

Description: Students will research water harvesting, looking specifically at rain gardens. Ultimately they will design a rain garden for somewhere on their campus, and will reach out to Watershed Management to help them make their design come to life.

Time Estimates: 3-6 class periods

Learning Target & Success Criteria: Students will design and build rain gardens around their school site in order to prevent flooding.

Standards: Science: HS.E1U3.14, HS+E.E1U3.9, HS+E.E1U3.11; ELA: W.2, W.7, SL.4

Where in the curriculum: In a larger unit about sustainability and the importance of water

Unit Plan

Compelling Question: How does rainwater harvesting prevent flooding & positively impact Tucson's groundwater levels?	
Unit Materials	• Teaching slides ◦ Links to additional resources on the slides themselves
Clarity: Learning Target Success Criteria Rationale	WHAT: I will design and build a rain garden. HOW: I'll successfully do this by: - Researching water harvesting; its importance, the difference between passive and active. - Researching the importance of rain gardens; the pros and cons. - Researching the different elements of a rain garden and materials needed. - Determining a site to build a rain garden. - Planning the rain garden based on acquired knowledge. - Building a rain garden based on plans. WHY: In order to prevent flooding and to help recharge the underground aquifer.
Standards and Practices	Science Standards: • HS.E1U3.14 Engage in argument from evidence about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other. • HS+E.E1U3.9 Construct an explanation, based on evidence, for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. • HS+E.E1U3.11 Develop and use a quantitative model to illustrate the relationship among Earth systems and the degree to which those relationships are being modified due to human activity Science and Engineering Practices: • Developing and Using Models A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. • Obtaining, Evaluating, and Communicating Information Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. • Constructing Explanations and Designing Solutions The end-products of science are explanations and the end products of engineering are solutions. The goal of science is the construction of theories that provide explanatory accounts of the world. The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Crosscutting Concepts: • Structure and Function The way an object is shaped or structured determines many of its properties and functions.

	• Systems and System Models A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. ELA Standards: • W.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. • W.7 Conduct short as well as more sustained research projects to answer a question or solve a problem • SL.4 Present information, findings, and supporting evidence in an organized, developed style appropriate to purpose, audience, and task		
Staging the Question	Create a poem about water. Options to help students brainstorm ideas: - Make a mind map about all of the things that come to mind from the word "water". (5 minutes) Use these ideas to help you write a poem or narrative. - Start with the word "water" and write a list of words, never stopping. Let the last word inspire the next word. (The final word may not relate to water at all, and that's ok!) (3 minutes) Use these ideas to write a poem or a narrative. - Write a story about your experience with water. It can be about anything: the rain, the beach, the pool, drinking water, drought, watering plants, etc. Make it personal. - Start with the title "Water is Life" or "Agua es vida" and write from there.		
Supporting Question 1	Supporting Question 2	Supporting Question 3	
What is a water harvesting? Why should we have rain gardens?	How do you design and build a rain garden?	How can we design a rain garden for our campus?	
Formative Performance Task	Formative Performance Task	Formative Performance Task	
Create a pamphlet urging people to build a rain garden! Include: - the definition of water harvesting - difference between active and passive harvesting - the benefits of rain water harvesting - benefits of rain gardens (in particular)	Add to your pamphlet: - the necessary elements of a rain garden - materials needed - plants that are best to plant in rain gardens	Sketch out a rain garden plan. The plan should include: a map of the location, what plants you want to plant, and where they will be planted, what materials you need to complete the rain garden and where they would go, how long it should take to build it. Create a presentation that includes your sketch.	
Featured Sources	Featured Sources	Featured Sources	
• Water Harvesting - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster • Water Wise Youth • Harvesting Water for Your Garden • Educator Professional Development & Resources AZProjectWET • Rainwater Harvesting in Tucson - GLHN	• 2020 Build Your Own Basin (English) Watershed Management Group • Build a Rain Garden! Watershed Management Group • Rain Garden Planting Zones - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster • Regional multi-use plant lists for water-harvesting landscapes - Rainwater	• Arizona Rain Gardens • Joaquin & Christian Tucson Desert Living Home Tour • Build a Rain Garden! Watershed Management Group • 2020 Build Your Own Basin (English) Watershed Management Group • Backwater or Eddy Basins - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster	

