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Water: Our Most Important Beverage

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The curriculum unit “Water, Our Most Important Beverage,” is written for a third grade class as part of the social studies and science curriculum. In 3rd grade the New Haven public schools study the community and its resources and government. Students also learn about the natural resources of the area and how good citizenship is important to the success of our local and national governments. In science we explore the earth and its resources, as well as the principles of scientific inquiry which includes developing the powers of observation, predicting outcomes, and interpreting data. Our students also study recycling and conservation. Both of these larger curriculum areas can be taught through a curriculum unit in water.

My students are inner city children who like many of us have thought little about our drinking water and where it actually comes from. Many of them would predictably say that water comes from the tap at the sink or out of the water fountain. While the unit seeks to show them the wider picture of where water comes from, it also seeks to make them understand that we are truly tied to nature through our basic need of water. Without water there would be no life on the earth. The supply of water we have is limited by nature. It is not always where we want it when we want it. And we know that due to increasing use of chemicals and the improper disposal of these chemicals often shows up in our water supply. As the world population escalates we have an increased need for a resource that is necessary for all life on this planet. Our dependence on this natural resource makes it imperative that students be encouraged to advocate for laws and standards that will keep our waters safe. They will someday be in charge of these resources and education is the best way to ensure that they include the safety of our drinking water as part of the responsibility of being a good citizens.

The following is an outline of the contents of the unit:

I. Earth’s Water

A. How much water is on the earth?

B. Where is the Earth’s water located?

II. Local Water

A. Where do New Haven and its neighbors get their water?

B. What is done to the water to make it safe to drink?

III. The Rain Cycle

A. How does the rain cycle work?

B. How does rain water get polluted?

IV. Problems Facing Our Water Supply

A. contaminants

B. governmental legislation

C. Public involvement

V. How Can We Help?

A. How do students and their families use water?

B. What can students do to conserve water at home and in school?

As a way of introducing the unit I will begin with one of the basic concepts taught in 2nd and 3rd grade social studies, namely needs versus wants. In studying the community and how it functions students are taught that people must balance their needs and wants. In this case water is a definite need but as they shall see there are difficult choices which must be made if the supply of clean drinking water is to be maintained.

Students will be asked to write a few lines about what they know about water and/or contribute their ideas to the development of a class KWL chart (What I Know, What I Want to Know, and What I Learned) to be constructed as the unit develops. The KWL chart is a widely used graphic organizer which helps students focus on what information they are learning when they are dealing with nonfiction topics. A preliminary brainstorming idea to gauge children's prior knowledge can generate interest in the topic and show students that they already possess a great deal of knowledge about a subject they may not thing they know much about. Children can have individual KWL charts and as for this project I would set up a wall of chart papers to keep track of the information learned. It is a visual reminder to the students of the progress they are making and what still needs to be researched.

Beside a KWL chart the class would begin the building of a word wall of terms that will be important to the unit. In elementary school we often use word walls in reading to show word families, new vocabulary, or different spelling structures. In this case the word wall would list new terms which students are learning while studying the unit and keep them literally right in front of them. They would be there for review and for students to refer to as they prepare reports or complete journal writing assignments.

It would also be beneficial to look at the globe. Most likely students will think what is the problem? There seems to be plenty of water on the earth. Once we begin to delve into the state of earth's water supply students will soon see that most of the water is unusable by people. For young students nothing helps more than a visual. Try illustrating the relative amounts of water on the earth as opposed to land and usable versus unusable water. This can be easily facilitated by doing either of two activities suggested on the - website. 11

Objective: To illustrate the amount of usable water on the earth.

Materials: 100 ziti macaroni (One could also use 100 Dixie cups filled with water and dyed in a similar fashion with food coloring).

red, green, and blue food dye

Procedure:

The 100 ziti macaroni will represent the earth's water.

