Glendale Unified School District

High School

June 18, 2019

Department:	Career Technical Education / Science
Course Title:	Honors Environmental GIS
Course Code:	7128V/7129V
Grade Level(s):	11-12
School(s) Course Offered:	Clark Magnet High School
UC/CSU Approved (Y/N, Subject):	College-Preparatory Elective (D) / Laboratory Science – Integrated Science with honors designation
Course Credits:	10
Required Prerequisites:	Grade of C or better in Science Research and Geology of Disasters
Recommended Prerequisite:	Integrated I and Physics, Biology, or Chemistry (can be concurrent)
Recommended Textbook:	The ArcGIS Book: 10 Big Ideas about Applying The Science of Where
Supplementary Textbook:	Environmental Science for AP, by Friedland and Relyea
Course Overview:	Honors Environmental GIS is the capstone course for the Environmental Engineering Pathway, Engineering and Architecture industry sector. Honors Environmental GIS is a course that integrates geospatial technologies with environmental science. The course incorporates the use of geographic information systems in science, government, and business to evaluate and address environmental issues and to promote sustainability. Students are trained to use a remotely operated vehicle with sonar and GPS to collect marine spatial data. Field work is

emphasized and field trips are a major component of the class. The course focuses on project based, student directed learning aimed toward entering original research into science competitions. Students will follow the project management book of knowledge in this course and implement the five phases of project management throughout each unit. Each project will include a GIS component utilizing spatial data collection through Esri mobile apps, data analysis using ArcGIS Pro and/or ArcGIS Online, and communication of results using Esri story maps. The format of the course is iterative, allowing students to improve their skills and advance their understanding of the process of science throughout each unit. Student groups will identify and collaborate with industry partners on each project.

Course Content-First Semester

Unit 1: **Identification and Mitigation of a Local Land/Water Environmental Issue** (*10 weeks)*

STANDARDS

CTE Career Readiness Standards: 2.1-2.6, 3.6, 4.1-4.4, 4.6, 5.1-5.4, 6.1, 6.3, 6.4, 6.6, 7.3-7.7, 8.4, 8.6, 9.1-9.4, 9.6, 9.7, 10.1-10.4

Career Technical Education Engineering & Architecture Standards: D1.1, D2.1-2.7, D3.1, D3.2, D3.4, D3.6-D3.8, D6.1-D6.5, D8.1-D8.3, D9.1-9.5, D10.1-10.8, D13.1-13.5, D14.1-14.6,

Common Core State Standards: ESS3A, C, ETS1 A, B, C, LS11-12.1, LS11-12 RLST 11-12.2, 11-12.4, 11-12.7, 11-12.10 WS 11-12.1, 11-12.2, 11-12.4, 11-12.5, 11-12.6, 11-12.7, 11-12.8 WHSST 11-12.2, 11-12.5, 11-12.6, 11-12.7, 11-12.8 SEP 1-8

A. In this unit, students compare and contrast the scientific method with the engineering design process as they explore an overview of environmental topics affecting the lithosphere and biosphere. Topics surrounding Earth's systems, biodiversity, pollution, land and water resources are emphasized. Students will learn to validate sources as they research local environmental issues. They will be able to summarize key points from informational text and audio podcasts from the World Ocean Radio on current environmental topics. Students will collaborate in teams to choose a specific topic to research in depth. Together, students will produce an action plan identifying an issue, proposing mitigation steps that will be taken, how they implemented their ideas, and evaluating the success of their project. Each team will submit their project to a science competition before the deadline.

B. Key Assignments

Literature Review: In this assignment, students work in small groups to identify and evaluate the impacts of human activities on the land/water issue. Through research, students will construct explanations for both sides of the environmental issue. They will take a position and use claim, evidence, reasoning to engage in argument from evidence to support their position. Students will produce a written literature review using validated sources and proper source citing in the MLA format.

Project Proposal: Students will develop an experimental design that incorporates the summary and rationale for their proposed project, statement of need, the methods and materials they will use in their study, metrics they will use to measure success, a budget, timeline and references.

Action Plan: Students will complete an Action Plan for the Land Water Challenge portion of the Lexus Eco Challenge. Using Google Slides, students will collaborate to integrate their literature review and project proposal into part one and two of the action plan. They will implement their plan and provide evidence of success through documentation and analysis of their data. Students will create original images, maps, graphs and graphics for their action plans and meet all deadline submission requirements. They will evaluate the success of their projects using the metrics they set in their project proposals.

