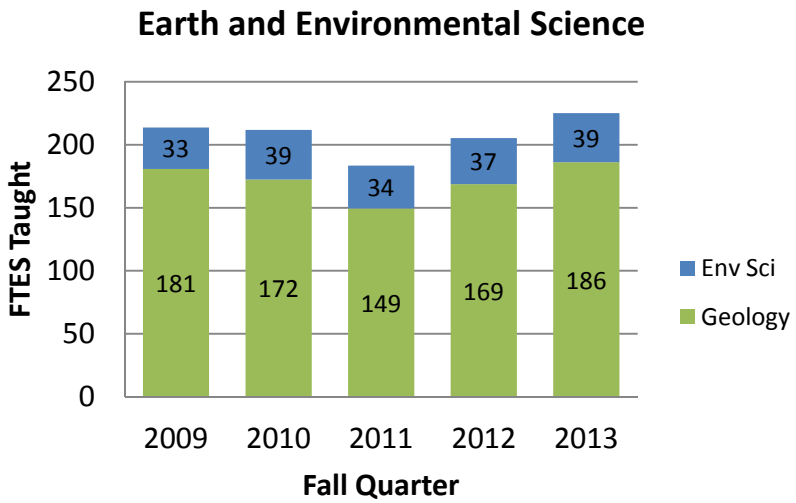
Environmental Science BS Program Annual Report 2013-14

Department of Earth and Environmental Sciences

The Department of Earth and Environmental Sciences in the College of Science offers degrees in Geology (BS, BA, MS) and Environmental Science (BS). The scope of this report is the Environmental Science BS program.

Enrollment

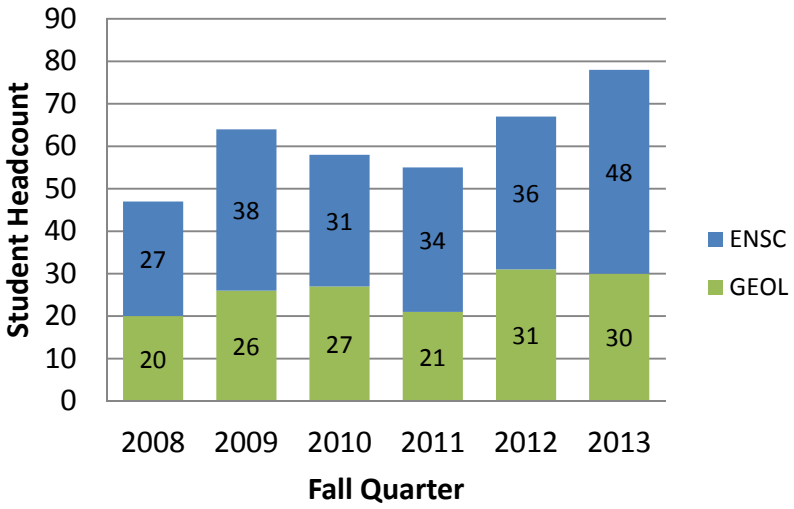
Enrollment in courses offered by the department as measured by Fall Quarter FTES has increased during the past two years and is currently 225 (see figure below), the majority from Geology courses. A large portion of the department's enrollment is due to its participation in the General Education (GE) Program. This includes Freshman Learning Communities (clusters) and upper-division GE. The department taught in four GE clusters during AY 2013-14. Two of these included lower-division introductory Environmental Science courses; Global Environmental Problems (ENSC 2801), and Global Environmental Issues (ENSC 2802). Enrollment in Environmental Science courses have been relatively modest to date because most of the courses required for the major are taught by other departments. However, we expect enrollment to increase in the future due to an increased number of majors, a new tenure-track faculty member, and new course offerings.



FTES for courses in Geology and Environmental Science.

Number of Majors

The number of Environmental Science majors has steadily increased during the past two years and reached an all time high of 48 in 2013.



Number of majors in Environmental Science and Geology programs, 2008-2013.

Student Advising

Advising for the Environmental Science program is provided by the program coordinator.

We created roadmaps for student advisement, which are provided below.

Faculty

The Department hired a new tenure-track faculty member with expertise in Environmental Science, who started in Fall 2013, and who now serves as the Environmental Science Program Coordinator. The department has five tenure-track or tenured faculty members; one Assistant Professor, two Associate Professors and two full Professors.

Due to the small number of regular faculty, we utilize ten lecturers to teach a variety of courses, including introductory courses for non-majors as well as upper-division and graduate level

courses for majors. Most are part-time and have been teaching in the department for several years. All have at least an MS degree, and seven have a PhD in Geology or a related field.

Staff

The department has two staff members, an Administrative Support Assistant and Instructional Support Technician. The ASA provides office support and the technician prepares and maintains materials for labs.

Assessment

The department developed and implemented new assessment materials for the Environmental Science program during 2013-14. The revised materials and assessment results for 2013-14 are provided below.

