

# Water Conservation



## Main Questions

What does it mean to conserve water?

Who has to ration water?

What does water conservation mean in different contexts - individuals, communities, and industries?

## Grade level

Grades 5-6

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## Rationale for Unit:

The content of this water conservation unit is a coherent unit about the water use and conservation practices of individuals and communities. First, students start off thinking about their own water use habits and what they can and cannot live without in terms of water usage. By starting with individuals, students can become aware of what they already know about water conservation. During the engage activity, students are asked to work in "families" with a tight water budget. At this point, the students are thinking about water usage in groups. Here, students also must contend with the idea of tradeoffs. As the lesson continues into the explore phase, students examine water usage from another perspective: lack of water usage - water rationing. Students examine the problems that individuals around the world have with respect to water rationing. Then, students seek out data about water rationing and map it on a global map. Students are then challenged to think about these water rationing patterns and to develop an explanation for them. At this point, students can test out their ideas about the patterns by collecting more data. To reinforce this idea of water rationing across the globe, the students listen and respond to a story about water rationing in Singapore where several of the issues from the Engage activity re-surface. The explain phase assigns some terminology to the water conservation discussions and provides students with more ideas on individuals' conservation options. The elaborate activity gives students the opportunity to examine water conservation on the scale of larger groups such as companies and communities. Students first simulate the process of sharing water given different water rights scenarios, and the social implications of water as a limited resource are explored. Then, students are challenged to think of ways these water stakeholders can conserve water. Because water conservation practices of companies and communities will be less familiar to students than were the conservation practices of individuals, students will use primary and secondary sources to investigate these ideas. Thus, this unit follows water conservation from individuals to individuals within families to individuals across the globe to companies and communities.

The learning cycle was chosen as an instructional method because of the integrity it provides to a unit. Initially, student ideas are elicited and students think about the relevance of water conservation to their own lives. Then, students try out some of their ideas about water usage and conservation issues across different environments. Then, the explain phase allows the entire class to come to some common understandings upon which to build additional information. Finally, the elaboration phase provides a new context in which to think about water conservation - societal water conservation. The evaluation part of the learning cycle is on-going and provides formative and summative feedback to the instructor and students about the attainment of learning objectives.

## Background Information:

### Water: A Limited Resource

Even though water seems abundant in some places, the usable water available for mankind's use is actually very limited. Only 3% of the Earth's water is freshwater, and the rest is unavailable for use because it is saltwater<sup>7</sup>. Furthermore, a full three fourths of the Earth's freshwater is tied up in glaciers and ice caps<sup>7</sup>. Much of the Earth's freshwater is underground and called groundwater. This groundwater is located in soil and rock<sup>7</sup> and may be stored in underground deposits of water called aquifers. Three fourths of U.S. cities obtain their drinking water from aquifers. Groundwater is particularly susceptible to poor land use habits that lead to water pollution<sup>7</sup>. Clearly freshwater is a precious resource.

### Water Rights

Water is not distributed equally across the globe. Asia and South America average about 13,000 cubic kilometers of water availability, while Africa and Australia average around 3,000 cubic kilometers<sup>8</sup>. When one factors in the population of these continents, one can determine how much water is available per person per year. Australia's and Oceania's water availability consists of 82,200 cubic meters per person per year<sup>8</sup>. South America averages 38,200 cubic meters per person per year<sup>8</sup>. North and Central America's water availability is such that each person could have access to 17,400 cubic meters of water per year<sup>8</sup>. The per capita availability of water is much less for Europe (4,230 cubic meters), Africa (5,720 cubic meters), and Asia (3,920 cubic meters)<sup>8</sup>. From these calculations, the importance of factoring in *both* water availability *and* population density is evident.

To determine how this availability is translated into practice, water rights indicate how people can legally use water. One can think of water rights as the right to *use* water not to *own* water. Water access has been an important issue throughout history, and different people have come up with different water rights as a result. In the Eastern part of the United States, people developed the Riparian Rights (Common Law Doctrine) that gave people who own land adjacent to water the right to use that water. More recently, this Common Law requires people to justify their use of water and ensure that everyone else can have access to the water as well. In the Western U.S., where water is far more scarce, different ways of thinking about water rights evolved. In the West, the Prior Appropriation Doctrine regulates water usage. This doctrine states that the first people in an area have the first right to the water supply until all the water is allocated<sup>3</sup>.

