

United States Nuclear Regulatory Commission Official Hearing Exhibit In the Matter of:	CROW BUTTE RESOURCES, INC. (License Renewal for the In Situ Leach Facility, Crawford, Nebraska)
	ASLBP #: 08-867-02-OLA-BD01 Docket #: 04008943 Exhibit #: NRC-054B-00-BD01 Admitted: 8/18/2015 Rejected: Other:
	Identified: 8/18/2015 Withdrawn: Stricken:



Figure 4. Project overview in Section 35 T30N R51W, facing south. Photograph taken by N. Graves, on 12/02/2010.



Figure 5. Project overview in Section 2 T29N R51W, facing northeast. Photograph taken by A. Howder on 12/03/2010.

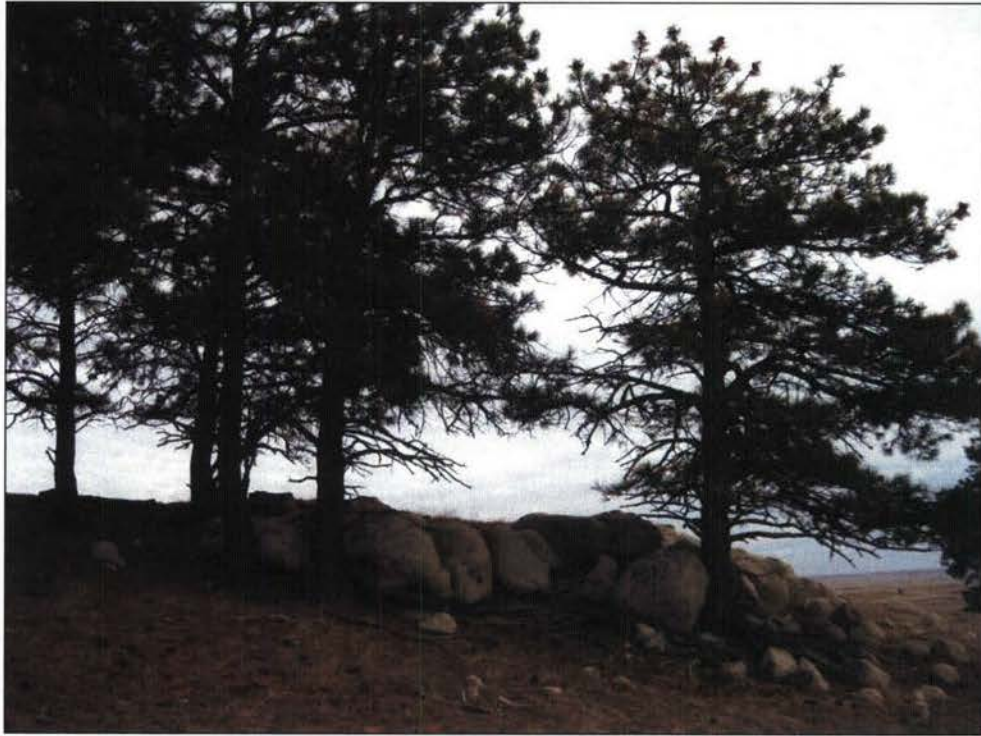


Figure 6. Project overview in Section 1 T29N R51W, facing southeast. Photograph taken by A. Howder on 12/04/2010.

F. Topographic Map

V. Environmental Setting

A. Present Environment

1. General Topographic Features

The MEAUP is located in the northern Nebraska Panhandle roughly 10 to 12 miles south of Crawford, Nebraska and five miles northeast of Marsland, Nebraska. This portion of the Nebraska Panhandle is dominated topographically by the Pine Ridge escarpment, a rugged, stony region of forested buttes and deep canyons that divides the High Plains to the south from the Missouri Plateau to the north. The project area straddles the southernmost boundary of the Pine Ridge escarpment and another distinct topographic region to the south, the Dawes Table lands. Taken together, these regions form a unique local mosaic of topography, geology, and habitat within the project area.

