Environmental Engineering
ABET Evaluation Summary
2016-2017

This document describes the evaluation of ABET Program Educational Objectives (PEOs) and Student Outcomes for the Environmental Engineering undergraduate program for 2016-17. Data were collected throughout the year and evaluated by the CEE Assessment Committee (Drs. Barr, Dupont, McNeill, and Tullis) in June 2017.

Program Educational Objectives
The Environmental Engineering (EnvE) Program Educational Objectives (PEOs) are reviewed by each of the program’s three constituencies (Table 1).

Table 1: PEO Review Process and Schedule for EnvE Program Constituency

<table>
<thead>
<tr>
<th>Constituency</th>
<th>Review opportunity</th>
<th>Frequency</th>
<th>Most recent reviews</th>
<th>Date of next review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>Freshman Orient. (CEE 1880)</td>
<td>Every freshman class</td>
<td>Spring semester 2017</td>
<td>Fall semester 2017</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Fall and Spring)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Junior design course</td>
<td>Every junior class</td>
<td>Spring 2017</td>
<td>Spring 2018</td>
</tr>
<tr>
<td></td>
<td>(CEE 3880)</td>
<td>(Spring)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Senior exit interview</td>
<td>Every graduating class</td>
<td>April 2017</td>
<td>April 2018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Spring)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employers</td>
<td>Advisory Board meeting</td>
<td>Annually (typically late</td>
<td>November 2016</td>
<td>November 2017</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fall)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty</td>
<td>CEE Faculty Retreat</td>
<td>Annually (August)</td>
<td>August 2016</td>
<td>August 2017</td>
</tr>
</tbody>
</table>

**Students:** The PEOs are introduced to the freshman class in CEE 1880 as part of a lecture on the accreditation and licensing processes (see the slides in Appendix A). PEOs are again shown to the juniors in CEE 3880. This reminds continuing students about the PEOs and allows transfer students (who typically do not take CEE 1880) to see the PEOs. Finally, as part of the senior exit interview process, graduating seniors are given an opportunity to review the PEOs in an effort to establish some big picture career goals. No feedback was received from students related to the PEOs.

**CEE Advisory Board:** The CEE Advisory Board met on November 8, 2016 (see Appendix B for meeting minutes). The PEOs were reviewed and discussion included the desire for the program to encourage students to improve their communication skills (PEO1) and support for including “sustainability considerations” in PEO2. The Advisory Board unanimously approved keeping the current PEOs. The PEOs will continue to be reviewed and discussed at all future annual Advisory Board Meetings.

**Program Faculty:** The PEOs are reviewed and discussed with the program faculty at the annual faculty retreat, which takes place every August just prior to the Fall semester. The faculty unanimously approved keeping the current PEOs during the 2016 faculty retreat (see Appendix C for meeting minutes). The PEOs will continue to be reviewed and discussed at all future annual faculty retreats.
**Student Outcomes**
Evaluation of the Student Outcome attainment is conducted by the CEE Assessment committee on a specified schedule with approximately one-third of the Student Outcomes assessed every year (Table 2). When deficiencies are identified, recommendations are made to fix specific problems and support continuous improvement.

<table>
<thead>
<tr>
<th>Evaluation Date</th>
<th>School Year</th>
<th>Outcomes evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2015</td>
<td>2014-15</td>
<td>a, b, c, d</td>
</tr>
<tr>
<td>May 2016</td>
<td>2015-16</td>
<td>e, f, g</td>
</tr>
<tr>
<td><strong>May 2017</strong></td>
<td><strong>2016-17</strong></td>
<td><strong>h, i, j, k</strong></td>
</tr>
<tr>
<td>May 2018</td>
<td>2017-18</td>
<td>a, b, c, d</td>
</tr>
<tr>
<td>May 2019</td>
<td>2018-19</td>
<td>e, f, g</td>
</tr>
<tr>
<td>May 2020</td>
<td>2019-20</td>
<td>h, i, j, k</td>
</tr>
</tbody>
</table>

The assessment process uses data from three sources: student coursework, FE Exam results, and senior exit interviews. The 2016-17 Assessment of Student Outcomes includes data from Fall 2016 and Spring 2017.