### Water Use

Water use can be considered off-stream use (when water is removed from its source) or in-stream use (boating, hydroelectric power, aquatic habitats, and recreation)<sup>1</sup>. Consumptive use occurs when water is removed from the stream or groundwater source and is not immediately returned to it<sup>1</sup>. Water is essential for our society. Artificial irrigation is responsible for 40% of the world's food<sup>2</sup>. Additionally, one fifth of worldwide electricity is generated by hydroelectric plants<sup>2</sup>.

Dependence on water can be problematic however. Many people lack clean drinking water and sanitation services. These individuals are highly susceptible to water-borne illnesses that kill between 10,000 to 20,000 children a day<sup>2</sup>. Cholera outbreaks in Latin America, Africa, and Asia have recently been on the rise<sup>2</sup>. Additionally, the need to dam waterways has forced many people out of their homes and ruined habitats for many organisms. There are as many as

70,000 dammed waterways in the U.S. alone. The damming of water world wide may be responsible for a noticeable shift in the wobble of the Earth. Because of the ecological devastation of aquatic life in these dammed rivers, some dams have been removed as of late<sub>2</sub>.

### Trends in Water Use

There are several important trends in American freshwater use. First, people use much more surface water than ground water. People's use of freshwater increased from 1950 to 1980, and then the usage has leveled off. This trend is encouraging since the human population has been increasing even since 1980 and suggests that conscientious water use is taking effect. For the U.S., the largest uses of water are irrigation and thermoelectric industry. These two uses have leveled off or declined since 1980<sub>1</sub>. Why has the use of water leveled off in a time when the population is still increasing. First, people are using water more efficiently<sub>2</sub>. Second, people are reprioritizing their water use and eliminating some previous uses<sub>2</sub>

There are also certain patterns in how water gets used within cities and homes. In an urban environment, 64% of the water is used by single families, 12% is used by multiple family households, 7% is used commercially, and 3% is used in public venues<sub>6</sub>. Given that most of the water is used by households in these urban areas, one might examine how these residential families use their water. Residential families use 63% of their water indoors and 37% outdoors<sub>6</sub>. Inside the house, residential families typically allocate their water in the following ways: 10% on baths, 22% on laundry, 13% at faucets, 18% on showers, 2% on dishwashing, and 35% on toilet use<sub>6</sub>. Knowledge of how water is used is important for determining where to address water conservation efforts.

### Water Needs

Even though one can see the people use water in a great many ways and often use a great amount of water, how much water do people actually need? Peter Gleick suggests that an individual person needs about 50 liters per person per day<sub>8</sub>. He calculates that people need 5 liters for drinking, 20 liters for sanitation, 15 liters for bathing, and 10 liters for food preparation<sub>8</sub>. His calculations exclude the amount of water necessary for growing food.

### Water Conservation

Water conservation is the "careful use and protection of water resources and involves both the quantity of water used and its quality"<sub>1</sub>. This water conservation can take many forms. The US Water Resources Council defines water conservation as (1) reducing the demand for water, (2) improving the efficiency of water use, or (3) improving the land use practices that require water<sub>6</sub>.

Water conservation brings with it several benefits. First and most obviously, the amount of water used is decreased. Additionally, water conservation can save energy because water heaters will be less used. In fact water heaters are the second largest energy user in the house<sub>6</sub>. Furthermore, water conservation reduces the flow of wastewater, and this saves energy because the wastewater treatment plants have less to treat. At the same time, the reduced flow of wastewater reduces the amount of chemicals that must be used and put out into the environment as well<sub>6</sub>. Furthermore, water conservation protects the environment by increasing the streamflow<sub>6</sub>. Finally, water conservation is cost-effective: reducing water usage results in reduced water bills<sub>6</sub>. In these important ways, water conservation has many advantages.

