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REPORT OF THE CULTURAL RESOURCE MONITOR AT THE RILEY GULCH FRAC PAD IN GARFIELD COUNTY, COLORADO INCLUDING THE TEST EXCAVATIONS AT ARCHAEOLOGICAL SITE 5GF1185: A MULTI-COMPONENT PREHISTORIC HABITATION FOR WPX ENERGY ROCKY MOUNTAIN, LLC

GRI Project No. 2014-37
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Submitted to

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Abstract

At the request of WPX Energy Rocky Mountain, LLC (WPX) and the Colorado River Valley Field Office of the Bureau of Land Management (BLM CRVFO), cultural resources monitoring was conducted during construction of the Riley Gulch Frac Pad Project located at the mouth of Riley Gulch in the Parachute Creek valley in Garfield County, Colorado. The construction took place on private lands and was monitored between the dates of 19 June and 15 July 2014. Carl Conner served as Principal Investigator for Grand River Institute (GRI) of Grand Junction, Colorado, under BLM Antiquities Permit No. C-52775. Curtis Martin served as Project Archaeologist and supervised a crew of three to four others during the monitoring and ultimately the data recovery of features exposed by construction in site 5GF1185.

In 1982, when it was discovered during a survey of the Union Oil of California holdings, 5GF1185 was identified as a prehistorically occupied rockshelter. At that time, the area beneath the overhang was trowel-tested, which revealed stratified cultural deposits in the form of artifacts and charcoal to at least a depth of 60cm. As a result of the recent archaeological monitoring, the site boundary was expanded eastward to include open cultural contexts on the gulch bottom. In that area, pipeline and pad construction projects exposed 23 thermal features (hearths and natural burns) and evidence of two prehistoric houses. Radiocarbon dates for the thermal and structural features range from about 4000 BC to 500 AD. The discovery of open house structures dating to the Middle-Late Archaic periods is important in the rendering of the prehistory of the region. The rarity of such finds is implicit in the context that only three others have been identified and excavated in west-central Colorado.

Excavations were closed at the site by the Bureau of Land Management Colorado River Valley Field Office in July of 2014 for project review. Based on the Conditions of Approval (COA) for the Frac Pad project, the review resulted in the covering and reburial of the pithouses for their preservation.

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1.0 Introduction

At the request of WPX Energy Rocky Mountain, LLC (WPX) and the Bureau of Land Management's Colorado River Valley Field Office (BLM-CRVFO), Grand River Institute (GRI) conducted cultural resources monitoring for the construction of the Riley Gulch Frac Pad. Carl Conner served as Principal Investigator for Grand River Institute (GRI) of Grand Junction, Colorado, under BLM Antiquities Permit No. C-52775. WPX construction supervisors for the project were Wally Hammer and Kent Rider. The monitoring and test excavations were carried out to meet requirements of Executive Order 11593, Federal Land Policy and Management Act of 1976, the National Historic Preservation Act (as amended in 1992), the National Environmental Policy Act (NEPA) of 1969, and other Federal Laws and regulations that protect cultural resources.

A pre-field check-in was made through the BLM-CRVFO on 18 June 2014. Archaeological work for this project occurred between 19 June and 15 July 2014. All surface disturbing activities were monitored and inspected for the presence of cultural manifestations prior to the initiation of work and during the blading and grading operations. Curtis Martin served as Project Archaeologist and supervised a crew of three to four others during the excavations. Test excavations in the area of the structural features (Feature 9 Locus) were conducted by Martin, Holly Shelton, Alexandra Price, Courtney Groff, Thuong (Nicky) Pham and Masha Ryabkova. This report was written and compiled by Conner, Martin, Shelton, Groff, and Barbara Davenport. During the monitoring for the frac pad, significant cultural resources in the form of thermal and structural features were encountered. These are described in the following report.

2.0 Location of Project Area

The project area is located on private lands at the mouth of Riley Gulch in the Parachute Creek valley of Garfield County, Colorado. [redacted]

3.0 Justification for Monitor

During the monitoring for the Riley Gulch Water Lines Project for WPX, evidence of five *in situ* subsurface cultural thermal features were encountered within the walls of the pipeline trench (Conner 2014). This resulted in the expansion to the east-northeast of previously recorded site 5GF1185, the Riley Gulch Rockshelter, and established it as a multicomponent open camp as well as a sheltered camp. These features contained sufficient charcoal to be radiocarbon dated and produced four Late Archaic dates ranging from 800-450BC to 20-220AD, and a single Formative age date of 410-580AD. Accordingly, monitoring was required for the Riley Gulch Frac Pad located on adjacent land.

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4.0 Environment

The project area is within the Piceance Creek Basin, one of the major geologic subdivisions of Colorado. The Piceance Creek Basin is an elongate structural downwarp of the Colorado Plateau physiographic province that apparently began its subsidence approximately 70 million years ago during the Laramide Orogeny. Sediments from surrounding highlands were deposited in the basin, accumulating to a thickness of as much as 9000 feet by the lower Eocene epoch, when subsidence ceased. Regional uplift occurred in the Late Tertiary, and erosion of the area has continued since (Young and Young 1977:43-46).

Physiographically, the study area is in the central Roan Plateau region (Fenneman 1931). The edges of the plateau are defined by steep slopes and prominent cliffs, known as the Roan Cliffs (Hail 1992). It includes Parachute Creek, a north-south trending 14.7 mile long tributary of the Colorado River, and is distinguished by its many deep-cut secondary canyons including Riley Gulch. Elevations in the vicinity of Riley Gulch range from 5400 feet at the floor of Parachute Creek to 8500 feet on the canyon rims.

The cliffs on each side of Parachute Creek consist of the Eocene Green River Formation in the upper aspect of the cliffs and the Wasatch Formation that is evident in the lower exposed bedrock. Intertonguing with the overlying Uinta Formation (late Eocene) is complex. Visible on the upper cliffs of both sides of the Parachute Creek valley, the light gray-brown Parachute Creek Member, the youngest member of the Upper Green River Formation, sits atop the Garden Gulch and Anvil Points members, both located within the Lower Green River Formation. The Parachute Creek member is primarily composed of oil shale, a dolomitic marlstone formed in lacustrine sediments, that has been exploited as an alternative energy resource. Bedrock outcrops in the lower levels of the cliffs and in the valley are composed of the Upper Wasatch Formation (Eocene) that presents as variegated red and dull grey-yellow claystone and fine to medium grained sandstones (Hail 1992).

The Wasatch formation underlies the study area. It consists of a series of interbedded variegated mudstones, sandstones, and siltstones of varying colors – brick red, tan, white, and purple. Forming after a period of erosion, the Wasatch is the first extensive continental deposit following those of the Cretaceous-age Mesa Verde Group. Sediments are stream, floodplain, and swamp deposits. To the east, where the formation is thicker, its age ranges from the Paleocene (53ma) to middle Eocene (47ma) epochs of the Tertiary periods. The types of fossils found in the Wasatch suggest a moist tropical to subtropical environment existed here at that time (Armstrong and Kihm 1980:48).

Soils are shallow loams on the ridge slopes with intermixed shale, or fractured shale. Away from the steep mountain slopes, soils deepen and become somewhat darker and loamier. The Quaternary geology of Parachute Creek and Riley Gulch is primarily the result of cool wet periods that resulted in extensive alluvial deposition of poorly sorted sands, clasts and larger rocks originating from Uinta Fm (Eocene) sandstone and Green River Fm (Eocene) sandstone, marlstone and mudstone. These talus and slopewash deposits formed multiple massive alluvial fans in the steep narrow secondary and tertiary canyons of Parachute Creek (Molenaar 1990). These fans, also formed on both sides of the valley, often merged, completely covering the valley floor. Through time flooding has resulted in repeated episodes of dissection and deposition of the minor canyons and valley floors. This, combined with ongoing channel variability and sheetwash occurrences, have produced the present strata and topography of the Parachute Creek and Riley Gulch area.

Elevation of the project area averages about 5380 feet, which falls within the Upper Sonoran and Transitional Zone. The natural vegetation cover in the canyon bottom is sagebrush/grasslands and riparian growth. Greasewood is common along the drainages, where the soil is more saline. Pinyon-juniper forest occurs on the ridges and their slopes. Ground cover ranges from 20 to 40 percent. These communities support a variety of wildlife species although the intensive energy activities of the area and the proximity of Interstate 70 have pushed most to surrounding mountains. There, mule deer, elk, coyote, and black bear are common, as are cottontail rabbits, beavers, and various rodents. Mountain lion, bobcat, fox, skunk, badger, and weasel are also likely inhabitants. Bird species observed in the area include the jay, raven, red-shafted flicker, long-eared owl, turkey, golden eagle and various other raptors.

The relatively low elevations of the valley bottom are host to a cool semiarid climate where temperatures can drop to -15 degrees F during the winters and summer temperatures may reach 100 degrees F; there is a maximum of 160 frost-free days and the annual precipitation is about 14 inches. The surrounding higher elevations are characterized as cooler and moister. Annually, the high mountain temperatures could average 5 degrees cooler and the precipitation as much as 10 inches greater than the surrounding low elevations (USDA SCS 1975:244).

5.0 Paleoclimate

A graphic illustration of regional climatic studies by Petersen (1981) for the La Plata Mountains and by Chen and Associates for the Battlement Mesa area (Conner and Langdon 1987:3-17) is presented in Figure 5.1. As one can see, the two graphs are not in complete agreement, but they offer comparable assessments of the region's paleoclimate based on the present knowledge of the geomorphology. In addition, the following is a distillation of the discussion of general climatic shifts derived from geologic implications as reported in the Class I for the GJFO (Conner et al. 2011:2-8 through 2-50).

In the Southern Rocky Mountains, generally warm, moist conditions prevailed during the Early Holocene (ca. 11,700 BP). As the generalized warming trend continued, the warm/ moist conditions began to change. At the lower elevations, dry/wet climatic fluctuations appear to have brought on drought conditions between 11,200 and 9500 BC in the San Juan and Wyoming Basins, lowering the water table and concentrating surface water into shrinking water holes. In other areas, especially the higher terrain, increased effective precipitation would have produced a rise in the ground water tables, local lake levels, and the number of springs, as well as an expansion of tall and short grass forage regions (Eckerle 1992).

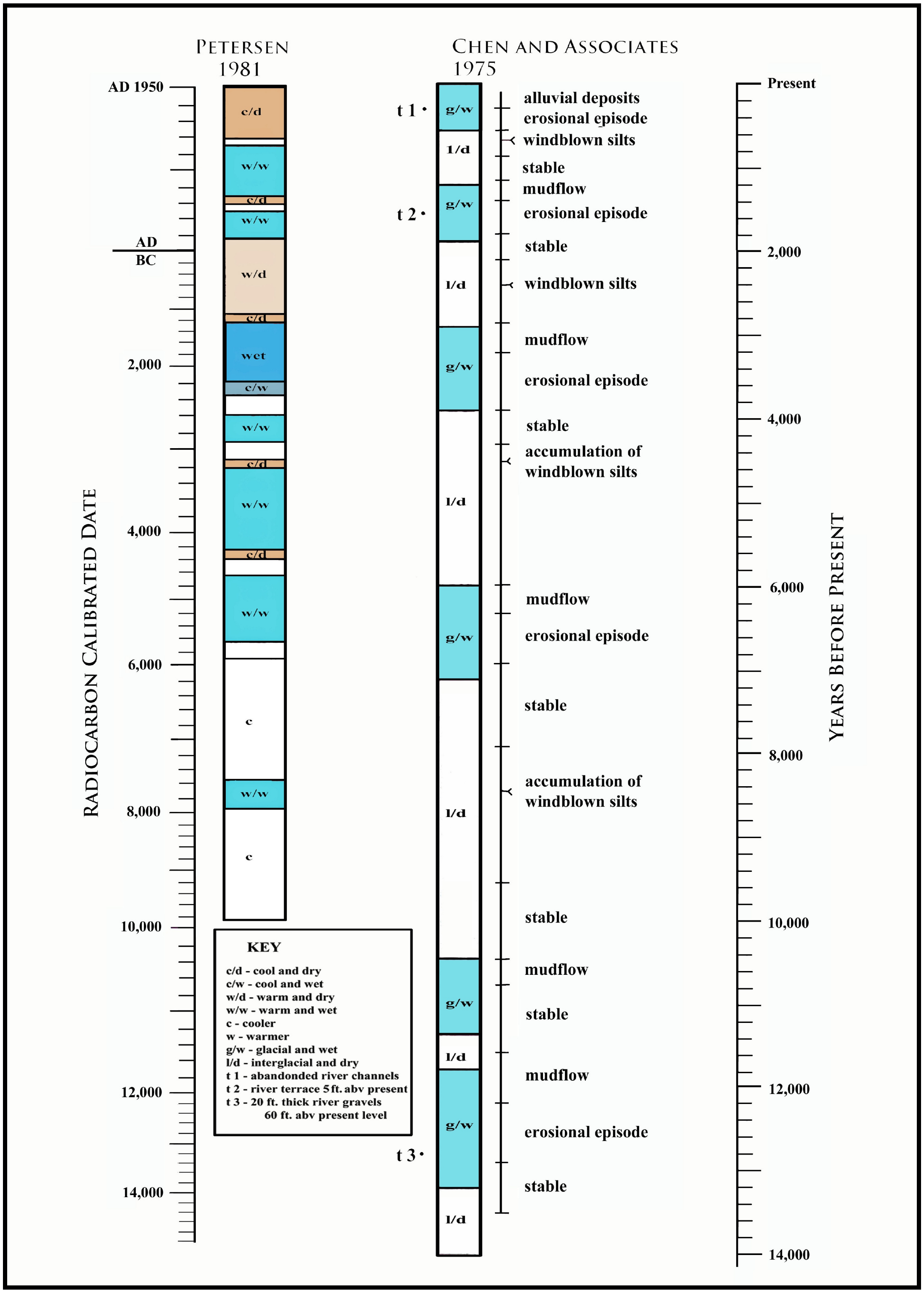

Figure 5.1. Illustration of regional climatic studies by Petersen (1981) for the La Plata Mountains and by Chen and Associates for Battlement Mesa Community (Conner and Langdon 1987:3-17).

About 9200 BC, wetter environmental conditions again prevailed and timberline was lower in the La Plata Mountains. Dunal areas began to stabilize and the sage brush began to replace the desert shrub. However, around 9000 BC another change occurred and the environment became drier. Between then and about 4300 BC the timberline in the San Juan Mountains gradually retreated to higher elevations than at present. Somewhere around 8250 BC the monsoon pattern appears to have shifted southward.

The Paleoarchaic period (7500-5500 BC) witnessed a deterioration of regional climates accompanied by higher average temperatures and less effective moisture. The three following periods are defined by cultural changes and punctuated by climatic episodes: Early Archaic (ca. 5500-3750 BC), Middle Archaic (ca. 3750-1250 BC), and Late Archaic (ca. 1250 BC - AD 1300).

The Early Archaic (5500-3750 BC) exhibits a good deal of cultural continuity with the preceding period. This period marks the first half of the Middle Holocene and represents the harshest drought conditions experienced by the prehistoric population. Based on excavation data, evidence of occupation of northwest Colorado during the Middle Archaic Period, ca. 3750-1250 BC, greatly expands in comparison to the previous periods. This occurs in the second half of the Middle Holocene and roughly corresponds to the Neoglacial period, which exhibited an overall increase in effective moisture and cooler temperatures.

Climatic fluctuations occurred during this period and two distinct dry episodes are recorded by Petersen (1981) for the La Plata Mountains and by Chen and Associates for the Battlement Mesa area (Conner and Langdon 1987:3-17). The environmental model prepared for Battlement Mesa Community shows an accumulation of windblown silts ca. 3250 BC (at the end of an extended, increasingly dry episode of the Neoglacial period) and again ca. 600 BC. Between 2850 BC and 2550 BC, is a time of increased moisture which is evidenced in the stabilization of dune fields and reversion to sagebrush steppe of much of the area covered in desert shrub communities.

The Late Archaic/Formative (1250 BC - AD 1300) is a time of apparent stress on settlement systems. Drought-like conditions coupled with population packing (increased populations in smaller ecological niches) caused adaptive strategies to reach a pinnacle of intensification. The initial portion of the Late Archaic Period appears to consist primarily of climatic conditions somewhat similar to the present with periodic fluctuations between cooler and wetter, cooler and drier, or hotter and drier conditions, depending upon geographic location.

In summary, the end of glacial conditions came around 13,400 BC [* represents calibrated dates]. An early drought, called the Clovis drought by Haynes (1991), caused erosion and is associated with most of the Pleistocene extinctions. Glacial conditions returned in the Younger Dryas between 11,000 and about 9000 BC*. Severe drought in the early Holocene lasted from 9000 to 5500 BC*, interrupted once around 7450 BC*, which coincides with Pryor Stemmed occupations in the region. After 5500 BC*, climates ameliorated. Conditions between 5500 and 3100 BC* approached but did not exceed conditions during the

Late Glacial; changing plant communities, frost heave, syngenetic (in-place) weathering, and changing lake levels all point to cooler conditions. Droughts interrupted the generally cooler-moister conditions after 5500 BC*, with major periods of drought identified between and 1850 to 950 BC*, 275 BC* to 165 AD*, 900 to 1350 AD*. After about 150 years ago, conditions have caused deflation and alluvial deposits have moved in fits and starts downstream, via avulsion.

Geologic evidence can identify changes in climate within a scale of hundreds of years, but lacks precision when compared to tree ring data, but the two compare nicely. The sequence of deposition and erosion is easy to see, but dating the sequence with radiocarbon determinations obtained mostly from cultural features presents its own challenges. Furthermore, although the changes due to climate change are visible in the stratigraphic record, the boundary conditions that favor deflation over deposition in loess deposits or trigger fine clastic deposition in alluvial valleys are not precisely known. Nevertheless, a coarse summary of climate based on alluvium and aeolian deposition can be suggested, and is generally supported by tree ring data for at least the last 2000 years.

6.0 Relevant Prehistoric Background

Local and regional archaeological studies suggest nearly continuous human occupation of west-central Colorado for the past 12,000 years. The prehistory of the region is outlined in the Colorado Council of Professional Archaeologists' *Colorado Prehistory: A Context for the Northern Colorado River Basin* (Reed and Metcalf 1999). Therein, manifestations of the Paleoindian Era, big-game hunting peoples (ca. 11,500 - 6400 BC); the Archaic Era hunter/gatherer groups (ca. 6500 - 400 BC); the Formative Era horticulturalist/forager cultures (ca. 400 BC- AD 1300); the Protohistoric Era pre-horse hunter/gatherers (Early Numic, ca. AD 1300 - AD 1650) and early historic horse-riding nomads (Late Numic, ca. AD 1650 - AD 1881) are discussed. At 5GF1185, archaeological materials and radiocarbon data derived from the monitors and test excavations indicate occupations during the Archaic and Formative periods. The regional manifestations of these periods are summarized below.

6.1 Archaic Chronology

Evidence of the Paleoarchaic transition period (ca. 7500-5500 BC) is found in the surface finds of diagnostic artifacts that indicate three traditions appear to be operating in the region: the Plano Tradition of the Late Paleoindian Period with links to the Great Plains, a Stemmed Point Complex with links to the Great Basin, and the Foothill-Mountain Complex--possible precursor to the Mountain Tradition extant in the southern Rocky Mountains. Three periods follow that are defined by cultural changes and punctuated by climatic episodes: Early Archaic (ca. 5500-3750 BC), Middle Archaic (ca. 3750-1250 BC), and Late Archaic/Formative (ca. 1250 BC - AD 1300).

The Paleoarchaic period (7500-5500 BC) witnessed a deterioration of regional climates accompanied by higher average temperatures and less effective moisture. Climatic warming caused a reorganization of the resource base. Biota retreated to the more conducive climates of high altitudes and low altitudes adapted to desert-like conditions. The volatility of the environment initiated cultural change which resulted in the transformation of a highly mobile, big-game hunting lifestyle into a semi-sedentary hunting and gathering lifestyle.

This subsistence pattern reflected a combination of considerations regarding resource availability, predictability, and productivity. The Archaic foragers focused their subsistence activities on species with higher caloric return rates when available and, when unavailable, shifted to resources with lower rates. Intra-regional differences in the distribution, density, and seasonal availability of significant dietary plants and animal species would have affected settlement strategies. Some high priority resources were more abundant in or restricted to certain areas, for example, pinyon pine in the Colorado Plateau uplands. In northwest Colorado, the lowland deserts and grasslands and the upland forests occur in relative close proximity and were likely exploited via base camps along their ecotones.

Based on the dry climatic conditions, this period was one when the early Uto-Aztecan speaking foraging bands of the west-central Great Basin migrated to its southwestern edge. Decreasing effective moisture in subsequent centuries probably motivated these hunter-gatherers to abandon the lowlands of this region in favor of better-watered middle Holocene refuges. Migration destinations likely included areas east of the Colorado River with movement onto the Colorado Plateau and also southward to the northern Sierra Madre Occidental. Climatological factors may also have encouraged some bands to continue migrating southward (Merrill et al. 2009).

The Early Archaic (5500-3750 BC) exhibits a good deal of cultural continuity with the preceding period. Semi-sedentary hunting and gathering remained the most effective adaptive strategy. Procurement efforts centered on a broad spectrum of biotic zones that were exploited through a central-place foraging strategy. The intensification in procurement efforts is manifested in the burgeoning visibility of processing features as well as pit (pithouse) and basin (house-pit) structures. This period marks the first half of the Middle Holocene and represents the harshest drought conditions experienced by the prehistoric population. Again, much of the data derives from surface finds of projectile points which cross-date from other regions to this period. Radiocarbon dates from this period from multi-component sites tentatively argue in favor of subsistence and settlement strategies logistically organized on ecological economic zones that radiated out from a household residential base. Evidence of decreased mobility and longer-term, seasonal residency in the form of pithouses has been found in the mountain areas, but subsistence data are sparse.

Evidence of occupation of northwest Colorado in the Middle Archaic Period, ca. 3750-1250 BC, from excavation data greatly expands in comparison to the previous periods. This cool moist period in the second half of the Middle Holocene is evidenced by a wide variety of projectile point styles covering large regions of the Intermountain West, with the greatest influences coming from the Great Basin and the Wyoming Basin, with some minor contacts from the Southwest. The number of radiocarbon dates increases dramatically over previous periods. The occurrence of radiocarbon dates at several multi-component sites from this period suggests that subsistence and settlement strategies were indeed logistically organized on ecological economic zones that radiated out from a household residential base. In fact, this adaptation had become so well established that what may have once been simple, highly ephemeral, household residential bases had now become true "base camps," which later metamorphosed into "localities" that were repeatedly and systematically re-occupied.

The Middle Archaic roughly corresponds with the Neoglacial period, which exhibited an overall increase in effective moisture and cooler temperatures. On the Colorado Plateau, these conditions were conducive to the expansion of the pinyon pine forest northward from New Mexico into central Colorado and eastern Utah by around 2750 BC (Berry and Berry 1986). With the advent of these more favorable environmental conditions, a shift by the aboriginal populations down to the middle and lower elevation levels would have been comfortably feasible. As the radiocarbon data reveal, there is an overall drop in the date frequencies for the Colorado mountains along with a corresponding rise in the date frequencies of the northern Colorado Plateau.

Climatic fluctuations occurred during this period and two distinct dry episodes are recorded by Petersen (1981) for the La Plata Mountains and by Chen and Associates for the Battlement Mesa area (Conner and Langdon 1987:3-17). Data supporting the first dry episode is derived from excavations conducted in the Alkali Creek Basin (located just north of the Gunnison Basin) and reported by Markgraf and Scott (1981). Their study indicates the presence of a montane pine forest at an elevation of 9,000 feet until ca. 3250 BC. The environmental model prepared for the Battlement Mesa Community shows an accumulation of windblown silts ca. 3250 BC (at the end of an extended, increasingly dry episode of the Neoglacial period) and again ca. 600 BC.

Between 2850 BC and 2550 BC, the increased moisture allowed the pinyon pine to expand northward from New Mexico into central Colorado and eastern Utah, and it became a major component of the La Plata Mountains in southwestern Colorado. By about 1700 BC, pinyon/juniper forest is present in the canyon bottoms and washes of the Colorado Plateau. This period exhibits stabilization of dune fields and reversion to sagebrush steppe of much of the area covered in desert shrub communities. Consequently, increased game populations and a wider variety of edible plants were available to the human populations at lower elevations.

The Middle Archaic is distinguished on the basis of increased variability in material culture. Reed and Metcalf (1999:79) also suggest that this period is characterized by less sedentisim in settlement patterns and perhaps greater seasonality in the use of higher elevations. Archaeological evidence for this patterned seasonal transhumance is found in the remains of shallow basin structures and their associated artifacts identified from this period at the Indian Creek Site near Whitewater (Horn et al. 1987) and in the Gunnison Basin at Curecanti Reservoir (Euler and Stiger 1981; Jones 1986).

There also appears to have been sporadic contact with Middle Plains Archaic groups as defined by Frison (1978) and evidenced by diagnostic artifacts associated with the McKean Techno-complex. Again, such finds indicate that there was frontier contact in northwest Colorado between highly mobile bands of hunters and gatherers during the Middle Archaic Period due to improved climatic conditions, which provided opportunities for exploration. It may well be that there are no fixed or well-defined boundaries present and that all the groups are generally operating in an open, free interaction zone within the region.