1. Dye 97 pieces blue. They represent the water that is in the oceans.

2. Dye one piece green. It represents the amount of water available for plants, people, and animals.

3. Dye 2 pieces red. They represent the water stored in glaciers and at the poles.

4. Spread the macaroni out so that student can see the proportions.

Earth's Water

Since the earth does not lose any of its water into outer space its water system is a closed system very much like that of a terrarium. Virtually all the water that exists now has existed for ages, and was here even when the dinosaurs roamed the earth. Basically, water is continually moving around the earth as water vapor, liquid water, and ice. The water cycle provides for water to be continually recycled around the globe.

While two thirds of the earth is water, over 99 per cent of this water is not usable. Of the 0.3% left much of that is not available for our use. The vast amount of fresh water available to us is stored in the ground. The earth's total supply of water is about 326 million cubic miles of water. Surface-water sources (such as rivers) only make up about 300 cubic miles or 1/10,000th of one percent and yet these rivers are the source of most of the water we use. 2

Water Source	Water Volume, in cubic miles	Percent of total water
Oceans	17,000,000	97.24%
Icecaps, Glaciers	7,000,000	2.14%
Ground Water	2,000,000	0.61%
Fresh water lakes	30,000	0.009%
Inland seas	25,000	0.008%
Soil Moisture	16,000	0.005%
Atmosphere	3,000	0.001%
Rivers	300	0.0001%
Total water volume	326,000,000	100% 3

Because we take for granted that water will be there whenever we turn on a tap we tend to dismiss any notion that our water supply could be in danger. The ancient peoples and those who live in third world countries probably share a better perspective on the situation than we do. They live each day concerned about rainfall and unclean water. As far back as recorded history people have struggled with the necessity to provide clean water to the rest of the population. In ancient drawings it is apparent that the Egyptians were using a variety of methods to remove impurities from the water. The Roman engineers developed a water supply system that delivered 130 million gallons of water daily through aqueducts. 4

For earlier peoples if the water was clear it was presumed to be clean and safe to drink. The 16th and 17th centuries were marked by many significant scientific discoveries. However, even though Anton Van Leeuwenhoek invented the microscope during this time it would be nearly two hundred years before the scientific community would realize that the tiny microscopic organisms he sketched were capable of carrying diseases into the water supply. Not until the 1870's when Dr. Robert Koch and Dr. Joseph Lister demonstrated this process would water treatment processes be aggressively pursued. This led to the beginning of a recognition that the community had to ensure a supply of quality drinking water. The development of water filtration in here was interrupted by the Civil War, but once that was concluded the United States became a leader in the art of water treatment.5

In 1908 the Bubbly Creek plant in Chicago started regular use of chlorine disinfection. In 1942 the U.S. Public Service adopted the first set of drinking water standards, and the membrane filter process for bacteriological analysis was approved in 1957. 6It soon became apparent that there were serious treats to maintaining a safe supply of drinking water. As a result, in 1974 the enactment of the Safe Drinking Water Act finally linked the government, the public health community, and the water utilities throughout the country to work together to safeguard the water supply in the United States. Its purpose was to govern the quality of drinking water in rural areas as well as large urban centers. In 1986 this Act was revised, calling on the EPA to help enforce the regulations.7

In 1977 the Federal Water Pollution Control Act was amended and was commonly know as the Clean Water Act. This act established the foundation for trying to control the pollutants that were directly discharged from homes or businesses into the waters of the United States. It also financed wastewater treatment plants and tried to help manage polluted runoff. The purpose was to clean up waterways so that fish and other wild life could be restored to their natural habitats and to make these waters recreation places for citizens to use.8

The history of water is an interesting sidebar to the topic of clean water. For elementary age students the concept of time and how they fit into it is difficult to understand. We are always encouraged to use timelines as a way of explaining history to our students. I suggest a classroom timeline which may or may not be partially or totally produced by students depending on their ages, capability, and available time. For my third graders I would most likely choose some important people and events from the history of water (as well as relevant events from the history and city) and have them research their importance. Then each child would make a poster containing an explanation of the event or person along with the appropriate date or dates. I would use a series of ropes which are hung around my room to be the actual time line. It would be marked with signs showing the centuries. Students would actually build the timeline by hanging their posters around the room in the appropriate spot.