Lab: Spatial Analysis of Contaminants in Marine Sediments
Students will use GIS to identify a study area, then design an experiment to collect, map and analyze marine sediments for contaminants. Chemical analysis will be performed under the supervision of professional chemists at the California State University, Long Beach Institute for Integrated Research on Materials, Environment and Society (IIRMES) laboratory. Students will graph results using Excel or Google Spreadsheets. The lab report will be integrated into a story map to showcase the finished project.

Presentation: Students will present their project at a formal conference or symposium. The format of their presentation can be either a poster or paper presentation as a slideshow or storymap.

Unit 2: **Identification and Mitigation of a Local Air/Climate Environmental Issue** (*10 weeks)*

STANDARDS

CTE Career Readiness Standards: 2.1-2.6, 3.6, 4.1-4.4, 4.6, 5.1-5.4, 6.3, 6.4, 6.6, 7.3-7.7, 8.4, 8.6, 9.1-9.4, 9.6, 9.7, 10.1-10.4

Career Technical Education Engineering & Architecture Standards: D1.1, D2.1-2.7, D4.1-4.7, D6.1, D8.1-D8.3, D11.1-11.5, D12.1-12.4

Common Core State Standards: ESS3A, C, D, ETS1 A, B, C, LS 11-12.1, LS 11-12 RLST 11-12.2, 11-12.4, 11-12.7, 11-12.10 WS 11-12.1, 11-12.2, 11-12.4, 11-12.5, 11-12.6, 11-12.7, 11-12.8 WHSST 11-12.2, 11-12.5, 11-12.6, 11-12.7, 11-12.8, SEP 1-8

A. In this unit, students investigate environmental issues affecting the atmosphere. Air pollution, ozone depletion, greenhouse gases, climate change, fossil fuels and renewable energy are focused on as students use the scientific method and engineering design process to design an original research project to help mitigate the environmental problem they've identified. Students will collaborate in teams to choose a specific topic to research in depth. Students will collect and analyze air/climate data using geospatial technologies. Together, students will produce an action plan identifying an issue, proposing mitigation steps that will be taken, how they implemented their ideas, and evaluating the success of their project. Each team will submit their project to a science competition before the deadline.

B. Key Assignments

Literature Review: In this assignment, students work in small groups to identify and evaluate the impacts of human activities on a local air/climate issue. Through research, students will construct explanations for both sides of the environmental issue. They will take a position and use claim, evidence, reasoning to engage in argument from evidence to support their position. Students will produce a written literature review using validated sources and proper source citing in the MLA format.

Project Proposal: Students will develop an experimental design that incorporates the summary and rationale for their proposed project, statement of need, the methods and materials they will use in their study, metrics they will use to measure success, a budget, timeline and references.

Action Plan: Students will complete an Action Plan for the Air/Climate Challenge portion of the Lexus Eco Challenge. Using Google Slides, students will collaborate to integrate their literature review and project proposal into part one and two of the action plan. They will implement their plan and provide evidence of success through documentation and analysis of their data in part three of their action plan. Students will create original images, maps, graphs and graphics for their action plans and meet all deadline submission requirements. They will evaluate the success of their projects using the metrics they set in their project proposals in part four of the action plan.

Lab: Air Quality Assessment
Students will design an experiment using the Atmotube personal air quality monitor to collect, map, and analyze air quality data. They will import their data into ArcGIS Online for further analysis and display the culmination of the project in a story map format. Students will generate graphs of their data that will be included in their final lab report.

Presentation: Students will present their project at a formal venue. The format of their presentation can be either a poster or paper presentation as a slideshow or storymap.

Course Content-Second Semester

Unit 3: <u>Scaling up a Project to a Global Perspective</u> (*10 weeks)*

STANDARDS

CTE Career Readiness Standards: Same as Units 1 & 2 with the addition of: 7.8, 9.5

Career Technical Education Engineering & Architecture Standards: D1.1, D2.1-2.7, D8.1-D8.3,

Common Core State Standards: ESS3A, C, D, ETS1 A, B, C, LS 11-12.1, LS 11-12 RLST 11-12.2, 11-12.4, 11-12.7, 11-12.10 WS 11-12.1, 11-12.2, 11-12.4, 11-12.5, 11-12.6, 11-12.7, 11-12.8 WHSST 11-12.2, 11-12.5, 11-12.6, 11-12.7, 11-12.8, SEP 1-8

A. Students will take an earlier project completed in this class and examine the issue at the global scale. They will re-engineer an experimental design in order to collect global data and reach a global audience for outreach and education. An action plan will be created and submitted to the Final Challenge of the Lexus Eco Challenge, meeting all deadlines requirements.

