

December 13, 2018

Dennis Pickeral  
Executive Director  
Stenton  
4601 N 18th Street  
Philadelphia, PA 19144

**Re: Logan Family Cemetery and Dinah Memorial GPR Survey**

Dear Mr. Pickeral:

The following letter report documents the methods and findings of a ground-penetrating radar (GPR) survey of Stenton Park in the vicinity of the 19<sup>th</sup>-century Logan family cemetery (Grids 2-3 in Figure 1) and the approximate location of the former memorial to Dinah (Grid 1), who had been enslaved and later worked under the Logans as a paid servant. These two locations are currently outside of the bounds of the National Historic Landmark of Stenton, the Georgian-style country house built by James Logan ca. 1730, but were part of the home's historic grounds. Today these two locations are within Stenton Park, which is administered by Philadelphia Parks & Recreation (Figure 2).

AECOM conducted the survey in order to determine whether the concrete pad poured atop the location of the Logan cemetery extends to the full bounds of the cemetery. As an additional research question, Stenton requested AECOM look in the former location of the memorial to Dinah to detect the signatures of potential graves.

**Background**

Prior to the field survey, the staff at Stenton kindly provided some of their background research and thoughts regarding the Logan cemetery and Dinah's memorial. This information was communicated via phone calls and emails in September and October of 2018. This information was particularly helpful as the Dinah memorial is no longer extant and the Logan family cemetery is now covered with a concrete slab.

The memorial to Dinah once stood near the present-day Stenton Park recreation center. The memorial was not placed immediately after Dinah's death ca. 1803, but was installed a century later. While there is no documentation to confirm that this memorial marked her exact burial location, Stenton's research indicates that she and potentially others could be buried in this area. The silhouette of the memorial appears in a 1930s aerial photograph of the property (Figure 3). The memorial was removed prior to fieldwork and so could not be mapped during this survey. This area is currently undergoing renovations to the recreation center and its surroundings, including the installation of new sidewalks, utilities, and a playground (Figure 4).

Per Stenton's research, the earliest documented burial in the Logan family cemetery was that of George Logan in 1821, with substantial stone walls constructed around the cemetery at some point in the 19<sup>th</sup> century. A 19<sup>th</sup>-century photograph (Figure 5) suggests there were approximately 10-20 marked graves within the cemetery. The photo also shows a small stone building identified in historic documents as "the crypt," presumably a location for storing bodies in the winter months prior to spring burial. There is also the potential that this building may have served as a spring or ice house prior to the installation of the cemetery.

By the 1930s, the cemetery had been reduced in size, covering the northern half of its former extent (Figure 3). The southeastern wall of the cemetery was moved to reflect this new boundary and a remnant portion of this wall exists to the present (Figure 6). At some point in the 20<sup>th</sup> century, the cemetery wall and any remaining grave markers were presumably removed and the site was covered in a concrete pad for preservation purposes. A small marker, flush with

the ground surface and listing only seven names, appears in the center of the pad. The concrete has weathered somewhat since its installation. The southern half of the former cemetery is currently covered by grassy vegetation similar to the rest of Stenton Park (Figure 7).

## Methodology

On October 7, 2018, AECOM surveyed two (2) areas within Stenton Park. The survey and analysis of the GPR data was conducted by Meagan Ratini and Elisabeth LaVigne of AECOM. This survey was undertaken using a GSSI Utilityscan Integrated System with a digital 350 HyperStacking antenna and Panasonic Toughpad collector. This antenna has a depth range of 0-40 feet, depending on the nature of the soils, and is typically the best antenna choice for archaeological survey when subsurface conditions are unknown. The 350HS antenna and Panasonic Toughpad data collector are mounted on a Utility Cart and utilize odometer-triggered collection of data. The measured collection of data allows for the creation of grid-based 3D renderings of the data as well as the accurate re-location of subsequently identified anomalies. The locations of grid points and any obstacles, utilities, site features, or anything else of note were collected using a sub-meter Arrow GPS handset.

