The Archeology, History, and Geomorphology of the Ray Long Site (39FA65), Angostura Reservoir, Fall River County, South Dakota

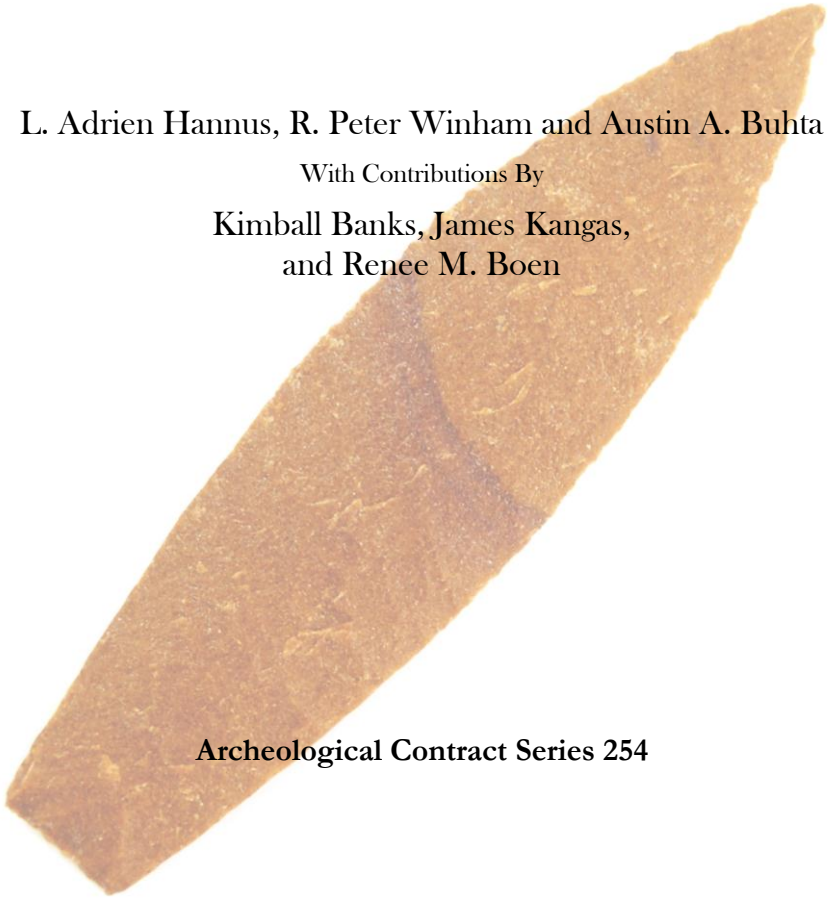
Manuscript I

Volume I
Cultural Resources Report

L. Adrien Hannus, R. Peter Winham and Austin A. Buhta

With Contributions By

Kimball Banks, James Kangas,
and Renee M. Boen



Archeological Contract Series 254

Prepared by:
Archeology Laboratory
Augustana College
2032 South Grange Avenue
Sioux Falls, South Dakota 57105

Prepared for:
U.S. Department of the Interior,
Bureau of Reclamation
Rapid City Field Office 515 9th Street, Room 101
Rapid City, South Dakota 57701

Prepared under Cooperative Agreement Nos. R09AC60006 and 09FC602369
U.S. Department of the Interior, Bureau of Reclamation

The Archeology, History, and Geomorphology of the Ray Long Site (39FA65), Angostura Reservoir, Fall River County, South Dakota

Manuscript I

Volume I
Cultural Resources Report

L. Adrien Hannus, R. Peter Winham and Austin A. Buhta

With Contributions By

Kimball Banks, James Kangas,
and Renee M. Boen

L. Adrien Hannus, Ph.D.
(Principal Investigator)

April 2012

Archeological Contract Series 254

Prepared by:
Archeology Laboratory
Augustana College
2032 South Grange Avenue
Sioux Falls, South Dakota 57105

Prepared for:
U.S. Department of the Interior,
Bureau of Reclamation
Rapid City Field Office 515 9th Street, Room 101
Rapid City, South Dakota 57701

Prepared under Cooperative Agreement Nos. R09AC60006 and 09FC602369
U.S. Department of the Interior, Bureau of Reclamation

Cover Image: Replica Angostura Projectile Point produced by Bruce A. Bradley.

ABSTRACT

This manuscript represents the first of three reports detailing the results of historical, archeological, and geomorphological research conducted at the Ray Long site (39FA65), Angostura Reservoir, Fall River County, South Dakota. Due to an alluring combination of antiquity, preservation, and the presence of a poorly understood cultural technocomplex, the Ray Long site has been the subject of archeological scrutiny and intermittent investigations for over six decades. Ray Long is best known as the type-site for the Angostura complex, an enigmatic Paleoindian group that occupied the Plains around 9,000 years ago. However, archeological and radiocarbon evidence indicate that the site was inhabited by other groups who both predated and postdate the Angostura occupation. Manuscript I presents an overview of the background of archeological research conducted at Angostura Reservoir and the Ray Long site, as well as a detailed account of work conducted at the site by the Archeology Laboratory, Augustana College, between 1993 and 2010. The subsequent manuscripts, Manuscripts II and III, include discussions on radiocarbon dates obtained from the site, the geology and geomorphology of the site, a review of site collections curated at the Smithsonian Institution, a detailed reevaluation of the Angostura cultural technocomplex, and an assessment of the science and management of the site to-date, as well as in the future.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS CONTINUED

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES CONTINUED

LIST OF FIGURES CONTINUED

LIST OF FIGURES CONTINUED

LIST OF FIGURES CONTINUED

LIST OF FIGURES CONTINUED

INTRODUCTION

Kimball Banks

The years dating from the late 1940s to the early 1960s represent one of the most critical periods in American archeology. During a 25-year span, the Inter-Agency Archaeological and Paleontological Salvage Program (IAPSP) of the National Park Service along with the River Basin Survey (RBS) of the Smithsonian Institution dominated the profession. Both programs were organized in response to the extensive construction of dams, reservoirs, and flood control projects authorized by the Flood Control Act of 1944. The objective of the act was to exercise "...jurisdiction over the rivers of the Nation through the construction of works of improvement for navigation or flood control..." [Public Law 534, Chapter 665 (H.R. 4485)]. The act represented one of the largest, if not the largest, civil works undertakings in American history, authorizing the expenditure of over one billion dollars for projects in 32 states.

Projects affected almost all major drainages; however, the greatest expenditure and effort were in the west. Almost two-thirds of the authorized projects took place west of the Mississippi River, many of which were in California and the upper Missouri River basin. Projects involved river channelization and the construction of levees and dikes, dams and reservoirs, irrigation undertakings, and facilities for the generation and transmission of hydroelectric power. The primary federal agencies involved were the U.S. Army Corps of Engineers (Corps) and the Bureau of Reclamation (Reclamation). In the upper Missouri River basin, the Pick-Sloan Plan authorized the Corps to construct the Garrison, Oahe, Big Bend, Ft. Randall, and Gavins Point dams on the main stem of the Missouri and Reclamation to construct dams on its major tributaries, such as the Jamestown, Dickinson, Heart Butte, Shadehill, Keyhole, Angostura, Canyon Ferry, Yellowtail, Boysen, and Buffalo Bill dams, among others (Roberts 1952).

The IAPSP and RBS were organized to "salvage" the major archeological sites that were going to be inundated or otherwise damaged by these construction projects, especially the dams and reservoirs (Snyder et al. 2000; Thiessen 1994a, 1994b). The implementation and funding of these programs were the Federal government's tacit acknowledgement that it bore a legal and fiscal responsibility for the management of cultural resources doomed or damaged by federal actions. The recognition that the Federal government has a responsibility to protect cultural resources on Federal lands was previously articulated in the Antiquities Act of 1906 [16 U.S.C. 431-433].

Federal archeological salvage programs conducted in association with civil works projects came into vogue during the Great Depression, the most noticeable of these being the activities associated with the Tennessee Valley Authority. Many of these were "make work" projects to promote employment. During this period, Congress passed the Historic Sites Act of 1935 [16 U.S.C. 461-467], which extended Federal involvement in historic preservation to non-federal lands and to archeological and historic sites not under federal ownership. Section 1 of the Act states: "It is hereby declared that it is a national policy to preserve for public use historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the United States" [16 U.S.C. 461].

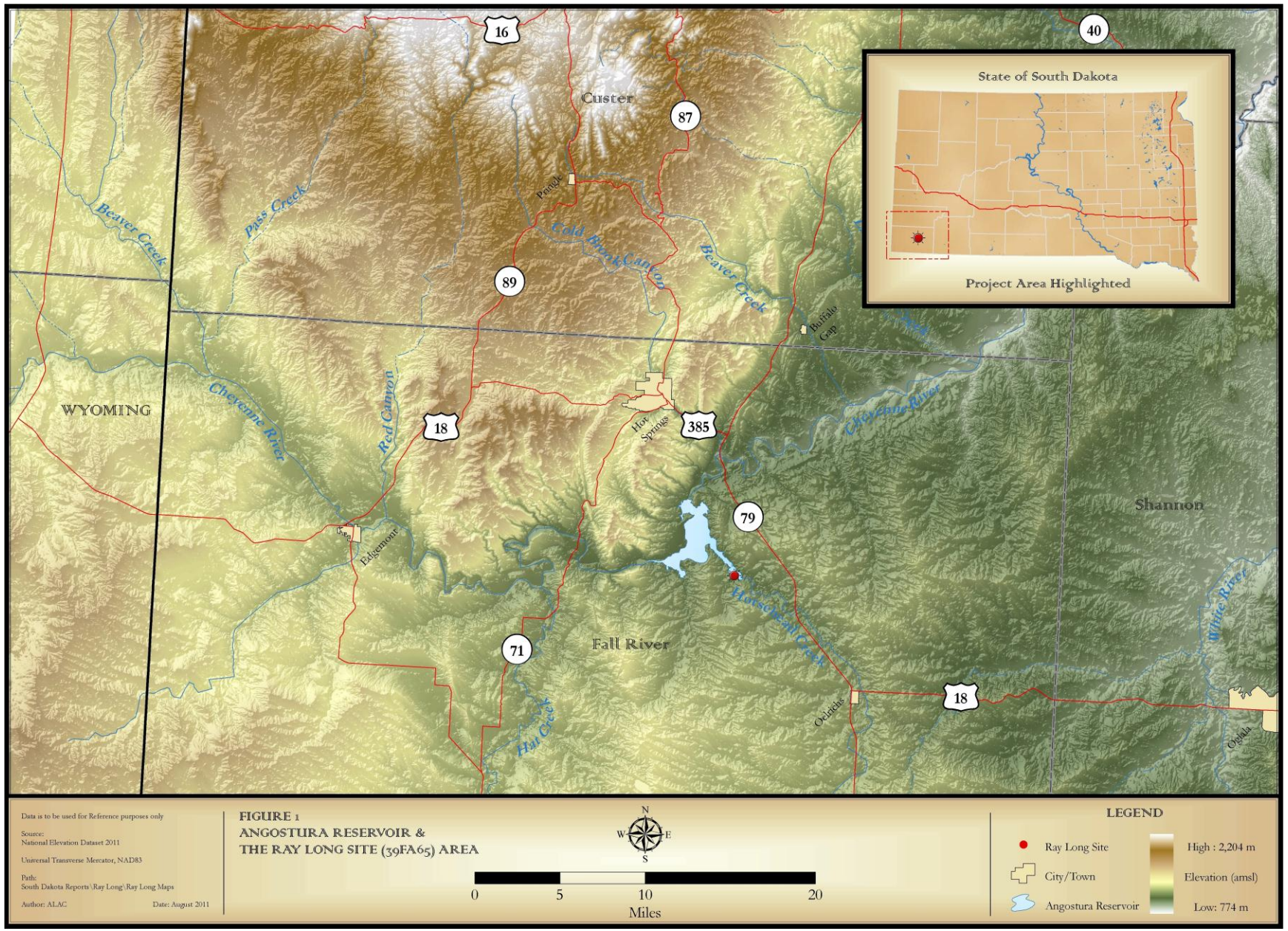
Among other things, Section 2 of the Act authorizes the Secretary of the Interior, through the National Park Service, to preserve data from archeological and historic sites, survey archeological and historic sites, and make necessary investigations and researches of historic and archeological sites. The Act also authorizes the Secretary to "…acquire in the name of the United States by gift, purchase, or otherwise any property, personal or real, or any interest or estate therein, title to any real property to be satisfactory to the Secretary" [16 U.S.C. 462], and to "contract and make cooperative agreements with States, municipal subdivisions, corporations, associations, or individuals, with proper bond where deemed advisable, to protect, preserve, maintain, or operate any historic or archeologic building, site, object, or property used in connection therewith for public use, regardless as to whether the title thereto is in the United States" [16 U.S.C. 462].

