



Sustainable Water Solutions

Weighing the Pros and Cons

How do we assess the benefits and drawbacks of various solutions to a problem? To decide how one potential solution compares to another, we have to consider the pros and cons of each from many dimensions: environmental, social, cultural, and economic. In this activity, students will work together to map out the strengths and limitations of potential solutions to some important water use and conservation issues.

This lesson is part of a larger unit in the Flipside Science series: **Fresh Solutions: Water Use and Conservation**. In this unit, students practice different steps in design thinking within the context of global water issues. Engage your students in creative ideation with the preceding activity in this unit, **Rapid Brainstorming: How Can We Conserve Our Water Resources?** At the end of this unit, your students can participate in a design thinking challenge to tackle a water conservation issue at home or school.

Grade levels: 6-8

Essential questions

1. What are the advantages and disadvantages of different solutions that have been proposed for global water issues we are facing in the world today?
2. How do we assess the environmental, social, cultural, and economic benefits and drawbacks of various solutions to a problem?
3. How do we ultimately decide what solution is the 'best'?

Objectives

Students will

1. Explore some of the solutions being proposed for global water issues like our growing need for freshwater, water waste, groundwater depletion, and agricultural water use.
2. Learn how to evaluate and compare various solutions to a problem by mapping out the multidimensional strengths and weaknesses of each.

Materials needed

- Computer lab with one computer for every student (computers should have Internet access) and one computer that the instructor can project from
- One pair of audio headphones for each student

Grade levels: 6-8

Total activity time: 60 minutes

Materials needed:

- Computer lab
- Audio headphones
- Projector
- Flipside Science videos
- Student Worksheets





- Projector
- **Flipside Science videos:**
 - ***How Do We Meet the Growing Need for Water?***
 - ***Desalination: From Sea to Sink***
 - ***Water-Wise Farms: How Can We Grow More Crop Per Drop?***
 - ***Waste Water Recycling: Putting Greywater to Good Use***
 - ***Recharging Aquifers: Replenishing our Groundwater Resources***
- **Student Worksheets** (1 per student)

Pre-activity

If you are using this activity within the *Fresh Solutions: Water Use and Conservation* unit, it is recommended you progress through the **Your Hidden Water Footprint: Defining a Problem to Find a Solution, Exploring Our Growing Need for Water, and Rapid Brainstorming: How Can We Conserve Our Water Resources?** lessons before continuing with this one. You can also use this lesson independently.

Activity procedure

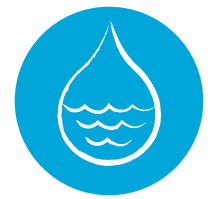
Total Activity Time: 60 minutes

Part I: Exploring global water issues (15 min.)

Teacher note: If you preceded this activity with the **Exploring Our Growing Need for Water and/or Rapid Brainstorming: How Can We Conserve Our Water Resources?** activity, you can skip to Part II.

1. Hand out to students or write on the board a list of questions for them to think about while they watch the ***How Do We Meet the Growing Need for Water?*** video (see below).
2. Show students the ***How Do We Meet the Growing Need for Water?*** video.
3. Ask student to jot down some of their thoughts about the questions that they were asked to consider while watching the video. Give them 5-10 minutes to do this. You might want to play the video another time through for students. Discuss these questions as a class after students have had a chance to reflect individually.
 - a. *What kinds of water issues were raised in the video?*
 - b. *Where can we find freshwater on the earth? What are some freshwater reservoirs, or places where it is stored?*
 - c. *Why is a growing population a concern for our water resources?*
 - d. *What is one impact of overpumping groundwater? What do we use groundwater for?*
 - e. *Who/what uses water? Who/what is the largest user of water?*





f. *In what ways is water wasted?*

4. Ask students to choose one of the main water issues introduced in the video on which to focus (growing need for freshwater, water waste, aquifer over-pumping, and agricultural water use) and to find a partner who chose the same issue. *Note: To expedite this process or if you would like to ensure that all water issues are represented, you can also have students pick water issues out of a hat and pair up that way too.*

Part II: Comparing water conservation solutions (25 min.)

