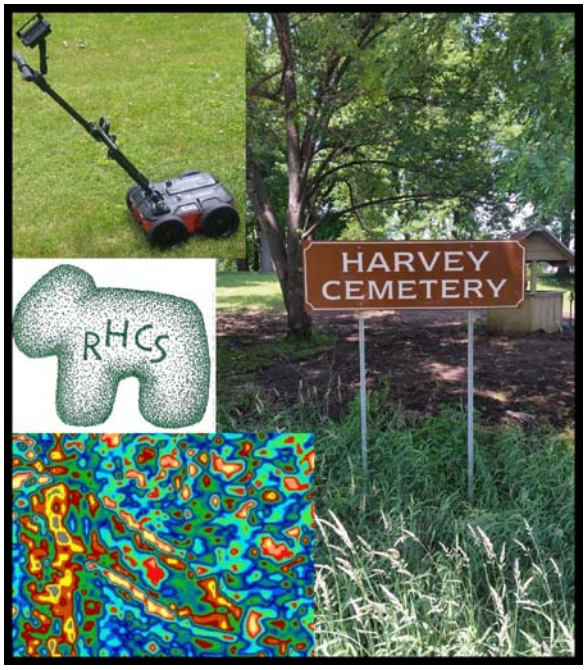
Locating Unmarked Graves at Harvey Cemetery using Ground Penetrating Radar, Delaware Township, Polk County, Iowa.



RHCS 194

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ABSTRACT

A ground penetrating radar (GPR) survey was conducted by Rolling Hills Consulting Services, L.L.C. (RHCS) within the Harvey Cemetery parcel located in the SE ¼ of Section 27, Township 79 North, Range 23 West, Polk County, Iowa. This survey was requested to assist in marking the location of unmarked burials within the cemetery boundary. The results show an oval-shaped area in the northwest portion of the survey area where grave-shaped anomalies are present. This area coincides with a treeless, flat area, within the survey boundary. The oval-shaped feature also follows the orientation of the overall landform on which it is found. Interpretations from this project include the possibility of ten current burials and six possible former grave shafts, all within the oval-shaped boundary. Based on this survey, the oval-shaped area is the area most likely to contain unmarked graves. However, these are only interpretations based on the data collected and should not be considered what exactly exists underground.

INTRODUCTION

The Polk County Iowa Public Works Department requested Rolling Hills Consulting Services, L.L.C. (RHCS) conduct a ground penetrating radar survey to assist in locating unmarked graves in Harvey Cemetery, located in the SE ¼ of Section 27, Township 79 North, Range 23 West (Delaware Township), Polk County, Iowa (Figure 1).

Harvey Cemetery can be found at the intersection of NE 23rd Avenue and Oak Hill Drive in Des Moines, Iowa. The area surveyed covers roughly 0.17 hectares (0.42 acres) and the bounding Universal Transverse Mercator (UTM) coordinates for the surveyed area are 457951 - 457987E and 4607198 - 4607248N using the North American Datum of 1983 (NAD83), Zone 15 North. Harvey Cemetery can be located on the 1976 Des Moines Southeast, USGS 7.5-Minute Quadrangle (Figure 2).

The report and survey were completed in June 2018 by the Principal Investigator, Chad A. Goings. All project documents can be found at Rolling Hills Consulting Services, L.L.C., 601 East 2nd Street, Washington, Iowa, 52353 and questions pertaining to this report can be answered by contacting Mr. Goings at (319) 461-7427. The National Archaeological Data Base Form is included at the end of this report (Appendix 1).

GEOLOGY

REGIONAL GEOLOGY

The project area is located in a landform region known as the Des Moines Lobe (Figure 1). This relatively young physiographic region was heavily influenced by recent glacial activity associated with the surging of the Laurentide Ice Sheet (LIS) from 12,000 to 14,000 years ago (Prior 1991). The glacial ice made its way to present-day Des Moines and then retreated with occasional advances creating the Bemis, Altamont, and Algona end moraines. Three minor end moraines were also created during the Altamont surge: the Clare, Renwick and West Bend. This region of Iowa mostly consists of flat, glacial till plains; however, in areas near big river valleys or end moraines the relief is more significant. Natural, freshwater glacial lakes and prairie potholes are common.

All of the upland sediments of the Des Moines Lobe are included within the lithostratigraphic unit termed the Dows Formation. This formation consists of the Alden (massive, uniform diamicton), Morgan (interbedded diamicton), Lake Mills (mostly massive laminated silts and silty clays) and Pilot Knob (interbedded upland sands and gravels) members (Bettis et al. 1996: 8). The Woden Member consists of colluvium and organic material found in closed and semi-closed depressions. The size of the depression is often correlated with the types and arrangements of sediments. (Bettis et al. 1996: 29). The Noah Creek

Formation is Wisconsinan in age and consists of coarse sand and gravels found in stream valleys and outwash plains. These thick sand and gravel arrangements are unlike others in the area making them easy to distinguish (Bettis et al. 1996: 22).

The drainage network on the Des Moines Lobe is not well-established. Within most larger valleys, Holocene-aged deposits of the Deforest Formation are found (Bettis and Littke 1987). The most recent deposits are termed the Camp Creek Member and contain historic or post-settlement alluvium. Historic or late prehistoric artifacts may occur within this member. The Roberts Creek Member is usually found in floodplain settings and may contain early historic through Late Archaic archaeological materials. The Gunder Member usually occurs on low alluvial terraces, typically has well-expressed soil horizination and can contain Woodland through PaleoIndian artifacts. Finally, the Corrington Member is found in alluvial fan and colluvial slope settings and late prehistoric through PaleoIndian artifacts may be discovered in multiple buried land surfaces. These lithographic units often intertwine and bury one another, commonly making valley geological investigations complex.

LOCAL GEOLOGY

SURFICIAL GEOLOGY

The surficial geology of Polk County has been mapped by the Iowa Geological Survey at a scale of 1:100,000 (Quade et al. 2003). Harvey Cemetery is located within an area mapped as aligned ridge forms to discontinuous elongated hummocky ridge forms of the Morgan Member or Pilot Knob Member of the Dows Formation (Quade et al. 2003). These areas typically consist of less than eight meters of stratified sand and gravel with interbedded stratified loamy glacial till. Textures are variable but are overall loamy sediments (Quade et. al 2003).

SSURGO SOILS

The soil database was obtained for Harvey Cemetery (Figure 3) from the Web Soil Survey (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm). This website is maintained by the Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture (USDA).

The soils mapped in Harvey Cemetery are mostly of the Clarion loam soil series (Figure 3). Clarion loam soils are very deep, moderately well drained soils found on uplands. These soils form in glacial till. The typical profile for Clarion soils are Ap-A1-A2-Bw1-Bw2-C1-C2.

A small portion of the southern part of Harvey Cemetery is mapped as Lester loam soils. Lester soils are very deep, well drained soils that form in calcareous, loamy till. They are found on convex slopes on glacial moraines and till plains. The typical profile for Lester soils are Ap-Bt1-Bt2-Bk1-Bk2-C.

SOIL INTERPRETATIONS FOR GROUND PENETRATING RADAR

Maps show that the soils and sediment in the area of Harvey Cemetery are of a loamy texture. The texture of the soils and sediment is an important consideration in ground penetrating radar surveys. The electromagnetic radar waves transmitted from the GPR unit behave differently in different types of sediment. This can affect the interpretation of GPR results as well as the overall quality of the survey. For example, soils and sediments that contain a high clay or water content are not typically conducive to GPR surveys because of the high electrical conductivity of these substances. Loamy soils have an equal percentage of clay, silt, and sand. Loamy soils are not ideal soils for ground penetrating surveys but present ‘average’ conditions and GPR surveys are not by any means impossible in loamy soils.

HARVEY CEMETERY HISTORY

Historic plat maps (Figure 4) and historic aerial photographs (Figure 5) of Harvey Cemetery area were studied to see how the area has changed over the years. Several sources were examined to obtain information on the cemetery and the Harvey family. The Harvey surname has a historic connection with Delaware Township in Polk County, Iowa. In fact, one of the earliest known settlers of the township was Stephen Harvey who came in 1848 from Shelby County, Indiana. He resided near the cemetery in Section 27 and Section 34 of Delaware Township (Anonymous 1880: 354). The first post office in the township was at the home of Stephen Harvey and was called Harvey's Point. It remained there until 1854 when it was moved to Rising Sun. Mr. Harvey's home was also the location of the first Methodist Church as Stephen Harvey was the first to build a frame house in the township in 1852 (Anonymous 1880: 659). He built a saw mill on Four-Mile Creek in 1854.

Stephen Harvey, Jr. owned land in Section 27, where the cemetery is located (Anonymous 1880: 957). He is listed as a farmer in that section. His brother was Lysander Harvey. Lysander Harvey owned land in Section 5 of Delaware Township. Lysander moved to the area with his father, Samuel Harvey, when Lysander was fourteen years old (Anonymous 1880: 354). Lysander married Rachel Roberts in 1853. They had eight children (Anonymous 1880: 914).

Stephen Harvey, Jr. married Mary Stewart in 1854. They had ten children: Dice E., Hannah, Theodore D., James S., Cyrus, Vera, Charles, William, John S., and Elviria (Anonymous 1880: 957). In 1880, they owned 181 acres near the cemetery with 700 trees, 400 of which were pear trees (Anonymous 1880: 957). Stephen and Mary are currently buried in Oakwood Cemetery, Polk County, Iowa. Stephen died in 1910 and Mary died in 1914 (www.findagrave.com). Lysander Harvey, who died in 1893, may have once been buried in Harvey Cemetery but is currently buried in Oakwood Cemetery in Polk County.

