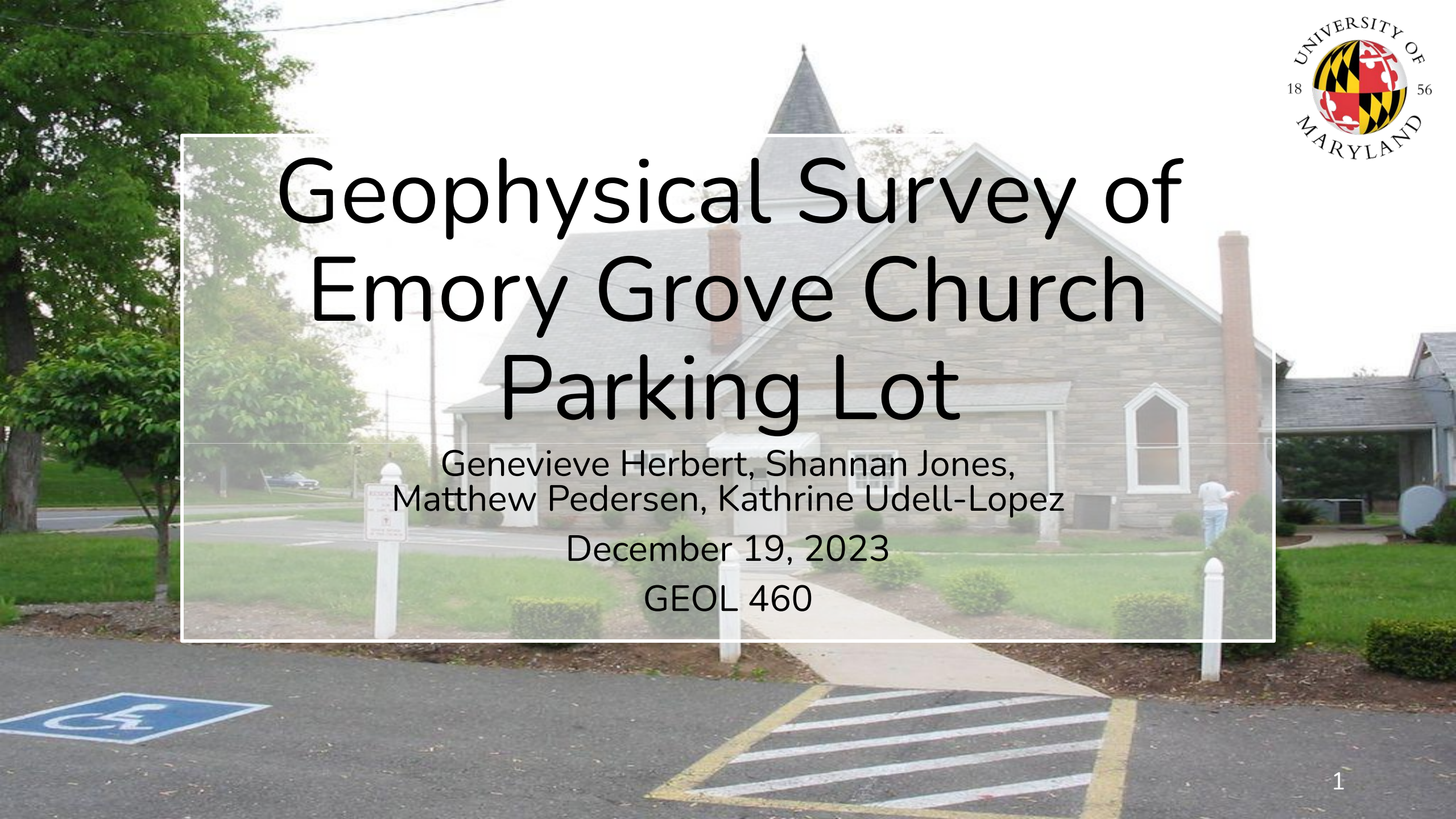


Geophysical Survey of Emory Grove Church Parking Lot

Genevieve Herbert, Shannan Jones,
Matthew Pedersen, Kathrine Udell-Lopez

December 19, 2023

GEOL 460

Emory Grove: History

Tight-knit community founded 1864 by freed slaves

Home to 500 residents at peak

Hosted Methodist gatherings ("camp meetings")

Dismantled due to 1960s/70s urban renewal

Source: Heritage Emory Grove Homepage, 2023

Emory Grove United Methodist Church, 1974
https://mdhistoricaltrust.wordpress.com/2022/08/17/the-montgomery-county-emory-grove/

Mindful Redevelopment

Prioritize historical honor and community cohesion

Our task: Analyze subsurface so redevelopment efforts won't disturb potential unmarked graves.

1864

HERITAGE

EMORY GROVE

Housing Opportunities Commission OF MONTGOMERY COUNTY

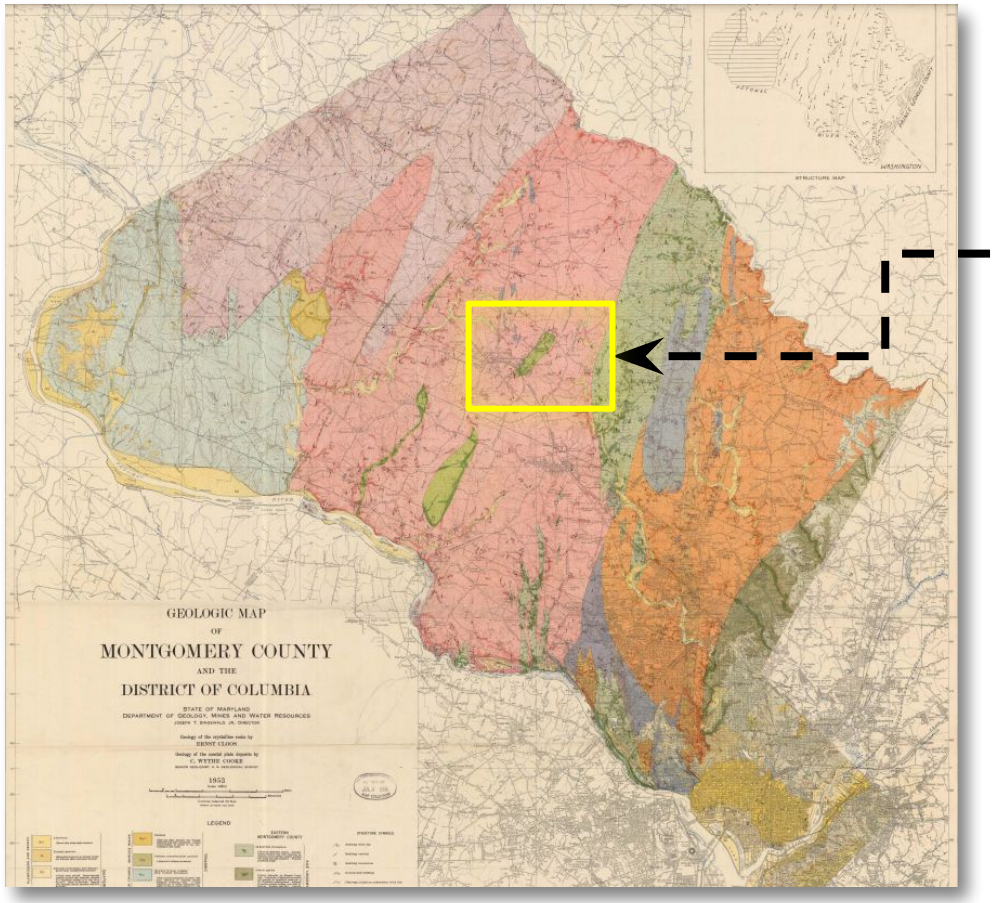
In partnership with:

