Ground Penetrating Radar Survey

at St. Luke's Church (046-0024/44IW0271)

Isle of Wight County, Virginia

March 2017

Prepared for:

Historic St. Luke's Restoration, Inc.

14477 Benn's Church Boulevard

Smithfield, VA 23430

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Contents

Introduction

This survey was conducted on behalf of Historic St. Luke's Church who is interested in understanding the landscape and below ground remains surrounding the historic church. The fieldwork portion of this survey took place on May 18th and 19th, 2016. Historic St. Luke's Church is located in Smithfield, Virginia. Fieldwork was conducted by archaeologist Clay Swindell and Dr. Malcolm LeCompte. Ground Penetrating Radar (GPR) data processing and report preparation was done by Clay Swindell.

The primary goal of this project was to follow up on previous archaeological investigations done by the James River Institute for Archaeology (JRIA). Excavations conducted by JRIA at St. Luke's Church in 2011 were done to assess a proposed drainage project around the exterior of the church. During the course of their excavations, 18 unmarked burials; six posthole features; 1950s restoration trenches; and several artifacts associated with the original construction of the building were recovered. Based on the results of these investigations, it was decided that more unmarked burials were likely associated with the structure. GPR offers a non-intrusive method towards identifying them.

St. Lukes Church is located in the community of Benns Church, near Smithfield in the Isle of Wight County, Virginia (figure 1).

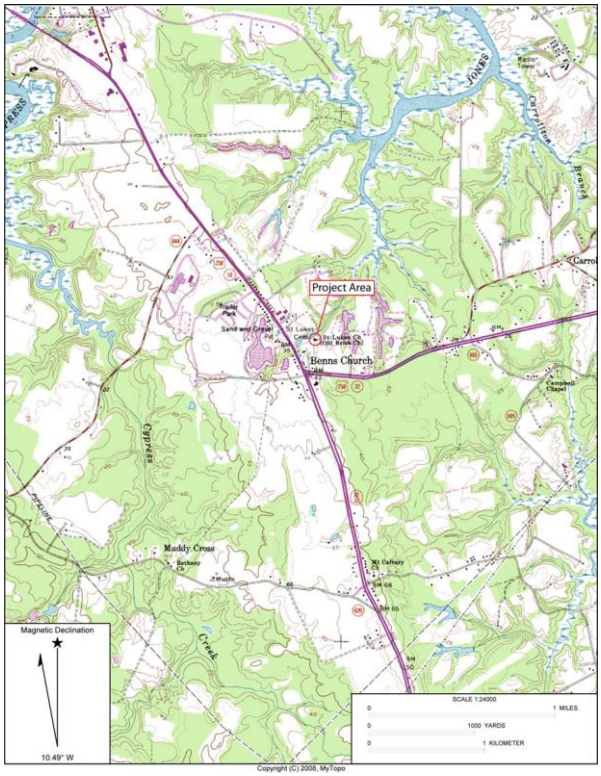

Figure 1: Location of St. Luke's Church on detail of U.S.G.S. 7.5' Benns Church

Figure 2: Orthomoasic Image of St. Luke's Church derived from U.A.V.

Historic Background

St. Luke's Church is one of Virginia's oldest standing churches. Likely constructed in the late 17th century, the church has been referred to as the "Old Brick Church" and the Newport Parish Church. Architecturally it is very handsome with its tower and Gothic detailing. It served as the principle church for the Isle of Wight's Newport Parish until the 1830s when it was replaced by Christ Church and abandoned until restoration began in 1890a (Laird and Smith, 2012). The church was added to the National Register of Historic Places in 1966 and the Virginia Landmarks Register in 1969. Today, Historic St. Luke's Church is maintained by a non-profit organization whose mission is to preserve, protect, and promote this historic church landmark and its collections, documents, history, graveyard, and surroundings.

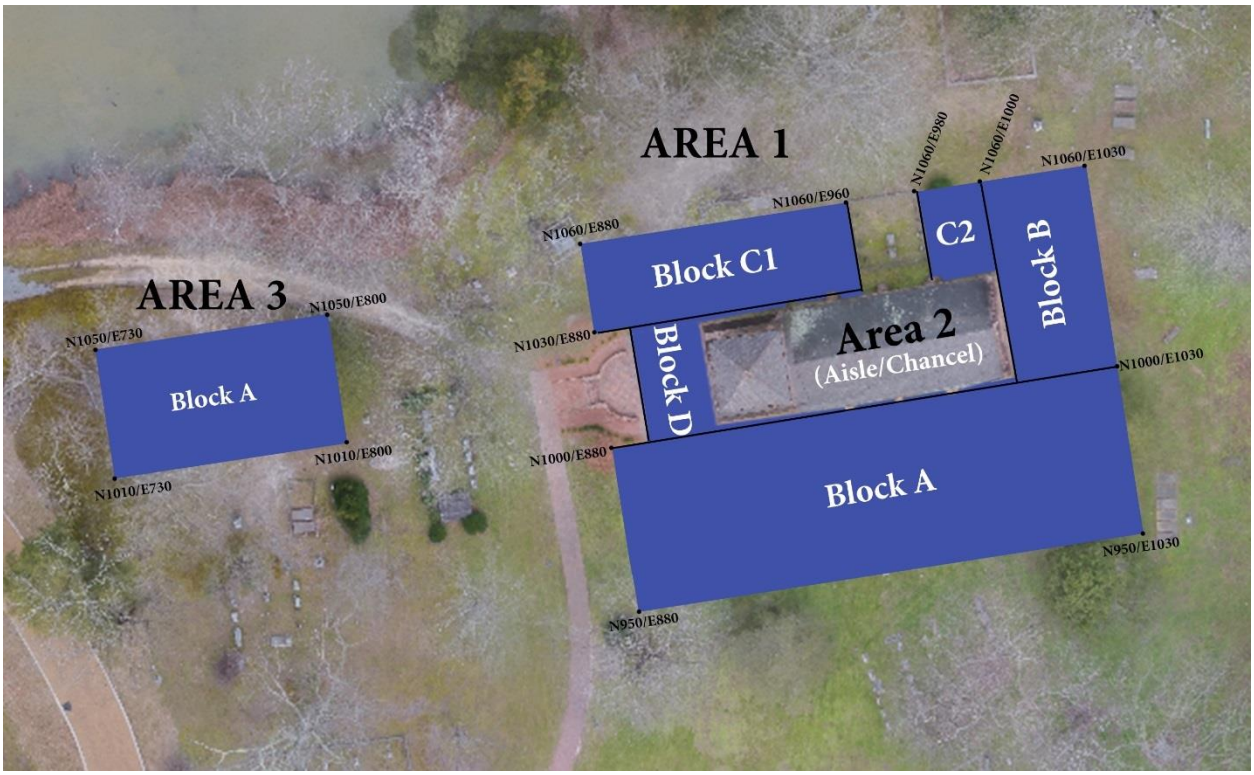

Figure 3: Figure showing location of project areas and blocks

Methodology

Field Methods

Prior to conducting the GPR survey, the James River Institute for Archaeology established a grid around the exterior of the church. This grid extends approximately 50ft out from the south and east exterior walls of the church structure and was continued west away from the church to include another area of interest.

The survey was divided into three areas (see figure 3). **Area 1** was located around the exterior of the church structure. Within this area 5 blocks (A, B, C1, C2, D) were surveyed to surround all sides of the church. Survey in this location was conducted to first determine any structural remains associated with the property and to locate any unmarked burials. **Area 2** was located inside the church and included scans in the Chancel as well as along the Aisle that divides the nave. Survey in the Chancel was conducted to determine the presence of any other graves besides the two marked. Likewise, the Aisle was surveyed to address the claim that there was an unmarked burial somewhere along its extent. **Area 3** was located 80 meters west of the historic structure. A single block was surveyed in this location with the intent of determining any unmarked graves or below ground structural remains.

Transects were oriented north/south to better identify the east/west oriented burials as well as to work between the existing head stones. Each transect within the blocks began at the north-west

corner offset east by 1.25ft or the distance from the gpr carriage tire to the center of the antenna. The one exception was along the isle where transects ran along an east/west axis.

GPR Equipment

The equipment used for this survey is the GSSI SIR 3000 data acquisition system with a 900 mhz antenna. While not ideal for relocating burials, the suggested 400 mhz antenna was unavailable. We feel the 900 mhz antenna combined with perpendicular transects to the typical burial orientation did well.

Data Processing

In order to prepare the raw radar data for analysis and presentation, it is necessary to apply several functions to correct for the many variables present during survey collection. This was achieved by using several functions available in RADAN 6.5 software. Described here are this project's data processing objectives and the methods used to meet them.

To meet the objective of removing system noise and other variables, three methods were applied to the dataset. The first was to apply vertical surface position adjustments. This provides for more accurate depth calculations because it sets the top of the scan to the ground surface. The second method was to apply a high-pass filter that serves the purpose of reducing frequency noise and the final method was to use Migration to remove diffractions where deeper objects can be obscured by shallow objects. Afterwards gain was increased to enhance any anomalies.

Because all data, except along the Aisle of the church were collected along the y-axis the coordinates shown in the radar returns do not correlate with the overall grid. This is because the software assumes that the lower left corner represents 0/0. As such, the overall dimensions are correct including spacing but the coordinates themselves are incorrect. When interpreting the results, the reader should refer to the overall block coordinates show in figure 3.

Analysis and Results

Area 1

Area 1 includes those locations surveyed immediately around the church exterior. This includes Block A, Block B, Block C1, Block C2 and Block D (see figure 3). Each block posed different obstacles and challenges during survey that effected results. These along with results are described in detail below.

Block A

Block A was located on the south side of the structure measuring 50ft (north/south) by 150ft (east/west). Radar returns for a total of 60 transects were gathered in this block spaced 2.5ft apart. Transect 1 began at the N1000/E880 coordinate of the JRIA grid and was oriented south. Data was then gathered in a zig-zag method where transect 2 was gathered heading north (see figure 4). This pattern continued through the extent of the block. As noted in the methodology section of this report, transects in this block were offset by 1.25ft east of beginning coordinate. This shifts the entire overall image by this measurement and should be considered when trying to relocate anomalies in the field

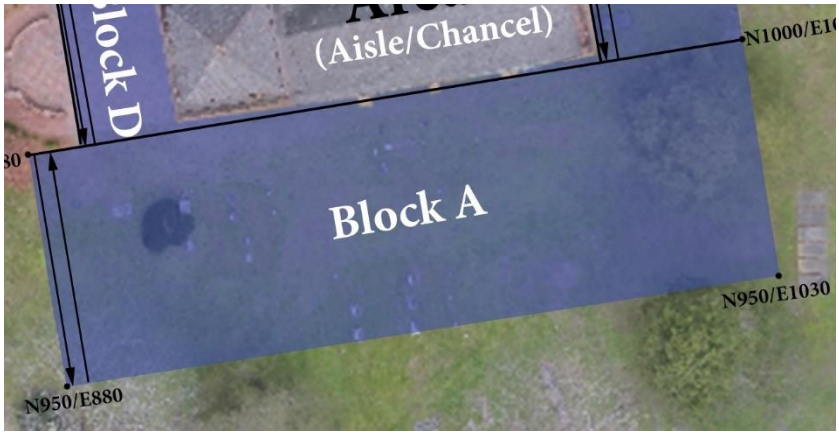

Figure 4: Block A showing transect directions (not to Scale). Note that transects are offset east by 1.25ft.