Of course, water conservation has some drawbacks as well. First, water supply is a business and all water supply employees are impacted by reduced water needs. Additionally, water conservation essentially frees up water that may be used to induce growth and sprawl in already populated-places<sup>6</sup>. Finally, as people practice water conservation, they may become accustomed to using less water. In times of water shortages, there may not be any more reductions that can be made<sup>6</sup>. In these ways, water conservation may have some undesirable impacts.

Domestic use of water can be conserved in a number of ways as well. Some of these ideas pertain to water use in the kitchen. These water conservation strategies include purchasing water-saving appliances<sup>1</sup>, cleaning vegetables and fruit in a pan of water instead of letting water run while washing<sup>4</sup>, steam vegetables rather than boiling them<sup>4</sup>, scrape dishes (instead of rinsing) before loading the dishwasher<sup>4</sup>, running the dishwasher only when its full<sup>4</sup>. Water conservation efforts in the bathroom include using efficient bathroom fixtures (low flow toilets)<sup>1</sup>, turning off water when not absolutely needed during bathing<sup>1</sup>, fixing leaks promptly<sup>1</sup>, taking showers instead of baths<sup>1</sup>, and turning off the water when brushing teeth or shaving<sup>4</sup>. In the laundry room, one can save water by only running full loads<sup>4</sup>, using shorter wash cycles<sup>4</sup>, and buying a water-efficient machine<sup>4</sup>. With respect to the lawn, there are several ways to improve water conservation. These methods include replacing lawns with decorative gravels and native plants in dry areas<sup>1</sup>, watering lawns at times to minimize evaporation<sup>1</sup>, using mulch around garden plants<sup>1</sup>, planting drought-resistant vegetation<sup>1</sup>, not cutting lawn grass too short (shading the soil to minimize water loss)<sup>4</sup>, avoiding overwatering<sup>4</sup>, collecting rainwater off surfaces in your yard in rain buckets<sup>4</sup>, minimize the use of fertilizers which require additional water<sup>4</sup>, and start composting<sup>4</sup>. All of these around-the-house strategies can be used to conserve water. By the same token, schools can also do many things to conserve water. In an English school, the installation of water saving equipment such as urinal controls and self-closing push taps reduced the school's water consumption by 73%<sup>5</sup>! These domestic water conservation methods can seriously impact the supply of water in homes, schools, and cities.

Changes in agricultural irrigation can be made to save much water since 80% of the consumptive use of freshwater occurs in agriculture<sup>1</sup>. Some ideas<sup>1</sup> for agricultural include (1) price agricultural water to encourage conservation, (2) use lined/covered canals, (3) use monitoring and scheduled release of water for maximum efficiency, (4) integrate surface and groundwater use more effectively, (5) irrigate at times when evaporation is less likely, (6) improve sprinklers, (7) improve the soil to increase infiltration and minimize runoff, (8) encourage growth of crops that require less water.

Industry use of water can also be conserved. Industry conservation<sup>1</sup> of water may include (1) using cooling towers for steam generation that do not require water, (2) increasing in-plant treatment and recycling of water, and (3) several of the methods for domestic use.

### Sustainability & Water Use

In many places, people and industries thrive in areas where they do not have an adequate water supply. For example, in California 2/3 of the states runoff occurs north of San Francisco, but 2/3 of the water usage in California occurs south of San Francisco<sup>1</sup>. In New York City, water has been imported from other areas (dammed rivers and Long Island aquifers) for over a hundred years<sup>1</sup>.

Sustainable water use is defined<sup>1</sup> as "the use of water resources by people that allows our society to develop and flourish into an indefinite future without degrading the various

components of the hydrologic cycle or the ecological systems that depend on it." Water sustainability includes the development of water resources to maintain a healthy population of people and healthy ecosystems. Water management is a particularly tricky issue in areas such as the southwestern U.S. and arid parts of the world where water is less abundant<sup>1</sup>.

