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Geophysical Survey Report

316 Huguenot St.
New Rochelle, NY

Prepared for TEAM Environmental Consultants

Introduction

A geophysical survey was performed by Underground Surveying, LLC of 72 Gray's Bridge Road, Unit Q Box 5, Brookfield, CT for TEAM Environmental Consultants of 30 Industrial Dr., Middletown, NY. The survey was performed on May 14, 2018 at 316 Huguenot St., New Rochelle, NY. The purpose of the survey was to search for evidence of an underground storage tank (UST) and, if possible, mark its location and depth.

Technology

The following survey was performed with ground penetrating radar (GPR) technology, and magnetic locator technology. Before reading the full report, we advise that you read the following paragraphs to gain a basic understanding of the technology and to understand its limitations.

Ground Penetrating Radar (GPR)

Quite often, non-metallic, inaccessible, unknown or abandoned utilities cannot be located with traditional cable and pipe locators. When this occurs, Ground Penetrating Radar (GPR) must be used in conjunction. GPR is a non-invasive, non-destructive geophysical surveying technique that is used to produce a cross-sectional view of objects embedded within the subsurface. We currently use the GSSI SIR-3000 to perform our GPR surveys. This piece of equipment, which is manufactured by Geophysical Survey Systems Inc., is their latest data acquisition system and the industry's number one choice for data accuracy and versatility.

All GPR units consist of three main components: a power supply, control unit and antenna. To understand how these components interact to provide usable data, we must first understand the performance of a scan. A scan is performed by moving the antenna across the surface linearly to create a series of electromagnetic pulses over a given area. During a scan, the control unit produces and regulates a pulse of radar energy, which is amplified and transmitted into the subsurface at a specific frequency by the antenna.

Antenna frequency is inversely proportional to penetration depth, which makes antenna selection the most important step in the survey design process. Below is a list of antenna frequencies, their application and maximum penetration depth.

Frequency (MHz)	Sample Applications	Max Depth (ft.)
2600	Concrete, Roadways, Bridge Decks	1
1600	Concrete Roadways, Bridge Decks	1.5
900	Concrete, Shallow Soil, Archaeology	3
400	Shallow Geology, Utility Locating, Environmental, Archaeology	9
200	Geology, Environmental	25
100	Geology, Environmental	60

During a scan, the control unit records the strength and time required for the return of any reflected energy. Reflections are produced in the data screen profile (on the control unit) whenever the energy pulse enters and exits contrasting subsurface materials. The way it responds to each material is determined by two physical properties: dielectric constant and electrical conductivity.

The dielectric constant is a descriptive number that indicates how fast electromagnetic energy travels through a material. Energy always moves through a material as quickly as possible, but certain materials slow down the energy more than others. The higher the dielectric, the slower the energy will move through the material, and vice versa. Below is a list of some common materials with their corresponding dielectric constants and velocity values.

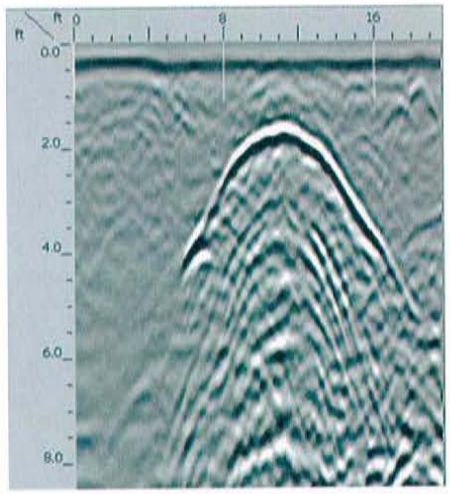
Material	Dielectric	Velocity (mm/ns)
Air	1	300
Fresh Water	81	33
Ice	3	167
Dry Sand	3-6	120-170
Wet Sand	25-30	55-60
Silt	10	95
Wet Clay	8-15	86-110

Dry Clay	3	173
Marsh	12	86
Average Soil	16	75
Granite	5-8	106-120
Limestone	7-9	100-113
Concrete	5-8	55-120
Asphalt	3-5	134-173
PVC	3	173

To determine the location of a subsurface target in the data screen profile, there must be a contrast between the dielectric values of the material one is scanning through and the target one is searching for. For example, a pulse moving from dry sand (dielectric of 5) to wet sand (dielectric of 30) will produce a strong, highly visible reflection, while moving from dry sand (5) to limestone (8) will produce a weak one. In addition, if one knows the dielectric value of the subsurface material one is scanning through, the control unit can measure the amount of time required to receive the reflected signal and convert this to depth.