• Rainwater Harvesting Rebate City of Tucson • The Many Benefits and Advantages of Rainwater Harvesting • Rainwater Harvesting • Water Reuse: Rain Water Harvesting (U.S. National Park Service) • Advantages & Benefits of Rainwater Harvesting		Harvesting for Drylands and Beyond by Brad Lancaster • Native Plant List for Rain Gardens • Appendix 4 Rainwater Harvesting • Rain Garden Care Handbook	• Regional multi-use plant lists for water-harvesting landscapes - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster
Extension		Extension	Extension
• The Nature of Groundwater Teacher Resources AZProjectWET • Community W.A.T.E.R. Field Studies for Schools Ironwood Tree Experience		• Planting for a Rainy Day (PfaRD) Teacher Resources AZProjectWET	Each student/group will present their sketch to the class and the class will vote on which area they would like to build a rain garden. (If there are materials/time/etc. for more than one rain garden, have the class pick as many sketches as you have capacity for.)
Compelling Question: How does rainwater harvesting prevent flooding & positively impact Tucson's groundwater levels?	Summative Performance Task	With the help of Watershed Management and your classmates, build the rain garden based on your design. • Reach out to Watershed Management (or another local organization) and ask for their help in building the rain garden and providing you with plants, tools, etc.	
	Featured Resources	• Consultation Request Watershed Management Group	
	Extension	Pick some sites around campus to set up active rain water harvesting (rain barrels). Write a grant to get funds to purchase rain barrels. Set up active rain water harvesting at your school site.	
Taking Informed Action	1. Write a letter to the TUSD Governing Board asking for additional rain gardens to be constructed around TUSD school sites. 2. Write a proposal for Budget de la Gente to get a rain garden built in your neighborhood, especially in areas that already flood. 3. Plan a rain garden for your own yard		

Lessons

Rain gardens	
Supporting Question # 1	What is water harvesting? Why should we have rain gardens?
Learning Target: What am I learning today?	I am learning: definitions and examples of water harvesting; the difference between active and passive water harvesting; the benefits of rain water harvesting, and rain gardens in particular.
Success Criteria: How will I know that I have learned it?	I can: define water harvesting and identify examples; explain the difference between active and passive water harvesting; describe the benefits of rain water harvesting and rain gardens.
Why am I learning this?	This is important because as water becomes more scarce, it is important to know how to harvest rain and help to replenish the groundwater.
Formative Performance Task	Students will create a pamphlet urging people to build a rain garden. The pamphlet should be persuasive and informative. Include: the definition of water harvesting; examples of different ways to harvest water; the difference between active and passive harvesting; the benefits of rain water harvesting, the benefits of rain gardens.
Sources	Teaching slides – slides #5-27
Additional Sources	• Water Harvesting - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster • Water Wise Youth • Harvesting Water for Your Garden • Educator Professional Development & Resources AZProjectWET • Rainwater Harvesting in Tucson - GLHN • Rainwater Harvesting Rebate City of Tucson • The Many Benefits and Advantages of Rainwater Harvesting • Rainwater Harvesting • Water Reuse: Rain Water Harvesting (U.S. National Park Service) • Advantages & Benefits of Rainwater Harvesting
Extension Activity	→ Students can complete The Nature of Groundwater Classroom Program with AZ Project WET. → Students can attend a field trip with Ironwood Tree Experience to investigate storm water parks in Tucson.