The geographical extent and magnitude of the projects authorized by the Flood Control Act energized the professional community, resulting in the organization of the IAPSP and the RBS. Although the IAPSP and the RBS undertook projects throughout the country, their most expensive and ambitious projects were in the Dakotas. IAPSP and RBS archeologists conducted numerous inventories and excavations at reservoir projects along the main stem of the Missouri, as well as on its tributaries. These investigations form the basis of much of our understanding of prehistory and archeology in the Dakotas. The chronologies and taxonomy established by the RBS investigations are still in use today by most archeologists working in the Dakotas.

Among the tributary reservoir areas investigated by the RBS were Jamestown, Dickinson, and Heart Butte reservoirs in North Dakota, Angostura and Shadehill reservoirs in South Dakota, and Keyhole Reservoir in Wyoming. Excavations conducted at Keyhole and Angostura reservoirs shaped our understanding of the Paleoindian and Archaic periods in the upper Great Plains. Richard P. Wheeler conducted these excavations. His investigations of site 48CK7 at Keyhole Reservoir (Wheeler 1996) helped define the Plains Archaic McKean focus. His investigations at site 39FA65, the Ray Long site, at Angostura Reservoir (Figure 1) and his subsequent recognition of the Paleoindian Angostura complex (Wheeler 1995) are the subject of this manuscript.

Congress included Angostura Dam and Reservoir as part of the Pick-Sloan Missouri Basin Project, which was authorized under the Flood Control Act of 1944. Reclamation was to administer the construction. The dam and reservoir were constructed to provide water to the Angostura Irrigation Unit.

IAPSP and RBS archeological crews surveyed, recorded, and investigated sites at Angostura Reservoir between 1946 and 1950. They identified 34 "open occupation sites," 22 "open workshops," 3 petroglyph sites, 1 "tipi ring," and 1 rockshelter within the reservoir boundaries and 18 sites "of various types" outside the boundaries (Wheeler 1995:10-12). Two of the sites recorded in the reservoir, 39FA7 and 39FA35, were subsequently combined. Seventeen sites in or near the reservoir were tested or excavated, including the Ray Long site, between 1948 and 1950 (Wheeler 1995). Seventeen reports and articles were published that discuss these investigations in whole or in part (for a comprehensive list, see Wheeler 1995:13-15). Wheeler's report (1995) is the most comprehensive of these. Wheeler documented the results of the 17 sites that were excavated and describes 21 occupation sites and 18 workshop sites that were recorded in or near the reservoir but were not further investigated.


16
40
87
89
18
385
79
71
18
Custer
Pringle
Hot Springs
Buffalo
Crap
Edgemont
Oelrichs
Oglala
Shannon
Fall River
WYOMING
Beaver Creek
Pass Creek
Cold Brook Canyon
Beaver Creek
Cheyenne River
Red Canyon
Cheyenne River
Horsehead Creek
White River
Hat Creek
State of South Dakota
Project Area Highlighted
Data is to be used for Reference purposes only
Source:
National Elevation Dataset 2011
Universal Transverse Mercator, NAD83
Path:
South Dakota Reports\Ray Long\Ray Long Maps
Author: ALAC
Date: August 2011
FIGURE 1
ANGOSTURA RESERVOIR &
THE RAY LONG SITE (39FA65) AREA
N
W
E
S
0
5
10
20
Miles
LEGEND
Ray Long Site
City/Town
Angostura Reservoir
High : 2,204 m
Elevation (amsl)
Low: 774 m

Today, the Dakotas Area Office of Reclamation manages Angostura Dam and Reservoir, as well as the archeological and historic resources around the Reservoir. When droughts in the 1980s and 1990s lowered the level of the Reservoir, many of the previously inundated archeological properties were again exposed. The Dakotas Area Office then contracted for an inventory and evaluation of these exposed properties (Hannus 1986; Hannus et al. 1993; Haug et al. 1987; Haug et al. 1992; Lippincott 1996). Concern over wave action that was continuing to adversely affect the Ray Long site led to a cooperative agreement in 1992 between the Archeology Laboratory, Augustana College (ALAC), Sioux Falls, South Dakota and Reclamation for further investigations at the site.

The cooperative agreement had both research and management objectives. The research objective was to try to resolve the unanswered questions raised by Wheeler's excavations concerning the stratigraphy and geomorphology of the Ray Long site and the relationship of the Angostura complex chronologically and culturally to the broader northern Plains Paleoindian tradition. The management objective was to assess ways to stabilize the site that would have minimal impact on any remaining archeological deposits. Thus the field methodology had to be structured to address both objectives.

This manuscript is the outcome of those investigations. With respect to the research objective, the investigations documented herein have refined our understanding of the nature of the Paleoindian occupation at the site and the relationship of the Angostura complex to the other Paleoindian complexes in the northern Plains. With respect to the management objective, cultural deposits are still present, the site has been recommended as eligible for inclusion in the National Register of Historic Places (NRHP), and the site has been stabilized successfully, thereby preserving the remaining deposits for the future. More generally, this project demonstrates the successful melding of research and management to further the protection of a historic property.

HISTORY OF ARCHEOLOGICAL RESEARCH AT ANGOSTURA RESERVOIR

R. Peter Winham and Kimball Banks

Prior to 1946, no archeological investigations had been undertaken in the Angostura Reservoir area (Wheeler 1995:4). The Smithsonian's RBS was responsible for the original salvage archeology of the reservoir area, conducting surveys and excavations between 1946 and 1950 (Wheeler 1995:10-13). A preliminary survey was conducted from August 6-8, 1946, by a Missouri Basin Project party consisting of J. Joseph Bauxar and Paul L. Cooper. These men located and examined five sites (39FA6-39FA10). A short report describing the sites, assessing the area's archeological potential, and recommending a reconnaissance of the entire area was issued in June of 1947 (Bauxar 1947).

During the following year, from June 4 to September 15, 1948, Jack T. Hughes and J. M. Shippee returned to the area and began a comprehensive and intensive survey and salvage program prior to completion of the dam. They located 30 occupation sites, 19 workshop sites and one petroglyph site in the reservoir area, as well as nine sites outside the reservoir area.

Seventeen of the occupation sites recorded in and near the Angostura Reservoir area were selected for excavation by field parties of the Missouri Basin Project in 1948-1950. The amount of work accomplished at these sites ranged from exposing the cultural deposit underlying a tipi ring and unearthing a stone hearth at site 39FA13, to the excavation and screening of the entire floor fill at a small rockshelter, site 39FA8. The investigations were undertaken in accordance with the immediate objective of the salvage operations, which was the sampling of as many culturally informative sites in and near the pool area as time and funds permitted (Wheeler 1995:15).

During the 1948 season, the investigators tested the Harney site (39FA10) and conducted trial excavations at one workshop site (39FA14) and 11 occupation sites (39FA8; 39FA9; 39FA13; 39FA23; 39FA38; 39FA45; 39FA48; the Landers site, 39FA54; 39FA56; Area A of the Ray Long site, 39FA65; and the Kolterman site, 39FA68) in the reservoir area (Haug et al. 1987; Wheeler 1995). Hughes (1949) prepared a summary of the 1948 season's work in which he proposed a cultural sequence consisting of eight different manifestations or loci, ranging from Paleoindian to protohistoric. Little other than generalized trait lists was presented to support his conclusions (Haug et al. 1987; Haug et al. 1992).

The next year, intensive investigations in the Angostura area were conducted by a Missouri Basin Project crew from July 7 through November 7, 1949. Jack T. Hughes acted as supervisor through September 3 and Richard P. Wheeler supervised the fieldwork during the remainder of the season. Two occupation sites, one workshop site, and two petroglyph sites were located in the reservoir area, and seven sites were located outside the reservoir area. Excavations were conducted at 14 occupation sites (the Harney site, 39FA10; 39FA23; 39FA30; 39FA35; 39FA38; 39FA42; 39FA45; 39FA48; the Landers site, 39FA54; 39FA56; 39FA61; Areas A, B and C of the Ray Long site, 39FA65; the Kolterman site, 39FA68; and 39FA83) (Wheeler 1995).

Between May 22 and July 18, 1950, two additional sites were documented outside of the reservoir and excavations were conducted at Area B of site 39FA23, at 39FA83, and at Areas A and B of the Ray Long site (Wheeler 1995:12). From 1946-1950, 60 sites were identified in the reservoir and an additional 18 were recorded outside of its boundaries (Figure 2; Table 1).

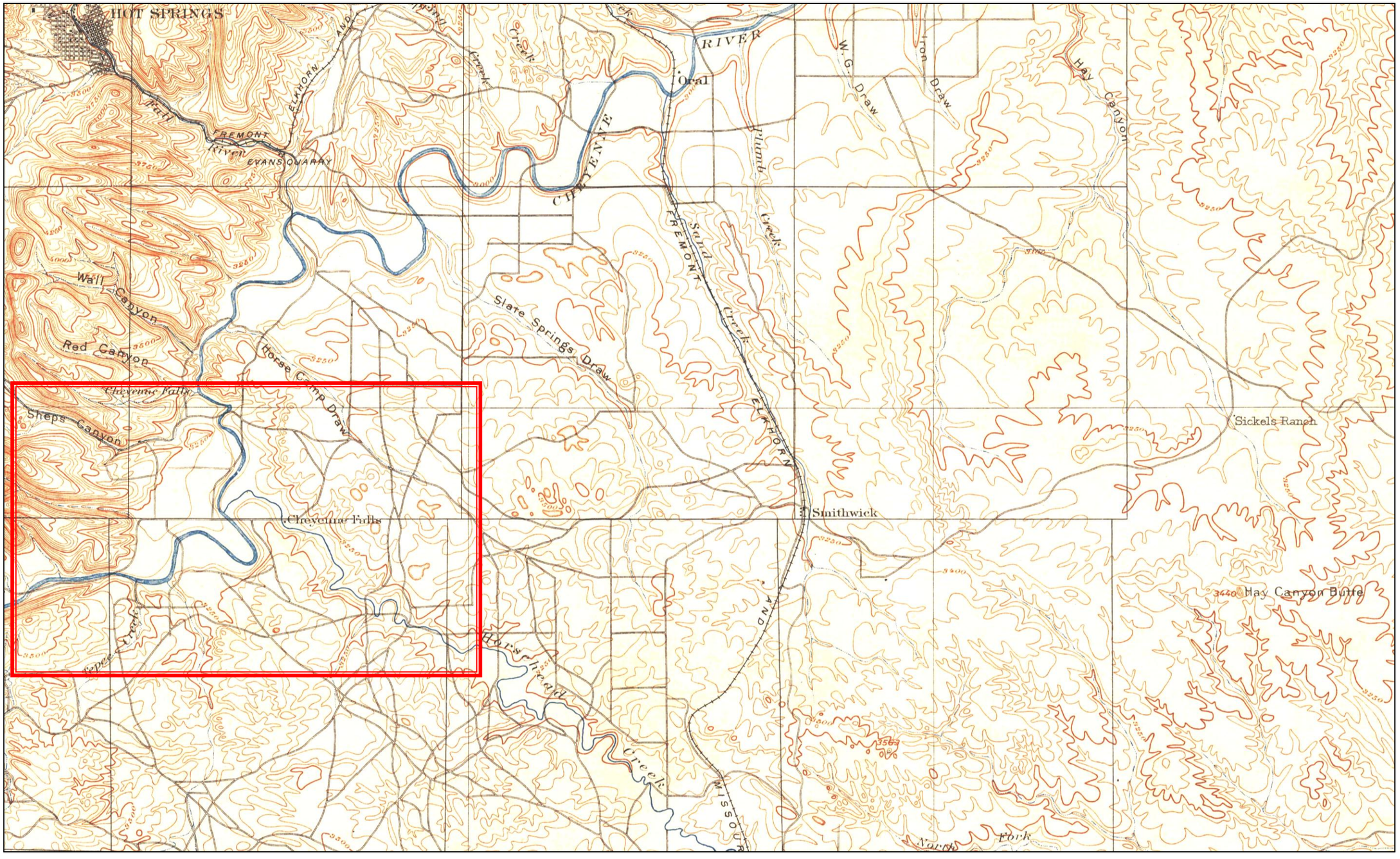


Figure 2. Pre-dam topography of the Angostura Reservoir area (adapted from U.S. Geological Survey 1:125,000-scale topographic quadrangle Oelrichs [1916]).

Table 1. Archeological Sites Identified In the Angostura Reservoir Area Between 1946 and 1950 (Wheeler 1995).

Site Number	Site Type*/ Cultural Affiliation (as per Wheeler†)	Report Reference(s)	Excavated by RBS?
39FA6	Occupation/Mid-Late Prehistoric	Wheeler 1995:451-455	No
39FA7/39FA35‡	Artifact Scatter/Late Archaic, Late Prehistoric	Haug et al. 1987:93-94; Wheeler 1995:216-224	Yes
39FA8/39FA91‡	Petroglyph & Rockshelter/Mid-Late Prehistoric	Haug et al. 1987:131-132; Wheeler 1995:59-63	Yes
39FA9	Occupation/Early-Late Prehistoric	Wheeler 1995:337-348	Yes
39FA10 (Harney)	Occupation/Mid-Late Prehistoric	Wheeler 1995:285-336	Yes
39FA11‡	Artifact Scatter/Paleoindian	Haug et al. 1987:73-77; Wheeler 1995:471-472	No
39FA12	Occupation/Mid-Late Prehistoric	Wheeler 1995:456	No
39FA13	Occupation/Early-Late Prehistoric	Wheeler 1995:64-77	Yes
39FA14	Occupation/Mid-Late Prehistoric	Wheeler 1995:457-459	No
39FA15	Occupation/Unknown	Wheeler 1995:464	No
39FA16	Workshop/Unknown	Wheeler 1995:473	No
39FA17	Workshop/Unknown	Wheeler 1995:474	No
39FA18	Workshop/Unknown	Wheeler 1995:474	No
39FA19‡	Artifact Scatter/Unknown	Haug et al. 1987:77-80; Haug et al. 1992:29-30; Wheeler 1995:463	No
39FA20	Occupation/Unknown	Wheeler 1995:465	No
39FA21	Workshop/Late Prehistoric	Wheeler 1995:469	No
39FA22‡	Artifact Scatter/Late Prehistoric	Haug et al. 1987:80-81; Haug et al. 1992:30-31; Wheeler 1995:468-469	No
39FA23‡	Occupation/Late Prehistoric	Lippincott 1996; Wheeler 1995:85-139	Yes
39FA24	Occupation/Unknown	Wheeler 1995:465-466	No
39FA25‡	Artifact Scatter/Late Prehistoric	Haug et al. 1987:81-84; Wheeler 1995:474	No
39FA27‡	Artifact Scatter/Prehistoric & Euroamerican	Haug et al. 1987:84-85; Wheeler 1995:475	No
39FA28‡	Artifact Scatter/Prehistoric & Euroamerican	Haug et al. 1987:85-87; Wheeler 1995:469	No
39FA29	Occupation/Unknown	Wheeler 1995:466-467	No
39FA30	Occupation/Late Prehistoric	Wheeler 1995:195-215	Yes
39FA31‡	Occupation/Late Archaic, Late Prehistoric	Haug et al. 1987:87-92; Haug et al. 1992:31-39; Wheeler 1995:466	No
39FA32	Workshop/Unknown	Wheeler 1995:474-475	No
39FA33	Workshop/Unknown	Wheeler 1995:472	No
39FA34	Occupation/Unknown	Wheeler 1995:464	No
39FA35/39FA7‡	Artifact Scatter/Late Archaic, Late Prehistoric	Haug et al. 1987:93-94; Haug et al. 1992:39-40; Wheeler 1995:216-224	Yes
39FA36‡	Artifact Scatter/Unknown	Haug et al. 1987:95-96; Wheeler 1995:465	No
39FA37	Workshop/Unknown	Wheeler 1995:472-473	No
39FA38‡	Occupation/Middle Archaic	Haug et al. 1987:96-97; Haug et al. 1992:40-45; Wheeler 1995:349-355	Yes
39FA39‡	Artifact Scatter/Late Archaic or Late Prehistoric	Haug et al. 1987:97-98; Wheeler 1995:470	No
39FA40	Workshop/Unknown	Wheeler 1995:473	No
39FA41	Workshop/Unknown	Wheeler 1995:473	No
39FA42	Occupation/Late Prehistoric	Wheeler 1995:48-58	Yes
39FA43‡	Occupation/Unknown	Haug et al. 1987:98-101; Haug et al. 1992:45-47; Wheeler 1995:472	No
39FA44	Workshop/Middle Prehistoric	Wheeler 1995:470-471	No

Table 1 (continued).

Site Number	Site Type*/ Cultural Affiliation (as per Wheeler†)	Report Reference(s)	Excavated by RBS?
39FA45‡	Occupation & Foundation/Plains Village & Euroamerican	Haug et al. 1987:101-110; Wheeler 1995:17-29	Yes
39FA46‡	Occupation/Unknown	Haug et al. 1987:110-111; Haug et al. 1992:48-49; Wheeler 1995:467	No
39FA47	Occupation/Unknown	Wheeler 1995:467	No
39FA48	Occupation/Late Prehistoric	Wheeler 1995:30-47	Yes
39FA51‡	Artifact Scatter/Mid-Late Prehistoric	Haug et al. 1987:111-112; Haug et al. 1992:49-52; Wheeler 1995:455-456	No
39FA52‡	Occupation/Middle Archaic	Haug et al. 1987:113-114; Haug et al. 1992:52-54; Wheeler 1995:461-463	No
39FA53‡	Artifact Scatter/Unknown	Haug et al. 1987:115-116; Wheeler 1995:471	No
39FA54 (Landers) ‡	Occupation/Middle Archaic	Haug et al. 1987:116-120; Haug et al. 1992:55-62; Wheeler 1995:356-371	Yes
39FA56‡	Artifact Scatter/Middle-Late Archaic	Haug et al. 1987:120-122; Wheeler 1995:225-246	Yes
39FA58	Petroglyph/	Wheeler 1995:476-480	No
39FA60	Occupation/Mid-Prehistoric	Wheeler 1995:460-461	No
39FA61	Occupation/Mid-Late Prehistoric	Wheeler 1995:78-84	Yes
39FA63	Occupation/Mid-Late Prehistoric	Wheeler 1995:457	No
39FA64	Occupation/Late Prehistoric	Wheeler 1995:459-460	No
39FA65 (Ray Long)	Occupation/Early-Mid Prehistoric	Hannus 1986; Hannus et al. 1993; Wheeler 1995:372-450	Yes
39FA68 (Kolterman)	Occupation/Mid-Late Prehistoric	Wheeler 1995:247-284	Yes
39FA69‡	Occupation/Late Prehistoric	Haug et al. 1987:125-127; Haug et al. 1992:64-65; Wheeler 1995:466	No
39FA73	Petroglyph/Unknown	Wheeler 1995:476-480	No
39FA74‡	Artifact Scatter/Unknown	Haug et al. 1987:127-128; Haug et al. 1992:65-67; Wheeler 1995:463	No
39FA75‡	Petroglyph & Rockshelter/Unknown	Haug et al. 1987:128-129; Wheeler 1995:476-480	No
39FA82‡	Artifact Scatter/Unknown	Haug et al. 1987:130-131; Wheeler 1995:464-465	No
39FA83	Occupation/Mid-Late Prehistoric	Wheeler 1995:140-194	Yes

*** Wheeler's *Workshop* designation is synonymous with the current *Artifact Scatter* designation.**
‡ Revisited by ARC/ALAC during the 1985 reservoir survey project (see Hannus 1986; Haug et al. 1987; Lippincott 1996).
† Wheeler utilized Mulloy's (1958) chronological framework in organizing his data (see Wheeler 1995:481-497 for a discussion of his chronological sequence). For sites more recently revisited, the contemporary designations are used.

No additional cultural resource projects took place in the Angostura reservoir area until 1977, when Mark Hackbarth, South Dakota State Archaeological Research Center (ARC) conducted a survey of the proposed North and South Marina projects. He found little evidence of the sites previously recorded in these localities by the River Basin Survey due to an already constructed parking lot at site 39FA25 and a trailer court at site 39FA53 (Haug et al. 1987).

In the years since 1977, as part of its responsibilities under Sections 106 and 110 of the National Historic Preservation Act, Reclamation has conducted a number of cultural resource inventories

and evaluations of archeological and historic sites on the lands it administers around the reservoir. Mapped petroglyph sites in the reservoir area were also revisited in 1980 as part of a larger thematic study of regional rock art sites (Sundstrom 1981, 1984). Drought in the mid-1980s and early 1990s lowered the level of the reservoir at Angostura, exposing a number of sites that are usually inundated. This presented an opportunity for archeologists to reexamine sites along the shoreline. During this time, Reclamation contracted with ARC to conduct an inventory and evaluation of those sites within the reservoir area (Haug et al. 1987; Haug et al. 1992).

ARC conducted the cultural resources inventory of Reclamation property at Angostura Reservoir in 1985. Approximately 4,500 acres were surveyed; 60 new sites were recorded (Table 2); 27 sites recorded by the RBS in the 1940s were relocated; and 28 sites were not relocated. It was recommended that 28 of the 87 newly recorded and relocated sites should be revisited or evaluated and another 18 should be tested for NRHP eligibility. Among the 87 newly recorded and relocated sites documented, 95 components were identified including 14 isolated finds, 47 artifact scatters, 17 occupations, 2 petroglyphs, 4 rockshelters, 2 faunal concentrations, and 9 historic sites (Haug et al. 1987).

Table 2. Previously Unrecorded Sites Identified at Angostura Reservoir During 1985 ARC Survey (Haug et al. 1987).

