**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. Propose, design, and contrast conventional and low-impact storm water management techniques for a new subdivision.

You are an engineer employed at BlueWater, Inc., a Logan, Utah water resources engineering firm. Consolidated Concrete Developers (CCD) has acquired a choice 7-acre parcel on 1000 North between 200 and 400 East in Logan (Figure 1), wants to build a new mixed residential-commercial use development, and has asked your firm to outline a basic design and estimate the cost for an on-site storm water impoundment to deal with the runoff produced by the development.

The natural drainage of the site is to the west into the adjacent twin canals with the east side (400 East) 17 feet higher than the west edge of the property. The existing structures on the southwest corner of the property will be demolished. The development plan will reserve 2 acres for a recreation center, parking lot, and landscaping, then put the storm water management system and as many 1/5 acre house lots as possible on the remaining portion. The recreation center building will have a ½ acre footprint, ½ acre parking lot, with the remainder turfgrass. 10% of the residential area will require roads and 5% will be an unpaved bicycle trail to connect the residential area to the recreation center. Each residential lot will have a 1,500 sq ft single floor home and 3,500 square feet of driveway, sidewalk, and patio area around the home.

CCD wants to know:

1. The volume and duration of runoff generated by the development
2. How much land area they must reserve for the storm water management system,
3. How many houses they can build,
4. The reliability of the storm water management system over the estimated 40-year life of the development, and
5. Costs for the onsite storm water management system

Additionally, CCD would also like to compare design features and costs for a standard detention system that meets code requirements to a second system that is “green” and/or uses low-impact development techniques. Your report should recommend the preferred option.

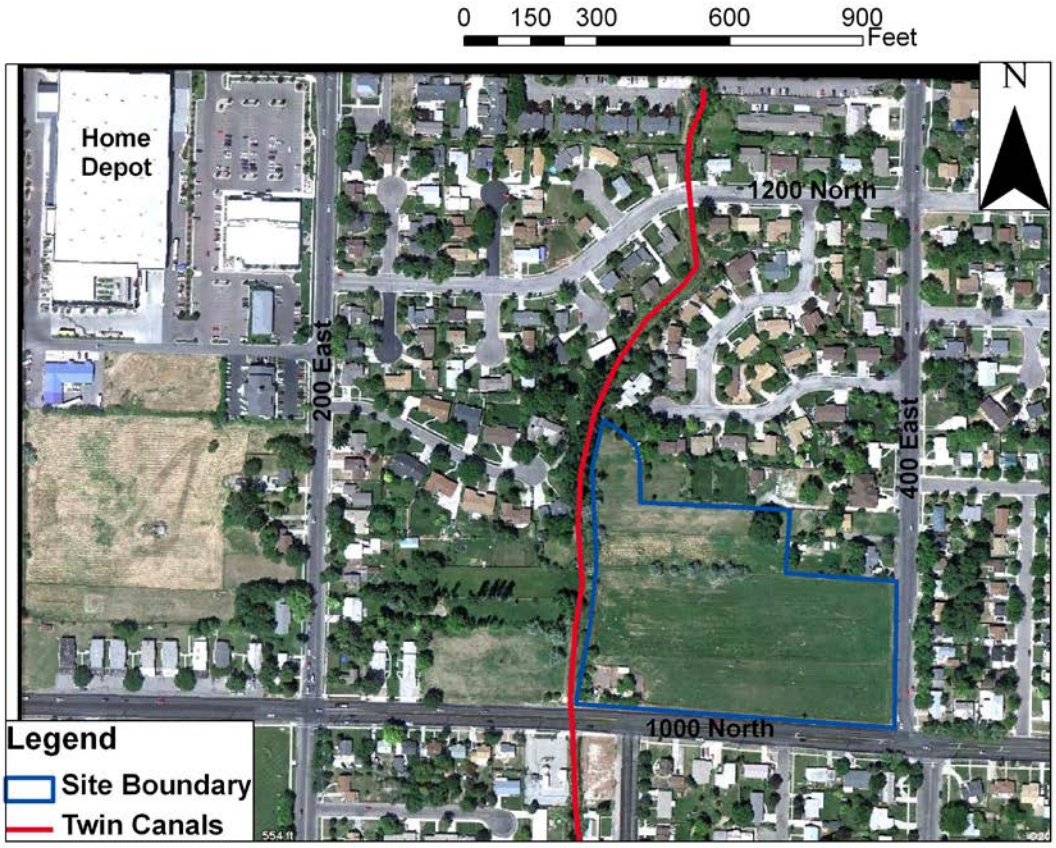


Figure 1. Boundary for proposed commercial and residential development in Logan, UT.

