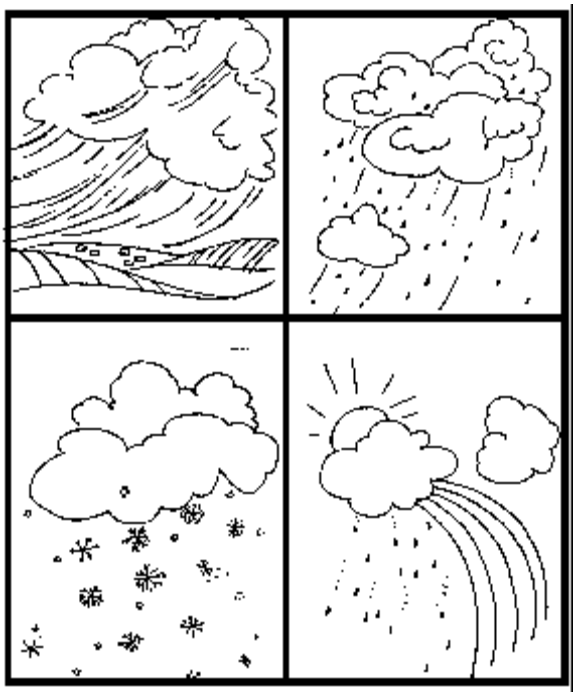
Water Cycle

The Earth's Gift

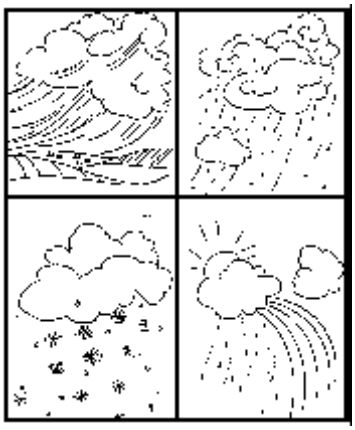
SIXTH GRADE

WATER



1 WEEK
LESSON PLANS AND
ACTIVITIES

WATER CYCLE
OVERVIEW OF SIXTH GRADE



WATER

WEEK 1.

PRE: *Evaluating components of the water cycle.*
LAB: *Experimenting with porosity and permeability.*
POST: *Discovering the major waterways.*

OCEANS

WEEK 2.

PRE: *Exploring ocean movements.*
LAB: *Experimenting with the ocean's movements.*
POST: *Comparing the different reasons for ocean movements.*

ATMOSPHERE

WEEK 3.

PRE: *Discovering the jet stream.*
LAB: *Tracing atmospheric winds.*
POST: *Discovering different air masses in the United States.*

WEATHER

WEEK 4.

PRE: *Comparing weather map patterns.*
LAB: *Comparing satellite photos with weather maps.*
POST: *Researching books for weather information.*

WATER CYCLE - WATER (6)

PRE LAB

Students learn vocabulary that describes the water cycle.

OBJECTIVES:

1. Evaluating the components of the water cycle.
2. Exploring the water cycle in detail.

VOCABULARY:

evaporation
groundwater
precipitation
surface water
water cycle

MATERIALS:

worksheet
crayons

BACKGROUND:

Students by the 6th grade should be familiar with the mechanism of the water cycle. They might not realize the significance of water to enable life to exist on Earth. The following is a summary of the importance of water to life.

1. Water remains a liquid over a very wide temperature range, namely, a range of 100<C between freezing and vaporization. This spans the temperatures of most parts of the Earth where life can occur.

2. Water has a very high specific heat, which means that it can absorb or lose much heat before its temperature changes. This is important in maintaining body heat in mammals, such as ourselves.

3. Water has a high latent heat of vaporization. For this reason, water evaporates slowly from ponds and lakes, where many life forms are dependent on it.

4. Water is less dense in its solid state than in its liquid state, so that ice floats instead of sinking. This property permits life to develop in polar regions and subpolar regions where ice floats and allows life to continue living below the surface. If ice were heavier than water, it would sink, and more ice would form on top of it. As a result, all life in the waters would be trapped in the ice in the many areas of the world where it gets cold enough to freeze water.

