Final Report: Ground-Penetrating Radar Investigation of Shepherd of the Hills Trout Hatchery, Branson Missouri

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Overview:

In early November, 2002, the geophysics crew from the University of Missouri-Rolla (UMR) conducted a ground penetrating radar (GPR) study for the Missouri Department of Conservation, at the Shepherd of the Hills Trout Hatchery, Branson Missouri. The primary objective was to locate any/all air-filled voids (related to karstic activities?) that might be present beneath the fish runs and beneath the asphalted walkways between and surrounding the fish runs.

A total of 370 GPR profiles were acquired on-site using a 900 MHz antenna (high resolution; depth penetration of about 4.5 ft). An additional 30 GPR profiles were acquired using a 400 MHz antenna (intermediate resolution; depth of penetration of about 9 ft). The acquired GPR data were processed and interpreted using RADAN software.

The interpretations (re: locations of possible subsurface voids) were plotted on a suite of base maps that collectively cover the entire hatchery study site. The specific location of each interpreted anomaly (with respect to prominent surface reference features) is noted on the attached spreadsheets (one for each base map).

Introduction:

The non-invasive ground penetrating radar (GPR) tool, as employed at the Shephard of the Hills trout hatchery site, produces a continuous cross-sectional time image of the subsurface (and prominent features therein) as it is dragged along predetermined traverses. Prominent features at the study site would include (but are not limited to) the top of pavement, the base of pavement, the top of air-filled voids, the base of air-filled voids, underground utilities (cables, pipes, etc.), and the base of in-filled excavations.

Data Acquisition

A total of 370 parallel, N-S, 900 MHz GPR profiles were acquired in the study area. The spacing between adjacent profiles was 2 ft; the trace spacing along each profile was about 0.35 in. This high-frequency antenna is theoretically capable of imaging air-filled voids with heights on the order of 3 in. (Note: 900 MHz data were acquired across the entire paved section of the study area, excepting the water-filled fish runs.)

An additional 30 parallel, N-S, GPR profiles were acquired (in selected areas only) using a 400 MHz antenna. These data were acquired mostly in areas where previous subsidence (due to failure of pavement overlying air-filled voids) had been noted.

Data Interpretation

The processed GPR profiles were visually interpreted with the goal of identifying any/all anomalies (anomalous reflected events) that could be caused by the presence of air-filled voids beneath pavement. The identified anomalies have been superposed onto a suite of base maps (Figures 1-15), which collectively cover the entire study area, and ranked (high, medium, low). The anomalies ranked high are those that have (in our opinion) the greatest probability of being caused by air-filled voids. In our opinion, these anomalies should be investigated first. The anomalies ranked low are those least likely to be caused by air-filled voids. Spread sheets documenting the x/y coordinates of each anomaly (relative) to prominent surface features) are also attached.

Please note that the interpretation of GPR data (and indeed all geophysical data) is inherently ambiguous. Ground-truthing is generally essential in order to constrain and validate interpretations.