W2 Course Review Form

draft revisions as of Fall 2021

To complete this form, please type responses below. You will also need to provide supporting documents by adding them to the bottom of this application form or including them as attachments with your proposal. Email your complete proposal, consisting of the following items, to the Writing Across the Curriculum Coordinator:

1. This W2 Course Review application
2. A syllabus draft that covers the policies, goals, and grade breakdown for the course and includes the schedule to show deadlines and writing instruction. Your syllabus should explain to students why writing is important in this class and what they will learn.
3. Documents that demonstrate the following:
    a. writing assignments (detailed in question #2)
    b. instruction (detailed in question #3)
    c. assessment (detailed in question #4)

Please send all of these items as one single file! (PDF and Word are both fine.)

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1. Instructor name:
   Emma Witt

   Instructor program/school:
   ENVL-NAMS

   Course acronym, number, & title:
   ENVL 3435 Groundwater Hydrology
   (cross list with GEOL 3435 Groundwater Hydrology)

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2. **Assignments:** Fill out the table below to show what writing students will do in the course, and what students will learn about writing through those assignments. Please include at least 3 separate, distinct examples of writing assignments listed below.

Writing Assignment	***Specify if the assignment is low, middle, or high stakes writing and briefly explain why***	***Writing-Related Learning Objectives for this Assignment***
Groundwater Model Assignment	High Represents the culmination of half a semester's work on aquifer properties.	Demonstrating complex concepts for audiences using figures (maps, graphs, models) and tables, effectively captioning these tools, and considering their design.
Audience and purpose questions	Low Do for both assignments to ensure students are thinking of the audience	2.Considering the audience and writing for different readers
Vernal Pond Hydrology Draft	Medium Requires significant time, offers chance to get feedback and improve	Demonstrating complex concepts for audiences using figures (maps, graphs, models) and tables, effectively captioning these tools, and considering their design.

See Assignment Descriptions (pages XX and YY) and Writing goal descriptions (pages ZZ and AA) for more examples.

3. **Writing Instruction:** In addition to identifying *what* you will teach, we are also interested in *how* you will teach writing in this course. For this section, please include documentation demonstrating how students will learn the skills that the course is designed to teach. Please include at least 2 separate, distinct examples.

   Examples might include one or more of the following:
   - handouts or worksheets that walk students through particular writing skills
   - teaching notes or a lesson plan that demonstrate how you teach writing
   - sample teaching slides used in the classroom
   - sample papers that you distribute to students to show them applied examples of the skills
   - a summary or synopsis of a writing skills textbook or other "how to write" resources that you assign
   - screenshots of interactive digital lessons on writing skills
   - a description of a skill-building writing activity that you assign to students
   - assignment sheets or instructions for assignments that make clear which

skill(s) the student is learning and how the assignment will cultivate those skills
- a writing workshop worksheet.

Whatever examples you choose to include, please make sure the committee can see how you'll use those materials in your class. So, for example, if you include a handout of writing tips or a sample paper, please also add a note telling the committee how you use those materials in your instruction.

Note: The WAC committee is particularly interested in how the lesson plans will align with your learning objectives, the writing assignments, and/or how you will assess student writing.

learning objective	how you're teaching it/class activity
2.Considering the audience and writing for different readers	Appendix A: Audience and purpose questions Assignment description: Groundwater model
Demonstrating complex concepts for audiences using figures (maps, graphs, models) and tables, effectively captioning these tools, and considering their design.	Assignment description: vernal pond study

Yellow highlights in assignment descriptions indicate specific writing skill development aspects of the assignments.

4. **Assessment:** Explain your method for responding to student writing. What kinds of feedback do you give on drafts and final papers or projects? What areas do you focus on as you comment on student writing? You can include a sample rubric and/or feedback to demonstrate.