In trying to connect state and local history to the study of the local water supply I think Lynne Cherry's book "A River Ran Wild" is an excellent story. It tells of the Nashua River and how it existed during the days before the European settlers came. The Native Americans lived along the river and respected it taking only what they needed and keeping a balance going. The 1600s mark the coming of European settlers and eventually industrialization and takeover by the colonists. In the ensuing years the river became over used, smelly and polluted. In the 1960s a grass roots effort led by a woman named Marion Stoddart fought to see the river cleaned up.9

The story of the Nashua River and the settling of Massachusetts are similar to that of the settlement and growth of Connecticut. Here the early settlements were influenced by the available rivers from the Connecticut to the Thames, Housatonic and locally the Quinnipiac. In both states the Native Americans were

pushed off their lands as a result of what is known as King Philip's War. The early agrarian society soon gave way to the expanse of industrialization from textiles to gun making, hat production, silver crafting, and later aviation industries. Locally the Quinnipiac River became polluted from upstream industrialization much like the Nashua. I think this story gives a nice way of organizing the chronology of the problem. 10

Local Water

Water is supplied to all or portions of New Haven and the surrounding towns of East Haven, Branford, North Branford, Cheshire, Hamden, Woodbridge, Orange, West Haven, and Milford by the Regional Water Authority. The Regional Water Authority or RWA is a non-profit organization. Besides serving these 12 towns the RWA also owns land but does not supply water in 4 other towns: Guilford, Madison, Killingworth, and Prospect. It supplies about 55 million gallons of water per day to some 400,000 consumers. When water use peaks the RWA can supply up to 90 million gallons of water a day. This is done by drawing water from its system of reservoirs which can hold more than 19 billion gallons of water, as well as, wells in two towns.11

The water source for this region is nine active reservoirs and five wellfields (see map available at the RWA website). 88% of the water supplied by the RWA comes from the nine active reservoirs. The remaining 12% is pumped from wells in Cheshire and Hamden. Water flows to consumers through a network of approximately 1,600 miles of pipes, pumping stations and storage tanks. As a result of this system a neighborhood may get its water from two or more sources. In the case of New Haven the water into the city comes from Lake Galliard in North Branford, Lake Saltonstall, and the West River.12

The Regional Water Authority acquired the New Haven Water Company in 1980. At that time it became the owner of more than 25,000 acres of land stretching across the 16 towns that form the Regional Water District. The legislation which created the Authority mandates that it with "providing and assuring the provision of an adequate supply of pure water at reasonable cost … and to the degree consistent with the foregoing, of advancing the conservation and compatible recreational use of land held by the Authority." 13

The RWA has a 17-member Representative Policy Board one from each of the area towns served. These members are appointed by the chief elected official from the town and approved by the local legislative body. The Governor also appoints one member. This board selects a five-member Authority which oversees the operation of the water. They act like the board of directors in an investor owned utility. The Representative Policy Board has also established an Office of Consumer Affairs which acts as an advocate for consumer interests with regards to matters such as rates, water quality and supply. The Authority provides the funding for this office. Both boards meet monthly. The voting power of the board is weighted so that the towns with the most customers have a larger proportion of votes. The representatives approve rate changes charged by the authority, capital projects which cost more than $1 million, the issuing of bonds, and the sale of any property. 14

Rain Cycle

As previously stated the water on the earth continually recycles itself and that water or hydraulic cycle is the method through which this occurs. The easiest way to explain this is to begin with the ocean water. The surface water in the ocean is warmed by the sun and evaporates into water vapor. It rises into the air and drifts up as air currents lift it and push it possibly hundreds of miles over land. The water droplets are lifted even higher where they get into colder air. At this point the vapor changes back into a liquid (condensation). Here it may condense on a tiny particle of dust, smoke and salt crystals, to become part of a cloud. After a while this vapor joins with other vapors to become a large drop which earth's gravity pulls down to the surface. Depending on where it falls the raindrop can end up in a variety of places. If it lands on sidewalk or a leaf it will probably evaporate (transpiration) and begin its journey through the cycle again. If it lands on the ground and goes down into an underground aquifer it could be tens of thousands of years before the raindrop finds its way out of the ground again. It could run into an underground well and be pumped out to irrigate crops or for use by people to drink, bath with or wash their clothes. From these places it will either go back into the air or go down the sewers and into rivers and eventually back into the ocean or back underground. 15

In order for students to internalize an understanding of the rain cycle students will prepare stick puppets and act out the water cycle.