### Possible Student Misconceptions about Water Conservation

Students may hold many misconceptions about water conservation. For instance, they may not realize how much available freshwater is used by agriculture compared to domestic use. Additionally, many students may not realize that many "lakes" are really reservoirs and not natural to an area. Consequently, many students may not realize the ways in which damming water impacts aquatic ecosystems. Furthermore, students may think that water conservation is only an issue in deserts and not realize the impact of population density and pollution on water availability for human use.

1. Botkin, D.B., & Keller, E.A. (2000). *Environmental Science: Earth as a Living Planet*. New York: John Wiley & Sons, Inc.
2. Gleick, P.H. (2001). Making every drop count. *Scientific American*, 284(2): p. 40-46.
3. The Watercourse and the Council for Environmental Education. (1995). *Project Wet Curriculum & Activity Guide*. Activity: Pass the Jug.
4. City of Red Deer Public Works. 2005. Water Saving Tips Brochure. From <http://www.city-red-deer.ab.ca>. Retrieved May 31, 2005.
5. Environment Agency : Water Resources. (2005). From <http://www.environment-agency.gov.uk/subjects/waterres/>. Retrieved June 12, 2005.
6. Maddous, W.O. (1987). *Water Conservation*. Denver, CO: American Water Works Association.
7. Anderson, C., editor. (1998). *Water Conservation: Teacher Resource Guide*. Menlo Park, CA: Dale Seymour Publications.
8. Gleick, P.H. (2000). *The World's Water: 2000-2001: The Biennial Report on Freshwater Resources*. Washington, D.C.: Island Press.

## Objectives:

### *Engage:*

- TSSBAT compare activities by how much water they require
- TSSBAT make a plan to reduce water usage for a family

### *Explore:*

- TSSBAT use a globe to locate cities that ration water
- TSSBAT identify patterns on a map of water-rationing places
- TSSBAT analyze the water-rationing pattern to determine its fit with precipitation/population/land use patterns.
- TSSBAT describe how people on different sides of a water-rationing issue might feel.

### *Explain:*

- TSSBAT define conserve
- TSSBAT define ration
- TSSBAT develop a water conservation plan for an individual, a school, or a family.

### *Elaborate:*

- TSSBAT explain how societal entities such as businesses use water.
- TSSBAT compare the water usage of different kinds of society entities.
- TSSBAT gather information (research) about ways in which various industries can conserve water.
- TSSBAT compare the Riparian and the Prior Appropriation Doctrine approaches to individuals' water rights.

## Indiana Academic Standards:

### 5<sup>th</sup> Grade

- 5.1.2 Begin to evaluate the validity of claims based on the amount and quality of the evidence cited.
- 5.1.6 Explain how the solution to one problem, such as the use of pesticides in agriculture or the use of dumps for waste disposal, may create other problems.
- 5.2.8 Recognize when and describe that comparisons might not be accurate because some of the conditions are not kept the same.
- 5.5.8 Realize and explain that predictions may be more accurate if they are based on large collections of objects or events.
- 5.5.10 Explain the danger in using only a portion of the data collected to describe the whole.
- 5.6.2 Demonstrate how geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representation can never be exact in every detail.

### 6<sup>th</sup> Grade

- 6.1.8 Describe instances showing that technology cannot always provide successful solutions for problems or fulfill every human need.
- 6.2.7 Locate information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases.
- 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.
- 6.3.8 Explain that fresh water, limited in supply and uneven in distribution, is essential for life and also for most industrial processes. Understand that this resource can be depleted or polluted, making it unavailable or unsuitable for life.
- 6.4.8 Explain that in all environments, such as freshwater, marine, forest, desert, grassland, mountain, and others, organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter. Note that in any environment, the growth and survival of organisms depend on the physical conditions.
- 6.5.3 Explain why shapes on a sphere\* like Earth cannot be depicted on a flat surface without some distortion.
- 6.5.5 Explain the strengths and weaknesses of using an analogy to help describe an event, object, etc.
- 6.5.6 Predict the frequency of the occurrence of future events based on data.

