.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

4. Learning Outcome: Adaptability to new avenues of scientific and engineering inquiry that offer interdisciplinary and practical applications to societal needs related to water and the environment.
Performance Indicator: The dissertation and defense include information showing the student's ability to interpret their research results with consideration of broader impacts and interdisciplinary applications.

Indicate ranking (1=lowest; 5=highest): _____
Comments:

APPENDIX J

The Faculty and Their Research (alphabetical)

A red C indicates Core Faculty Status

Adams, Dean - Professor, Department of Civil Engineering, University of Nevada, Reno.
Water chemistry; appropriate technology water and wastewater treatment systems; lake and reservoir restoration; treatment and land application of municipal biosolids; sensitized photooxidation of recalcitrant organic and inorganic contaminants and new analytical methods development. vdadams@unr.nevada.edu

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Adams, Kenneth - Assistant Research Professor, Division of Earth and Ecosystem Sciences, Desert Research Institute.
Geoarchaeology; geomorphology; paleoenvironmental research and quaternary chronology; spatial analysis; active tectonics. Ken.Adams@dri.edu

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Andraski, Brian - Research Hydrologist, U.S. Geological Survey, University of Nevada, Reno.
Research focuses on the effects of soil-plant-atmosphere interactions on unsaturated flow and transport, and on methods for characterizing these processes. This research includes laboratory, field, and modeling studies. andraski@usgs.gov

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C **Arnone, Jay** - Associate Research Professor, Division of Earth and Ecosystem Sciences, Desert Research Institute.
Global change biology; vegetation-soil water interactions; terrestrial nutrient cycling; multi-trophic interactions in terrestrial ecosystems in response to environmental factors; plant physiological ecology. Jay.Arnone@dri.edu

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C **Benson, Dave** - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Mathematics of tracer movement through highly heterogeneous porous material, including fractional-order PDEs; hydraulics of fractured rock; stochastic processes; numerical methods, particularly vapor transportation in soil contaminated with NAPLs. dbenson@dri.edu

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Berger, Glenn - Research Professor, Division of Earth and Ecosystem Sciences, Desert Research Institute.
Geochronology (quaternary); paleoenvironmental research; applied environmental studies. Glenn.Berger@dri.edu

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C **Biondi, Franco** - Assistant Professor, Department of Geography, University of Nevada, Reno.
Dendrochronology; climate change; reconstruction of climate and forest dynamics; paleoclimate of western North America and Central America; statistics of proxy climate data. fbiondi@unr.edu

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C **Boyle, Douglas** - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Watershed hydrology; integrated modeling of watershed scale processes related to water quantity

and quality; streamflow forecasting; GIS; remote sensing; sensitivity analysis; automatic and manual parameter estimation, and multi-criteria analysis. Doug.Boyle@dri.edu

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Bullard, Tom - Assistant Research Professor, Division of Earth and Ecosystem Sciences, Desert Research Institute.
Quantitative geomorphology and quaternary geology of arid, semiarid and tropical regions; fluvial geomorphology and geomorphic processes; tectonic geomorphology and earthquake hazards; soils-geomorphology applied to landscape evolution, natural hazards, hazardous waste disposal, reclamation, environmental assessments and geoarchaeology. Tom.Bullard@dri.edu

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[C]**Chambers, Jeanne** - Adjunct Associate Professor, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.
Ecosystem responses to environmental changes; Great Basin watersheds and riparian ecosystems. chambers@unr.edu

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Childress, Amy - Associate Professor, Department of Civil Engineering, University of Nevada, Reno.
Physical and chemical processes for water and wastewater treatment; membrane separations on environmental applications; colloidal and interfacial processes in aquatic systems. amyec@unr.edu

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Cochran, Gil - Emeritus Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Limited water resource management; role of water in air quality problems; impact to water resources from human activities. Gil.Cochran@dri.edu

