AQUATICS

LESSON PLAN

Meets the following 5th Grade Science Standards:

Earth Science:

3a: Water on Earth moves between the oceans and land through the process of evaporation and condensation. Students should be able to trace diagrams of the water cycle and understand what they represent.

3b: Students know when liquid water evaporates, it turns into water vapor in the air and can reappear as liquid when cooled or as solid if cooled below the freezing point of water.

3c: Students know water vapor in the air moves from one place to another and can form fog or clouds, which are tiny droplets of water or ice, and can fall to Earth as rain, hail, sleet, or snow.

3d: Fresh water in rivers, lakes, underground sources, and glaciers are limited. Recycling and decreasing use of water helps its availability.

3e: Students know the origin of water for their local communities.

Physical Science:

1g: Students know properties of water (H^20)

Life Science:

2g: Students know plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide and water (respiration).

Investigation and Experimentation:

6b: Develop a testable question.

6f: Use tools to perform test.

6g: Create graphs/record data.

6h: Draw conclusions/Is more information needed?

6i: Write a report.

Meets the following 6th Grade Science Standards:

Energy in the Earth System:

4a: The sun is the major source of energy for phenomena on the Earth's surface; it powers winds, ocean currents, and the water cycle.

Investigation and Experimentation:

7b: Use tools to perform tests

7c: Create graphs

7d: Record steps and results from investigation.

7e: Compare evidence with proposed explanation.

Ecology:

5e: Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and social composition. (To support vigorous growth, water and soil don't want an excess amount of acidity or alkalinity)

Shaping Earth's Surface:

2b: Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural recurring patterns.

OBJECTIVES:

1. Introduce students to the importance of water and to the water cycle; explain the origin of the water in the lake.
2. Define the term watershed and discuss the role of a watershed and how it affects the water in the lake.
3. Define aquifer and discuss what role it plays in fresh water storage.
4. Teach students to determine the health of the lake using chemical assessments.
5. Observe the riparian habitat along the lake, taking a physical assessment of the water and surrounding plant life.

BACKGROUND:

Where does water come from? Where is it stored? It can be said that God created water on the 2nd day of creation (Genesis 1:1-10), and we have been seeing the same water ever since as it cycles around and around in the water cycle. From Genesis 7 we learn that great amounts of water are stored beneath the earth surface and that at the time of the flood, God caused the great springs to burst up and flood the earth. Maintaining healthy water systems is our responsibility Ps. 8:4-6, and is necessary for the health of humans, plants, and animals. It is perhaps one of our greatest commodities. Through the science of chemical assessment, physical observation, and the observation of plant life, we can determine the health of our lake.

PROCEDURES:

1. Discuss the term Watershed and show a map of the watershed for the lake. Hike to the lake and, during your hike, point out how the water would funnel towards the creek. **(6^{th})**
2. Demonstrate the water cycle with a flow chart, defining the terms including transpiration and respiration. (**5^{th})** Students should learn that the sun is the source of energy that drives the water cycle.
3. Discuss bodies of water and the types of areas where water is stored; define aquifers and discuss their importance. **(6^{th})**
4. Explain how temperature, dissolved oxygen, and the PH level of water affect the health of a body of water.
5. Show students how to make a chemical assessment of the creek, assisting them with PH strips and thermometers.
6. Explain the 9 physical attributes to look for when studying the physical health of a stream. Have students use field notes to take a physical assessment of the creek. **(6^{th})**
7. Gather students and discuss the results of their studies and observations.

At the completion of this class the student:

- Should know:
    - The intricacies of the water cycle.
    - Where water is stored, including the source of water for the lake.
    - Definitions of watershed, aquifer, and pH level.
    - Know what makes a creek healthy based on two assessments.

- Should be able to:
    - Determine the health of the lake using two a chemical and physical assessment.

