Subsurface Geoarchaeological Investigations for the Buena Vista Gaming and Entertainment Project, Amador County, California

By:
Philip Kaijankoski
Jack Meyer

December 2010

Buena Vista Wastewater Treatment Plant,

NPDES 10-05; NPDES 10-06;
NPDES 10-07; NPDES 10-13

Exhibit B

USGS Topographic Quadrangles:
Ione, Calif. (1962)

Township and Range:
T5N R10E
Section 19

Keywords:
Extended Phase 1, Geoarchaeology, Radiocarbon Dating, Buried Soil

Submitted to:
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Cover Image:
Buried soil exposed in Trench 12

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INTRODUCTION

Far Western Anthropological Research Group, Inc., on behalf of AECOM, conducted subsurface geoarchaeological investigations for the proposed Buena Vista Gaming and Entertainment Project. The project area is located in the Sierra Nevada foothills approximately 5.5 miles southeast of Ione, in Amador County, an area where buried archaeological sites are common. The nature of the construction activities and the involvement of federal permits from the National Pollution Discharge Elimination System and the Environmental Protection Agency will require compliance with Section 106 of the National Historic Preservation Act of 1966 (36 CFR 800, revised 2004), which mandates federal agencies to consider the effects of federally permitted, authorized, or funded projects on historic properties.[1] The identification efforts documented in this report were carried out in accordance with the Historic Property Treatment Plan appended to a Memorandum of Agreement executed for this project.

This report documents background research to identify depositional landforms with the potential for buried archaeological sites in the project's area of direct impact, in addition to the methods, results, and findings of geoarchaeological explorations conducted in September 2010 by Far Western personnel. In addition, the report describes the age, nature, and extent of the major subsurface strata identified and discusses the substantive findings from the project area as a whole including the potential for buried archaeological sites. The exploratory work consisted of a series of backhoe trenches excavated under the supervision of Far Western Geoarchaeologist Philip Kaijankoski, who meets the Secretary of Interior's Professional Qualifications Standards for prehistoric archaeology. As a result of this investigation, one isolated prehistoric artifact consisting of a siltstone flake was identified in Trench 11 at a depth of 0.0-0.4 meters below surface. No other archaeological materials were identified.

GEOENVIRONMENTAL HISTORY AND SETTING

The western Sierra Nevada has undergone a series of dramatic environmental changes during the period of human occupation. These changes have had a distinct effect on the distribution of plant and animal communities, which in turn had a direct bearing on past human settlement-subsistence strategies. Likewise, there is a close relationship between the nature and extent of large-scale environmental fluctuations and the timing of significant landscape changes, which consequently have affected the preservation of archaeological sites from different time periods.

Twenty-one thousand years ago, the crest of the Sierra Nevada was covered by a massive sheet of glacial ice that extended from the Feather River to the headwaters of the Kaweah River (north to south). Pollen and macrofossil evidence indicate that late Pleistocene (>11,500 cal BP) conditions on the western slope of the Sierra Nevada may have been comparatively cold and dry (Adam 1967; Anderson 1987; Atwater et al. 1986; Cole 1983; Davis 1999; Davis and Moratto 1988). The late glacial landscape record is generally marked by extensive erosion of upland slopes and channels, and rapid deposition in lowland valleys. Stratigraphic and radiocarbon evidence indicates that glacial recession (deglaciation) was well under way by 19,000 years ago, and was essentially complete by 16,000 years ago (Anderson 1990; Anderson and Smith 1994; Clark and Gillespie 1997; Koehler and Anderson 1994; Pohl et al. 1996).

Paleoenvironmental records from the western Sierra consistently indicate a transition to warmer and dryer conditions during the early Holocene (11,500 to 7000 cal BP), as indicated by the upslope expansion of forests. Radiocarbon and stratigraphic evidence from the western Sierra slope and other parts of central California suggests that many early Holocene land surfaces were buried by deposition caused by increased runoff and flooding around 7000 cal BP. The presence of buried early Holocene-age soils and archaeological deposits in depositional landforms on the western slope provides compelling evidence of this relatively rapid transition (Meyer 2008; Meyer and Dalldorf 2004; Stewart et al. 2002; Wood 1975).

[1] "Historic properties" are defined under Section 106 as archaeological, architectural, or traditional cultural resources that are listed on or eligible to the National Register of Historic Places.

While often characterized as being warmer and drier than today based on studies from the Great Basin and desert southwest, inconsistent paleoenvironmental records from the Sierra Nevada during the middle Holocene (7000 to 4000 cal BP) indicate a period of climatic variability, with more-moderate temperatures than the early Holocene but with a series of distinct wet and dry phases. However, the middle Holocene hydrological record from the central Sierra seems to reflect the relatively arid conditions that prevailed in other parts of the region. During this time, forests continued their expansion upslope reaching elevations greater than today (Scuderi 1987). Stratigraphic records indicate that middle Holocene-age landforms remained relatively stable following a depositional pulse between 7000 and 6800 cal BP, marking the early/middle Holocene transition throughout the western Sierra.

During the late Holocene (4000 to 150 cal BP) environmental records from the Sierra generally reflect a trend toward cooler and wetter conditions over roughly the past 4,000 years (Anderson 1990; Anderson and Smith 1994; Davis et al. 1985; Davis and Moratto 1988; Koehler and Anderson 1994; Wood 1975; Woolfenden 1996). Records from various localities indicate there was an increase in precipitation and runoff between about 4500 and 2500 cal BP throughout the western Sierra. Pollen records also indicate a return to more-mesic conditions in the region at this time, with increased precipitation and less-pronounced seasonal temperature variations more characteristic of modern climate (West 2000).

The latest Holocene (2000 to 150 cal BP) is marked by two climatic extremes that are recognized worldwide as the Medieval Drought and the Little Ice Age. Also known as the Medieval Warm Period or Medieval Climatic Anomaly, the Medieval Drought consists of two extremely dry periods that occurred between 1100 and 890 cal BP, and 790 and 650 cal BP, which were separated by a "period of increased wetness" between about 840 and 740 cal BP (Stine 1994:549). Overall, the periods of drought were marked by: (1) increased temperatures; (2) decreased effective precipitation (winter snowpack, soil moisture, and groundwater levels); (3) changes in tree lines at high elevations; (4) desiccation of peat bogs and meadows; and (5) the expansion of forests into some middle-elevation meadows. By about 650 cal BP, these warm, dry conditions began to give way to the Little Ice Age, or Matthes glaciation, in the Sierra Nevada (Matthes 1939), which reached its maximum extent about 100 years ago (AD 1850) and retreated thereafter (Stine 1996).

Regional climatic variability in the late Holocene is also reflected by stratigraphic records in many alluvial landforms throughout central California. Floodplains and fans across the region record multiple periods of stability and soil formation, followed by brief episodes of sediment deposition (Rosenthal and Meyer 2004a, 2004b). These cycles of deposition and land stability appear to reflect regional fluctuations in precipitation and vegetation cover, which alternatively made the landscape prone to widespread erosion and deposition at different times during the late Holocene (Rosenthal and Meyer 2004b).

More recently, historic-period grazing, logging, mining, cultivation, and replacement of native plants by non-native species have significantly altered the environment and landscape of the Sierra. During the middle to late 1880s, protective vegetation cover was greatly reduced by an intense drought and livestock grazing, which made the landscape particularly susceptible to erosion (Burcham 1982:171; Dull 1999). These changes caused widespread degradation of the uplands, rapid sediment deposition in the lowlands, and the formation of deeply incised channels in many alluvium-filled valleys. Today, historic-age sediments often form the lowest terraces along the active stream and river channels (Biggar et al. 1978; Marchand and Allwardt 1981).

THE PROBLEM OF BURIED SITES

Although it has long been suspected that natural processes have obscured many archaeological sites in California (Heizer 1949:39-40, 1950, 1952:9; Lillard et al. 1939; Moratto 1984:214), until recently archaeological visibility has not been treated as a significant problem as it has in other parts of North America. The lack of geoarchaeological studies is an ongoing problem for researchers seeking to understand the relationship between regional site distribution patterns and demographic and settlement-subsistence change in central California (Meyer and Rosenthal 1997).

Over the past decade, however, it has become increasingly apparent that a significant portion of the archaeological record has been buried by natural geological processes in the Central Sierra Nevada (e.g., Meyer

2008; Meyer and Dalldorf 2004). Recent geoarchaeological studies emphasize that these changes have produced a significant bias in the types of archaeological deposits that can be identified through traditional pedestrian survey, and underscore the correlation between buried archaeological deposits and the presence of now-buried land surfaces (Meyer 1996, 2000; Meyer and Dalldorf 2004; Meyer and Rosenthal 1997, 2008; Rosenthal and Meyer 2004a, 2004b). For example, during geoarchaeological investigations for the East Sonora Bypass project, Meyer (2008) examined the landscape context of 68 cultural components from 43 archaeological sites in the west-central Sierra Nevada. This revealed that at least 40% of site components occur in buried context, with the greatest incidence found in gently sloping fans and footslopes. Furthermore, while all of the recent prehistoric components examined were strictly surface manifestations, only one third of archaic age components occur at the surface. These large-scale patterns suggest that episodes of latest-Holocene (2000 to 150 cal BP) alluvial and colluvial deposition have buried most archaic-period (11,500 to 1100 cal BP) sites in west-central Sierra Nevada. It follows that archaic sites will always be under-represented and recent prehistoric sites over-represented in regional samples unless buried contexts are specifically targeted. Thus, if researchers are to understand the relationship(s) between regional site distributions and demographic and settlement-subsistence changes, then the potential effects of landscape evolution on the archaeological record must be considered.

At the same time, the potential for buried archaeological sites is a practical problem for resource managers who must make a good-faith effort to ensure that project activities do not inadvertently affect, or adversely impact, potentially important buried archaeological deposits. Early detection of buried archaeological deposits also avoids the potential for costly delays that may occur when resources are discovered after project construction has begun and late-discovery protocols are necessary. Recognizing these problems, this study represents an effort to identify archaeological resources that may be buried within the Buena Vista Gaming and Entertainment project area.