EMORY GROVE UNITED METHODIST CHURCH

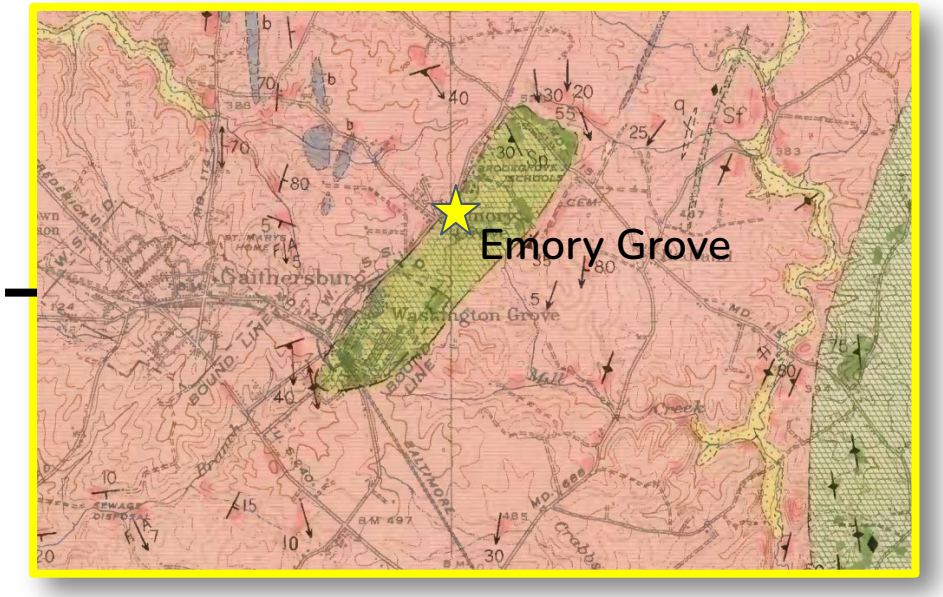
MONTGOMERY COUNTY 1776 MARYLAND

Partners in the Heritage Emory Grove Plan https://heritageemorygrove.com/

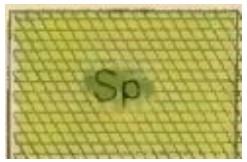
Geological Makeup of the Site



Source: Singewald et al., 1953

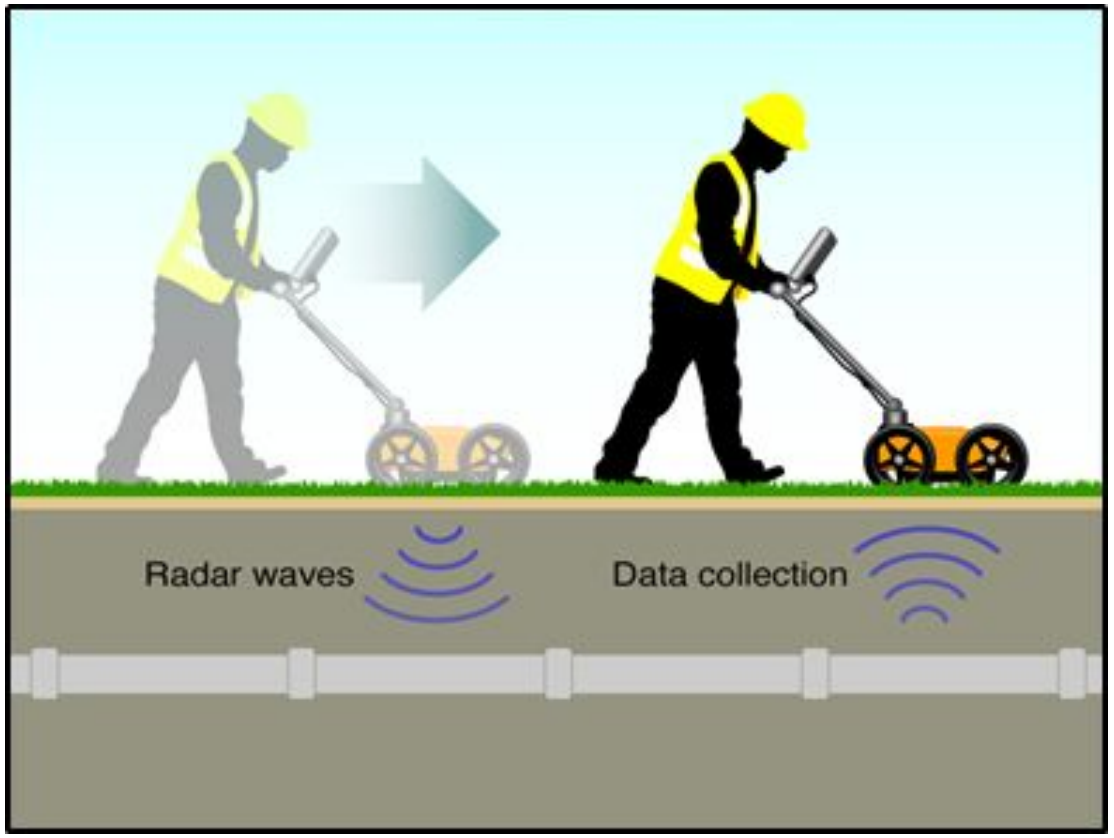


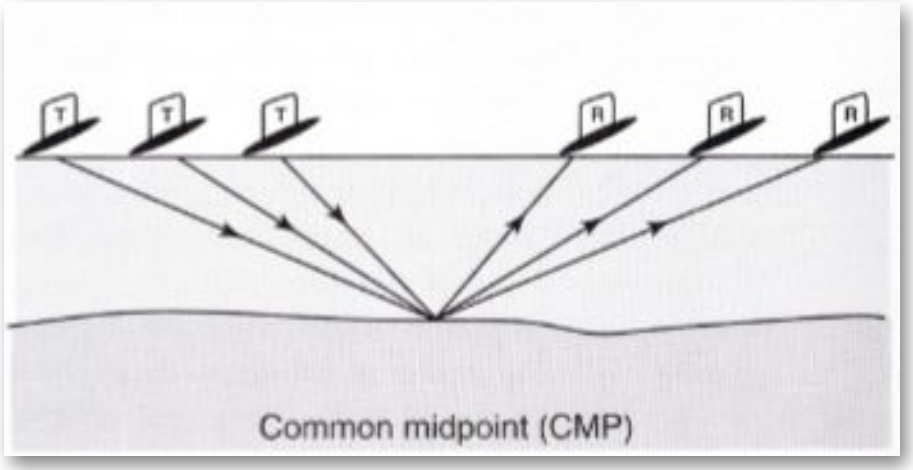
= Wissahickon formation



= Serpentine

What is Ground Penetrating Radar?





$$v = c/\sqrt{\mu_r \varepsilon_r}$$

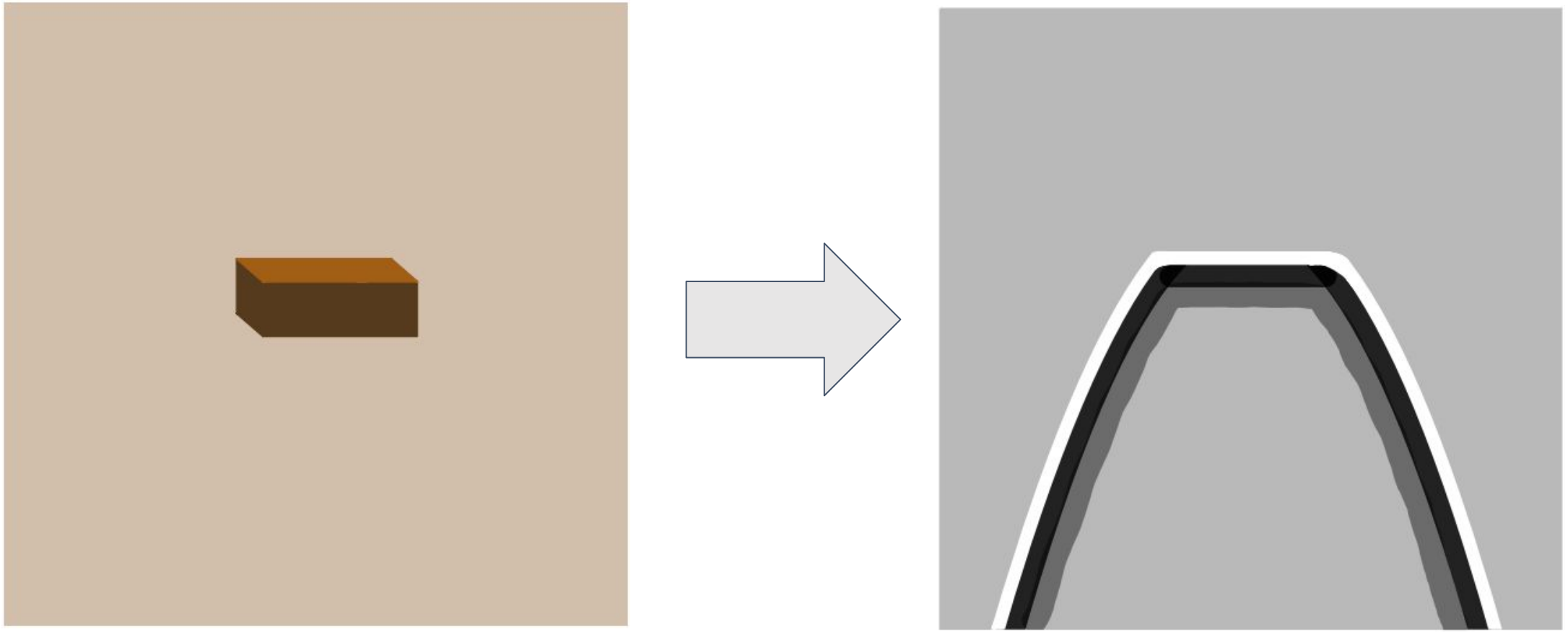
v: Radar velocity

c: Speed of light, 3×10^8 m/s

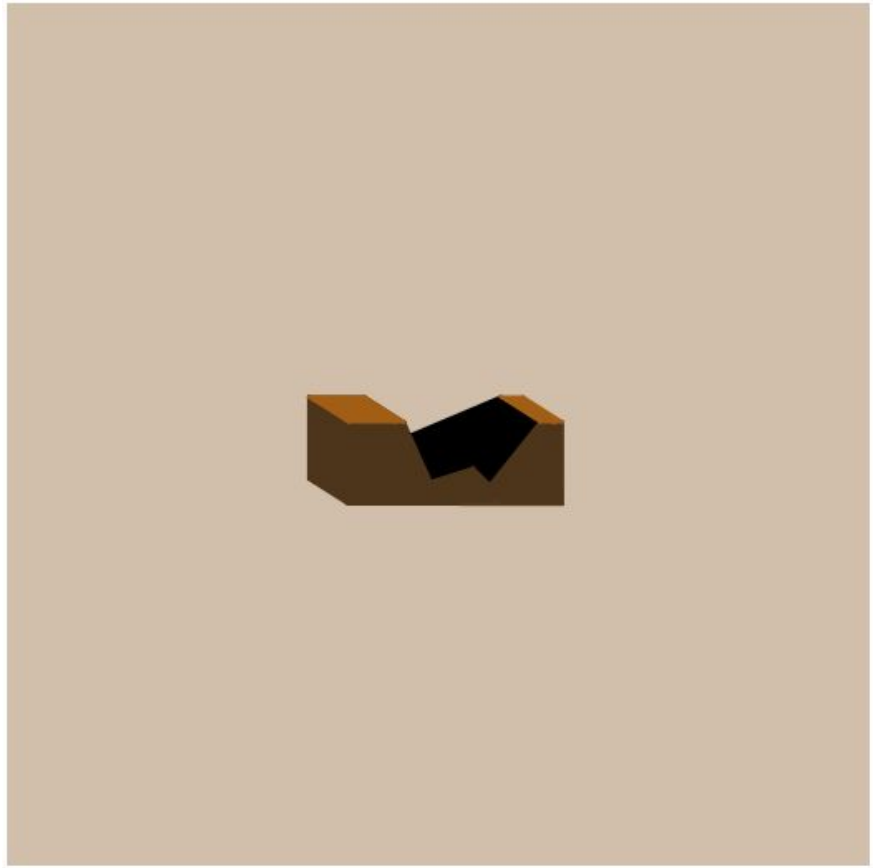
μ_r: Magnetic permeability, ≈ 1

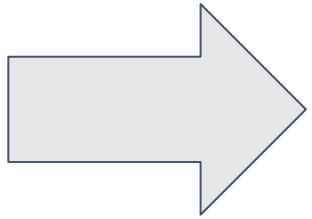
ε_r: Relative dielectric permittivity

Target Appearances in the Data

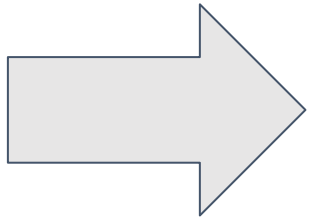


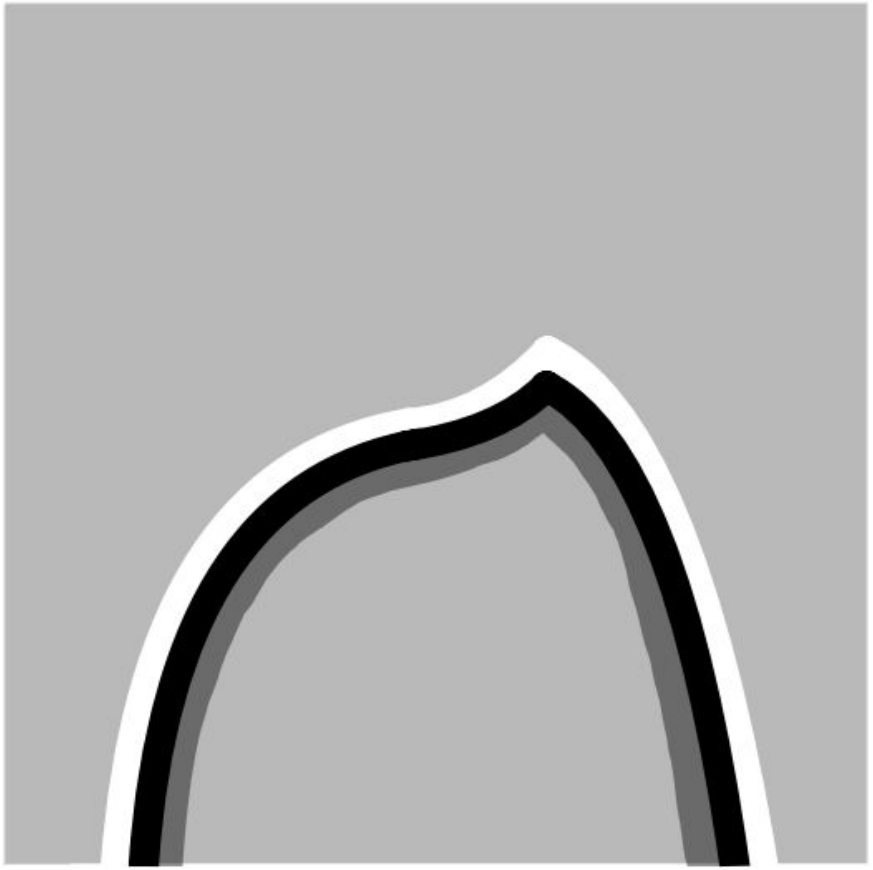
Target Appearances in the Data





Target Appearances in the Data





A Triple-Instrument Effort

Parking Lot

Instrument: SIR-4000

- frequency: 400 & 200 MHz
- sampling rate: 25 scans/m

Common-midpoint profile (CMP): 45 cm initial spacing, 10 cm increments

Landscaped Area

GS-LF

- frequency: 350 MHz
- sampling rate: 60 scans/m

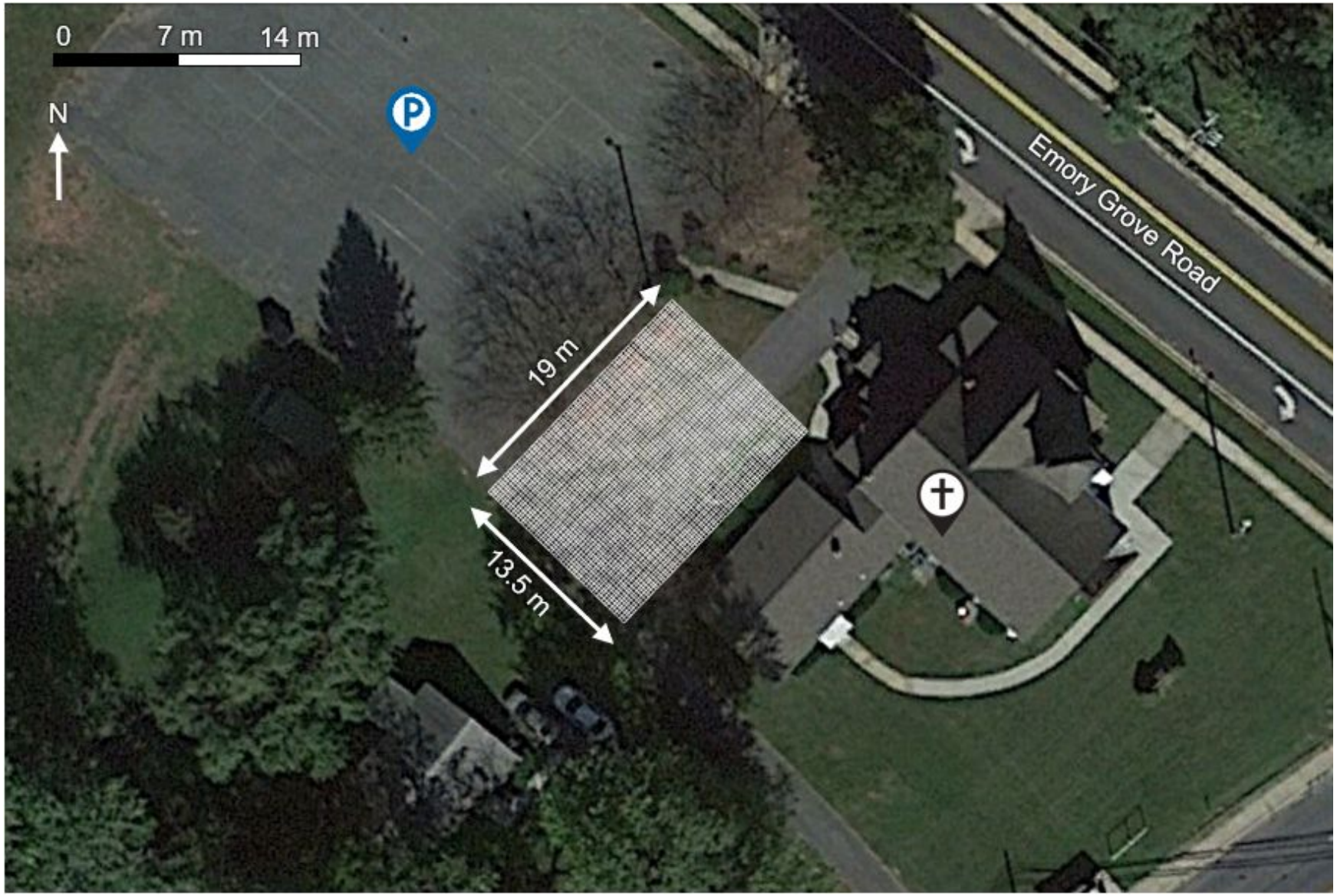
SIR-4000

- frequency: 400 MHz
- sampling rate: 50 scans/m

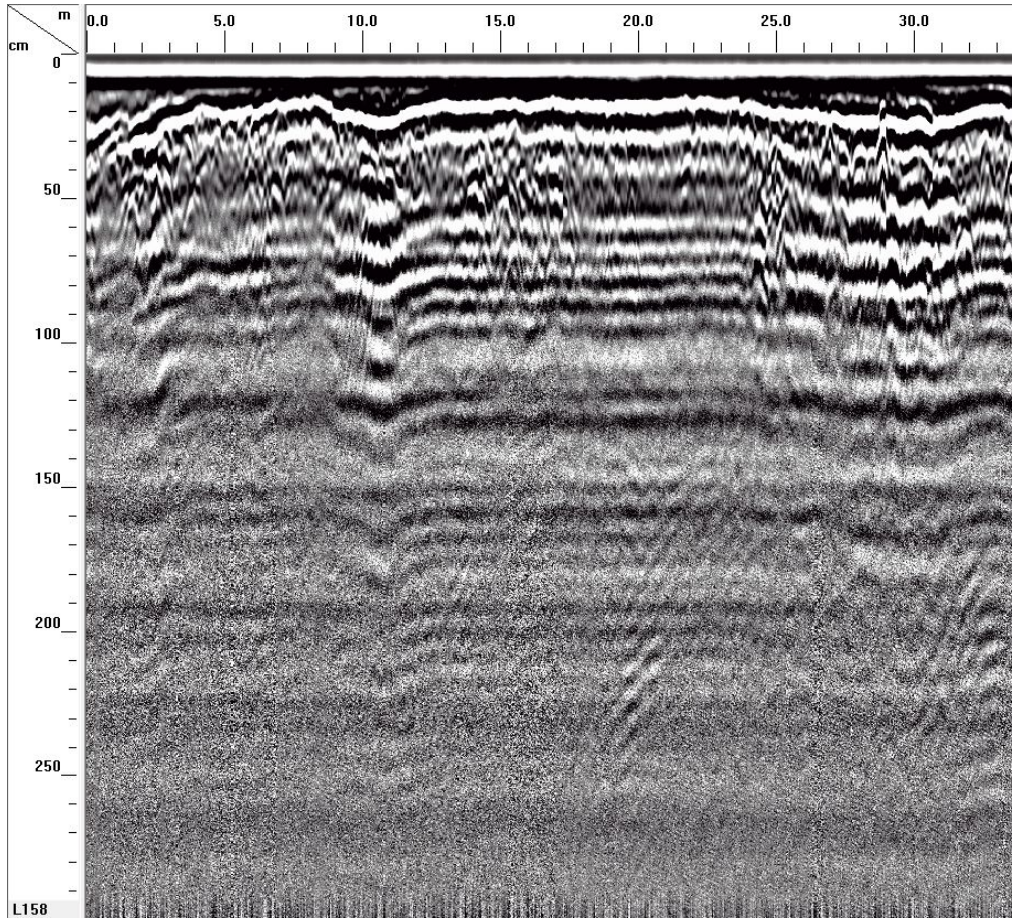
Methods

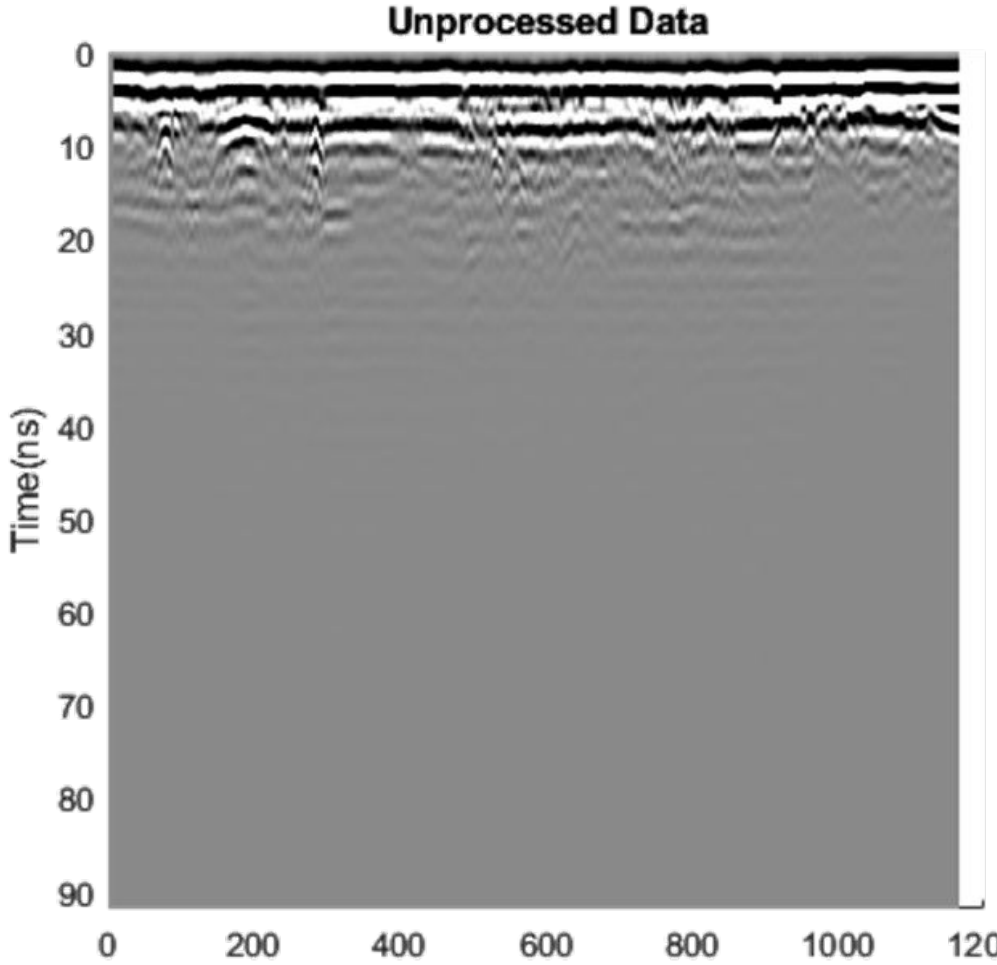

Emory Grove United Methodist Church GPR survey site
GPR survey site at the Emory Grove United Methodist Church parking lot
Legend
Emory Grove United Methodist Church
Chorlton Ct
Emory Grove Rd
34 m
13 m
Emory Grove United Methodist Church
Emory Grove Rd
Google Earth
80 ft
N

Methods



The Raw Data: It's Pretty Noisy





GPR Processing

Time-zero correction

Filters:

Horizontal:

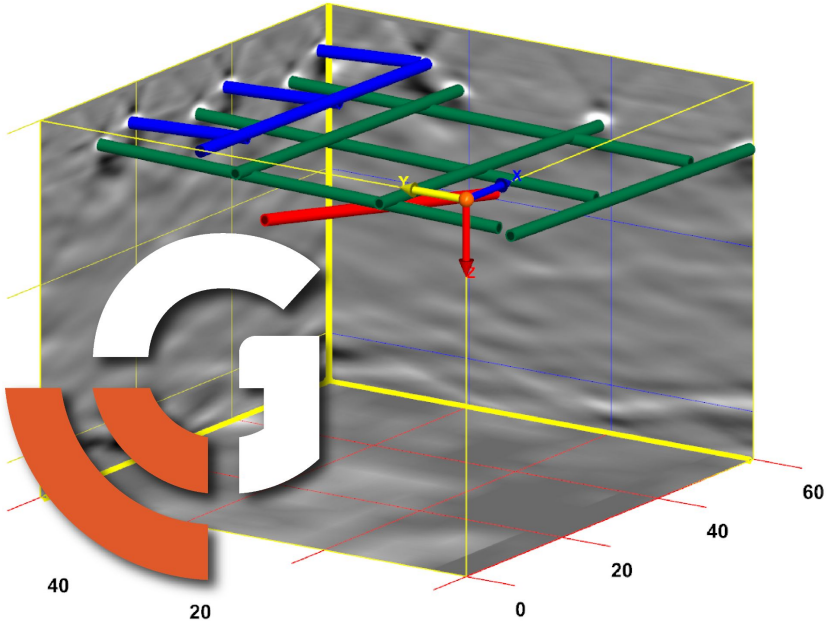
background removal

Vertical:

- Low pass
- High pass

Gaining

Migration



MATLAB

Processing Steps

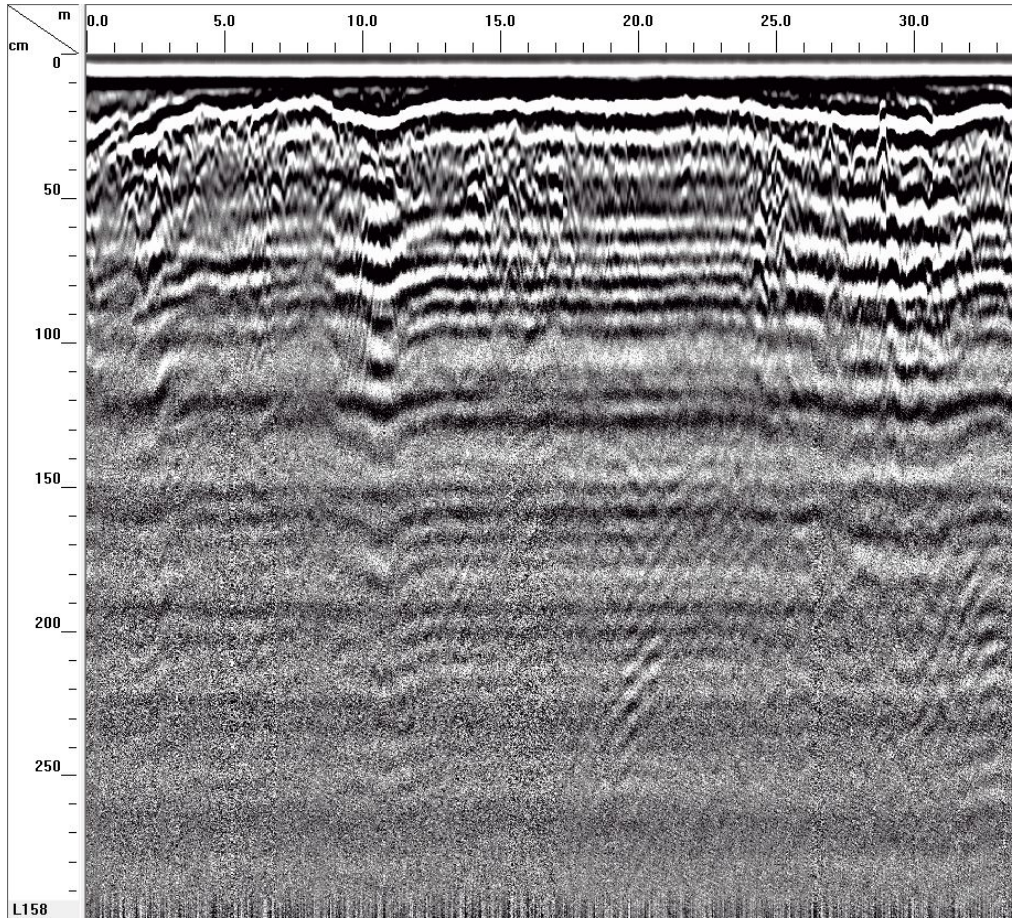
Parking Lot

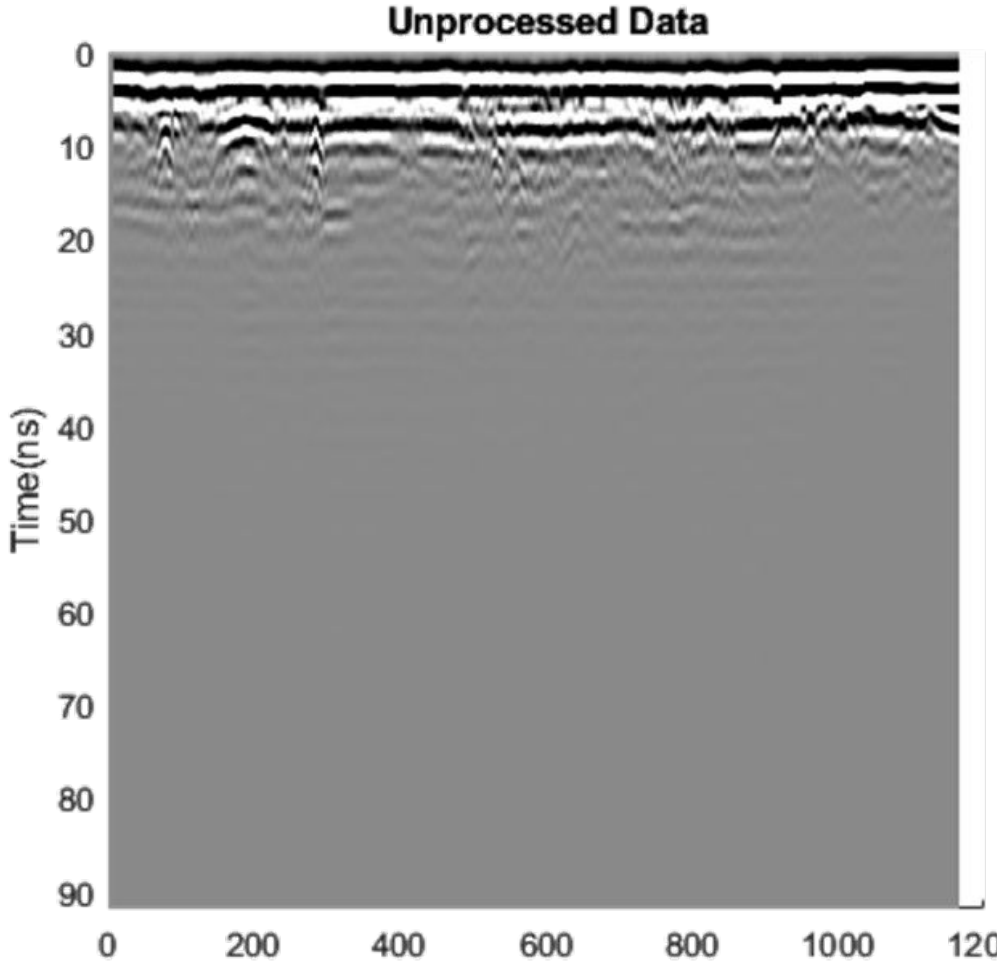
- Adjust gain and time zero
- Background removal and filtering (600 MHz low pass and 200 MHz high pass)
- Horizontal filters (length of 51)
- Migrate CMP velocity into dataset

