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# Geophysical Survey of Wisconsin Burial Site OC-0042: Brazeau Pioneer Cemetery

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**PETER N. PEREGRINE, DIRECTOR**



# **Geophysical Survey of Wisconsin Burial Site OC-0042: Brazeau Pioneer Cemetery**

Peter N. Peregrine, Lawrence University  
November, 2018

## **Final Report** Wisconsin PLP # 18-030

### **Abstract:**

On October 23 and 25 a geophysical survey using geomagnetic, soil resistivity, and ground penetrating radar methods was conducted to determine if there are unmarked interments at Wisconsin Burial Site OC-0042, the Brazeau Pioneer Cemetery. The survey was undertaken on behalf of the Town of Brazeau in anticipation of using the cemetery for burial. The survey found no evidence of extant interments in the cemetery.



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## Introduction and Context

The research reported here was undertaken to locate unmarked interments in the Brazeau Pioneer Cemetery. The cemetery is catalogued as Wisconsin Burial Site OC-0042 and is located at the southwest corner of North White Potato Lake Road and Parkway Road in Section 24, Township 31, Range 18 East, Oconto County, Wisconsin (see Figures 1 & 2). The cemetery was deeded to the Town of Brazeau in 1980, but there are no records of any interments being made. The Town of Brazeau cemetery (BOC-0040) is running out of space, and the Town would like to use the Brazeau Pioneer Cemetery for new interments. Professor Peter Peregrine of Lawrence University offered to undertake a geophysical survey of the cemetery to determine whether unmarked interments were present. This report describes the findings of this survey.

The Brazeau Pioneer Cemetery is located at southwest corner of White Potato Lake Road and Parkway Road in the Town of Brazeau, Oconto County. The site is not identified as a cemetery on early Oconto County maps (e.g. George A Ogle and Company 1912, H.G. Razall Company 1898; Hixson and Company 1915), and thus is unlikely to have operated as a cemetery before being donated to the Town of Brazeau. The name Pioneer Cemetery was given to the site because early graves are reputed to be located on top of a hill on the north edge of the site, though no markers are present and large trees now cover much of the reputed area of interments. There is one marker on the east side of the site placed by the Town of Brazeau to identify the cemetery (Figure 3).

## Methods

The geophysical survey of the Brazeau Pioneer Cemetery was conducted by Peregrine and four Lawrence University students<sup>1</sup> on October 23 and 25, 2018. Work was performed as part of a field archaeology class. Geomagnetic survey was conducted October 23, 2018 over two 30 meter by 30 meter grid units (Figure 3). Soil resistivity and ground penetrating radar surveys were conducted October 25 over the eastern 30 meter grid used for the geomagnetic survey (Figures 4 & 5).

Geomagnetic data were collected using a Geoscan FM256 differential gradiometer (Geoscan Research 2009). This instrument consists of two magnetometers arranged one atop the other with a 0.5 meter separation. Each magnetometer measures the earth's magnetic field and the difference between the two readings, which is equivalent to the vertical gradient of the earth's magnetic field, is recorded. The instrument is sensitive enough to measure tiny variations in the earth's magnetic field, variations that might be caused by subtle soil changes or the presence of buried materials (Aspinall, Gaffney, and Schmidt 2009). For this application sensitivity of the FM256 was set at 1.0 nanotesla, or about 1/25,000<sup>th</sup> of the earth's total magnetic field. Data were collected at 0.25 meter intervals along 0.5 meter spaced parallel north-south lines and using a zig-zag method in which data were collected south-north on odd-numbered lines and north-

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<sup>1</sup> Ethan Courey, Joe Kortenhof, Emma Lipkin, and William Nichols.



south on even numbered lines. Complete 30 meter by 30 meter grid units were each collected at a single time, without interruption.

