Title

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FINAL REPORT
ESPINOSA ADOBE/SCHOCH DAIRY (CA-MNT-1429H)
GEOPHYSICAL INVESTIGATIONS

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Introduction

This report describes subsurface geophysical investigation using ground penetrating radar and electrical conductivity techniques conducted at the Espinosa Adobe/Schoch Dairy during October 2000.

Background Site Description

Site CA-MNT-1429 (Espinosa Adobe) is located on the Schoch Dairy (APN 113-211-014) along Highway 101 near Salinas, California. The original adobe was built in 1823 by the Espinosa family on their Rancho Bolsa de las Escarpinas. Descendents of the Espinosa family occupied the site until 1889 when it was sold. The land was developed into a dairy and owned by successive families until the Schoch family purchased it in 1944. Standing adobe walls were present until the 1950's, as documented by Schoch family photographs. The foundations of the adobe residence remain on the Schoch Dairy property, although the dairy buildings cover much of the adobe site area under investigation.

During the geophysical survey, it rained much of the day and for a few days prior to the survey leading to wet, muddy conditions. The soil was clayey and in some areas well mixed with the by-products of dairy operations (cattle feces and urine). Underground utilites and structures (buildings, fences, sheds) associated with the dairy as well as vehicles and miscellaneous metallic objects were also present at this site.

Methods

On October 30, 2000, geophysical investigations were conducted at the Schoch Dairy to search for buried objects and structures associated with the Espinosa Adobe site. Two geophysical techniques were employed: ground penetrating radar and electrical conductivity. Magnetic field measurements were not conducted since it was thought that they would be dominated by the modern metal objects present at the site (cars, buildings, gates, etc.). Seismic reflection imaging, which is a promising technique given the wet and clayey conditions of the site, was not utilized due to the time constraints of the survey.

GPR

Radar mapping is a means for delimiting buried site stratigraphy, and objects or structures that disrupt the natural stratigraphy. Ground penetrating radar (GPR) transmits high frequency electromagnetic energy into the ground and measures energy reflected from buried interfaces, such as between soil and rock or wood. The radio frequency electromagnetic waves GPR uses as an energy source are sensitive to the dielectric properties of the soil and reflective objects within it. The principle factors effecting soil dielectric properties are clay composition, compaction, and water content. Increased water content results in lowered wave velocity. The presence of electrically conductive clay or alkaline soils results in high GPR energy attenuation, and limits the depth of its penetration into the ground. By collecting data on a grid of points along the surface, a series of maps of radar reflectivity can be produced at various depths, called time-slices.

At the Schoch Dairy, we used a GPR unit manufactured by Geophysical Survey Systems Inc (GSSI) model SIR-2000 (Subsurface Interface Radar) with a 400 MHz antenna that is translated over the ground. Data were collected within a total window of 30 nsec from the surface, and were divided into 7 nsec time-slices for display (0-7 nsec, 7-14 nsec, 14-21 nsec, and 21-28 nsec). Each of these time-slices is an average of the electromagnetic reflectivity at the depths corresponding to those times. The radar data were collected along 0.5m separated survey tracks and gridded with approximately 1 m search radius to filter out clutter and pipes, and to emphasize the largest features.

Electrical Conductivity

Electrical conductivity uses low frequency electromagnetic (~15 kHz) energy to detect changes in site electrical properties. It is an effective means for detecting soil moisture content or buried metallic objects because their high electrical conductivity. Instruments for measuring electrical conductivity have a transmitting antenna and a receiving antenna separated by some horizontal distance. The antennas, unlike GPR, are not typically in contact with the ground. The antenna separation sets the optimal depth for detection of buried objects and structures. Metallic objects, such as fences, cars, and pipes produce a particularly strong signature, since they are efficient conductors of electrical energy. Moving the instrument parallel to a pipe will produce an enhanced electrical conductivity signal, whereas moving the instrument perpendicular to a pipe will produce a reduced electrical conductivity signal. Similar to GPR, electrical conductivity data are collected on a grid of points along a surface. Conversely, a single map of conductivity averaged over the depth range of the instrument is produced.

