APPENDIX A

DETAILED PROCEDURE FOR DETERMINING A PARTICLE SIZE DISTRIBUTION

This page intentionally left blank.

PROCEDURAL GUIDE:

The particle size groups which need to be identified for use with the sediment yield procedure are:

clay: less than 0.002 mm

p_1 = silt (si): 0.002 mm - 0.05 mm (x_g=0.01)

p_2 = very fine sand (vfs): 0.05 mm - 0.1 mm (x_g=0.0707)

p_3 = fine, medium & coarse sand: 0.1 mm - 1.0 mm (x_g=0.316)

p_4 = very coarse sand: 1.0 mm - 2.0 mm ([x_g=geometric mean] x_g=1.41)

The SCS surveys and soil series descriptions do not give these groups directly, although they do give the general textural class of the soil, e.g., loam, clay loam, or sandy clay as well as data on particle size distribution. By using these two sets of soil information, i.e., general textural class and data on the particular size distribution, the required soil particle size groups can be determined.

First, the required particle size groups except for the silt group (p_1) and clay can be determined by using the particle size distribution data. These size distribution data are expressed in soil series as cumulative percentages less than 3 inches passing the:

#4 sieve (<4.74 mm)

#10 sieve (<2 mm)

#40 sieve (<.42 mm)

#200 sieve (<.074 mm)

These cumulative percentages provide data points for determining a particle size frequency distribution curve using the log probability method.

First the range of values corresponding to the sieve number are plotted on log probability paper (Figure A.1). Then, a straight line is drawn close to the mean of each of the plotted ranges, giving a cumulative frequency distribution. By extrapolating the line down to the 0.05 mm size, the 3 larger particle size groups (p_2, p_3, p_4) used in the design analysis can be determined. The particle sizes are read from the cumulative frequency distribution line and the percent in the particle size class is determined by subtracting out the next smaller class.