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[C]**Cooper, Clay** - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Heat and mass transport in multiphase porous media; geothermal systems; unstable flow and transport processes. clay@dri.edu

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[C]**Dana, Gayle** - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Snow and glacier hydrology; watershed hydrology; ecosystem energy flux modeling; remote sensing; climate change effects on hydrological systems; limnology. Gayle.Dana@dri.edu

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Danko, George - Professor, Department of Mining Engineering, University of Nevada, Reno.
Fluid mechanics; slurry transport; mine dewatering and pumping; heat, mass, and contaminant transport in natural and engineered subsurface systems. danko@unr.edu

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Dennett, Keith - Assistant Professor, Department of Civil Engineering, University of Nevada, Reno.
Physicochemical processes for water and wastewater treatment; optimization of coagulation and

flocculation for removal of colloidal matter and natural organic matter; bench-scale and pilot-scale testing of conventional surface water treatment systems; erosion and resuspension of cohesive and noncohesive sediments; prediction and monitoring of scour around bridge piers; wetland systems for nutrient removal; influence of natural organic matter on the surface chemistry of clay minerals; physicochemical monitoring of groundwater recharge systems. dennett@unr.nevada.edu

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Donaldson, Sue - Water Quality Education Specialist, University of Nevada Cooperative Extension.
Documenting the effectiveness of best management practices for nonpoint source pollution mitigation and pesticide contamination of soil and water; stream restoration; bioengineering techniques. donaldsons@unce.unr.edu

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[C]**Duan, Jennifer** - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Using computational models to simulate flow, sedimentation and morphological processes in open channels. Jennifer.Duan@dri.edu

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Fernandez, George - Associate Professor, Department of Applied Economics and Statistics, University of Nevada, Reno.
Modeling plant genotype by environment interaction and estimating environmental sensitivity; trend analysis of water resources; developing time series models and forecasting the future behavior of water resources trends. gcjf@unr.nevada.edu

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French, Richard H. - Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Open-channel hydraulics, surface water hydrology, hydraulic processes on alluvial fans, and environmental fluid mechanics. Dick.French@dri.edu. Dr. French has left UNR in September 2004 but remains on several student committees

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[C]**Fritsen, Christian** - Assistant Research Professor, Division of Earth and Ecosystem Sciences, Desert Research Institute.
Microbial life in extreme environments-thermodynamics of ice; microalgal ecophysiology; hydrological optics; nutrient dynamics in extreme environments; trophodynamics of polar ecosystems. Chris.Fristen@dri.edu

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[C]**Gustin, Mae** - Assistant Professor, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.
Investigation of natural sources of atmospheric mercury; the role of plants in the biogeochemical cycling of mercury; mercury pollution in the Steamboat Creek Truckee River watershed; arsenic in the Humboldt River and in ground waters in Fallon, NV. msg@unr.nevada.edu

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Halford, Keith J. - Ground-Water Specialist, Nevada District, Water Resources District, U.S. Geological Survey.
Expertise includes ground-water flow and solute transport simulation, parameter estimation,

kriging, aquifer testing, geophysical logging, optimization, ground-water/surface water interactions, and hydrologic applications of spreadsheets. khalford@usgs.gov

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House, Kyle - Research Geologist, Nevada Bureau of Mines and Geology.
Fluvial geomorphology; paleohydrology; paleoflood hydrology; riverine and alluvial fan flood hazard mapping and assessment; quaternary geology. khouse@unr.edu

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Jacobson, Roger - Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Environmental geochemistry; isotope hydrology and waste stabilization.
Roger.Jacobson@dri.edu

[C]**Johnson, Dale** - Professor, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.
Forest soils; nutrient cycling and plant nutrition. dwj@unr.edu

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[C]**Karlin, Robert E.** - Professor and Chairman, Department of Geological Sciences, University of Nevada, Reno.
Geophysics and applications of geophysical methods to subsurface flow systems.
karlin@mines.unr.edu