California State University, East Bay

APR Summary Data

Fall 2008 - 2013

Dept. of Earth and Environmental Sciences						
	Fall Quarter					
A. Student Headcount	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
1. Undergraduate	43	45	43	40	48	66
2. Postbaccalaureate	2	5	1	0	0	0
3. Graduate	2	14	14	15	19	12
4. Total Number of Majors	47	64	58	55	67	78
	College Years					
B. Degrees Awarded	**07-08**	**08-09**	**09-10**	**10-11**	**11-12**	**12-13**
1. Undergraduate	3	14	9	6	7	5
2. Graduate	0	0	1	0	2	5
3. Total	3	14	10	6	9	10
	Fall Quarter					
C. Faculty	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Tenured/Track Headcount						
1. Full-Time	4	4	4	4	4	5
2. Part-Time	0	0	0	0	0	0
3a. Total Tenure Track	4	4	4	4	4	5
3b. % Tenure Track	40.0%	40.0%	30.8%	33.3%	30.8%	35.7%
Lecturer Headcount						
4. Full-Time	0	0	0	0	0	0
5. Part-Time	6	6	9	8	9	9
6a. Total Non-Tenure Track	6	6	9	8	9	9
6b. % Non-Tenure Track	60.0%	60.0%	69.2%	66.7%	69.2%	64.3%
7. Grand Total All Faculty	10	10	13	12	13	14
Instructional FTE Faculty (FTEF)						
8. Tenured/Track FTEF	2.2	0.92	3.61	3.33	3.28	4.58
9. Lecturer FTEF	2.48	4.6	3.33	3.73	3.87	4.27
10. Total Instructional FTEF	4.69	5.51	6.94	7.07	7.15	8.85
Lecturer Teaching						
11a. FTES Taught by Tenure/Track	66.5	22.5	63.7	65.2	63.4	68.2
11b. % of FTES Taught by Tenure/Track	48.4%	10.5%	30.1%	35.5%	30.9%	30.3%
12a. FTES Taught by Lecturer	70.9	191.1	148.2	118.3	141.9	156.9
12b. % of FTES Taught by Lecturer	51.6%	89.5%	69.9%	64.5%	69.1%	69.7%
13. Total FTES taught	137.3	213.7	211.9	183.5	205.3	225.1
14. Total SCU taught	2060.0	3205.0	3178.0	2752.0	3079.0	3377.0

D. Student Faculty Ratios	2008	2009	2010	2011	2012	2013
1. Tenured/Track	30.2	24.6	17.6	19.6	19.4	14.9
2. Lecturer	28.5	41.6	44.5	31.7	36.7	36.8
3. SFR By Level (All Faculty)	29.3	38.8	30.5	26.0	28.7	25.4
4. Lower Division	44.3	44.5	41.9	30.9	35.2	24.7
5. Upper Division	15.3	34.0	27.9	25.3	34.8	29.7
6. Graduate	11.0	17.5	4.2	5.6	4.9	6.1
E. Section Size	2008	2009	2010	2011	2012	2013
1. Number of Sections Offered	27.0	26.0	27.0	31.0	32.0	35.0
2. Average Section Size	23.9	35.5	36.2	30.1	34.9	32.1
3. Average Section Size for LD	29.6	40.5	46.1	34.3	36.1	33.3
4. Average Section Size for UD	15.8	30.8	29.9	26.4	35.3	34.2
5. Average Section Size for GD	11.0	17.0	12.0	14.0	14.0	10.0
6. LD Section taught by Tenured/Track	10	1	8	8	9	9
7. UD Section taught by Tenured/Track	4	3	3	2	0	7
8. GD Section taught by Tenured/Track	0	1	2	4	7	4
8a. N sections taught by TT	14	5	13	14	16	20
9. LD Section taught by Lecturer	6	12	4	8	6	9
10. UD Section taught by Lecturer	5	8	8	7	9	8
11. GD Section taught by Lecturer	2	1	2	2	1	0
11a. N sections taught by Lecturers	13	21	14	17	16	17
12. % of Sections taught by TT (#8a / #1)	48.1%	80.8%	51.9%	54.8%	50.0%	48.6%

Source and definitions available at: http://www.csueastbay.edu/ira/apr/summary/definitions.pdf

	Fall Quarter					
Headcount Enrollment	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Environmental Science						
1. Undergraduate	26	36	30	34	36	48
2. Postbaccalaureate	1	2	1	0	0	0
3. Graduate	0	0	0	0	0	0
4. Total Number of Majors	27	38	31	34	36	48
Geology						
1. Undergraduate	17	9	13	6	12	18
2. Postbaccalaureate	1	3	0	0	0	0
3. Graduate	2	14	14	15	19	12
4. Total Number of Majors	20	26	27	21	31	30

	College Years					
Degrees Awarded	**07-08**	**08-09**	**09-10**	**10-11**	**11-12**	**12-13**
Environmantal Science						
1. Undergraduate	1	5	6	3	4	4
2. Graduate	0	0	0	0	0	0
3. Total Number of Majors	1	5	6	3	4	4
Geology						
1. Undergraduate	2	9	3	3	3	1
2. Graduate	0	0	1	0	2	5
3. Total Number of Majors	2	9	4	3	5	6

	2008	**2009**	**2010**	**2011**	**2012**	**2013**
D. Student Faculty Ratios	Environmental Science					
1. Tenured/Track	.	.	.	.	.	8.1
2. Lecturer	89.2	61.7	73.9	36.5	45.6	86.9
3. SFR By Level (All Faculty)	89.2	61.7	73.9	36.5	45.6	17.7
4. Lower Division	89.2	61.7	73.9	36.5	45.6	18.4
5. Upper Division	.	.	.	.	.	13.0
6. Graduate	.	.	.	.	.	0.0
E. Section Size						
1. Number of Sections Offered	1.0	2.0	2.0	4.0	3.0	6.3
2. SCU taught	356.0	492.0	592.0	511.0	548.0	585.0
FTES (=SCU/15)	23.7	32.8	39.5	34.1	36.5	39.0
3. Average Section Size	89.0	61.5	74.0	33.3	45.7	27.6
4. Average Section Size for LD	89.0	61.5	74.0	33.3	45.7	27.6
5. Average Section Size for UD	0.0	0.0	0.0	0.0	0.0	0.0
6. Average Section Size for GD	0.0	0.0	0.0	0.0	0.0	0.0
7. LD Section taught by Tenured/Track	0	0	0	0	0	4
8. UD Section taught by Tenured/Track	0	0	0	0	0	2
9. GD Section taught by Tenured/Track	0	0	0	0	0	0
10. LD Section taught by Lecturer	1	2	2	4	3	1
11. UD Section taught by Lecturer	0	0	0	0	0	0
12. GD Section taught by Lecturer	0	0	0	0	0	0
D. Student Faculty Ratios	Geology					
1. Tenured/Track	30.2	24.6	17.6	19.6	19.4	19.8
2. Lecturer	21.3	39.0	38.9	30.1	34.3	33.4
3. SFR By Level (All Faculty)	25.7	36.3	26.9	24.4	26.6	28.0
4. Lower Division	38.4	40.7	34.8	29.1	32.1	28.4
5. Upper Division	15.3	34.0	27.9	25.3	34.8	31.5
6. Graduate	11.0	17.5	4.2	5.6	4.9	6.1
E. Section Size						
1. Number of Sections Offered	26.0	24.0	25.0	27.0	29.0	28.8
2. SCU taught	1704.0	2713.0	2586.0	2241.0	2531.0	2792.0
FTES (=SCU/15)	113.6	180.9	172.4	149.4	168.7	186.1
3. Average Section Size	21.3	33.1	33.0	29.6	33.5	33.0
4. Average Section Size for LD	25.7	36.6	40.5	34.6	33.7	35.5
5. Average Section Size for UD	15.8	30.8	29.9	26.4	35.3	34.2
6. Average Section Size for GD	11.0	17.0	12.0	14.0	14.0	10.0
7. LD Section taught by Tenured/Track	10	1	8	8	9	5
8. UD Section taught by Tenured/Track	4	3	3	2	0	5
9. GD Section taught by Tenured/Track	0	1	2	4	7	4
10. LD Section taught by Lecturer	5	10	2	4	3	8
11. UD Section taught by Lecturer	5	8	8	7	9	8
12. GD Section taught by Lecturer	2	1	2	2	1	0