GEOARCHAEOLOGICAL METHODS

Exploratory testing for buried archaeological sites is becoming an important part of the initial identification process in California and across North America (Monaghan et al. 2006). When subsurface explorations are designed and conducted in an informed fashion, they help satisfy the Section 106 requirement that "a reasonable and good faith effort to carry out appropriate identification efforts" is made to identify all archaeological resources [36 CFR 800.4(b)(1)]. The following section discusses the background research and field methods utilized in this investigation.

BACKGROUND RESEARCH

Background research for the project included a review of available geological maps, soils surveys, and other relevant literature. Geologically the project area is situated on the Ione Formation, which is Eocene-age marine and non-marine sandstone, mudstone, and conglomerate (Bartow and Marchand 1979). No detailed Quaternary geologic maps or soil surveys were found that contained the fine grained mapping of small and/or discontinuous depositional landforms required for this study. Previous studies have shown that buried archaeological deposits in the western Sierra foothills tend to be associated with low-angle landforms with slopes of nine degrees or less. Therefore field explorations targeted low-angle alluvial fans and foot slopes in the area of direct impact for the proposed project.

FIELD METHODS

Exploratory testing was conducted in the project area on September 28 and 29, 2010, under the supervision of Far Western Geoarchaeologist Philip Kaijankoski, who was assisted by AECOM archaeologist Anna Starkey. Several Native Americans coordinated by the Buena Vista Rancheria were present during excavations. The work generally focused on the southern portion of the project area where substantial ground disturbance is planned, and targeted low-angle depositional landforms, such as ridges, fans, and footslopes, that may contain buried soils and associated archaeological deposits. Fourteen subsurface exploratory trenches were excavated in the project area to determine the presence or absence of buried prehistoric archaeological remains (Appendix A). The exact location and size of each trench was determined in the field based on existing conditions and constraints and the ongoing results of trenching. The trench dimensions averaged about 1.1 meters (3.6 feet) wide, 0.9 meters (~3.0 feet) deep, and 3.6 meters (~11.8 feet) long. In all, about 50.9 cubic meters of material were excavated from the trenches (more than 49.7 linear meters overall), for an average of about 3.6 cubic meters per trench. The dimensions and descriptions of each trench can be found in Appendix B.

The presence or absence of archaeological materials was determined by examining and raking the deposits as they were removed from the trenches and by examining the trench walls. The trench locations were plotted using a GPS device, and the depth and general nature of the exposed geologic deposits were recorded, with additional attention given to deposits that appeared to contain Holocene-age buried soils and/or archaeological materials. Project personnel were not allowed to enter a trench more than 1.5 meters (~5.0 feet) in depth, in accordance with the California Occupational Safety and Health Administration (CAL-OSHA) standards. All trenching was supervised by the project geoarchaeologist.

One sample of organic material (i.e., buried soil) was collected from Trench 4 and submitted to the Beta Analytic lab in Miami, Florida for radiometric analysis, with a radiocarbon date obtained (Table 1). The radiocarbon-dating methods and sample data sheet are provided in Appendix C, along with the results, which are also presented in the following sections.

Table 1. Radiocarbon Dating Results from the Buena Vista Project Area.

Test Pit Number and Horizon Sampled	Material Dated	Depth (m)	CRA ^{14}C BP	Min. Cal BP	Cal BP	Max. Cal BP	Lab No.
Trench 4, Horizon 2ABtb	Soil (SOM)	0.5-0.6	3450±40	3620	3700	3830	Beta-287025

Notes: CRA ^{14}C BP is the conventional radiocarbon age from lab; cal BP is the central age intercept from the calibration program; minimum/maximum cal BP given at 2-sigma probability (95% confidence); additional information in Appendix C.

Stratigraphic Identification and Soil Descriptions

Natural and/or cultural stratigraphy was identified whenever possible by carefully examining the deposits exposed in the sidewalls of the trenches. Stratigraphic units (strata) were identified on the basis of physical composition, superposition, relative soil development, and/or textural transitions (i.e., upward fining sequences) characteristic of discrete depositional cycles. In the field, each stratum exposed in the test pits was assigned a Roman numeral (I, II, III, etc.) beginning with the oldest or lowermost stratum (sometimes bedrock) and ending with the youngest or uppermost stratum. Buried soils (also called paleosols), representing formerly stable ground surfaces, were identified in the field on the basis of color, structure, horizon development, bioturbation, lateral continuity, and the nature of the upper boundary (contact) with the overlying deposit, as described by Birkeland et al. (1991), Holliday (1990), Retallack (1988), and Waters (1992), among others.

