Down Under

Groundwater

Contrary to popular belief, ***groundwater*** is not underground rivers. It is water between soil and rock particles in the ground, like water in a sponge. Groundwater movement varies from inches per year to feet per day. When rock layers contain empty spaces (*porous*) that are interconnected (*permeable*), they are called *aquifers.* Aquifers can be near the surface or thousands of feet down. They range from a few feet to hundreds of yards thick and can be many miles long. When all the pores are filled, an aquifer is said to be *saturated.* The upper boundary of a saturation zone is called the *water table* when it is located fairly near the surface. Aquifers that have an impermeable layer like clay or shale below, but not above them, are called *unconfined aquifers* and are the most common type*. Confined aquifers* are surrounded on top and bottom by impermeable layers.

Half of the people in the U.S. rely on groundwater for their drinking water. The largest aquifer in the U.S. is called the Olgallala Aquifer. It extends for 800 miles through 8 states from South Dakota to Texas. It is an important supplier of both drinking and irrigation water for those states.

Aquifers are *recharged,* or resupplied, when it rains, when water sinks down, or *percolates,* through soil layers to the aquifer, or when water seeps through the banks of rivers and lakes. Aquifers are *discharged* when water is pumped out through wells that have been dug or when water rises to the surface through natural springs because of earth layer pressure.

Surface contaminants are largely filtered out by the soil and rocks as water sinks through earth layers. However, groundwater pollution is a growing concern. It can be caused by leaking underground storage tanks, leaking septic tanks, animal waste, fertilizer, pesticides, road salt, and hazardous materials being poured on the ground.

Groundwater Protection at the Landfill

Metro Waste Authority utilizes a number of safeguards at its Metro Park East landfill to protect groundwater from contamination. When the landfill was excavated 30 years ago on top of over 75 feet of naturally-occurring clay (impermeable), two feet of clay was first compacted. This was followed by a heavy plastic liner (the same type of plastic that milk jugs are made of) over the clay and up the sides of the landfill. Eighteen inches of pea gravel was then laid down on top of the plastic liner. Each day, garbage is compacted on top of these layers and covered with 6 inches of soil or a removable tarp.

When it rains, or snow melts, at the landfill, the water seeps down through the garbage, picking up contaminants. This liquid, called *leachate*, is collected in pipes that lie beneath the garbage but on top of the protective layers, so that no contaminants can enter the soil or groundwater. The pipes carry the leachate to a series of wetlands right on the landfill premises.

The wetlands contain a variety of plants that naturally filter the leachate until all that remains is a liquid that can be safely applied to a nearby prairie.

Metro Waste Authority also has 22 special wells to regularly monitor groundwater quality throughout the landfill area.

Des Moines Water Works' Groundwater Resources

Des Moines Water Works (DMWW) relies on surface water from the Raccoon and Des Moines Rivers for providing about 3/4 of the water treated at its Fleur Drive Treatment Facility, but the other 1/4 of the water supply comes from **groundwater** that lies beneath Water Works Park. Water that filters though the banks of the Raccoon River, as well as through the bottom of the ponds located in the park, recharge this groundwater system. The three-mile collection pipe is called the Infiltration Gallery.

At DMWW's new Treatment Plant at Maffitt Reservoir in the southwestern part of Des Moines, nine wells collect groundwater to add to DMWW's water supply.

DMWW is making use of part of the Jordan Aquifer to store already-treated water through its Aquifer Storage and Recovery (ASR) program. In this program, which began in 1999, clean, treated water is pumped to the Jordan Aquifer down an abandoned well in Ankeny. The water can later be pumped out during times of peak demand, such as in the summer. It only needs to have a small amount of chlorine added before it is sent to customers.

Groundwater Activities

Aquifer Action - Students can act out how water moves through different types of materials in aquifers. Have two or three students represent water molecules and the rest of the class be various aquifer materials. **Gravel -** students become gravel by standing with arms outstretched, not touching other students. Have water molecules move through the students (can move easily). **Sand** - students become sand by standing with arms, elbows out and barely touching as water molecules try to move through them (a little more difficult). **Clay -** students become clay by standing with their arms at their sides, touching each other, so water molecules cannot move through them (impermeable). Discuss what material would be the best aquifer for drilling a well into (gravel).

Groundwater Contaminant Mystery- Students experiment to locate a leaky underground storage tank that is polluting groundwater. Divide students into groups of 4-5 students and give each group a 9" x 13" aluminum pan filled with about two inches of sand, a heaping teaspoon of unsweetened powdered lemonade drink mix, a plastic straw, and some pH testing strips. Instruct each group to bury their lemonade mix somewhere in the sand (all in one spot). Have groups exchange their pans with another group and begin the search
for the "leaky underground tank" (lemonade). Show students the color of a pH strip when it touches plain water as compared to when it turns a red color when it touches an acid like the lemonade powder mixed with water. Instruct students to make it rain on their pans of sand until all of the sand is damp. Show them how to "test" an area by inserting their straw into the sand and then pulling it up while holding a finger across the top to keep the water sample inside and then releasing a drop onto a pH test strip to see if it turns red. Can they find it?