

**GROUND PENETRATING RADAR SURVEY REPORT
HAR-US 68/SR 31 Roundabout, PID 121008
CITY OF KENTON, HARDIN COUNTY, OHIO**



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EXECUTIVE SUMMARY

Advanced Geologic Sciences, LLC (AGS, LLC) performed a Ground Penetrating Radar (GPR) Survey across two parcels of land located northeast of the intersection corner of Perry Street and South Detroit Street, in Kenton, Ohio. These two parcels of land are identified by the Hardin County Auditor Office as Land Parcel Numbers 3601006700 and 361000130000 and are herein defined collectively as the **GPR Study Area**. The **GPR Study Area** is part of a larger area (herein defined as the **RMR Site Property**) that was evaluated during a recent RMR Assessment.

The objective of this geophysical investigation is to locate the presence/absence of Underground Storage Tanks (USTs) initially identified in the historic Sanborn Maps evaluated during the RMR Assessment. Per that assessment, the USTs were identified as located at or near a service station previously present in the **GPR Study Area**.

The geophysical data was collected using a GSSI SIR3000 acquisition system with a cart-mounted 400MHz antenna. This survey located multiple anomalies associated with possible USTs and/or their dispensing island; various buried pipes; and the remains of potential foundations/roads associated with previous commercial operations in/adjacent to the **GPR Study Area**.

INTRODUCTION

The City of Kenton, Hardin County, Ohio, is working in partnership with the Ohio Department of Transportation (Ohio DOT) to implement safety improvements on U.S. Route 68 (i.e. South Detroit Street) and State Route 31 (i.e. Main Street). This project will include the construction of a roundabout on U.S. 68 near the intersection of Perry Street. As part of this project, Main Street in this area will be rerouted with a stop-controlled T-intersection east of the roundabout.

The proposed construction activities will have a total take of approximately 0.654 acre and will include deep excavations for the drainage features associated with the construction activities. Both permanent and temporary right-of-way acquisitions will be required during this project.

As part of the project review activities, a RMR Assessment was conducted on the **RMR Site Property** (see **Figure 1**). The results of the RMR Assessment were compiled in the **RMR Assessment Report, HAR-US 68/SR 31 Roundabout, PID 121008, City of Kenton, Hardin County, Ohio**, December 2024, and was completed by Clune Consulting Services, LLC.

Per the **RMR Assessment Report**; 1) an auto sales/service station was present on the east end of the **RMR Site Property** from 1946 to 1959; 2) a service station was present in the **GPR Study Area** on the west end of the **RMR Site Property** from approximately 1948 to 1966; and 3) between approximately 1888 and 1955, a lumber yard/sawmill and other similar businesses were located across most of the entirety of the **RMR Site Property**. For the ease of identification, the location of the former service station was identified as being completely within the area defined by the Hardin County Auditor's Land Parcel Numbers 3601006700 and 361000130000.

Historic Sanborn maps associated with the **GPR Study Area** identified three USTs were associated with the service station. Based multiple historic Aerial Photographs suggest the service station was demolished at some time between 1980 and 1994.

Based on the **RMR Assessment Report** the USTs associated with the former service station may still be present in the area immediately northeast of the intersection corner of Perry Street and South Detroit Street. As such, the City of Kenton and the Ohio DOT have requested a GPR survey be conducted on the two before mentioned land parcels to locate anomalies associated with the presence/absence of the USTs. However, if present those type anomalies would require an excavation be implemented to confirm/deny the USTs continued existence, which is outside the scope of this GPR survey.

RMR SITE PROPERTY

The **RMR Site Property** is located at 40.642831° latitude and -83.609152° longitude. The elevation of the property is approximately 955 feet with drainage toward the Scioto River located immediately to the north.

Per the **RMR Assessment Report**, a service station was previously present on the western side of the **RMR Site Property** from approximately 1948 to at least 1966. In addition, a lumber yard was present across parts of the **RMR Site Property** from approximately 1888 to 1955 along with similar commercial operations that included lumber and planing mills, log yards, a box factory and “The Scioto Furniture Company”.

Three USTs were present in the **RMR Site Property** per the 1948 and 1955 Sanborn Maps. These USTs were located on the northern side of the service station that was demolished sometime in the past. Per the **RMR Assessment Report** no specific information exists as to the status of these USTs, whether they still remain on-site or where previously removed.

No Structures are currently present on the **RMR Site Property**, with the northern portion of the property being covered in grass. The remaining southern parts of the **RMR Site Property** are currently covered in gravel. Although the **RMR Site Property** is now vacant, the **RMR Assessment Report** indicates it has recently been used for temporary parking of Semi-Trailers that are unrelated to the current property ownership (see **Figure 2**).

RMR SITE PROPERTY PHYSICAL AND GEOGRAPHIC FEATURES

Per the **RMR Assessment Report** the soils present in the **RMR Site Property**, as classified by the United States Department of Agriculture, Natural Resource Conservation Service (USDA NRCS), are part of the Ockley-Urban land complex, with 0 to 2 percent slopes. Based on Ohio Department of Natural Resources (ODNR) Geologic data, the shallow bedrock geology in/around the **RMR Site Property** consists solely of Tymochtee Dolomite of Silurian age. This dolomite is brownish black to gray in color and has shale laminae. Soils present above this dolomite, up to the ground surface, are predominantly sand and gravel and are part of the Scioto Alluvial Aquifer, with common groundwater yields of 5 to 25 gallons per minute.

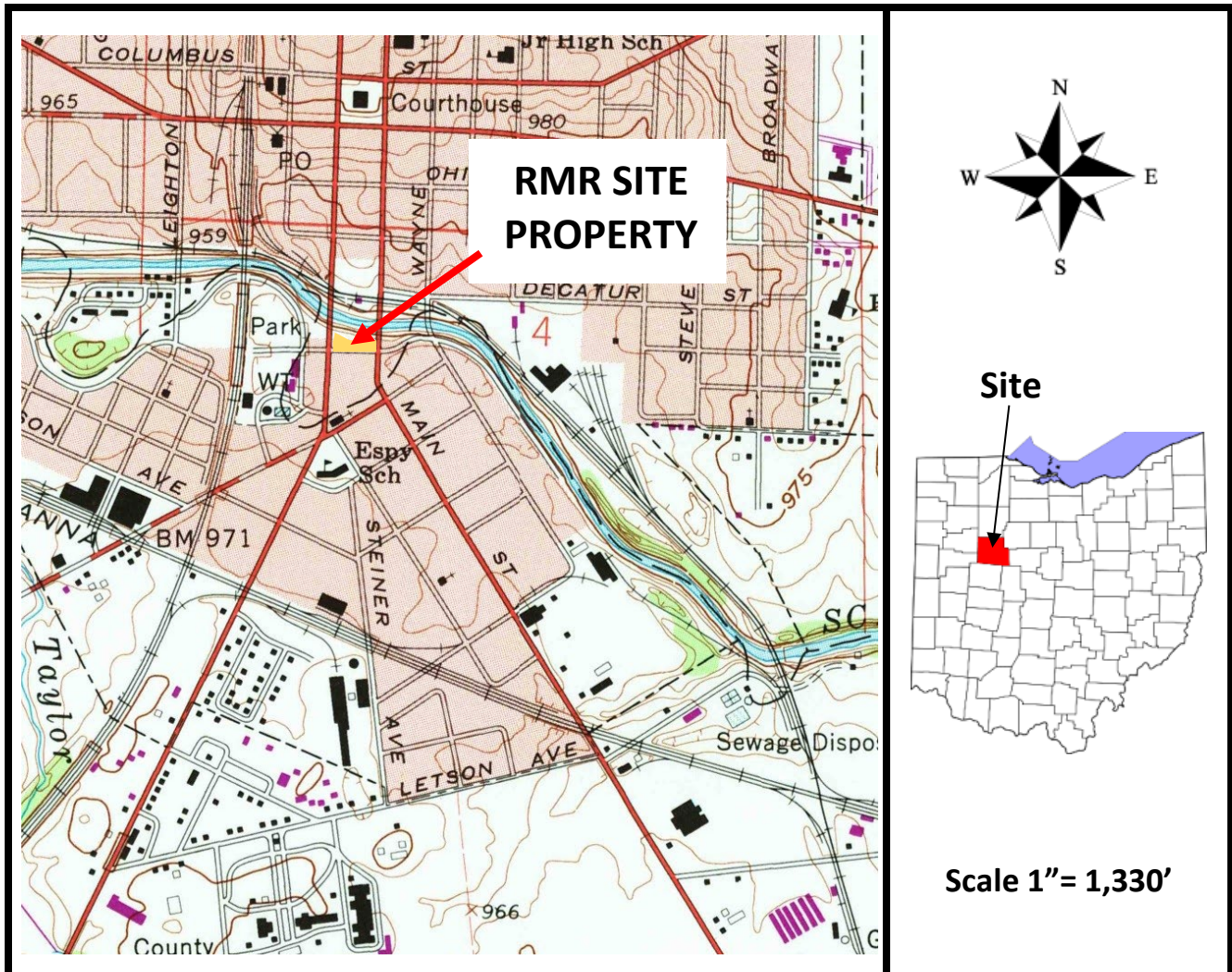


Figure 1. RMR Site Property Location (from Kenton Quadrangle, Ohio, 7.5-Minute Series, 1973).