Master horizons describe in-place weathering characteristics and were designated by upper-case letters (A, B, C); an "R" designates solid bedrock. These are preceded by Arabic numerals (2, 3, etc.) when the horizon is associated with a different stratum (i.e., 2Cu); number 1 is understood but not shown. The upper part of a complete soil profile is usually called the A-horizon, with a B-horizon being the zone of accumulation in the middle of a profile, and the C-horizon representing the relatively unweathered parent material in the lower part of a profile. Lower-case letters are used to designate subordinate soil horizons (Table 2). Combinations of these numbers and letters indicate the important characteristics of each major stratum and soil horizon; they are consistent with those outlined by Birkeland et al. (1991), Schoeneberger et al. (1998), and the USDA Soil Survey Staff (1998).

RESULTS AND FINDINGS OF EXPLORATORY TESTING

Exploratory testing was conducted throughout the project area within low angle landforms that have the potential for buried archaeological sites where project related subsurface impacts are anticipated. The results and findings of exploratory testing are discussed below, followed by an assessment of the potential for buried

Table 2. Key to Subordinate Soil Horizons.

Subordinate Horizons	Description
p	Disturbed zone (e.g., artificial fill or plow zone)
b	Horizon buried at location where described (not used with C-horizons)
ox	Oxidized iron and other materials in C-horizon (subsurface)
t	Illuvial accumulation of silicate clay in the subsurface strata
u	Unweathered parent material (used only with C-horizons)
w	Development of color and/or structure with little or no illuvial accumulation compared to underlying C-horizon (subsurface)

archaeological sites in the portions of the project area not examined by this study. A generally consistent stratigraphic sequence was documented throughout the project area, consisting of three distinct stratigraphic units discussed in order from oldest to youngest below. The exception to this is Trench 7 that which is discussed separately below.

Stratigraphic unit I consists of a well-developed buried soil (generally identified as 2ABtb-horizon) of variable color and texture with strong blocky structure, extremely firm consistency, and distinct clay films on ped faces. The variability observed in this unit is likely due to the fact that it was encountered throughout the project area on both fans and ridges. This unit was encountered at depths of about 0.4 meters below surface, often overlain by unit III discussed below. No archaeological materials were identified in this buried soil. A sample of the 2ABtb-horizon in Trench 4 yielded a radiocarbon date of 3450±50 BP, or 3700 cal BP (Beta-287025). Taken together the stratigraphic (i.e., well-developed soil profile) and radiocarbon evidence indicate that this unit is likely Pleistocene in age and remained stable at the surface of the project area for a considerable time period up to at least the late Holocene.

Stratum II consists of poorly sorted clast supported gravels in a sand matrix exhibiting little or no soil development. This unit was only observed in Trench 10 where it was overlain by unit III and in Trench 11 where it overlain a stream channel facies of unit I. The nature of this unit, in addition to its limited extend near a drainage indicates that it is the result of a recent stream channel deposition predating unit III. An isolated siltstone flake was identified within this unit in Trench 11 at a depth of 0.0-0.4 meters below surface, the context of which strongly suggests that this artifact was redeposited by stream activity. No other archaeological materials were identified in this unit.

Stratigraphic unit III generally consists of a relatively thin stratum of a gray silt loam surface horizon with weak granular structure (A) grading to parent material of massive white gravely sandy loam (C). This unit was identified at the surface of every trench location except Trench 7 extending to depths of 0.3 to 0.6 meters below surface. No archaeological materials were identified in this unit. The nature of this unit coupled with its broad expanse indicates that it is the result of deposition by colluvial slope wash. While the radiocarbon date from the buried soil in Trench 4 below this unit suggests that unit III may have been deposited as early as 3,700 years ago, the weakly developed soil profile indicates it is of more recent origin. Additionally, given that the radiocarbon date was from a well-developed soil increases the potential of incorporating older carbon. As such this date should serve only as a minimum age for the underlying unit I and a maximum age for the overlying unit III.

A different stratigraphic sequence was observed in Trench 7, which was excavated in a topographically higher portion of the project area on a ridge line immediately above a rock containing a couple. Due to land leveling associated with home construction it was suspected that artificial fill may overlie the historic land surface in this area. Trench 7 did in fact reveal artificial fill extending to 0.2 meters below surface, where it overlain extremely hard sandy loam with clay films bridging grains. The nature of the underlying unit indicates it is the Eocene-age Ione formation and the lack of a surface horizon indicates it was truncated by construction activities prior to deposition of the artificial fill. No archaeological materials were identified in this area.

Potential for Buried Archaeological Sites

The results of this investigation indicate that large portions of the project area have little or no potential for buried archaeological sites as it consists of high angle erosional landforms and/or bedrock exposed at the surface. The field investigation targeted the remaining low angle depositional landforms where project related subsurface impacts are anticipated and only one naturally redeposited artifact was identified. A well-developed buried soil was identified in the majority of trenches excavated, which indicates a potential for buried archaeological sites. However, given that 14 trenches were excavated within a relatively small area and no archaeological site was identified indicates that a substantial buried site is not present within this area. As such the potential for buried sites in this area has been exhausted.

