APPENDIX J

SOILS AND GEOLOGY

LIMITATION AND FEATURES OF THE UnB-URBAN LAND MONTAUK COMPLEX, 3 TO 8 PERCENT SLOPES SOIL MAP UNIT

Building Site Development	**Limitation**
Shallow excavations	Moderate: dense layer[1], wetness
Dwellings without basements	Moderate: wetness
Dwellings with basements	Moderate: wetness
Small Commercial buildings	Moderate: wetness, slope
Local roads and streets	Moderate: wetness, frost action[2]
Lawns and landscaping	Slight
Water Management	**Limitation**
Features affecting drainage	Percs slowly[3], slope
Features affecting irrigation	Percs slowly, rooting depth, slope
Features affecting grass waterways	Rooting depth, percs slowly
Sanitary Facilities	**Limitation**
Effluent absorption fields	Severe: percs slowly, wetness
Soil and Water Features	**Feature**
Hydrologic group[4]	C
High water table depth	2.0-2.5 feet
High water table kind	Perched
High water table months	February to May
Potential frost action	Moderate
Risk of corrosion for uncoated steel	Low
Risk of corrosion for concrete	High

[1] **Dense layer** – A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

[2] **Frost action** – Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

[3] **Percs slowly** – The slow movement of water through the soil adversely affecting the specified use.

[4] **Hydrologic soil groups** – Refers to soils grouped according to their runoff-producing characteristics. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent. high water table, or are shallow over nearly impervious bedrock or other material.

ENGINEERING INDEX PROPERTIES OF THE UnB-URBAN LAND MONTAUK COMPLEX, 3 TO 8 PERCENT SLOPES SOIL MAP UNIT

Depth	USDA Texture	Classification		Fragments > 3”
		Unified	AASHTO	
0-7”	Fine sandy loam.	SM, SM-SC	A-2, A-4	0-5%
7-34”	Fine sandy loam, gravelly sandy loam, silt loam.	SM, ML, SM-SC, CL-ML	A-2, A-4, A-1	0-15%
34-60”	Sandy loam, loamy sand, gravelly sandy loam.	SM, SP-SM, GM, GP-GM	A-2, A-1, A-4	0-15%

Depth	Percent passing sieve number				Liquid Limit	Plasticity Index
	4	10	40	200		
0-7”	80-100	75-100	45-95	20-85	< 20	NP-4
7-34”	60-100	55-95	35-90	15-80	< 20	NP-4
34-60”	60-100	55-95	20-80	10-50	< 15	NP-2

PHYSICAL AND CHEMICAL PROPERTIES OF THE UnB-URBAN LAND MONTAUK COMPLEX, 3 TO 8 PERCENT SLOPES SOIL MAP UNIT

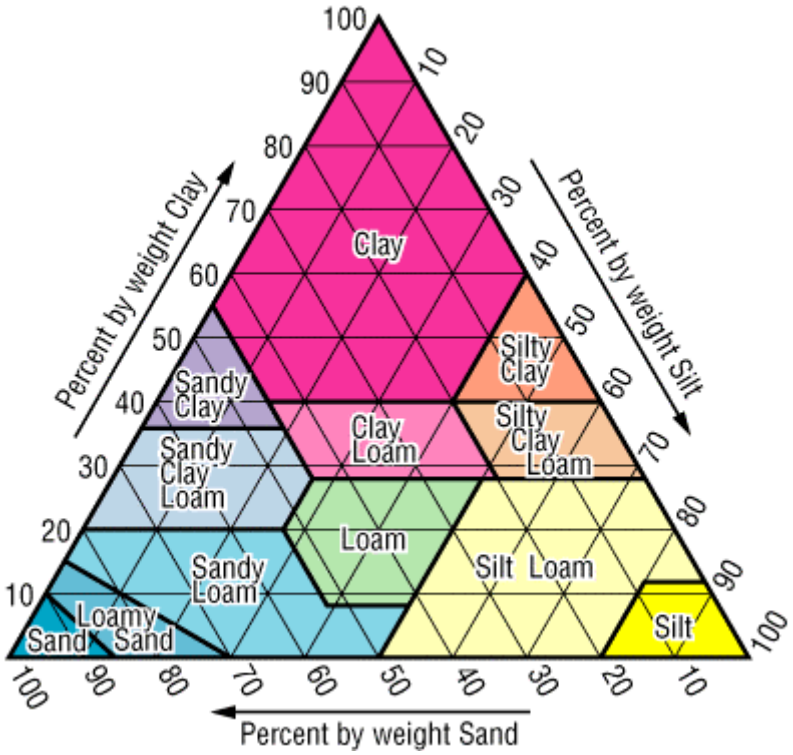
Depth	Clay (%)	Moist Bulk Density (g/cc)	Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)	Erosion Factors		Organic Matter (%)
						K	T	
0-7”	6-18	1.00-1.25	0.6-6.0	0.16-0.20	3.6-6.0	0.24	3	2-6
7-34”	6-18	1.30-1.60	0.6-6.0	0.10-0.16	3.6-6.0	0.24		
34-60”	1-18	1.70-1.90	0.06-0.6	0.02-0.08	3.6-6.0	0.24		