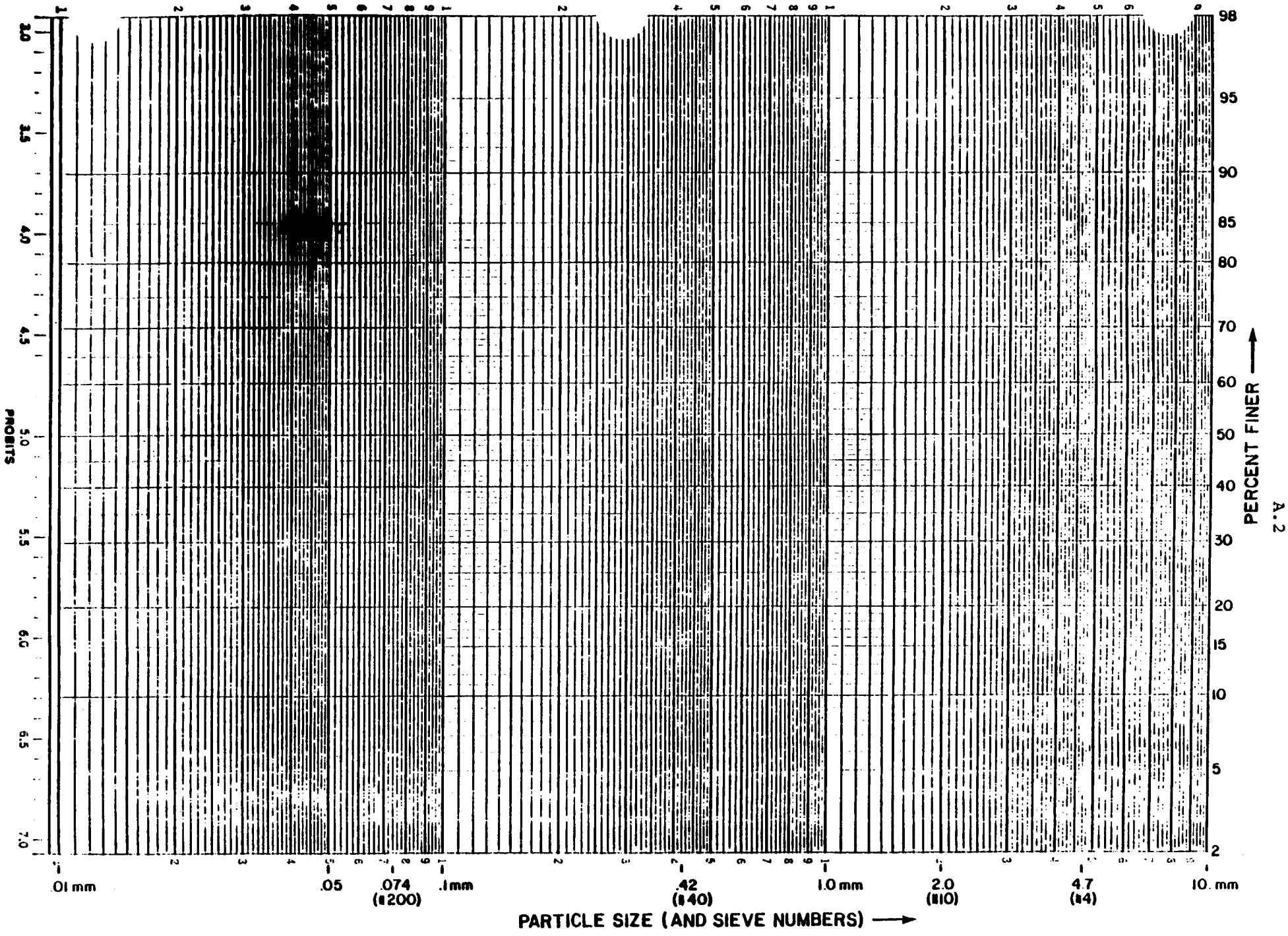

Figure A.1. Log-probability paper.

Silt (p_1) is estimated from the textural class given in a soils description. A textural class is simply a name given to each soil which designates the ranges of sand, silt and clay it contains. Table A.1 defines the textural classes and their associated sand, silt and clay components. Because this classification is based on the <2 mm particle sizes, the percent silt in a particle class must be adjusted to the percentages upon which the frequency distribution method is based, namely the <3 inch particle sizes. This adjustment is included below in a step-by-step procedure for determining the particle size groups using SCS soil series information:

*1. Plot the cumulative percent given in SCS series description at appropriate points on Figure A.1.

*2. Draw a straight line through the values (or range of values) and extrapolate the line to 0.05 mm size.

*3. Determine the cumulative percent corresponding to the required size classes (0.05, 0.1, 1.0, 2.0 on x axis).

*4. Subtract the next smaller percent from each reading which gives the percent for the 3 coarsest particles size groups (0.05-0.1 mm; 0.1-1.0 mm; 1.0-2.0 mm) (based on <3 inch size sample).

*5. To determine p_1 (0.002-0.05), identify the assigned texture class given in the soil series description.

*6. Determine the mean silt percent corresponding to the assigned texture class for the given soil (Table A.1).

*7. Multiply the mean silt percent by the cumulative percent <2 mm (see step 3) to give the percent 0.002-0.05 mm (percent <3" size).

*8. Subtract the cumulative percent of the three large particle sizes plus the percent 3 inches to 2 mm from 100 to give the clay percentage.

Table A.1. Percent Sand, Silt and Clay in Textural Classes (<2 mm sized particles)

Textural Class	Range in Percent		
	sand (2.0-0.05 mm)	silt (0.05-0.002 mm)	clay (<0.002 mm)
Sand*	85-100	0-15	0-10
Loamy Sand*	70-90	0-30	0-15
Sandy Loam*	43-80	0-50	0-20
Loam	23-52	28-50	7-27
Silt Loam	0-50	50-88	0-27
Silt	0-20	80-100	0-12
Sandy Clay Loam	45-80	0-28	20-35
Clay Loam	20-45	15-53	27-40
Silty Clay Loam	0-20	40-73	27-40
Sandy Clay	45-65	0-20	35-55
Silty Clay	0-20	40-60	40-60
Clay	0-45	0-40	40-100

*Coarse : Greater than 25 percent coarse sand

Fine : 50 percent or more fine sand; less than 25 percent coarse sand

Very Fine: 50 percent or more very fine sand

EXAMPLE:

1. Given: SCS soil series data.

USDA Texture	Percentage <3 Inches Passing Sieve			
	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)
Loam	100-95	85-95	80-90	45-65

2. Plot data (Figure A.2) according to Steps *1 through *8 above.

3. Tabulate data.

Particle Size (mm)	Cumulative Frequency (Mean) %	Particle Size Class mm	% (<3" size)
		0.002-0.05*(p_1)	
<0.05	50		37
		0.05-0.1(p_2)	
<0.1	62		12
		0.1-1.0(p_3)	
<1.0	90		28
		1-2.0(p_4)	
<2.0	94		4

