United States Department of Agriculture **160 East 7th Street**
Soil Conservation Service **Chester, PA 19013**

Subject: GPR and EM Field Assistance, New Jersey; 21-23 October 1992 **Date:** 26 October 1992

To: Ronnie L. Taylor
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Purpose:
To provide ground-penetrating radar (GPR) transect data on the depth to bedrock in various map units in Warren County. To conduct electromagnetic induction (EM) surveys at soil characterization sites in Salem and Gloucester Counties.

Principal Participants:
Jim Doolittle, Soil Specialist, SSQAS, SCS, Chester, PA
David Kingsbury, Soil Scientist, Annandale, NJ
Lenore Matula, Soil Scientist, Hammonton, NJ

Activities:
Ground-penetrating radar transects were conducted in delineated areas of several map units in Warren County on 21 and 22 October. A presentation on the uses of geophysical techniques in soil surveys was delivered to the New Jersey Association of Professional Soil Scientists at the state office building in Somerset on the evening of 22 October. Electromagnetic induction surveys were conducted at eight sites in southern New Jersey on 23 October. During the week of 26 October, these sites will be sampled by Dr. Robert Grossman of the Soil Investigation Staff, Lincoln, NE.

Equipment:
The ground-penetrating radar unit used in this study is the Subsurface Interface Radar (SIR) System-8 manufactured by Geophysical Survey Systems, Inc. Components of the SIR System-8 used in this study were the model 4800 control unit, ADTEK SR 8004H graphic recorder, power distribution unit, transmission cable (30 m), and the model 3110 (120 MHz) antenna. The system was powered by a 12-volt battery. A scanning time of 75 nanoseconds was used. This scanning time provided a profiling depth of about 5 feet.

All GPR transects were conducted in open fields. The antenna was towed behind a 4WD vehicle at a speed of about 3 km/hr. At 10 or 15 second intervals, referenced observation points were annotated on the radar profiles. Though the GPR provides a continuous record of subsurface conditions, estimates of the depth to bedrock were restricted to these observation points.

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1. Use of trade names in this report is for identification purposes only and does not constitute endorsement by the author or SCS.

Results:

GPR Bedrock investigations in Northern New Jersey:

Thirty-one transects were conducted within delineated areas of map units NaC, Nassau rocky silt loam, 8 to 15 percent slopes; NbB, Nassau shaly silt loam, 3 to 8 percent slopes; and NFD, Nassau-Rock outcrop complex 15 to 25 percent slopes. Nassau is a member of the loamy-skeletal, mixed, mesic Lithic Dystrochrepts family. In the areas transected in northern Warren County, rock outcrops were few and exceedingly restricted. Nassau was the dominant soil in the areas studied with GPR. The following tables summarize observations for each transect according to soil depth classes. In addition, the table provides data on the average, minimum and maximum depth to bedrock for each transect. All depths are expressed in inches.

Transect #	M.U.	SOIL DEPTH CLASSES (number of observations) outcrop	shallow	mod-deep	deep	DEPTHS (inch) AVG.	Min.	Max.
1	NfD	2	21	5	0	15.5	0	39
2	NfD	0	14	0	0	13.5	10	18
3	NfD	0	11	7	0	19.7	13	37
4	NfD	0	12	2	0	16.2	8	30
5	NfD	0	5	4	0	19.9	13	30
6	NfD	0	14	7	0	18.6	12	42
7	NfD	0	17	4	0	17.4	10	34
8	NaC	0	12	6	0	19.1	12	35
9	NaC	0	11	6	0	18.1	10	31
10	NfD	0	16	5	0	18.0	11	28
11	NfD	0	12	11	0	20.8	11	48
12	NfD	0	14	5	0	17.4	11	32
13	NfD	0	11	10	0	20.0	13	35
14	NfD	0	9	6	0	18.9	13	28
15	NfD	0	7	6	0	19.8	14	28
16	NfD	0	9	6	0	19.1	12	28
17	NbB	0	1	9	0	28.9	19	37
18	NbB	0	6	5	0	22.2	8	43
19	NbB	0	6	9	0	21.7	12	32
20	NaC	0	9	2	0	15.0	10	35
21	NaC	0	11	0	0	12.6	9	17
22	NfD	0	13	0	0	14.9	11	17
23	NfD	0	6	5	0	18.4	10	29
24	NfD	1	6	7	2	23.4	0	44
25	NbB	0	8	2	1	18.8	12	41
26	NbB	1	8	3	1	19.2	0	47
27	NbB	0	8	2	1	21.0	12	42
28	NaC	0	11	3	1	20.0	10	61
29	NaC	1	10	1	0	11.7	0	21
30	NbB	1	6	4	0	16.9	0	33
31	NbB	1	9	3	0	15.1	0	27

EM Survey of Sampling Pits in Southern New Jersey:

At each sample site, ten measurements were taken with the EM38 meter. Five measurements were taken with the EM38 meter in both the horizontal and vertical dipole orientations. No apparent

relationship was evident in the data sets between EM response and soil texture. Generally, wooded sites not influenced by agri-chemicals had lower EM responses. Further analysis of the EM data will await processing of characterization data.

Soil: Keyport
Classification: Clayey, mixed, mesic Aquic Hapludults
Vegetation: wooded
Location: 39°34.71′ N; 75°22.50 W
Average EM38 Response:
Horizontal - 8.0 mS/m
Vertical - 8.2 mS/m

Soil: Keyport
Classification: Clayey, mixed, mesic Aquic Hapludults
Vegetation: cultivated
Location: 39°36.06′ N; 75°22.89 W
Average EM38 Response:
Horizontal - 8.0 mS/m
Vertical - 11.8 mS/m

Soil: Mattapex
Classification: Fine-loamy, mixed, mesic Aquic Hapludults
Vegetation: cultivated (with heavy doses of poultry manure)
Location: 39°37.65′ N; 75°22.34 W
Average EM38 Response:
Horizontal -13.0 mS/m
Vertical - 13.6 mS/m

Soil: Mattapex
Classification: Fine-loamy, mixed, mesic Aquic Hapludults
Vegetation: wooded
Location: 39°38.03′ N; 75°19.78 W
Average EM38 Response:
Horizontal - 5.0 mS/m
Vertical - 2.6 mS/m

Soil: Freehold
Classification: Fine-loamy, mixed, mesic Typic Hapludults
Vegetation: wooded
Location: 39°44.29′ N; 75°21.62 W
Average EM38 Response:
Horizontal - 8.0 mS/m
Vertical - 7.8 mS/m

Soil: Freehold
Classification: Fine-loamy, mixed, mesic Typic Hapludults
Vegetation: cultivated
Location: 39°44.29′ N; 75°21.62 W
Average EM38 Response:
Horizontal - 5.0 mS/m
Vertical - 3.4 mS/m

Soil: Westphalia
Classification: coarse-loamy, siliceous, mesic Ochreptic Hapludults
Vegetation: cultivated
Location: 39°42.85′ N; 75°18.02 W
Average EM38 Response:
Horizontal - 7.2 mS/m
Vertical - 6.0 mS/m

Soil: Westphalia
Classification: coarse-loamy, siliceous, mesic Ochreptic Hapludults
Vegetation: wooded
Location: 39°42.85′ N; 75°18.02 W
Average EM38 Response:
Horizontal - 5.2 mS/m
Vertical - 2.0 mS/m

It was my pleasure to work in your state and with members of your staff.

With kind regards.

James A. Doolittle
Soil Specialist

cc:
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