WATER-WISE: BATON ROUGE GROUNDWATER DATA

Mathematics 9th Lesson Plan

ESSENTIAL QUESTION: What does the data tell us about saltwater intrusion?

OBJECTIVES:

1. Students will determine the rate of change of saltwater intrusion in the Southern Hills Aquifer System.
2. Students will make predictions for future intrusion based on data.
3. Students will use the Pythagorean Theorem to find the length of the aquifers.
4. Students will use proportions to estimate when our current water fell as rain.
5. Students will determine the speed of groundwater.
6. Students will examine ways to conserve water.

COMMON CORE STANDARDS:

- CCSS.MATH.CONTENT.HSA.CED.A.1: Create equations and inequalities in one variable and use them to solve problems.
- CCSS.MATH.CONTENT.HSF.IF.B.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*
- CCSS.MATH.CONTENT.HSF.LE.A.1: Distinguish between situations that can be modeled with linear functions and with exponential functions.
- CCSS.MATH.CONTENT.HSF.IF.A.1: Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
- CCSS.MATH.CONTENT.HSF.IF.B.5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
- CCSS.MATH.CONTENT.HSF.IF.B.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- CCSS.MATH.CONTENT.HSG.MG.A.1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*

- CCSS.MATH.CONTENT.HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- CCSS.MATH.CONTENT.HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.
- CCSS.MATH.CONTENT.HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- CCSS.MATH.CONTENT.7.G.B.6: Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
- CCSS.MATH.CONTENT.6.G.A.1: Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.
- CCSS.MATH.CONTENT.8.EE.A.3: Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger*.
- CCSS.MATH.CONTENT.8.G.B.7: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
- CCSS.MATH.CONTENT.8.EE.A.4: Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology

ANTICIPATORY SET:

Ask students to make some predictions. These predictions will be addressed throughout the activities.

1. How long would it take for groundwater to travel around this classroom?
2. How long ago did our current water come from?
3. What do they think is the biggest threat to groundwater?

Teacher will need to do a mini lesson on the water cycle process and aquifer system for background information.

ACTIVITIES:

- **Math Activity: How Long Would it Take?** This activity will give students a visual of how slow groundwater moves. Students will measure the perimeter of the classroom and use this along with the rate of groundwater to figure out how long it would take for groundwater to travel the classroom. After this, they will find out how long it takes for ground water to travel from the school to a selected location outside of the states.
- **Math Activity: Where Did Our Water Come From?** This activity will show students that it takes a very long time for us to get the groundwater we currently have. Students will use drawings of the recharge area and use Pythagorean theorem to figure out what time our water came from.
- **Math Activity: Rate of Water Use:** This activity involves interpreting and analyzing data from a table. Students will analyze water trends compared to population growth.
- **Math Activity: Chloride Concentration Data Reading:** Students use raw data from chloride concentration readings to analyze data. The teacher will need to give some information on how the data is collected and compiled before doing the activity.
- **Math Activity: Saltwater Intrusion Predictions:** Students will be given a graph of the area of saltwater intrusion for one of the wells. Students will find the size of the saltwater intrusion for the years given and use this data to find the rate of change over time. Finally, students will make a prediction based on their findings.

CLOSURE:

Ask students to write down three things they learned or found most shocking about their calculations. Brainstorm with the class some ways to conserve water.