Rainwater Harvesting

Lesson 10: Communicating Your Achievements

INTRODUCTION

Lesson 10 encourages students to consider rainwater harvesting within the broader context of the human water supply. Students will create a presentation that includes overhead, cross-sectional, and schematic views of their design. They will also explain how their design addresses the problem, meets specified criteria and constraints, and describe at least one design decision made to improve performance or better accommodate those constraints. A rubric is used to assess the quality and completeness of their presentations.

Teaching Strategies

This final lesson is a great opportunity for students to showcase their hard work and develop public speaking skills.

Depending upon your objectives for this unit, you could turn this into a student design competition with a possible goal of presenting the best design to your administration for implementation.

Use the rubric as a tool to evaluate the cohesiveness of students' designs and their comprehension of system functions.

OBJECTIVES

- BUILD THE SYSTEM: **Obtain, evaluate and communicate information** about how the designed rainwater harvesting system meets specified criteria and constraints of the engineering design process.
- BUILD THE SYSTEM: **Make an argument based on evidence** about how the designed rainwater harvesting system meets specified criteria and constraints of the engineering design process.
- RELATE: Identify the relationships between Rainwater Harvesting and Saving Water, Reducing Water Waste, Drought, Flooding, and Erosion, and Green Stormwater Infrastructure.
- TAKE A PERSPECTIVE: Given that our region is projected to get hotter and more arid, what is rainwater harvesting from the perspective of water conservation and heat mitigation?

MATERIALS AND EQUIPMENT

- Worksheet: *Your Rainwater Harvesting System Worksheet*
- Rubric: *Rainwater Harvesting System Design Rubric*
- Student Prepared: To-Scale Site Inspection Diagrams for each student group
- *Sample Work Folder*: Includes example system diagrams, site plan diagrams, and student presentations

The Rainwater Harvesting Unit is adapted with permission from the Arizona Project WET, Rainwater Harvesting Aqua STEM Program.

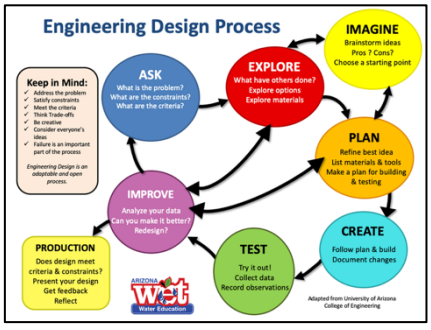
PRESENTATION GUIDE

Connect to the Unit

In Lesson 9, students began designing their rainwater harvesting systems with the goal of meeting the criteria and constraints defined by the unit's driving question. They were introduced to the concept of continuous improvement and encouraged to regularly review and evaluate their designs. Through peer review, students gathered feedback—serving as an informal test of their ideas—and used it to refine their systems. They were also informed that they would present their final designs to an audience in Lesson 10.

Launch the lesson

In this lesson, which spans two class periods, students will obtain, evaluate, and communicate information about how their designed rainwater harvesting system meets specified criteria and constraints of the Engineering Design Process. They will make an argument based on evidence. Finally, students will consider how rainwater harvesting is related to the larger water distribution system and heat in the Southwest.



Students have now examined the driving question and answered it through exploration, imagination, planning, creation, testing, and improvement.

Ask the students: "When we put all of these steps together, what were you actually doing? What's the benefit of using a process like this?"

They are utilizing the Engineering Design Process to solve a problem in the most effective way.

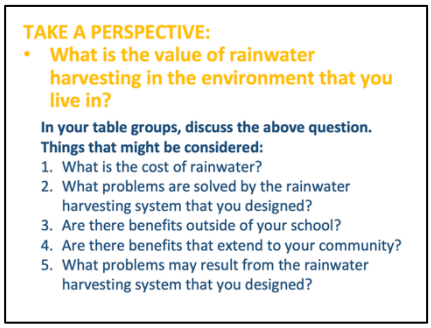
BUILD THE SYSTEM:

• What is a rainwater harvesting system a part of?

It is part of our water supply, the local water cycle, the natural system, and our water resources.

It is a small-scale system that has very similar parts to large-scale water supply systems!

It is a way to conserve our potable water while mitigating heat by creating shade and evapotranspiration.



TAKE A PERSPECTIVE:

• What is the value of rainwater harvesting in the environment that you live in?

Encourage students to zoom out and consider rainwater harvesting from the broader context of the environment that we live in. While many students recognize that we live in an arid region with limited water resources, challenge them to think more deeply: What does that really mean? Is it just about conserving potable water, or are there other important factors to consider? For example, reducing stormwater runoff, supporting natural ecosystems, improving soil health, or increasing community resilience to climate change?

Students should discuss the above question in small groups at their table. Here are a few ideas they might consider:

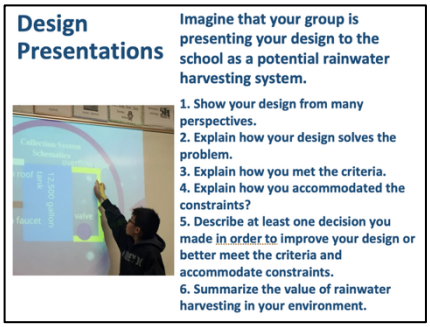
1. What is the cost of rainwater?