In order to maintain spatial control over the geophysical survey, three (3) geophysical grids were established across the two (2) survey areas (Figure 1). Grid 1 was placed in the vicinity of the former memorial to Dinah and measured approximately 10.5 meters by 9 meters (34.4 feet by 29.5 feet). The other two grids were placed over two portions of the Logan family cemetery. Grid 2 was placed to give full coverage to the concrete pad as well as some surrounding area to the north, west, and east, and measured approximately 13 meters by 29 meters (42.7 feet by 95.1 feet). Grid 3 was placed in the probable location of the southern half of the cemetery grounds and measured approximately 9 meters by 15 meters (29.5 feet by 49.2 feet). Grids 2 and 3 were placed 2 meters (6.6 feet) apart in order to avoid the extant portion of cemetery wall, the slope between the concrete pad and surrounding ground surface, rubble, and what appeared to be a large animal burrow. All grids were surveyed unilaterally in transects 25 centimeters apart in a direction which was most likely to cross graves perpendicularly.

Anomalies were identified post-fieldwork by examining the GPR data within RADAN 7 software. Identification was made utilizing 2D profiles of the data, as well as 3D renderings of each grid, allowing “slices” at different depths to be viewed. Anomalies are identified by the geophysicist as patterns in the data that do not appear natural, such as linear, circular, and rectangular features, and are often characterized by strong reflections of radar energy. The signatures of human burials tend to be subtle reflections and other contextual clues such as surrounding stratigraphy may be necessary for a more confident interpretation of the radar data. Anomalies can be caused by features related to human activity (termed anthropogenic), but they can also be caused by natural occurrences. Only ground-truthing an anomaly can conclusively verify the geophysicist’s interpretation of what is causing the anomaly.

## Grid 1 Results

Extensive ground surface changes have occurred in the vicinity of Grid 1 during the 20<sup>th</sup> and 21<sup>st</sup> centuries, including most recently a new recreation center, sidewalk courses, utilities, and hardscaping (Figure 4). These changes present challenges for geophysical equipment, which functions best on level ground with consistent surface materials. Within Grid 1, several ground surfaces were encountered including a robust sidewalk, graded gravel, and ungraded construction fill. This necessitated processing the data in several stages in order to properly see through each type of surface.

Radar signals were found to penetrate approximately 2.25- 2.5 meters (7.3-8.2 feet) below the ground surface (see Figure 8). No anomalies were found which could conclusively be identified as burials. Given the age and potential for degradation of any potential burials in this vicinity, as well as the high possibility of modern disturbance, this is not altogether surprising and does not wholly exclude the possibility of highly degraded burials in this area. One circular anomaly found under the sidewalk (Figure 9) may be anthropogenic in nature, but considering its shallow depth and highly disturbed location is unlikely to be historic. Alternatively, it may be a natural ground disturbance caused by vegetation.

## Grids 2-3 Results

Grids 2-3 had radar penetration to approximately 2.5-3 meters (8.2-9.8 feet) below the ground surface in different parts of the survey area (see ground conditions in Figure 6 and Figure 7). By looking at the data within RADAN timeslices, it was readily apparent that evidence of the cemetery is intact below and extending beyond the modern concrete pad (Figure 10). Anomalies typified by strong reflections of radar energy were identified as walls, possible grave stones, and the possible "crypt." What is unusual is that these features appear to be capped by approximately 1.0-2.0 meters (3.3-6.6 feet) of fill covering the historic ground surface throughout the cemetery, suggesting that much of the cemetery is still *in situ*. The largest features of the historic cemetery visible in the GPR data are traces of all four walls of the original nineteenth-century cemetery layout, including a visible break for the cemetery entrance (Figure 11). The wall itself seems to be most intact in Grid 2, appearing approximately at 0.25 meters (0.8 feet) below the modern ground surface in Grid 2 and possibly extending at least 2 meters (6.6 feet) deep (Figure 12). In Grid 3, which was the portion of the cemetery that had been eliminated by the 1930s, the wall begins approximately 1 meter (3.3 feet) below the ground surface and extends to approximately 2 meters (6.6 feet).