2. Project Area

a. Topography

The Pine Ridge escarpment covers more than one thousand square miles across far eastern Wyoming, northern Nebraska and extreme southern South Dakota (Nebraska State Historical Society 2000). It is a ridge of steeply-eroded bluffs, ravines, badlands, and low hills with biotic communities that more closely resemble those of the Black Hills region nearly 100 miles north in South Dakota (Mellor 1916, Nebraska State Historical Society 2000). The Pine Ridge is a pine-dominated western forest within the grassland-dominated High Plains (Nebraska Legacy Project). The escarpment is composed of sandstone, siltstone, and volcanic ash (Nebraska Legacy Project).

The Dawes Table is a relatively flat plain south of the Pine Ridge. As the high table landscape approaches the Niobrara, it is smoothed into rolling hills cut by broad drainages (Mellor 1916). Local deposits of dune sand are found north of the Niobrara (Mellor 1916). The soil of the Dawes Table is very uniform and residual in origin, deriving from the underlying Arikaree formation (Mellor 1916).

b. Hydrology

The main water sources of the Pine Ridge are a small system of streams, including White River, Hat Creek, and Soldier Creek, that support deciduous woodlands and meadows in their floodplains (Nebraska Legacy Project). The Dawes Table is dissected by steep, narrow tributaries that drain southward and eastward into the Niobrara River (Mellor 1916).

Surface water within the cultural study area derives principally from rain and snow. Center-pivot irrigation brings water to the surface in the central portion of the MEAUP.

c. Geology

Sedimentary strata ranging from late Cretaceous through Tertiary age was exposed throughout the project area. The Pierre Shale of Late Cretaceous age is the oldest formation in the region. The Pierre is a widespread dark gray to black marine shale, with relatively uniform composition throughout. The Pierre outcrops extensively in Dawes County north of the project area, but disturbed areas within the MEAUP

revealed these materials. The Pierre Shale is the confining bed below the Basal Chadron Sandstone member which is the host for uranium mineralization

The White River Group is Oligocene in age and consists of the Chadron and Brule Formations. The Chadron is the oldest Tertiary Formation of record in northwest Nebraska. It lies with marked unconformity on top of the Pierre Shale. Regionally, the vertical thickness of the Chadron Formation varies greatly. This is attributed to the extreme variability of the Basal Sand unit of this formation. The Chadron Formation is comprised of three distinct members: the Basal Sandstone Member, the depositional product of a large, vigorous braided stream system which occurred during early Oligocene; the Middle Chadron Member, a distinct and rapid facies change from the underlying Basal Sandstone consisting of brick red clay; and the Upper Chadron Member, a sequence of massive claystones and siltstones ranging in color from a dark blue-green to greenish-brown generally considered fluvial channel and flood plain deposits.

The Brule Formation lies conformably on top of the Chadron Formation and, combined with the Chadron, comprise the White River Group. The Brule outcrops throughout the main ore trend. It is made up almost entirely of siltstones with minor sand channels. The contact between the Upper Chadron Member and the overlying Brule Formation is a gradational one. The Brule Formation can generally be identified by its buff to medium brown color in contrast to the greens of the underlying Chadron.

The Arikaree Group overlies the Brule Formation and outcrops are present across the MEAUP. The Gering Formation is Oligocene in age (Souders 1981) and lies unconformably on the Brule Formation. The Gering is predominantly buff to brown, fine grained sandstones and siltstones. The Monroe Creek Formation is Miocene in age and overlies the Gering Formation. The Monroe Creek is lithologically similar to the Gering with buff to brown, fine grained sandstone. The unique characteristic of the Monroe Creek is the presence of large "pipy" concretions. The Harrison Formation is the youngest member of the Arikaree Group. It is described as lithologically similar to the Gering and Monroe Creek Formations, with fine grained unconsolidated buff to light gray sands, and noted for its abundance of fossil remains (Witzel 1974:55).

Quaternary alluvial and colluvial material are present in the permit area ranging in depth from 0 to 40 feet. The material consists of Oligocene/Miocene rock fragments, silt, sand and gravel.

d. Soils

Sediments in the project area consist primarily of silt loam or clay loam over fine sandy loams, with depths and stratigraphy varying, due to topography, across the project area. The predominant soil type in the northern portion of the project area consist of several Alliance silt loam soil types located across the upland high plains and hill slopes that are deep, well-drained, sediments that consist of silt loam and/or silt clay loams overlying very fine sandy loam to approximately 60 inches below surface (NRCS <http://websoilsurvey.nrcs.usda.gov>).

