Faculty Development Plan

Department of Geological Sciences

Overview

This document describes my proposed activities in the areas of scholarship, teaching, and citizenship. In each of these areas, I reflect on my own strengths and weakness, lay out my goals and plans to achieve these goals, describe the relationship between personal goals and department needs, and describe resources needed to achieve these goals. The goal is to create a rigorous plan that will help me be successful in my third year review, and that can be adjusted over time to help me have a successful six year review and productive career.

I. Scholarship

My greatest strength in scholarship is a genuine interest and enthusiasm for my research area. Because of the interesting opportunities that arise in my research area, I sometimes feel that that my interests are too broad and that I am not creating a focused line of research. I am trying to develop my own niche within the subdiscipline of hydrogeology/biogeochemistry (see theme below), and I will address other tangential projects as time and resources permit. The intensive field- and laboratory-based research program I am initiating seamlessly involves armies of undergraduate and graduate students. I will include students in all aspects of my research so they can be included as co-authors on manuscripts.

A major theme of my research is trace element cycling in the hydrologic system. I am currently pursuing several projects that deal with this theme, including:

a) *Trace element geochemistry of the Provo River.* The goal of this project is to identify trends in trace element concentrations in the Provo River, and use stable isotopes to evaluate potential trace element sources. This project is valuable because the Provo River is a focus watershed of the $20 million iUTAH EPSCoR grant, from which I am seeking additional support for my research. I am trying to become the go-to person for Provo River water chemistry in order to create future opportunities for funding and collaborations. I have already collected samples along the entire reach of the Provo River on five different occasions (November, February, April, May, and June 2013), with one more sampling trip planned for August 2013. I will continue to collaborate with Dave Tingey, Steve Nelson, Diego Fernandez (U of U), and the iUTAH group on this project. I have enlisted several students to help with field work, lab analyses, and data reduction. Preliminary results indicate some interesting trends for a variety of elements, which can be linked to natural and anthropogenic processes.
b) *Trace element cycling in groundwater and surface water in the Wind River Range.* The goal of this project is to evaluate the processes controlling trace element concentrations in shallow groundwater and streams in a high elevation semiarid watershed (Red Canyon Creek, Wyoming). This project is important because it is opening up new collaborations with

hydrogeologists/geochemists from University of Missouri, SUNY-Plattsburgh, SUNY-Cortland, and Syracuse. I am expecting that these collaborations will lead to joint publications and proposals in the future. These researchers have already invested thousands of dollars to install shallow groundwater wells, and they have allowed access to their field site to investigate trace element interactions in groundwater and surface water. The field work for the initial investigation was successfully completed during July 2013, and lab results should be ready by October 2013.

c) *Trace element export from melting glaciers in Grand Teton National Park*. The goal of this project is to determine whether glaciers are a source of contaminants to high elevation watersheds at GTNP. This project is important because glaciers are a hot topic (or cold topic?) for future research, and little is known about what effect the loss of glaciers will have on hydrologic systems in mid-latitude regions. This research is also an important first step in developing collaborations with fellow BYU colleague Summer Rupper, who specializes in glacier research. We have already successfully completed the first round of sampling during July 2013, and will return to the field area in August 2013 for the second round of sampling. Lab analyses for this project will extend into the fall.

Other projects that I have begun to pursue with my three incoming M.S. students include: 1) trace element geochemistry of snow and dust in the Uinta Mountains (Dylan Dastrup); 2) trace element exchange in the hyporheic zone of the middle Provo River (Timothy Goodsell); and 3) mercury geochemistry in Utah Lake wetlands (Brian Selck). These projects further expand my research program on trace element cycling in three important components of the hydrologic system: snow, groundwater, and wetlands.

