United States Department of Agriculture
Soil Conservation Service
160 East 7th Street
Chester, PA 19013-6092

Subject: Ground-penetrating radar (GPR) studies on claypan soils at MSEA Site near Centralia, MO, 14 to 19 October 1991

Date: November 7, 1991

To: Russell C. Mills
State Conservationist
USDA- Soil Conservation Service
Parkade Center, Suite 250
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Purpose:
To evaluate the suitability of using ground-penetrating radar (GPR) techniques to map the depth to the argillic horizon in claypan soils at the MSEA site near Centralia, Missouri

Participants:
Steve Anderson, Soil Scientist, U. of Missouri, Columbia, MO
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Activities:
I arrived in Columbia, Missouri, during the afternoon of 15 October 1991. Field studies were conducted at the Centralia MSEA Site on 16 and 17 October 1991. I returned to Chester, Pennsylvania, on 18 and 19 October.

Equipment:
The ground-penetrating radar unit is the Subsurface Interface Radar (SIR) System-8 manufactured by Geophysical Survey Systems, Inc. [1]. Components of the SIR System-8 used in this study were the model 4800

1. Use of trade names in this report is for identification purposes only and does not constitute endorsement.

control unit, model SR-8004H graphic recorder, model DT-6000 tape recorder, power distribution unit, transmission cable (30 m), and the models 3102 (500MHz) and 3110 (120 MHz) antennas. The system was powered by a 12-volt vehicular battery.

Discussion:
Geophysical tools provided rapid, cost effective, and nondestructive methods for quality assurance and site assessments. Compared with conventional methods these tools provide greater areal coverage per unit time and cost. However, no one geophysical tool is suitable for applications or will provide the appropriate data at all sites.

The high clay content and the dominance of 2:1 expanding lattice clays severely restricted the profiling depth and appropriateness of using radar techniques at the Centralia MSEA Site. Soils at the MSEA Site are members of the Adco (fine, montmorillonitic, mesic Albaquic Hapludalf) and Mexico (fine, montmorillonitic, mesic Udollic Ochraqualf) series.

After initial calibration trials, use of the model 3102 antenna was discontinued because of poor profiling depths (restricted to the surface layer) and resolution of subsurface interfaces. The model 3110 antenna provided better profiling depths. However, this antenna could discern the upper boundary of the claypan only in the exceptionally dry "CRP" plots and where it occurred between depths of 13 and 36 inches. At depths shallower than 13 inches, the upper boundary of the clay pan was masked on radar profiles by the strong reflections from the soil surface. Below depths of about 36 inches, reflections were too indistinct to be observed on unprocessed radar profiles.

Interpretations of the depth to the claypan were made based on the composite imagery manifested at each observation site. These interpretations were verified at thirty observation sites. Interpretations supported general groupings based on depths to the observed claypan.

Results:
1. Results of the radar survey were highly interpretative. Interpretations were verified in the field and support a broad grouping scheme based on composite radar images.

2. Preliminary maps of the depths to claypan have been prepared based on radar interpretations from two plots which were schematically surveyed with the GPR. These maps are useful as they chart the location of buried channels and the generalized topography of the claypan with the plots.

3. A short technical report will be prepared following the processing of radar data through RADAN software.

I enjoyed this opportunity to work in your state and with members of your staff and co-operating agencies.

With kind regards.