5. Water is a remarkable solvent not only for the reasons mentioned above but also for gases such as oxygen and carbon dioxide. The oxygen must be soluble in the water phase

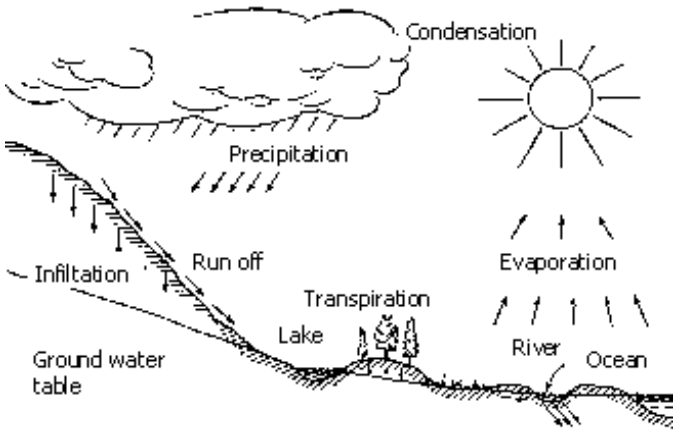
of the living cell in order for it to be used for oxidation of food. At the same time, another gas, carbon dioxide, must also be soluble to escape to the outside of the cell, from where it travels to the lungs to get expired.

6. Water exhibits surface tension. The molecules of water on the surface of a calm and quiet pond tend to be drawn into the liquid, so that the liquid surface is taut, like a sheet of rubber drawn over the open mouth of a jar. This tautness is called surface tension. It can support small objects like a sewing needle. This "skin" on the water can also cause a handicap to mayflies and caddisflies that try to emerge from their juvenile images. It also can trap flying insects that accidentally fall into the water and are unable to fly out.

7. Water exhibits viscosity. One can observe the effects of viscosity alongside a stream or river with uniform banks. The water along the banks is nearly still, while the current in the center may be swift. This resistance between the layers is called viscosity. This property allows smaller fish to live near the shore, while larger fish are able to swim efficiently in strong currents. Viscosity is also responsible for the formation of eddies, creating turbulence that leads to good mixing of air in the water and more uniform distribution of microscopic organisms.

PROCEDURE:

1. The water cycle can be very simple, but the more times a student is introduced to the concepts, the more involved the cycle becomes. The movement of water involves more than just evaporation and precipitation. Go over the major parts of the water cycle as illustrated by the diagram below.

