

# How GPR Complements Precision Locators

Talk for BCCGA

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from **RADIODETECTION** 

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## Outline

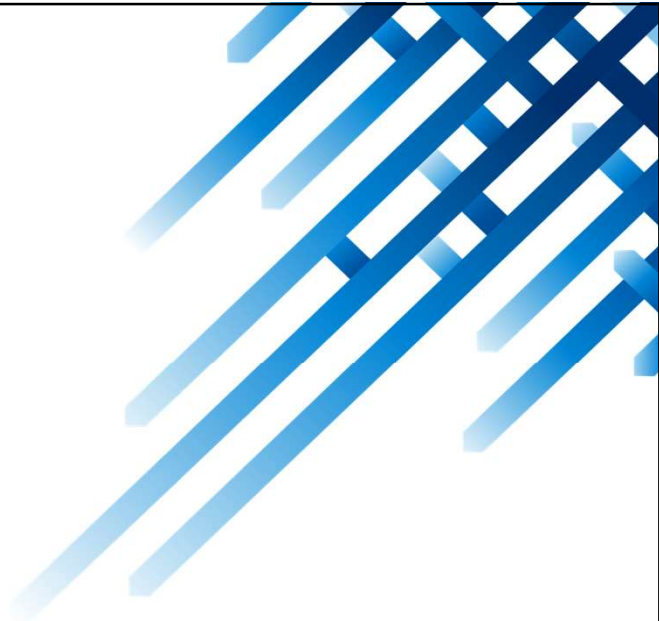
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**SPX**   
**TECHNOLOGIES**

1. Introduction
2. Complementary technologies
3. How GPR Works
4. Case Studies

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# Introduction



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## Sensors & Software

**SPX**   
**TECHNOLOGIES**



### The World's GPR Resource Center

- Started in 1988
- Design and manufacture high quality equipment
- Recognized worldwide
- In 2020, bought by Radiodetection

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## Applications of GPR



# GROUND PENETRATING RADAR



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## Complementary Technologies



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## Solutions for locating objects

**Issue:** Preventing utility strikes saves lives, prevents damage and minimizes downtime.

**Solution:**

- No single technology can locate all utilities
- Every technology has its benefits, but its limitations must be understood



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## Advantages of GPR

- Find metallic and non-metallic utilities
- Find unknown targets, not on any drawings
- Potential to see very deep
- Large area coverage
- Visual record, can be well documented
- Accurate depths



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## Challenges of GPR

- Performance varies, due to soil conditions
- Cannot identify type of utility directly from GPR data
- Data interpretation can be difficult
- GPR will find all objects, even ones you are not interested in



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## Basic GPR Theory

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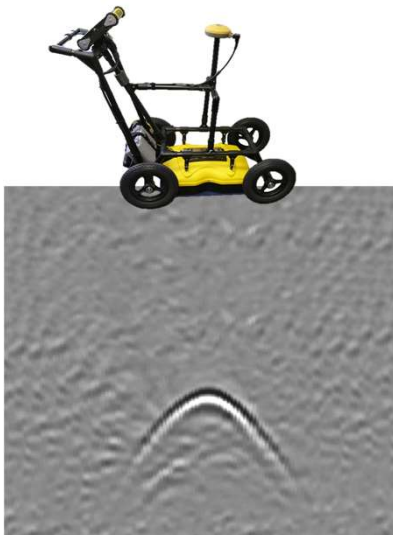


## How GPR Works



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## GPR Images the Subsurface

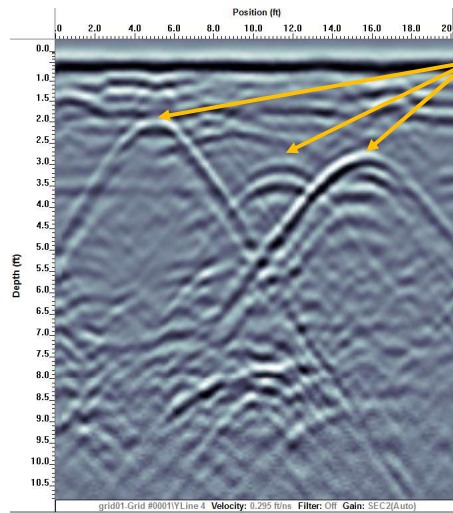


### Ground Penetrating Radar

- “ground” can be soil, rock, concrete, wood, anything non-metallic
- emits an electromagnetic pulse into the ground
- record echoes called “traces”
- builds a cross-sectional image from the echoes