Draft assignment feedback

Sample Rubric

Note: The WAC committee is interested in how your method of assessment contributes to the teaching and learning of writing in the class, not simply as a means of ranking and assigning grades

PARTS OF THIS APPLICATION:

Draft syllabus pages 5-8

Assignment Descriptions

- Groundwater Model page 9
- Vernal Pond Study page 10

Writing Goals

- Demonstrating complex concepts for audiences using figures (maps, graphs, models) and tables, effectively captioning these tools, and considering their design page 11
- Considering the audience and writing for different readers page 12

Appendices pages 13-22

- Audience and purpose questions
- Map/figure example from different types of scientific writing
- Feedback example
- Rubric

GROUNDWATER HYDROLOGY

ENVL 3435 | Course Guide and Syllabus | Fall 2023 | W2 Application Draft

INSTRUCTOR INFORMATION

Contact Information

- **Emma Witt**, Associate Professor of Environmental Studies
- You can call me Emma or Dr. Witt, or Professor. My preferred pronouns are she/her.
- Email address: emma.witt@stockton.edu
- Phones: 609-626-6854 (office, voicemails go to my email); 609-568-0352 (cell, call or text)
- Office Location: AS 120

Office Hours

My fall 2022 office hours are **TBD.** If those times do not work for you, please email or text me, or check my calendar and appointment system on Blackboard to set up a time that will work for you. Course information

COURSE INFORMATION

Objectives

1. Understand the role of groundwater in the hydrologic system.
2. Gain an understanding of aquifer properties and how they influence groundwater flow. Demonstrate this knowledge using a demonstration aimed for an appropriate audience.
3. Learn the principles of groundwater flow, on both local and regional scales
4. Quantify groundwater recharge and understand groundwater management
5. Apply knowledge of groundwater to field and modeling techniques.
6. Practice communicating complicated groundwater-associated topics to appropriate audiences

Student Learning Outcomes

As a result of active participation in this course, students will:

1. Apply the water budget approach of hydrologic sciences to solve groundwater supply, management, and surface water interaction problems.
2. Solve a range of problems associated with aquifer characteristics, groundwater measurement, and saturated flow.
3. Relate basic concepts of aquifers and groundwater supply to investigate New Jersey's coastal plain aquifers.
4. Construct groundwater maps and models.

5. Investigate current topics in groundwater research.
6. Gain experience in writing for technical and non-technical audiences.

Essential Learning Outcomes

Stockton University's Essential Learning Outcomes (ELOs) are ten competencies that students are expected to develop as a result of a Stockton education. The following ELOs are addressed in this course:

- **Communication Skills**. The ability to create and share ideas and knowledge effectively with diverse audiences and in various formats.
- **Critical Thinking**. The ability to formulate an effective, balanced perspective on an issue or topic.
- **Information Literacy and Research Skills**. The ability to locate, evaluate, analyze, and use information to solve problems or to produce an argument.
- **Program Competence**. The ability to use and to integrate concepts, theories, and principles in one's major field of study in a masterful way.
- **Quantitative Reasoning**. The ability to understand and to work confidently with numbers and mathematical concepts.
- **Teamwork and Collaboration**. The ability to join with others to achieve a common goal.

Materials

- Fetter, C.W. Applied Hydrogeology, Fourth Edition. 2001. Prentice Hall, Upper Saddle River New Jersey. ISBN:0-13-088239-9
  An electronic/international version of the textbook is fine. The 5th edition is also good.

- Hofmann, A.H. (2016). Writing in the Biological Sciences: A comprehensive resource for scientific communication. Oxford University Press.
  2nd, 3rd, or 4th edition

- Calculator that can do sin/cos/tan etc

Software and Computing Requirements

We will use the following software in this course. I have also included the recommended way to access this software from an off-campus location. You may use other software if you are more comfortable doing so. Learn new techniques whenever you can.

Name	Source
Microsoft Excel	Your student fees provide you with a copy of Office 365 free of charge. Download and installation instructions
ArcMap, ArcGIS Pro and ArcGIS Online	Access using AppStream VDI
R Studio	Can download, it is free*. https://www.r-project.org/ Access using AppStream VDI

*I cannot help you with downloading and installing this. I had to get ITS to help me.

All of my instructional materials were made using a PC. If you have a Mac…get ready to use Google a lot.

Attributes

Q2-This course is offered with a Q2 attribute, meaning you are expected to demonstrate your ability to apply mathematical principles to course materials.

W2-If approved, this course will also be offered with a W2 attribute, so improving as writers is an objective of the course.

ASSIGNMENTS AND GRADING

Problem Sets (30% of total grade; 5% each)

Each unit will have selected problems for you to solve and demonstrate your mastery of the quantitative aspect of that unit. There will be six (6) total problem sets. Each is worth 5% of your total grade. Problem sets will be graded on a correct/incorrect basis. For each problem, you will earn full credit if you arrive at the correct answer and show your work. You will earn half credit if you arrive at the incorrect answer and show no work. No credit will be given if work is not shown.

