



Employing Non-Invasive Remote Sensing Technology in Cultural Resource Investigations

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Raba Kistner

- ▶ San Antonio (HQ)
- ▶ Austin
- ▶ Brownsville
- ▶ Dallas/Fort Worth
- ▶ Freeport
- ▶ Houston
- ▶ McAllen
- ▶ New Braunfels
- ▶ Arizona (New)
- ▶ Oklahoma (New)
- ▶ Nebraska
- ▶ New York
- ▶ Utah
- ▶ Mexico
- ▶ Plus multiple project offices across the U.S., Canada and Mexico.

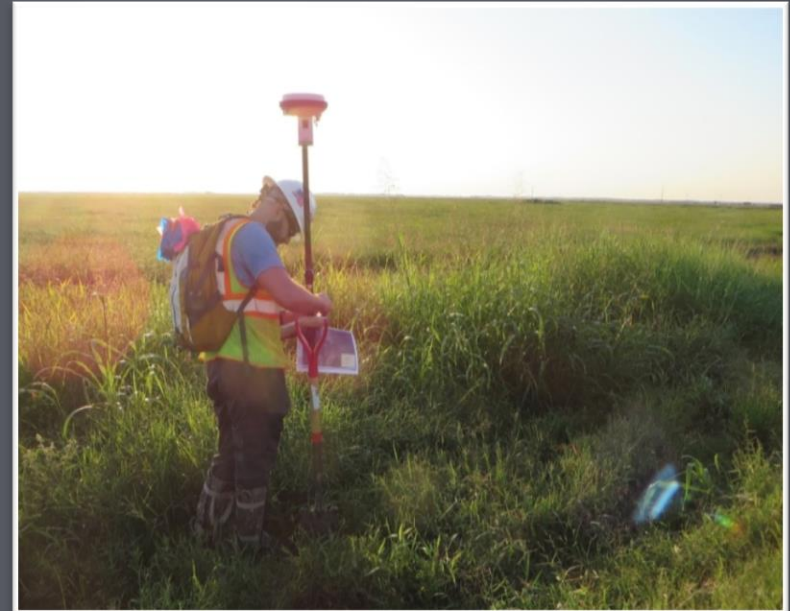




Safety

► Compliance with industry standards

- Appropriate Personal Protective Equipment (PPE)
 - Safety Vests
 - Hard Hats
 - Steel-toed boots
 - Safety glasses, gloves
- Tailgate meetings
 - Daily review of potential hazardous conditions





What are Cultural Resources?

Structures 50+ Years Old



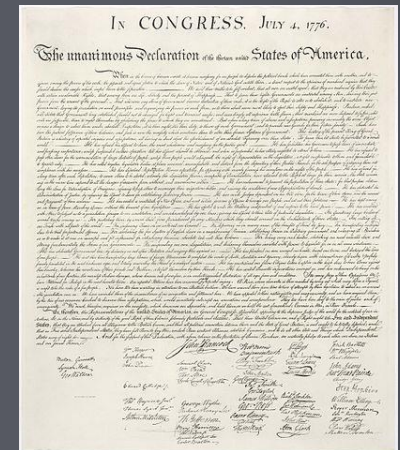
Historic Sites & Features



Prehistoric Sites & Features



Artifacts



Documents

What are Cultural Resources?



Cemeteries

What is Cultural Resource Compliance?

▶ Federal Level

- National Environmental Policy Act (NEPA)
- National Historic Preservation Act (NHPA) – Section 106

▶ State Level

- The Antiquities Code of Texas (ACT)
 - Texas Historical Commission (THC)

▶ Local Level

- San Antonio - City Archaeologist
- City designated Historic Preservation Codes



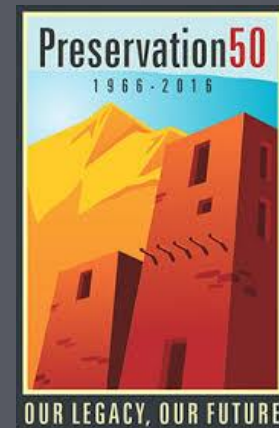
National Environmental Policy Act (NEPA)



- ▶ Considers impacts to the *human* and natural environment
- ▶ Defines the environment in terms of natural and cultural resources
- ▶ Concerned with the broader human environment (visual impacts, social impact, landscape)

National Historic Preservation Act (NHPA)

- ▶ Seeks to determine the impact of an “undertaking” on properties with historic (or archaeological) resources with the *potential* to be *eligible* for inclusion on the National Register of Historic Places (NRHP)
- ▶ Properties listed on the NRHP reflect key moments in our country’s history – and human history



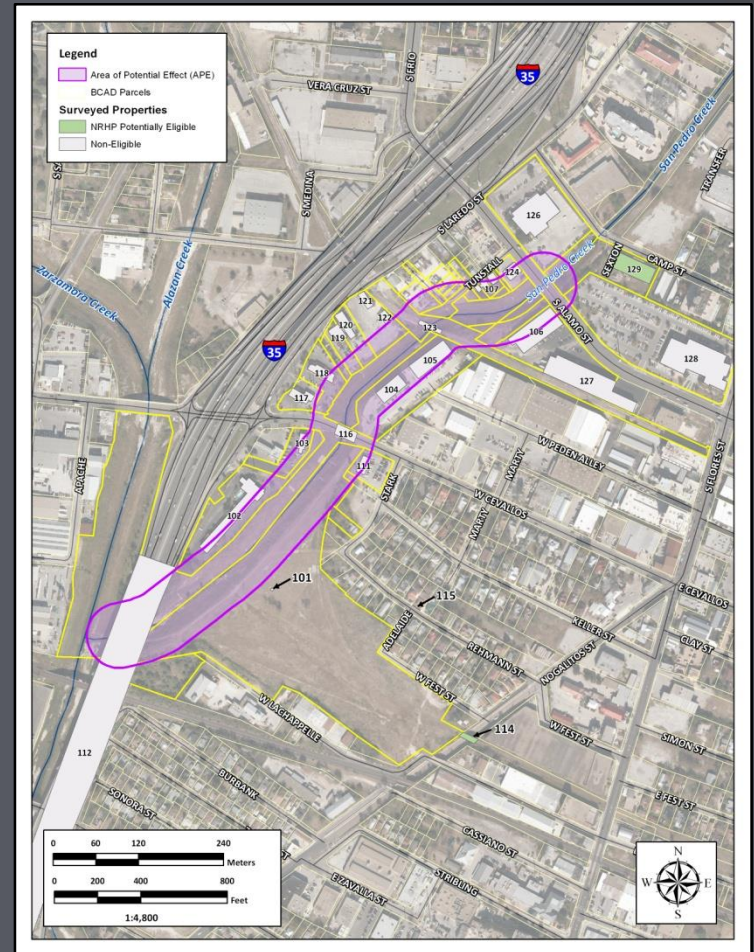


Which Projects are Subject to NHPA and NEPA?

