

10-30-2014

Magnetometer Surveys: Attempts and Issues in Locating a 1948 Private Water Well on the Shore of Lac Sault Dore, Price County, Wisconsin

Kenneth R. Neuhauser
Fort Hays State University, kneuhaus@fhsu.edu

Kristopher J. Neuhauser
Fort Hays State University, kjneuhauser@mail.fhsu.edu

Follow this and additional works at: <https://digitalcommons.csbsju.edu/compass>



Part of the [Earth Sciences Commons](#)

Recommended Citation

Neuhauser, Kenneth R. and Neuhauser, Kristopher J. (2014) "Magnetometer Surveys: Attempts and Issues in Locating a 1948 Private Water Well on the Shore of Lac Sault Dore, Price County, Wisconsin," *The Compass: Earth Science Journal of Sigma Gamma Epsilon*: Vol. 86: Iss. 3, Article 1.

DOI: <https://doi.org/10.62879/c26163123>

Available at: <https://digitalcommons.csbsju.edu/compass/vol86/iss3/1>

This Article is brought to you for free and open access by the Journals at DigitalCommons@CSB/SJU. It has been accepted for inclusion in The Compass: Earth Science Journal of Sigma Gamma Epsilon by an authorized editor of DigitalCommons@CSB/SJU. For more information, please contact digitalcommons@csbsju.edu.

Magnetometer Surveys: Attempts and Issues in Locating a 1948 Private Water Well on the Shore of Lac Sault Dore, Price County, Wisconsin

Kenneth R. Neuhauser¹ and Kristopher J. Neuhauser²

Department of Geosciences
Fort Hays State University
Hays, KS 67601

[1kneuhaus@fhsu.edu](mailto:kneuhaus@fhsu.edu)

[2kjneuhauser@mail.fhsu.edu](mailto:kjneuhauser@mail.fhsu.edu)

ABSTRACT

Two different magnetometer surveys in northern Wisconsin during the summers of 1997 and 2010, using two different Geometrics magnetometers, a proton precession G-816 unit and a cesium vapor G-858 unit, in an attempt to locate a surface-target position of, and depth to, an abandoned 1948 private water well, successfully targeted the suspect surface position and the depth to the well head spike. Both surveys detected 400-gamma anomalies and estimated the depth to the spike at 2 meters. A land owner, private family photograph taken in 1951, was used to compare the anomaly's position to the actual surface position of the well. Two, one meter deep pits were hand dug in 2004, in an attempt to excavate, remove and replace the well spike; however, the attempt was not successful due to large trees, roots, and available equipment. For aesthetic reasons, the land owners were reluctant to cut the trees down at that time in order to continue excavation. After the 2010, magnetometer survey, a second excavation attempt was not made, and no future excavation attempts are planned at this time.

KEY WORDS: well recovery

INTRODUCTION

Magnetometers can often be used to locate buried iron-bearing objects. In the 1940s, water wells were commonly constructed by hand where brass tubes covering perforated steel pipes were hand driven to desired depths. Surface hand-pumps were then constructed to pull groundwater to the surface. Such a well was constructed in 1948, on private property in northern Wisconsin (fig. 1); however the surface hand pump was removed and reconnected underground to a rubber hose that, in turn, was connected to a motorized

pump in the basement of the nearby cabin during the 1960s.

LOCATION AND SITE DESCRIPTION

The survey site is located 16 km west of Phillips, Wisconsin between County Road W and Lac Sault Dore on private property previously co-owned by the principle co-author and his siblings (fig. 2). The terrain consists of glacial sandy soil, vegetation, and several buildings. The GPS UTM coordinates for the lower left-hand corner of the 2010 survey grid are 688774 Easting and 5063226 Northing. The largest

potential causes of interference to the readings are steel tools in the nearby garage,

the electrical line to the garage, and an iron clothes line.



Figure 1. Surface hand pump visible right center (circle). Author (right foreground) in 1951. Author's brother and mother also pictured. Photo by Mrs. Marie Forber, author's grandmother.

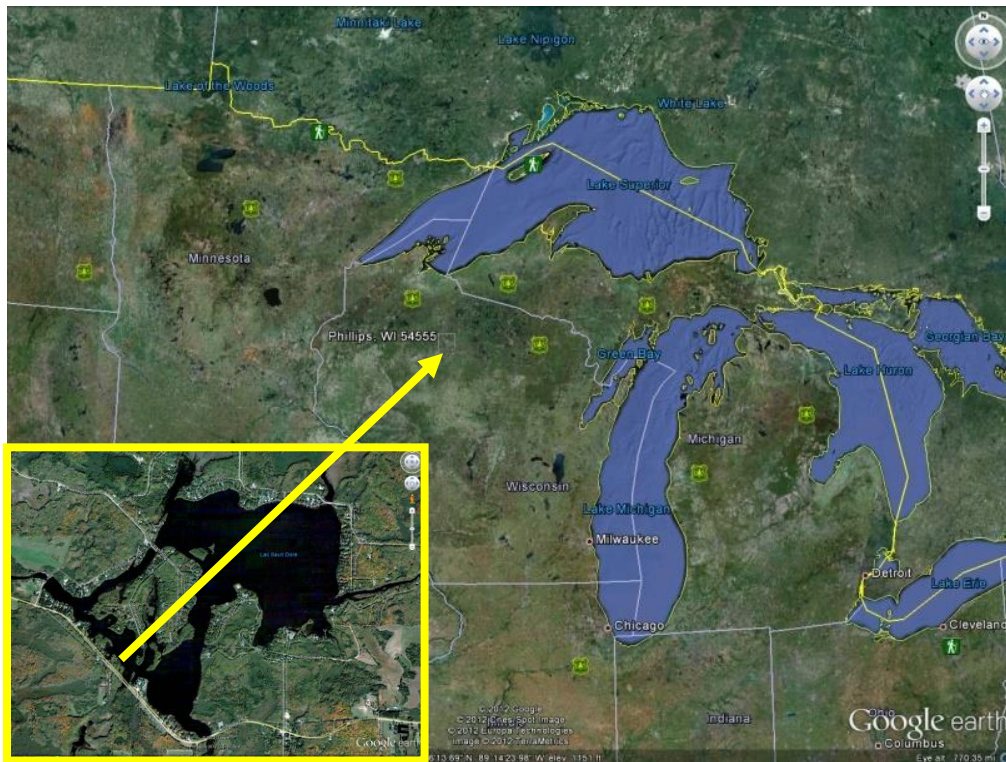


Figure 2. Index map of study area; arrow point to approximate locale. (Google Earth)

METHODOLOGY and EQUIPMENT

Techniques employed to locate the well head followed those outlined by Breiner (1973), Frischknecht, *et al.* (1983), Jachens, *et al.* (1985), Martinek (1988), Rivers (1995), and Jordan and Hare (2002). In the 1997, survey a 10 x 10 meter grid with wooden stakes placed every 1.5 meters with one grid axis oriented N20W and a second grid axis was at N70E (fig. 3). A Geometrics G-816 proton precession magnetometer was used for the 1997, survey (fig. 4A) and in 2004 to spot check the 1997, suspect site (figs. 4B). Individual data points were recorded with the G-816, and the data were typed into a spreadsheet, imported to and contoured using Surfer 4.0 (Golden Software).



Figure 3. Fort Hays State University's 1997 Geology field camp students setting up grid east of garage. Photo by K.R. Neuhauser.

The 2010, survey used a 5 x 15 meter grid (fig. 5) with EW-NS oriented plastic flags at 5 meter intervals. A Geometrics G-858 optically pumped cesium magnetometer was used for the 2010 survey. The G-858 unit recorded the data continuously on the recording console as the operator walked along the grid, and the data

were downloaded and contoured using *MagMapper 2000* (Geometrics).



Figure 4. A) Students using G-816 in 1997, survey on left (photo by K.J. Neuhauser).

B) Author with G-816 unit and Mr. John Neuhauser (father of co-author K.J. Neuhauser) taking field notes during spot check in 2004 on right. Photo by K.R. Neuhauser.

In both surveys, we verified that the electricity was turned off and that metal tools in the garage, as well as vehicles and one boat were moved far enough away as to not interfere with the magnetic readings (fig. 6). However, we were unable to move the iron clothes line which was connected to a buried cement base.

The depth estimate was calculated using *Grapher 6.0* (Golden Software) and the half-width rule (Peters, 1949). 2010 grid GPS points were recorded using a Garmin GPS-12 unit. No GPS coordinates

were taken for the 1997 survey because we did not have the instrument. No contouring analyses were made with the 2004 data since no grid survey was set up during a spot check.



Figure 5. 2010 study site. Co-author Kris Neuhauser ready with G-858 cesium magnetometer unit. Plastic flags at 5-meter grid intervals. Inset diagram of a hand pump system with drill spike (WSH, 2012). Photo by K. J. Neuhauser.



Figure 6. Checking to verify electricity turned off. Arrow points to electric line to garage. Photo by K. J. Neuhauser.

