

Hydrological Maps of the Santa Fe Region

Infiltration in the Arroyo Unit, Lesson 3

Lesson Summary: Students will explore geologic and hydrologic maps to better understand the water resources in Santa Fe.

Suggested Timing: 1 hour

New Mexico State Standards

Performance Expectation(s):

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Science & Engineering Practices:

[Developing and Using Models:](#) Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop a model to describe unobservable mechanisms.

[Constructing Explanations and Designing Solutions:](#) Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Disciplinary Core Ideas:

[ESS2.C: The Roles of Water in Earth's Surface Processes:](#) Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. Global movements of water and its changes in form are propelled by sunlight and gravity.

[ESS3.A: Natural Resources:](#) Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

[ESS3.C: Human Impacts on Earth Systems:](#) Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Crosscutting Concepts:

[Energy and Matter:](#) Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

[Cause and Effect:](#) Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Evidence Statements:

- [MS-ESS2-4 Evidence Statements](#)
- [MS-ESS3-4 Evidence Statements](#)

ELA CCSS Connections:

- RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-2)
- WHST.6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS2-2)
- SL.8.5: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-2)

Math CCSS Connections:

- MP.2: Reason abstractly and quantitatively. (MS-ESS2-2)

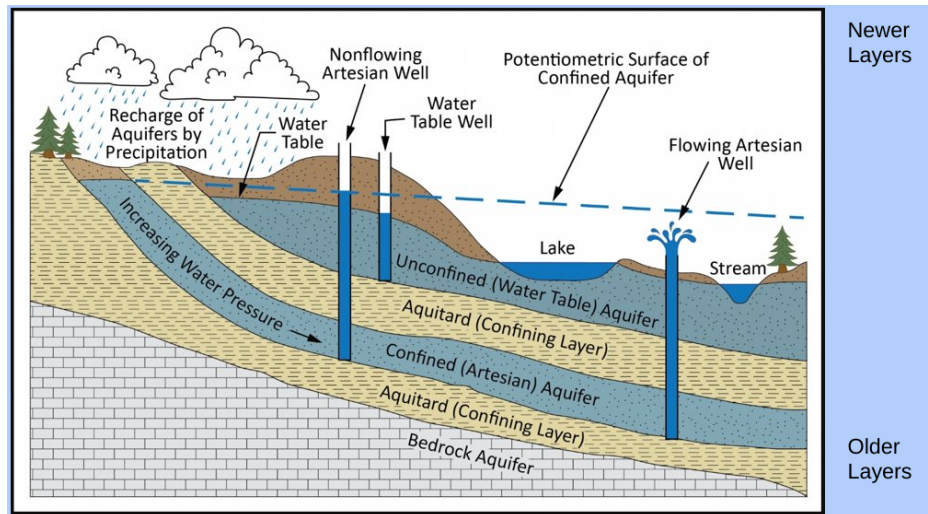
Content Objectives and Daily Learning Targets	Objectives: <ul style="list-style-type: none"> ● I can explain why some layers of rock hold more water than others. ● I understand the layers of geology underlying Santa Fe. ● I understand why groundwater is a limited resource.
Focus Question	What are the geological layers under Santa Fe?
Language Objectives	<ul style="list-style-type: none"> ● Students will use scientific language verbally and in writing.
Vocabulary	<ul style="list-style-type: none"> ● Aquifer - an underground layer of permeable rock, rock fractures, or unconsolidated materials that hold water. ● Deposit - process of laying material down or depositing. ● Infiltration - the downward entry of water into the soil. ● Igneous rock - types of rock that are formed through the cooling and solidification of magma or lava. ● Metamorphic rock - rocks that arise from the transformation of existing rock to new types when they are subjected to high heat, high pressure, hot mineral-rich fluids or, more commonly, some combination of these factors. ● Sedimentary rock - types of rock that are formed by the accumulation or deposition of mineral or organic particles at Earth's surface, followed by cementation. ● Well - a shaft sunk into the ground to obtain water or determine the depth of the water table.
Materials	<ul style="list-style-type: none"> ● Maps ● Clay in multiple colors ● Cardboard to put under the clay ● Toothpicks ● Painters tape ● Lab notebooks
Preparation before class	<ul style="list-style-type: none"> ● Read background information to prepare ● Print materials ● Cut apart the description of layers for students ● Collect materials
Assessments (Formative/	<ul style="list-style-type: none"> ● Participation in class discussion



Summative), Rubrics, Success criteria	<ul style="list-style-type: none"> • Notes in lab handout or journal • Success Criteria: <ul style="list-style-type: none"> ○ Students model is accurate and shows understanding of newer to older layers in the ground. ○ Students use what they learned to make connections between surface water and water in the ground.
EL Supports	<ul style="list-style-type: none"> • Key vocabulary should be provided in English and student's native language • Use think-pair-share • Help students with reading technical information
Culturally Relevant Strategies	<ul style="list-style-type: none"> • Students are practicing academic and social skills. • Students are learning about the local environment, which is relevant to their lived experience.
Special Education Modifications	<ul style="list-style-type: none"> • Follow student IEP • Create lab groups that allow students to share their strengths

Lesson Plan Details

ENGAGE (~10 min):	<ul style="list-style-type: none"> • Have students look back at the model from lesson 1.2 as well as the cross section they drew at the beginning of that lesson. • Give them maps of Santa Fe, showing the mountains, rivers, and other geologic features, provided in Introduction, Lesson 2. • Ask them to discuss what they have learned with their lab partners and then with their new information, draw what they think is underground. • Ensure they understand the oldest layers are at the bottom and the newest are closer to the surface.
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EXPLORE (~5 min):	<ul style="list-style-type: none"> ● Give students the “Hydrological maps” of the cross sections showing what is under Santa Fe. ● Ask students to try to make sense of the maps in their lab groups using the descriptions and their prior knowledge. What are they looking at? What do the layers mean? What different types of rocks are there in the layers? They can make notes directly on the maps and add the maps to their science journals.
EXPLAIN (~10 min):	<ul style="list-style-type: none"> ● Review and explain the maps with students. ● Show how the cross sections and the physical features maps are connected. ● Assign each student a different layer of the formation to read and share with the rest of the class. This can be done by working your way through the layers as a class and calling on students as you go. These details are on page 3 of the “Geological Map of Santa Fe, Explanation of Cross Section Units” and “Geology of the Santa Fe Area” map and descriptions, pgs. 5-6. Students will need assistance understanding these descriptions. A more detailed description is available in the “Hydrology Background Reading for Teachers” document. ● Discuss the different layers, when they were formed, and the relative density of the different rock formations. Relate this back to the lessons on erosion and deposition. The upper layers are sedimentary deposits from the mountains. This also makes them less dense, as often sedimentary rocks are less dense and have more space for water to slowly flow between the source material. ● Have students take notes in their science journal.
ELABORATE (~15 min):	<ul style="list-style-type: none"> ● Have students use clay to build models of the geology underlying Santa Fe. This can be individually or in lab groups. ● Have them label the layers and make notes about the permeability and where our well water comes from. These can be made as flags with the toothpicks and painters tape. ● Ask them to add where they would place wells.
EVALUATE (~15 min):	<ul style="list-style-type: none"> ● Discuss how this is related to arroyos, water, and infiltration. ● Do a think-pair-share activity: “Why is it important to slow water down instead of moving it quickly through our arroyos to the river?” ● Have students record their thinking in their science journals.

Additional Sources:

- [5 Es of Science Instruction](#)
- [5E Model of Instruction](#)
- [ISEC model of lesson sequence](#)