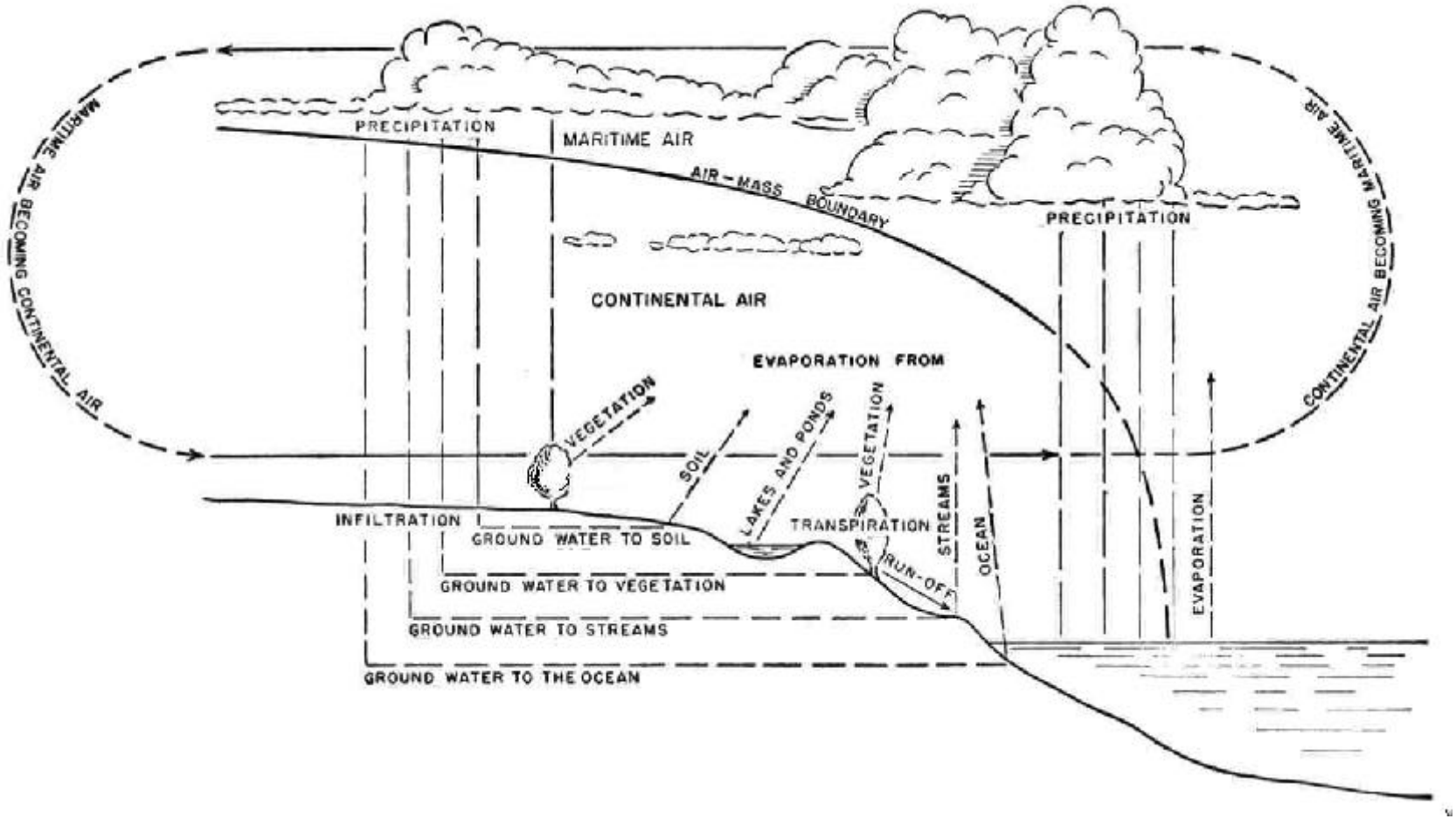


evaporation - the changing of liquid to water vapor
condensation - the changing of water vapor to a liquid
precipitation - forms of water vapor that are heavy enough to fall to the Earth's surface such as rain, snow, sleet, hail, and fog
infiltration - the process by which water seeps into the soil
water table - the level below which the ground is saturated with water

lake - a body of water larger than a pond and too deep in parts for rooted plants to live
river - a natural stream of water larger than a creek and emptying into an ocean, lake, or another river
ocean - the bodies of salt water that cover nearly three fourths of the surface of the earth
groundwater - water found below the surface of the Earth
runoff - water that flows on the surface or through the ground into streams, rivers, lakes and oceans
transpiration - the evaporation of water from the leaves of plants

2. Use the worksheet and have the students draw in some of the components to make the diagram easier to understandable. You may want the students to write a paragraph on the water cycle, taking information from the worksheet.

WATER CYCLE - WATER (6)



WATER CYCLE - WATER (6)

LAB

Students learn about movement of water through the ground.

OBJECTIVES:

1. Exploring ground water.
2. Experimenting with porosity and permeability.

VOCABULARY:

groundwater
permeability
porosity
water movement

MATERIALS:

lab sheet
graduated cylinders
250 ml beakers
4 different types of sand or WATER CYCLE - WATER (6)
sand charts
size and sorting sand chart
plastic water bottle (small)
different sands, soil, small rocks
water mixed with mud (dirty water)
funnel

BACKGROUND:

Ground water is water stored under the surface of the earth. Convey to the students that ground water sometimes takes hundreds of years to accumulate. A good example of this occurs in the Sahara Desert in Africa, where ground water has accumulated for thousands of years and is still being used for drinking and irrigation. Ground water is stored in the ground below us, where different types of rocks can act as reservoirs. Sand or sandstone is the best material for a reservoir and forms extensive aquifers underground, but not all sands are created equal, as students will find out in lab.

Filtering water through different porous substances cleans water naturally in the ground. Substances like charcoal and diatomite (white powder that people put in pools), help to filter small particles that may be suspended in water.

The ground on which we live, is made up of many layers of different types of rocks. Water can move into the tiny pores within the rocks or soil. As they move, the different rocks

can trap the particles in the pores. Some rocks have more pores than other rocks and can act as a reservoir of water or an aquifer. Some municipal water supplies depend on ground water for a source of drinking water. Filtering techniques are used in municipal water supplies. Water from a reservoir is cleaned through a combination of filtering and chemical processes.

PROCEDURE:

1. At the beginning of this lab, review the main components of the water cycle. This lab shows students how ground water moves through rocks that have a high porosity.