Department of Earth and Environmental Sciences
California State University, East Bay

ASSESSMENT PLAN 2013-14

ENVIRONMENTAL SCIENCE B.S.

27 September 2014

Department of Earth and Environmental Sciences
California State University, East Bay

Assessment Plan 2013-14
Environmental Science B.S.

Contents

Department of Earth and Environmental Sciences
California State University, East Bay

Program Learning Outcomes
Environmental Science B.S.

Students graduating with a B.S. in Environmental Science from Cal State East Bay will be able to:

1. demonstrate knowledge of the principles of form, function and organization of organisms at the levels of molecules, cells, tissues, organs, organisms, populations, and communities. (Biology)
2. demonstrate knowledge of the fundamental principles of chemistry, chemical structure, bonding, equilibrium, dynamics, and reactions, as well as classes of organic compounds and reactions. (Chemistry)
3. characterize the nature and distribution of earth materials, the processes by which the materials are formed and altered, and the nature and development of the landscape. (Earth Science)
4. synthesize knowledge of the major components of the physical environment, including landforms, climate, vegetation, and soils. (Synthesis)
5. critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form. (Communication)

Department of Earth and Environmental Sciences
California State University, East Bay

Program Learning Outcomes
Environmental Science B.S.

ILO Alignment Matrix. The table below shows which Institutional Learning Outcomes (ILOs) are addressed by each of the Program Learning Outcomes (PLOs) listed above.

ILO	**PLO 1**	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**
1. Thinking & Reasoning	**X**	**X**	**X**	**X**	**X**
2. Communication					X
3. Diversity	X				X
4. Collaboration				X	X
5. Sustainability				X	X
6. Specialized Education	X	X	X	X	X

Department of Earth and Environmental Sciences
California State University, East Bay

Program Learning Outcomes
Environmental Science B.S.

Students graduating with a B.S. in Environmental Science from Cal State East Bay will be able to:

1. demonstrate practical skills and theoretical knowledge of the biology, chemistry, geology, and physics relevant to the Earth system, in both laboratory and field settings;
2. collect, analyze, and interpret quantitative and qualitative data in order to characterize and address environmental issues;
3. critically consider scientific findings within the context of the social, cultural, economic, ethical, and human dimensions of contentious environmental issues;
4. synthesize knowledge of the major components of the Earth system, including physical, biological, and human systems, as well as human impacts;
5. critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form.

ILO Alignment Matrix. The table below shows which Institutional Learning Outcomes (ILOs) are addressed by each of the Program Learning Outcomes (PLOs) listed above.

ILO	**PLO 1**	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**
1. Thinking & Reasoning	**X**	**X**	**X**	**X**	**X**
2. Communication		X			X
3. Diversity			X	X	X
4. Collaboration				X	X
5. Sustainability			X	X	X
6. Specialized Education	X	X	X	X	X

Curriculum Map for Program Learning Outcomes

CSU East Bay, Dept. of Earth & Environmental Sciences

Degree: B.S. in Environmental Science

				Program Learning Outcomes				
Assessed	**Prefix**	**Course**	**Title**	**PLO 1**	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**
	ENSC	2210	Environmental Geology +		I	I	I	P
	ENSC	2211	Environmental Geology Lab +			I	I	
	ENSC	2400	Environmental Biology	I				
	ENSC	2401	Environmental Biology Lab	P				
	ENSC	2800	Environmental Problems of California	I	I	I	I	I
	ENSC	2801	Global Environment Problems	I	I	I	I	I
	ENSC	2802	Global Environmental Issues	I	I	I	I	I
*	ENSC	2900	Field Activity in Environmental Science	I	I	I	P	
*	ENSC	3500	Environmental Hydrology +			M	M	P
	ENSC	3999	Issues in Environmental Science					P
*	ENSC	4140	Hazardous Waste Management +		P		M*	P*
	ENSC	4200	Global Change					P
*	ENSC	4800	Seminar in Environmental Science	P	P	P	M*	M*
	ENSC	4900	Independent Study				P	P
	GEOL	2101	Physical Geology			I		
	GEOL	2102	Earth and Life Through Time	I		I	I	
	GEOL	2210	Environmental Geology +		I	I	I	P
	GEOL	2211	Environmental Geology Lab +			I	I	P
*	GEOL	2600	2600 Introduction to GIS			P	P	
	GEOL	3110	Principles of Geomorphology			M	P	
	GEOL	3110	Principles of Geomorphology			M	P	
	GEOL	3500	Environmental Hydrology +		P	M	M	P
	GEOL	3601	Mineralogy and Optical Crystallography		P	M		
	GEOL	3701	Igneous and Metamorphic Petrology		P	M		
	GEOL	3801	Sedimentology and Stratigraphy			M		
	GEOL	3810	Structural Geology			M		
	GEOL	3910	Geologic Field Methods			M	P	
	GEOL	4010	Applied Geophysics			M		
	GEOL	4130	Survey of Geochemistry		M	P		P
	GEOL	4140	Hazardous Waste Management +		P		M	P
	GEOL	4320	Hydrogeology			M	P	P
	GEOL	4320	Hydrogeology			M	P	P