The specific short-term research goals I plan to accomplish by February 2014 include:

a) Attend NSF Early Career Workshop in July
b) Submit MEG proposal for snow/dust research in October
c) Present Provo River research at GSA in October
d) Submit proposal for dust research to NSF-Hydrologic Sciences in December
e) Present Wind River research at AGU in December
f) Submit Provo River manuscript to Applied Geochemistry in January
g) Prepare outline for Teton or Wind River manuscript by February
h) Encourage my three incoming M.S. students to defend their prospectuses by February

My goals for scholarship are to:

a) Publish at least one primary author peer-reviewed manuscript per year in a top tier journal. I have already published two first-author papers in both 2012 and 2013, and I plan to publish the Provo River and Wind River manuscripts in 2014, the Teton manuscript in 2015, three M.S. student papers (as senior author) in 2016, and at least one first-author manuscript in 2017.
b) Present at two professional conferences per year. Conferences are vital to establishing my research program as they provide opportunities for networking, keeping up with recent

advances, obtaining feedback on current research projects, and getting new ideas for future research opportunities. I am planning to present at GSA and AGU in 2013, and some combination of GSA, AGU, or other meetings such as International Conference on Mercury as a Global Pollutant, Goldschmidt, International Association of Hydrogeologists, and European Geophysical Union during 2014-2017. Encourage students to present at conferences as well.

c) Submit one large proposal for external funding per year, and several smaller proposals for external funding as opportunities arise. During 2013 I have already received one small grant ($5K) from the University of Wyoming/National Park Service for Teton glacier research, submitted one moderate-sized proposal ($65K) for mercury research on Great Salt Lake to the Utah Department of Forestry Fire and State Lands (not funded). I plan to submit a proposal to NSF-Hydrological Sciences for snow and dust research in December. I will continue submitting proposals annually to NSF (or similar).
d) Serve as a reviewer for journals and volunteer to serve on review panels for funding agencies. I reviewed a paper for Journal of Hydrology in early 2013, and I contacted the program manager for NSF-Hydrologic sciences to express my interest in serving on a panel.

My individual goals in scholarship (described above) are well aligned with department needs, as outlined below:

a) The department expectations document states that all faculty should publish at least one significant peer-reviewed article per year as primary author. At least 50% of articles should be published in high quality venues, which in my case include Journal of Hydrology, Science of the Total Environment, Chemosphere, Hydrologic Processes, Applied Geochemistry, and similar venues. The document also states that each faculty member should participate in at least two conferences per year. The faculty member should drive his or her own research program and involve students in all aspects of research, including publishing results and presenting research at conferences. New faculty should submit an average of one funding proposal per year until commitments for research are maximized, with "significant" grants averaging in the few tens of thousands of dollars per year. The research plans described above meet or exceed all of the department expectations.

Resources that will continue to enhance my research program include:

a) Assistance from Dave Tingey and the hydrogeochemistry/stable isotope laboratory.
b) Laboratory space (remodel of BNSN C028 nearly complete; will need more space in BNSN C030 in the future).
c) Department support for undergraduate and graduate students (in addition to those I am able to fund via external grants).

II. Teaching

I really enjoy being with students and helping them learn—I show genuine concern for the students in and out of the classroom. My first round of teaching evaluations reflected my strengths, but also

pointed out some things on which I need to improve. I need to learn the material better, try to bring the gospel into the classroom wherever possible, and make the classroom experience more student-driven. I also need to learn new teaching techniques from colleagues and other resources. Finally, because of my quiet personality and I feel that my enthusiasm for the subjects I teach may not come across to the students in a classroom setting. I need to open up and show more excitement to help the students become more engaged in the learning process.

I have already prepared and taught three new courses during the past year (Geol 435 during fall 2012, Geol 635 during winter 2013, and Geol 410 during spring 2013). The courses I am planning to teach in the future are:

a) Fall 2013
    a. Geol 230 (team-teach with Summer Rupper)
    b. Geol 435 (repeat)
b) Winter 2014
    a. Geol 101 (new prep)
    b. Geol 535 (new prep)
c) Spring 2014
    a. Geol 410 (repeat)
d) Fall 2014
    a. Geol 230 (repeat) or Geol 101 (repeat)
    b. Geol 435 (repeat)
e) Winter 2015
    a. Geol 635 (repeat)
    b. Geol 636 (new prep)
f) Spring 2015
    a. Geol 410 (repeat)
g) Fall 2015
    a. Geol 230 (repeat) or Geol 101 (repeat)
    b. Geol 435 (repeat)
h) Winter 2016
    a. Geol 101 (repeat)
    b. Geol 535 (repeat)
i) Spring 2016
    a. Geol 410 (repeat)
j) Fall 2016
    a. Geol 230 (repeat) or Geol 101 (repeat)
    b. Geol 435 (repeat)
k) Winter 2017
    a. Geol 635 (repeat)
    b. Geol 636 (repeat)