CONCLUSIONS AND RECOMMENDATIONS

This subsurface geoarchaeological investigation for the Buena Vista Gaming and Entertainment Project was conducted to determine the presence or absence of buried archaeological materials and buried soils that are likely to contain such materials in order to guide further archaeological work in the project area, if warranted. This investigation targeted low angle, potentially Holocene-age depositional landforms, where project related impacts are anticipated. A series of trenches were mechanically excavated in these areas to depths ranging from 0.7 to 1.2 meters below surface. All excavated deposits were examined for archaeological materials.

This investigation identified only one isolated prehistoric artifact, which appeared have been removed from its original contexts by natural stream activity and redeposited at its present location. A laterally extensive, likely Pleistocene-age, buried soil was documented throughout the project area. However, given that 14 trenches were excavated and only one isolated artifact was identified it is unlikely that a substantial buried archaeological site is located in this area.

The results of this study suggest the probability of encountering large or substantial buried prehistoric archaeological deposits in the areas where earth disturbances are planned is low. While unlikely, there is some possibility that small, sparse, and/or isolated buried prehistoric archaeological materials could be associated with the well-developed buried soil found in the project area. Given this possibility, it may be prudent to have a qualified archaeologist or cultural monitor conduct periodic spot checks in the areas where the buried soil is exposed during construction to help insure that potentially important cultural resources are not adversely impacted by project-related activities.

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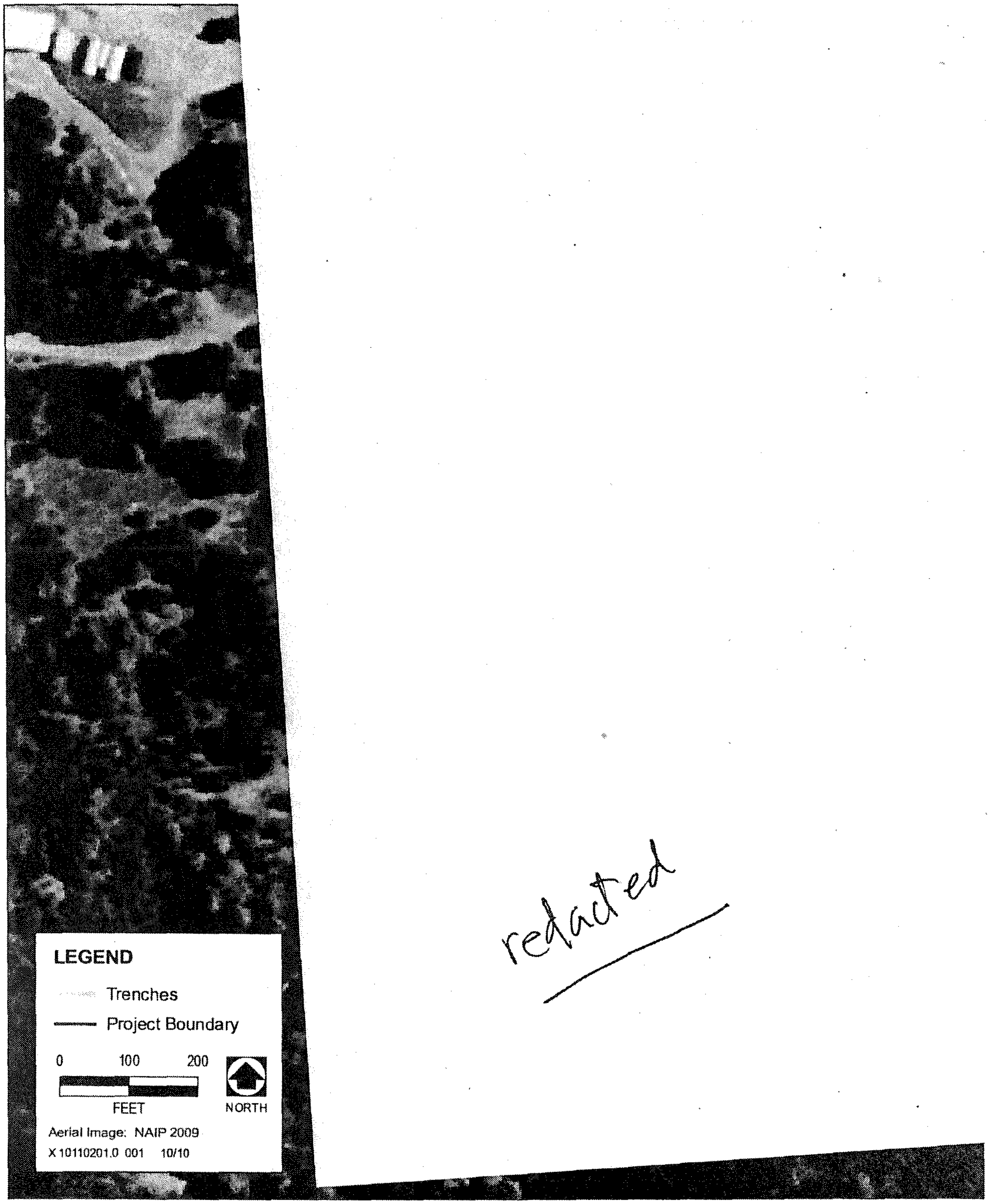
APPENDIX A