*From Table A.1 where loam has a mean of 39 percent (of <2 mm sample). This is multiplied by 94 percent, which is the % of <2 mm sized particles from <3" size sample

4. Percent Clay = 100 - (37 + 12 + 28 + 4 + 6) = 13%
(from Step *8 above)

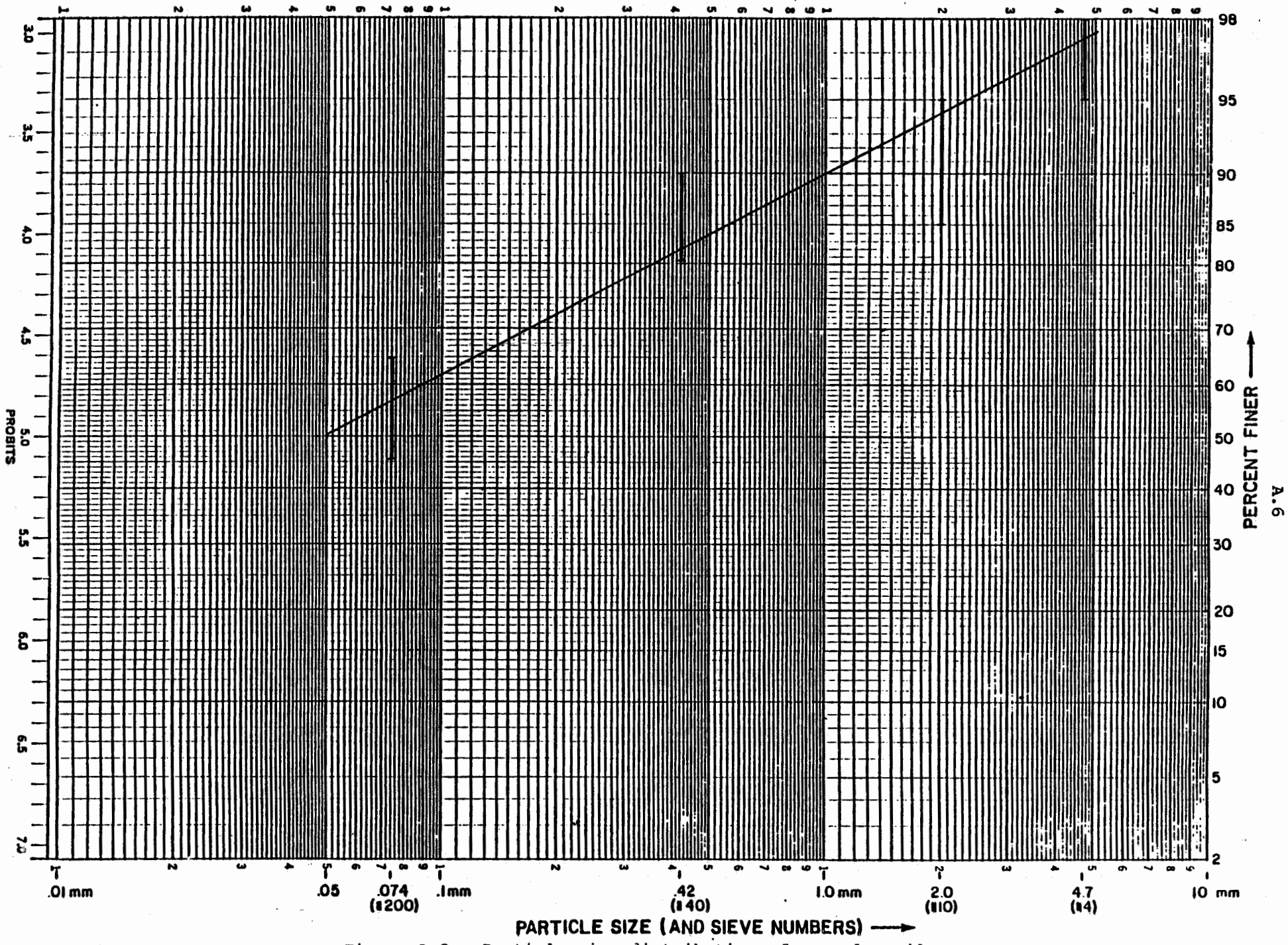

Figure A.2. Particle size distribution of example soil.