Rain gardens	
Supporting Question #2	How do you design and build a rain garden?
Learning Target: What am I learning today?	I am learning: the necessary elements of a rain garden, which plants are best to plant in a rain garden and why, what materials are necessary to construct a rain garden, and how to create a rain garden.
Success Criteria: How will I know that I have learned it?	I can: identify plants that will succeed in rain gardens, outline the steps of creating a rain garden, and identify what tools or materials that are needed to help build a rain garden.
Why am I learning this?	This is important because if someone is going to use your pamphlet to build a rain garden they should have all of the needed information to be successful.
Formative Performance Task	Students will add to their pamphlet: the necessary elements of a rain garden, plants that will succeed in rain gardens, materials needed and steps to creating a rain garden.
Sources	Teaching slides – slides #28-40
Additional Sources	• 2020 Build Your Own Basin (English) Watershed Management Group • Build a Rain Garden! Watershed Management Group • Rain Garden Planting Zones - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster • Regional multi-use plant lists for water-harvesting landscapes - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster • Native Plant List for Rain Gardens • Appendix 4 Rainwater Harvesting • Rain Garden Care Handbook
Extension Activity	Students can complete Planting for a Rainy Day with AZ Project WET.

Rain gardens	
Supporting Question #3	How can we design a rain garden for our campus?
Learning Target: What am I learning today?	I am learning: how to design a rain garden that will help my school campus minimize areas of flooding.
Success Criteria: How will I know that I have learned it?	I can: identify good spots on campus for a rain garden, sketch out a plan for a rain garden that will (ideally) help prevent flooding.
Why am I learning this?	This is important because when rain water pools it can affect the quality of the road, but it also becomes hard to infiltrate into the ground helping to replenish the groundwater. By building a rain garden, I will help water soak in and replenish the aquifer.
Formative Performance Task	Sketch out a rain garden plan. The plan should include: a map of the location, what plants you want to plant, and where they will be planted, what materials you need to complete the rain garden and where they would go, how long it should take to build it. Create a presentation that includes your sketch.
Sources	Teaching slides – slides #41-55
Additional Sources	• Arizona Rain Gardens • Joaquin & Christian Tucson Desert Living Home Tour • Build a Rain Garden! Watershed Management Group • 2020 Build Your Own Basin (English) Watershed Management Group • Backwater or Eddy Basins - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster • Regional multi-use plant lists for water-harvesting landscapes - Rainwater Harvesting for Drylands and Beyond by Brad Lancaster
Extension Activity	Each student/group will present their sketch to the class and the class will vote on which area they would like to build a rain garden. (If there are materials/time/etc. for more than one rain garden, have the class pick as many sketches as you have capacity for.)

Rain gardens	
Compelling Question	How does rainwater harvesting prevent flooding & positively impact Tucson's groundwater levels?
Learning Target: What am I learning today?	I am learning: about rain gardens, their importance and how to build them.
Success Criteria: How will I know that I have learned it?	I can: design and build a rain garden, after presenting my idea to my school administration.
Why am I learning this?	This is important because I am a steward of the land and want to help conserve water since we live in the Sonoran Desert and we're in a drought.
Summative Performance Task	With the help of Watershed Management and your classmates, build the rain garden based on your design. Reach out to Watershed Management (or another local organization) and ask for their help in building the rain garden and providing you with plants, tools, etc.
Featured Resources	Consultation Request Watershed Management Group Teaching slides
Extension Activity	Pick some sites around campus to set up active rain water harvesting (rain barrels). Write a grant to get funds to purchase rain barrels. Set up active rain water harvesting at your school site.
Taking Informed Action	- Write a letter to the TUSD Governing Board asking for additional rain gardens to be constructed around TUSD school sites. - Write a proposal for Budget de la Gente to get a rain garden built in your neighborhood, especially in areas that already flood. - Plan a rain garden for your own yard
Sources for Taking Informed Action	governingboard@tusd1.org https://budgetdelagente.tucsonaz.gov/ Rain Gardens · Tucson Clean & Beautiful