2 Soils and Ground Water

2.1 Soil Texture and Group Determinations

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2.1.1 Determining Soil Textural Classifications

Soil texture is determined by the proportion of three separates: sand, silt, and clay. It is one of the most important characteristics of soil for water movement because of its relationship to pore size distribution and pore continuity. Permeability, aeration, and drainage are all related to the soils' ability to filter and adsorb or otherwise retain pollutants for treatment. Sizes of the major separates are shown in Table 2-1.

Table 2-1. Sizes of mineral, soil, and rock fragments.

Material	Equivalent Diameter[a]	Passes Sieve #
Clay	<0.002 mm	425
Silt	0.002–0.05 mm	270
Very fine sand	0.05–0.10 mm	140
Fine sand	0.10–0.25 mm	100
Medium sand	0.25–0.50 mm	50
Coarse sand	0.50–1.00 mm	16
Very coarse sand	1.00–2.00 mm	10
Gravel	2.00 mm–75 mm	3 in.
Cobbles	75–250 mm	10 in.
Stones	250–600 mm	24 in.
Boulders	>600 mm	—

a. Natural Resources Conservation Service, National Soil Survey Handbook (NSSH) Part 618 (Subpart A), 618.46 (D) and 618.31(K) 3ii
Notes: millimeter (mm); inches (in.)

The Soil Textural Classification used by Idaho was adopted from the United States Department of Agriculture (USDA). Soil textures of proposed soil absorption sites are determined according to these guidelines. Once the textures have been determined, then the soil design groups may be specified for the absorption system design. Characteristics of each soil texture are shown in Table 2-2. To determine the texture classification of soils, refer to Table 2-2,

Table 2-3, and Figure 2-1 for summaries of the soil particle distributions and percentages in each of the textures. Refer to Figure 2-2 for a flowchart of the steps for determining soil classification.

Table 2-2. Soil textural characteristics.[a]

Soil Texture	USDA Soil Textural Classification	Dry Soil Description (0%-25% available moisture percent[b])	Moist Soil Description (75%-100% available moisture percent)	
			Ball[c] Formation	Ribbon[d] Between Thumb and Finger
Coarse	Fine sand Loamy fine sand Sand Coarse sand Loamy coarse sand Loamy sand Very fine sand	Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure	Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers	Will not ribbon
Moderately coarse	Sandy loam Fine sandy loam Very fine sandy loam Coarse sandy loam Loamy very fine sand	Dry, forms a very weak ball, aggregated soil grains break away easily from ball	Wet, forms a ball with wet outline left on hand, light to medium water staining on fingers	Makes a weak ribbon between thumb and forefinger
Medium	Sandy clay loam Loam Silt loam Silt	Dry, soil aggregations break easily, no moisture staining on fingers, clods crumble with applied pressure	Wet, forms a ball with well-defined finger marks, light to heavy soil/water coating on fingers	Ribbons between thumb and forefinger
Fine	Clay Clay loam Silty clay loam Sandy clay Silty clay	Dry, soil aggregations easily separate, clods are hard to crumble with applied pressure	Wet, forms a ball, uneven medium to heavy soil/water coating on fingers	Ribbons easily between thumb and forefinger