- ▶ Projects *funded in whole or in part* under the direct or indirect jurisdiction of a federal agency (grants; awards; matching funds; etc.)
- ▶ Projects *requiring a federal permit, license, or approval* (USACE Section 404-Clean Water Act; etc.)
- ▶ Projects *subject to state and/or local regulations* administered pursuant to a delegation or approval by a federal agency



The APE under NEPA and NHPA



Antiquities Code of Texas (ACT)

- ▶ Established the Texas Historical Commission (THC)
- ▶ Applies to:
 - Projects constructed on land owned by a “political entity of the state” or
 - Projects Sponsored by a “political subdivision of the state”
 - “Political Subdivision” is defined as a local government entity created and operating under the laws of Texas, including a city, county, school district, or special district created under Article III, Section 52(b)(1) or (2), or Article XVI, Section 59, of the Texas Constitution. (Section 191.003 of the Antiquities Code of Texas)





Cultural Resource Studies

- ▶ Once the proposed route has been identified, a cultural resource investigation should be conducted, based on permitting and/or land ownership.
- ▶ Field investigations start with a Pedestrian Survey (Phase I); as archaeological sites are identified, investigations may continue to Phase II - eligibility testing. If a site is eligible for listing on NRHP, Phase III mitigation investigations may be conducted.



Non-Invasive Tools for Cultural Resource Compliance

▶ Non-Invasive Tools and Methodologies

- Aid in identifying key locations within a project footprint to target for archaeological investigation
- May decrease the area that will have subsurface impacts during an archaeological investigation





Remote Sensing Tools

► Drones & Applications

- Provides high-resolution imagery
- Assessment tool to aid in identifying key cultural resources or areas for investigation





Remote Sensing Tools

▶ Ground Penetrating Radar (GPR) & Applications

- Provides a 3-D model of subsurface deposits
- Allows for an assessment of potential disturbances to deposits
- Identifies potential archaeological features to target during archaeological investigations

▶ GSSI SIR-4000 GPR controller

▶ 400 mega-Hertz (MHz) antenna

▶ RADAN[®] 6.6/ RADAN[®] 7





RADAN 6.6 3-D Model





GPR in Downtown San Antonio

- ▶ Identifying the San Pedro Acequia in three different areas in San Antonio
 - *Acequias* are canals or ditches used to bring water to homes and agricultural fields.
 - The first *acequias* were constructed in 1718, when the Spanish arrived in San Antonio. In the 1900's, the system fell into disrepair, and the City filled in the channels in urban areas.