My specific goals to become a better teacher include:

a) Attend NSF Early Career Workshop in July 2013.
b) Use campus resources for teaching (e.g., SCOTS). Continue to use mid-course evaluations to invite feedback from students during the semester. Attend teaching-related workshops on campus.
c) Increase knowledge of subjects I teach by studying a separate textbook (in addition to the one we are using in class) for each class I teach.
d) Attend scientific conferences and bring current discussions to the classroom.
e) Bring up gospel connections to subject material.
f) Attend classes taught by other professors in the department or university, or engage in discussions with them, in order to learn new teaching methods and to learn new subject material. These classes include: numerical methods (Barry Bickmore), groundwater modeling (Norm Jones), and environmental isotope geochemistry (Steve Nelson).
g) Invite feedback from other faculty, beyond what is expected for the 3rd year review.
h) Document student mentoring activities.
i) Open up and show more enthusiasm while I am teaching.

My individual goals and plans for teaching are well aligned with department and university needs, as outlined below:

a) The department expectations document states that teaching is valued equally with scholarly activity, and that student learning is the primary objective. Teaching should occur in the classroom and in the mentoring of student research in the laboratory and in the field. Teaching will be evaluated by student ratings, classroom visits by other faculty, review of course materials, and interviews with students. Thorough preparation should be demonstrated in lectures and course materials. A description of effective mentoring of students should be included in the candidate's file. Faculty are responsible for documenting their teaching abilities (other than student evaluations), and new faculty should participate in activities to improve teaching (including workshops and university resources). My teaching load is approximately 6 credits per fall and winter semester, and three credits in either spring or summer term. Courses may include Geol 101 or 111, Geol 435, Geol 410, Geol 635, and other courses in my area of expertise.

Resources that will allow me to improve my teaching:

a) Department support to attend workshops aimed at improving teaching.
b) Department support for teaching assistants.
c) Department/college course development grants.

III. Citizenship

I feel that I am very good at working with a wide variety of people across different departments and institutions and creating new collaborations. I enjoy working on multidisciplinary projects that combine research interests from hydrogeology, biology, geochemistry, and atmospheric sciences. I feel that this

developing collaborations with fellow BYU colleague Summer Rupper, who specializes in glacier research. We have already successfully completed the first round of sampling during July 2013, and will return to the field area in August 2013 for the second round of sampling. Lab analyses for this project will extend into the fall.

Other projects that I have begun to pursue with my three incoming M.S. students include: 1) trace element geochemistry of snow and dust in the Uinta Mountains (Dylan Dastrup); 2) trace element exchange in the hyporheic zone of the middle Provo River (Timothy Goodsell); and 3) mercury geochemistry in Utah Lake wetlands (Brian Selck). These projects further expand my research program on trace element cycling in three important components of the hydrologic system: snow, groundwater, and wetlands.

The specific short-term research goals I plan to accomplish by February 2014 include:

a) Attend NSF Early Career Workshop in July
b) Submit MEG proposal for snow/dust research in October
c) Present Provo River research at GSA in October
d) Submit proposal for dust research to NSF-Hydrologic Sciences in December
e) Present Wind River research at AGU in December
f) Submit Provo River manuscript to Applied Geochemistry in January
g) Prepare outline for Teton or Wind River manuscript by February
h) Encourage my three incoming M.S. students to defend their prospectuses by February

Research Strategies

My primary research strategy is to do the following each year: 1) publish at least one peer-reviewed manuscript as primary author; 2) present at two conferences; and 3) submit at least one proposal for external grant. In order to accomplish these tasks, I need to become much more efficient and productive. To that end, I plan to:

a) Write for at least 30 min each morning
b) Arrive at the office by 7 am each day in order to have 1-2 hours for uninterrupted work
c) Don't check email before noon
d) Set aside 1 hour each Monday afternoon for staying current with the literature
e) Audit one class per semester that will help me develop new skills in my field

Methods to Evaluate Success

I will evaluate success of my research goals by whether or not I complete them within the specified timeline. I will evaluate success of my research strategies by keeping a daily log of time spent writing, checking email, reviewing literature, and auditing classes. I will consider myself successful if I do everything as described, with some leniency only for days that I'm doing field work.