2. Students will discover that large grains allow water to move freely and also have large pore spaces (can hold more water). You may want to use the diagram on the right to help you illustrate this principle. Follow the directions on the student lab sheet. Do not use plastic beakers or graduated cylinders because the sand will scratch the plastic.

3. Have the students measure and compare their results in order to draw conclusions. Sand size and sorting of the sand particles do have a lot to do with how water moves. You may want to introduce the term POROSITY (meaning the pore space available for liquid) and PERMEABILITY (how freely the liquid moves through the sand). In the diagram to the right, you can notice that water can only flow through open space. The best aquifers have large porosities and permeability. In poorly sorted sands, there is usually more pore space available.

4. This is just an introduction to these concepts. You can reuse the sand even if it is wet. However you must drain the water and if you are doing more than one lab in a row, you may want to save dry sand for students to do the sorting of the sand. If the sand grains are large it tends to have more porosity and permeability. The smaller the grains of sand the less pore space allowed for the movement of water. The small amount of sand used in this experiment may cause differences in results. The objective is just to recognize water movement.

5. In exercise 3, students will be testing how to filter water. The tube is just a small water bottle, that is filled with different layers of material that will help clean the water. You may want students to prepare this at home and then experiment in class. You will require a lot of different types of soil and sand if you are doing this in class. Use different sand, rock, charcoal, or similar items that may help clean the water. Get a plastic water bottle (small) and make 5-7 nail size holes on the bottom of the bottle. (You may want parents to help with this at home.)

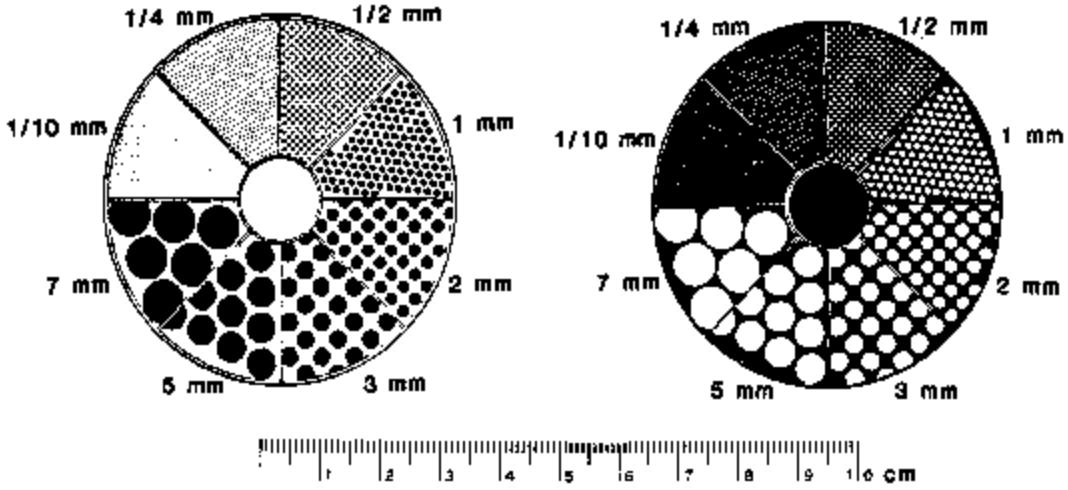
6. Have the students add one type of material one at a time so that layers are formed. For example first add one inch of sand then add one inch of charcoal. A funnel, if you have one, can make this step easier, otherwise just have them use their hands as if they were in a sand box. Make sure the materials are dry when you are making the layers.

7. Use the worksheet to record the type of materials used to fill the bottle. Fill in the type of material that you used for each layer and assign it a color in the legend area. Using the colors you have indicated in the legend, have the student color the different layers in the bottle shape to match what their bottle actually looks like. Each student will demonstrate if their filter can clean dirty water in class. You may want to test out the filter, by adding dirty water and see how well your filtering tube can clean dirty water.