The raw magnetic data were downloaded from the FM256 into the Geoplot 4.0 software package (Geoscan Research 2016). Analyses conducted on the data involved (in the following order) (1) “clipping” to remove high and low data points more than one standard deviation from the mean; (2) “despiking” to remove any point source data spikes; (3) “destaggering” to remove effects of the zig-zag data collection technique; (4) “zero mean traverse” and “zero mean grid” to balance the data values across the separate grids; and (5) “interpolation” conducted once in both the X and Y directions to make each pixel represent 25 square centimeters. The image resulting from this processing is presented as Figure 3. Magnetic highs appear as darker grays; magnetic lows as lighter grays.

Soil resistivity data were collected using a Geoscan RM85 resistance meter system (Geoscan Research 2015). The RM85 is a flexible soil resistivity collection system developed specifically for archaeological applications. It allows a wide variety of probe arrays for different archaeological applications. For the Brazeau Pioneer Cemetery survey a “twin array” was used. In this configuration two sets of dipoles are used—one stationary and one mobile. The stationary dipole provides a constant measure of soil resistivity that is used to create a differential reading with the mobile dipole, which is moved across the measurement grid. In this way, the resistivity reading is the difference between two individual readings, one being constant and the other varying by the soil conditions it encounters (Schmidt 2013). Soil resistivity data were collected at 0.5 meter intervals along 0.5 meter spaced parallel north-south lines and using a zig-zag method. Three readings were collected in each pass, so that each pass covered 1.5 meters east-west. The complete 30 meter by 30 meter grid unit was collected at a single time, without interruption.

The raw resistivity data were downloaded from the FM256 into the Geoplot 4.0 software package (Geoscan Research 2016). Analyses conducted on the data involved (in the following order) (1) “despiking” to remove small, excessively high resistivity readings likely caused by a rock or metal object immediately between the dipole spikes; (2) “high pass filtering” to balance the data evenly around a zero mean; (3) “destaggering” to remove effects of the zig-zag data collection technique; (4) “low pass filtering” to enhance small resistivity anomalies; and (4) “interpolation” conducted once in both the X and Y directions to make each pixel represent 25 square centimeters. The image resulting from this processing is presented as Figure 4. Soils with higher resistivity appear as darker grays; soils with lower resistivity as lighter grays.

round penetrating radar data were collected using a Geomatrix Groundvue3 radar system with a single 400MHz antenna (aUtsi Electronics 2018). The Groundvue 3 is a cart-mounted GPR antenna and receiver system designed with shallow-earth applications such as archaeology. As the wheels turn the GPR antenna is triggered at 17.6 millimeter intervals. The antenna sends an electric pulse into the ground and then records the time it takes for the pulse to be reflected by subsurface materials and return to the antenna. This time is equivalent to the depth of various features beneath the ground. The form of the individual reflections are recorded as a “reflection trace” which is stacked with adjacent traces to create a two-dimensional vertical profile of the

subsurface. Adjacent two-dimensional profiles can be combined to create a three-dimensional model of the subsurface.

At the Brazeau Pioneer Cemetery individual GPR traces were collected over the same 30 meter by 30 meter grid used for the resistivity survey. Profiles were collected at 0.5 meter intervals along 0.5 meter spaced parallel north-south lines using a zig-zag method. A second set of traces were collected along 0.5 meter spaced parallel east-west lines using a zig-zag method. The traces were downloaded and imported into the REFLEXW 8.5 software package (Sandmeier 2018). During import the traces were converted into two-dimensional profiles. The north-south profiles were transformed into a three-dimensional model using the Scan3d module within REFLEXW. The east-west profiles were, unfortunately, corrupted at some point during processing and it was decided that reprocessing them would take more time than their utility for this project would provide. During conversion to the three-dimensional model the profiles were corrected for start time (that is, the time from where the signal first leaves the antenna and when it first hits the ground surface), and a low-pass filter based on the mean of each trace was performed (dewow). The image presented in Figure 7 shows the subsoil at roughly 1.2 meters below the ground surface. Darker grays represent less reflective surfaces, lighter grays represent more reflective surfaces.