James A. Doolittle
Soil Specialist

cc:
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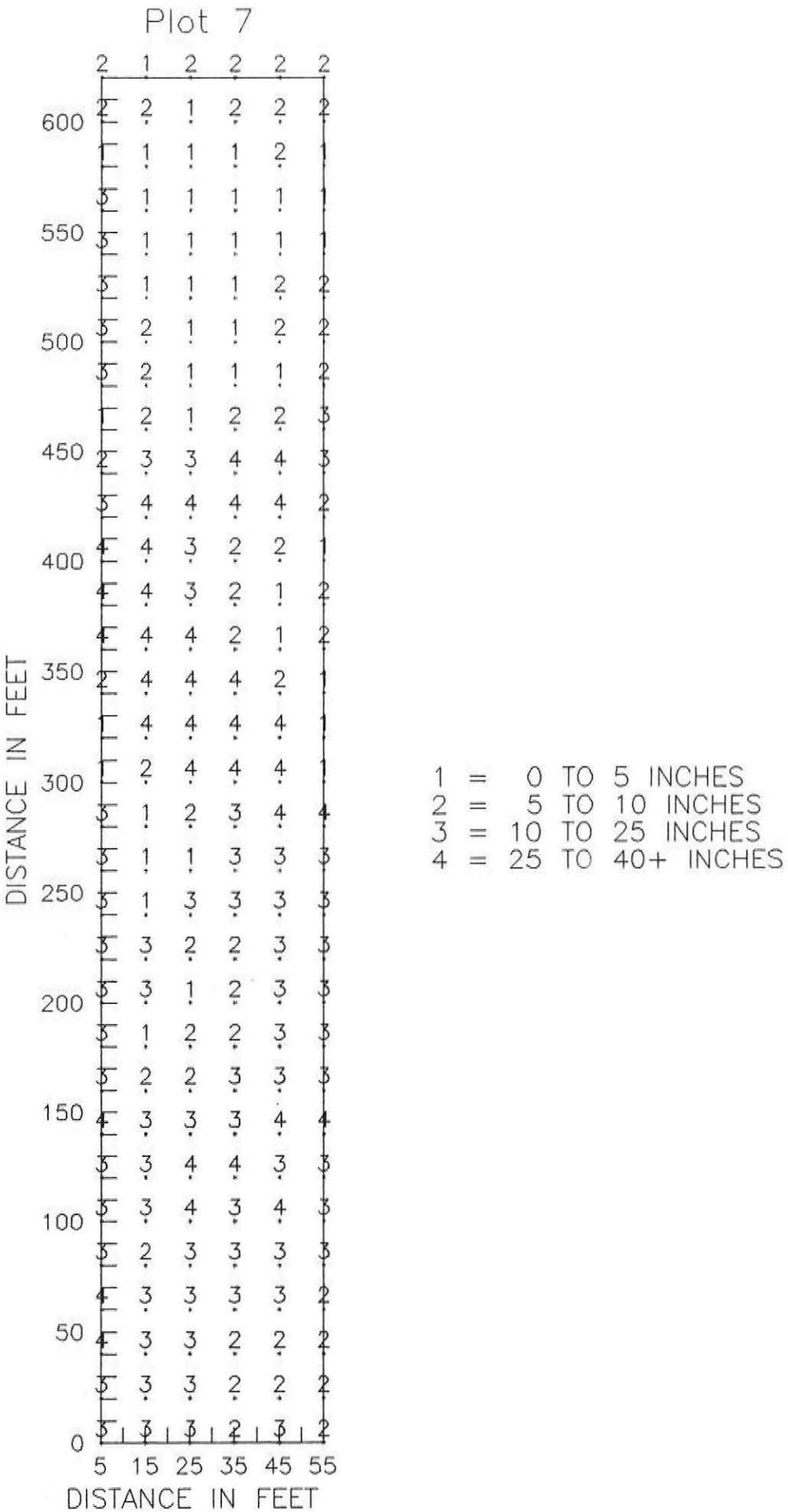
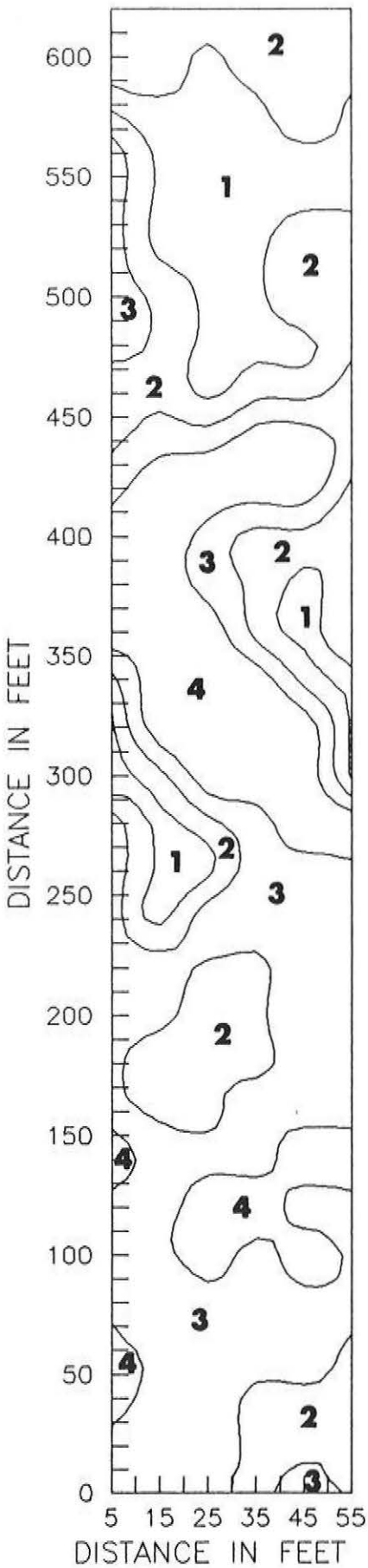
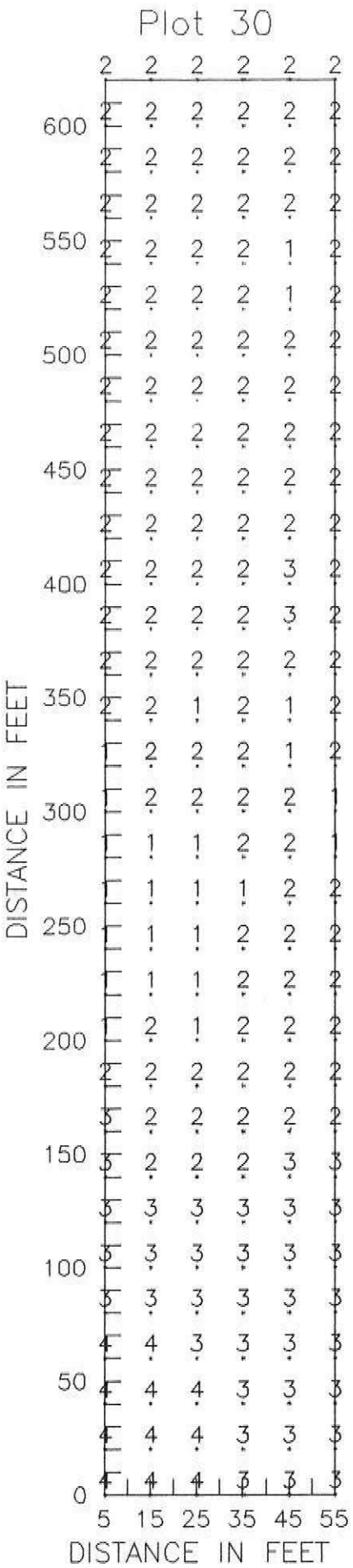

