4–1 THE WATER PLANET

Content on Water

Water Everywhere

Fresh water, salt water, water table, water works, water hazards, potable water, bath water, boiling water—our lives are built around this essential compound, water. Earth is often called the water planet because three quarters of its surface is covered with water. Throughout their existence on earth, humans have taken the plentiful water supply for granted. Only recently have humans come to regard this renewable resource with the respect it deserves.

We do not have an endless water supply. Even though planet earth is very wet, 97% of all the water on earth is salt water and cannot be used by terrestrial plants and animals. Of the remaining 3% of fresh water, 2% is tied up in glaciers around the polar caps. That leaves 1% of the earth's total water that is available for human use. Water occurs in all three states of matter—solid, liquid, and gas—and is distributed throughout the earth in terrestrial, oceanic, and atmospheric reserves.

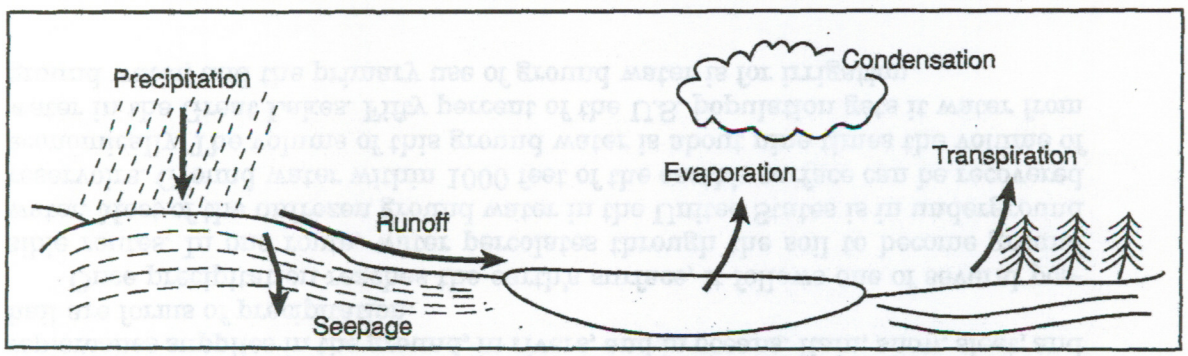

FIGURE A. The Water Cycle

Water Cycle

The water, or hydrologic, cycle has moved water from one part of the earth to another since the existence of the earth. New water is never created, and the total

volume of water has remained constant for millions of years. We are using the same water in which bacteria evolved and that the dinosaurs drank. Water molecules spend thousands of years circulating from the bodies of living things to surface water, to water vapor and back to the ocean or glaciers.

Figure A illustrates the water cycle. This cycle is sustained by energy from the sun. The sun's heat causes water to evaporate (or change from a liquid to a gas) from the land and seas. Water also enters the atmosphere by transpiration, an evaporative process in which plants lose water. Water frozen in glaciers can evaporate to a gaseous form by the process of sublimation.

Water vapor in the atmosphere condenses into a liquid again and forms clouds. From these clouds, water falls in various forms of precipitation and replenishes supplies in the ground, in rivers, and in oceans. Rain, snow, sleet, and hail are forms of precipitation.

Once precipitation reaches the earth's surface, it follows one of several possible routes. In one route, water percolates through the soil to become ground water. Most of the unfrozen ground water in the United States is in underground reservoirs. Ground water within 1000 feet of the earth's surface can be recovered economically. The volume of this ground water is about nine times the volume of water in the Great Lakes. Fifty percent of the U.S. population gets it water from ground water, and the primary use of ground water is for irrigation.

Ground Water

Ground-water supplies can be depleted if the rate of withdrawal exceeds the natural rate of recharge or replenishment. Under the Great Plains of the United States, a huge aquifer, or underground reservoir, exists called the Ogallala aquifer. Humans have removed water from the Ogallala since the 1930s to irrigate the dry land of the Great Plains regions, converting this area to the lush "breadbasket of America." Water has been pumped from the Ogallala for the last 60 years and has been used primarily to irrigate fields. The removal of water from this aquifer is 50 times faster than can be replenished by rain. The water table is dropping drastically as the reservoir is emptied. Consequently, farmers are changing their farming methods to raise crops that require little or no water.

Water that does not infiltrate the ground becomes runoff, which travels as streams and rivers to the sea. The land area that delivers the water and its load of sediment and dissolved minerals is called the watershed or drainage basin. Water flows from high elevations to lower ones due to the force of gravity. Rapid flow over steep terrain often erodes and reshapes the land. Materials washed into a river from the land, together with the sediment that eroded from the channel, make up a river's load. The kinds and amounts of substances dissolved in water depend on the climate, the rock and soil composition, and human activities in the basin. Pollutants in the drainage basin can include gas and oil from road surfaces, fertilizers from fields, animal manure from feedlots, and pesticides from farms.

Water that falls as precipitation can also rejoin existing water bodies such as rivers, lakes, and oceans. Water molecules that fall into fresh water systems are available to plants and animals, which must have water to survive. These molecules will one day be excreted from the animals and evaporated from the plants to reenter the atmospheric water supply.