An article was published in the Des Moines Register on June 24, 2008 about a local historian named Duane Pierce. The article related to his research of Harvey Cemetery. According to the article, previous research, and the Polk County death records on Harvey Cemetery, there were once sixteen people buried in Harvey Cemetery. The article stated that most of them had been moved to other nearby cemeteries in the 1940s and 1950s. Research showed that at least two burials likely remained in the cemetery. They were the graves of Eliza B. Lee and the infant son of John T. and Viretta (Harvey) West (Finney 2008).

The article contains interviews with neighboring land owners Raymond and Donna Wallace who had lived adjacent to the cemetery since the early 1960s. Donna Wallace stated that "we've always known there were a couple of graves over there, but there were never any stones or visitors as long as we've lived here" (Finney 2008).

More information on the cemetery was obtained from various Internet sites on the history of Polk County. One Internet site mentions that the cemetery went unnoticed until 2002 when the Polk County Auditor's office came across it. The land owner in 2002 was using it as a 'junk pile' and was unaware it was a cemetery. This site mentions that there are 'no surviving markers, or burial records for this cemetery' (frelik.homestead.com/Polk8.html). The site does mention that the Polk County death records from 1880 to 1907 list the following people buried there (frelik.homestead.com/Polk8.html):

Iva May Barton
Wilbur H. Harvey
William H. Wade
William W. Hammond

Letitia Hartman
Lysander Harvey
Ralph Johnson
Nancy Morehead
Samuel Myren
Emma G. Wyman
Cora Bitting
Lilly O. Davis
Child of P.W. Howrick
Roda A. Lee
E.B. Lee
Infant son of John. T. and Viretta Harvey West

The site mentions that the last visible markers that were left in the cemetery were those of E.B. Lee and the infant son of John T. and Viretta Harvey West. It is noted that E.B. Lee died on November 5, 1875 and the infant son on March 6, 1880. Finally, the Internet site states that "…it should be kept in mind that most of the occupants were removed to nearby Rising Sun cemetery. Not all names appear in the Rising Sun records however" (frelik.homestead.com/Polk8.html).

A publication titled "Polk County, Iowa Cemeteries" was found by the author at the Iowa State Historical Library in Des, Moines, Iowa. It appears the publication was compiled by the Vital Statistics Committee, Polk County Genealogical Society in 1930-1931. Harvey Cemetery is listed in the publication and was visited at the time by a Mrs. Ambler and the granddaughter of Elisha B. Lee, a Mrs. Susan (West) Jacks. At that time, two stones were visible: a marble stone for Elisha B. Lee with the death inscription of November 5, 1875 (age 76 years, 8 months) and a broken stone for the infant son of John T. and Viretta Harvey West. This publication states "this was a family burial ground. All that remains now are two graves, the rest have been removed to the Rising Sun Cemetery. It was on the Stephen Harvey farm, which is still in the family".

The Indiana Magazine of History contains Bible Records from the Stephen Harvey family (http://purl.dlib.indiana.edu). It includes a section on Elisha B. Lee who was born on March 4, 1796 and died on September 5th, 1872. The record states that Elisha B. Lee "is buried in the old Harvey graveyard in Delaware Twp., Polk County, Iowa. He was a soldier in the war of 1812 (https://scholarworks.iu.edu/journals/index.php/imh/article/view/7014/7741).

Of the names mentioned above, there is a current headstone for Iva May Barton in Rising Sun Cemetery. She was born in 1877 and died on December 23, 1888 at the age of 11 (www.findagrave.com). There is a current headstone for Emma G. Wyman in Oakwood Cemetery. She was born in 1889 and died in 1892 (www.findagrave.com) at the age of 2-3 years old. There is record of a Wilbur Harvey in Oakwood Cemetery. Wilbur Harvey was born in 1889 and died February 25, 1891 at the age of 2-3 years old (iowawpagraves.org). Nancy Morehead is also on record at Oakwood Cemetery. She was born in 1889 and died on September 21, 1896 at the age of 7 years old (iowawpagraves.org). There is a current gravestone for Lettita Andrews Hartman at Oakwood Cemetery. She dies on February 23, 1893 at the age of 67 (www.findagrave.com).

There is a record for a William Hammond in Saint Ambrose Cemetery in Des Moines. He died on April 4, 1888 and was 1 year old. There are two death records for a Ralph Johnson in Polk County, Iowa during this time frame. One was for a Ralph Johnson who died on June 10, 1895 at the age of 5 and another was for a Ralph Johnson who died on January 18, 1907 at the age of 15 (www.familysearch.org). This second

Ralph Johnson has a tombstone in Woodland Cemetery (www.findagrave.com). Lilly O. Davis is on record for Polk County as having died on April 21, 1897 at the age of 4 (www.familysearch.org).

There is a death record for a Samuel Meyren who died on November 2, 1893 at the age of 38 (www.familysearch.org). There is also a death on record for May 31, 1897 for an unnamed Howrick born to P.W. Howrick, a 25-day old infant (www.familysearch.org). A death record for Roda A. Lee exists on file and she died on May 30, 1897 at the age of 63 (www.familysearch.org). A record for the infant death of Johnie West exists for Polk County in March of 1880 (www.familysearch.org) and remarks on this page for Johnie West in the Iowa Mortality Schedule indicate that "diphtheria …bad here and very fatal for some time".

There are two gravestones for a Lysander Harvey in nearby cemeteries. In Pine Hill Cemetery, there is a headstone for Lysander Harvey born in 1811 in New York and died on January 4, 1898. At Oakwood Cemetery, there is a gravestone for Lysander Harvey born in 1834 and died November 20, 1893 (www.findagrave.com). The second appears to have the correct information for the Lysander Harvey related to Stephen Harvey (https://www.genealogy.com/ftm/r/e/g/Bret-R-Regis-MN/WEBSITE-0001/UHP-0501.html).

Name	Date of Death	Age at Death	Current Burial Location	Source
Iva May Barton	December 23, 1888	11	Rising Sun Cemetery	www.findagrave.com
Wilbur H. Harvey	February 25, 1891	2-3	Unknown	iowawpagraves.org
William H. Wade	Unknown	Unknown	Unknown	N/A
William W. Hammond	April 4, 1888	1	St. Ambrose Cemetery	familysearch.org
Letitia Hartman	February 23, 1893	67	Oakwood Cemetery	www.findagrave.com
Lysander Harvey	November 20, 1893	59	Oakwood Cemetery	www.findagrave.com
Ralph Johnson	June 10, 1895 or January 18, 1907	5 or 15	Woodland Cemetery	familysearch.org
Nancy Morehead	September 21, 1896	7	Oakwood Cemetery	iowawpagraves.org
Samuel Myren (or Meyren)	November 2, 1893	38	Unknown	familysearch.org
Emma G. Wyman	1892	2-3	Oakwood Cemetery	www.findagrave.com
Cora Bitting	Unknown	Unknown	Unknown	N/A
Lilly O. Davis	April 21, 1897	4	Unknown	familysearch.org
Child of P.W. Howrick	May 31, 1897	25 days	Unknown	familysearch.org
Roda A. Lee	May 30, 1897	63	Unknown	familysearch.org

Elisha B. Lee	November 5, 1875 or September 5, 1872	76	Harvey Cemetery	www.findagrave.com http://purl.dlib.indiana.edu
Infant son of John. T. and Viretta Harvey West (likely named Johnie West)	March, 1880	infant	Harvey Cemetery	familysearch.org

Table 1. Research summary of names associated with Harvey Cemetery burial records.

In summary (Table 1), it appears that of the sixteen names associated with Harvey Cemetery at least nine were children. As of the 1930s, at least two gravestones were visible in the cemetery for Elisha B. Lee and the infant West son. However, (1) several burial locations are unknown at this time or do not seem to appear in local cemetery records, (2) it should not be assumed with certainty that the headstones found at local cemeteries for these names actually contain a burial, (3) it should not be assumed with certainty that the headstones found at local cemeteries for these names are the same person, and (4) although the last account of gravestones at Harvey Cemetery mentions two, it does not mean that there were not more burials at the time without visible headstones.

It is therefore uncertain, based on the history examined here, how many burials may be in Harvey Cemetery today. It appears that at a minimum, there are two: Elisha B. Lee and an infant. If the unknowns from above are added, it could be at least nine burials.

METHODOLOGY

Ground Penetrating Radar (GPR) is a form of remote sensing and as such, it has the potential to provide information about materials underground without coming in direct contact with that material. Therefore, it is a non-invasive or non-destructive method that can work well in mapping grave locations in cemeteries because it does not disturb the burials in any way. It is considered an active remote sensing method that works by emitting electromagnetic energy pulses from a ground-based antenna and then records any waves that are bounced off materials or changes underground.

A sketch map was created before the survey to show topography and location of various features within the survey area (Figure 6). For this survey, a Geophysical Survey Systems, Inc. (GSSI) 350MHz UtilityScan GPR unit was used (Figure 7). Before each grid survey, the antenna and survey wheels were calibrated using the UtilityScan interface. This was done to ensure accurate depth and distance measurements, respectively. A maximum vertical scan depth of three meters was set on UtilityScan interface which is a sufficient depth to locate burials. A scan density of 100 scans per meter was used and the field dielectric was set at eleven based on the loamy soil material.