WATER CYCLE - WATER (6) LAB

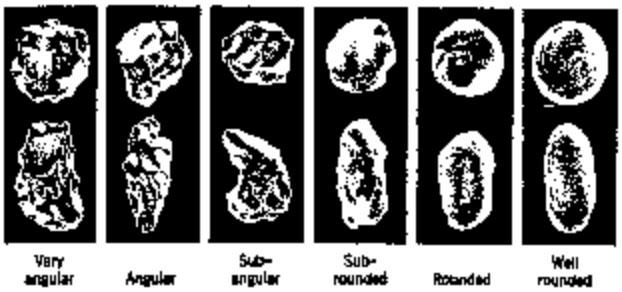
SAND CHART

Sorting refers to particles that are the same size (well sorted) or many different sizes (poorly sorted.) Roundness refers to whether the particle is angular or rounded. Both sorting and roundness provide information on the duration of the particle in the erosional cycle.



sorting

roundness



WATER CYCLE - WATER (6)

PROBLEM: Does water flow at different rates in different types of sand?

PREDICTION: _____

MATERIALS: 4 graduated cylinders (25ml), 4 different types of sand, 250 ml beaker of water

EXERCISE 1. Using the sand charts, measure the size and sorting of the 4 different sands. Record the results in the chart below.

	LOCATION	SIZE	SORTING
SAND #1			
SAND #2			
SAND #3			
SAND #4			

EXERCISE 2. Fill the graduated cylinder with 15 ml, each with a different sand. Make sure they are filled to the same height. Pour approximately 5 ml of water into each tube very slowly. Time how long it takes for all the water to reach the bottom. (Count one thousand one, one thousand two). Record your results in the chart below.

	TYPE OF SAND	TIME
SAND #1		
SAND #2		
SAND #3		
SAND #4		

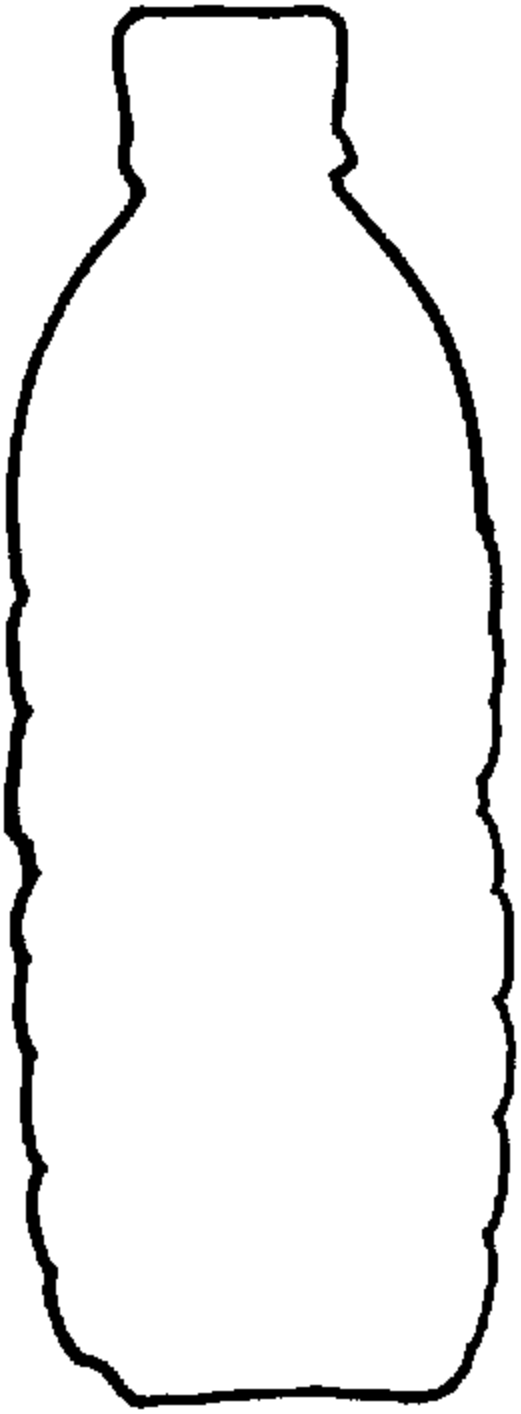
EXERCISE 3. Make a filtering machine by using different rocks, sand, or soil in a plastic container. Record what you put in and how much in the worksheet provided. Follow your teachers instructions.

CONCLUSION:

1. Does sand size have anything to do with how fast the water moves?Why? Does the sorting of the sand have anything to do with how fast the water moves? Why?