GPR SURVEY PREPERATION

Per the February 7, 2025 AGS, LLC proposal, a GPR survey was identified for the **GPR Study Area** extent (see **Figure 2**). As identified above, the primary goal of the GPR survey is to locate the presence/absence of USTs or like targets as identified in the historic Sanborn maps that are/were adjacent to a service station located on the western side of the **GPR Site Area** (see **Figure 3**).

During the GPR survey preparation activities, visual review of the **GPR Study Area** identified the top portion of a buried hydraulic lift outer casing is still present in the area of former service station building (see **Photograph 1**). This casing is currently flush with the ground surface and appears to be completely filled with gravel. Further, the solid steel lift piston appears to have

been removed sometime in the past. Whether or not any hydraulic liquids are still present inside the casing could not be determined based on the gravel fill materials.

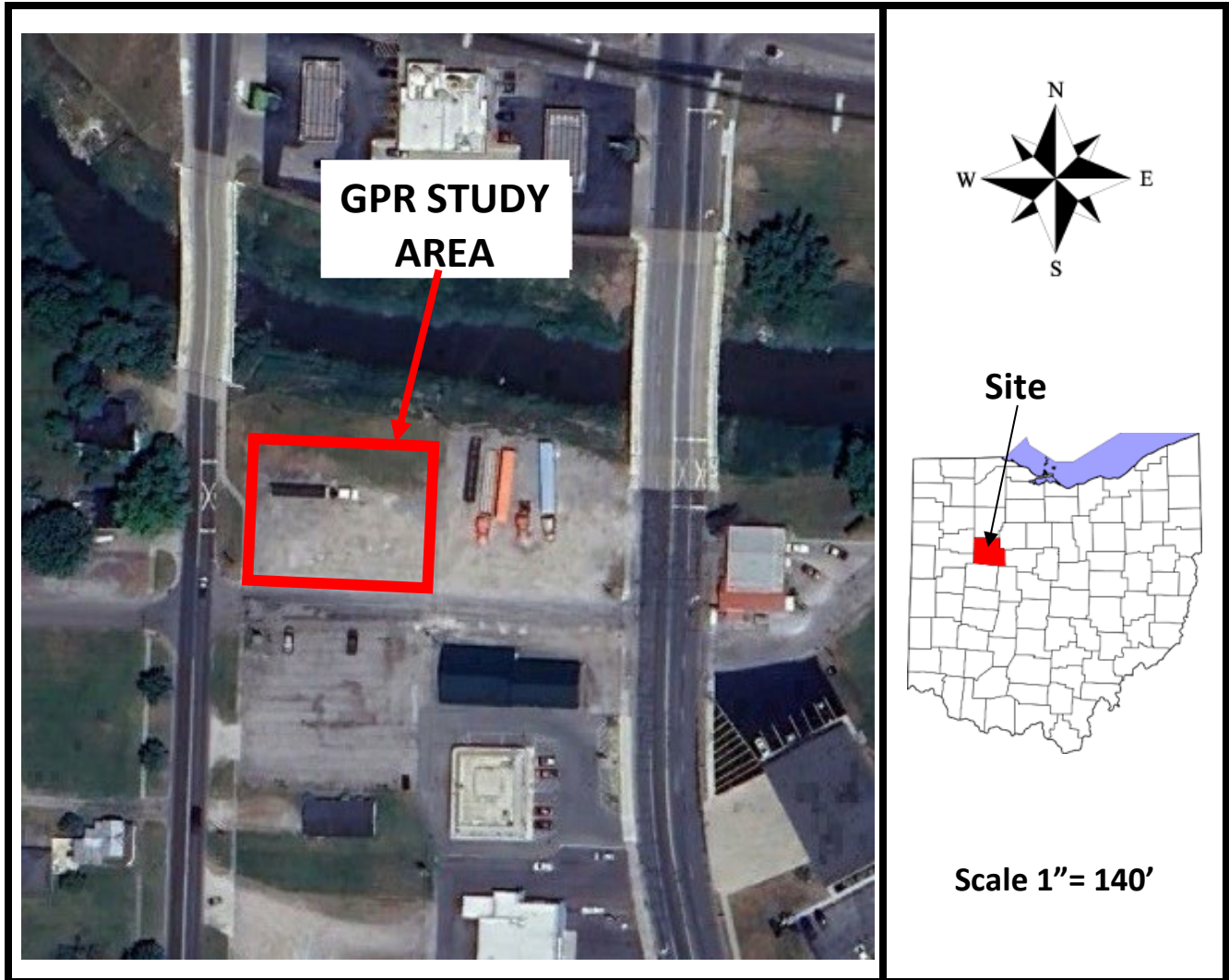


Figure 2. GPR Study Area Location (from Google Earth Pro, June 2023 Air Photograph).

The next activity associated with the GPR survey preparation was to locate the corners of the combined two parcels of land to create the grid system needed for the GPR data collection. The four corners of the **GPR Study Area** were surveyed using a Trimble TSC3 controller connected to the Ohio DOT system using their nearby RTK base station for real-time kinematic high precision location data. **Table 1** includes the latitude and longitude measurements of the four corners of **GPR Study Area** which encompasses an area of slightly less than 0.40 acre.

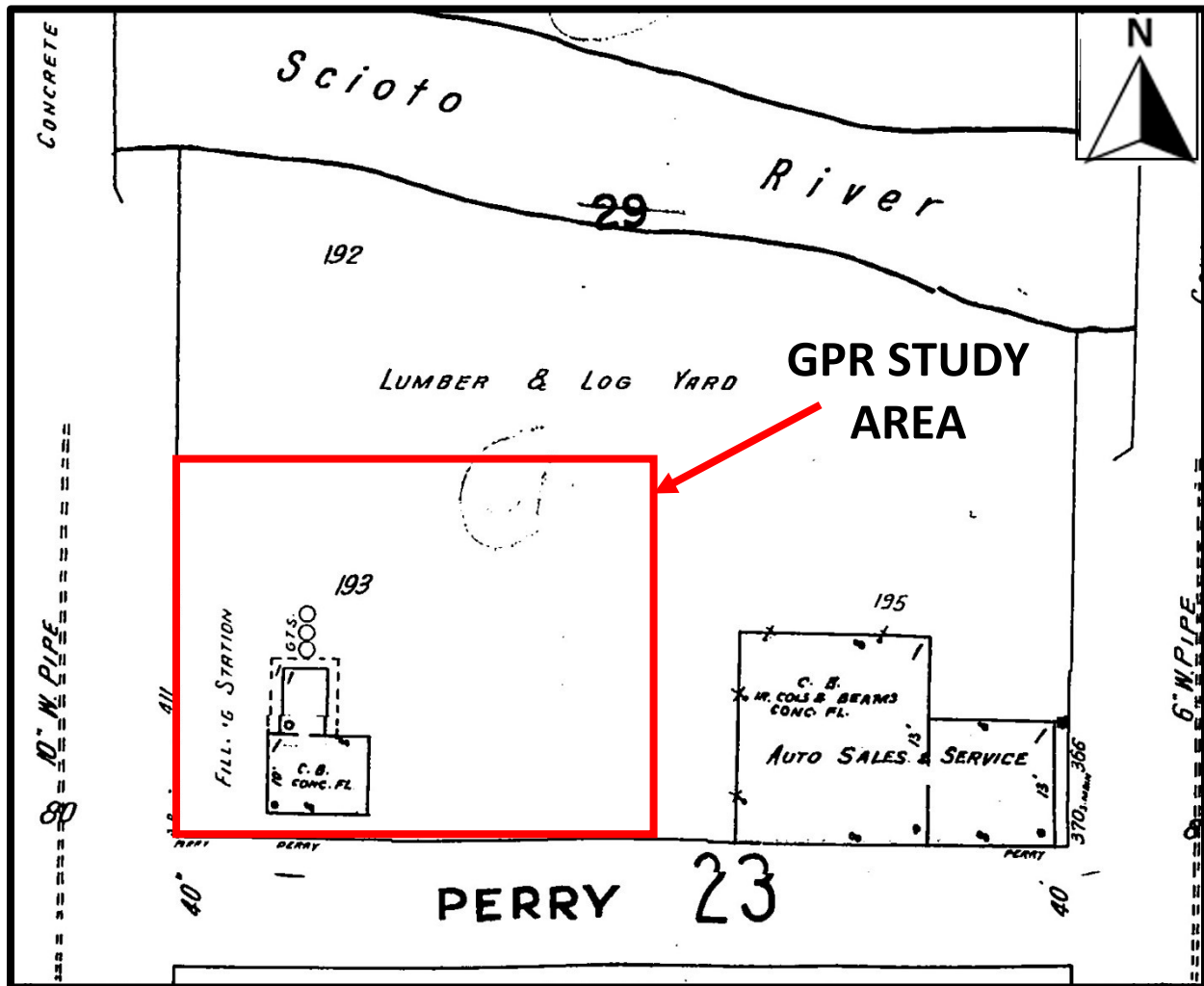


Figure 3. 1948 Sanborn Map with Overlay of the GPR Study Area.