**Student Coursework:** Outcomes h, i, j, and k were reviewed in 2016-17 (Table 2). Assessment data are summarized in Table 3 and Figure 1; detailed evaluation of each outcome is presented in Appendix D. Student assignments are evaluated on a 0-1-2 scale, which corresponds to the student’s performance not meeting, partially meeting, and meeting the Outcome Objective, respectively. The EnvE program has two goals for student performance:

- Goal 1: a minimum of 70% of the students will perform at a 2 level
- Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

Both goals were met for the four outcomes assessed this year. Note the “sample size” in Table 3 refers to the number of individual examples of student work that were assessed for each outcome, not the number of students.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Sample size</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>Sum of 1&amp;2 ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>h</td>
<td>429</td>
<td>80%</td>
<td>17%</td>
<td>3%</td>
<td>97%</td>
</tr>
<tr>
<td>i</td>
<td>171</td>
<td>94%</td>
<td>6%</td>
<td>1%</td>
<td>99%</td>
</tr>
<tr>
<td>j</td>
<td>430</td>
<td>83%</td>
<td>15%</td>
<td>2%</td>
<td>98%</td>
</tr>
<tr>
<td>k</td>
<td>574</td>
<td>86%</td>
<td>12%</td>
<td>2%</td>
<td>98%</td>
</tr>
</tbody>
</table>
**Fe Exam:** Our goal is to have 100% pass rate on the FE exam; our minimum acceptable level of performance is a pass rate at or above the national average. Table 4 summarizes the FE results for the past six years, including the percentage of students who had passed the FE exam by the time of graduation. The USU EnvE pass rate has been either 100% or comparable to the national average (considering the small number of USU EnvE graduates).

**Table 4: EnvE Graduates Passing FE Exam vs. National Pass Rate**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>USU EnvE graduates</td>
<td>10</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>USU EnvE pass rate at graduation</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>89%</td>
<td>100%</td>
</tr>
<tr>
<td>National EnvE pass rate</td>
<td>83%</td>
<td>88%</td>
<td>84%</td>
<td>77%</td>
<td>76%</td>
<td>77%</td>
</tr>
</tbody>
</table>

FE Exam performance by first-time test takers for various engineering topics is summarized in Figures 2, 3, and 4. The uncertainty ranges are relatively large given the small number of students taking the exam; nevertheless, during the Spring 2017 testing period, USU EnvE students performed at or above the national average (including the uncertainty range) on all engineering topics. Overall, the fact that nearly all EnvE students continue to pass the FE exam is a strong, independent, external indicator for meeting Student Outcomes a, e, f, and k. It is also an indication of a good foundation for life-long (independent) learning skills.
Figure 2: Scaled Fe Exam results (fluid mechanics, water resources, and water/wastewater). Error bars represent uncertainty range for scaled scores.

Figure 3: Scaled Fe Exam results (air quality, solid/hazardous waste, groundwater/soils). Error bars represent uncertainty range for scaled scores.
Figure 4: Scaled FE Exam results (math, stats, ethics and professional practice, economics). Error bars represent uncertainty range for scaled scores.

Senior exit interview: Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “fully met” or “partly met”, which was achieved with 100% of students rating Outcomes i, j, and k as “fully met” and with 67% of students rating Outcome h as “fully met” and 33% as “partly met” for a total of 100% (Figure 5). Acknowledging that this is a subjective self-evaluation with a small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.
Figure 5: Student exit interview ratings of progress on Outcomes h, i, j, and k

**Summary:** The CEE Assessment Committee met in June 2017 and evaluated all of the assessment data presented herein. The evaluation of student work, FE Exam results, and senior exit interviews indicates that Outcomes h, i, j, and k are being met.

**Recommendations**
Evaluate Outcomes a, b, c, and d as planned during the 2017-18 school year.
Appendix A
Slides from CEE 1880
(introducing freshmen students to ABET PEOs and outcomes)
ABET is a voluntary, non-profit organization that accredits college and university programs in the disciplines of applied science, computing, engineering, and engineering technology. ABET accredits programs that provide education for students pursuing professions in engineering and engineering technology. ABET accreditation is voluntary and achieved through a peer review process of educational programs. The standard for accreditation established by the profession for which the program is accredited is the criteria for determining if a program meets the standards. ABET accreditation is recognized by the Council for Higher Education Accreditation (CHEA).

Program Educational Objectives
Program educational objectives (PEOs) are broad statements that describe what graduates are expected to achieve within five years of graduation.

