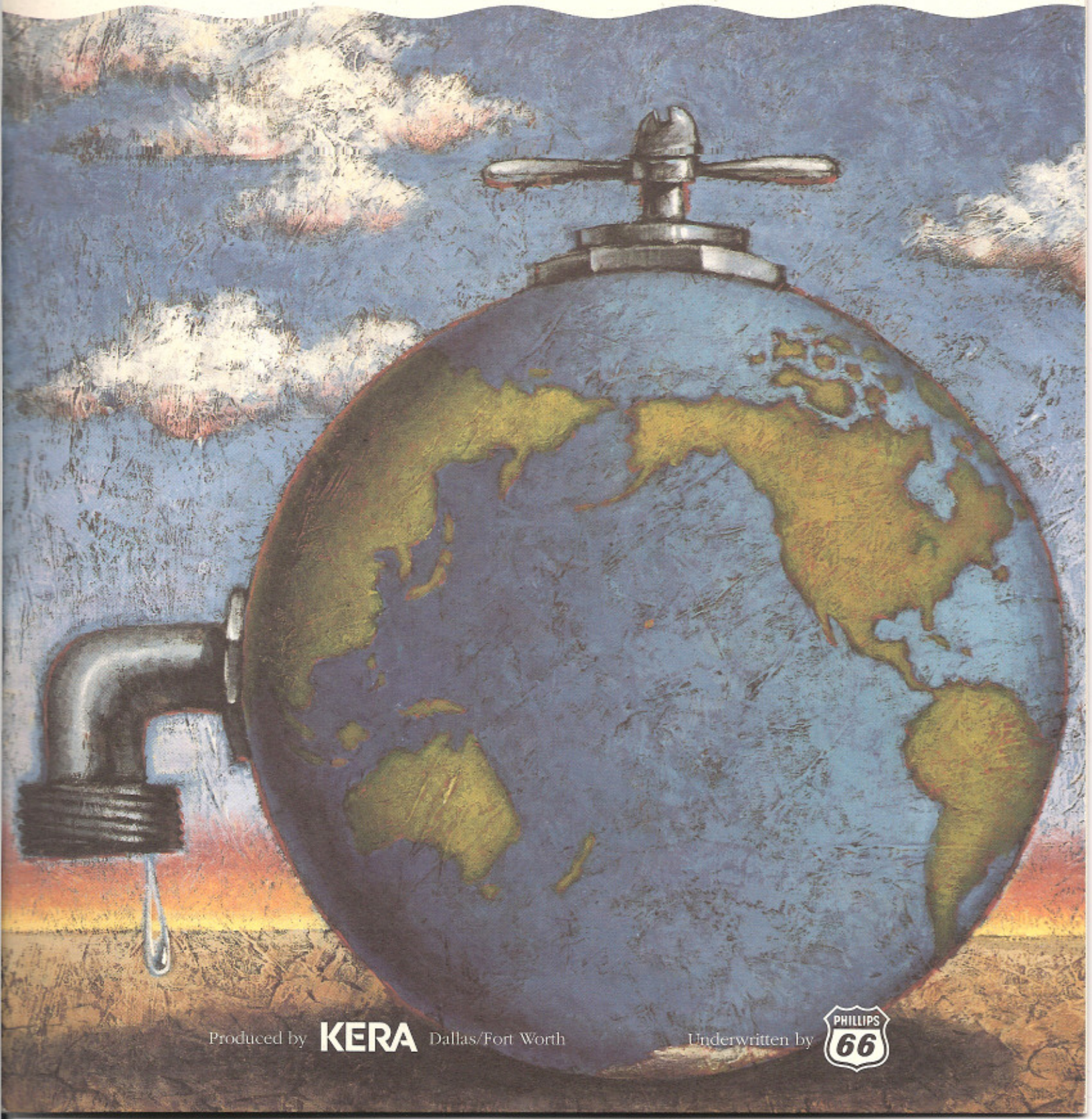
Water

TEACHER'S GUIDE



Produced by KERA Dallas/Fort Worth

Underwritten by PHILLIPS 66

Introduction

THREE-QUARTERS OF THE EARTH IS COVERED BY WATER, BUT IN MANY places there's never enough to drink. Why? Because people have come to depend on water in ways the earth cannot sustain.

We grow water-intensive crops in arid regions. We build ever-expanding cities that overtax the natural water supply. Instead of learning to live within the limits of nature, people have treated water as a limitless commodity. In fact, the world does not have a water *supply* problem. The trouble is water *demand*.

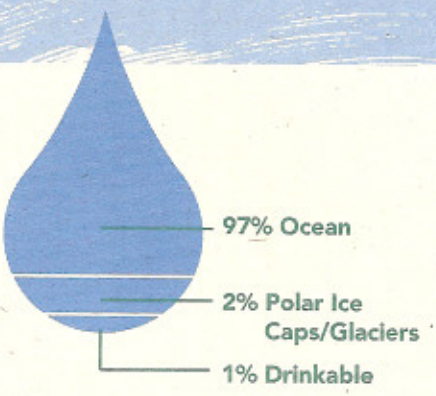
Water, a public television program hosted by James Earl Jones, explores the major issues involving our insatiable thirst:

- **Does population growth affect the availability of water?**
- **Do human uses of water damage wildlife?**
- **Why do cities and farmers battle over water rights?**
- **How do wasteful agricultural practices squander our water reserves?**

Jones introduces a team of international television correspondents who provide in-depth coverage of how these issues affect people worldwide. Between the reports, Jones explains basic background about the state of the world's water supply—from military conflicts in the Middle East to water-borne epidemics in Africa.

Many teaching materials focus on water *pollution* and *quality*. Using the one-hour *Water* program in your classroom can expand these lessons by providing a global perspective on problems involving water *quantity*.

The ultimate goals of *Water* are to highlight solutions and to foster a better understanding of why we should conserve the world's most precious natural resource.



97% of the earth's water is in the ocean, 2% is frozen in glaciers and polar ice caps. Less than 1% is readily available for people to drink.

In This Guide

THIS TEACHER'S GUIDE WAS SPECIALLY DESIGNED TO ENHANCE *WATER'S* effectiveness as a teaching tool in high schools. Included in this guide:

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5 Educational Objectives
Suggested classroom uses for the program that provide teachers with measurable goals.

6 Vocabulary
Unfamiliar terms or phrases used in the program and words that may be used during classroom activities and discussion.

7 Pre-viewing Tips
Suggested approaches to prepare students for the program. These tips don't require technical knowledge of water issues or the environment and can be used by teachers of any discipline or specialty.

During the Program
Suggested ways to present the program in segments or in its entirety.

8 Program Synopsis
A description of the material covered during each segment of the program.

10 Post-viewing Discussion Tips
Questions designed to aid classroom discussion after viewing the program in an effort to help students understand the program's most important points.

12 Student Activities
Ideas that students can use for individual projects, collaborative small-group activities or class-wide exercises. Ideas for action-oriented service learning projects are included.

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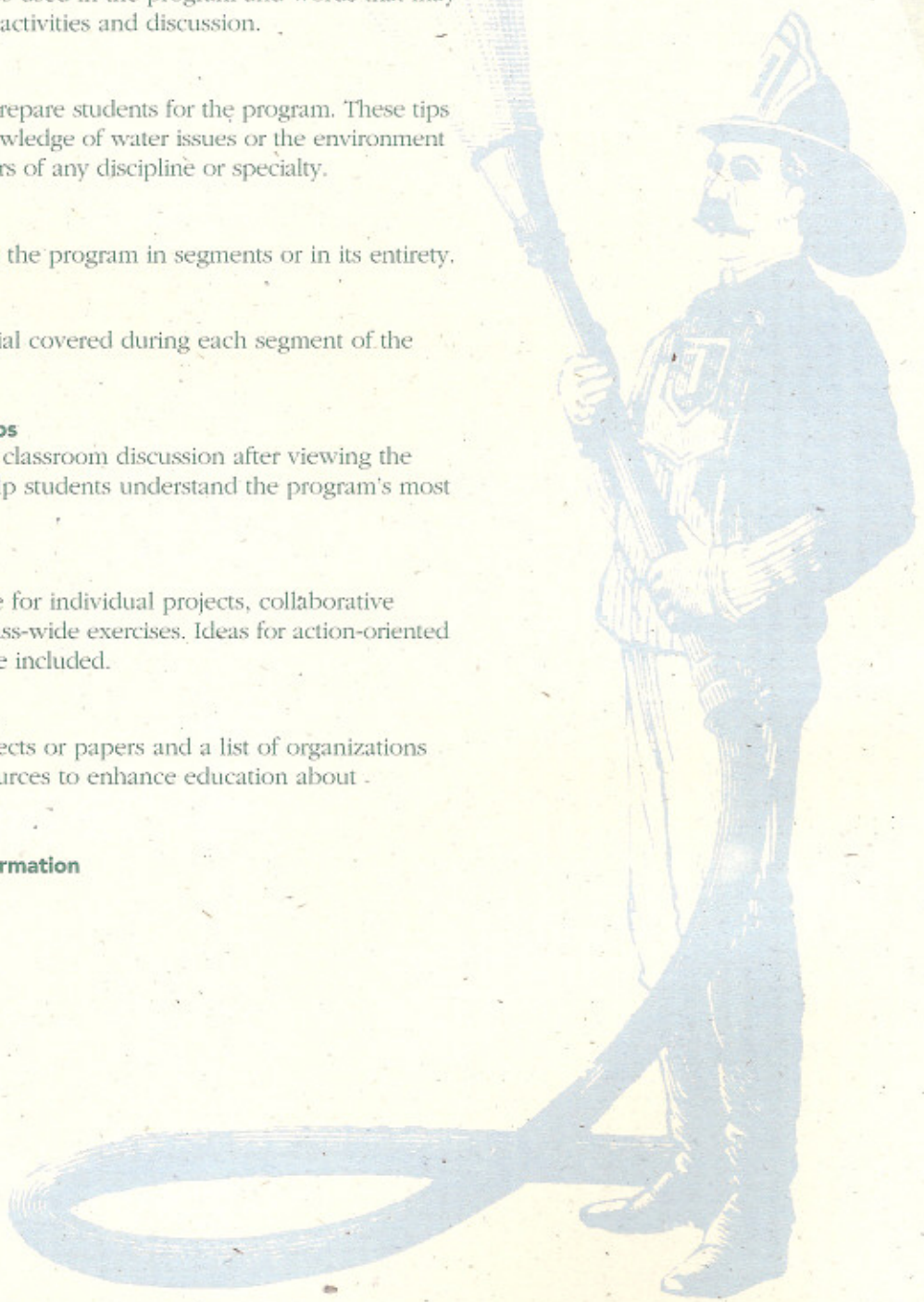


Educational Objectives

WATER CONTAINS INFORMATION THAT IS PARTICULARLY HELPFUL FOR HIGH school students in geography, social studies or science classes.

Introduce the concept of natural resources management
Screening *Water* will expose your students to one of the most important environmental issues facing society today: water-supply management. The program illustrates the importance of conserving the world's water, stresses a solution-oriented approach to complex issues and explains the role of economics in environmental decision-making.

Increase student vocabulary
The program contains a wealth of water-related words that can broaden your students' vocabulary, including several Australian terms.

Strengthen mathematics skills
Multi-step math problems are presented in this guide's Student Activities chapter. These problems introduce unusual water-related units of measure and can develop your students' problem-solving skills.

Improve international cultural awareness
Water shows students how people in other countries are solving their water-related problems. The program takes viewers from dusty cattle towns in the Australian Outback to tenement housing in Mexico City. *Water* contains a rich mixture of international voices, including Spanish subtitles during the report from Mexico.

Involve students in action-oriented projects
Classroom discussion and student activities can broaden the lessons of *Water* to include the concept of environmental stewardship. Students can investigate where their own water comes from and what they can do to protect it. Activities help students to assess the skills and talents required to make a difference in their community.

There are 26 countries that have more people than their water supplies can sustainably support.
Source: *Last Oasis* by Sandra Postel

Vocabulary

Artesian water is an underground water supply that bubbles to the surface under its own pressure.

Aquifer is an underground supply of water.

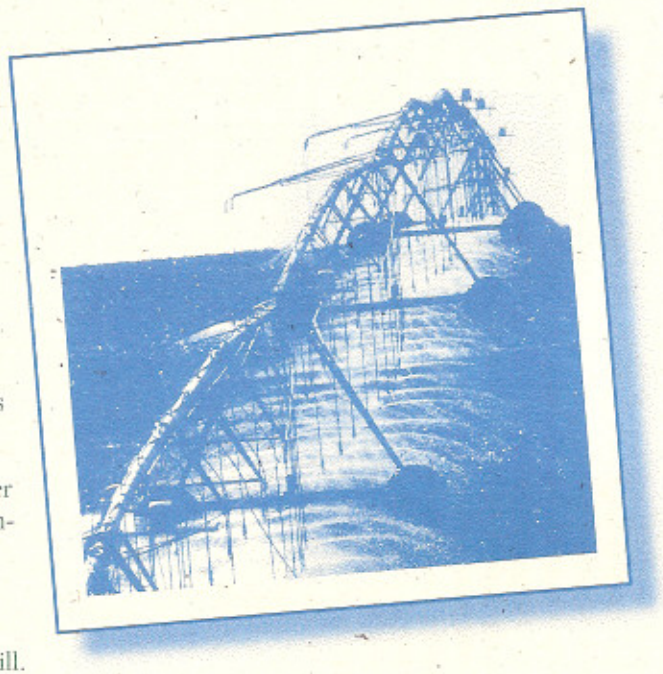
Aqueduct is a canal designed to transport water.

Bore and Bore Drain are Australian terms for a well and a system of open ditches to distribute water from a well.

Cistern is a tank, usually underground, for storing water.

Desalination is an expensive process of removing salt from seawater or salty groundwater. Two methods are commonly used: boiling the saltwater or forcing it through salt-trapping membranes (sometimes called desalinization).

Glacier is a large, moving body of ice that remains frozen year-round.



Grazier and Pastoral Industry are Australian terms for a rancher and the ranching industry.

Groundwater is water beneath the ground, found in cracks of rocks or in wet layers of soil.

Hydroelectric Dams produce electricity by using the force of falling water to spin electric generators.

Irrigation supplies water to crops by artificial means, such as canals or sprinklers.

Percolation is used in the program to refer to irrigation water that is lost by seeping into the ground beneath unlined ditches or canals.

Reservoir is an artificial lake created by a dam.

Siphon is a pipe that uses air pressure to move water uphill. The California Aqueduct uses a siphon system to move water over mountain ranges.

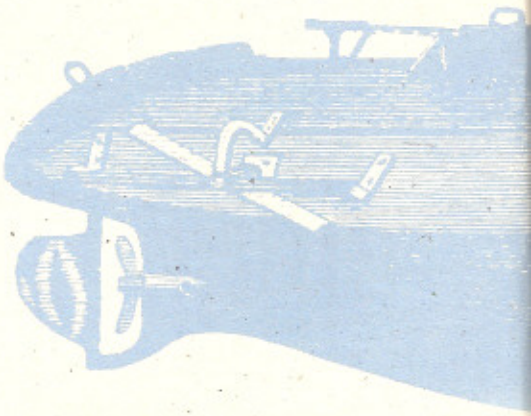
Squatters are homeless people who illegally move into vacant buildings. The presence of squatters has increased community tension over water rationing in Mexico City.

Sustainable Use is a philosophy that says people should balance their use of water to match nature's ability to renew the supply. To use more water than nature provides cannot be sustained.

Water Bank was a temporary system established in California for farmers to sell water to the government, which then sells the water to cities.

Water Rationing limits how much water a person, household or neighborhood receives when water is in short supply.

Watershed is an area of land where all water drains into the same river, stream, reservoir or other body of water.



Pre-viewing Tips

BEFORE VIEWING THE PROGRAM WITH YOUR STUDENTS, WRITE "HOW MUCH water do you use every day?" on the chalkboard. Ask students to guess. The answer: An average American uses 188 gallons per day, according to the *1993 Information Please Environmental Almanac.*

Next, explain how the seeming abundance of water in the world is an illusion—less than one percent of the earth's water is available for people to use. A quick demonstration can reinforce the point.

Demonstration

Use one gallon of water to represent the world's water supply. One tablespoon of the gallon would roughly approximate the fraction that is fresh water (less than 1%). The rest is seawater (97%) or polar ice/glaciers (2%).

Bring a variety of measures to use as props (a measuring cup, a soup ladle, etc.) and ask students to guess which one would hold the world's fresh water supply.

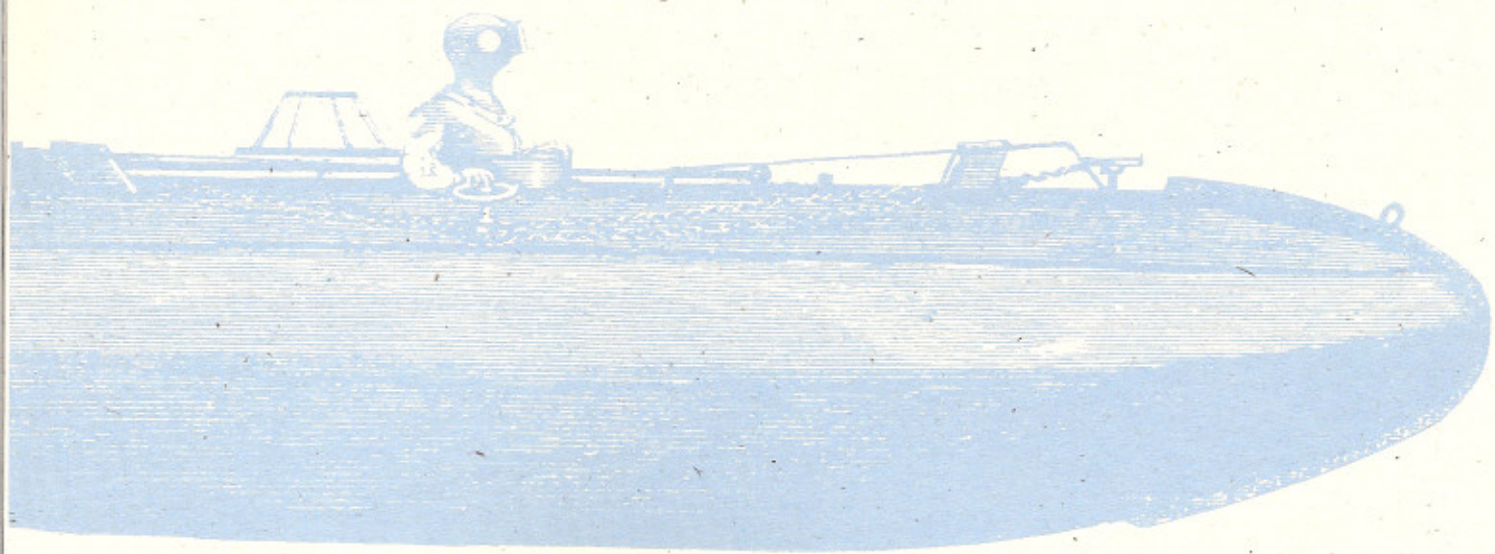
Instead of using water, you can communicate this information by drawing a tablespoon, measuring cup and gallon container on the chalkboard.

Tell students they are going to watch a program that explains why there are worldwide water problems: intense demand and limited supply. Ask them to look for issues in the program that apply to their community. You could also ask students to imagine themselves as one of the characters in the program. What would they do—and how would they feel—if confronted with the problems facing people in the *Water* program?

If all the world's water would fit in a one gallon bucket, only one tablespoon would be fresh, drinkable water.

During the Program

The Program Synopsis in this teacher's guide contains a detailed description of the issues raised during each segment of *Water*, with running lengths for each segment. Consider stopping the tape to discuss the show segment-by-segment. The best place to stop the videotape is during the one second of black that comes at the end of the California, Australia and Mexico segments.



Program Synopsis

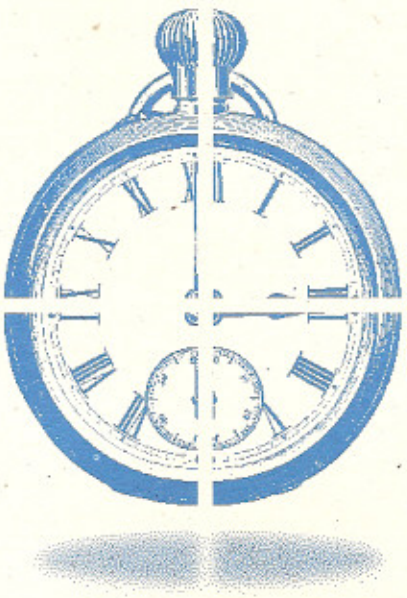
Introduction
(Runs 2:40)
We live in a world where water is rationed by race and religion, where police patrol the streets to find people wasting water, where 30,000 people die every day because of dirty drinking water. The program begins with these grim realities and nature's basic irony: Although three-quarters of the earth is covered with water, most is too salty to drink or is frozen in polar icecaps. Less than one percent is available for people to use. (Host James Earl Jones)

California Water Merchants
(Runs 13:00)
Who should be first in line for water when there's not enough: farmers who grow our food, or cities where most people live and work? California officials are experimenting with "water marketing," an attempt to see if people can cooperate in managing the state's scarce water supply. Many farmers have fallowed land to sell water to Los Angeles. The sales raise questions about where the water will do the most good: industry or agriculture. And they revive memories of the early 1900s, when urban and rural interests battled for control of valuable water resources in California's Owens Valley. (Reporter Terry FitzPatrick)

Water Economics
(Runs 1:20)
More than one billion people worldwide cannot afford a clean, reliable water supply. Small-scale water projects in Africa and South America are improving people's lives, but there are economic limits to what technology can do. The biggest new source of water will come from conserving the supply we already have. (Host James Earl Jones)