Site Number	Site Type/ Cultural Affiliation	Report Reference(s)	Evaluated by ARC?
39FA807	Isolated Find/Unknown	Haug et al. 1987:132-134	No
39FA808	Artifact Scatter/Unknown	Haug et al. 1987:134-135	No
39FA809	Artifact Scatter/Unknown	Haug et al. 1987:135-139; Haug et al. 1992:67-68	Yes
39FA810	Isolated Find/Unknown	Haug et al. 1987:139-140	No
39FA811	Isolated Find/Unknown	Haug et al. 1987:140-141	No
39FA812	Isolated Find/Unknown	Haug et al. 1987:142-143	No
39FA813	Artifact Scatter/Unknown	Haug et al. 1987:144-147; Haug et al. 1992:68-72	Yes
39FA814	Isolated Find/Unknown	Haug et al. 1987:147-149	No
39FA815	Isolated Find/Unknown	Haug et al. 1987:149-150	No
39FA816	Artifact Scatter/Unknown	Haug et al. 1987:150-152	No
39FA817	Artifact Scatter/Unknown	Haug et al. 1987:153-155	No
39FA818	Isolated Find/Unknown	Haug et al. 1987:155-157	No
39FA820	Isolated Find/Unknown	Haug et al. 1987:157-159	No
39FA821	Artifact Scatter/Unknown	Haug et al. 1987:159-161	No
39FA822	Artifact Scatter/Unknown	Haug et al. 1987:161-163	No
39FA823	Artifact Scatter/Unknown	Haug et al. 1987:163-165; Haug et al. 1992:72-74	Yes
39FA824	Artifact Scatter/Unknown	Haug et al. 1987:165-167; Haug et al. 1992:74-76	Yes
39FA825	Occupation/Unknown	Haug et al. 1987:167-168; Haug et al. 1992:76-77	Yes
39FA826	Artifact Scatter/Unknown	Haug et al. 1987:168-170; Haug et al. 1992:77-79	Yes
39FA827	Isolated Find/Unknown	Haug et al. 1987:170	No
39FA828	Irrigation Flume/Euroamerican	Haug et al. 1987:171-174	No
39FA829	Artifact Scatter/Unknown	Haug et al. 1987:174-175; Haug et al. 1992:79-81	Yes
39FA830	Rockshelter/Unknown	Haug et al. 1987:175-176; Haug et al. 1992:81-83	Yes
39FA831	Rockshelter/Unknown	Haug et al. 1987:177-178; Haug et al. 1992:83	Yes
39FA832	Isolated Find/Unknown	Haug et al. 1987:178-180	No
39FA833	Artifact Scatter & Foundation/ Paleoindian, Late Archaic & Euroamerican	Haug et al. 1987:180-185; Haug et al. 1992:83-86	Yes
39FA834	Artifact Scatter & Farmstead/ Unknown & Euroamerican	Haug et al. 1987:185-190	No
39FA835	Artifact Scatter/Unknown	Haug et al. 1987:190-193; Haug et al. 1992:86-87	Yes

Table 2 (continued).

Site Number	Site Type/ Cultural Affiliation	Report Reference(s)	Evaluated by ARC?
39FA836	Artifact Scatter/Unknown	Haug et al. 1987:193-196	No
39FA837	Farmstead/Euroamerican	Haug et al. 1987:196-199	No
39FA838	Artifact Scatter/Unknown	Haug et al. 1987:199-200	No
39FA839	Farmstead/Euroamerican	Haug et al. 1987:201-204	No
39FA840	Isolated Find/Unknown	Haug et al. 1987:204-205	No
39FA841	Artifact Scatter/Unknown	Haug et al. 1987:205-207; Haug et al. 1992:88	Yes
39FA842	Artifact Scatter/Middle Archaic	Haug et al. 1987:207-210; Haug et al. 1992:88-90	Yes
39FA843	Farmstead/Euroamerican	Haug et al. 1987:210-211	No
39FA844	Artifact Scatter/Unknown	Haug et al. 1987:211-212	No
39FA845	Occupation/Unknown	Haug et al. 1987:212-216; Haug et al. 1992:90-93	No†
39FA846	Artifact Scatter/Unknown	Haug et al. 1987:216-221; Haug et al. 1992:93-94	Yes
39FA847	Artifact Scatter/Unknown	Haug et al. 1987:221-222; Haug et al. 1992:94-97	Yes
39FA848	Artifact Scatter/Unknown	Haug et al. 1987:222-224	No
39FA849	Artifact Scatter/Unknown	Haug et al. 1987:224-226; Haug et al. 1992:97-99	Yes
39FA850	Isolated Find/Unknown	Haug et al. 1987:226-229	No
39FA851	Occupation & Artifact Scatter/ Middle Archaic, Late Archaic, Late Prehistoric & Euroamerican	Haug et al. 1987:229-239	No
39FA852	Isolated Find/Unknown	Haug et al. 1987:239-240	No
39FA853	Artifact Scatter/Unknown	Haug et al. 1987:240-241	No
39FA854	Occupation/Middle Archaic, Late Archaic	Haug et al. 1987:241-246	No
39FA855	Artifact Scatter/Unknown	Haug et al. 1987:246-247	No
39FA858	Artifact Scatter/Unknown	Haug et al. 1987:247-250	No
39FA859	Artifact Scatter/Unknown	Haug et al. 1987:250-252	No
39FA860	Occupation/Plains Village (Late Prehistoric)	Haug et al. 1987:252-256; Haug et al. 1992:99-104	Yes
39FA861	Occupation/Plains Village (possibly Extended Coalescent)	Haug et al. 1987:256-258	No
39FA862	Artifact Scatter/Unknown	Haug et al. 1987:258-259	No
39FA863	Occupation/Unknown	Haug et al. 1987:259-260; Haug et al. 1992:104-107	Yes
39FA864	Artifact Scatter/Unknown	Haug et al. 1987:260-262; Haug et al. 1992:107-108	Yes
39FA865	Faunal/Non-cultural	Haug et al. 1987:262-263; Haug et al. 1992:109-110	Yes
39FA866	Artifact Scatter & Foundation/ Unknown & Euroamerican	Haug et al. 1987:264-265; Haug et al. 1992:110-114	Yes
39FA867	Artifact Scatter/Unknown	Haug et al. 1987:266-267; Haug et al. 1992:114-115	Yes
39FA868	Occupation/Unknown	Haug et al. 1987:267-269; Haug et al. 1992:114-120	Yes
39FA869	Isolated Find/Unknown	Haug et al. 1987:269-270	No
39FA59*	Artifact Scatter/Unknown	Haug et al. 1987:122-125; Haug et al. 1992:62-65	Yes

*** 39FA59 was first recorded by a RBS crew as a paleontological site. The 1985 survey identified cultural material in association with it.**
† This site is included in the evaluation report because it was originally believed to have been evaluated. However, it was later learned that crews actually evaluated site 39FA84*6* thinking that it was 39FA84*5* (see Haug et al. 1987:94).

As part of the 1985 activities, ALAC, through a subcontract with ARC, undertook a surface survey and subsurface testing program at the Ray Long site. In addition, more detailed investigations were carried out in 1985 at site 39FA23 by a crew from ARC under the direction of Robert A. Alex (Lippincott 1996). Site 39FA23 is across Horsehead Creek from the Ray Long site. The RBS originally investigated this site in 1948 and 1949, and it was among the sites reported on by Wheeler (Wheeler 1995). Reclamation sponsored further excavations here in 1985 after the site was exposed during the period of lowered reservoir levels. These excavations demonstrated the presence of intact deposits (Lippincott 1996), which supported many

archaeologists' belief that inundated sites still have the potential to yield useful information. Along with features, artifacts, and faunal remains, radiocarbon samples were recovered from site 39FA23 and successfully dated.

During the summer and fall of 1987, ARC conducted examinations and evaluations of 37 of the sites located on the 1985 survey (Haug et al. 1992). The bulk of the 1987 test excavations was confined to site 39FA31, the Ray Long site (39FA65), the Lander site (39FA54), site 39FA860 and site 39FA868. As a result of the 1987 work, 28 sites were recommended to be not eligible for NRHP listing, five met one or more criteria for inclusion on the NRHP, and four were outside the Reclamation property lines or could not be relocated (Haug et al. 1992).

In 1989, a crew from ARC conducted a highway project survey just north of Reclamation property near sites 39FA845 and 39FA846. While surveying the reservoir shoreline and beach, which was very broad due to a low reservoir level, they noted a concentration of artifacts about 200 m northwest of the site identified in 1987 as 39FA845. This concentration had not been mapped by the 1985 team, and the 1987 team had not explored up the beach that far. The most likely explanation is that the sites had been mapped incorrectly in 1985 and that the 1987 crew had relocated 39FA846 but believed from maps that it was the location of site 39FA845. In that event, the recommendations for site 39FA845 in the 1987 evaluation would apply to 39FA846 (Haug et al. 1992:94). Therefore, the actual site 39FA845 was not evaluated and its National Register eligibility status remained in doubt until 2008.

In 2008, Reclamation sponsored a site relocation and assessment survey in the Angostura, Bell Fourche, and Shadehill reservoirs in western South Dakota. Archeologists from the University of North Dakota's Department of Anthropology conducted the investigations. They revisited 12 sites at Angostura Reservoir, including two NRHP-listed sites (39FA75 and 39FA91), seven sites that had been previously determined NRHP-eligible (39FA23, 39FA31, 39FA65, 39FA828, 39FA833, 39FA860, and 39FA868), one site previously found to be not eligible for NRHP-listing (39FA846), and two unevaluated sites (39FA844 and 39FA845) (Jackson and Toom 2009:4.1). Sites 39FA844 and 39FA845 were evaluated and found to be not eligible for NRHP-listing (Jackson and Toom 2009:4.51-4.63), and the eligibility status of site 39FA23 was altered from eligible to not eligible based on observations suggesting that the site had largely been destroyed by a combination of wave action and offshore currents (Jackson and Toom 2009:4.1-4.7).

In his summary of the 1948 RBS work completed in the Angostura Reservoir area, Waldo Wedel stated that none of the sites in the reservoir area showed evidence of any single long-time occupancy and that frequent and repeated use of the locality by various peoples over a long period of time seemed to be indicated (Wedel 1953a:21). After the 1949 work, Wedel's conclusions changed very little. He then stated that the region appeared to have been intermittently occupied by a long succession of native peoples throughout a period of several millennia and that the investigated sites showed no evidence of prolonged, continuous occupation or intensive pursuit of horticulture (Wedel 1953b:75). Subsequent investigations carried out over the course of the past six decades have demonstrated that evidence of a wide range of prehistoric peoples occupying the Angostura Reservoir area is present in the archeological record and that all periods except the Early Archaic have been identified in site assemblages there.

HISTORY OF ARCHEOLOGICAL RESEARCH AT THE RAY LONG SITE (39FA65) PRIOR TO 1993

R. Peter Winham and Kimball Banks

The Ray Long site (39FA65) is a Paleoindian occupation site initially investigated by the Smithsonian Institution RBS between 1948 and 1950. The site is situated on a remnant Pleistocene terrace on Horsehead Creek just upstream from the creek's confluence with the Cheyenne River (Figure 3 [see Appendix A]). It is flanked by two intermittent drainages. Ray Long is one of very few sites in the northern plains from the Paleoindian period to retain intact, buried cultural deposits. Archeological samples from the site were among the first to be dated using the then new radiocarbon dating method. More recently obtained dates from the site indicate occupation from 9540 to 11,000 years ago. In addition, the site has produced a previously unknown series of projectile points that form the basis for the typological complex identified as "Angostura," which dates to approximately 9300 Radiocarbon Years Before Present (RCYBP).

Archeologist Richard P. Wheeler undertook investigations at the Ray Long site between 1948 and 1950 (Wheeler 1995). He excavated three blocks, Areas A, B, and C, across the terrace (see Figure 3). Area A is along the eastern edge; Area B is on the terrace proper; Area C is along the western edge adjacent to Horsehead Creek. The major efforts were expended in Areas A and B (Figures 4-7). To clarify site stratigraphy, Wheeler also excavated two test trenches at the extreme northern edge of the site.