The Late Archaic/Formative (1250 BC - AD 1300) is a time of apparent stress on settlement systems. Drought-like conditions coupled with population packing caused adaptive strategies to reach a pinnacle of intensification. Such intensification is reflected in heightened processing of seeds and other lower rate-of-return resources, cultigen manipulation, and evidence of a shift to the bow and arrow. The Archaic lifeway likely continued as a survival strategy for hunter-gatherer groups through the end of the Formative period.

The initial portion of the Late Archaic Period appears to consist primarily of climatic conditions somewhat similar to the present with periodic fluctuations between cooler and wetter, cooler and drier, or hotter and drier conditions, depending upon geographic location. The same seasonal patterns of floral and faunal exploitation probably continued much as they had during the Middle Archaic Period. However, uncertainty caused by the fluctuating environmental conditions, coupled with increasing population densities, may have led to changes in social organization and a greater necessity to define group territories and home ranges. This may have been due to pressures from outside groups trying to relocate as a result of adverse environmental conditions in other areas.

One final aspect of importance during this critical period concerns the introduction or development of the bow and arrow, a major technological innovation over the preceding atlatl and dart. Exactly when this change occurred is controversial, but the majority of the available data indicate ca. AD 300.

6.1.1 Archaic Era Architecture in the Mountains of Colorado

The most basic typology organizes the multifarious record of Archaic architecture into two general types: formal and informal. The key distinguishing feature between formal and informal is the amount of labor invested in the construction. Formal structures exhibit heightened investment of labor and evince a proclivity toward prolonged or repeated occupation. Semi-subterranean structures are typical manifestations of formal structures. Informal structures are characterized by expedient construction and a short term occupation.

A more finite classification of Archaic architecture is represented in the work of Thompson and Pastor (1995). Three different structure types (i.e., pithouses, house pits and temporary shelters) were identified in the Wyoming Basin on the basis of “associated features (internal or external), density and diversity of material remains (e.g., tools, bone, fire-cracked rock, debitage), and the patterning and interrelationships of those remains” (Thompson and

Pastor 1996:90). Pithouses were identified as deep, round subterranean depressions containing interior features and internal architectural features (niches, walls), and that have midden refuse areas away from the structure. Examples include structures at the Medicine House site (McGuire 1984) and possibly the Shoreline site (Walker and Ziemens 1976). House pits were identified according to smaller dimensions in diameter and depth. These structures were also noted to lack internal architecture, such as prepared floors and ventilator shafts. Examples include structures at Maxon Ranch (Harrell and McKern 1986), Sweetwater Creek (Newberry and Harrison 1986), and Split Rock Ranch (Eakin 1987). Temporary structures were described primarily as sun/wind breaks manufactured out of brush or wood. Remnants of four post molds encircling several small hearths at 48SW4492 (Creasman et al. 1983) appear to be temporary structures that were constructed to provide relief from the wind or the summer sun. Evidence for this structure type is extremely limited due to its ephemeral nature.

The ultimate goal of "typing" architecture is to unveil and discern the behavioral implications it carries for interpreting hunter-gatherer settlement and subsistence. For example, the presence of substantial structures carries implications concerning group mobility. Significant investment of labor suggests a strong tether to place and the importance of seasonal sedentism – both of which have been ethnographically documented (Gilman 1987). In the Rocky Mountains, evidence of substantial structures has stimulated speculation of a unique Archaic adaptation (i.e. the Mountain Tradition) to upland terrain – contesting the original idea that the mountains were exploited on a transitory seasonal basis (Black 1991). Despite criticism, the concept of a Mountain Tradition has directed "attention toward the existence of a rich prehistoric record that stands independent of broader culture areas like the Great Basin or Plains" (Reed and Metcalf 1999:79).

The occurrence of storage and habitation structures in this region has only in recent years been documented, primarily due to cultural resource management projects. The recent study by Metcalf and Reed (ed. 2011:139) detailed data from a sample of 65 house pits with occupations spanning nearly the entire Archaic Era (Figure 6.1).

House pit ages ranged from the oldest at 8170 to 8022 cal BP (5MF6255) to the youngest at 3970 to 3560 cal BP (5MF2990). Their best documented/dated houses in the sample have ages between 4835 and 8170 cal BP, and the majority of houses date between 5600 and 7100 cal BP. Notably, the use of house pits was not observed for the period 3600-2500 BP in northwest Colorado during the UBL/WIC/REX projects, but such is known to occur in the Grand Valley area (near De Beque and Parachute) during the period ca. 3000-2700 BP (Berry et al. 2013).

Prior to their study, two of the oldest pithouses in Colorado were found in the Yarmony site near Kremmling and dated between 5380 and 4800 BC (cf. calibrations in Metcalf and Black 1991:57-58). Also, at altitudes of 8,000 feet or more in Colorado, what were apparently wattle and daub structures have been found in the Curecanti National Recreation Area near Gunnison (Cassells 1997) and at the Hill Horn and Granby sites near the town of Granby (Wheeler and Martin 1982). The Curecanti structures date between 3400 and 1500 BC

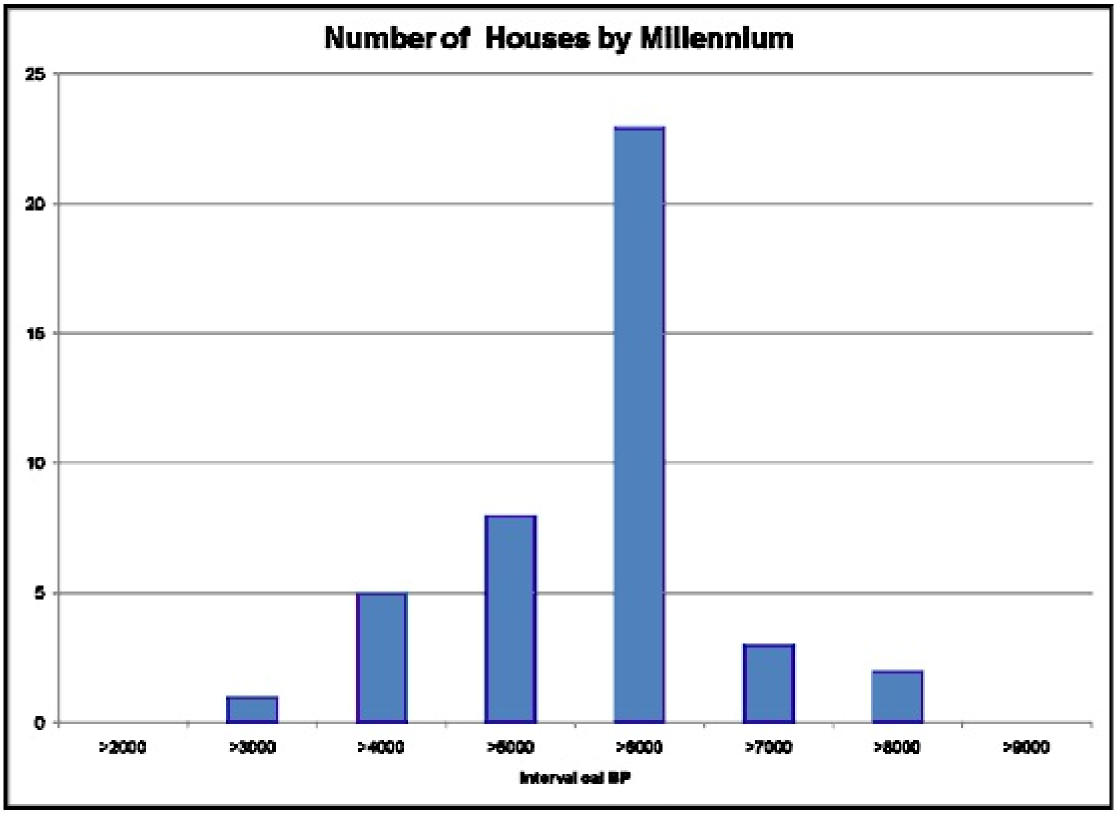

Figure 6.1. Number of dated UBL/ WIC/REX projects house pits by cal BP millennia (Metcalf and Reed ed. 2011:131, Figure 59). [Shown in BP date reference - years Before Present]

(Cassells 1997:106-108). The Granby structures date to 2500 BC and the Hill Horn structures may date as early as 7000 and as late as 2500 BC (Wheeler and Martin 1982:24).

Interestingly, recent excavations at the McClane Rockshelter, 5GF741, located in the Roan Plateau, provided evidence that Middle Archaic McKean Complex groups were creating structures within rockshelters by constructing brush and/or pole walls around the perimeter of the overhang – essentially making sheltered houses. The interior exhibited a centrally located thermal feature, and lined and unlined storage pits. The evidence of these houses occurred in the two lowest stratigraphic units, which contained three occupation levels dating between ca. 4200-3000 BP. Winter occupation is surmised for these three habitations (Berry et al. 2013).

The Collbran Pipeline project, a monitor completed by GRI in the Parachute-De Beque-Collbran area, produced another Middle Archaic house. In site 5ME16789, a pithouse was exposed by the pipeline trench at an approximate depth of 120cm below vertical datum. Radiocarbon dates of 4600±40BP (Beta No. 263487) and 4610±40BP (Beta No. 303014) were obtained from the structure. During excavation, a roughly circular (approximately 5m diameter), basin-shaped depression (0-15cm) containing a highly patterned arrangement of six floor features (Figure 5.11-5). Chipped stone, ground stone and bone were recovered from the structure. The door opening appears to have been placed on its southwestern edge, which was destroyed during trenching activity; however, the profile of the south side of the trench reveals the character of the likely entrance to the shelter. In that profile is an ash stain with two lobes that penetrate the ground to lower levels than the surrounding stain. This appears to be indicative of pathways exiting the pithouse and the presence of a central post at the entrance (removed by pipeline construction). It is also indicative of an open wall or entry on the southwest side. Metcalf and Reed (2011:77) note finding similarly arranged house pit structures in northwest Colorado:

> Similar in some ways to the NN House, a number of project area house pits were noted to have incomplete walls or walls that were only defined by a low lip, most often on the downhill sides. Many of the project house pits were built into slopes, with the back wall cut more steeply into the slope deposits in order to achieve a flat floor, a characteristic also noted by Shields (1998:82) for houses in this area. The creation of a flat floor apparently often resulted in this lack of a defined wall on the downhill side, and thus archaeologists have sometimes proposed that entrances were on the downhill side of such house pits. A downhill entrance was specifically suggested for the 44 House at site 5MF2990, the Blue Knife Site house pit (5MF3198), Feature 1 at the Vortex Site (5MF3587), Structure B at Mouse House Site (5MF6175), and Feature 15 at site 5MF6255.

Metcalf and Reed (ibid.) then go on to state the NN pithouse "may then be similar to a Havasupai three-sided or double lean-to structure depicted in the Handbook of North American Indians, Southwest, Vol. 10 (Schwartz 1983, Figure 42). In the photograph [shown in this report as Plate 6.1], the lean-to is an open, three-sided shelter with a forked tree trunk or branch used as a center support. Walls are brush, with dirt mounded around their base. It appears there may be an interior hearth [set off-center]. The open work area in front of the shelter is flat and closely matches the floor elevation under the shelter."

Plate 6.1 Three-sided lean-to structure characterized as a "double lean-to" that was utilized at Havasupai and depicted in the Handbook of North American Indians, Southwest, Vol. II (Schwartz 1983, Figure 42).

Importantly, the fragment of the diagnostic projectile point found with the 5ME16789 pithouse is an Elko type, which implies cultural influence from the Great Basin. Subsequent occupations in the region, as identified in the McClane Rockshelter, indicate influence from the Plains and Northern Rocky Mountains by McKean Complex groups (Berry et al. 2013).

The early part of the Late Archaic period exhibits an important cultural phenomenon centered on the Colorado River Valley between De Beque and Parachute. First identified at Battlement Mesa Community during excavations for the town's development, a pithouse was uncovered at 5GF126, located on a bench associated with a nearby spring, that contained two possible occupations dated ca. 2900 and 2770 BP. Excavations exposed a roughly circular, basin-shaped depression measuring approximately 4.5m in diameter and up to 65cm in depth. Eight small, shallow holes around and within the perimeter of the pit-house and a single large hole at the center of the floor implied the presence of a superstructure, presumably constructed of wooden poles (Figure 6.2, following page).

Importantly, a small, distinctly loaf-shaped sandstone mano was one of the groundstone pieces found on the pithouse floor. It was pecked and ground on all sides to a sub-rectangular (nearly cubic) form (Plate 6.2). Similar specimens were observed at Locus II and in local collections. This distinctive mano is an artifact type that is diagnostic of this Late Archaic culture recently named the Battlement Mesa Complex. Three other such manos were recovered from a floor cache in the same type of pithouse structure at 5ME16786 that dated 2760±70 BP (Conner et al. 2014:6.16).

Plate 6.2. Loaf-shaped manos recovered from 5GF126: Top found on surface of Locus II, bottom located on pithouse floor.

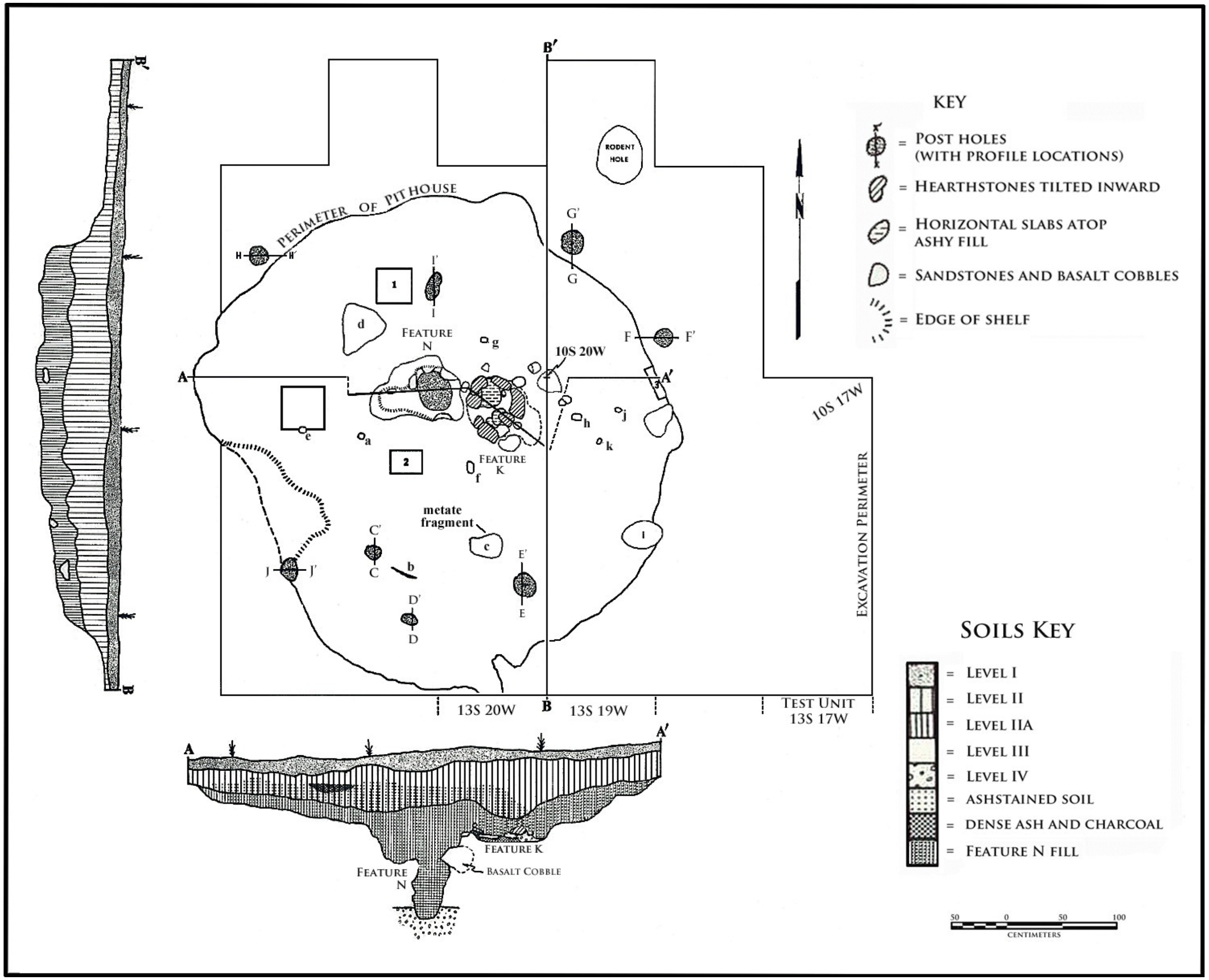

Figure 6.2. Plan and profile views of the Kewclaw Site, 5GF126 Locus 1, Feat. 5, Pithouse.

6.1.2 Archaic Thermal Features

A wide variety of non-architectural features occur throughout the Archaic. Undoubtedly, most of these features were constructed for cooking food; however, some without thermal characteristics may have also been used for storage.

Relatively little research has been devoted toward understanding the function of such features. However, "archaeologists are beginning to do more with ethnographic descriptions and with experimentation" (Reed and Metcalf 1999:81, 82). For instance, Stiger (1998:65) experimented with the heat-output of four feature types at the Tenderfoot site and Francis (2000:5) went so far as to calculate the potential volume of camas and biscuit root that could be processed in a large cobble filled feature at 48SU1002 in the Upper Green River Basin of Wyoming. Thompson and Pastor (1995:91) also experimented with volume calculations for slab-lined features in southwest Wyoming and determined that the vast majority ranged from 40 to 60 liters. This 40 to 60 liter subset contained features dating from the Great Divide (7750-5600 BC) through the Uinta (AD 1-1400) phases. A second cluster of features had calculated volumes ranging from 80-150 liters; the majority of these dated to the Opal phase (5600-3400 BC). Two extremely large (268.6 and 285.6 liters) features were noted and both date to the Pine Spring phase (3400-1450 BC).

Features are also one aspect of technological organization used to look at temporal changes. Reed and Metcalf (1999) organized 450 dated features, with origins in the Northern Colorado Basin, into 500-year increments. Originally, there were more than 50 descriptive labels for the 450 dated features. For the analysis, Reed and Metcalf decided on seven basic categories: simple ash stains, simple hearths, basin hearths, rock-filled pits, rock-lined pits, slab-lined pits, and fire-cracked rock features. Results from the analysis indicate:

> Simple stains and basin hearths appear earliest in time, and along with simple hearths, are important in all time periods. Rock- and slab-lined pits attain importance early in the Archaic, and also show increased frequency of use around 2000 to 2500 BC and again in the Formative era. Rock-filled features have generally the same temporal distribution as rock- and slab-lined features. Features that are primarily clusters of fire-cracked rock occur in the latter half of the prehistoric record (Reed and Metcalf 1999:82).

In the Gunnison Basin, a similar temporal distribution is evinced. Stiger (1998: Figure 7-2) indicates that unlined firepits occur in all periods. Specialized boiling pits occur from about 7500-4650 BC, and slab-lined pits occur from about 7000-1200 BC. Large fire-cracked rock features occur from 4650-1200 BC. Smaller fire-cracked rock features are more abundant later in time.

Several avenues of research are proposed to promote a better understanding of the associations between feature morphology, function and site activity. For instance, experiments with the heat out-put of different feature types may lend insight into the intensity of activities at a site and/or the length of occupancy. The temporal distribution of features or, more correctly stated, the frequencies of radiocarbon dates through time, has often served as a tool for estimating population. Finally, the temporal distribution of different feature types may carry implications concerning social organization (Stiger 1998).

6.2 Formative Era

The Formative Era from 400 BC – AD 1300 (as defined by Reed and Metcalf 1999:6) is represented in western Colorado by the Fremont, Anasazi/Ancestral Puebloan, Gateway, and Aspen Traditions. The Fremont Tradition people are likely the most represented in Northwest Colorado and may have occupied it from ca. AD 200-1500; but there remain many unanswered questions concerning the Fremont. It is generally agreed, however, that various horticulturists (Formative) groups – possibly of diverse origins and languages, but sharing similar material traits and subsistence strategies – occupied selected areas in Utah and western Colorado during that time.

The first real attempt to provide a regional synthesis of the Formative Period appeared in the West Central Colorado Prehistoric Context (Reed 1984). At that time, the archaeologists working in the area were operating under the Formative Stage concept as defined by Willey and Phillips (1958:146) wherein the Formative Stage was defined as "the presence of agriculture, or any other subsistence economy of comparable effectiveness, and by the integration of such an economy into well established sedentary village life." No temporal contemporaneity was implied. Very little work had been done, and much of the previous research had operated under the assumption that the sites were representative of the Fremont or Anasazi Traditions, with little consideration given the possibility that another, undefined tradition might be represented. However, one proposition put forward within this first Context was that these sites represented an *in situ* development from an Archaic technocomplex wherein people practicing an Archaic tradition lifestyle adopted a Formative Stage lifestyle as the need to intensify food production arose. Cultigens may have been perceived as relatively unimportant to the hunting and collection of wild foods, which were still able to meet most of the economic needs.

The Formative Era is inextricably linked to the domestication of plants and the development of ceramics. The origins of the defined Anasazi and Fremont cultures that occupied the region are deeply rooted in the Archaic-possibly as early as 3000 BC. The principal events that link the Formative and the Archaic are the expansions of populations and the transmittal of maize horticulture from Mexico. Expansion into the southwest from Uto-Aztecan speaking horticulturists is noted as early as 1000 BC, but earlier evidence of the adoption of maize is found in the general region and suggests multiple incursions by horticulturists into the Southwest from Mexico.

Production of the three principal domesticates – maize, beans and squash – in Mesoamerica was widespread by 2000 BC. Reliance on this triumvirate was preceded by varying subsistence strategies including mixed foraging, horticulture, and ultimately low level food production. These stages are characterized as prefarming, transition to farming, and dependence on farming. It is in this last stage that dispersal or expansion from homeland regions likely occurred. Regional adoption of maize horticulture results from a decision to minimize subsistence risk (Gremillion 1996:199). In contrast, for a horticultural society, examples of risk minimization shifts would be in diversification to fall-back wild plant resources or in the dispersal of growing plots (Kennett et al. 2006:197). For a hunter- gatherer group to adopt horticulture meant a change in the fabric of their culture in order to organize planting, harvesting, storage, protection, and distribution of food. The rewards in adoption of agriculture are found in abundance of selected resources and by the resultant increase in population. The risk is found in the variability of climate causing shortfalls and the occurrence of boom and bust cycles. Bust cycles would result in a substantial decrease in population and force the remaining people to aggregate in environmentally favorable niches.

6.2.1 Defining the Formative Expression in West-central Colorado

The local Formative Era groups adopted many of the Anasazi traits, yet remained distinct in several characteristics including a one-rod-and-bundle basketry construction style, a moccasin style, trapezoidal shaped clay figurines and rock art figures, as well as a gray coiled pottery (Madsen 1989:9-11). The Fremont apparently retained many Archaic subsistence strategies, such as relying more on the gathering of wild plants and having less dependence than the Anasazi on domesticated ones – maize, beans, and squash. However, maize horticulture was practiced by the Fremont in selected areas throughout the region, as indicated by excavations in east central Utah and west-central Colorado (Barlow 2002; Hauck 1993; Madsen 1979; Wormington and Lister 1956).

Finds in west-central Colorado suggest a regional Fremont variant that is characterized by distinctive stylistic rock art, a reliance on overhangs and rock outcrops for shelter, an absence of surface storage structures, and a possible figurine complex. Maize was apparently grown throughout the area, but the level of dependence on this resource and other domesticates has not been established. The most common type of Fremont projectile point found here is the Rose Spring Corner-notched; others include the Uinta Side-notched, Bear River Side-notched, Nawthis Side-notched, Bull Creek, and East-gate Expanding Stem (Holmer and Weder 1980). As in Utah, Puebloan trade wares are commonly found at Fremont sites, sometimes in association with Fremont pottery types (Madsen 1977:vi; Jennings and Sammons-Lohse 1981:75-94).

From their excavations of cave and arroyo sites on Glade Park, Lister and Dick (1952) documented the presence of "Fremont-Basketmakers" as they uncovered unbaked molded clay figurines as well as evidence of maize horticulture. In the same area on Glade Park and also along the Colorado River, Conner and Ott (1978) recorded several Fremont petroglyph and pictograph panels. Again on Glade Park, a radiocarbon date of 950 BP (AD 1100) and a Rose Spring Corner-notched point were obtained from excavations at the Gore Site, known for its splendid Fremont (Classic Sieber Canyon) rock art (Clifton Wignall, personal communication).

In the De Beque area, a previous study for Chevron Shale Oil Company identified Turner Grey pottery at site 5GF656 and artifacts associated with the Fremont period at three other sites (LaPoint et al. 1981:4-57). Southwest of De Beque, a Classic Sieber Canyon Style rock art panel occurs in a side canyon of the Colorado River. South of the Colorado River near the town of Mesa, excavations by Grand River Institute at Jerry Creek Reservoir #2 produced radiocarbon dates, associated projectile points, and ceramics from the Fremont Period (Martin et al. 1981:92, 135). Again, in the Mesa/Collbran area, local collectors have recovered a number of southwestern pottery types. The Young collection was analyzed and found to contain seven identifiable types of decorated Puebloan wares and several corrugated wares comparatively dating between AD 1000-1300 (Annand 1967:57). Groups I and II of the analysis are not assigned as to cultural affiliation but, from the descriptions given, are very likely Fremont types.

Excavations at Battlement Mesa in the early 1980s produced an interesting continuum of diagnostic artifacts and radiocarbon dates related to the Formative Era occupation. Table 6.1 summarizes the findings.