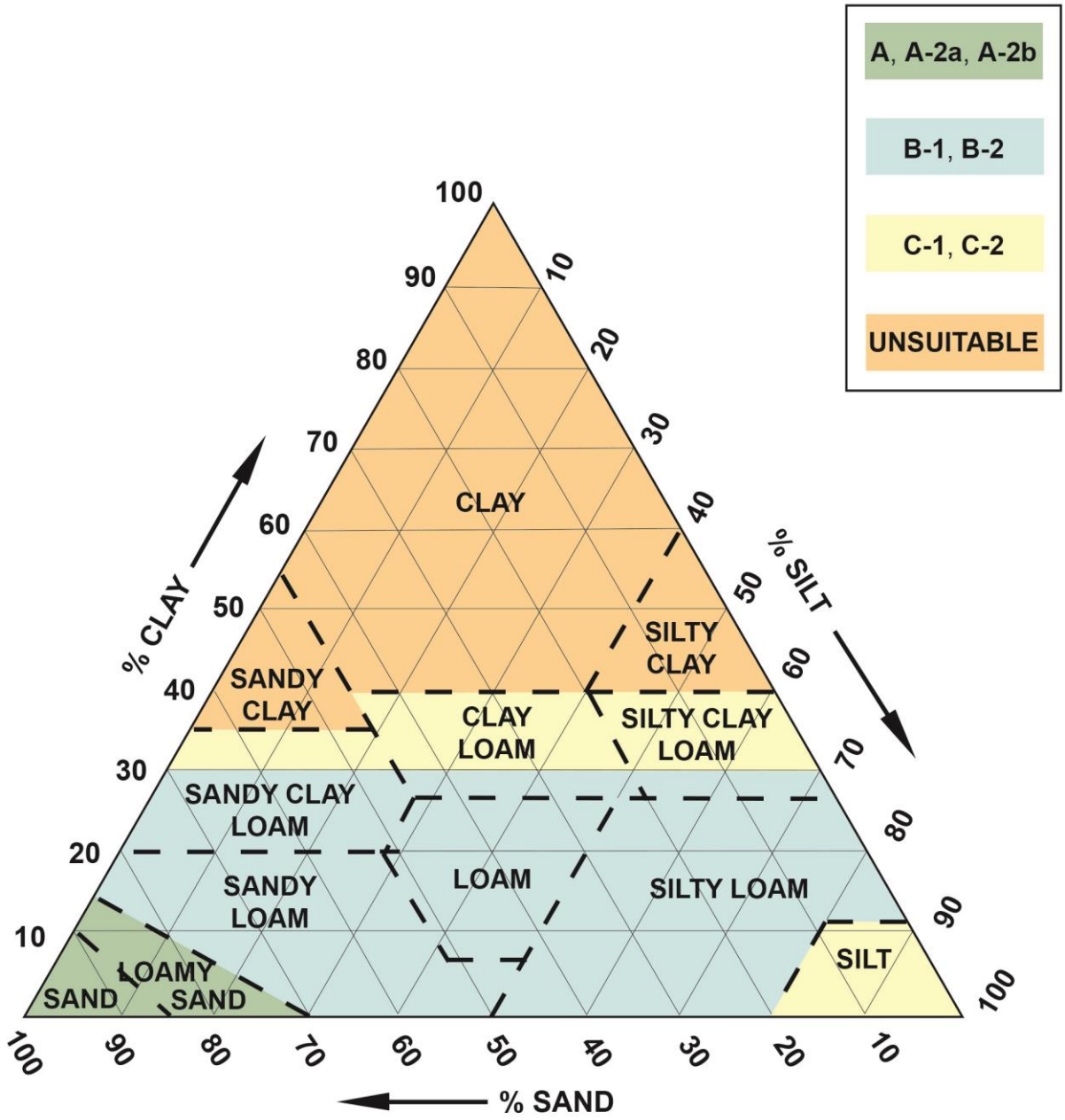
a. Adapted from USDA Natural Resource Conservation Service (NRCS). 2005. *Estimating Soil Moisture by Feel and Appearance*. Program Aid Number 1619.
b. Available moisture percent is that percent of the available water-holding capacity of the soil occupied by water.
c. Ball is formed by squeezing a handful of soil very firmly with one hand.
d. Ribbon is formed when soil is squeezed out of hand between thumb and forefinger.

Table 2-3. Soil textural proportions.