AQUATICS
TEACHER'S NOTES

Scripture References:
Genesis 1:6-10 – Creation of water – *"And God said, "Let there be a vault between the waters to separate water from water." So God made the vault and separated the water under the vault from the water above it. And it was so. God called the vault "sky." And there was evening, and there was morning—the second day. And God said, "Let the water under the sky be gathered to one place, and let dry ground appear." And it was so. God called the dry ground "land," and the gathered waters he called "seas." And God saw that it was good."*
Genesis 7:11-12 – Source of water – *"In the six hundredth year of Noah's life, on the seventeenth day of the second month—on that day all the springs of the great deep burst forth, and the floodgates of the heavens were opened. And rain fell on the earth forty days and forty nights."*
Genesis 1:26-28, Psalm 8:4-6 – Man's Responsibility to rule and care for earth – *"Then God said, "Let us make mankind in our image, in our likeness, so that they may rule over the fish in the sea and the birds in the sky, over the livestock and all the wild animals, and over all the creatures that move along the ground." So God created mankind in his own image, in the image of God he created them; male and female he created them. God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish in the sea and the birds in the sky and over every living creature that moves on the ground."* ***Genesis 1:26-28*** *"What is mankind that you are mindful of them, human beings that you care for them? You have made them a little lower than the angels and crowned them with glory and honor. You made them rulers over the works of your hands; you put everything under their feet:"* ***Psalm 8:4-6***

I. Water: Importance and Origins

A. We want students to recognize how essential water is to their life and how often they use it without realizing it. Ask students to write down what they use water and then discuss the answers as a class.
   1. Here are some great examples: drinking, bathing, cooking, ice (cool drinks), washing dishes, washing the car, putting out fire, flushing toilets, brushing teeth, cleaning out paint brushes, irrigation, transporting goods, beautiful fountains, ice skating, air conditioning, swimming, coolant for car batteries, and more.

B. God created water on the 2nd day of creation (Genesis 1:6-10) and it has been here with us ever since. Water changes form and location via the water cycle. It is possible that the water particles you drink today were the water particles in the Sea of Galilee that was calmed by Jesus. Water has three forms: vapor, liquid, and ice.

C. The water cycle describes how water moves from the earth to the atmosphere and back to the earth. It is a continuous cycle that has no end.

D. The water cycle is driven by **solar energy. Solar radiation** heats the surface of bodies of water (liquid). The water turns to vapor and evaporates into the atmosphere; the water particles later reduce into a denser form **(condensation**) and then return to earth in the form of **precipitation** (rain, snow, or hail) completing the water cycle**.**

E. Water can leave the earth in three ways.

1. **Evaporation**. The sun heats the surface of water and causes its particles to heat up and become a gas which then rises into the atmosphere as water vapor.
2. **Transpiration**. Water evaporates from plants and rises into the atmosphere as water vapor.
3. **Respiration**. Animals and humans release water into the air as they breathe; this water vapor results from plant and animals cells breaking down sugar to obtain energy. Carbon Dioxide also occurs providing plants with one of the three elements they need to create energy and oxygen.

II. Bodies of Water and Water Storage

A. Water is stored on earth as salt water and fresh water. 96.5% of the water on earth is stored in oceans as salt water. Only 2.5% is stored as fresh water. The breakdown is as follows:

1. 68.7% is stored in Icecaps and glaciers
2. 1.2% is stored in surface water (lakes, swamps, rivers)
3. 30.1% is stored in groundwater (water stored beneath the earth Surface)

B. 30% of the freshwater soaks into the ground by **infiltration** and is stored in aquifers. **Aquifers** are made of porous rock that holds water below the water table. Overuse and mismanagement can deplete a water source.

C. A **watershed** is an area of land that funnels precipitation and water runoff into creeks, streams, lakes, ponds and swamps. The lake is part of the watershed. Different watersheds are separated by hills, mountains and other large land masses.

EXAMPLE: The Continental Divide is a BIG watershed. If water hits on the east side of the mountains, it will eventually go to the Atlantic Ocean and if it hits on the west side it will go to the Pacific Ocean.