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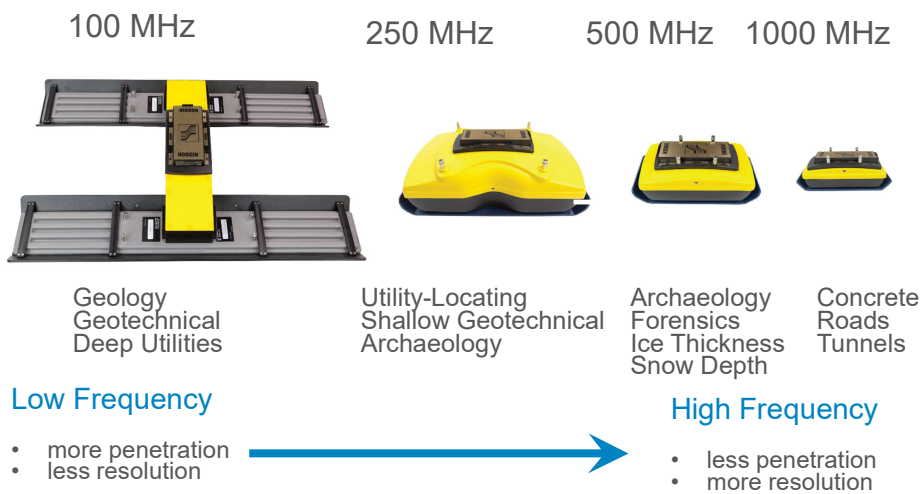
## Line Scan (or cross-sectional view)



Targets located at apex of 'hyperbola'

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## Typical Applications by Frequency

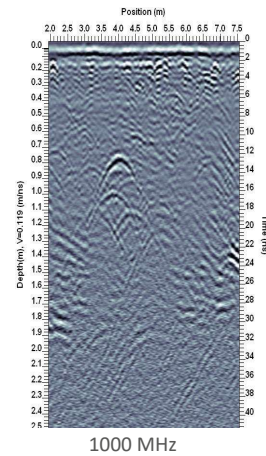
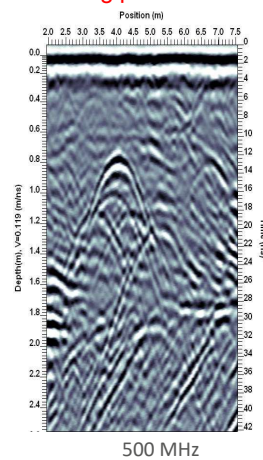
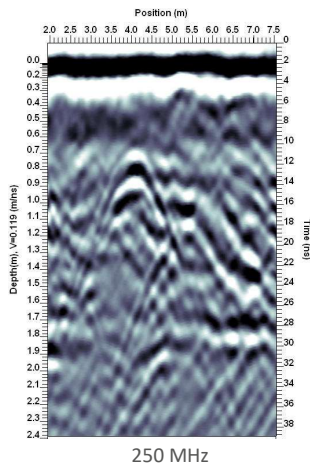


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## Frequency

Tradeoff between depth penetration and resolution

← Increasing resolution →  
← Increasing penetration →

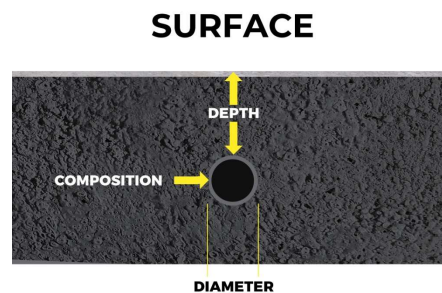


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## Factors Affecting Target Detection

The ability to detect a target depends on:

- Electrical conductivity of material above the target
- Target Composition
- Target Diameter



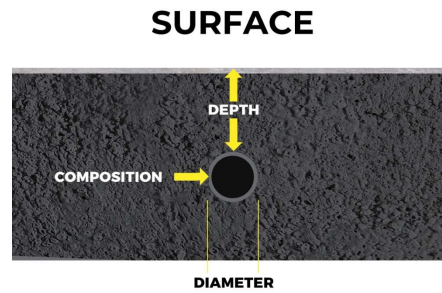
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## Target Properties

The ability to detect a target depends on:

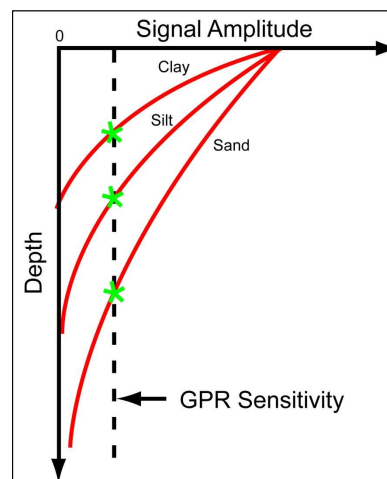
- Electrical conductivity of material above the target
- Target Composition
- Target Diameter



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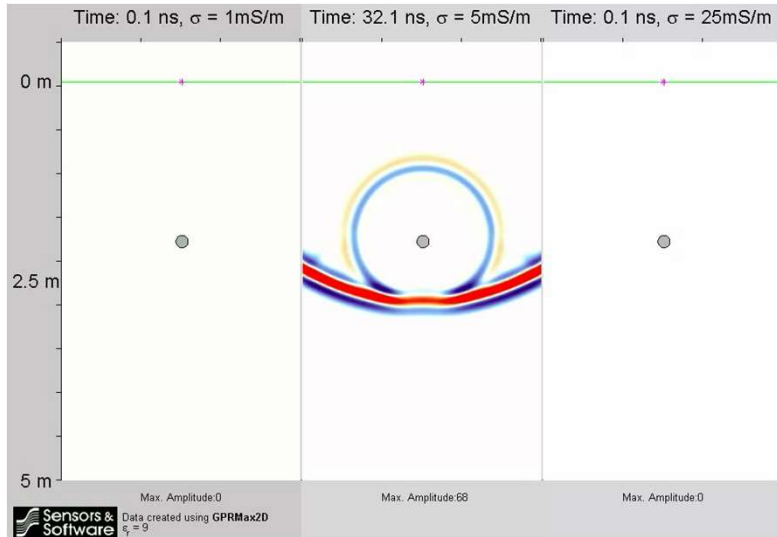
## Electrical Conductivity determines Signal Attenuation

- Amplitude depends on the host material
- Soils absorb radio waves
- Sands and gravel are favorable for GPR
- Fine grained soils such as silt and clay absorb
- Salty water is totally opaque



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## Exploration Depth depends on Attenuation

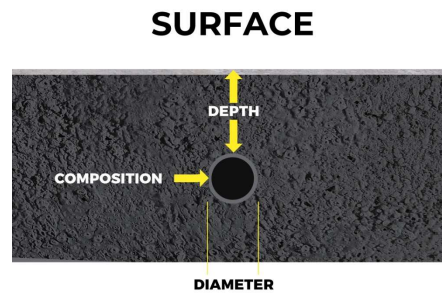


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## Target Properties

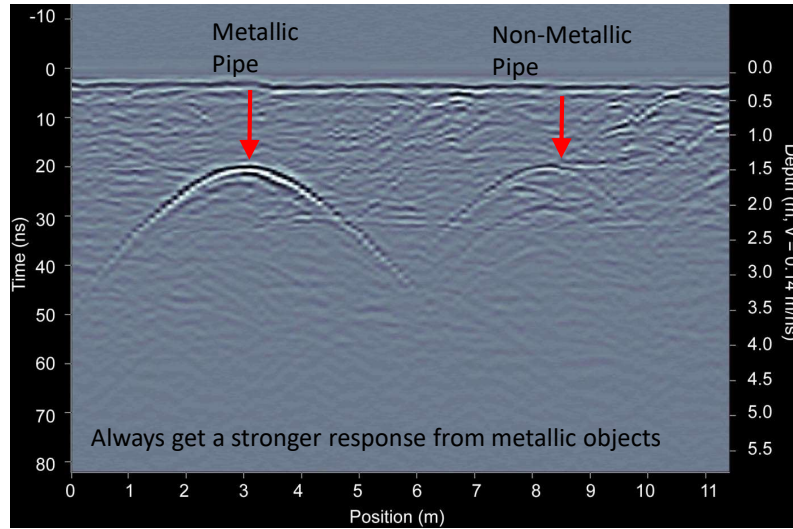
The ability to detect a target depends on:

- Electrical conductivity of material above the target
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## Metallic and Non-Metallic Pipes

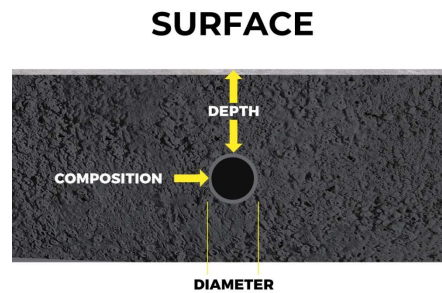


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## Target Properties

The ability to detect a target depends on:

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## Grid Scan

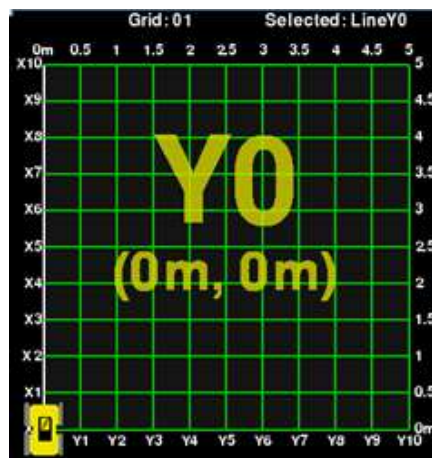
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## Grid Scan

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TECHNOLOGIES

- The interface guides you through grid collection
- Can recollect a line if you make a mistake
- Don't necessarily have to finish every line eg. obstruction



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## Collecting X Lines



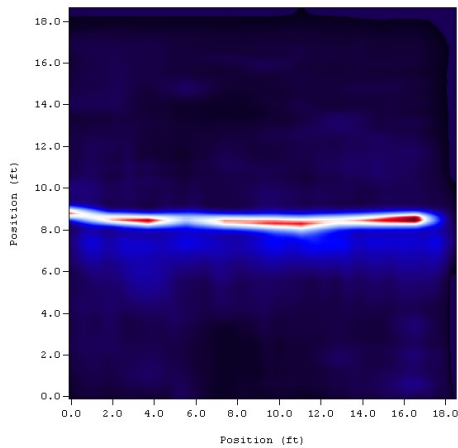
Play



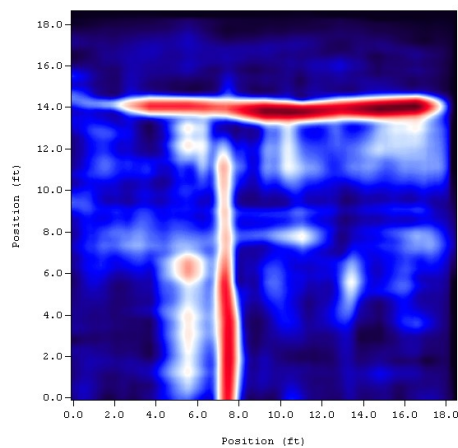
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## Depth Slices of Grid Area



Depth = 2'



Depth = 4'

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## Software Outputs

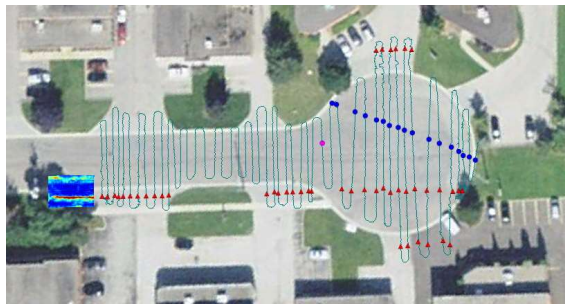
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## GPS automatically added to GPR data

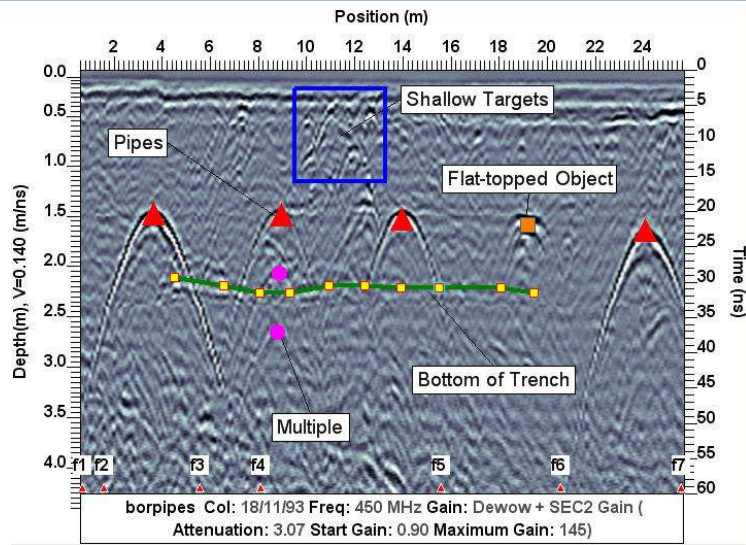
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- GPS data can be used to augment GPR data for simple geotagging or reports
- KMZ files can be output and directly opened in Google Earth



