Elementary Lesson Plan #1

GRADE(S): 3rd, 4th, 5th

TOPIC: Ground Water

TITLE: Aquifer Model

OVERVIEW: The water that we use every day in Texas come from one of two sources: surface or ground water. Surface water is from rivers and lakes. Ground water flows or is pumped from below the surface. An underground source is called an aquifer.

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS:

Science, 3rd Grade

(b) Knowledge and Skills

(3.1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during field and laboratory investigations;

(B) make wise choices in the use of conservation of resources and the disposal or recycling of materials.

(3.2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:

(A) plan and implement descriptive investigations including asking well defined questions, formulating well defined hypotheses, and selecting and using equipment and technology;

(B) collect information by observing and measuring;

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(D) communicate valid conclusions;

(E) construct simple graphs, tables, maps, and charts to organize, examine, and evaluate information.

(3.3) Scientific processes. The student knows that information, critical thinking, and scientific problem solving are used in making decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(C) represent the natural world using models and identify their limitations.

(3.11) Science concepts. The student knows that the natural world includes earth materials and objects in the sky. The student is expected to:

(A) identify and describe the importance of earth materials including rocks, soil, water, and gases of the atmosphere in the local area and classify them as renewable, nonrenewable, or inexhaustible resources.

English Language Arts and Reading, 3rd Grade

(b) Knowledge and Skills

(3.12) Reading/inquiry/research. The student generates questions and conducts research using information from various sources. The student is expected to:

(E) interpret and use graphic sources of information, including maps, charts, graphs, and diagrams (2-3).

Social Studies, 3rd Grade

(b) Knowledge and Skills

(3.16) Social studies skills. The student applies critical thinking skills to organize the use of information acquired from a variety of sources including electronic technology. The student is expected to:

(E) interpret and create visuals including graphs, charts, tables, timelines, illustrations, and maps.

Science, 4th Grade

(b) Knowledge and Skills

(4.1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during field and laboratory investigations;

(B) make wise choices in the use of conservation of resources and the disposal or recycling of materials.

(4.2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:

(A) plan and implement descriptive investigations including asking well defined questions, formulating well defined hypotheses, and selecting and using equipment and technology;

(B) collect information by observing and measuring;

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(D) communicate valid conclusions;

(E) construct simple graphs, tables, maps, and charts to organize, examine, and evaluate information.

(4.3) Scientific processes. The student knows that information, critical thinking, and scientific problem solving are used in making decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(C) represent the natural world using models and identify their limitations.

(4.4) Scientific processes. The student knows how to use a variety of tools and methods to conduct scientific inquiry. The student is expected to:

(A) collect and analyze information using tools including calculators, microscopes, cameras, safety goggles, sound recorders, clocks, computers,

thermometers, hand lenses, meter sticks, rulers, balances, magnets, and compasses.

Social Studies, 4th Grade

(b) Knowledge and Skills

(4.22) Social studies skills. The student applies critical-thinking skills to organize and use information acquired from a variety of sources including electronic technology. The student is expected to:

(B) analyze information by sequencing, categorizing, identifying cause-and-effect relationships, comparing, contrasting, finding the main idea, making generalizations and predictions, and drawing conclusions;

(C) organize and interpret information in outlines, reports, databases, and visuals including graphs, charts, timelines, and maps;

(F) use appropriate mathematical skills to interpret social studies information such as maps and graphs.

English Language Arts and Reading, 4th Grade

(b) Knowledge and Skills

(4.13) Reading/inquiry/research. The student inquires and conducts research using a variety of sources. The student is expected to:

(D) interpret and use graphic sources of information such as maps, graphs, timelines, tables, and diagrams to address research questions (4-5).

Science, 5th Grade

(b) Knowledge and Skills

(5.1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during field and laboratory investigations;

(B) make wise choices in the use of conservation of resources and the disposal or recycling of materials.

(5.2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:

(A) plan and implement descriptive investigations including asking well defined questions, formulating well defined hypotheses, and selecting and using equipment and technology;

(B) collect information by observing and measuring;

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(D) communicate valid conclusions;

(E) construct simple graphs, tables, maps, and charts to organize, examine, and evaluate information.

(5.3) Scientific processes. The student knows that information, critical thinking, and scientific problem solving are used in making decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(C) represent the natural world using models and identify their limitations.

(5.4) Science processes. The student knows how to use a variety of tools and methods to conduct scientific inquiry. The student is expected to:

(A) collect and analyze information using tools including calculators, microscopes, cameras, safety goggles, sound recorders, clocks, computers, thermometers, hand lenses, meter sticks, rulers, balances, magnets, and compasses.