## NAAEE Guidelines:

### **Strand 1: Questioning, Analysis, and Interpretation Skills**

- A) Questioning
- B) Designing investigations
- C) Collecting information
- D) Evaluating accuracy & reliability

- E) Organizing information
- G) Drawing conclusions/ developing explanations

## **Strand 2: Knowledge of Environmental Processes and Systems**

### ***2.1: The Earth as a Physical System***

- A) Processes that shape the Earth

### ***2.3: Humans & Their Societies***

- A) Individuals & groups
- C) Political & economic systems
- D) Global connections
- E) Change & conflict

### ***2.4: Environment & Society***

- A) Human/environment interactions
- B) Places
- C) Resources
- E) Environmental issues

## **Strand 3: Skills for Understanding and Addressing Environmental Issues**

### ***3.1: Skills for Analyzing & Investigating Environmental Issues***

- A) Identifying & investigating issues
- B) Sorting out the consequences of issues
- C) Identifying & evaluating alternative solutions and courses of action

### ***3.2: Decision-Making & Citizenship Skills***

- A) Forming & evaluating personal views
- B) Evaluating the need for citizen action
- C) Planning & taking action

## **Strand 4: Personal and Civic Responsibility**

- A) Understanding societal values & principles
- B) Recognizing citizen's rights & responsibilities
- D) Accepting personal responsibility

## Materials:

### *Engage:*

- Water usage cards
- board to write on
- cup of water to drink

### *Explore:*

- Globes (1 per pair)
- Colored pencils
- Internet access
- Handouts:
  - Country map
  - List of cities with water rationing (if no internet access)
  - World Population & Desert maps
- Singapore news release

### *Explain:*

- Water Conservation Brochure
- Board to write on
- Formative Quiz

### *Elaborate:*

- Cups (1 per student)
- Water jug
- Water users descriptions
- Funnel
- Water
- Measuring Cup

## Procedures:

### *E*ngage (Water usage and conservation)

#### Warm-up

1) Ask students the following question while drinking a glass of water:

- How am I using water right now?
- Can anyone tell me how they've used water in the last week? (jot these down on board)
- Which of these ways you use water are most important to you?
- Rank these different ways of water by putting a 1 next to the most important, a 2 next to the next most important, and so on.
- What did you decide was the most important use of water for you?
- Did everyone find the same things?
- Which uses did most people agree upon as most important?

#### Cards activity

1) Tell students the following directions:

Okay, we are going to get into groups of 3 (your "family") and play a game of water use cards. Here are the directions: you have 15 cards for each family. Each card shows a different use of water. Your family has a total of 1500 gallons of water each week. Each of your cards tells you how much water each of the activities requires. You are going to decide as a family which activities you all can do without and which activities you want to keep. You have to be holding 5 cards at the end, and your water usage has to add up to 1500 gallons of water or less.

2) Pass out cards.

3) Let students play.

4) Ask the following questions:

- Can a member of each group go up to the board and write down the water uses that they kept?
- Which activities did most people agree upon?
- Why did people seem to agree upon these activities?
- What kinds of activities did people decide to give up?
- Why did people decide to give these activities up?
- Did each family experience water rationing in the same way? Why or why not?
- If water rationing were reduced to 1000 gallons of water each week, what would you do?
- How long could you and your family continue rationing water this way?

### *E*xplore (Where is water conservation needed?)

1) Tell students:

In some places people can only use a certain amount of water. Usually, the local, state, or national government tells people that they need to try not to use very much water.

2) Ask students:

- Where do you think you'd find places that have to save water?
  - How could we find out what places have to save water?
- 3) If internet access is available, let students search for this information. If not, hand out list of 20 rationing cities found on the internet.
  - 4) Pass out maps, globes, and colored pencils. Instruct students to use the globes and mark where these places are on this map.
  - 5) Ask students the following questions:
    - Who has to save water?
    - Is there any pattern to the places where people have to save water?
    - Why do you think these places don't have enough water?

(If students say, these places are dry or these places have lots of people, then pass out maps. If students come up with other possible patterns, let them return to the internet to find global distributions of these things e.g. agricultural distribution, etc.)