Plot 7
DISTANCE IN FEET
600
550
500
450
400
350
300
250
200
150
100
50
0
5 15 25 35 45 55
DISTANCE IN FEET
1 = 0 TO 5 INCHES
2 = 5 TO 10 INCHES
3 = 10 TO 25 INCHES
4 = 25 TO 40+ INCHES

Plot 7

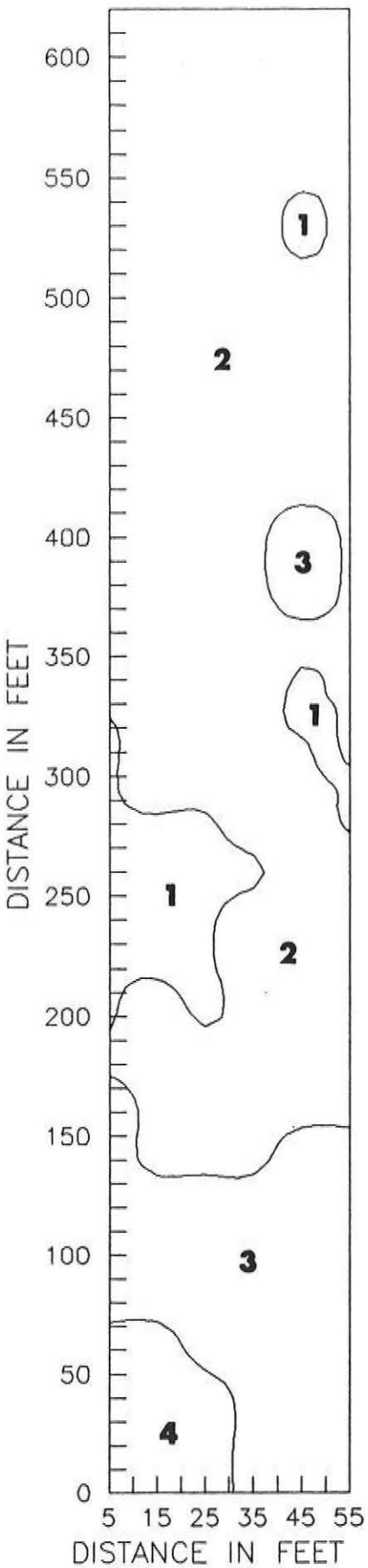


1 = 0 TO 5 INCHES
2 = 5 TO 10 INCHES
3 = 10 TO 25 INCHES
4 = 25 TO 40+ INCHES



1 = 0 TO 5 INCHES
2 = 5 TO 10 INCHES
3 = 10 TO 25 INCHES
4 = 25 TO 40+ INCHES

Plot 30



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