Two large, potentially anthropogenic features appear in the GPR data for Grids 2-3 (Figure 11). Directly adjacent to the northeastern wall of the cemetery, a circular anomaly approximately 2.4 meters (7.9 feet) in diameter is visible at approximately 0.5 meters (1.6 feet) deep and extends to an unclear depth. The fill above the anomaly appears to be a different material and it may have slumped in the center (Figure 13). Nothing comparable appears in any known historic photographs or maps, and its nature is unknown. The second large potentially anthropogenic feature appears in a portion of Grid 3 and likely extends through some part of the gap in data between the grids (Figure 14). This approximately 2-meter- (6.6-foot) wide anomaly is first visible at approximately 1.5 meters (4.9 feet) below the modern ground surface. This anomaly appears in the rough location of the crypt in relation to the cemetery walls shown in the 19<sup>th</sup>-century photograph of the cemetery (see Figure 5).

The survey was also able to detect a potential historic ground surface at approximately 1-1.5 meters (3.3-4.9 feet) deep in Grid 2. Approximately 10-20 high energy reflections which may be stone grave markers are visible about 0.5 meters (1.6 feet) above this surface on various profiles (Figure 15 and Figure 16). These reflections could be caused by stone inclusions in the fill itself, but based on spacing and the relation to the ground surface, it seems plausible that these are upright markers still in place.

Within the cemetery walls in Grid 2, it is possible to detect potential evidence graves such as shaft cuts and reflections that could be indicative of coffin lids or shaft bases starting at approximately 1.75 meters (5.74 feet) to 2.5 meters (8.2 feet) below the current ground surface (Figure 17). Depth of fill prohibited a full count of graves, however there appear to be at least ten interments, suggesting that all burials within this cemetery remain intact. The fill over the entire cemetery means that the detection of burials deeper than approximately 1.5 meters (4.9 feet) below the historic ground surface may not be identified, as the stronger reflections of the coffin lid and burial itself would be below the detection depth. Due to the attenuation of radar signal with depth, more subtle grave signatures directly below the fill may also be unclear. Approximately 1 meter (3.3 feet) outside of the cemetery wall to the southwest, one anomaly was identified that has a signature of a potential burial, but if it is a grave, it extends outside the testing grid and would need ground-truthing in order to determine if it is in fact a burial. In Grid 3, the depth of fill appears too great to determine whether any potential burials exist in this area.

## Conclusions

The GPR survey in Grid 1 in the approximate location of the former memorial to Dinah was unable to detect any signatures indicative of burials, suggesting one of several possibilities: that any remains of Dinah and her family may have been disturbed at some point since their interment; that any existing burials are either too deep or too degraded below modern fill to be detected by this survey; or that Dinah and her family were buried in another locations, rather than where the memorial was erected.

The GPR data from Grids 2-3 (the Logan family cemetery) overall suggest a highly intact historic cemetery landscape buried beneath at least one fill episode. The portions of the cemetery wall covered by this survey suggest that three of

the four cemetery walls are mostly complete. The southwestern wall appears shorter in the radar profiles and the southeastern wall is barely visible, suggesting that they may historically have been robbed out in order to construct the smaller cemetery wall seen in the 1930s aerial photograph. Considering that no trace of the original southeastern wall or the crypt appear in that same photograph, this area was presumably covered by a layer of fill by that time. The later infilling episode at some point in the 20<sup>th</sup> century seems to have left at least some portions of the cemetery wall above ground, but covered the remainder of the cemetery in approximately 1.0-1.5 meters (3.3-4.9 feet) of fill. This fill episode may have also extended into Grid 2 in order to create a more level surface between the two halves of the cemetery.