You may correct and resubmit any problems for which you did not arrive at the correct answer as many times as needed. Full credit will be given for corrected responses.

Groundwater Model Demonstration (25% of total grade)

Working with a group of 2-3 other students, you will use the groundwater models available to make an instructional video with the purpose of explaining an aquifer characteristic to a non-technical audience. This video needs to be narrated, so you will submit a script, demonstration plan, and description of the aquifer property to be shown as part of the assignment, as well as your completed video.

Vernal Pond Study (25% of total grade)

Throughout the semester we will collect data from one of the campus vernal ponds with the aim of increasing our understanding of the role of groundwater in the system. You will compile the data we collect into a technical report that addresses what we found as well as next steps for investigation. This report will require not only field investigations, but also an understanding of the Coastal Plain aquifer system and research from the literature.

Participation and Attendance (20% of total grade)

I'll take attendance during class meetings, and there will be assignments you do in class that will be included as part of your participation grade. Attending greater than 90% of class meetings and completing at least 90% of participatory assignments will ensure full credit in this area.

Grading Scale

94-100	A	70-72	C-
90-93	A-	67-69	D+
87-89	B+	63-66	D
83-86	B	60-62	D-
80-82	B-	0-59	F
77-79	C+	Note that a C is the minimum grade for the W2 to count.	
73-76	C		
73-76	C-		

Note: I'm ending this draft syllabus here, but my real syllabi go on for several more pages about university policies, absences, LAP, etc.

ASSIGNMENT DESCRIPTION: GROUNDWATER MODEL

Objectives

- Demonstrate mastery of an aquifer property (hydraulic conductivity) and the impact of different values of that property on groundwater flow.
- Communicate the essential components of groundwater movement to an audience.
- Practice writing for a non-technical audience and in a manner different from the standard research paper.

Background Information

Models and time lapse photography can be excellent tools to visualize processes we can't see in groundwater because A) groundwater happens underground and B) sometimes it happens very slowly. This video shows the movement of water (or a pollutant, if you prefer) through a saturated medium. The water moves from high head to low head around an obstruction. In the video, the material is fairly uniform, and the hydraulic head is constant. You will make this video, and then you will change something about the aquifer materials you use, and you will do it again. You will develop a complete video (with a script) that could be used in ENVL 1100 to describe how aquifer materials, specifically hydraulic conductivity, impact groundwater movement.

Steps

1. Characterize your aquifer materials. You will complete a sieve analysis and develop sediment size curves for the uniform materials (trial 1), as well as for the coarser or finer materials you use in trial 2. In addition, you will prepare an explanatory tool for understanding these graphs.
2. Make your videos. Using the aquifer models, you will make your two videos, ensuring that you have enough footage for your final product.
3. Complete your Audience and Purpose questions.
4. Write a draft script and submit it.
5. Work on your video editing.
6. Complete video, with voice over using approved script.
7. Show your video to another Groundwater group.
8. Make any edits suggested, submit final video by XXXX.
9. Complete your self-reflection

Assessment

I will offer feedback on your Audience and Purpose questions, draft script, and final product. You will assess your final product and the process in your reflection. You will offer feedback to your classmates via the peer review process (when another group shows your group their video).

ASSIGNMENT DESCRIPTION: VERNAL POND STUDY

Objectives

- Construct a model of a vernal pond on campus based on data we collect.
- Gain experience collecting LiDAR data, processing it, and putting it in ArcGIS.
- Work on writing technical writing skills by developing a report similar to those produced by USGS, NJGS, and other government agencies.

Components:

Your final report must have:

- Model of the vernal pond. This model should be visual, but be accompanied by a detailed methodology.
- Data from the dataloggers, organized so that the direction of groundwater flow spatially and temporally is evident. An explanation of the water flow trends must accompany this component.
- Site description that accurately describes the coastal plain aquifer system and characteristics of the Kirkwood-Cohansey surficial aquifer. Part of this should include details of the sample core we took in class.
- Discussion that places our findings into appropriate context. Imagine your characterization of this vernal pond could be used by U.S.G.S., NJ DEP, or the Pinelands Commission to better understand the relationships between these features and the regional hydrology.