Objective: Students will make stick puppets of the sun, the earth, a raindrop, a cloud and a leaf.

Materials:

Patterns of the sun, the earth, a raindrop, a cloud, and a leaf.

Pencils

Tag board

Glue

Thin craft sticks

A variety of water markers

Procedure:

1. Students trace a copy of each pattern on a piece of tag board.

2. Cut out all pieces.

3. Color each piece appropriate colors.

4. Attach one stick to each pattern. Allow pieces to dry overnight.

5. Students can review the rain cycle by using the hands on puppets to illustrate each step.

The earth is heated by the sun. Water evaporates and forms a cloud. When the cloud becomes filled with rain

droplets it begins to rain. The rain drops fall possibly on a leaf where it later evaporates (transpiration) or it follows a path underground or falls into a stream where it goes back into the ocean and the cycle begins again.

Problems facing our water supply

The water supply of New Haven comes from at least three different sources: either Lake Galliard in North Branford, Lake Saltonstall in East Haven, or the West River, and/or Lake Galliard. As you can see the water for the city has a distance to travel and this impacts its quality. It is not enough to consider the condition of the lake or reservoir but also the path that the water travels to get there. This area which the water travels through on its way to the lake or reservoir is called a watershed. Those surrounding towns like Hamden, North Haven, Woodbridge and Cheshire which also have people getting their water from wells must also consider the activities going on around them that may impact their drinking water. Whereas surface water is stored in lakes, rivers or reservoirs, well water is stored in underground holding area called aquifers.16 In order for student to see what an aquifer is like there is a good experiment offered by the EPA website that is called Aquifer in a cup. In the experiment students make their own model of an aquifer to see how it can be polluted and affect the drinking water.

Objective: Students will make individual models of an aquifer to help them understand their importance and how they work.

Materials needed

Clear plastic cups 2 ¾” deep x 3 ¼” wide

1 piece of modeling clay that can be flattened into a 2’pancake

White play sand that fill each student’s cup ¼”

Aquarium gravel natural color or small pebbles about ½ cup per student. Pebbles should be washed to remove any dust so they will not cloud the cup.

Red food coloring

Eye droppers

Containers of clean water and small cups to scoop water with

Procedure

1. Put ¼” of white sand into bottom of each cup completely covering the bottom. Pour water into the sand wetting it completely but make sure all the water is absorbed. Let students see the water while absorbed is still around the particles of sand and is stored like in an aquifer.

2. Have students flatten a piece of clay into a pancake big enough to cover half of the container. It represents a “confining layer” that keeps water from passing through.

3. Pour some small amount of water over it so students and see that ht e water stays on top and doesn't travel through the clay.

5. The next layer should be the aquarium rocks. Have students slope the rocks forming a high hill and a valley. Now pour water over the rocks. The rocks form a porous layer. Pour water over the rocks and students will see that water is stored in between them and that a "surface" supply of water (a small lake) has formed.

6. Have students now put a few drops of red food coloring on top of the rock hill as close to the side as possible. Explain that the dye represents the pollution from motor oils, chemicals, farm chemicals and trash. Students should see the red coloring spread through the rock and also out into the surface water.