Lamorey, Gregg - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Application of geostatistical and parameter estimation techniques to hydrological problems; incorporation of boundary constraints for estimating heads; determination of unsaturated hydraulic conductivities; estimating uncertainties when working with sparse data sets.
Gregg.Lamorey@dri.edu

Lancaster, Nick - Research Professor, Division of Earth and Ecosystems Sciences, Desert Research Institute.
Aeolian processes; process geomorphology; paleohydrology; sediment transport.
Nick.Lancaster@dri.edu

[C]**Louie, John** - Associate Professor, Nevada Seismological Laboratory and Department of Geologic Sciences, University of Nevada, Reno.
Reflection seismology; tectonics; site assessment; hydrogeophysics. louie@seismo.unr.edu

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Marion, Giles - Associate Research Professor, Division of Earth and Ecosystems Sciences, Desert Research Institute.
Soil chemistry; global climate change; biogeochemical process modeling. Giles.Marion@dri.edu

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McCall, Katherine - Assistant Professor, Department of Physics, University of Nevada, Reno.
Macroscopic physical behavior of inhomogeneous and porous materials; nonlinear elasticity, nonlinear wave propagation, and fluid transport. mccall@physics.unr.edu

[C]**McConnell, Joe** - Associate Research Professor, Department of Hydrologic Sciences, Desert Research Institute.
Polar and alpine snow and snowmelt hydrology; global environmental hydrology; integrated watershed systems. Joe.McConnell@dri.edu

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[C]**McDonald, Eric** - Associate Research Professor, Division of Earth and Ecosystem Sciences, Desert Research Institute.
Short-and long-term physiochemical and hydrological processes and changes; dynamic relations among soil, vegetation, and surficial processes; use of soil-geomorphic relations to understand landscape evolution; role of soils in site characterization and development of mitigation and management. Eric.McDonald@dri.edu

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[C]**Meerschaert, Mark** - Associate Professor, Department of Physics, University of Nevada, Reno.
Fractals and fractional diffusion; stochastic modeling for porous diffusion; time series analysis for river flows; probability models with heavy tails. mcubed@unr.edu. Dr. Meerschaert left UNR in December 2004, but continues to advise one doctoral student.

[C]**Miller, Glenn** - Professor, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.
Environmental chemistry and toxicology. gcmiller@unr.nevada.edu

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[C]**Miller, W. Wally** - Professor and Chairman, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.
Hydrology; soil system ecology; physical and chemical ecology of Sierra Nevada forested watersheds; water quality interactions. wilymalr@cabnr.unr.edu

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[C]**Narayanan, Rangesan** - Professor, Department of Applied Economics and Statistics, University of Nevada, Reno.
Natural resource and environmental economics; water resource planning, allocation and management; cost-benefit analysis; operations research and econometrics. rang@agnt1.ag.unr.edu

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[C]**Norris, Gary M.** - Professor, Department of Civil Engineering, University of Nevada, Reno.
Consolidation-stress-strain-strength permeability response of soil and its effect on the groundwater flow regime. norris@unr.edu

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Panorska, Anna - Assistant Professor, Department of Mathematics, University of Nevada, Reno.
Probability and Statistics: modeling and estimation of heavy-tailed data, modeling in finance and natural sciences: hydrology, environment, climate, air pollution. ania@unr.edu

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[C]**Papelis, Charalambos** - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Environmental geochemistry; macroscopic and spectroscopic studies of trace element interactions with mineral surfaces; geochemical modeling. Lambis.Papelis@dri.edu

Peacock, Mary - Assistant Director for Research, Department of Biology, University of Nevada, Reno.
Population viability; habitat fragmentation on population dynamics; aquatic biology.
mpeacock@scs.unr.edu

