DEPARTMENT: Science COURSE: Environmental Engineering

Curriculum Development Timeline

School: Township of Ocean Intermediate School

Course: Environmental Engineering

Department: Science

Board Approval	Supervisor	Notes
August 2021	Patrick Sullivan	Born Date
August 2024	Patrick Sullivan	Updated to include New State Mandates

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Township of Ocean Pacing Guide			
Week	**Quarter 1/ Quarter 3**	**Week**	**Quarter 2/ Quarter 4**
1	Exploring Environmental Concerns: Local Wildlife Habitat (terrapins), Individual Carbon Footprint Analysis	11	Engineer a Solution: Create a prototype, event planning and scheduling
2	Exploring Environmental Concerns: (Air, Water, Soil: Pollution)	12	Engineer a Solution: Create a Prototype
3	Exploring Environmental Concerns: (Deforestation, Genetic Modification)	13	Engineer a Solution: Create a Prototype, calculate costs and profits (impact)
4	Exploring Environmental Concerns: (Increasing Carbon Footprint, Climate Change/ Global Warming)	14	Engineer a Solution: Test and make adjustments to the prototype
5	Exploring Environmental Concerns: Roles of Environmental Engineers	15	Engineer a Solution: Test and Evaluate Prototype
6	Engineer a Solution: Define the Impact Area and Research	16	Engineer a Solution: Final Product
7	Engineer a Solution: Imagine Possible Solutions and Determine Best Contest	17	Communicate Results: Writing an article, meet/contact sources, participate in an event, create video or other presentation.

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8	Engineer a Solution: Create a "Pitch"- Overview of the Concept	18	Communicate Results: Writing an article, meet/contact sources, participate in an event, create video or other presentation.
9	Engineer a Solution: Choose the best solution and begin Shark Tank Presentation.	19	Communicate Results: Writing an article, meet/contact sources, participate in an event, create video or other presentation.
10	Engineer a Solution: Marketing- Social Media set up	20	Communicate Results: Final Shark Tank Presentation/ Submit Project

Core Instructional & Supplemental Materials including various levels of Texts
Sustainable Jersey School: https://www.sustainablejerseyschools.com/ Elevate Science, People and the Planet: https://caravanlab.com/ Gardening Activities: https://kidsgardening.org/garden-activities-earth-day-fun/?mc_cid=e43e5b62c7&mc_eid=60d7e55c7e%C2%A0 Phet Simulations National Geographic NOAA Website Environmental Engineering Projects: https://www.sciencebuddies.org/science-fair-projects/science-projects/environmental-engineering/middle-school Environmental Activities/Resources: http://teachers.egfi-k12.org/tag/environmental-engineering/

Time Frame	**Unit 1 (5 Weeks)**
Topic	
Exploring Environmental Concerns	
Alignment to Standards	

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MS-ESS3-1: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused climate change over the past century.
MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Learning Objectives and Activities

Learning Objectives:
By the end of the unit, students will:
- Understand human impact on the environment.
- Identify how they are affecting the carbon cycle.
- Relate human impact on the environment to a local terrapin species.

Learning Activities:
- Research local Diamondback Terrapin. Understand their environmental needs while relating it to why they are a species of special concern in New Jersey.
- Participate in a carbon footprint assessment to understand how individual students are affecting the carbon cycle.
- Using Newsela, and other resources, read about how humans have negatively impacted the environment and how it is affecting the earth.
- Research careers in Environmental Engineering to understand what this field accomplishes.

Assessments

Formative:
- Class discussion on reading assignments
- Guided discussions
- Google Classroom Posts and Online Discussions

- List and describe threats to the planet/environment
- Analyze graphics depicting human impacts to the environment

Summative:
- Research Presentation
- Carbon Cycle Project
- Writing Tasks

Benchmark:
-

Alternative:
- Topic debate on climate change
- Further research and presentation

Interdisciplinary Connections

New Jersey Student Learning Standards

ELA:
RI.CR.7.1. Cite several pieces of textual evidence and make relevant connections to support analysis of what an informational text says explicitly, as well as inferences drawn from the text.
RI.CI.7.2. Determine a central idea in an informational text and explain how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.
RI.MF.7.6. Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information.
W.AW.7.1. Write arguments on discipline-specific content (e.g. social studies, science, math, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence.
RI.AA.7.7: Trace and evaluate the argument and specific claims in a text, assessing the reasoning is sound and the evidence is relevant and sufficient to support the claims.
W.SE.7.6: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Career Readiness, Life Literacies, and Key Skills

9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.
9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.

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9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4). **9.4.8.CT.1**: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2). **9.4.8.GCA.2:** Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
Technology Integration
8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best.
Career Education
CRP2. Apply appropriate academic and technical skills. **CRP4.** Communicate clearly and effectively and with reason. **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them. **CRP11.** Use technology to enhance productivity.