4
New Zealand Water and Wildlife
Runs 10:00

3
Mexican Water Rationing
Runs 14:15



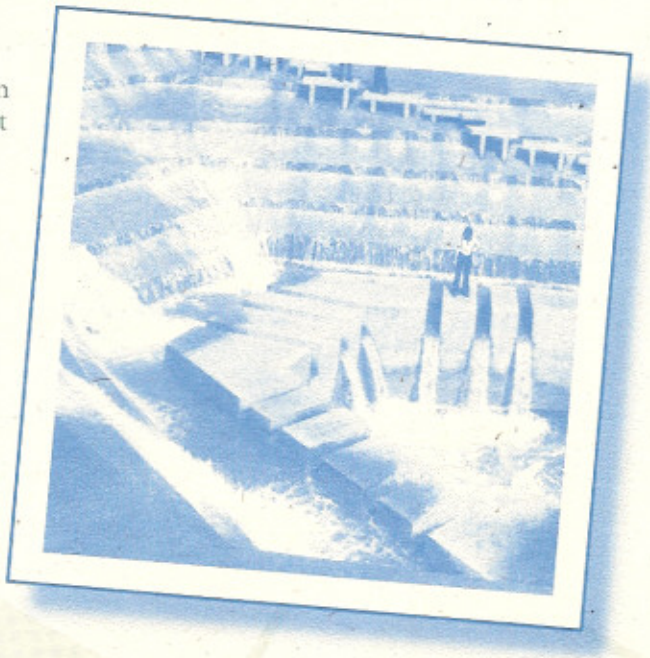
1
California Water Merchants
Runs 13:00

2
Austraillian Water Wasters
Runs 9:00

Water contains four major segments and is structured like a one-hour network news magazine. The videotape may easily be stopped after a segment for classroom discussion. Teachers may show the entire program or just a few segments.

Australian Water Wasters
(Runs 9:00)
Wasting water wasn't a worry in the outback of Australia until the wells started to go dry. For a century, natural artesian pressure has pushed water up to the surface, and ranchers have let their wells gush uncontrollably. Tragically, 95 percent of the water was never put to use and evaporated. Now, the underground pressure is failing and workers are busy capping thousands of free-flowing wells (called "bores" in Australia). (Reporter Lucy Broad)

A Thirsty Planet
(Runs 1:00)
Twenty-six nations now have more people than their water supplies can sustainably support. (Host James Earl Jones)



Mexican Water Rationing
(Runs 14:15)
Economic opportunities in Mexico City are attracting a flood of immigrants. But as more buildings go up, water pressure goes down. Many people must drink from buckets and public barrels, millions face daily rationing, and thousands of families have been evicted to protect areas deemed vital to the water supply. Engineers admit they can't build pipelines fast enough, and the city has embarked on a campaign of water conservation. (Producer Magdalena Acosta)

Water Wars
(runs 1:10)
Water is vital to economic security, which is why water is a major issue in Middle East peace talks. (Host James Earl Jones)

New Zealand Water and Wildlife
(Runs 10:00)
Engineers thought that building dams would provide a renewable and cheap supply of electricity. But the dams have altered the environment so severely that many of New Zealand's exotic birds are on the brink of extinction. The country has new rules mandating "sustainable" management of the system, but economic forces make these rules difficult to follow. (Reporter Peter Llewellyn)

Closing Comments
(Runs :20)
(Host James Earl Jones)

Post-viewing Discussion Tips

ENCOURAGE YOUR STUDENTS TO TALK ABOUT THE PROGRAM AND THEIR reactions to it. These questions can stimulate discussion, or could be topics for student compositions:

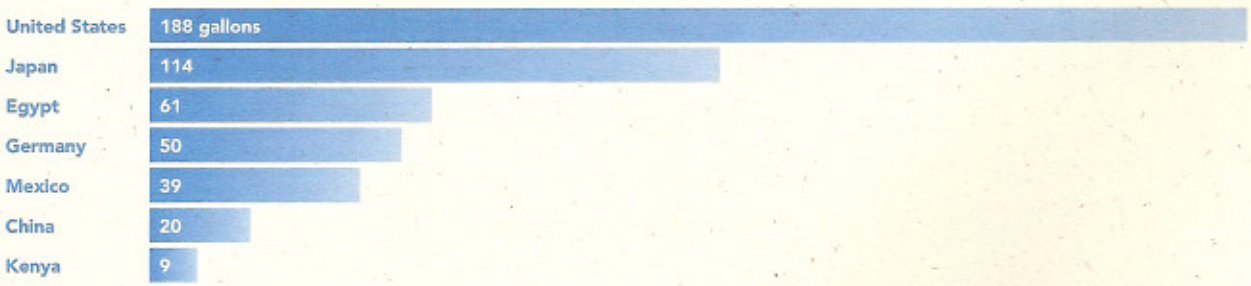
What lessons from *Water* apply to your community?
Do farmers and city residents waste water where you live? Is your city outgrowing the local water supply? Is there a local conservation program to make the water supply go further? Are local fish or wildlife endangered because people use too much water? Is your water supply safe to drink?

Where does your water come from?
Wells? Rivers? Lakes? Reservoirs? Can your students find their water supply on a map? Is the supply adequate to handle population growth? What's being done to increase future water supplies? How is the water purified before distribution?

Are you a water waster?
Ask students if they turn off the tap while brushing their teeth or shampooing their hair. Do they use a hose instead of a broom to clean the sidewalk? Do they have a low-flow shower head? Do they take short showers (less than 5 minutes) to conserve water? Do they have a low-flow toilet or have they placed a brick in the tank to reduce the amount of water used by each flush? Do the rain gutters at home direct water onto the lawn or into a barrel instead of down a storm drain? Are there leaky pipes or faucets at home? Do they wait until the dishwasher is full before they run it?