SIZE LIMITS OF SOIL SEPARATES IN THE USDA SOIL TEXTURAL CLASSIFICATION SYSTEM

Name of soil separate	Diameter limits (mm)
Very coarse sand*	2.00 - 1.00
Coarse sand	1.00 - 0.50
Medium sand	0.50 - 0.25
Fine sand	0.25 - 0.10
Very fine sand	0.10 - 0.05
Silt	0.05 - 0.002
Clay	less than 0.002

* Note that the sand separate is split into five sizes (very coarse sand, coarse sand, etc.). The size range for sands, considered broadly, comprises the entire range from very coarse sand to very fine sand, i.e., 2.00-0.05 mm.

USDA SOIL TEXTURE CLASSIFICATION TRIANGLE



ASTM TERMINOLOGY

The basic reference for the Unified Soil Classification System is ASTM D 2487. Terms include:

Coarse-Grained Soils	More than 50 percent retained on a 0.075 mm (No. 200) sieve
Fine-Grained Soils	50 percent or more passes a 0.075 mm (No. 200) sieve
Gravel	Material passing a 75-mm (3-inch) sieve and retained on a 4.75-mm (No. 4) sieve.
Coarse Gravel	Material passing a 75-mm (3-inch) sieve and retained on a 19.0-mm (3/4-inch) sieve.
Fine Gravel	Material passing a 19.0-mm (3/4-inch) sieve and retained on a 4.75-mm (No. 4) sieve.
Sand	Material passing a 4.75-mm sieve (No. 4) and retained on a 0.075-mm (No. 200) sieve.
Coarse Sand	Material passing a 4.75-mm sieve (No. 4) and retained on a 2.00-mm (No. 10) sieve.
Medium Sand	Material passing a 2.00-mm sieve (No. 10) and retained on a 0.475-mm (No. 40) sieve.
Fine Sand	Material passing a 0.475-mm (No. 40) sieve and retained on a 0.075-mm (No. 200) sieve.
Clay	Material passing a 0.075-mm (No. 200) that exhibits plasticity, and strength when dry (PI ³ 4).
Silt	Material passing a 0.075-mm (No. 200) that is non-plastic, and has little strength when dry (PI < 4).
Peat	Soil of vegetable matter.

UNIFIED SOIL CLASSIFICATION (USC) SYSTEM (FROM ASTM D 2487)

Major Divisions			Group Symbol	Typical Names
Course-Grained Soils More than 50% retained on the 0.075 mm (No. 200) sieve	**Gravels** 50% or more of course fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of course fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

AASHTO TERMINOLOGY

AASHTO soil terminology comes from AASHTO M 145, "Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes". Aggregate terminology comes from AASHTO M 147, "Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses". Basic terms include:

Boulders & Cobbles	Material retained on a 75-mm (3-inch) sieve.
Gravel	Material passing a 75-mm (3-inch) sieve and retained on a 2.00-mm (No. 10) sieve.
Coarse Sand	Material passing a 2.00-mm sieve (No. 10) and retained on a 0.475-mm (No. 40) sieve.
Fine Sand	Material passing a 0.475-mm (No. 40) sieve and retained on a 0.075-mm (No. 200) sieve.
Silt-Clay	Material passing a 0.075-mm (No. 200) sieve.
Silt Fraction	Material passing the 0.075 mm and larger than 0.002 mm.
Clay Fraction	Material smaller than 0.002 mm.
Silty	Material passing a 4.75-mm (No. 4) sieve with a PI ≤ 10
Clayey	Material passing a 4.75-mm (No. 4) sieve with a PI ≥ 11
Coarse Aggregate	Aggregate retained on the 2.00 mm sieve and consisting of hard, durable particles or fragments of stone, gravel or slag. A wear requirement (AASHTO T 96) is normally required.
Fine Aggregate	Aggregate passing the 2.00 mm (No. 10) sieve and consisting of natural or crushed sand, and fine material particles passing the 0.075 mm (No. 200) sieve. The fraction passing the 0.075 mm (No. 200) sieve shall not be greater than two-thirds of the fraction passing the 0.425 mm (No. 40) sieve. The portion passing the 0.425 mm (No. 40) sieve shall have a LL ≤ 25 and a PI ≤ 6. Fine aggregate shall be free from vegetable matter and lumps or balls of clay.

AASHTO SOIL CLASSIFICATION SYSTEM (FROM ASTM M 145)

General Classification	Granular Materials 35% or less passing the 0.075 mm sieve							Silt-Clay Materials >35% passing the 0.075 mm sieve			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	---	---	---	---	---	---	---	---	---	---
0.425 (No. 40)	30 max	50 max	51 max	---	---	---	---	---	---	---	---
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid limit	---		---	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[a]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

[a]Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL - 30

Soil Property Terminology Used in Tables

Available water capacity – The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at *field moisture capacity* and the amount at *wilting point*. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile of to a limiting layer is expressed as follows:

	Inches
Very low	0 to 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	More than 5.2

Erosion factors – Factors that are used in the Revised Universal Soil Loss Equation (RUSLE), which is a quantitative procedure for calculating soil loss do to erosion.

K factor – The soil erodibility factor that represents both susceptibility of soil to erosion and the rate of runoff, as measured under the standard unit plot condition. Soils high in clay have low K values, about 0.05 to 0.15, because they are resistant to detachment. Coarse textured soils, such as sandy soils, have low K values, about 0.05 to 0.2, because of low runoff even though these soils are easily detached. Medium textured soils, such as the silt loam soils, have a moderate K values, about 0.25 to 0.4, because they are moderately susceptible to detachment and they produce moderate runoff. Soils having a high silt content are the most erodible of all soils. They are easily detached; tend to crust and produce high rates of runoff. Values of K for these soils tend to be greater than 0.4. Organic matter reduces erodibility because it reduces the susceptibility of the soil to detachment, and it increases infiltration, which reduce runoff and thus erosion.

T factor – The soil loss tolerance expressed in tons per acre per year. Soil loss tolerance values of 1 through 5 are used. These values represent the tolerable tons of soil loss per acre per year where food, feed and fiber plants are to be grown. T values are not applicable to construction sites or other non-farm uses of the erosion equation.

Field moisture capacity – The moisture content of a soil, expressed as a percentage of the oven dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 to 3 days after a soaking rain.

Liquid limit – The moisture content at which the soil passes from a plastic to a liquid state

Plasticity index – The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit – The moisture content at which a soil changes from semisolid to plastic.

Permeability – The quality of the soil that enables water to move downward through the soil profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	Less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	More than 20 inches

Risk of corrosion – The potential of soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Risk of corrosion is expressed as low, moderate, or high.

Soil Reaction – a measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as follows:

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Wilting point – The moisture content of soil, on an oven dry basis, at which a plant wilts so much that it does not recover when placed in a humid, dark chamber.