- What can you say about why these areas have to save water when others don't?
  - How confident are you in your conclusion?
  - Why might we not be completely confident in these conclusions? (sample of places, inaccuracy of maps)
- 6) In groups of 2 or 3, instruct students to develop a plan and implement it to find out more about why certain areas are more prone to have to save water than other places. Instruct students to present their questions and findings in a short written paper (2 pages double-spaced) that will be edited into a class "Report on Water Rationing." As students submit their reports electronically, edit them into this volume. Then, print out a copy for each student.
  - 7) Then tell students:  
I have a short description of how a Singapore city had to deal with saving water. Find Singapore on your globe. Is this area an area that seems to have a lot of water problems or not?
  - 8) Read the story
  - 9) Ask students the following questions:
    - How would you feel if you were a person living in this city at this time?
    - What if you were a farmer?
    - What if you were the governor who had to tell everyone to save their water?
    - Did the people in the story consider some of the options that you had considered in the Cards activity?

## ***E****xplain* (Water Conservation Methods)

- 1) Ask students the following questions:

- What kinds of things did the people in the Singapore study do to save water?
  - What kinds of other things could people do to save water?
- 2) Pass out brochure and review the conservation ideas. Make a note of defining rationing & water conservation.
  - 3) Instruct students to make a poster showing how they and their family could conserve water.
  - 4) Pass out formative assessment quiz. Allow students to answer & turn in.

## ***E***laboration (Water Rights)

### Simulation 1:

- 1) Arrange students so that they are sitting around a table & give each student a cup. Starting at one end, have the students pour water into their cup (taking as much as they think they need) and then passing it on to the next person.
- 2) Ask students (some of whom got water & some who didn't): How do you feel about this?
- 3) Explain that sometimes there is not enough water to go around.
- 4) Ask students what they could do to ensure that everyone at the table got enough water?
- 5) Repeat the activity following the students' plan.

### Simulation 2:

- 1) Describe riparian rights system: those people who owned land bordering water had access to the water and could use it as they wished. Ask students how this jug activity related to riparian rights.
- 2) Explain how Prior Appropriation Doctrine gives the first people in an area the right to use water regardless of their borders.
- 3) Have each student write down birth month & day on a card & display it. Order the students by their birthdays.
- 4) Pass out the Water Users descriptions by number. The #1 student moved into the area first etc.
- 5) Have the students read their Water Users descriptions and note how much water is used. Then, pass the jug around again in the order of the numbered cards. Tell students to read their description aloud and take the corresponding amount of water. Nonconsumptive water users such as the hydroelectric plants & fisheries can take their water & then pour it back in.
- 6) When the water runs out, ask students:
  - What do you think of this system?
  - How does your role use water?

- How could your role save water?
- 7) Instruct students to write a brief summary of the two approaches to water rights. Instruct students to write down the merits and drawbacks of each method. Ask students to think about where in the world they might expect to find these different patterns of rights based on the Explore activity. Instruct students to provide reasons for their prediction. Have students share their ideas in small groups and then as a whole group (informal presentations).
  - 8) As a final project, instruct students to take their assigned role and research how that entity could conserve water. Tell students to describe the advantages and disadvantages associated with changing these practices. Students may communicate their findings in either a poster or oral presentation due in 1 week.

## **E**valuation

### Engage phase:

- informal assessment of students as they offer answers to whole-group questions and when they play cards with their "families".

### Explore phase:

- informal assessment of students as they offer answer to questions
- student maps with water rationing areas colored in
- student plans about how they could find out more about these patterns & findings in the "Report on Water Rationing"

### Explain phase:

- informal assessment of students as they offer answer to questions
- poster of students ideas about how their family could conserve water
- formative quiz: definition of conservation and rationing; question where students have to say where people conserve water and supported explanation of why these areas are prone to water conservation needs; list how students can conserve water; rank various activities in terms of water requirement.

### Elaborate phase:

- informal assessment of students as they offer answer to questions
- Oral summary of the two different approaches to water rights & evaluation of the merits/drawbacks of both
- Research poster/presentation about water conservation efforts for their assigned roles.