RESULTS and CONCLUSIONS

Analyses indicate a near circular, 400-gamma anomaly (fig. 7) from the 1997, survey; and a sub-circular, elongate 400-gamma anomaly (fig. 8) from the 2010, survey. The target zone for both anomalies is amid a grove of large balsam and blue spruce trees which made excavation difficult. The well pipe head causing the anomaly is calculated to be buried ~2.0 meters below ground level (fig. 9). In 2004, two, one-meter deep pits were hand dug using spades, chisels, and axes in an attempt to excavate, remove and replace the well spike; however, the attempt was not successful due to the trees, their roots, and

no access to better equipment. Also, for aesthetic reasons, the land owners (the Neuhauser family) were reluctant to cut the trees down at that time in order to continue hand excavation. Given the anomaly positions relative to the 1950, photograph, it is our belief that the targeted zones do indeed represent where to dig to locate the well head. After the 2010, magnetometer survey, a second excavation attempt was not made, due to the owners having the property up for sale. The property was sold in January of 2014, and no future attempts to excavate are pending and depending on the wishes of the new owner.

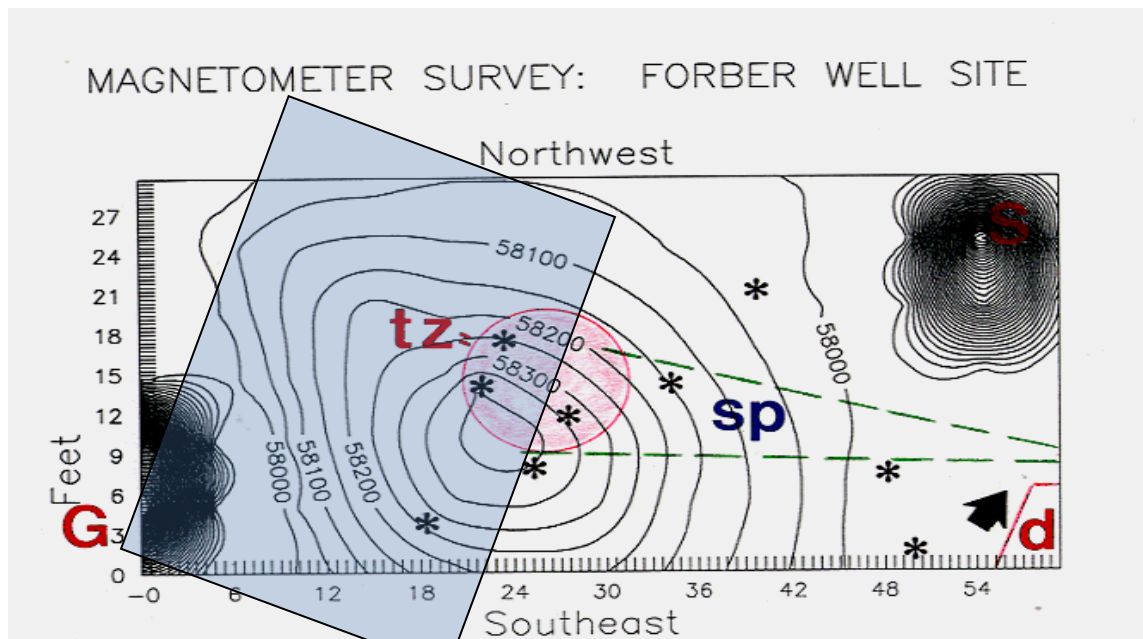


Figure 7. Figure illustrates the isogam anomaly map of the 1997 survey. Blue rectangle = 2010 survey zone G = garage tz = target zone (red circle) d = deck sp = suspect buried water line to house. S = steel clothes line post * = fir trees