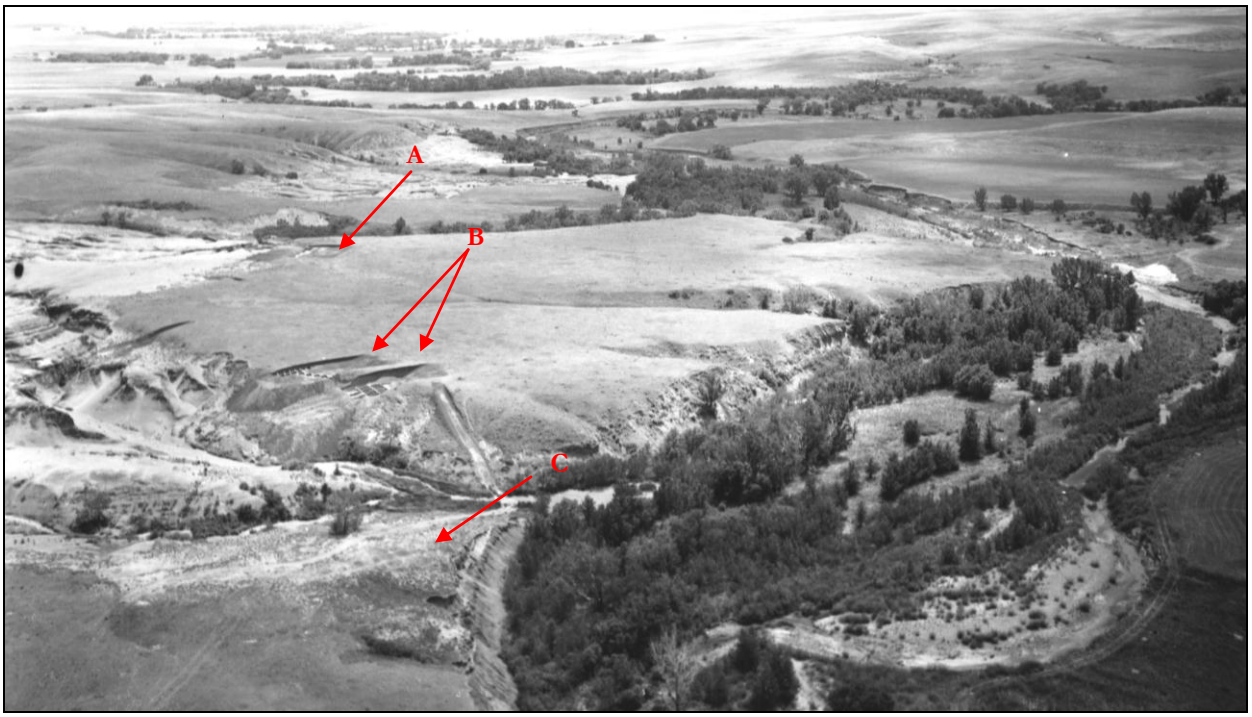


Figure 3. Aerial photograph of the Ray Long site taken July 15, 1950 by R. P. Wheeler, facing ESE. Areas A, B, and C are identified by the red arrows.

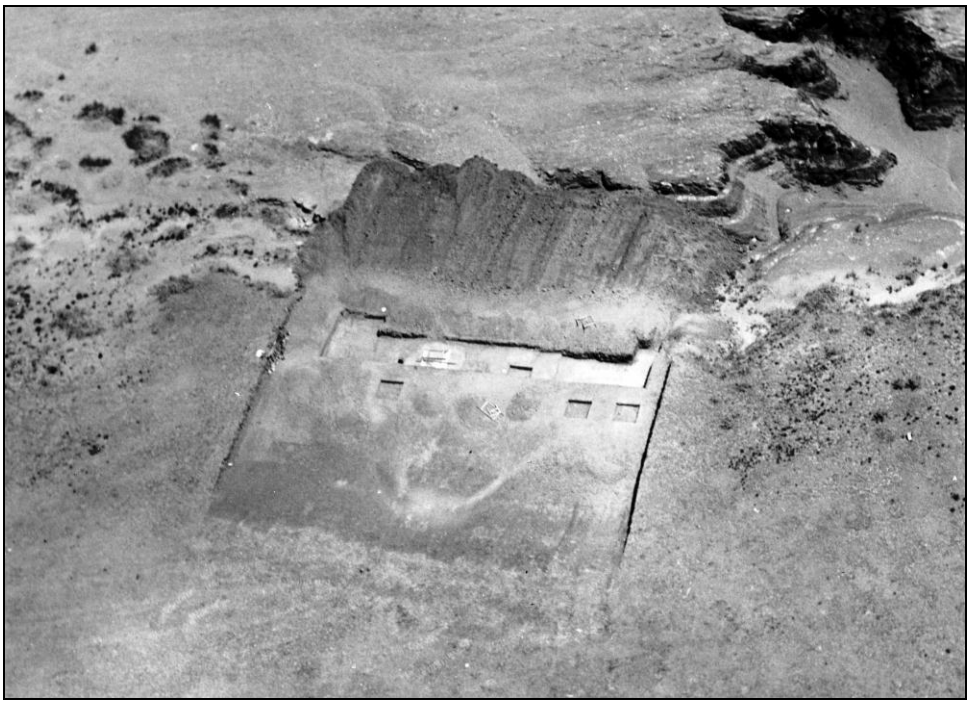


Figure 4. Aerial photograph of Area A of the Ray Long site taken July 15, 1950 by R. P. Wheeler, facing E.

A discovery in Area A suggested the site might have the potential to yield significant information on the early prehistory of the area. The discovery included three artifacts "…of special interest because of their potential great antiquity…the medial section and the proximal section of narrow lanceolate projectile points with parallel diagonal 'ripple flaked' surfaces, and a stemmed point with sharply constricted tip and concave base" (Wheeler 1995:372). The first two were examples of what Wheeler called Angostura points (Wheeler 1995:372). Wheeler believed the third artifact was a drill tip reworked from an Angostura point (Wheeler 1995:372).

Figure 5. Photograph of excavations in progress at Area A of the Ray Long site taken by R. P. Wheeler on July 6, 1950, facing SSE.

Wheeler identified three components that he designated as A, B, and C. Component C is the oldest; it was radiocarbon dated to 9380 ± 500 RCYBP. This component was found in Area A. Component B was dated to 7715 ± 740 RCYBP and 7073 ± 300 RCYBP and was found in Area B. Wheeler's Angostura points came from these two components. Component A was undated and was found in Area C. Wheeler assumed that this component was the youngest based on the presence of a Duncan point; a point type which is typically associated with the Middle Archaic period on the northern plains (Wheeler 1995:401).

Figure 6. Aerial photograph of Trenches 1 and 2 at Area B of the Ray Long site taken by R. P. Wheeler on July 12, 1950, facing SE. A tent at Area A is visible in the upper left corner of the image.

Wheeler's investigations resulted in the recognition of the Angostura complex; however, the complex remains poorly defined. Wheeler's description of the complex was based on 48 tools from Component B and 29 tools from Component C. The tools attributed to the complex included 13 hammerstones, as well as palettes, milling stones and handstones. The Angostura projectile point was defined based on the analysis and description of 12 incomplete specimens recovered from the site, including three from Component B and 9 from Component C; no complete Angostura points were identified (Wheeler 1995:Table 4).

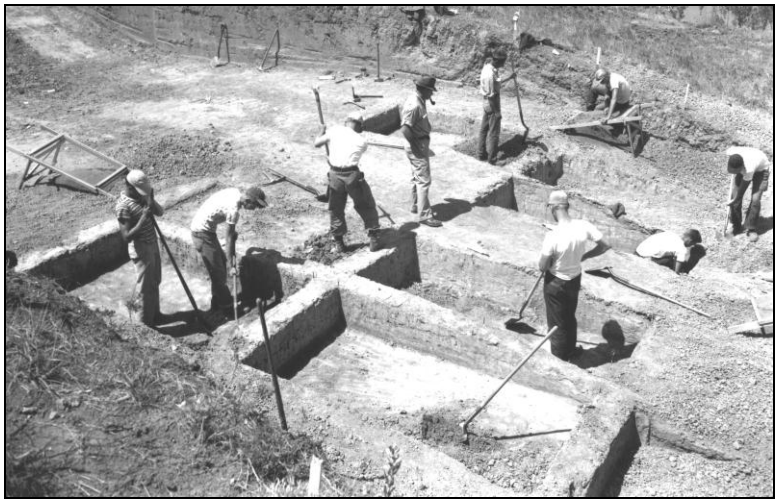


Figure 7. Photograph of excavations in progress at Trench 1, Area B of the Ray Long site taken by R. P. Wheeler on June 13, 1950, facing SW.

Because they were geographically separated, Wheeler identified three cultural components; however, their stratigraphic relationship with respect to the Angostura complex was not clearly defined. The presence of Angostura points in both Components B and C suggests that the complex spanned some 2,000 years. Contrary to this, the radiocarbon dates suggest a 500 to 3,000 year stratigraphic hiatus between the two components. Considering that the samples were dated in the early 1950s and have very large standard deviations, their accuracy is questionable. This, in turn, calls into question the stratigraphic relationship between Components B and C, and the

stratigraphic relationship of these two components with Component A also remains uncertain. The presence of a Duncan point in Component A suggests that it postdates Components B and C; however, the Component A assemblage also contains a drill that was described by Wheeler (1995:401) as a "reworked Angostura point."

No further archeological work was undertaken at the Ray Long site until a drought in the mid-1980s and early 1990s lowered the level of the reservoir at Angostura, exposing a number of areas that had previously been inundated. The lower reservoir levels also revealed the extent to which wave action had cut into the terrace upon which the Ray Long site is located. Wave action had created a cliff face along the west and south sides of the site that varied from 5 to 10 feet in height. Reclamation contracted with ARC to inventory and evaluate exposed sites in the reservoir area; as part of that investigation, ARC subcontracted with ALAC to determine whether the Ray Long site still possessed integrity and satisfied any of the criteria necessary to be considered eligible for listing in the NRHP.

ALAC conducted investigations at Ray Long in 1985 and determined that wave action and inundation had significantly altered the terrace (Hannus 1986 [see Appendix B]). Wheeler's Area C had eroded away and Area A also appeared to have suffered significantly. In contrast, Area B appeared to have been affected only marginally as Wheeler's bulldozer trenches were still clearly visible (Figure 8). Consequently, the ALAC investigations focused on Area B. A series of six backhoe trenches (Trenches A-F) was also excavated in and near the original location of Smithsonian Trenches 1 and 2 to better understand the geomorphology and stratigraphy of the site (Figure 9). Features consisting of charcoal concentrations associated with unprepared hearths were found in two trenches and radiocarbon dates were obtained from four features in Trench F. These dates range from 9050 ± 310 B.C. to 7000 ± 140 B.C. (Hannus 1986 [see Appendix B]).

Figure 8. 1985 aerial overview of Area B (Wheeler's 1949 excavation area) of the Ray Long site. Arrows indicate old scars from bulldozer utilized by Wheeler in 1949. Backhoe trenches were placed within and beside the bulldozer scars, including Trench F.