## Supplemental Components/Appendix:

### References for Lesson Plan in General:

Anderson, C., editor. (1998). *Water Conservation: Teacher Resource Guide*. Menlo Park, CA: Dale Seymour Publications.

Botkin, D.B., & Keller, E.A. (2000). *Environmental Science: Earth as a Living Planet*. New York: John Wiley & Sons, Inc.

Environment Agency : Water Resources. (2005). From <http://www.environment-agency.gov.uk/subjects/waterres/>. Retrieved June 12, 2005.

Gleick, P.H. (2000). *The World's Water: 2000-2001: The Biennial Report on Freshwater Resources*. Washington, D.C.: Island Press.

Gleick, P.H. (2001). Making every drop count. *Scientific American*, 284(2): p. 40-46.

Maddous, W.O. (1987). *Water Conservation*. Denver, CO: American Water Works Association.

The Watercourse and the Council for Environmental Education. (1995). *Project Wet Curriculum & Activity Guide*. Activity: Pass the Jug.

### References for Engage:

Council for Environmental Education. 1992. *Project Wild Aquatic Education Activity Guide*.

The Watercourse and the Council for Environmental Education. 1995. *Project Wet Curriculum & Activity Guide*. Activity: Easy Street.

### References for Explore:

Associated Press Website. (2002)  
<http://www.waterconserve.info/articles/reader.asp?linkid=8901> Retrieved 6/1/2005.

Associated Press Website. (2004).  
<http://www.waterconserve.info/articles/reader.asp?linkid=30080> Retrieved 6/1/2005.

California Environment Report Website. (2003).  
<http://www.southlandreports.com/012903Story1.htm>. Retrieved 6/1/2005.

cvillenews.com. (2002). <http://www.cvillenews.com/2002/02/20/water-rationing-possible/>. Retrieved 6/1/2005.

Enchanted Learning Website. [www.enchantedlearning.com](http://www.enchantedlearning.com) Retrieved May 31, 2005.

Guyana: Land of Six Peoples Website. (2004).  
<http://www.landofsixpeoples.com/gytodayfoursevenjs.htm>. Retrieved 6/1/2005.  
[http://www.sokwanele.com/articles/sokwanele/waterconservation\\_11feb2004.html](http://www.sokwanele.com/articles/sokwanele/waterconservation_11feb2004.html). Retrieved 6/1/2005.

Inquirer News Service. (2004). [http://www.inq7.net/nat/2004/jan/10/nat\\_11-1.htm](http://www.inq7.net/nat/2004/jan/10/nat_11-1.htm). Retrieved 6/1/2005.

Islamabad Online. (2003). <http://lists.isb.sdnpk.org/pipermail/sdwg-pak/2003-August/000063.html>. Retrieved 6/1/2005.

JapanUpdate Website. (2004). <http://japanupdate.com/en/?id=5602>. Retrieved 6/1/2005.

Puget Sound Business Journal Website. (2005).  
<http://www.bizjournals.com/seattle/stories/2005/04/11/daily21.html>. Retrieved 6/1/2005.

Science.Designerz.com Website. (2005). <http://science.news.designerz.com/portugals-drought-hit-algarve-faces-water-rationing-in-october.html>. Retrieved 6/1/2005.

Singapore Ministry of Education Website  
<http://www.moe.gov.sg/ne/sgstory/waterration.htm>. Retrieved 6/1/2005.

Sokwanele Civic Action Support Group Web site. (2004).

The Australian Website (2005).  
[http://www.theaustralian.news.com.au/common/story\\_page/0,5744,15183634%255E2702,00.html](http://www.theaustralian.news.com.au/common/story_page/0,5744,15183634%255E2702,00.html) Retrieved 6/1/2005.

The City of Red Deer Website. (2003). <http://www.city.red-deer.ab.ca/Keeping+You+Informed/News+Releases/Archive/2003/July/The+City+issues+mandatory+water+rationing+order.htm>. Retrieved 6/1/2005.

The Hindu, India's National Newspaper Online. (2004).  
<http://www.hindu.com/2004/11/23/stories/2004112314250300.htm>. Retrieved 6/1/2005.