During the infilling of the cemetery, it appears that at least 10-20 grave markers were possibly left *in situ*, implying that the burials they commemorate were also left in place. Analysis of radar profiles also detected at least ten anomalies that are interpreted as graves. These findings suggest that there are more burials in the Logan family cemetery than the seven names listed on the present-day marker (Figure 18). No clear indications of burials outside the cemetery walls were detected; however one anomaly was identified that could require further testing in order to determine whether it is a burial or not. It is important to note that the cemetery walls extended almost to the edges of the GPR grids in many places, so additional area may need to be more fully investigated to conclusively determine that there are no other burials outside of the nineteenth-century wall. The full extent of the easternmost corner of the historic cemetery walls was outside of the limits of Grid 3. The depth of fill in that location is unknown.

AECOM recommends that any ground disturbance in the areas of Grids 2-3 (surrounding the concrete pad and approximately 12 meters [40 feet] to its southeast) be avoided or overseen by an archaeological monitor in order to protect the buried historic features and surfaces related to the Logan family cemetery.

Thank you for allowing us to assist you with this project. Please feel free to contact me if you have any questions or require additional information.

Yours sincerely,



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**Appendix A**



**Figure 1 - Location of GPR grids on modern aerial map. (Note that this aerial predates sidewalk and recreation center reconstruction in the vicinity of Grid 1.)**