USDA Soil Textural Classifications	Sand (%)	Silt (%)	Clay (%)
Sand	>85	<15	<10
Loamy sand	70–90	<30	0-15
Sandy loam	43–85	<50	<20
Loam	23–52	28-50	7–27
Silty loam	<50	50–88	<27
Silt	<20	>80	<12
Sandy clay loam	45–80	<28	20–35
Clay loam	20–45	15–53	27–40
Silty clay loam	<20	40–73	27–40
Sandy clay	45–65	<20	35–55
Silty clay	<20	40–60	40–60
Clay	<45	<40	>40

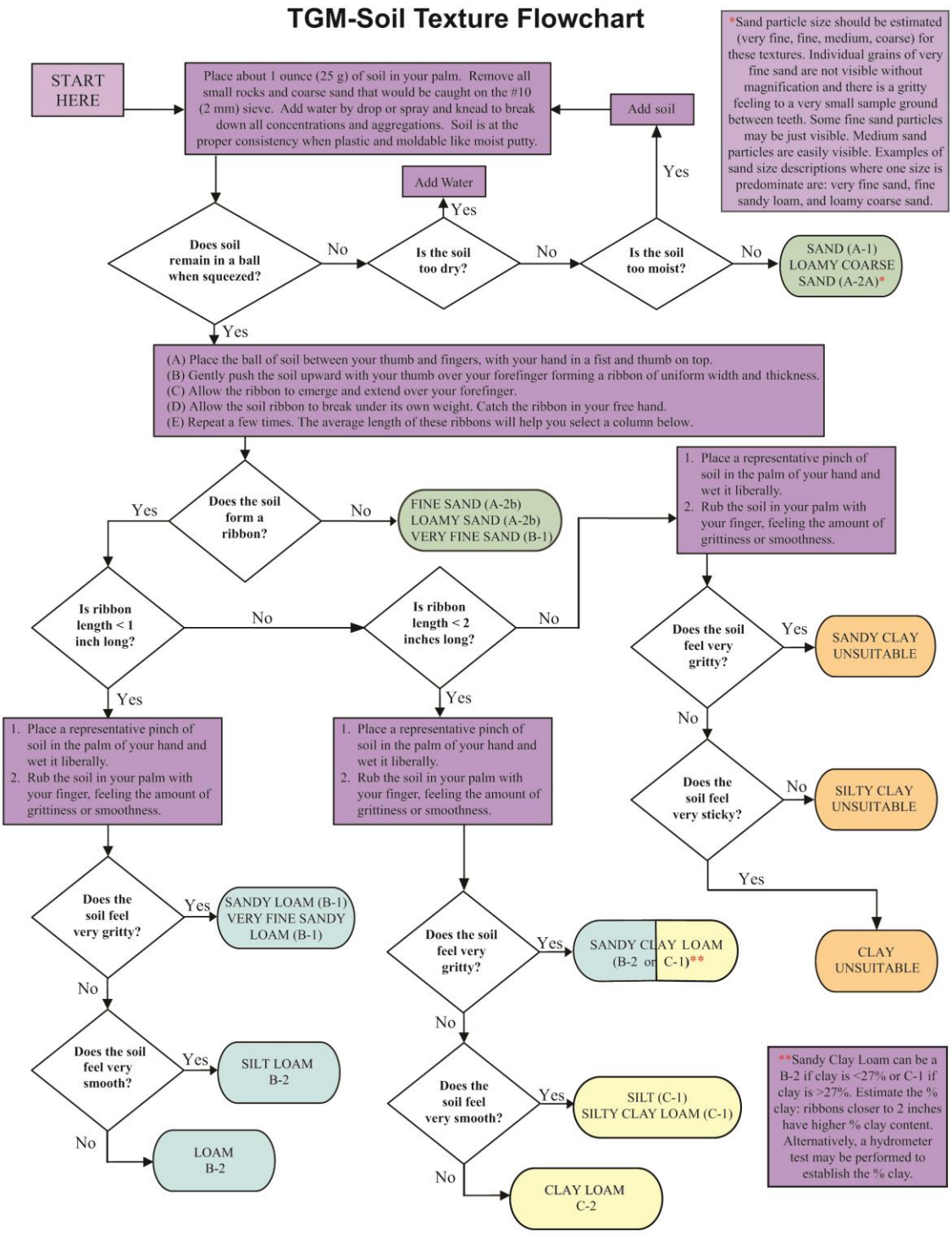
Basic textural names may be modified if the soil mass contains 15%–95% of stones, cobble, or gravel by adding the name of the dominant rock fragment:

- Gravelly or stony = 15%–35% of the soils volume is rock fragments.
- Very gravelly or very stony = 35%–60% of the soils volume is rock fragments.
- Extremely gravelly or extremely stony = 60%–95% of the soils volume is rock fragments.
- 95% or more should take the name of the geological type, such as granite, gneiss, limestone, or gravel.