The Jordan Times Website. (1999). <http://www.jordanembassyus.org/072099006.htm>. Retrieved 6/1/2005.

The Samoa Observer Online (2004).  
<http://www.samoobserver.ws/news/opinions/op1004/0110op001.htm>. Retrieved 6/1/2005.

U.S. Water News Online. (2002).  
<http://www.uswaternews.com/archives/arcglobal/2taibeg5.html> Retrieved 6/1/2005.

U.S. Water News Online. (2003).  
<http://www.uswaternews.com/archives/arconserv/3chefac2.html>. Retrieved 6/1/2005.

Walta Information Center Website (2005).  
<http://waltainfo.com/EnNews/2005/Apr/08Apr05/Apr08e3.htm> Retrieved 6/1/2005.

References for Explain:

City of Red Deer Public Works. 2005. Water Saving Tips Brochure. From  
<http://www.city.red-deer.ab.ca>. Retrieved May 31, 2005.

References for Elaboration:

The Watercourse and the Council for Environmental Education. 1995. *Project Wet Curriculum & Activity Guide*. Activity: Pass the Jug

Supplemental Resources for Teachers

American Water Works Association. <http://www.awwa.org/waterwiser/>. Retrieved 6/1/2005.

H<sub>2</sub>OUSE Water Saver Home Website. <http://www.h2ouse.org/>. Retrieved 6/1/2005.

Soil and Water Conservation Society. <http://www.swcs.org/> Retrieved 6/1/2005

Water Conserve -- Water Conservation Portal. <http://www.waterconserve.info/> Retrieved 5/31/2005.

West, Krista. (2003). Restoring the Rio. *Scientific American*, 289(5): 26-27.

Water Use Cards

<b>Flushing a toilet</b> 3 gallons	<b>Brushing teeth</b> , letting water run 2 gallons	<b>Shower</b> , 5 minutes 25 gallons
<b>Watering indoor plants</b> 3 gallons	<b>Bath</b> 40 gallons	<b>Washing car</b> 80 gallons
<b>Watering lawn</b> 40 gallons	<b>Cooking a meal</b> 2 gallons	<b>Washing dishes by hand</b> (1 meal) 3 gallons
<b>Washing clothes</b> , 1 load) 50 gallons	<b>Cleaning house</b> 5 gallons	<b>Drinking</b> 2 gallons/day
<b>Filling a blowup pool</b> 60 gallons	<b>Watering the garden</b> 20 gallons	<b>Running through the sprinkler</b> 80 gallons

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## Water Use Descriptions

#1	You are a descendent of the first homesteader that moved into the area. You own a goat dairy farm and grow alfalfa and corn.	Use 2 cups
#2	Your ancestor was heading toward CA during the great gold rush, but got distracted by the flowers. While picking daisies, he found a huge deposit of copper and started a copper mining company. Your family runs this small, but lucrative, operation	Use 2 cups
#3	Your great-great-grandmother came out to teach the children of the copper miners. You still live on the property bought and need water for personal use and crop irrigation.	Use 1 cup
#4	You represent a small community of families who work in the mine. You use water for daily domestic and irrigation purposes. Your water needs may increase as the town grows.	Use 2 cups
#5	Your grandparents left their farm in Iowa to start a farm here. You help meet the needs of the growing community. Your grandfather is still alive and resists using modern farming practices.	Use 5 cups
#6	To avoid the competition in the big city, your father moved his coat hanger factory to this growing community. The industry provides a means of income for community members.	Use 2 cups
#7	You represent a hydroelectric company with a dam upstream of the town. The water you use passes through the dam to generate electricity. Show this by pouring three cups of water back into the jug (some is lost to evaporation).	Use 4 cups
#8	You represent a town that grew as more people escaping the city moved to the country side. Consequently, your town has become a city. You use water for domestic and irrigation purposes.	Use 3 cups
#9	You are a high-tech farmer that has moved here to supply food to the growing communities.	Use 2 cups
#10	You have decided to start an industry that you think meets a growing need: shoulder pad storage racks.	Use 1 cup