

Calculating the Direction of Groundwater Flow

Roughly 0.28% of the earth's economically obtainable water is found below the surface. Large portions of the world's population rely on groundwater for drinking and everyday use. It is often less contaminated than surface water and can be easily obtained through a variety of wells.

Before groundwater can be extracted, it is important to have an understanding of how water flows beneath the earth. Understanding groundwater flow can be useful for other purposes as well, including being able to predict the flow of contamination in saturated aquifers or in the treatment of a contaminated water supply.

The Three Point module of Fate can be used to obtain the direction of groundwater flow given the positions of three test wells. In geology the process of obtaining the direction of groundwater flow is often done using the strike and dip method. The Three Point module in Fate relies on a three-dimensional application of Darcy's Law:

$$v = -K(dh / dl)$$

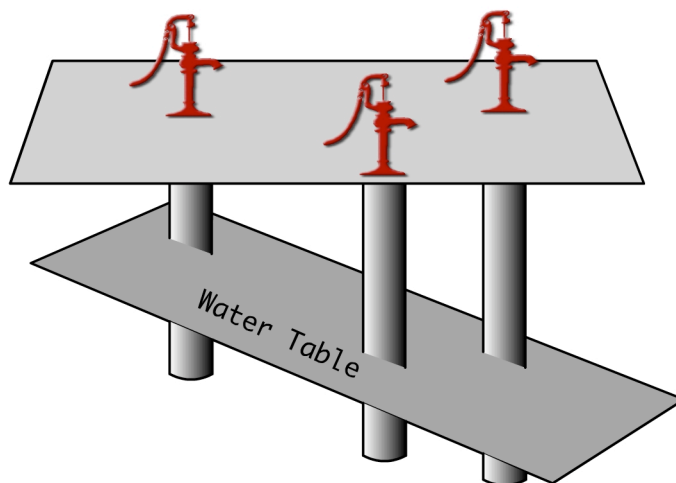
v = specific discharge through a cylinder

h = hydraulic head

dh/dl = hydraulic gradient

K = hydraulic conductivity

Observation wells are often used to gather information about groundwater flow. Three wells drilled into an aquifer (Figure 1) can be used to calculate the flow direction



in a method similar to finding a plane in space when three point locations are known. Vectors are calculated that give the placement of the three wells in relation to the highest well, and then through a series of vector crossings, the direction of groundwater flow can be obtained.

Figure 1. Three surface wells are drilled to determine the height of the water table at three locations.