#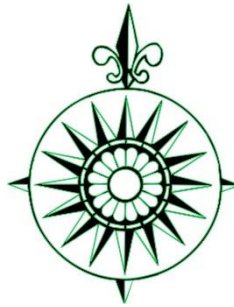 A Report on Ground Penetrating Radar Survey of Armold / Litch Burial Yard and Goodridge Family Burial YardLunenburg, Massachusetts.

08/02/2022

Conducted by
Robert W. Perry
TOPOGRAPHIX, LLC
Hudson, NH

Requested by
William Bernard
(DPW Director)

TOPOGRAPHIX® LLC

Mr. Bill Bernard (DPW Director)
Mr. Todd Holman (Superintendent   08/02/2022
520 Chase Road
Lunenburg, MA 01462

Subject: Ground penetrating radar of possible burial sites
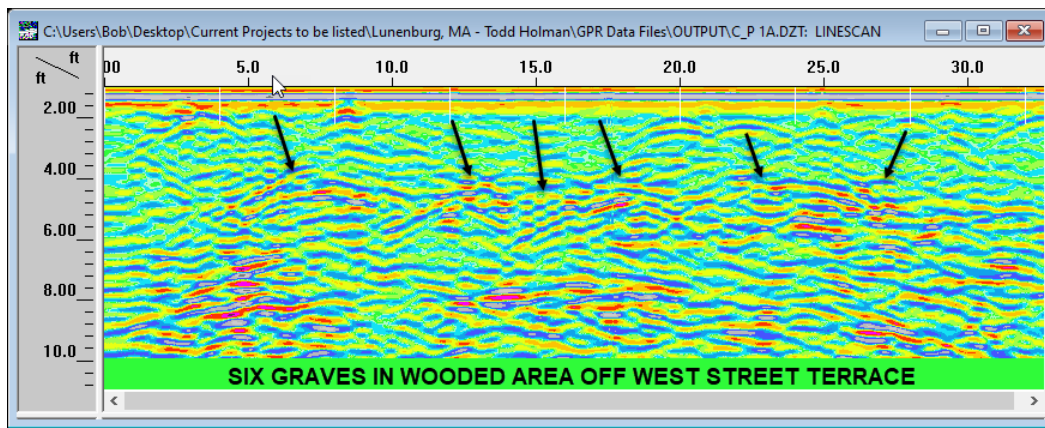
Dear Mr. Bernard

I want to thank you for allowing TOPOGRAPHIX LLC to service your GPR requirements.

Ground Penetrating Radar (GPR) was used at two locations. Both locations were located in Luneburg, Massachusetts, on West Street Terrace, and at Goodridge Cemetery, at the crossroads of Lincoln and Fish Streets.

Armold / Litch Burial Yard:

A total of six anomalies were discovered that indicated the presence of unmarked graves. Apparently, there were seven burials, but there was no indication of a seventh burial. Many times in wooded areas like this, the radar reflections of the grave anomalies are sometimes masked by surrounding tree roots and rocks. However, the grave discoveries were of good interpreted quality at a depth between three and four feet. Three-inch metal disks along with green flags were placed on the ground marking the centermost position of the grave anomaly. Scan results indicated that the grave shafts were in the north-south direction, in alignment with an east-west position.
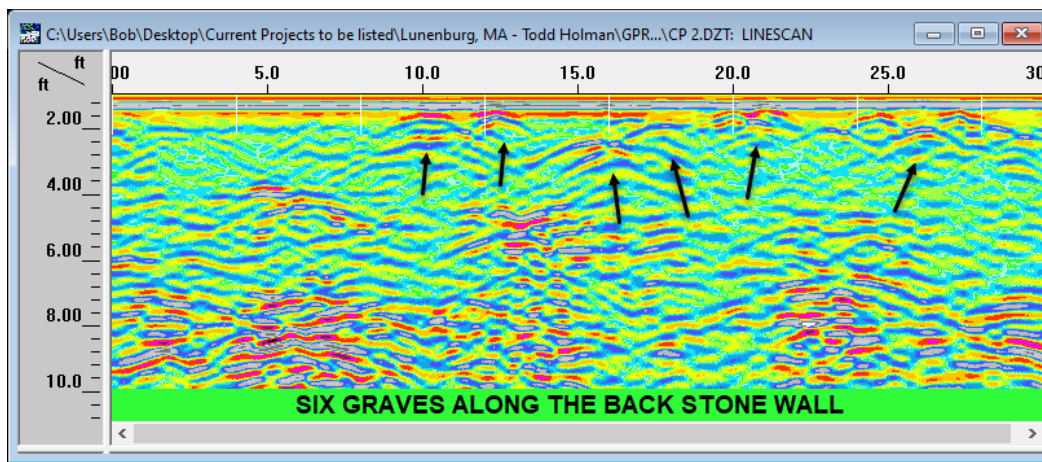
C:\Users\Bob\Desktop\Current Projects to be listed\Lunenburg, MA - Todd Holman\GPR Data Files\OUTPUT\C_P 1A.DZT: LINESCAN

SIX GRAVES IN WOODED AREA OFF WEST STREET TERRACE

Goodridge Family Burial Yard:

A total of six anomalies were discovered along the back stone wall indicating the presence of unmarked graves. There was also one grave anomaly located in front of the six along the back wall, indicating that another row was started for future burials.

Before scanning the Goodridge area, a test scan was performed of known graves with headstones that were located about midway between the stone wall and the street. Whenever possible, I try to scan known graves in the area to get a GPR computer reading of soil conditions with grave anomalies to use as a visual reference. Scan results were of good interpreted quality at an average depth of two feet. Three-inch metal disks along with green flags were also placed on the ground marking the centermost position of the grave anomaly.

The computer processing for the GPR profile scan seen below had depth adjustment performed to eliminate some of the surface interference from environmental conditions, which I explain those conditions under **Ground Penetrating Radar (GPR)** below.

C:\Users\Bob\Desktop\Current Projects to be listed\Lunenburg, MA - Todd Holman\GPR...\CP 2.DZT: LINESCAN

SIX GRAVES ALONG THE BACK STONE WALL

Rating System for Burials:

Operating by the fact that grave shafts are typically longer than two feet, the confidence level rating on whether an anomaly could be considered a human grave was determined by the observation of the same anomalous pattern repeating itself in the neighboring two-foot lateral scan.

- An anomaly detected on one pass along the survey- line would be rated as Low Probability of human grave.
- The anomaly detected on the second pass (coming from the opposite direction) along the survey line would be rated as High Probability of human grave.

In addition to the position of the anomaly along the survey line, the hyperbolic signature of each anomaly as compared to the unique hyperbola characteristic typically observed from the presence of tree roots, layering, or bedding of various rocks, ground voids, disturbed soil layers, and burial holes.

GPR Equipment Used:

The radar unit used for the project was the SIR-3000, manufactured by Geophysical Survey Systems, Inc. (GSSI). A 400 MHz antenna was used with a scanning rate of 24 scans per foot at a penetration depth of 10 feet. The scan method I used is referred to as exploratory scanning, meaning that no grid lines were used to keep the radar scanning on track when scanning large open areas.

Ground Penetrating Radar (GPR):

Ground-penetrating Radar uses a high EM pulse transmitted from a radar antenna to probe the earth. The transmitted radar pulses are reflected from various materials within the ground, and this return is detected by the radar receiver.

Different materials reflect energy back to the surface in different ways, and some factors come into play when collecting GPR data. Collecting GPR data is subject to earth material properties, location, and ground conditions. Heat, humidity, groundwater saturation, salt, iron deposits, as well as interfering effects such as radiofrequency, cell phones, including extensive metal structures as cars passing by, and traffic lights, all have an effect on the radar data being collected.

Examples of Commonly Detected Objects:

The examples shown below are presented for informational use only. The examples illustrate how a single ground-penetrating radar scan along a survey line can reveal a unique hyperbolic (curve) characteristic of each of the targeted objects. Vertical scales include Time (ns) or Depth (ft/m) as well as horizontal scale for ground distance viewed at the top of the images.
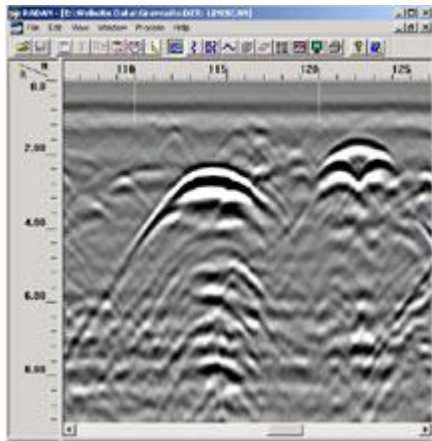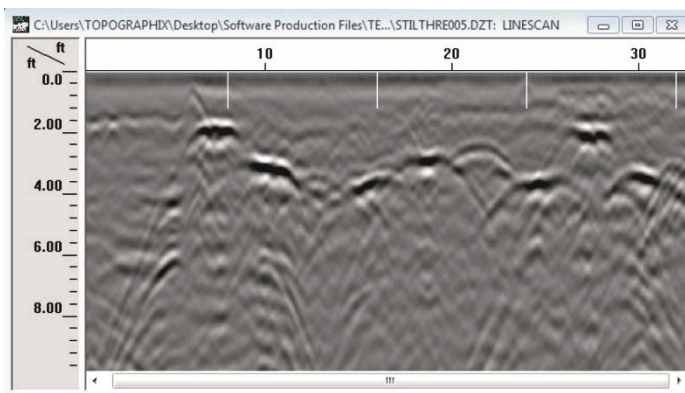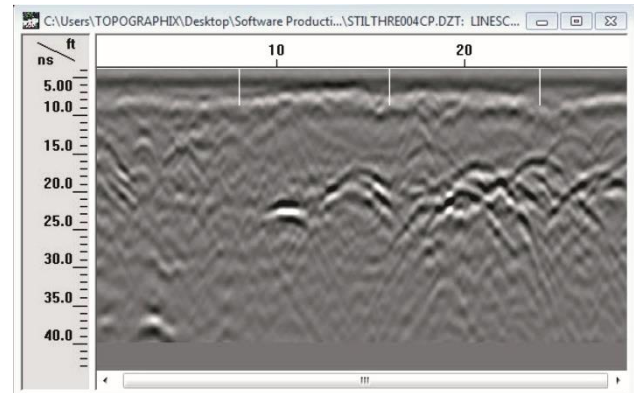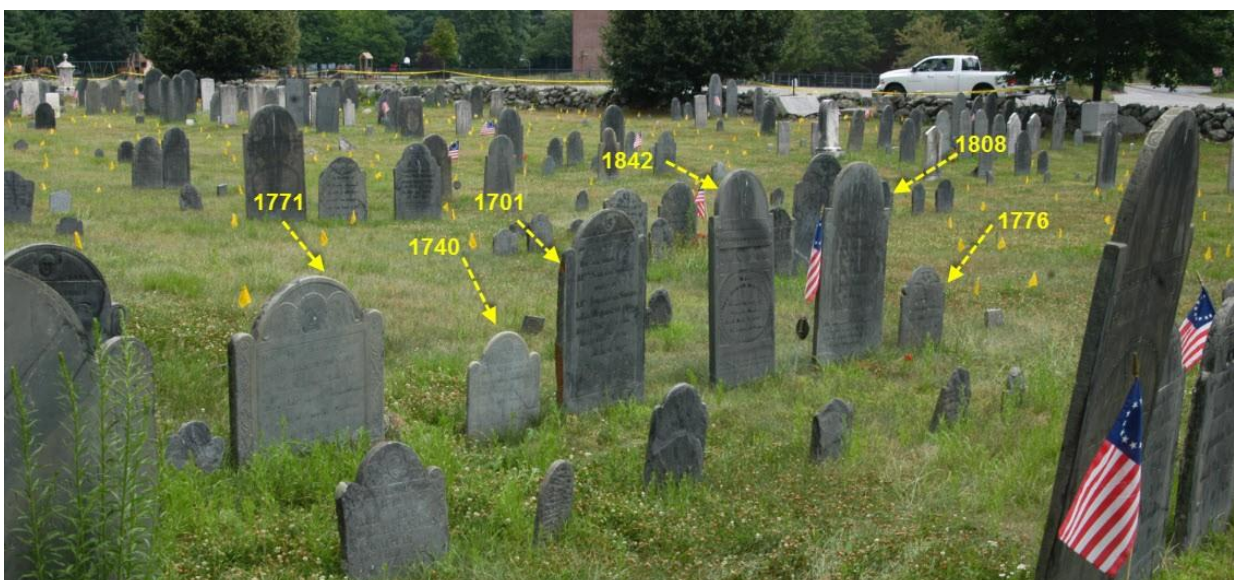
Graves (Coffin)
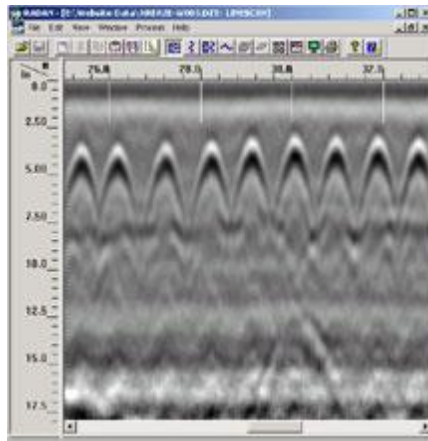