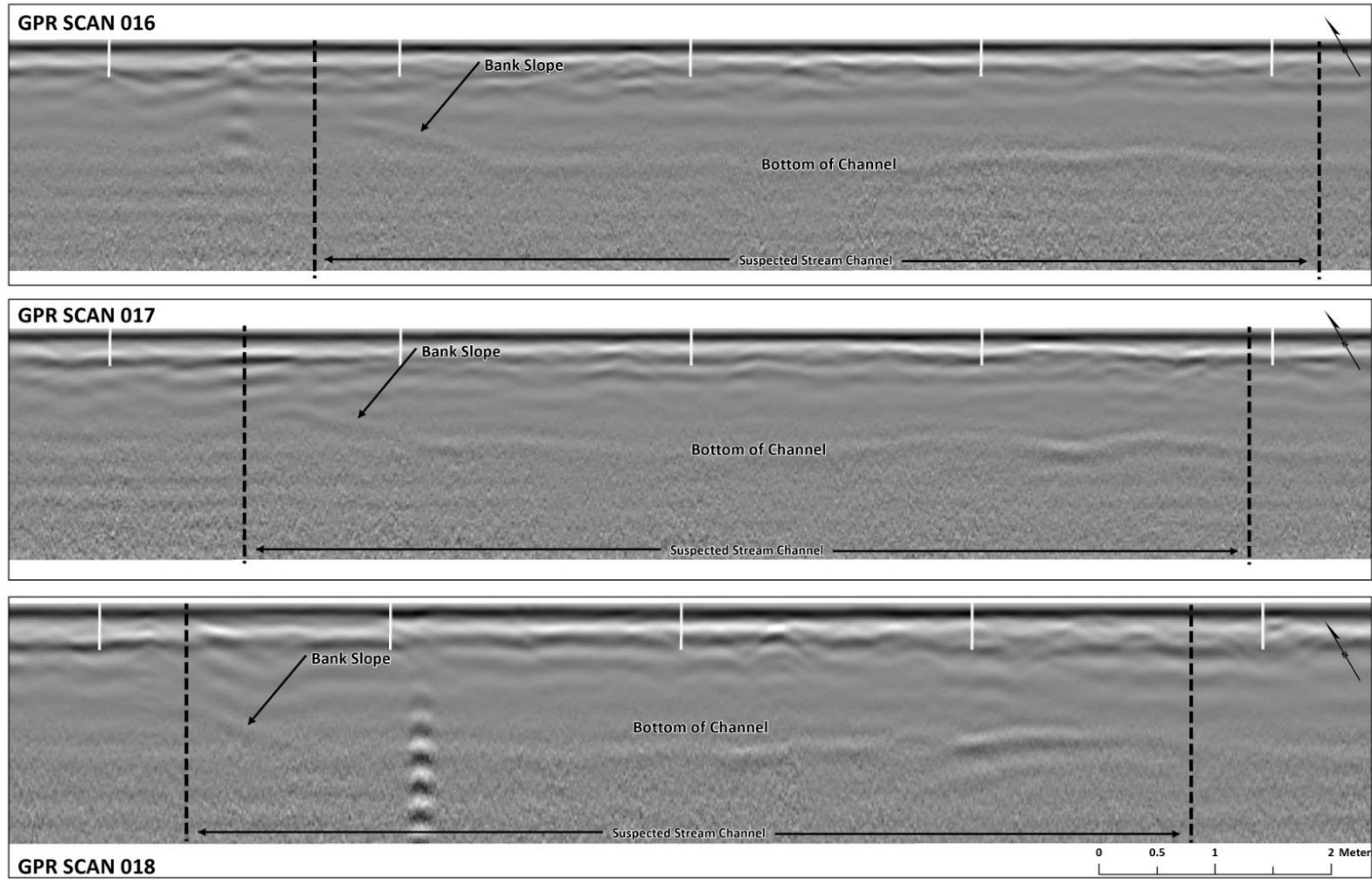
San Pedro Acequia at Nogalitos Street



San Pedro Acequia at Nogalitos Street 3D GPR



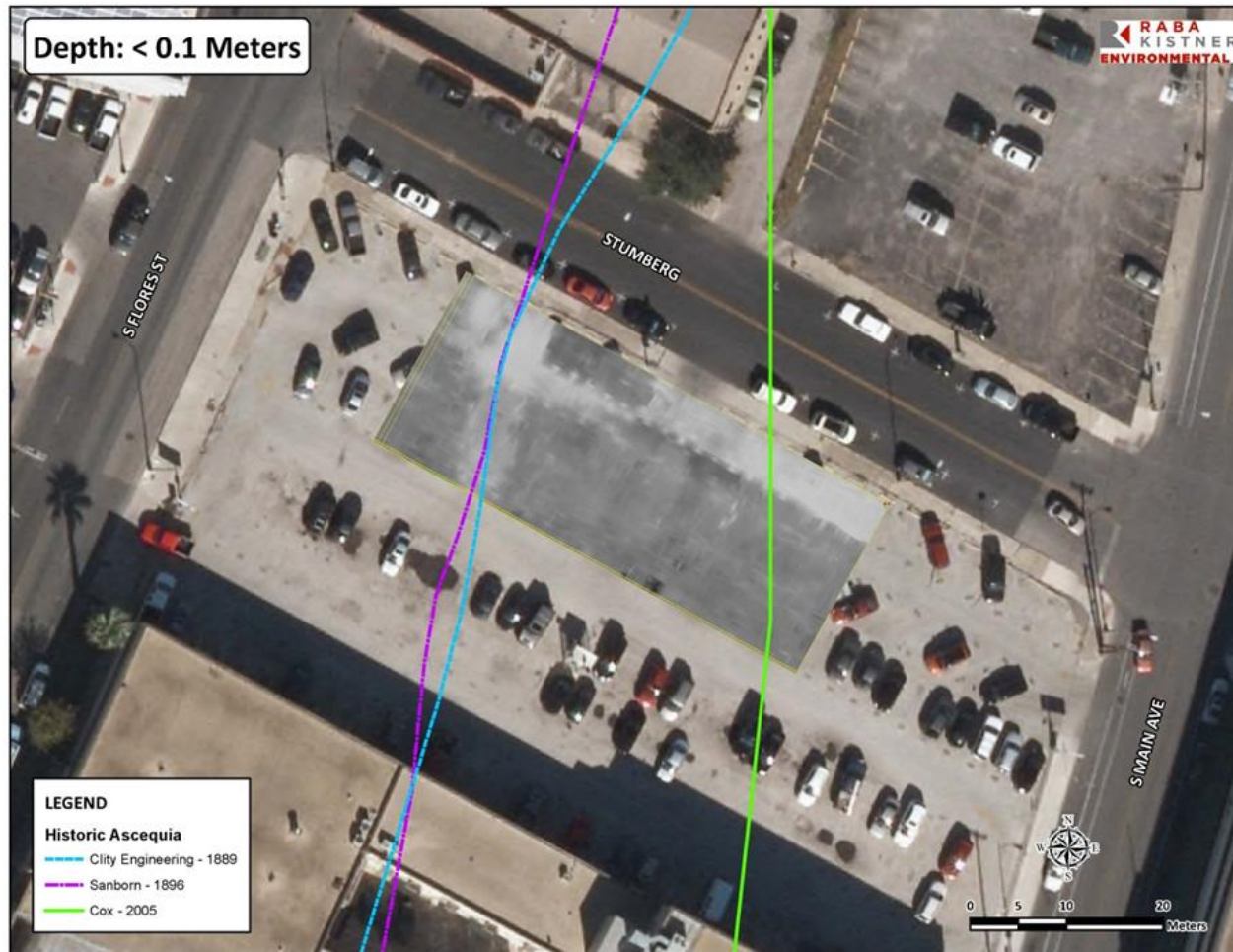
San Pedro Acequia at Nogalitos Street Individual Scan