Steps

1. Gain an understanding of hydraulic head, sediment distribution, porosity and hydraulic conductivity as they relate to groundwater movement from lecture, problem sets, and readings.
2. Complete Audience and Purpose questions.
3. Use datalogger dataset to compile time-series graphs of hydraulic head for the vernal pond over time. Submit draft graph, caption, and explanation.
4. Work with class to develop LiDAR model of the vernal pond, and work with ArcGIS to turn these data into a 3D model of the pond and underlying sediments. Submit draft map, caption, and explanation.
5. Work with class to analyze sediment cores from the pond and surrounding area. Submit draft of this description with any necessary accompanying figures.
6. Compile a complete report, with sections that address the following items:
    a. Describe the geologic and geomorphology of the vernal pond setting.
    b. Detail the hydrology of the pond, including it's relationship to the regional hydrology.
    c. Explain how the pond's structure influences its hydrology.
    d. Provide context as to why vernal ponds in general are important and how land use can degrade them. Use evidence of the pond model we made to evaluate this pond's susceptibility to degradation

W2 APPLICATION: ASPECTS OF WRITING I HOPE TO ADDRESS IN THIS COURSE

1. Demonstrating complex concepts for audiences using figures (maps, graphs, models) and tables, effectively captioning these tools, and considering their design.

RESOURCES:

- Hofmann, A.H. (2016). Writing in the Biological Sciences: A comprehensive resource for scientific communication. Oxford University Press.
  2nd, 3rd, or 4th edition

  This book does a great job (I think) of introducing students to the basics they should be considering when choosing among graphs, tables, and describing data in text. It also covers which graphs should be used with different data types, appropriate table organization, and begins to address captioning.
  I require this book in many of my courses, and would require it in this one as well.

- Tufte, E.R. (2001). The Visual Display of Quantitative Information, Second Edition. Graphics Press, NH.

  In addition to having lots of detail about graphs and data, this book has numerous examples of what to/not to do that I would use in my teaching about writing and communicating information. It includes information about maps, which is useful for this class, and provides much deeper detail about types of graphs and considerations when making figures effective.
  This book wouldn't be required, but the Library has a copy I'd ask to be placed on reserve, and if I'm considering asking the program to buy a copy for the AS computer labs or using PD money to do so.

- Existing maps in USGS, NJDEP, and other reports.

  One easy way to help students understand the types of maps, graphs, and tables they should be able to make is to show them. I have some examples, but I think having them find examples is also useful.

LEARNING ACTIVITIES

1. Reading from Hoffmann book and associated quiz (participation points, low stakes).

2. Find your own graph, map, table in a technical report and dissect it (participation points, low stakes).

3. Lectures on considerations in graphing and mapping

4. Sediment size distribution curve formulation and explanation (part of Groundwater Model Assignment, medium stakes).

5. LiDAR vernal pond model, hydrology graph and sediment model (part of Vernal Pond Assignment, high stakes).

6. Video for groundwater model assignment (part of Groundwater Model Assignment, high stakes)

Considering the audience and writing for different readers

RESOURCES

1. Audience and Purpose Questions-Adapted from Bean, J.C. 2011. Engaging Ideas: The Professor's guide to Integrating Writing, Critical Thinking, and Active Learning in the Classroom. Jossey-Bass San Francisco CA
2. Groundwater in the news
   This assignment asks students to find a news article related to groundwater and identify how the author has explained a complex groundwater concept for a broad audience. I also ask if the students feel the author has done so successfully, and why or why not.
3. Hofmann, A.H. (2016). Writing in the Biological Sciences: A comprehensive resource for scientific communication. Oxford University Press.
   2nd, 3rd, or 4th edition

   In one of the early chapters, this book distinguished between science writing and scientific writing, and notes that the basic precept of writing is "write with the reader in mind". An assignment where students find related articles, one from the peer-reviewed literature (scientific writing) and one from the popular media (scientific writing) helps drive the difference between writing approaches home for many students.
4. Readability-grade level checker
   I feel like there are websites out there that tell you what level your writing is at. I would like to use one so students can run a draft through it and see where they are and briefly explain if they are at a level appropriate for their audience.