Landscaped Area

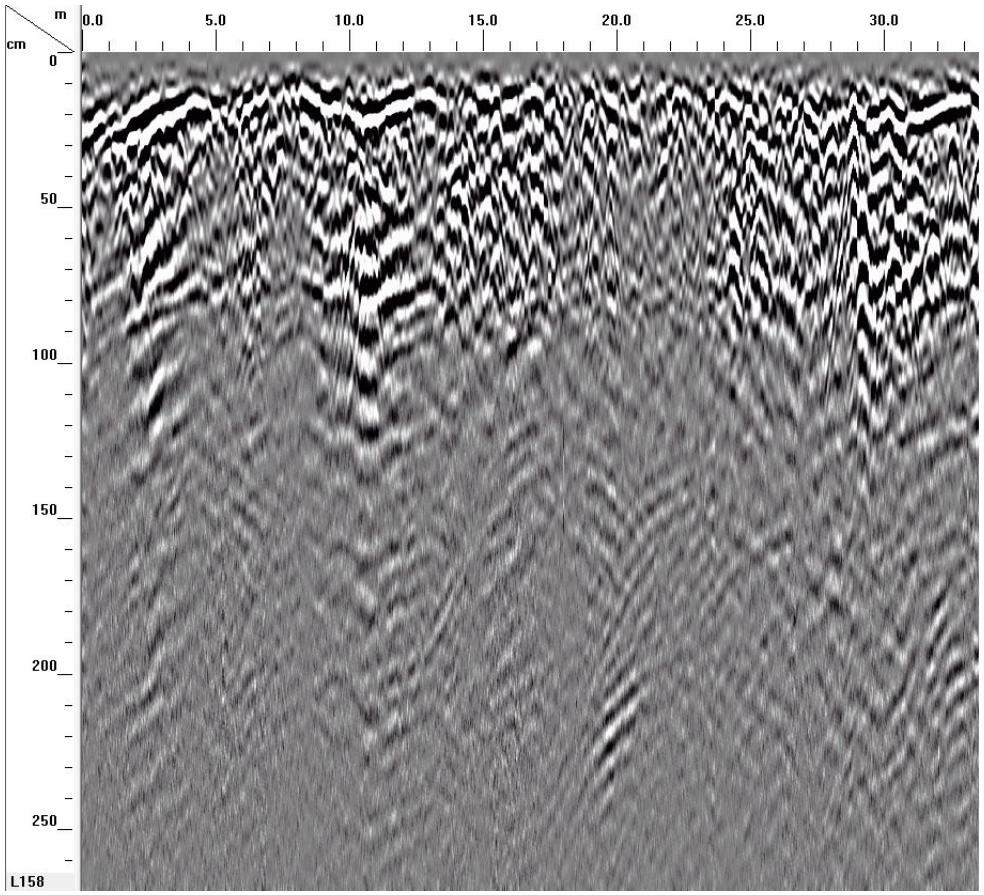
- Adjusted t0
  - Church-parallel: 39 ns
  - Church-perpendicular: 113 ns
- Applied background removal
- Filtering:
  - Low pass: 600 MHz
  - High pass: 200 MHz

