



Extension FactSheet

Food, Agricultural and Biological Engineering, 590 Woody Hayes Drive, Columbus, Ohio 43210

Limiting Layers in Ohio Soils— Restrictions to Wastewater Treatment

Brian Slater, Assistant Professor and Extension Soil Scientist, Natural Resources

Karen Mancl, Professor and Extension Water Quality Specialist, Food, Agricultural and Biological Engineering

Soil is an excellent medium for treating wastewater. Over a million septic systems in Ohio rely on effluent treatment in soil. However, many Ohio soils present limitations to wastewater treatment. Wastewater treatment depends on natural soil processes that work best in unsaturated soil, which permits adequate transport of air and water. A depth of 4 feet of suitable material is needed below the distribution system for adequate effluent treatment.

Limiting Layers

Only 6 percent of the area of Ohio soils is ideally suited to traditional septic system leach fields. Many soils do not provide adequate depth above materials that restrict water and air movement, or are seasonally saturated with water. Some soil layers are too permeable for good contact between soil and effluent. Zones in or below the soil where these limitations occur are called limiting layers. Limiting layers and conditions in Ohio soils include water tables and saturated conditions, hard or dense layers within or below the soil with low permeability, and excessively permeable coarse sand and gravel layers.

Saturated Soil

Saturated conditions result when all soil pores are filled with water. These conditions are present below the water table or in saturated zones in the soil profile. Many Ohio soils have a water table present at shallow depths during some seasons (especially winter and spring). Where saturation occurs, microorganisms rapidly deplete oxygen, and the resulting anaerobic conditions impede biological, chemical and physical treatment of contaminants in wastewater. Pollutants can move quickly through saturated soil and may move considerable distances with the risk of contaminating ground or surface water.

Soil scientists often identify the regular presence of saturated conditions in the soil by describing patches of contrasting soil colors. These color changes include *low chroma depletions*, often seen as gray colored mottles where iron oxides coating soil grains have dissolved and moved under anaerobic conditions, and dark layers resulting from organic matter accumulation where biological activity is slowed due to saturation.

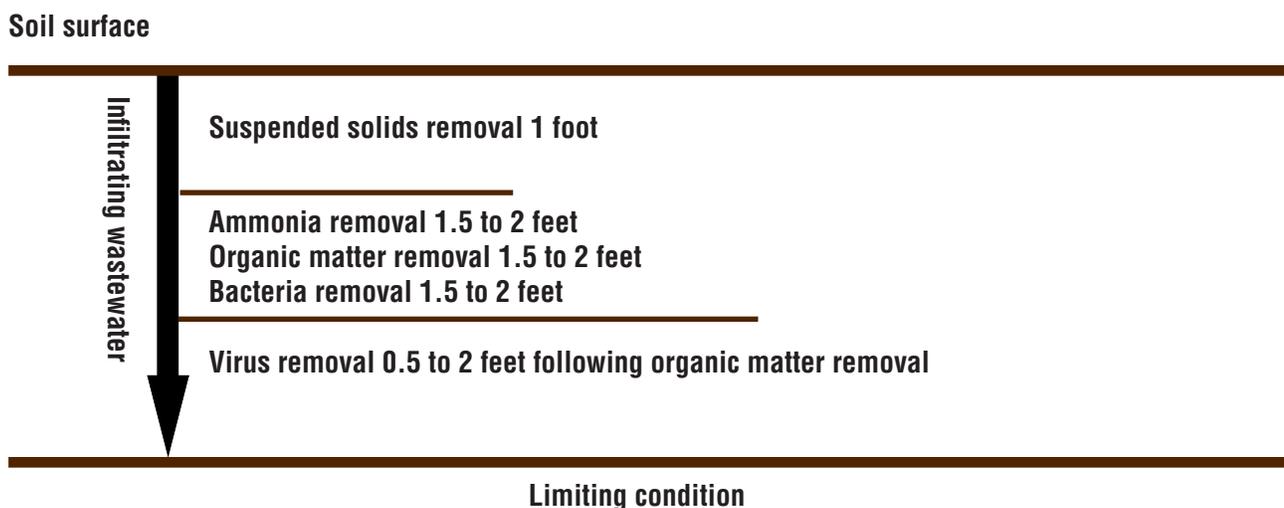
Dense Glacial Till

Till is common soil parent material and substratum in glaciated parts of Ohio. Glacial till consists of unsorted sand, silt, clay and coarse fragments, or variable composition and physical properties. Many tills below Ohio soils are dense materials, and have little porosity and a low capacity to transmit water or air. Common features of dense tills include firm or harder consistence (high resistance to being broken down), the lack of structure (massive or coarse platy units) and the lack of significant root penetration or weathering at depth. Little effluent treatment occurs in dense till due to the low permeability and little biological activity. Dense tills may impede the movement of treated water away from the site and cause the formation of perched saturated conditions in the soil profile, especially with the addition of wastewater.

Rock

Solid or jointed rock materials occur below soils mostly in eastern and southeastern Ohio, areas not affected by glaciation. These dense materials permit little root penetration and little water or air movement or storage. Some softer materials including shales also occur, but they are dense and have horizontal bedding and massive structure. These materials limit effluent treatment and transport.

Figure 1. Range of removal depths of pollutants in wastewater as infiltrating through unsaturated soil. Removal depth is influenced by soil permeability.



Dense Soil Layers

Some layers within soil profiles restrict water and air movement, and hence limit wastewater treatment. The most important of these in Ohio are fragipans and dense clay layers. Fragipans are hard, dense layers that are compact, hard and brittle when dry. Fragipans occur as layers up to several feet thick, usually starting at a depth of at least 18 inches below the surface, except where erosion has removed topsoil. Common features used to identify fragipans include coarse prismatic polygonal structures with coatings of silty material, the presence of strong mottling (irregular yellowish brown and light and dark gray patterns especially above the pan) and gray-colored vertical seams. Fragipans generally restrict root penetration and water movement.

Dense clay layers with low permeability (less than 1 inch per hour) occur in some soils, especially in northwest Ohio.

Excessively Permeable Layers

Where the rate of water movement is excessive (greater than 20 inches per hour), effluent may move through the profile too quickly for treatment to be completed or for sufficient contact between the effluent and the soil to occur.

Other highly permeable layers may occur below finer soil material and may transport untreated effluent too quickly to ground or surface water resources. These layers include coarse sand and gravel layers having less than 15 percent of fine material and highly fractured bedrock.

Identifying Limiting Layers

The depth and nature of the limiting layer is critical to the selection and design of an onsite wastewater treatment system. While published soil surveys describe limiting layers that may occur in an area, the surveys do not present the fine scale spacial variability of the soil. Observations on the lot must be made by a qualified soils professional. Excavations and soil pits are necessary for making these observations.

The Association of Ohio Pedologists publishes a list of consulting soil scientists. It is posted as a pdf file at the following web address: <http://www.ohiopedologists.org/Information/ConsultantsBrochure.pdf>

OSU Extension offers training in site and soil evaluation for system designers. A list of people who have completed the design school is posted at the following web site: www.ag.ohio-state.edu/~setll

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Keith L. Smith, Associate Vice President for Agricultural Administration and Director, OSU Extension

TDD No. 800-589-8292 (Ohio only) or 614-292-1868

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