Table 6.1. Summary of Formative Era chronology indicators resulting from inventory and excavation for the Battlement Mesa Community Cultural Resources Study (Conner and Langdon 1987). [RADIOCARBON DERIVED DATES ARE BOLDED]

Site No.	C-14 data/Diagnostic artifact comparative date	Diagnostic Artifacts/Features
5GF133	diagnostics: ca. AD 1225-1300; ca. AD 1100-1300	Uinta Side-notched points; Tusayan B/W ceramic sherd; Tusayan Corrugated sherds
5GF123	diagnostics: ca. AD 700-1300	Uncompahgre Complex Coal Creek Phase points
5GF134	**AD 1030-1140**	Rose Spring Corner-notched point; [clay on hearth]
5GF129	**AD 715-895**	Rose Spring Corner-notched point
5GF134	**AD 615-765**	Rose Spring Corner-notched point; and pit structure
5GF132	diagnostic: ca AD 500-1100	Rose Spring base
5GF128	**AD 565-665** **AD 420-550** **AD 295-425**	Rose Spring Corner-notched point; clay balls; pendant
5GF122	**AD 225-395**	Slab-lined floor
5GF127	**AD 65-245**	Dated thermal feature

7.0 Field and Analytical Methodology

The cultural resources monitor at the Riley Gulch Frac Pad was conducted throughout the initial vegetation clearing, topsoil removal, and grading of the right-of-way. This involved on-the-ground visual inspection by the archaeologists following all the ground disturbing equipment at a cautionary distance during the preparation of the frac pad. Thermal and structural features were encountered during the monitoring and their locations were plotted with a Trimble GPS unit and incorporated onto an overall plan map of the project area. Depths below the present ground surface (pgs) for all features were determined by extrapolating, as closely as possible, from remnants of this surface at the nearest undisturbed localities.

At the discovery of buried cultural features, all ground disturbing activities in the vicinity of the identified feature(s) were halted and a buffer area of at least 100 feet from the identified feature(s) was to be protected from any additional disturbance until such time as the feature(s) were mitigated via data recovery. In such cases, appropriate samples for analysis to determine cultural/temporal affiliation and subsistence were collected and analyzed as warranted. In the case of the more extensive cultural remains discovered at the Feature 9 Locus, a trackhoe was employed to remove approximately two meters of overburden followed by controlled excavation using hand tools, as described more fully in the discussion of the findings at this locus.

Additionally, in order to establish and document the provenience of the excavations and findings at the Feature 9 Locus, a fixed datum point was established on the undisturbed ground surface to the west-northwest of the edge of the frac pad. For the sake of convenience and accuracy, a Mapping Datum was established on the exposed surface of the locus and all subsequent excavation was referenced to this point. The permanent datum point is 15.0m west-northwest of the Mapping Datum at an Azimuth of 292° (declination was established at 10°from magnetic north). For vertical control, a Vertical Datum was established in the vertical cut bank that currently defines the northwest edge of the Feature 9 Locus at a depth of 135cm below the actual present ground surface at that location.

All excavated fill, other than that collected as radiometric or micro- or macrobotanical samples, was screened through 1/8-inch hardware cloth shaker screens as explained in the Results of the Test Excavations section. Detailed plan maps and profile views were drawn, and photographs were taken at each feature or excavation locus.

Shovels, trowels, and brushes were used to conduct the excavations. Excavation at the Feature 9 Locus was carried out, and specimens were collected, by 10cm arbitrary levels as measured from the grid unit corner stake highest in elevation. When present, excavation controls were shifted to natural or cultural stratigraphic levels. Fill within formal cultural features was excavated and recorded as separate units.

All lithic debitage and chipped and ground stone tools that were found *in situ* were indicated on plan and/or profile maps, recorded as to depth below present ground surface

(PGS), and bagged as individual field specimens (FSs). Other artifacts and ancillary specimens were bagged in aggregate, and labeled by unit and level, or feature number. A single field specimen list was compiled for the entirety of the monitor project, beginning with "FS1." Table A-1, in Appendix A, provides a list of all collected artifacts and samples with location information. Soils, macro-botanical, pollen, and carbon samples were collected as warranted.

In the laboratory, artifacts were sorted according to morphological category and material type. Chipped stone debitage was examined for use wear, intentional retouch, evidence to indicate core rejuvenation or biface thinning/re-sharpening, and then grouped and tabulated according to size and lithic material type.

Pollen samples were sent to PaleoResearch Institute of Golden, Colorado. Macro-botanical and faunal materials were processed and identified in-house. Radiocarbon specimens were processed by International Chemical Analysis Inc. of Miami, Florida. Field notes and digital photos will be kept on file at Grand River Institute. All collected artifacts, digital copies of the photographs, and the written records will be curated at the Museum of Western Colorado in Grand Junction.

8.0 Project Background

Prehistoric site 5GF1185 was first recorded in 1982 as a rockshelter located on a south-facing slope at the mouth of Riley Gulch (Conner and Langdon 1983). Its boundary was expanded as a result of the archaeological monitoring for WPX's Riley Gulch Water Lines during March of 2014 to include the open drainage bottom north of the rockshelter (Conner 2014). Evidence of five *in situ* subsurface thermal features were encountered within the walls of the pipeline trenches–all of apparent cultural origin. This resulted in the expansion to the east of previously recorded site 5GF1185, the Riley Gulch Rockshelter. Each feature contained sufficient charcoal to be radiocarbon dated, and analysis produced four Late Archaic age dates, ranging from 800-450BC to 20-220AD, and a single Formative age date of 410-580AD. Based upon the proximity of the features to the previously documented extent of site 5GF1185, and the distinct possibility of additional subsurface cultural materials between the site and the newly discovered features, it was determined that they should all be considered a part of the same resource. A report detailing the project results (GRI Project # 2014-11) was prepared under the title of *Cultural Resources Monitor Report for the Riley Gulch Water Lines Project for WPX Energy Rocky Mountain, LLC in Garfield County, Colorado* (Conner 2014).

8.1 Previous Resource Description

Site **5GF1185,** the Riley Gulch Rockshelter, was originally recorded by an archaeological crew from Grand River Institute in July of 1983 (Conner and Langdon 1983). At the time, the site was described as follows:

Site lies at point of small interfluvial ridge. The rockshelter is formed by an east-facing

> overhang of a large boulder. Ash-stained soil, debitage, and artifacts are dispersed downslope from the overhang to a distance of 20m. Trowel excavation of a small test pit 100cm within the dripline of the overhang revealed cultural deposits greater than 60cm in depth. One projectile point fragment, two biface fragments, three unifaces, one metate fragment, two mano fragments, one mano and flakes numbering greater than 50 were recorded [on the site surface].

The site, at an elevation of 5400 feet, is situated at the base of a talus slope on the southeast facing side of a northeast-southwest trending ridge, and extends onto the open sage alluvial plain to the east. Surrounding vegetation consists of pinyon/juniper forest with an understory of sagebrush, greasewood, saltbush, rabbitbrush, and grasses. Soils consist of pale brown, sandy, pebbly loam.

The site was revisited by Grand River Institute in 2012 and found to be in good condition. The ash stained soil was found to currently be concentrated within an area measuring approximately 6m in diameter and situated immediately to the east of the boulder rockshelter. Additionally, a concentration of fire-cracked rock (FCR) was documented near the eastern boundary of the site, approximately 18m to the east of the shelter. A projectile point fragment, three mano fragments, a hammerstone, and twelve chert and porcellanite flakes were observed on the surface during the revisit.

One of the mano fragments (Plate 8.1) recovered from the site (5GF1185.s4) was described as:

> "...significant in style. Although only a 1/4 corner fragment was found, it displayed a definitive loaf/biscuit shape. It was a completely shaped (ground and pecked) cobble of rhyolite.... The specimen was collected as a diagnostic, because other manos of this type have been recovered from two Late Archaic pit structures in nearby areas. One pithouse, which dated 2770±60BP, that was excavated at Battlement Mesa during 1982 produced one of these distinctive manos (Conner and Langdon 1987:7-28). Three other similar manos were recovered from a floor cache in a pithouse structure at 5ME16786 that dated 2760±70 BP" (Conner et al. 2014:6.16).

Plate 8.1. Mano fragment 5GF1185.s4.

Site 5GF1185 was revisited again by Grand River Institute in 2014 as a part of the Riley Gulch Water Lines monitoring activities for WPX Energy Rocky Mountain, LLC. Five chert and quartzite flakes and a mano fragment were noted on the surface within the previously defined site boundary. Additionally, during the pipeline trenching to the east of the site boundary, a series of five cultural subsurface thermal features (designated A through E) were exposed in alluvial sandy loam at depths ranging from approximately 14 to 127cm below the present ground surface. As it was considered likely by the field archaeologist that similar buried cultural deposits exist between the previously-defined boundary of the site, and the newly-discovered features in the pipeline trench, it was deemed appropriate to consider the deposits exposed in the trench a buried extension of 5GF1185. This expanded the site significantly to the east and the newly defined boundary measured 210m east-west by 30 north-south.

Charcoal samples recovered from the five thermal features were sent to International Chemical Analysis, Inc. of Miami, Florida for processing. Table 8.1 presents the results of the analyses and complete sample reports, as provided by International Chemical Analysis are provided in Appendix A. For the calibrated dates 2 sigma calibration (95% probability) was used.

Table 8.1. Results of Radiocarbon Analyses for Features A-E 5GF1185.

Feature	Conventional Age	Calibrated Age (2 sigma calibration)
Thermal Feature A	1970±40 BP	CAL 50 BC - AD 125
Thermal Feature B	1560±40 BP	CAL AD 410-580
Thermal Feature C	1900±40 BP	CAL AD 20-220
Thermal Feature D	2300±40 BP	CAL 420-210 BC
Thermal Feature E	2530±40 BP	CAL 800-540 BC

The results of the radiometric analyses of the charcoal samples from each of the five thermal features exposed in the walls of the pipeline trenches revealed occupations dating primarily from the Late Archaic Era (Thermal Features A, C, D, and E) as well as from the Formative Era (Thermal Feature B). Although, as would be anticipated, the oldest of the hearth feature–Feature E–is also the most deeply buried, and the youngest – Feature B – is the closest to the present ground surface, the depths of the remaining three features do not correlate to their respective ages as conveniently. However, given the likely variations of the present ground surface due to site formation processes and the unknown level of the original ground surface, the depths of Features A, C, and D are not so irregular as to be considered aberrant in any way. Section 9.3 of this report presents a detailed description of the site formation processes.

The radiocarbon dates of the five features are comparable to those received from the excavations at Battlement Mesa Community. The oldest feature, Thermal Feature E, dates to approximately the same age as the youngest feature at site 5GF126. Thermal Feature D dates to about the same period as a slab-lined cooking feature found at 5GF125. Two of the dates – those from Thermal Features A and C – fit into approximately the same occupational period as 5GF127. Importantly, Thermal Feature B's date is comparable to that of Battlement Mesa site 5GF128, from which artifacts were recovered that are diagnostic of the early Fremont Culture.

Accordingly, based on the findings from the monitor of the waterlines, the site's previous evaluation of eligible for listing on the NRHP was confirmed. Also, the surface disturbing activities revealed additional subsurface cultural manifestations and expanded the site boundary.

9.0 REPORT OF FINDINGS – ARCHAEOLOGICAL MONITOR OF THE RILEY GULCH FRAC PAD

During the frac pad monitoring phase of the project, a series of 20 features (Figure 9.1) were exposed and documented: 19 thermal features plus a concentration of horse bones (designated Feature 1). A review of the results has determined that five of the charcoal/ash features were likely non-cultural, but important as environmental indicators of wildfire that swept the drainage bottom. These include Features 5, 7, 10, 12, and 16, of which all but Feature 5 were radiocarbon dated. Those that were determined to be cultural features, as with those discovered during the trenching operations in March of 2014, are being considered as an extension of previously recorded site 5GF1185, the Riley Gulch Rockshelter.

Feature 9, which is situated at the northwestern edge of the pad, evolved into a series of house or "living" floors and is designated as the "Feature 9 Locus." Four of the individual thermal features (13, 17, 18, and 19) are immediately adjacent to the house floors, and have been included in the "Feature 9 Locus" description (Section 9.2).

The remaining thermal features – Features 2 through 12, and 14 through 16 – were distributed throughout the frac pad construction area in two roughly defined clusters: Features 2 through 5, 15 and 16 are in the northern half of the pad (Features 5 and 16 are situated relatively near the eastern edge of the Feature 9 Locus). Features 6 through 8, 10 through 12, and 14 are in a notably tight cluster at the extreme south end of the pad, and relatively near the five thermal features that were uncovered during the previous pipeline trench construction that passes along the southern edge of the pad (Conner 2014).

9.1 Thermal Feature Descriptions

The thermal features recovered during the frac pad monitor, which varied somewhat in nature and design, range in age from approximately 2200 to 5000 years, spanning the time from the Middle Archaic through the early Formative periods. For a majority of the individual

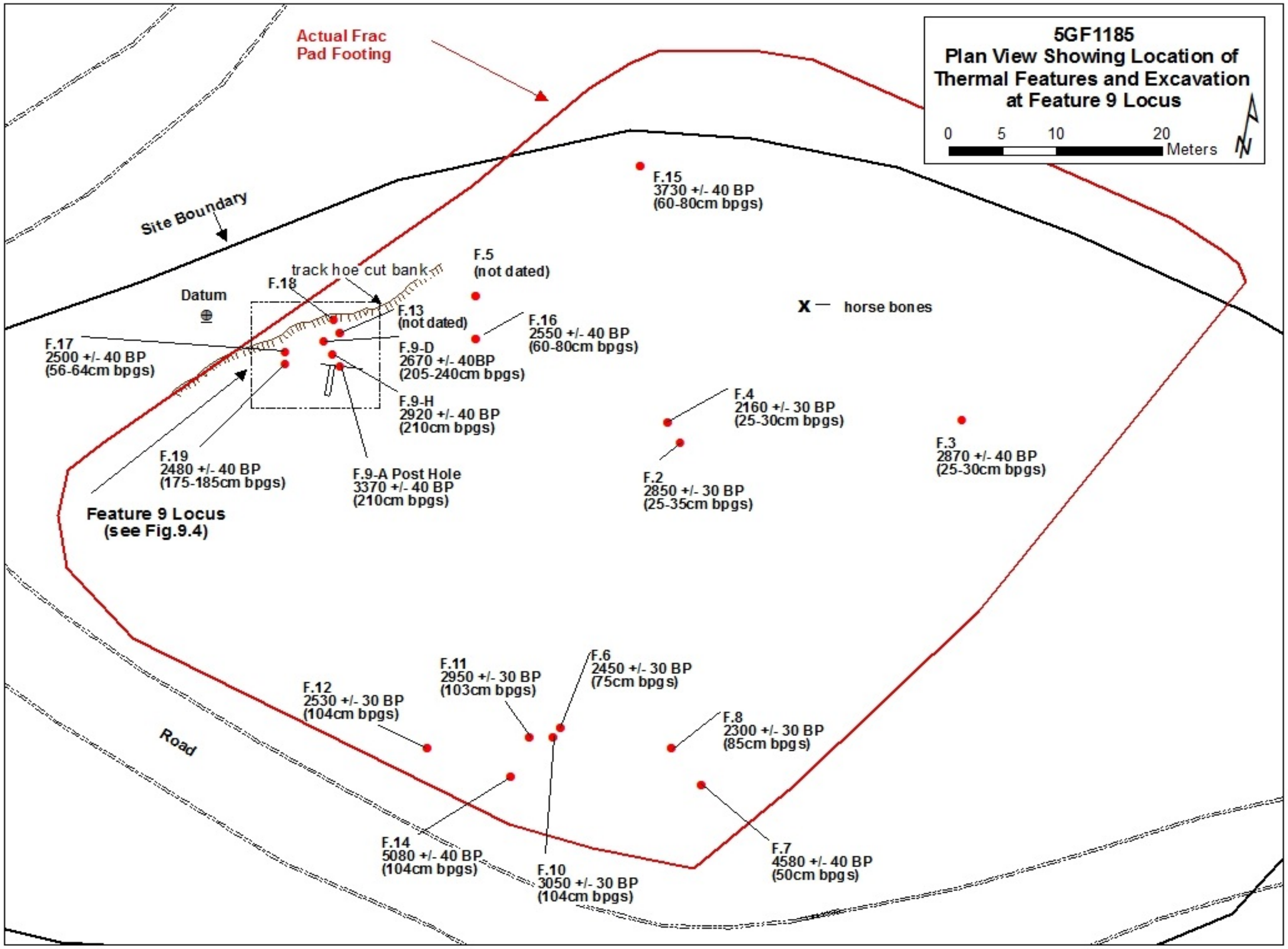

Figure 9.1. Plan view of thermal and structural features recovered during the Riley Gulch Frac Pad Monitor project.

features, their depths below the present ground surface (pgs) were estimated, because the ground surface had typically been removed by heavy equipment by the time they were exposed. However, an effort was made by the monitoring crew to ascertain those depths based on nearby undisturbed remnants of the pgs. The depths of the individual features do not correlate well with their ages, as they do not strictly follow a pattern of oldest dates occurring in the most deeply buried contexts. This is reflective of the significant amount of alluvial mixing that has occurred, and is still in process, at the mouth of Riley Gulch where repeated episodes of deposition and erosion have been taking place for millennia. A discussion of the site formation processes and alluvial depositional sequences of the site area is presented in Section 9.3.

Feature 1 is a concentration of modern horse bones. They were determined to be non-significant.

Feature 2 consists of an amorphous lens of ash and charcoal that appears to represent the remnants of the base of a deflated hearth at a depth of approximately 25-35cm below the present, pre-construction, ground surface. Upon being exposed by a bulldozer ripper, the feature measured 59cm north-south by 44cm east-west and up to 5cm in depth – after an undetermined amount of the upper portion of the feature had been removed by the dozer disturbance (Plate 9.1). A substantial amount of charcoal remained *in situ* within the feature fill, in addition to approximately 250 grams of thermally-blackened sandstone fragments. The sandstone had been notably shattered by the impact of the earth-moving equipment and it appears possible that all of the fragments had originally consisted of two sandstone clasts. No other cultural remains were recovered nearby or within the feature fill. A radiocarbon analysis of the charcoal from Feature 2 resulted in a conventional date of 2850±30BP.

Plate 9.1. Feature 2, plan view of ash stain after exposure by bulldozer. Scale is 10cm and north is at the top. Note tread indentations from dozer track.

Feature 3 consists of a deflated, rock-filled thermal feature that was damaged by the impact of a bulldozer blade at a depth of approximately 25-30cm below the present, pre-construction, ground surface. The remnants of the apparent hearth measured 31cm east-west by 19cm north-south and up to 3cm in depth–after an undetermined amount of the upper portion of the feature had been removed by the dozer disturbance (Plate 9.2). A moderate amount of charcoal and ash remained *in situ* within the feature fill, in addition to a number of cobble-sized sandstone clasts. No other cultural remains were recovered nearby or within the feature fill. A radiocarbon analysis of the charcoal from Feature 3 resulted in a conventional date of 2870±40BP.

Plate 9.2. Feature 3, plan view of thermal feature after impact from bulldozer blade. Scale is 10cm and north is at the top.

Feature 4 is a lens of ashy soil and charcoal that appears to represent the bottom of a basin-shaped hearth that was exposed by a bulldozer cut at a depth of approximately 25-30cm below the present, pre-construction, ground surface. The circular feature measured 60cm in diameter and up to 5.5cm in depth – after an undetermined amount of the upper portion of the feature had been removed by the dozer disturbance (Figure 9.2, Plates 9.3 and 9.4). A moderate amount of charcoal and ash remained *in situ* within the feature fill, in addition to several cobble-sized sandstone clasts along the interior perimeter of the feature as well as one that is situated 35cm to the north. No other cultural remains were recovered nearby or within the feature fill. A radiocarbon analysis of the charcoal from Feature 4 resulted in a conventional date of 2160±30BP – the most recent date recovered from any of the thermal features on this project.

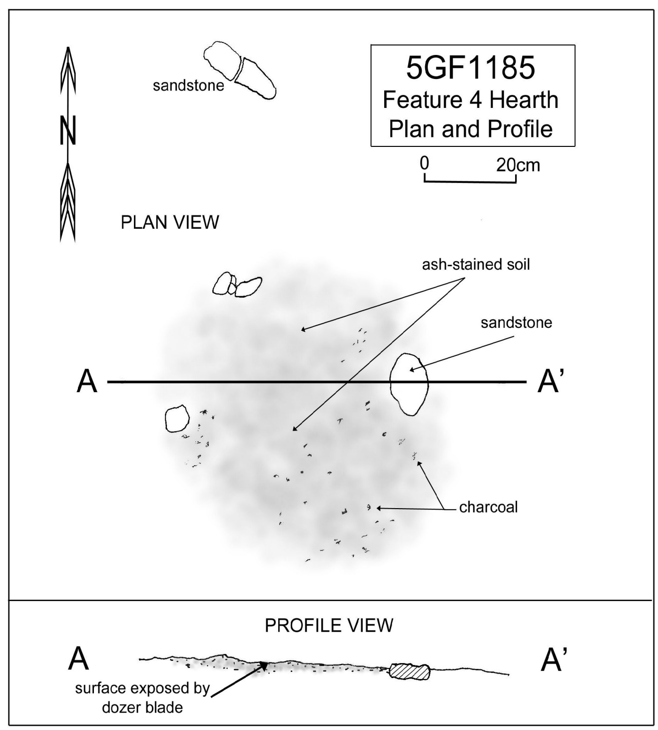

Figure 9.2. Feature 4 plan and profile.

Plate 9.3. Feature 4, plan view of apparent base of basin-shaped hearth after impact from bulldozer blade Scale is 10cm and north is at the top. Note tread indentations from dozer track.

Plate 9.4. Feature 4, profile view of apparent base of basin-shaped hearth after impact from bulldozer blade. Scale is 10cm, view is south. Note rocks pedestaled in excavated portion of feature in foreground.

Feature 5 consists of a small, amorphous concentration of ashy soil that possibly represents the remnants of a natural burn at a depth of approximately 50-90cm below the present, pre-construction, ground surface. Upon being exposed by a bulldozer ripper, the feature measured 37cm east-west by 28cm north-south and up to 3cm in depth (Plate 9.5). Virtually no charcoal remained within the ashy fill, nor were there any associated rocks or evidence of *in situ* thermally-altered soil. No collections were made at the feature and no other cultural remains were recovered nearby or within the feature fill.

Plate 9.5. Feature 5, 3/4 view of ash concentration after impact by dozer ripper. Scale is 10cm, view is west.

Feature 6 is the most intact of all of the thermal features recovered during the project, outside of the Feature 9 Locus–approximately 80% of the fill remained intact after having been exposed by the blade of the bulldozer. It consists of a basin-shaped hearth at a depth of approximately 75cm to 90cm below the present, pre-construction, ground surface. The northern-most portion of the hearth was removed by the pass of the bulldozer, exposing the feature in profile. As a result, virtually none of the upper portion was lost due to construction activities.

Upon excavation, the circular feature measured 56cm in diameter and up to 16cm in depth (Plates 9.6 and 9.7 and Figure 9.3). The feature fill consisted of ashy soil with a moderate amount of charcoal remaining *in situ*, primarily concentrated near the base of the hearth. Four cobble-sized sandstone clasts rested within the ashy fill of the hearth, quite obviously having been intentionally placed there by the feature's architect. These stones were configured in a roughly rectangular arrangement, and conceivably could have served as a "rest" for a comal over the hot coals of a cooking fire. No other cultural remains were recovered nearby or within the feature fill.

Plate 9.6. Feature 6, plan view of basin-shaped hearth after impact from bull-dozer blade. Scale is 5cm and south is at the top. Note the four rocks placed in hearth fill.

Plate 9.7. Feature 6, profile view of basin-shaped hearth. Scale is 5cm and view is south.

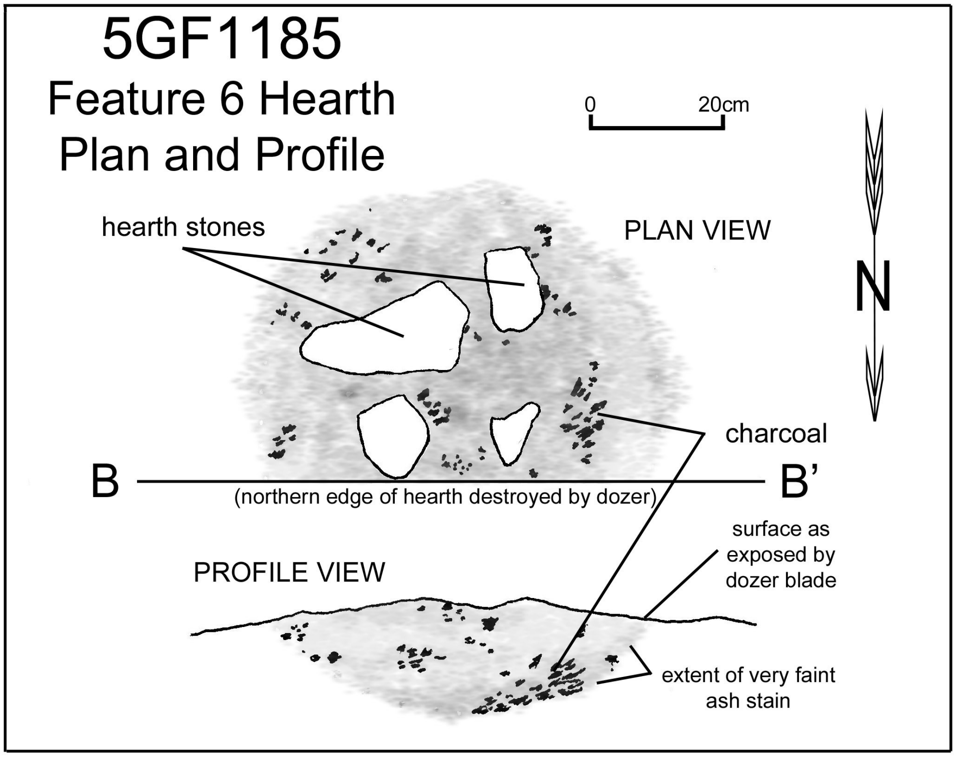

Figure 9.3. Plan and profile views of Feature 6.