Predominant sediments spanning the northern and central portion of the project area (Sections 26 and 35 T30N R51W and Sections 1 N½, 2 N½ T29N R51W) consist of the Oglala-Canyon loam, Rosebud Canyon loam, and Canyon soil types (NRCS <http://websoilsurvey.nrcs.usda.gov>). The Oglala-Canyon loam soil type is located across the upland hill slopes and ridges and is derived from loamy residuum weathered from soft fine-grained sandstone. These shallow, well drained, sediments consist of loam or very fine sandy loam overlying weathered bedrock typically occurring by 14 to 24 inches below surface. The Rosebud Canyon loam soil type is located across the hill slopes and ridges and is derived from loess over weakly cemented

fine-grained sandstone. These shallow sediments consist of loam or very fine sandy loam overlying weathered bedrock typically occurring by 14 inches below surface. The Canyon soil type is located along the steep dissected drainages and are shallow, well-drained, sediments that consist of loam over very fine sandy loam overlying weathered bedrock typically occurring by 15 inches below surface.

Predominant soil types in the central portion of the project area (Sections 1 N½, 2 SE¼, 11, 12, 13 T29N R51W and Sections 7, 18 N½ T29N R50W) consist of the Bridget silt loam, several Busher loamy very fine sandy soils, and the Tassell soil types (NRCS <http://websoilsurvey.nrcs.usda.gov>). The Bridget silt loam soil type is located across the hill slopes above the large drainage systems and are deep, well-drained, sediments that consist of silt loam overlying very fine sandy loam to approximately 60 inches below surface. There are several Busher loamy very fine sand soil types across the upland hill slopes that consist of loamy very fine sand overlying weathered bedrock by approximately 44 inches below surface. The Tassell soil type is located across the ridges and is derived from residuum weathered from calcareous sandstone. These shallow, well-drained, sediments consist of loamy very fine sand and fine sandy loam overlying weathered bedrock by approximately 18 inches below surface.

Predominant soil types in the southern portion of the project area (Sections 18 S½, 19, 20, 29, and 30 T29N R50W) consist of the Valent and Dwyer loamy fine sands, Bankard loamy coarse sand, Vetat and Bayard, and Busher loamy very fine sands soil types (NRCS <http://websoilsurvey.nrcs.usda.gov>). There are two Valent and Dwyer loamy fine sands located across the agricultural lowlands and defined as eolian sand hummocks or eolian sand dunes. These deep, well-drained, sediments consist of loamy fine sand overlying fine sand or loamy sand to approximately 60 inches below surface. The Bankard loamy coarse sand soil type is located across the frequently flooded floodplains along the drainage ways characterized as sandy alluvium or sandy lowland sediments. These deep sediments consist of loamy coarse sand over stratified loamy fine sand and gravelly coarse sand to approximately 60 inches below surface. The Vetat and Bayard soils are relocated along the stream terraces and are derived from loamy alluvium over eolian deposits. These deep sediments consist of fine sandy loam over sandy loam to approximately 60 inches below surface. There are several Busher loamy very fine sands soil types located across the hill slopes above the agricultural lowlands. These moderately shallow, well-drained, sediments consist of loamy very fine sand over weathered bedrock typically occurring by 44 inches below surface.

In the northern portion of the project area (Sections 26 and 35 T30N R51W and Sections 1 N½, 2 N½ T29N R51W) there is some potential for stable intact sediments across the undulating uplands above the large heavily dissected drainage system. In all other areas of the northern project area, exposed sandstone bedrock exposed across ridge tops and along drainages suggests shallow sediment deposits. Across the undulating uplands, ARCADIS examined drainage and road cuts, animal mounds (which were numerous), and disturbance from erosion, tree harvesting, livestock and elk, and historic occupation, that did not reveal buried cultural materials. In the central portion of the project area (Sections 1 N½, 2 SE¼, 11, 12, 13 T29N R51W and Sections 7, 18 N½ T29N R50W) there is potential for stable intact sediments across the undulating uplands above the drainages. ARCADIS observed little exposed sandstone bedrock, but the occurrence of weathered sandstone gravels intermixed with loam and sand increased. Across the undulating uplands, ARCADIS examined drainage and road cuts, animal mounds (which were numerous), and disturbance from erosion, agriculture, livestock, and historic occupation, that did not reveal buried cultural materials. The greatest potential for stable intact sediment deposits occurs in the southern portion of the project area (Sections 18 S½, 19, 20, 29, and 30 T29N R50W). Across this lowland agricultural area, ARCADIS observed no exposed sandstone bedrock, and the sporadic occurrence of weathered sandstone gravels intermixed with loam and sand. ARCADIS examined cultivated fields (providing excellent visibility),