Before the GPR survey commenced, a systematic grid was placed across the Harvey Cemetery parcel (Figure 7). Stakes were placed every ten meters across the parcel and were measured using two tapes to allow for a hypotenuse distance. The overall grid measured 36 meters in the X direction and 40 meters in the Y direction (Figure 7). The stake at the lower-left corner of the parcel was set at 100X and 100Y to allow for positive coordinates in smaller areas surveyed west and south of the overall grid.

It is best to orient a GPR survey perpendicular to the long axis of the targets, which in this case are historic burials. Unfortunately, there were no current headstones or information that allowed for

determination of the grave orientation(s). Therefore, surveys were conducted along both the X-axis and the Y-axis of cemetery parcel. Surveys were conducted using the width of the antenna which was 50 centimeters. The entire parcel was surveyed in both the X and Y directions. Every scan began at a baseline and ended at the property boundary and were surveyed in only one direction (i.e., not zig-zagged back and forth). A total of four grids were collected: two in the Y-direction and two in the X-direction (Figure 7). It should be noted that the grid collection in the X-direction occurred after an intense rainfall and heavy soil moisture could affect GPR results. The soil was dry for grid collection in the Y-direction with no recent rainfall.

The GPR scans were processed using GSSI's RADAN 7 software. The following processes were run on all scans. A time zero correction was run to ensure that the top of the scan profile was equivalent to the ground surface. A background noise removal filter was applied to remove any horizontal banding noise. An exponential range gain process was run to set all of the O-Scope peaks to the same size throughout the time range. Finally, before 3D visualization, a manual migration was run to better calibrate the dielectric and remove hyperbolic tails which helps improve the geometry of the targets when creating 3D time slice maps.

RESULTS

After preliminary processing of all line scans, 3D time-slice maps were created in RADAN to see if any initial anomalies were presented that could be further investigated. After careful analysis, an obvious oval-shaped feature was evident in the Y-direction scans. This feature was located in the northwest corner of the parcel in the area that is relatively treeless and the flattest portion of the surveyed area (Figure 8). The oval feature is oriented from the northwest to southeast direction and seems to follow the landscape orientation. The feature became most evident around two meters in depth in the time slices, which if the dielectric is correct, corresponds to the depth where one would expect to find buried remains. The feature, as presented in the 3D images, appears to consist of various anomalies that seem to represent the sizes and shapes of various burials. In other words, larger shaped anomalies for adults and smaller shaped anomalies for children (Figure 9). The 3D time slice was georeferenced in ArcGIS to show the location of the oval-shaped feature on the 2017 aerial photograph (Figure 10).

Analysis of each two-dimensional scan was also done. Grave shafts, disturbed soil, and potential burials were noticed within the oval-shaped area in the two-dimensional profiles (Figure 11). From the data collected, it is hard to distinguish how many current burials are located within Harvey Cemetery, but the data shows that the oval-shaped area is likely the cemetery boundary. An overall interpretation, based on the data collected, is provided in Figure 12. It should be kept in mind that this map is just an interpretation based off the data collected and should not be considered what actually exists underground.

PRELIMINARY GROUND-TRUTHING

In a preliminary effort to test the results, two shallow soil cores (i.e., <50 cm deep) were taken outside and within the oval-shaped anomaly area. An intact soil, showing a natural transition between the surface and subsurface horizons, was seen in a core taken just east of the oval-shaped area (Figure 12). This was compared to a soil core taken in the oval-shaped area which shows a "mixed" or "disturbed" soil as one would expect in a grave shaft. This further demonstrates that the oval-shaped area is likely the old cemetery area.

CONCLUSIONS AND RECOMMENDATIONS

A ground penetrating radar survey was conducted for a 0.17-hectare (0.42 acre) area that has a historic connection to the location of the Harvey family cemetery. The purpose of the survey was to assist in

locating unmarked graves within the survey boundary. GPR anomalies appear in an oval-shaped area in the northwest corner of the survey area which coincides with a treeless, flat area. 2D and 3D GPR data interpretations show that maybe as many as ten burials are currently in the cemetery along with six former grave shafts. These are only interpretations, however, and should not be considered what actually exists underground.

The following recommendations are made:

1) The oval-shaped area in the northwest corner is likely the boundary of the old cemetery. This area is the most sensitive. This area should definitely be avoided when planning any development projects in the area.

2) Additional geophysical surveys in the oval-shaped area may assist in confirming or furthering interpretations in this report. These surveys might include soil resistivity or electromagnetic surveys.

3) It appears that shallow soil probes may also be a useful, non-invasive tool for further investigations or planning. For example, if an area within the parcel were proposed for development, locations with intact soil profiles could be safely assumed to not be former grave locations.

Based off the archival research, GPR data, and soil geomorphology for the project area, the methods were justified; however, no method, geophysical or otherwise, is sufficient enough to possibly identify all subsurface materials within a given area. Because of the nature of GPR, it is possible that other burials may be present that were not identified here. Extreme caution should be used if ground disturbing is to occur. RHCS is also available to answer any questions regarding these issues and Chad A. Goings can be reached at (319) 461-7427.

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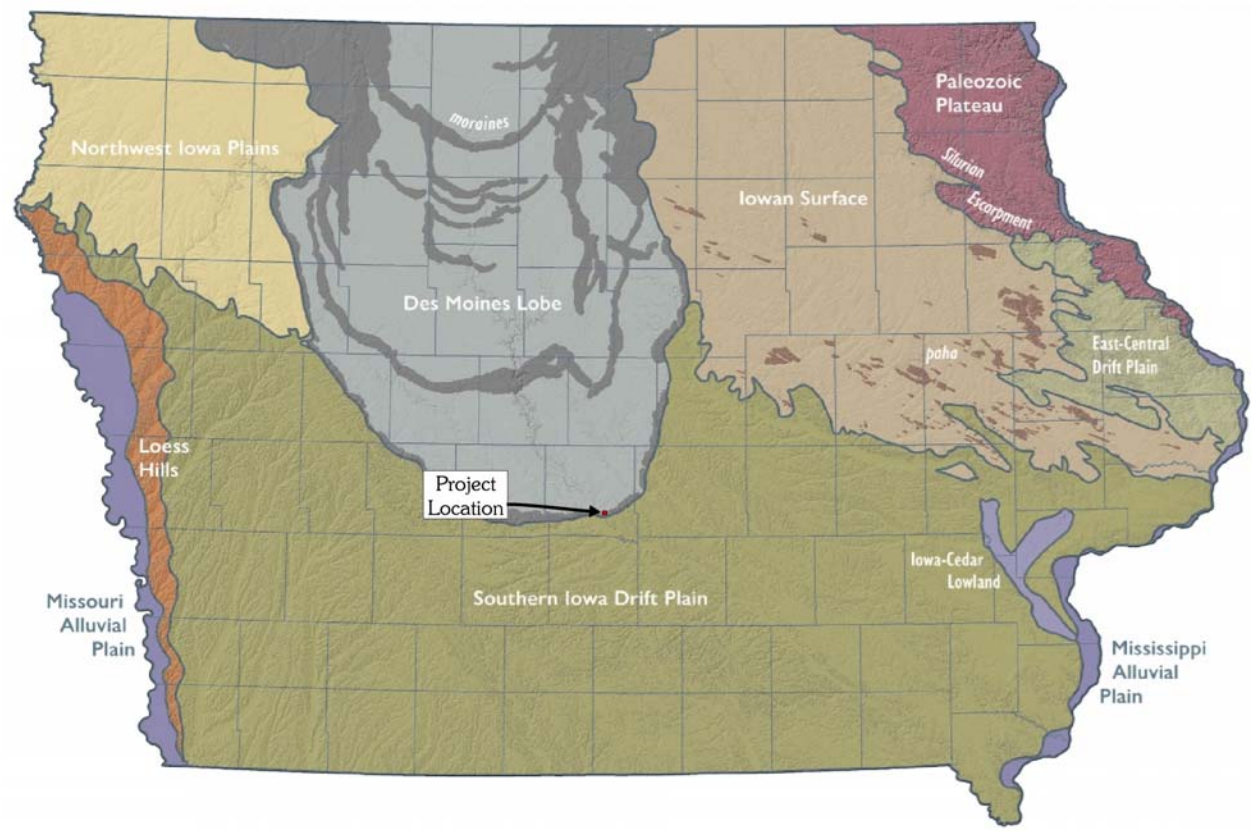

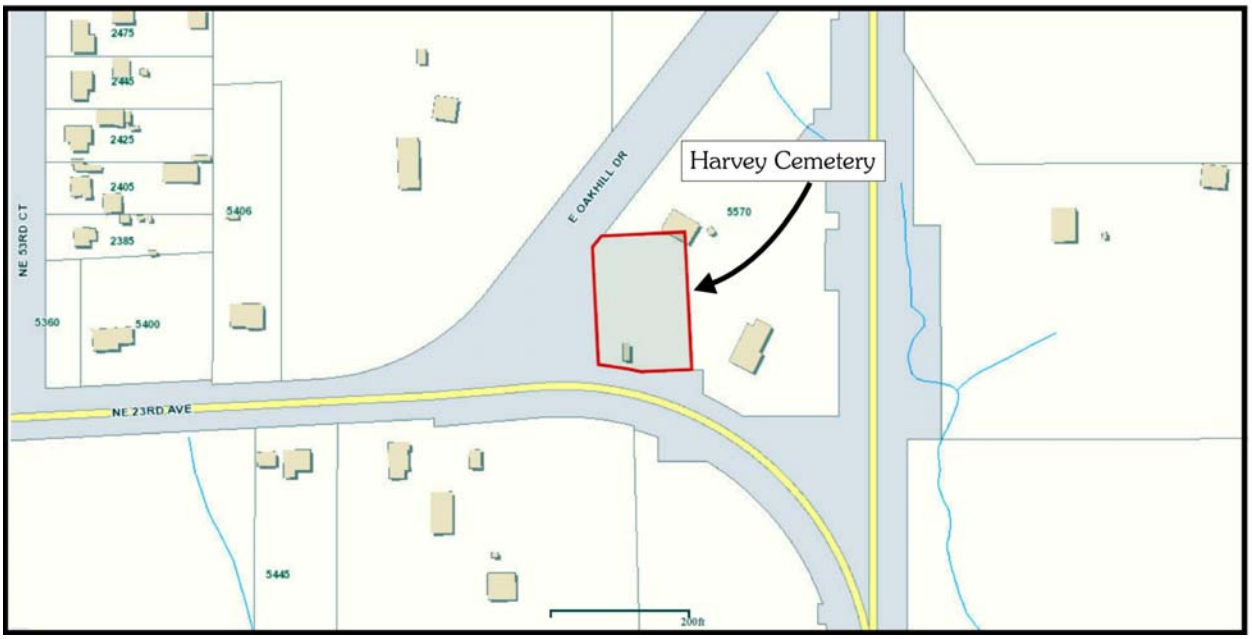

Figure 1. Location of Harvey Cemetery in Polk County, Iowa.

