GLOSSARY

BEDROCK – Solid rock

CLAY – Particles less than 0.002 millimeters in diameter

GRAVEL – Particles greater than 2.0 millimeters in diameter

LIQUID LIMIT – Moisture content of a soil at which the soil passes from a plastic to a liquid state. The moisture content is expressed as a percentage of the dry weight of soil

MAXIMUM DRY DENSITY – For a given soil and a constant compactive effort the dry density of soil material increases as moisture content increases until the optimum moisture content is reached. After that, the dry density decreases with increase in moisture. The highest dry density is termed the maximum dry density

OPTIMUM MOISTURE CONTENT – The water content of soil which exists when the soil is compacted to the maximum dry density. Moisture content is expressed in percentage of dry weight of soil

pH – A measure of the acidity or alkalinity of a soil mass

	pH
Extremely acid	below 4.5
Very strongly acid	4.5–5.0
Strongly acid	5.1–5.5
Moderately acid	5.6–6.0
Slightly acid	6.1–6.5
Neutral	6.6–7.3
Mildly alkaline	7.4–7.8

PLASTIC INDEX – The numerical difference between the liquid and plastic limits. It indicates the range of moisture content within which the soil is plastic. Moisture content is expressed as a percentage of the dry weight of soil

PLASTIC LIMIT – Moisture content of a soil at which the soil passes from a solid to a plastic state. The moisture content is expressed as a percentage of the dry weight of soil

RESIDUUM – Material derived from weathering of rocks in place

SAND – Particles ranging from 0.05 to 2.0 millimeters in diameter

SILT – Particles ranging from 0.002 to 0.05 millimeters in diameter

SOIL ASSOCIATION – A group of soils developed on similar parent materials and under similar climatic and topographic conditions

TERRACE DEPOSITS – Old alluvium bordering a stream or former channel of a stream. Continuous downward erosion by the stream has left these deposits well above the present-day flood plain

THICKNESS OF SOIL – Detailed studies of soils by the U.S. Soil Conservation Service are mainly confined to depths of less than 6 feet because they are primarily concerned with suitability for agriculture purposes. Soil scientists determine soil thickness by boring a series of holes with a hand auger; if the total thickness of the soil is 6 feet or less, then the thickness measurements of soil scientists are reliable. If, however, the thickness of unconsolidated material is greater than 6 feet, the total thickness is an estimate. Numerous well records show that depth of weathering is not uniform throughout the county and thus thickness estimates of soil and parent material greater than 6 feet may not be reliable