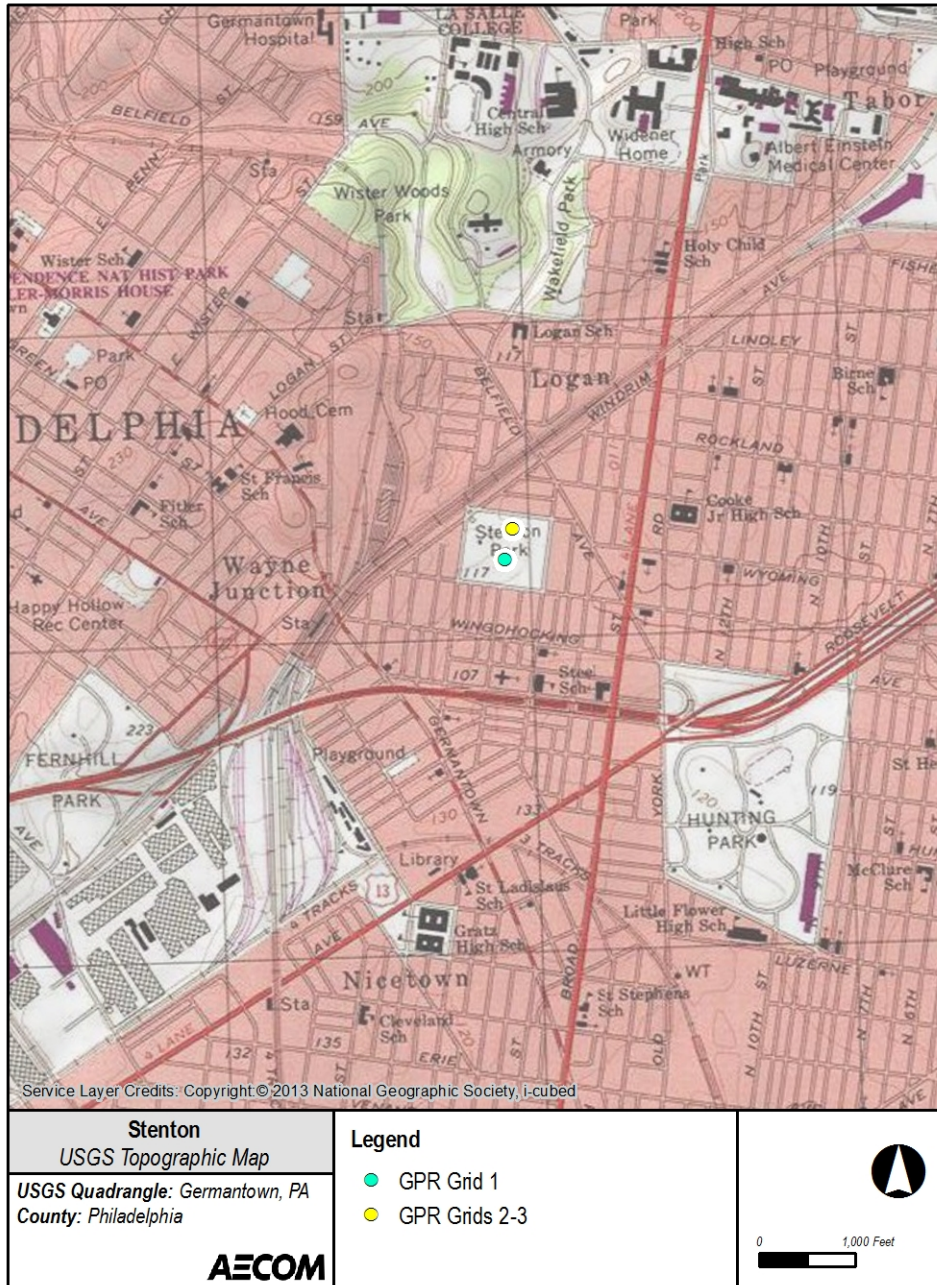


Figure 2 - Topographic map of project area



**Figure 3 - Aerial photograph of Stenton Park, ca. 1930, with annotations showing the location of the memorial to Dinah as well as the reduced cemetery size. (Image courtesy of Stenton)**



**Figure 4 - Current conditions of Grid 1, facing southwest**





**Figure 5 - 19th-century photograph of the Logan family cemetery, presumably facing northwest. (Photograph courtesy of Stenton)**



**Figure 6 - Current conditions of Grid 2, the likely northwestern half of the cemetery, facing west. Remnant wall is visible in the left of the image.**



**Figure 7 - Current conditions in Grid 3, the likely location of the southeastern half of the cemetery, facing north toward Grid 2 upslope.**





Figure 8 - Grid 1 GPR results. (Note that the aerial predates recreation center reconstruction and related landscape changes. The present-day sidewalk is outlined in orange.)

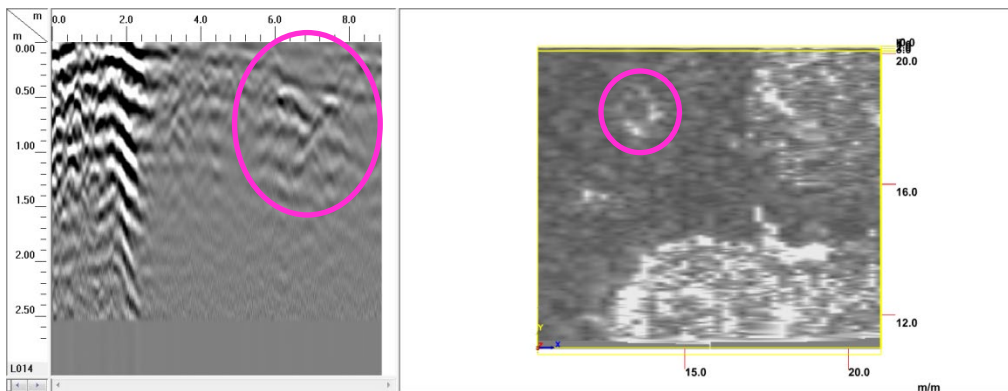


Figure 9 - Circular anomaly in Grid 1 circled in fuchsia in profile (left) and plan view (right).