After the corners of the **GPR Study Area** were identified, an east-west grid system was created using tap measures placed along the northern and southern boundaries of the **GPR Study Area**. Additional tap measures were then spaced to create the north-south grid lines. These north-south grid lines were spaced every 5 feet and were used as fixed points for additional floating grid lines that were spaced every 1.25 feet east to west. These floating grid lines were then used to create the survey lines for the cart-mounted GPS system data collection activities.



Photograph 1. Buried Hydraulic Lift Outer Casing.

Location of Study Area Corners	Latitude ^o	Longitude ^o
Northeast Study Area Corner	40.6430502	-83.6088072
Northwest Study Area Corner	40.6430650	-83.6093373
Southeast Study Area Corner	40.6427218	-83.6088226
Southwest Study Area Corner	40.6427375	-83.6093518

Table 1. Corner Locations of the GPR Study Area (in Latitude and Longitude).

GPR SURVEY METHODS

The GPR survey was conducted on March 13, 2025. The field conditions on the day of the survey were dry given little precipitation had occurred across the entire **RMR Site Property** within at least three days prior to performing the GPR survey. The temperature during the survey was in the mid-70°s F, with partly cloudy conditions. The wind velocities during the GPS survey were variable between 0 to 10 mph.

All of the GPR geophysical data were collected using a GSSI SIR3000 acquisition system with a cart-mounted 400MHz antenna. The GPR data were collected continuously along equally spaced north-south trending transect lines located on the grid system created across the two parcels. The GPR transects were spaced every 1.25 feet starting east to west with the first transect located just outside the eastern boundary of the two parcels and from there to just outside the western boundary of the two parcels for a total of 150 feet in length. GPR data for each transect line were collected starting from the northern edge of Perry Street and going northward 120 feet, again just outside the southern and northern boundaries of the two parcels.

All survey data was retained within the GSSI SIR3000 acquisition system as the GPR survey progressed. Due to the length of time needed to conduct the GPR survey on March 13, 2025, battery replacements occurred as needed with the GSSI SIR3000 system. However, no data loss or corruption occurred as the batteries were replaced.

DATA PROCESSING

All of the GPR survey data was transferred from the GSSI control unit onto a separate computer for post-processing using GSSI RADAN 7 software. Post-processing included shifting the ground-surface radar reflection to 0 (zero) time and filtering for the removal of the ubiquitous antenna-ground ringing signal. Amplitude scaling of these processed data was done as necessary for the entire data volume during visualization.

The processed data were then used to create a 3-D block model of the subsurface conditions so that multi-layer subsurface slices could be generated. These sliced layers were then used as maps to help identify specific subsurface anomalies or patterns that may represent burial targets of interest. The depth of the selected slice layers was dependent upon several factors including well defined reflectors. The standard color scale used herein include saturated Red (+) and Blue (-) for large amplitudes, grading through to an unsaturated color of white for those at or near

zero amplitudes. Based on the 3-D block model, the dominant subsurface slice layers illustrating potential targets of interest are associated within the upper-most 4 to 6 feet below ground surface (BGS).

RESULTS – GPR TRANSECT IMAGES AND PLAN VIEW SLICE MAPS

The GPR survey generated over 120 transect lines across the **GPR Study Area**. Post processing of transect line data created the 3-D block model used for the plan view slice maps. Examples of these GPR slice maps are presents in **Figures 4 to 7**.

Data patterns presented in the GPR slice maps were then coupled with the Sanborn Maps and the historic Aerial Photographs presented in the **RMR Assessment Report**. Nine GPR transect lines applicable to potential targets of interest were further reviewed and are presented in **Figures 8 to 10**. These GPR transects lines are identified as Profiles A to I and illustrate subsurface anomalies (highlighted by black outlines). The depth scale (units in feet) of the GPR transect lines are present on the left side of the figures. The length (units in feet) of the GPR transects lines are present on the top. The site-specific x-coordinates and y-coordinates of the nine GPR Transects are provided in **Table 2**. The x-coordinate start at 0.0 and it is associated with the southwest corner of the **GPR Study Area**. The y-coordinate start at 0.0 and it is associated with the southeast corner of the **GPR Study Area**.

Transect Line Name	X Coordinate	Y Coordinates
Transect A	6.25	0.0 to 100.0
Transect B	18.75	0.0 to 90.0
Transect C	23.75	0.0 to 90.0
Transect D	46.25	10.0 to 110.0
Transect E	66.25	10.0 to 110.0
Transect F	81.25	10.0 to 110.0
Transect G	128.75	0.0 to 100.0
Transect H	136.25	0.0 to 100.0
Transect I	146.25	0.0 to 100.0

Table 2. GPR Transects Line (using Site-Specific Coordinates with units in Feet).

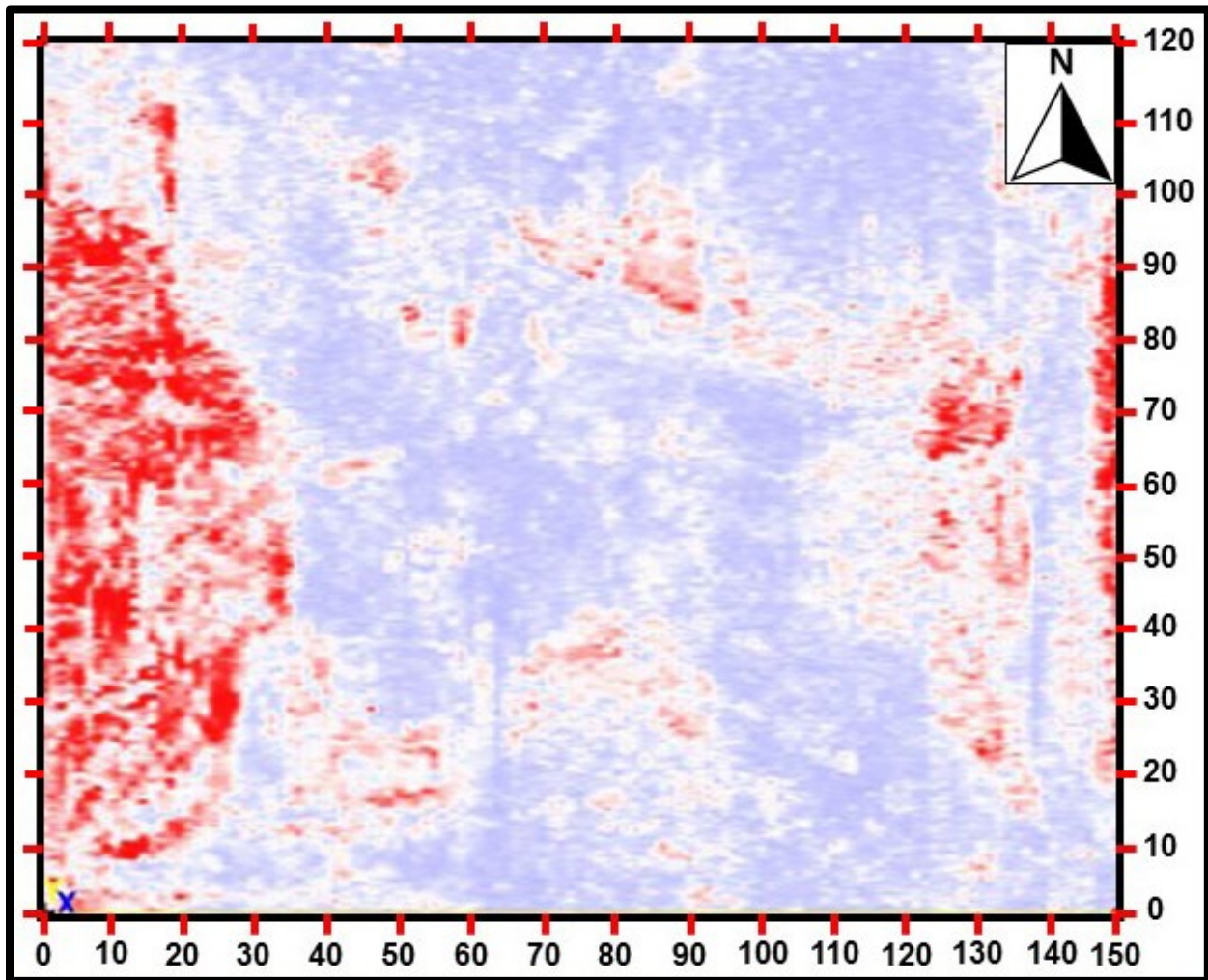


Figure 4. Plan View Slice Map of the GPR Site Area at 1.6 feet BGS.