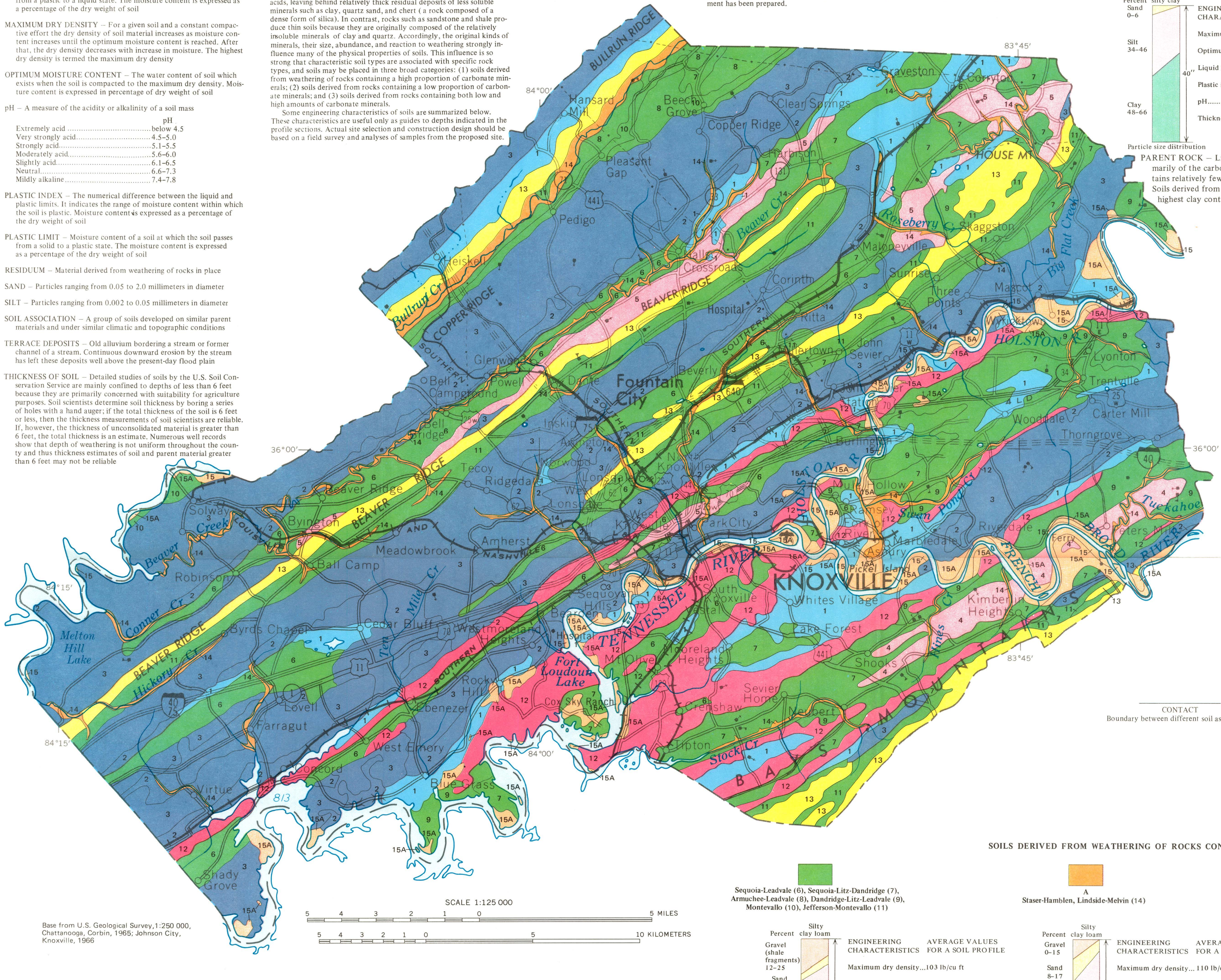
PHYSICAL CHARACTERISTICS OF SOILS

Sedimentary rocks in Knox County are composed of carbonate minerals (calcite and dolomite), silica (quartz and chert), and silicate (clay) minerals in varying proportions. Weathering removes the most soluble minerals, leaving the least soluble to be acted upon by other soil forming processes. Rocks such as limestone, dolomite, calcareous sandstone, and calcareous siltstone, contain a high proportion of carbonate minerals. Carbonate minerals are readily dissolved by naturally produced weak acids, leaving behind relatively thick residual deposits of less soluble minerals such as clay, quartz sand, and chert (a rock composed of a dense form of silica). In contrast, rocks such as sandstone and shale produce thin soils because they are originally composed of the relatively insoluble minerals of clay and quartz. Accordingly, the original kinds of minerals, their size, abundance, and reaction to weathering strongly influence many of the physical properties of soils. This influence is so strong that characteristic soil types are associated with specific rock types, and soils may be placed in three broad categories: (1) soils derived from weathering of rocks containing a high proportion of carbonate minerals; (2) soils derived from rocks containing a low proportion of carbonate minerals; and (3) soils derived from rocks containing both low and high amounts of carbonate minerals.

Some engineering characteristics of soils are summarized below. These characteristics are useful only as guides to depths indicated in the profile sections. Actual site selection and construction design should be based on a field survey and analyses of samples from the proposed site.

LAND RESOURCE ANALYSIS MAPS OF KNOX COUNTY

Knox County has a 1972 population in excess of 270,000. The Metropolitan Planning Commission (1968) projects an increase in population to approximately 360,000 by 1990. As the population grows and favorable areas like west Knox County approach their limit of development, more and more marginal land will be utilized. In order to utilize the existing land resources safely and efficiently, and in order to maintain a suitable environmental quality, knowledge concerning the physical environment and its limitations should be readily available to planners and decision makers. To provide some of these data, a series of maps, I–767, summarizing current knowledge about critical aspects of the physical environment has been prepared.



SCALE 1:125 000

5 4 3 2 1 0 5 MILES

5 4 3 2 1 0 5 10 KILOMETERS

Base from U.S. Geological Survey, 1:250 000, Chattanooga, Corbin, 1965; Johnson City, Knoxville, 1966

E X P L A N A T I O N

Numbered map units are soil associations from U.S. Geological Survey (1972)

SOILS DERIVED FROM WEATHERING OF ROCKS CONTAINING A HIGH PROPORTION OF CARBONATE MINERALS

Stony land-Talbott (1)

Clay to silty clay. Percent: Sand 0–6; Silt 34–46; Clay 48–66. 40″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
Maximum dry density	90 lb/cu ft
Optimum moisture	29
Liquid limit	69
Plastic index	31
pH	4.5–5.0
Thickness of soil	0 to more than 6 ft

PARENT ROCK – Limestone, which is composed primarily of the carbonate mineral calcite ($CaCO_3$), contains relatively few insoluble minerals other than clay. Soils derived from weathering of limestone contain the highest clay content of any soil in the county.