drainage and road cuts, animal mounds (which were numerous), and disturbance from erosion, agriculture, livestock, and historic occupation, that did not reveal buried cultural materials. Exposed surfaces and stratigraphic profiles were frequent throughout the project area provided many opportunities to not only observe sediments but rule out the occurrence of subsurface archaeological deposits.

e. Vegetation

The project area is located within the shortgrass prairie ecoregion of western Nebraska, the westernmost and driest part of the North American grasslands. Shortgrass prairies are typified by low annual precipitation and a single, low-lying herb layer dominated by bunch-grasses (Nebraska State Historical Society 2000). The Nebraska Panhandle is the driest part of the state and receives only about 14 inches of annual precipitation, the majority of which occurs in a 120- to 150-day growing season from April to September (Johnsgard 2001). Within the project area, the shortgrass prairie ecoregion supports a surprisingly high diversity of sub-habitats, including mixed grass prairie, western coniferous forest, and pockets of deciduous woodlands (Nebraska Legacy Project). Native vegetation of the Dawes Table region is a mosaic of short grass and mixed grass prairie. Unlike short grass prairie, the mixed grass type supports two herb layers, one within 12 inches of the ground surface and another, more open grass layer reaching upwards of 48 inches from the ground surface, and includes bunch and sod-forming grasses as well as forbs. Observed Dawes Table vegetation includes western wheat grass (*Agropyron spicatum*), grama grass (*Bouteloua oligostachya*), and buffalo grass (*Bulbilis dactyloides*), with yucca (*Yucca glauca*) present on more exposed ridges. Native vegetation of the Pine Ridge region is dominated by ponderosa pine (*Pinus ponderosa*) ranging from open parkland to closed forest. Beginning in the 1880s, the Pine Ridge region of Nebraska was intensively logged (Johnsgard 2001). Wildfires have also significantly impacted ponderosa pine forest distribution. Other observed Pine Ridge vegetation in the project area includes mountain mahogany (*Cercocarpus* spp.).

Vegetation cover ranged from sparse to moderate, consisting of primarily short grasses and mixed grass prairie with some yucca throughout the MEAUP. The northern portions of the project also consisted of cottonwoods, Ponderosa pine, and various sedges. Bare ground visibility varied from moderate to excellent throughout most of the project area averaging 70 percent, increasing to 100 percent along drainage cuts and across pastures and cultivated fields and decreasing to 50 percent on grassy areas in the southernmost sections of the project. For most of the project area, vegetation conditions were good for the discovery and documentation of cultural materials.

3. Constraints on Discovery and Preservation

Factors which may have affected the discovery and preservation of cultural resources include uranium testing locations (**Figure 8**), logging and drag scars, slash piles (**Figure 9**), fencing, general farming activities, plowing, two-track roads, fires, stock tanks, irrigation, lighting conditions, mud, snow cover, erosion (**Figure 10**), erosion control, dumps, monitoring wells (**Figure 11**), livestock, cultivation, and construction. Access to all portions of the project area by crown-and-ditch roads was very good. Overall, conditions were very good for the discovery of cultural materials and fair for the documentation of cultural materials in northwestern Nebraska.