We measured electrical conductivity at the Schoch Dairy using an instrument manufactured by Geonics (model EM-38) with peak detection sensitivity for objects and structures at 0.5m depth, but can sense strong conductors over one meter deep. Data were collected at 0.4 sec intervals at walking speed along the same 0.5m separated survey tracks used for the GPR measurements. The data were corrected for walking speed (shifted backward along track), gridded, and displayed as an average over the instrument's depth range.

Survey Grids

Typical grid sizes for these surveys have dimensions of 15m to 50m with data acquired along survey track lines separated by 0.5m. GPR and electrical conductivity data can be collected sequentially along the same tracks for efficient data gathering and for complementary result comparison.

Eleven grids of geophysical data were collected at the Schoch Dairy. Typically, data are collected over larger grid areas, but since the Schoch Dairy buildings and associated objects (cars and fences) covered much of the site area, the geophysical survey was conducted as a series of small grids, often sandwiched between the modern structures. Figure 1 shows a map of the Schoch Dairy buildings with the eleven geophysical grids superimposed.

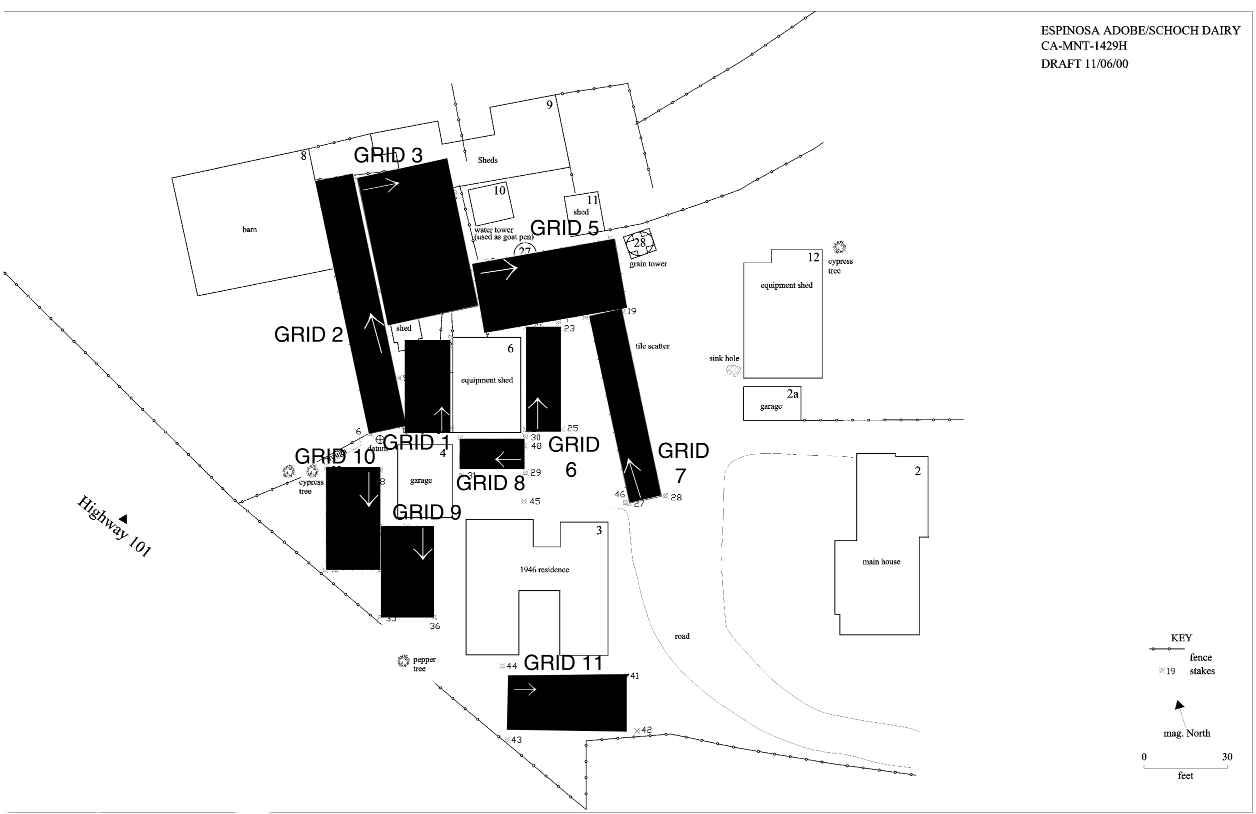

Figure 1. Geophysical grid locations at Espinosa Adobe.