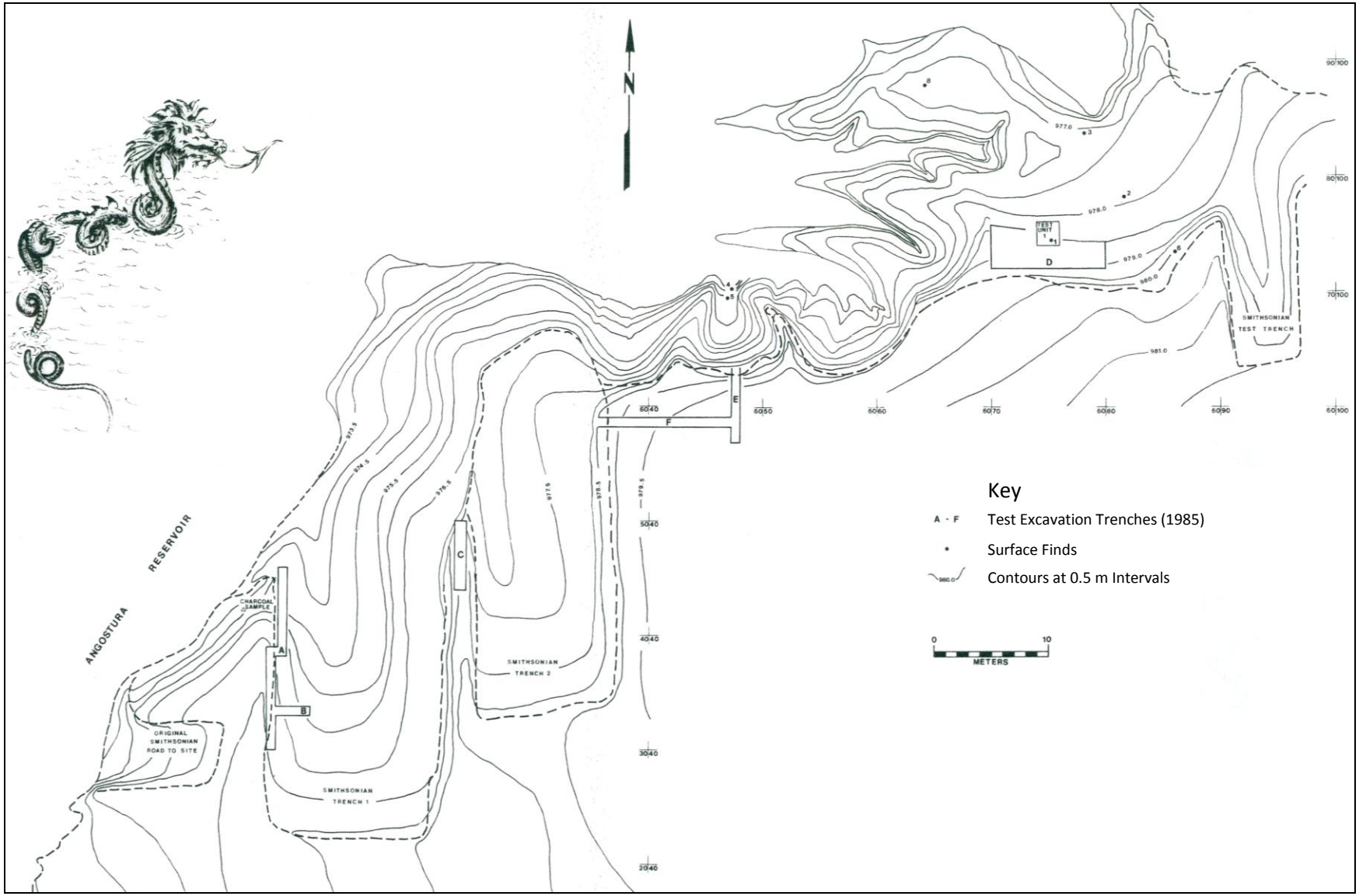


Figure 9. Plan view of Area B of the Ray Long site depicting the location of Trenches A-F in relation to the excavation areas of the Smithsonian Institution (from Hannus 1986:11).

Additionally, a pedestrian survey conducted during the 1985 field season resulted in the recovery of three Angostura point fragments from a deflated part of the site east of Area B (Figure 10). See Hannus (1986:42-54 [Appendix B]) for a discussion of these projectile point fragments and other lithics recovered during the 1985 field season.

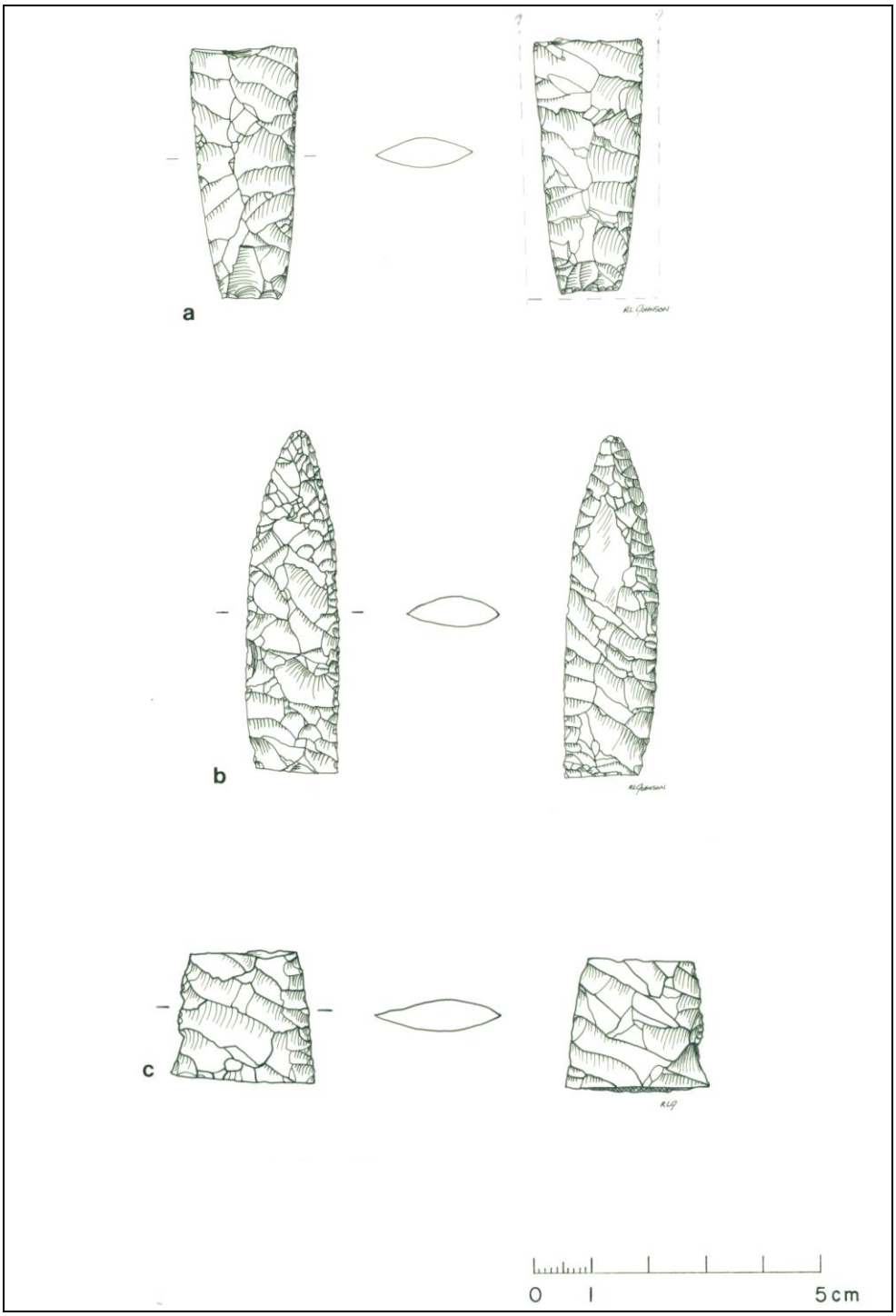


Figure 10. Technical drawing of Angostura projectile point fragments recovered from surface of site 39FA65 in 1985: (a) basal portion (85-1) (dashed lines indicate lateral and basal grinding); (b) proximal portion (85-2); (c) midsection (85-3) (from Hannus 1986:43).

The 1985 investigations underscored the complex nature of the deposits at Ray Long and raised additional questions about the geomorphology and stratigraphy of the site, as well as the chronological and cultural/technological relationship between Wheeler's Angostura complex and other Paleoindian complexes in the northern plains. Radiocarbon dates of 11,000 ± 310 RCYBP and 8950 ± 140 RCYBP from features in Trench F indicated the possibility of even older occupations. In addition, fragments of three Angostura points were recovered. Finally, pollen and phytoliths were found to be present. The results of the 1985 work did clarify that enough of the site retained sufficient integrity to be considered eligible for inclusion in the NRHP under Criterion D.

In 1987, ARC conducted NRHP test evaluations at several sites throughout the Angostura Reservoir area (Haug et al. 1992). During their field season, ARC briefly visited the Ray Long site and excavated a test unit at Area B between the old Smithsonian Institution trench and one of ALAC's trenches (Haug 1987:3). However, the exact location of the excavation unit and the results of the testing have not been published.

Lowered reservoir levels persisted into the early 1990s. Because the reservoir level was not at the base of the terrace, Reclamation archeologists in the Dakotas Area Office became concerned that wave action would continue to eat away the terrace edge and destroy the Ray Long site. The Dakotas Area Office entered into a cooperative agreement with ALAC in 1992 for further investigations at the site. The research objectives concerned the stratigraphy and geomorphology of the site and a better understanding of the Angostura complex; the management objective involved an assessment of how to stabilize the archeological deposits.

In 1992, ALAC returned to the Ray Long site to conduct further archeological and geomorphological investigations (Hannus et al. 1993 [see Appendix C]). During this time, backhoe Trench F was reopened and four additional backhoe trenches, Trenches G-J, were cut between Areas A and B of the site (Figure 11). Additionally, a 1-m-x-1-m test unit was excavated immediately north of Trench F and a surface evaluation of the alluvial fan landform was conducted by the project geomorphologist. These evaluations, coupled with elevational data and the trench profiles, allowed for the proposed reconstruction of the past site area landform (Albanese 1993). The reconstruction suggested that the site is situated within a late Pleistocene/early Holocene alluvial fan that was crossed by numerous braided streams flowing in a southwesterly orientation into Horsehead Creek. It was further posited that the prehistoric occupants of the site likely camped on fan surfaces between these small, shifting stream channels. Because of the rapid sediment accumulation, landforms were not typically exposed long enough to allow for pedogenesis to occur (Albanese 1993:25).

Limited field investigations continued at Ray Long during 1993, 1994, 1995, 1996, 1998, 2000, and again in 2010. The results of those investigations are provided in subsequent sections of this report.

