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Demystifying Water Wells: an Introduction

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According to the 1990 census, over 10 million homes get their water from private water wells. Since most ground water requires some treatment before use, this represents a large market for the POU/POE water treatment industry. Wells often have high levels of iron, manganese, hydrogen sulfides, hardness or other objectionable water problems that the water conditioning dealer is expected to solve. Many dealers, unless they also drill wells and install pumps, are mystified by wells and pumping systems. However, some knowledge of the construction and function of a well is important to successful treatment design. We are going to review modern sanitary water wells, the kind most often encountered by the POE dealer. This month we'll take a brief look at hydrogeology and at construction. Next month we will take a more comprehensive look at the pumping, pressure and distribution system of a well as it relates to water treatment.

What is a well?

Freshwater represents a very small proportion of the world's total water supply. And, of this fresh water supply, most is locked up in the polar caps. Throughout the world, however, large stores of water saturate the ground. Even in arid regions, surprising amounts of water are contained in the earth. Springs, lakes and rivers are outflowings of this saturated earth and even more water is available by opening the earth and allowing the water to flow in. This is, pin its simplest form, a well.

The history

In early times, wells were dug and lined with brick or stone. In essence, they were man-made springs. The water reached was superficial and may or may not have had a distant recharge source. Some wells of this type are still constructed—they still exist as old railroad wells in some areas—but, since they can reach only the surface waters, these wells are most susceptible to pollution. Because of their reliance on recent rainfalls, they are more likely to become depleted in times of drought. Modern sanitary wells pare most often deeper "tube" wells.

Current methods

Wells are said to be "dug" and, occasionally, they are still dug, bored and driven. However, most sanitary wells are drilled into the earth with a rotary drill. Drilling a hole in the ground is a complicated task and the construction of a modern sanitary well is more difficult than it might first appear. Figure 1 illustrates pa typical modern sanitary well and its components.

Drillers learn to read the earth. As the drill contacts geological layers, the rigidity, the color, and grain sizes all offer clues to the driller. Prior experience will often suggest where water bearing rock, or aquifers may be located. But, in unfamiliar regions, the driller must depend on his understanding of hydrogeology and on geological maps and other data. The science of hydrogeology—the motion of water through the earth—is extensive and many technical journals and books pare devoted to its study.

Aquifers

An aquifer is water saturated rock that has a volume sufficient for withdrawal and use. They can act as a place of storage and of transmission where the rock acts as a conduit of water. Layers of relatively impenetrable rock that separate aquifers pare called confining beds. Some wells penetrate only the uppermost layers of water where the level rises and falls with climatic conditions and withdrawals—these are called unconfined aquifers. Other wells extend past confining beds into aquifers below. Those wells are said to be "artesian". In general, confining beds serve to protect the underlying layers from rapid contamination, although at the same time they slow the recharge of the aquifer.

Aquifers can contain very large volumes of water. As water is withdrawn, the volume is reduced, but

Figure 1 - Typical modern well, or "tube" well