1. Hand out one **Student Worksheet** to each student. Explain to students that they will be watching videos that will introduce them to some possible solutions that people have thought of for the issue on which they are focusing.
2. With their partners, students will guide themselves through the activity as outlined on their **Student Worksheets**. During this time, students will be asked to watch the Flipside Science water solution video for the problem they chose and they will proceed through an exercise weighing the pros and cons of the solution(s) introduced in the videos. Remind students to wear headphones while watching the videos on their own computers. As they work, walk around the classroom and ask different groups to explain their thinking. Probe them to uncover environmental, social, cultural, or economic factors that relate to proposed solutions.

Teacher tip: *The solutions introduced in the Flipside Science videos are not the only solutions, nor necessarily the best solutions for the water issues they address. To help you facilitate students' evaluations of these different solutions, we've created a supplemental **Teacher Toolkit** for each solution video. Each toolkit contains more information about the solutions outlined in the videos, as well as the pros and cons of these solutions. It is recommended you familiarize yourself with these toolkits before this activity.*

3. Remind students when they have 15 minutes and 5 minutes left in the activity.

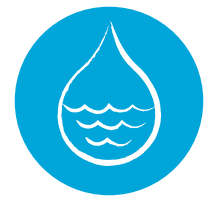
Wrapping up (20 min.)

1. Come back together as a class, and ask students share out (in 1-2 minutes) the water issue they focused on and the pros and cons of the solutions they explored.
2. Ask students to reflect on their experience.
 - a. *Do we have one perfect solution for each of these issues? Why or why not? Do you think one exists?*
 - b. *What steps can we take to try to develop the best solutions we can?*
 - c. *What does it mean to consider the different 'dimensions' of a problem or solution? (E.g., economic, environmental, social, cultural, etc.)*
 - d. *Why is it important for you (as young people) to think about these issues?*

Next steps

Fresh Solutions: Water Use and Conservation Design Thinking Challenge: Challenge your students to apply their design thinking skills and design a solution to a water conservation issue at home or school! Choose from a spectrum of challenges one that suits your available class time and resources.





Fresh Solutions: Water Use and Conservation



Your Hidden Water Footprint:
Defining a Problem to Find a Solution



Sustainable Water Solutions:
Weighing the Pros and Cons



Exploring Our Growing Need for Water



Fresh Solutions:
Design Thinking Challenge



Rapid Brainstorming:
How Can We Conserve Our Water
Resources?

About Flipside Science

Flipside Science is a youth-powered series that tackles complex environmental topics and empowers viewers to make a difference. This engaging and upbeat collection of videos, hosted by Academy youth, explores how local communities are addressing environmental problems with solutions ranging from vertical farming to greywater recycling.

Head to [Flipside Science](#) to find the complete list of videos and activities in this series.

Next Generation Science Standards (6-8)

Engineering Design in the NGSS: *At the middle school level, students learn to sharpen the focus of problems by precisely specifying criteria and constraints of successful solutions, taking into account not only what needs the problem is intended to meet, but also the larger context within which the problem is defined, including limits to possible solutions.*

California's Environmental Principles and Concepts

- **Principle I:** The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services. As a basis for understanding this principle:
 - **Concept c:** Students need to know that the quality, quantity, and reliability of the goods and ecosystem services provided by natural systems are directly affected by the health of those systems.
- **Principle II:** The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies. As a basis for understanding this principle:
 - **Concept a:** Students need to know that direct and indirect changes to natural systems due to the growth of human populations and their consumption rates influence the geographic extent, composition, biological diversity, and viability of natural systems.
 - **Concept b.** Students need to know that methods used to extract, harvest, transport, and





consume natural resources influence the geographic extent, composition, biological diversity, and viability of natural systems.

- **Concept c.** Students need to know that the expansion and operation of human communities influences the geographic extent, composition, biological diversity, and viability of natural systems.
- **Principle V:** Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes. As a basis for understanding this principle:
 - **Concept a:** Students need to know the spectrum of what is considered in making decisions about resources and natural systems and how those factors influence decisions.

Additional resources

- [KQED Science: Why Isn't Desalination the Answer to All California's Water Problems?](#)
- [NPR KQED Public Radio: Why California Farmers are Conflicted About Using Less Water](#)
- [San Francisco Public Utilities Commission: Recycled Water](#)
- [San Francisco Public Utilities Commission: Groundwater](#)
- [California Academy of Sciences Science News: Water Use: Drought and Beyond](#)