There were a few obstacles that necessitated the splitting of transects up to avoid them. This lead to gaps in the radar returns where some transects are truncated or missing sections. Major obstacles in included bushes and existing headstones. The architectural buttresses on the exterior of the church also posed a challenge. The GPR wheeled sled had to be pushed back as far as possible at the beginning of those transects heading south. All attempts were made to start and stop each transect along the same line but the buttresses sometimes made this impossible. This issue was mitigated during processing.

It was noticed during the survey that a few of the headstones were offset from where the actual burial shaft was located according to radar. This suggest that in some instances burial markers have been replaced or moved over the years.

From the results many identified and unidentified burial were identified. The red returns in the image are high returns from the radar and represent obvious burials. These may represent the presence of metal caskets. The light gray returns also appear to represent potential burial shafts whose identification has been lost to time. It is likely that these weaker signal returns represent the much older burials and in some instances it appears as though the more modern graves disturb older ones. Also note the presence of the JRIA trench just along the exterior of the building. It shows up as a long linear return in figures 5, 6 and 7. A set of images from this block at different depths shows large clustering of potential graves adjacent to the building itself. As you move

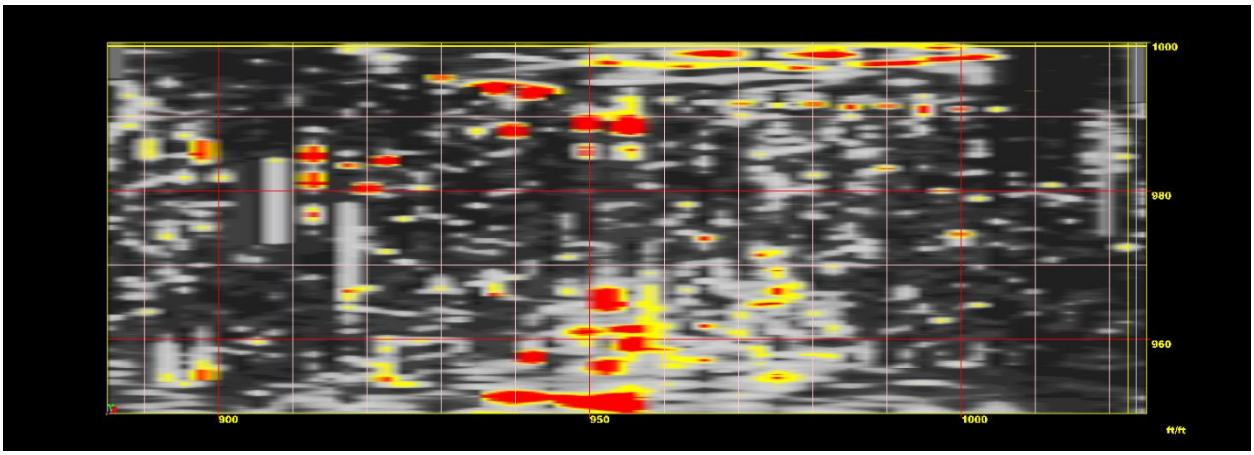

Figure 5: Block A radar returns at 1 ft below the surface

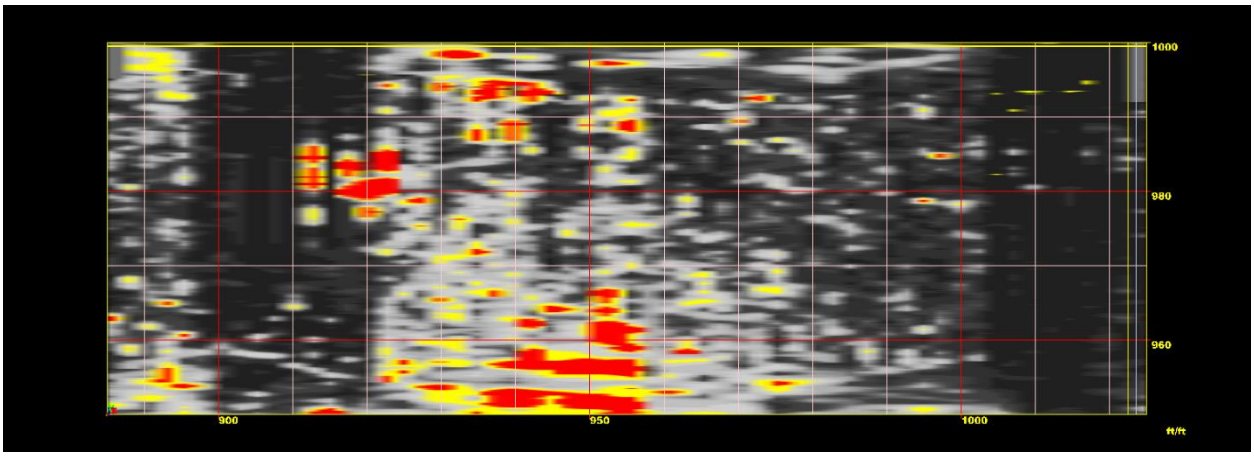

Figure 6: Block A radar returns at 2 ft below the surface

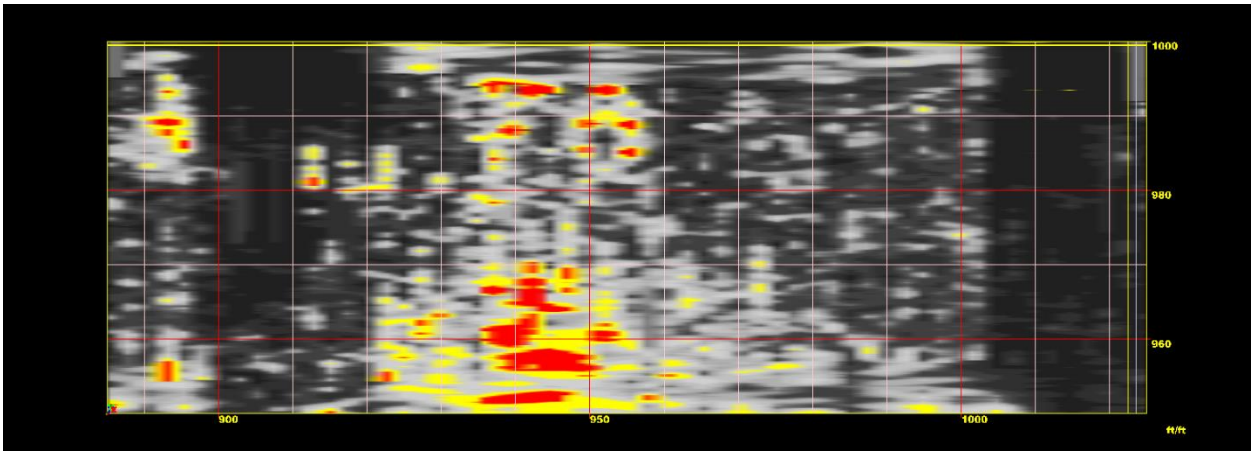

Figure 7: Block A radar returns at 3 ft below the surface

Block B

Block B was located on the east side or rear of the church. This block was 50ft x 30ft and had a total of 11 transects. There are marked burials capped with large stones just at the rear of the structure. In some cases these were avoided and in some cases the transect ran a top the grave itself. Several potential burials were encountered in this block though the density appears to be slightly less than it was on the south side of the structure. All anomalies appear to have an east/west orientation suggesting that these are also probable burials.

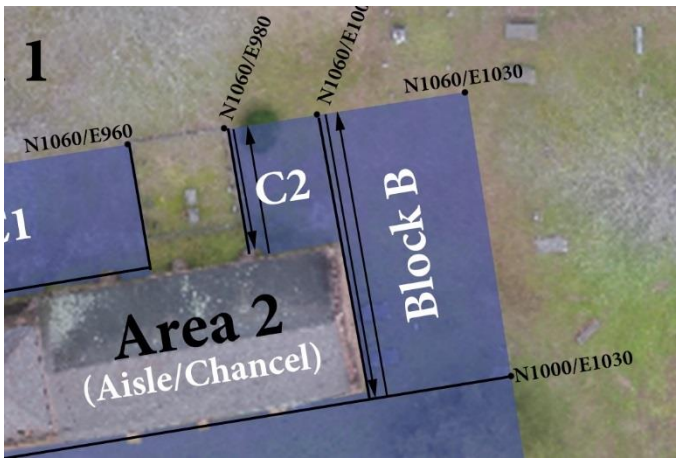

Figure 8: Block B showing transect directions (not to Scale). Note that transects are offset east by 1.25ft.

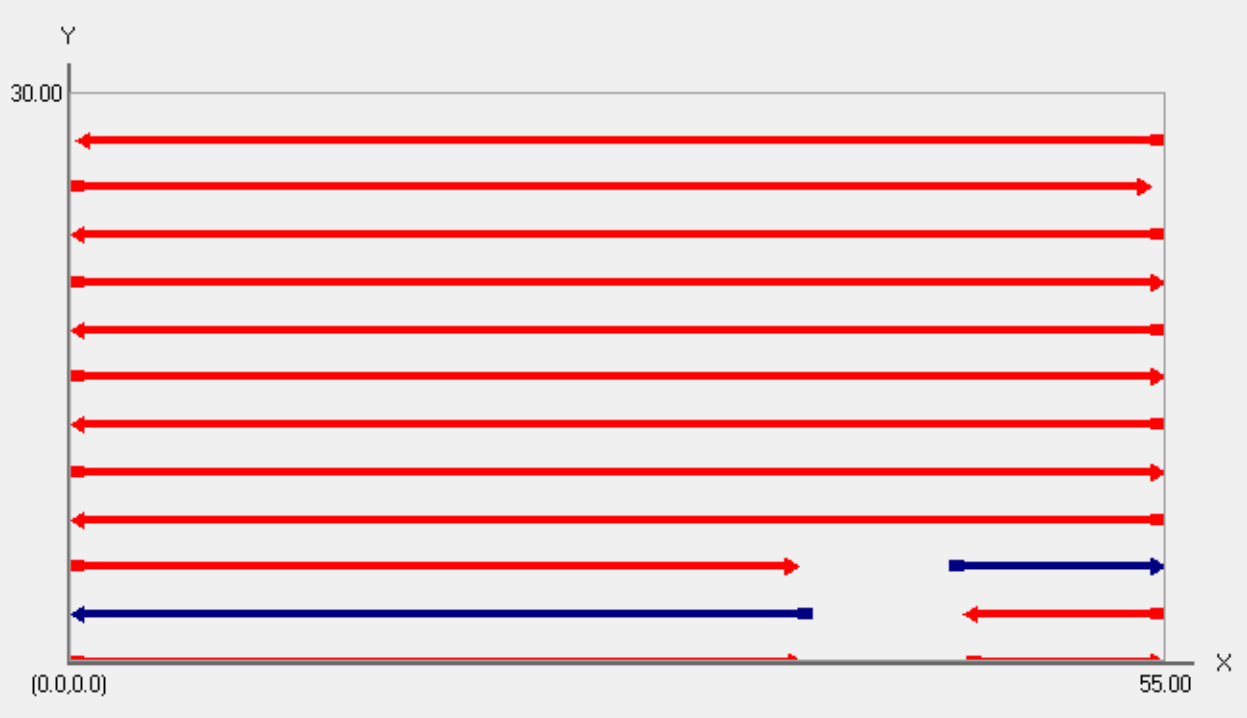

Figure 9: Block B Transects and Directions

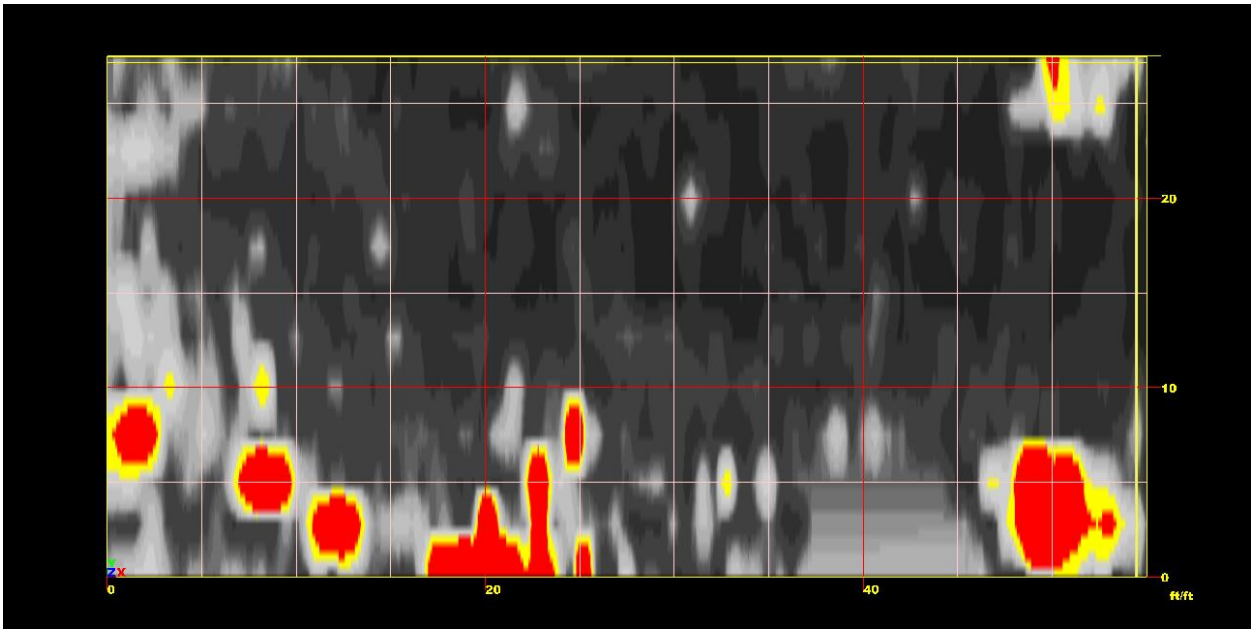

Figure 10: Block B Radar return at 1ft below surface

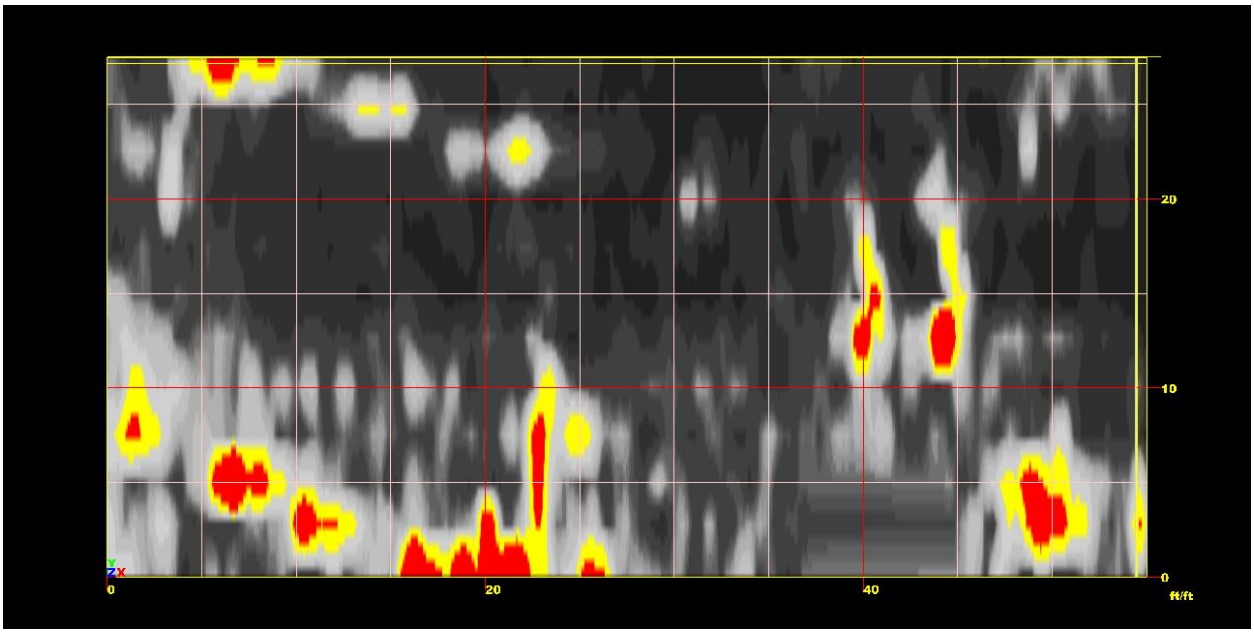

Figure 11: Block B Radar return at 2ft below surface

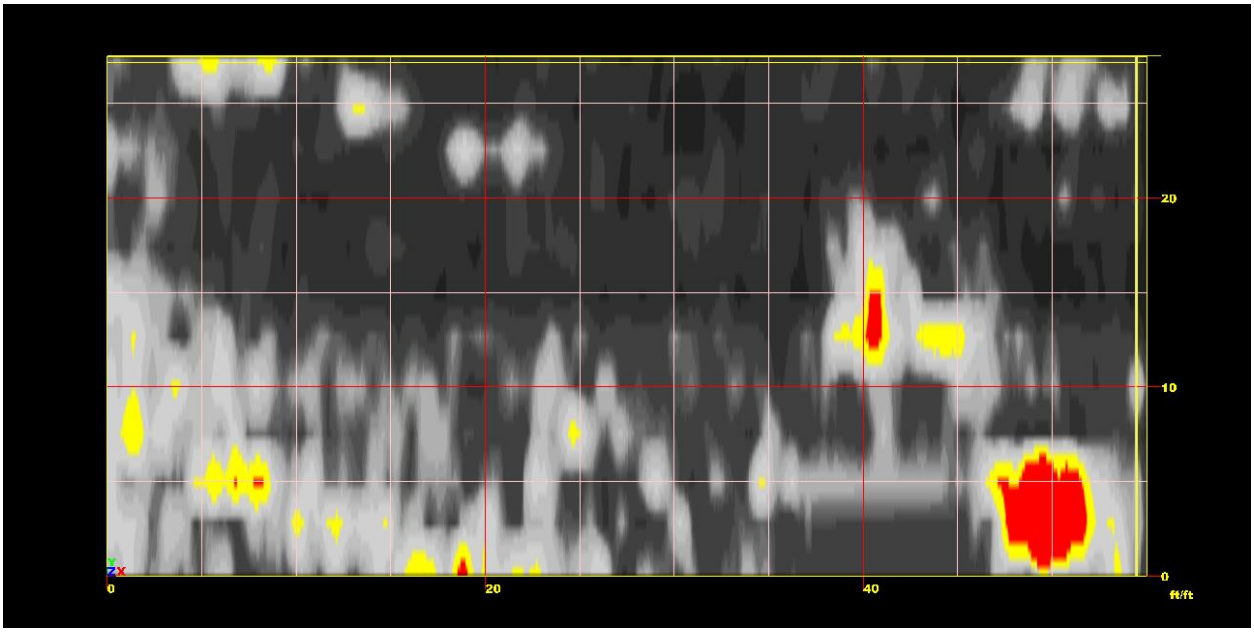

Figure 12: Block B Radar return at 3ft below surface

Block C1

Block C1 was located on the north side of the church. Due to the location of a large cluster of burials surrounded by a small stone perimeter this block was divided in two. The gap was not survey due to the inability to move GPR along transects. There were similar challenges in Block C1 with some transects having to be divided up or cut short (figure 14). There were a total of 32 transects in this location. As can be seen in figure 16, very distinctive returns are present at 2ft below the surface. Again, all are oriented along the east/west axis and it appears as though the density is very high like it was on the south side.

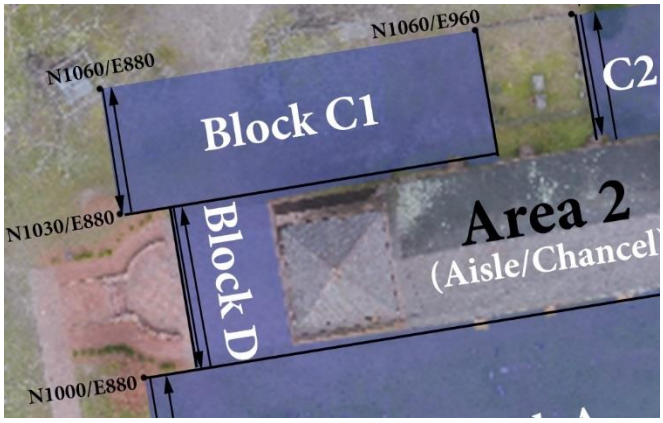

Figure 13: Survey Block C1 showing transect directions (not to Scale). Note that transects are offset east by 1.25ft.