Course Development Project Grant Proposal—2013

My course development project is focused on Introduction to Groundwater, a 400 level elective course. One of the major learning outcomes for the students is to produce a potentiometric surface map from groundwater level measurements. However, from previous experience I have found that students have a very difficult time conceptualizing what groundwater level measurements mean because many of them have never seen a piezometer. Ideally we would take the class to an area that has already been instrumented with a piezometer field, but this is not feasible because it would require an expensive all day field trip.

For my course development grant, I am requesting $300 to build a mobile "piezometer field" that we can use on campus. These piezometers would be 1" PVC pipe installed in cement in a bucket. Each bucket would have three piezometers at different depths to represent a nested well site. I would build ~10 stations in a similar fashion. The outside of the bucket would display the necessary information about each piezometer (depth, screen interval, diameter) and a simple geologic log. Each piezometer would contain a different water level that students would measure as part of a lab. From the water level measurements and geologic information, the students would then construct a potentiometric surface map for the piezometer field. This idea was developed by my colleague Chris Lowry at SUNY-Buffalo, and he says it has been very successful with his classes.

The $300 grant would cover the costs of:

- 5 gallon buckets
- Cement
- PVC pipe
- Water level meters

The water level meters are fairly expensive, so I would request additional money from my department if the $300 grant is not sufficient.

Citizenship Strategies Project Proposal—2013

The purpose of this project is to identify specific activities that I would like to accomplish by February 2014 that will help me contribute to the university community. These activities include collaborative teaching, collaborative scholarship, service, and collaboration with colleagues outside of BYU.

Collaborative Teaching Activities

I would like to collaborate with Steve Nelson as I develop a new contaminant hydrogeology course for winter semester. Steve has a lot of knowledge in the subject area; in fact, he team-taught the course with Alan Mayo for several years. He says he is not interested in team-teaching the course anymore, but he is willing to help me with it. I will take him up on his offer and ask for feedback on my course materials and syllabus, I will invite him to give a guest lecture in the class on radionuclide transport in groundwater, and I will ask him to come to the class to provide feedback on my teaching. I hope to open the door for a situation where I can return the favor and provide feedback on his courses as well.

Collaborative Scholarship Activities

I will ask somebody in the department (not yet sure who that will be) to review my Provo River manuscript after I complete the first draft. I will offer to review this person's work so we can develop a collaborative relationship for reviewing papers.

Service

I was recently asked to chair a committee that is aimed at evaluating our field camp course in relation to similar courses taught at other universities. I will engage with colleagues at other universities to find out how their courses are run, read geoscience education literature related to field camp courses, and organize meetings with the committee.

Collaboration with Colleagues outside the University

I will volunteer to host a speaker for the fall seminar series. I would like to invite Vic Heilweil of the USGS to give a talk on his recent work in hydrogeology. Vic is currently serving as the president of the US chapter of International Association of Hydrogeologists, so he is well connected and would be a great person to have on campus.

Scholarship Strategies Project Proposal—2013

The purpose of this project is to develop a plan for scholarly activities that will help prepare me for a successful third year review. As part of this plan I will identify: 1) the theme of my research and associated projects; 2) goals that I plan to accomplish by February 2014; 3) specific strategies of scholarly productivity that I will incorporate in my work; and 4) methods to evaluate my scholarly success at the conclusion of the project.

Research Theme and Specific Projects

A major theme of my research is trace element cycling in the hydrologic system. I am currently pursuing several projects that deal with this theme, including:

a) *Trace element geochemistry of the Provo River.* The goal of this project is to identify trends in trace element concentrations in the Provo River, and use stable isotopes to evaluate potential trace element sources. This project is valuable because the Provo River is a focus watershed of the $20 million iUTAH EPSCoR grant, from which I am seeking additional support for my research. I am trying to become the go-to person for Provo River water chemistry in order to create future opportunities for funding and collaborations. I have already collected samples along the entire reach of the Provo River on five different occasions (November, February, April, May, and June 2013), with one more sampling trip planned for August 2013. I will continue to collaborate with Dave Tingey, Steve Nelson, Diego Fernandez (U of U), and the iUTAH group on this project. I have enlisted several students to help with field work, lab analyses, and data reduction. Preliminary results indicate some interesting trends for a variety of elements, which can be linked to natural and anthropogenic processes.