1. Graduates will possess strong communication in oral and written form and successfully work in teams.
2. Graduates will possess a broad knowledge of earth and environmental science, geology, and geohazard science.
3. Graduates will possess a broad knowledge of civil engineering and related disciplines.
4. Graduates will possess a broad knowledge of environmental engineering and related disciplines.
5. Graduates will possess a broad knowledge of geotechnical engineering and related disciplines.
6. Graduates will possess a broad knowledge of water resources engineering and related disciplines.
7. Graduates will possess a broad knowledge of transportation engineering and related disciplines.
8. Graduates will possess a broad knowledge of structural engineering and related disciplines.
9. Graduates will possess a broad knowledge of geotechnical engineering and related disciplines.
10. Graduates will possess a broad knowledge of water resources engineering and related disciplines.
11. Graduates will possess a broad knowledge of transportation engineering and related disciplines.
12. Graduates will possess a broad knowledge of structural engineering and related disciplines.
13. Graduates will possess a broad knowledge of geotechnical engineering and related disciplines.
14. Graduates will possess a broad knowledge of water resources engineering and related disciplines.
15. Graduates will possess a broad knowledge of transportation engineering and related disciplines.
16. Graduates will possess a broad knowledge of structural engineering and related disciplines.
17. Graduates will possess a broad knowledge of geotechnical engineering and related disciplines.
18. Graduates will possess a broad knowledge of water resources engineering and related disciplines.
19. Graduates will possess a broad knowledge of transportation engineering and related disciplines.
20. Graduates will possess a broad knowledge of structural engineering and related disciplines.

Market Outcomes
The Civil Engineering and Environmental Engineering Program at Utah State University prepares students to be successful as engineers and professionals in the field of environmental engineering. The program is designed to provide a strong foundation in the principles of engineering, as well as a broad knowledge of the field. Graduates are expected to possess strong communication skills, both written and oral, and the ability to work in teams. Additionally, graduates are expected to possess a broad knowledge of the field, including the ability to apply engineering principles to solve complex problems. Graduates are also expected to possess the ability to conduct professional and technical research, and the ability to engage in lifelong learning. The program is designed to provide graduates with the knowledge and skills necessary to be successful in their careers, and to be prepared for further education, if desired.
Code of Ethics (from ASCE)

Fundamental Principles

Engineers uphold and advance the integrity, honor, and dignity of the engineering profession by:

1. Using their knowledge and skill for the advancement of human welfare and the environment;
2. Being honest and impartial and serving with fidelity the public, their employers and clients;
3. Shying to increase the competence and prestige of the engineering profession; and
4. Supporting the professional and technical activities of their disciplines.

Fundamental Canons (from ASCE)

- Engineers shall hold paramount the safety, health and welfare of the public and shall perform their professional duties with honesty and integrity in the performance of their professional duties.
- Engineers shall perform services only in areas of their competence.
- Engineers shall act in professional matters for each employer or client as faithful agents or trustees and shall not permit others to profit at their expense.
- Engineers shall not seek or accept compensation on the merit of their services and shall not work or combine with others.
- Engineers shall act in such a manner as to maintain and enhance the honor, integrity, and dignity of the engineering profession.
- Engineers shall continue their professional development through their careers and shall provide opportunities for the professional development of those engineers under their supervision.

And after graduation, becoming a Licensed Professional Engineer

- Obtain a Bachelor of Science in Civil Engineering or Environmental Engineering.
- Obtain a Professional Engineer (PE) license by passing the Fundamentals of Engineering (FE) exam.
- Complete the Fundamentals of Engineering exam.
- Take the Civil Engineering exam to become a Licensed Professional Civil Engineer.
Appendix B
Minutes of the CEE Advisory Board Meeting Nov 8, 2016

Intro
• Fall 2016
  o Passing FE exam is now a requirement
  o FE exam now has more civil based updates
  o Civil pass rate : 95%
  o CEE 1880 is taught both spring and fall
    ♣ Freshman class is the same size as sophomore class
  ♣ Our department is growing
    • Worried about maintaining quality of one on one connection
    ♣ This is why we are meeting with CEE 1880 classes
    • Gives the students an opportunity to meet and ask questions
  ♣ Questions for the students
    • Why did you decide to study CEE?
    • What is your biggest difficulty being a CEE student so far?
    • What has been your best experience so far as a CEE student?
    • What improvements to the program can you suggest?