CEE 5/6460 Fall 2012

PBL-2: Storm water design Due: October 18

**Assessment Form for in-class small-group participation**

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 evaluations, 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:

| Poor | | Average | | Outstanding |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

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

**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.

PBL-2: Storm water design Name: _____

| Category (Max. Score) | No Evidence | Doesn't Meet Standard | Nearly Meets Standard | Meets Standard | Exceeds Standard | Self-Score | Instructor Score |
|---|---|---|---|---|---|---|---|
| **Title (2)** | Absent<br>0 | Evidence of two or less<br>0 | Evidence of three<br>1 | Evidence of four<br>1 | Title – can assess main point from title alone; Name, Instructor's Name, Course, Date, Neatly finished. 2 | | |
| **Introduction (10)** | Absent, no evidence<br>0 | There is no clear introduction or main topic.<br>1 - 5 | Introduction states the main topic but either:<br>1. Does not give a full overview, Or:<br>2. Too detailed, repeats later in the paper. 6 - 7 | The introduction states the main topic and previews the structure of the paper.<br>8 | The introduction states the main topic and previews the structure of the paper. Good overview of the design and strategy. An effective summary. Gives enough detail to interest the reader.<br>9 - 10 | | |
| **Organization and structural development of the idea: procedure, results, discussion (15)** | Not applicable | Paragraphs fail to develop the main idea. No evidence of structure or organization.<br>1 – 9 | Organization of ideas not fully developed. Paragraphs lack supporting detail sentences. No transitions.<br>9 - 11 | Paragraph development present but not perfected. Each paragraph has sufficient supporting detail sentences. No transitions.<br>12 - 13 | Section headers and paragraphs sequence ideas and show logic. The first sentence of each paragraph summarizes the paragraph. Successive sentences provide detail and develop the main idea. Transitions enhance organization.<br>14 – 15 | | |
| **Engineering Design (33)** | The writer has no clue what they are talking about.<br>0 – 42% | One, possibly two design points addressed.<br>45 – 58% | Sketchy: left out required design points. Did not work on this as much as you should have, and it shows.<br>61 – 79% | All the necessary points are covered, but discussion lacks adequate detail.<br>82 – 88% | Provides what was explicitly asked for. The function of each piece is demonstrated to the reader in adequate, but not overwhelming, detail.<br>91 – 100% | | |
| | 1. Background and forecasting: storm water code requirements, design storm event hyteograph, and runoff generated on undeveloped site (9) | | | | | | |
| | 2. State performance objectives (3) | | | | | | |
| | 3. Identify + development alternatives: define SWMM inputs to represent alternatives (6) | | | | | | |
| | 4. Evaluate alternatives against performance objectives: SWMM results (6) and cost analysis (3) | | | | | | |
| | 5. System reliability (2) | | | | | | |
| | 6. Recommend preferred alternative (4) | | | | | | |

PBL-2: Storm water design Name: _____

| 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. 1 –8 | 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. 9 – 11 | Almost no errors in punctuation, capitalization, spelling, sentence structure, word usage, significant figures, and presentation of figures and tables. 12 - 13 | 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. 14 - 15 | | |
| **Conclusion (10)** | Absent 0 | Incomplete and/or not focused. 4 - 6 | The conclusion does not adequately restate the main results. 7 | The conclusion restates the main results. 8 | The conclusion restates the main results, and is an effective summary. 9 - 10 | | |
| **References (5)** | Absent 0 | Off-the-wall sources cited and/or multiple errors. 1 – 2 | Appropriate sources cited, but multiple errors in citing and formatting references. 3 | Good sources used, only a few errors in citing and formatting references. 4 | All prior work cited; bibliography in the correct format with no errors. Uses innovative sources of information. 5 | | |
| **Appendices (10)** | Absent or data vomited onto last page. 0 - 3 | Too much data or too little data OR Evidence of one. 4 – 5 | Too much data or too little data OR Evidence of two. 6 - 7 | Too much data or too little data OR Evidence of three. 8 | Separate appendix for each topic, each contains a title, discussion, and proper formatting and display of information. 9 - 10 | | |
| **TOTAL** (100) | | | | | | | |