Time Frame	**Unit 2 (5 Weeks)**
Topic	
Engineer a Solution: Define the Impact Area and Research	
Alignment to Standards	
MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. **MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. **MS-ETS1-2:** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	

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MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Learning Objectives and Activities

Learning Objectives:
By the end of the unit, students will:
- Gain a deeper understanding of a specific negative environmental human impact on the earth.
- Identify how their interest issue is affecting the carbon cycle.
- Identify possible solutions to their impact area of interest

Learning Activities:
- Students will use the internet and library resources to research an area that they are interested in to better understand how humans play a role in negatively impacting the environment.
- Using the internet, students will research solutions that are already positively impacting the environment that relate to their specific area of interest.
- Create a “pitch” for the Shark Tank Presentation
- Market Design
- Research and Develop
- Event Scheduling

Assessments

Formative:
- Weekly check in’s
- Recorded report on progress
- Class discussion
- Quick Pitch

Summative:
- Project Construction
- Blueprint/ Action Plan

Benchmark:
-

Alternative:
- Carbon cycle presentation for specific interest area

Interdisciplinary Connections

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New Jersey Student Learning Standards

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RI.CI.7.2. Determine a central idea in an informational text and explain how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.
RI.MF.7.6. Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information.
W.AW.7.1. Write arguments on discipline-specific content (e.g. social studies, science, math, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence.
RI.AA.7.7: Trace and evaluate the argument and specific claims in a text, assessing the reasoning is sound and the evidence is relevant and sufficient to support the claims.
W.SE.7.6: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Career Readiness, Life Literacies, and Key Skills

9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1)
9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Technology Integration

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.

Career Education

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

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CRP11. Use technology to enhance productivity.

Time Frame	**Unit 3 (6 Weeks)**
Topic	
Engineer a Solution: Prototype	
Alignment to Standards	
MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. **MS-ETS1-2:** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. **MS-ETS1-3:** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. **MS-ETS1-4:** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	
Learning Objectives and Activities	
Learning Objectives: *By the end of the unit, students will:* ● Gain a deeper understanding of a specific negative environmental human impact on the earth. ● Design an action plan for a solution to their impact area of interest. ● Create the solution to their impact area of interest. ● Perfect design solution. ● Create a plan on budget and impact to the environment. **Learning Activities:** ● Using the Engineering Design Process, students will choose their favorite design solution and work toward developing a prototype or action to teach the community how to have a sustainable future. ● A shark tank presentation will be created in order to explain the budget, design, and prediction on how this can save the environment. ● Calculating costs and profits (impact on environment)	
Assessments	

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Formative:
- Budget and supplies presentation
- Prototype Design
- Weekly check in's
- Recorded report on progress
- Class discussion

Summative:
- Project Construction
- Blueprint/ Action Plan

Benchmark:
-

Alternative:
-

Interdisciplinary Connections

New Jersey Student Learning Standards

ELA:

W.AW.7.1. Write arguments on discipline-specific content (e.g. social studies, science, math, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence.
RI.AA.7.7: Trace and evaluate the argument and specific claims in a text, assessing the reasoning is sound and the evidence is relevant and sufficient to support the claims.
W.SE.7.6: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Career Readiness, Life Literacies, and Key Skills

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Technology Integration

8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.

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8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem. **8.2.8.ED.3:** Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
Career Education
CRP2. Apply appropriate academic and technical skills. **CRP4.** Communicate clearly and effectively and with reason. **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them. **CRP11.** Use technology to enhance productivity.

Time Frame	**Unit 4(4 Weeks)**
Topic	
Communicate Results	
Alignment to Standards	
NJSLS-S from previous Units	
Learning Objectives and Activities	
Learning Objectives: *By the end of the unit, students will:* ● Produce a final shark tank project to present to peers and the community. ● Enter into a contest to reach as many people as possible ● Reflect on projects and impact ● Make contacts within the community **Learning Activities:** ● Students will determine the best way to share their results with the community and peers. ● A visual presentation including budget and impact will be constructed. ● Submit a final project to the community contest that will be most related to the environmental issue selected. ● Community connections and outreach ● Submit article to media ● Participate in environmental event	

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Assessments
Formative: • Community action plan • Observational Assessment • Individual Meetings **Summative:** • Final Submission of project • Article for Paper **Benchmark:** • Shark Tank Presentation **Alternative:** • Social Media Posts
Interdisciplinary Connections
New Jersey Student Learning Standards **ELA:** **W.AW.7.1.** Write arguments on discipline-specific content (e.g. social studies, science, math, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. **RI.AA.7.7:** Trace and evaluate the argument and specific claims in a text, assessing the reasoning is sound and the evidence is relevant and sufficient to support the claims. **W.SE.7.6:** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
Career Readiness, Life Literacies, and Key Skills
9.2.8.CAP.2: Develop a plan that includes information about career areas of interest. **9.2.8.CAP.12**: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential. **9.4.8.CI.1:** Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4). **9.4.8.CT.1**: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change,

and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Technology Integration

8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Career Education

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Modifications (ELL, Special Education, At Risk Students, Gifted & Talented, & 504 Plans)

ELL:

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring
- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

Supports for Students With IEPs:

- Allow extra time to complete assignments or tests

- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

At-Risk Students:
- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:
- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

Supports for Students With 504 Plans:
- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns