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Thursday, February 22, 2007

**To:** Michael Kenyon  
District Conservationist  
USDA-NRCS

**Subject:** Ground-Penetrating Radar Survey, Sawmill Pond,  
North Kingston, RI.

**Background:**

On February, 13, 2007 a ground-penetrating radar (GPR) survey was conducted on Sawmill Pond located in North Kingston, RI. The purpose of the survey was to determine the thickness of peat material (soft sediment), provide a bathymetric map of the mineral (hard) bottom, and determine a volume estimate of the ponds hard bottom. The request for this survey came from the Southern RI Conservation District.

**NRCS Participants:**

Jim Turenne, Assistant State Soil Scientist, Rhode Island NRCS.  
Robert Tunstead, Soil Scientist/GPR Specialist, Massachusetts NRCS.

**Equipment:**

A SIR-2000 GPR controller and a 200 MHz antenna manufactured by Geophysical Survey Systems Inc. was used for this survey. A complete description of the GPR equipment is available upon request; a brief description of GPR technology is available at: <http://nesoil.com/gpr>. A Garmin GPS receiver was used to record the locations of the GPR observation marks. Ground-truthing of the GPR data was conducted using steel rods.

**Survey Procedure:**

The GPR unit was first calibrated and scaled to be capable of profiling to the required depths. Once the device was set a series of random traverses was made across the pond to cover a sufficient spacing. A series of 6 transects were made on the pond. At random locations on each transect observation event marks were placed on the radar profiles by the operator and a GPS waypoint was recorded to geo-reference the mark. This allows a depth measurement to be recorded for each point on the pond and a contour map to be generated. Once the survey was completed two areas were cored and the depth to soft and hard bottom was determined. This ground-truth is needed to establish a velocity of the electromagnetic signal and thus a depth scale and also to assist with the interpretation of the data.

**Results:**

A total of 125 observations were recorded in 8 acres of the pond (the area along the southern part of the pond were not profiled with the GPR due to lack of ice). An example of a radar profile is shown in figure 1, all of the radar profiles were converted to a bitmap image and copies of each transect is available upon request. The radar

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recorded the soft and hard bottoms of the pond along with other features such as point objects (boulders, debris, etc.). Ground-truthing two locations allowed a depth scale to be established and each of the point event marks was interpreted for the depth to hard bottom. The interpreted depths of the hard bottom were added to each GPS location (X,Y, Z data) and the data was used to generate a contour plot of the hard bottom using the SURFER program.

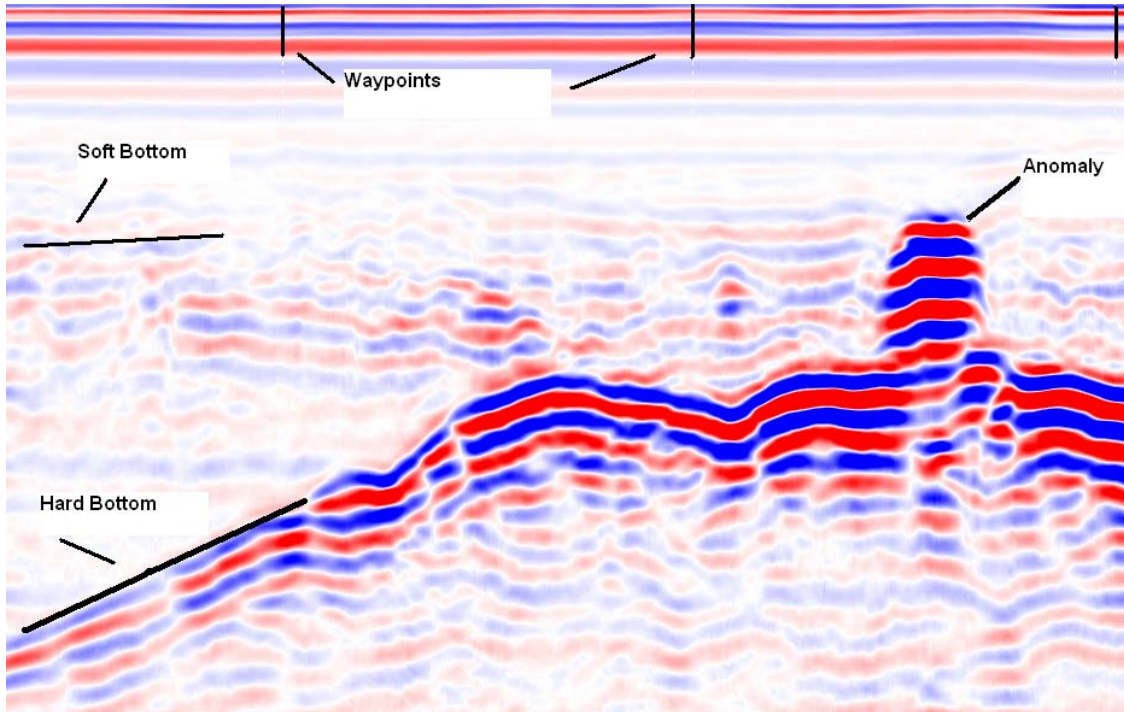
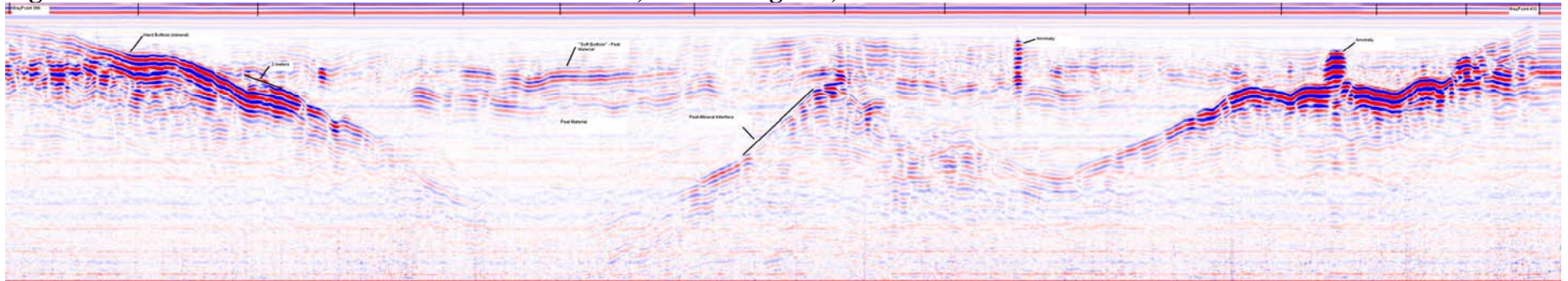
Figure 2 is a contour plot of the hard bottom of Sawmill Pond. The maximum depth to hard bottom is approximately 13 feet located in the NW part of the pond; the average depth to hard bottom is 4.25 feet. The contour plot in figure 2 was made using a relative pond elevation set to 0 feet (absolute elevations can be made using the RTK survey the engineering staff performed during the summer). The water depth at the time of the survey (depth to soft bottom) was approximately 2 feet. A volume estimate of the ponds hard bottom was calculated using the SURFER software; this value came out to 1,406,904 cubic feet. An estimate of organic material (soft bottom) can be determined if this volume is needed.

Updated soil mapping would now map this pond out as a fresh-water submerged soil due to the fact that emergent, rooted vegetation occurs throughout the pond. Using the average thickness of the organic (soft bottom) material the pond would be re-mapped as a ponded phase of the Carlisle soil (Frasiwassists classification) which is mapped to the north of Sawmill Pond. Prior to the damming of the pond, the deep organic Carlisle soils occupied the area. The GPR survey and the contour map generated from the data show the pond to consist of 4-5 kettle holes interconnected by ridges of stratified outwash deposits (Adrian soil inclusions).

Figure 3 shows the location of the point observations for the pond and the depths to interpreted hard bottom for some of the points. Figure 4 is a 3D image map generated from the contour plot data. This map shows the 4-5 depressions called kettle holes which form the deep basins on the pond.

