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Geophysical Detection of Voids within the Levee, Duck Creek Conservation Area, Missouri

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16. Abstract

Ground penetrating radar, resistivity and surface waves will be acquired along the levee in the Duck Creek Conservation Area. These non-invasive geophysical data will be used to locate and map voids that have been excavated (by animals) into the levee at the Duck Creek Conservation Area

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Overview:

In March 2005, the geophysics crew from the University of Missouri-Rolla (UMR) spent three field days acquiring resistivity and ground-penetrating radar (GPR) data for the Missouri Department of Conservation (MoDOC) at the Duck Creek Conservation area, southeast Missouri (Figure 1). The primary objective was to locate any/all shallow air-filled voids (rodent burrows) that might be present beneath the firm-packed roadway atop critical sections of the levee. The sections of levee identified as critical were selected by MoDOC personnel.

A total of 160 lineal feet of resistivity data and 19,200 lineal feet of GPR data were acquired along test sections of roadway (Figure 1). These geophysical data were processed and interpreted on-site. Thirteen prominent anomalous features were identified on the geophysical data (twelve GPR; one resistivity) and tested using a shallow drill. Drilling confirmed that none of the anomalous features were caused by shallow, air-filled voids.

Our conclusion is that the tested sections of roadway do not overlie shallow air-filled rodent burrows.

Introduction:

The GPR tool and the resistivity tool, as employed at the Duck Creek Conservation site, produce essentially continuous cross-sectional images of the subsurface along predetermined traverses. Air-filled voids (with diameters on the order of 1 foot or more and at depths of less than 3 feet) should produce prominent anomalies on both data sets.

When the UMR geophysical crew arrived at the Duck Creek Conservation area, they were escorted to the study site (Figure 1). They were also shown a photograph of a segment of roadway that had collapsed into a rodent burrow. The burrow was described as having originated on the side of the levee, and as having been terminated (by the animal) beneath the firm-packed roadway material (at a depth of about 1 foot). The burrow, which ultimately collapsed because of vehicular traffic, was presented as the primary target of the geophysical survey.

The UMR geophysical crew spent the first field day acquiring test GPR and resistivity data. The UMR crew did not acquire any MASW (multi-channel analysis of surface wave) data because the resistivity and GPR tools were deemed to be much more cost-effective given the nature of the primary target and site conditions. The test GPR data provided much greater depth penetration (~4 feet) then initially expected, and the decision was made to acquire production GPR data only, because the GPR tool is much more cost-effective than the resistivity tool.

The UMR geophysics crew spent two additional field days acquiring production geophysical date in the study area. The data were processed and interpreted in the field. Anomalies were flagged and tested while the UMR crew was in the field.

Data Acquisition

A total of 19,200 lineal feet of GPR data was acquired along 4800 lineal feet of roadway (four parallel GPR profiles spaced at 2.5 foot intervals were acquired along each segment of roadway surveyed). In addition, 160 lineal feet of resistivity data were acquired.

Data Processing and Interpretation

The GPR and resistivity data were processed and interpreted in the field. Thirteen prominent anomalies on both data sets were identified (12 GPR; 1 resistivity) and tested by the drill while the UMR crew was in the field. (Example resistivity and GPR data are presented in Figures 2 and 3, respectively.)

Results and Conclusions

The MoDOC drill crew determined that none of the tested geophysical anomalies were caused by air-filled rodent burrows. Our conclusion is that the tested segments of levee roadway do not overlie any air-filled animal burrows of substantive size.