LEARNING ACTIVITIES

1. Audience and purpose questions (for both big assignments, low stakes)
2. Reading from Hoffmann book and associated quiz (participation points, low stakes).
3. Science vs scientific writing (participation points, low stakes)
4. Groundwater in the news (participation points, low stakes)
5. Final report for Vernal Pond Assignment-part of evaluation will be "written for technical audience" (high stakes)
6. Video and script for Groundwater Model assignment-evaluated in part for audience suitability (high stakes).

APPENDIX A: AUDIENCE AND PURPOSE QUESTIONS

Audience and Purpose

These are things you should be thinking about when writing.

Who is your audience?

Before reading my paper, my readers will think this way about my topic as it relates to Lake Fred.

But after reading my paper, my readers will think this DIFFERENT way about my about my topic as it relates to Lake Fred

What is my level of expertise relative to my assigned audience?

How do I want to change my reader's view of my topic?

How much does my audience already know about the issue I am addressing?

How much does my audience care about the issue I am addressing?

What constitutes old and new information for my audience?

How resistant is my audience to my topic?

How busy is my audience?

Adapted from Bean, J.C. 2011. Engaging Ideas: The Professor's guide to Integrating Writing, Critical Thinking, and Active Learning in the Classroom. Jossey-Bass San Francisco CA

APPENDIX B: SAMPLE MAPS FROM DIFFERENT FORMS OF SCIENTIFIC WRITING

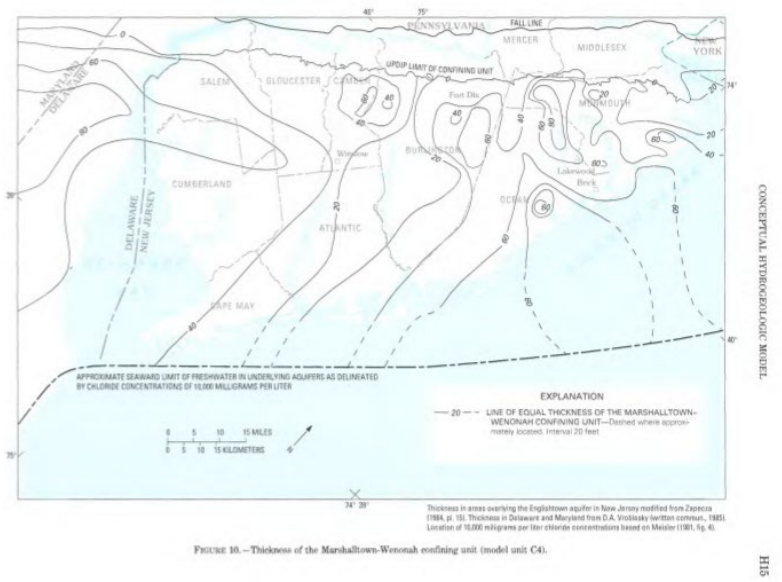


FIGURE 10.—Thickness of the Marshalltown-Wenonah confining unit (model unit C4).

Here is a figure from Ground-water Flow in the New Jersey Coastal Plain USGS Professional Paper (https://pubs.usgs.gov/pp/1404h/report.pdf) . I find this caption a bit sparse, but there is additional information in the figure. We will compare figures like this to those found in the scientific literature (example on next page).

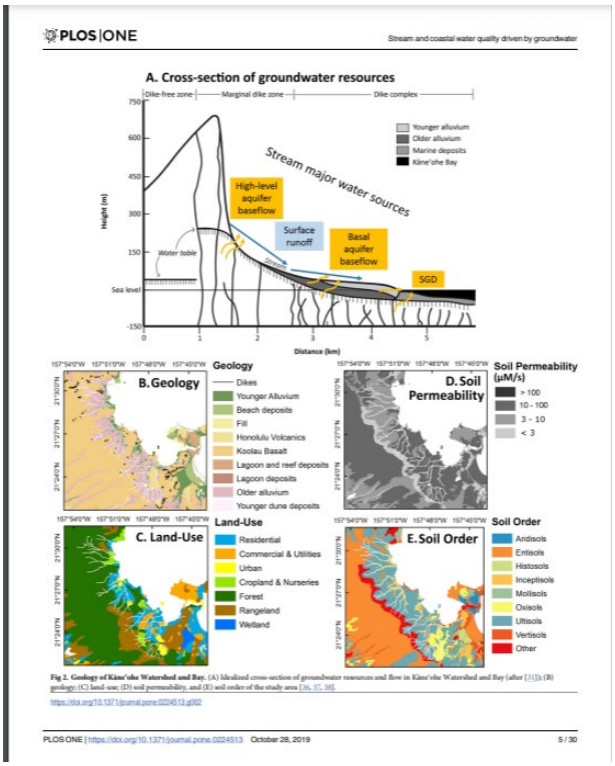


Fig 2. Geology of Kāne'ohe Watershed and Bay. (A) Idealized cross-section of groundwater resources and flow in Kāne'ohe Watershed and Bay (after [31]); (B) geology; (C) land-use; (D) soil permeability, and (E) soil order of the study area [36, 37, 38].

