# TBL 3: HIGH-RESOLUTION MAGNETIC SURVEY IN LOCATING ABANDONED BRINE WELLS IN HUTCHINSON, KANSAS (Xia and Williams)

## Overview

Many improperly abandoned wells exist in Canada and the US. They are difficult to find as they are often covered by soil so they are not visible by eye. Their small diameter makes them difficult to locate by direct probing of the ground. In this case study, the authors use magnetic surveys to locate abandoned wells.

## Setup

Q1. What (a) motivated the study? and (b) was the primary objective of the geophysical study?

Q2: The authors gathered background information about the problem at hand. Name two of the sources or methods they used.

## Physical properties

Q3. Which physical property is used as the primary diagnostic physical property? Why is it diagnostic in this setting?

## Survey

Q5. What instrument was used and what was measured?

Q6. Why was a base station not deemed necessary?

## Data

Q7: Although no base station was used, the data were corrected and adjusted before plotting for visual analysis. List the corrections or adjustments applied in the paper.

## Interpretation

Q8: The paper refers to “monopole” anomaly. However, in physics, a magnetic monopole doesn’t exist. Why is “monopole” a valid concept here ([GPG Link](https://gpg.geosci.xyz/content/magnetics/magnetics_basic_principles.html#approximating-targets-using-magnetic-charges))?

Convey your answers by showing the sign and distribution of magnetic charges for the following circumstances.



Q9: The diagram below shows a magnetic positive charge below surface. Sketch the expected total field magnetic anomaly. Earth field is vertically down (Inclination: 90 degree).



Q10. Draw a magnetic negative charge below surface and the associated field lines. On top of the surface, draw the expected total field magnetic anomaly. Does a positive monopole or a negative monopole better predict the field data?



Q11. Use GPG: Compute the charge on the top of the pipe. Assume following parameters.

=150

B0=55,000 nT (assume vertically downward, I=90)

Effective surface area=?

Q=?

Then what is the predicted value of total magnetic field (Bt) at ah height of 1m above the pipe?

Q13. Open up the dipole app ([Link](https://mybinder.org/v2/gh/geoscixyz/gpgLabs/master?filepath=Notebooks%2FMagneticDipoleApplet.ipynb)). For modelling purposes, the strength of the monopole is equal to the charge. Put the monopole (top of the pipe) at the surface.

1. Plot total magnetic field (Bt) (capture image from the app)
2. How does the maximum value of the anomaly compared to that computed in Q11?
3. Calculate the depth of burial using the half-width rule ([GPG link](https://gpg.geosci.xyz/content/magnetics/magnetics_interpretation.html#estimating-depth-of-burial-from-half-width)). Note that measured height in the app is 1m above the surface.

Q13. Consider below figure (Fig. 6 in the article).



1. What is the peak amplitude of the anomaly? Estimate the depth of burial from the half-width of the anomaly. Note that the sensor height was 2.5ft.
2. How does the amplitude of anomaly compare with the theoretical amplitude in Q11?
3. How might you account for these differences in amplitude?

Team Numer:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Participating team members are: