Lesson designed by the City of Lubbock Water Utilities Conservation Education Department
406 Muncipal Drive Lubbock, Texas 79403 (806) 775-2586

WATER SHORTAGES: ISSUES AND SOLUTIONS

I. Objectives:

1.Students will be able to define Water Shortage.
2.Students will be able to discuss solutions to water shortages.
3.Students will be able to explain water solutions explored locally.
4.Students will use critical thinking skills to analyze media from internet, local newspapers and promotional materials from local sources.

III. Materials

1) Critical Thinking Worksheet
2) Brochures, newspaper articles, websites and other materials about local water issues

IV. Introduction

1) Worldwide drinking water is a topic of discussion. Locally this is a particularly hot topic as we live in a semi-arid region of the United States. Receiving on average only about 19 inches of rainfall per year. As our resources decline and demand increases with a growing population, water shortages will become more frequent and solutions will become priority for the City of Lubbock and every other area of the world.

V. What is a Water Shortage? How do we solve the Problem?

1) According to the US Weather Bureau, a drought exists whenever rainfall for a period of 21 days or longer falls substantially below average.

a. The Great Plains average 35 consecutive days of drought per year
    i. 75-100 successive days every 10 years
    ii. Up to 120 consecutive days without rain have been recorded
b. Drought is common and the result is water shortages
    i. Shortages can be attributed in part to the failure of ag and municipal users to adapt to drought – that is to save water (conserve) during dry years.
c. Current rainfall/drought information for Lubbock
    i. Available at (Lubbock Climate Information)
    http://www.srh.noaa.gov/lub/climate/
    (All time Lubbock Records)
    http://www.srh.noaa.gov/lub/climate/records_alltime_klbb.php

2) Increasing Water Supplies

a. Even if per capita water usage stays the same, total water use in the US by 2050 will increase substantially because of population increase.
b.Where will this water come from?!?!?
    i. Water Conservation
    ii. Reclamation of Sewage
    iii. Development of Groundwater
    iv. Desalinization
    v. Rainmaking
    vi. Diversion of surface water to water short areas
    vii. Harvesting Icebergs

3) Conservation – Using Water More Efficiently
   a. On the Farm – 70% of all water is used by farmers, mainly for irrigation
      i. 150 gallons of water = 1lb of cotton
      ii. 15,000 gallons of water = 1 bushel of wheat
      iii. Ways to reduce water usage on the farm
         1. Reducing seepage
         2. Use drip
         3. Heat sensors
   b. In Industry
      i. Improving technology
   c. At Home
      i. Shorter showers, turn off while brushing teeth, wash only full loads, fix leaks, etc.
      ii. In yard – sprinkler systems, nozzles, mulch, etc.

4) Reclamation of Sewage Water
   a. Sewage produced by homes contains human waste. Huge amounts are generated each day.
   b. Goes to sewage treatment plant that removes many pollutants.
   c. City of Lubbock treats 29.39 million gallons per day!
      i. We already use that treated water, called effluent for
         1. Excel cooling towers – approximately 4 million gallons per day
         2. City Farms – 13.5 million gallons per day
         3. Wilson Farms – 5.54 million gallons per day
         4. Stream Discharge – 3.5 million gallons per day
   d. Could we use it for drinking water?
      i. YES! Upgrades to Wastewater Treatment Plant.

5) Developing Groundwater Resources
   a. Conservation and water reclamation are two highly sustainable options. They promote key principals of sustainability – efficiency and recycling. The potential of these options is incredible. The more traditional and perhaps less sustainable approach to meet rising demand involves the development of new water sources.
      i. Current use of Ogallala
         1. depletion
            a. Because of geological isolation, the Ogallala aquifer is slow to recharge (on average about ½ inch per year). Current usage is depleting the aquifer by 1 ft per year.
         2. playas – These ephemeral lakes play a vital role in aquifer recharge. They are rapidly disappearing as roads, towns, businesses and farming practices fill them in, convert them to storm water drainage basins, and pollute them.
         3. high energy requirements – It takes a lot of electricity to pump water up from hundreds of feet underneath the ground.

6) Desalinization
   a. "Water, water everywhere, but not a drop to drink"
      i. 70% of Earth is covered by seawater, in some places 6 miles deep. There are also salt water aquifers.
      ii. Desalinization is the removal of salt from seawater in order to make it usable for humans, crops, and wildlife.