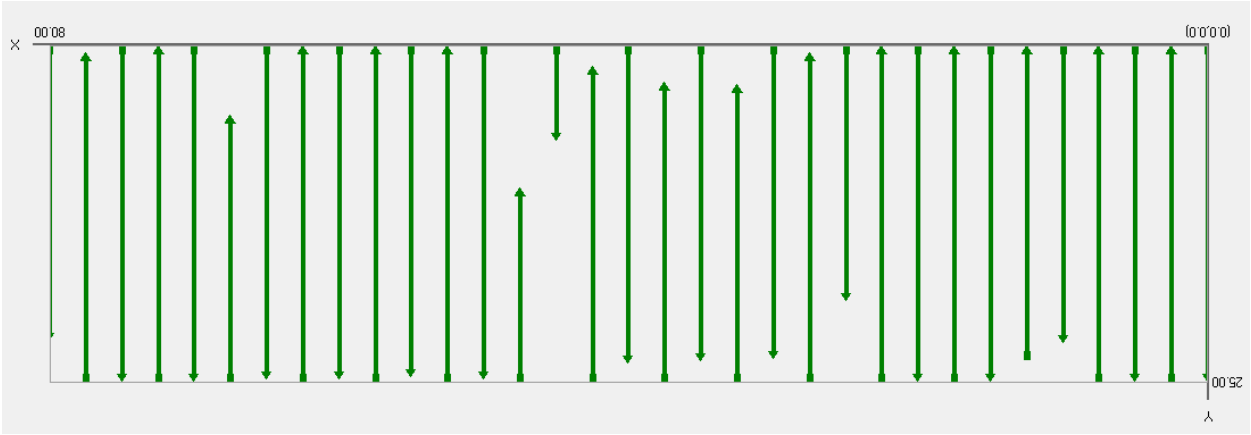

Figure 14: C1 Transect Directions (Note that breaks are due to obstacles.

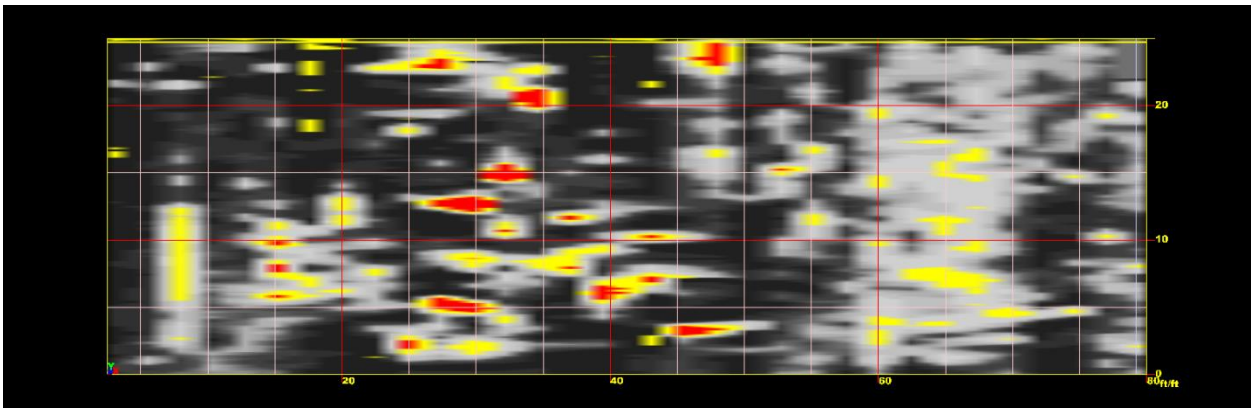

Figure 15: Block C1 Radar Returns at 1ft below Surface

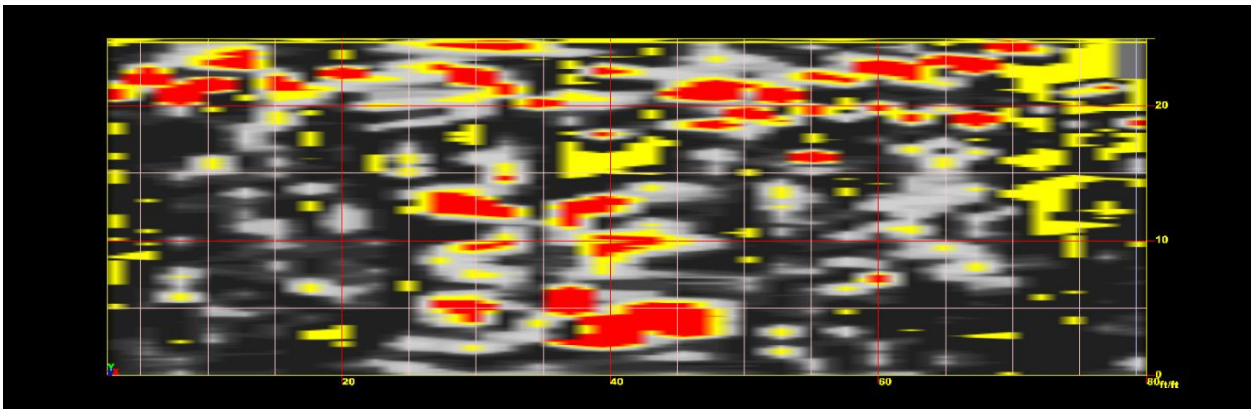

Figure 16: Block C1 Radar Returns at 2ft below Surface

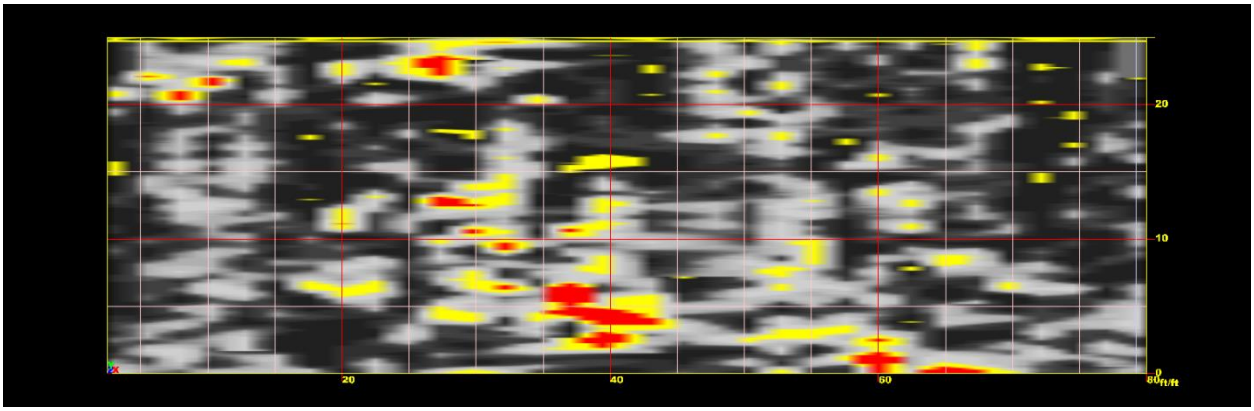

Figure 17:BLOCK C1 RADAR RETURNS AT 3FT BELOW SURFACE

Block C2

Block C2 is a continuation of C1. There were a total of 8 transects conducted in this location. As can be noted from the returns, burial density seems lower here than elsewhere. There are high returns out away from the structure though between 2-3ft below the surface a high return is noted up against the structure. Again, GPR anomalies appear to have the typical east/west axis orientation.

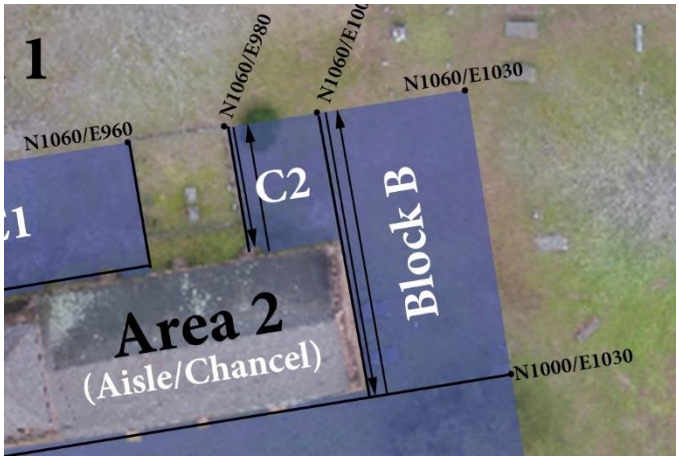

Figure 18: Survey Block C2 showing transect directions (not to Scale). Note that transects are offset east by 1.25ft.