A
Fullerton-Bolton-Clarksville (3)

Cherty clay. Percent: Gravel (angular chert) 25–40; Sand 6–7; Silt 25–32; Clay 21–44. 70″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
Maximum dry density	97 lb/cu ft
Optimum moisture	25
Liquid limit	71
Plastic index	37
pH	4.5–5.0
Thickness of soil	more than 6 ft

B
Decatur-Dewey-Emory (2)

Silty clay. Percent: Gravel (angular chert) 0–12; Sand 12–16; Silt 35–43; Clay 37–45. 60″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
Maximum dry density	103 lb/cu ft
Optimum moisture	22
Liquid limit	49
Plastic index	24
pH	5.1–5.5
Thickness of soil	More than 6 ft

PARENT ROCK – Dolomite, which is composed primarily of the carbonate mineral dolomite [$CaMg(CO_3)_2$], contains a relatively large quantity of insoluble chert and clay minerals. Soil derived from weathering of the dolomite characteristically consists mainly of clay and chert in about equal proportions (column A). Locally, however, much of the chert has been removed by solution, thereby artificially increasing the clay content (column B).

Bland-Camp (4)
Sequoia-Bland-Leadvale (5)

Silty clay. Percent: Gravel 0–9; Sand 4–5; Silt 34–46; Clay 40–62. 20″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
pH	4.5–6.0
Thickness of soil	0–4 ft

PARENT ROCK – Calcareous siltstone with subordinate shale and limestone. Calcareous siltstone contains clay and the mineral calcite as a cement between silt-sized grains of quartz. Weathering removes the cement producing a residuum high in silt- and clay-sized particles.

Tellico-Neubert (12)

Clay loam. Percent: Gravel 0–6; Sand 23–26; Silt 27–29; Clay 39–50. 76″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
Maximum dry density	107 lb/cu ft
Optimum moisture	20
Liquid limit	43
Plastic index	20
pH	5.1–6.0
Thickness of soil	0 to more than 6 ft

PARENT ROCK – Calcareous sandstone with subordinate shale. Calcareous sandstone contains the mineral calcite as a cement between grains. Weathering removes the cement producing a residuum relatively high in sand- and silt-sized particles of quartz.

SOILS DERIVED FROM WEATHERING OF ROCKS CONTAINING A LOW PROPORTION OF CARBONATE MINERALS

Muskingum-Lehew-Jefferson (13)

Sandy loam or sandy clay loam. Percent: Gravel 0–18; Sand 51–55; Silt 17–25; Clay 6–28. 20″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
pH	4.5–5.0
Thickness of soil	0–4 ft

PARENT ROCK – Sandstone with subordinate shale. Soil derived from weathering of these rocks contains abundant sand- and silt-sized particles of quartz.

CONTACT
Boundary between different soil associations

SOILS DERIVED FROM WEATHERING OF ROCKS CONTAINING BOTH A LOW AND A HIGH PROPORTION OF CARBONATE MINERALS

Sequoia-Leadvale (6), Sequoia-Litz-Dandridge (7), Armuchee-Leadvale (8), Dandridge-Litz-Leadvale (9), Montevallo (10), Jefferson-Montevallo (11)

Silty clay loam. Percent: Gravel (shale fragments) 12–25; Sand 5–6; Silt 37–42; Clay 33–40. 20″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
Maximum dry density	103 lb/cu ft
Optimum moisture	21
Liquid limit	52
Plastic index	27
pH	4.5–5.5
Thickness of soil	0–4 ft

PARENT ROCK – Shale with subordinate limestone and siltstone. Shale is composed of a mixture of clay minerals and silt-sized quartz particles. Weathering readily removes thin beds of limestone to a depth of 20 feet, thereby giving the false impression in surface exposures that the bedrock is all shale. Soil developed on shales characteristically contains clay- and silt-sized particles in about equal amounts with abundant partly weathered shale fragments.

A
Staser-Hamblen, Lindside-Melvin (14)

Silty clay loam. Percent: Gravel 0–15; Sand 8–17; Silt 41–52; Clay 27–40. 44″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
Maximum dry density	110 lb/cu ft
Optimum moisture	17
Liquid limit	32
Plastic index	12
pH	5.6–6.0
Thickness of soil	More than 6 ft

B
Huntington (15)

Loam. Percent: Gravel 0–9; Sand 37–49; Silt 35–36; Clay 7–27. 60″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
pH	6.1–7.3
Thickness of soil	More than 6 ft

C
Cumberland (15A)

Silty clay loam. Percent: Gravel 3–14; Sand 15–22; Silt 37–42; Clay 27–40. 60″. Particle size distribution

ENGINEERING CHARACTERISTICS	AVERAGE VALUES FOR A SOIL PROFILE
Maximum dry density	102 lb/cu ft
Optimum moisture	23
Liquid limit	48
Plastic index	20
pH	5.1–5.5
Thickness of soil	More than 6 ft

PARENT ROCK – Alluvium, which is material deposited by streams, is a mixture of material from different bedrock sources. Alluvium deposited along minor streams (column A) has a high proportion of clay- and silt-sized particles, reflecting the dominant character of the soil material in local drainage areas of Knox County. Alluvium (column B) and terrace deposits (column C) along major streams have a higher proportion of sand-sized particles, reflecting the character of soil material throughout a larger area beyond Knox County.

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PHYSICAL CHARACTERISTICS OF SOILS IN KNOX COUNTY, TENNESSEE

By
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For sale by U.S. Geological Survey, price 75cents