Each grid was marked on the ground with non-metallic, wooden corner stakes, and then surveyed for placement on the map of Figure 1. Within each grid, the two geophysical data sets were collected along survey lines with 0.5 m spacing, using survey lines parallel to the longest dimension of the grid. The direction of the first survey line in each grid is shown as an arrow. Non-metallic measuring tapes were placed along the ground surface and control marks were entered into the data at 1 m intervals during data collection to aid in data processing.

Results

Electrical Conductivity

The electrical conductivity data are shown in map view in Figure 2. All the individual grids were presented in Appendix 1 of the *Field Report of Geophysical Investigations at the Espinosa Adobe/Schoch Dairy CA-MNT-1429H* delivered November 2000 to Pacific Legacy. Regions of high electrical conductivity are shown with red & white colors, whereas regions with low electrical conductivity are shown with blue & black colors. The metal buildings and fences of the Schoch Dairy are readily seen in the electrical conductivity data when in close proximity, such as near the grid edges. In other areas, the data primarily show the location of buried metal pipes (blue linear features surrounded by red). In particular, an array of pipes is seen emerging from the vicinity of the well (northern edge of grid 5).

Notice the difference in the signal from the buried pipe that crosses both survey grid 2 and grid 3 along an east-west direction. In grid 2, the direction of data collection is perpendicular to the pipe, causing the pipe to appear as a low conductivity feature surrounded by high conductivity. Conversely, in grid 3, the pipe appears as a high conductivity feature because the survey direction is parallel to the pipe, although the feature has lower contrast with the background than in grid 2.