Notes:

See attached Program Learning Outcomes (PLOs)

\+ This course cross listed, appears under both ENSC and GEOL

This course used for 2013-2014 assessment

Levels: I = Introduced; P = Practiced; M = Mastered

CSUEB Environmental Science B.S. Program Learning Outcome Evaluation

Course evaluated: ENSC 4800 Seminar in Environmental Science, Winter 2014

Assignment evaluated: *"Brownfield Action" capstone project*

PLO evaluated: *PLO #4 (pre-revision), "synthesize knowledge of the major components of the physical environment, including landforms, climate, vegetation, and soils" ("synthesis" objective), PLO #5 (pre-revision), "critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form" ("communication" objective).*

Rubric(s) used: Critical Thinking Rubric ("synthesis" PLO), Laboratory Skills/Course Project Rubric ("communication" PLO)

"Synthesis" objective evaluation (ENSC 4800 Seminar in Environmental Science)

14 students evaluated, 14 students in class
Class total average: (6.50 out of 15, 5 is meeting PLO), class total standard deviation: 1.45

Student	Competencies	Problem Solving	Embracing Contradictions	Innovative Thinking	Connecting, Synthesizing	Total
01	1	1	1	2	2	7
02	1	1	1	1	2	6
03	1	1	1	1	1	5
04	2	1	1	1	2	7
05	1	1	1	1	2	6
06	2	2	1	1	2	8
07	0	1	0	1	1	3
08	2	1	1	1	2	7
09	2	1	2	1	1	7
10	2	1	1	1	2	7
11	2	2	2	1	2	9
12	1	1	1	1	1	5
13	2	1	1	1	2	7
14	2	1	1	1	2	7
Class average	**1.50**	**1.14**	**1.07**	**1.07**	**1.71**	**6.50**
Standard deviation	**0.65**	**0.36**	**0.47**	**0.27**	**0.47**	**1.45**

(Interpretation on next page.)

Interpretation: Students scored particularly high on the "connecting and synthesizing" portion of the rubric, which fits the nature of this assignment as an integrated capstone project simulating a real-world situation. Students scored low in the areas of problem solving and embracing contradictions, two areas that are very important for environmental science since "real world" scenarios deal with incomplete data, and many unknown factors. That said, low student scores in these areas could also be attributable to the non-standard and open-ended nature of the assignment, which several students reported "not really getting" until about six weeks into the quarter. Low scores in "innovative thinking" are also likely due to the nature of the assignment (which takes the form of a contract prescribing specific deliverables—there is not a great deal of room for innovation). **Attached are two student papers (Students 5 and 11) as examples.**

"Communication" objective evaluation (ENSC 4800 Seminar in Environmental Science)

14 students evaluated, 14 students in class

Class total average: (6.79 out of 15, 5 is meeting PLO), class total standard deviation: 1.85

Student	Organization	Presentation	Quantitative Skills	Execution	Connecting, Synthesizing	Total
01	1	2	1	0	1	5
02	2	2	1	1	2	8
03	1	2	1	0	1	5
04	2	2	1	2	2	9
05	2	3	0	2	2	9
06	2	2	1	1	2	8
07	0	1	0	0	1	2
08	2	2	2	1	1	8
09	1	1	1	1	1	5
10	1	1	1	1	2	6
11	2	1	2	2	2	9
12	1	1	1	1	2	6
13	1	2	1	2	1	7
14	2	1	1	1	2	7
Class average	**1.43**	**1.64**	**1.00**	**1.07**	**1.57**	**6.79**
Standard deviation	**0.65**	**0.63**	**0.55**	**0.73**	**0.51**	**1.85**

Interpretation: For the level to truly approach that of a "professional" most students need to work on details such as organization and execution, but overall students rated well in these areas. Most students were able to reasonably approach the quantitative portion of the assignment (which has no exact "correct" answer, but has a correct approach), but a few students chose not to attempt the calculation. One student who attempted the calculation came up with a nonsensical answer, but the student's report was otherwise reasonable and well-presented. Quality, on-time execution is an issue with some students. Overall, the students met the PLO for "communication" of discipline-specific information, but there is significant room for improvement. **Attached are two student papers (Students 5 and 11) as examples.**

"Communication" objective evaluation (ENSC 4140 Hazardous Waste Management)

Assignment evaluated: *Hazardous waste capstone presentation (based on research paper)*

PLO evaluated: *PLO #5 (pre-revision), "critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form" ("communication" objective).*

Rubric(s) used: Laboratory Skills/Course Project Rubric

12 students evaluated, 12 students in class
Class total average: 4.75 (out of 12, 4 is meeting PLO), class total standard deviation: 1.96

Student	Organization	Presentation	Quantitative Skills*	Execution	Connecting, Synthesizing	Total
01	1	2	N/A	1	1	5
02	1	1	N/A	1	2	5
03	2	2	N/A	1	1	6
04	2	1	N/A	1	1	5
05	0	0	N/A	0	1	1
06	0	1	N/A	1	1	3
07	1	3	N/A	1	2	7
08	1	0	N/A	1	0	2
09	2	1	N/A	2	2	7
10	1	1	N/A	1	1	4
11	2	2	N/A	1	2	7
12	1	1	N/A	1	2	5
Class average	**1.17**	**1.25**	**N/A**	**1.00**	**1.33**	**4.75**
Standard deviation	**0.72**	**0.87**	**N/A**	**0.43**	**0.65**	**1.96**

* Quantitative skills not evaluated in this assignment

Interpretation: Students in this class did a good job of synthesizing their understanding from the class and applying it to their individual projects. Execution was an area where the students were particularly weak–though their work for the final project was for the most part on-time and adequate. Overall, the program is meeting its communication objective for most students, but there is substantial room for improvement in student performance. **Attached is one student's presentation (Student 11) as an example.**