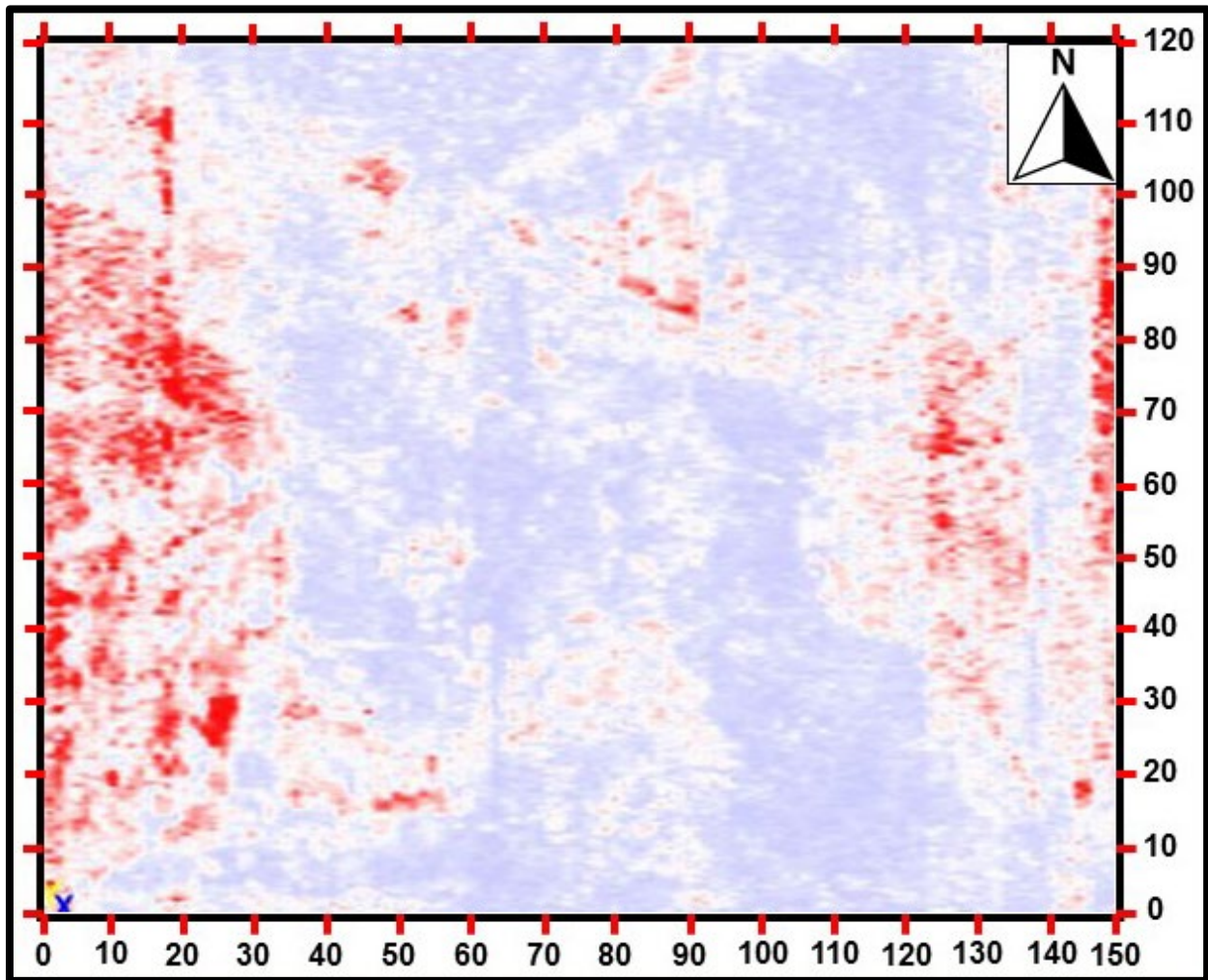


Figure 5. Plan View Slice Map of the GPR Site Area at 2.0 feet BGS.

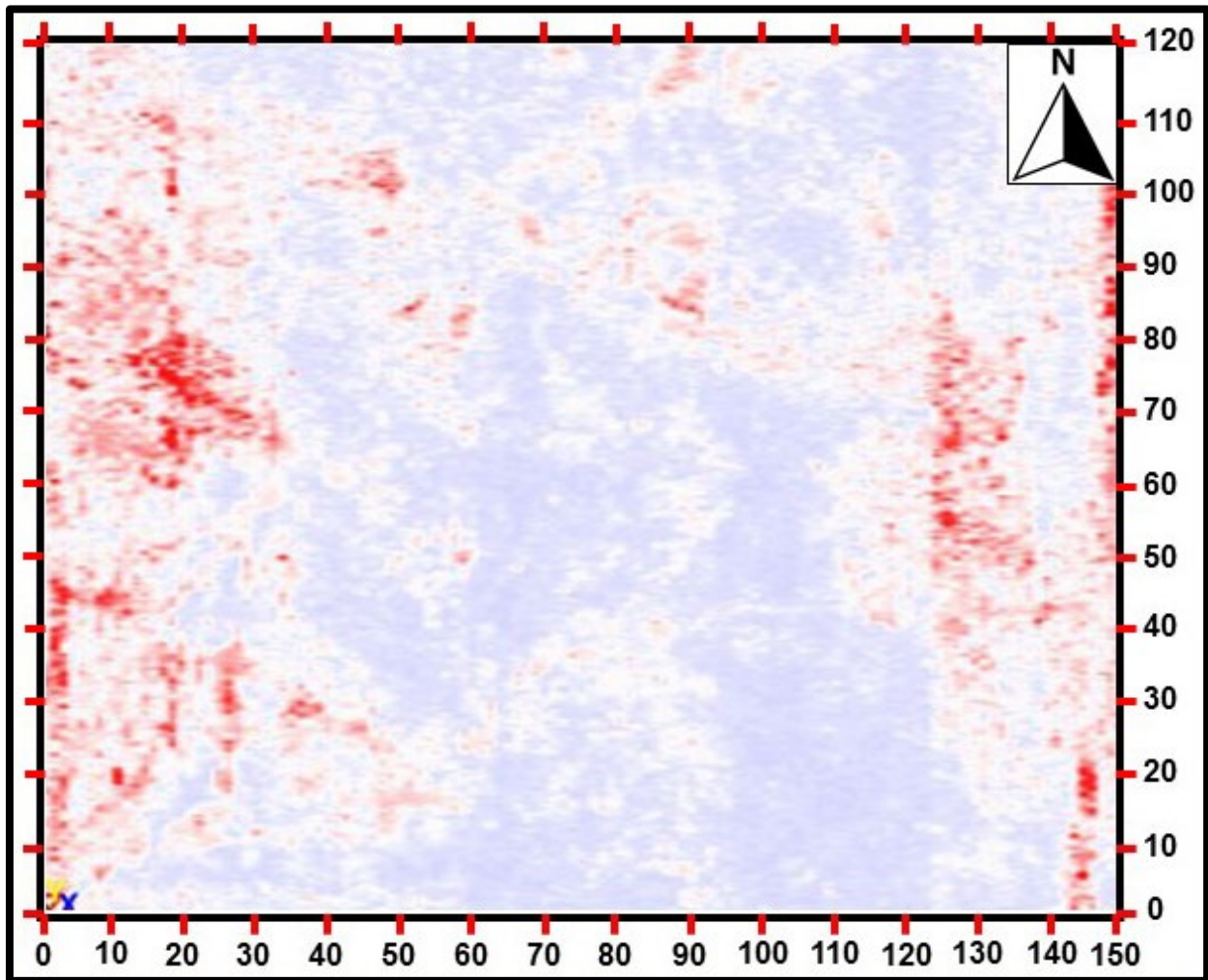


Figure 6. Plan View Slice Map of the GPR Site Area at 2.3 feet BGS.