Approximately 2.5 gallons (5.9kg) of feature fill was collected and dry-screened through a series of soil sieves (4.75mm, 2mm, and 1mm) in order to isolate any pertinent floral, faunal, or artifactual materials. All screened fill was subsequently examined under magnification. The materials from the finest screen (1mm) were also processed as a flotation sample. The charcoal fragments were identified as *Artemisia* (sagebrush), a carbonized *Amaranth* seed, and mineralized *Typhus* (cattail) leaf fragments, likely present as a result of intentional cultural choices. A radiocarbon analysis of the charcoal from Feature 6 resulted in a conventional date of 2450±30BP.

Feature 7 consists of a pair of adjacent, amorphous concentrations of ashy soil that possibly represent the remnants of a cultural thermal feature at a depth of approximately 50cm below the present, pre-construction, ground surface. Upon being exposed by a bulldozer blade, the feature measured 77cm northeast-southwest by 37cm northwest-southeast but no more than 2cm to 3cm in depth (Plate 9.8). A minimal amount of charcoal remained within the ashy fill and there were no associated rocks or other cultural materials. The soil surrounding the feature was oxidized, providing evidence of *in situ* thermal alteration. A small amount of charcoal was collected from the feature fill and radiocarbon analysis resulted in a conventional date of 4580±40BP. Based on the configuration of this feature and lack of associated cultural materials, it was deemed to be the result of a natural burn.

Plate 9.8. Feature 7, pair of adjacent, amorphous concentrations of ashy soil after being exposed by bulldozer blade. Scale is 10cm and view is south.

Feature 8 is an ovate lens of ashy, pebbly soil and charcoal that appears to represent the bottom of a basin-shaped hearth that was significantly damaged by a bulldozer cut at a depth of approximately 85cm below the present, pre-construction, ground surface. The feature measured 24cm northeast-southwest by 30cm northwest-southeast and up to 1.8cm in depth–after an undetermined amount of the upper portion of the feature had been removed by the dozer disturbance (Plates 9.9 and 9.10). A moderate amount of charcoal and ash remained *in situ* within the sandy, pebbly feature fill, and the soil in contact with the ash lens was notably darker than that of the surrounding soil, possibly as a result of thermal alteration. No rocks or other cultural remains were noted within or near the feature. A radiocarbon analysis of the charcoal from Feature 8 resulted in a conventional date of 2300±30BP.

Plate 9.9. Feature 8, plan view of lens of ash and charcoal after significant damage by bulldozer. Scale is 5cm and north is to the top.

Plate 9.10. Feature 8, looking west at shallow basin of ash, charcoal and pebbly soil. Scale is 5cm.

Feature 9. Construction activities at the extreme northwest corner of the frac pad exposed an area of ash, charcoal, and oxidized sandstone clasts which proved to be of a much greater horizontal extent than that typically represented by a hearth and, consequently, expanded excavation was initiated at what became a concentrated locus of thermal features (including Features 17, 18, and 19) and apparent house floors. The descriptions of the findings at the Feature 9 Locus are discussed in section 9.2.

Feature 10, is a small, amorphous concentration of ashy soil and small charcoal flecks and fragments that possibly represents the remnants of a natural burn at a depth of 104cm below the present, pre-construction, ground surface. Upon being exposed by a bulldozer ripper, the feature measured 27cm in diameter and up to 4.5cm in depth (Plate 9.11). An 892 gram sample of feature fill was collected, dry-screened in the lab, and examined under magnification, with negative results. Charcoal from the fill of Feature 10 was processed as a radiocarbon sample, which produced a conventional date of 3050±30BP. No other cultural remains were recovered nearby or within the feature fill.

Plate 9.11. Feature 10, plan view of amorphous concentration of ash, charcoal. Scale is 5cm, west is at top.

Feature 11 is a roughly circular concentration of slightly ashy soil with relatively large fragments of charcoal (up to 8mm) imbedded in otherwise "sterile" soil (identical to that of the surrounding deposits). It likely represents the extreme bottommost margin of a hearth that was almost completely destroyed by a bulldozer cut. It is at a depth of 103cm below the present, pre-construction, ground surface. What remains of the feature measured 25cm north-south by 19cm east-west with virtually no depth to the feature greater than the diameter of the charcoal fragments themselves–less than 1cm (Plate 9.12). No rocks or other cultural remains were noted within or near the feature. A radiocarbon analysis of the charcoal from Feature 11 resulted in a conventional date of 2950±30BP.

Plate 9.12. Feature 11, plan view of feature hearth base after being nearly destroyed by bull-dozer blade Scale is 10cm, east-northeast is at the top.

Feature 12, is a relatively large amorphous concentration of ashy soil and small charcoal flecks and fragments that possibly represents the remnants of a natural burn, at a depth of 104cm below the present, pre-construction, ground surface. Upon excavation the feature measured 130cm north-south by 104cm east-west and up to 2.5cm in depth (Plate 9.13). Charcoal from the fill of Feature 12 was processed as a radiocarbon sample, which produced a conventional date of 2530±30BP. No other cultural remains were recovered nearby or within the feature fill.

Plate 9.13. Feature 12, plan view ashy soil. Scale is 25cm, north is at the top.

Feature 13 consisted of a concentration of dark ashy soil and charcoal with pebble to small cobble-sized fragments of sandstone found entirely within the bucket of a tracked excavator (trackhoe) as it was clearing the overburden from above the complex of cultural materials at the Feature 9 Locus. Although no details of the feature could be reconstructed from the completely disturbed remains in the bucket, it is quite definite that the charcoal, ash, and rocks came from a cultural thermal feature that had originally existed at a depth of approximately 125cm to 145cm below the present, pre-construction, ground surface near the northwestern edge of the frac pad.

Feature 14 is a basin-shaped hearth that was exposed by a bulldozer cut at a depth of 104cm below the present, pre-construction, ground surface. The ovate feature measured 46cm east-west by 30cm north-south by 14cm in depth and the fill consisted of lightly ash-stained soil with sparse but substantial charcoal flecks and fragments. It does not appear that a significant amount of the upper portion of the feature had been removed by the dozer disturbance (Plate 9.14). Two oxidized, cobble-sized sandstone clasts were found imbedded in the eastern portion of the feature fill, measuring 7.2 x 7.0 x 5.5cm and 6.0 x 5.4 x 2.3cm. No other cultural remains were recovered nearby or within the feature. A 645 gram sample was collected from the west half of the fill, however it produced nothing in the way of floral, faunal, or artifactual materials other than the charcoal itself, which has been identified as *Artemisia* (sagebrush). A radiocarbon analysis of the charcoal from Feature 14 resulted in a conventional date of 5080±40BP – the oldest date recovered from any of the thermal features on the project.

Plate 9.14. Feature 14, 3/4 view of basin shaped hearth after having been profiled through middle. Note the two oxidized cobbles found in the east half of the feature. Scale is 10cm, view is west.

Feature 15, is a small, amorphous concentration of ashy soil with a few small charcoal flecks and fragments that possibly represents the remnants of a cultural thermal feature at a depth of 60-80cm below the present, pre-construction, ground surface. Upon being exposed by a bulldozer ripper, the feature measured 21cm in diameter and 11cm in depth (Plate 9.15). A 336 gram sample of the feature fill was collected from the northwest portion of the ashy spoil, which was dry-screened in the lab and examined under magnification, with negative results. A small amount of charcoal from the fill of Feature 15 was processed as a radiocarbon sample, which produced a conventional date of 3730±40BP. No other cultural remains were recovered nearby or within the feature fill.

Plate 9.15. Feature 15, 3/4 view of ash concentration after having been profiled. Scale is 10cm, view is northwest.

Feature 16 consists of an amorphous concentration of ashy soil and charcoal that possibly represents the remnants of a cultural thermal feature at a depth of approximately 60-80cm below the present, pre-construction, ground surface. Upon being exposed by a bulldozer blade–it appears as if at least 90% of the feature was destroyed – the feature measured 50cm north-south by 30cm east-west and 5cm to 7cm in depth (Plate 9.16). Although a number of small, randomly scattered, sandstone pebbles were present within the feature fill, the feature is apparently the remains of a natural burn. A 750 gram soil sample was collected from the north half of the fill, however it produced nothing in the way of floral, faunal, or artifactual materials other than the charcoal itself. No other cultural materials were found within or near the feature. Charcoal was collected from the feature fill and radiocarbon analysis resulted in a conventional date of 2550±40BP.

Plate 9.16. Feature 16, plan view of ash concentration. Scale is 10cm, view is north.

Features 17, 18, and 19. Construction activities at the extreme northwest corner of the frac pad exposed an area of ash, charcoal, and oxidized sandstone clasts–Feature 9–which proved to be of a much greater horizontal extent than that typically represented by a hearth and, consequently, expanded excavation was initiated at what became a concentrated locus of thermal features (including Features 17, 18, and 19) and apparent house floors. The descriptions of the findings at the Feature 9 Locus are discussed in the following section.

9.2 Structural Feature Descriptions (Feature 9 - Locus)

As noted above, construction activities at the extreme northwest corner of the frac pad exposed an area of deeply-buried ash, charcoal, and oxidized sandstone clasts that extended to the edge of the existing pad disturbance – Feature 9. A WPX project trackhoe was employed for the removal of approximately two vertical meters of overburden at the location in order to facilitate the archaeological investigation of the area for the purpose of further defining the horizontal and vertical nature and extent of the cultural deposits. A mapping datum (Vertical Datum) was established 135cm below the present ground surface (pgs) at a point on the cut bank. Although prior to removal by the track hoe the pgs had sloped gradually to the south-southeast above the entire Feature 9 Locus, the slope accounted for no more than a few centimeters of elevation loss between the Vertical Datum and the southeastern edge of the locus. The Mapping Datum at the eastern edge of the Feature 9 Locus excavations is 70cm below Vertical Datum (approximately 205cm below pgs) and 220cm below the elevation of the permanent Site Datum, which is located 15m to the west-northwest at an angle of 292° Azimuth.

The expanded excavation disclosed a concentrated locus of thermal features and an apparent house floor. The entire complex of cultural features was designated as the Feature 9 Locus, and includes individual thermal Features 17, 18, and 19. Five sub-features within Feature 9 itself, Sub-features 9-A through 9-E were exposed and documented at a depth of 217 to 225cm below the present ground surface that define a semi-circular arrangement measuring approximately three meters in diameter—apparently the perimeter of a prehistoric house or habitation floor (Figure 9.4). These sub-features consist of three apparent post holes indicating the locations where the bases of wooden superstructure framework posts once rested, a side-by-side pair of river cobble manos and a slab metate fragment among a concentration of relatively large sandstone clasts and small boulders, and a slab-lined shallow basin.

A series of three distinct levels of cultural ash and charcoal, designated as Sub-feature Levels 9-F, 9-G, and 9-H, were exposed in the walls of two contiguous 40cm-deep test trenches (Test Trenches 1 and 2) that were excavated north-south through Feature 9 (Figure 9.5). Excavation of individual 1 meter square grid units was then initiated in an effort to further define the extent and nature of the uppermost of the cultural layers exposed in Test Trench 1 (Sub-feature 9-F). Additional excavation is proposed to the east and west of the existing grid units in an attempt to further define habitation level Sub-feature 9-F. It is anticipated that additional sub-features will be encountered in these explorations which will complete the delineation of the apparent circular house floor.

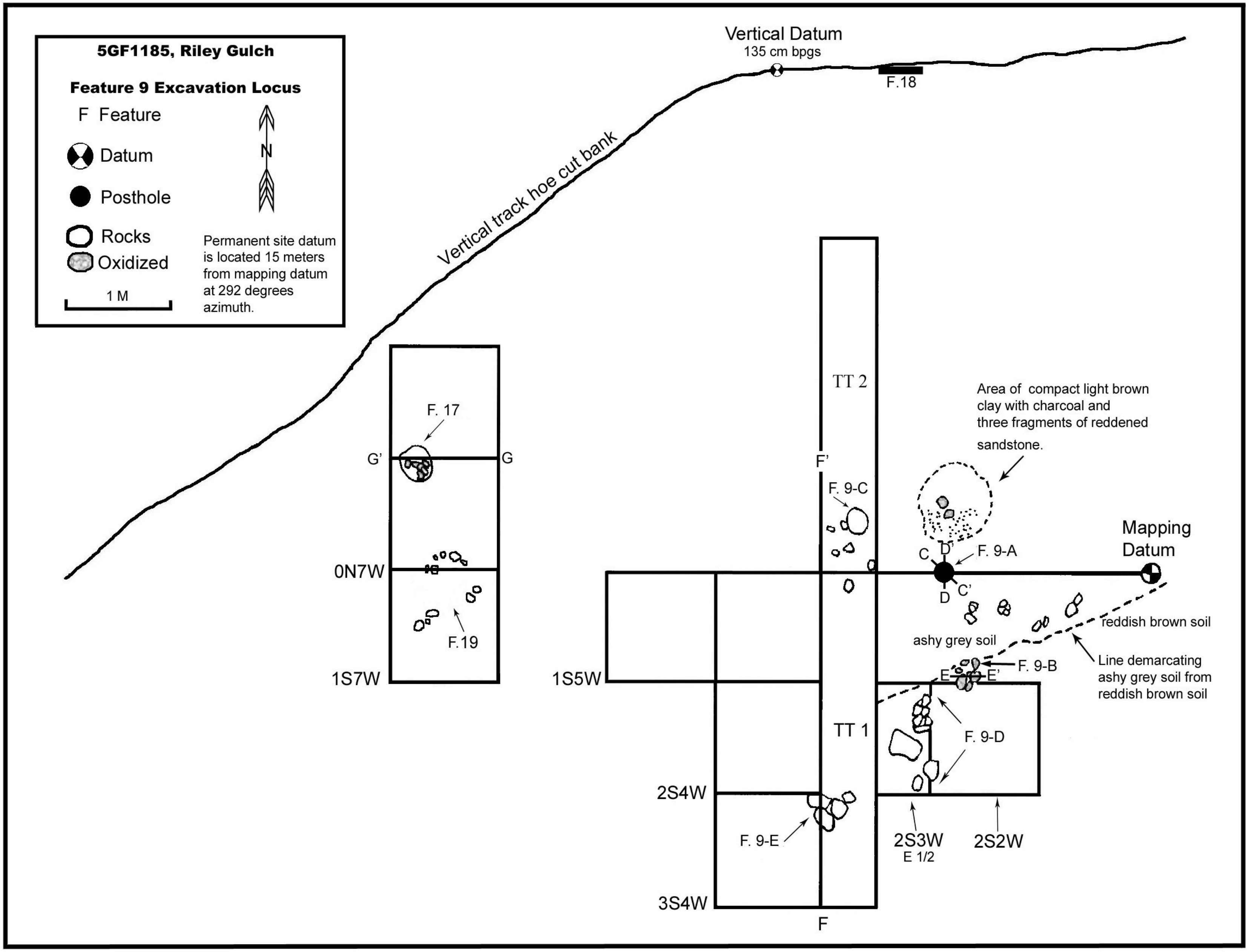

Figure 9.4. Excavation units and features at the Feature 9 Locus.

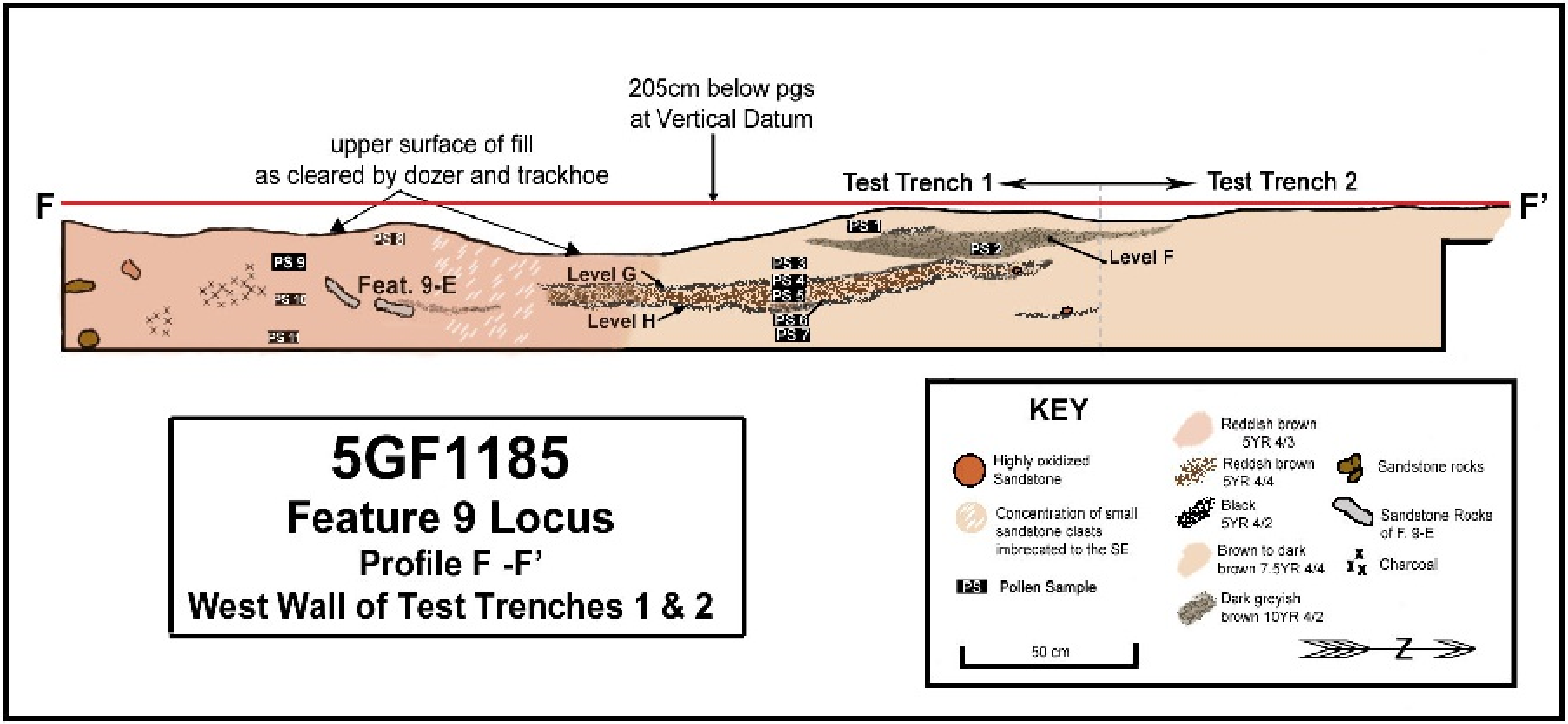

Figure 9.5. Profile F-F', West wall of Test Trench 1 and the southern portion of Test Trench 2 at the Feature 9 Locus.

Four to five meters to the west-northwest of the exposed sub-features of Feature 9, and likely associated, two additional features were exposed and documented: Feature 17, a small basin-shaped hearth, and Feature 19, a circular arrangement of un-oxidized sandstone clasts. Another separate thermal feature, Feature 18, was discovered exposed in the profile of the track hoe cut approximately four meters to the north of Sub-feature 9-C, however, due to the fact that it is notably higher in the alluvial fill, it is considered to be from a more recent occupation. Descriptions of Features 17 through 19 are presented below, after the discussion of the Feature 9 sub-features.

Scant but definitively cultural lithic debitage has been recovered from all levels and most loci within the Feature 9 Locus. As artifactual materials have been encountered to the deepest levels of Test Trench 1, it is also anticipated that additional cultural deposits exist at greater depths than what has been currently exposed.

Radiocarbon, pollen, macro-botanical, and invertebrate (mollusk) samples were also collected. Fourteen radiocarbon (charcoal) samples from the thermal features within the frac pad, including three (9-A, 9-D and 9-H) from Feature 9, were submitted to International Chemical Analysis, Inc. for analysis and dating. The results of this analysis are presented in Table 9.3. The results of the palynological analysis is presented in report section 9.5.2.

Upon the initial exposure of Feature 9, a disconformity was noted in the form of a line of demarcation dividing the ash-stained soils of the feature to the northwest and an area of reddish-brown soil to the southeast (Figure 9.4). Initially, this was interpreted as the possible southeastern edge of the house floor, however, additional excavation determined this delineation to reflect the northwestern limit of a natural erosional (flood) episode that had cut into the ashy cultural fill.

Sub-feature 9-A is quite evidently a post hole. In plan view it is a roughly circular hole measuring 17.5cm x 18.5cm in diameter at the upper surface and it is 17cm in depth (Plate 9.17 and Figure 9.6). The unconsolidated and unstratified fill within the post hole consisted of gray ash and occasional charcoal fragments – likely remnants of a burned post, as contrasted to the surrounding soil of very compact sandy clay and sub-rounded, pebble-sized sandstone fragments. The sides of the hole constrict slightly towards the base. Charcoal was collected from the feature fill and radiocarbon analysis resulted in a conventional date of 3350±40BC. Interestingly, another sample of charcoal from nearby and at the same depth in Feature 9 produced a notably more recent conventional date of 2670±40BP.

Just to the north of Sub-feature 9-A was a roughly circular, 70cm diameter area of compact, light-brown clay with scattered flecks of charcoal and three small fragments of reddened sandstone. Although it did not give the impression of being an *in situ* cultural feature *per se*, the feature was added to the Locus 9 plan map (Figure 9.4).

Sub-feature 9-B, situated 80cm to the south-southeast of 9-A, appears to be another post hole, although notably different in design. Rather than a simple, ash-filled hole excavated

Plate 9.17. Sub-feature 9-A, post hole after excavation, view north.

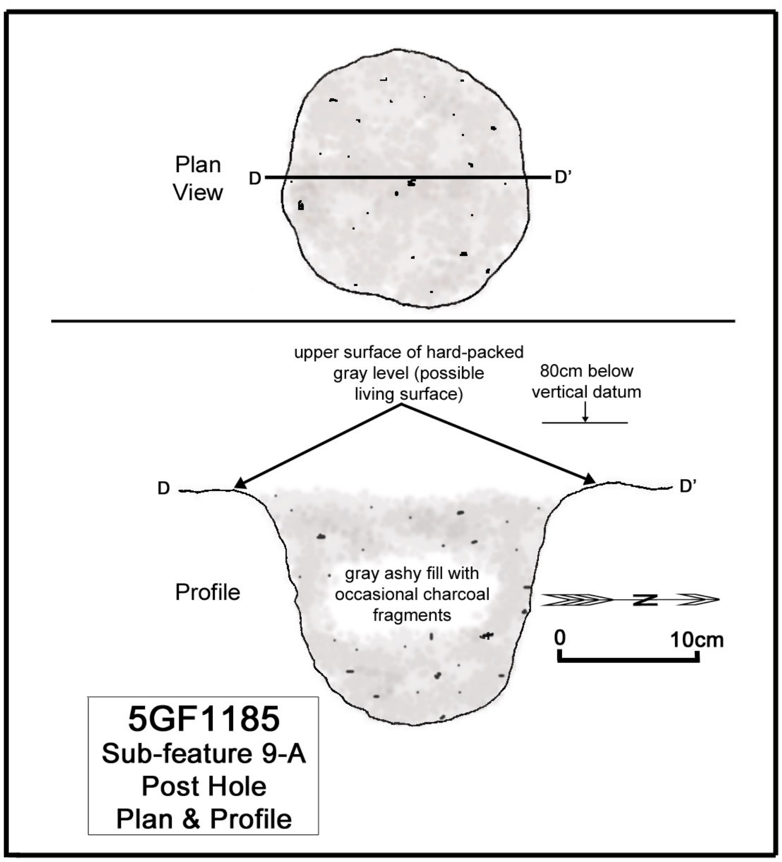

Figure 9.6. Sub-feature 9-A, post hole, plan and profile views.

into the soil, this feature consists of a tightly-packed, 29cm diameter circular concentration of 15 sandstone clasts that rest directly on the reddish-brown alluvium, immediately to the southeast of the disconformity mentioned above (Plate 9.18 and Figure 9.7). The clasts range in size from 3 x 2 x 0.5cm to 7 x 9 x 10cm. The interpretation of the feature, particularly when taking into account its position on the arc of other sub-features that appear to define the exterior circumference of a circular house floor, is that it is the remnant of a rock-filled base, or foundation, within a post hole.

Plate 9.18. Sub-feature 9-B plan view, concentration of sandstone clasts – a possible post hole. Scale is 10cm and north-northwest is at the top.

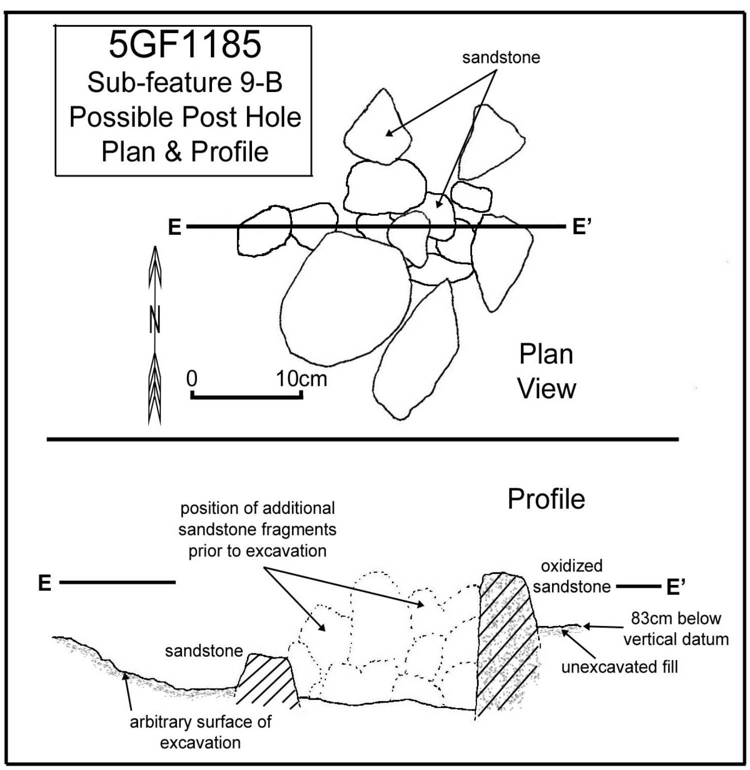

Figure 9.7. Sub-feature 9-B, possible post hole.

Sub-feature 9-C, 80cm to the northwest of Sub-feature 9-A, is a 9cm diameter circular disconformity in the alluvial fill that consists of a very hard-packed, light gray, pebbly lens surrounded by noticeably darker gray soil. Two areas of the soil that have oxidized to a reddish-brown color exist on the exterior of the lens to the north and south–possibly the result of a burned post (Plate 9.19). It would be difficult to interpret Sub-feature 9-C as an isolated feature, however, again, it is directly on the semi-circular arc of other sub-features and has been interpreted as the base of another post hole.

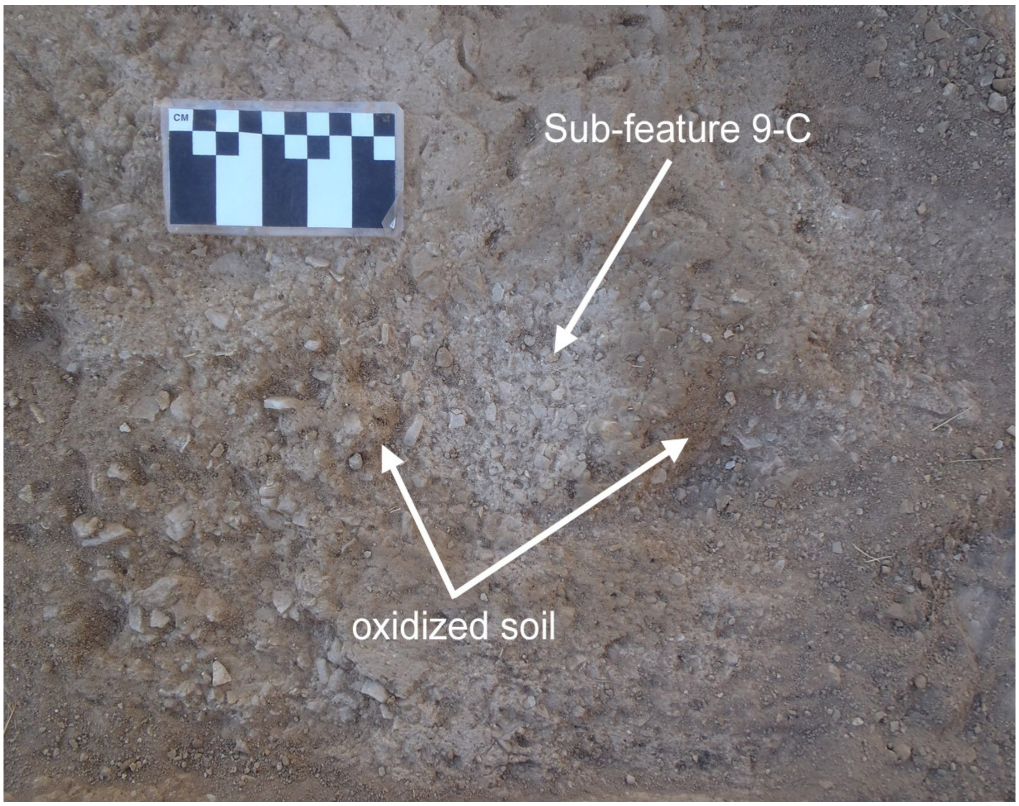

Plate 9.19. Sub-feature 9-C, apparent post hole. Scale is 10cm and west is at the top. Note the two areas of oxidation on either side of the gray soil.

Sub-feature 9-D is a concentration of unmodified sandstone clasts and groundstone artifacts–also in line with the semi-circle of sub-features that appear to define the perimeter of a domicile (Plate 9.20). The entire grouping of rocks and artifacts within excavation units 2S3W (East ½) and 2S2W measures approximately 1.5m east-west by 1.0m north-south, however, it is possible that additional cultural materials remain *in situ* in adjacent, unexcavated, grid units. The artifacts directly associated with the sub-feature consist of two manos (FS91 and FS93), a metate fragment (FS92), and a large metate (FS96). These artifacts, and the results of the pollen analysis from their contexts, are described in the following sections.

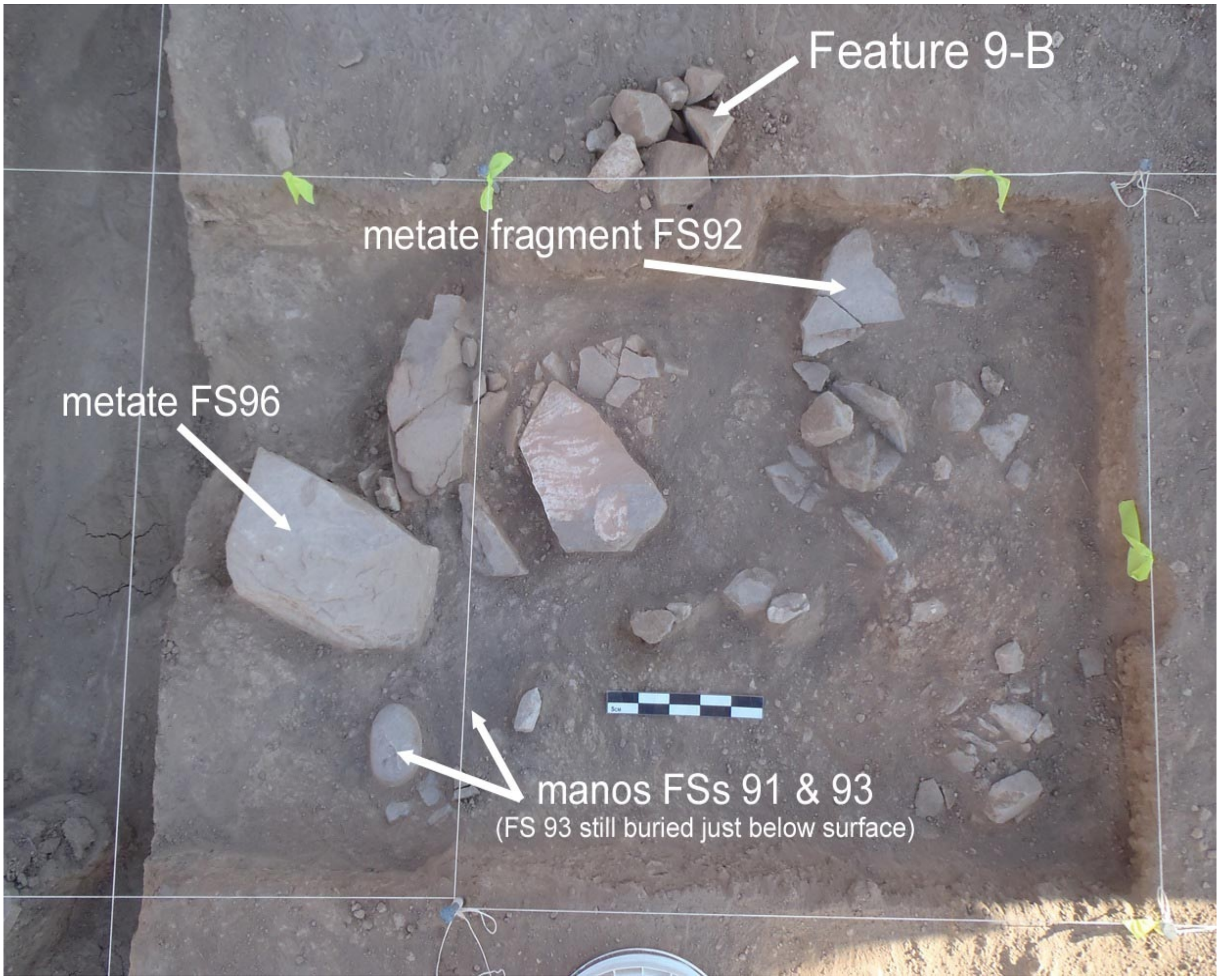

Plate 9.20. Sub-feature 9-D, concentration of sandstone clasts and groundstone artifacts within grid units 2S3W (East ½) and 2S2W. Scale is 25cm and north is at the top. Note Sub-feature 9-B.

Sub-feature 9-E, the southernmost of the features thus far encountered that make up the arc of Feature 9 sub-features, is another concentration of sandstone clasts situated near the south end of Test Trench 1. The sub-feature consists of four sandstone slabs arranged adjacent to each other so as to create a shallow, 18 x 20cm diameter, half-basin that is open to the north (Plate 9.21 and Figures 9.4 and 9.5). The slabs disappear into the unexcavated fill of unit 3S4W, and the sub-feature remains to be fully exposed. Although scattered charcoal fragments and small oxidized sandstone pebbles exist in the fill in the general area of the feature, there is no conclusive evidence of thermal activity or heating associated with 9-E, and the purpose of the "half-basin" remains undetermined. A support for an additional structural post base position is a possibility.

Plate 9.21. Sub-feature 9-E, 3/4 view looking south at remains of apparent basin-shaped, slab-lined feature within Test Trench 1. Scale is 10cm.

Sub-features 9-F through 9-H are levels of ash and charcoal that have been exposed in profile in the west wall of Test Trenches 1 and 2 that extend westward into unexcavated fill (Figure 9.5). The uppermost level, Sub-feature 9-F, has been further exposed horizontally by the excavation of the upper 10cm of excavation units 1S4W and 2S4W that exposed randomly dispersed ashy soil with occasional flecks and fragments of charcoal and small sandstone fragments, some of which exhibited thermal oxidation. It is this Level 9-F and, possibly, lower levels 9-G and 9-H that appear to be associated with the house structure Sub-features 9-A through 9-E.

As can be seen in the profile of these ash layers in Figure 9.5, it is apparent that they have been somewhat impacted by sequences of erosion and deposition since the occupation or occupations at Feature 9. The layers exhibit the characteristics of alluvial deposition in terms of their somewhat basin-shaped cross sections, in the fact that they slope slightly downhill to the south, and that they feather out at their southern edges and disappear entirely. The presence of moving water and sediment through the Feature 9 Locus, particularly in the southern portion, is graphically demonstrated at Sub-feature 9-E where a concentration of minute imbricated (layered) tabular sandstone pebbles were trapped in an eddy on the downslope (east-southeast) side of the feature stones, indicative of an east-southeasterly stream flow.

It was further demonstrated that stream flow during flood stage of Riley Gulch continues to move across what is now the exposed portion of Feature 9 by a flood episode in mid-September of 2014 when flood waters from Riley Gulch washed across the entire area of the frac pad, including the plastic-covered excavations at Feature 9 Locus, repositioning and depositing volumes of sediment in its wake (Plates 9.22 and 9.23).

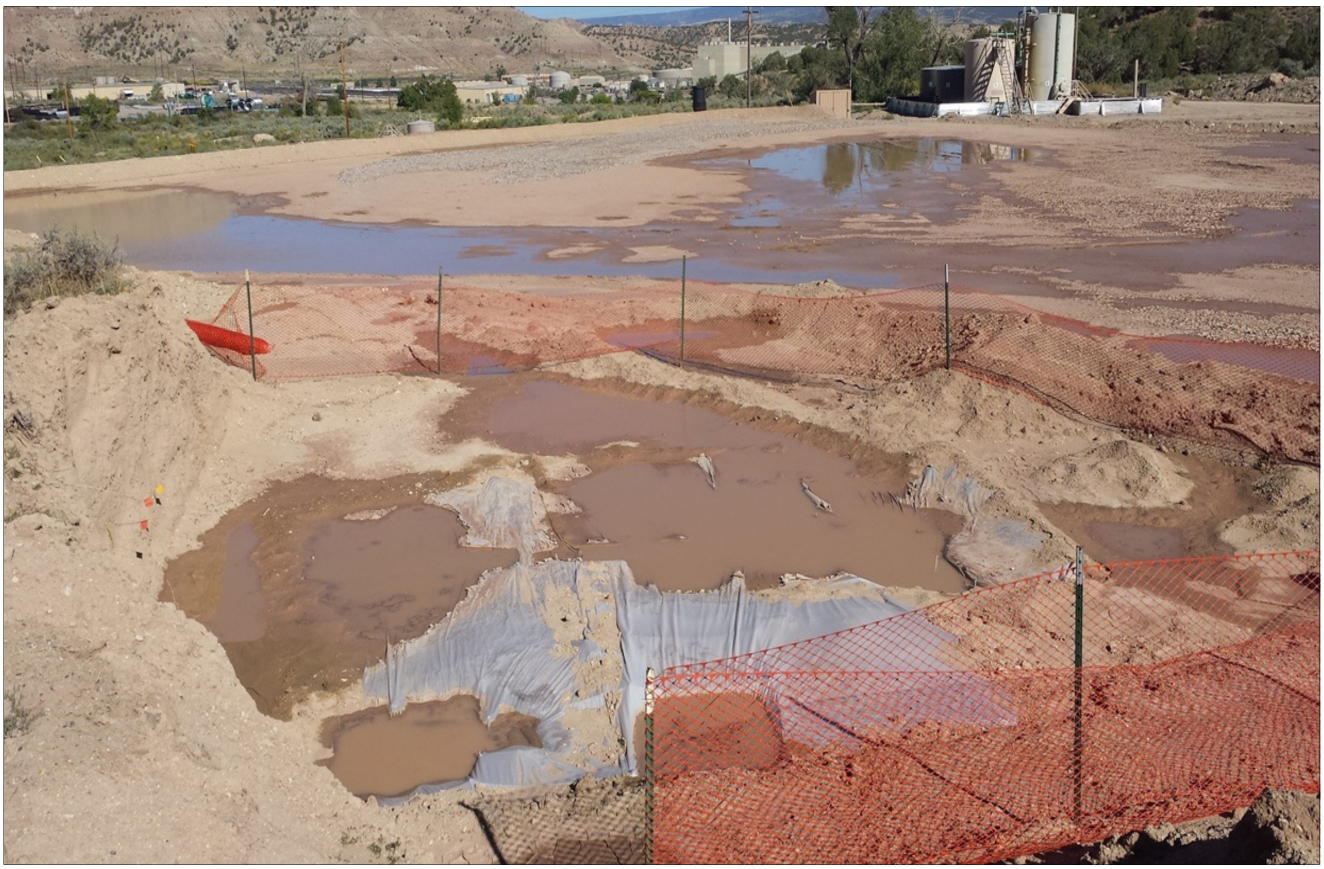

Plate 9.22. Feature 9 Locus, in foreground, and the Riley Gulch frac pad, in background, after flooding in September 2014, looking northeast. Note the plastic sheeting covering Feature 9 within the mesh barrier fencing.

Plate 9.23. Feature 9 Locus, within protective fence, and Riley Gulch, in background, after flooding in September 2014, looking southwest. The flood waters that deposit alluvium onto the site area, both in modern times and in antiquity, originate both from Riley Gulch and a ridge and unnamed drainage to the northwest–out of photo to the right.

Thermal Features 17, 18, and 19, although within what has been designated as the Feature 9 Locus, are somewhat separate spatially and have been assigned specific and discrete identifiers.

Feature 17 is an intact basin-shaped hearth located 4m west-northwest of Sub-feature 9-C at a depth of approximately 191 to 199cm below the present ground surface (56 to 64cm below Vertical Datum). Although the uppermost ash and charcoal was exposed by the bucket of the trackhoe, it is apparent that only 2 to 3cm of the upper extent of the eastern portion of the hearth was lost due to construction activities.

Upon excavation, the circular feature measured 33.5cm in diameter and 8.5cm in depth (Plates 9.24 and 9.25). The feature fill consisted of dense gray to dark gray ash with a moderate amount of charcoal interspersed without pattern throughout the basin. Approximately nine sandstone slabs and cobbles–ranging in size from 3 to 12.5cm in diameter– rested atop the ashy fill of the hearth, and four additional rocks were buried within the basin fill.

Plate 9.24. Feature 17, within the Feature 9 Locus, intact, rock-filled, basin-shaped hearth, after profiling. Note the dense ash and charcoal fill and *in situ* sandstone clasts. Scale is 10cm and 3/4 view is looking south.

Plate 9.25. Feature 17 plan view after excavation. The 10cm scale rests within the hearth basin. Note the sandstone clasts at upper left that were removed from within the hearth fill. South is at the top.

A total of 1628kg of feature fill was collected and dry-screened through a series of soil sieves (4.75mm, 2mm, and 1mm) in order to isolate any pertinent floral, faunal, or artifactual materials. All screened fill was subsequently examined under magnification. The materials from the finest screen (1mm) were also processed as a flotation sample. Charcoal from Feature 17 was collected, and identified as *Artemisia* (sagebrush) wood fragments. Radiocarbon analysis resulted in a conventional date of 2500±40BP.

Feature 18 was exposed in profile in the trackhoe cut bank that forms the northwestern edge of the frac pad. Although it is within the Feature 9 Locus, it was located at a depth of only 165cm below the present ground surface at that location and is undoubtedly from a much later habitation at the site, if it is, indeed, of cultural origin. As exposed in the cut bank, the feature consisted of a lens of ash and charcoal measuring approximately 35cm east-west. The excavation was curtailed before the exact nature and extent of the feature could be ascertained, and no charcoal or macrobotanical samples had yet been taken.

Feature 19, 1m south-southeast of hearth Feature 17, is a roughly circular arrangement of sandstone cobbles that measures 72cm east-west by 55cm north-south (Plate 9.26). The portion of the feature that is situated in grid unit 0N7W forms a precise semi-circle, however the stones to the south, in unit 1S7W are somewhat scattered. At least four of the stones in the northern, intact, part of the feature are placed so as to slope inwards towards the center of the circle. Although there was little in the way of ash or other evidence of thermal activity, several small fragments of charcoal were recovered from within the feature and radiocarbon analysis resulted in a conventional date of 2480±40BP. No other cultural remains were found in or near the rock circle.

Plate 9.26. Feature 19, within the Feature 9 Locus, circular rock arrangement plan view, within grid units 0N7W and 1S7W. Scale is 25cm and north is at the top.

9.3 Site Formation Processes and Depositional Characteristics

Pleistocene and Holocene age surface deposition is evident throughout Parachute Creek and Riley Gulch as alluvium, coalescing alluvial fans, talus, fluvial deposition, and slope and sheet wash. Sandstone bedrock boulders are present on alluvial slopes and talus slopes and slabs of sandstone occur intermittently on flood plains. The majority of these boulders are exposed and moved secondary to episodes of heavy, sudden flooding and the resultant landslides which occur frequently throughout the entire Parachute Creek drainage. Deeper sheet deposits, having occurred during warm, dry climatic periods (Huntington 1914), are weathered and altered by secondary processes (Miller and Nelson 2010) and this is evident at depth in trench walls exposed during the water pipeline trench construction during the monitor of an earlier project (Conner 2014). Aeolian processes are active and although surface aeolian deposition is present, it is thin and subject to deflation accruing only where there is adequate stored pore water with resultant vegetal growth that inhibits the deflation process.

Soil dynamics related to the archaeology at the project area are primarily alluvial originating from the productive Upper Green River Formation and are subject to the availability of water for formation of stacked sequences. Alluvium in Riley Gulch consists of unconsolidated silt and detritus, fine and coarse sand and the small to medium gravels that are located in and near streambeds. These deposits have long been subject to relocation due to the effects of torrential rainstorms that result in flooding and stream gain that is concentrated and localized by the smaller tertiary drainages within Riley Gulch. Over time, the Feature 9 Locus, and the frac pad area as a whole at site 5GF1185 have been significantly affected by these processes which originate from three sources: a major drainage, located in Riley Gulch proper and southwest of the project area, one lesser drainage to the WSW, and a nearby talus slope located immediately to the northwest of the excavation. Episodes of flooding and ongoing dissection, incision and avulsion within the major drainage has resulted in repeated deposition of these reworked sediments onto the open expanse of the project area.

The broad mouth of Riley Gulch significantly slowed flood waters allowing sediments to drop out and fan widely over the project area. The occurrence of a reddish brown soil abutting and cutting into the ashy grey cultural soil is clearly demarcated in the southeast quadrant of the Feature 9 Locus. The clear demarcation of these soils provides a convenient and visual demonstration of this depositional process (Figures 9.4 and 9.5). The minor WSW drainage functioned in much the same manner as the major drainage, however, due to a steeper grade it retained a more forceful ESE flow and deposited not only silty alluvium but coarser sands, clasts and small to medium sandstone cobbles. As evident in Sub-feature 9-E these clasts and smaller rocks are imbricated to the direction of flow. Sheetwash from the talus slope added to soil accumulation that covered the project area to depths ranging from 25cm to 240cm below present ground surface in a gradually expanding southeasterly flow as evidenced by appropriately imbricated sandstone clasts in Test Trenches 1 and 2. The combined and repeated occurrences of flooding and sheetwash from the two drainages and the talus slope have resulted in multidirectional sediment stacking and intertonguing of the sediments that comprise the WPX Frac Pad monitor area and the Feature 9 Locus.

9.4 Lithic Analyses

Scant but definitively cultural lithic artifacts were recovered from all levels and most loci within the Feature 9 Locus. The following sections on chipped and ground stone describe these finds.

9.4.1 Chipped Stone Analysis

Table 9.1 summarizes the analysis of the recovered artifactual material from the project. As can be seen in this tabulation, all artifactual materials were recovered from the Feature 9 Locus, with the exception of some of the ancillary collections as described in Section 9.5. This likely does not reflect a paucity of portable artifacts throughout the other areas of the frac pad, but rather the fact that a majority of the cultural fill within the Feature 9 Locus was excavated with trowel and whisk broom, whereas that elsewhere was excavated after near complete disturbance by heavy equipment. Although a certain amount of the soil surrounding, and within, each of the thermal features documented elsewhere on the pad was screened during the recovery process, it amounted to a small amount of fill compared with that processed at Feature 9. Appendix B contains a list of all collected artifacts, which will be returned to the private land owner or curated at a facility of WPX's choice.

No formal tools were recovered within the category of chipped stone and, somewhat surprisingly, only a small amount of debitage was found considering the volume of cultural fill that was excavated and screened – using 1/8" mesh hardware cloth shaker screens.

Two basic categories of tool stone material were recorded: brown chert (with one or two white specimens) and a mottled gray to dark gray – almost black–siltstone. The siltstone consisted of a rather low-grade, granular material, notably substandard as a tool stone when compared to the chert debitage that was found, as well as to many of the other raw materials known from other lithic sites in the region. As a result, the characteristic attributes that typify debitage created by intentional stone chipping or "flint knapping" were often masked by the granularity of the material and it was difficult in many cases to make a determination as to whether individual specimens were definitively the result of human activities or occurring naturally as non-cultural fragments and spalls. The "comment" column in Table 9.1 includes a notation for those items that have been interpreted as "possibly non-artifactual." Regarding the size of the flakes, "large" is defined as over 5cm in diameter, "medium" is between 5mm and 5cm, "small" is less than 5mm, and "micro" refers to very small pressure flakes typically 1mm to 5mm or smaller.

The vertical provenience of each specimen is presented as the depth below the Vertical Datum (bvd) at the locus, which was established on the vertical cut bank wall at the north edge of the locus (see Figure 9.4).