Who uses the most Water?
Do rich, industrialized nations use more water than poor, agrarian societies? Draw a bar graph on the blackboard, and list the seven countries shown below. Ask students to match the name of the country with the correct bar on the graph. Will pressure on the world's water supply increase as poor countries raise their standards of living? Why does the U.S. use more water than other countries? (Answer: flush toilets, dishwashers, clothes washers, landscape watering, car washes, daily showers and baths.) Can conservation lower water use without reducing people's standard of living? (See figures for Japan and Germany.)

Daily Household Water Use Per Person In Gallons



Source: *1993 Information Please Environmental Almanac.* Figures do not include per capita consumption of water for agricultural and industrial uses.

What will happen if we don't conserve water?
Will your community face water shortages like Mexico City? Is there a conservation campaign in your community? Should the businesses, industry government and citizens of your community do more to reduce water use? Who should take responsibility for water conservation: government officials who manage the water system or businesses and individuals who use the water?

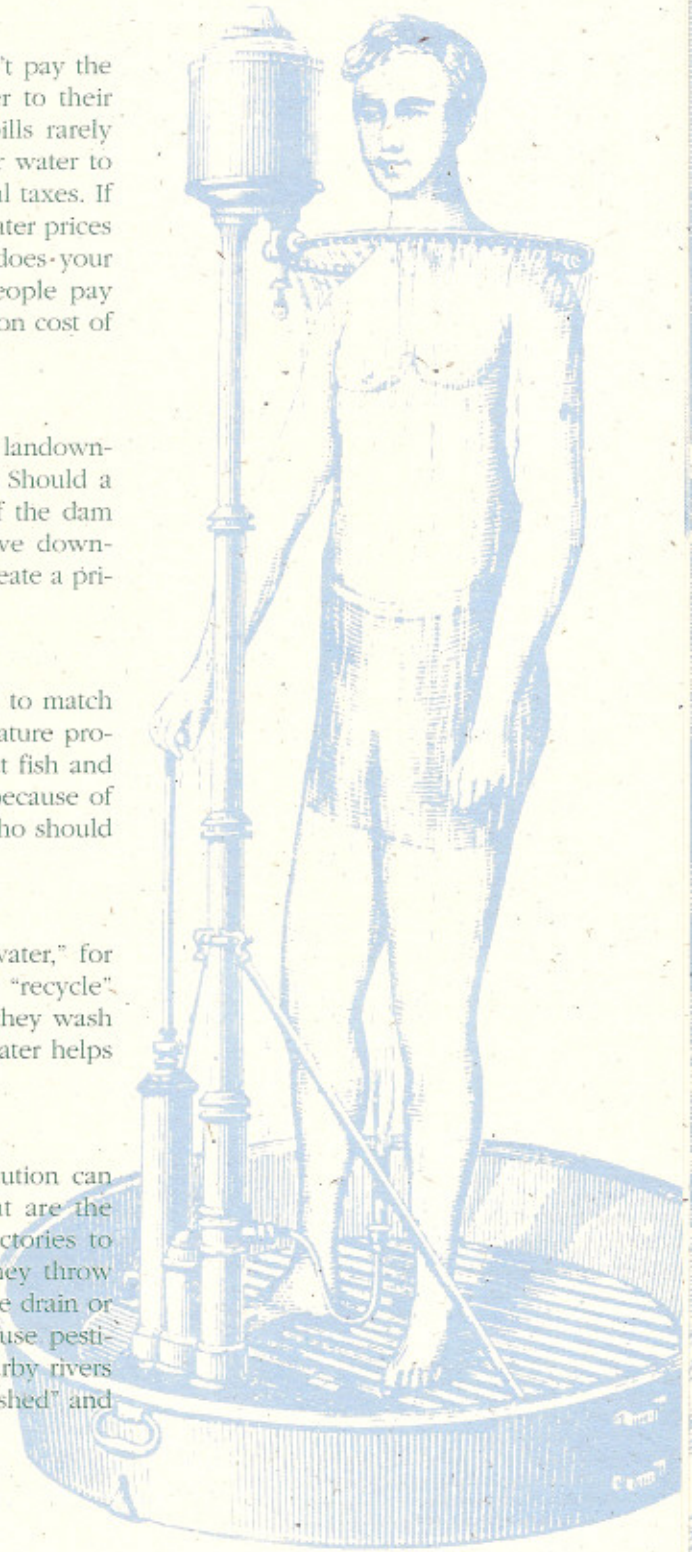
What do you pay for water?
Most water use in the United States is subsidized. Farmers don't pay the full cost of the dams and irrigation systems that deliver water to their fields—much of the cost is borne by taxpayers. City water bills rarely cover the full cost of the pipes and filtration plants that deliver water to their homes. Again, much of the cost is covered through general taxes. If people had to pay the full cost of water service directly—and water prices went up—would people reduce their water use? How much does your community charge for water? Are homes metered, and do people pay more money each month if they use more water? Is the per-gallon cost of water high enough to encourage conservation?

Who owns your water?
Should government own the water supply or should individual landowners have the right to use whatever water is on their property? Should a landowner have the right to build a dam on his or her land if the dam will cut off the water supply for people (or animals) who live downstream? Should government get out of the water business and create a privatized system similar to telephone and electricity companies?

What is "sustainable use"?
This philosophy says people should balance their use of water to match nature's ability to renew the supply. To use more water than nature provides cannot be sustained. Should people use less water so that fish and wildlife are able to survive? Are any local species endangered because of human water use? If there's not enough water to go around, who should be first in line—people or animals?

Can you recycle water?
Does your community use treated sewage, known as "gray water," for landscape watering or industrial processes? Do your students "recycle" water at home by using bath water in the flower garden? Do they wash the family car on the lawn instead of in the driveway so the water helps the grass instead of running down the sewer?

Does pollution affect water supply?
Polluted water is of little use to anyone; therefore, water pollution can reduce the amount of water available to a community. What are the sources of pollution that threaten your water supply? Are factories to blame, or do individual households pollute water, too? Do they throw household chemicals that could harm the water supply down the drain or storm sewer that could harm the water supply? Do students use pesticides and fertilizer on their lawns that can be washed into nearby rivers during a rainstorm? Do they understand the concept of a "watershed" and how human activity affects water quality?



Student Activities

Household Water Audit

Have students read their water meters to learn how much water their families use in a day, week or month. Have them write a report on where water is used in the home. Have them measure how many gallons their shower uses in a minute. Have them measure how many gallons it takes to water the lawn (run the sprinkler into a bucket for one minute, measure how much water you've collected, and multiply this amount by the number of minutes it takes to water the yard). Ask students to suggest how family water use could decrease (see "Are you a water waster?" in the Post-viewing Discussion Tips section of this guide). Have students work together in small groups to spot trends that apply to every home. Have a local water expert come to class to help students learn how to read a water meter and conduct a household water audit. (Note: It's very important in this activity to teach students how to read a water meter because some meters measure cubic feet instead of gallons. One cubic foot of water equals approximately 7.5 gallons.)

Adopt-a-Waterbody

Select a section of river or lake where students can clean up trash and monitor water levels and water quality. This can become an ongoing, year-long project. Students can organize a "streamwalk" to look for things that might threaten water quality, such as pipes that lead into the stream or bare stream banks where storm runoff might contribute to water pollution.

Water Patrols

Buy a rain gauge so students become aware of weekly, monthly and seasonal precipitation amounts. Work with the school maintenance staff to coordinate landscape watering with the student readings of the rain gauge. Have students patrol the grounds to determine which trees, bushes and flowers need immediate watering and which ones can wait a few days. Have students read the school water meter, and organize a campaign to reduce the school's water use. Consider starting a xeriscape garden, one which thrives on natural rainfall only.

Map Your Watershed and Water Supply

Students can develop map reading skills by using topographic maps to show where the storm water goes in your community. Students can also obtain charts of your water supply, sewage treatment and storm drainage systems. By drawing information from these charts onto recognizable maps of your community, students can learn where your water comes from and where sewage and storm runoff goes.

Math Exercises

These exercises can develop a student's problem-solving skills while teaching new concepts of measurement and creative ways to communicate abstract concepts. You can do them as in-class exercises or assign them as homework.

MATH PROBLEM ONE

How much water do people in your community use? Call your local water authority to ask how much water your city consumes on a daily basis. Divide this figure by the number of people in your community to calculate per capita water use. Students can also calculate annual per capita water consumption: Multiply daily use by 365, then divide by the population.

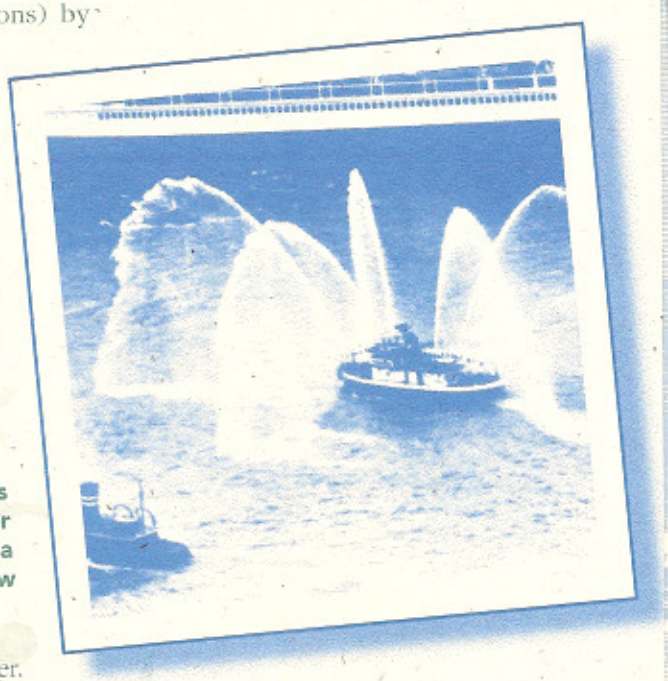
MATH PROBLEM TWO

Does your town use more water than it receives through rain and snow? This problem introduces a water measurement called acre feet: the amount of water it takes to cover one acre of land with one foot of water.

Step 1 Divide your city's annual water consumption (in gallons) by 326,000 to discover how many acre feet are used. One acre foot of water equals 326,000 gallons.

Step 2 Find out how many acres are in your city. Multiply your town's area (in square miles) by 640 to discover the number of acres. One square mile equals 640 acres.

Step 3 Divide the acre feet of water used by the number of acres in the city, and you'll discover how deeply you could flood the town. Does this "flood" represent more precipitation than you receive each year through rain and snow? If so, where did your city get the extra water?



MATH PROBLEM THREE

Do low-flow devices save you money? A regular shower head uses 50 gallons during a 10-minute shower. An average low-flow shower head uses 25 gallons and costs $12. Water typically costs 2/10 of a cent per gallon (.2 cents). If you take one shower every day, how much money will the low-flow shower save in 5 years?