_____

WATER CYCLE - WATER (6)



LEGEND

WATER CYCLE - WATER (6)

POST LAB

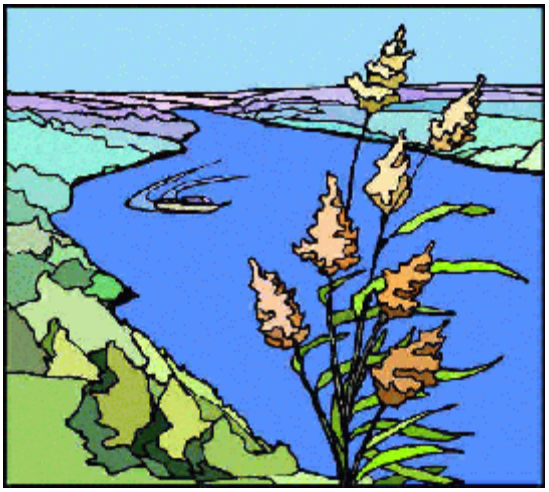
Students use the internet to explore their states waterways.

OBJECTIVES:

1. Discovering the major waterways.
2. Exploring the need for water in California.

VOCABULARY:

agriculture
aqueduct
drought
waterways
reservoir
dam



MATERIALS:

Internet
worksheet
map of California

BACKGROUND:

Watersheds refer to how water moves through a given area. Water may be pure H_2O when it starts the process from precipitation, but gains dissolved substances as it moves throughout the system. For instance, as water erodes through rocks, it dissolves the minerals that make up rocks.

Water is a universal solvent, which basically means many compounds and elements can dissolve within the matrix of water. The substances are dissolved usually in the "ionic" form which are easy for organisms to take it out of the water. For instances, dissolved oxygen is easily dissolved at the atmosphere water interface, which is used by the fauna that lives in the water.

Every place where humans live have to consider their water supply. Throughout history, humans that were able to maintain water supplies were the most successful. The Romans are noted for their ability to keep a water supply through the use of aqueducts. Large droughts in Egypt probably lead to part of its downfall as a great civilization.

Cities that sustain large populations, like New York City, have to think about where their water comes from and how to maintain a flow. City and state officials have to think about how to maintain the water supply in times of drought and even have to think about what happens when there is too much water.

Water issues in the United States are very complicated and different from state to state. For instance, most of California would be a desert if different cities didn't buy water rights from different areas. Los Angeles, for example, owns water rights as far as Nevada, and San Francisco owns rights in the Sierra Nevada.

California's agricultural business is greatly dependent upon water. Without water, the Central Valley, Sacramento Valley, and San Fernando Valley would not be centers of agriculture. Most of these areas would be deserts if it wasn't for water especially in the southern portion of the state. California's fight for water is very important, especially when the distribution of water is so uneven. The northern part of the state naturally has water, but the southern half does not get enough rainfall. The California Aqueduct, one of the largest man-made structures in the world, brings northern water to the south. The southern part of the state has also "trapped" part of the Colorado River through the Colorado aqueduct. The capture of water by southern California has a very intriguing history especially in the early 1900's.

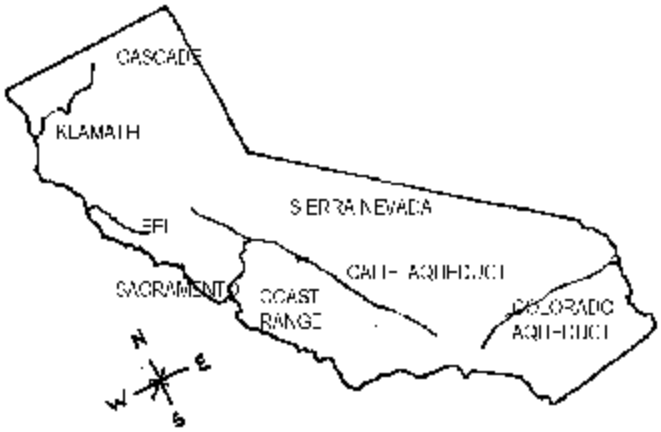
California needs its reservoirs and dams to secure that water will always be available. Drought conditions are common throughout history in California. To insure the availability of water California had developed a system of reservoirs and dams.

PROCEDURE:

1. Discuss with students the need for clean water for a prosperous civilization. Emphasize that the United States provides its citizens with some of the best quality water throughout the world.

