Springs

Springs and spring water have long been a source of fascination and intrigue. In ancient times philosophers and scientists erroneously believed that springs were formed when saltwater from the oceans moved in tunnels under the land, was purified, and raised to the land surface. Springs were often considered mysterious and are a subject of considerable folklore.

A Roman architect named Vitruvius proposed the theory accepted today. He speculated that springs were fed by rainfall and snowmelt that soaked into the ground and reemerged at another location. Since then, numerous studies have confirmed Vitruvius's theory.

In more recent times, springs have been used for public bathing facilities, public water supplies, private water supplies, and watering livestock. Springs in Minnesota have been used for domestic water for farm houses, milk houses, barns, and livestock tanks.

What is a Spring?

A spring occurs when groundwater appears at the land surface. Springs occur in various forms and are classified by the rock type in which the spring occurs, how the spring was formed, how much water flows from the spring, the temperature of the water, and if the water flow varies from season to season. Some springs may fall into more than one classification.

Classifications of Springs

Artesian Springs

Occur when the groundwater, under pressure, finds its way to the land surface (Fig. 1).

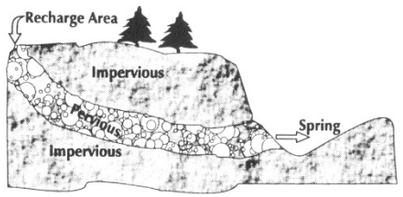

Fig. 1

The spring flows because the pressure in the aquifer (water bearing soil or rock), which is covered by a confining layer (clay or other impervious material), is greater than atmospheric pressure at the land. A spring is formed when the water reaches the surface through a fracture or porous layer. These types of springs usually occur along faults (a fracture in the earth), or in areas of great topographic relief such as cliffs or valleys.

Gravity Springs

Are formed by water soaking into the ground until the water encounters a confining layer that will not let the water seep further down (Fig. 2).

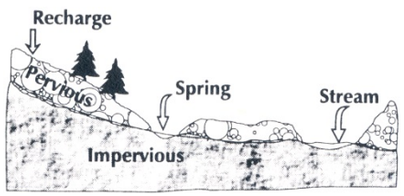

Fig. 2

The water then flows across the top of the confining layer until it reaches the ground surface. Examples of gravity springs are springs found in hillsides or cliffs. The springs along the north shore of Lake Superior and along the Mississippi and St. Croix River Valleys are generally of this type.

Perennial Springs

Drain a large land surface area and flow continuously throughout the year.

Intermittent Springs

Flow only during certain times of the year when rainfall or snowmelt is sufficient to recharge the soil and groundwater.

Tubular Springs

Most commonly associated with limestone channels and cavern, and volcanic lava tubes. The water is contained in caves or solution cavities in the limestone, or hollow "tubes" formed by cooling lava. Cavities or tubes may range from microscopic in size to large openings measuring many tens of feet across. Large tubular springs in some parts of the United States flow over a million gallons per minute. The large springs of southeastern Minnesota are tubular springs.

Seepage Springs

Are formed when groundwater slowly seeps out of the ground. Seepage springs usually occur in sand, gravel, or organic materials and generally are found in depressions or valley bottoms. Seepage springs are different from artesian springs because they are not necessarily confined (contained below a dense layer of clay or other material) and usually have low flows.

Thermal Springs

Are springs that release groundwater warmer in temperature than groundwater in the surrounding watershed area. Examples of thermal springs are warm springs, hot springs, mudpots, and geysers such as those at Yellowstone National Park. Thermal springs are most commonly found in areas with a recent history of volcanic activity.

Springs and Artesian Wells

Springs are often confused with flowing artesian wells. An artesian well is a hole or boring that has been drilled into a water-bearing formation or "aquifer" that is under pressure. The water in an artesian well rises above the top of the aquifer (water-bearing formation) until the pressure is equalized. In a flowing artesian well, the water rises above the ground surface and the water flows out of the well casing to equalize the pressure.

Are Springs Sources of Safe Water?

Usually not. Water quality from springs may vary from year to year and even minute to minute. The Minnesota Department of Health (MDH) routinely sampled springs for coliform bacteria and nitrate-nitrogen in the 1960s and 1970s. Coliform bacteria indicate the possible presence of disease-causing organisms. Elevated nitrate-nitrogen levels typically result from sewage, animal wastes, or nitrogen fertilizers. Water samples were collected statewide from springs at various times of the year. The results indicated that 85 to 90 percent of the

sampled springs were contaminated with coliform bacteria or nitrate at one or more times.

Springs are susceptible to contamination from surrounding land uses. Springs usually are formed in close proximity to the area where water seeps into the ground. This area is called a "recharge" area. Since the recharge area is close to the spring outlet, there is inadequate filtering of the water and removal of contaminants. Common sources of contamination are septic systems, barn yards, fertilizer and pesticides, chemical or petroleum leaks, and old dumps and landfills.

Periodic testing of springs for bacteria and nitrate has been proven to be generally ineffective in assuring a sanitary water supply because of rapid fluctuations in water quality and because many other possible contaminants may be present in spring water. In most cases, springs have not been tested for pesticides, industrial wastes, petroleum products, or toxic metals. These contaminants may be present in the spring water at one time or another depending upon where the water originates, and land-use practices around the spring.

Because the quality of spring water is often unacceptable, MDH does not recommend using spring water as a drinking water supply. MDH recommends using a safe, tested source of water such as a public water supply, a properly constructed private well, or bottled water.

Can Springs be Protected?

Many springs are on private property, but when springs are located on municipal, state, or federal property the spring water may be accessible to the public for drinking. The protection of springs from contamination can be improved by restricting land-use practices around the spring recharge area, but there are no guarantees. Recharge areas for springs are usually on higher ground near the spring, but the recharge area may be located off of the property on which the spring is located.

Amendments to the Federal Safe Drinking Water Act have significantly changed the criteria by which surface water supplies, including springs, may be used as public water supplies. Starting in 1993, surface water systems, including springs, must be filtered and disinfected before the water may be made available to the public. Disinfection of spring water is difficult since the disinfectant is often not in contact with the water long enough to be totally effective. The Federal Safe Drinking Water Act will also greatly increase the testing required for spring water. The increased costs in supplying spring water to the public may mean that most springs will not be used as a drinking water source, and access to the springs will be restricted.

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