Pinsky, Mark - Associate Professor, Department of Mathematics, University of Nevada, Reno.
Modeling and simulation of complex nonlinear systems, stability analysis of partially uncertain dynamical systems, abstraction and reduction techniques for large nonlinear models, numerical and asymptotic analysis, inverse problems, modeling and control of bifurcation and chaos phenomena, waves phenomena. pinsky@unr.edu

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[C]**Pohll, Greg** - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Coupled surface/subsurface numerical modeling; numerical modeling of flow and transport in saturated and unsaturated subsurface systems; uncertainty analysis and inverse methods; analysis of wetland hydrology. Greg.Pohll@dri.edu

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Price, Jonathan - Director and State Geologist, Nevada Bureau of Mines and Geology.
Geology and geochemistry of ore deposits; igneous petrology; aqueous geochemistry and environmental geochemistry; solution mining; geologic hazards. jprice@unr.edu

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Qualls, Jerry - Assistant Professor, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.
Microbial transformations of mercury in soils; geochemistry and transport of dissolved humic substances; Fe and Al precipitation of phosphorus as a means of controlling eutrophication in wetlands; formation of soil organic matter by microbial and chemical transformations; ecology of invasive plants in riparian and wetland areas. qualls@equinox.unr.edu

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[C]**Rosen, Michael** - Research Hydrologist, US Geological Survey.
Water quality of basin and range surface and ground water, sedimentology and geochemistry of saline lakes and the formation of dolomite in modern evaporitic environments.
mrosen@usgs.gov

[C]**Sada, Don** - Associate Research Professor, Desert Research Institute.
Relationships between environmental factors and the structure and function of Great Basin aquatic invertebrate and vertebrate communities, aquatic mollusk biogeography and taxonomy, wetland conservation planning, particular emphasis on arid and semiarid systems.
Don.Sada@dri.edu

[C]**Saito, Laurel** - Assistant Professor, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.

Aquatic ecosystem management; interdisciplinary modeling in water resources; reservoir management; ecosystem modeling; stable isotope analysis. lsaito@cabnr.unr.edu

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[C]**Shevenell, Lisa** - Research Hydrogeologist, Nevada Bureau of Mines and Geology.
Hydrogeology; subsurface flow and contaminant transport; isotope hydrology; aqueous geochemistry of thermal and nonthermal systems; karst hydrology. isaas@unr.edu

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Siddarthan, Raj - Professor, Department of Civil Engineering, University of Nevada, Reno.
Soil response under static and dynamic loading including liquefaction behavior; dynamic behavior of rigid and flexible retaining walls; dynamic pavement response to traffic; pavement materials characterization; effects of blast loading on saturated medium; wave loading on offshore slopes; transportation risk assessment studies. siddhart@unr.edu

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[C]**Stillings, Lisa** - Geologist, U.S. Geological Survey.
Aqueous geochemistry; trace metal/metalloid release and transport; suspended sediment and colloidal transport of trace minerals; diel cycling and redox speciation of arsenic in surface waters. stilling@usgs.gov

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[C]**Strobel, Michael** - Research Hydrologist, US Geological Survey.
Designing and conducting aquifer tests in low-permeable materials, climate reconstruction and atmospheric-deposition records in ice cores, fracture flow in glacial sediments, and regional ground-water flow modeling. Studying contaminant deposition in snow and in the Sierra Nevada Mountains and in the study of wildfire effects on hydrogeology and soil geochemistry in the Basin and Range. mstrobel@usgs.gov

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[C]**Swanson, Sherman** - Associate Professor, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.
Ecology and hydrology of riparian ecosystems, including streamside vegetation, relationships with channel morphology, watershed hydrology, and rangeland management.
sswanson@cabnr.unr.edu

[C]**Taylor, Kendrick** - Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Ice core studies for paleoclimatology; geophysical methods in groundwater exploration.
Kendrick.Taylor@dri.edu

