

Learning Objectives:

- a. *Demonstrate critical analysis skills and capabilities expected of practicing water resources engineers, including to identify, evaluate, and recommend alternatives.*
- b. *Coherently and concisely present engineering designs in written format.*
- c. *Recognize, describe, and adapt engineering designs to physical, economic, environmental, social, political, and other constraints that limit water resources engineering and management.*
- d. *Complete water resources designs in a timely fashion*
- e. *Work individually to solve a water resources problem*
- f. *Apply public-domain water resources models to solve current water problems*
- g. *Identify cost effective water conservation actions for an individual residential household.*

You are a practicing engineer employed at BlueWater Consulting, a water resources engineering firm located in Logan, Utah. Your housemate/spouse/partner/friend recently saw a “Slow the Flow” ad and has hired your firm to recommend cost-effective water conserving actions his/her household can implement to slow the flow.

It is your responsibility to:

- Estimate the household's total, indoor, and landscape water use (by monitoring household water uses for a week and, if available, from prior billing data),
- Describe the household's landscape coverage,
- Compare the estimated landscape water use to the VLE model predicted landscape water need.
- Identify potential conservation actions your client can implement and report capital costs to implement, likely water savings on an annual basis, and payback periods in months or years to recover the capital costs.
- Explain uncertainties in your estimates (for example if the household loses one person or the price of water doubles).
- Recommend actions your client should take and further steps required of the client to implement them.

For help with monitoring household water use, you may use or modify, as necessary, the monitoring worksheet developed for Amman, Jordan (Table 1, next page).

The Value Landscape Engineering spreadsheet model is available at http://www.engr.usu.edu/wiki/index.php/Value_Landscape_Engineering_Spreadsheet_Models (select version 1.5).

Climate data including reference evapotranspiration is available at the Utah Climate Center (<http://climate.usurf.usu.edu/>).

Otherwise, you are responsible to obtain all the other data you need.

Table 1. Water Use Monitoring Worksheet								
Residence Type:		House	Apartment	Dorm	Other			
Number of residences served by water meter:								
Number of persons served by water meter:								
Water meter reading (gallons)								Estimated water volume per use (gallons)
Date Time								
Activity / End-use		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
INDOOR								
<u>Bathroom</u>								
Flush toilet	[flushes]							
Squat toilet	[flushes]							
Shower	[minutes]							
Bath	[volume]							
Faucet for shaving	[minutes]							
Faucet for teeth brushing	[minutes]							
Other faucet use	[minutes]							
<u>Kitchen</u>								
Faucet for drinking	[minutes]							
Faucet for dishwashing	[minutes]							
Dishwasher run	[runs]							
Floor mopping	[uses]							
Other faucet use	[minutes]							
<u>Other</u>								
Laundry machine	[uses]							
Other faucets	[minutes]							
Plant watering	[volume]							
OUTDOOR-Culinary								
Outdoor faucets	[minutes]							
Lawnwatering	[minutes]							
Car washing	[minutes]							
Swimming pool	[refills]							
OUTDOOR-Non Culinary								
Lawnwatering	[minutes]							
Livestock	[buckets]							
USE AWAY FROM HOME								
<u>Bathroom</u>								
Flush toilet	[flushes]							
Squat toilet	[flushes]							
Faucet use	[minutes]							
<u>Other</u>								
1. Drinking (bottled)	[liters]							
2. Urinal	[flushes]							
3. Laundry	[loads]							
4. Shower	[minutes]							

Category (Max. Score)	No Evidence	Doesn't Meet Standard	Nearly Meets Standard	Meets Standard	Exceeds Standard	Self-Score	Instructor Score
Word Usage and Format (15)	Not applicable	Writing is consistently unclear, not acceptable, & unprofessional for college level. Numerous errors in punctuation, capitalization, spelling, word usage, sentence structure, tables, and figures. <u>1-8</u>	Writing is understandable, but has misspelled words, poor English grammar and word choice. Figures are too small and/or poorly labeled, although they are usually of acceptable quality and focus. Bad or inconsistent fonts. Could be improved by being more meticulous. <u>9-11</u>	Almost no errors in punctuation, capitalization, spelling, sentence structure, word usage, significant figures, and presentation of figures and tables. <u>12-13</u>	Punctuation, capitalization, spelling, sentence structure, word usage, and significant figures all correct. Clear, consistent fonts. Good word processing skills. Figures have adequate contrast. Informative figure and table titles and legends. Figures have appropriate axis tick spacing, labels, and legends. Table columns cohesive, labeled, and specify units. Document is firmly stapled. <u>14-15</u>		
Conclusion (10)	Absent <u>0</u>	Incomplete and/or not focused. <u>4-6</u>	The conclusion does not adequately restate the main results. <u>7</u>	The conclusion restates the main results. <u>8</u>	The conclusion restates the main results, and is an effective summary. <u>9-10</u>		
References (5)	Absent <u>0</u>	Off-the-wall sources cited and/or multiple errors. <u>1-2</u>	Appropriate sources cited, but multiple errors in citing and formatting references. <u>3</u>	Good sources used, only a few errors in citing and formatting references. <u>4</u>	All prior work cited; bibliography in the correct format with no errors. Uses innovative sources of information. <u>5</u>		
Appendices (10)	Absent or data vomited onto last page. <u>0-3</u>	Too much data or too little data OR Evidence of one. <u>4-5</u>	Too much data or too little data OR Evidence of two. <u>6-7</u>	Too much data or too little data OR Evidence of three. <u>8</u>	Separate appendix for each topic, each contains a title, discussion, and proper formatting and display of information. <u>9-10</u>		
TOTAL (100)							

Directions: You are to collaborate in a small group of students for a short amount of time to discuss the best approach towards solving the design problem. You may use class notes, books, and/or calculators/computers. This is a problem-based learning (PBL) exercise. PBL is any learning environment in which the problem drives the learning. After working through this problem, you will know why you are learning the new knowledge available in lectures and readings. Learning in the context of the need-to-solve-a-problem also tends to store the knowledge in memory patterns that facilitate later recall for solving problems.

Discuss your approach to the problem before number crunching.

Goals for In-Class Group Work:

1. Define and describe the problem
2. Identify the knowledge and skills needed
3. Specify the objectives
4. Develop a suggested approach
5. Identify the essential resources needed to address the requirements of the assignment

At the end of class, hand in the following materials:

1. One person will be randomly selected to document the group's solution. This may include a description of your approach, information you feel is missing, questions you still have, as well as your best shot at a solution. Include uncertainties or assumptions in your approach that may affect the solution.
2. Evaluate each other (and yourself) on your participation by filling out the 'Participation Evaluation Form'. The information collected with this form will be considered by the Instructors in assigning the class participation grade.

Collaborate, but do your own work: You may use any of the ideas developed during this time towards your design write-up, although the calculations and writing should be done individually.

In-Class Small Group Participation Assessment Form

Name: _____

Date: _____

Directions: On a scale of 1-5 please rate the participation and contributions of the members of your group. Your candid and truthful evaluations are requested. Your assessments along with those of the other members of your group will be taken into account in determining your grade. Your assessment should address the following categories:

- A. Level of participation
- B. Communication facilitated group creativity and encouraged others to participate
- C. Contribution of ideas
- D. Preparation and reading done before class

Your ratings for each of your group members should be based on the following scale:



Group Member (last name)	A. Participation	B. Communication	C. Ideas	D. Preparation