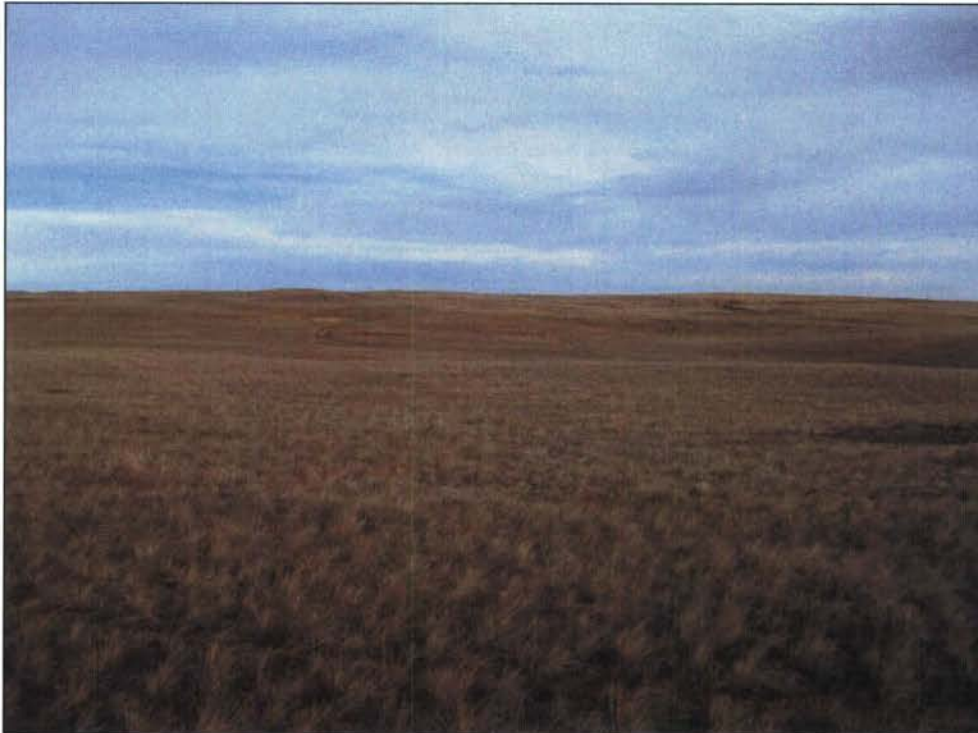


Figure 8. Disturbance (two-track road and uranium testing) in Section 29 T29N R50W, facing north. Photograph taken by A. Graves on 11/18/2010.



Figure 9. Disturbance (slash pile center of photo) in Section 35 T30N R51W, facing south. Photograph taken by S. Rosenthal on 11/21/2010.



Figure 10. Disturbance (erosion, animal trails, cultivation) in Section 2 T29N R51W, facing south. Photograph taken by N. Graves on 12/02/2010.



Figure 11. Disturbance (monitor wells) in Section 18 T29N R50W, facing southeast. Photograph taken by A. Howder on 12/17/2010.

VI. Background Research

Background research consisted of four literature and data searches, including: a files search and architectural/structures property search conducted through the Nebraska SHPO; review of the National Register of Historic Places (NRHP) database for Dawes County, Nebraska; review of the National Historic Landmark inventory (NHL); review of General Land Office (GLO) Plats; and local literature review.

A. SHPO Files Searches

No previous surveys or archaeological sites were revealed by the SHPO file search. Four historic structures (DW00-240, DW00-241, DW00-242, DW00-243) were identified during the architectural/structures property search, two of which (DW00-242, DW00-243) were re-recorded during the current investigation, and two that (DW00-240, DW00-241) lie outside the MEAUP. Site DW00-240 is the Gary & Greg Oetken Ranch that dates to 1940 and is a one-story side gable house with a gable extension, clapboard siding, 1/1 wood windows, and an asphalt shingle roof. A Morton shed, two small gable front sheds, cattle sheds, grain bins, and side gable shed are also present at the site. The locale lies over 150 feet south of the MEAUP. Site DW00-241 is the P. Furman Farmstead that has an unknown date and is a one-and-a-half story gable front house with a full width open porch, cross gable dormer and 1/1 windows. A very large Gambrel roof barn features a gable roof extension, horizontal board siding, shed dormers, a ridge vent, and a hay hood. Other buildings include a modern Morton shed, grain bins, and a shed roof chicken house. The locale lies 100 feet west of the MEAUP. Information about these structures was identified during reconnaissance level surveys, and none have been evaluated for NRHP eligibility.

B. NRHP and NHL Review

Eleven sites were revealed in the NRHP online database, none of which lie within ten miles of the MEAUP. These registered sites include: James Bordeaux Trading Post (DW00-002) listed 1972/03/16; Henry Wohlers, Sr. Homestead (DW00-043) listed 2004/10/15; Chadron Commercial Historic District (DW03) listed 2007/3/27; Chadron State College Historic Buildings (DW03) listed 1983/09/08; Hotel Chadron (DW03-023) listed 2002/08/15; Dawes County Courthouse (DW03-081) listed 1990/07/05; Chadron Public Library (DW03-091) listed 1990/06/21; Crawford United States Post Office (DW04-007) listed 1992/05/11; Co-Operative Block Building (DW04-024) listed 1985/09/12; Fort Robinson and Red Cloud Agency (DW07) listed 1966/10/15; and Army Theater (DW07-147) listed 1988/07/07. The NHL review listed one landmark, the Fort Robinson and Red Cloud Agency, located 15 miles north northwest of the MEAUP.