[C]**Tempel, Regina N.** - Assistant Professor, Department of Geological Sciences, University of Nevada, Reno.
Low-temperature aqueous geochemistry; geochemical numerical modeling methods, water-rock interactions in sedimentary basins resulting from fluid flow, and geochemical evolution of groundwaters. gina@mines.unr.edu

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[C]**Thomas, James** - Associate Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Aqueous geochemistry; isotope applications to solving hydrologic problems; age dating ground waters; surface water and lake chemistry; environmental studies. Jim.Thomas@dri.edu

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[C]**Tyler, Scott W.** - Director, Graduate Program of Hydrologic Sciences, University of Nevada, Reno.
Transport of water and contaminants in the unsaturated (vadose) zone, with particular emphasis on arid and semiarid systems; energy budgets across land/atmosphere interface and variable density subsurface flow and its relation to ore forming processes. tylers@unr.edu

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Verburg, Paul - Assistant Research Professor, Desert Research Institute.
Effects of climate change on forest ecosystems; soil organic matter dynamics; soil chemistry. Paul.Verburg@dri.edu

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[C]**Walker, Mark** - Assistant Professor, Department of Natural Resources and Environmental Sciences, University of Nevada, Reno.
Nonpoint source management for public drinking water protection; microbial contaminants in water; risk assessment and modeling for water supply protection. mwalker@equinox.unr.edu

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Wallace, Alan - Research Geologist, U.S. Geological Survey.
Regional geology of the Great Basin and surrounding areas, with emphasis on late Cenozoic volcanic and sedimentary systems and epithermal and lacustrine-related mineral deposits. alan@usgs.gov

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[C]**Warwick, John** - Executive Director, Division of Hydrologic Sciences, Desert Research Institute.
Numerical modeling of the transport and fate of contaminants in surface water systems. A secondary research theme has involved quantifying the impact of imperfect knowledge on the confidence associated with model predictions (uncertainty analysis). John.Warwick@dri.edu

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Wells, Stephen G. - President, Desert Research Institute.
Geomorphology and quaternary geology of arid and semiarid regions; fluvial and hillslope processes; interlinkages, rates, and magnitudes, understanding landscape dynamics and evolution in responses to climate change, tectonic activity, and surface disturbances such as wildfire, application of geomorphology to land management, hazardous waste disposal, or natural hazards. Steve.Wells@dri.edu

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[C]**Wheatcraft, Steve** - Professor, Department of Geological Sciences, University of Nevada, Reno.
Quantification of spatial variability and its impacts on subsurface solute transport; variable density flow and subsurface transport phenomenon. wheatcraft@unr.edu

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[C]**Young, Michael** - Assistant Research Professor, Division of Hydrologic Sciences, Desert Research Institute.
Characterization of soil hydraulic and transport properties; numerical predictions of water movement and contaminant migration in unsaturated material; development of integrated, subsurface monitoring systems for waste disposal sites; near-surface soil-water processes.
Michael.Young@dri.edu

APPENDIX K
Recent Peer-Reviewed Journal and Book Chapters of HSP Faculty and Students

Student authors are in Bold

2005 or In Press

Adams, K.D., 2004, Estimating palaeowind strength from beach deposits-Reply: Sedimentology, v. 51, p. 671-673.

Anderson, P. and M.M. Meerschaert**,** Parameter estimation for periodically stationary time series, *Journal of Time Series Analysis*, to appear.

Baeumer. B, D.A. Benson, and M.M. Meerschaert, Advection and dispersion in time and space, *Physica A*, to appear.

Benson, D.,C. Tadjeran, M.M. Meerschaert I. Farnham, and G. Pohll, Radial fractional-order dispersion through fractured rock, *Water Resources Research*, to appear.

Baeumer B., M.M. Meerschaert**,** and J. Mortensen, Space-time fractional derivative operators, *Proceedings of the American Mathematical Society*, to appear.

Bekhit, H. M., and A. E. Hassan, Stochastic Modeling of Colloid-Contaminant Transport in Physically and Geochemically Heterogeneous Porous Media , *Water Resources Research*, in press.