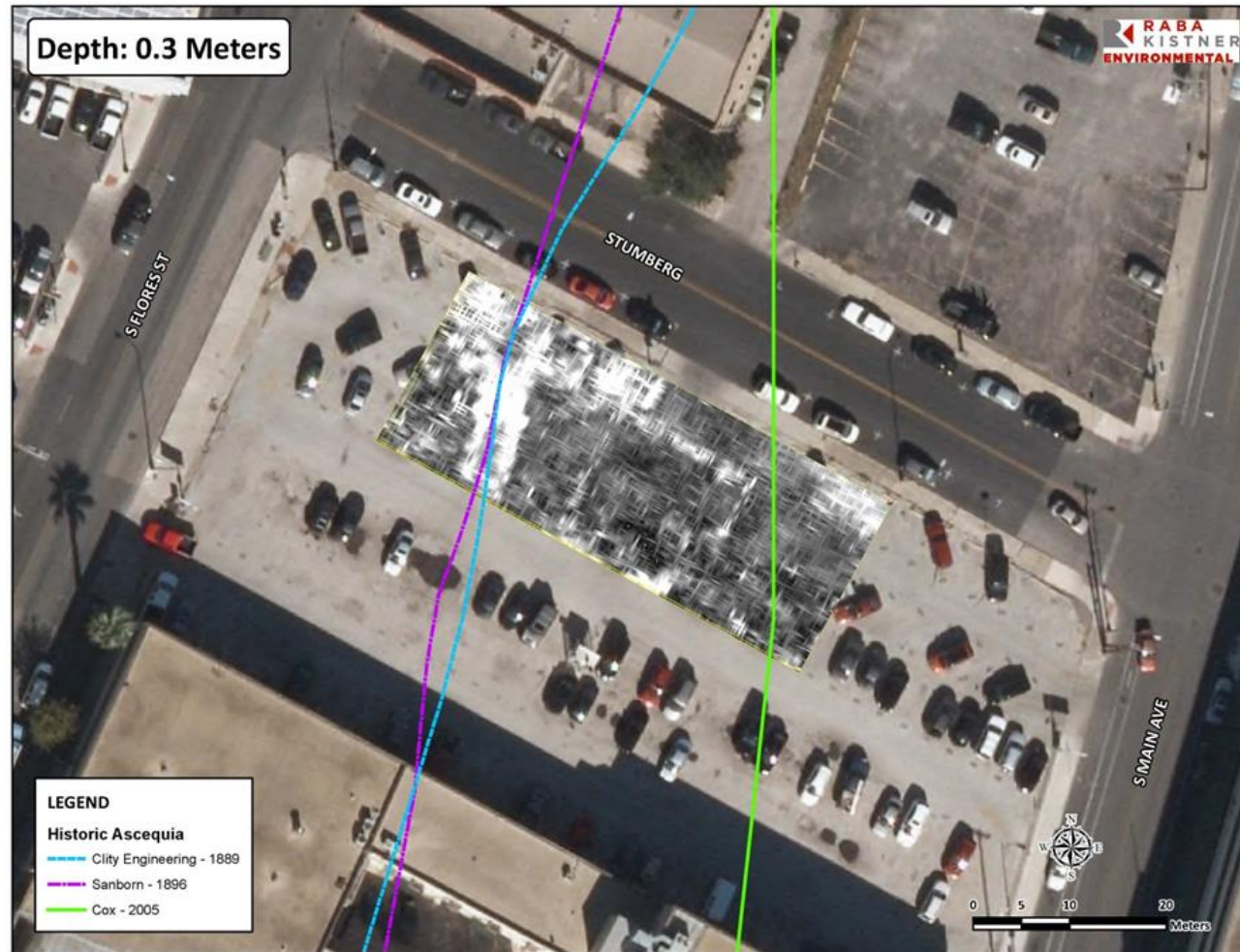
San Pedro Acequia at Commerce Street



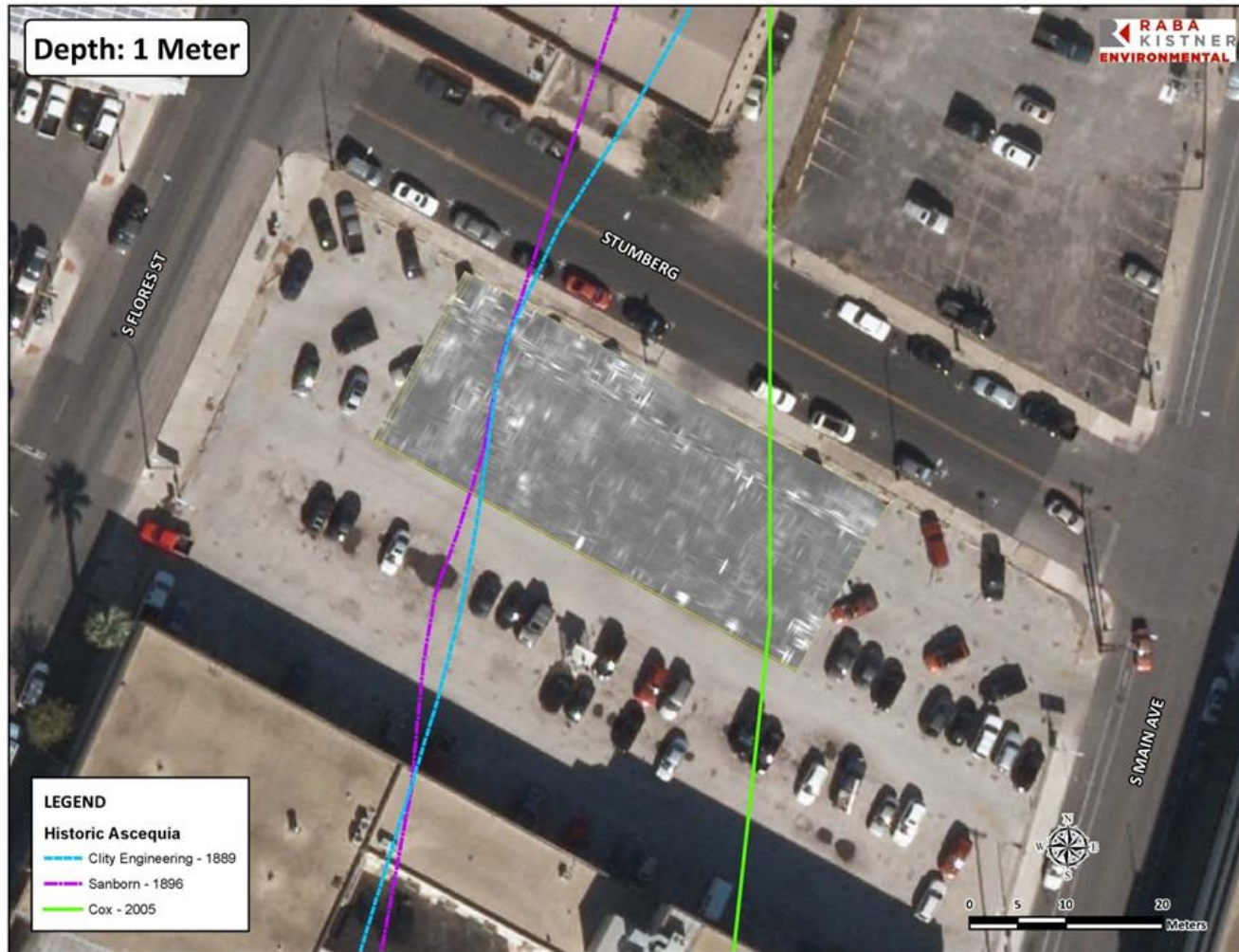
San Pedro Acequia at Commerce Street 3-D Layer at 0.1m



San Pedro Acequia at Commerce Street 3-D Layer at 0.3m



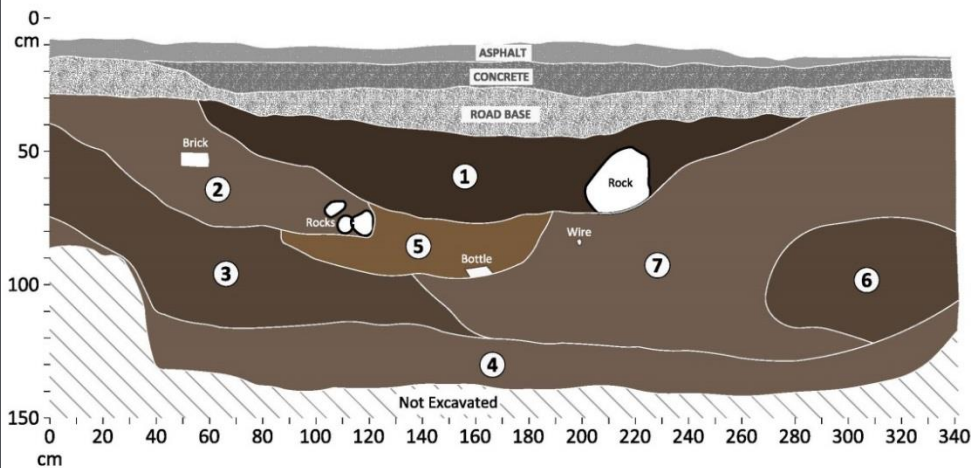
San Pedro Acequia at Commerce Street 3-D Layer at 1m