ABET-Laurie
• Review of PEOs
  o Program educational objectives
  o What our students will be able to do 5 years out
  o Feedback from advisory board?
    ♣ Professional licensure?
      • Yes/no-we get aggregate stats on our students; just a number who passed the PE and FE exams
      • EnvE students are tracked since there are so few
    ♣ No additional comments
  o Student outcome ratings
    ♣ rated from 0-2
      • 0-didn’t understood
      • 1-kind of understood
      • 2-completety understood
    ♣ Goal to have more than 70% at the “2” level
    ♣ Is there a better time to evaluate different outcomes?
      • We’re looking at evaluating different classes
    ♣ EnvE was successful with all student outcomes measured
  o Fe exam pass rate
    ♣ Goal is to have 100% pass rate
    ♣ CEE is above the national average
  o Outcomes B&F are being reevaluated along with H,I,J, & K

Note: non-ABET related items have been removed from these minutes
Questions/Comments

Engineers view ethics differently than other professionals

- It would have been helpful to know that not all professionals have such a strong view on ethics
  - Attorneys allegiance are to their clients—engineers are more honest with their evaluations, etc.
  - Information can easily be taken, twisted, and turned
- You can’t under-teach ethics. I applaud any effort you make to be sure our students leave with a firm code of ethics.

What happens to students who don’t pass the FE exam?

- We offer resources and help to be sure that our students pass. Even if it’s not on the first, or second time
- “I would never change the requirement on passing the FE exam”
Laurie-ABET
• Review program (PEO)
• To-do list for this year
PEO handout
• Changes?
  o What are students doing 5 years after graduation?
• Criteria 4
  o Student coursework
  o FE exam
  o Exit interview results
• Outcome of student schedule
  o Each year we review a subset of the outcomes
  o Subsets B,E,F,G
• Student course work rating scale
  o 0,1,2 rating scale
  o We need at least 70% at the 2 level
  o 80% at performing level (1-2)
  o Summary
    ♣ E outcome met
    ♣ G outcome met
    ♣ B goal was not met (design and conduct)
    ♣ F goal not met (ethics)
    ♣ Environmental met all goals =]
• FE Exam
  o 100% pass rate
  o Minimum goal is to be at or above national pass rate
  o CE 98% pass rate
    ♣ 69% nationally
  o Environmental
    ♣ 78% pass rate
      • 76% nationally
  o Last year, we were above, or within, the error bar of national average for performance
  o Bottom line:
    ♣ All students scored at or above on all FE exam topics
• Senior exit interviews
  o Self assessment for students
  o We would like to see that 80% are understanding curriculum
    ♣ All students feel they met expectations
• Evaluation
  o Student course work: goals met for outcomes E,G but not for B, F
  o Outcomes B,F need to be redone
We didn't assess enough classes

- Evaluation schedule
  - H,I,J,K plus B,F
  - Assess two outcomes in all required UG classes

- Outcome B
  - Design and conduct experiments
    - Materials
    - Fluids
    - Soils
    - Hydraulics
    - Others?
  - We've failed the last two years with outcome B

- Outcome F
  - Ethics
    - This can be done in any and all of our classes
    - The challenge is assessing....
      - [www.asce.org/ethics](http://www.asce.org/ethics)
      - Case studies and ethically considered column
      - Ideas for classes

- Outcomes H,I,J
  - Outcome H
    - Anything beyond the textbook
  - Outcome I
    - CEE orientation
    - EnvE sophomore seminar
    - Junior/senior design
    - Others?
  - Outcome J
    - Knowledge of contemporary issues
      - Everyone!

- Outcome K
  - Ability to use techniques and skills for modern engineering
    - Anyone using software, design codes
    - May have to rely on elective classes
    - CEE 4870/4880?

- Program criteria for CE
  - Probability and statistics
  - Include principles of sustainability in design
  - Explain basic concepts in project management, business, public policy, and leadership
    - These don't' need to be formally assessed, but we do have to discuss where the students are getting these concepts in our curriculum.
Appendix D
Detailed Evaluation for Outcomes h, i, j, and k

See following pages
Outcome h: the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

**Student Course Work Assessment**

Student work is rated on a $0 – 1 – 2$ scale:

- 0 = student did not understand the fundamental principle or component
- 1 = student applied some but not all of the fundamental principles in their solution
- 2 = student applied the correct fundamental principles in their solution

The EnvE program has two goals for student performance for student course work assessment:

- Goal 1: a minimum of 70% of the students will perform at a 2 level
- Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

As recommended by the Assessment Committee the last time this outcome was evaluated (2013-2014), the number of assessments for this outcome has increased. Student performance on this outcome has been assessed on ten assignments in five different courses (429 samples of student work; see Table H-1 on the next page). Student performance satisfactorily meets both Goal 1 and Goal 2 (Figure H-1).