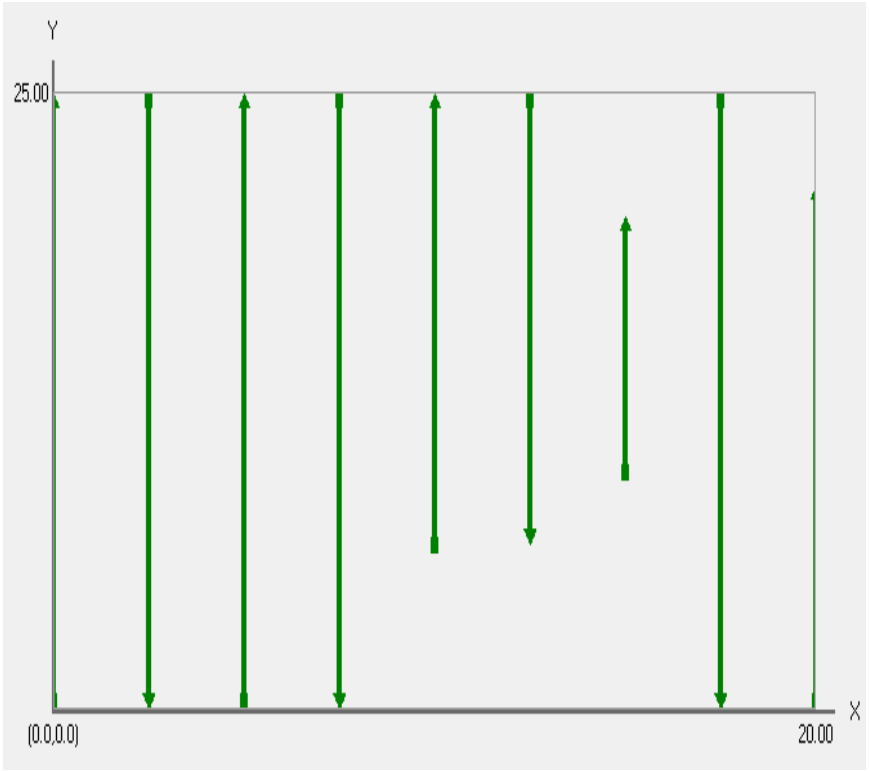

Figure 19: Block C2 Transects and Directions

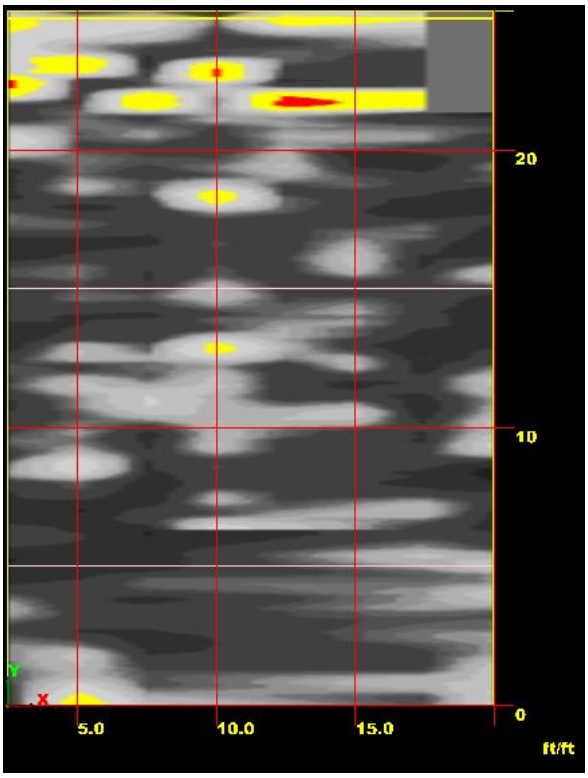

Figure 20: Block C2 Radar returns at 1ft Below Surface

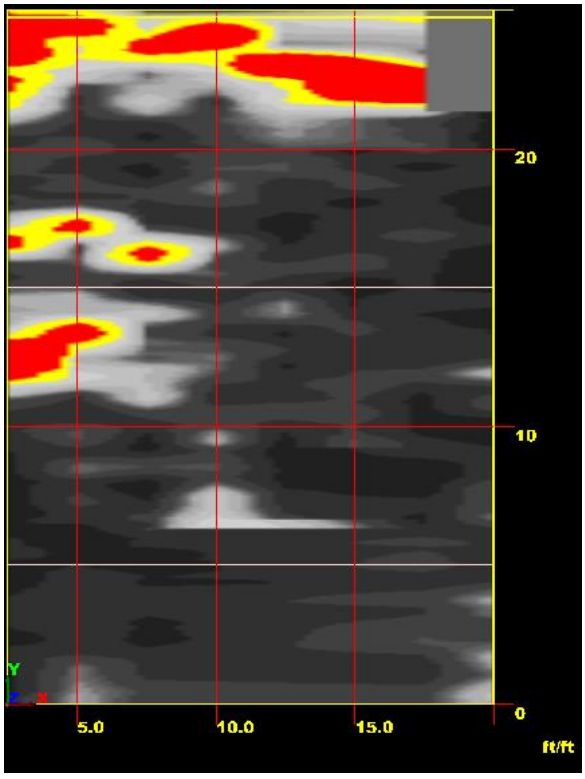

Figure 21: Block C2 Radar Returns at 2 Ft below Surface

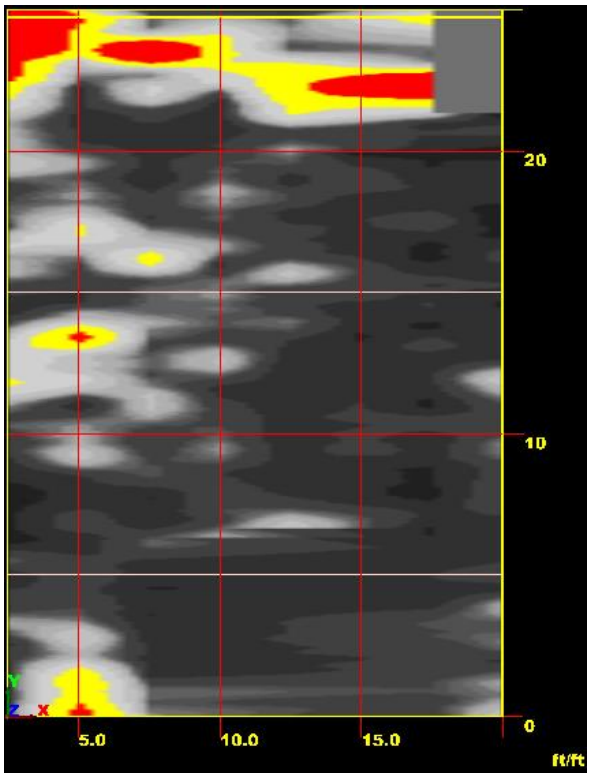

Figure 22: Block C2 Radar Returns at 3ft below surface

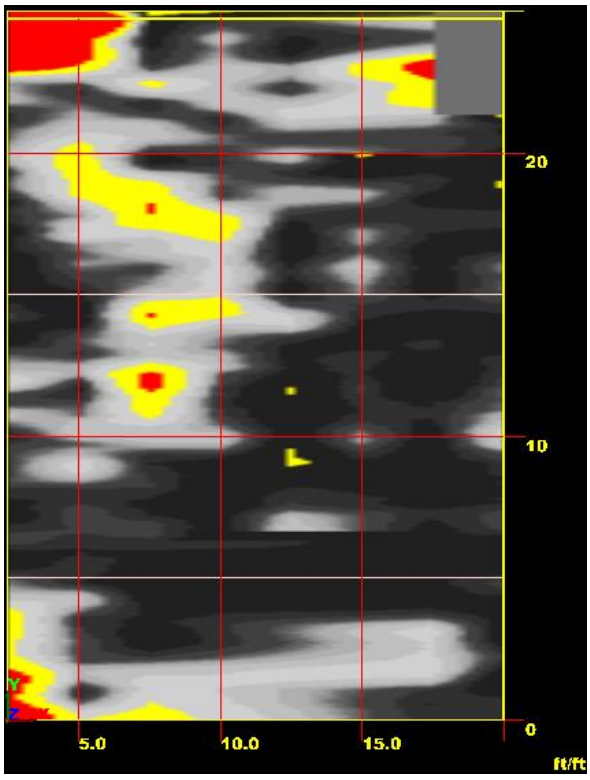

Figure 23: Block C2 Radar Returns at 4.5ft below surface

Block D

Block D represents the courtyard just in front of the entrance. With a total of 9 transects this block produced a few prominent anomalies noted throughout the images for different depths. It is possible some of these features represent burials though it should be noted that density is down. Given the position of the block at the entrance, it is likely this area was infrequently used in that capacity.