b) *Trace element cycling in groundwater and surface water in the Wind River Range.* The goal of this project is to evaluate the processes controlling trace element concentrations in shallow groundwater and streams in a high elevation semiarid watershed (Red Canyon Creek, Wyoming). This project is important because it is opening up new collaborations with hydrogeologists/geochemists from University of Missouri, SUNY-Plattsburgh, SUNY-Cortland, and Syracuse. I am expecting that these collaborations will lead to joint publications and proposals in the future. These researchers have already invested thousands of dollars to install shallow groundwater wells, and they have allowed access to their field site to investigate trace element interactions in groundwater and surface water. The field work for the initial investigation was successfully completed during July 2013, and lab results should be ready by October 2013.

c) *Trace element export from melting glaciers in Grand Teton National Park*. The goal of this project is to determine whether glaciers are a source of contaminants to high elevation watersheds at GTNP. This project is important because glaciers are a hot topic (or cold topic?) for future research, and little is known about what effect the loss of glaciers will have on hydrologic systems in mid-latitude regions. This research is also an important first step in

broad scope has given me numerous opportunities in the past and will continue to open doors for me in the future. However, I often feel intimidated by more established researchers; I need to step out of my comfort zone to meet new people at conferences or other places. I also need to contribute to research projects occurring in the department. I need to develop new relationships with hydrogeologists in industry in order to create solid connections to industry for potential resources for the department and job opportunities for my students in the future. I also need to develop a presence in my field so I can have more service opportunities.

My goals for citizenship include:

a) Attend conferences and workshops, and go out of my way to meet new people. I will attend the NSF Early Career Workshop as well as the GSA and AGU national meetings.
b) Continue conversations with colleagues that I met at the Early Career Workshop (Li Jin, Lixin Jin, Anthony Chappaz, Chris Lowry, and Sarah Godsey)
c) Discuss my research with other faculty in the department in order to develop joint projects. I have begun to collaborate with Steve Nelson and Summer Rupper on different projects.
d) Serve on a department/university committee when called upon to do so.
e) Start BYU student chapter of AEG and attend dinner meetings with students to facilitate opportunities for students to meet potential employers. I attended two dinner meetings with about 20 BYU students in 2012, and we have started to fill out the paperwork to create a new student chapter.
f) Serve as a reviewer for journals and volunteer to serve on review panels for funding agencies. I reviewed a paper for Journal of Hydrology in early 2013, and I contacted the program manager for NSF-Hydrologic sciences to express my interest in serving on a panel.

My goals in citizenship are aligned with department needs, as outlined below:

a) My hire letter states that hydrogeology is an important component of the department because of the opportunities it provides for post-graduate employment. The department expects me to develop a culture of professionalism within the hydrogeology program, oversee hydrogeology courses, and cultivate relationships with the companies/individuals that will increase students' exposure to the profession. Involvement with AEG will help with this expectation.
b) The department expectations document states that faculty members should be willing to serve on committee assignments and have a good attitude to make the department a better place to work. Faculty are also expected to serve the scientific community outside the university by serving as a reviewer or editor for journals and serving on review panels.

GEOL 435 - Groundwater

Fall 2013, N127 ESC on T Th from 9:00 am - 10:30 am

Instructor Information:

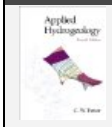
Name:

Office Phone:

Office Location:

Email:

Course Materials:

Image	Item	Vendor	Price (new)	Price (used)
	Applied Hydrogeology (4th Edition) Required by Jr., C.W. Fetter Prentice Hall; Edition 4 (975222000) ISBN: 9780130882394	BYU Bookstore	190.95	139.65
	Hydrogeology Laboratory Manual (2nd Edition) Required by Lee, Keenan Prentice Hall; Edition 2 (1036738800) ISBN: 9780130465498	BYU Bookstore	90.00	67.50

Course Design:

Students are expected to master much of the material outside of class, and we will build on that understanding with in-class activities. Online quizzes will be administered prior to each class period to assess students' level of understanding of the assigned reading material. Some class time will be spent on lectures, but the majority of our time will be spent on lab assignments and small group activities. Thus in order to be successful students will need to be prepared prior to class and engaged with the activities during class.

