



Soil and Site Evaluation Guidelines for Onsite Wastewater Management Systems

Role of Soil in Wastewater Treatment

Soil is the most important part of an onsite wastewater management system as it is an excellent medium for treating wastewater. A detailed evaluation of a proposed site and its soil characteristics is essential for designing an onsite wastewater treatment system that will effectively treat wastewater for decades.

Wastewater delivered to soil from a septic tank contains a number of contaminants (organic matter, soluble nutrients and a variety of microorganisms) that need to be removed before the wastewater enters groundwater or a surface water body. The role of soil is to remove contaminants by natural physical, chemical and biological processes that are active in healthy soil.

Required Soil Conditions

Since many of the natural processes required to treat wastewater depend on adequate aeration, unsaturated soil is essential for wastewater treatment. Hence the soil must be sufficiently permeable for water to move through and beyond the soil profile. Adequate depth of soil ensures the wastewater is in contact with soil material for a sufficient period of time for treatment to take place. Information on the depth of soil and the ability of the soil to accept and transmit water (permeability) provides the basis for assessing the suitability of soil for wastewater treatment.

Together with information on the amount of wastewater produced, soil depth and soil permeability are used to select, design and install an onsite wastewater system that suits the soil and site conditions.

Limiting Layers

The depth and nature of the limiting layer is critical to the selection and design of an onsite wastewater management system. Limiting layers are zones in the soil where the flow of wastewater and air is restricted and as a result, wastewater treatment and dispersal processes can be substantially reduced. Limiting layers include seasonal high groundwater table, bedrock and impermeable soil such as clay or compact glacial till. Soils comprised of coarse sands and gravels are also considered to be limiting because they are too permeable to provide effective treatment. When limiting layers are present, alternative onsite wastewater system designs are often needed to ensure the wastewater is effectively treated and dispersed into the soil and groundwater environment. The type of alternative system selected depends on the nature of the limiting layer and the effect it will have on wastewater treatment and dispersal. Common alternative system designs include pressurized sand mounds, above ground total area fields, shallow or sand lined trenches, and secondary wastewater treatment systems (i.e., biofiltration or aerobic treatment units).

Soil Depth

In Manitoba, there must be a minimum depth of 1 metre (3.25 feet) of unsaturated, aerobic soil present between the bottom of the soil absorption system and a limiting layer. This is also known as the “vertical separation distance”.

Permeability

The ability of soil to transmit water has traditionally been described as its permeability. Permeability is often estimated from other soil properties including texture, structure and consistency. **Hydraulic**

conductivity is a quantitative parameter (a number) that indicates water transmission. Hydraulic conductivity varies with the soil moisture content, but is frequently measured by first saturating the soil.

Site Assessment

Soil and site assessment involves the following series of steps:

- Review local soil information from the province's soil maps
- Conduct a visual assessment of the property to identify landscape features such as slope, surface water drainage and vegetation. Discuss development plans with the property owner including size of the residence, number of bedrooms, source of potable water
- Probe the soil to obtain a general understanding of the soil conditions on the property
- Excavate soil test pits or use auger boreholes to evaluate the soil conditions (texture, structure, consistence, color, rooting depth) and to determine the depth to limiting conditions, if present. A soil sample must be collected and submitted to a qualified laboratory for soil texture analysis.
- Use the soil and site information to select and design an appropriate onsite wastewater management system. Be sure the system is sized based on an accurate estimate of the daily wastewater flow rate for the residence or business. Current and future development plans should be considered.

Soil Profile

Physical and chemical properties of the soil materials related to water and air movement and storage, root growth, and biological activity need to be investigated to gain an understanding of the quality of the available soil materials for wastewater treatment. In lieu of actual measurements of water movement and storage in the soil over an extended period, soil characteristics are used to indicate drainage conditions within the profile.