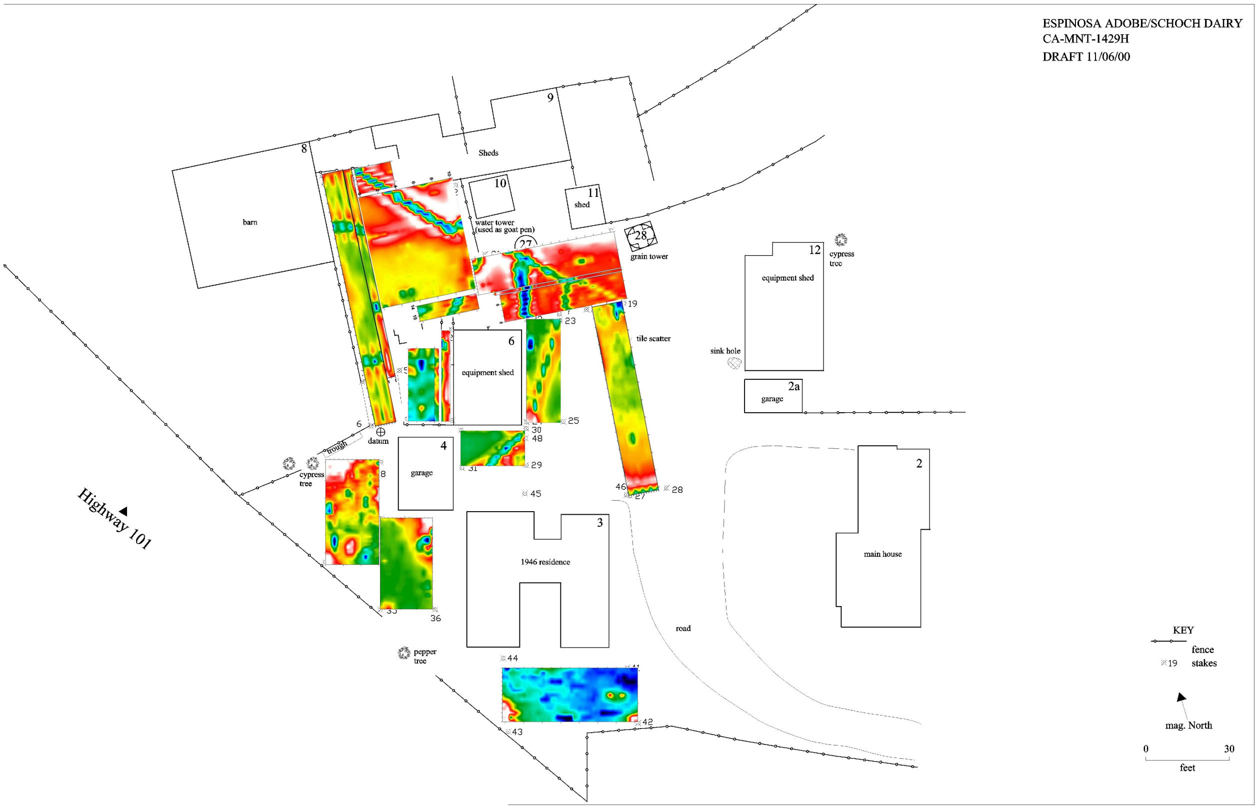

Figure 2. Electrical conductivity survey of Espinosa Adobe site. High conductivity areas are red and low conductivity areas are blue. Buried metal pipes a easily seen as blue surrounded by red linear features.

GPR

The GPR data are shown in map view in Figure 3. All the individual grids were presented in Appendix 2 of the *Field Report of Geophysical Investigations* delivered November 2000, and for each grid, time slice images are shown with increasing depth. All images have red colors for reflective material and blue colors for non-reflective material. In Figure 3, only the uppermost radar section is shown. The radar data show some of the pipe features revealed by the electrical conductivity survey and other features as well, but many of the high reflectivity features (red patches, Figure 3) are presumably reflections from puddles of water and subsurface pooling. Areas of adobe wall are typically associated with linear areas of high radar reflectivity, however, melted adobe and surrounding adobe-similar soil type weakens this signal.

The data sets collected in the mud and cow manure were of mixed quality. The radar signal was attenuated at shallow depths by the high conductivity soil, and there were multiple reflections from the water-air interface. The GPR data in the drier grids are of better quality. The radar data were generally cluttered, with lots of pipes and other objects in the ground. To interpret the data, we first examined each of the profiles in the grid to determine appropriate search radius and depth. Then we sliced each grid into 4 slices of 7 ns per slice. Velocity analysis determined that, depending on wet-dry conditions, a 7 ns slice varied between 25cm and 40cm depth. We use 25 cm for a 7 ns slice in the wet areas and 35cm to 40cm in the dry areas; on all the maps we left the slices in time, not depth. In grid 1, there are highly reflective materials in the western and southern portions of the grid. There is some continuity with grid 2, beyond the pipe that passes between these two grids. Grid 6 may also have evidence for adobe walls emerging near building 6. Grid 7 looks homogeneous or energy attenuated, consistent with the mostly featureless electrical conductivity image. Grid 8 has a pipe running through it but also some potentially interesting features in the western portion of the radar image. Grid 9 reveals a possible septic tank, although it must be non-metallic due to the lack of an electrical conductivity signature. The possible tank has lots of multiple reflections from it, as would be seen in a buried concrete structure. Grid 10 has a discontinuous and cluttered radar image; perhaps it is also part of a leach field.

