

the stream is directly proportional to the rate at which groundwater is being recharged. Estimates of groundwater recharge were based on streamflow-hydrograph analysis of the Stoneycreek River (Roland and Stuckey, 2008; Stuckey, 2006; USGS, 2014d). Direct precipitation, stormwater runoff, and evapotranspiration are assumed components of the groundwater recharge estimates. The recharge units were derived from the average precipitation (SCAS OSU, 2000), soil characteristics and land surface slope (USDA, 2008), land use (PSU, 2007), and underlying geology (DCNR, 2001; **Figure 7**). The resulting rate has a mean value of 0.417 million gallons per day per square mile (8.75 inches per year). Recharge is applied to the shallowest layer of the model. Water moves in a vertical direction to the underlying layers in accordance with the hydraulic conductivity of the layer.

5.5 Hydraulic Conductivity

Hydraulic conductivity is the measure of the ease with which water flows through an aquifer, and can be calculated through aquifer tests (*i.e.*, pump tests) on wells. Because hydraulic conductivity within a regional aquifer system can vary greatly, a single conductivity value cannot be applied uniformly to the modeled area. The hydrogeologic model was calibrated with a parameter estimation program to conform to the observed values of groundwater head (*i.e.*, well water level). The calibration process was conducted by varying the hydraulic conductivity input for each geologic formation and model layer, as well as horizontal and vertical anisotropy factors, until the resulting groundwater flow model predicted head values that fit the set of observed water level data.

Through the parameter estimation process, hydraulic conductivity values for the modeled area were estimated to be between 0.001 and 94 feet per day. Given the various layer thicknesses, the hydraulic conductivity range equates to a transmissivity range of 0.2 to 16,000 square feet per day (**Table 2**). Further, it was found from the calibration process that the bedrock aquifers exhibit a high degree of anisotropy in the vertical conductivity field. This means that the flow of groundwater is easier (higher conductivity) in a horizontal (bed-parallel) direction than in a vertical direction. The ratio of horizontal conductivity to vertical conductivity ranges from 1.1 to 790, with a median ratio of 53.