



United States  
Department of  
Agriculture

Soil  
Conservation  
Service

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Subject: SOI - GPR Trip Summary - Delaware,  
October 28 - November 1, 1985

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To: Bobbye Jack Jones  
State Conservationist  
Soil Conservation Service  
Dover, DE

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### PURPOSE

To field test the ground-penetrating radar (GPR) on selected soils within Sussex County, Delaware, and to use the system to determine the composition of delineated areas of Evesboro loamy sand, loamy substratum, 0 to 2 percent slopes.

### PARTICIPANTS

Jim Doolittle, Soil Specialist (GPR), SCS, NENTC, Chester, PA  
Joe Gibson, Soil Scientist, USA Corps of Engineers, FT. Belvoir, VA  
Dick Hall, State Soil Scientist, SCS, Dover, DE  
Jim Luzader, Soil Conservationist, SCS, Georgetown, DE  
Marty Rabenhorst, Asst. Professor, Univ. of Maryland, College Park, MD  
Bill Reybolt, Nat'l. Leader for Soil Geog., SCS, Washington, DC

### EQUIPMENT

The subsurface interface radar is the SIR System-8. This system consists of the model 4800 radar control unit, model SR-8004H graphic recorder, model DT-6000 digital tape recorder, and the model 30 program control unit. The 80, 120, and 300 MHz antennas were field tested on various soils on 28 October 1985. The 120 MHz antenna, with the model 705DA transceiver, provided the best balance of resolution and probing depth, and was preferred for this field study.

### DISCUSSION

During the week, areas of Evesboro loamy sand, loamy substratum, 0 to 2 percent slopes (EVA) were transected with the GPR in diverse locations throughout Sussex County. Admittedly, the composition of this map unit is variable. In the course of obtaining ground-truth soil information, the following established series were observed within delineated areas of this map unit: Downer (coarse-loamy, siliceous, mesic Aquic Hapludults), Evesboro (mesic, coated, Typic Quartzipsamments), Fort Mott (loamy, siliceous, mesic Arenic Hapludults), Hammonton (coarse-loamy, siliceous, mesic Aquic Hapludults), Klej (mesic, coated Aquic Quartzipsamments), Matawan (fine-loamy, siliceous, mesic Aquic Hapludults), Sassafras (fine-loamy,



siliceous, mesic Typic Hapludults), and Woodstown (fine-loamy, siliceous, mesic Aquic Hapludults). However, none of these soils are dominant in all delineations. This map unit is variable in terms of soils and soil properties.

The average depth to an argillic horizon or loamy 2C horizon is approximately 31 inches, with an observed range of 12 to 95 inches. The distribution of pedons into classes, based on the depth to a loamy strata is: 40 percent within 0 to 20 inches; 46 percent between 20 and 40 inches; 12 percent between 40 and 60 inches; and 2 percent greater than 60 inches. The distribution of Hapludults occurring within this map unit into particle-size classes is estimated to be 57 percent fine-loamy and 43 percent coarse-loamy. Seventy percent of the Hapludults are moderately well drained; 30 percent are well drained.

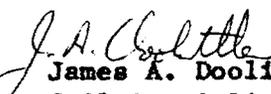
Enclosures 1 through 3 provide a statistical summary of the data collected for the Evesboro map unit (EVA) in Sussex County. The mapped areas are estimated to be 46 percent Arenic Hapludults, 40 percent Typic Hapludults, and 14 percent Typic Quartzipsamments. For statistical, interpretative, and descriptive purposes, the Arenic and Typic Hapludults have been treated as similar soils. It is estimated that 12 percent of the Quartzipsamments are deep to the loamy 2C horizon. The other 2 percent of the Quartzipsamments are very deep to the loamy substratum. The Quartzipsamments are principally excessively drained, although a small percentage is somewhat poorly drained.

## RESULTS

Map unit EVA, Evesboro loamy sand, loamy substratum, 0 to 2 percent slopes, is highly variable in terms of its taxonomic members. Its present name and interpretations are inappropriate for most mapped areas of this unit. This map unit has been sampled sufficiently to attain a 70 percent level of confidence concerning the map unit components. On the basis of GPR transect data, the following statement can be made:

"In 70 percent of the areas mapped as Evesboro loamy sand, loamy substratum, 0 to 2 percent slopes, Arenic Hapludults (proposed Pepperbox soil) and similar soils comprise 76 to 96 percent of the delineation. In the other 30 percent of the areas of this map unit, the percentage of Arenic Hapludults and similar soils may be either higher than 96 percent or lower than 76 percent. Dissimilar soils make up 4 to 24 percent of most mapped areas."

On the basis of this data, either a recorrelation or remapping of this unit is recommended. If recorrelated, the use of an undifferentiated group is also recommended, Pepperbox and Evesboro soils, 0 to 2 percent.

  
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cc: A. Holland, F. Miller, D. Hall



Map Unit: Evesboro loamy sand, loamy substratum, 0-2% slopes

SOILS	MEAN $\bar{x} = \frac{\sum x}{N}$	STANDARD DEVIATION $S = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$	STANDARD ERROR $Se = \frac{S}{\sqrt{N}}$	CONFIDENCE LIMIT $C = \bar{x} \pm t Se$	NUMBER OF TRANSECTS $N_e = \frac{(t)^2 (S)^2}{(L)^2}$
Typic Hapludults	40%	37.4	11.3		-----
Arenic Hapludults	46%	37.2	11.2		-----
Typic Quartzipsamments	14%	32	9.6	14 ± 10	12 at 70%
Hapludults	86%	32	9.6	86 ± 10	12 at 70%

- Confidence interval will be at a specific level of confidence (90%)
- L is the allowable error or range between the estimated mean and the true mean and will be ± 10% of the true population mean.  $L = a\bar{x}$  where "a" is a percent, in this case 10.
- See chapter 3 of GPR technical Guide for reference

AVERAGE COMPOSITION OF SELECTED MAP UNITS AS DETERMINED BY THE GPR TRANSECT METHODS

Map Unit Symbol and Name	Transects	Soils	Percent	Confidence <sub>2</sub> Interval (Percent)	Confidence Level (Percent)	Dissimilar Soils	Percent
EVA-Evesboro loamy sand, loamy substra. 0-2% slopes.	11	Arenic Haplud-					
		ults -----	46	75-95	70	Evesboro -----	12
		Similar soils	40			Other -----	2