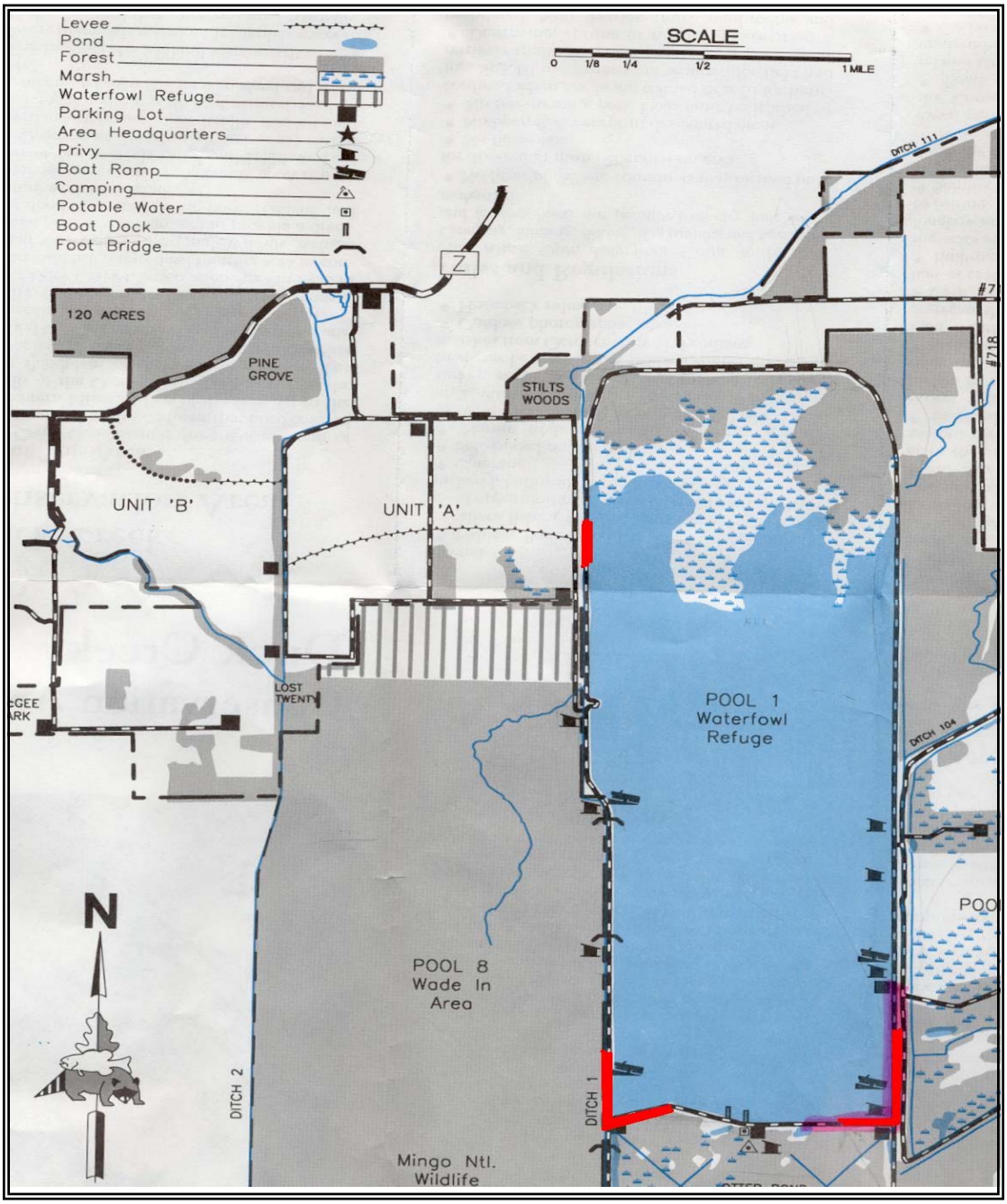

Figure 1: Map of the Duck Creek Pool showing the areas where GPR data were acquired. Resistivity data were acquired only along the highlighted northwest test segment of levee roadway.