Briggs, R. W**.**, Wesnousky, S. G., and Adams, K. D., In Press, Younger Dryas and late Holocene lake stands in the Pyramid Lake subbasin of Lake Lahontan, Nevada, USA: Quaternary Research.

Brook, E J.W.C. White and A.S.M Schilla, M.L. Bender and B. Barnett,
J.P. Severinghaus, K. C. Taylor, R. B. Alley, E. J. Steig* Timing of millennial-scale climate change at Siple Dome, West Antarctica, during the last glacial period *In press in Quaternary Science Reviews

Clarke D, M.M. Meerschaert**,** and S.W. Wheatcraft**,** Fractal Travel Time Estimates for Dispersive Contaminants, *Ground Water*, to appear.

Dong, W., S.E. Lindberg, J. Chanton, R.G. Qualls, and **T. Meyers**. A mechanism for bimodal emission of gaseous mercury from aquatic macrophytes in the Everglades. Atmospheric Environment. In press.

Duan, J.G. and Nanda, S.K. Simulation of suspended sediment deposition around spur dikes with an enhanced depth-averaged two-dimensional model, Journal of Hydraulic Engineering/, in press.

Duan, J.G. An analytical approach to calculate the rate of bank erosion, Journal of Hydraulic Engineering/, accepted.

Duan, J.G. and Pierre Julien. Numerical simulation of the inception of meandering channel, /Journal of Earth Surface Processes and Land Forms/, in press.

Gammons, C.H., **C.L. Shope**, T.E. Duaime, In Press. A 24-hour investigation of the hydro-geochemistry of baseflow and storm water in an urban area impacted by mining: Butte, Montana. *Hydrological Processes*.

Gee, G.W., Z.F. Zhang, S.W. Tyler, **W.H. Albright** and M. J. Singleton. *In Press.* Chloride-mass balance for predicting increased recharge after land use change. *Vadose Zone Journal.*

Gustin, M. S., L.Saito, and M. Peacock. *In press*. Mercury concentrations and ^{15} N and ^{13} C values in fish of the Truckee River watershed, Nevada, USA. *Science of the Total Environment*

Hu, W.X., Jichun Wu, Craig Shirley, Dongxiao Zhang, A Numerical Method of Moments for Reactive Solute Transport in Physically and Chemically Nonstationary Formations: Linear equilibrium Sorption with Random K_d , /*J. Stoch. Envir. and Risk Assess*/, 20: 46-63, DOI 10.1007/s00589-003-0253-5, 2004.

Kampf, S.K. and S.W. Tyler. In Press. Spatial characterization of evaporation and land surface energy budgets at the Salar de Atacama using ASTER image classification. *Advances in Water Research.*

Kampf, S.K., S. W. Tyler, C. O. Astete, J. F. Munoz and P. Adkins. *In Press.*. Evaporation and land surface energy budget at the Salar de Atacama, Northern Chile. *J. of Hydrology*

Kozubowski, T.,M.M. Meerschaert**,** A.K. Panorska, and H.P. Scheffler, Operator geometric stable laws, *Journal of Multivariate Analysis*, to appear.

Lyons, W.B., K.A. Welch, G. Snyder, J. Olesik, E.Y. Graham, G.M. Marion, and R.J. Poreda. 2005. Halogen geochemistry of the McMurdo dry valleys lakes, Antarctica: Clues to the origin of solutes and lake evolution. *Geochim. Cosmochim. Acta*. 69, 305-323.

Marion, G.M., J.S. Kargel, D.C. Catling, and S.D. Jakubowski. 2005. Effects of pressure on aqueous chemical equilibria at subzero temperatures with application to Europa. *Geochim. Cosmochim. Acta.* 69, 259-274.