7. Have students take their aquifer home and explain what is happening to our water supply to their parents.17

When the regional Water Authority takes water from wells or reservoirs there may be tiny particles of dirt and leaves or other organic matter with certain contaminants in it. By the word contaminant I mean anything which enters the water and has the affect of making it unacceptable as drinkable water. Therefore as water is pumped in along the miles of pipe the water goes to a water treatment plant where chemicals are introduced which will cause the particles to sink to the bottom. Filtering is also done to remove very fine particles. Ground water which comes from wells is usually cleaner since it is usually cleansed by its journey through layers of the earth. However this assumption is dependent on what is in the ground that the water is traveling through. The quality of the water will depend on the local conditions. 18

The potential contaminants fall into four categories:

(1) Inorganic (metals and minerals)

(2) Volatile organic chemicals (mostly industrial solvents and chemicals)

(3) Synthetic organic chemical (mostly pesticides).

(4) Biological contaminants (bacteria, viruses, parasites)19

There are two types of pollutants: point source and nonpoint source. Point source contamination is when something harmful is put directly into the water. An example of this would be a spill from an oil tanker into the ocean. A nonpoint source of contamination occurs when some harmful substance gets into the water indirectly. An example of this is when fertilizers enter the water supply through runoff. Rules and regulations have more effect on point source contamination while nonpoint source contamination is more difficult to stop. Pollution from runoff or industrial waste is harder to control because they occur as a byproduct of some other activity which is often economically difficult to eliminate. For example much of the pollution from petroleum and radioactive substances are the result of nuclear power plants, and the industrial and medical use of radioactive material. Can we turn off power plants or stop medical use of radioactive materials? It would be hard to justify. Can we jeopardize jobs by eliminating industries that pollute the environment? While we can try to clean up certain industries total elimination is almost impossible. The nature of nonpoint source pollution often means that the contamination has gone into the groundwater and cleanup there may be difficult if not impractical. The cost to local, state and the federal government often precludes any attempt to deal with nonpoint source pollution.20

In order to guarantee that its customers have the highest quality water the Regional Water Authority follows a

four-step process: (1) Protection: monitoring the quality of the water and activities that take place on the surrounding land. (2) Treatment: Water is filtered and treated with chlorine to kill microbes that can cause illness, (3) Distribute: Supply clean water through pipes that are periodically flushed to remove naturally occurring sediments, (4) Monitor: Verify the cleanliness and safety of the water supply by testing samples in the laboratory. The WRA also employs a police patrol that monitors the lands to keep the recreation areas safe and the preserve the water quality in the watersheds.21

Thanks to one member of the seminar, I was introduced to the Freddy the Fish story and website which illustrates in a wonderful hands on way how the waters become polluted. The activity basically involves telling the story of Freddy the Fish. Students are given a number of things like soil, paper dots, pancake syrup, soapy water, etc. to mimic the pollutants that find their way into our water systems. The story is told in nine sections. In each section Freddie who is a fish made from sponge travels downstream in an aquarium. As each part of the story is told Freddie goes by a portion of the river where some type of waste is put into the environment by polluters or in this case the classroom students. Students are encouraged to make comments and observe after the pollutants enter the aquarium. At the end of the story students can see how the problem of water pollution happens. 22

How can we help?

At this point students will be asked to suggest ways to save water and protect its quality. Hopefully students will come up with some of the following:

1. Stop letting the water run when you are brushing your teeth, or waiting for a cold glass or water from the tap.

2. Have any dripping faucets fixed. A leaky faucet with a drip of just 1/16 of an inch in diameter can waste 10 gallons of water a day.

3. Don’t fill a washing machine or dish washer unless you have a full load.

4. Close the hose when you are watering the grass or flowers, or washing your car.

5. Limit the use of pesticides and/or use natural lawn care products.

6. Don’t throw toxic chemicals, or oil down the storm drains.

7. Dispose of containers and left over cleaners at the recycling center in your town.

8. Become active in water conservation and government policies that will help the water supply.

Students will be asked to take their ideas about water conservation and quality and make up posters. These can be hung in the classroom or displayed throughout the school so students can share what they are learning with others. If possible students might be given the chance to share what they have learned with younger students.

For the culminating activity of the unit I hoped to do an activity which would become the class science fair

project. What I have decided on is for students to do a demonstration of the water filtering process. This experiment is based on the idea presented in the U.S. Environmental Protection Agency web site. 23As part of our study we would visit the regional water treatment plant which is very good about having school children visit its plant. The visit would show the basic five step approach that most water treatment facilities utilize: (1) aeration ;(2) coagulation ;(3) sedimentation; (4) filtration; and (5) disinfection.