Course Purpose and Learning Outcomes:

The purpose of this course is for students to learn the fundamentals of groundwater in order to be prepared for potential employment in the environmental consulting industry. Expected learning outcomes include:

1. Create a water budget for Mono Lake Basin.
2. Evaluate the relationship between grain size, sorting, and hydraulic conductivity using Darcy's Law.
3. Produce a potentiometric surface map and water table map for a well field.
4. Evaluate the relationship between mechanical energy, hydraulic head, and force potential.
5. Construct a flow net to describe groundwater flow.
6. Evaluate different aquifer test methods for calculating aquifer parameters.
7. Evaluate different methods for calculating groundwater recharge rates.

8. Describe groundwater flow paths for confined and unconfined aquifers.
9. Produce a consulting report describing the hydrogeology of a basin.

Attendance Policy:

Class attendance is expected. Please email me or call me If you are unable to attend a class session for any reason. Some of the exam questions will come from material presented in class, even if that material isn't found in the text book or assignments.

Participation Policy:

Participation in classroom discussions and laboratory experiments is expected. Please complete reading assignments, take online quizzes, and come to class prepared.

Grading Scale:

Grades	Percent
A	93%
A-	90%
B+	87%
B	83%
B-	80%
C+	77%
C	73%
C-	70%
D+	67%
D	63%
D-	60%
E	0%

Schedule:

Date	Learning outcome	Pre-class activity	In-class activity	Assignments due
T - Sep 03		**Quiz 1 Opens**	Introduction to class Class discussion: The importance of groundwater	
Th - Sep 05	Learning outcome #1: Create a water budget for Mono Lake Basin.	Fetter: Chapter 2 **Quiz 2 Opens** **Quiz 1 Closes**	Class discussion: Hydrologic cycle	
T - Sep 10	Learning outcome #1: Create a water budget for Mono Lake Basin.	Lee: Lab 1 (Water Budget of Mono Lake: Precipitation and Evaporation) **Quiz 3 Opens** **Quiz 2 Closes**	Lab assignment: Precipitation and evaporation	**Unit Conversion**
Th - Sep 12	Learning outcome #1:	Lee: Lab 2 (Water Budget of	Lab assignment:	

	Create a water budget for Mono Lake Basin.	Mono Lake: Runoff, Storage, and Groundwater Flow) **Quiz 4 Opens** **Quiz 3 Closes**	Runoff, storage, and groundwater flow	
T - Sep 17	Learning outcome #2: Evaluate the relationship between grain size, sorting, and hydraulic conductivity using Darcy's Law.	Fetter: Sections 3.1 to 3.5 **Quiz 5 Opens** **Quiz 4 Closes**	Class discussion: Darcy's Law Introduction to lab experiment	**Water Budget of Mono Lake**
Th - Sep 19	Learning outcome #2: Evaluate the relationship between grain size, sorting, and hydraulic conductivity using Darcy's Law.	Lee: Lab 6 **Quiz 6 Opens** **Quiz 5 Closes**	Lab assignment: Porosity, specific yield, specific retention	
T - Sep 24	Learning outcome #2:	Lee: Lab 7	Lab assignment:	

	Evaluate the relationship between grain size, sorting, and hydraulic conductivity using Darcy's Law.	**Quiz 7 Opens** **Quiz 6 Closes**	Darcy's Law	
Th - Sep 26	Learning outcome #3: Produce a potentiometric surface map and water table map for a well field.	Fetter: Sections 3.6 to 3.12 **Quiz 8 Opens** **Quiz 7 Closes**	Class discussion: Properties of aquifers Introduction to water level measurements lab	**Porosity, Specific Yield, Specific Retention, Darcy's Law, and Hydraulic Conductivity**
T - Oct 01	Learning outcome #3: Produce a potentiometric surface map and water table map for a well field.	Class handout for water level measurements lab **Quiz 9 Opens** **Quiz 8 Closes**	Lab assignment: Water level measurements	
Th - Oct 03	Learning outcome #3: Produce a potentiometric surface map and water table map for a well field.	Class handout for water level measurements lab **Quiz 10 Opens**	Lab assignment: water level measurements	