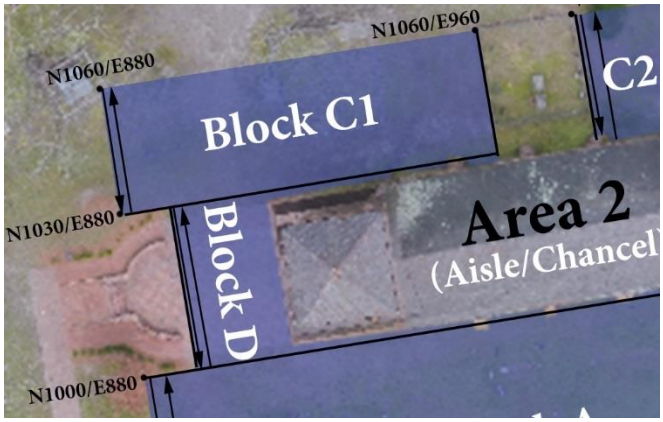

Figure 24: Location of Block D in relation to other blocks

Figure 25

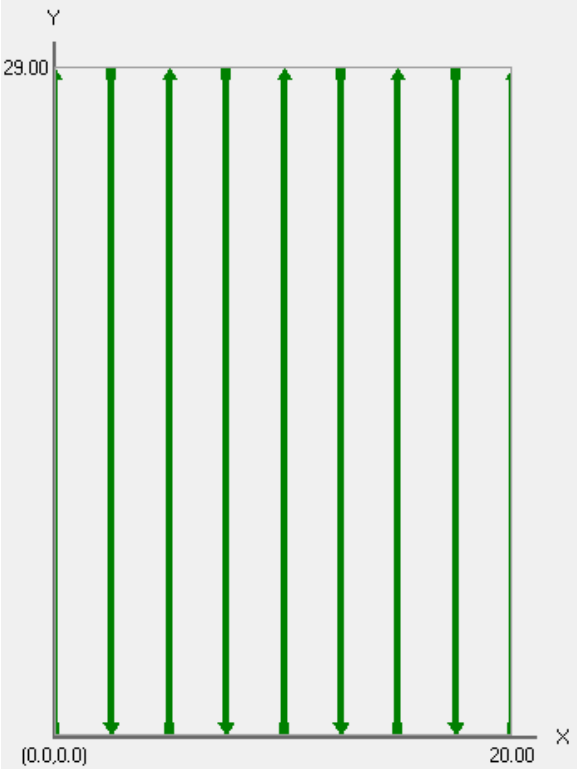

Figure 26: Block D Transect Directions

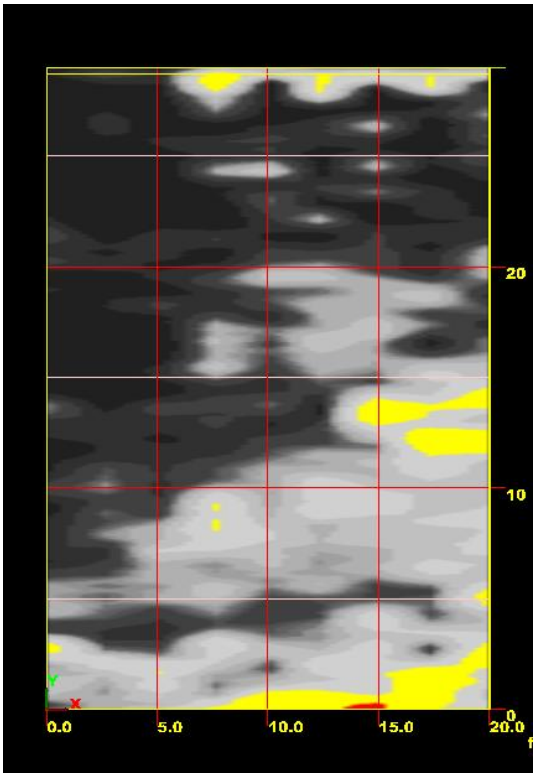

Figure 27: Block D (Courtyard) Data Returns at 1ft Below Surface

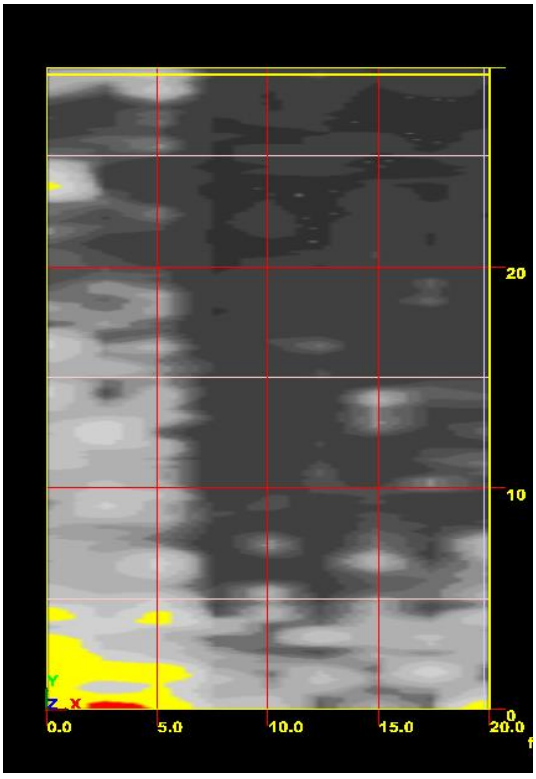

Figure 28: Block D (Courtyard) Data Returns at 2ft below Surface

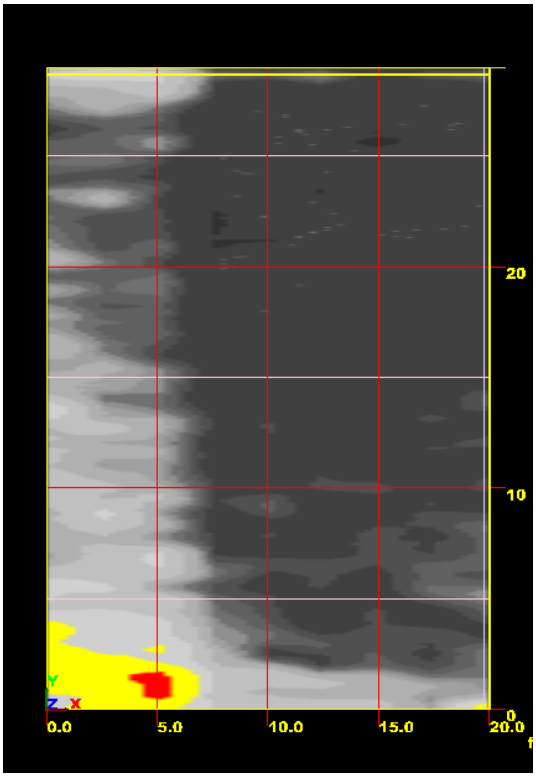

Figure 29: BLOCK D (COURTYARD) DATA RETURNS AT 3ft Below Surface

Area 2

Area to relates to the interior portions of the church. Within area two, there were to small surveys done in the chancel and along the nave aisle. There is no established grid within area two so it this area cannot be tied directly into the existing grid. The beginning of each transect was relative to an arbitrary starting line documented in the field

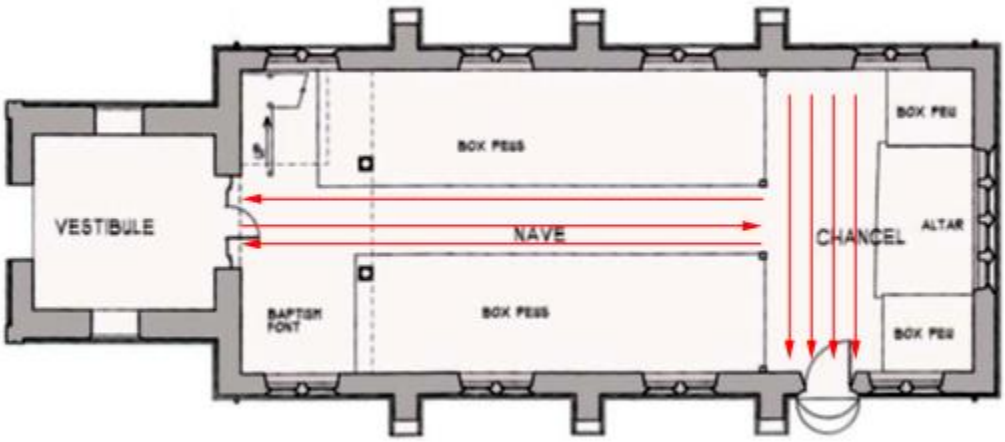

Figure 30: Area 2 or Church interior.

Chancel

The Chancel represents the space around the alter where the clergy and choir are located during service. The survey of this block was to explore the idea that more than two individuals were buried in the chancel. The most prominent of these is Colonel Joseph Bridger (d. 1686) who was removed from his plantation at Whitemarsh and reburied in the chancel at St. Lukes in the 1890s. His remains were analyzed during a 2007 joint project between the Smithsonian Institution and Archaeological and Cultural Solutions, Inc. The second grave Besides Bridger's located in the chancel. Both appear as very strong returns in the radar returns (figures 32, 32, 34). There is some suggestion that there is a third unmarked burial. Figures 33 and 34 show the presence of a small disturbance located in the north west portion of the chancel. This survey appears to have caught the edge of a feature oriented east/west that extends west towards the Nave. It appears as a much smaller return. The idea that this is an unmarked burial should be taken with caution. It is just as likely that this feature is associated with the renovation or perhaps relate to portions of the original fabric of the structure. It is recommended that a more detailed and larger survey of the chancel take place to test this hypothesis. Also noted in the returns is an anomaly associated with the side entrance.

Figure 31: Chancel Transects and Directions

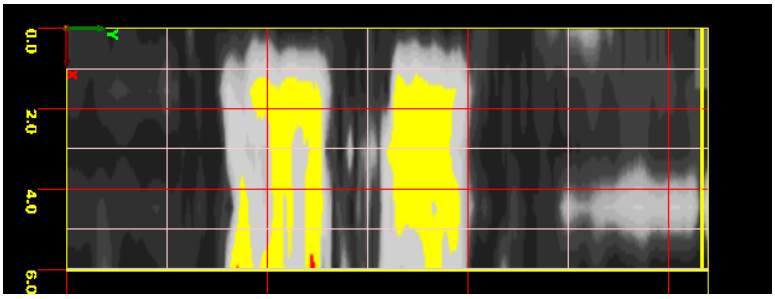

Figure 32: Chancel Radar returns at 1 ft below surface

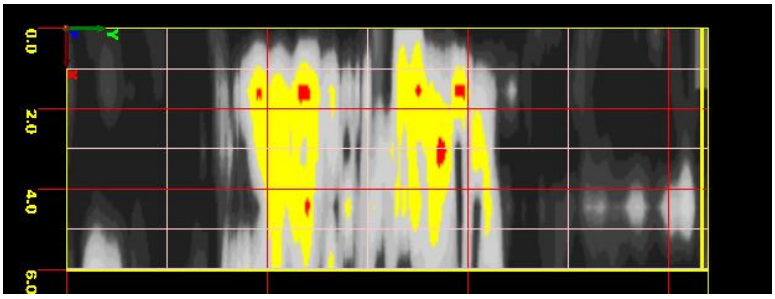

Figure 33:CHANCEL RADAR RETURNS AT 2 FT BELOW SURFACE

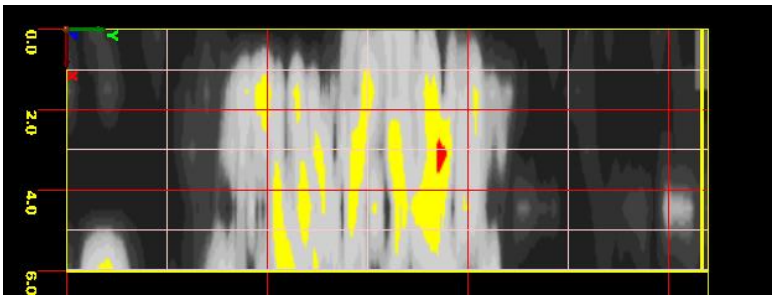

Figure 34:CHANCEL RADAR RETURNS AT 3 FT BELOW SURFACE

Aisle

Scans of the aisle were done to explore the idea that there were burials in this area. Survey transects for this block began at the location where the nave aisle transitions to the chancel. There was enough room for a total of three transects. As can be seen in figures 36, 37, and 38, there is a large anomaly that takes up the entire width of the aisle just before entering the chancel area. Figure 39 shows this feature in profile which appears to persist down below four feet. It is possible this relates to renovations or is associated with the original interior. The profile also seems to show underlying stratigraphy perhaps related to the original aisle or an earlier floor. It is tempting to suggest that the features in this block represent portions of the original construction or even another burial just at the entrance to the chancel. However, the changes to the interior over the centuries may be represented in what are just modern disturbances. More work, including ground truthing, is recommended to make any definitive statements.