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Assistant State Soil Scientist  
Rhode Island USDA-NRCS

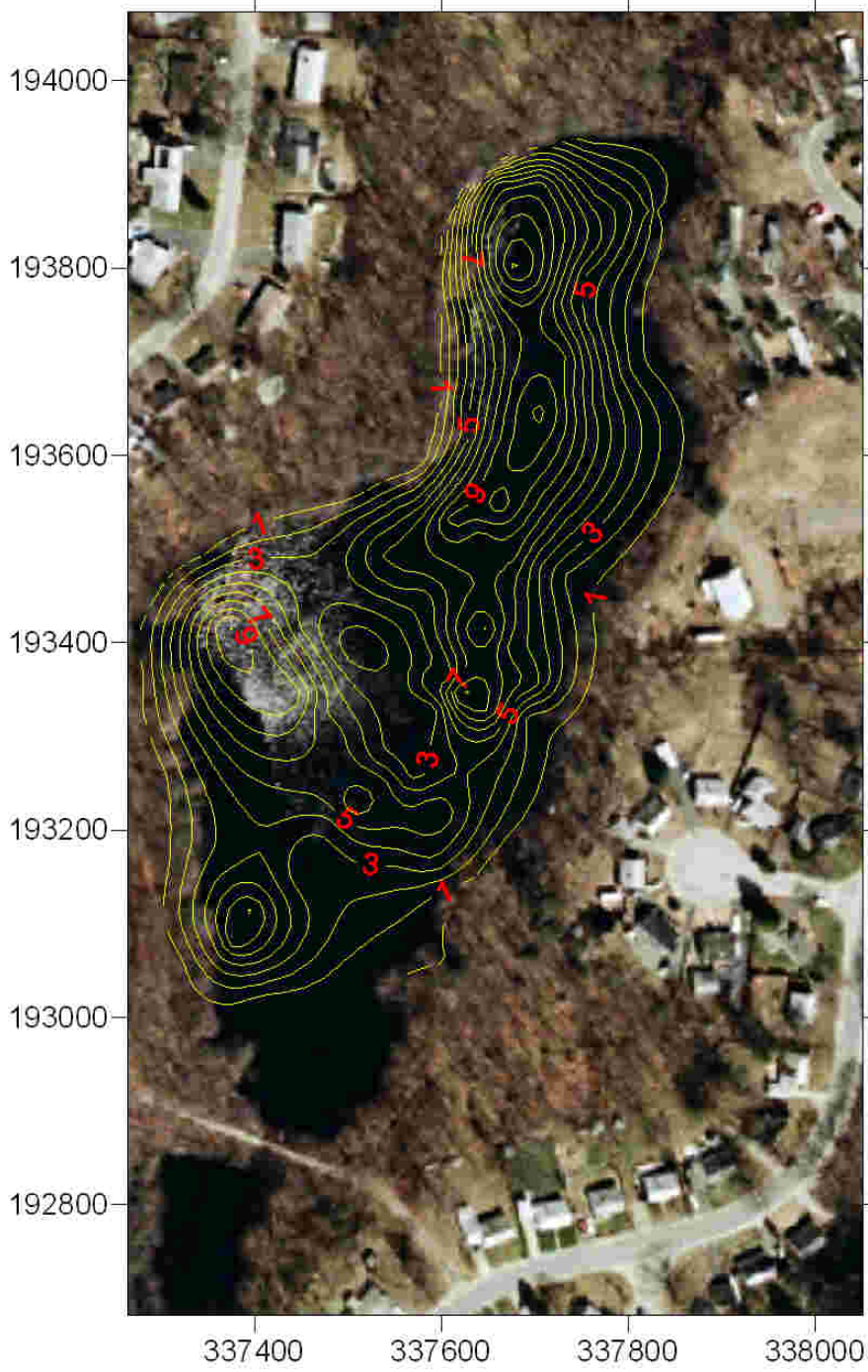
**Figure 1: GPR Profile from Transect 6 – Sawmill Pond, North Kingston, RI:**



