

Groundwater Restoration

An Introduction to Environmental Engineering: Part 1

Introduction:



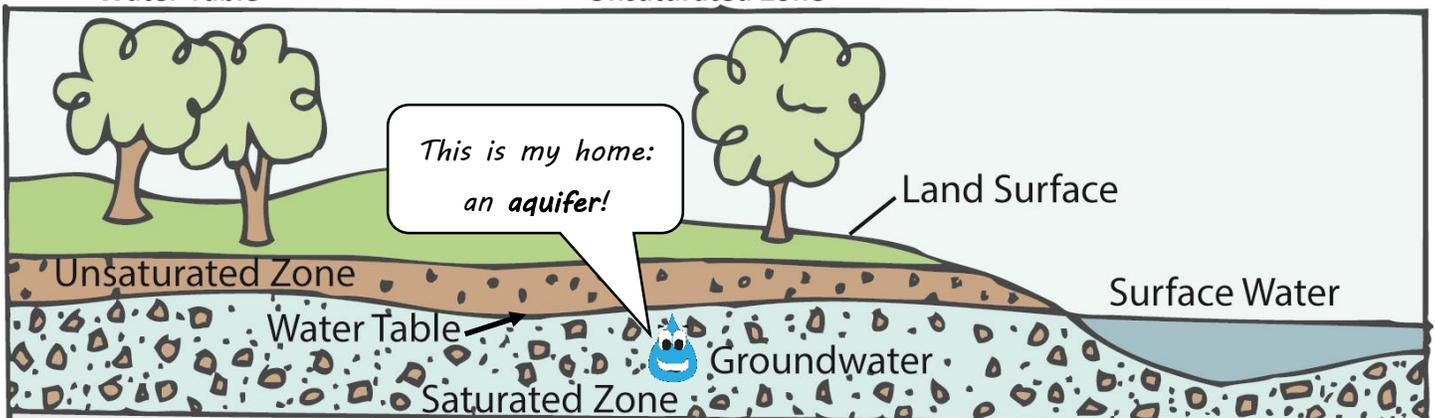
*Hi there! My name is Remy Groundwater. Today you're going to learn all about my home - aquifers! Groundwater is stored in, and moves slowly through, layers of soil, sand, and rocks called **aquifers**. Instead of just talking about aquifers, let's build one!*

Step 1: Pour gravel into a clear plastic container and spread out evenly. The gravel represents an aquifer. Slowly add water to your aquifer. Watch the water level increase in the gravel. Stop adding water when about half of the gravel is saturated. The water found in the cracks and spaces of the gravel represents **groundwater**. Groundwater is a natural resource that is used for drinking, recreation, industry, and agriculture.

Step 2: Create a lake in your model. Push the gravel to the sides of the container allowing the water to create a lake. The lake represents surface water. **Surface water** is water above the surface of the land, including lakes, rivers, streams, ponds, floodwater, and runoff.

Step 3: Using the diagram below as a guide, locate the following in your model aquifer:

- Groundwater
- Water Table
- Saturated Zone
- Unsaturated Zone
- Surface Water



Step 4: Slowly add more water directly to the aquifer by pouring water on the gravel. Watch how the water **percolates** (moves) down through the gravel and becomes groundwater. What happens to the elevation of the lake as you add water to your aquifer?



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An Introduction to Environmental Engineering: Part 2

Introduction:



Hello again! Remy Groundwater here. Did you know that decisions humans make can positively or negatively affect groundwater? Choosing to use less water in our day to day lives can help keep our groundwater sustainable for future generations - a huge positive! Unfortunately, many of our actions, if we are not careful, can lead to pollution or over use of groundwater.

Step 1: Obtain samples of colored water, potting soil, vegetable oil, salt, baking soda, and vinegar. These samples represent different **contaminants** (pollutants) that can affect the quality of both surface and groundwater.

Step 2: Follow the directions in Remy's table.

Pollutant	Directions for adding to Model Aquifer	 Remy's Story
Household Chemicals	Pour colored water over one spot on the gravel.	Household chemicals can permeate (spread throughout) the soil and seep into groundwater if not properly disposed.
Sediment	Pour potting soil into the lake.	When natural vegetation is removed, sediment (soil) can wash into surface water. Too much sediment can hurt aquatic life.
Oil	Pour the vegetable oil into a paper or toy boat. Put the boat on the lake, and tip the boat over.	Oil spills can occur when oil is being transported. They are very difficult to clean up, and the oil can seep into groundwater.
Road Salt	Pour the salt along the edge of the gravel and lake.	Salt is an excellent way to keep ice off roads in the winter, but too much salt is bad for the environment. Do you like drinking salt water?
Pesticides and Fertilizers	Pour the baking soda all over the gravel.	Pesticides and fertilizers are very helpful in growing plants. However, too much of either is harmful to the environment.
Acid Rain	Pour the vinegar all over the gravel and lake as if it was raining.	When air pollution reacts with water in the atmosphere, acid rain can develop. Acid rain is very damaging not only to the environment, but to building structures as well.



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An Introduction to Environmental Engineering: Part 3

Introduction:



Hey! I need your help! In case you don't know, my name is Remy Groundwater, and my home aquifer is polluted. Can you help me engineer a device that will clean up the groundwater in my aquifer? I am positive that if we work together as a team we can restore the groundwater!