Social Studies, 5th Grade

(b) Knowledge and Skills

(5.25) Social studies skills. The student applies critical-thinking skills to organize and use information acquired from a variety of sources including electronic technology. The student is expected to:

(B) analyze information by sequencing, categorizing, identifying cause-and-effect relationships, comparing, contrasting, finding the main idea, making generalizations and predictions, and drawing conclusions;

(C) organize and interpret information in outlines, reports, databases, and visuals including graphs, charts, timelines, and maps;

(F) use appropriate mathematical skills to interpret social studies information such as maps and graphs.

English Language Arts and Reading, 5th Grade

(b) Knowledge and Skills

(5.13) Reading/inquiry/research. The student inquires and conducts research using a variety of sources. The student is expected to:

(D) interpret and use graphic sources of information such as maps, graphs, timelines, tables, and diagrams to address research questions (4-5).

DID YOU KNOW?

An aquifer is a layer of porous material such as sand, rock, or gravel filled with ground water.

Conjunctive use is the combined use of both surface and groundwater.

Ground water is water in aquifers.

Recharge is the downward flow of rainfall through the soil into the aquifer.

Mining is the withdrawal of more water than can be replaced by recharge.

Porosity is the amount of open space in a substance. The more porous the rock formation, the more water it will hold.

Subsidence is the sinking of the land surface due to the compaction of the supporting layers of clay. Pumping too much groundwater often causes this.

LEARNING EXPERIENCE:

GENERAL TIME FRAME: Approximately 45 minutes. If students draw additional maps or use a large jar for their aquifer, additional time may be allowed.

Materials:

For **each** aquifer model:

- Glass jar
- Food coloring (optional)
- 1-2 cups of aquarium gravel
- 1-2 cups of soil
- ½ cup grass
- 1-2 cups water
- poultry baster
- ruler
- measuring cup
- paper and pencil

Advanced Preparation:

1. Obtain all materials listed in **Materials** section.
2. Obtain a map of the Texas Aquifers.

Procedure:

1. Pour 3 inches of aquarium gravel into jar.
2. Cover gravel with 2-3 inches of soil and pack firmly.
3. Cover soil with a thin layer of grass.
4. Add several drops of food coloring (in a contrasting color to the gravel) to 1 cup of water. The water should be sufficient to reach the to of the gravel layer.
5. Pour enough water into the jar so that gravel is covered.
6. Measure water depth and record.
7. Insert poultry baster until it reaches the bottom of the jar.
8. Squeeze bulb of the baster until the tube is filled as full as possible with water.
9. Empty water into measuring cup and record the amount.
10. Repeat steps 9 and 10 until no more water is available.

Students will use the chart below while completing steps #6 through #10.

CHART FOR RECORDING RESULTS:

	Depth of Water	Amount of Water	Appearance of Water
Prior to Pumping			
Pump #1			
Pump #2			
Pump #3			
Pump #4			
Pump #5			

Teacher Talk:

1. Ask students if they know where the water that they use every day comes from.
2. Tell students about the two types of water sources and hypothesize which they use.
3. Go over the definitions in the **Did You Know?** section.
4. Give students the following information about Texas:
   (A) Aquifers provide almost half of all water used in Texas;
   (B) Texas has 9 major and 20 minor aquifers;
   (C) 96% of all ground water in Texas comes from its 9 major aquifers;
   (D) Ground water use has declined 20% since 1974 due to less land being irrigated and more metropolitan areas converting to surface supplies.
5. Show the students the location of these aquifers on a map.
6. Tell the students that they are going to build a model of an aquifer complete with a pumping station.
   The colored water represents the rainwater.
   The gravel represents the aquifer.
   The soil is the formation above the aquifer.
   The poultry baster is the water well or pumping station.

Teacher Questions	Possible Replies
1. Why does the water flow into the gravel layer and why does it hold more water than the soil?	1. Gravity makes the water flow downward and the gravel has more pore spaces for the water to fill.
2. What would happen if there was a drought situation and no water reached the gravel?	2. There would be no water available to pump out.
3. What would a city need to make sure that they would always have water available for use?	3. Cities could have alternate surface supplies and conservation measures like limiting landscape watering during the summer, raise water bills, educate the public about water issues.

RESOURCES:

Literature on water conservation by the Texas Water Development Board. View and order currently available brochures at http://www.twdb.state.tx.us/assistance/conservation/pubs.htm, contact Patsy Waters at patsy.waters@twdb.state.tx.us, fax the form to (512) 936-0812, call (512) 463-7955 or write to:

Conservation
Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

Maps of Texas River Basins, Aquifers, and Regional Reservoir Basin Maps are available on TWDB's website at **http://www.twdb.state.tx.us/mapping/index.htm**

EXTENSIONS:

1. Students may conduct research in the library or by computer to find an aquifer map of Texas and identify the major and minor aquifers in Texas.
2. Students may also contact their local water supplier and inquire as to from where the water comes. Also, ask for a copy of the plans for water conservation during drought conditions.
3. The students may contact the water departments of several selected cities and inquire as to their water source.