TRENCH LOCATION MAP



Source: AECOM 2010

Trenches

Not for Public Review

APPENDIX B

TRENCH SOIL DESCRIPTIONS

Appendix B - Trench Descriptions

Trench No.	Length (m)	Width (m)	Depth (m)	Cubic Meters	Description and Observations
1	4.0	1.2	0.9	4.32	Surface horizon of pale brown (10YR 6/3, dry) sandy loam with moderate granular structure (A) to 0.3 m, over light gray (10YR 7/1, dry) loam with weak subangular blocky structure (C) to 0.45 m, over gray (7.5YR 6/1, dry) silt loam with moderate angular blocky structure and many prominent clay films on ped faces (2ABtb) to 0.8 m, over light gray (7.5YR 7/1, dry) gravely sandy loam with moderate subangular blocky structure and distinct clay films on ped faces (2BC) extending to bottom of trench at 0.9 m.
2	4.0	1.2	0.9	4.32	Surface horizon of grayish brown (10YR 5/2, dry) loam with moderate granular structure (A) to 0.2 m, over very pale brown (10YR 7/3, dry) silt loam with weak subangular blocky structure (C) to 0.4 m, over brown (7.5YR 4/4, dry) gravely sandy loam with strong subangular blocky structure and common distinct clay films on ped faces and coating and bridging grains (2Btb) to 0.6 m, over brown (7.5YR 4/4, dry) cobbly sandy loam with weak subangular blocky structure and few clay films on ped faces (2BC) extending to bottom of trench at 0.9 m.
3	4.0	1.2	0.7	3.36	Surface horizon of grayish brown (10YR 5/2, dry) loam with moderate granular structure (A) to 0.25 m, over very pale brown (10YR 7/3, dry) silt loam with massive structure with abrupt wavy lower contact (C) to 0.4 m, over brown (7.5YR 4/4, dry) gravely sandy loam with strong subangular blocky structure and common prominent clay films on ped faces (2ABtb) to 0.55 m, over brown (7.5YR 4/4, dry) cobbly sandy loam with weak subangular blocky structure and few clay films on ped faces (2BC) extending to bottom of trench at 0.7 m.
4	3.7	1.2	0.8	3.55	Surface horizon of grayish brown (10YR 5/2, dry) loam with moderate granular structure (A) to 0.2 m, over light gray (10YR 7/1, dry) silt loam with massive structure (C) to 0.5 m, over brown (7.5YR 4/4, dry) sandy loam with strong subangular blocky structure and common prominent clay films on ped faces (2ABtb) to 0.7 m, over brown (7.5YR 4/4, dry) gravely sandy loam with weak subangular blocky structure, few clay films on ped faces, and extremely hard consistency (2BC) extending to bottom of trench at 0.8 m. A sample of 2ABtb horizon radiocarbon dated to 3450±40 BP, or 3700 cal BP (Beta-287025).
5	4.2	1.2	1.1	5.54	Surface horizon of light brownish gray (10YR 6/2, dry) sandy loam with massive structure and few cobbles (A) to 0.25 m, over dark grayish brown (10YR 4/2, dry) clay loam with moderate coarse prismatic structure, extremely hard consistency, common faint clay films coating and bridging grains, and common slickenslides on ped faces (2Ab) to 0.7 m, over grayish brown (10YR 5/4, dry) clay loam with strong medium subangular blocky structure and many distinct clay films on ped faces and coating and bridging grains (2Btb) extending to bottom of trench at 1.1 m.
6	3.0	1.2	0.9	3.24	Surface horizon of light brownish gray (10YR 6/2, dry) sandy loam with weak coarse granular structure and common cobbles (A) to 0.5 m, over dark grayish brown (10YR 4/2, dry) clay loam with moderate medium subangular blocky structure, very hard consistency, common distinct clay films on ped faces and coating and bridging grains (2ABtb) to 0.7 m, over brownish yellow (10YR 6/6, dry) clay loam with subangular blocky structure and common faint clay films on ped faces (2BCox) extending to bottom of trench at 0.9 m.