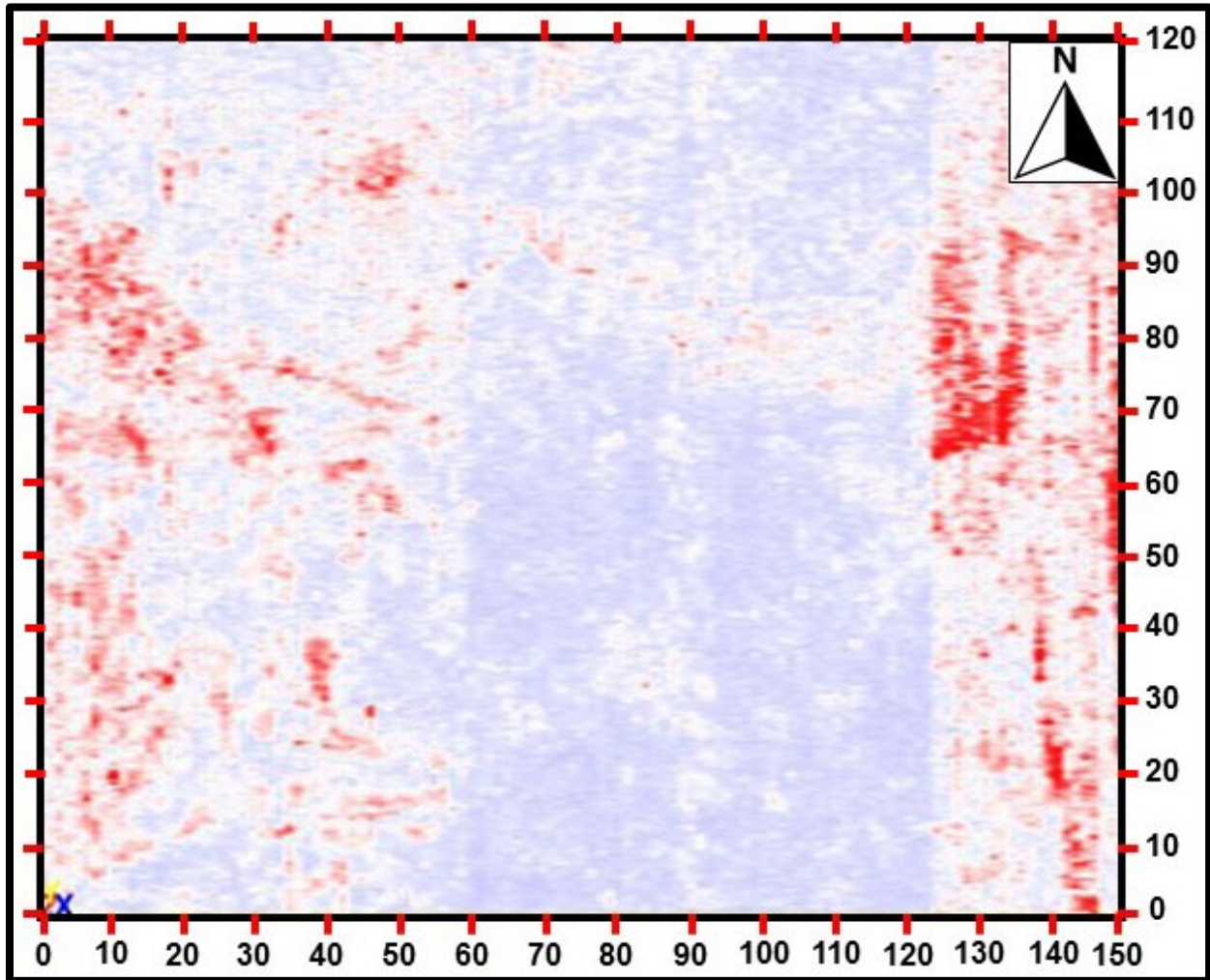


Figure 7. Plan View Slice Map of the GPR Site Area at 3.6 feet BGS.

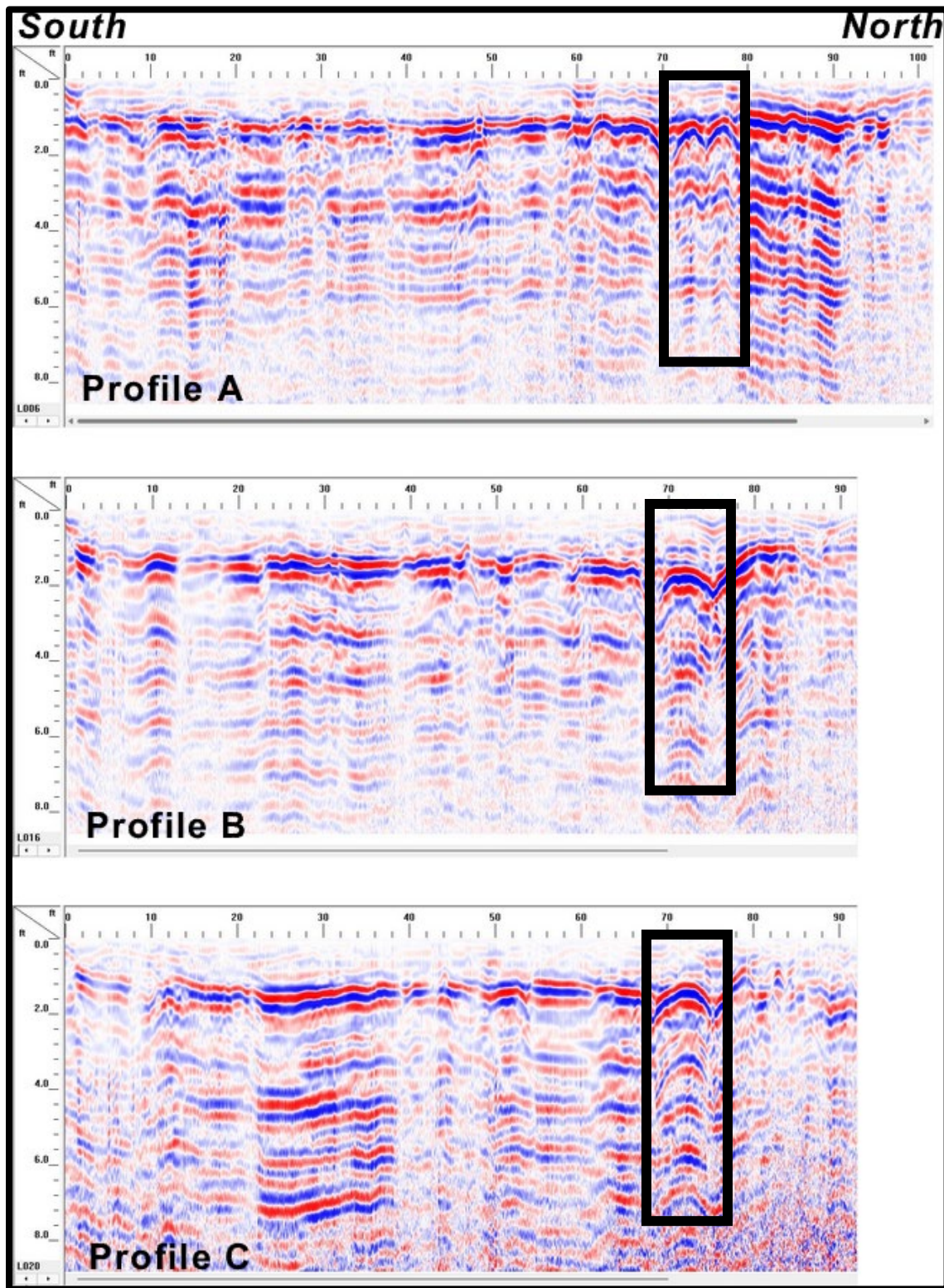


Figure 8. GPR Transect Profiles A to C Illustrating Subsurface Anomalies in Black.