![Figure H-1: Summary of ratings of student work on Outcome h](image)
<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 2620</td>
<td>Env Microbiology</td>
<td>Sorenson</td>
<td>Sp 2017</td>
<td>13</td>
<td>exam question</td>
<td>economic and env impact of biofuels</td>
<td>54</td>
<td>31</td>
<td>15</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>essay HW</td>
<td>summarize EIS - env, econ, societal</td>
<td>76</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>essay HW</td>
<td>summarize TMDL - env, econ, societal</td>
<td>92</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>essay HW</td>
<td>summarize Superfund site - env, econ, societal</td>
<td>67</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>field trip report</td>
<td>env, econ, societal consid of WWTP</td>
<td>78</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>CEE 3650</td>
<td>Wastewater Treatment</td>
<td>Dupont</td>
<td>Sp 2017</td>
<td>7</td>
<td>mini-design</td>
<td>Env and cost impacts of TMDL</td>
<td>57</td>
<td>29</td>
<td>14</td>
</tr>
<tr>
<td>CEE 4200</td>
<td>Engineering Economics</td>
<td>Alminagorta</td>
<td>F 2016</td>
<td>76</td>
<td>exam</td>
<td>economic impact of eng solutions</td>
<td>89</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>8</td>
<td>lab exercise</td>
<td>effect of BMP on nutrient loading in river</td>
<td>88</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>8</td>
<td>lab exercise</td>
<td>env relevance of nutrients in a river</td>
<td>88</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>8</td>
<td>lab exercise</td>
<td>sources of nutrients into water bodies</td>
<td>75</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>
**FE Exam Results**
Not applicable to this outcome.

**Senior Exit Interviews**
Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 67% of students rating Outcome b as “met” and 33% as “partly met” for a total of 100% (Figure H-2). Acknowledging that this is a subjective self-evaluation and a very small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

![Outcome h](chart.png)

Figure H-2: Student exit interview ratings of progress on Outcome h

**Summary**
The evaluation of student work and senior exit interviews indicates that Outcome h is being met.

**Recommendations**
Evaluate Outcome h as planned during the 2019-20 school year.
Outcome i: a recognition of the need for, and an ability to engage in life-long learning

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

0 = student did not understand the fundamental principle or component
1 = student applied some but not all of the fundamental principles in their solution
2 = student applied the correct fundamental principles in their solution

The EnvE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

This outcome is assessed in the freshman orientation class, sophomore seminar, and the second and third classes of the capstone design sequence (171 samples of student work; see Table I-1 on the next page). Student attainment is demonstrated through a memo on the importance of life-long learning, a quiz on professional registration requirements (including associated continuing education requirements), and an essay on a guest speaker’s discussion of this topic. Student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure I-1). To additionally reinforce this idea in the capstone design sequence, since the 2014-2015 academic year, all guest speakers who are professional engineers are requested to include the topic of life-long learning in their presentation.

![Figure I-1: Summary of ratings of student work on Outcome i](image-url)
Table I-1: List of student work assessed for Outcome i

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 1880</td>
<td>CEE Orientation</td>
<td>Rahmeyer</td>
<td>F 2016</td>
<td>73</td>
<td>group HW</td>
<td>rules for professional licensure</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 1880</td>
<td>CEE Orientation</td>
<td>Rahmeyer</td>
<td>Sp 2017</td>
<td>65</td>
<td>group HW</td>
<td>rules for professional licensure</td>
<td>83%</td>
<td>15%</td>
<td>2%</td>
</tr>
<tr>
<td>CEE 2890</td>
<td>Environ sophomore seminar</td>
<td>McLean</td>
<td>Sp 2017</td>
<td>16</td>
<td>group project</td>
<td>need for lifelong learning in design</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 4870</td>
<td>Civil Engineering Design II</td>
<td>Peralta</td>
<td>F 2016</td>
<td>7</td>
<td>quiz</td>
<td>quiz on continuing ed requirements</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 4880</td>
<td>Civil Engineering Design III</td>
<td>Peralta</td>
<td>Sp 2017</td>
<td>7</td>
<td>quiz</td>
<td>quiz on lifelong learning in Code of Ethics</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
**FE Exam Results**
Not applicable to this outcome.