## **Results of Investigations**

The grayscale map of magnetic readings (Figure 4) shows few anomalies, and none with the typical oblong appearance of an interment. The grayscale map of the soil resistivity readings (Figure 5) and ground penetrating radar scans (Figure 6) do not indicate the presence of interments either. Indeed both appear to portray natural changes in soil characteristics by elevation rather than cultural features (Figure 7). No interments appear to be present in the Brazeau Pioneer Cemetery.

As with any non-invasive survey method, one cannot be certain that the lack of apparent interments ensures that interments are not present (David, Linford, and Linford 2008), but for the purposes of planning under Wisconsin State Statutes 157.11 and 157.70, it is reasonable to assume that there are no interments in the Brazeau Pioneer Cemetery. However, oral tradition suggesting that pioneer interments may be located on the large hill on the north of the site (Figure 8) indicating that any disturbance of this area should be undertaken with the expectation that interments might be found (see Wisconsin State Statutes 157.111; 157.112; 157.115(2); 157.60; 157.70).

## **Recommendations**

1. In consultation with the Wisconsin State Historical Society, the Town of Brazeau should consider opening the Brazeau Pioneer Cemetery to new interments.
2. In consultation with the Wisconsin State Historical Society, the Town of Brazeau should consider restricting new interments to the area south and east of the large hill reputed to contain pioneer interments.