Trench No.	Length (m)	Width (m)	Depth (m)	Cubic Meters	Description and Observations
7	3.0	1.2	0.7	2.52	Redeposited surface horizon of grayish brown (10YR 5/2, dry) cobbly loam with massive structure (Ap1) to 0.1 m, over pea gravel with white (10YR 8/1, dry) concrete staining (Ap2) to 0.2 m, over brownish yellow (10YR 6/6, dry) sandy loam with massive structure, extremely hard consistency, and faint clay films coating and bridging grains (2Cox) extending to bottom of trench at 0.7 m.
8	4.0	1.2	1.1	5.28	Surface horizon of grayish brown (10YR 5/2, dry) loam with moderate granular structure (A) to 0.2 m, over very pale brown (10YR 7/3, dry) silt loam with few gravels and cobbles, and massive structure with abrupt wavy lower contact (C) to 0.4 m, over grayish brown (10YR 5/2, dry) sandy clay loam with subangular blocky structure and common distinct clay films on ped faces (2ABtb) to 0.7 m, over brown (7.5YR 4/4, dry) gravely sandy loam with subangular blocky structure, extremely hard consistency, and few clay films on ped faces (2BC) extending to bottom of trench at 1.1 m.
9	3.0	1.0	1.1	3.30	Surface horizon of pale brown (10YR 6/3, dry) loam with weak subangular blocky structure (A1) to 0.3 m, over gray (10YR 5/1, dry) sandy loam with weak granular structure (A2) to 0.5 m, over brown (10YR 5/3, dry) clay loam with 75% small to large gravel, weak fine angular blocky structure and common distinct clay films coating and bridging grains (2ABtb) extending to bottom of trench at 1.1 m.
10	3.0	1.0	1.0	3.00	Surface horizon of light gray (10YR 7/2, dry) sandy loam with weak granular structure (A) to 0.5 m, over gray (10YR 5/1, dry) clast supported small to large rounded gravels in sand matrix (2C) extending to bottom of trench at 1.0 m.
11	3.3	1.0	1.2	3.96	Surface horizon of grayish brown (10YR 5/2, dry) sandy loam with weak granular structure (AC) to 0.2 m, over gray (10YR 5/1, dry) sandy loam with 25% small to medium gravels (Cu), gray (10YR 5/1, dry) clast supported gravels and cobbles in clay loam matrix, extremely hard consistency, and common faint clay films coating and bridging grains (2BC) extending to bottom of trench at 1.0 m. One siltstone flake recovered from upper 0-0.4 m below surface.
12	3.0	1.0	1.0	3.00	Surface horizon of light gray (10YR 7/2, dry) silt loam with weak granular structure (AC) to 0.25 m, over light gray (10YR 7/2, dry) sandy loam with massive structure with abrupt wavy lower contact (Cu) to 0.4 m, over brown (7.5YR 5/3, dry) clay loam with moderate angular blocky structure and common distinct clay films on ped faces (2Ab) to 0.8 m, over light brown (7.5YR 6/3, dry) clay loam with moderate angular blocky structure and common distinct clay films on ped faces (2Btb) extending to bottom of trench at 1.0 m.
13	2.5	1.0	1.0	2.50	Surface horizon of light gray (10YR 7/2, dry) sandy loam with weak granular structure (A) to 0.25 m, over light gray (10YR 7/2, dry) sandy loam with massive structure, weak bedding, and abrupt irregular lower contact (C) to 0.6 m, over reddish brown (5YR 4/4, dry) sandy loam with fine angular blocky structure, common distinct clay films on ped faces, and common indurated sandstone inclusions (2BCox) extending to bottom of trench at 1.0 m.
14	5.0	1.0	0.9	4.50	Surface horizon of light gray (10YR 7/2, dry) gravely sandy loam with weak granular structure (A) to 0.4 m, over dark brown (10YR 3/3, dry) clay loam with moderate angular blocky structure and common distinct clay films on ped faces (2ABtb) extending to bottom of trench at 0.9 m.

APPENDIX C

RADIOCARBON RESULTS

BETA

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Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

November 10, 2010

Dr. William Hildebrandt/Liz Honeysett
Far Western Anthropological Group
2727 Del Rio Place
Suite A
Davis, CA 95618
USA

RE: Radiocarbon Dating Result For Sample BV-T4-50-60

Dear Dr. Hildebrandt and Ms. Honeysett:

Enclosed is the radiocarbon dating result for one sample recently sent to us. It provided plenty of carbon for an accurate measurement and the analysis proceeded normally. As usual, the method of analysis is listed on the report sheet and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analysis. It was analyzed with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of the analysis was charged to the MASTERCARD card provided. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood
Digital signature on file

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Dr. William Hildebrandt/Liz Honeysett — Report Date: 11/10/2010

Far Western Anthropological Group — Material Received: 10/25/2010

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 287025	3460 +/- 40 BP	-25.6 o/oo	3450 +/- 40 BP

SAMPLE : BV-T4-50-60
ANALYSIS : AMS-ADVANCE delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 1880 to 1670 (Cal BP 3830 to 3620)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.6:lab. mult=1)