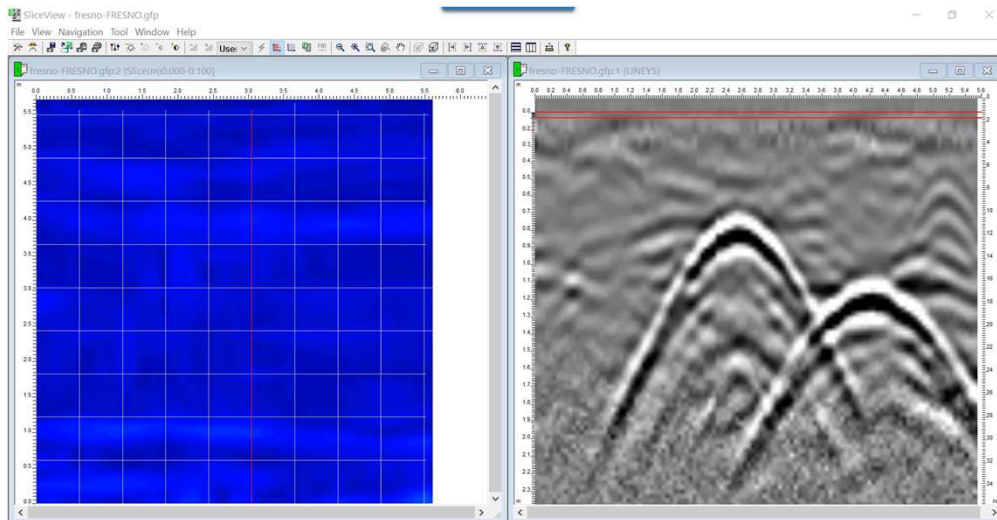
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## LineView with Interpretations



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## Depth Slices to 3D View



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Figure 3  
The true location of the survey was to provide history and not necessarily the 3D profile showing the 1-D line. The 3D image shows the location of the survey and the location of the church building. The 3D image shows the location of the survey and the location of the church building.

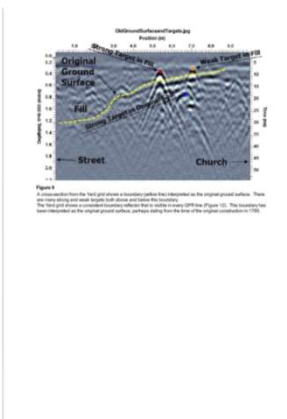


Figure 4  
A cross section from the 3-D plot shows a cross-section profile that is dependent on the original ground surface. These are very rough and not meant to show or indicate the location. The 3-D plot shows a cross-section profile that is dependent on the original ground surface. These are very rough and not meant to show or indicate the location.

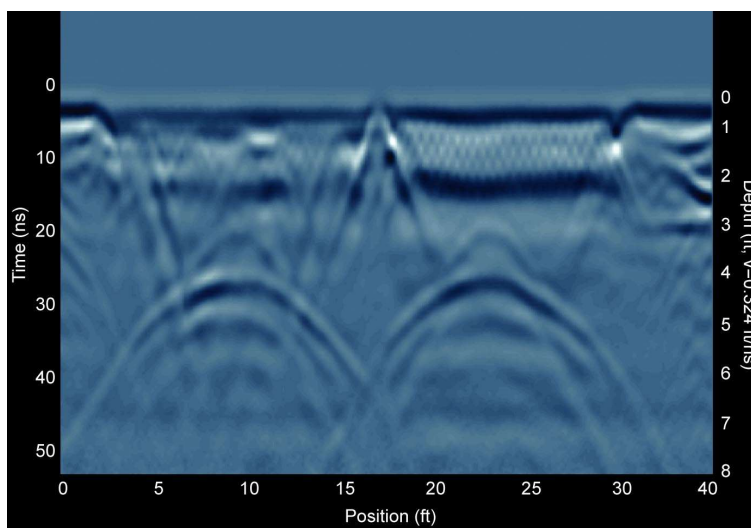
# Data Examples

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## Underground Storage Tanks