2. What problems might be solved by the rainwater harvesting system that they designed?

3. Are there benefits outside of their school context?

4. Are there benefits that extend to their community? *Have they thought of flood mitigation? Reducing erosion? Saving water that would otherwise be wasted?*

5. What problems may result from the rainwater harvesting system that they designed?



Design Presentations

Students design their presentations and present their system designs:

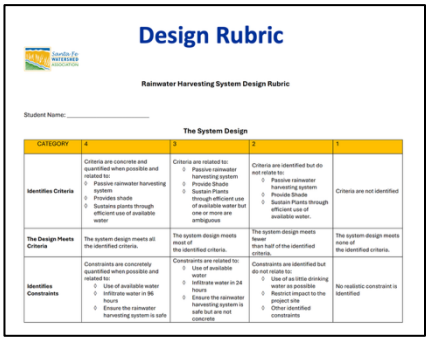
Imagine that your group is presenting your design to the school as a potential rainwater harvesting system.

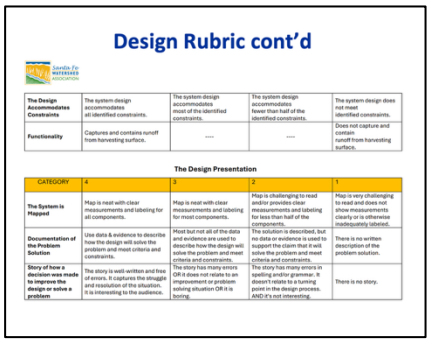
1. Show your design from many perspectives.

2. Explain how your design solves the problem.

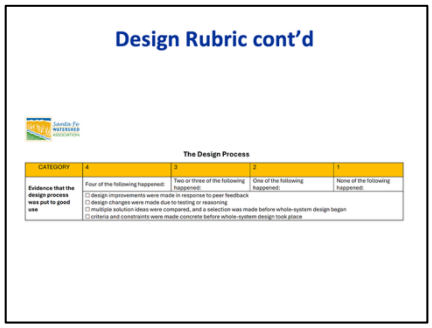
3. Explain how you met the criteria.

4. Explain how you accommodated the constraints.

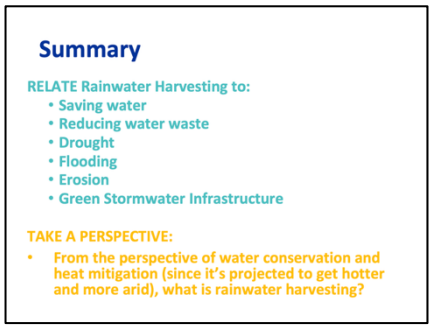




CATEGORY	4	3	2	1
The System is Mapped	Map is neat with clear measurements and labeling for all components.	Map is neat with clear measurements and labeling for most components.	Map is challenging to read and/or provides clear measurements and labeling for less than half of the components.	Map is very challenging to read and does not show measurements clearly or is otherwise inadequately labeled.
Documentation of the Problem Solution	Use data & evidence to describe how the design will solve the problem and meet criteria and constraints.	Most but not all of the data and evidence are used to describe how the design will solve the problem and meet criteria and constraints.	The solution is described, but no data or evidence is used to support the claim that it will solve the problem and meet criteria and constraints.	There is no written description of the problem solution.
Story of how a decision was made to improve the design or solve a problem	The story is well-written and free of errors. It captures the struggle and resolution of the situation. It is interesting to the audience.	The story has many errors OR it does not relate to an improvement or problem solving situation OR it is boring.	The story has many errors in spelling and/or grammar. It doesn't relate to a turning point in the design process. AND it's not interesting.	There is no story.



CATEGORY	4	3	2	1
Evidence that the design process was put to good use	Four of the following happened: ☐ design improvements were made in response to peer feedback ☐ design changes were made due to testing or reasoning ☐ multiple solution ideas were compared, and a selection was made before whole-system design began ☐ criteria and constraints were made concrete before whole-system design took place	Two or three of the following happened:	One of the following happened:	None of the following happened:



5. Describe at least one decision you made to improve your design or better meet the criteria and accommodate constraints.

6. Summarize the value of rainwater harvesting in your environment.

It is very important that students use data—particularly the supply, demand and infiltration basin data—to justify their design decisions. They will also tell a "story" about a decision that they made to improve the design.

Use the Rainwater Harvesting System Design Rubric to communicate to students the expectations and grade presentations.

RELATE Rainwater Harvesting to:

- Saving water
- Reducing water waste
- Drought
- Flooding
- Erosion
- Green Stormwater Infrastructure

TAKE A PERSPECTIVE:

• Given that our region is projected to get hotter and more arid, what is rainwater harvesting from the perspective of water conservation and heat mitigation?

It is a viable tool to use water efficiently one building at a time to cool and beautify the landscape. If many people implemented rainwater harvesting practices across buildings and homes, it could have a huge effect on reducing municipal water use.

Harvested rainwater is generally not part of Santa Fe's municipal water supply, since water comes from surface water from the Santa Fe River, Buckman Direct Diversion (Colorado River Compact water via the Rio Grande), and groundwater. Use of rainwater reduces the use of treated potable water and lowers payment for that water. It also improves soil moisture and assists in recharging the groundwater system.