D. **Pollution** is able to enter many of our waterways by watersheds. Let's say you are cleaning the grease off your car's engine up there in the parking lot, and then you hose the soap and grease into the dirt or a big rain storm comes and washes the soap and grease on down the hill. Eventually all that soap and grease can end up in your local watershed. Those of you that live near the ocean hear about the ocean being polluted and dangerous to life after heavy rain storms. This is caused from all the yuck from those streets running down a watershed into the ocean. It

is good to learn about your local watershed and what you can do to keep your streams, lakes and oceans clean.

III. Assessing the Health of a Water Source

A. CHEMICAL ASSESSMENT Have students conduct the following three tests and record their data to help them answer the testable question, is our lake a healthy body of water?

1. *Temperature.* Cooler water is healthier. It allows more oxygen storage which is necessary for animals and plants to live. **Have a student use a thermometer to test the temperature of the lake.** The temperature of a creek can be affected by several things.
    a. Sunlight.
    b. Warm water being let into the stream.
    c. Sediment and particles clogging the water and storing solar energy.
    d. Depth: Shallow water warms quickly, whereas a deeper stream tends to remain cooler.
2. *Dissolved Oxygen.* Dissolved oxygen refers to how much air is in the water. Oxygen is vital for stream animals and plants to grow and live. **Use our chemical test to see how much dissolved oxygen is in the lake.** There are several things that effect the amount of dissolved oxygen there is in a creek.
    a. Temperature.
    b. Turbulence: A stream that moves quickly or that is falling is putting oxygen into the water.
    c. Algae: The large collection of algae can use much of the oxygen from the water.
3. *pH level.* The pH level in water tells the level of acidity or alkalinity in the water. The pH scale runs from 0-14. 7 is a balanced level of acidity and alkalinity. **Have the student teams use a pH strip to test the pH level of the lake. Show students the pH strips of different liquids to illustrate the variety of acidity and alkalinity in every day products.**
    a. Fish, plants and some insects start to die if the pH is below # 6 or above #10.

B. PHYSICAL ASSESSMENT. Have students investigate the lake by observing, analyzing and documenting the following 10 physical assessments as they relate to the lake. Give them at least 10 – 15 minutes to complete this on their own, come back together as a group and go over their observations, going into detail when needed.

1. *Flow.* If a stream flows all year, it is a healthier stream. Our lake does not get consistent water flow

2. *Path.* A stream that has a meandering path is a sign of health. A straight stream indicates that it has been disturbed or straightened by catastrophic events. Our lake has a meandering path.
3. *Pools and Riffles.* Pools and riffles indicate health because they affect water temperature, turbidity and dissolved oxygen.
4. *Turbidity.* Turbidity refers to the clarity of the water. Cloudy water interferes with photosynthesis and oxygen levels, as well as temperature. There are several things that affect turbidity.
    a. Soil erosion: With no solid banks, and soil falling into a creek, you have more particles in the water. The more particles, the cloudier the water.
    b. Stirred up sediment.
    c. Pollution: The more gunk and junk in the water the cloudier it becomes, which equals less sun, less photosynthesis, and less plant and animal life.
    d. High levels of algae
5. *Stream Bottom.* Sandy bottoms move with increased flow and affect turbidity, temperature, and dissolved oxygen. Gravel and hard rock bottoms are indicative of a healthier stream. Sediment, loose clay and debris indicate a less healthy stream. A bed of boulders, gravel, secured logs and some sand make a more desirable stream bottom.
6. *Obstructions.* Obstructions allow debris and sediment to gather affecting the flow and health of a stream.
7. *Erosion.* Erosion causes banks (the ground directly next to the stream) to change. A bare bank that rises straight up (12 inches or taller) negatively affects the stream. A gentle bank that slowly slopes up with vegetation is healthier as it acts as a filter and provides share, food, and shelter to its area.
8. *Vegetation Variety.* Banks with mature trees indicate O.K. health, but stream banks with shrubs, young and old trees, grasses, and a variety of plant life indicate a healthy stream habitat.
9. *Vegetation Overhang.* Undercut banks with vegetation growing out over the water are a sign of health. The overhang cools the water and provides shelter and food.