"Synthesis" objective criteria

	Exemplary 3	Accomplished 2	Competent 1	Insufficient Evidence 0
1. Competencies *Strategies and skills that apply to Earth Science problem solving (i.e. discipline-specific lab & field exercises)*	**Clearly understands** purpose and role of the exercise and its importance and context within the Earth Sciences and/or related subfield. Proposes/develops **new means/methods** to address the problem.	**Strong understanding** of purpose and role of the exercise and its importance and context within the Earth Sciences and/or related subfield. Uses **discipline-appropriate means** to address the problem.	**Understanding** of the purpose and role of the exercise and some insight into its importance and context within the Earth Sciences and/or related subfield. **Follows instructions** and understands the steps.	Poor understanding of the purpose and role of the exercise with little/no insight into its importance and context within the Earth Sciences and/or related subfield. **Unable** to follow instructions.
2. Problem Solving	Develops a **logical, consistent plan** to solve problem, **recognizes consequences** of solution, and **can articulate** reason for choosing solution.	Develops a **plan** to solve the problem. Has some **insight into consequences** and **some ability to articulate** reason for choosing solution.	**Considers and rejects less acceptable approaches** to solving problem.	Only a **single approach** is considered and used to solve the problem.
3. Embracing Contradictions	**Integrates** alternate, divergent, or contradictory perspectives or ideas **fully**. **Proposes/uses** multiple working hypotheses.	**Incorporates** alternate, divergent, or contradictory perspectives or ideas in an **exploratory** way. **Applies** multiple working hypotheses.	**Includes** (**recognizes** value) alternate, divergent, or contradictory perspectives or ideas in a limited way. Has **difficulty** creating multiple working hypotheses.	**Fails to acknowledge** alternate, divergent, or contradictory perspectives or ideas. **No use** of multiple working hypotheses.
4. Innovative Thinking	**Creates** a novel/unique idea, method, hypothesis, format, or product.	**Imagines/conceives** a novel/unique idea, method, hypothesis, format, or product.	**Reformulates** a collection of available ideas.	**No new ideas.**
5. Connecting, Synthesizing	**Synthesizes** ideas or solutions into a **coherent whole.** **Creates** connections to higher-level discipline-specific concepts and practices.	**Connects** ideas or solutions in novel ways. **Recognizes** connections to higher-level discipline-specific concepts and practices.	**Recognizes existing connections** among ideas or solutions.	**No recognition** of significance of exercise to discipline or global context.

"Communication" objective criteria

	Exemplary 3	**Accomplished 2**	**Competent 1**	**Insufficient Evidence 0**
1. Organization	Organization is **clear, consistent, observable,** and **skillful**; content is **cohesive.**	Organization is **clear, consistent & observable.**	Organization is **intermittently observable.**	Organization is **poor** or **not observable.**
2. Presentation	Work is **attractive, clean, clear, accurate,** visually **strong.**	Work is **well-produced, clear, mostly-accurate,** visually **effective.**	Work is **adequate** with **minor errors,** visually **inert.**	Work is **unclear, informal, minimally conveys intent,** and **error-prone.**
3. Quantitative Skills	Applied **innovative** and **insightful** mathematical methods and techniques. Demonstrates mathematical **mastery.**	Applied **situation-appropriate** mathematical methods and techniques. Demonstrates **solid** math skills.	Applied **basic** mathematical methods. Demonstrates **modest** math skills.	**Unable** to apply basic mathematical methods and techniques. **Insufficient** math skills.
4. Execution	Work is complete to levels **above expectation,** and turned in **early or on time.**	Work is **strong, complete,** and turned in **on time.**	Work is **adequate, complete,** and turned in **on time.**	Work is **incomplete** or **not turned in on time**
5. Connecting, Synthesizing	**Synthesizes** ideas or solutions into a coherent whole. **Creates** connections to higher-level discipline-specific concepts and practices.	**Connects** ideas or solutions in novel ways. **Recognizes** connections to higher-level discipline-specific concepts and practices.	**Acknowledges existing connections** among ideas or solutions.	**No recognition** of significance of exercise to discipline or global context.

Guidelines for Phase One ESA Project ENSC 4800 Seminar, Winter 2014

The following guidelines apply for the Brownfield Action ESA Project. The project is worth 50% of your grade in this course (per the syllabus). All submissions must be digital and in PDF format, with the exception of maps *(unless you would like to digitize your maps, which would be excellent)*.

Student deliverables

Each student must submit their own 8-10 page (plus Table of Contents for the body of the report) ESA report *(double-spaced, 12-point font, one-inch margins)*. Requirements for the report are outlined below.

ESA report

The report should include the following, in addition to a Table of Contents:

- *Physical Description:* Describe the surface topography of Self-Lume (SL) property and the entire "site." Include the shape of "site" and the dimensions, and acreage of both the "site" and SL property. Put dimensions, areas, and acreages in a chart. Give specific values for relief of the entire "site" and slope between SL septic tank to town well.
- *Subsurface:* Physical description of subsurface beneath SL property and entire "site" including sediment type, sediment size analysis (that is, range of particle sizes), % porosity, permeability, and surface bedrock topography.
- *Aquifer:* Physical description of aquifer under SL property and entire "site." Include: *(1)* the nature of the aquifer (What kind of aquifer is it?), *(2)* calculations of aquifer thicknesses (between water table elevations and bedrock elevations) at each well on "site." Put these calculations into a table. *(3)* direction of water flow from SL to town well, and *(4)* the velocity and time it would take for water to travel from SL to town well.
- *Self-Lume Property Concerns:* Itemize any findings at the SL property that are probable sources of contamination and warrant a Phase Two ESA.
- *"Site" Concerns:* Itemize any findings at the "site" that are probable sources of contamination and warrant a Phase Two ESA.

A note on grading

Grades will be assigned on an individual basis, so the ESA report will be the primary means of determining your project grade. However, high quality supporting documents are the basis for your ESA, so it is in your interest to do a good job on the maps, appendix, budget, etc.

