drilled in those areas. Recharge varies laterally between playa, interplaya, and drainage ditch environments.

Although the effectiveness of the fine-grained zone to act as a retardant to vertical groundwater movement is not fully understood, the presence of the fine-grained zone under the perched aquifer probably serves to significantly slow the downward migration of contamination to the Ogallala aquifer while allowing the horizontal spread of potential contamination to be limited to buried channel deposits in the perched aquifer. It is important to note that the perched aquifer is stratigraphically higher (closer to the surface) and not directly hydraulically connected with the underlying Ogallala aquifer. The depth to groundwater ranges from 64 to 88 meters (210 to 290 feet) below land surface in the perched aquifer and from 100 to 140 meters (340 to 460 feet) in the underlying Ogallala aquifer (Figure 4.6.1.2–3).

The rate of groundwater movement, otherwise known as the groundwater velocity, can be calculated from estimates of the following physical hydrogeologic properties: hydraulic conductivity, defined as the estimation of the relative ease of groundwater movement; hydraulic gradient, or slope of the groundwater level; and the effective porosity, or the amount of void space through which groundwater movement can occur. The hydraulic properties have been measured from field and laboratory tests. These properties are used to calculate the rates of groundwater withdrawal and the potential spread of contamination. Aquifer performance tests were used to estimate groundwater velocities.

The results of these aquifer tests are highly variable and are dependent on the testing location, relative heterogeneities in the subsurface sediments from one location to another, duration of the test, variations in testing procedures, and the method of analysis. These variations in aquifer performance testing lead to differences in groundwater velocity estimates. Travel time estimates for groundwater movement in the perched aquifer are provided in Table 4.6.1.2–1. Three estimates are given.

TABLE 4.6.1.2–1.—*Estimated Groundwater Velocities and Travel Times in the Perched Aquifer*

HYDRAULIC PARAMETER	CONSERVATIVE ESTIMATE	REALISTIC ESTIMATE	UPDATED CALCULATION
Hydraulic Conductivity meters/day (feet/day)	24.6 (80.7)	12.3 (40.4)	16.9 (55.6)[a]
Hydraulic Gradient	0.011	0.0071	0.008[b]
Effective Porosity	0.15	0.25	0.34[c]
Linear Velocity meter/day (feet/day)	1.8 (5.9)	0.34 (1.1)	0.06 (0.2) to 0.40 (1.3)
Travel Time (years)	2.1	11	9.5 to 62

[a]Hydraulic conductivity from Neuman analysis of PTX06-1017
[b]Average hydraulic gradient in Zone 12 and east area
[c]Specific yield value from Neuman analysis of PTX06-1017
Sources: Texas A&M University 1995:62; Argonne 1995a:4-19; PC 1996; Pantex 1995K:19, 27