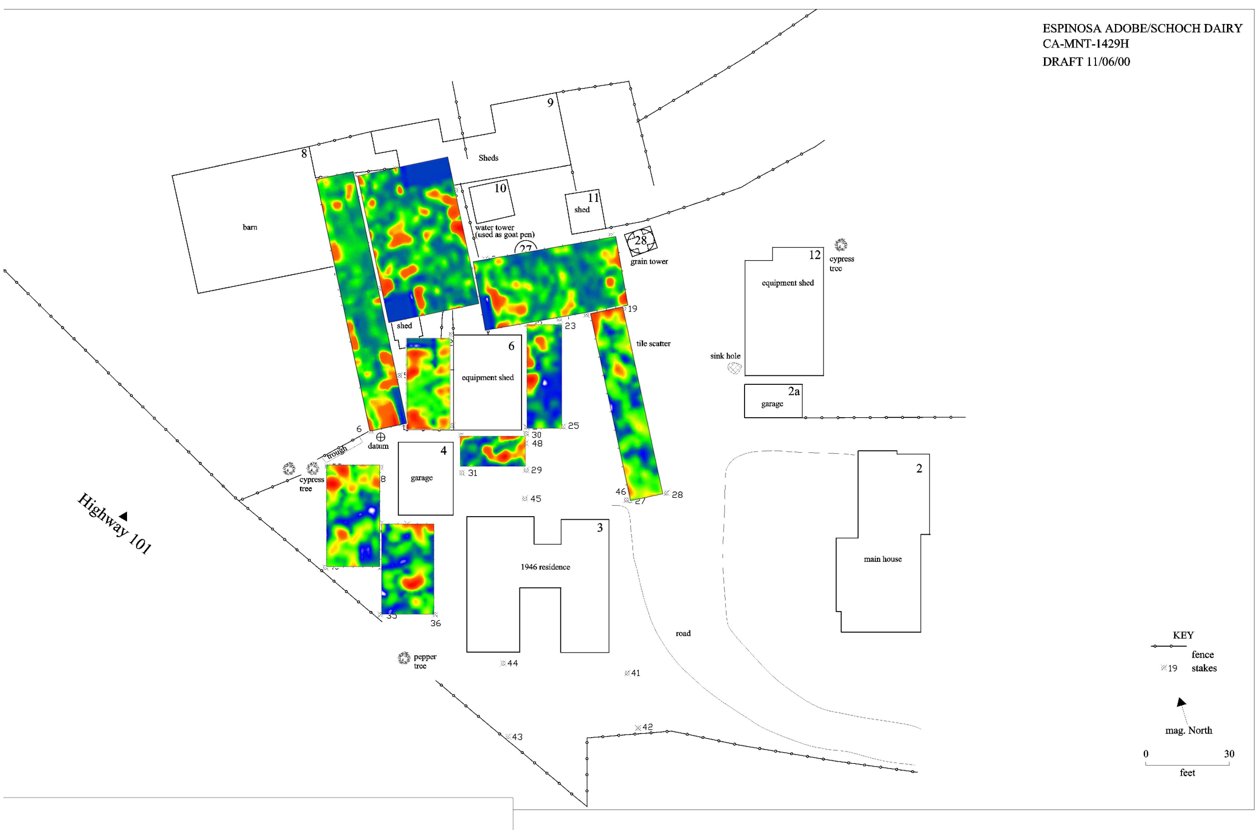

Figure 3. Shallow ground penetrating radar time slice (0-7 ns = 0 – 40 cm) of Espinosa Adobe site. Areas of high reflectivity are red and areas of low reflectivity are blue.

Conclusions and Archaeological Testing Comparison

Archaeological testing of the site was conducted in early November 2000 (Appendix 1). Based on documented research and the geophysical investigations described above, ten trenches were mechanically cut with a 2-foot wide backhoe bucket. Of the five trenches that revealed important resources, two trenches in grid 6 and one in grid 1 exposed portions of the adobe building, the trench in grid 7 exposed roof tiles, and what appears to be a 19th century well was found in grid 5.

In general, neither GPR nor electrical conductivity did well at imaging the features found in the test trenches. The GPR signal was attenuated by the soil type (clay) and condition (wet) such that most reflections are of water puddles or subsurface pools. Adding to poor electromagnetic wave penetration was the general high electrical conductivity of the soil (as seen in the background electrical conductivity data) from presumably the cattle waste leaching into the soil at the site. Also, melted adobe and adobe-similar sandy clay loam soil found in the trenches reduces the reflective signal strength needed to image the adobe wall.