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# Figures

**Figure 1:** General location of Brazeau Pioneer Cemetery (BOC-0042) within the State of Wisconsin.

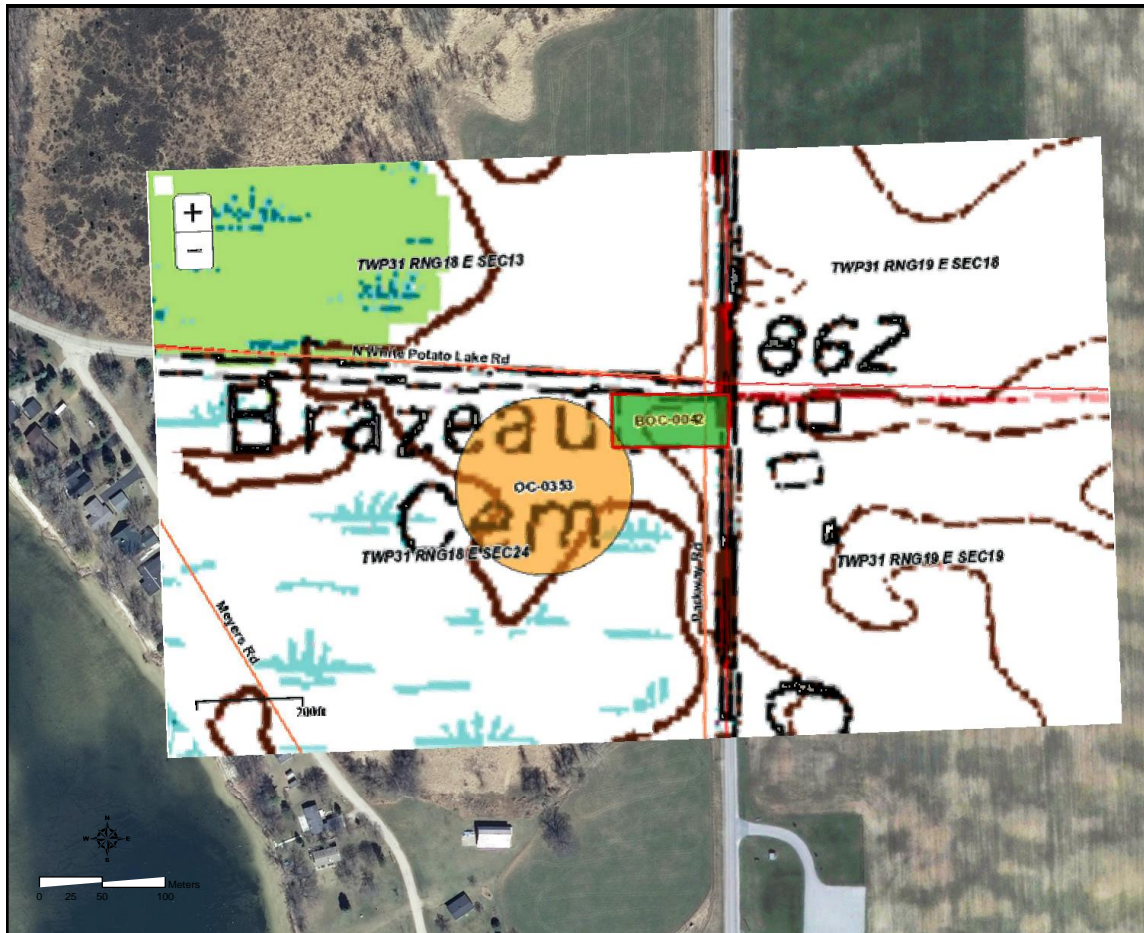
Counties



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MAPS

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**Figure 2:** USGS 7.5 minute quad image showing the location of BOC-0042, Brazeau Pioneer Cemetery.

