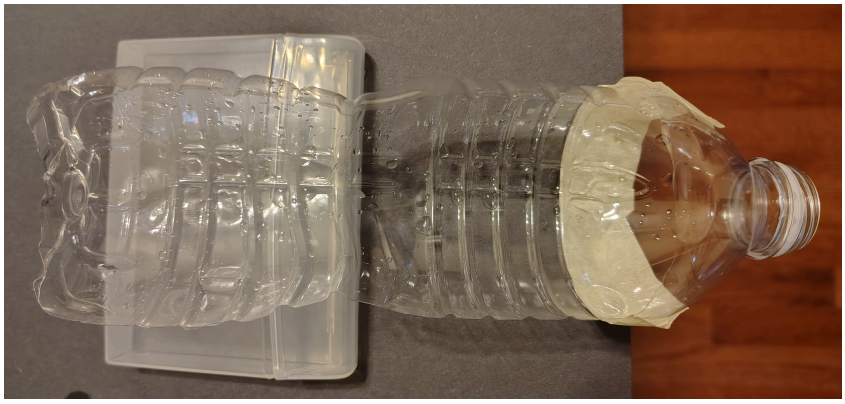
	LESSON PLAN: Building a Rain Garden 2 40 minute class periods
Standard	MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment 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.
Vocabulary	Water cycle Precipitation Precipitation occurs when water falls from the sky as a solid or liquid Runoff
Objective	Students will use their understanding of the water cycle to design, build, test, and redesign a rain garden prototype.
Supplies	Empty water bottles - 1 per group (**Teacher should cut the bottle before hand, this can be difficult and a little dangerous for students. Look at the pictures below to see how you should cut the bottles.)** Clay/Play-doh - ¼ of a container per group Aquarium Rocks/Pebbles - approximately 3 oz per group Sand - approximately 3 oz per group Soil- approximately 3 oz per group Water - 100 mL per group Food Coloring - a couple of drops Grass/Leaves - a handful per group
Bell Ringer	What do you remember about the water cycle? Draw a diagram or write your response.

Engineering Design	Question - How can we develop a garden that positively impacts the water cycle? Procedures - 1. Each group should start with one empty bottle. 2. Put an eraser under the closed end of the bottle, so it tilts at an angle with the spout of the bottle hanging over the edge of the desk/table. 3. Predict: If you pour water in the elevated end of the bottle, where will it go? What part of the water cycle does this represent? Write or draw your response. 4. After you have made your prediction, hold an empty cup under the spout of your bottle while another team member pours 100 mL into the base of the bottle. 5. What happened to the water you poured into the bottle? Did this match your prediction? 6. Now it's time to make your first prototype of a rain garden. Look at the materials that are available for your garden. Pick two that you would like to use for your garden and explain why you plan to use them. 7. Material: Explanation: 8. Material: Explanation: 9. Draw and label a diagram of where you will place the items in your bottle. When you have finished your diagram, show your teacher to gain access to your materials. 10. Once you have your materials, build your prototype. 11. Draw an updated diagram of your prototype or take a picture of it. 12. After drawing your prototype, have one team member hold the empty cup under the spout while another team member pours 100 mL of water into the other end of the bottle. Measure the amount of runoff you had and list it in the data table. 13. What worked well with your prototype? 14. What could be improved with your prototype? Prototype 2 15. Look back at your responses to questions 11-14. 16. Pick two materials (at least one must be different from your first prototype) you plan to use for your second prototype and complete the chart below. 17. Material: Explanation: 18. Material: Explanation: 19. Draw and label a diagram of where you will place the items in your bottle. When you have finished your diagram, show your teacher to gain access to your materials. 20. Once you have your materials, build your prototype. 21. Draw an updated diagram of your prototype or take a picture of it. 22. After drawing your prototype, have one team member hold the empty cup under the spout while another team member pours 100 mL of water into the other end of the bottle. Measure the amount of runoff you had and list it in the data table. Lab Sheet
Closing Question	If you could make one more rain garden prototype, what would you use? Why?

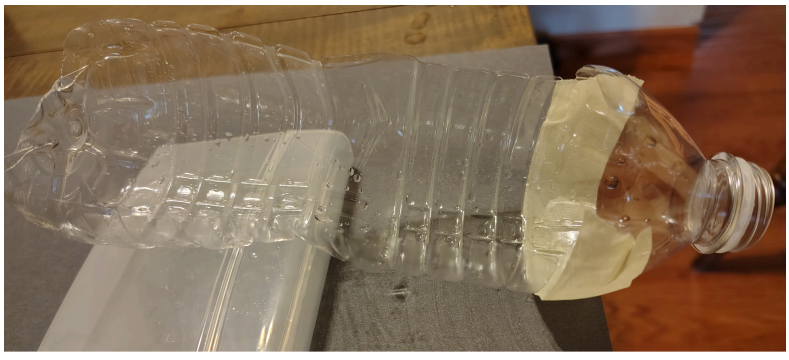
Notes	See images below. This lesson plan was modified from The Rain Garden copyrighted by ScienceBuddies. https://www.sciencebuddies.org/teacher-resources/lesson-plans/rain-garden



To make the container for the runoff garden, cut the side of a water bottle or other similar container. This should be done by the teacher as the water bottles can be difficult to cut.



Overhead view of the elevated bottle with the spout over the edge of the table.



Side view of the bottle being elevated with the spout over the edge of the table.



Side view of elevated bottle with rocks inside.