Step 1: Use the ice cube tray to test the ability of different materials to clean water. Place samples of each material you wish to test into separate slots on the tray. Then, using a syringe, add a small amount of polluted water to the material. Record your results in the table below. You may wish to perform the experiment multiple times to verify your results. Remy has already done an example for you!

Material	Observations from Slot 1
Coffee Filter	Removed dirt particles from water

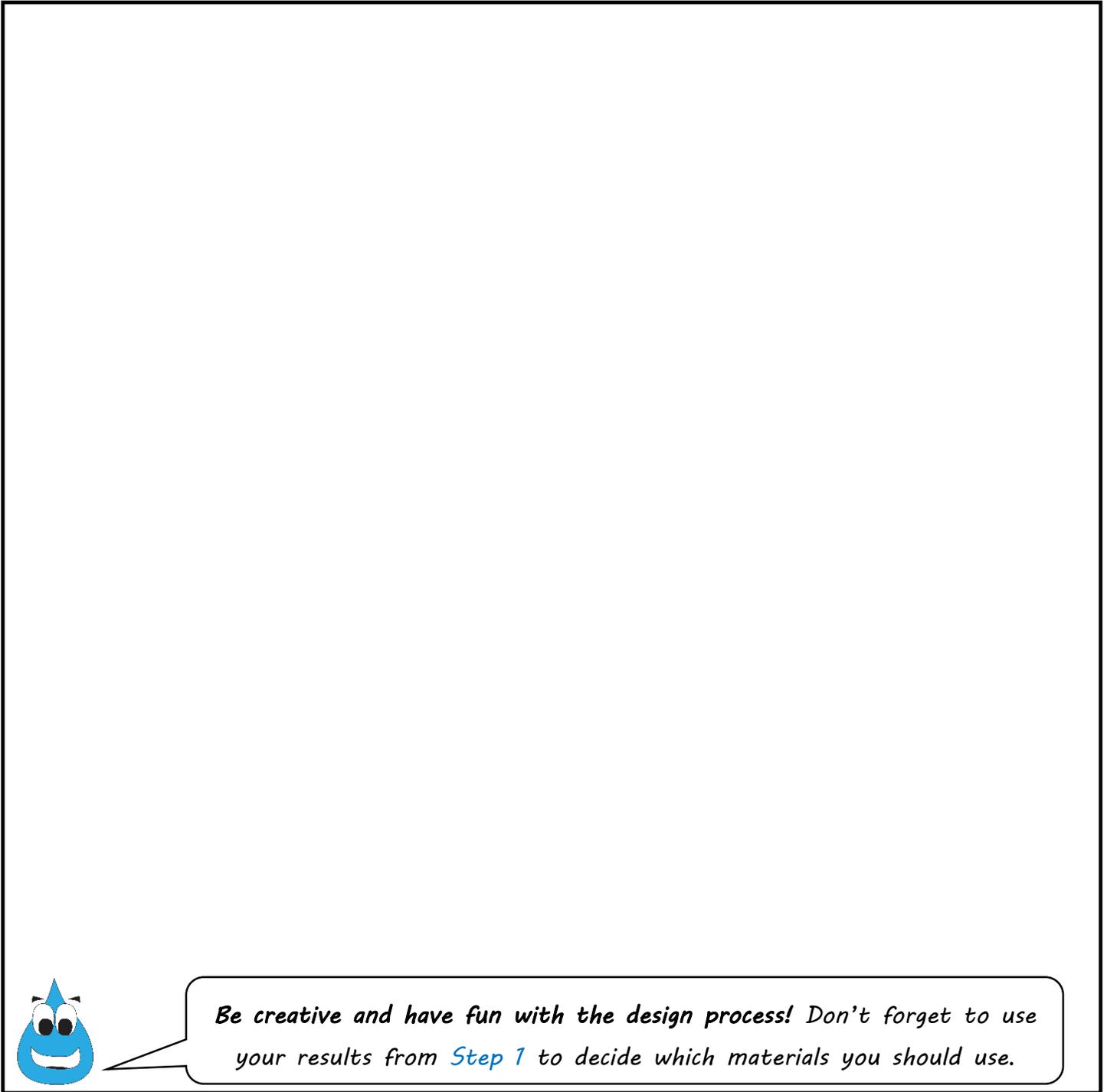
*Here's a helpful hint:
Rinse the activated carbon with clean water before using it to clean dirty water.*



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Step 2: Now that you have discovered how the various materials clean the polluted water, your task is to design a filter. Use the box below to draw the blueprint of your design. Don't forget to have your teacher sign off on it before you begin the actual building process!



Be creative and have fun with the design process! Don't forget to use your results from [Step 1](#) to decide which materials you should use.

Teacher Signature _____



Step 3: Work with your team to build and test your filter!

1. Remove 50 mL of polluted water from your model aquifer using the syringe. What is the appearance of the dirty water? What does it smell like?



I'm so excited to test your design and clean up this dirty water!

2. Pour the 50 mL of polluted water into your filter. Watch as the water moves through your filter. What is the appearance of the filtered water in your collection cup? What does it smell like?

3. Send two to three people from your team to visit at least two other teams to observe the results of their filters. Did their filters work better or worse than your teams? Why or why not? Record your observations below.

Team Name	Did their filter work better, worse, or the same?	Why or why not?

4. After exploring the results of other filters, are there ways your team can improve your filter in the future?



You did it! Thanks for helping clean up my home aquifer!