C. Additional Sources

A search of the Online Bureau of Land Management's Public Land Patent Records revealed that the sections of interest were patented between 1891 and 1917. There are 9 patents associated with the sections, and several sections did not have patent information online. No individuals or family names were identified in the patent search that played highly significant roles in local, regional, State, or National historic development. Although, a one Private John F. Cody was granted 160 acres of Bounty Land in Section 11 T29N R51W for his military service in the Texas and New Mexico Indian War between 1850 and 1855. A review of the Nebraska State Surveyors online GLO plats of the townships did not reveal any features of interest. Aerial photographs were consulted to identify and understand the nature of linear features that became evident during survey.

D. Cultural Context

Archaeological materials from the full range of prehistoric culture periods are represented in northwestern Nebraska (Frison 1991; McIntosh 1996). However, the earliest periods, Paleoindian and the Early to Middle Plains Archaic, are represented by only a small number of sites. Important prehistoric site types in the region include rock shelters and kill and faunal processing sites. Prehistoric site densities can vary from extremely high in some settings, such as ridge tops and areas near large and reliable drainages, to nonexistent in settings that are ecologically homogenous or are distant from water. Factors affecting the variability in site density are not always readily apparent. Previous cultural inventories in the general area have identified prehistoric sites on broad ridges or hilltops and on benches and terraces near large drainages. Many of these prehistoric sites, however, are small, surficial artifact scatters lacking temporally diagnostic materials.

Culture history in northwestern Nebraska is conventionally divided into broad temporal periods (Frison 1991; Frison and Mainfort 1996; McIntosh 1996; Reher 1979; Walker 1977; Wood 1998) consisting of the Paleoindian (ca 12,000-8,000 BP), Early Plains Archaic (8,000-5,000 BP), Middle Plains Archaic (5,000-2,500 BP), Late Plains Archaic (2,800-1,500 BP), Woodland (3,000-1,000 BP), Late Prehistoric (1,800-300 BP), Protohistoric (300-200 BP), and Historic (200-50 BP).

The Paleoindian period in northwestern Nebraska includes the Clovis, Folsom, Agate Basin, Hell Gap, Alberta, Cody, and Frederick, and is primarily represented by isolated finds (Frison 1991; McIntosh 1996). The more temperate, cool, and mesic conditions of the early Paleoindian (Late Pleistocene/Early Holocene) period promoted more mosaic faunal assemblages on the northwest plains, including now extinct large mammal species such as mammoth and *Bison antiquus*. Paleoindian life ways are often considered to have been based on large mammal hunting by small, highly mobile bands. However, several sites suggest possible communal aggregation. Frison and Mainfort (1996:151) speculates that grasslands were already established during the Pleistocene/Holocene transition, but drying trends near the end of the Paleoindian period around 8,400 BP, known as the Altithermal, resulted in more arid conditions, expansion of prairie grasses, and the retreat of more mesic vegetation to higher elevations. With these climatic and environmental changes came diverse culture changes throughout the Paleoindian period. In the Sand Hills of northwestern Nebraska, Paleoindian projectile points have been found in the expansive valley blowouts and in the water or on banks of streams (McIntosh 1996:17). Artifacts diagnostic of the Paleoindian period include lanceolate projectile points often associated with extinct fauna. Several isolated Clovis point finds have been documented along the western and eastern extremities of the Sand Hills (McIntosh 1996:11) and isolated Plainview-Goshen, Agate Basin, Alberta, and Hell Gap, projectile point finds have been documented across the western portions of the Sand Hills. Numerous isolated Cody Complex projectile points, such as the Scottsbluff and Eden point types, have been documented across the Sand Hills (McIntosh 1996:16). Excavations at the Scottsbluff Bison Quarry (10,000-9,000 BP) in central western Nebraska located just below Signal Butte revealed a bison bone bed (*Bison antiquus*), one Allen projectile point, Agate Basin and Cody Complex material, and diverse radiocarbon dates (Hofman and Graham 1998:105-106). The Hudson-Meng Paleoindian bison kill site located north of the project area is a large kill site with several hundred animals probably representing separate kill events dating to the early Cody Complex, with an Alberta component as demonstrated by a radiocarbon date of 9820 RCYBP retrieved from charcoal (Frison 1991: 178; Hofman and Graham 1998:110-111). More recent work by Todd and Rappson suggest the Hudson-Meng bone bed is a natural-death assemblage and the Alberta artifacts occur above the bone bed (Frison 1991: 178-179; Hofman and Graham 1998:110-111). The Clary Ranch site is another Paleoindian bison kill site located along Ash Hollow Creek in Garden County, Nebraska, southeast of the