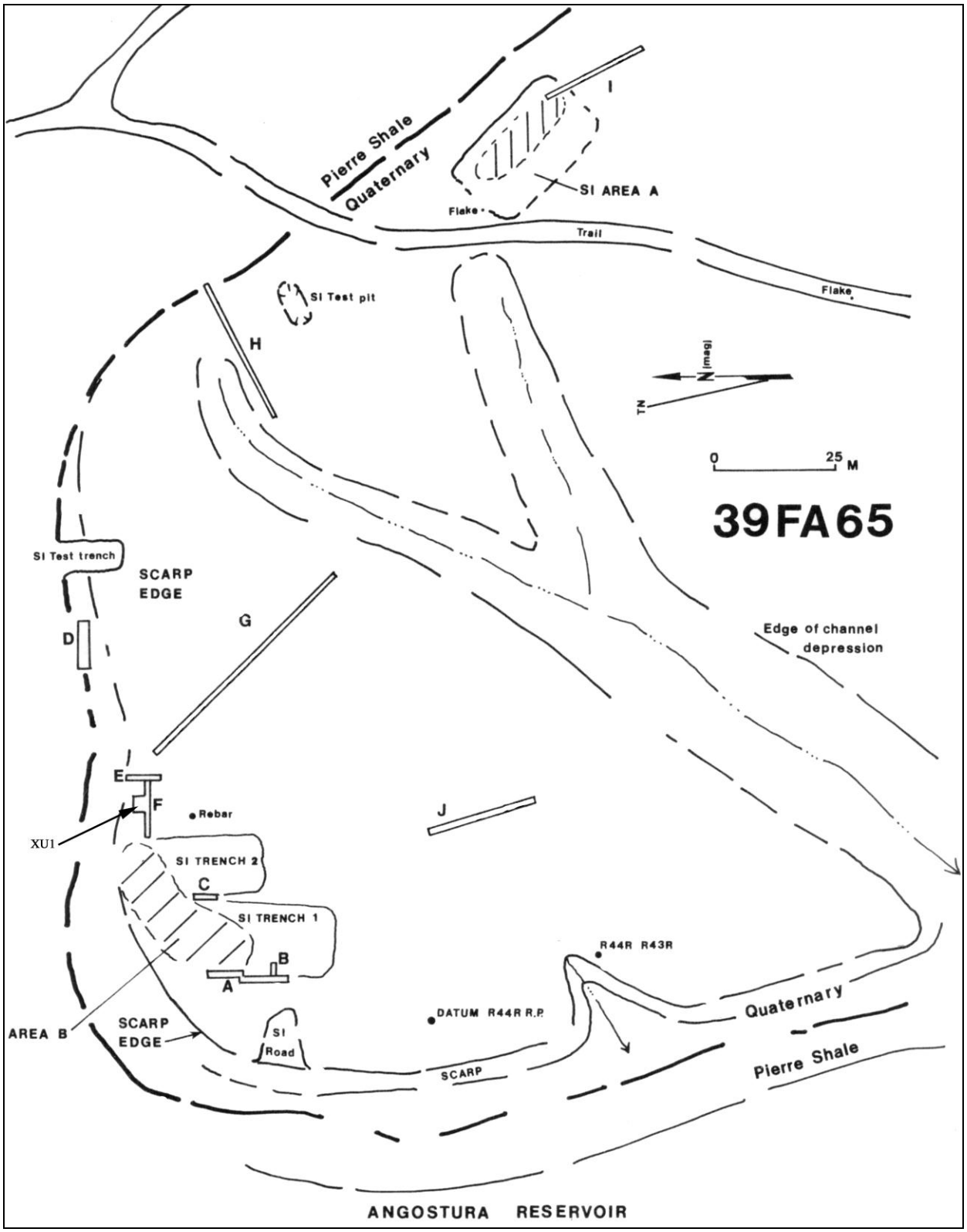


Figure 11. 1992 plan view of the Ray Long site depicting the location of Trenches G-J and XU1 (adapted from Hannus et al. 1993:29).

1993 FIELD INVESTIGATIONS

Archeological and geomorphological investigations comprising the 1993 field season at the Ray Long site were undertaken between September 19 and 26, 1993. The field crew was composed of L. Adrien Hannus, R. Peter Winham, Gene Anderson, and David Greenlund. During this time, four new trenches were opened and profiled (Trenches K-N), one excavation unit was opened along the east wall of Trench M (XU1), and two soil profiles were drawn adjacent to the former Smithsonian Trenches 1 and 2 (Profiles 1 and 2). In addition, a soil sample was collected from Profile 1, and a small number of surface artifacts were collected and analyzed (Figure 12). A charcoal sample obtained from a burned earth feature in XU1 was also submitted for Accelerator Mass Spectrometry (AMS) dating. Details of the 1993 investigation results are addressed below.

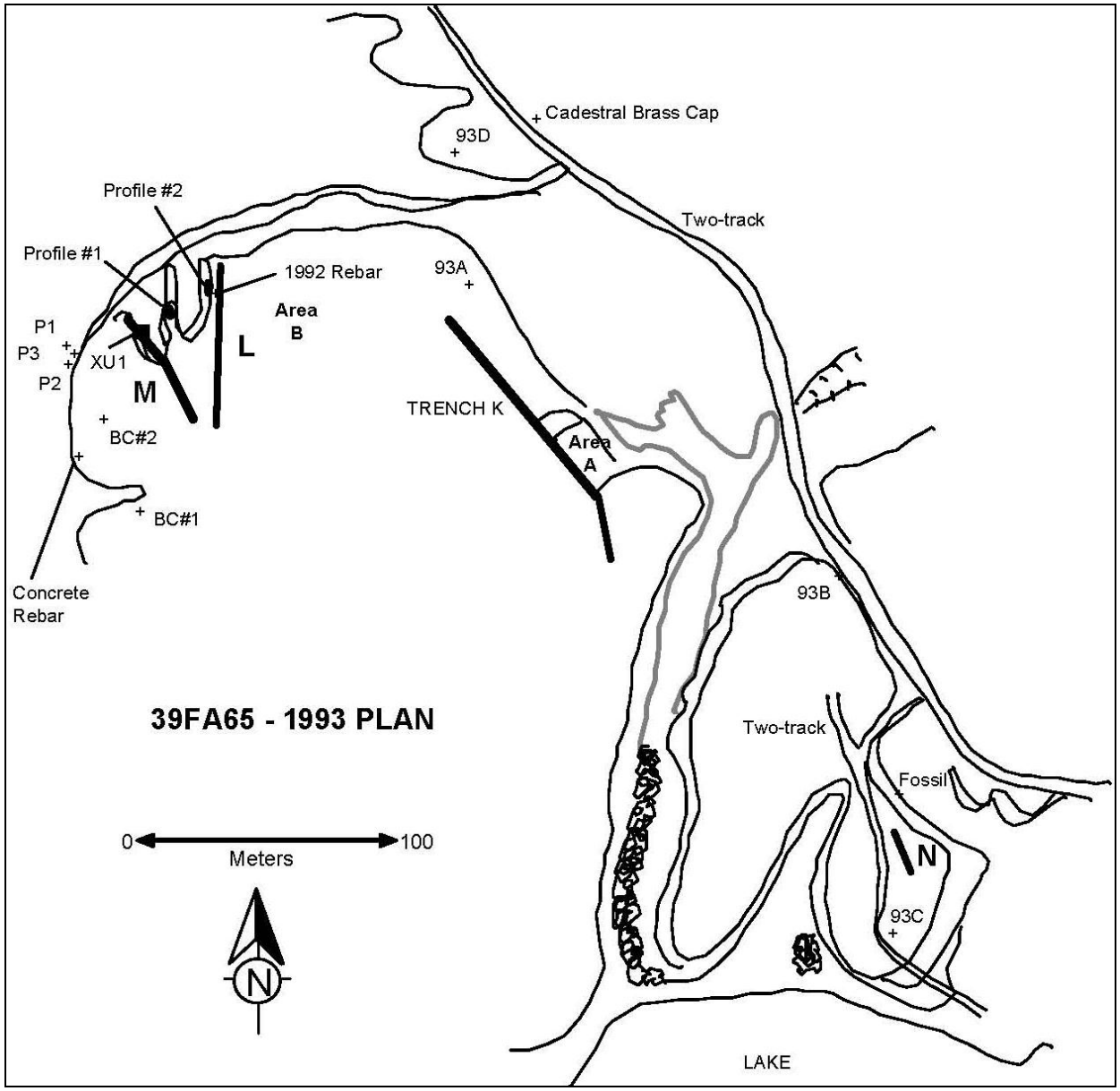


Figure 12. Plan view of the Ray Long site (39FA65) identifying the areas investigated (Trenches K-N, XU1, and Profiles 1 and 2) during the 1993 field season.

SMITHSONIAN INSTITUTION AREA B TRENCH PROFILES

The eastern wall profiles of Trenches 1 and 2 from the SI-RBS excavations were exposed and profiled by then Project Geoarchaeologist John Albanese (Figures 13 and 14; see Figure 12, above). Detailed drawings and soil descriptions for Profiles 1 and 2 are provided in the 2009 site geologic report (Albanese 2009 [see Appendix D]). A soil column sample was also collected from Profile 1 during this time for possible future pollen and phytolith analyses; however, the sample has not been processed.

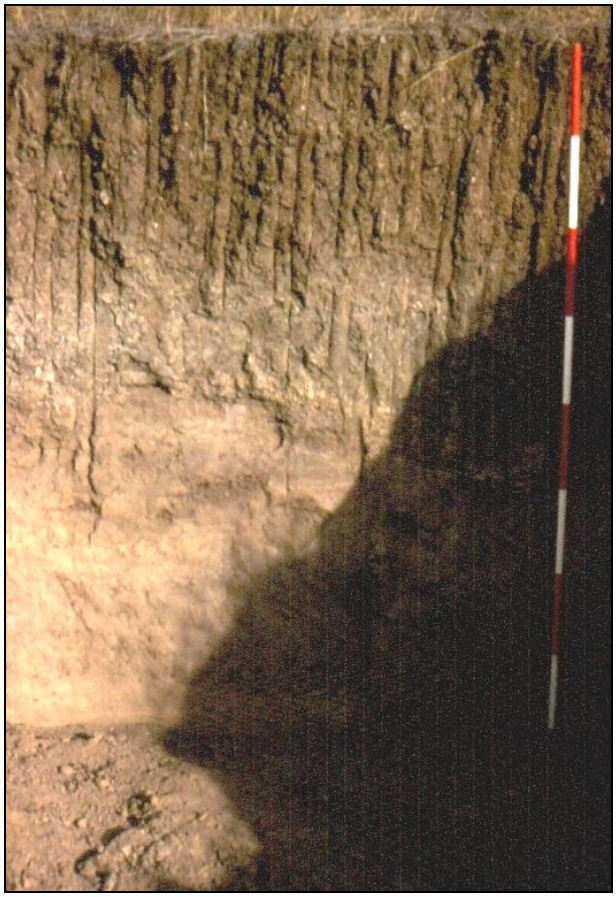


Figure 13. Profile 1, facing NE.

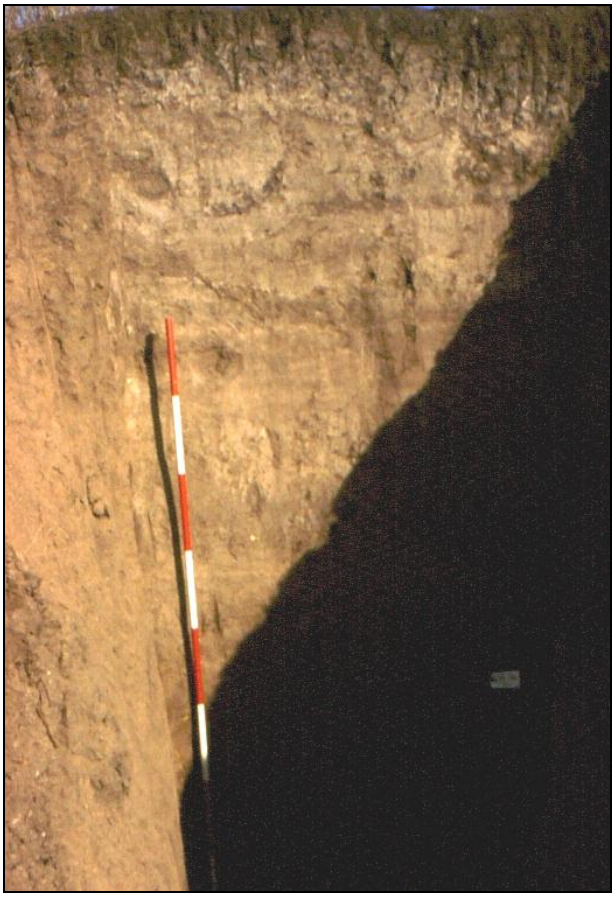


Figure 14. Profile 2, facing NE.

SURFACE COLLECTED ARTIFACTS

Three lithic artifacts (Specimens 1-3) were collected from a surface inspection of the site during the 1993 field season (Figure 15). These specimens, mapped as *P1*, *P2*, and *P3* (see Figure 12, above), are briefly described below.

Specimen 1

Specimen 1 (Catalog No. 12-0046-8) is a piece of secondary reduction shatter produced from a reddish brown-colored (5YR 4/3) jasper material. The specimen contains a scallop-shaped fossil marine shell. It measures 26.2 millimeters (mm) in length, 42.85 mm in width, and 11.5 mm in thickness, and weighs 12.6 grams (g).

Figure 15. Artifacts collected during 1993 surface reconnaissance.

Specimen 2

Specimen 2 (Catalog No. 12-0046-9) is the distal tip of a biface. The specimen was produced from a secondary cobble of Tongue River silicified sediment and is reddish gray (5YR 5/2) in color. It exhibits heavy use-wear on both lateral margins. It measures 34.9 mm in length (broken), 35.8 mm in width, and 12.6 mm in thickness, and weighs 16.7 g.