I expect you to do a good job on this assignment – it is half of the course grade, two-thirds of the class time, and represents a great opportunity for you to apply the skills you have learned. Excellent work will receive an excellent grade *(a grading rubric will be distributed as we get further into the project)*.

Team deliverables

Each team must submit:

1) A cover letter to Seymour Buckmeister *(see below)*
2) One set of four maps (site map, topographical map, bedrock map, water table map)
3) Appendix of supporting documents
4) One-page, categorized budget (as the first page of the Appendix)

Cover Letter

The cover letter to Mr. Seymour Buckmeister should include:

1) Purpose for writing the report
2) Brief summary stating issues of concern at Self-Lume property
3) Summary of any solid evidence of contamination in Moraine Township (the "site")
4) State whether a Phase Two is recommended and provide rationale
5) Provide an itemized list of requirements for a Phase One ESA stated under the "Provisions and Specifications" found in the contract, which your company completed (items 15 a-k)

Appendix

The appendix should include:

1) A Table of Contents
2) A one-page, categorized budget (first page)
3) All supporting documents gathered throughout the investigation

Acknowledgements

The Brownfield Action simulation was created by Dr. Peter Bower of Barnard College and Columbia University. It is supported by the Columbia Center for New Media Teaching and Learning, and the National Science Foundation of the United States. This assignment is slightly adapted from Dr. Bower's, and many of the documents used in this part of the class were originally created as a result of Dr. Bower's work. I am eternally grateful for Dr. Bower's work and for the use of his shared materials. – *M.M., January 2014*

CALIFORNIA STATE UNIVERSITY EAST BAY

Academic Roadmap

Department of Earth and Environmental Sciences
B.S. in Environmental Science
Option in Environmental Systems and Resource Management

Note: This roadmap is an example of one schedule that will enable you to graduate in four years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

YEAR 1 (0 – 45 UNITS)	FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
	CHEM 1101 Gen. Chem. I	(5)	CHEM 1102 Gen. Chem. II	(5)	CHEM 1103 Gen. Chem. III	(5)	GE: General Elective ME: Major Elective
					ENSC 2900 Field Activity	(3)	
	Cluster		Cluster		Cluster		
	GS 1011 GE Activities I	(1)	ENGL 1001 College Writing I	(4)	GS 1013 GE Activities III	(1)	
	GE:		GE:				
	TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
					TOTAL UNITS FOR YEAR		

Year 1 (0 – 45 units)

You should . . .

Complete your Freshman Cluster Classes

and consider . . .

Take General Education courses

CALIFORNIA STATE UNIVERSITY EAST BAY

YEAR 2 (46 - 90 UNITS)	FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
	ENSC 2800 Env. Prob. of CA	(4)	ENSC 2400 Env. Biology & ENSC 2401 Env. Biology Lab	(4) (1)	ME (year 2 or year 3):		GE: General Elective ME: Major Elective
	PHYS 2701 Intro to Physics I	(4)	PHYS 2702 Intro to Physics II	(4)	PHYS 2703 Intro to Physics III	(4)	**ME: Major Elective** ***(Must complete one course from the following):*** ECON 4306 Environmental Econ (4), GEOG 4330 Sustainable Development (4), HIST 3505 CA Environmental History (4), PHIL 3151 Environmental Ethics (4), POSC 3460 Environmental Law (4), POSC 4171 Pub Policy and Environment (4); ***(and one course from the following list):*** ENSC 3999 Issues in Environmental Sciences (4), ENSC 4140 Hazardous Waste Management (4), ENSC 4200 Global Change (4) *(Note: Up to 8 units of the required core elective courses may also count for GE)*
	ENSC 2210, & ENSC 2211 Env. Geol. Lab	(5)	STAT 3010 Stat. Meth. in Soc. Sci. or STAT 3031 Stat. Meth. in Bio.	(4) (4)	MATH 1304 Calculus I	(4)	
	GE:		GE:		GE:		
	TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
					TOTAL UNITS FOR YEAR		

Year 2 (46– 90 units)

You should . . .

Complete areas A1-A4
Complete lower division GE requirements
Complete English 1002
Declare a major
Meet with your major advisor
Meet with an AACE advisor

and consider . . .

Attend "Strictly Sophomores"
Apply to CSSP or summer internship
Explore student organizations
Explore leadership opportunities

CALIFORNIA STATE UNIVERSITY EAST BAY

YEAR 3 (91 – 135 UNITS)

FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
BIOL 3110 Princ. of Ecology	(4)	ENVT 4100 Env. Impact Analysis	(4)	GEOG 3000 Resource Mgmt.	(4)	GE: General Elective ME: Major Elective
GEOL 2600 Intro. to GIS	(4)	ENSC 3500 Env. Hydrology	(5)	ME (year 2 or year 3):		**Technique Courses –** *Students must complete two or three courses (8-15 units) from the following list:* ENVT 4910 Internship (2-4), ENVT 3400 Env. Res. Analysis (4), GEOG 3030 Exploring GIS (4), 3410 Air Photo Interpretation (4), 3450 Literature and Research Methods (5), 3605 Computer Cartography (5), 4425 Remote Sensing of Earth Environments (4), 4605 Environmental Applications of GIS (5)
Technique Course:		Knowledge Course :		Technique Course:		
GE:		GE:		GE:		
TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
TOTAL UNITS FOR YEAR						**Knowledge Courses –** *Students must complete two or three courses (7-13 units)* GEOG 4130 Biogeography (4), ENVT 4800 Senior Seminar in Env. Studies (3), 4320 Energy and Society (4), 4350 Water Resources and Mgmt (4), 4355 Watershed Mgmt (4), GEOL 3110 Principles of Geomorphology or GEOG 3115 Physical Landscape Analysis (4), **One of the following for Knowledge Courses:** ENVT 4300 Environmental Field Studies (5) or GEOG 4125 Field Physical-Biotic Geography (4) or ENVT/GEOG 3480 Applied Field Studies (4)

Year 3 (91– 135units)

You should . . .

Take the Writing Skills Test in fall quarter
Enroll in ENGL 3000 if needed
Complete at least one upper division GE requirement

and consider . . .