**Senior Exit Interviews**
Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 100% of students rating Outcome i as “met” (Figure I-2). Acknowledging that this is a subjective self-evaluation and a very small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

![Outcome i Rating graph](image_url)

**Summary**
The evaluation of student work and senior exit interviews indicates that Outcome i is being met.

**Recommendations**
Evaluate Outcome i as planned during the 2019-20 school year.
Outcome j: a knowledge of contemporary issues

**Student Course Work Assessment**

Student work is rated on a 0 – 1 – 2 scale:

0 = student did not understand the fundamental principle or component  
1 = student applied some but not all of the fundamental principles in their solution  
2 = student applied the correct fundamental principles in their solution

The EnvE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level  
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

This outcome was assessed in multiple classes by having students demonstrate knowledge of contemporary issues through HW, writing assignment, or exam (430 samples of student work; see Table J-1 on the next page). Student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure J-1).

![Outcome j bar chart](image)

**Figure J-1:** Summary of ratings of student work on Outcome j
Table J-1: List of student work assessed for Outcome j

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 1880</td>
<td>Civil and Environmental Eng. Orientation</td>
<td>Rahmeyer</td>
<td>F 2016</td>
<td>73</td>
<td>group HW</td>
<td>group essay on contemporary issues</td>
<td>89</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>CEE 1880</td>
<td>Civil and Environmental Eng. Orientation</td>
<td>Rahmeyer</td>
<td>Sp 2017</td>
<td>65</td>
<td>group HW</td>
<td>group essay on contemporary issues</td>
<td>91</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>CEE 2890</td>
<td>Environmental sophomore seminar</td>
<td>McLean</td>
<td>Sp 2017</td>
<td>16</td>
<td>group project</td>
<td>contemp issues -- eng. in develop countries</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>HW</td>
<td>Cache Valley PM2.5 issue</td>
<td>89</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>field trip report</td>
<td>solid waste mgmt current issues in CV</td>
<td>73</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Environmental Management</td>
<td>McNeill</td>
<td>F 2016</td>
<td>79</td>
<td>field trip report</td>
<td>current issues in Logan City drinking water</td>
<td>73</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>CEE 3640</td>
<td>Drinking Water Treatment</td>
<td>McNeill</td>
<td>Sp 2017</td>
<td>32</td>
<td>HW</td>
<td>essay on Flint, MI drinking water scandal</td>
<td>91</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>CEE 3650</td>
<td>Wastewater Treatment</td>
<td>Dupont</td>
<td>Sp 2017</td>
<td>7</td>
<td>group project</td>
<td>contemp issues for WWTP</td>
<td>57</td>
<td>43</td>
<td>0</td>
</tr>
</tbody>
</table>
**FE Exam Results**
Not applicable to this outcome.

**Senior Exit Interviews**
Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 100% of students rating Outcome b as “met” in 2016-17 (Figure J-2). Acknowledging that this is a subjective self-evaluation and a very small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

![Outcome j Rating Chart](image)

**Summary**
The evaluation of student work and senior exit interviews indicate that Outcome j is being met.

**Recommendations**
Evaluate Outcome j as planned during the 2019-20 school year.
Outcome k: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

- 0 = student did not understand the fundamental principle or component
- 1 = student applied some but not all of the fundamental principles in their solution
- 2 = student applied the correct fundamental principles in their solution

The EnvE program has two goals for student performance for student course work assessment:

- Goal 1: a minimum of 70% of the students will perform at a 2 level
- Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

Multiple classes across the curriculum assess students’ ability to use modern tools including surveying equipment; tools for evaluating environmental quality parameters such as BOD, hardness, and dissolved oxygen; and various software programs like excel/VBA, HEC-HMS, and EPANET (574 samples of student work; see Table K-1 on the next page). Overall, student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure K-1).