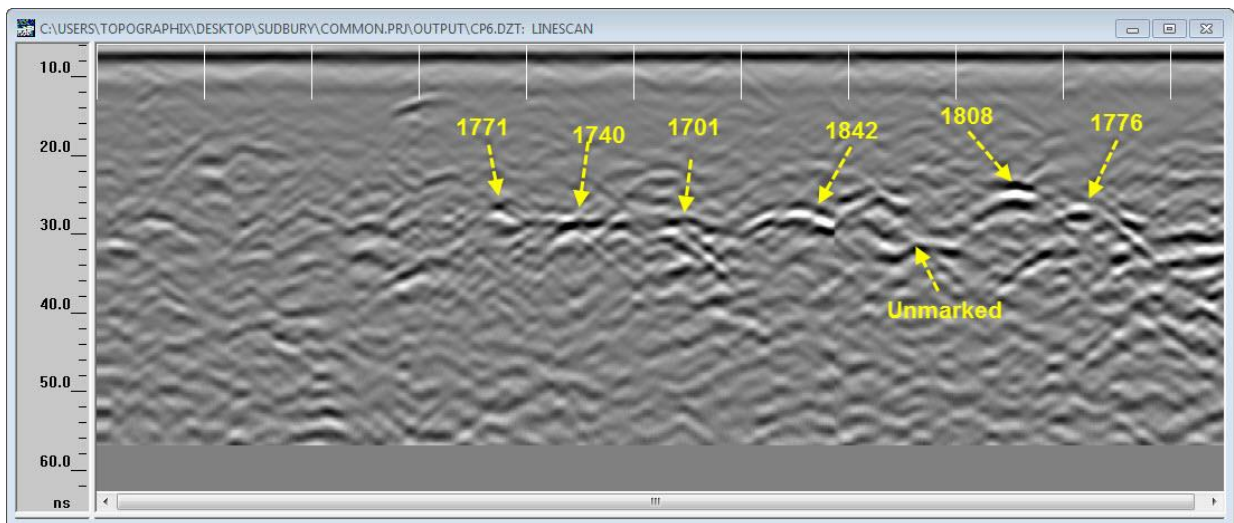*Rebar*
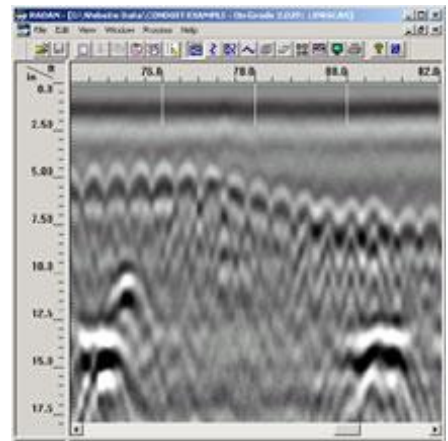
Conduits

Burial Vaults

Graves Early 1800s

The two pictures you see below show six dated headstones from a Revolutionary - Pre-Civil War Era. Picture 1 shows dated headstones, and Picture 2 shows a GPR profile of the same six burials as they appear on ground radar.

Picture 1: Site Picture of Six Dated Headstones (Revolutionary Burial Ground)

Picture 2: Six Dated Graves from the 1700s to early 1800s (Revolutionary Burial Grounds)

Regards,

Robert W. Perry