Table 9.1. Debitage from the Feature 9 Locus at 5GF1185

Chipped Stone Analysis							
FS#	**Provenience Within Locus**	**Depth below Vert. Datum (cm)**	**No. of items**	**Material/Color**	**Size/Cortex**	**Source**	**Comments**
18	Upper surface of exposed cultural fill	~70-80	1	Chert. White w/ black dendritic inclusions	Small interior		
23	Upper surface of exposed cultural fill, 1.9m SSE of Feat. 9-A	~70-80	1	Siltstone. Dark gray pebble frag	Medium primary	Parachute Creek Member/Upper Green River Formation (?)	Possibly non-cultural
24	Upper surface of exposed cultural fill, 1.8m S of Feat. 9-A	~70-80	1	Siltstone. Mottled gray	Medium secondary	Parachute Creek Member/Upper Green River Formation (?)	Minute unifacial utilization flakes along one straight edge. Heavy calcite patina on ventral surface.
25	Test Trench 1	78.5	1	Siltstone. Dark gray	Small interior	Parachute Creek Member/Upper Green River Formation (?)	
30	Test Trench 1	80-90	1	Siltstone. Dark gray	Small interior	Parachute Creek Member/Upper Green River Formation (?)	
31	Test Trench 1	90-100	1	Siltstone. Dark gray	Small interior	Parachute Creek Member/Upper Green River Formation (?)	Angular shatter. Probably non-artifactual

33	Test Trench 1, N ½	90-100	1	Chert. Mottled brown/gray	Small interior		
35	Test Trench 1, N ½	100-110	1	Chert. White broken pebble fragment	Microflake primary		Possibly non-artifactual
38	Test Trench 2, S ½	70-80	1	Chert. Brown	Microflake interior		
38	Test Trench 2, S ½	70-80	2	Siltstone. Dark gray	Microflake interior	Parachute Creek Member/Upper Green River Formation (?)	
42	Test Trench 2, S 1/3	~100	1	Chert. Brown cobble fragment	Large secondary		
46	Test Trench 1, S 1/3	100-110	1	Chert. Brown	Small interior		
59	1S4W	67	1	Siltstone. Dark gray	Medium interior	Parachute Creek Member/Upper Green River Formation (?)	Hinge fracture at distal end
72	3S4W (*in situ*, grid center)	71	1	Siltstone. Dark gray	Large interior	Parachute Creek Member/Upper Green River Formation (?)	Possible unifacial use flakes along one straight edge

72	3S4W	70-72	1	Siltstone. Dark gray	Medium primary	Parachute Creek Member/Upper Green River Formation (?)	Possibly non-artifactual
74	2S3W, E ½	90	1	Siltstone. Mottled gray	Medium primary	Parachute Creek Member/Upper Green River Formation (?)	Possibly non-artifactual
75	3S4W	70-80	2	Siltstone. Dark gray	Small interior	Parachute Creek Member/Upper Green River Formation (?)	Possibly non-artifactual
76	1S4W, Sub-feature 9-F	72	1	Siltstone. Gray	Small interior	Parachute Creek Member/Upper Green River Formation (?)	Possibly non-artifactual
81	1S4W, Sub-feature 9-F	60-70	1	Siltstone. Dark gray	Microflake interior	Parachute Creek Member/Upper Green River Formation (?)	
82	3S4W	70-80	1	Siltstone. Dark gray	Microflake interior	Parachute Creek Member/Upper Green River Formation (?)	

85	1S2W, Sub-feature 9-D	70-80	1	Siltstone. Dark gray	Microflake interior	Parachute Creek Member/Upper Green River Formation (?)	
87	1S2W, N ½	80-84	1	Chert. Mottled brown	Small interior		Biface thinning flake
89	3S4W	80-90	2	Chert. Mottled brown	Small interior		
89	3S4W	80-90	1	Siltstone. Dark gray	Medium primary	Parachute Creek Member/Upper Green River Formation (?)	
89	3S4W	80-90	1	Siltstone. Dark gray	Small interior	Parachute Creek Member/Upper Green River Formation (?)	
TOTALS			**28**	**19 siltstone, 9 chert**	**21 interior, 2 secondary, 5 primary** **7 micro, 13 small, 6 medium, 2 large**		

9.4.2 Groundstone Analysis

A total of four groundstone tools and tool fragments were recovered from the excavations at the Feature 9 Locus (one of which was found in several fragments). Two of the tools are manos (FS91 and FS93) and the other two are metates (FS92 and FS96). Notably, all four artifacts were found within less than a meter of each other, as elements of Sub-feature 9-D within excavation units 2S3W (East ½) and 2S2W at depths ranging from 84-98cm below Vertical Datum (Fig. 9.4, Table 9.2, and Plate 9.20). It remains a possibility that additional cultural materials remain *in situ* in adjacent, unexcavated, grid units.

The three smaller groundstone artifacts, and a pollen wash from the surface of the larger metate (FS96), were submitted to PaleoResearch Institute of Golden, Colorado for pollen analysis. The entirety of the pollen analysis results are presented in section 9.5.2. In summary:

> The pollen record of 2 metates [FS92 and FS96] and one mano [FS91] from the Parachute Creek [Riley Gulch] house floor (5GF1185) yielded Amaranthaceae pollen aggregates, suggesting the possibility that seeds from a member of the amaranth family were ground. In addition, small quantities of Ericaceae, Lamiaceae, *Opuntia*, *Shepherdia*, *Sphaeralcea* and *Typha angustifolia*-type pollen were noted in the groundstone samples, indicating their availability and suggesting the possibility that kinnikinnik, a member of the mint family, prickly pear cactus, and buffaloberries, globemallow, and/or cattail were ground using one or more of these pieces of groundstone. The pollen record from these two metates and one mano are very similar to the records obtained from the modern ground surface and a cultural cobble [mano FS93], documenting prehistoric vegetation as very similar to that of today (Cummings and Milligan 2014:16).

Table 9.2. Pollen recovered as sediment samples and groundstone washes that were processed for purposes of determining paleoenvironmental conditions and ethnobotanical use.

FS/PS (Sample No.)	Depth (cm below vertical datum)	Provenience	Description
12	PGS	N/A	Sediment sample, collected from surface as a control
15	85 (Resting 15cm below T.T.1)	2S 2W NE Corner	Metate
13	84	2S 3W E1/2 Feature 9D	Cultural cobble found with metate
14	91-92 (Resting at 21-22cm below T.T.1)	2S 3W E1/2	Mano
16	98	2S 3W E1/2	Soil from metate (FS# 96)

Manos

FS91 consists of a bifacial sandstone river cobble mano that has been moderately ground. Both utilized faces exhibit convex, slightly beveled, ground surfaces. Remnants of sharpening peck marks remain visible on the most heavily worked of the two faces. A slight amount of grinding, possibly as an attempt at shaping the tool, can be seen on the cobble's edges. The stone is reddish-brown, possibly as a result of heat alteration. The tool measures 12.4 x 9.1 x 6.8cm. Pollen analysis of a wash from the surface of this tool (Pollen Sample 14) resulted in:

> The most notable difference between this sample and that recovered from Sample 15 [metate FS92] is the larger quantity of *Pinus* pollen in this sample and the presence of a small quantity of *Typha angustifolia*-type pollen. The quantity of Amaranthaceae pollen observed in this wash was smaller than that noted in Sample 15, although aggregates were noted in both samples. This sample yielded a similar quantity of microscopic charcoal, suggesting this metate [sic] [mano] also might have been burned following its last use at discard. Total pollen concentration was approximately 115 pollen per cm^2 of washed ground surface (Cummings and Milligan 2014:15).

FS 93 consists of an unshaped sandstone river cobble with evidence of very slight grinding on one convex surface. The grinding stone is characterized by the presence of several dozen natural pock marks or vesicles on the surface. The tool measures 13.7 x 10.1 x 6.2cm. Pollen analysis of a wash from the surface of this tool (Pollen Sample 13) resulted in:

> It was found with the metate represented by Sample 15 [FS92]. The pollen signature for this sample was very similar to that recovered from Sample 15 [metate fragments FS92]. Differences were minor, involving primarily a less varied pollen signature. Total pollen concentration was similar to that of the metate, at approximately 300 pollen per cm^2 of washed surface (Cummings and Milligan 2014:15).

Metates

FS92 consists of three conjoined fragments of a fragmentary sandstone slab metate found together in the northern portion of excavation unit 2S2W. The metate is heavily ground and pecked on one face, and unaltered on the other. A very slight concavity of approximately 2mm is apparent when a straight-edge is placed across the ground surface in one orientation, but is level in the perpendicular direction. The fragments, when joined, produce a metate fragment that measures 18.0 x 15.4 x 1.9cm. Pollen analysis from the grinding surface (Pollen Sample 15) resulted in:

> Sample 15 represents a metate recovered from the northeast corner of Unit 2S2W. The pollen record for this sample is very similar to that from the present ground surface. Notable exceptions include the presence of small quantities of Brassicaceae, *Opuntia*, *Shepherdia*, and *Sphaeralcea* pollen, indicating availability of resources for processing.

> *Typha angustifolia* pollen was absent from this sample. The Amaranthaceae pollen frequency was slightly larger than that observed in the modern surface sample and a few aggregates of this pollen type were recovered, providing the only possible evidence of grinding. These pollen types were not observed in quantities sufficient to indicate grinding using this metate. This metate also yielded a large quantity of microscopic charcoal, suggesting the possibility that it was burned following its last use and that this entire pollen record represents pollen that accumulated from association with the sediments, thus representing the local environment. Total pollen concentration was relatively small at approximately 225 pollen per cm^2 of washed ground surface (Cummings and Milligan 2014:15).

FS96 is a large sandstone metate that exhibits a very slight, flat, ground surface on one side of the angular boulder. The ground surface, which was facing down in the fill, is patinated with a coating of calcite and the rock exhibits reddening approximately 80% of the way through its thickness, from the ground surface inwards. The metate measures 40.3 x 30.2 x 13 2cm. Analysis of a pollen wash from the grinding surface (Pollen Sample 16) resulted in:

> Sample 16 represents sediment from a...metate (FS 96). The pollen signature from this sediment sample is very similar to that recovered from the other three washes examined from this site. The Amaranthaceae pollen is elevated and accompanied by aggregates, as it was in Samples 14 (mano) [FS91] and 15 (metate) [FS92]. The pattern of recovering Amaranthaceae aggregates suggests that both metates and the mano might have been used to grind seeds of a member of the amaranth family, formerly termed Cheno-ams in pollen work. Pollen observed in Sample 16 that represents plants available for grinding includes Ericaceae (heath family containing kinnikinnik) and Lamiaceae (mint family). Interpretation of Ericaceae pollen to represent grinding using this metate hinges on more detailed knowledge of modern and recent local vegetation. It is more likely that the small quantity of Lamiaceae pollen observed in this sample represents grinding a member of the mint family, because Lamiaceae pollen was not observed in any other sample from this study. Total pollen concentration was approximately 8900 pollen per cc of sediment. Microscopic charcoal was approximately as abundant as pollen in this sample, and is probably part of the sediment signature, rather than an indication of burning of the possible metate.

9.4.3 Lithic Tool Stone Materials

The terminology used here has its basis in the geologic literature and is fully elucidated in Miller (1992), however, other descriptive names are applied to these rocks. For instance, translucent opalitic chert is commonly called chalcedony. Chalcedony is a crypto-crystalline rock, indicating a concealed or hidden crystal habit (albeit viewable in cross-polarizing light), and forms in hydrothermal or geothermal settings while opalitic chert forms in surface environments, usually in water during fluctuating pH conditions. Opal, by definition, contains a small amount of water and has a Moh's hardness in the range of 6.5 as opposed to 7.0 for true chalcedony. It should be noted, however, that after opalitic chert is deeply buried and affected by geothermal heating, vugs or fractures in the rock are usually filled with chalcedony.

Opalitic chert is variegated and translucent to some degree, even in thick samples. Miocene opalitic chert ranges in color from almost clear to milky gray to white (often referred to as chalcedony), and brown to red; formed in shallow, ephemeral lakes; and almost always contains ostracodes (clam shrimp) and stromatolitic (i.e. algal) banding. "Local" sources include Troublesome and Browns Park formations (Miocene), east and north, respectively, from the Steamboat Mesa area, but a useful secondary source exists in nearby river gravel, in the present bed or in terraces. The primary opalitic chert of the northern Uncompahgre Plateau comes from Burro Canyon Formation (Jurassic-Cretaceous); it is white to cream, yellow, and pink to red in color, and co-occurs as interbeds with the orthoquartzite and porcellanite from the same formation. There are numerous sources of this material in the Uncompahgre Uplift.

Other names are commonly applied to opalitic chert types. "Pumpkin" chert, an orange-to-red chert with manganese dendrites is usually derived from Mississippian, Pennsylvanian and Permian rocks. A local type is imported from quarries in the Morgan Formation located along the Yampa River. Similarly, "pigeon blood" chert is white or clear opalitic chert with blebs of hematite and probably ferrihydrite and is formed in karst in Paleozoic limestones, but also in Miocene playa lakes. The name "root beer" chert is often applied to any dark brown chert formed in terrestrial environments in perennial and ephemeral lakes or, less commonly, during subaerial erosion of limestone over hundreds of millions of years. A type regionally observed has been identified in quarries found in Sand Wash Basin. "Jasper" is applied to any red, orange or yellow chert, but is more specifically spherulitic felsite which originates in rhyolite source rocks such as those found on the Flat Tops and Grand Mesa. Banded opalitic chert from the Green River Formation (Eocene) is referred to as "tiger" or "shavetail" chert and was formed on the bed of lakes Gosuite and Uinta. The material is usually dark brown or black with tan banding, and inclusive invertebrates, especially ostracodes, are commonly replaced by light blue opalitic chert or chalcedony. The banding represents lake varves – alternating opalitic chert and porcellanite – representing clastic deposition during monsoons (porcellanite) and silica precipitation in the dry season during deposition.

Knife River Flint or KRF from Golden Valley Formation (Eocene) in western North Dakota is also opalitic chert that has been identified in Protohistoric artifact collections as far south as the Uncompahgre Plateau (Conner et al. 2007:22). A local source is also found near Crawford in west-central Colorado. It is identified by numerous palm leaf or frond fragments, the latter identified by parallel veins where voids are left by loss of the organics that are filled with chalcedony. Miller and Larson (1990) presents a series of photographs of KRF taken at high magnification under cross-polarizing light where the chalcedony crystal habit is clearly contrasted with the surrounding amorphous opalitic chert.

Orthoquartzite and porcellanite are silica cemented clastic rocks, the former sandstone and the latter mudstone (i.e., siltstone or claystone). Mesozoic clastic rocks are identifiable by mineral composition which is almost exclusively quartz and black chert grains due to prolonged rework and transport. Many Mesozoic orthoquartzites exhibit authigenic chalcedony filling interstices and voids, and quartz grains and silica cement have been altered to high refractive quartz by a combination of heat and pressure in diagenesis. Light-colored orthoquartzites are described as "salt and pepper" with black chert grains being the "pepper." *Sucrosic* is another term applied to these rocks, describing reflected light from facets on fractured quartz and other mineral grains.

Most of these rocks have distinct characters useful in identification. Dakota Formation (Cretaceous) is commonly light colored, typically "salt and pepper" and sucrosic; related Burro Canyon Formation (Jurassic-Cretaceous) orthoquartzite is variegated, ranging from tan to cream to red and green. Also, Burro Canyon Formation green porcellanite was used as tool stone in many areas, and tools of this material have been observed throughout the region. Cloverly Formation (Cretaceous) is chiefly identified by quartz overgrowths on clastic grains and even colors, ranging from gray to tan to red to purple. Morrison Formation (Jurassic) porcellanite contains fossil roots and rhizomes, and fucoids (worm burrows) associated to a fossil soil, and mottling related to exsolution of iron oxy-hydroxides.

Dakota Formation has many exposures in the Uncompahgre Uplift. Morrison Formation is consistently exposed along the north side of the uplift, along the Redlands fault which marks the geologic boundary between the Grand Valley and the Uncompahgre Uplift, but no specific quarry or procurement areas are known by these authors. Cloverly Formation is exposed in the western Plains area, around the Black Hills and Hartville uplifts in eastern Wyoming and overlies Morrison Formation there.

Obsidian is commonly called volcanic glass because it is found in "obsidian flows" within the margins of rhyolitic lava flows. The obsidian flows are a phenomenon where felsic lava extruded from a volcano cools rapidly with minimum crystal growth, a result of the presence of a high silica content which induces a high viscosity and polymerization degree to the lava. This material is a hard and brittle substance that fractures with very sharp edges, and was used by Native Americans primarily as cutting tools and projectile points. Because it is volcanic, it has a particular chemical signature that can be identified by its source; hence the term "sourcing" of obsidian. Obsidian is found on many sites in the region and is derived from sources primarily found in Idaho, Wyoming, New Mexico, and Utah.

9.5 Ancillary Specimen Analyses

Radiocarbon, pollen, macro-botanical, and invertebrate (mollusk) samples were also collected. The results of their analyses are presented in this section.

9.5.1 Radiocarbon

Twenty-two charcoal samples from the site were submitted for radiocarbon dating by International Chemical Analysis, Inc. of Miami, Florida. The results are shown in Table 9.3.

Table 9.3. Riley Gulch Conventional Radiocarbon Dates

Lab Number	^{14}C Date (BP)	Standard Deviation	Delta ^{13}C	Material	Provenience
ICA-ICA/CO/C/0402	1560	40	-25.7	Charcoal	Thermal Feature B
ICA-ICA/CO/C/0403	1900	40	-25	Charcoal	Thermal Feature C
ICA-ICA/CO/C/0401	1970	40	-25	Charcoal	Thermal Feature A
ICA-14C/0703b	2160	30	-20.2	Charcoal	Feature 4
ICA-ICA/CO/C/0404	2300	40	-25	Charcoal	Thermal Feature D
ICA-14C/0706b	2300	30	-16.9	Charcoal	Feature 8
ICA-14C/0704b	2450	30	-17.9	Charcoal	Feature 6
ICA-15C/0113	2480	40	-24.1	Charcoal	Feature 19
ICA-15C/0114	2500	40	-22.7	Charcoal	Feature 17
ICA-ICA/CO/C/0405	2530	40	-23	Charcoal	Thermal Feature E
ICA-14C/0711b	2530	30	-19.9	Charcoal	Feature 12
ICA-14C/0714b	2550	40	-24.7	Charcoal	Feature 16
ICA-14C/0707b	2670	40	-17.5	Charcoal	Feature 9-D
ICA-14C/0701b	2850	30	-18.1	Charcoal	Feature 2
ICA-14C/0702b	2870	40	-21.7	Charcoal	Feature 3
ICA-15C/0253	2920	40	-23.7	Charcoal	Feature 9-H
ICA-14C/0710b	2950	30	-25	Charcoal	Feature 11
ICA-14C/0709b	3050	30	-23.6	Charcoal	Feature 10
ICA-14C/0708b	3370	40	-25.3	Charcoal	Feature 9-A Post Hole
ICA-14C/0713b	3730	40	-16.2	Charcoal	Feature 15
ICA-14C/0705b	4580	40	-24.1	Charcoal	Feature 7
ICA-14C/0712b	5080	40	-27.1	Charcoal	Feature 14

Given the nature of the exploratory excavation there are, as yet, no reported stratigraphic relationships among the various dated samples. Hence, contingent upon subsequent excavation, we will assume the dates to be accurate with the stated measurement error and consolidate clusters of contemporaneous dates through weighted averaging prior to tree-ring calibration. The results of the approach are shown in Table 9.4. Contemporaneity testing and averaging of dates was accomplished with the utilities provided with Calib Version

7.1.1 (Stuvier, Reimer and Reimer 2015) as were the calibrations using the Intcal13 calibration curve.

Note that a conventional radiocarbon date can result in multiple tree-ring calibrated ranges owing to ambiguities (multiple intercepts) of the calibration curve. Accordingly, each date is assigned a relative probability that can serve as an indicator of which of the ranges is the most likely temporal estimator.

Table 9.4. Riley Gulch Averaged (where appropriate) and Calibrated Dating Summary.

Lab Numbers	^{14}C Date (avg.)	One Sigma (avg.)	Delta ^{13}C (avg.)	Intcal13 Calibrated Date	Relative Prob.	Material	Provenience
ICA-ICA-CO/C/0402	1560	40	-25.7	AD 425-AD584 AD 590-AD 590	0.998 0.002	Charcoal	Thermal Feature B
ICA-ICA/CO/C/0403 ICA-ICA/CO/C/0401	1935	28	-25	AD 16-AD 127 AD 5-AD 14	0.975 0.025	Charcoal	Thermal Feature C Thermal Feature A
ICA-14C/0703b	2160	30	-20.2	358 BC-AD 277 259 BC-AD 239 236 BC-AD 107	0.424 0.028 0.548	Charcoal	Feature 4
ICA-ICA/CO/C/0404	2300	24	-21	404 BC-358 BC 282 BC-257 BC 243 BC-236 BC	0.904 0.082 0.015	Charcoal	Thermal Feature D and Feature 8
ICA-14C/0704b ICA-15C/0113 ICA-15C/0114 ICA-ICA/CO/C/0405	2480	18	-37.5	754 BC-733 BC 690 BC-681 BC 670 BC-661 BC 649 BC-608 BC 595 BC-545 BC	0.162 0.070 0.063 0.311 0.394	Charcoal	Features 6, 17, 19 and Thermal Feature E
ICA-14C/0711b ICA-14C/0714b	2540	24	-35	793 BC-752 BC 682 BC-669 BC 632 BC-630 BC 612 BC-592 BC	0.662 0.138 0.019 0.181	Charcoal	Features 12 and 16 (Natural Burns)
ICA-14C/0707b	2670	40	-17.5	902 BC-794 BC	1.00	Charcoal	Feature 9-D
ICA-14C/0701b ICA-14C/0702b	2860	24	-19.9	1117 BC-971 BC 960 BC-934 BC	0.905 0.095	Charcoal	Features 2 and 3
ICA-15C/0253 ICA-14C/0710b	2940	24	-24.3	1207 BC-1139 BC 1135 BC-1115 BC	0.769 0.230	Charcoal	Features 9-H and 11
ICA-14C/0709b	3050	30	-23.6	1408 BC-1258 BC 1232 BC-1218 BC	0.973 0.027	Charcoal	Feature 10 (Natural Burn)
ICA-14C/0708b	3370	40	-25.3	1749 BC-1601 BC 1593 BC-1531 BC	0.973 0.127	Charcoal	Feature 9-A
ICA-14C/0713b	3730	40	-16.2	2281 BC-2249 BC 2231 BC-2218 BC 2213 BC-2023 BC 1991 BC-1985 BC	0.049 0.014 0.931 0.006	Charcoal	Feature 15

ICA-14C/0705b	4580	40	-24.1	3499 BC-3433 BC 3379 BC-3309 BC 3296 BC-3283 BC 3276 BC-3265 BC 3240 BC-3104 BC	0.196 0.393 0.012 0.011 0.388	Charcoal	Feature 7 (Natural Burn)
ICA-14C/0712b	5080	40	-27.1	3965 BC-3788 BC	1.00	Charcoal	Feature 14

The initial temporal perspective is that the site has been occupied repeatedly from 4000 BC to AD 500. It is unlikely that occupation was continuous throughout this 4500 year period but additional data will be required to demonstrate specific periods of occupation versus non-occupation. Additionally, some of the features appeared to represent natural burns as opposed to cultural features. A first approximation is as follows:

1) The six earliest dates range form 3965BC to 794BC with both overlapping and non-overlapping determinations suggesting intermittent Archaic occupation. Two periods of suspected wildfire episodes occurred during this time: a) a radiocarbon sample from Feature 7 indicated that one happened either between 3379-3309BC (39% probability) or 3240-3104BC (38%); and, b) a sample from Feature 10 indicated that another burn episode took place between 1408-1258BC (97%). A review of Figure 5.1 indicates that both periods occur during dry periods. The earlier one is close to a windblown silt episode at Battlement Mesa.

2) The first dating cluster comes from two contemporaneous radiocarbon samples from Features 9-H and 11 at 1207-1115BC.

3) The strongest dating cluster in evidence comes from the four contemporaneous radiocarbon samples from Features 6, 17, 19, and Thermal Feature E at 745-545BC.

4) Evidence of an episode of wildfire during the Late Archaic occupation comes from radiocarbon samples from Features 12 and 16 ranging from 793-592BC with a 68% probability that it occurred between 793-752BC. Again, a review of Figure 5.1 indicates that it occurred during a dry period, and close to a windblown silt episode at Battlement Mesa.

5) The next five dates appear to represent a continuum from 404BC to AD5.

6) Finally, following a break of four centuries, the final indications of occupation of the site are dates ranging between AD425-590.

9.5.2 Palynology

Pollen samples were sent to PaleoResearch Institute of Golden, Colorado, for analyses. Linda Scott Cummings and Jennifer L. B. Milligan, with assistance from R. A. Varney and Abigail R. Dockter, conducted the analyses and prepared their report (Technical Report 14-105). The following presents their findings.

Five samples were submitted for pollen analysis from this site (see Table 9.2). They represent sediment collected from the nearby modern surface as a control, two metates and two manos. The results of this analysis are presented in section 9.3.2.

9.5.2.1 Pollen Analysis Methods

A chemical extraction technique based on flotation is the standard preparation technique used at the PaleoResearch Institute for recovering pollen grains from sediments. This particular process was developed for extracting pollen from sediments where the preservation has been less than ideal and the pollen density is lower than in peat. It is important to recognize that it is not the repetition of specific and individual steps in the laboratory but rather mastery of the concepts of extraction and how the desired result is best achieved, given different sediment matrices, that results in successful recovery of pollen for analysis.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the sediment, after which the samples were screened through 250-micron mesh. The samples were rinsed until neutral by adding water, letting the samples stand for 2 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate was added to each sample once it reached neutrality, then the samples were allowed to settle. This process was repeated with ethylenediaminetetraacetic acid (EDTA). These steps remove clay prior to heavy liquid separation. The samples then were freeze-dried under vacuum.

Use of groundstone in processing plants and animals may leave evidence on the artifact surface that includes concentrations of pollen and starch, which can be recovered by washing the ground surfaces. Two metates and two manos from 5FG1185 were submitted for pollen analysis. The results of these analyses are presented in section 9.4.2, Groundstone Analysis.

The four groundstone tool were examined and all visible dirt was removed using tap water and gentle hand pressure to remove any modern contaminants. A small portion of each ground surface was tested with dilute (10%) hydrochloric acid (HCl) to detect the presence of any calcium carbonates. None were present. Then, the ground surfaces were washed with a 0.5% Triton X-100 solution to recover any pollen and starch grains. The surface was scrubbed with an ultrasonic toothbrush and rinsed thoroughly with reverse osmosis deionized (RODI) water. Each sample then was sieved through 250-micron mesh to eliminate any large particles that might have been released during the washing process. The particles and liquid recovered were centrifuged, then freeze-dried under vacuum.