		Quiz 9 Closes		
T - Oct 08	Learning outcome #3: Produce a potentiometric surface map and water table map for a well field.	Class handout for water level measurements lab **Quiz 10 Closes**	Lab assignment: water level measurements	**Potentiometric surface/water table map**
Th - Oct 10		Study for exam **Quiz 11 Opens**	Exam #1	**Exam 1**
T - Oct 15	Learning outcome #4: Evaluate the relationship between mechanical energy, hydraulic head, and force potential.	Fetter: Sections 4.1 to 4.5 **Quiz 12 Opens** **Quiz 11 Closes**	Class discussion: mechanical energy, force potential, hydraulic head	
Th - Oct 17	Learning outcome #5: Construct a flow net to describe groundwater flow.	Fetter: Sections 4.1 to 4.5 **Quiz 13 Opens** **Quiz 12 Closes**	Work in small groups to draw flow nets	

T - Oct 22	Learning outcomes #6: Evaluate different aquifer test methods for calculating aquifer parameters.	Fetter: Sections 5.1 to 5.4 **Quiz 14 Opens** **Quiz 13 Closes**	Class discussion: groundwater flow to wells	**Groundwater Flow**
Th - Oct 24	Learning outcomes #6: Evaluate different aquifer test methods for calculating aquifer parameters.	Fetter: Sections 5.5 to 5.9 **Quiz 15 Opens** **Quiz 14 Closes**	Class discussion: aquifer tests	
T - Oct 29	Learning outcomes #6: Evaluate different aquifer test methods for calculating aquifer parameters.	Lee: Lab 9 **Quiz 16 Opens** **Quiz 15 Closes**	Lab assignment: aquifer testing	
Th - Oct 31	Learning outcomes #6: Evaluate different aquifer test methods for	Lee: Lab 9 **Quiz 17 Opens**	Lab assignment: aquifer testing	

	calculating aquifer parameters.	**Quiz 16 Closes**		
T - Nov 05	Learning outcome #7: Evaluate different methods for calculating groundwater recharge rates.	Fetter: Chapter 6 **Quiz 18 Opens** **Quiz 17 Closes**	Class discussion: groundwater recharge	**Aquifer Testing**
Th - Nov 07	Learning outcome #8: Describe groundwater flow paths for confined and unconfined aquifers.	Fetter: Sections 7.1 to 7.3 **Quiz 19 Opens** **Quiz 18 Closes**	Class discussion: groundwater flow	**Groundwater Recharge**
T - Nov 12	Learning outcome #8: Describe groundwater flow paths for confined and unconfined aquifers.	Fetter: Sections 7.1 to 7.3 **Quiz 20 Opens** **Quiz 19 Closes**	Class discussion: groundwater-surface water interactions	
Th - Nov 14	Learning outcome #8: Describe groundwater	Fetter: Sections 7.4 to 7.6 Fetter: Sections 7.1 to 7.3	Class activity: case studies	**Regional groundwater flow**

	flow paths for confined and unconfined aquifers.	**Quiz 20 Closes**		
T - Nov 19		Study for exam **Quiz 21 Opens**	Exam #2	**Exam 2**
Th - Nov 21		**Quiz 22 Opens** **Quiz 21 Closes**	Class activity: case studies	
T - Nov 26	**Friday Instruction**			
W - Nov 27	**No Classes**			
Th - Nov 28	**Thanksgiving Holiday**			
T - Dec 03	Learning outcome #8: Describe groundwater flow paths for confined and unconfined aquifers.	Fetter: Chapter 8 **Quiz 23 Opens Quiz 22 Closes**	Class presentations	**Geology-groundwater presentation**
Th - Dec 05	Learning outcome #9: Produce a consulting report describing the hydrogeology of a basin.	Lee: Lab 19-21 **Quiz 23 Closes**	Work on final paper	

T - Dec 10	Learning outcome #9: Produce a consulting report describing the hydrogeology of a basin.		Work on final paper	
Th - Dec 12	Learning outcome #9: Produce a consulting report describing the hydrogeology of a basin.		Work on final paper	
F - Dec 20		Final paper due		**Groundwater analysis of Lost Valley Basin**

University Policies

Honor Code

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Sexual Harassment

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education and pertains to admissions, academic and athletic programs, and university-sponsored activities. Title IX also prohibits sexual harassment of students by university employees, other students, and visitors to campus. If you encounter sexual harassment or gender-based discrimination, please talk to your professor or contact one of the following: the Title IX Coordinator at 801-422-2130; the Honor Code Office at 801-422-2847; the Equal Employment Office at 801-422-5895; or Ethics Point at http://www.ethicspoint.com, or 1-888-238-1062 (24-hours).

Student Disability

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.