project area. Excavations at the Clary Ranch, conducted by University of Nebraska State Museum in 1979, revealed bison teeth and projectile points indicating the site dates to 8,500 BP (Koch 2000).

The Early Plains Archaic is marked by continued arid climatic conditions associated with the Altithermal. Interpretations of human adaptation to drier and warmer conditions generate expectations of decreased population densities, and movement of groups and individuals to higher elevations (mountains and foothills rather than interior basins). Drier conditions in the lowland basins correlated with decreased forage for large game and the likely shift of mammal populations to higher elevations. However, Reher (1979) notes that xeric vegetal species that would replace mesic grasslands often contain components that are edible and useful to human populations (i.e. succulents and legumes). The Altithermal and the broader trend toward late Holocene environmental conditions are associated with patterns of behavioral adaptation called the broad spectrum hunter-gatherer by Frison and Mainfort (1996:152). Changes in subsistence and life ways include a growing diversification in the kinds of resources exploited and new technologies used in their procurement and processing. Materials recovered from Early Archaic sites in the Northern High Plains show increasing numbers of vegetable or plant staples such as prickly pear, sego lily, yucca pods, and chokecherry (Frison 1991). Ground stone implements and formal thermal features are more visible in the archaeological record attesting to changes in technology. Elsewhere in the northwestern Plains, habitation structures begin to appear in the archaeological record during the Early Archaic in the form of housepits. Structural features of this age, however, are unknown in northwestern Nebraska. Stratified Early Archaic sites are unknown in northwestern Nebraska. Artifacts diagnostic of the Early Archaic period, and found in northwestern Nebraska, consist of isolated occurrences of Logan Creek projectile points, also called Hawken points, identified as the Hawken site point type. The Hawken site, located south of Sundance, Wyoming, is an arroyo trap bison kill site that produced nearly 300 hundred projectile points and dates to approximately 6,500 BP to 5,040 BP (Frison 1991:187-188; McIntosh 1996:21).

The Middle Plains Archaic is associated with the amelioration of the xeric Altithermal conditions and a trend toward our modern climate. Increasing numbers of Middle Archaic sites are often suggestive of increasing population densities. The period is nearly synonymous with the McKean Complex, a cultural taxonomic unit characterized as a widespread and highly successful cultural adaptation (Frison 1998; Kornfeld and Todd 1985; Kornfeld et. al 1995). The McKean type site is located in southeastern Wyoming along the banks of Keyhole Reservoir. McKean is a hunting and gathering manifestation distinguished by lanceolate, stemmed, and side-notched projectile point types (Frison 1998:163). Stemmed lanceolate McKean points were found at the Signal Butte site in western Nebraska in an excavation level from which radiocarbon dates placed them at 4,550 and 4,170 BP (Frison 1991:101). The number of stone circles on the Northern Plains runs into the hundreds of thousands, while most date to the Late Prehistoric period, a few are clearly Middle Archaic features (Frison 1998:154). Artifacts diagnostic of the Middle Archaic period and documented in northwestern Nebraska include the McKean, Duncan, and Hanna, projectile point types (McIntosh 1996). Several significant mortuary sites (ca 3,000 to 1,500 BP) have also been documented in western Nebraska. The Gering Burials site, located near Highway 26 east of Gering, and the Bisterfeldt Potato Cellar site, located east of Scotts Bluff National Monument, are Middle to Late Archaic mortuary sites that have revealed sophisticated burial patterns and funerary offerings (Koch 2000).