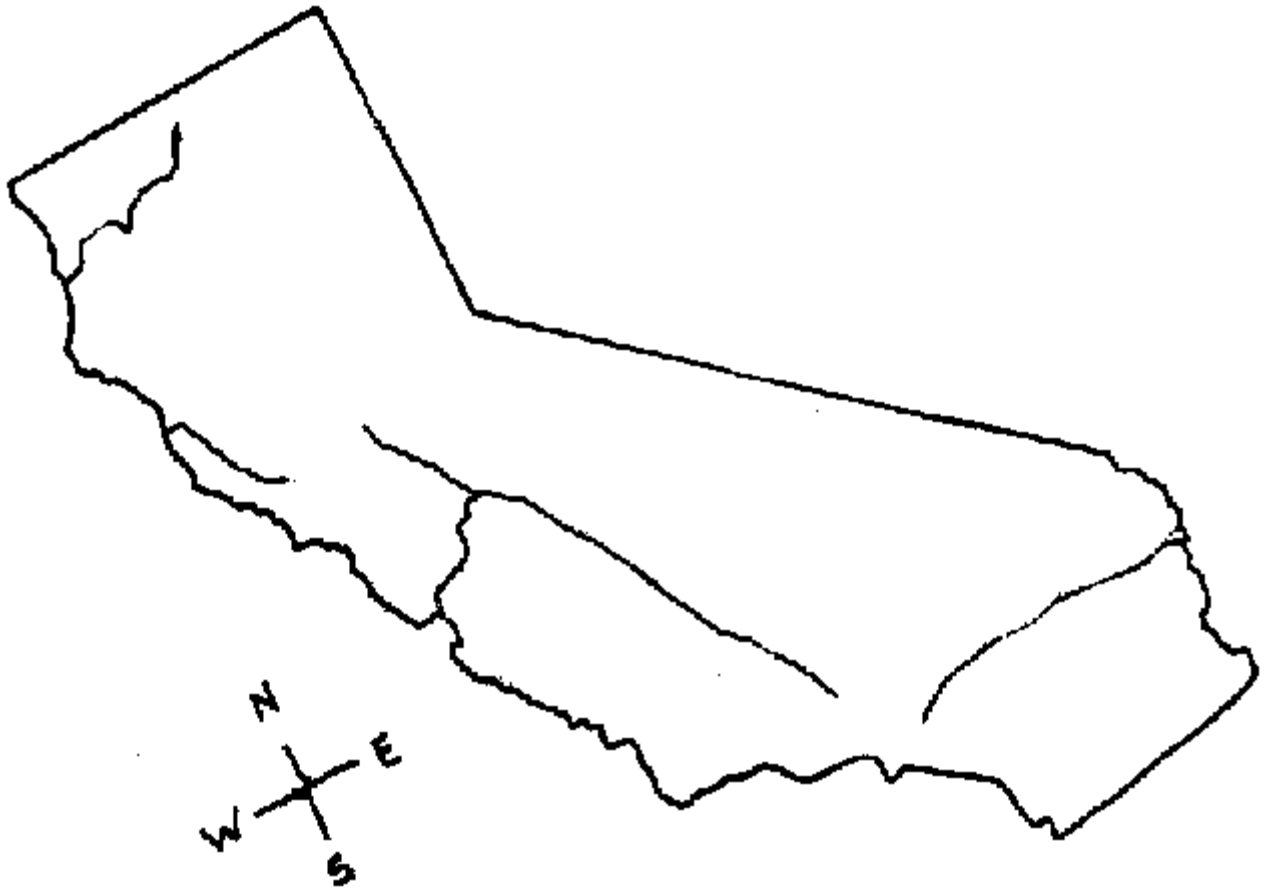
2. Conduct an internet search on your own state. You can go to the Environmental Protection Agency website on watersheds to help guide you (http://www.epa.gov/surf/). You might want to create a worksheet specific to your state, like the one on California.

3. Maps should be available for students of California so they can locate the major waterways in order to complete the worksheet. The answers are on the map below.



WATER CYCLE - WATER (6) POST

Why is water so important to California? _____



DRAW THE FOLLOWING:

* THE MAJOR WATER SOURCES:
  COAST RANGE, SIERRA NEVADA,
  CASCADE RANGE

* MAJOR WATER TRANSPORT RIVERS:
  COLORADO RIVER, SACRAMENTO RIVER
  KLAMATH RIVER, EEL RIVER

* MAN-MADE AQUEDUCTS:
  CALIFORNIA AQUEDUCT,
  COLORADO AQUEDUCT

Which industries would fail in California if a long-term drought occurred?

_____

_____