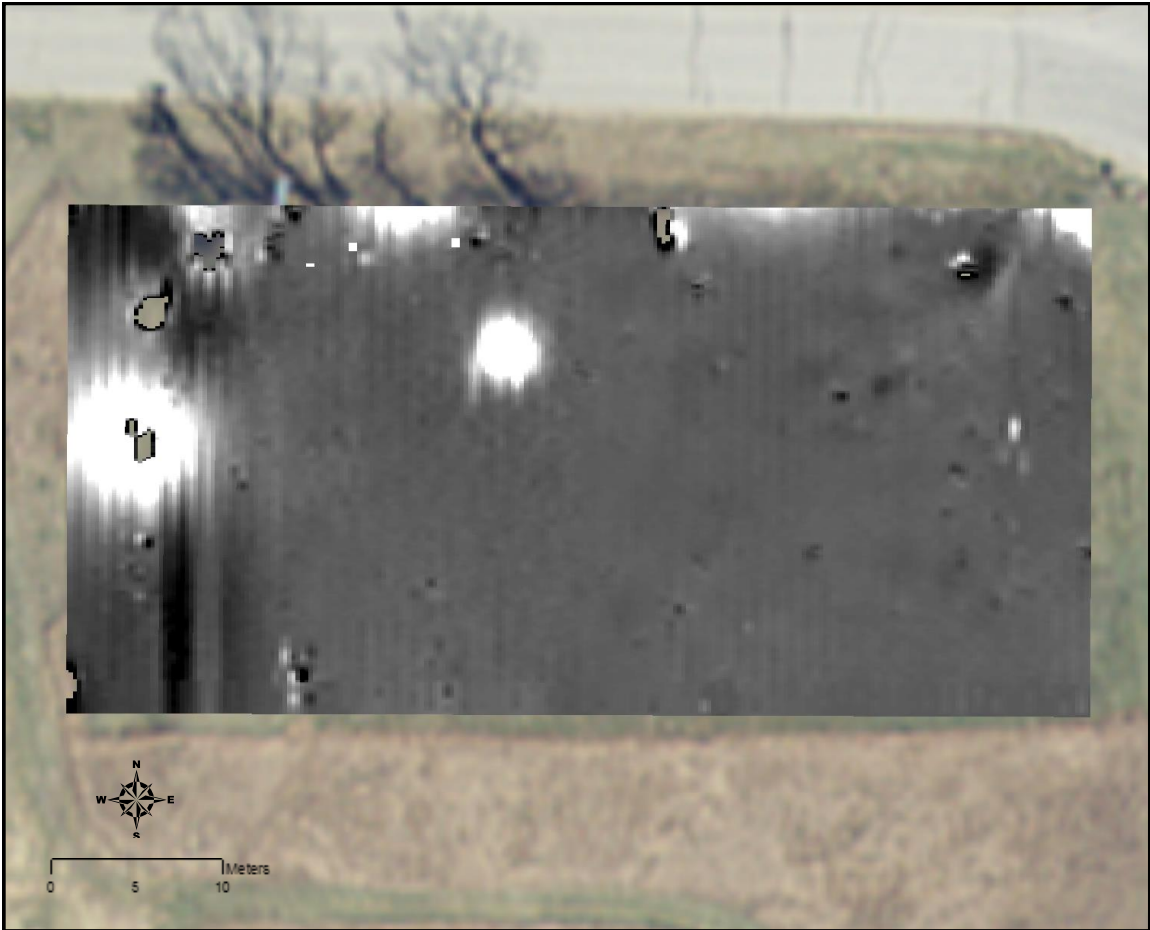


**Figure 3:** Brazeau Pioneer Cemetery from the east showing the marker placed by the Town of Brazeau. The individual in the photograph is taking GPR scans with the Groundvue3 radar system.