The electrical conductivity data did well at identifying buried metal pipes, but the signal from these pipes overwhelms the data, prohibiting the imaging of cultural resources. Also, metal from the buildings and fences can be seen by the high conductivity at grid edges. Note, however, that most low electrical conductivity features are surrounded by high conductivity, indicating the presence of metallic objects, such as observed with pipes. Two places where this is not true are in grid 1 and grid 6 (Figure 2). Both of these anomalies correspond to the location of the adobe wall found in trench 1 and the projected adobe wall near trench 3, respectively (Appendix 1).

Appendix 1.

To: Tom Wheeler, Caltrans Central Region
From: Julia G. Costello, Foothill Resources, Ltd.
CC: Tom Jackson, Pacific Legacy, Inc.

Date: 15 November 2000

RE: Espinosa Adobe/Schoch Dairy Project (CA-MNT-1429H), Caltrans Contract No. 06-A0242, Task Order 10

FIELD COMPLETION REPORT

Site CA-MNT-1429 is identified as the location of the original adobe built in 1823 by the Espinosa family on their Rancho Bolsa de las Escarpinas. The site was occupied by Espinosa descendents until 1889. Sold that year to Antonio Souza Marques, the land was developed and run as a family dairy through 1936, owned successively by three families (two from Portugal and one from Denmark). The property was leased for several years until purchased by the Schoch family in 1944, developing it into a modern dairy. The adobe building survived through 1930, when it appeared on a Caltrans map; by 1954 it was in ruins.

Field Work Summary
Phase II test excavations at CA-MNT-1429H were completed in two phases of work. The mapping and geophysical work took place on October 30, 2000, with Julia Costello (P.I., Foothill Resources, Ltd) and Tom Wheeler (Caltrans) on site. John Hildebrand, Larry Conyers, and Sean Wiggins (all representing Scripps Institution of Oceanography, UCSD) surveyed 10 grid areas (GPR-1 to GPR-11) with ground penetrating radar and electrical conductivity (grid GPR-4 was not examined). Magnetic field measurements were rejected due to the large amounts of metal around the site. Concurrently, on October 30-31, Virginia Hellman and Jack McIlroy (both from the Anthropological Study Center, Sonoma State University) made a basemap of the site area and assisted the geophysical team.

The archaeological testing of the site was carried out between November 8 and November 12, with Julia Costello and Tom Wheeler on-site the entire time. The crew from Sonoma State included Mark Selverston (Crew Chief), Virginia Hellman, Jack McIlroy, Bryan Mischke, and Michael Stoyka. Two Caltrans archaeologists, Terry Joslin and Kelda Wilson, joined the effort for two days while assistance was also provided by three of the Schoch children and two of their friends. John Hildebrand was on site November 8, supplying the results of the geophysical work and helping to select areas for testing based on those readings.

Ten testing locations were chosen based on documentary research and the geophysical investigations (Table 1). The trenches were mechanically cut with a backhoe using a 2-

foot wide bucket with smooth edge. Three of the trenches exposed portions of the 1823 adobe building, one trench revealed what appears to be a 19th-century well, and one trench exposed a concentration of tejas (roof tiles) and artifacts, also dating to the 19th century. A small cache of mid 19th-century artifacts was also found adjacent to the adobe wall in Trench 5. The remaining five trenches did not encounter any potentially important resources. All trenches were profiled, mapped, photographed, and the soil layers described. Larry Conyers visited at the end of excavations, on November 11, to evaluate the results of the "ground truthing" and refine the geophysical interpretations. The results of the geophysical study were hampered by wet site conditions on October 30. Reanalysis of the data is planned, however, guided by the archaeological findings.

Other archaeological methods were used to determine artifact distribution and site boundaries. Shovel Test Units (STU) were excavated along the southwestern border of the site, adjacent to the Highway 101 alignment. A systematic surface inventory was made using 5 uniformly spaced transect lines laid long the hillside on the northern boundary of the site. Tom Wheeler remained on site November 13 to oversee backfilling of the trenches and spreading gravel over selected trench areas.