Sodium polytungstate (SPT), with a density of 1.8 g/ml, was used for the flotation process on all eight samples. The samples were mixed with SPT and centrifuged at 1,500 rpm for 10 minutes to separate organic from inorganic remains. The supernatant containing pollen and organic remains was decanted. Sodium polytungstate again was added to the inorganic fraction to repeat the separation process. The supernatant was decanted into the same tube as the supernatant from the first separation. This supernatant then was centrifuged at 1,500 rpm for 10 minutes to allow any remaining silica to be separated from the organics. Following this, the supernatant was decanted into a 50-ml conical tube and diluted with distilled water. These samples were centrifuged at 3,000 rpm to concentrate the organic fraction in the bottom of the tube. This pollen-rich organic fraction was rinsed, then all samples received a short (25 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were acetylated for 10 minutes to remove extraneous organic matter. The samples were rinsed with RODI to neutral. Following this a few drops of potassium hydroxide (KOH) were added to each sample which was then stained lightly with basic fuchsin. Due to the presence of large quantities of minute organic debris, the samples were centrifuged at high speeds for short intervals to remove this debris for better viewing.

A light microscope was used to count pollen at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and may be interpreted to represent either pollen dispersal over short distances or the introduction of portions of the plant represented into an archaeological setting. The aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the percentage pollen diagram. A plus sign (+) on the pollen diagram indicates that the pollen type was observed outside the regular count while scanning the remainder of the microscope slide. The percentage pollen diagram was produced using Tilia 2.0 and TGView 2.0.2. Total pollen concentrations were calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment.

“Indeterminate” pollen includes pollen grains that are folded, mutilated, or otherwise distorted beyond recognition. These grains were included in the total pollen count since they are part of the pollen record. The microscopic charcoal frequency registers the relationship between pollen and charcoal. The total number of microscopic charcoal fragments was divided by the pollen sum, resulting in a charcoal frequency that reflects the quantity of microscopic charcoal fragments observed, normalized per 100 pollen grains.

Pollen analysis also included observation and recording of starch granules and, if they were present, their assignment to general categories. We did not, however, search for starches outside the pollen count. An additional search for starches is performed only when starch analysis is part of the suite of analyses performed. Starch granules are a plant's mechanism for storing carbohydrates. Starches are found in numerous seeds, as well as in starchy roots and tubers. The primary categories of starches include the following: with or without visible hila, hilum centric or eccentric, hila patterns (dot, cracked, elongated), and shape of starch (angular, ellipse, circular, or lenticular). Some of these starch categories are typical of specific plants, while others are more common and tend to occur in many different types of plants.

9.5.2.2 Pollen Analysis Findings

The modern surface sample (PS12) yielded moderate quantities of *Juniperus*, *Pinus*, Amaranthaceae, and *Artemisia* pollen, representing juniper, pine, plants in the amaranth family, and sagebrush. Small quantities of *Abies*, *Quercus*, High-spine Asteraceae, Liguliflorae, *Ephedra nevadensis*-type, *E. torreyana*-type, *Trifolium*-type, Poaceae, Polemoniaceae, *Eriogonum*, Rosaceae, *Sarcobatus*, and *Typha angustifolia*-type pollen represent fir, oak, plants in the sunflower family, plants in the chicory tribe of the sunflower family, two types of ephedra or Mormon tea, clover, grasses, plants in the Jacob's Ladder family, wild buckwheat, plants in the rose family, greasewood, and cattails (Figure 9.8). A small quantity of *Sporormiella* dung fungal spores were recovered, representing dung fungus that grows on the dung of grazing animals. Only a very small quantity of microscopic charcoal was noted. Total pollen concentration was calculated at approximately 31,000 pollen per cc of sediment.

Although two vertical series of pollen samples were collected from the west wall of Test Trench 1 (Figure 9.5), only those recovered as washes from the grinding surfaces of the four groundstone tools were submitted for analysis. The results of these are presented in Section 9.4.2, Groundstone Analysis.

9.5.2.3 Summary and Conclusions for Pollen Analysis

The pollen record of two metates and two manos from the Parachute Creek house floor (5GF1185) yielded Amaranthaceae pollen aggregates, suggesting the possibility that seeds from a member of the amaranth family were ground. In addition, small quantities of Ericaceae, Lamiaceae, *Opuntia*, *Shepherdia*, *Sphaeralcea* and *Typha angustifolia*-type pollen were noted in the groundstone samples, indicating their availability and suggesting the possibility that kinnikinnik, a member of the mint family, prickly pear cactus, and buffaloberries, globemallow, and/or cattail were ground using one or more of these pieces of groundstone. The pollen record from these tools is very similar to the records obtained from the modern ground surface, documenting prehistoric vegetation as very similar to that of today.

9.5.2.4 Ethnobotanic Review

A commonly accepted practice in archaeological studies is to reference ethnographically documented plant uses as indicators of possible or even probable plant uses in pre-Columbian times. The ethnobotanic literature provides evidence for the exploitation of

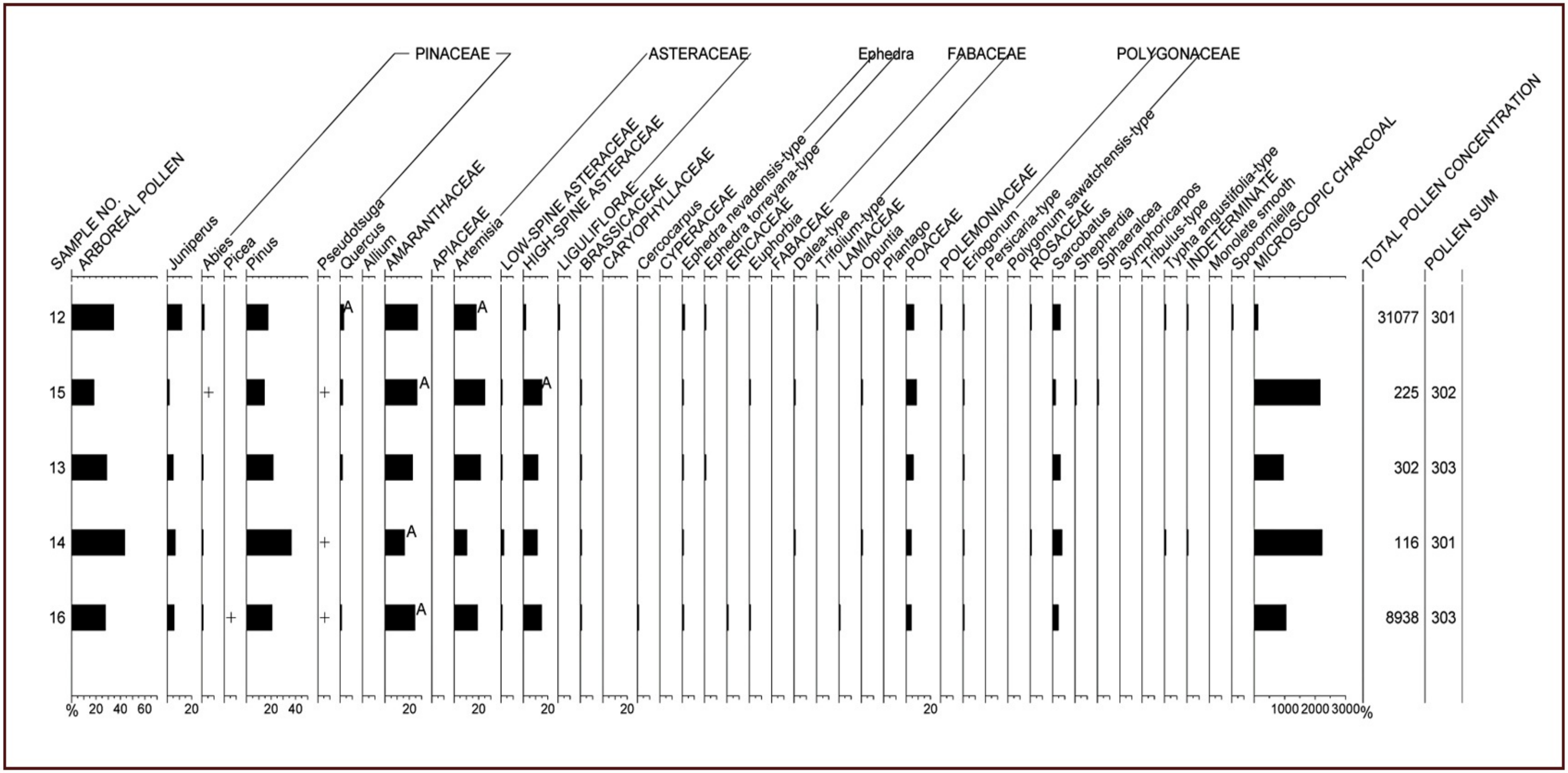

Figure 9.8. Graph of findings of the pollen analysis.

numerous plants in historic times, both by broad categories and by specific example.

Numerous sources of evidence for exploitation of a given resource tend to suggest widespread utilization and, at the same time, strengthen the possibility that the same or similar resources were used in the past. We consulted ethnographic sources both inside and outside the study area to permit a more exhaustive review of potential uses for individual plants. Ethnographic sources document historic use of some plants as a carryover from the past. A plant with medicinal qualities most likely was discovered in pre-Columbian times, with its use persisting into historic times. Unfortunately, however, a loss of plant knowledge most likely occurred as cultures moved from subsistence to agricultural economies and/or were introduced to European foods during the historic period. The ethnobotanic literature serves only as a guide for potential uses in pre-Columbian times, not as conclusive of those uses. Pollen, phytoliths, starch, and macrofloral remains, when compared with the material culture (artifacts and features) recovered by the archaeologists, can become indicators of use. We review native plants represented by pollen in the following paragraphs to provide an ethnobotanic background for discussing the remains.

***Allium* (Wild onion)**

Allium (wild onion) are herbaceous perennial plants with long, slender basal leaves and a single flower stalk with white, pink, or reddish purple flowers. The bulbs of most species are edible, and vary in degree of onion odor and flavor. Bulbs were eaten fresh and cooked and were used as a seasoning. Bulbs also were dried for future use. *Allium acuminatum* (tapertip onion) was popular with Paiute groups. *Allium anceps* (twinleaf onion) was cooked on hot rocks by the Northern Paiute, then mashed into cakes and eaten. The bulbs also were roasted in sand. Wild onions grow in moist ground around ponds and streams, in meadows, and in marshes (Kirk 1975:171-173; McGary 2001:21, 23; Moerman 1998:56; Sweet 1976:61).

Amaranthaceae (Amaranth Family)

Recent revision to botanical taxonomy, using gene-based APG (1998) and APG II (2003) systems, subsumes Chenopodiaceae under Amaranthaceae and places *Sarcobatus* as the single genus in its own family (Sarcobataceae). The term Cheno-am was widely used in pollen analysis to refer to many members of the Chenopodiaceae and the genus *Amaranthus*. With this change in family designation we report Cheno-ams under the new family designation Amaranthaceae. *Sarcobatus* is not associated with Amaranthaceae on the diagram, reflecting its new status in its own family.

Plants that produce similar pollen, termed Amaranthaceae here, include the genera *Amaranthus* (amaranth, pigweed), *Chenopodium* (goosefoot), *Atriplex* (saltbush), *Monolepis* (povertyweed), and *Suaeda* (seepweed). These plants are weedy annuals or perennials, often growing in disturbed areas such as cultivated fields and the vicinity of habitation sites. Amaranthaceae were used as food, both for their greens and seeds. Seeds were sometimes eaten raw but most often were parched, ground into meal, and used to make mushes and cakes.

Leaves were eaten fresh or cooked as greens. The greens are most tender when young, in the spring, but may be used at any time. Various parts of Amaranthaceae plants were gathered from early spring through the fall (Harrington 1967; Kirk 1975; Sweet 1976; Tilford 1997). *Chenopodium* seeds, while they contain calories roughly equivalent to corn, provide significantly more protein and fat (Asch 1978:307 cited in Kindscher 1987:82). Young *Amaranthus* leaves contain significant amounts of protein, calcium, phosphorus, potassium, vitamin A, and vitamin C (Watt and Merrill 1963:6 cited in Kindscher 1987:22).

***Amaranthus* (Amaranth, Pigweed)**

Members of the genus *Amaranthus* are herbaceous annual plants with small flowers and abundant seeds (Kearney and Peebles 1960:265). *Amaranthus* leaves, reported to have an asparagus-like flavor, were an important source of iron and vitamin C. *Amaranthus* poultices were used to reduce swellings and to soothe aching teeth. A leaf tea was used to stop bleeding, as well as to treat dysentery, ulcers, diarrhea, mouth sores, sore throats, and hoarseness (Angier 1978:33-34; Harris 1972:58; Kirk 1975:63; Krochmal and Krochmal 1973:34-35).

***Chenopodium* (Goosefoot)**

Chenopodium are weedlike herbaceous annuals or perennials with small, green flowers (Kearney and Peebles 1960:251). *Chenopodium* seeds were noted to have been important resources for Fremont groups (Madsen 1989). *Chenopodium* leaves are rich in vitamin C and were eaten to treat stomachaches and to prevent scurvy. Leaf poultices were applied to burns, and a tea made from the whole plant was used to treat diarrhea. *Chenopodium* is a weedy annual capable of producing large quantities of seeds that may be harvested in the late summer and fall. *Chenopodium* is commonly found in cultivated fields, waste places, open woods or thickets, and on stony hills. It is an opportunistic weed, often establishing itself rapidly in disturbed areas (Fernald 1950:592-596; Kirk 1975:56-57; Martin 1972; Sweet 1976:48).

Atriplex (Saltbush)

Atriplex (saltbush, shadscale) occurs as both an annual herb and perennial shrub. The leaves and young shoots have a salty taste and were used as a seasoning. Saltbush twigs were boiled or baked with meat. Wood ashes were used to color cornmeal and as a substitute for baking powder. A poultice of the chewed plant was applied to ant, bee, and wasp sting swellings. *A. confertifolia* (shadscale) was burned and the smoke inhaled as a treatment for epilepsy. Northern Paiute applied the leaves to sore muscles and used a decoction of leaves as a cold remedy. *Atriplex* seeds are very nutritious and can be ground into a meal, mixed with water and consumed as a beverage, or mixed with some other meal and used as flour. The seeds do not ripen until mid-fall, and remain on the shrubs throughout the winter into the next growing season. *Atriplex* leaves, twigs, and blossoms yield a bright yellow dye. *Atriplex* is found widely scattered throughout the western United States in waste places and fields, growing in arid, alkaline, or saline soils (Bryan and Young 1940:32; Kearney and Peebles 1960:225; Kirk 1975:59; Moerman 1986:85-86; Moore 1990:29; Mozingo 1987:46-66;

Muenscher 1980:180; Weiner 1972:75).

Brassicaceae (Mustard Family)

Several members of the Brassicaceae (mustard) family were exploited for seeds and greens, the latter of which were used as potherbs. Brassicaceae seeds ripen in early summer. *Descurainia* and *Lepidium* are noted commonly in macrofloral records from the Southwest. All species of *Descurainia* (tansy-mustard) are edible. Native people often baked fresh young leaves in firepits lined with stones. Alternating layers of leaves and hot rocks were used to create a steamer. The plants were steamed for about 30 minutes then used immediately or were dried for later use (Harrington 1967:308). The parched and ground seeds were used to thicken soup and to make pinole. A poultice of the plants was applied to toothaches and used as a lotion for frostbite and sore throats. In Mexico the seeds are poulticed and applied to wounds. *Descurainia* is a weedy annual or biennial found on hillsides, in plains, valleys, fields, waste places, and along roadsides (Harrington 1967:307-308; Kearney and Peebles 1960:349; Kirk 1975:38; Moerman 1986:151; Muenscher 1980:242). *Lepidium* (peppergrass) are weedy annual or biennial plants. The leaves contain vitamins A and C, iron, and protein, and may be eaten fresh or cooked as potherbs. Seeds have a peppery taste and may be used to flavor salads and stews. Indians used bruised plants or a leaf tea to treat poison ivy and scurvy. Leaves were poulticed on the chest for croup. Navaho-Kayenta peoples used the plant for "effects of swallowing an ant," and the plant was "rubbed on baby's face to put infant to sleep" (Moerman 1986:257-258). *Lepidium* also was used as a disinfectant, for heart palpitations, dizziness, or poulticed to "draw blister quickly" (Moerman 1986:258). *Lepidium* grows in dry or moist soil in fields, cultivated ground, and waste places (Foster and Duke 1990:34; Kirk 1975:37; Muenscher 1980:250; Peterson 1977:26).

Lamiaceae (Mint Family)

Members of the Lamiaceae (mint) family are characterized by square stems and hairlike oil glands of the surfaces of the leaves and stems (McGee 1984:204). Mints are well-known from ancient times as foods, flavorings, scents, and medicines. *Agastache* (giant hyssop, horsemint), *Dracocephalum* (dragon head), and *Salvia* (sage) seeds were eaten, while *Lycopus* (bugleweed) and *Stachys* (hedge nettle) have edible tubers that were eaten raw or cooked. *Agastache* was a staple food for the Paiute. All species of *Salvia* have edible seeds, which were parched, ground into a flour, or ground and cooked as a mush. Most sage seeds were available between March and June; however, *Salvia mellifera* (black sage) and *Salvia leucophylla* (purple sage) seeds were collected between January and July. Young *Lycopus*, *Stachys*, and *Monarda* (bee balm, wild bergamot) were cooked as potherbs. Young *Mentha* (mint) plants are good sources of vitamins A and C. The fresh or dried leaves of several plants commonly were used to make a tea. Plants that were used for flavoring tea include *Agastache*, *Mentha*, *Monarda*, and *Prunella* (self-heal, heal-all) (Angier 1978:172; Bean and Shipek 1978:552; King 1990:16; Kirk 1975; Moerman 1998:51-52; Peterson 1977).

In addition to general flavoring, several members of the mint family were important medicinally. Mints that were used to treat stomachaches, indigestion, and/or colic include *Agastache*, *Mentha*, *Trichostema* (blue curls, vinegar weed), *Monardella*, and *Salvia*. *Agastache*, *Mentha*, *Monardella*, and *Trichostema* leaves also were used as a cold remedy (Angier 1978; Moerman 1986; Moore 1993). Paiute people chewed fresh *Mentha* leaves or drank an infusion of the plant to keep cool (Moerman 1998:338-341). *Trichostema* foliage has a penetrating acrid odor. The leaves were chewed and put in the cavity of an aching tooth. Fresh leaves were mashed and thrown into streams to stupefy fish. The plant also was used to keep insects away (Moerman 1986:487; Sweet 1976:29). *Agastache* and *Stachys* leaves were mashed and applied as poultices to sores, swellings, joint pain, and sprains. *Stachys* leaves also were applied to earaches (Kirk 1975:83; Moerman 1986:21, 468; Moore 1993:145-147). *Monarda* is regarded as the most potent mint. An oil extract was used as a liniment, and fresh leaves were crushed, soaked in water, and the liquid drank to ease back pain. *Monarda* also was used to treat kidney diseases (Angier 1978:173; Hutchens 1991:203). A decoction of *Prunella* roots, leaves, and blossoms was taken for the heart, and the plant juice was rubbed on boils (Gunther 1973:45; Moerman 1986:439). A decoction of *Salvia* leaves was chewed for gas pain, made into a wash for headaches and eye inflammation, made into a decoction for pneumonia, and poulticed and applied to the chest for coughs, colds, and fevers (Moerman 1986:370, 433-435, 445-446). *Scutellaria* (skullcap) is used as a tonic, nervine, and antispasmodic. It is valuable for controlling nervous irritation. Skullcap is often used with other plants to treat weak hearts nervous conditions, hydrophobia, insomnia, and cramps (Hutchens 1991:249-251).

***Opuntia* (Prickly Pear Cactus)**

Opuntia (prickly pear cactus) are perennial, low-growing cacti with flattened, roundish segments (pads) up to 10cm long and bearing clusters of spines. All species of *Opuntia* produce edible fruit. The fruits were eaten raw, stewed, or dried for winter use. Seeds were eaten in soups or dried, parched, and ground into meal to be used in gruel or cakes. Young stems or pads were peeled and eaten raw or roasted. The spines were cut or burned off both the fruit and stems in preparation for consumption (Harrington 1967:24). Peeled pads were used as a dressing on wounds and to treat snakebites. Tea made from the pads was used to treat lung ailments. Dakota groups used the mucilaginous stem juice as a mordant to fix the colors painted on hides. Prickly pear cacti grow throughout the western United States on arid, rocky, or sandy soils. They are occasionally noted growing east to New York and Massachusetts, and west to British Columbia and Washington (Foster and Duke 1990:88; Harrington 1964:382-384; Kindscher 1987:154-157; Kirk 1975:50-52; Medsger 1966:61; Moerman 1998:365-369; Muenscher 1980:317). *O. fragilis*, *O. macrorhiza*, and *O. polacantha* are wide-ranging species that grow over much of the western plains, including Canada (USDA Natural Resources Conservation Service 2011). Members of the cactus (Cactaceae) family, such as prickly pear, were important foods because cactus fruits, buds, and stems provided some essential nutrients not available in most native foods (Gasser 1981:224). Historically *Opuntia* fruits were eaten by early settlers and explorers, especially as an emergency food (Kindscher 1987; Kirk 1975). In more recent times, the spines were burned off prickly pears with a blow torch so the pads could be used as emergency cattle feed in times of drought (Harrington 1967: 248).

Poaceae (Grass Family)

Seeds from Poaceae (grass), including *Agropyron* (wheatgrass), *Hordeum* (little barley grass), *Elymus* (ryegrass), *Eragrostis* (lovegrass), *Achnatherum* (ricegrass), *Poa* (bluegrass), *Sporobolus* (dropseed), and others, have been widely processed and consumed as food. Grass grains could be eaten raw but usually were parched and ground into meal to make various mushes and cakes. Several species of grass contain hairs (awns) that were singed off by parching the seeds. Young shoots and leaves occasionally were cooked as greens. Roots were eaten raw, roasted, or dried and ground into flour. Grass also is reported to have been used as a floor covering, tinder, basketry material, and to make brushes and brooms. Various grasses were used in the manufacture or decoration of pahos (prayer sticks). Grass seeds ripen from spring to fall, depending on the species, providing a long-term available resource (Chamberlin 1964:372; Colton 1974:338, 365; Cushing 1920:219, 253-254; Ebeling 1986; Harrington 1967:322; Kirk 1975:177-190; Whiting 1939:65-66).

Shepherdia (Buffaloberry)

Three species of *Shepherdia* (buffaloberry) all produce edible berries. Berries can be eaten raw, or dried and stored for future use. *S. argentea* (silver buffaloberry) is a shrub or small tree with silvery leaves and bright red or golden fruits. The berries have a pleasantly tart flavor and make a good jelly. Native peoples gathered the fruits by hand-picking or by spreading a thin cover on the ground and beating off the berries onto it. These berries were eaten raw, cooked into a sauce to flavor buffalo meat, or dried for winter use. The berries are sweeter after a frost. *S. argentea* grows in the western one-third of the United States, often along streams, valley bottoms, and river bottoms. *S. rotundifolia* (round-leaf buffaloberry) is an evergreen shrub with silvery leaves. The ripe fruit contains a sweet, watery, pale-yellow juice. *S. canadensis* (russet buffaloberry) has more bitter-tasting berries, although cooking improves the flavor. The leaves and younger twigs have rust colored scales. These shrubs are thornless and are found in moist, usually shaded, slopes in more northern states (Angell 1981:64; Elmore 1976:32; Harrington 1967:282-284; Kirk 1975:115-116; Mozingo 1987:195-197).

Sphaeralcea (Globemallow)

Sphaeralcea (globemallow) are annual or perennial herbs covered with star-shaped hair tufts. Flowers range in color from white and pale yellow to lavender, apricot, and red. This plant was utilized for a variety of medicinal purposes. Crushed leaves are slimy and mucilaginous and can be used to make a plaster or poultice for any skin inflammation. Crushed *S. coccinea* (scarlet globemallow) leaves were made into a poultice for skin inflammations and for sore, blistered feet. The roots were ground and applied to snake bites and sores. Fresh leaves or flowers were chewed, and a strong tea made from crushed leaves was used for treating sore throats, hoarseness, and minor irritability of the stomach and small intestine. A weak root decoction also was used to treat upset stomach complaints. *Sphaeralcea* tea has been used as a hair rinse, and a strong tea will curl hair if it is not washed out. The Shoshoni used *Sphaeralcea* as an emetic, to treat upset stomach, as a poultice for swellings or rheumatism, as an eyewash, and as a decoction to treat colds, venereal diseases or use as birth control. Navajo-Kayenta peoples used an infusion of the plant to stop bleeding, as a lotion for skin diseases, as a tonic to increase appetite, and as a ceremonial fumigant ingredient. Navajo groups also used *S. angustifolia* as a ceremonial medicine and to treat coughs, colds, and influenza. Native groups in Nevada also used *Sphaeralcea* as an eyewash and to treat colds, as well as to treat rheumatism and swellings. Species of *Sphaeralcea* can be found growing along roadsides, on banks, in fields and forest openings, on rocky hills and mesas, on dry plains and slopes, and in desert scrub (Harrington 1964:370-372; Hickman 1993:760-762; Moerman 1998:539-540; Moore 1979:166-168; Shields 1984:53; Train et al. 1957:93).