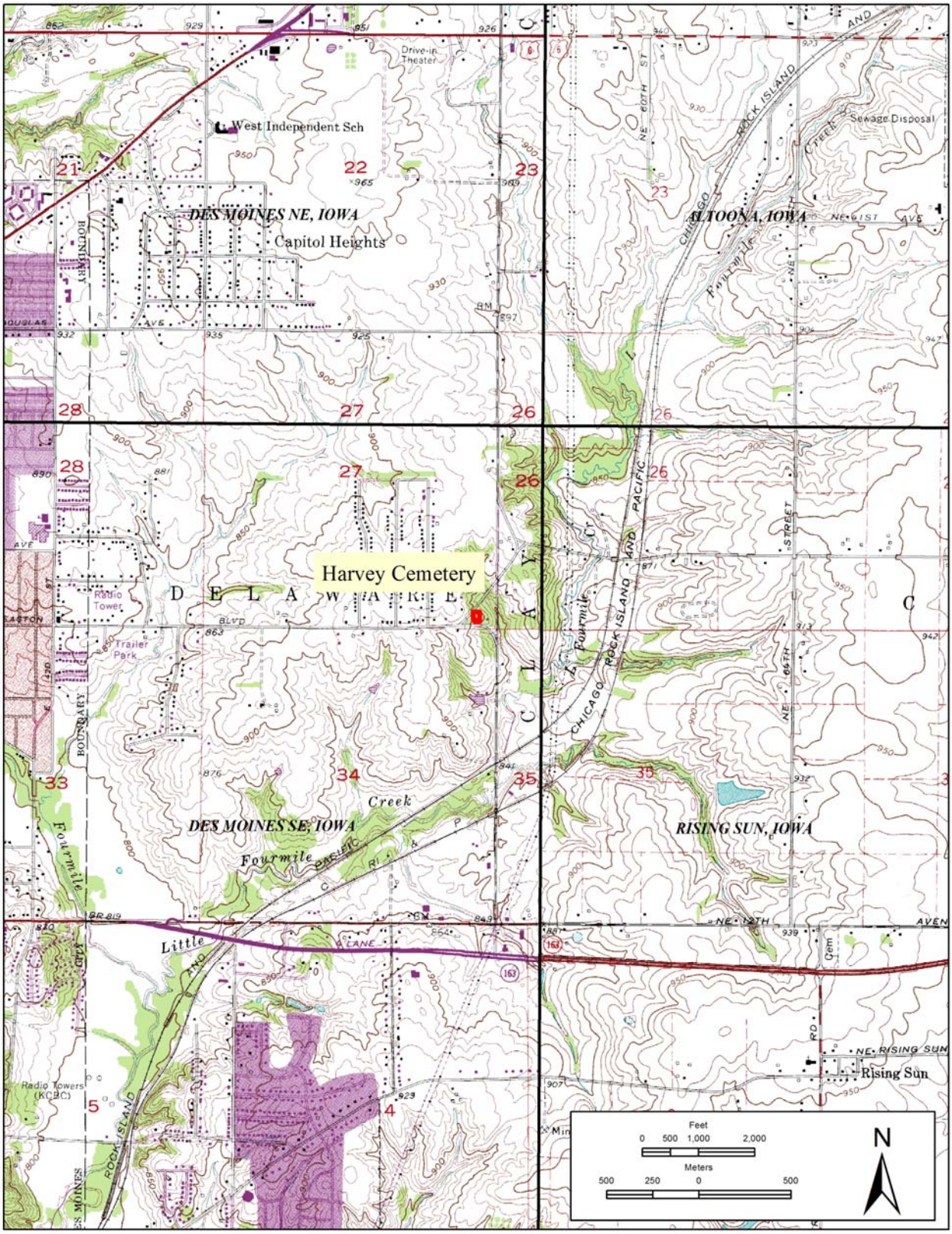

Figure 2. Location of Harvey Cemetery on the 1976 Des Moines SE, USGS 7.5-Minute Quadrangle.

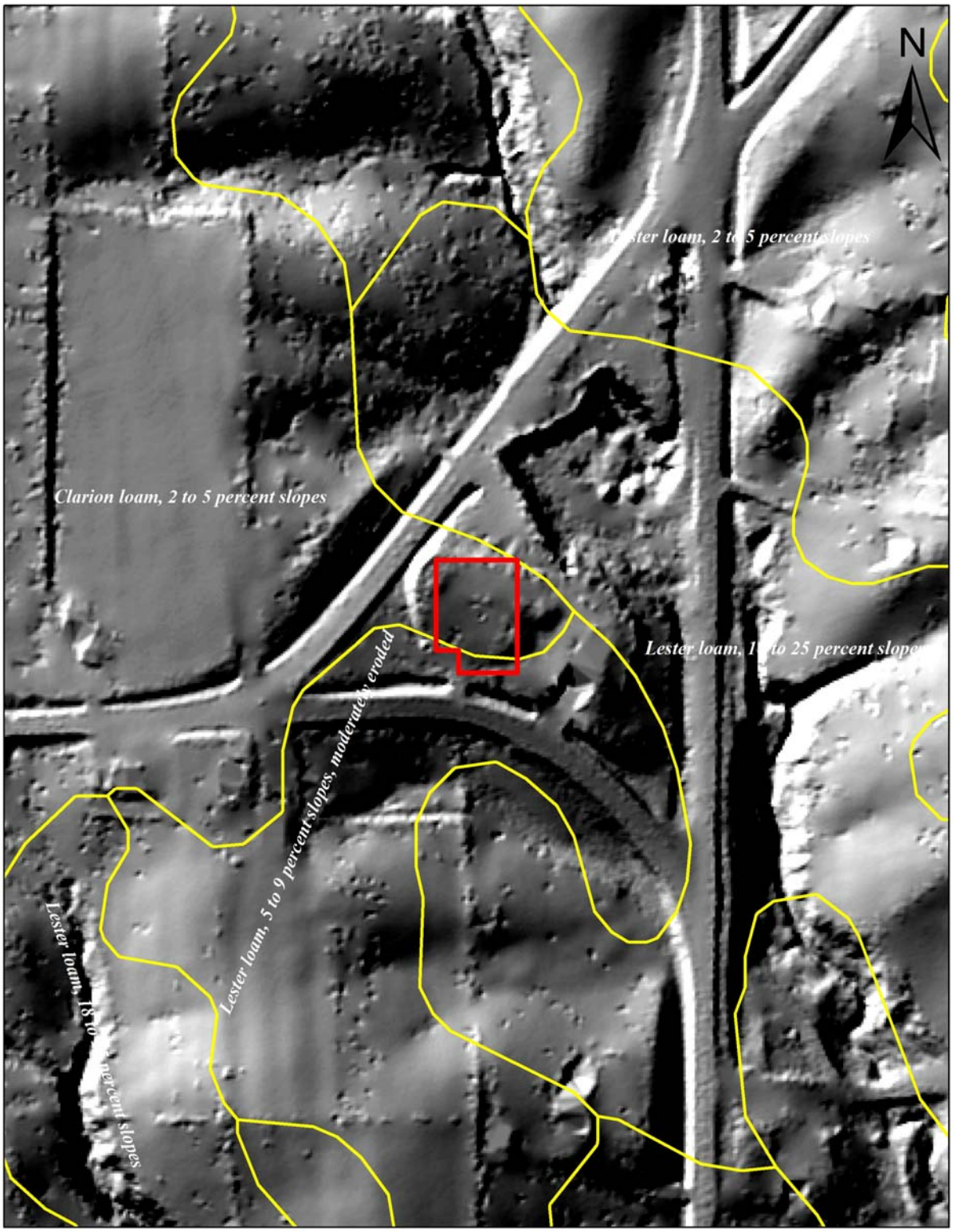

Figure 3. SSURGO soils for Harvey Cemetery property (in red) with 1-meter LiDAR hillshade.