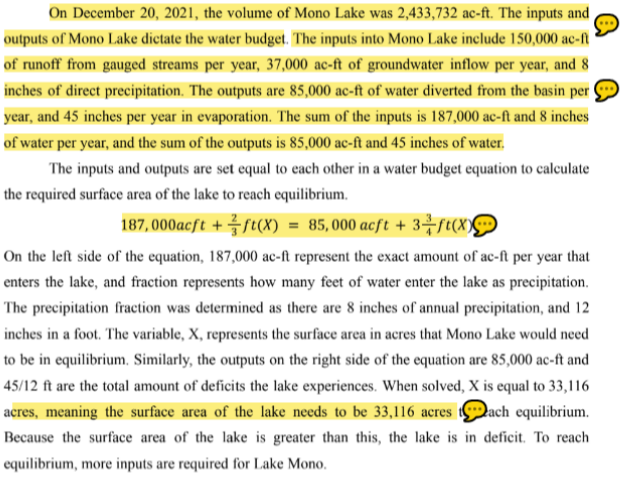
https://doi.org/10.1371/journal.pone.0224513.g002

PLOS ONE | https://doi.org/10.1371/journal.pone.0224513 October 28, 2019 5 / 30

From McKenzie, T., Dulai, H., & Chang, J. (2019). Parallels between stream and coastal water quality associated with groundwater discharge. PLoS One, 14(10) doi:http://dx.doi.org/10.1371/journal.pone.0224513

APPENDIX C: EXAMPLES OF FEEDBACK

Draft assignment feedback

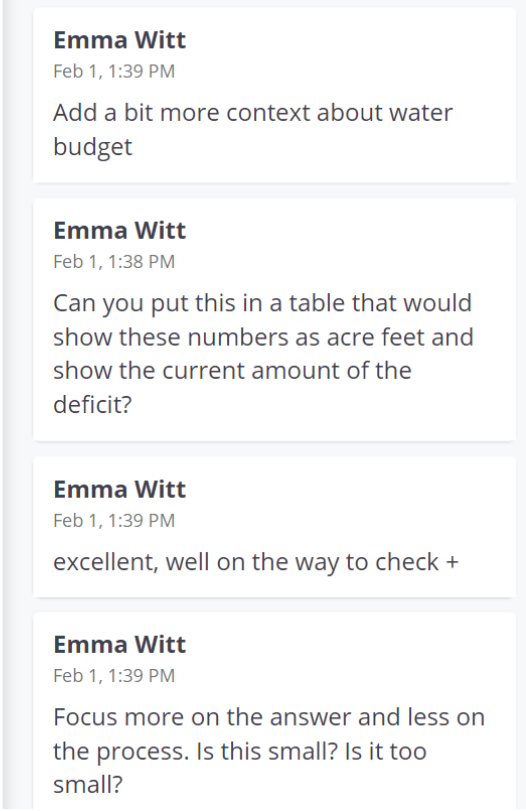


On December 20, 2021, the volume of Mono Lake was 2,433,732 ac-ft. The inputs and outputs of Mono Lake dictate the water budget. The inputs into Mono Lake include 150,000 ac-ft of runoff from gauged streams per year, 37,000 ac-ft of groundwater inflow per year, and 8 inches of direct precipitation. The outputs are 85,000 ac-ft of water diverted from the basin per year, and 45 inches per year in evaporation. The sum of the inputs is 187,000 ac-ft and 8 inches of water per year, and the sum of the outputs is 85,000 ac-ft and 45 inches of water.

