Purifying our Water

Adapted from: Suffolk County Water Authority, Water Filtration Project: www.teachengineering.org,

Lesson Concepts: This lesson will introduce students to the three major aquifers that supply Long Island individuals with our fresh drinking water. They will also identify a variety of pollutants that are contaminating our ground water as well as gain an understanding of the importance of having access to clean water supply. Construction of a purification systems to clean or purify this source.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Science and Engineering Concepts	Disciplinary Core Ideas	Cross Cutting Concepts
Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	Developing Possible Solutions A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. Models of all kinds are important for testing solutions.	Influence of Science, Engineering, and Technology on Society and the Natural World All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.

ELA Connection: WHST.6-8.9 SL.8.5	Draw evidence from informational texts to support analysis, reflection, and research. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
Math MP.2	Reason abstractly and quantitatively.

Teacher Background

Groundwater on Long Island has become compromised. Not only does groundwater contain rocks and dirt, it may also contain bacteria, other microorganisms, and other pollutants that make it unsafe for drinking. Subsequently, water that comes into our homes is filtered through a water treatment process to remove impurities making it safe to drink. All of Long Island's drinking water comes from groundwater which is stored in an aquifer system. An aquifer is an underground layer of permeable rock, sand, and/or gravel. The three most important aquifers on Long Island are the Upper Glacial Aquifer, the Lloyd Aquifer, and the Magothy Aquifer.

Materials Needed: Variety of materials to build filtration/purification systems, prepared dirty drinking water, 4 beakers,

Prerequisite: Students should have some knowledge about the water cycle, ground water, and water pollution.

Engage

Polluted water images…what do you see?

Explain

Ask: Where does Long Island get its drinking water? What water source would this be called?

Model Long Island's aquifer system.

Construct a flow chart showing how you think water gets from the aquifer into our homes… Groundwater to faucet….on your student activity page.

Explore

Ask: How do pollutants get into our drinking water?
Can you think of a way we could clean dirty water?

Introduce activity: Building a water purification system
Explain to students that they will be using a variety of materials to construct a water filtration system.

Instruct students to illustrate filtration model in student activity page.
Remind students that the diagram must include labels indicating materials used,
The model should show the movement of water through the system.
Before proceeding to the construction stage, students must present diagrams for teacher approval.

Questions to consider while you design your system:
What is the goal of your design? (Clean the water.)
What are the constraints? (Materials available to construct model.)
How will you determine if your design is successful? (Water looks clean, pollutants trapped by system.)

Show the dirty drinking water…this is what you will need to clean.
Show four containers of this dirty water in different stages of being purified, or cleaned.
Show the rubric to students that will be used to assess each group's purifying system.
Explain that each group will model their design for class…opportunities to share and celebrate designs.

Monitor progress by walking about and checking in with groups.

Once filtration systems have been constructed, begin a museum walk…one at a time, each group will be given sample of dirty water to filter. Class can gather around each filter, or each filter design can be brought to front of class and tested one at a time.

Allow time for positive (warm) feedback from peers.

Evaluate

Rubric for Assessment

Criteria	Doesn't Meet Expectations	Almost meets expectations	Meet Expectations	Exceeds Expectations
Filtering System	Water looks the same as it did before filtering Matches Glass D	Water looks somewhat cleaner than before filtering Matches Glass C	Water looks almost clear Matches Glass B	Water looks clear, matches Glass A

Ask: Is there any modification you could make to your filter?
Discuss with group and write ideas onto Student Activity Page.

Ask students to list at least 3 possible sources of ground water contaminates.

Elaborate

Ask students to construct a flow chart showing the path water takes from the aquifer to the home and back into the ground.

Extension:

Have students create their own aquifer

Take field trip to SCWA in Holbrook for educational tour

Name

Purifying Water Student Activity Page

Activity One:

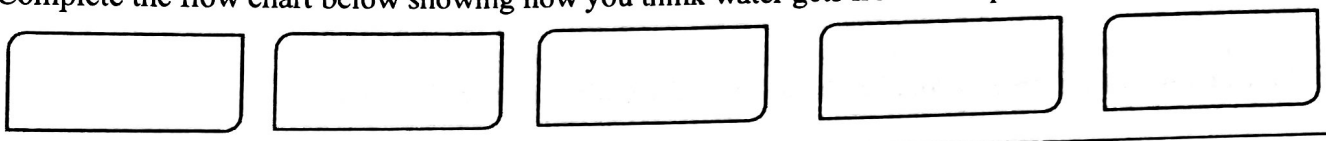
What do you see?

How do you think this happened?

Activity Two:

Where does Long Island get its drinking water? What water source would this be called?

Complete the flow chart below showing how you think water gets from the aquifer into your home.



Activity Three:

Illustrate your filtration model in the space provided below:

- Does your diagram/model include labels indicating materials used?
- Does it show the movement of water through the system.

Activity Four

Using the rubric below, evaluate your group's filter.

Criteria	Doesn't Meet Expectations	Almost meets expectations	Meet Expectations	Exceeds Expectations
Filtering Model	Water looks the same as it did before filtering Matches Glass D	Water looks somewhat cleaner than before filtering Matches Glass C	Water looks almost clear Matches Glass B	Water looks clear, matches Glass A

Is there any modification you could make to your filter? Write your ideas below:

Activity Five

Discuss the following questions with your group. Using at least 3 complete sentences, write your response in the space provided.

- How did this activity help you visualize the path water takes from precipitation into the ground?
- Why is it important to respect our water sources?
- What types of pollutants (contaminates) do you think affect the quality of our drinking water?