1. 1st plant built in California – produces 28,000 gallons of freshwater daily.
2. 75 installations established along Florida. (capable of producing 114 million gallons per day)
3. Middle East relies on desalinization for drinking water
4. Development of salt-resistant crops – Barley in California
5. El Paso is the site of the world's largest inland desalinization plant.
    a. Produces 27.5 million gallons of fresh water daily.
    b. Pumps brackish water from the Hueco Bolson (aquifer). More information at http://www.epwu.org/water/desal_info.html

7) Rainmaking
    a. Cloud seeding – dispersing tiny crystals of silver iodide in moist air. The hope is that these crystals will serve as condensation nuclei, particles around which moisture will collect until raindrops are formed.
    b. Called – weather modification
    c. Examples
    d. Problems with Weather Modification
        i. Legal, political, economic and environmental
            1. high cost
            2. possibility of increasing rainfall in one area could reduce rain in another area
            3. lack of control over the amount and precise location of precipitation.

8) Harvesting Icebergs
    a. Billions of liters of fresh water are locked up in Antarctic icebergs.
    Some believe that one day this water may be used to irrigate cropland in California.
    b. Researchers predict that use of the extensive icebergs in Antarctic to support crops in our southwestern states is realistic, both technically and economically.
        i. In their scheme, a number of iceberg blocks could be harvested and cabled together to form "trains". The trains would then be pushed into suitable ocean currents and guided north for more than 6,000 miles to a "parking" area off the coast of various countries. Warm-water discharges from electrical power plants along the coast would speed up the meltdown of the icebergs. The water would then be piped inland for either domestic, industrial or agricultural use.
        ii. Interestingly, the water supplied by this measure in southern California would actually be much less salty than that of the Colorado River, which is being intensively tapped for irrigation farming today. By using such iceberg water, southern Californians could reduce their expensive withdrawals from the Colorado River by at least 1 million acre-feet per year. The cost of this plan would be less than that of water obtained by desalinization or from the Colorado River.
        iii. Sounds exciting, right? But before a single iceberg is guided north, the environmental effects of those icy mountains on coastal water temperatures, fish reproduction, and migration, and climatic patterns must be thoroughly studied.
        iv. http://www.rand.org/pubs/papers/P5137/ - Copy of the Report compiled by Rand.

9) Diversion of surface water to water short areas (Long Distance Water Transport)
    a. Although costly and controversial, water diversion projects are seen by some developers and government officials as a way to provide water to water-short regions.
    b. Example: The California Water Project

i. Looking down on the Earth, American astronauts could only identify two artificial structures: The Great Wall of China and the main aqueduct of the California Water Project (CWP).

ii. In California 70% of its potentially usable water falls on the northern third of the state, while 77% of the demand is located in the semi-arid southern two thirds, where only 5 inches of rain falls per year.

1. The CWP was built to equal out water distribution in California.

2. The most complex and expensive water diversion project in the history of the world!

   a. 21 dams and reservoirs
   b. 22 pumping stations
   c. 685 miles of canals, tunnels and pipelines.
   d. Cost well over $2 billion – enough to build 6 Panama Canals!

3. Criticism from environmentalists.

   a. Loss of scenic beauty
   b. Destruction of fish and wildlife habitat
   c. Free-flowing wild rivers dammed

4. Regardless of these criticisms and the enormous cost to the people of California, the CWP is an accomplished fact and is helping to alleviate Southern California's recurring water shortages.

5. According to some, this project is likely to be one of the last of its kind.

   a. Too expensive
   b. Far more cost effective and sustainable means of meeting future demands must be employed, among them population stabilization and water efficiency measures in homes, offices, and businesses.
   c. Also essential to creating an environmentally sustainable water supply system are measures to recycle water and recharge groundwater.

VI. ACTIVITY

Have Students work in groups of 4 or 5 to examine City of Lubbock brochures, handouts and newspaper articles dealing with water. Have students fill out worksheet, discuss as a class.

Name_____

WATER SHORTAGES ISSUES AND SOLUTIONS WORKSHEET

Title of Articles Examined:

What water related issue is discussed in your articles?

Does the article address how to solve the issue? If so, what does it recommend and do you agree?

CRITICAL THINKING

1. Discuss the statement, "The United States does not really have a water shortage; it is plagued with a water distribution problem."

2. In your opinion, what solution is best for ensuring Lubbock has a water supply for a long time to come?

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