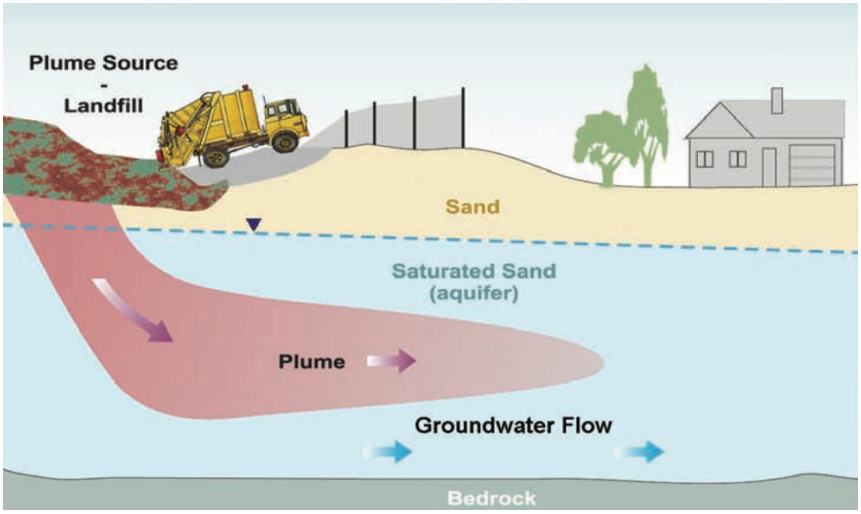
Groundwater Plume Activity

Introduction: As we have learned, groundwater provides 98% of drinking water. For this reason, among others, it is hugely important to understand the ways in which groundwater can be polluted. Groundwater plumes occur when the ground above or surrounding an aquifer is contaminated. This contamination seeps through the layers of the soil and can infiltrate the water table and groundwater. A plume forms when the initial site of the contamination expands and moves due to the underground flow of water. New technology has begun to allow for the tracking of underground plumes based on well data like the direction and rate of groundwater flow, and the permeability of the aquifer. This experiment will allow you to mimic the formation process of a groundwater plume.



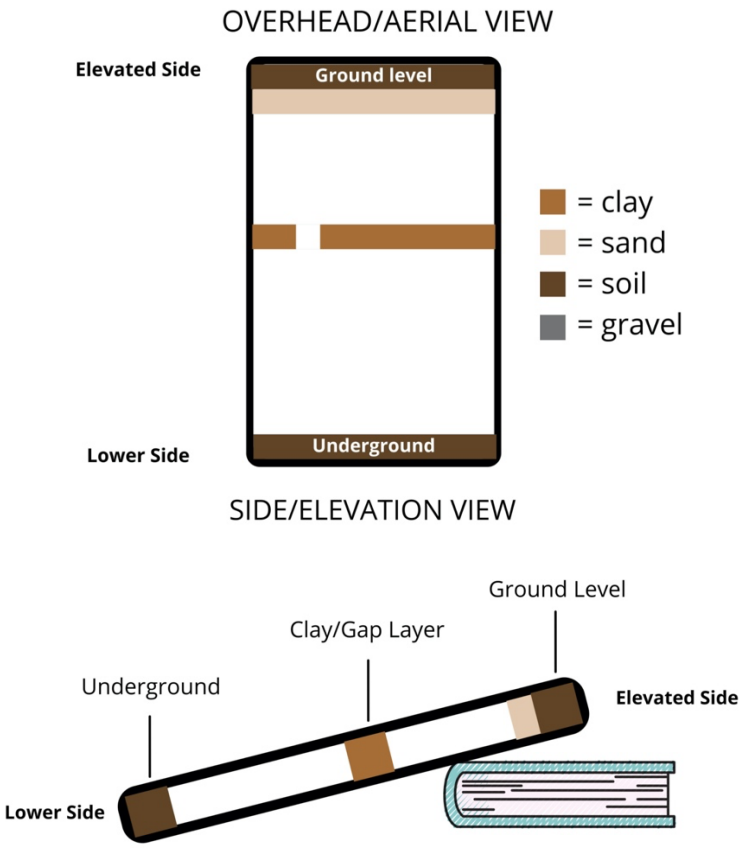
You will need:

- Clear container (glass baking dish, rectangular plastic Tupperware, glass bread pan, etc.)
- Kool-aid or other powder dye
- Spray bottle of water
- A thick book (used to elevate container)
- Spoon
- Sand (sandbox, stream bank, non-clumping kitty litter)
- Clay (natural clay/molding clay/play-doh/bread dough/putty)
- Gravel (driveway gravel, aquarium rocks)
- Soil

Instructions:

1. The clear container will be stratified with layers of material, to represent a cross section view of the ground. First place a layer of clay near the center of the dish. This layer should span the shorter side of the container and in height, should be slightly shorter than the lip of the container. The layer should be built vertically and will appear like a wall placed in the center of the pan. Press it down tightly to the bottom, then create a small gap in the layer, so it is not connected all the way across the dish. You should be able to see this gap on the bottom. Once the clay layer is placed, use the sand, gravel, and soil to create layers above and below the clay layer, all built vertically. The top layers, representing the ground surface, should be soil on top, then sand. You can make as many layers as you like.

   View the image below for guidance on the set clay, sand, and soil layers. Any other layers are up to you!



2. Once your container is full of your geologic layers, bury 1-2 spoonfuls of Kool-Aid in the top, ground level layer.
3. Place the book under the end of the container with the buried Kool-Aid, to elevate it.

4. Over a span of around 30 minutes, use the spray bottle of water to spray and saturate the layers in the container continually, but slowly, focusing on the area with the Kool-Aid.
5. Around every 5 minutes, stop spraying the water, and carefully lift the dish until you can view the bottom of the container. What do you observe? Has the plume of water started to take any path?

Reflection:

What did you observe happening once the sediment and Kool-Aid was saturated? How did the color flow throw the layers?

What do the following materials represent:

Sand/Clay/Gravel/Soil?
Kool-Aid?
Water?

How could this pollution enter the water cycle?

What are the implications of anthropogenic surface pollution on groundwater?

Would the type of rock surrounding the pollution have an effect on its movement? Why or why not?