Since the GPR emits electromagnetic energy, it is subject to attenuation (natural absorption) as it moves through a material. Energy moving through resistive (less conductive) materials such as dry sand, ice or dry concrete will penetrate much further than energy moving through absorptive (more conductive) materials such as salt water or wet concrete. As a result, the greater the contrast in electrical conductivity between the material one is scanning through and the target one is searching for, the brighter the reflection; high conductive materials such as metals produce the brightest reflections.

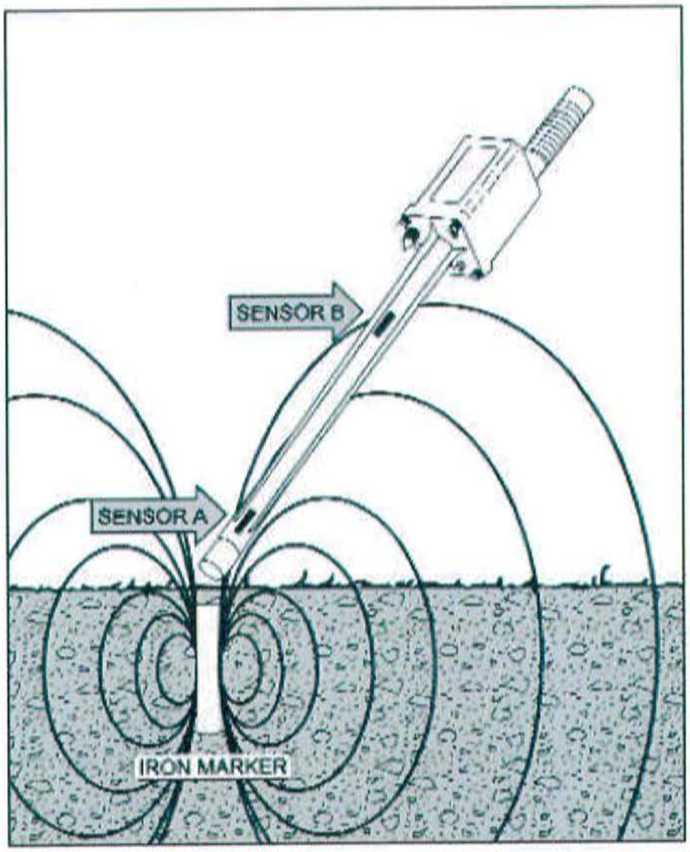
To understand how dielectric and electrical conductivity differences translate into visual data requires an understanding of how the antenna emits energy. Imagine the antenna scanning perpendicular to a UST. Energy emits from the antenna in a 3-dimensional cone shape, not in a straight line as one might think. The two-way travel time for energy at the leading edge of the cone is longer than for energy directly below the antenna. Because it will take longer for energy at the leading edge to be captured, when the antenna first approaches the UST, it will appear low in the data screen profile. As the antenna moves closer to the UST and the distance between them decreases, the reflections will appear higher in the profile. At the point where the antenna is located directly above the UST, the minimum distance of separation is reached and the reflections reach their zenith. As the antenna moves away from the UST and the distance between them increases, the reflections appear lower in the profile once again. After the scan is completed, the center of the UST will appear in the data screen profile as an upside down U, which is referred to as a hyperbola. A image of a UST hyperbola is shown below:



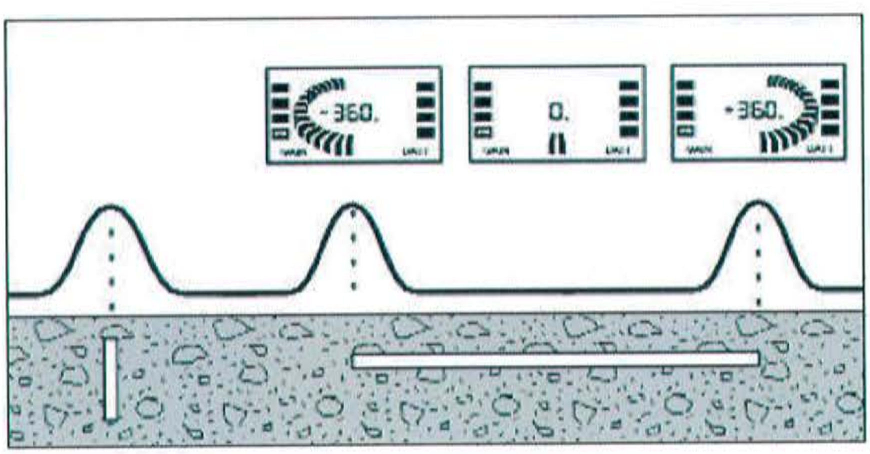
To gather, organize and present the data, a series of scans are performed within an orthogonal survey grid. At the end of each scan, the data screen profile is reviewed for the presence of a hyperbolic target. If present, the antenna is moved backward to place a cursor (which depicts the center of the antenna) on the center of the target. The location and depth of the target is then marked on the ground with chalk, paint and/or flags. Once the entire grid has been scanned, the marks are then reviewed to search for patterns similar to that of the desired targets; in this case a tank. Any target that appears in the data screen profile as a hyperbola in one direction, and as a flat line in the other, indicates the presence of a UST.

Magnetic Locator

All our Magnetic Locator surveys are performed with the Model GA-72Cd Magnetic Locator, which is manufactured by Schonstedt Instrument Company of 100 Edmond Road, Kearneysville, WV. The magnetic locator detects the magnetic field of ferromagnetic objects, by responding to the difference in the magnetic field between two sensors which are spaced apart about a distance of fourteen (14) inches. This instrument is unique in that it provides an audio signal, and visual indications, of both signal strength and polarity. The reason this is advantageous is that, although most objects can be located using either one of these indications, simultaneous use of both types enables one to pinpoint a target, determine its orientation, and identify magnetically detectable, non-metallic duct and cable. The figure below illustrates an application of the locator, in which it is being used to detect an iron marker - the type which is commonly used for property line identification. As shown, the magnetic field of the iron marker is stronger at Sensor A than it is at Sensor B. As a result, the frequency of the audio signal is higher than the idling frequency, forty (40) Hz, which exists when the field strength is the same at both sensors. This stronger signal also causes the digital indication to peak, in either the positive or negative direction, when the audio signal is at its highest frequency.



To perform a sweep, the locator is swept from side to side. When the locator comes within range of an iron object, the audio signal will peak, the bar graph will expand positive or negative, and the digital readout will peak as shown below; it is this peak response that indicates the existence of a metallic object buried underground.



Materials

The magnetic locating survey was performed with the Model GA-72Cd Magnetic Locator, which is manufactured by Schonstedt Instrument Company of 100 Edmond Road, Kearneysville, WV. The GPR survey was performed with the SIR-3000, which was manufactured by Geophysical Survey Systems, Inc., of Salem, NH.

Methods

Upon arriving onsite, a visual inspection was performed around the property to search for evidence of the following structures that are commonly associated with USTs: vents, fill pipes and supply/return lines. A magnetic locating survey was then performed around the areas in question, to search for evidence of any metallic objects. Finally, a GPR survey was also performed around the entire survey area - inside an orthogonal grid with 1-2 foot spacing, using a 400 MHz antenna - to more accurately determine the location and depth of any lines located during the cable and pipe or magnetic locating surveys, and to search for visual evidence of any potential underground storage tanks (USTs).

Results

Based on the results of the survey in the areas scanned, there appears to be an UST in the front parking area of the property. Additionally, there was an anomaly detected in the rear parking area of the property.

Discussion

The UST that appears to be in the front parking area of the site is approximately 3-4 feet deep and its location is shown in the photos below.

The anomaly found in the rear parking area is approximately 1-2 feet deep and is shown in the photo below.

If you have any questions, comments or concerns regarding this report, please don't hesitate to contact me at 203.993.0982 or kamal@undergroundsurveying.com.

Submitted on May 14, 2018 by Kamal Abdulrazak
Project Manager