**Figure 10 - Grids 2-3 GPR results, shown as semi-transparent to indicate relationship to modern landscape features, including the concrete pad and sidewalks.**

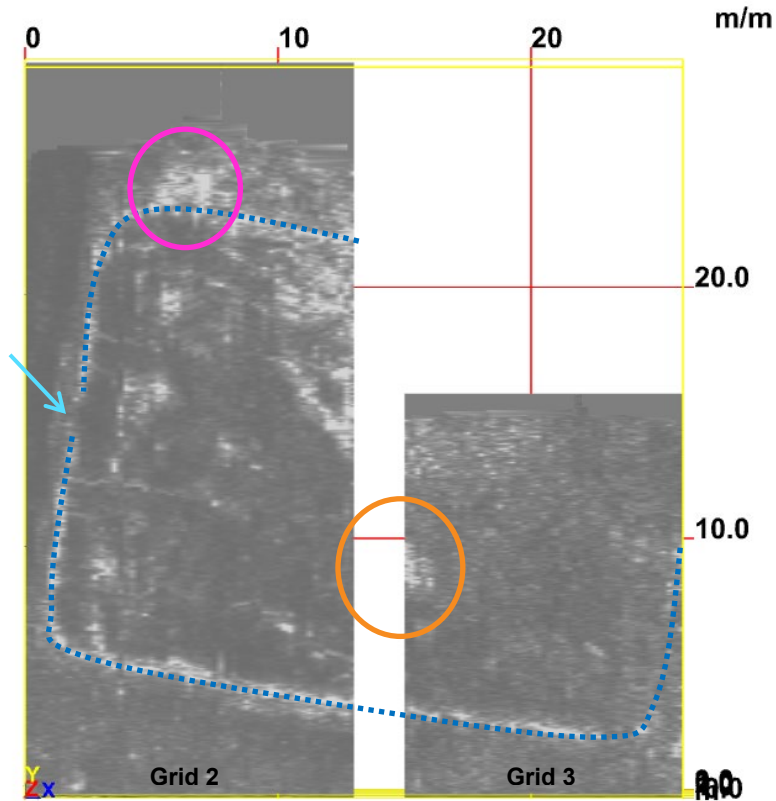


Figure 11 – Plan view of Grids 2-3 of data from approximately 90-235cmbs with features marked: the cemetery wall (blue dotted line), cemetery gate (light blue arrow), potential structural remains of the crypt (orange circle), and an unknown potentially anthropogenic feature (fuchsia circle). The other portions of the crypt are presumed to be in between the two grids.

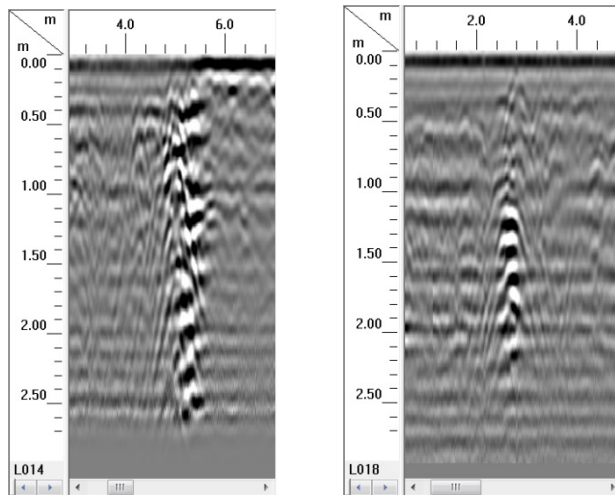
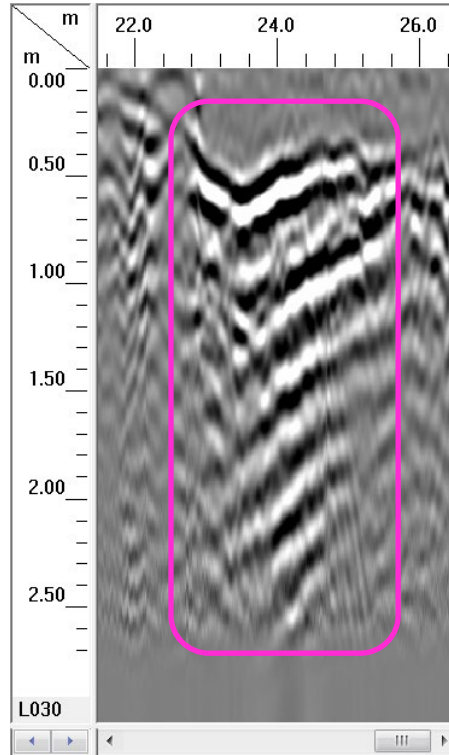
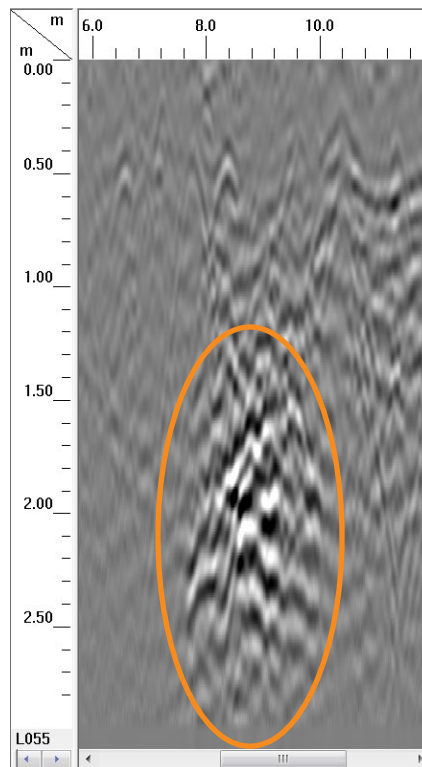


