Water Movement and Soil Treatment
Video Outline

I. Introduction
   A. Importance of an on-site system for treatment of wastewater
   B. Soil is an important part of this treatment system

II. Flow through an On-Site Wastewater Treatment System
   A. Activities in home generate wastewater (sink)
   B. Wastewater is collected by the home plumbing and carried out of the home
   C. Septic tank is the most common form of pretreatment and separates the floatable and settleable solids from wastewater
   D. Wastewater flows from the septic tank to the final treatment and dispersal component
      1. Gravity distribution trenches are the most common form of distribution systems. Wastewater distributes in trench and then flows through unsaturated soil.
      2. Wastewater must flow through unsaturated soil so the soil microbes can remove the contaminants from the wastewater.
      3. Wastewater moving under saturated conditions moves through the large openings in the soil and does not come in contact with the soil particle surfaces or the soil microbes attached to the soil particle surfaces.
   E. Some of this reclaimed wastewater is used by the plants growing in the landscape while the remainder moves down to the groundwater. The proportion of the reclaimed water that is used by the plants or migrates to the groundwater is determined by the location of the residence and specifically the climate.

III. Wastewater Distribution in Soil
   A. Gravity Distribution Trench
      1. Water enters the perforated pipe in the trench from the septic tank
      2. Wastewater falls out of the first few holes of the perforated pipe
      3. Initially, wastewater rapidly enters soil under the first few holes.
      4. Biomat develops at the soil interface and the flow of wastewater into the soil is regulated.
      5. Biomat is the key to having unsaturated conditions and thus good wastewater treatment in the soil.
      6. As biomat develops on the trench bottom, wastewater moves farther down the trench bottom.
      7. Wastewater still enters the soil where the biomat has developed but the flow is regulated.
      8. Over time, the whole trench bottom will be covered with biomat and the wastewater will pond in the trench.
      9. This trench is fully operational and functioning in the desired manner. As the trench

is fully ponded, wastewater will overflow into other trenches in the system.

B. Pressure Distribution (Use the Low Pressure Distribution graphic)
   1. Pressure distribution distributes the wastewater along the total length of the pipe.
   2. The pump tank holds the wastewater until a dose of wastewater is ready to be distributed into the soil. The pump then pressurizes the systems and distributes a dose of wastewater into the soil.
   3. This dosing and resting of the soil develops the desired unsaturated conditions and does not require the fully developed biomat for flow regulation.

IV. Unsaturated Flow Treatment
   A. Zoom in on soil particles to show water movement under unsaturated conditions.
   B. Soil particles have three main sizes sand, silt and clay and the proportion of these three soil particles develops the soil texture.
      1. Sand is the largest soil particle and a pure sand soil will have the largest soil openings between the particles. Clay particles are the smallest soil particles and also have very small openings between the particles. Water can flow at a greater rate through sand pore spaces than clay pore spaces because of the openings. These openings will also transmit air from the soil surface for the soil microbes to have oxygen to breath.
      2. Wastewater flowing under unsaturated conditions will be a film flow across the particles and not in the large openings in the soil. The larger openings should contain oxygen for the microbes. Contaminants in the wastewater are removed as the wastewater flows across the soil particles. These soil microbes can provide most of the wastewater treatment.

V. Water movement out of the Treatment System
   A. Reclaimed water moving out of the dispersal area is utilized by the landscape plants growing in the dispersal area and around the area. Depending on the wastewater loading rate, climatic conditions and time of year, this can be a significant component of the water.
   B. However, gravity distribution system mainly rely on downward movement of the reclaimed water. The water moves down until it reaches groundwater or a restrictive layer and then it moves horizontally away from the system.
   C. Water needs energy to force it through the soil and this is generally obtained by mounding groundwater below the trenches so it can then move laterally. This water mound will develop at the top of the water table or on the restrictive layer. This water is now moving under saturated conditions and the saturated hydraulic conductivity controls the water movement.
   D. The orientation of the dispersal area can have a big impact on how much water mounding must occur for the water to move out of the system. If the system is on a sloping site, the water will move downslope on a restrictive layer or groundwater. A narrow long system following the contour of the site will minimize the volume of water that must flow

downslope for a given length of field. While a short system extending up and down the hill will require more water to move down slope. If the flow requirement is too great, the water mounding may move up into the trenches, thus not allowing unsaturated conditions below the trenches and poor water treatment.

E. Stormwater should be diverted around the dispersal area to prevent saturation by rainwater. If the dispersal area is saturated by rainwater it will have a limited ability to accept wastewater.

VI. Conclusion

A. Treat of wastewater is accomplished and protection of public health
B. Soil is an effective treatment system as the water moves through the soil