Mayers, C.J., B.J. Andraski, C.A. Cooper, S.W. Wheatcraft, D.A. Stonestrom and R.L. Michel, Modeling tritium transport through a deep unsaturated zone in an arid environment, *Vadose Zone Journal*, to appear.

Neville, H. J. B. Dunham and M. M. Peacock. *In Press.* Genetic assessment of population dynamics and connectivity at various spatial scales in Lahontan cutthroat trout (*Oncorhynchus clarki henswawi*). In: Maintaining Connections for Nature: The Importance of Connectivity for Conservation, eds K. Crooks and S. Muttulingam. Cambridge University Press.

Qualls, R.G. 2004 Biodegradability of fractions of dissolved organic carbon leached from decomposing leaf litter. Environmental Science and Technology ,in press.

Qualls, R.G and Bridgham, S.D. Mineralization rate of 14C labeled dissolved organic carbon in soils from a weathering chronosequence. Soil Biology and Biochemistry. In press.

Rosen, M.R., Rowe, T.G., Goodbred, S.L., Shipley, D.O. and **Arufe, J.A**., in press, Importance of land use, streamflow, and water quality on toxicity of SPMD extracts deployed in streams from the Lake Tahoe and Truckee River Watersheds *in* R. M. Hughes, L. Wang, and P. W. Seelbach, editors. Influences of landscapes on stream habitats and biological assemblages. American Fisheries Society, Bethesda, Maryland.

Scalas, R. Gorenflo, F. Mainardi and **M**.M. Meerschae**rt**, Speculative option valuation and the fractional diffusion equation, *Fractional derivatives and their applications*, Vol. 2, to appear.

Shipley, D.O. and Rosen, M.R., in press, Identification of nitrate and dissolved-solids sources in ground water by GIS analyses. *Environmental Practice.*

Taylor, K.C., R.B. Alley, D.A. Meese, M.K. Spencer, E.J. Brook, N.W. Dunbar, R. Finkel, A.J. Gow, A.V. Kurbatov, G.W. Lamorey, P.A. Mayewski, E. Meyerson, K. Nishiizumi and G.A. Zielinski. *Dating the Siple Dome,* *Antarctica** ice core by manual and computer interpretation of annual layering*.In press in Journal of Glaciology.

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APPENDIX L
HSP PROGRAM BUDGET SUMMARY FOR FINANCIAL YEAR 2004/2005

HYDROLOGIC SCIENCES PROGRAM BUDGET					
		SOURCE			
HSP BUDGET	TOTAL	GRADUATE SCHOOL	MSESE LINE ITEM	COS TEACHING	PROVOST TEACHING
SALARIES					
PROFESSIONAL					
Tyler	8000	8000			
RAGEA	1823	1823			
DRI Teaching Support	116000			106,000	10,000
TOTAL PROF SALARY	125823				
CLASSIFIED					
Program Manager	36290				
Overtime	3707				
Insurance	6000				
Fringe (Miller only)	7984				
Merit (5%)	1815				
Personel assessment	356				
RAEGIA	533				
TOTAL CLERICAL	56684	38352	18332		
WAGES					
Student wages	2000				
TOTAL WAGES	2000	2000			
STUDENT SUPPORT					
3 MS @17,000	51000				
1.7 PHD at $18,000	30600				
Tuition	3450				
Student Appointments	2500				
Fringe	8700				
TOTAL STUDENT	96250	85750	10500		

OPERATING					
Projector	3000				
Laptop 4 projetcor	0				
Postage/packaging	600				
Office Supplies (printer cartridges, etc)	1800				
Phone	800				
Recruiting Adverts	650				
Misc.	900				
Seminar Speaker Travel	2800				
Hosting	500				
WRR Office Support	5000				
TOTAL OPERATIONS	16050	16050			
TRAVEL					
Recruiting Student Travel	1500				
Director 2 RT Rno-LV	250				
TOTAL TRAVEL	1750	1750			
Total Support	298557	153725	28832	106000	10000