The Phase II test excavations revealed that the 1823 Espinosa adobe home was constructed without a stone foundation. Foundation trenches were excavated below grade and then filled with either earth or adobe bricks. The adobe bricks measure 22x11x4-6 inches; reflecting the standard 1/3 x 2/3 of a vara (1 vara=ca. 33 inches) used in Alta California. The long north and south walls are 22 inches wide, while the eastern end is 33 inches wide; the western foundation was not trenched. The adobe building has an interior width of 15.7 feet, and an interior length of about 52 feet; exterior size is about 21.2 feet by 60.25 feet.

One box of artifacts from the Trench 9 sample was taken to Sonoma State for analysis. Two half-filled buckets of tejas were also taken to the lab for counting and weighing and perhaps some source analysis. Soil samples were collected from the adobe bricks, trench fill, surrounding matrix, and adjacent soil horizons. A size-constituent analysis will help identify the density and permeability of the adobe walls, and will also assist interpretation of the geophysical data. A sample of adobe bricks will also be subjected to flotation to recover floral remains.

Management Considerations

The historic component of this site may be eligible for the National Register of Historic Places (and California Register) under Criterion D. The hundreds of ranchos associated with the Mexican Period in California are poorly documented and few have survived to modern times. Information from archaeological excavations is vital to reconstructing the lives of this important historic population. Test excavations at Site CA-MNT-1429H have confirmed that remains of the 1823 Espinosa Adobe are extant on the site. In places, four courses of adobe bricks are present above portions of the foundations. This architectural integrity may allow for determination of doorway locations and thereby help deduce the domestic arrangements of the family. What appears to be an adobe addition may extend off of the eastern end wall of the building, suggesting information on renovations may also be recoverable from the site. The well may also provide concentrations of artifacts related to the Espinosa or other 19th-century occupants (due to logistical and time constraints, the well was not excavated to its depth). The sample of tejas and associated artifacts from Trench 9 also appear to date to the Espinosa occupation and can provide important information on family life.

Two special studies are recommended:

1. Soil analysis of samples from the adobe wall to determine size constituents;
2. Flotation of adobe brick samples to identify the potential of floral analysis; and
3. Inquiry into the possibility of sourcing tile fragments, to identify the mission where they were made.

Additional documentary research is also recommended to clarify some of the fieldwork findings. Artifacts and features encountered during excavation reflect nearly 180 years of continuous occupation. Their accurate identification and evaluation will be greatly facilitated by additional details of site occupants. During the different ownerships, who was living on the site and what were they doing? Can we find the people in census reports? Assessment records? A reconstruction of the site land use would also be valuable. What buildings and structures are associated with the various occupations? Do buildings show up on old USGS and other maps? Can former building locations and present buildings be dated and associated with various occupations? Are there other aerial photos available of this area? Although a case for NRHP significance can be made based on present information, it would be enhanced by additional documentary research.

Table 1
Identification of Mechanical Test Trenches, CA-MNT-1429H

Trench No.	Location	GPR Survey Area No.	Objective	Findings
T-1	Between lean-to #26 and equipment shed #6	GPR-1	West end of adobe	North and South adobe wall trenches
T-2	Under lean-to #26	GPR-2, south end	Extension of adobe to west; source of GPR readings	Nothing
T-3	North-west of equipment shed #6	GPR-6	Northwest corner of adobe; source of GPR readings	Northwest corner of adobe
T-4	Sink hole west of equipment shed #12	--	Visible sink hole	Schochs' report recent searching for gas tank
T-5	Southwest of equipment shed #6	GPR-6	Southeast corner of adobe	Southeast corner of adobe
T-6	East of barn #8	GPR-2	source of GPR readings	Nothing
T-7	In and north of shed # 7	GPR-3	"L" extension of adobe; source of GPR readings	Nothing
T-8	East side of barnyard	GPR-3	Visible sink hole	Probable well
T-9	Center of driveway/parking area	GPR-7	Visible tile concentration	19th century refuse dump
T-10	Near cypress tree	GPR-10	source of GPR readings	Nothing