***Typha* (Cattail)**

Typha (cattail) are perennial marsh or aquatic plants with creeping rhizomes. Native Americans used various parts of the cattail plant, which are rich sources of nutrients, throughout the year. In the spring, the young shoots were peeled and the inner portion was eaten raw or cooked as potherbs. During the summer, young flower stalks were taken out of their sheaths and cooked. The flowers were eaten alone or added as a flavoring or thickening for other foods. Pollen-producing flowers and the pollen itself were collected and used as flour, either alone or mixed with other meal. In the fall, the root stalks were collected, the outer peel was removed, and the white inner cores of almost pure starch were eaten raw, boiled, baked, or dried and ground into flour. Cattail roots were richer in starch during the fall. Cattail starch flour is similar in quantities of fats, proteins, and carbohydrates to flour from rice and corn (Harrington 1967:220-224). The seed-like fruits also were collected and eaten in the fall. Native Americans processed these fruits by burning off the bristles, after which the parched fruits could be more easily rubbed off the spike. The slightly astringent flower heads were sometimes used to relieve diarrhea and other digestive disorders. Cattail down was used as dressing for wounds, as padding in cradleboards, and as diaper wadding. The leaves and stems were used for weaving mats. These mats may have been used as sleeping mats. Cattails are found in marshy habitats in or near swamps, ponds, sloughs, and the edges of streams (Harrington 1967:220-224; Kirk 1975:171; Sweet 1976:8; Tilford 1997:28-29).

9.5.3 Summary of Analyses of Macrobotanical and Non-Modern Faunal Remains from Flotation Samples

During the course of the excavations, multiple macro-botanical and macro-faunal remains as collected from various features and associated contexts. Six soil samples of archaeological fill were collected for screening, soil flotation, processing, and microscopic analysis (Table 9.5). This work was conducted by Holly Shelton of Dominquez Archaeological Research Group. All soil samples collected in the field were gently screened using 4.75mm, 2.0mm, and 1.0mm graduated soil sieves in order to facilitate sorting by providing size divisions. Resultant segregated samples were visually inspected using a 3X lighted magnifying lamp and several macro-botanical specimens were extracted. All soil samples were subsequently subjected to flotation, then air dried, measured, and individually processed. Additional specimens were collected during screening. All specimens, from both the screening and the floatation samples, were then visually analyzed at magnifications of 15X and 30X using an American Optical Corporation *FORTY* binocular geologic microscope. Specimens were segregated into charcoal, floral and faunal categories.

Carbon samples collected from the soil samples that had not been reserved for radiocarbon dating were examined to determine potential for species identification. Notably, the sole wood charcoal type was *Artemisia* spp. (sagebrush) limb fragments identified in Features 6, 14 and 17. These are most likely the charred remnants of the wood fuel source used in the hearth features.

Identifications were attempted on all classes of flora at the genus level, family level and species level, dependent on the available diagnostic morphology, using standard texts and digital databases (Martin and Barkley 1961, Young and Young 1977, and Crow Canyon 2004).

Flotation processed soil samples from Feature 6 (dated 2450±30BP) produced a single carbonized *Amaranthacea* spp. (amaranth) seed and multiple moderately calcified *Typhus* spp. (cattail) leaf fragments. A carbonized leaf fragment, possibly Amaranth, was recovered from the Feature 17 (dated 2500±40BP) flotation sample. This data, combined with the results of the pollen analysis of samples collected from the ground stone artifacts located in Feature 9 Locus, Subfeature 9-D (dated 2670±40BP), confirm the presence of *Artemisia* spp., Amaranthacea, and *Typhus* angustifolia and support the likelihood of botanical food processing.

In addition, the flotation-recovered botanical remains from all six soil samples included uncarbonized modern roots, leaf fragments, and plant fibers. These plant remains are modern and intrusive and likely not associated with any archaeological remains (Minnis 1981, Keepax 1977). Modern plant remains in archaeological sites often occur secondary to bioturbation resulting from krotovina, root growth and decay, geologic processes, and combinations of all of these factors (Hester et. al. 2009). It is also to be noted that mineralized root casts, the result of secondary disseminated calcite formation, are present in all six soil samples and are representational of a cooler wetter climatic episode of the Late Holocene (Miller and Nelson 2010).

Non-modern faunal specimens recovered from the excavations were limited to two species of terrestrial pulmonate gastropods, *Succinea* spp. and *Oreohelix* spp. These gastropod remains are commonly found among excavated sites in the area and are useful climatic and environmental indicators for archaeological and geological stratigraphy.

Succinea is a genus of terrestrial, air-breathing gastropod that prefer wetland environments such as marshes, seeps and streams (Hendricks 2012). They may also be found in drier habitats with sparse vegetation but continually damp ground as they primarily consume algae and mosses (White-McLean 2011).

Table 9.5. Results of analyses of the soil flotation samples.

Feature	Level	Sample Weight	Results		
			Floral	**Faunal**	**Other**
6	75-82cm *bppgs	5936gm	1 carbonized *Amaranth* spp. seed > 15 *mineralized Typhus* spp. leaf fragments >50 carbonized *Artemisia* spp. wood fragments	>10 *Oreohelix* spp. shell fragments >10 *Succinea* spp. shell fragments	>20 mineralized root casts Multiple oxidized small sandstone clasts
10	104cm bppgs	892gm	–	–	>50 mineralized root casts Multiple oxidized small sandstone clasts
14	104cm bppgs	645gm	>50 carbonized *Artemisia* spp. wood fragments	2 *Succinea* spp. shell fragments	>10 mineralized root casts Multiple oxidized small sandstone clasts
15	60-80cm bppgs	336gm	–	–	Few oxidized small sandstone clasts
16	60-80cm bppgs	750gm	–	–	4 mineralized root casts Moderate amount of oxidized small sandstone clasts
17	185-191cm †bpgs	1628gm	1 carbonized *Amaranth* spp. Leaf fragment >10 carbonized *Artemisia* spp. wood fragments	8 carbonized *Succinea* spp. shell fragments	Multiple oxidized small sandstone clasts

*bppcgs – below present pre-construction ground surface
† bpgs – below present ground surface
[All samples contained medium to small sandstone and marlstone clasts, copious amounts of charcoal fragments, modern botanical residue, and insect exoskeletons/egg cases. The soils are moderately mineralized by secondary, disseminated calcite formation.]

Succinea spp. shells and shell fragments were recovered from the feature fill of Features 6, 14, and 17 during the soil processing for macrobotanical remains. In addition to the flotation samples, 18 *Succinea* spp. shells and shell fragments were recovered during on site screening from between 205cm and 225cm below vertical datum (bvd) during excavation of the Feature 9 Locus (9-D equivalent dating 2670±40BP), and 12 *Succinea* spp. shell fragments from Feature 6 (2450±30BP). All the mollusc shells and shell fragments recovered from the feature fill evidenced moderate calcine mineralization indicating they were likely present on the cultural surface of their associated features or deposited shortly after abandonment.

Oreohelix is another genus of terrestrial, air-breathing gastropods that are noted to be found along limestone outcrops and limestone rich, sandy soils, and in sparsely vegetated stands of juniper and/or sagebrush with ample debris or duff cover (Henderson 1912). Some species are known to occupy moister environments along streams and seeps (Hendricks 2012). An Oreohelix shell was found in the fill of Feature 6. As *Oreohelix* spp. is capable of metabolic rate suppression during estivation it can adapt to a more xeric environment when indicated and may therefore be a somewhat less accurate indicator species for paleoenvironmental climate.

Importantly, these snails' presence are suggestive of a cool/wet environments associated with the Late Holocene climate (Miller 1992). Accordingly, their association with the aforementioned features indicate the likelihood of wet episodes occurring during a warm/dry period (Figure 5.1). This and the consolidated and compacted sediments in the project area support the likelihood of intermittent inundation there. Occurrences of standing water may have been the result of flooding episodes and/or small impoundments. It is notable that heavy rains from September 1 to September 10, 2014 resulted in flooding of the project area (as shown in Plates 9.22 and 9.23) with standing water that remained until September 15, 2014.

10.0 DISCUSSION

The definable periods of occupation of 5GF1185 reach 5000 years into the past and represent occupations during the Archaic and Formative periods. Several of the dates obtained from this site also exhibit contemporaneity with other sites recorded in the Upper Colorado River Basin. Importantly, indications of house structures at the Riley Gulch Site date 3370±40BP and 2920±40BP.

The oldest date for a house structure is derived from carbon retrieved from a vertical post hole. A similarly dated level occurs in the McClane Rockshelter, 5GF741. Two late Middle Archaic/early Late Archaic cultural occupation levels dating 3430±40BP and 3020±30BP were identified at that site. Also, in evidence of such, were in-floor storage units at each level and living floor elements indicating the rockshelter functioned as a base camp and was likely enclosed with brush or a pole-wall superstructure. The 3370±40BP date from 5GF1185 can reasonably be pooled with that of the oldest of those two dates from 5GF741.

This results in an averaged date of 3400±28BP (1756-1624BC, MEAN OF 1690BC).

Another sheltered site dating within the Middle-Late Archaic transition period is site 5ME17953, which is located next to a spring in a side canyon of the Colorado River. There, situated in a large alcove overhang (~200m long), are remains of dry-laid walls of stacked roof-fall that form thirteen semi-circular structures of various sizes, construed to be a mix of habitation rooms and storage units. A conventional charcoal date of 3100±50BP was obtained from a thermal feature within one of the suspected habitation rooms. The site was interpreted to be a base camp due to its location, aspect, and architecture features.

The 2920±40BP date at 5GF1185 was derived from the lowest level of an apparent house structure at 5GF1185. At a slightly higher level a more recent occupation of the house was in evidence, but was not dated due to insufficient charcoal. The date for the lowest floor level is coeval with a date from the floor of the pithouse feature at 5GF126, which yielded a radiocarbon date of 2900±60BP. Another site that has a comparable date to the lower house floor at 5GF1185 is found at the Dotsero Burial site (5EA128), located near the confluence of the Eagle and Colorado rivers (Hand and Gooding 1980). There, Colorado Department of Highways archaeologists found linear, low-walled (10-40 cm) surface structures and a crevice burial containing human bones. A dog burial was also found nearby. One of the human bones was dated 2910±55BP (cal. 1289-930BC). The ca. 2900 and 2910BP dates from 5GF126 and 5EA128 are contemporaneous with Features 9-H and 11 of 5GF1185; together the four dates have a pooled average of 2930±21BP (1195-1060BC, MEAN of 1127.5BC).

A hearth feature within the 5GF126 pithouse represents a second occupation of the house and was dated 2770±60BP. Importantly, a pithouse site from the same period and containing the same diagnostic groundstone types (loaf manos and two types of metates) was identified at 5ME16786. Dates from the hearth feature produced a pooled average date of 2780±40BP (1016-830BC, MEAN OF 911BC). Accordingly, it is expected that carbon from the upper floor of the house at 5GF1185 will date approximately to the same period as these two other sites.

Technological sophistication at 5GF126 is manifest in the groundstone found in the pithouse – primarily a heavily ground, loaf-shaped mano and slab and shallow basin metates with side-notching for carrying. Notably, a fragment of this mano type was found in the talus of the rockshelter at 5GF1185. These artifacts required skill in the making, which suggests craft specialization. Importantly, there was also evidence of the manipulation (or possibly even domestication) of plants present in the form of unusually large Indian ricegrass pollen that was found under an overturned metate on the 5GF126 pithouse floor. [During the domestication process, which takes a very long time, pollen size gradually increases (Niederberger 1979:140).]

Fitting within the same time frame is site 5ME96, a rock shelter in the Colorado River canyon west of Fruita. It contains evidence of a low walled structure, a surface storage unit, a mano and two types of metates. The structural feature is the remains of a horseshoe-shaped, drylaid, sandstone clast foundation, located in the center of the shelter. The presence of deteriorated mud chinking within the foundation outline suggests that the rocks likely formed the base of a jacal structure that measured roughly $2m^2$. A radiocarbon sample was collected from charcoal exposed on the surface and apparently associated with that structure, which dated 2760±40BP. A second feature within the shelter is the remains of a surface storage structure made of long thin pieces of sandstone. The metates present include a slab type with a prepared surface and a shallow basin type, both typical of what has been named the Battlement Mesa Culture.

Another date for a more recent occupation of the pithouse at site 5ME16786 was 2620±40BP (cal. 894-668BC). It roughly corresponds to what thus far has been characterized as a living surface at 5GF1185 that dated 2670±40BP. These dates yield a pooled average of 2630±17BP (817-794BC, MEAN OF 805.5BC).

Four dates occur between 2500-2550BP at 5GF1185. Two hearth features at Battlement Mesa dated in the same range: 5GF126 (2500±100BP) AND 5GF129 (2530±105BP). These six were also pooled with a resultant average of 2527±17BP (791-553BC, MEAN OF 672BC).

A sheltered structural site in the general vicinity is the Sisyphus Rockshelter, located just north of the Colorado River between the towns of Parachute and De Beque. The overhang shelter contained ruins of a slab-lined, rectangular floor feature and three stone foundation walls that were dated 2410±70BP (Gooding and Shields 1985:56). Feature 6 at 5GF1185, a slab-lined storage unit at 5GF128 in Battlement Mesa Community, and an open air living surface at 5ME16786 possess approximately the same date. These dates were pooled with a result of 2438±19BP (745-410BC, MEAN OF 577.5BC).

The houses at 5GF126 and 5ME16786, and that at 5EA128 were apparently isolated on benches above the Colorado River and near secondary water sources. These topographic situations and the isolation of each structure (not within a village orientation) indicates that the structures were so located as to take advantage of good drainage and solar energy. There is nothing to suggest that the sites were selected for defensive purposes. It is probable that there were others in the area that were similarly situated on prominences above the river, adjacent to the numerous spring-fed drainages that emanate from the remnant river terraces.

As indicated, the Riley Gulch Site is important for its comparable contexts with many other structural habitations in the region, and by the fact that it contains both open and sheltered cultural contexts. Comparing the two types in one location will likely provide significant information about subsistence and settlement patterns for the Middle and Late Archaic periods.

11.0 SUMMARY AND RECOMMENDATIONS

As a result of archaeological monitoring for WPX's Riley Gulch Water Lines and Riley Gulch Frac Pad during the spring and summer of 2014, prehistoric rockshelter site 5GF1185 was expanded eastward to include open cultural contexts on the gulch bottom. In that area, the excavations for the two construction projects exposed 23 thermal features (hearths and natural burns) and evidence of two prehistoric houses. Radiocarbon dates for the thermal and structural features range from about 4000 BC to 500 AD. Excavations were closed at the site by the Bureau of Land Management Colorado River Valley Field Office in July of 2014 for project review. Based on the Conditions of Approval (COA) for the Frac Pad project, the review resulted in the covering and reburial of the pithouses for their preservation for future archaeological investigations. At that point, WPX became responsible for the preservation of this site's important scientific data.

The site is important for a number of reasons. In 1982, when it was discovered during a survey of the Union Oil of California holdings, the site was identified as a prehistorically occupied rockshelter. The area beneath the overhang was trowel-tested, which created a hole about 10cm in diameter and 60cm deep that revealed stratified cultural deposits in the form of artifacts and charcoal. This sheltered portion can potentially contribute information not only about variable uses of the site's habitation areas through time, but also important data regarding the environmental conditions that occurred during and between occupations.

This most recent discovery of open house structures dating to the Middle-Late Archaic periods is important in the rendering of the prehistory of the region. The rarity of such finds is implicit in the context that only three others have been identified and excavated in west-central Colorado. Until the first of these few sites was discovered in the early 1980s in the Battlement Mesa Community, it was not even considered that prehistoric people were living in house structures in the mountains of west-central Colorado.

To better understand these finds and their paleoenvironmental contexts, the data from this site should be preserved through excavation. Not only would the excavation provide for the recovery of important scientific information, but it would also release WPX from the responsibility of the site's perpetual preservation. Results of the excavations should be published in a professional report for agency use; as well, a lay document and media materials should be produced for public education and information sharing.

Concurrent with the excavation should be the continuation of involvement and collaboration with tribal members both in field observations and discussion of interpretations. The broad base of informal ethnographic and ethnohistorical information that has resulted from Tribal participation in previous collaborative projects with agency partners would be enhanced and extended through focused, in-field consultation at the site.

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Appendix A: Results of Radiocarbon Analysis

Table A.1. List of Conventional Radiocarbon Dates for Thermal and Structural Features

Lab Number	^{14}C Date (BP)	Standard Deviation	Delta ^{13}C	Material	Provenience
ICA-ICA/CO/C/0402	1560	40	-25.7	Charcoal	Thermal Feature B
ICA-ICA/CO/C/0403	1900	40	-25	Charcoal	Thermal Feature C
ICA-ICA/CO/C/0401	1970	40	-25	Charcoal	Thermal Feature A
ICA-14C/0703b	2160	30	-20.2	Charcoal	Feature 4
ICA-ICA/CO/C/0404	2300	40	-25	Charcoal	Thermal Feature D
ICA-14C/0706b	2300	30	-16.9	Charcoal	Feature 8
ICA-14C/0704b	2450	30	-17.9	Charcoal	Feature 6
ICA-15C/0113	2480	40	-24.1	Charcoal	Feature 19
ICA-15C/0114	2500	40	-22.7	Charcoal	Feature 17
ICA-ICA/CO/C/0405	2530	40	-23	Charcoal	Thermal Feature E
ICA-14C/0711b	2530	30	-19.9	Charcoal	Feature 12
ICA-14C/0714b	2550	40	-24.7	Charcoal	Feature 16
ICA-14C/0707b	2670	40	-17.5	Charcoal	Feature 9-D
ICA-14C/0701b	2850	30	-18.1	Charcoal	Feature 2
ICA-14C/0702b	2870	40	-21.7	Charcoal	Feature 3
ICA-15C/0253	2920	40	-23.7	Charcoal	Feature 9-H
ICA-14C/0710b	2950	30	-25	Charcoal	Feature 11
ICA-14C/0709b	3050	30	-23.6	Charcoal	Feature 10
ICA-14C/0708b	3370	40	-25.3	Charcoal	Feature 9-A Post Hole
ICA-14C/0713b	3730	40	-16.2	Charcoal	Feature 15
ICA-14C/0705b	4580	40	-24.1	Charcoal	Feature 7
ICA-14C/0712b	5080	40	-27.1	Charcoal	Feature 14

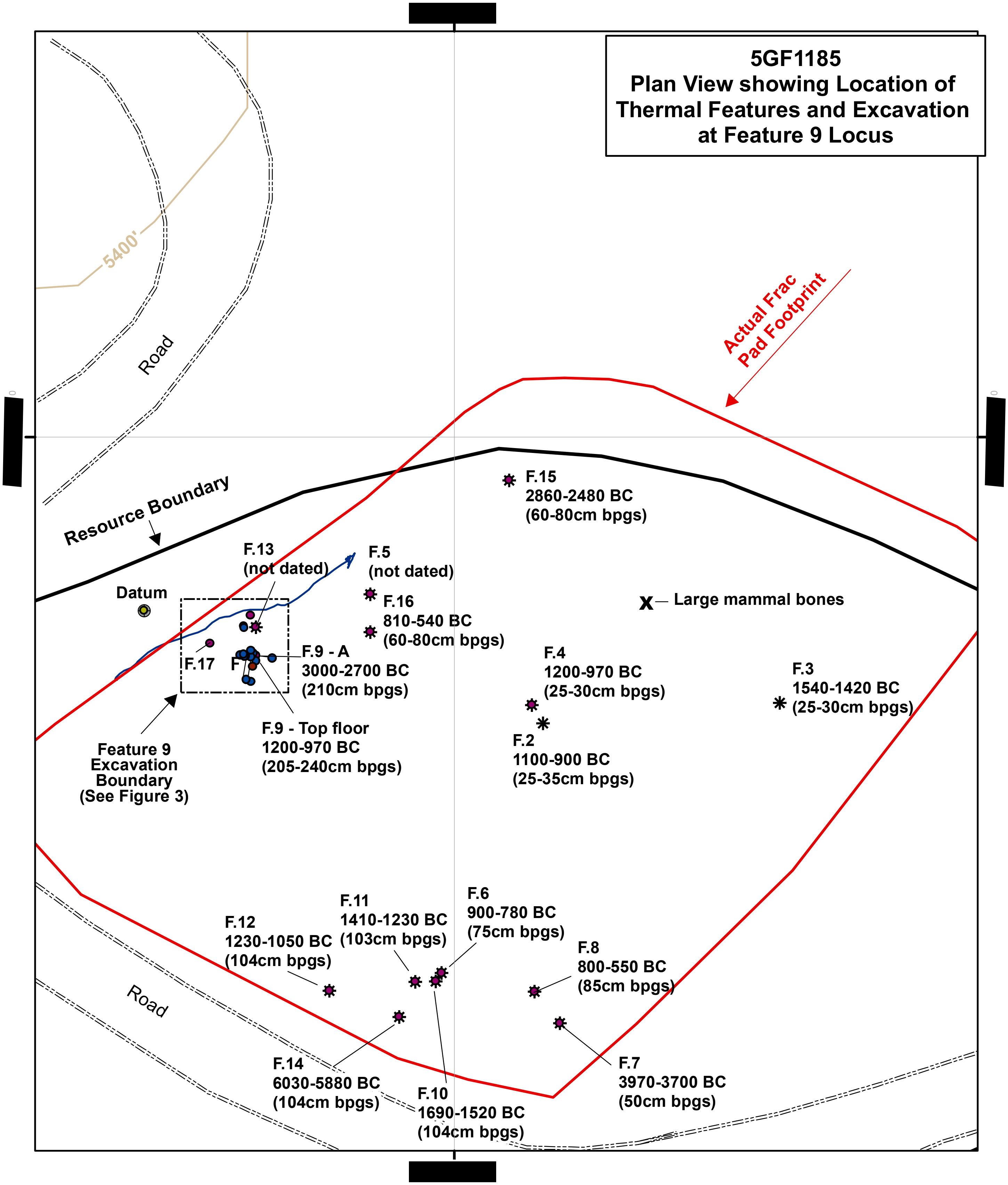

Figure A-1. Map showing thermal features and associated radiocarbon dates.

Appendix B: List of Collected Artifacts

Table B.1. List of Collected Artifacts from Locus 9.

FS#	Artifact	Provenience Within Locus	Depth below Vert. Datum (cm)	Material/Color	Comments
18	Flake - Small interior	Upper surface of exposed cultural fill	~70-80	Chert. White w/ black dendritic inclusions	
23	Flake - Medium primary	Upper surface of exposed cultural fill, 1.9m SSE of Feat. 9-A	~70-80	Siltstone. Dark gray pebble frag	Possibly non-cultural
24	Flake - Medium secondary	Upper surface of exposed cultural fill, 1.8m S of Feat. 9-A	~70-80	Siltstone. Mottled gray	Minute unifacial utilization flakes along one straight edge. Heavy calcite patina on ventral surface.
25	Flake - Small interior	Test Trench 1	78.5	Siltstone. Dark gray	
30	Flake - Small interior	Test Trench 1	80-90	Siltstone. Dark gray	
31	Flake - Small interior	Test Trench 1	90-100	Siltstone. Dark gray	Angular shatter. Probably non-artifactual
33	Flake - Small interior	Test Trench 1, N ½	90-100	Chert. Mottled brown/gray	
35	Flake - Microflake primary	Test Trench 1, N ½	100-110	Chert. White broken pebble fragment	Possibly non-artifactual
38	Flake - Microflake interior	Test Trench 2, S ½	70-80	Chert. Brown	
38	2 Flakes - Microflakes interior	Test Trench 2, S ½	70-80	Siltstone. Dark gray	
42	Flake - Large secondary	Test Trench 2, S 1/3	~100	Chert. Brown cobble fragment	

46	Flake - Small interior	Test Trench 1, S 1/3	100-110	Chert. Brown	
59	Flake - Medium interior	1S4W	67	Siltstone. Dark gray	Hinge fracture at distal end
72	Flake - Large interior	3S4W (*in situ*, grid center)	71	Siltstone. Dark gray	Possible unifacial use flakes along one straight edge
72	Flake - Medium primary	3S4W	70-72	Siltstone. Dark gray	Possibly non-artifactual
74	Flake - Medium primary	2S3W, E ½	90	Siltstone. Mottled gray	Possibly non-artifactual
75	2 Flakes - Small interior	3S4W	70-80	Siltstone. Dark gray	Possibly non-artifactual
76	Flake - Small interior	1S4W, Sub-feature 9-F	72	Siltstone. Gray	Possibly non-artifactual
81	Flake - Microflake interior	1S4W, Sub-feature 9-F	60-70	Siltstone. Dark gray	
82	Flake - Microflake interior	3S4W	70-80	Siltstone. Dark gray	
85	Flake - Microflake interior	1S2W, Sub-feature 9-D	70-80	Siltstone. Dark gray	
87	Flake - Small interior	1S2W, N ½	80-84	Chert. Mottled brown	Biface thinning flake
89	2 Flakes - Small interior	3S4W	80-90	Chert. Mottled brown	

89	Flake - Medium primary	3S4W	80-90	Siltstone. Dark gray	
89	Small interior	3S4W	80-90	Siltstone. Dark gray	
FS91	mano, bifacial	Locus 9		sandstone river cobble	
FS92	metate, slab	unit 2S2W		sandstone	3 fragments, conjoined
FS 93	mano,	Locus 9		sandstone river cobble	unshaped
FS96	large metate, unifacial,	Locus 9		sandstone	slab on angular boulder

Appendix C: OAHP Revisit Form
(BLM and SHPO copies only)