Meet with your major advisor
Meet with AACE advisor
Attend the Graduate School Fair
Seek leadership opportunities in a club or student government

CALIFORNIA STATE UNIVERSITY EAST BAY

YEAR 4 (136 – 180 UNITS)	FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
	Technique Course:	(2-5)	ENSC 4800 Env. Sci. Seminar	(3)	Technique Course:		GE: General Elective ME: Major Elective
	ME:		Knowledge Course		Knowledge Course:		
	GE:		GE:		GE:		
	TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
					TOTAL UNITS FOR YEAR		

Year 4 (136 – 180 units)

You should . . .

File for graduation
Complete upper division GE requirements
Take Major Requirement Electives (ME)

and consider . . .

Meet with major advisor
Meet with AACE advisor
Attend a Career Fair
Attend the Graduate School Fair
Conduct information interviews in your field

TOTAL UNITS ON PLAN	
MAJOR UNITS	
FRESHMAN CLUSTER UNITS	
GENERAL EDUCATION UNITS	
UNRESTRICTED ELECTIVE UNITS	

CALIFORNIA STATE UNIVERSITY EAST BAY

Academic Roadmap

Department of Earth & Environmental Sciences
B.S. in Environmental Science
Option in Life Science

Note: This roadmap is an example of one schedule that will enable you to graduate in four years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

YEAR 1 (0 – 45 UNITS)	FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
	CHEM 1101 Gen. Chem. I	(5)	CHEM 1102 Gen. Chem. II	(5)	CHEM 1103 Gen. Chem. III	(5)	GE: General Elective ME: Major Elective
	GE:		BIOL 1402 Plant Biology	(5)	BIOL 1403 Animal Biology	(5)	
	GS 1011 GE Activities I	(1)	ENGL 1001 College Writing I	(4)	GS 1013 GE Activities III	(1)	
	Cluster		Cluster		Cluster		
	TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
					TOTAL UNITS FOR YEAR		

Year 1 (0 – 45 units)

You should . . .

Complete your Freshman Cluster Classes

and consider . . .

Taking General Education courses

CALIFORNIA STATE UNIVERSITY EAST BAY

YEAR 2 (46 - 90 UNITS)	FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
	ENSC 2800 Env. Prob. of CA	(4)	ME (year 2 or year 3):		ENSC 2900 Field Activity	(3)	GE: General Elective ME: Major Elective
	PHYS 2701 Intro to Physics I	(4)	PHYS 2702 Intro to Physics II	(4)	PHYS 2703 Intro to Physics III	(4)	**ME: Major Elective courses:** ***Must complete two courses from the following:*** ECON2301 Principles of Microeconomics (4), ECON 4306 Environmental Economics (4), HIST 3505 California Environmental History (4), PHIL 3151 Environmental Ethics (4), POSC 3460 Environmental Law (4), POSC 4171 Public Policy and Environment (4)
	ENSC 2210,& ENSC 2211 Env. Geol. Lab	(5)	STAT 3010 Stat. Meth. in Soc. Sci. or STAT 3031 Stat. Meth. in Bio.	(4) (4)	MATH 1304 Calculus I	(4)	
							Note: Up to 8 units of the required core elective courses may also count for GE
	GE:		GE:		GE:		
	TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
					TOTAL UNITS FOR YEAR		

Year 2 (46– 90 units)

You should . . .

Complete areas A1-A4
Complete lower division GE requirements
Complete English 1002
Declare a major
Meet with your major advisor
Meet with an AACE advisor

and consider . . .

Attend "Strictly Sophomores"
Apply to CSSP or summer internship
Explore student organizations
Explore leadership opportunities

CALIFORNIA STATE UNIVERSITY EAST BAY

YEAR 3 (91 – 135 UNITS)

FALL	UNITS	WINTER	UNITS	SPRING	UNITS
BIOL 3110 Princ. of Ecology	(4)	ENVT 4100 Env. Impact Analysis	(4)	GEOG 3000 Resource Mgmt.	(4)
GEOL 2600 Intro. to GIS	(4)	ENSC 3500 Env. Hydrology	(5)	ME (year 2 or year 3):	
GE:		BIOL 4351 Biological Conservation	(4)	Option Course:	
GE:		GE:		GE:	
TOTAL UNITS		TOTAL UNITS		TOTAL UNITS	
				TOTAL UNITS FOR YEAR	

NOTES

GE: General Elective
ME: Major Elective

Option Courses –
***Must complete 18 units from the following*:**

BIOL 3215 Marine Biology (4)
or
M SC 4103 Marine Ecology (6);
BIOL 3216 Freshwater Environments (4),
3898 Cooperative Education (2),
4175 Population Biology (4),
4200 Plant Taxonomy (4),
4300 General Entomology (4),
4340 Environmental Microbiology (4),
4518 Animal Behavior (4),
4530 Ecological Methods (4),
4560 Wildlife Ecology (4),
4565 Ornithology (4),
4575 Herpetology (4),
4583 Vertebrate Biology (4),
M SC 4104 Quantitative Marine Science (6),
4144 Biological Oceanography (6),
BIOL 4516 Environmental Animal Physiology (4),
BIOL 4517 Environmental Toxicology (4)

Year 3 (91– 135units)

You should . . .

Take the Writing Skills Test in fall quarter
Enroll in ENGL 3000 if needed
Complete at least one upper division GE requirement

and consider . . .

Meet with your major advisor
Meet with AACE advisor
Attend the Graduate School Fair
Seek leadership opportunities in a club or student government

CALIFORNIA STATE UNIVERSITY
EAST BAY

YEAR 4 (136 – 180 UNITS)	FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
	Option Course:		ENSC 4800 Env. Sci. Seminar	(3)	Option Course:		GE: General Elective ME: Major Elective
	ME:		Option Course		Option Course:		
	GE:		GE:		GE:		
	TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
					TOTAL UNITS FOR YEAR		

Year 4 (136 – 180 units)

You should . . .

File for graduation
Complete upper division GE requirements
Take Major Requirement Electives (ME)

and consider . . .