Figure 35: Aisle Transect Directions

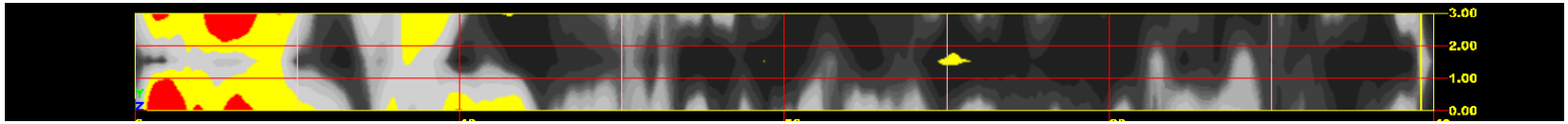

Figure 36: Aisle Radar Returns at 1ft below Surface

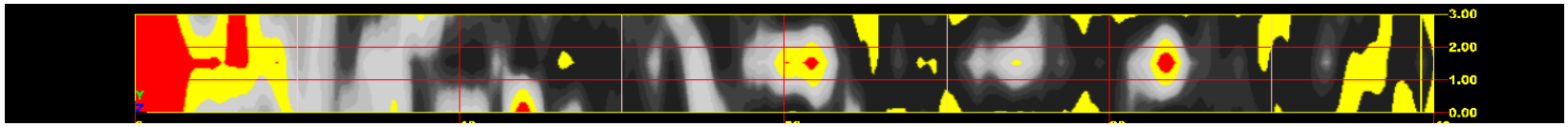

Figure 37:AISLE RADAR RETURNS AT 2FT BELOW SURFACE

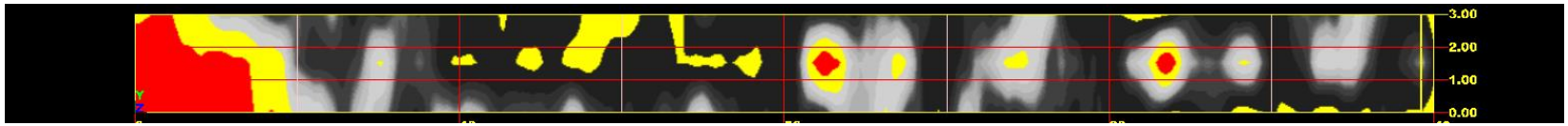

Figure 38:AISLE RADAR RETURNS AT 3FT BELOW SURFACE

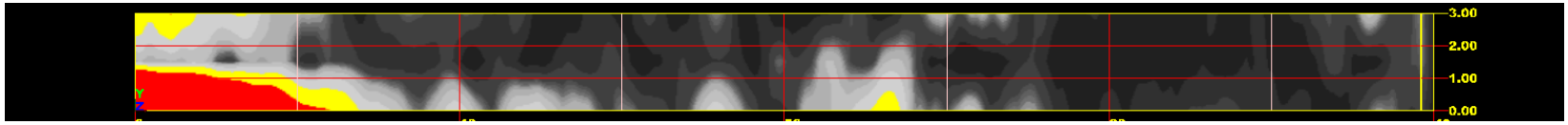

Figure 39:AISLE RADAR RETURNS AT 4FT BELOW SURFACE

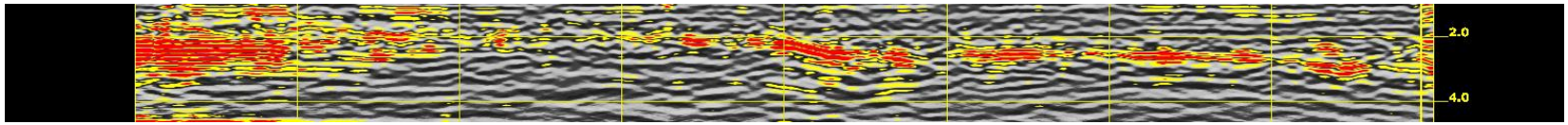

Figure 40: Aisle Center Transect Profile

Area 3

Area 3 was located 80 feet west of the historic structure. It was 70ft x 36ft and had a total of 28 transects. For the most part there were very few obstacles. A single block was surveyed in this location with the intent of determining any unmarked graves or below ground structural remains. As can be seen from the radar scans, there appear to be several features that may represent unmarked burials (figure 42, 43, 44). Several strong returns, noted by yellow and red, are a present