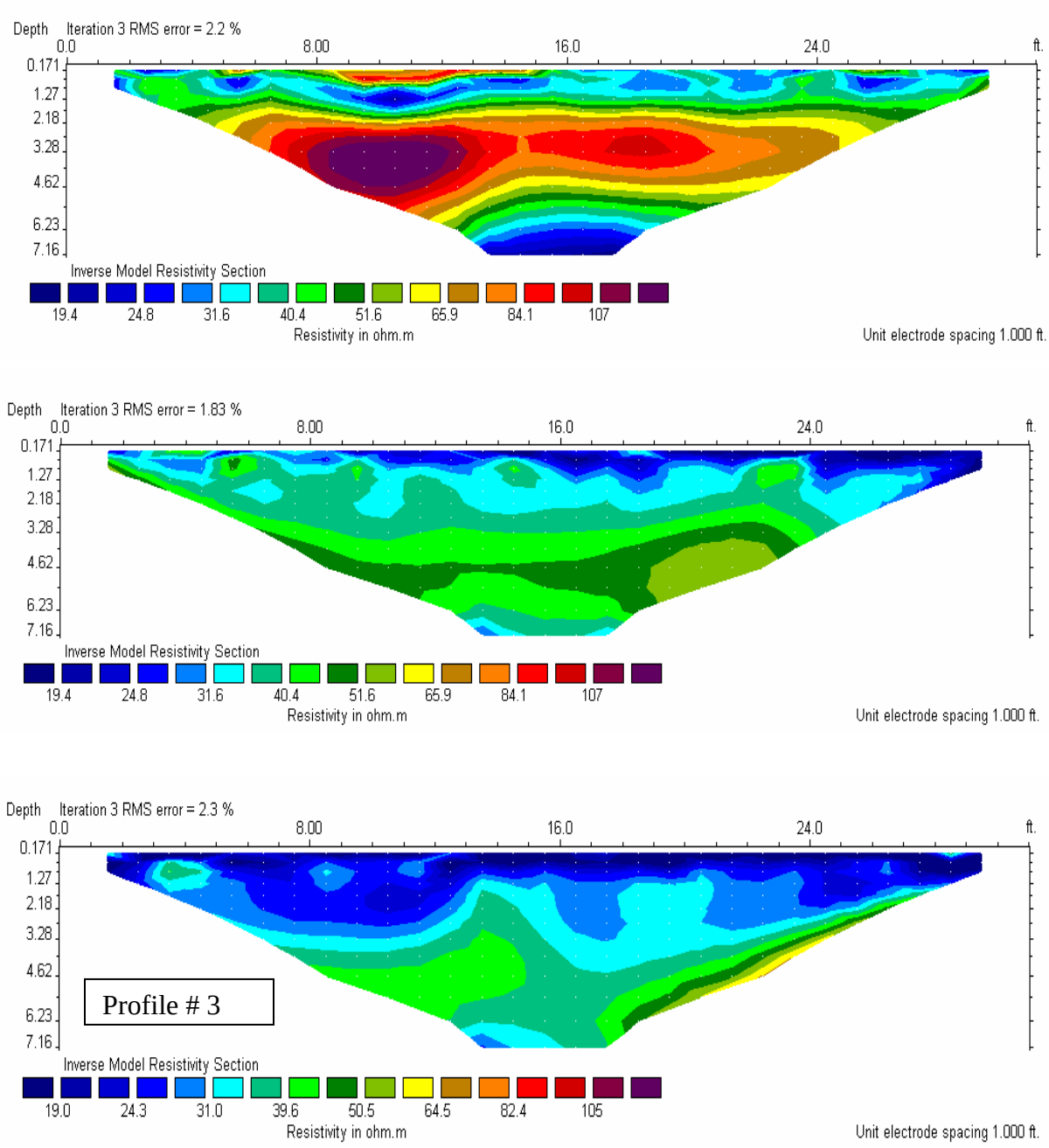

Figure 2: Example resistivity profiles. The high-resistivity anomaly on the uppermost resistivity profile was tested by the drill. According to the MoDOC drill crew, this anomaly was not caused by an air-filled animal burrow.