The inputs and outputs are set equal to each other in a water budget equation to calculate the required surface area of the lake to reach equilibrium.

$$187,000acft + \frac{2}{3}ft(X) = 85,000\,acft + 3\frac{3}{4}ft(X)$$

On the left side of the equation, 187,000 ac-ft represent the exact amount of ac-ft per year that enters the lake, and fraction represents how many feet of water enter the lake as precipitation. The precipitation fraction was determined as there are 8 inches of annual precipitation, and 12 inches in a foot. The variable, X, represents the surface area in acres that Mono Lake would need to be in equilibrium. Similarly, the outputs on the right side of the equation are 85,000 ac-ft and 45/12 ft are the total amount of deficits the lake experiences. When solved, X is equal to 33,116 acres, meaning the surface area of the lake needs to be 33,116 acres to reach equilibrium. Because the surface area of the lake is greater than this, the lake is in deficit. To reach equilibrium, more inputs are required for Lake Mono.



Emma Witt
Feb 1, 1:39 PM
Add a bit more context about water budget

Emma Witt
Feb 1, 1:38 PM
Can you put this in a table that would show these numbers as acre feet and show the current amount of the deficit?

Emma Witt
Feb 1, 1:39 PM
excellent, well on the way to check +

Emma Witt
Feb 1, 1:39 PM
Focus more on the answer and less on the process. Is this small? Is it too small?

This is a good example of how I grade draft writing assignments. This draft doesn't get a numeric grade, it gets a "check" to denote that the student has accomplished the aim of the assignment, and that the quantitative portion is correct. I offer suggestions for the student to improve the grade to a check-plus, which include working on writing (in this case-using fewer words about the process to be able to add context to the numbers) as well as an invitation to "dig deeper" (in this case, understanding the equilibrium level of the lake is beyond the scope of the original question, so it adds depth to the response).

Sample Rubric

INTRODUCTION						
Component	**Missing/Poor (0-2)**	**Poor-Fair (2-5)**	**Fair-Acceptable (5-7)**	**Acceptable-Good (7-8)**	**Good-Exceptional (8-9)**	**Exceptional (10)**
Opening Paragraph	All of the bullet points from fair/acceptable are true.	2 of the bullet points from fair/acceptable are true	• Larger problem not identified • No connection between author's aim and larger problem • Overall purpose (aim) of paper unclear.	A larger problem is identified. Tenuous connections made between author's aim and this larger problem.	The author's purpose is clear, but relationship to a larger problem is less clear. Slightly muddled relationships.	Captures the author's purpose and relates to a larger problem in a clear, concise, and accurate way. Each sentence is related and all are related to the purpose of the paper.
Introduction Body Paragraphs	Seems to be a random jumble of disconnected thoughts.	Is a compilation of summaries of papers with minimal connection made among them. Papers are not all relevant to the overall topic of the paper.	Is a compilation of three summaries of papers with minimal connection made among them. Papers are at least all relevant to the overall topic of the paper.	Tried to structure the introduction as more than a list of paper summaries, but wasn't overly successful.	Same as exceptional but maybe the topic sentences are less strong or supporting information not relevant.	Each paragraph has a clear topic, as shown by a strong topic sentence. Supporting information is included and relevant to the paragraph's topic and the overall focus of the paper. The funnel structure is employed to great effect.
Objective Statement	No objective statement is given.	An attempt at an objective statement was made. It either failed, or was really something else.	Objective statement is muddled or incorrect. Reaches too far or is not related to data.	Objective statement is clear and direct. Lacks connection to larger issue.	Same as exceptional but applicability statement is strained/tenuous.	Clear and direct. Includes applicability of data to larger issue.

METHODS						
Component	**Missing/Poor (0-2)**	**Poor-Fair (2-5)**	**Fair-Acceptable (5-7)**	**Acceptable-Good (7-8)**	**Good-Exceptional (8-9)**	**Exceptional (10)**
Site Description	Incomplete, inaccurate, and/or poorly cited	Missing any reference information from more than one of the bullet points in Good-Exceptional list.	Missing 3-4 bullets from Good-Exceptional list References included and appropriately cited	Missing 1-2 bullets from Good-Exceptional list. References included and appropriately cited	Includes: • What county and state is your site in? • What is the physiography of the site? Reference? • What is the mean annual temperature and precipitation • What was the measured temperature (max, average, min) at the nearest weather station to your site? Each point has an appropriate reference that is correctly cited.	Contains all the elements of the good-exceptional, and is so well written as to be exceptional.
Site Map	Missing	Google map screen shot	Missing 3-4 bullets from Good-Exceptional list	Missing 1-2 bullets from Good-Exceptional list.	Map has: • Only data points included in the analysis • Points are different colors • Legend • North Arrow • Scale bar • Basemap	Contains all the elements of the good/exceptional, including land use information.