San Pedro Acequia at Commerce Street

North Wall Profile



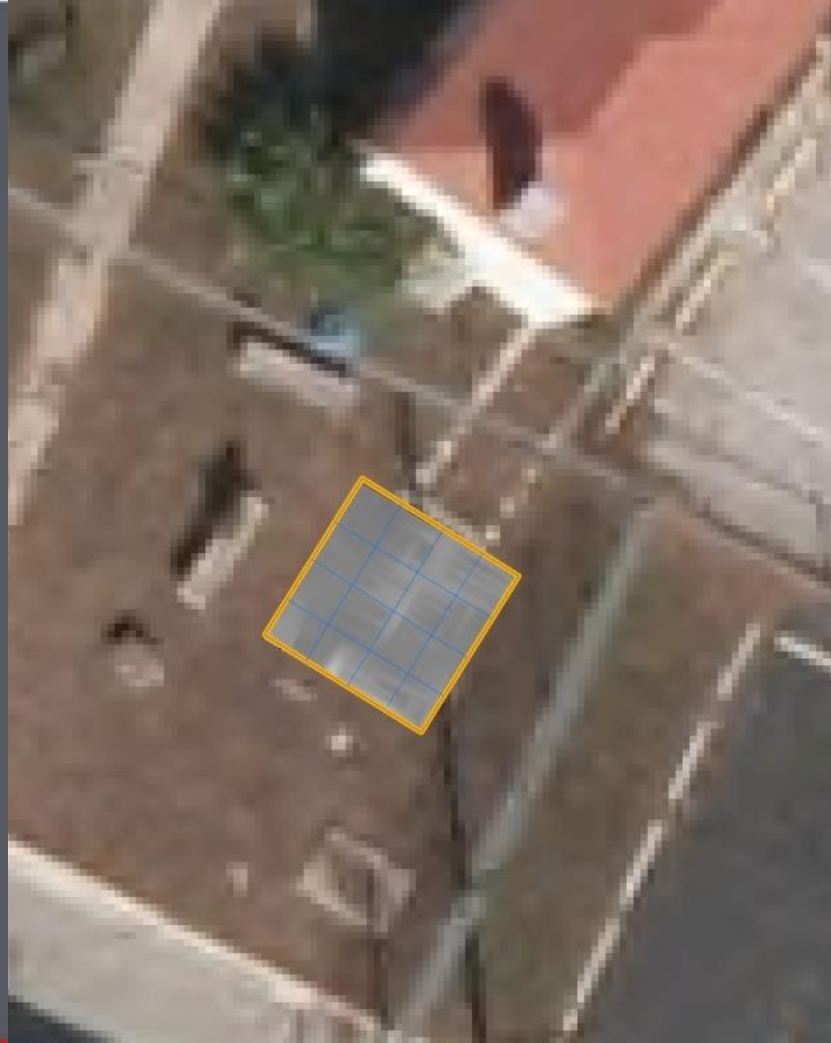
- 1 - 10YR2/1 - black, charcoal, with metal and wood fragments
- 2 - 10YR4/2 - dark grayish brown clay with some gravels
- 3 - 10YR3/2 - clay loam, orange mottles
- 4 - 10YR4/2 - clay with few gravels

- 5 - 10YR4/4 - sand, with orange mottling and metal fragments
- 6 - 10YR3/2 - clay loam, carbonate inclusions and charcoal
- 7 - 10YR4/2 - clay with charcoal and gravels