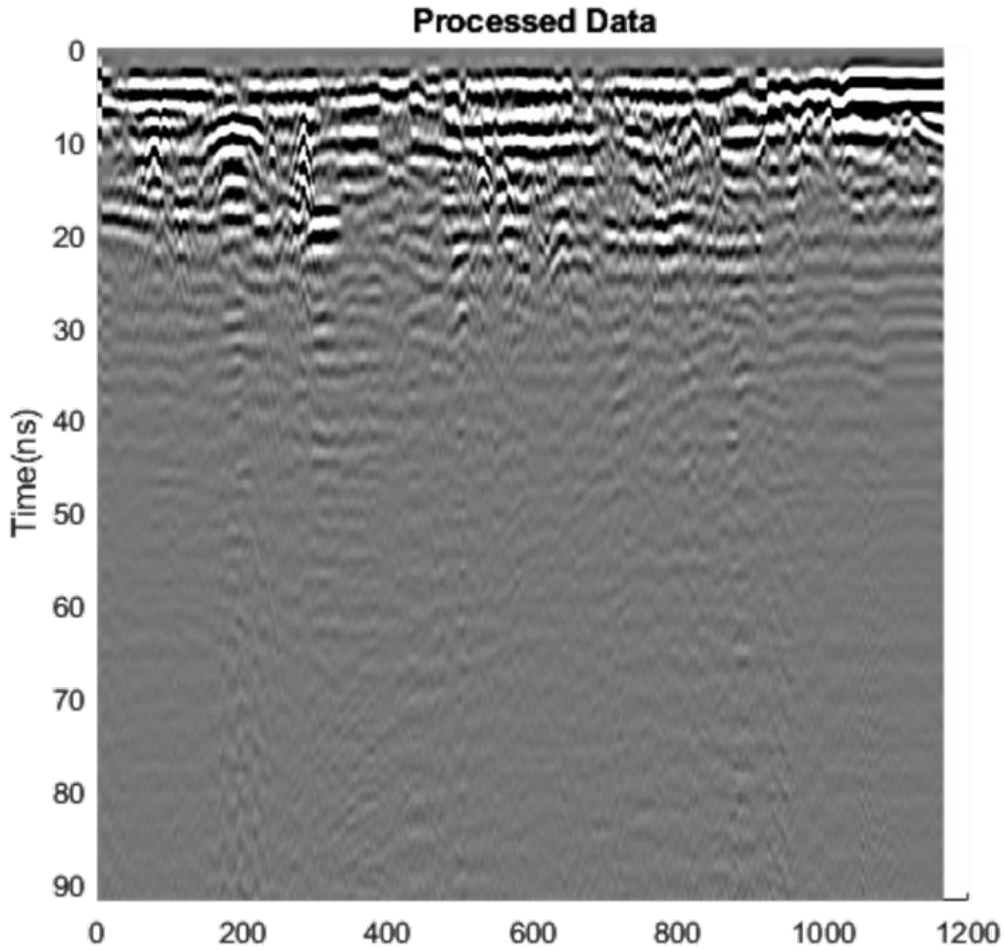
The Raw Data: It's Pretty Noisy





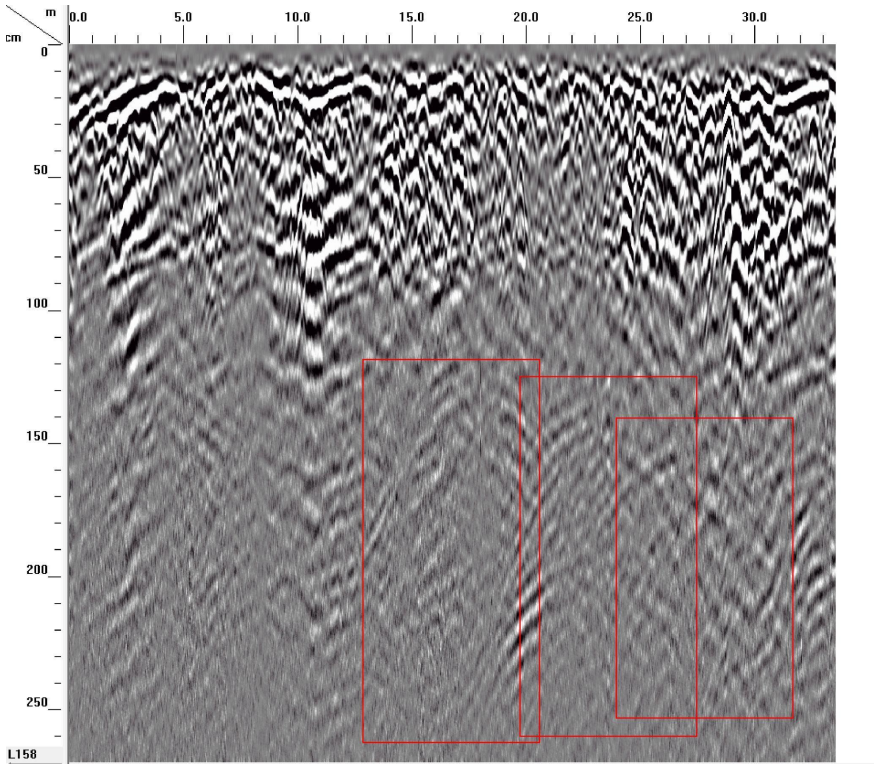
The Processed Data: Much Better



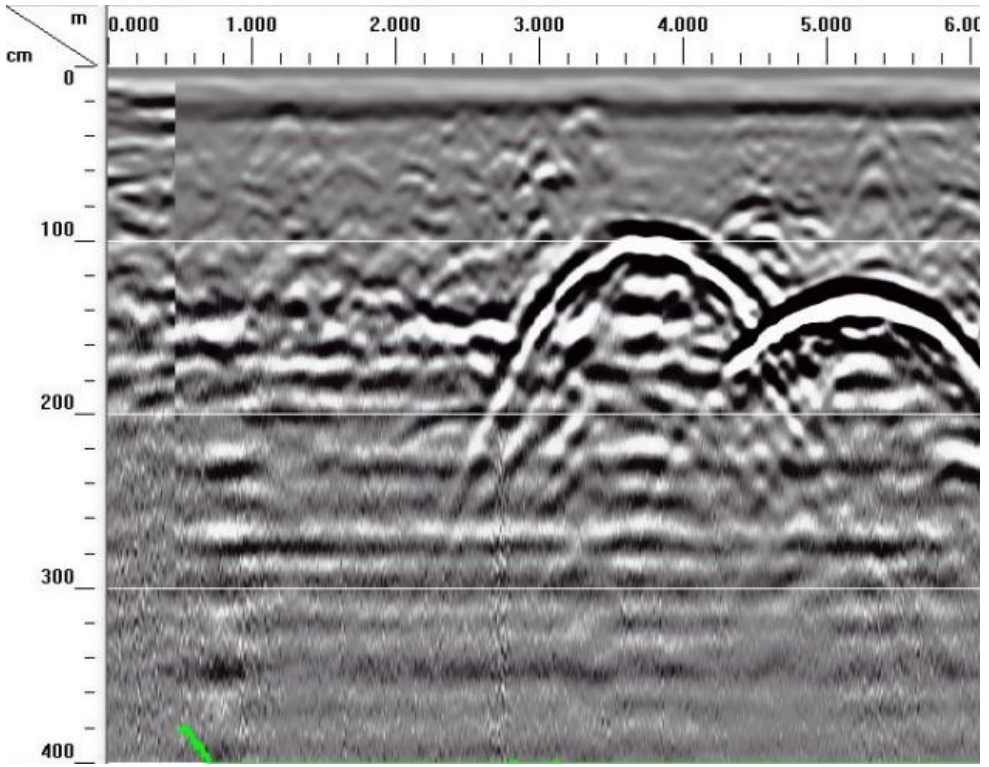


Diffractors versus a reference

Parking Lot

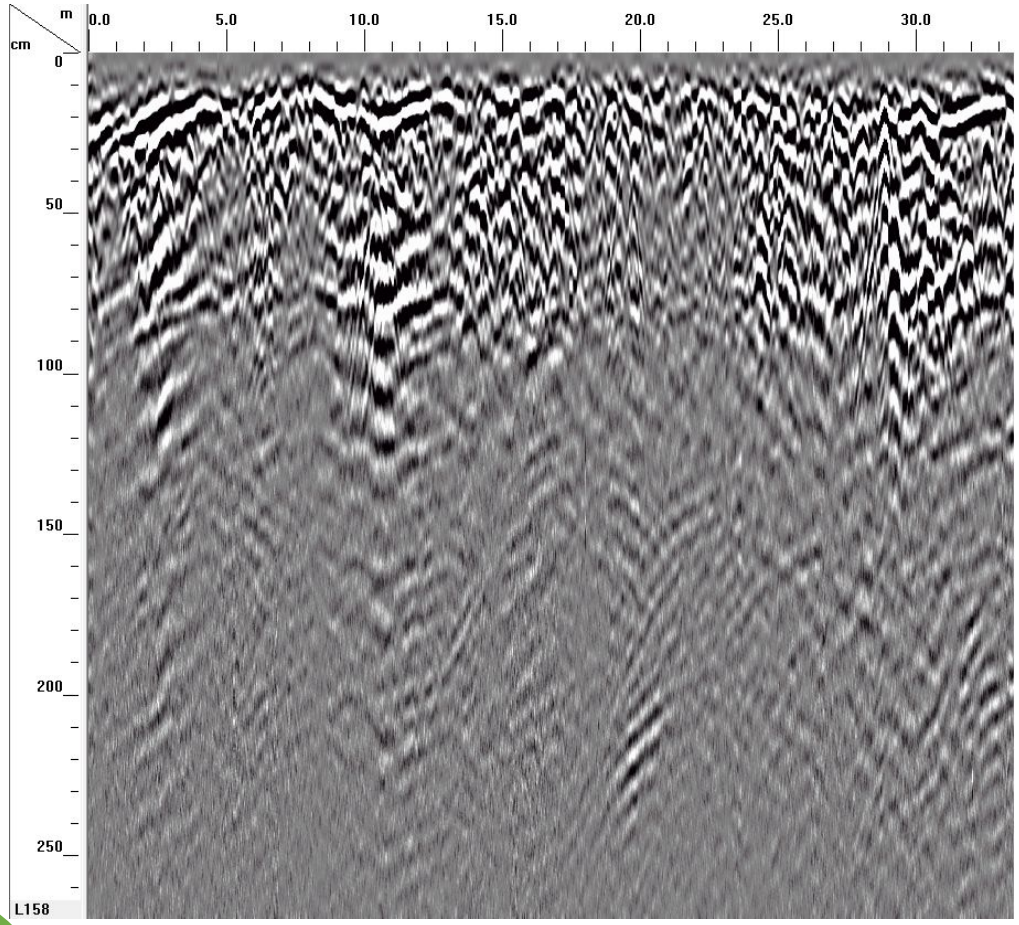


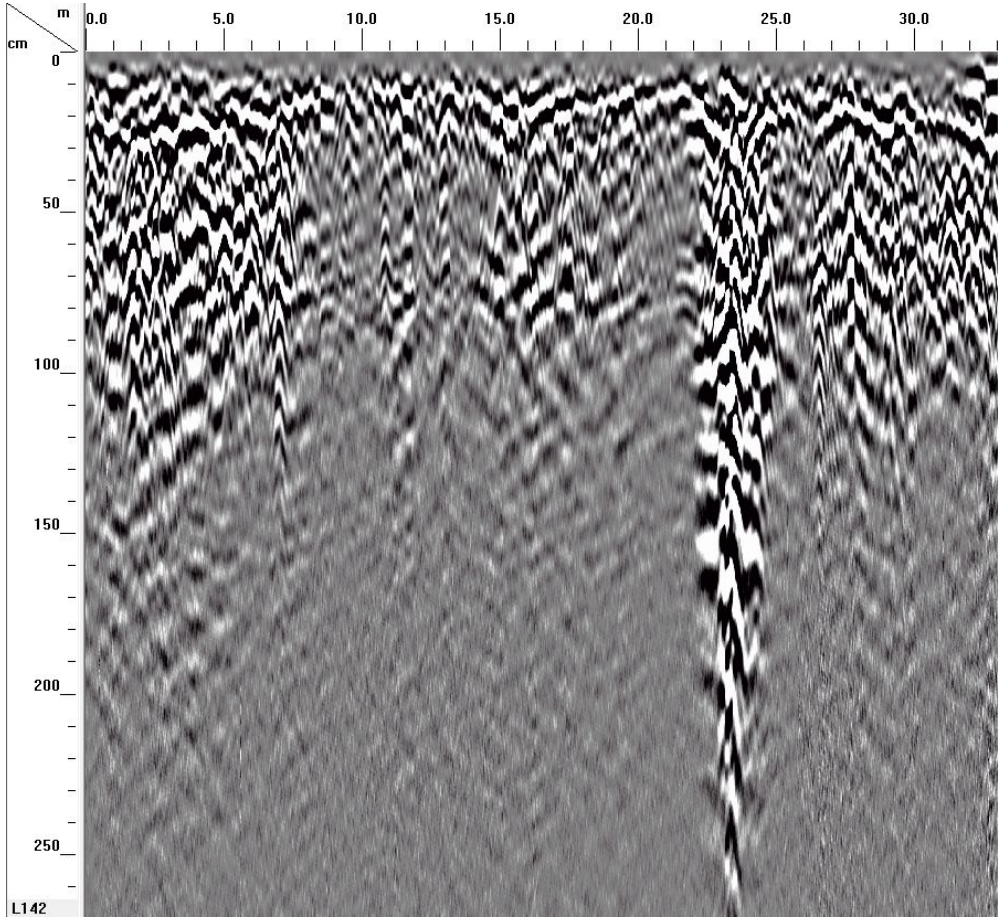
Reference



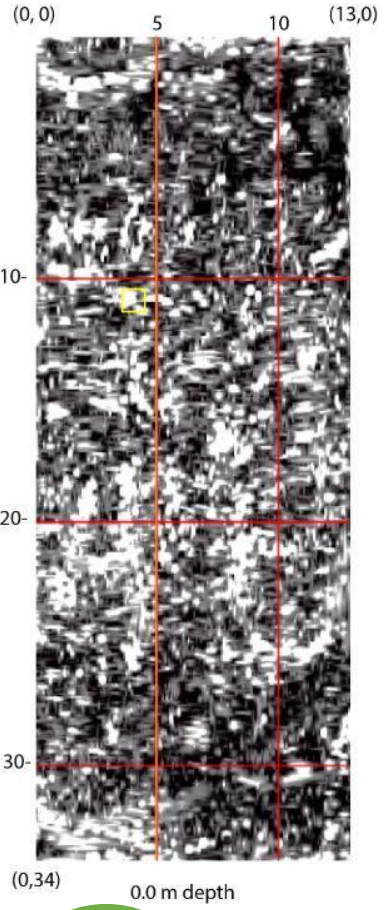
Emory Grove Cemetary Test Scan (9/26/2023)