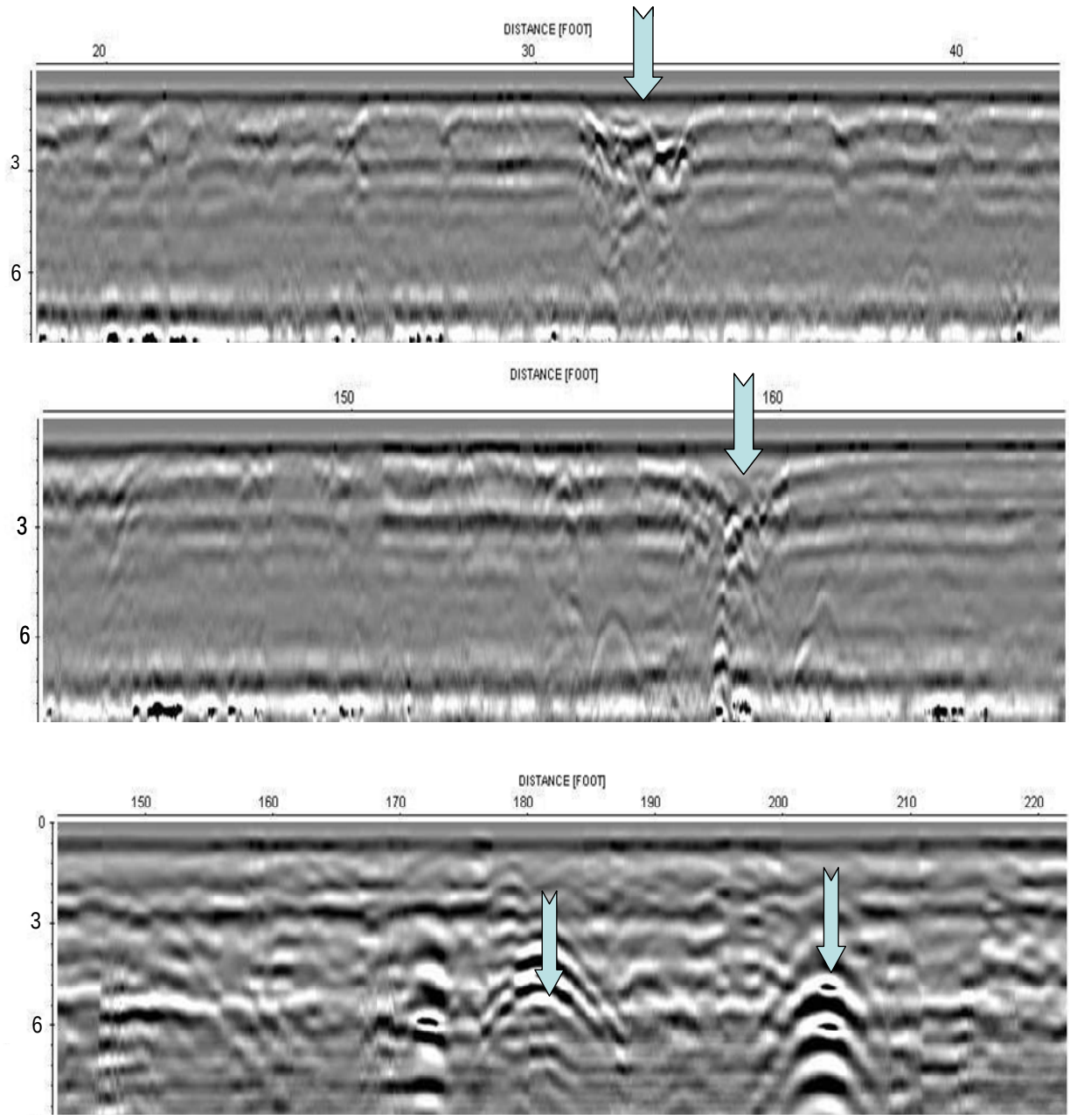

Figure 3: Example GPR profiles. All of the highlighted GPR anomalies were tested by the drill. According to the MoDOC drill crew, these anomalies were not caused by air-filled animal burrows.