Session 8
Septic Tank Drainfield Site Suitability and Evaluation Workshop
8-Percolation-Permeability-Infiltration.ppt

Power Point: DEQ Septic Percolation-Permeability-Infiltration.ppt. This power point consists of ___ frames, the purpose of which are to explain percolation, permeability, infiltration, followed by specific examples and details of measurement. In-depth information is provided on measurement techniques and percolation categories.

Frame 1: Percolation, also referred to as permeability, is a measure of the rate of water flow through 'water-saturated' soil. Percolation, which is a required measure as part of a septic tank traditional drain field site assessment, should assess water flow into and through the most limiting soil material either at the bottom of the drain trench or to a depth of eight feet.

The other measure of water flow frequently referred to is either infiltration or hydraulic conductivity. Although infiltration is normally considered as the rate of entry of water into the soil, at the soil surface, since percolation is measured at the bottom of the trench, it is reasonable to consider percolation as a measure of infiltration.

A variety of techniques and tools are available for measurement of percolation. Illustrated here are a constant head bore hole permeameter, or Amoozemeter, a double-ring infiltrometer, and a constant heal borehole infiltrometer. In practice, the Montana DEQ Circular 4 instructions call for a 'falling head' percolation test.

Frame 2: This figure helps illustrate the importance of measuring the percolation rate of 'water-saturated' soil. The procedure detailed in DEQ Circular 4 specifically states that the test hole or soil should be pre-soaked – which brings the test soil to a 'water-saturated' condition. It is a well-known fact that intake rate, percolation rate, infiltration rate of dry soil decreases with duration of wetting. This decrease is because of several factors, including: the filling of void space by infiltrating water, soil swelling upon wetting, plugging of pores by fine particles. With either pre-soaking or prolonged wetting, the percolation rate will reach a stable, equilibrium condition. As can be seen from this illustration, the equilibrium percolation rate may be only $1/10^{th}$ to ½ the intial percolation rate. Thus, it is important that percolation be determined on 'water-saturated' soil.

Frame 3: This next sequence of slides illustrates the relationship between soil structure and percolation – both qualitatively and quantitatively. Soil with either single-grained and granular structure generally will exhibit moderate to very rapid percolation. Rapid to very rapid percolation means 6 to more than 20 inches of water percolation per hour – which is too fast for effective treatment. This equates to as little as 3 minutes per inch and less than 10 minutes per inch of water percolation. Remember that biological treatment of waste contained in water requires resident time in the soil. A percolation rate of 10 minutes per inch or less will not allow for adequate resident time.

Moderate to moderately rapid percolation, which is often the case with soils having granular structure, means 0.6 to 6 inches of water percolation per hour – which is a rate allowing effective wastewater treatment. This equates to 10 to 100 minutes per inch of water percolation.

Frame 4: Soils having blocky or prismatic structure generally will have slow, moderately slow, or moderate percolation rates. Moderate to moderately slow percolation rates equate to 0.2 to 2 inches per hour, or 30 to 300 minutes per inch. These soils provide adequate treatment time and work quite effectively when drain fields are adequately sized to accommodate the wastewater volume. Undersized fields will likely experience hydraulic and biological failure over time.

Some soils with prismatic structure tend to experience significant swelling upon wetting – particularly if the soil is dominated by sodium or the wastewater is sodium-rich. In such cases, the wetted percolation rate is likely to be slow. The percolation rate may equate to less than 0.2 inches per hour or 5 to more than 16 hours per inch. These excessively long percolation times make these soils unsuitable for drainage fields.

Frame 5: The last group of structures include platy and massive structure – both common in clay-dominated soils. The wetted percolation rates seldom exceed 0.2 inches per hour and may be less than 0.01 inches per hour. These percolation rates equate to drainage times of 5 to more than 100 hours per inch of percolating water. Soils having platy or massive structure seldom achieve percolation rates which are suitable for septic tank drain fields – irrespective of drain field size.

Frame 6:

Frame 7: Questions?