Meet with major advisor
Meet with AACE advisor
Attend a Career Fair
Attend the Graduate School Fair
Conduct information interviews in your field

TOTAL UNITS ON PLAN	
MAJOR UNITS	
FRESHMAN CLUSTER UNITS	
GENERAL EDUCATION UNITS	
UNRESTRICTED ELECTIVE UNITS	

CALIFORNIA STATE UNIVERSITY EAST BAY

Academic Roadmap

Department of Earth and Environmental Sciences
B.S. in Environmental Science
Option in Physical Science

Note: This roadmap is an example of one schedule that will enable you to graduate in four years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

YEAR 1 (0 – 45 UNITS)	FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
	Cluster		Cluster		Cluster		GE: General Elective ME: Major Elective
	CHEM 1101 Gen. Chem. I	(5)	CHEM 1102 Gen. Chem. II	(5)	CHEM 1103 Gen. Chem. III	(5)	
					ENSC 2900 Field Activity	(3)	
	GS 1011 GE Activities I	(1)	ENGL 1001 College Writing I	(4)	GS 1013 GE Activities III	(1)	
	GE:		GE:		GE:		
	TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
					TOTAL UNITS FOR YEAR		

Year 1 (0 – 45 units)

You should . . .

Complete your Freshman Cluster Classes

and consider . . .

Taking General Education courses

CALIFORNIA STATE UNIVERSITY EAST BAY

YEAR 2 (46 - 90 UNITS)

FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
ENSC 2800 Env. Prob. of CA	(4)	ENSC 2400 Env. Biology and ENSC 2401 Env. Biology Lab	(4) (1)	MATH 1304 Calculus I	(4)	GE: General Elective ME: Major Elective
PHYS 2701 Intro to Physics I	(4)	PHYS 2702 Intro to Physics II	(4)	PHYS 2703 Intro to Physics III	(4)	**ME: Major Core Elective courses:** ***Must complete one course from the following:***
ENSC 2210, Env. Geol.	(4)	STAT 3010 Stat. Meth. in Soc. Sci. or STAT 3031 Stat. Meth. in Bio.	(4) (4)			ECON 4306 Environmental Economics (4), GEOG 4330 Sustainable Development (4), HIST 3505 California Environmental History (4), PHIL 3151 Environmental Ethics (4), POSC 3460 Environmental Law (4), POSC 4171 Public Policy and Environment (4);
ENSC 2211 Env. Geol. Lab	(1)					***and one course from the following list:*** ENSC 3999 Issues in Environmental Sciences (4), ENSC 4140 Hazardous Waste Management (4), ENSC 4200 Global Change (4) *Note: Up to 8 units of the required core elective courses may also count for GE*
GE:		GE:		GE:		
TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
				TOTAL UNITS FOR YEAR		

Year 2 (46– 90 units)

You should . . .

Complete areas A1-A4
Complete lower division GE requirements
Complete English 1002
Declare a major
Meet with your major advisor
Meet with an AACE advisor

and consider . . .

Attend "Strictly Sophomores"
Apply to CSSP or summer internship
Explore student organizations
Explore leadership opportunities

CALIFORNIA STATE UNIVERSITY EAST BAY

YEAR 3 (91 – 135 UNITS)

FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
BIOL 3110 Princ. of Ecology	(4)	ENVT 4100 Env. Impact Analysis	(4)	GEOG 3000 Resource Mgmt.	(4)	GE: General Elective ME: Major Elective
GEOL 2600 Intro. to GIS	(4)	ENSC 3500 Env. Hydrology	(5)	ME:		**Option Courses –** ***Must complete 22 units from the following list:***
Option Course :		Option Course :		Option Course:		*CHEM 2200 Quantitative Analysis (5),* *CHEM 2301 Survey of Org. Chem I (4),* *CHEM 2302 Survey of Org. Chem II (4),* *CHEM 4601 Environmental Chemistry I (5),* *CHEM 4602 Environmental Chemistry II (5),* *GEOL 3110 Principles of Geomorphology (4),* *GEOL 3601 Mineralogy (5),* *GEOL 3701 Igneous and Metamorphic Petrology (5),* *GEOL 3801 Sedimentology and Stratigraphy (5),* *GEOL 3810 Structural Geology (5),* *GEOL 3910 Geologic Field Methods (3),* *GEOL 4010 Applied Geophysics (5),* *GEOL 4130 Survey of Geochemistry (4),* *GEOL 4320 Hydrogeology (5),* *MATH 1305 Calculus II (4),* *4900 Independent Study (2),* *3898 Cooperative Education (Internship)*
GE:		GE:		GE:		
TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
TOTAL UNITS FOR YEAR						

Year 3 (91– 135units)

You should . . .

Take the Writing Skills Test in fall quarter
Enroll in ENGL 3000 if needed
Complete at least one upper division GE requirement

and consider . . .

Meet with your major advisor
Meet with AACE advisor
Attend the Graduate School Fair
Seek leadership opportunities in a club or student government

CALIFORNIA STATE UNIVERSITY
EAST BAY

YEAR 4 (136 – 180 UNITS)	FALL	UNITS	WINTER	UNITS	SPRING	UNITS	NOTES
	Option Course:		ENSC 4800 Env. Sci. Seminar	(3)	Option Course:		GE: General Elective ME: Major Elective
	ME:		Option Course		Option Course:		
	GE:		GE:		GE:		
	Unrestricted Elective:		Unrestricted Elective:		Unrestricted Elective:		
	TOTAL UNITS		TOTAL UNITS		TOTAL UNITS		
					TOTAL UNITS FOR YEAR		

Year 4 (136 – 180 units)

You should . . .

File for graduation
Complete upper division GE requirements
Take Major Requirement Electives (ME)

and consider . . .

Meet with major advisor
Meet with AACE advisor
Attend a Career Fair
Attend the Graduate School Fair
Conduct information interviews in your field

TOTAL UNITS ON PLAN	
MAJOR UNITS	
FRESHMAN CLUSTER UNITS	
GENERAL EDUCATION UNITS	
UNRESTRICTED ELECTIVE UNITS	