United States Department of Agriculture

Natural Resources Conservation Service

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Subject: Forensic -- Geophysical Assistance **Date:** 8 October 2002

To: Harold L. Klaege
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USDA-Natural Resources Conservation Service
760 S. Broadway
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Purpose:
At the request of the Garden City Police Department, the National Soil Survey Center provided ground-penetrating radar (GPR) assistance in an attempt to locate a possible criminal burial within a residential yard in Garden City, Kansas.

Participants:
Jim Doolittle, Research Soil Scientist, USDA-NRCS, Newtown Square, PA
Steven P. Graber, Resource Soil Scientist, USDA-NRCS, Dodge City, KS
Greg Hands, Sergeant, Finney County Sheriff Dept., Garden City, KS
Amanda Shaw, District Conservationists, USDA-NRCS, Garden City, KS
John W. Towns, Lieutenant, Garden City Police Department, Garden City, KS
Wes Tuttle, Soil Scientist (Geophysical), USDA-NRCS, Wilkesboro, NC
Larry Watson, Detective, Garden City Police Department, Garden City, KS

Activities:
All field activities were completed on the morning of 17 September 2002.

Equipment:
The radar unit is the Subsurface Interface Radar (SIR) System-2000, manufactured by Geophysical Survey Systems, Inc.[1] The SIR System-2000 consists of a digital control unit with keypad, VGA video screen, and connector panel. A 12-volt battery powered the system. This unit is backpack portable and, with an antenna, requires two people to operate. Antennas with center frequencies of 400 and 200 MHz were used in this study.

Study Site
The site was a small residential yard within a trailer park. Front, back, and side yards were small and enclosed by fences. Numerous cultural objects (including an automobile) were stored or placed along these fences, obstructing and limiting the size of the survey. Plants and small shrubs interfered with radar traverses and further restricted the survey area.

The site is located in an area that has been mapped as Ulysses silt loam, 1 to 3 percent slopes. The very deep, medium textured, well drained Ulysses soil formed in calcareous loess. Ulysses is a member of the fine-silty,

[1] Manufacturer's names are provided for specific information; use does not constitute endorsement.

mixed, superactive, mesic Aridic Haplustolls family. Moderate clay content with a large fraction of 2:1 expanding lattice clays that have a high cation exchange capacity, and the calcareous nature of the soil produced an less than favorable environment for the use of GPR.

Pulling the antennas back and forth across the open spaces in each yard completed the radar survey. Radar profiles were reviewed in the field. While the locations of point anomalies were picked out, no excavations were completed to verify their identity.

Background:
Ground-penetrating radar does not provide direct information that there is a body or other specific object within the soil. GPR detects but does not identify subsurface features. This geophysical tool is often most useful in reducing the search area by determining where target objects are not located. The effectiveness of GPR lies in its ability to detect soil disturbances and the intrusion of foreign materials. Using GPR, criminal investigators are able to determine the precise locations of subsurface disturbances, as well as the approximate size, the general shape, and the depth of the buried material. Success varies with soil conditions.

Results:
Depth of penetration was severely restricted by the conductive nature of the soil. Both antennas provided some near surface information. Parallel bands of low frequency noise caused by reverberated signals plagued radar profiles and interpretations. Penetration depths were similar with both the 200 and 400 MHz antennas. However, the 400 MHz antenna provided superior resolution of near surface features and was more extensively used.

The GPR provided no specific evidence of a large soil disturbance or a criminal burial. A large quantity of small, shallow (less than 20 inches in depth) point anomalies was detected within the yards. These anomalies reflect small, buried or partially buried cultural objects, and irregularities in the soil. None of these features were large. Because of strong signal reverberations, many of these features were identified as metallic objects. Soil irregularities were associated with compacted soils caused by pedestrian traffic. Others were associated with small, shallow depression visible on the soil surface. Most were randomly distributed about the yards. No anomaly appeared large or deep enough to be identified as a clandestine burial.

It was our privilege to assist you in this investigation.

With kind regards,

James A. Doolittle
Research Soil Scientist

cc:
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