B. Key Assignments

Project Proposal: Students will develop an experimental design that incorporates the summary and rationale for their proposed project, statement of need, the methods and materials they will use in their study, metrics they will use to measure success, a budget, timeline and references.

Lab: Design a Solution to Overfishing
Students use the Benthic Terrain Modeler GIS program to produce a map that identifies suitable habitat for a species of rockfish of their choice. Student habitat suitability models will be ground truthed in the field on a fishing charter. Before the field trip, students will follow the engineering design process and use Google Sketchup or a CADD program to design a descending device to alleviate barotrauma caused by rapid decompression of the fishes' gas bladder and return rockfish safely to depth. Students will build and test a prototype, and revise as necessary before a field test on the fishing charter. In the field, additional revisions to the design will be made until a working prototype is developed. Students will integrate their maps, multimedia, and models into a story map to showcase their project.

Action Plan: Students will complete an Action Plan for the Final Challenge portion of the Lexus Eco Challenge. Using Google Slides, students will collaborate to integrate their project proposal into part one and two of the action plan. They will implement their plan and provide evidence of success through documentation and analysis of their data in part three of the action plan. Students will create original images, maps, graphs and graphics for their action plans and meet all deadline submission requirements. They will evaluate the success of their projects using the metrics they set in their project proposals in part four of the action plan.

Presentation: Students will present their project at a formal venue. The format of their presentation can be either a poster or paper presentation as a slideshow or storymap.

Unit 4: **GIS Young Professional** (*10 weeks)*

STANDARDS

CTE Career Readiness Standards: 2.4, 3.1-3.9, 8.4, 9.4, 11.1-11.5

Career Technical Education Engineering & Architecture Standards: D1.1

Common Core State Standards: LS 11-12.1, 11-12.2, RLST 11-12.2, 11-12.10, WHSSST 11-12.1, 11-12.2, 11-12.4, 11-12.5, 11-12.6, 11-12.8

A. Students will update their resumes highlighting their GIS skills and any awards, accomplishments, achievements attained through the GIS Pathway. Each student will choose one or more additional contest or competitive scholarship to apply that will showcase their GIS skills or project. Students will act as mentors to underclassmen or teachers interested in learning or applying GIS in education. Students will seek out and apply for summer internship opportunities where they can apply their GIS skillset. Each student will participate in an Esri MOOC of their choosing to further their GIS skills and earn an industry certificate in GIS.

B. Key Assignments

- **Design a Lesson Plan**
  Students will either use their own original research, or course content of another class to create a lesson plan using ArcGIS Online that can be used by students with no prior GIS experience. Students will work with a teacher of their choice to pilot their lesson plan in the classroom. They will collect feedback from students and revise the lesson as necessary. The final version of the lesson plan will be shared with teachers in the content area.

- **Esri MOOC**
  https://www.esri.com/training/mooc/
  These free online classes offer a convenient, effective, and fun way to keep up with the fast-paced developments in geospatial technology. Classes are four to six weeks long and participants can study whenever they have spare time. A certificate is available upon completion.

- **Comprehensive Written Final**

Final Capstone Project

Scholarships/Awards: Students will identify and apply for at least one competitive scholarship or recognition award. Options include but are not limited to the following:

- USGIF Scholarship: To further the advancement of the geospatial tradecraft, USGIF is dedicated to assist promising students studying GEOINT, geospatial sciences, and related fields. The annual USGIF Scholarship Program recognizes the achievements of graduating high school seniors, undergraduate, graduate, and doctoral students.Scholarship recipients are selected based on their academic and professional excellence. Doctoral, graduate, and undergraduate winners receive $5,000, while graduating high school seniors are awarded $2,000. Students interested in using capabilities of geospatial science, data and technologies to address human security challenges are all encouraged to submit applications. Past scholarship recipients are encouraged to apply.

- President's Environmental Youth Award: The President's Environmental Youth Award (PEYA) recognizes outstanding environmental projects by K-12 youth. The PEYA program promotes awareness of our nation's natural resources and encourages positive community involvement. Since 1971, the President of the United States has joined with EPA to recognize young people for protecting our nation's air, water, land, and ecology. It is one of the most important ways EPA and the Administration demonstrate commitment to environmental stewardship efforts created and conducted by our nation's youth.

- Skills USA: SkillsUSA empowers its members to become world-class workers, leaders and responsible American citizens. SkillsUSA improves the quality of our nation's future skilled workforce through the development of Framework skills that include personal, workplace and technical skills grounded in academics.

  Students will compete in a Technical Skills or Leadership category in the Skills USA program.