Laboratory number: **Beta-287025**

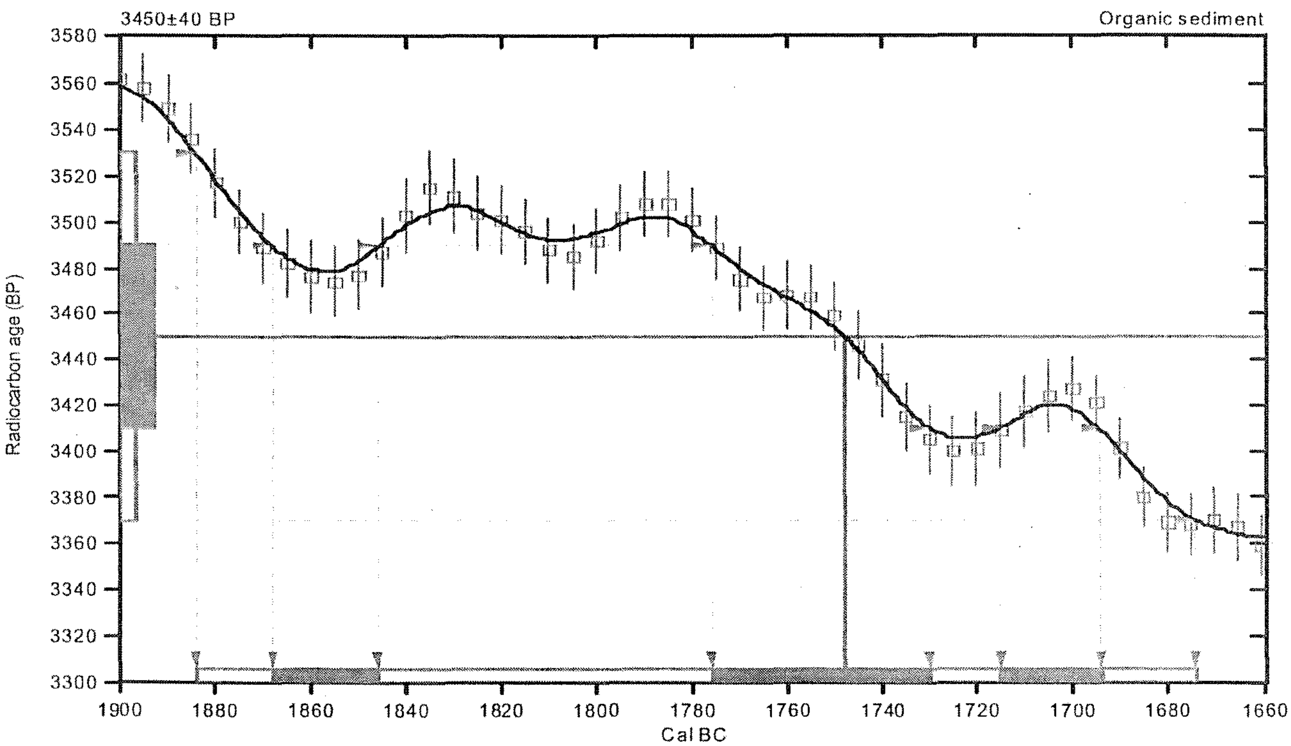
Conventional radiocarbon age: **3450±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 1880 to 1670 (Cal BP 3830 to 3620)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 1750 (Cal BP 3700)

1 Sigma calibrated results: (68% probability)
Cal BC 1870 to 1850 (Cal BP 3820 to 3800) and
Cal BC 1780 to 1730 (Cal BP 3730 to 3680) and
Cal BC 1720 to 1690 (Cal BP 3660 to 3640)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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BEIJING MUNICIPAL ENVIRNEMNTAL PROTECTION BUREAU STUDY TOUR ON US APPROACHES TO REGULATING AIR POLLUTION

August 18, 2011, 9:00 am – 12:00 pm,[1] Room 1806

BEIJING REPRESENTATIVES

Mr. Zhuang Zhidong 庄志东	Beijing Municipal Environmental Protection Bureau 北京市环保局	Deputy Director 副局长
Ms. Lu Jianru 卢建茹	Beijing Municipal Environmental Protection Bureau 北京市环保局	Division Chief 处长
Ms. Li Lixin 李立新	Beijing Municipal Environmental Protection Bureau 北京市环保局	Deputy Division Chief 副处长
Ms. Wang Junling 王军玲	Beijing Municipal Research Institute for Environmental Protection 北京环境保护科学研究院	Deputy Director 副院长
Ms. Xu Hui 徐辉	Beijing Municipal Environmental Monitoring Center 北京市环保监测中心	Senior Engineer 高工
Ms. Yang Hong 杨红	The Legal Affairs Office of the People's Government of Beijing Municipality 北京市人民政府法制办公室	Division Chief 处长
Mr. Ye Bing 冶冰	Urban Construction and Environmental Protection Office of the Standing Committee, Beijing Municipal People's Congress 北京市人大常委会城市建设环境保护办公室	Division Chief 处长

[1] *Please bring passports and arrive 10 minutes before the meeting to allow time for security screening. Jessica Kao will greet the delegates at the lobby.*

USEPA REPRESENTATIVES

Contact: Jessica Kao (高景仪), *Attorney, Office of Regional Counsel, EPA Region 9, kao.jessica@epa.gov, 415/972-3922*

Matt Haber, Senior Advisor, Air Enforcement Division, Office of Enforcement and Compliance Assurance, EPA HQ

Jeanhee Hong, Air Attorney, Office of Regional Counsel, EPA Region 9

Stanley Tong, Environmental Scientist, Rules Office, Air Division, EPA Region 9

Lily Wong, Environmental Scientist, Rules Office, Air Division, EPA Region 9

AGENDA

9:00 - 9:15 am	Welcome and Self-Introductions
9:15-10:00 am	Overview of [Air Permitting ??] (Matt Haber)
10:00 am -12:00 pm	Q & A