Figure 12 - Profiles of wall surrounding cemetery from Grid 2 (left) and Grid 3 (right)

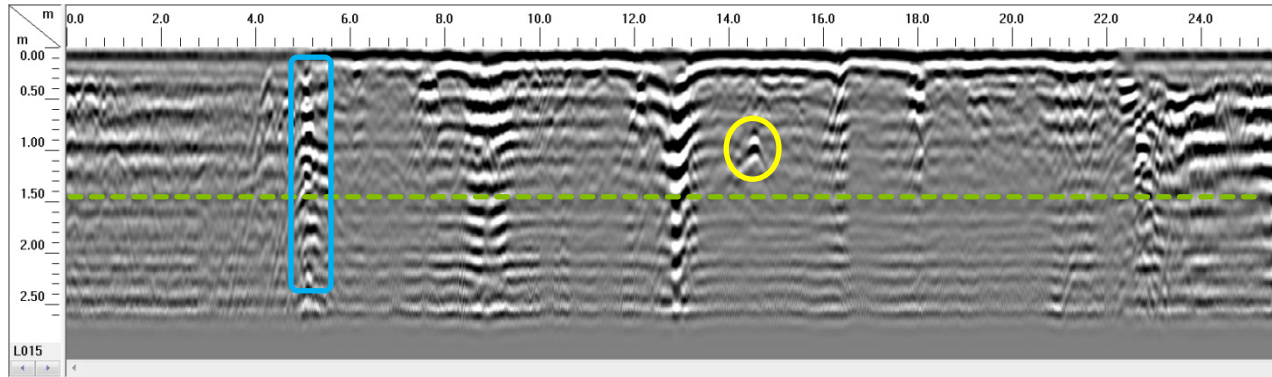




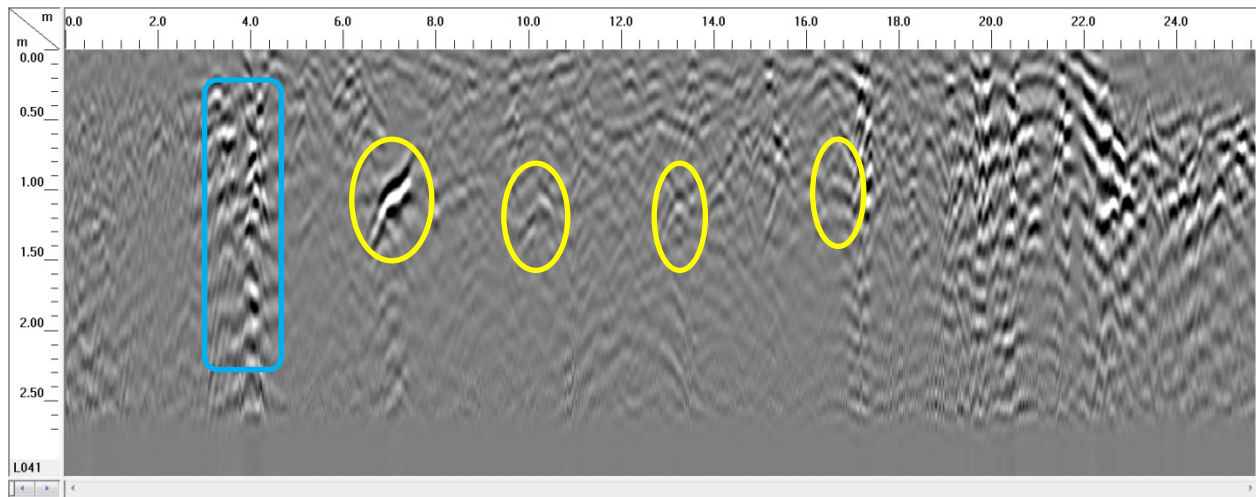
**Figure 13 - Profile of circular anomaly (roughly outlined in fuchsia) found in Grid 2 outside of cemetery wall**



**Figure 14 - Profile of potential crypt structure found in Grid 3, outlined in orange**



**Figure 15 - Profile from Grid 