Soil geomorphology combines the study of landscape with the study of soil genesis and strives to understand soils based on their place in and on the landscape.
Acknowledgement

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To understand the site...

You need to know how a soil forms

Since soil is dynamic it is important to know how it forms. This will help us in interpreting the soil once we have described it.
Factors of formation

☆ Parent Material

☆ Topography

➢ Vegetation/Biology

➢ Climate

➢ Time

Jenny originally came up with the first 5 factors. Some add anthropogenic (man) as a 6th factor due to the extreme and widespread influence man can have, others consider man as part of the Biology factor.
Parent Material

applies to all Rules

Just as you and I have parents so do soils. Many of the soil properties as ours are inherited from their parents. Often these inherited properties can be the difference between a suitable vs. unsuitable soil for an on-site wastewater system.
Map of soil systems in state
Parent Material

- Transported materials
- Bedrock or residual material
- Organic materials

Parent materials can be broken into three basic groups.
Marine

- Deposited in a marine environment
- Variable texture dependent on energy of depositional environment
  - Low energy – fine textured
  - High energy – coarse textured

The areas adjacent to the coast contain multiple environments for sediment deposition. Sediments deposited in this area are termed Marine sediments and are deposited in salt to brackish water.
Fluvial deposits are sediments deposited either in the active stream channel or on the flood plain associated with the channel. The sediments are coarser near the channel where the water is moving the fastest.
Active deposition occurs in the channel and the adjacent active flood plain. The channel is not static and meanders across the plain depositing and eroding material as it moves, thus the fluvial landscape has variably textured sediments across it. This air photo shows the active channel as well as some oxbows and meander scars.
Figure 4.—The soils on the uplands of the Talbot Surface formed in loamy or clayey sediment or in muck.
The depositional environments in a marine setting are constantly shifting with the beaches over washing onto the marshes or mud flats etc. As sea level rises or fall these zones shift back and forth resulting in an unpredictable assemblage of sediments and textures with depth. These photos taken approximately 100 feet apart illustrate how variable the differing sedimentary layers can be.
Sometimes even a blind squirrel can find a nut
Colluvium

- Parent material deposited by earth movement
  - Land slides-catastrophic, large scale
  - Slump or creep-gradual, small scale
- Slope related

Colluvial materials are deposited by gravity work on sediments on a slope. If the movement is slow it is often difficult if not impossible to see any effect on the soil. However, when movement is rapid enough the existing soil may be mixed, reoriented etc.
Colluvial soils may show evidence of multiple deposits

Often within a soil developed in colluvium, several events or depositions may be visible as in the soil on the left. Here gravel layers represent individual movements. On the right the brown sediment is colluvium whereas the lighter colored materials is residual soil. Thus it is possible to have more than one parent material represent in a single soil.
Bedrock or Residual Material

- Properties related to mineral present in parent rock and weathering
  - Clay mineralogy
  - Inherent fertility
- Particle size variable

Soils can also be developed in place from the underlying bedrock. These are referred to as residual materials. The soil developed from these materials inherit properties from the rock and the manner in which the rock weathers both physically and chemically.
Residual Soil

- Intrusive rock (acid crystalline)
- High clay content
- Weathers to kaolinitic clay minerals

Residual soils developed from felsic materials weather to low activity clays (kaolinitic). These clays do not expand upon wetting as are suitable for onsite wastewater systems.
Both soil are from the Raleigh area and in the Piedmont. The one on the left (redder) is a Cecil developed from a high grade metamorphic schist dominated by felsic (Si, K rich) minerals. The one on the right (yellowier) is an Appling developed from coarse grained igneous rock.
How does understanding parent material help understand the soils?
Clay Layer

1. Thin clay layer deposit in a single flood event, a marsh, or in a lake bottom
2. Based on the geomorphology of the area such layers are common and should be expected
3. If ignored, the layer may act as a bowl beneath the septic system causing effluent to back up

Illustrated is a thin clay strata. This strata could have been deposited during a single flood event, a marsh, or in a lake bottom. Knowing that this strata may occur in these deposits one can be on the lookout for it. Missing this layer in the design of an on site system could result in an under sized system and effluent perching above the layer. This could eventually lead to a failure.
Topography or slope position can greatly influence soil development. Think to your if you would rather build a dream house on the top of a hill or the bottom. Why? The primary reason has to due with drainage and water movement. Soil developed on different parts of the landscape reflect the effects of drainage.
Slope corrections
What is the slope?

% Slope =

\[(\text{Rise} \div \text{Run}) \times 100\]

1/1 x 100 = 100%
What is the slope?

\[
\% \text{ Slope} = \left( \frac{\text{Rise}}{\text{Run}} \right) \times 100
\]

<table>
<thead>
<tr>
<th>Rise</th>
<th>40 ft</th>
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<tbody>
<tr>
<td>Run</td>
<td>100 ft</td>
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\[
\% \text{ Slope} = \left( \frac{40}{100} \right) \times 100 = 40\%
\]
How much soil is needed?

A = S x W
A = 0.3 x 36
A ≈ 11”

A = 10.8”

Td = 12 + 12 + 6 + 11 = 41

30% slope
36” trench
Slope Names
Well drained at summit

Poorly drained in low area

Drier soil on summit appear reddish or yellow. Poorly drained soils are dark or black.
Lower Coastal Plain
Dry edge and wet soil relationship.
Consider this lot

1. Good soil
2. Slope < 10%

In dealing with slopes it is important to investigate the site and the adjacent site to observe how water will flow on a larger scale. This lot looked good as far as the soils were concerned. The septic tank is in but…
Topography must be considered.

After a small rain the lot flooded as it was placed in a head slope (concave-concave) position which accumulated water the small 5-10 acre water shed. A curtain drain and or swale may have mitigated some of this problem.
View the land in 3-D
Another view of slop names.
Slope classification. Green good, red bad…but not unsuitable.
Breaking the landscape into various parts.
View the whole landscape

- What is the parent materials
  - Soil properties
  - Internal drainage
- What is the slope?
  - Slope correction
  - Installation issues
- What landscape position
  - External drainage