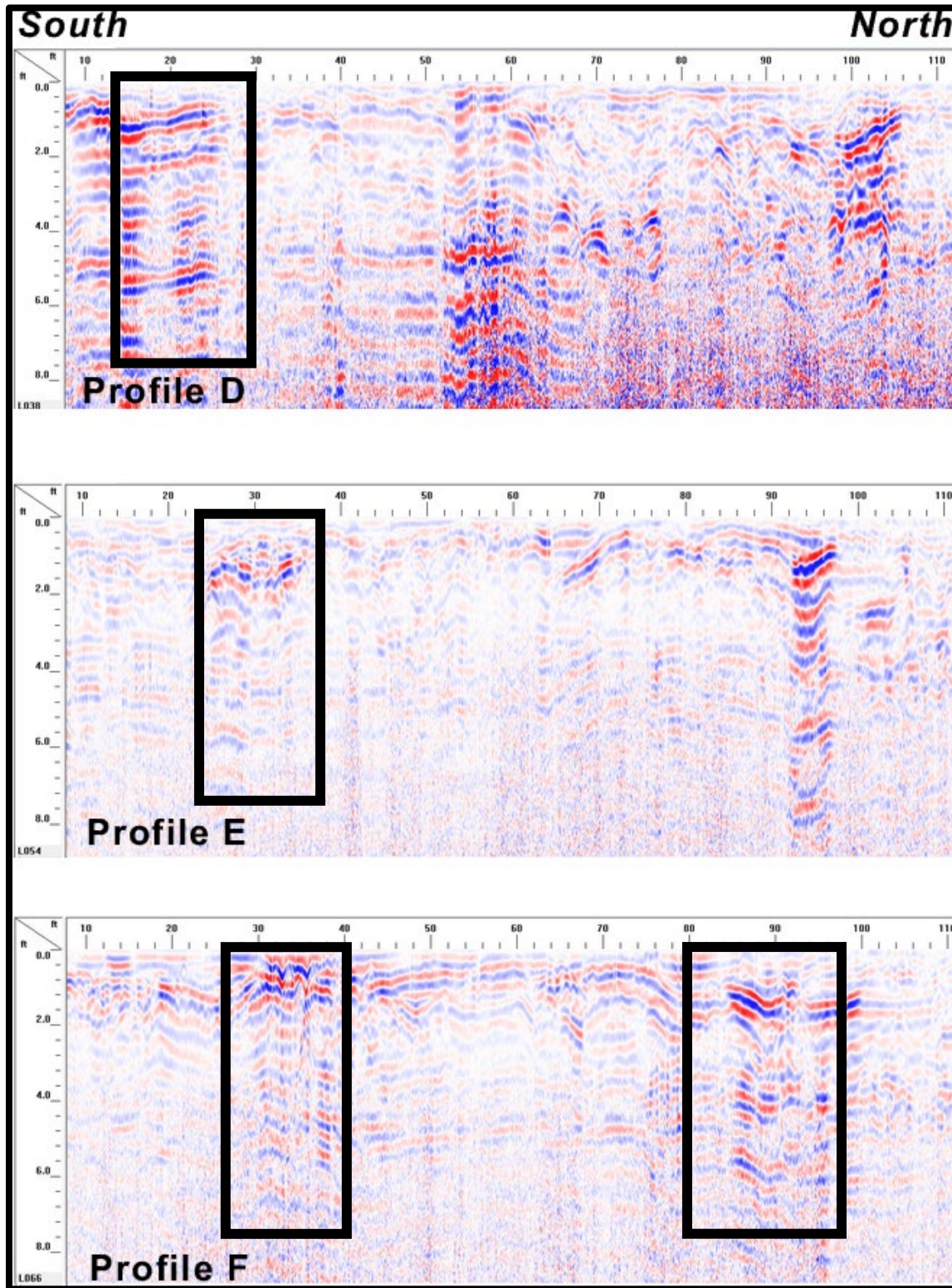


Figure 9. GPR Transect Profiles D to F Illustrating Subsurface Anomalies in Black.

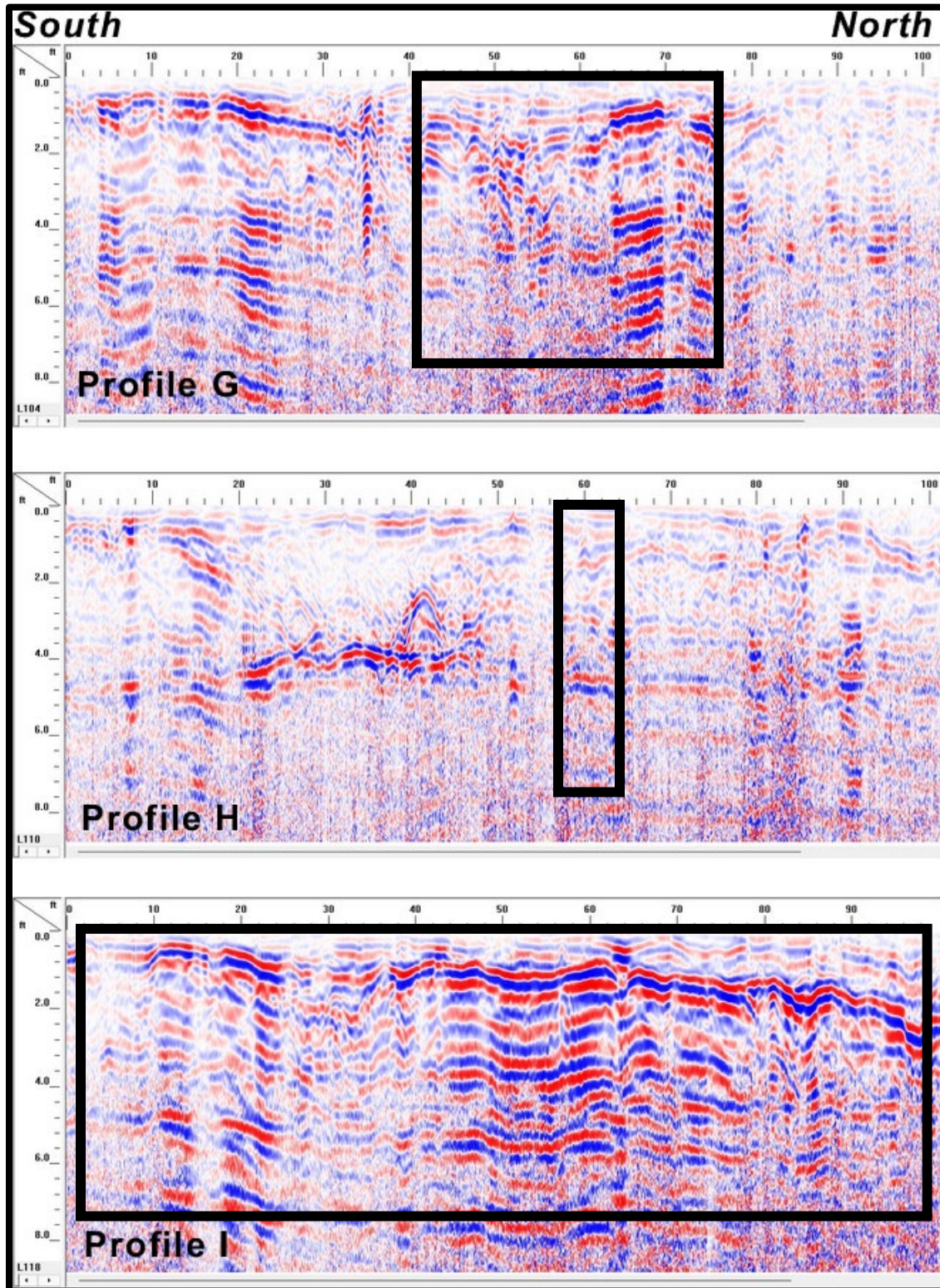


Figure 10. GPR Transect Profiles G to I Illustrating Subsurface Anomalies in Black.

INTERPRETATION OF GPR TRANSECTS AND SLICE MAPS

The interpretation of GPR data in **Figures 4 to 10** must consider reflectors that help identify potential subsurface features. Contrast is the most crucial factor in detecting buried targets, as successful identification relies on matching signal patterns to physical features and assessing the level of contrast with surrounding materials. Other key aspects include the feature's size and shape in relation to spatial resolution, its depth considering signal attenuation, and any noise that may obscure detection. Additionally, soil type, particle size, soil density, and moisture content play a significant role in data interpretation.

Clutter also affects pattern recognition during a GPR survey, with elements such as animal burrows, relict vegetation, buried foundations, utilities, and past excavations potentially influencing results. Since these patterns can be picked up by geophysical surveys, they must be carefully evaluated or filtered out to focus on relevant features. However, distinguishing true anomalies from false positives and negatives remains a challenge and may require further investigation, such as targeted excavation.

The compilation of the 3-D block model along with the selected nine transect lines are presented in **Figures 11 to 14**. **Figures 11 to 14** also include the interpretation for each of the subsurface anomalies that were identified across multiple GPR transects along with their likely source using the Sanborn Maps and the historic Aerial Photographs (see the **RMR Assessment Report**). This interpretation includes the hyperbolic reflectors associated with USTs; reflectors that represent the boundaries between different materials associated with foundations; reflectors that represent interfaces between different materials or density changes associated with former roadways; and finally flat reflectors, corresponding to the length-wise of a sewer or discharge pipe.