A black and white version is provided in Appendix B.

Figure 2-1. United States Department of Agriculture soil textural triangle.



A black and white version is provided in Appendix B.

Figure 2-2. Soil texture determination flowchart.

2.1.2 Soil Design Groups and Subgroups

This section is provided as a guide to field environmental health personnel in making technical allowances for standard systems and for health districts to use in selecting alternative systems. The required absorption area of a subsurface sewage disposal system depends on the texture of the soils in the proposed disposal system location. In a similar manner, required separation distances between the disposal area and features of concern, such as wells, surface water, and ground water, depend on soil texture. Soils surrounding the disposal system and those below it may not be the same.

The soil design group or subgroup (Table 2-4) used to determine the minimum effective soil depth, and applicable separation distances, describes the finest-textured soils adjacent to the drainfield trenches and beneath the drainfield for the effective soil depth.

All other soil textures and some soil features (i.e., gravel, coarse sand, all clays, organic muck, claypan, hardpan, and duripan) are unsuitable for installing a standard drainfield system.

Table 2-4. Soil textural classification design groups.

Soil Design Group	Soil Design Subgroup	Soil Textural Classification	Application Rate (GPD/ft^2)[a]
NS[b]	NS	Gravel Coarse sand	NS
A	A-1	Sand[c]	1.2
	A-2a	Loamy coarse sand	1.0
	A-2b	Fine sand Loamy sand	0.75
B	B-1	Very fine sand Sandy loam Very fine sandy loam	0.6
	B-2	Loam Silt loam Sandy clay loam (≤27% clay)	0.45
C	C-1	Silt Sandy clay loam[d] Silty clay loam[d]	0.3
	C-2	Clay loam[d]	0.2
NS	NS	Sandy clay Silty clay Clay Organic muck Duripan Hardpan Claypan	NS

a. Application rates are for domestic strength wastewater.
b. Not suitable (NS) for installation of a subsurface sewage disposal system.
c. See medium sand definition (section 3.2.8.1.2) for a manufactured material that may be acceptable for use.
d. Soils without expandable clays.
Notes: gallons per day per square foot (GPD/ft^2)

2.1.3 Soil Design Subgroup Corrections

A soil design subgroup may be lowered as indicated in this section. **(Subgroup correction is used to determine the application rate only; it will not change surface water or ground water separation requirements.)**

1. Soil with moderate or strong platy structure should be lowered one subgroup for design purposes.
2. Soil should be lowered one subgroup if 35%–60% of its volume is rock fragments (very gravelly, very stony).
3. Soil should be lowered by two subgroups if 60%–95% of its volume is rock fragments (extremely gravelly, extremely stony).
4. Soil with 95% or greater rock fragments is unsuitable as an effective soil for subsurface sewage disposal.
5. Uniform fine and very fine sand (e.g., blow sands) should be lowered two subgroups for design purposes. Soils that qualify for this modification have a coefficient of uniformity less than three ($C_u < 3.0$).

Example:

A soil evaluation results in the designation of loamy sand with rock fragment volumes estimated at 70% of the total soil volume within the effective soil depth below the drainfield installation. The loamy sand would be assigned a soil design subgroup of A-2b consistent with Table 2-4. Due to the estimated volume of rock fragments, the soil design subgroup would then be lowered by two subgroups resulting in an assigned soil design subgroup of B-2. Based on these determinations, the drainfield would be sized consistent with the B-2 soil application rate (0.45 GPD/ft^2; Table 2-4) to increase the available soil surface available for effluent treatment due to the soil surface being reduced by large fraction rock. However, both the required vertical (effective soil depth, IDAPA 58.01.03.008.02.c) and the horizontal separation distances (IDAPA 58.01.03.008.02.d) shall meet the requirements for soil design group A soils.