San Pedro Acequia at Arsenal 3-D GPR

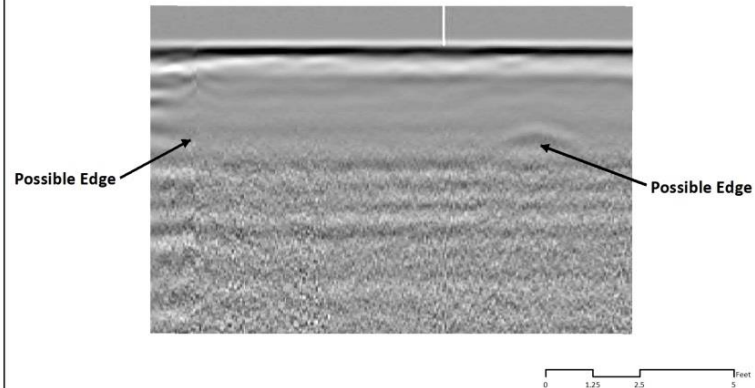


San Pedro Acequia at Arsenal

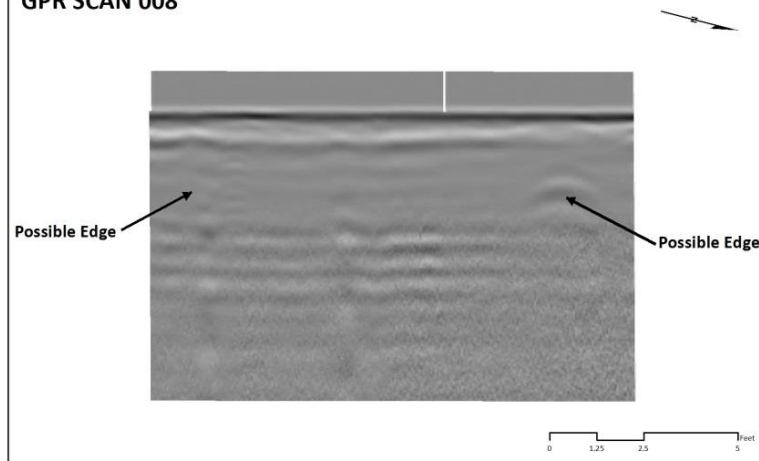


San Pedro Acequia at Arsenal Individual Scans

GPR SCAN 006



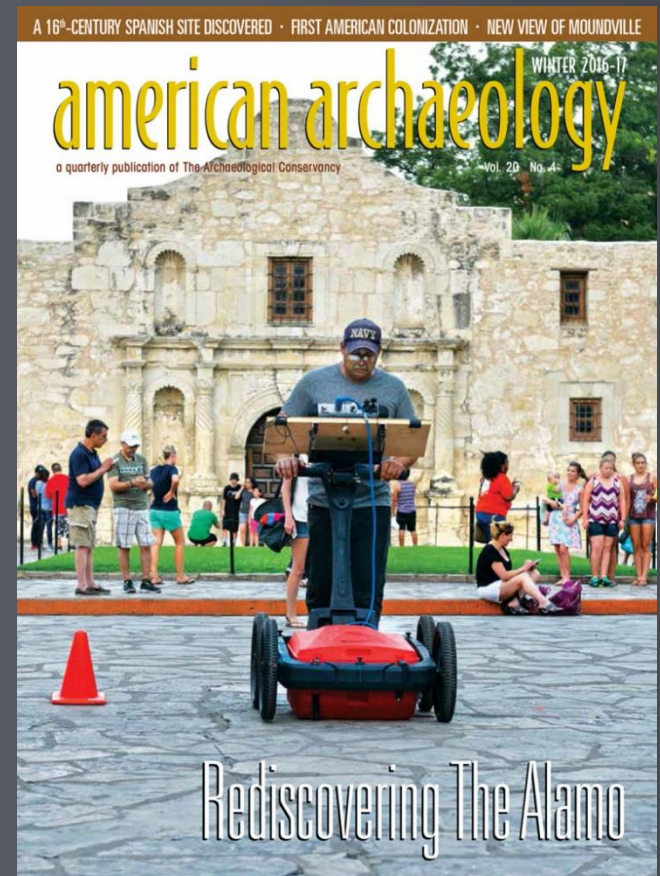
GPR SCAN 008



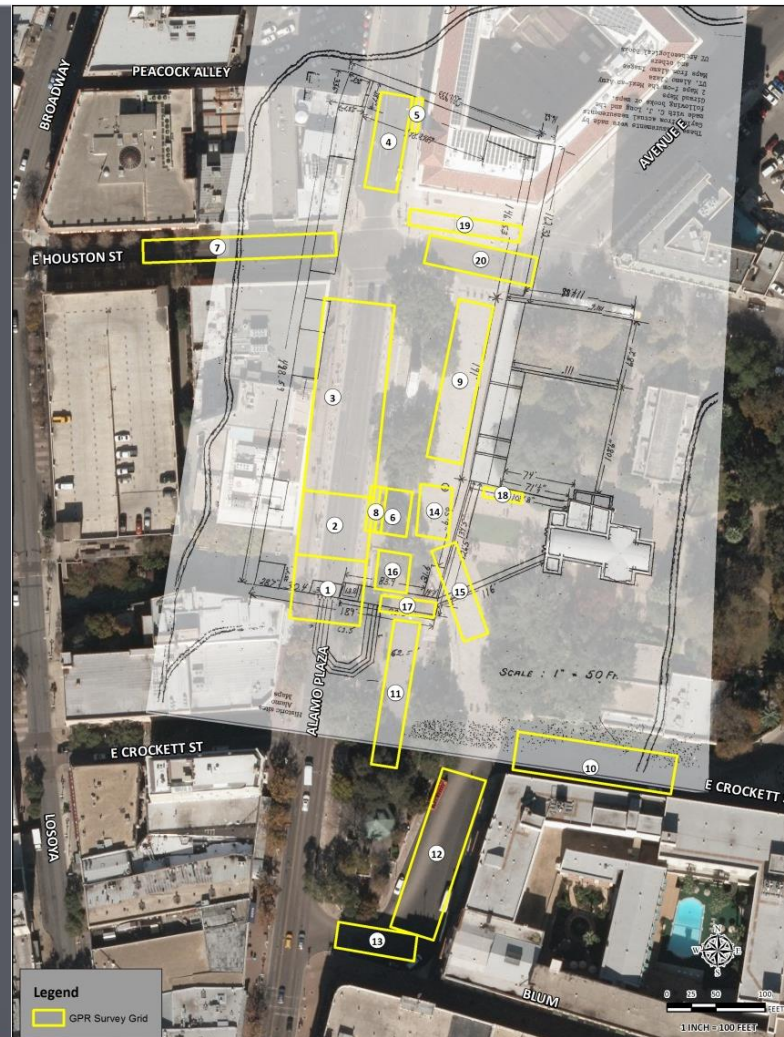
GPR in Downtown San Antonio

▶ Alamo Plaza

- The Alamo is an important cultural resource
- Alamo Plaza has been subjected to many renovations and alterations during its history
- A remote sensing survey provided the means to “view” under the paving stones within the Plaza and nearby roadways to see what features may remain.

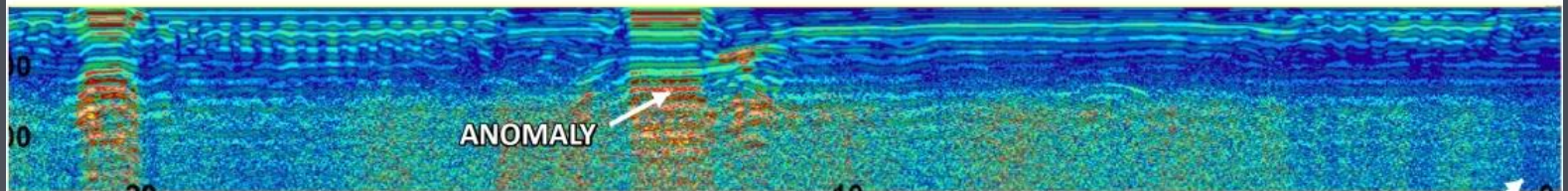


Alamo Plaza

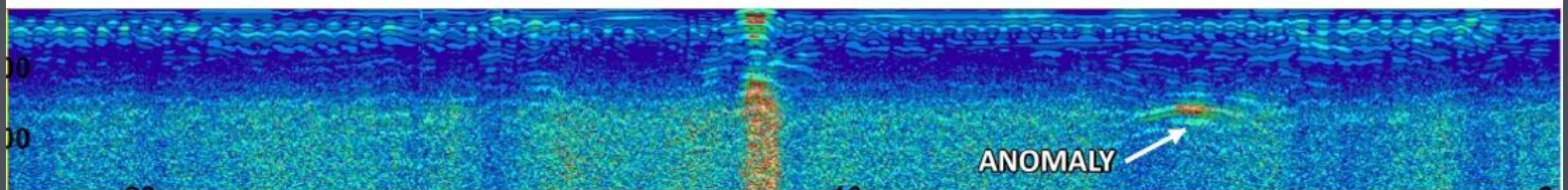


Alamo Plaza Grid 1 (South Wall)