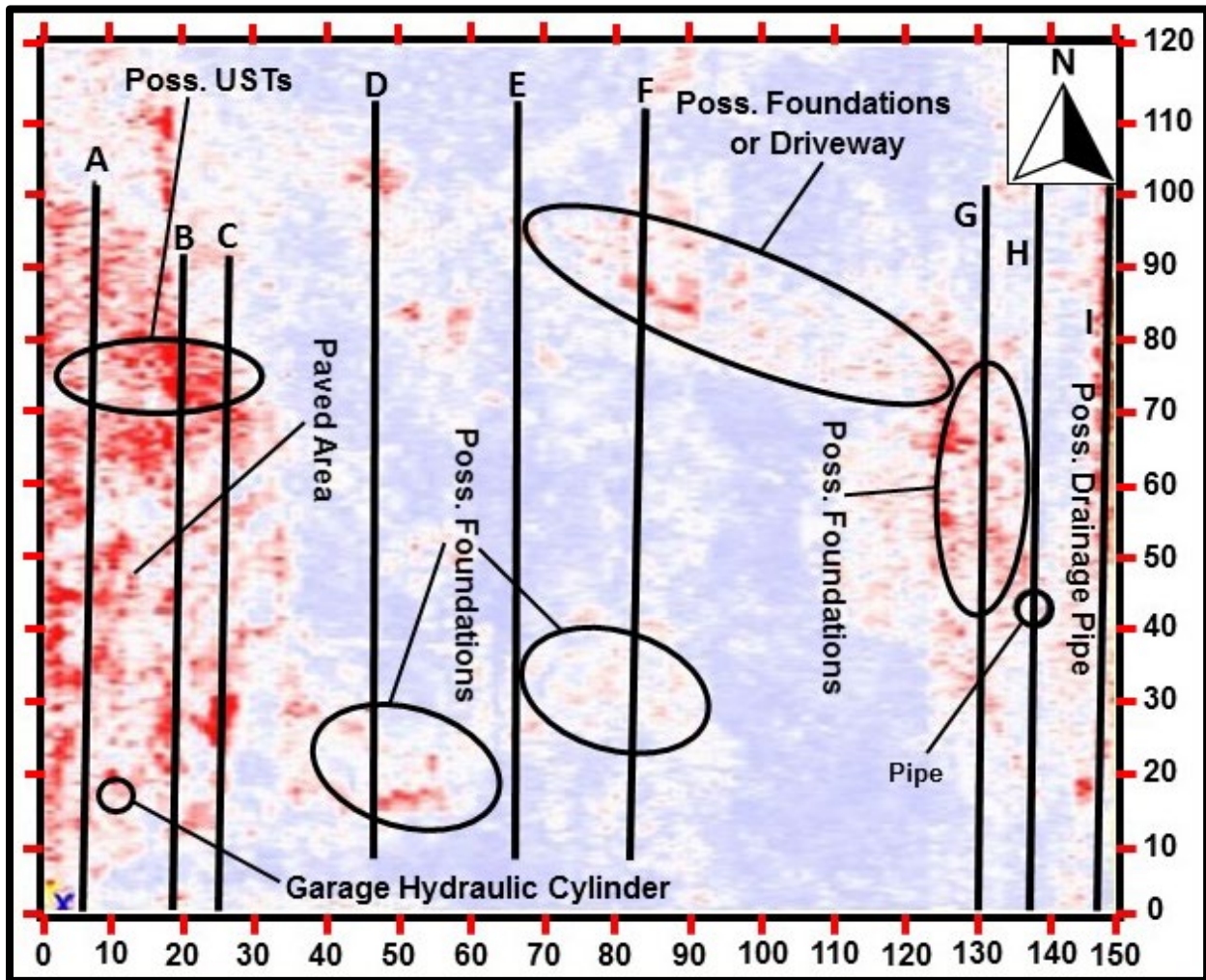


Figure 11. Plan View Slice Map of GPR Site Area at Depth of 1.6 feet BGS, with Transect Lines and Interpretation of Subsurface Anomalies Overlaid.

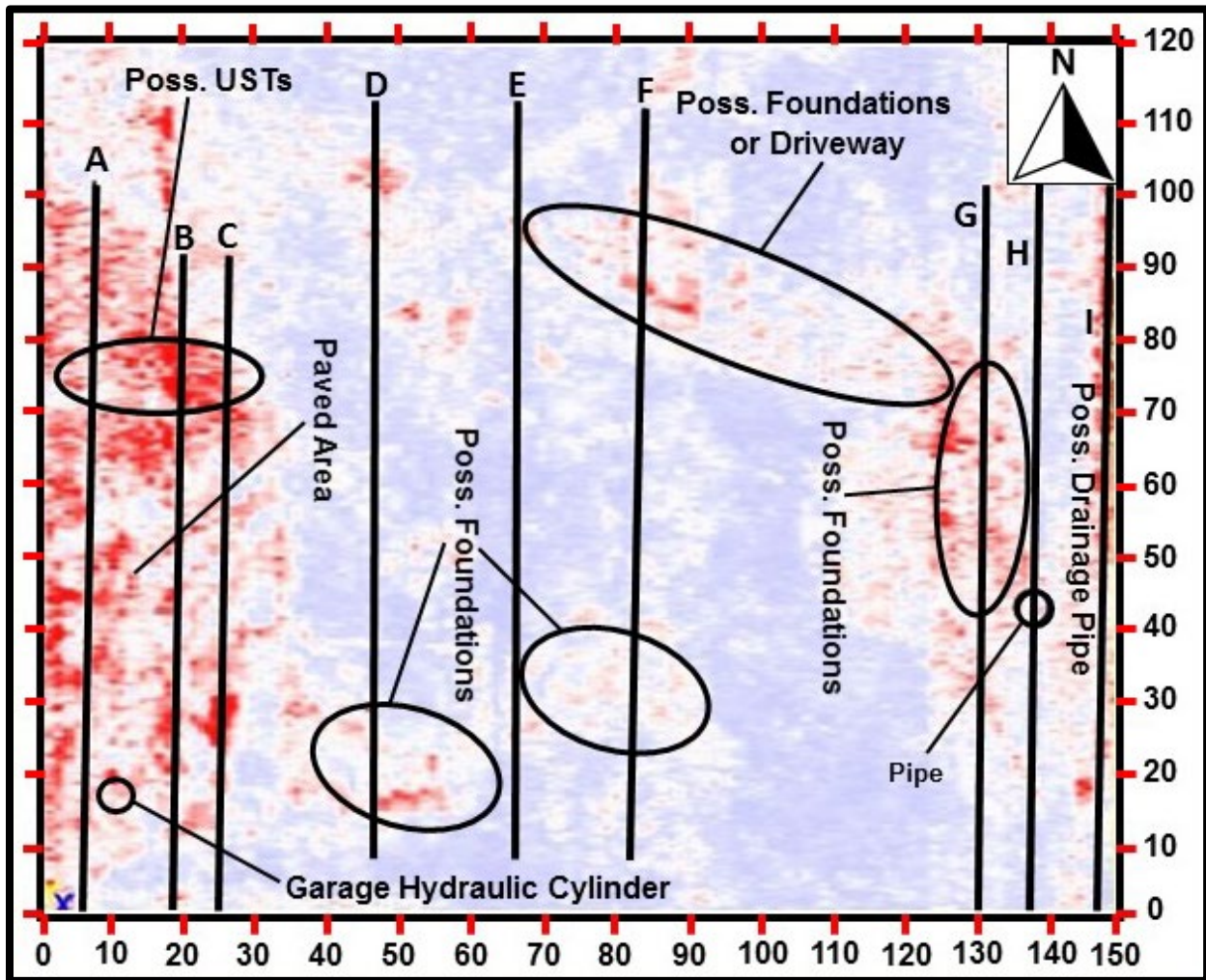


Figure 12. Plan View Slice Map of GPR Site Area at Depth of 2.0 feet BGS, with Transect Lines and Interpretation of Subsurface Anomalies Overlaid.