Block A

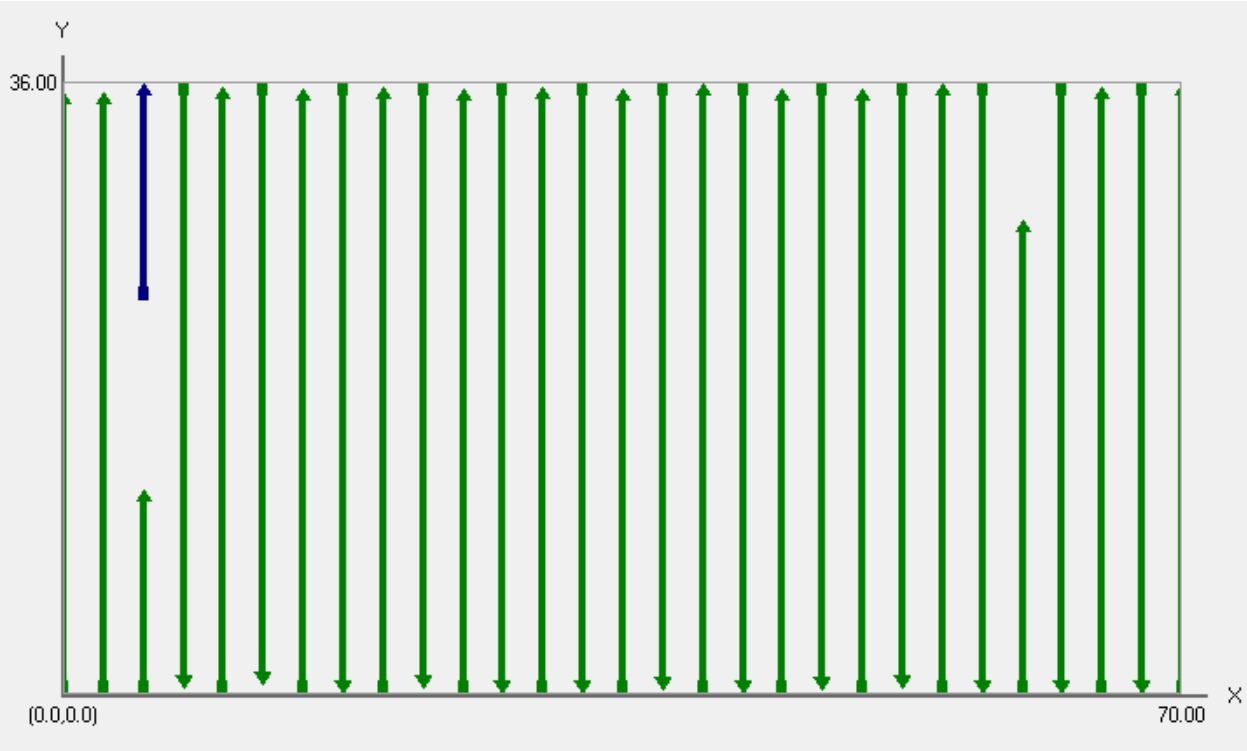

Figure 41: Block A Transect Directions

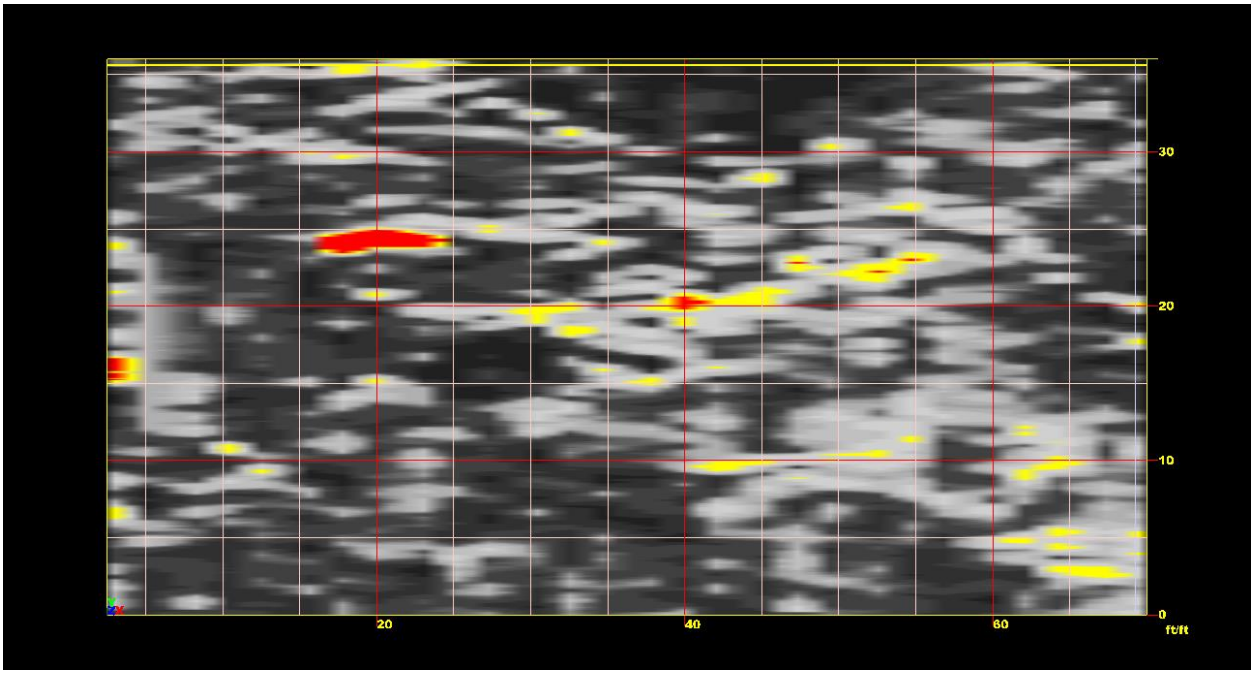

Figure 42: Block A Radar Returns 1ft below surface

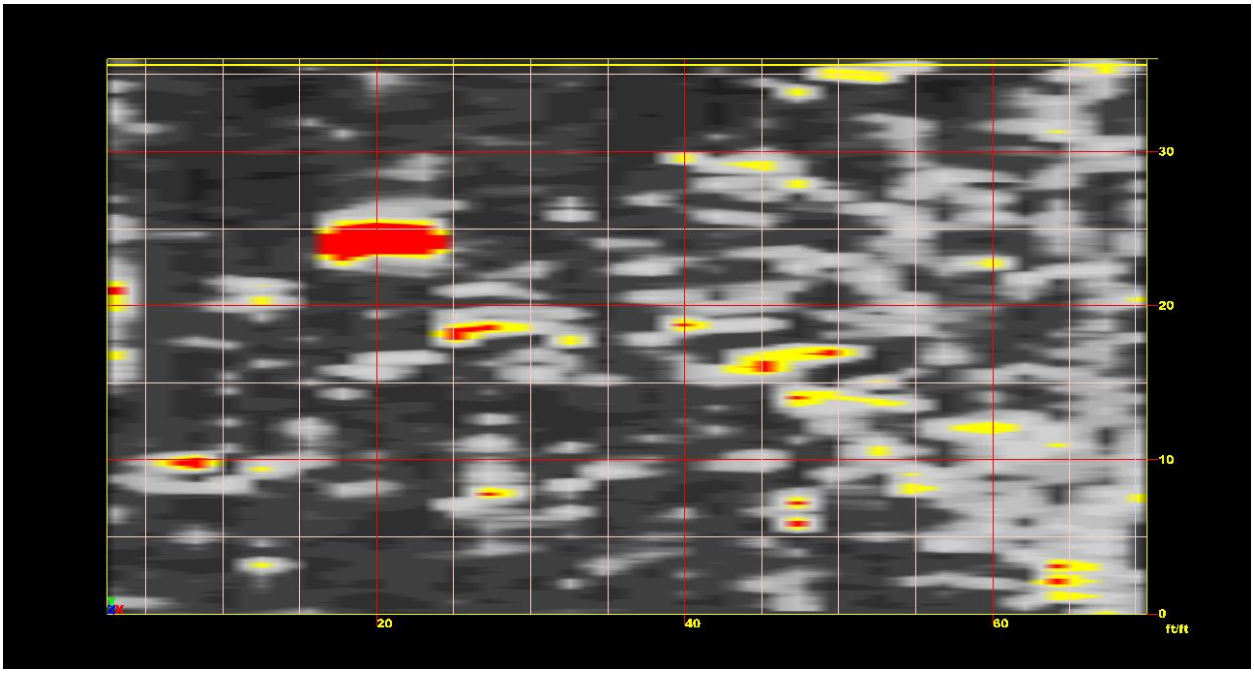

Figure 43:BLOCK A RADAR RETURNS 2FT BELOW SURFACE

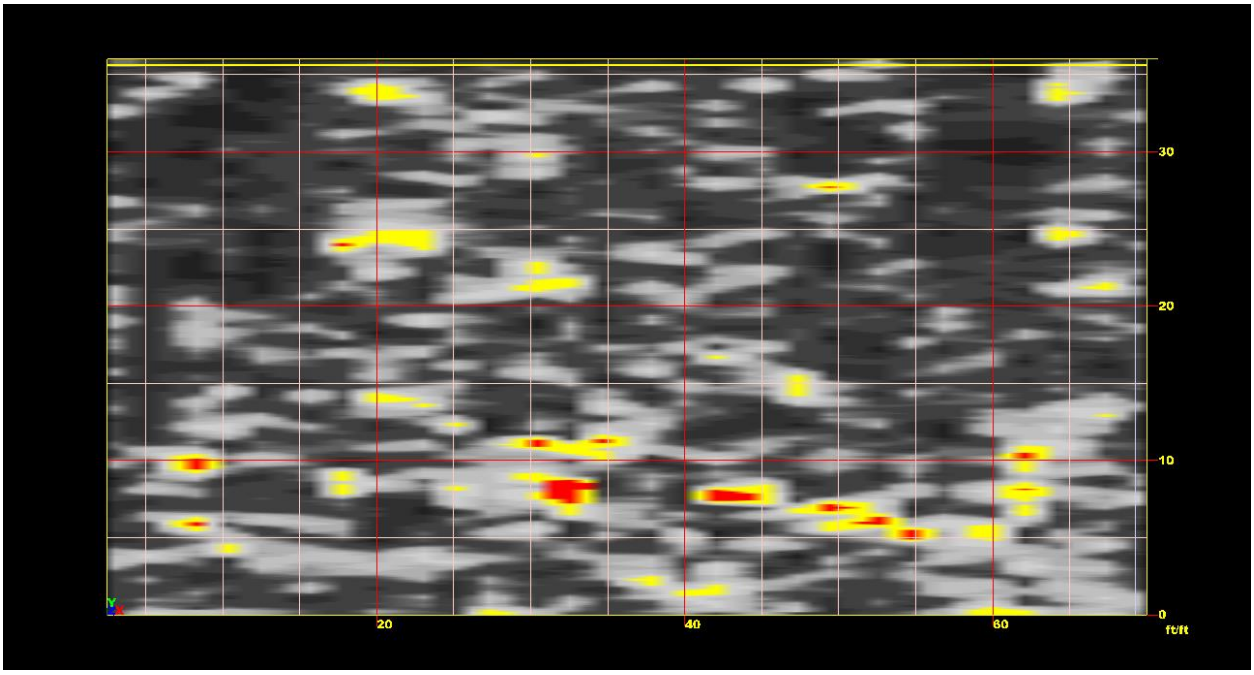

Figure 44: BLOCK A RADAR RETURNS 3FT BELOW SURFACE

Conclusions

The goal for this project was to record ground penetrating radar data for areas immediately surrounding St. Luke's church in order to identify any unmarked burials. Figures 45 and 46 demonstrate that there appears to be an extensive and unseen palimpsest of burials just beneath the surface at St. Luke's Church. It stands to reason that the largest densities of early burials exist in this area. Therefore, it is likely that many of the newly discovered plots from this radar survey relate to the earlier days of the churches' history.

As with all remote sensing technologies, there is a need to ground truth any results. The results from this survey are no exception. There are many interesting conclusions that could be considered from this survey. First is the idea that even marked burials are sometimes marked in the wrong location. Over the years headstones are added, replaced or damaged. This leads to mistakes in placement and is likely a common occurrence in all cemeteries. Second, is the idea that there are so many burials around the exterior that any ground disturbance is likely to impact one. Future ground disturbances should always consider this. Third is the potential for unmarked burials inside the interior of the church. This conclusion in particular needs further study. The idea that there are more than two inside the church comes from oral tradition. Effort should be taken to track down the origins of these stories to determine any validity. Next, more GPR work is needed in the chancel. Given the limitations of the survey there, a more detailed survey is recommended before this conclusion is explored.

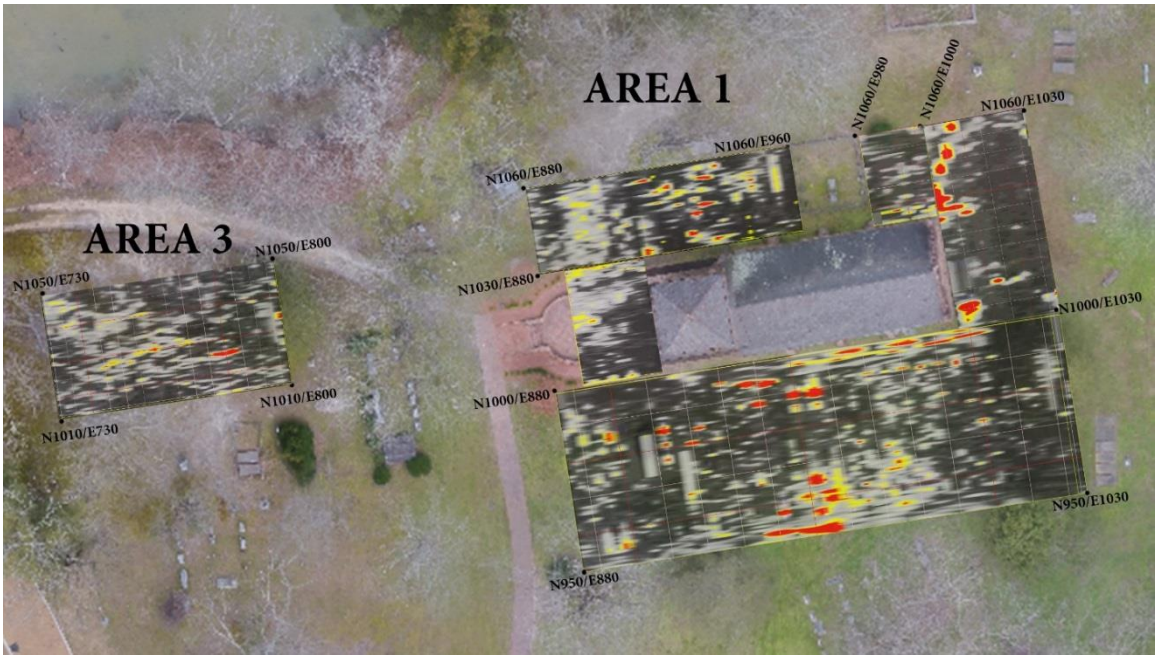

Figure 45: Radar results at 1ft below surface for entire project area

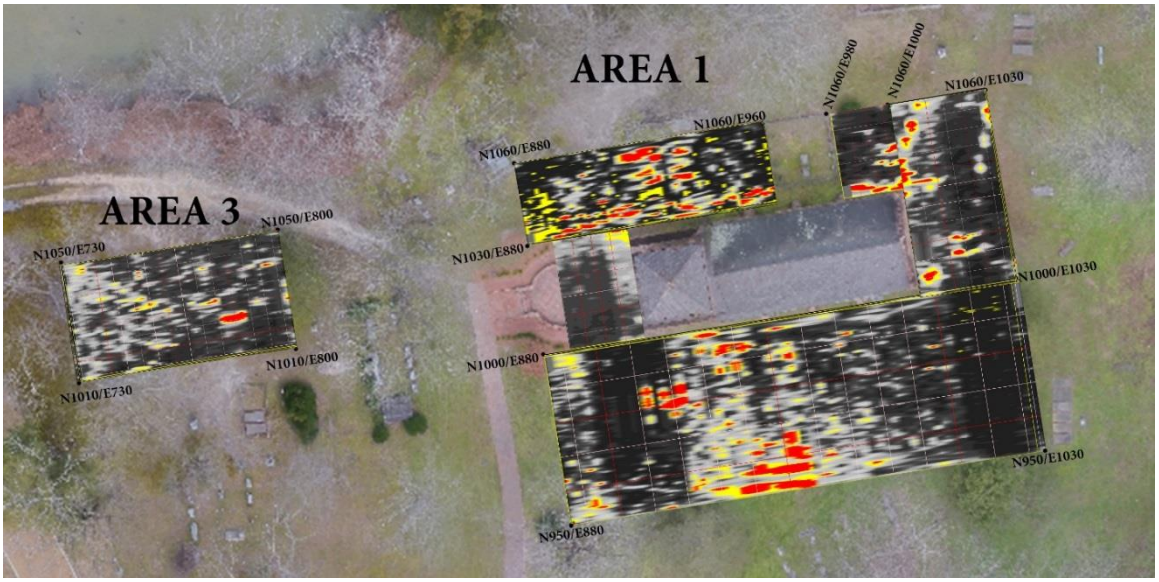

Figure 46:Radar results at 2ft below surface for entire project area

Bibliography

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2008 RADAN GPR data processing software manual

Appendix

Place holder for individual transect profiles. There are a lot!