The Late Plains Archaic period is marked by the continuation of the broad spectrum hunter-gatherer adaptation accompanied by a strong reliance on large game procurement. Numerous Late Archaic bison traps and procurement sites have been documented in eastern Wyoming, including Lance Creek (Haynes 1968), Fulton (Frison 1991:102), Powder River (Frison 1968), Mavrakis-Bentzen-Roberts (Bentzen 1962), Ruby (Frison 1971), and Muddy Creek (Hughes 1981) sites. Diagnostic projectile points encountered at

these sites include triangular corner notched Pelican Lake, Yonkee, and Besant types. The Yonkee projectile point was originally considered to be diagnostic of a late variant of the Middle Archaic McKean Complex (Reher 1979), but recent faunal analysis and refined radiocarbon dates place it within the Late Archaic (Frison and Mainfort 1996:22). Elsewhere in the Northern Plains, Archaic bison kill, processing, and camp sites have been recorded, but are unknown in northwestern Nebraska (Frison 1991; Frison 1998; Kay 1998). Isolated occurrences of Pelican Lake, Kobold, and Besant, projectile points have been documented across northwestern Nebraska (McIntosh 1996:22).

The Woodland Period is defined primarily on the basis of the earliest known use of ceramic vessels (Johnson and Johnson 1989:201). During the late part of this period in the Midwest, archaeologists have discovered the first evidence of horticulture such as squash, beans, and small amounts of corn (Koch 2000). Broad spectrum hunting and gathering continued to be the major form of subsistence. During this period, the bow and arrow is introduced and there is evidence of increased ceremonial elaboration. Considering Plains Woodland components often overlie Archaic components and the material culture at these sites vary only slightly, it appears the same lifeway continued essentially unchanged from at least 5,500 to 2,000 BP (Johnson and Johnson 1989:214). Woodland pottery has been found along the Wyoming-Nebraska border and in northeastern Colorado (Frison 1991:121). In the Nebraska panhandle, Woodland peoples lived in fairly small groups, utilized open campsites, and used skin-tents and natural shelters such as Ash Hollow Cave, located in the North Platte valley, for shelter (Koch 2000).

The Late Prehistoric period saw an increased reliance on organized large game hunting. Population densities are presumed to have been very high during the Late Prehistoric period as evidenced by the proliferation of recorded archaeological sites and radiocarbon dates. Side-notched projectile points dominated this period, but small, thin, corner-notched and triangular-points continue to be used. The Avonlea projectile point type is perhaps the most common diagnostic artifact of the Northwestern High Plains during the Late Prehistoric period (Frison 1991:113). The Nebraska State Historic Society excavated a Late Prehistoric site in Chadron State Park in 1940. This excavation revealed an irregular shaped soil stain and several charred post molds of a habitation floor along with bone tools such as awls, bison scapula hoes, a fishhook, beads, and a bison rib knife handle (Koch 2000). The Nebraska State Historic Society excavated a bison hunting camp near Fort Robinson on Slaughterhouse Creek in 1985 that dates to between 500 and 400 years BP (1500-1600 AD). Archaeologist's uncovered stone-lined hearths, fragments of thin pottery, stone tools, chipped stone debris that included obsidian from Idaho, and butchered bison bone.

The Protohistoric period in northwestern Nebraska was the territory of the Sioux, Pawnee, Plains Apache, Comanche, and Crow (McIntosh 1996). The period brought with it the introduction of the horse during the middle to late eighteenth century followed by the appearance of European trade goods (Frison 1991:122). Native Americans who inhabited the area along the Nebraska-South Dakota border had the horse between 1720 and 1725 (McIntosh 1996:24). Ancestors of the Plains Apache, the Dismal River Aspect culture group, occupied the Nebraska Panhandle from 1650 through the early 1700s and had some trade relations with Europeans. Iron bits, iron and copper jingles, a copper bell, and iron awls, have been documented at Dismal River Aspect sites in eastern Nebraska (McIntosh 1996:24). Through the 1700s, Native American groups in northwestern Nebraska were semi-sedentary, farming in the spring through late summer, and gathering for communal hunts in the fall and winter (McIntosh 1996:24).

The Historic period of the area falls within the last two hundred years, and begins with transient, widely separated incursions by explorers and fur traders coming in contact with the Native Peoples of northwestern