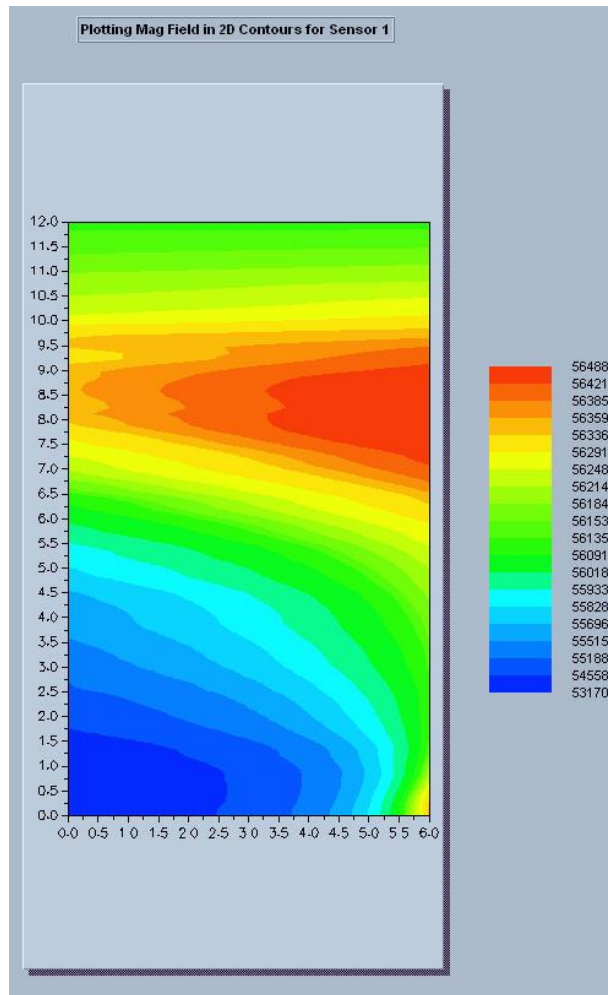


Figure 8. Isogram anomaly map of 2010 survey. North is to top of map. Red zone targets suspect well head surface position. Created with MagMapper 2000 (Geometrics).

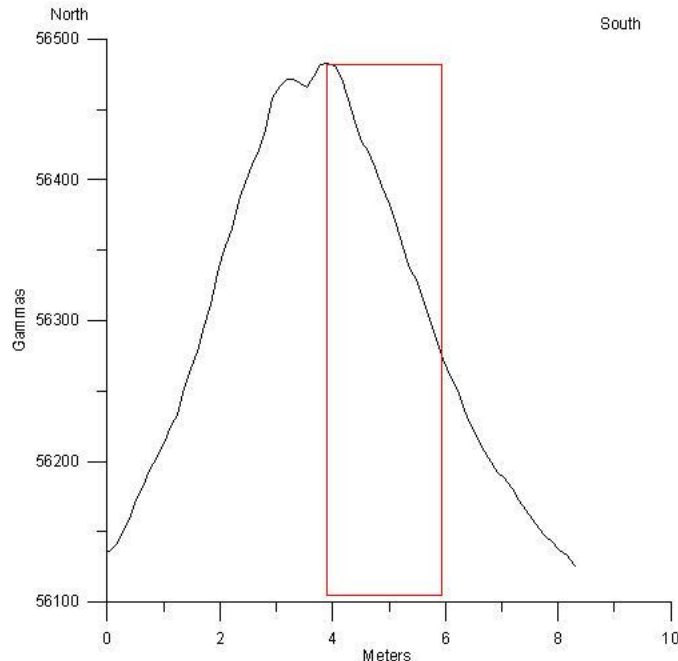


Figure 9 Depth estimate of ~2 meters using Peter's half-slope rule (1949).

ACKNOWLEDGMENTS

We thank the Geology Field Camp Class of 1997 for their work on the 1997 magnetometer survey, and John M. Neuhauser for recording field data and setting the field grid during the 2004 survey. We also thank the Neuhauser family for site access.

REFERENCES CITED

Breiner, S., 1973. *Applications manual for portable magnetometers*, Geometrics, Sunnyvale, California, 58 p.

Frischknecht, F.C., Muth, L., Grette, R., Buckley, T., and Kornegay, B., 1983. Geophysical methods for locating abandoned wells. *U.S. Geological Survey Open File Report 83-702*, 207 p.

Garmin GPS-12 - Southampton, UK

Geometrics - MagMapper 2000. San Jose, California.

Golden Software - Surfer 4.0 Golden, Colorado.

Golden Software - Grapher 6.0 Golden, Colorado.

Jachens, R.C., Webring, M.W., and Frischknecht, F.C., 1986. Abandoned well study in the Santa Clara Valley, California. *U.S. Geological Survey Open File Report 86-350*, 14 p.

Jordan, P.W. and Hare, J.L., 2002. *Locating Abandoned Wells: A Comprehensive Manual of Methods and Resources*. Solution Mining Research Institute, Encinitas, CA 23 p.

Martinek, G.C., 1988. Ground based magnetometer survey of abandoned wells at the Rocky Mountain Arsenal – A Case History.

Peters, L.J. 1949. The direct approach to magnetic interpretation and its practical applications. *Geophysics*, v. 14(3), p. 290-320.

Rivers, G.A., 1995. Well-integrity survey (Phase II) of abandoned homestead water wells in the High Plains aquifer, former Pantex Ordnance Plant and Texas Tech Research farm near Amarillo, Texas. *U.S. Geological Survey Open File Report 95-751*, 25 p.

Water Sanitation Hygiene (WSH) 2012 – www.wsh.org