Objective: To show students how water purification is done

Materials:

5 liters of swamp water or add 2 cups of dirt to 5 liters of water

1 two liter plastic soda bottle with its cap

2 two liter plastic soda bottles – one with the top removed and one with the bottom removed

1 one and one half liter (or larger) beaker or the bottom of another soda bottle

20 grams of alum (available in the pharmacy or spice isle of the supermarket

Fine sand (about800ml)

Coarse sand (about 800 ml)

Small Pebbles (washed natural aquarium stones are fine)

1 large (500ml or larger) beaker or jar

1 coffee filter

1 rubber band

1 tablespoon

A clock with a second hand or stopwatch

Procedure:

1. Pour about 1.5L of the Swamp Water into a 2L Bottle/ have students pass it around and describe its appearance.

2. The first step in cleaning the water is aeration. This means allowing trapped gases in the water to exit and adding oxygen to the water. Put the cap on the bottle and shake it vigorously for 30 seconds. Continue the process by pouring the water into one o the cut off bottles, and then pour it back into the other going back and forth 10 times. Students should describe any changes they see. Pour the aerated water into a bottle with its top cut off.

3. The next part of the process – coagulation- is a way of getting particles within the water to stick together so they can be more easily removed. This is accomplished by adding 20 g of alum crystals to the water. The mixture is then stirred slowly for 5 minutes

4. Sedimentation is the next process that is used in cleaning the water. Gravity pulls the alum and the impurities down to the bottom of the container. The water after stirring now must sit undisturbed. Students should observe the container for the next 20 minutes at 5 minute intervals and list their observations concerning the changes in the water.

5. The next step is to construct a filter using the bottle with its bottom cut off.

a. Attach the coffee filter to the outside neck of the bottle with a rubber band. Turn the

bottle upside down and pour a layer of pebbles into the bottle - the filter will keep

the pebbles from falling out of the neck.

b. Pour the coarse sand on top of the pebbles.

c. Pour the fine sand on top of the coarse sand.

d. Pour 5L (or more) of clean water over the filter. Try not to disturb the layer of sand.

6. Now you can carefully pour the swamp water into the filter being careful not to disturb the sediment which should now be on the bottom of the bottle. After pouring about two-thirds of the water into the filter pour the rest back into the bottle of swamp water. Compare the treated and untreated water.

The final step used by actual filtering plants ends with the addition of disinfectants to the water to purify it and kill any organisms that could be harmful. These chemicals are potentially harmful and so this experiment skips this step. While the water may seem clean it is not fit to drink.

I hope that throughout the unit my students will share what they are learning with their families and that we will share with other classes. It was also suggested to me that the students might have a water fair where they would show off the things they learned to their friends and family. I'm certain that would be a celebration they would enjoy.

This unit is a very small beginning in dealing with environmental concerns. There is a myriad of information on the web and there are numerous activities that students can do. There are many other areas which I have not had time to explore like dealing with how people can affect change and how difficult change is in our industrialized society.

As with all teaching this is a beginning effort and there are many other avenues which this unit can explore. I hope that it will spark interest in my students and that it will expand and contract with new materials as I use it.

Appendix A

The Story of Freddy the Fish

Duplicate one sheet per use, cut apart each story detail and distribute one script to each of nine students.

Imagine a clean river as it meanders through a protected wilderness area. In this river lives Fred the Fish. How is Fred? Fred has lived in this stretch of the river all his life. But now he is going on an adventure and travel downstream.

Fred swims into farm country. He passes a freshly plowed riverbank. It begins to rain and some soil erodes into the river. (Dump soil in into Fred's jar.) How is Fred?

Fred nears a housing development. Some fertilizer from the pastures and lawns washed into the river awhile back. (Place brown sugar in Fred's jar.) The fertilizer made the plants in the river grow very fast and thick. Eventually the river could not furnish them with all the nutrients they needed, and so they died and are starting to decay. Their decomposition is using up some of Fred's oxygen. How is Fred?