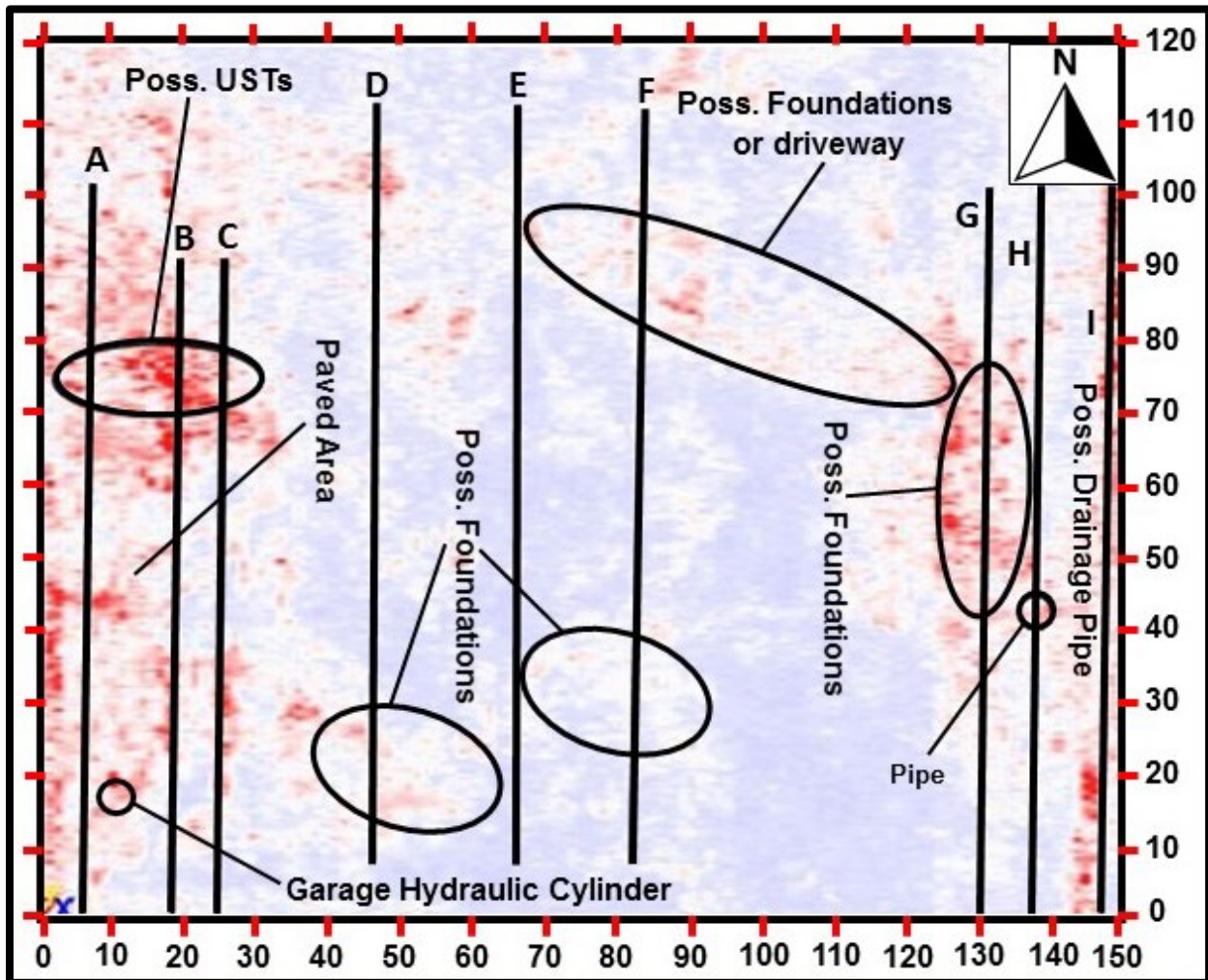


Figure 13. Plan View Slice Map of GPR Site Area at Depth of 2.3 feet BGS, with Transect Lines and Interpretation of Subsurface Anomalies Overlaid.

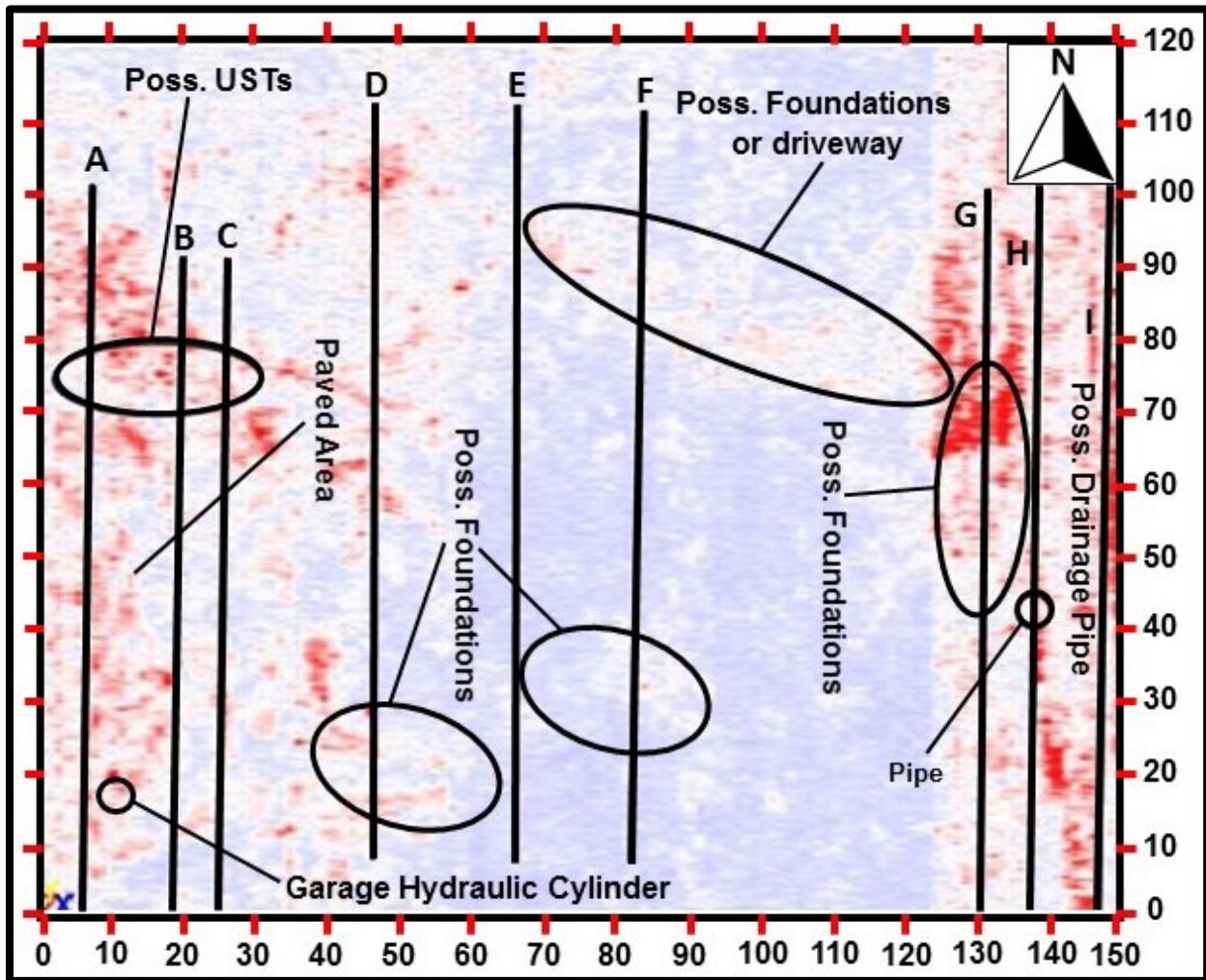


Figure 14. Plan View Slice Map of GPR Site Area at Depth of 3.6 feet BGS, with Transect Lines and Interpretation of Subsurface Anomalies Overlaid.

SUMMARY AND RECOMMENDATIONS

AGS, LLC performed a GPR survey to locate the presence/absence of USTs and related features as identified in the Sanborn maps at a former service station present in the **GPR Study Area**. In general, UST related targets of interest may still exist along the north and northwestern sides of the service station building. This includes potential USTs north of the service station and related service station infrastructure (i.e. such as a refueling island) present on the western and northwestern sides of the former service station building. Other potential GPR anomalies were identified eastward of the service station area and may reflect potential foundations, roads, utilities and sewer systems associated with the former furniture and lumber milling operations previously located in those portions of the two land parcels.

An additional target of interest was identified during the preparation activities of the GPR survey. This target is the buried hydraulic lift outer casing present inside the area of the former service station building. This casing was visually identified and will require its removal prior to the construction of the road improvements in/around the **RMR Site Property**. It should be noted these type lift systems are often deeply buried and are known to have previously contained gallons of petroleum based hydraulic liquids. As such, if these liquids are still present inside the casing, the excavation/removal activities of the casing should be conducted in a manner that prevents the spillage of these liquids as the buried outer casing is removed from the ground.

If USTs exists in the **GPR Study Area**, their existence can only be confirmed through excavation activities that are outside the scope of this GPR survey. Note: if these excavation activities confirm their existence, those UST must be removed/closed per BUSTR requirements. The only remaining issues associated with their closure should also address the fact that the current property owner of the **GPR Study Area** was not the UST Owner/Operator and that different UST closure requirements likely exist for these orphan tanks. As such, the closure requirement of the USTs should be conducted through consultation with BUSTR after their existence has been confirmed.