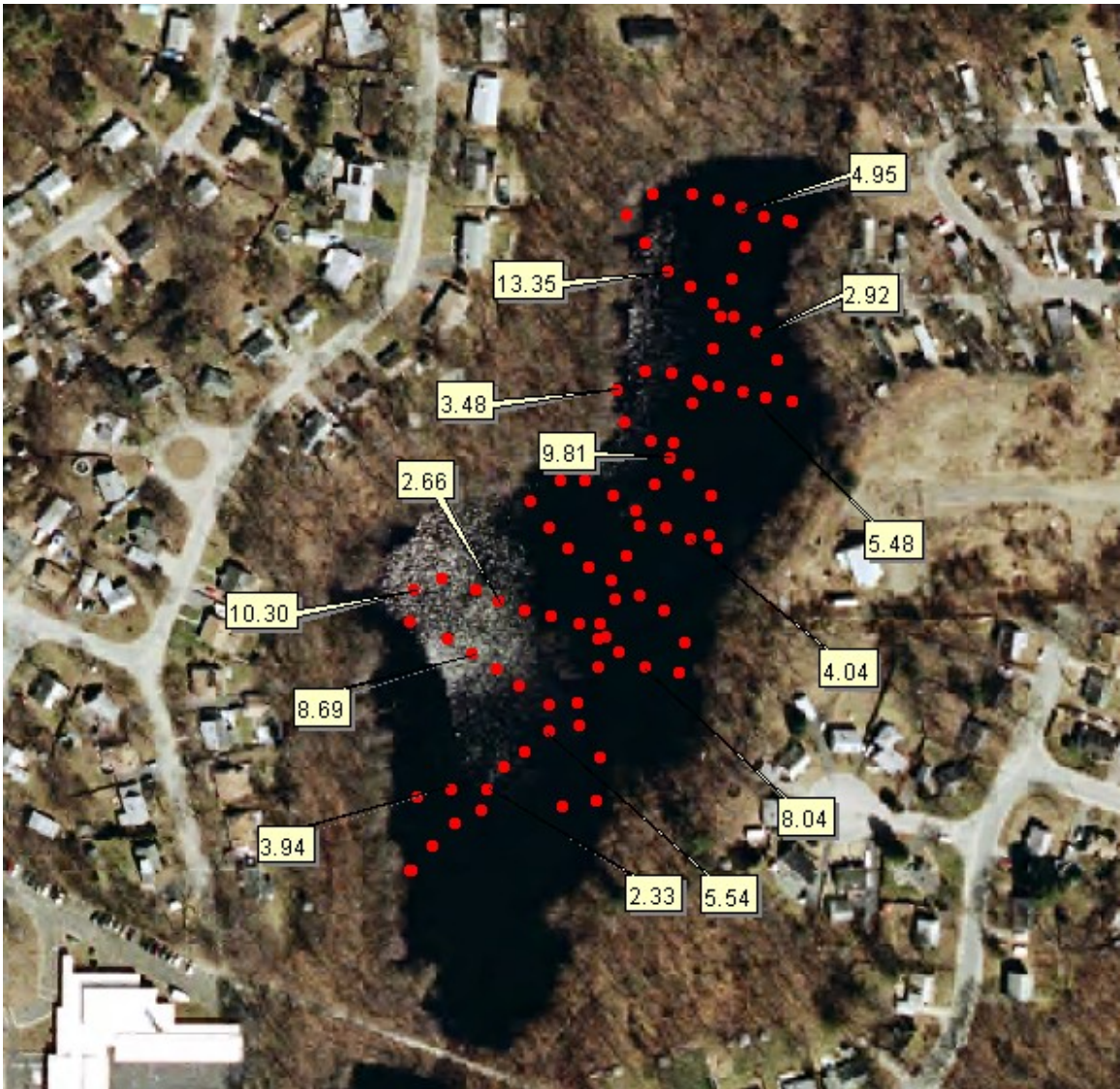
**Close up of eastern part of transect number 6.**



**Figure 2: Contour plot of depth to hard bottom, Sawmill Pond North Kingston, RI. Contour interval is 1 foot.**



**Figure 3: Location of GPR Observation Points (boxes show estimated epth to hard bottom:**



**Figure 4: 3D Image of Sawmill Pond.**

Figure 4: 3D-Image of Sawmill Pond.