![Figure K-1: Summary of ratings of student work on Outcome k](image-url)
Table K-1: List of student work assessed for Outcome k

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Instructor</th>
<th>Term</th>
<th>Enrol.</th>
<th>Method</th>
<th>Description</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 2240</td>
<td>Surveying</td>
<td>Caliendo</td>
<td>F 2016</td>
<td>121</td>
<td>lab</td>
<td>surveying traverse special problem</td>
<td>70%</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 2620</td>
<td>Env Microbiology</td>
<td>Sorenson</td>
<td>Sp 2017</td>
<td>13</td>
<td>lab</td>
<td>BODTrak lab technique</td>
<td>69%</td>
<td>23%</td>
<td>8%</td>
</tr>
<tr>
<td>CEE 2870</td>
<td>Intro to Programming</td>
<td>Urroz</td>
<td>F 2016</td>
<td>102</td>
<td>HW</td>
<td>use VBA and spreadsheet to calc flow in open channel</td>
<td>93%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>CEE 3430</td>
<td>Engineering Hydrology</td>
<td>Urroz</td>
<td>Sp 2017</td>
<td>81</td>
<td>HW</td>
<td>use excel and HEC-HMS to find hydrograph</td>
<td>89%</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td>CEE 3510</td>
<td>Hydraulics</td>
<td>Urroz</td>
<td>Sp 2016</td>
<td>69</td>
<td>exam</td>
<td>EPANET 2.0 for analysis of pipe network</td>
<td>86%</td>
<td>14%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 3510</td>
<td>Hydraulics</td>
<td>Urroz</td>
<td>Sp 2017</td>
<td>71</td>
<td>exam</td>
<td>EPANET 2.0 for analysis of pipe network</td>
<td>97%</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 3780</td>
<td>Solid and Haz Waste Mgmt</td>
<td>Dupont</td>
<td>F 2016</td>
<td>53</td>
<td>exam</td>
<td>spreadsheet to calculate effect of recycling on landfill</td>
<td>89%</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>CEE 5001</td>
<td>Field Irrigation Systems</td>
<td>Torres-Rua</td>
<td>F 2016</td>
<td>7</td>
<td>exam</td>
<td>remote sensing applications</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>7</td>
<td>lab</td>
<td>DO lab -- understanding QC requirements</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>7</td>
<td>lab</td>
<td>DO lab -- understanding analytical methods</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>7</td>
<td>lab</td>
<td>DO lab -- comparing methods</td>
<td>71%</td>
<td>29%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>7</td>
<td>lab</td>
<td>DO lab -- interpreting data</td>
<td>71%</td>
<td>29%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>7</td>
<td>lab</td>
<td>DO lab -- selecting best method to meet objectives</td>
<td>71%</td>
<td>29%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>7</td>
<td>lab</td>
<td>hardness lab -- understanding QC requirements</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>7</td>
<td>lab</td>
<td>hardness lab -- comparing analytical methods</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CEE 5610</td>
<td>Environ Quality Analysis</td>
<td>McLean</td>
<td>F 2016</td>
<td>7</td>
<td>lab</td>
<td>hardness lab -- selecting best method to meet objectives</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
**FE Exam Results**

Our goal is to have 100% pass rate on the FE exam; our minimum acceptable level of performance is a pass rate at or above the national average. Table K-2 summarizes the FE results for the past six years, including the percentage of students who had passed the FE exam by the time of graduation. The USU EnvE pass rate has been either 100% or just below the national average. Realistically, these values are considered comparable to the national average, considering the small number of USU EnvE graduates.

The fact that nearly all of the EnvE students pass the FE exam is a strong, independent, external indicator for meeting Student Outcomes a, e, f, and k. It is also a strong indication of a good foundation for life-long (independent) learning skills.

**Table K-2: EnvE Graduates Passing FE Exam vs. National Annual Pass Rate**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>USU EnvE graduates</td>
<td>10</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>USU EnvE pass rate at graduation</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>89%</td>
<td>100%</td>
</tr>
<tr>
<td>National EnvE pass rate</td>
<td>83%</td>
<td>88%</td>
<td>84%</td>
<td>77%</td>
<td>76%</td>
<td>77%</td>
</tr>
</tbody>
</table>

**Senior Exit Interviews**

Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as “met” or “partly met”, which was achieved with 100% of students rating Outcome i as “met” in 2016-17 (Figure K-2). Acknowledging that this is a subjective self-evaluation and a very small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

![Figure K-2: Student exit interview ratings of progress on Outcome k](image-url)
Summary
The evaluation of student work, FE Exam results, and senior exit interviews indicates that Outcome k is being met.

Recommendations
Evaluate Outcome k as planned during the 2019-20 school year.