Report for 2003IN112B: Soil and Mineralogical Processes Involved in Septic System Failure

There are no reported publications resulting from this project.

Report Follows

Soil Mineralogical Processes Involved in Septic System Failure

Problem and Research Objectives

Septic systems serve as the wastewater treatment system for 25% of the United States population. However, 10 to 20 percent of these systems are in failure. Often these failures are attributed to homeowner negligence and lack of maintenance. Typically these negligence induced failures occur after several years of use. In contrast, septic systems that fail very early after being properly installed and inspected by the health departments may not be the result of homeowner negligence, but rather the soils where the prescribed septic system was installed. A recent survey of county health departments throughout the state indicates that soils are the major reason for septic system failure.

The Indiana State Department of Health (ISDH) has utilized a prescriptive regulatory code (Rule 410 IAC 6-8.1) since 1990 for septic system management, which relies on proper design and assumes that a system is functioning adequately if designed properly. As with codes established in many other states, the soil absorption field design relies on inferred soil hydraulic conductivity from field evaluation of soil texture and soil structure, without input from other soil parameters such as soil dispersion characteristics or soil mineralogy. We propose to compare the measured hydraulic conductivity of typical soils in northeastern Indiana to the current design code.

Methodology

Eight similar pedons along a transect from Allen County to Grant County on the Bluffton Till Plain in northeastern Indiana were sampled and described according to NRCS standard procedures. Soil samples were collected by horizon and analyzed for chemical, mineral, and physical properties. Hydraulic conductivity was evaluated in the field at incremental depths from the surface horizon to the unweathered glacial till in 4 distinct zones (surface horizon, top of the argillic horizon, transition zone between solum and parent material, and parent material). The transition zone is the most critical depth in northeastern Indiana as this zone starts at ~ 0.6 m deep, the depth of a typical conventional trench septic system. The hydraulic conductivity of the soil was compared to the soil loading rates prescribed by the Indiana State Department of Health.

Principal Findings and Significance

The variability of the soil hydraulic conductivity was greatest at the surface and decreased with depth. This trend was most likely due to the large cracks near the soil surface. The hydraulic conductivity decreased with depth from the surface to the dense glacial till parent material. Hydraulic conductivity of the transition zone (~ 0.6 m to 1.0 m deep) ranged from 0.02 – 0.87 cm h^{-1}. The top of the argillic horizon had a greater hydraulic conductivity, ranging from 0.30 to 1.29 cm h^{-1}. These results suggest that shallower soil absorption field trenches may have a lower failure rate due to a greater soil hydraulic conductivity in the top of the argillic horizon.

Information Transfer Activities

This information was provided to the Indiana State Department of Health during several meetings with the Indiana Association of Professional Soil Classifiers, the Indiana State Department of Health, and the Indiana Environmental Health Association – Wastewater Management Committee. This new information has been interpreted by state health officials and

incorporated into the promulgated Rule 410 IAC 6-8.2, Residential Onsite Sewage Disposal Systems.

Students Supported

Two undergraduate students and a graduate student have been supported by these funds. Current and ongoing work by the graduate student includes a detailed mineralogical evaluation of the soils to determine the soil shrink-swell potential and dispersion in waters with varying ionic strengths.