Field Geophysics Exercise 01 - Find the Underground Storage Tank *(v2, July 2007)*

Expected Student Outcomes:

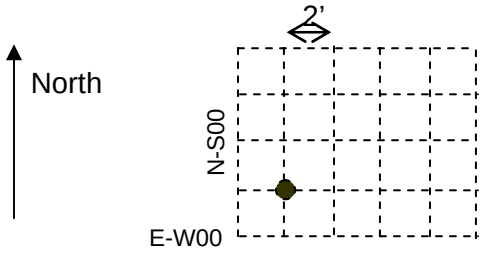
- Learn how to lay out a survey grid with tapes and stakes
- Use GPS to locate survey points at line intersections (optional)
- Become familiar with ground penetrating radar (GPR) data collection techniques
- Interpret GPR data and locate a buried underground storage tank (UST)
- Use this knowledge confirm the presence or absence of a suspected UST at a second location (optional)

Scenario

A neighbor has asked you to survey her front yard in order to define the boundaries of a 550-gallon underground storage tank UST) buried there. The UST is used to store her home heating oil. Leaking underground storage tanks (LUSTs) pose major environmental threats to soil and groundwater, so learning how to use this non-invasive exploration technique can be very valuable for future environmental professionals.

Procedure:

Step 1: Set up a grid with marker tapes. Grid size will probably be dictated by the size of the survey area. We used a grid of marker tapes that crossed each other every 2 feet:



We named the grid lines E-W00,01,02,03,04,05 and N-S00,01,02,03,04,05 initially. The heavy lines on the grid (see below) are the radar line names that were assigned automatically by the GPR unit. To minimize potential confusion, *one or more students should draw a sketch map of the grid in their field notes and clearly indicate both grid line and radar line names and positions.*

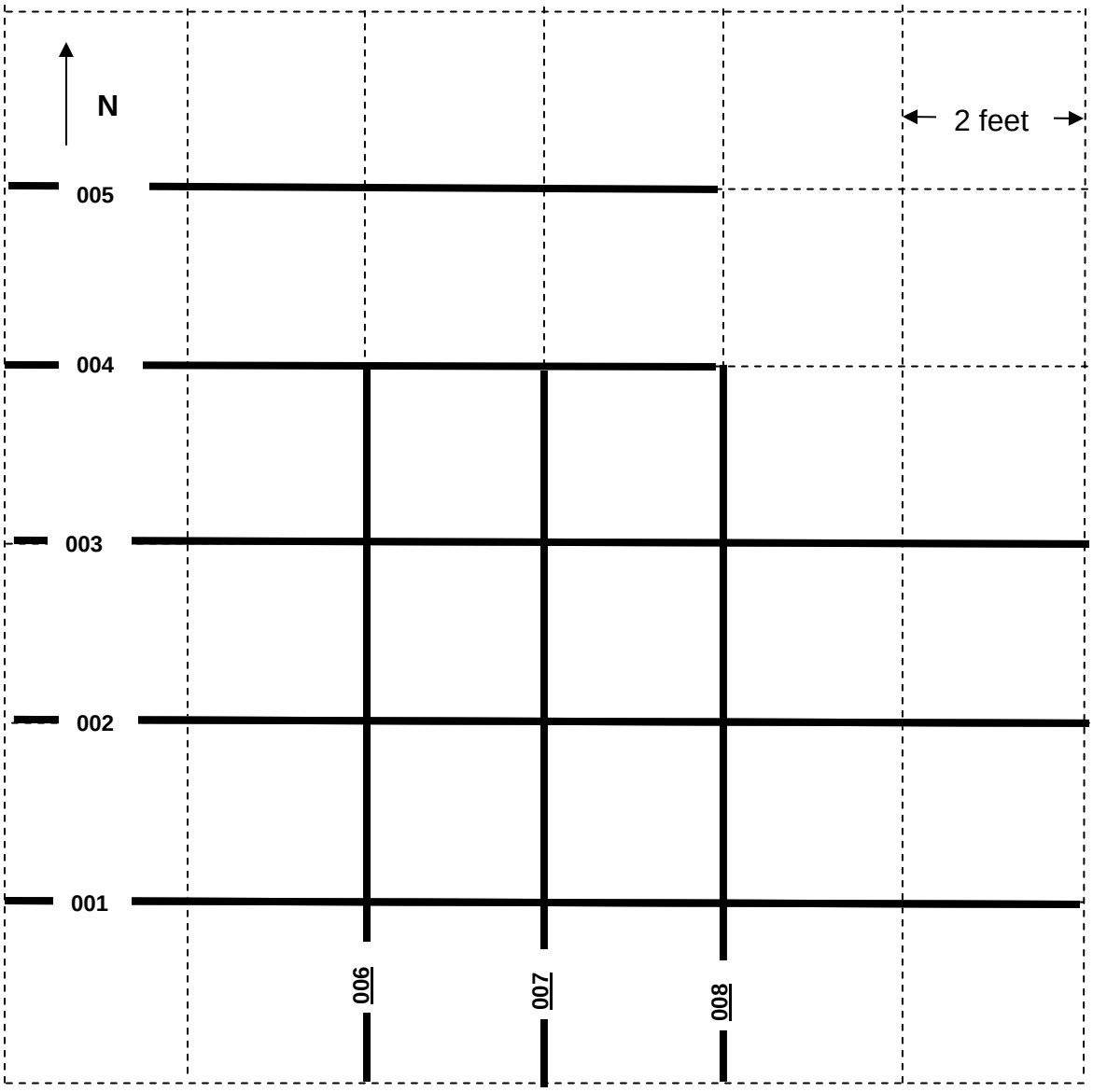
GPS points were taken at the intersections of these lines, in order to ultimately place the line in a correct, real-world map view. We used the lower left corner of the grid as 00E, 00N. The coordinates of the point shown are 02E, 02N (i.e., 2 feet east and 2 feet north of the grid origin).