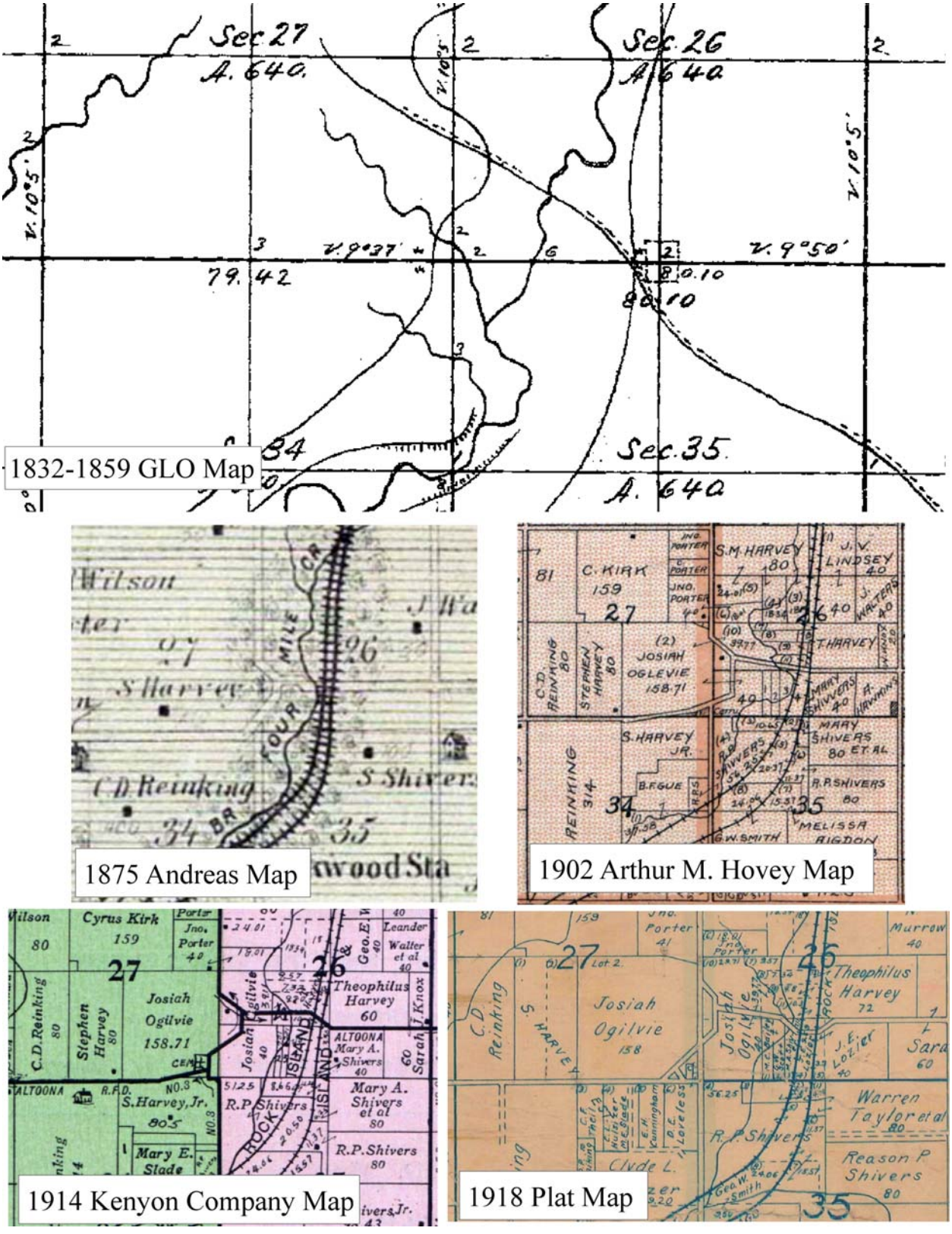

Figure 4. Historic plat maps of the cemetery area.

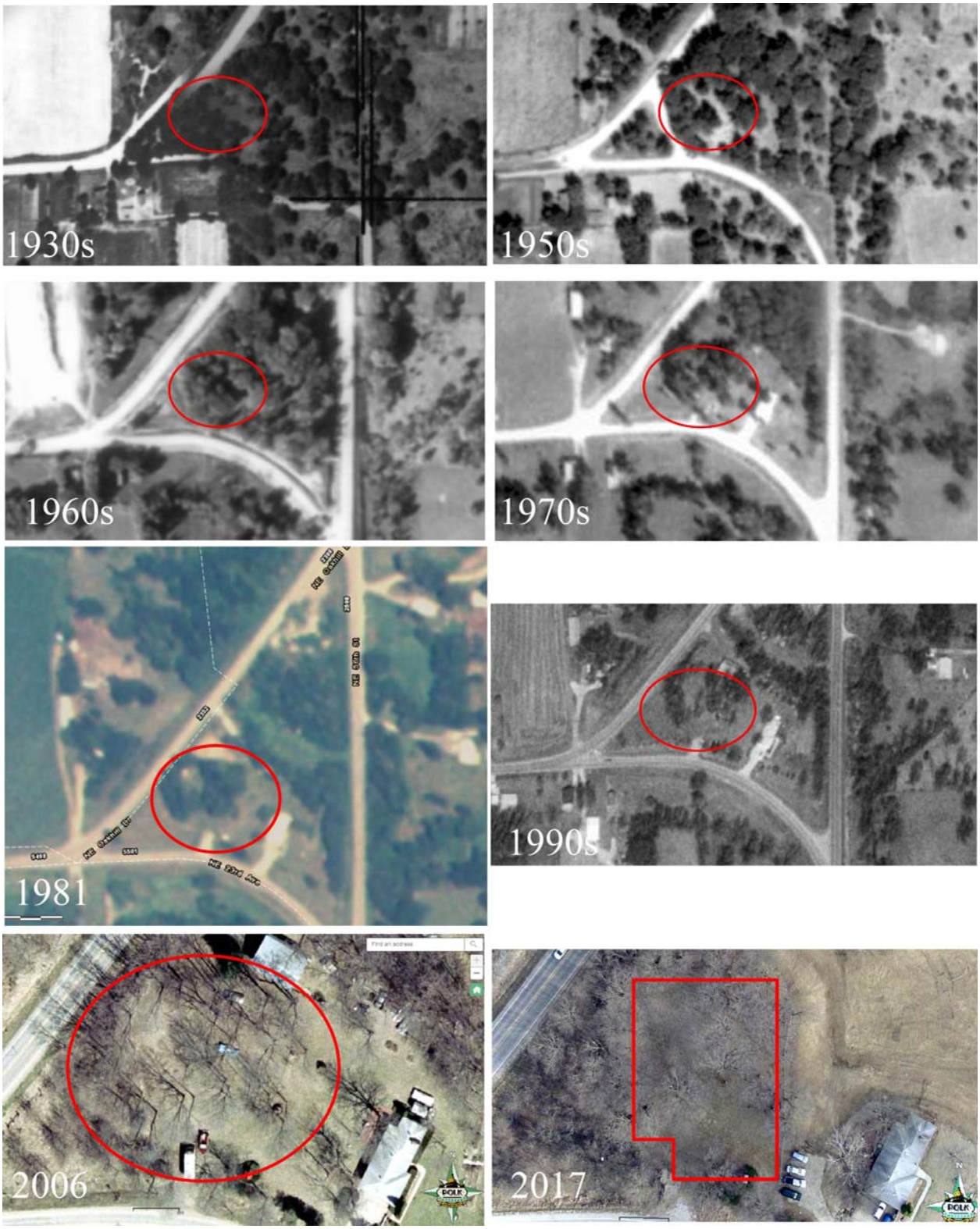

Figure 5. Historic aerial photographs from the Iowa Geographic Map Server and Polk County.

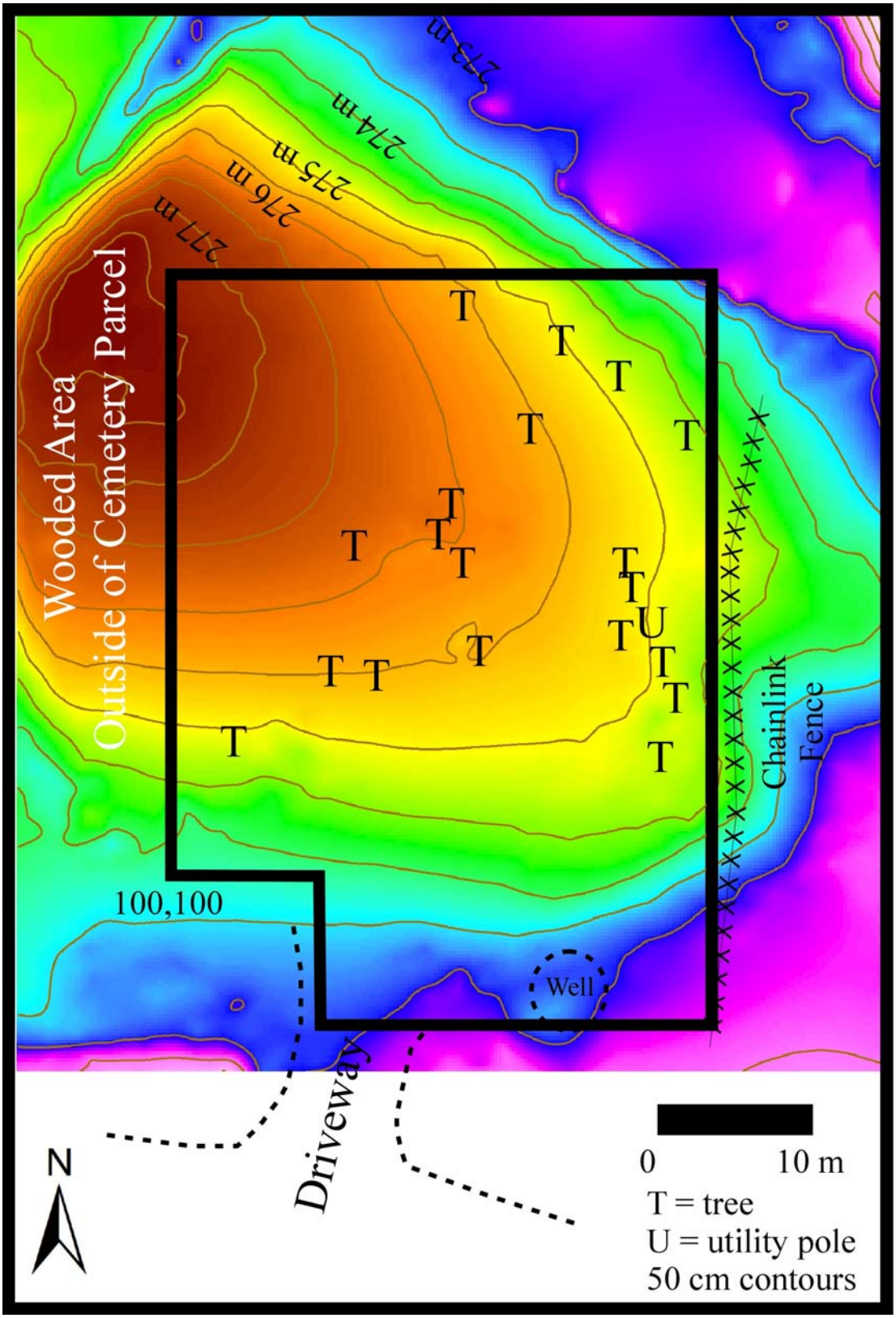

Figure 6. Sketch map of surveyed area with LiDAR topographic basemap.

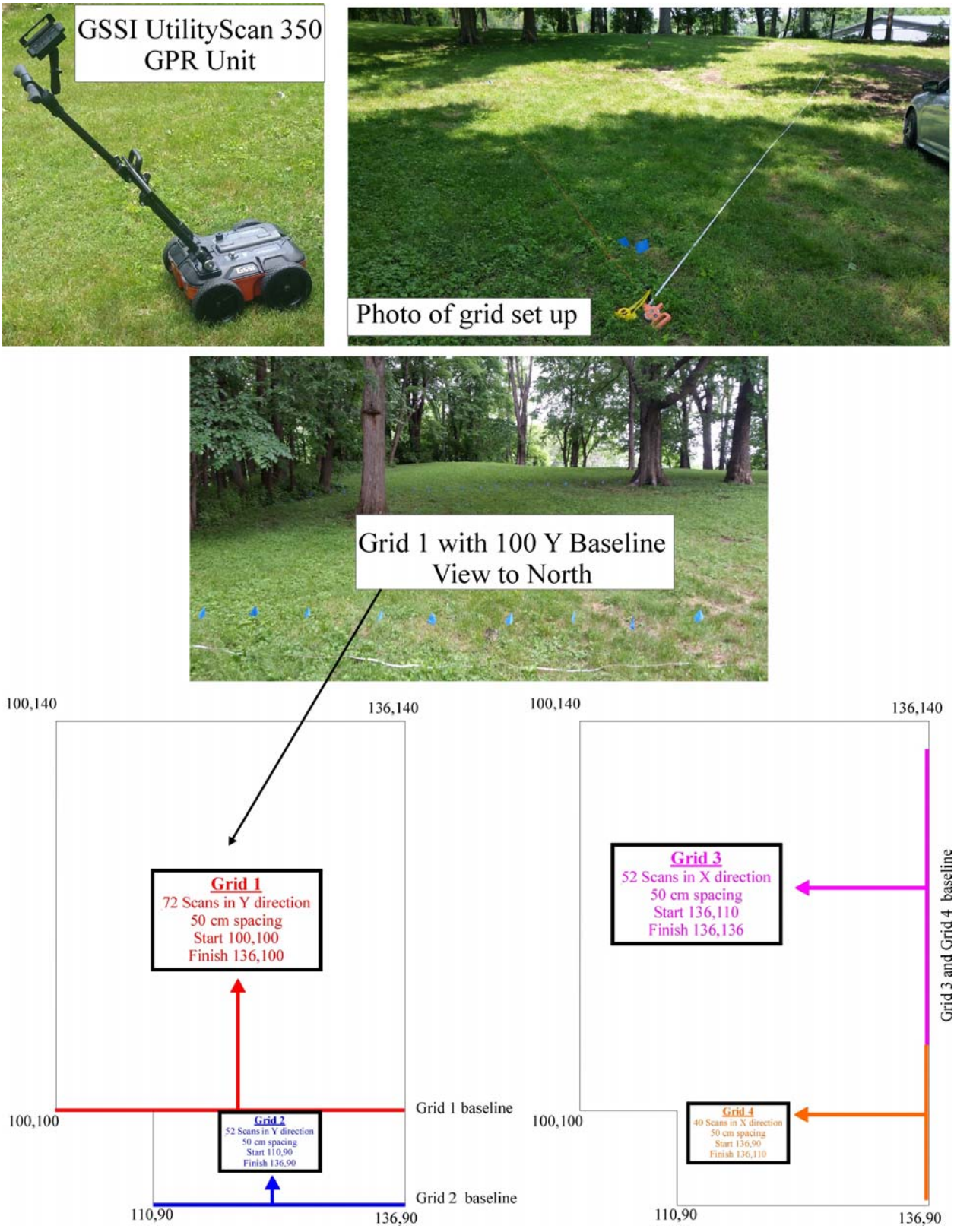

Figure 7. Photographs of survey equipment and grid set up.

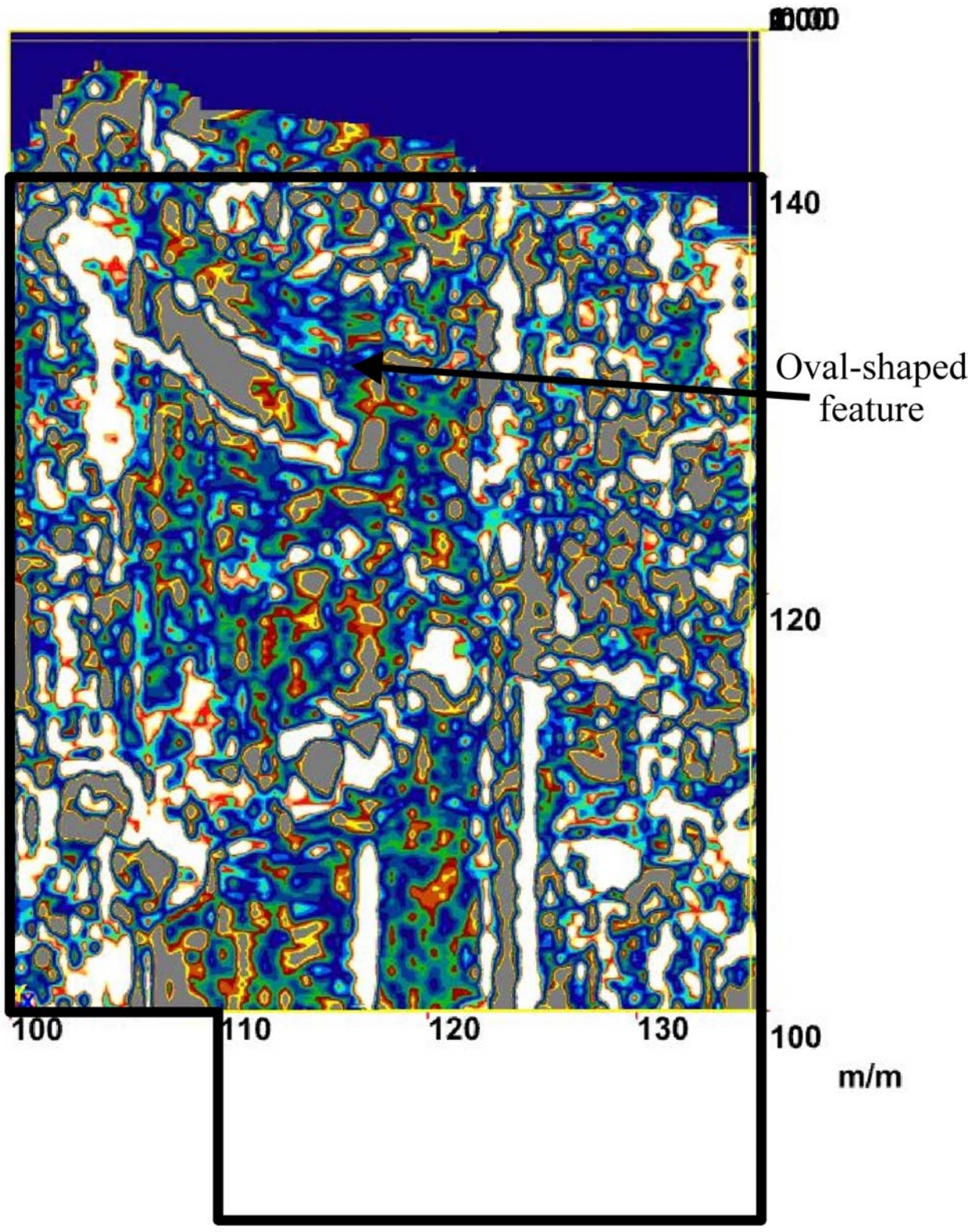

Figure 8. 3D time slice from roughly two meters deep showing location of oval-shaped feature.