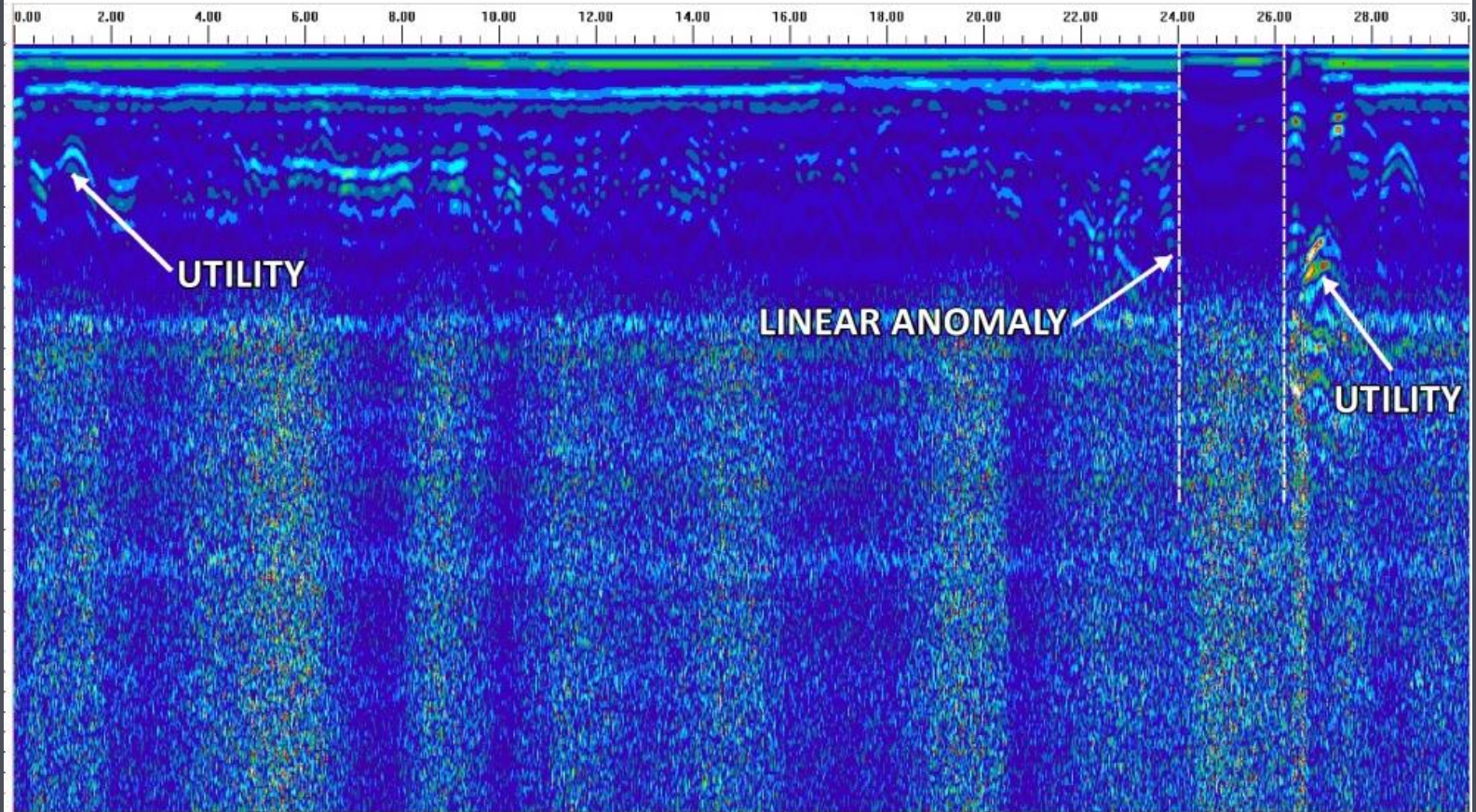
X-SLICE 2m



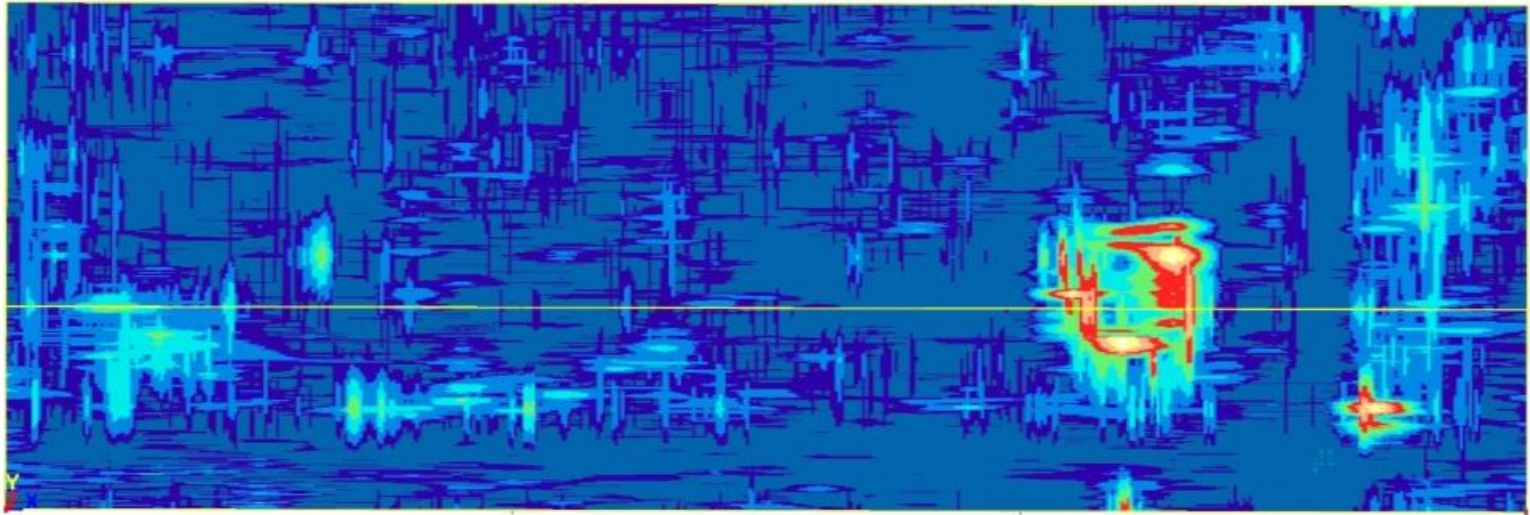
X-SLICE 14m



Searching for the North Wall



Searching for the North Wall

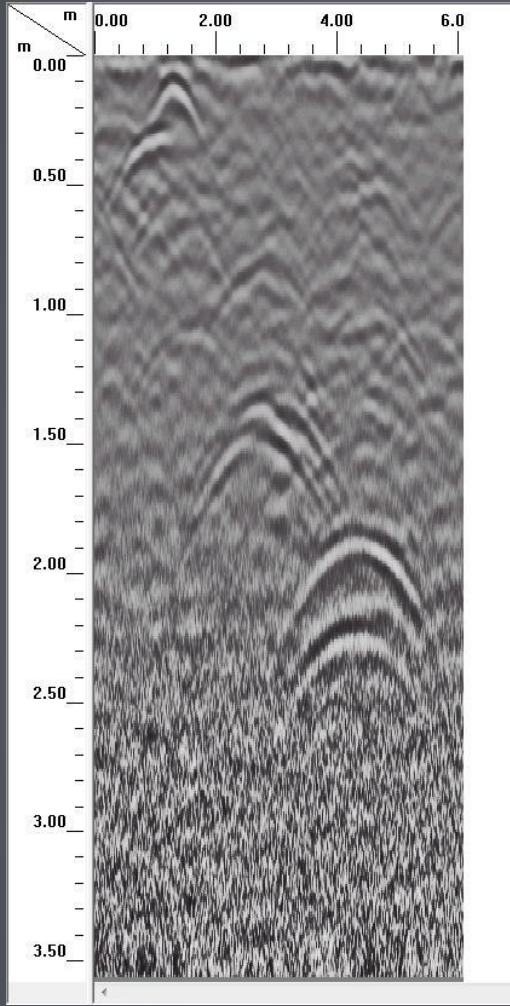


1880's Cemetery, Cypress, Texas

- Early German settlers in Harris County
- A remote sensing survey provided the means identify grave locations without removing topsoil or excavations
- Study included a public archaeology component using volunteers with the Houston Archeological Society