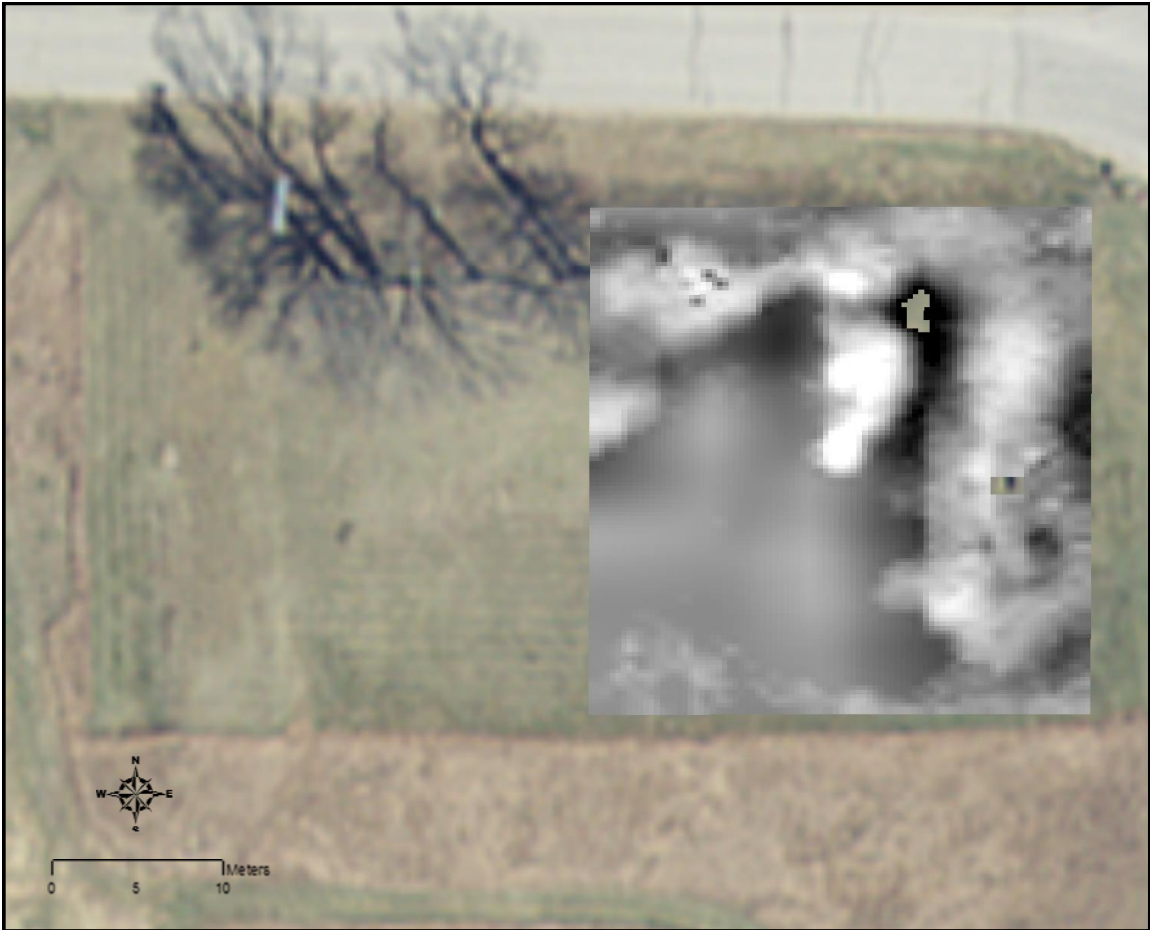




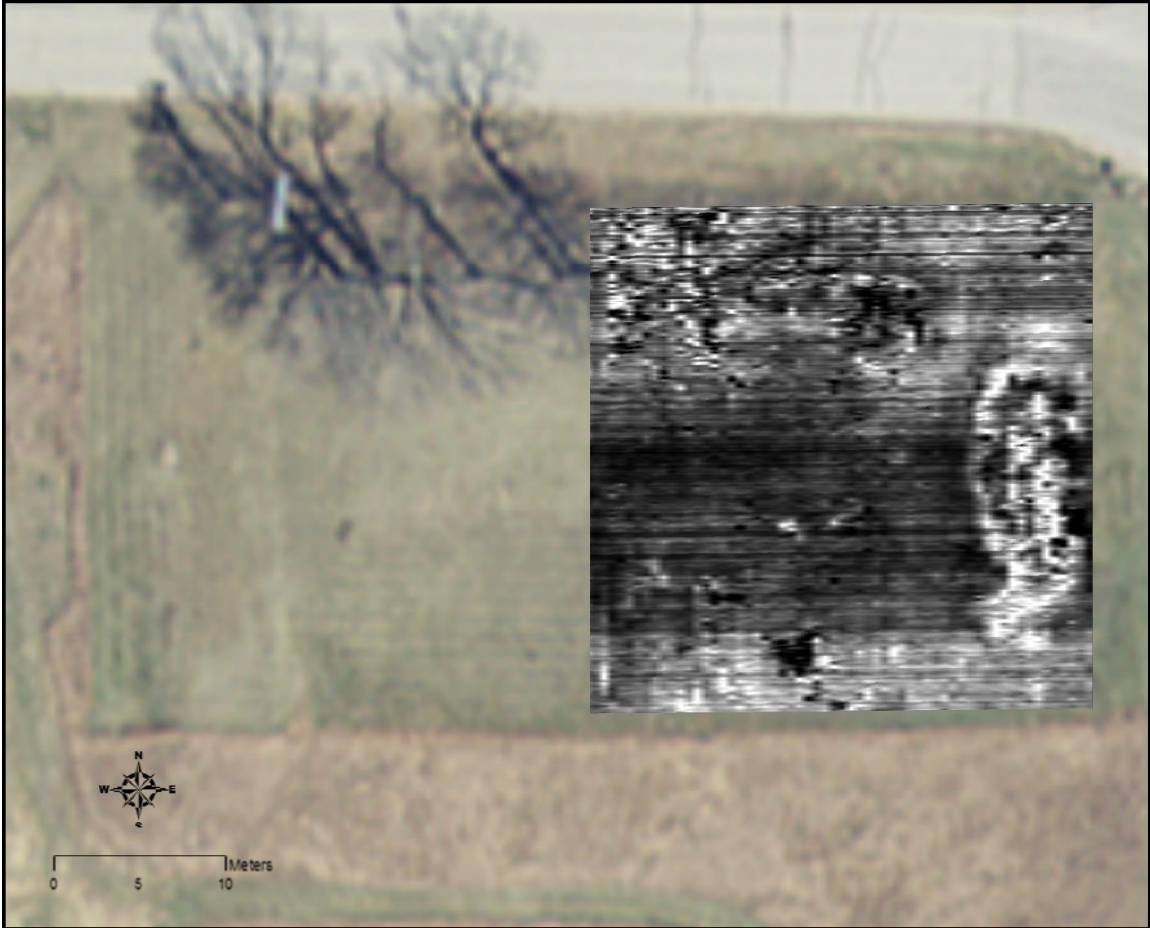
**Figure 4:** Geomagnetic map of the Brazeau Pioneer Cemetery



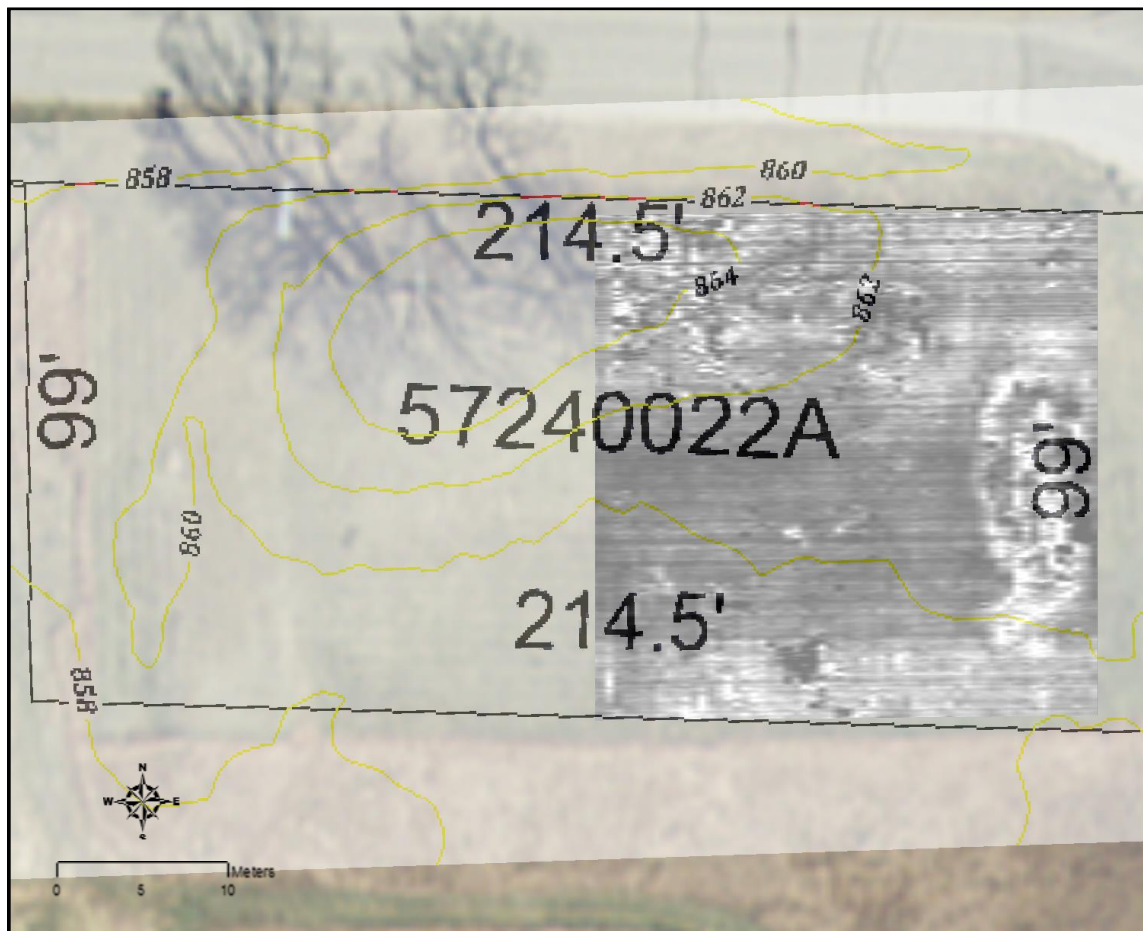
**Figure 5:** Soil resistivity map of the Brazeau Pioneer Cemetery



**Figure 6:** Ground penetrating radar map of the Brazeau Pioneer Cemetery.



**Figure 7:** Ground penetrating map of the Brazeau Pioneer Cemetery with elevation contours superimposed.





**Figure 8:** Large hill on the north side of the Brazeau Pioneer Cemetery as viewed from the southwest. The hill is reputed to contain pioneer interments.