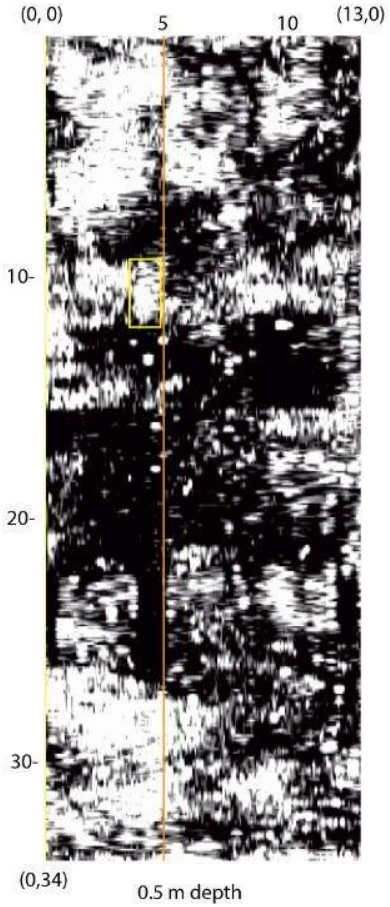
Subsurface vs. surface diffractors

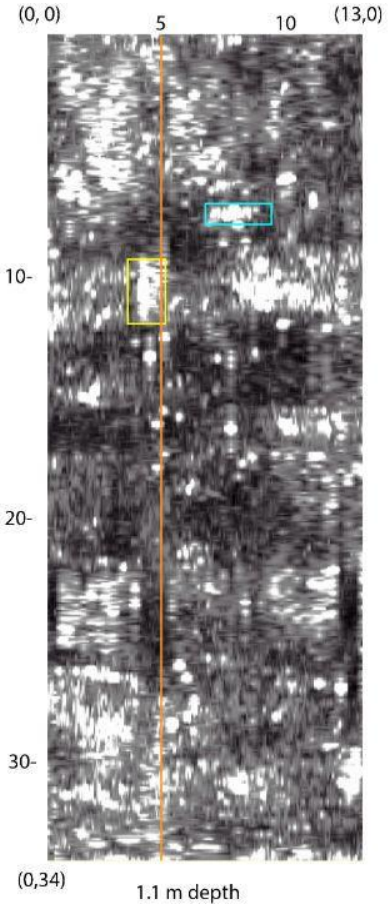


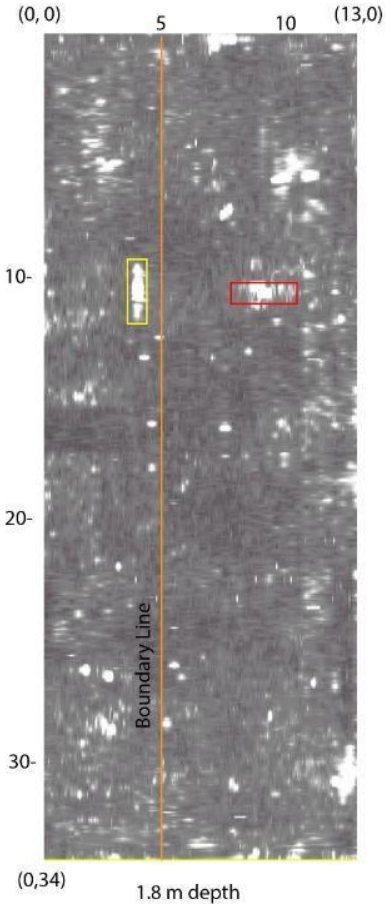


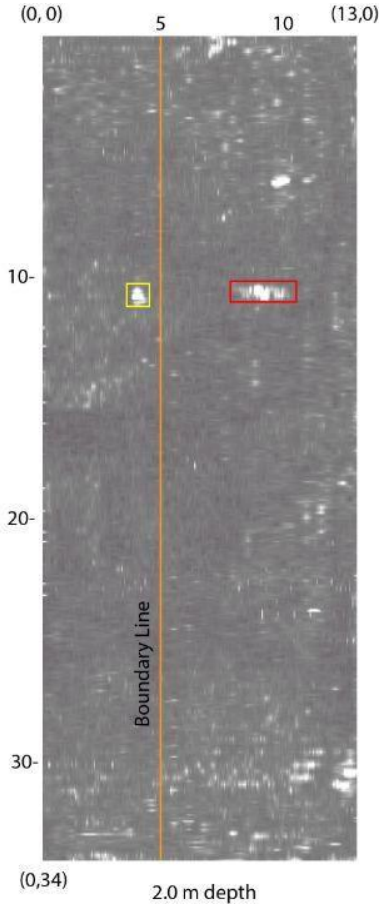
Debunking surface vs. subsurface signatures