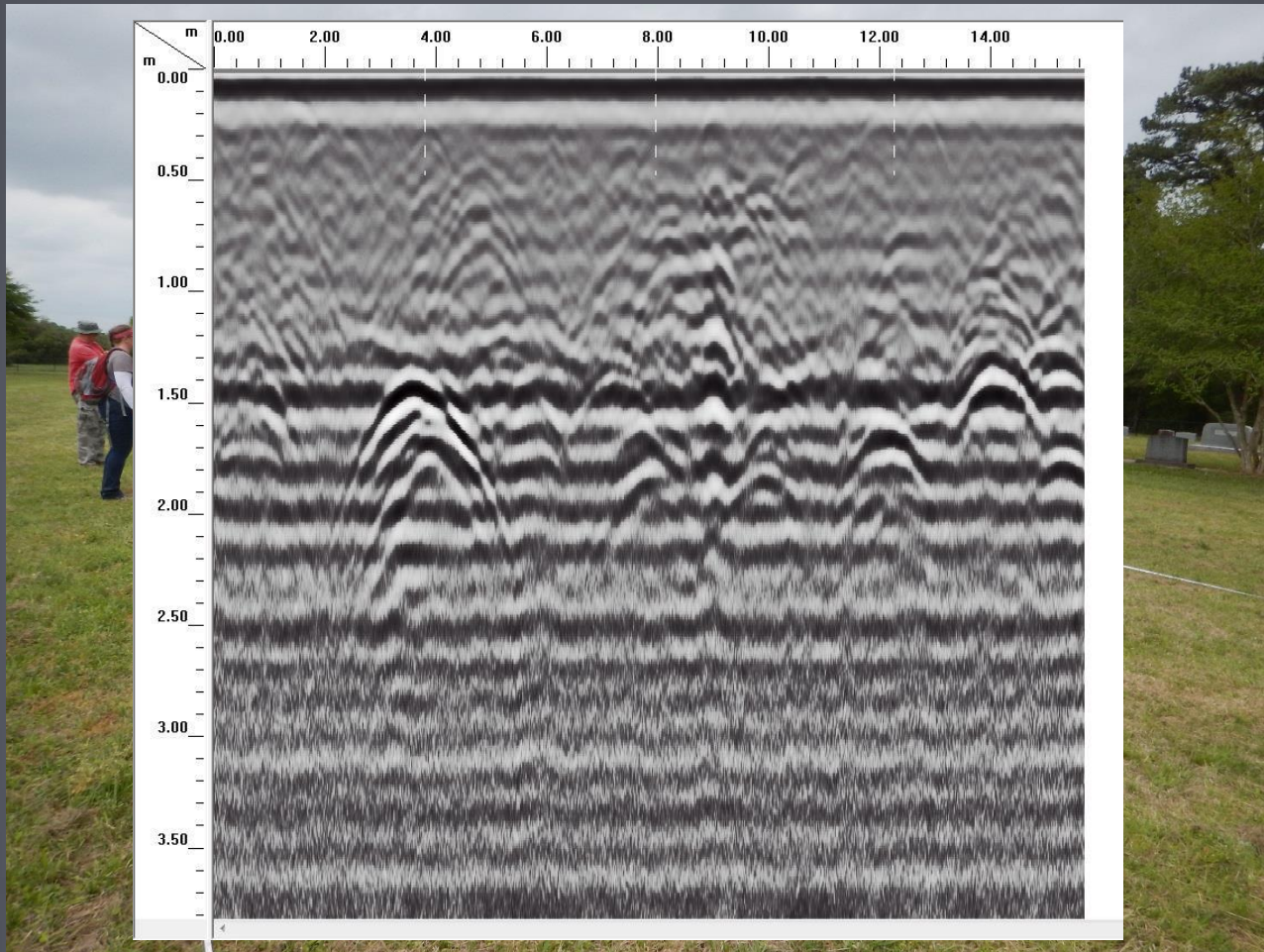


Cemetery, Cypress, Texas

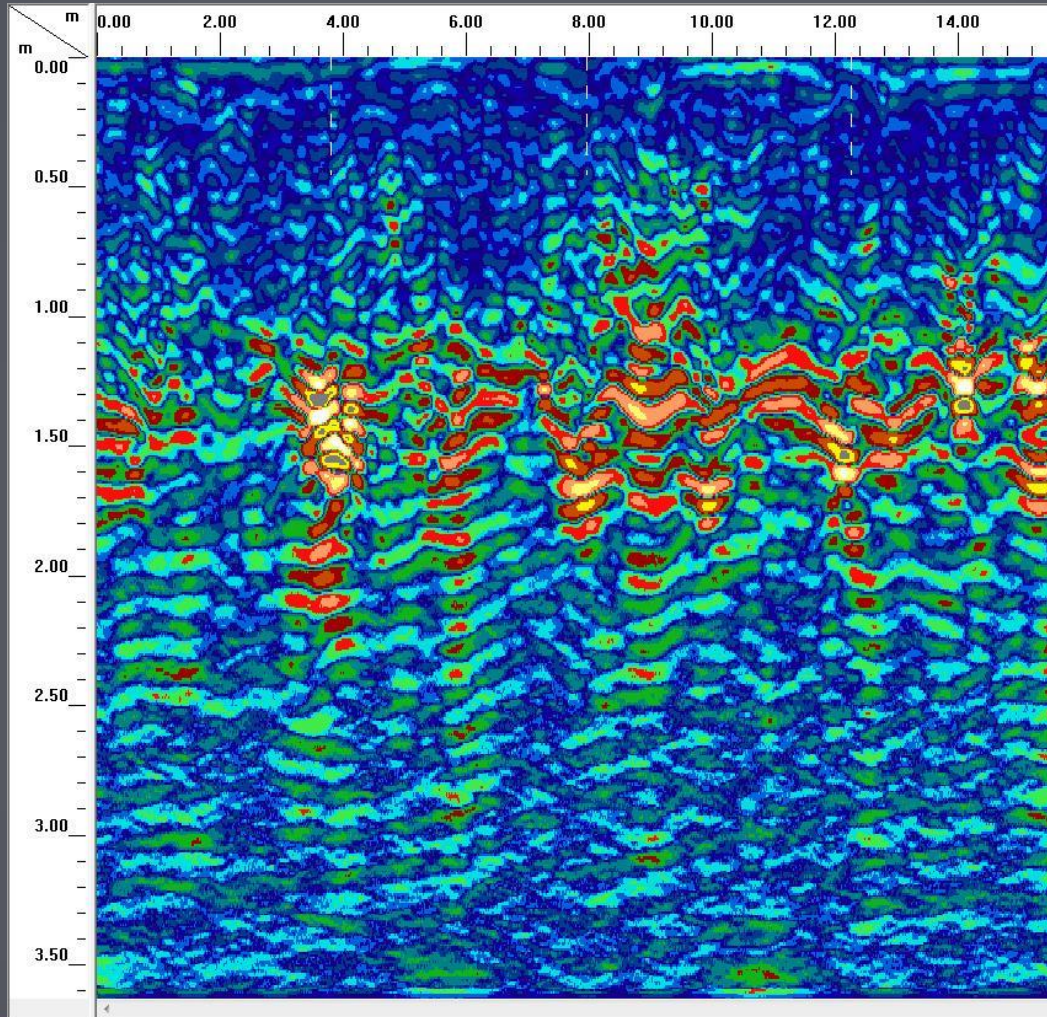




Cemetery, Cypress, Texas



Cemetery, Cypress, Texas





Many Thanks to:

Steve A. Tomka, PhD, Cultural Resources Program Director (RKEI)
Kristi Miller Nichols, Principal Investigator/Senior Archaeologist (RKEI)

***Raba Kistner Purpose:** To provide professional consulting services with passion and integrity, to help build a better world for our employees, their families, our clients, and the communities we serve.*



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