Step 1 Calculate how much water you'll save during each shower. Subtract the low-flow amount (25 gallons) from the regular shower amount (50 gallons). Answer: 25 gallons saved per shower.

Step 2 Discover how much money you'll save per shower. Multiply the water saved with each shower (25 gallons) times the amount you pay for water (.2 cents per gallon). Answer: 5 cents saved per shower.

Step 3 How much savings in 5 years? Multiply the savings per shower (5 cents) times the number of daily showers you take in 5 years (1825). Answer: $91.25 saved—by investing $12 in a low-flow shower head.

This calculation is called a *cost/benefit analysis.*

Pollution Prevention

Invite an expert on household hazardous waste to speak about the dangers that everyday chemicals can pose to local water supplies. Educate students about what they should do with used motor oil, pesticides, paint and other household chemicals. Involve students in a campaign to stencil warnings on storm drains to alert people that storm runoff can pollute nearby streams.

Field Trip

Organize a field trip to a local dam, reservoir, filtration plant, pumping station, water recycling facility or sewage treatment plant. Have students prepare questions about where their drinking water comes from, how it is treated and distributed, and what your community is doing to manage the growth of water demand. Alternatively: Have a local water expert come to class with a slide show presentation. Ask the expert what students can do to help conserve water.

Bibliography

THESE PUBLICATIONS WILL HELP STUDENTS TO WRITE PAPERS ON WATER issues or to research water-related class projects:

Last Oasis, 1992, by Sandra Postel. W.W. Norton & Co. This 240-page book chronicles water conservation efforts around the world and contains a wealth of worldwide water statistics.

Water, November 1993, by National Geographic Society. A 120-page special issue of *National Geographic Magazine* devoted exclusively to the topics of water supply, development, pollution and restoration in North America. Contains a fact-filled map poster. Note: This is a *special* issue, not the regular November 1993 issue.

Information Please Environmental Almanac, Houghton Mifflin Co. An annual 600-page compilation of environmental facts, including details of per-capita water consumption for all 50 states and more than 100 countries. Publication of this resource ended with the 1994 edition.

These publications can help teachers to plan water-related curricula and action-oriented student projects:

Educating Young People About Water, 1995, by Elaine Andrews and the Cooperative Extension National Review Team. This publication reviews 100 water-related teaching publications and provides water education goals for youth. Distributed by University of Wisconsin—Madison Environmental Resources Center, 216 Agriculture Hall, 1450 Linden Drive, Madison, Wisconsin 53706.

Give Water a Hand, 1995, National 4-H Council. Individual action guides for schools, home, community and farms to help students identify local water problems and plan activities to improve water quality. Distributed by University of Wisconsin—Madison Environmental Resources Center, 216 Agriculture Hall, 1450 Linden Drive, Madison, Wisconsin 53706.

The following organizations publish material to assist education about water issues:

American Water Works Association
6666 W. Quincy Ave.
Denver, Colorado 80235
303-794-7711 800-926-7737

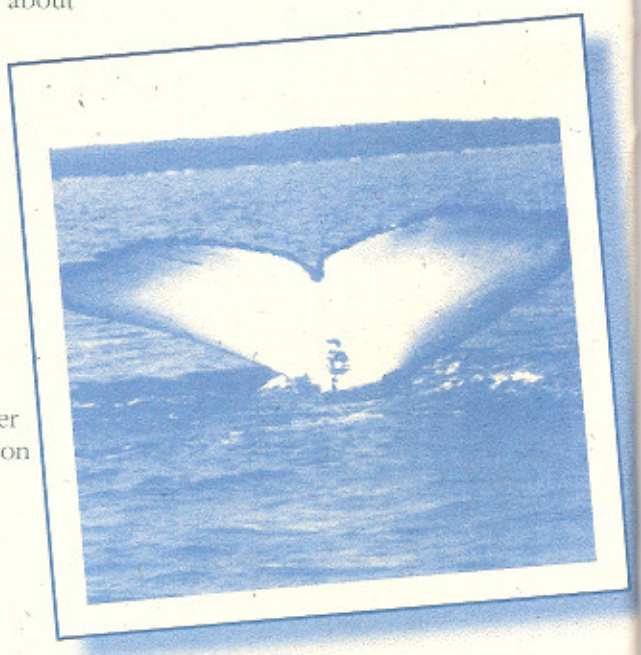
Global Rivers Environmental Education Network
721 East Huron Street
Ann Arbor, Michigan 48104
313-761-8142

Project WET (Water Education for Teachers)
201 Culbertson Hall
Montana State University
Bozeman, Montana 59717-0057
406-994-5392

Water Education Foundation
717 K Street, Suite 517
Sacramento, California 95814
916-444-6240

World Resources Institute
1709 New York Ave., N.W.
Washington, D.C. 20006
202-638-6300

Give Water a Hand
Environmental Resources Center
University of Wisconsin--Madison
216 Agriculture Hall
1450 Linden Drive
Madison, Wisconsin 53706
1-800-WATER20



Taping and Purchasing Information

Taping

Educational institutions have the right to tape *Water* off the air and play it for instructional purposes. Most PBS stations have a copy of *Water* and are allowed to broadcast the program until April 1998. (*Water* premiered on PBS stations in April 1995.) Call your local PBS station and ask if they plan to rebroadcast *Water*, or ask if the station can organize a special late-night transmission for your school to record.

Purchasing

Water is available on VHS videocassette for use in schools and libraries. The cost is $45, including shipping and handling. To order, write to:

Water Video
KERA-TV
3000 Harry Hines Boulevard
Dallas, Texas 75201

Telephone Orders
214-740-9288

A Spanish-language version of the program is also available.

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