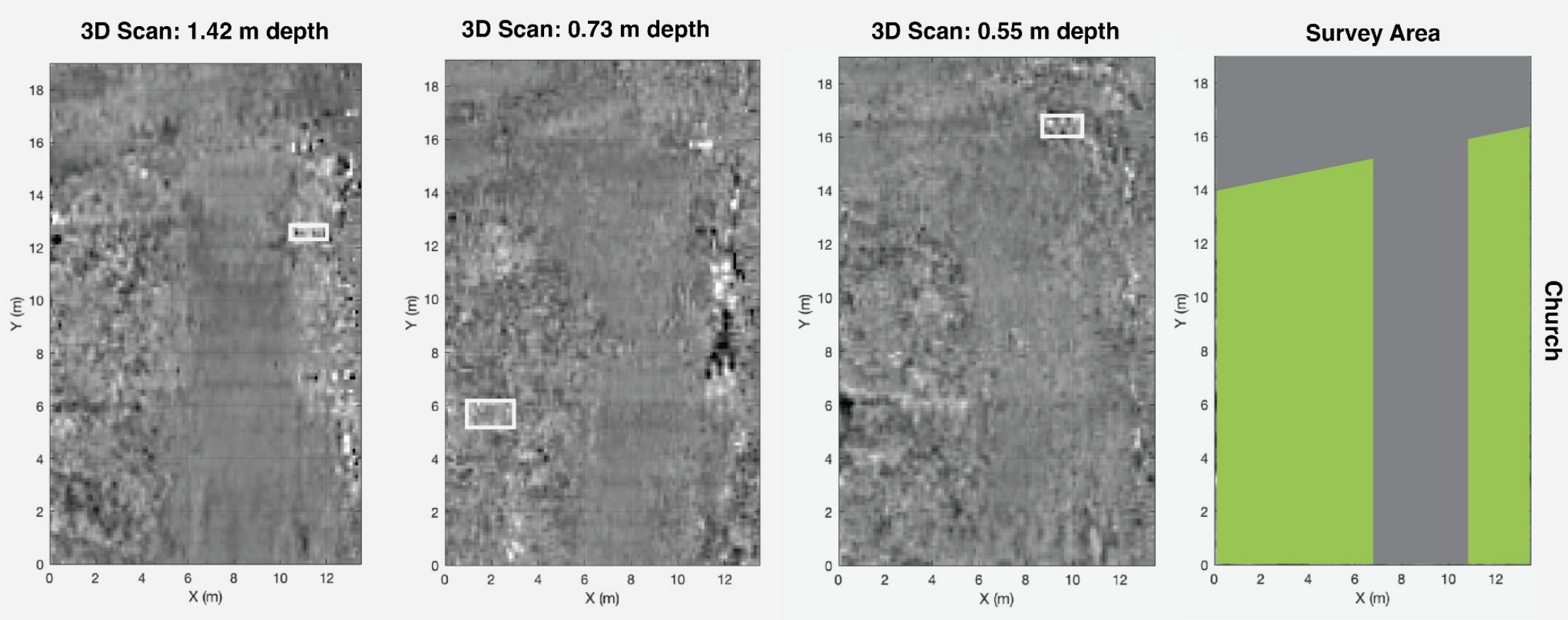




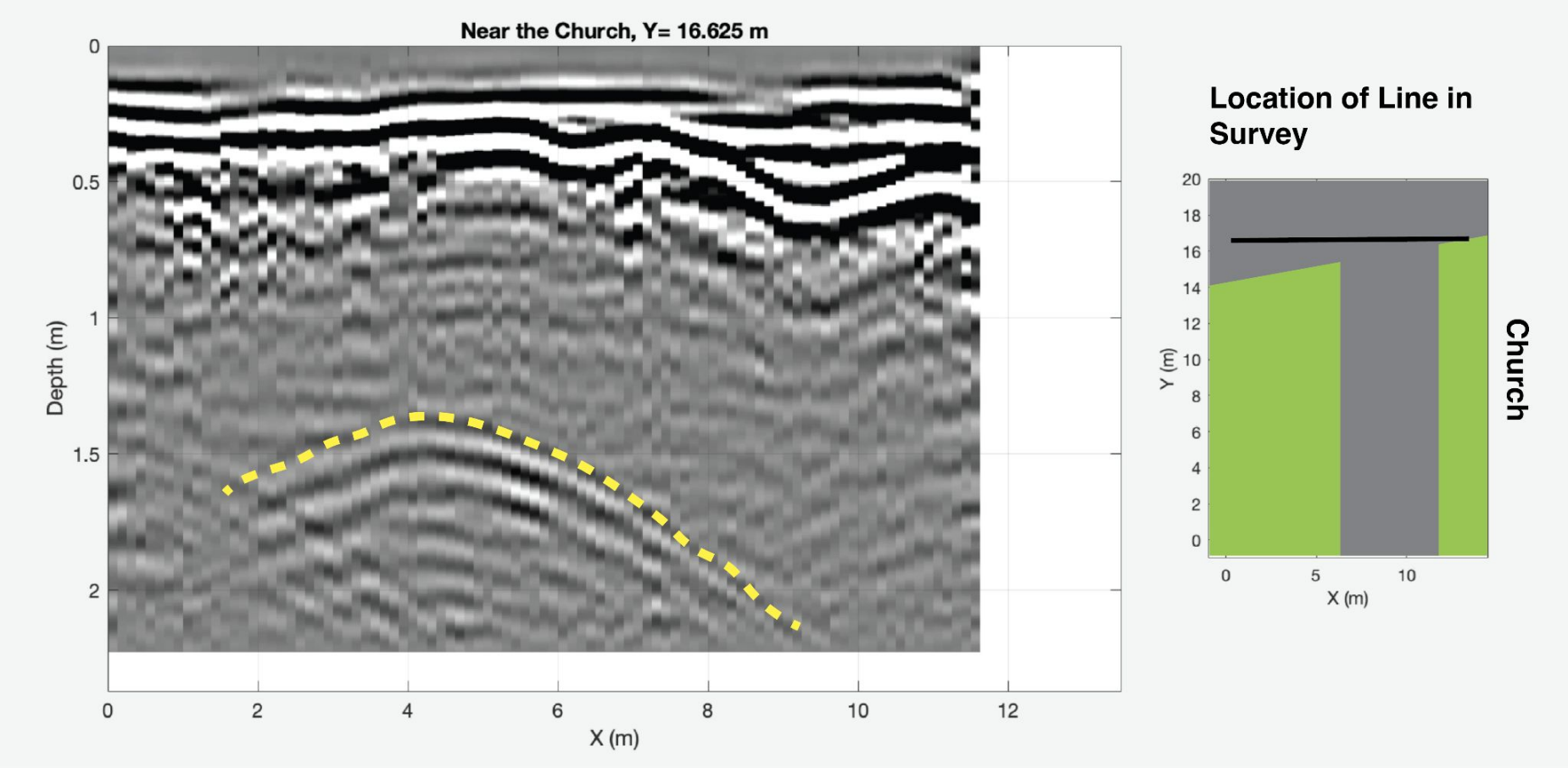




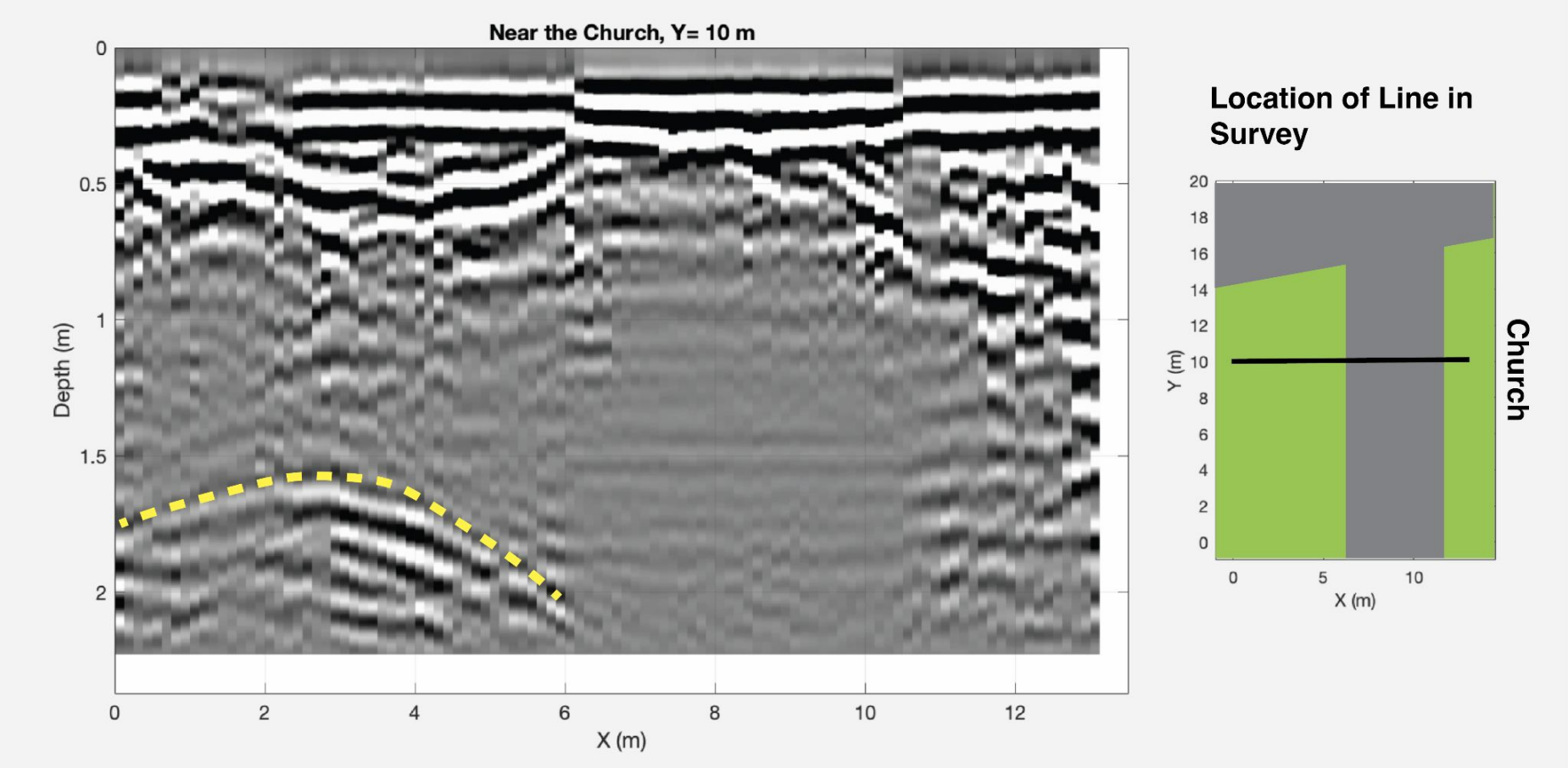
Landscaped Area: Potential Graves



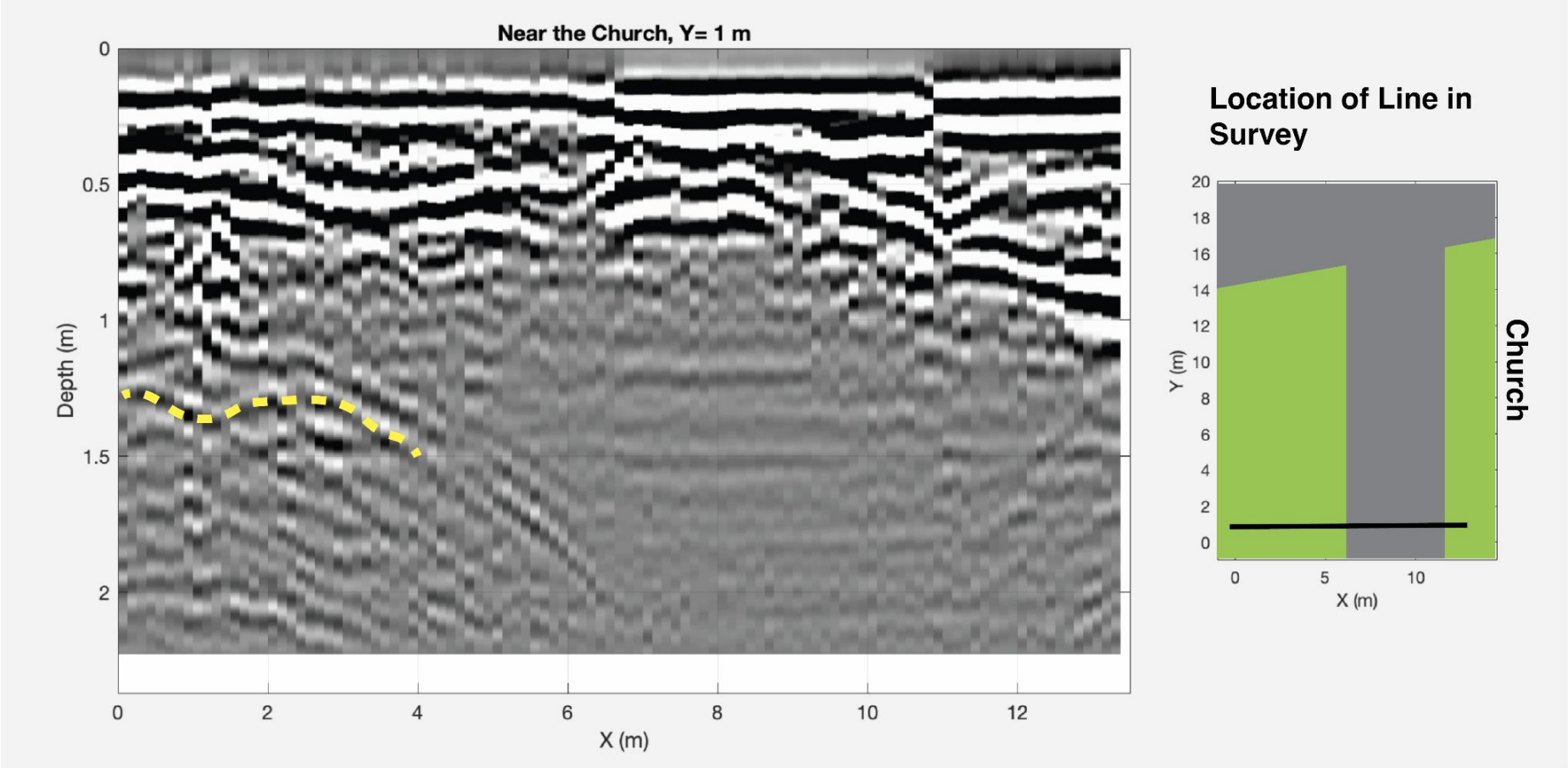
Landscaped Area: Boundary



Landscaped Area: Boundary



Landscaped Area: Boundary



Landscaped Area

Area appears to contain many diffractors

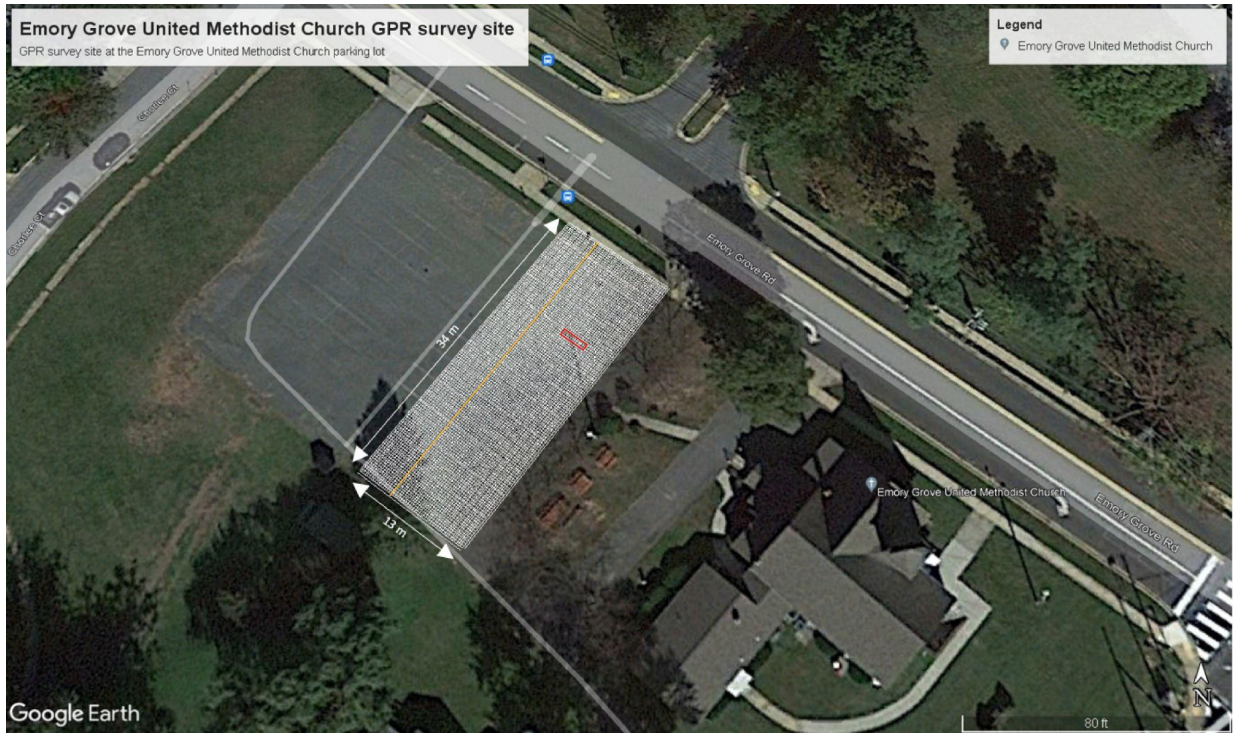
- Unclear whether buried objects are graves

Survey doesn't clearly identify old cemetery boundary based on diffractors and historical knowledge

- Recommend further surveying to establish a clear boundary

Parking Lot

- The boundary where no conclusive evidence for unmarked graves is marked by the orange line (~5 m from the (0,0) mark
- At least one diffractor that may be a grave is within the scan area (red box)
- More scans should be done to ensure the boundary is placed at an appropriate location



Acknowledgements

Thank you to:

- UMD Partnership for Action Learning and Sustainability (PALS)
- Pastor Tim
- Members of Emory Grove United Methodist Church
- Dr. Nicholas Schmerr and Jacob Giles
- Everyone in the audience!

Questions?

References

Homepage: History. (2023). Heritage Emory Grove. Retrieved December 5, 203, from https://heritageemorygrove.com.

Singewald, J. T. Jr., Cloos, E., & Cooke, C. W. (1953). *Geologic Map of Montgomery County and the District of Columbia*. State of Maryland Department of Geology, Mines and Water Resources. Retrieved from https://msa.maryland.gov/megafile/msa/stagsere/se1/se92/000000/000010/pdf/msa_se92_000010.pdf.