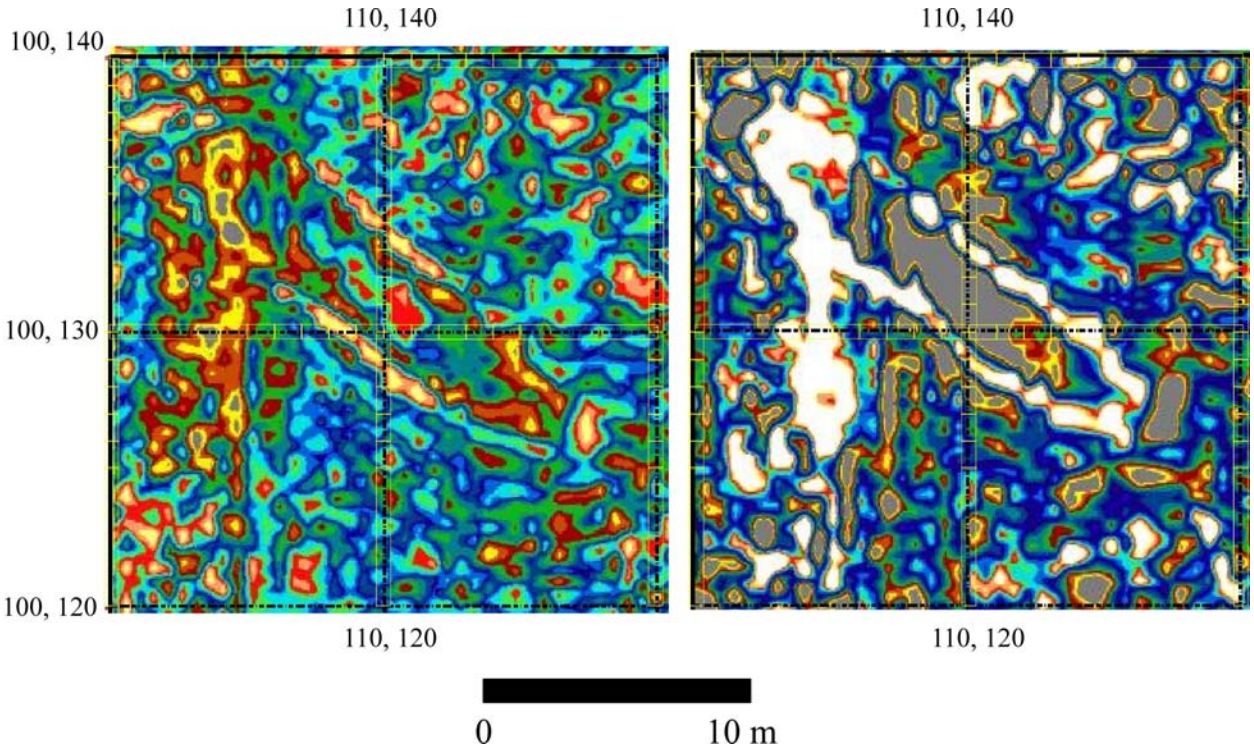

Figure 9. Close up of oval-shaped feature with two different color ramps.

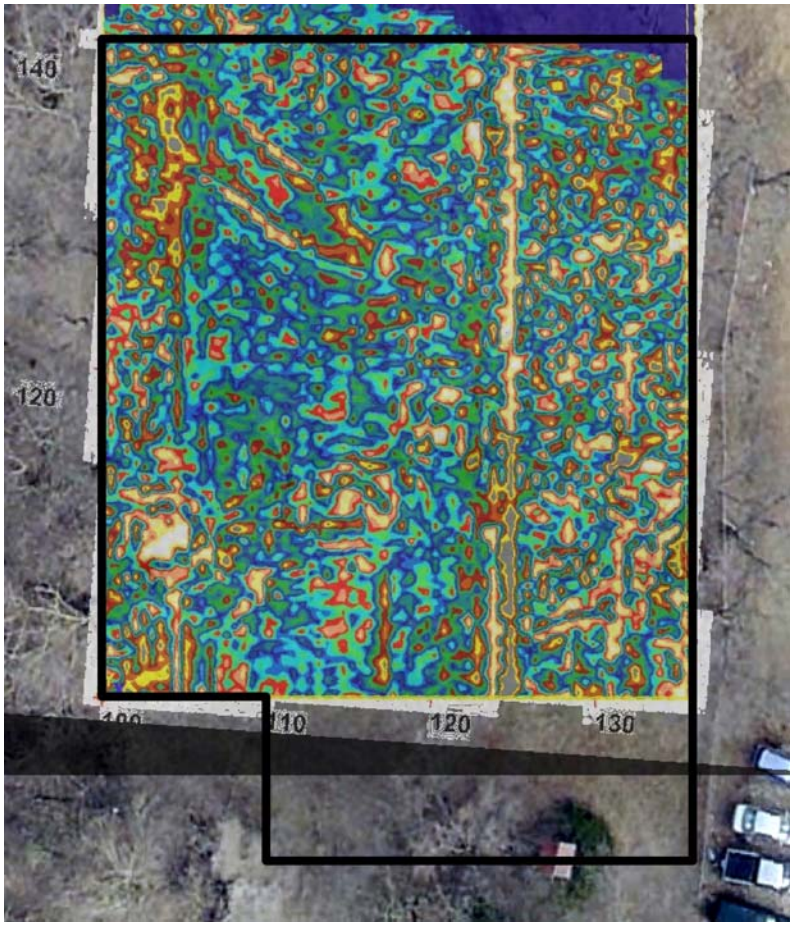

Figure 10. Above: Oval-shaped feature superimposed on 2017 aerial photograph.
Below: Photograph of oval-shaped area within staked boundary. View to northwest.

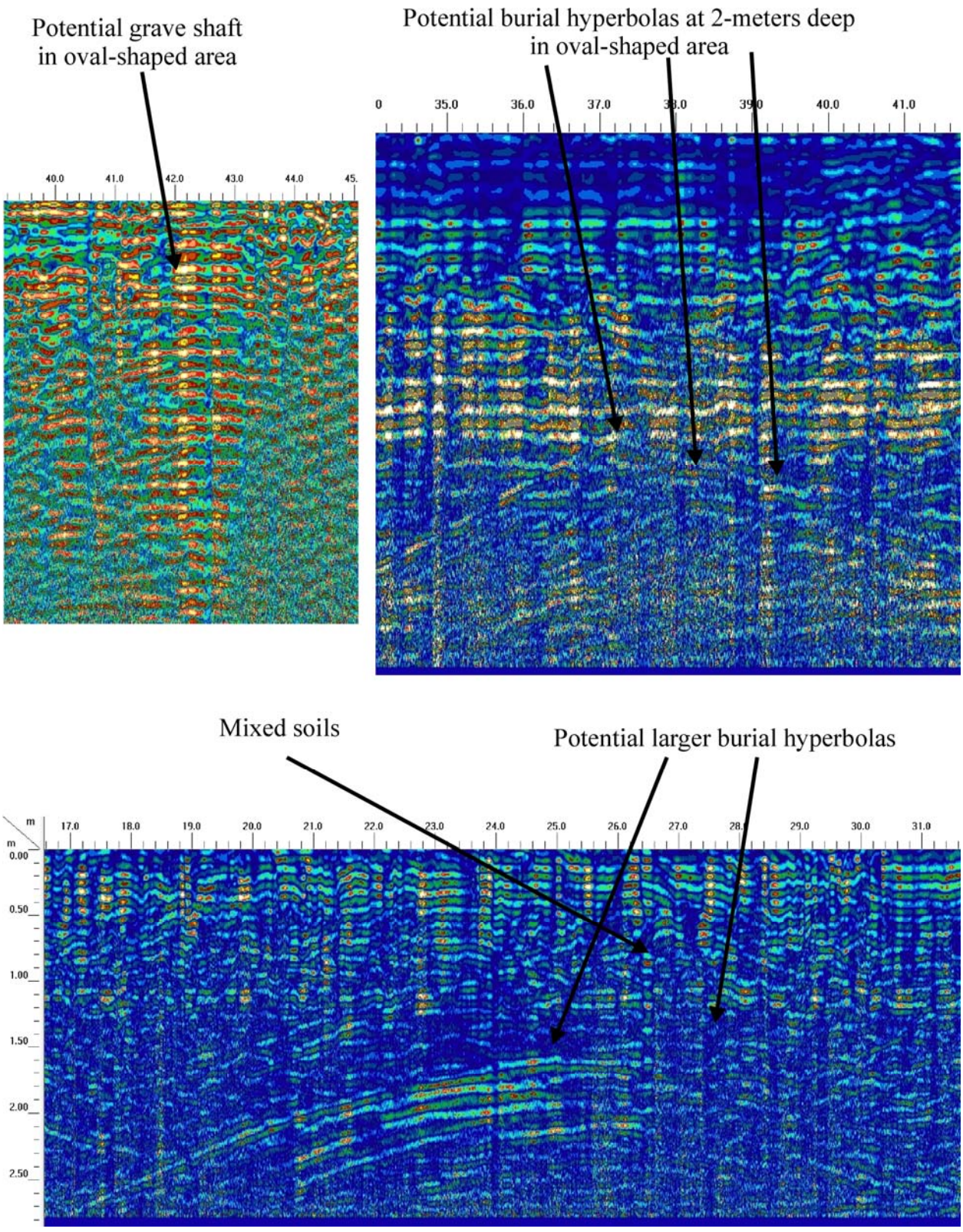

Figure 11. Examples of 2D scan interpretations and hyperbolas.