Field Methods	Missing	Has inaccurate or unreadable information	Missing 3-4 bullets from Good-Exceptional list, but has something	Missing 1-2 bullets from Good-Exceptional list.	• Include the name of the logger and the company information • How many measurements were taken? • On which day(s)? • How many per surface type?	Contains all the elements of the good-exceptional, and is so well written as to be exceptional.
Statistical Methods	Missing	Missing all bullets from good/ exceptional list, but has something	Missing 2 of the bullets from Good-Exceptional list.	Missing 1 of the bullets from Good-Exceptional list.	• What test did you use to determine normality? • What were the results of this test? • What test did you use to determine statistical significance? • What p-value did you use?	Contains all the elements of the good-exceptional, and is so well written as to be exceptional.

RESULTS						
Component	**Missing/Poor (0-2)**	**Poor-Fair (2-5)**	**Fair-Acceptable (5-7)**	**Acceptable-Good (7-8)**	**Good-Exceptional (8-9)**	**Exceptional (10)**
Results Section Narrative	Not present.	No evidence of statistical evaluation.	Has some information about normality (doesn't belong in results) OR Data interpreted incorrectly	Either p-value or statistical test is missing. Data interpreted correctly.	Results are described correctly, and include: • p-value • statistical test used	Results are described correctly, and include: • p-value • statistical test used • Some description beyond p-values (mean, difference in temperature, etc).
Results Section Graph	All of the bullet points in the Acceptable-Good box apply. Or graph is missing or inappropriate.	Three of the points in the Acceptable-Good box apply.	Two of the bullet points in the Acceptable-Good box apply.	• Error bars or letters are missing. • Caption may be weak or contain inaccurate information. • Statistics are included in caption but may be incorrect. • More than one axis label or units are missing or incorrect.	Graph is mostly correct, but may be missing one axis label or unit. Includes a strong caption that includes information about the statistical analysis. If needed, letters are present.	Graph is appropriate, with error bars, axis labels and units, a strong caption that includes information about the statistical analysis. If needed, letters are present.

DISCUSSION/CONCLUSION						
Component	**Missing/Poor (0-2)**	**Poor-Fair (2-5)**	**Fair-Acceptable (5-7)**	**Acceptable-Good (7-8)**	**Good-Exceptional (8-9)**	**Exceptional (10)**
Discussion	Missing	Missing 2 of the bullets from Good-Exceptional list.	Missing 1 of the bullets from Good-Exceptional list.	Includes all of the bullet points of good/exceptional, but needs work on the writing.	• Relates results clearly to overall objective of paper. • Includes information from the literature. • Offers explanations for results that differ from expected or confirms why results were expected • Identifies shortcomings and solutions	Contains all the elements of the good-exceptional, and is so well written as to be exceptional
Conclusion	Missing	Missing 1 of the bullets from Good-Exceptional list.	Most important findings are muddled or incorrectly stated. Offers unrealistic or flawed directions for future work	Includes all of the bullet points of good/exceptional, but needs work on the writing.	• Restates objectives and most important findings. • Offers directions for future work	Contains all the elements of the good-exceptional, and is so well written as to be exceptional
References	• Multiple instances of missing citations.	Two things in the fair-	• Missing multiple citations	• Two or three missing minor citations	One or two minor instances of missing	All references are cited correctly in the

	• Large chunks of inappropriate paraphrasing • No references included	acceptable box apply	• 1 small section of inappropriate paraphrasing • Reference list is incomplete.	• One major missing citation. • Issues with APA format	citations or incorrect references.	text and included in the reference list. APA format is correctly deployed, and no citations are missing.

THESE ARE VIOLATIONS OF THE ACADEMIC HONESTY POLICY AND WILL BE REPORTED TO THE PROVOSTS OFFICE

I use this rubric in my lower level class to evaluate lab reports. I envision grading with something similar in this course, particularly for the Vernal Pond report. The Groundwater Model may be trickier, but I'd use a rubric for that as well. I do give the students the rubrics before they submit the assignments.