Ohio Department of Natural Resources
Division of Soil and Water Resources
Fact Sheet

Fact Sheet 97–43

Surface Water and Ground Water Interaction

There is only a finite quantity of water on the Earth. Of that quantity, only a limited amount is available for human consumption. Roughly 98% is saline and is found in the oceans. The last 2% is fresh water found mostly in the atmosphere and locked up in glaciers. Drinkable water in lakes, rivers, and ground water accounts for less than 2% of the planet's fresh water reserves. Of this fresh water, ground water accounts for 97%. Because we have a small amount of consumable water, it is key that we know the mechanisms of how and where water flows.

Hydrologic Cycle

Ground water and surface water are intimately linked through the hydrologic cycle. The hydrologic cycle is a global phenomenon in which water continuously moves through an intricate system. We will begin our simplified explanation of the cycle at the oceans because they are the largest reservoirs of water on the planet.

Water from the oceans evaporates as a result of energy received from the sun. The water vapor eventually condenses to form clouds, some of which get blown landward. Once over land, if the condensation of the water vapor exceeds what the cloud can hold, precipitation will occur. Some precipitation will re-evaporate, some is absorbed by plants, and some infiltrates into the soil. When precipitation exceeds the rates of evaporation and infiltration, runoff into lakes, streams, and oceans starts. Eventually ground water and surface water find their way back to the oceans, thus completing the cycle.

Ground Water Basics

Recalling the hydrologic cycle, let's examine in greater detail the time following infiltration of the soil. Relatively small amounts of water can infiltrate below the surface. Water that does infiltrate will fill any subsurface pore spaces, cracks, or crevices. The water will continuously travel downward under the influence of gravity until an impermeable layer is reached. Water will continue to stockpile above the impermeable layer to create a large underground storage, or aquifer.

This water is free to move laterally (again under the influence of gravity) following the slope of the medium containing the aquifer. Travel rates will vary depending on the material and are generally much slower than surface water velocities. Typically, coarser grained material will transmit water more readily than finer grained material.

Over time ground water will travel to the surface. Ground water is discharged to the surface through several ways. Such examples would be the formation of natural springs, discharge to river and stream banks, discharge under river and stream beds, or direct discharge into the ocean. Where and how ground water is discharged to the surface depends on the water table. Surface water will appear where the water table intersects the surface topography.

Losing and Gaining Streams

Many rivers and streams throughout Ohio are strongly influenced by ground water. As streams flow, their primary source of recharge is precipitation. During times of drought or low precipitation, streams may rely totally on ground water input.

Ground water contribution may range from zero to 100% of normal flowing streams. Depending on the height of the water table and discharge of ground water, the contribution to the stream will vary. Along certain stretches of a stream path, ground water may discharge into the stream and the volume of the stream increases. This is called a gaining stream. Conversely, certain streams may overlie a deeply buried water table. During dry or arid conditions, water may seep from the stream down to the water table causing a reduction in the flow volume of the surface water. This is called a losing stream. Annually, Ohio has humid conditions, so water tables are generally high and losing streams are not common.

Sensitivity of Ground Water Recharge Areas

As the hydrologic cycle reveals, ground water is recharged primarily from precipitation. Precipitation

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that is actually converted into ground water depends on numerous factors. Such factors include the topography of the land, the nature (permeability) of the soils, the intensity and frequency of precipitation, and the density of vegetative cover.

Areas that have much precipitation, easily permeable soil, a low density of vegetative cover, and little relief are conducive for ground water recharge. These areas must be watched closely because any pollutant discarded in these areas can be rapidly transferred to the aquifer. Once the contaminant is in the aquifer, it travels with the ground water and is eventually discharged to surface water. Soils and rock may act as a limited filter for contaminants. Once these natural filters are overcome with excessive concentrations of pollutants, discharge to surface water is unavoidable.

Summary

We have seen that water resides in the ground and on the surface, and examined some interactions between the two. Through knowledge of these interactions we know that ground water and surface water are interwoven through the hydrologic cycle. As humans we must be aware of our influences on the natural environment. We must be aware that whatever we place on the land can affect our water supply either directly to surface water or indirectly via ground water.

For more information on surface and ground water interaction in buried valleys and other geologic settings contact:

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