

## Glacial Deposition and Groundwater in Dutchess County

**Time:** 2 class periods

**National Benchmarks:** Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.

**National Science Standards:** *Science as Inquiry:* A: Abilities necessary to do scientific inquiry; Understandings about scientific inquiry; *Science in Personal and Social Perspectives:* F: Natural resources

**New York State Standards:** 1, 4, 6

**Objective:** Students will identify the permeability rates in different glacial deposits and be able to infer what local townships can best benefit from residential wells.

### Lesson Outline:

1. Students read excerpt from “The Hudson: A History”
2. Students complete lab activity to determine the permeability of different glacial deposits

### Materials:

- Glacial Deposits Map of Dutchess County (Dutchess County Department of Planning)
- Ground Water Occurrences of Dutchess County (Dutchess County Department of Planning)
- Soil Permeability of Dutchess County (Dutchess County Department of Planning)
- One clear plastic cup of each of the following: Glacial Till (mixed particle size), Lacustrine deposit (stratified silt and clay), Sand and Gravel (stratified sand and gravel)
- 100 ml beaker
- Food coloring
- Stop watch

**Preparation:** Students should have a sound background in porosity, permeability, and glacial geology before attempting this lesson. In fact, this lesson is best suited as a synthesis of all students have learned about weathering, erosion, glacial geology, and ground water.

**Engagement:** Students should be given several minutes to read the excerpt from The Hudson: A History by Tom Lewis. After the class has finished reading the teacher should lead a discussion about the glacier that covered the Hudson valley during the last ice age. Some questions that should be asked include, “How did the glacial ice impact the landscape of the Hudson Valley?” and “What are pieces of evidence left behind by the glacier that still exist today?” and finally, “How do these glacial features influence our lives today?”

**Explore:** Students will begin the lesson by answering the preliminary questions using the Glacial Deposits Map for Dutchess County. After they have completed the questions each group of students will get a sample cup of each of the three glacial deposits and complete the lab activity, recording their results as they go. After completing the activity, students should answer the activity questions based on their results.

Students should next answer the questions in the predictions section of the lesson, basing their answers off of what they learned doing the activity and the Glacial Deposit Map for Dutchess County and Dutchess County Groundwater Occurrences Map. If students have access to a computer in the classroom they should get on-line to begin their research, if not they should do so on their own. As a conclusion, students will write a paragraph addressing what they learned by doing the lesson.

**Explain:** Thousands of years ago an enormous ice sheet blanketed the Hudson Valley in what was called the Wisconsinan Glaciation. The ice reshaped the land in its southern advance and northern retreat, leaving scars and signs that can still be discerned today. We have these glaciers to thank for the landscape we enjoy so much today – from the beaches of Long Island, to the Hudson River, to the Catskills. The glaciers played at least some role in each of their formations.

Yet, the glaciers did more than just carve and create natural beauty. They left behind sediments that play an integral role in our everyday lives. These sediments are used in industrial, commercial, and residential ways that we often don't even realize. Some glacial sediments act as natural reservoirs of groundwater that can be tapped for human use. We must be aware of these sediments' locations and capabilities so that we can utilize them wisely and avoid contaminating a resource that is so important for sustaining communities here in the Hudson Valley.

**Extension:** Another way to do the activity in this lab would be to use a modified sieve that could be used to accurately measure permeability rates in each of the sediment samples. To make the sieves one could use a small piece of PVC pipe and attach a piece of fine wire mesh to the bottom using a rubber band or other means of attachment. The mesh should hold the sediment in and let the water drain out. Students can use these sieves to time how long it takes for the water to drain from each sample and record their results in a table. At the end of the activity students can compare results and come up with an average rate of permeability for each sample.

**Evaluate:** Students should be able to complete the activity and answer the questions appropriately.

**Comments:**

**References:** This lab was compiled and written by Kirk Dorton, Arlington High School, Arlington, NY.