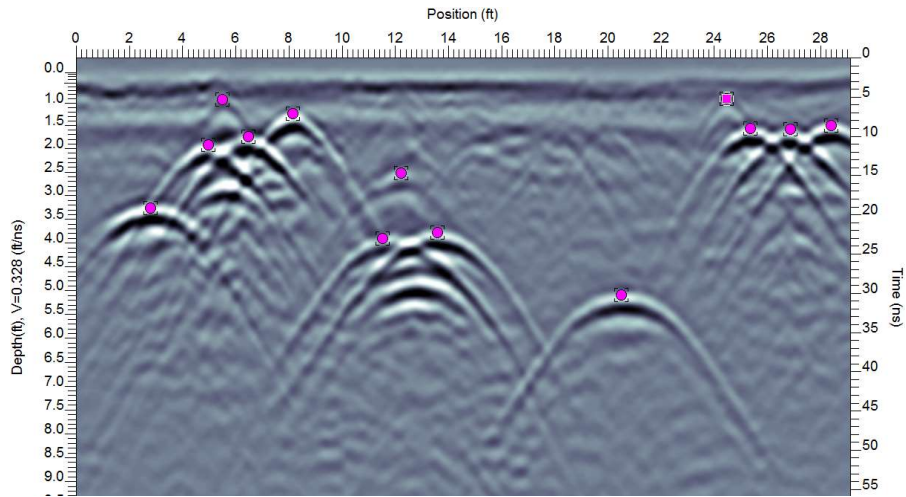
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TECHNOLOGIES



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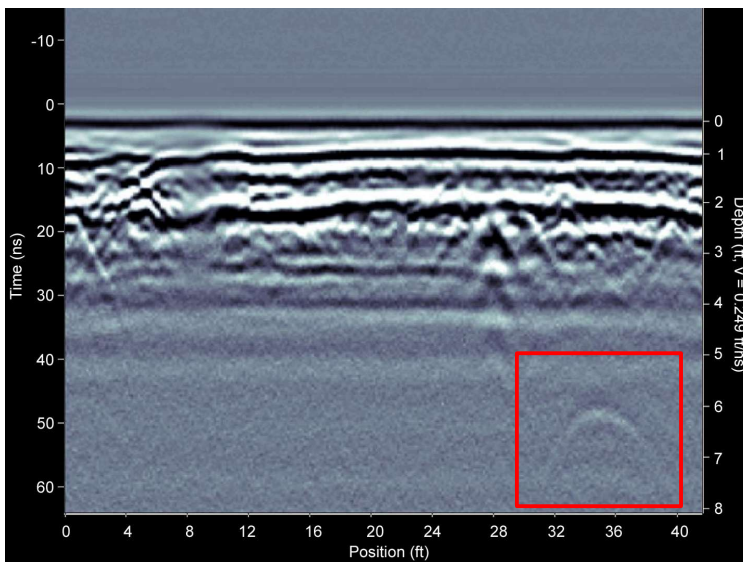


## Locate Utilities that are close to each other



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## Subtle Targets



A 6ft deep  
Concrete-Asbestos  
pipe produces a  
faint but detectable  
response

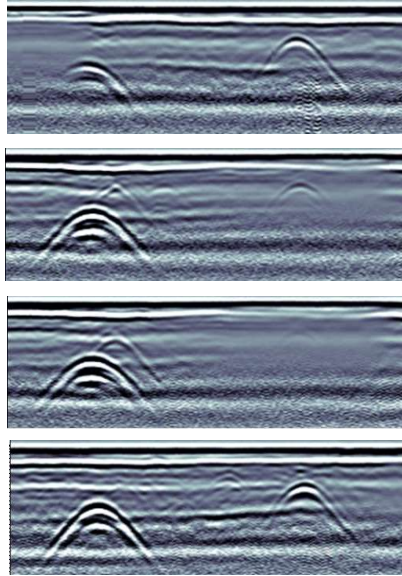
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## Interpretation?

4 parallel lines a few feet apart  
What is the most plausible explanation of what happened to the pipe on Line 3?

- 1) Localized high attenuation
- 2) The pipe is broken and full of soil
- 3) The pipe gets deeper
- 4) The pipe changes direction



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## Online Resources

### Online Courses

<http://www.SensofU.com>

### Newsletters

<http://www.sensof.ca/resources/newsletters/>

### Case Studies

<http://www.sensof.ca/resources/case-studies/>

### LMX200 Training Video

<https://www.sensof.ca/training-events/training/lmx200-training-videos/>



**Thank you for attending**



**Any questions?**

**E-mail**

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