If you are limited in terms of the number of tapes at your disposal, you can place stakes at the ends of your lines, on the outside edges of the survey area. Avoid using metal stakes within the survey area, as they could reflect your radar signal, especially if you are using an unshielded antenna as we did. We use this approach in Jersey City, and it works very well.

Step 2: Stretch a tape between stakes for the line being recorded, then drag the transceiver on top of the tape. Place a "mark" on the radar line every 2 feet (or interval you deem appropriate) at the line intersections, both to locate the line in space, and to properly position any anomalies observed on the line. Recording strategies differ from unit to unit, so the actual recording of the data will have to be tailored to your particular unit. *(**NOTE**: We use a GSSI SIR-20, for which we have written straightforward operating instructions that can be made available upon request.)*

Step 3: Once your data have been recorded, you will process it. As with data collection, data processing is very specific to the equipment you use. For the lines we collected in Jersey City and attached to this exercise, we used GSSI's RADAN software. There are 5 E-W lines (001-005) and 3 N-S lines (006-008). The white marks on each line represent the locations of crossing lines (radar and/or gridlines) every 2 feet (+/-).

Step 4: Map the outline of the UST on the grid below by determining its edges on each radar line relative to the white marks and transferring this information to the grid (550-gallon USTs are typically cylindrical in shape and measure 6 ft long x 4 ft wide). Depth estimates in feet are on the vertical axis on the left side of each line. **NOTE:** Radar lines, like seismic lines, are subject to "sideswipe" because the radar signal is a spherical wavefront that captures information that is laterally adjacent to the line upon which it is portrayed. This can result in incorrect mapping, because an anomaly may appear - erroneously - to be directly below a surface line.



Step 5: Prepare a writeup of this exercise, including your objectives (find and map the location of a buried UST), your procedure (especially if you do this in the field), and your findings to include with your grid map showing the outline of the UST. In particular, comment upon possible sources of error (this is difficult to do for those who don't actually collect the field data). Be advised that several different, untrained students were used to drag the transceiver along the line, and most of them were not very smooth with their technique. For example, on the E-W lines at the northern end of the survey (004 and 005), the student actually lifted the radar unit off the ground while moving it to the next "mark". This undoubtedly affected data quality.