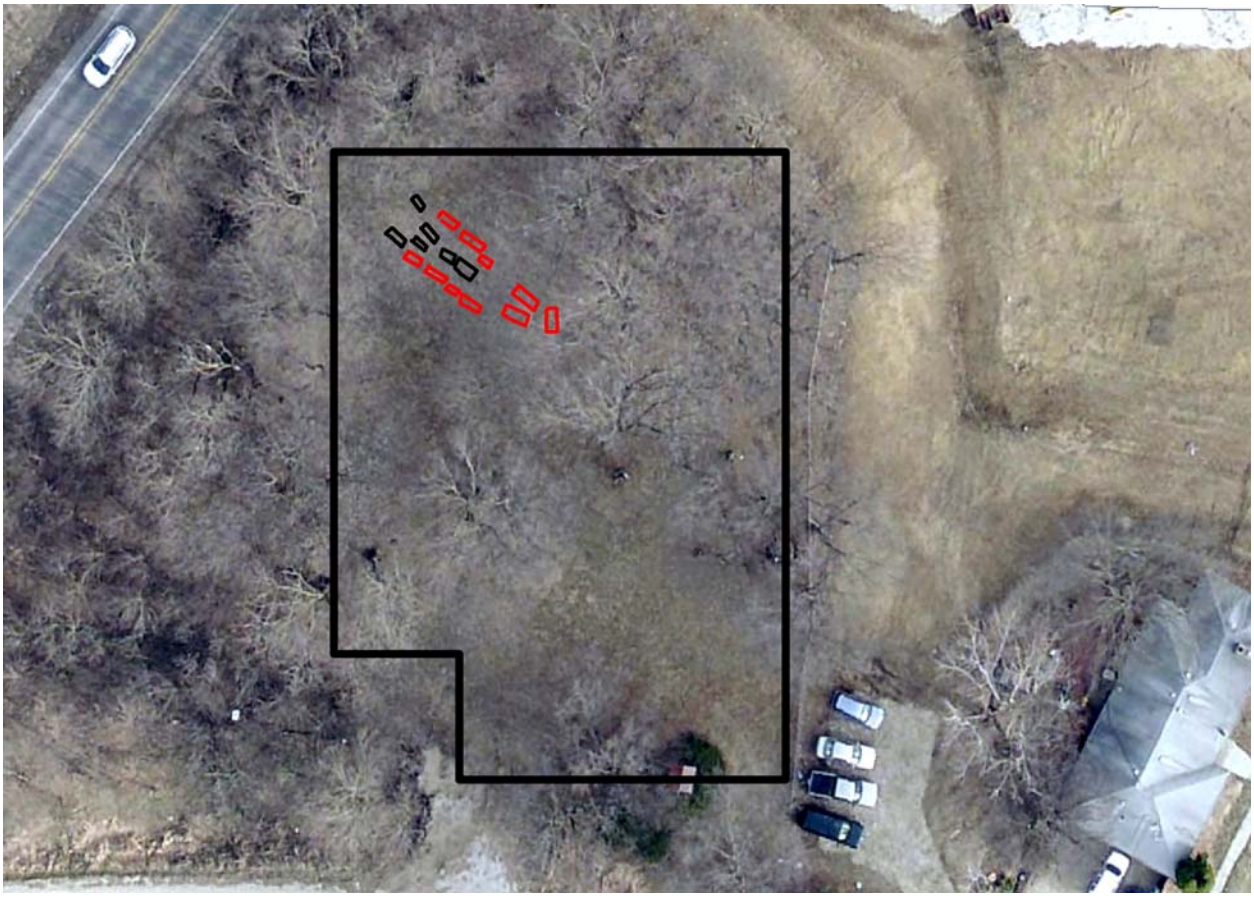

Figure 12. Interpretation: red locations seem to show burial; black locations seem to show grave shaft.

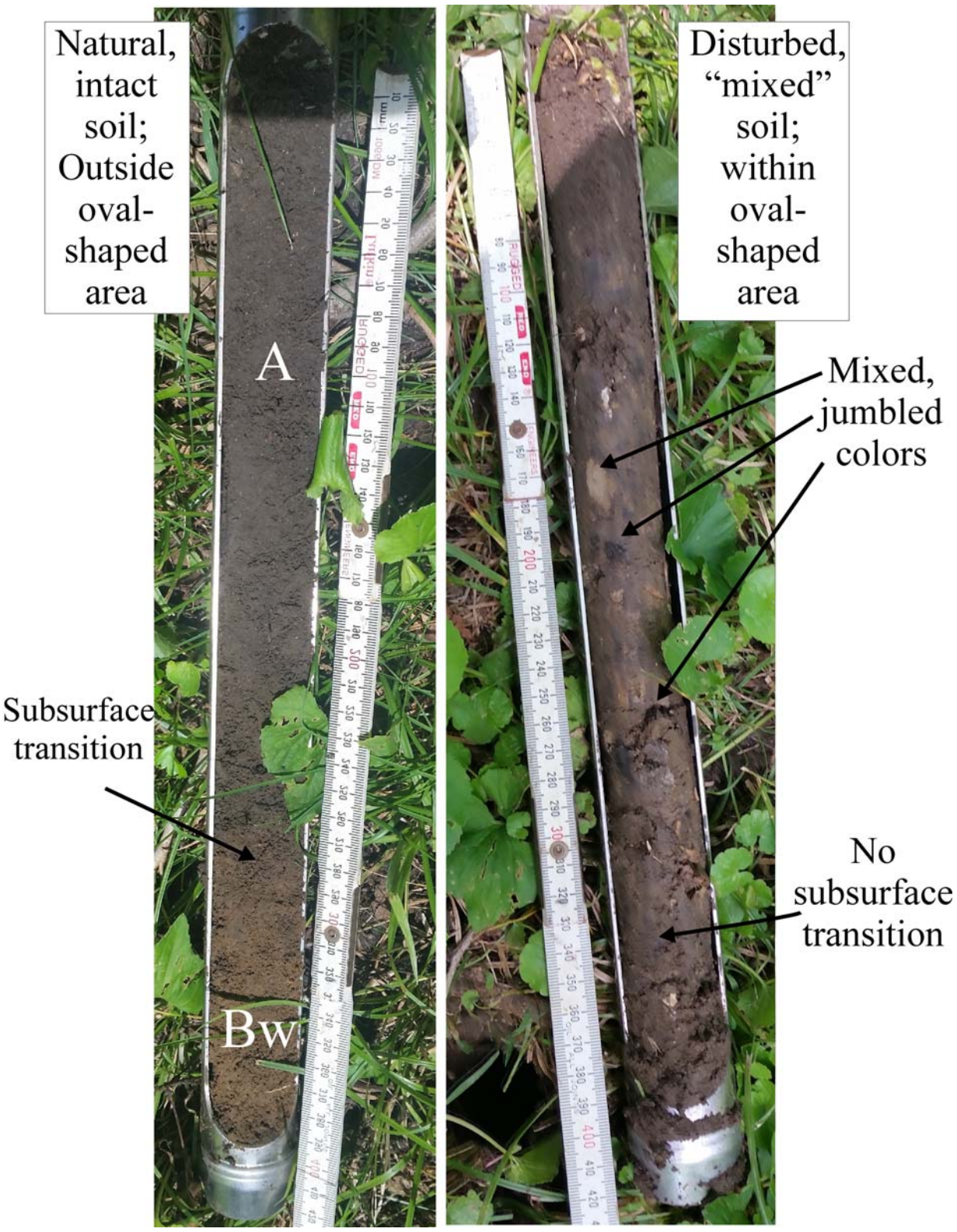

Figure 13. Pictures of differences in intact, natural soils versus "mixed" soil in oval-shaped area.

Appendix I

Database Doc Number: _____

National Archeological Data Base - Reports: Data Entry Form

1. R and C #:

2. Authors: Chad A. Goings

Publication Date: June 2018

3. Title: Locating Unmarked Graves at Harvey Cemetery using Ground Penetrating Radar, Delaware Township, Polk County, Iowa.

= = = = = =

4. Report Title: RHCS#194

Volume #: Report #:194

Publisher: Rolling Hills Consulting Services, L.L.C.

Place: Washington, Iowa

= = = = = =

5. Unpublished

Sent from:

Sent to:

Contract #:

= = = = = =

6. Federal Agency:

= = = = = =

7. State: Iowa

County: Polk

Town:

= = = = = =

8. Worktype: 46 – Remote Sensing

= = = = = =

9. Keyword: 0-Types of Resources/Features 1-Generic Terms/Research Questions 2-Taxonomic Names 3-Artifacts Types/Material Classes 4-Geographic names/Locations 5-Time Periods 6-Project name/Study Unit 7-Other Keywords

0.42 acre	[7]	No Resources	[0]
Des Moines Lobe	[4]	Remote Sensing	[1]
	[ ]		[]

= = = = =

10. UTM Zone:

15	Easting:	457951	Northing:	4607198
15	Easting:	457987	Northing:	4607248
15	Easting:		Northing:	
15	Easting:		Northing:	

= = = = = =

11. Township: 79N

Range: 23W

Other Publication Types

12. Monograph

Name: _____

Place: _____

13. Chapter

In: _____ First: _____ Last: _____

14. Journal

Volume:____ Issue #: _____ First: _____ Last: _____ ISSN:____

15. Dissertation

Degree: PH.D. LL.D. M.A. M.S. B.A. B.S. Institute: _____

16. Paper

Meeting: _____

Place: _____

17. Other

Reference Line: _____

= = = = = =

18. Site #: _____

= = = = = =

19. Quad Map #: Des Moines Southeast 1976, 7.5-minute Quadrangle