2 showing likely historic ground surface (green dotted line), and potential grave marker (yellow). The cemetery wall appears outlined in blue.**



**Figure 16 – Possible line of grave markers (circled in yellow) and cemetery wall (blue).**

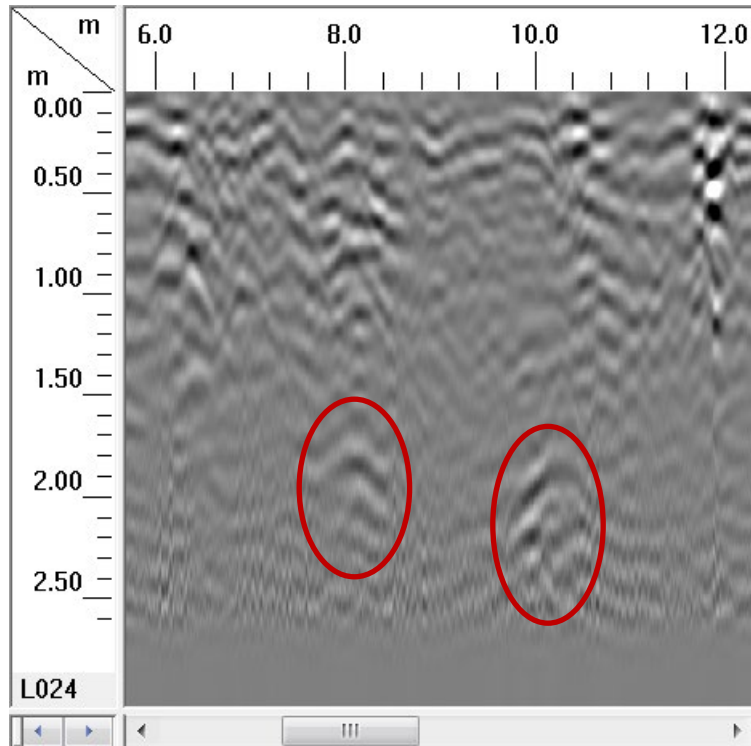


Figure 17 - Profile from Grid 2 showing potential graves circled in red.



Figure 18 - Memorial marker embedded in concrete pad