Fred swims beside a large parking lot. Some cars parked on it are leaking oil. The rain is washing the oil into the river below. (Pour pancake syrup into Fred's jar.) How is Fred?

During a recent cold spell, ice formed on a bridge. County trucks spread salt on the road to prevent accidents. The rain is now washing salty slush into the river. (Put salt in Fred's jar.) How is Fred?

Fred swims past the city park. Some picnickers didn't throw their trash into the garbage can. The wind is blowing it into the river. (Sprinkle paper dots into Fred's jar.) How is Fred?

Several factories are located downstream from the city. Although regulations limit the amount of pollution the factories are allowed to dump into the river, factory owners are not abiding by them. (Pour warm soapy water into Fred's jar.) How is Fred?

The city's wastewater treatment plant is also located along this stretch of the river. Also a section of the plant has broken down. (Squirt two drops of red food coloring into Fred's jar.) How is Fred?

Finally, Fred swims past hazardous waste dump located on the bank next to the river. Rusty barrels of toxic chemicals are leaking. The rain is washing these poisons into the river. (For each leaking barrel, squeeze one drop of green food coloring into Fred's jar.) How is Fred?

Taken from Gammar, Debbie. (1997). *Environmental Teaching Guide Vol. 2* . TNRCC. pg. 35-36.

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Cast, C. Vance. *Where Does Pollution Come From?* Hauppauge, New York: Barron's Educational Series, Inc., 1994. The book uses the character of Clever Calvin who describes different kinds of pollution from solid waste, acid rain to noise and air pollution. There is a glossary and experiment included.

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from its discovery by Indians through the polluting years of the Industrial Revolution to the ambitious cleanup that revitalized it.

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Locker, Thomas. *Water Dance* . New York: Voyager Books: Reprinted Edition, 2002.

McKinney, Barbara Shaw. *A Drop Around the World* . New York: Dawn Publishers, 1998.

Manning, Mick and Brita Granstrom. *Splish Splash Slosh! A book about Water* . New York: Franklin Watts, 1997. Illustrations and simple text discuss water, where it comes from and how it is treated so that we can use it for drinking, washing, and playing.

Web Sites

American Water Works Association

http://www.awwa.org/advocacy/learn/INFO/BHIST-3.cfm

USGS Water Resources

http://ga.water.usgs.gov/edu/watercyclegraphic.html

EPA Kids Page – Water Cycle

http://epa.gov/region07/kids/wtrcycle.htm

Regional Water Authority

http://www.rwater.com/waterandmore/index.shtml

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Gonick, Larry and Alice Outwater. *The Cartoon Guide To The Environment.* New York: Harper Collins Books, 1996. This book covers in a concise yet informative way the main topics of environmental science including pollution, waste disposal and recycling, deforestation, ozone depletion and global warming.

Suzuki David with Barbara Hehner. *Looking At the Environment* . New York: John Wiley & sons, 1991. This book is geared to children but is useful to teachers. It discusses different aspects of the environment including water, waste disposal. It also presents some activities that children can do.

Endnotes

1 *All The Water in the World*

2 *Where is Earth's Water Located* , Source: Nace,U.S. Geographical Survey, 1967 and the hydrologic Cycle (Pamphlet), U>S> Geological Survey,1984, http://ga.water.usgs.gov/edu/earthwherewater.html ,(4/1/03)

page 2

3 *Where is Earth's Water Located,* p.2

4 *Brief History of Drinking Water* , http://www.awwa.org/advocacy/learn/INFO/HISTORYOFDRINKINGWATER.CFM , page1 5/24/03

5 *Brief History of Drinking Water* , p. 2

6 *Brief History of Drinking Water* , p.2

7 *SDWA: Safe Drinking Water Act,* http://www.swbic.org/education/env-engr/sdwa/ 7/2/2003

8 *Introduction to the Clean Water Act* , http://www.epa.gov/watertrain/cwa/rightindex.htm 6/30/03

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