Specimen 3

Specimen 3 (Catalog No. 12-0046-10) is a chalcedony tertiary reduction flake measuring 19.15 mm in length, 13.55 mm in width, and 2.3 mm in thickness; it weighs 0.6 g. It is mottled white (2.5YR 8/1) in color.

GEOMORPHOLOGICAL TRENCHES

Four backhoe trenches were excavated during the 1993 field season. These trenches, designated *K-N*, were opened for the purpose of expanding the geomorphological investigations of the alluvial fan landform that contains the site. Detailed profile drawings and soil descriptions for Trenches K-N are provided in the 2009 site geologic report (Albanese 2009 [see Appendix D]). A brief overview of each trench is provided here.

Trench K

Trench K was excavated adjacent to the southwestern edge of Area A in a northwesterly-southeasterly orientation (Figure 16; see Figure 12, above). It measured approximately 110 meters (m) in length and averaged 2.25 m in depth. The trench contained three separate buried alluvial stream channels with sediment consisting of shale particle facies and a total of five lithologic units below colluvium (Albanese 2009:13 [see Appendix D]). This trench was devoid of cultural manifestations.

Figure 16. Overview of Trench K, facing NW.

Trench L

Trench L was excavated in Area B immediately adjacent to the eastern edge of Smithsonian Institution Trench 2 (Figure 17; see Figure 12, above). Oriented largely along the north-south axis, Trench L measured approximately 75 m in length and averaged 3.05 m in depth. In his report, Albanese (2009:82 [see Appendix D]) indicates that only a portion of Trench L was documented and that it was "…not possible to view any details concerning lithology and sedimentary structure [in this trench]." The trench was excavated perpendicular to the formation flow of the alluvial fan. The fan is composed of weathering shale that includes indurated, laminated, or fissile claystones and siltstones. The angle of the cut resulted in a 'chunky' vertical face that precluded fine detail profiling. This trench was devoid of cultural manifestations.

Figure 17. Overview of Trench L, facing N.

Trench M

Trench M was excavated in Area B and intersects the southwestern portion of Smithsonian Institution Trench 1 (Figure 18; see Figure 12, above). Positioned in a northwesterly-southeasterly orientation, Trench M measured approximately 50 m in length and averaged 2.10 m in depth (Albanese 2009:84-85 [see Appendix D]). In the eastern wall of Trench M, near the northern terminus of the trench, a reddish, charcoal-rich stain was observed. This stain, ultimately designated Feature 93-1 (F93-1), was further investigated through the excavation of a 1-m-x-1-m test unit (see below).

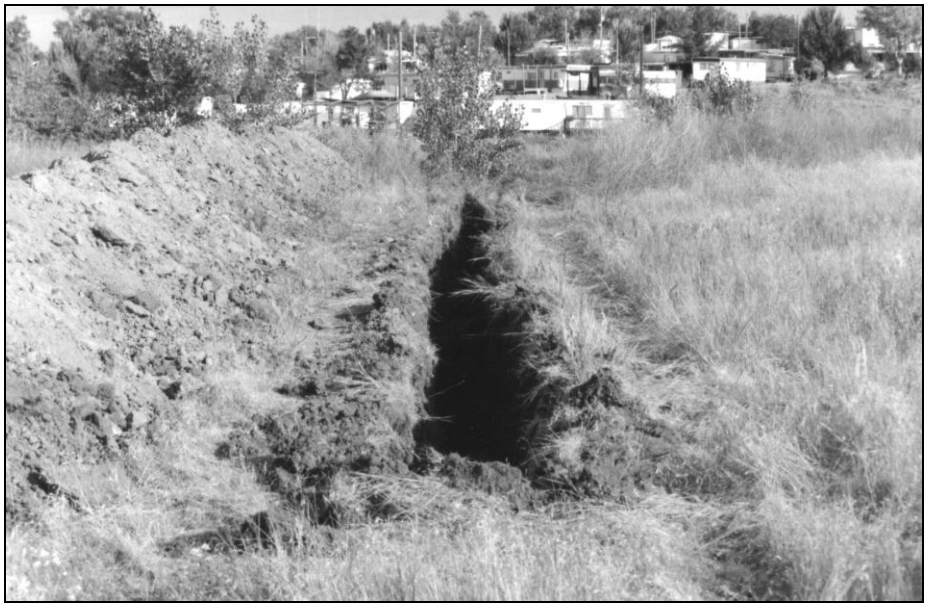


Figure 18. Overview of Trench M, facing N.

Trench N

Trench N was opened some 200 m southeast of Area A, well removed from the primary site locale in order to explore the full extent of the fan deposit (Figure 19; see Figure 12, above). Positioned on a northwesterly-southeasterly line, it measured about 20 m in total length and averaged 1.70 m in total depth (Albanese 2009:86-87 [see Appendix D]). The trench was devoid of cultural material.

Figure 19. Overview of Trench N, facing NNW.

EXCAVATION UNIT 1

One goal of the 1993 investigations at Ray Long was to obtain a sample for radiocarbon dating from the same stratigraphic layer/surface that was examined and dated by the Smithsonian Institution in Area B of the site. Wheeler notes that, during their investigations, "Trench 1 Features were found between 3199.63 and 3197.82 ft. amsl [above mean sea level]" (Wheeler 1995:407). Geomorphological Trench M provided an opportunity to obtain such a date. Close examination of the eastern wall profile revealed a reddened burn area with significant charcoal deposits at the same elevation as the features excavated in Smithsonian Trench 1. A 1-m-x-1-m excavation unit, XU1 (Figures 20 and 21), was opened into the eastern wall of Trench M at the location of this burn area, which was designated F93-1 (Figure 22).

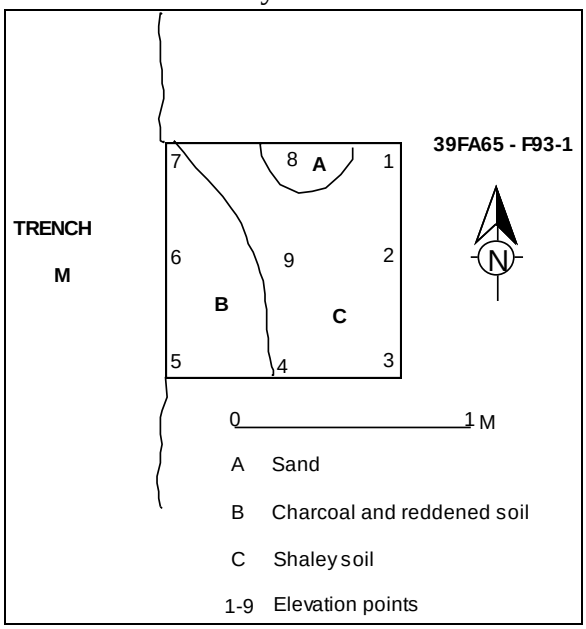


Figure 20. Plan view of F93-1, XU1, Trench M.

XU1 was excavated to a depth of between 1.51 and 1.58 m below datum. The 1985 and the 1992-1996 investigations at the site used a Brass Cap Datum, positioned at an elevation of 976.64 m (3,204.36 feet) amsl, to correlate all finds and profiles. Nine elevation readings were obtained from the floor of the unit upon reaching the layer containing F93-1 (Table 3). These elevation readings correlate well with those obtained by Wheeler.

Figure 21. Overview of XU1, Trench M, facing S.

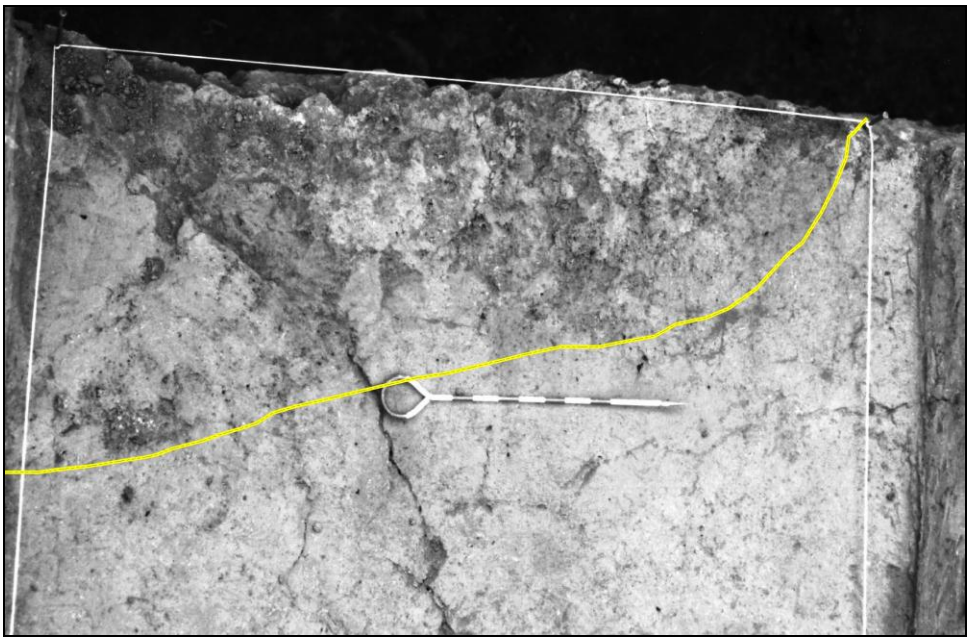


Figure 22. Close-up of Feature 93-1 outlined along the western edge of XU1, Trench M.

Table 3. Elevation Data, Feature 93-1, XU1, Trench M.

Reading Point	Elevation (feet amsl)
1	3199.40
2	3199.40
3	3199.38
4	3199.32
5	3199.17
6	3199.20
7	3199.24
8	3199.37
9	3199.30

A sample of the reddened, charcoal-rich soil from F93-1 was collected and submitted for AMS radiocarbon assay. The date returned from this sample was 8545 ± 65 RCYBP (I-18881 [see Appendix E]). This date was then calibrated with the use of CALIB 6.0 and the INTCAL09 calibration curve (Reimer et al. 2009), the results of which are presented in Table 4. Stratigraphically, this feature was positioned slightly above the features mapped by Wheeler in Trench 1; however, it is still within the same clay-shale (cs) zone as these other features.

Table 4. Calibrated AMS Date from Feature 93-1, XU1, Trench M.

Sample No.	Laboratory No.	^{14}C Age (RCYBP)	Standard Deviation	Calibrated Range (in cal B.P.) & (Relative Area Under Probability Distribution)		Material Dated
				1σ (68.3 percent area enclosed)	2σ (95.4 percent area enclosed)	
1	I-18881	8545	65	9481-9550 (1.000)	9436-9634 (0.979) 9642-9662 (0.021)	Charcoal

1994 FIELD INVESTIGATIONS

The 1994 archeological field season at the Ray Long site took place between June 7 and 30, 1994. The field crew was composed of L. Adrien Hannus, R. Peter Winham, Gene Anderson, David Greenlund, Medora Danz, Judy Nelson, Scott Parsons, Tammy Prokop, Jana Sharpe, and Juanita Short. Archeozoologist Jean-Philip Brugal, Université d'Aix-en-Provence, Marseilles, France, joined the crew briefly, and John Albanese continued geomorphological investigations at the site. During this field period, one new trench was opened and profiled (Trench P), four excavation units were opened in Area A (Units A1-A4), eight excavation units were opened in Area B (Units 8N 3W – 8N 6W and 9N 3W – 9N 6W), the cut bank exposure on the western edge of the site was examined, and a small number of artifacts were collected and analyzed (Figure 23). Soil samples collected from the excavation units were submitted for pollen and phytolith analysis and a sample obtained from a burned earth and charcoal feature in Unit 9N 4W was also submitted for radiocarbon dating (see Appendix E). The 1994 investigation results are addressed below.

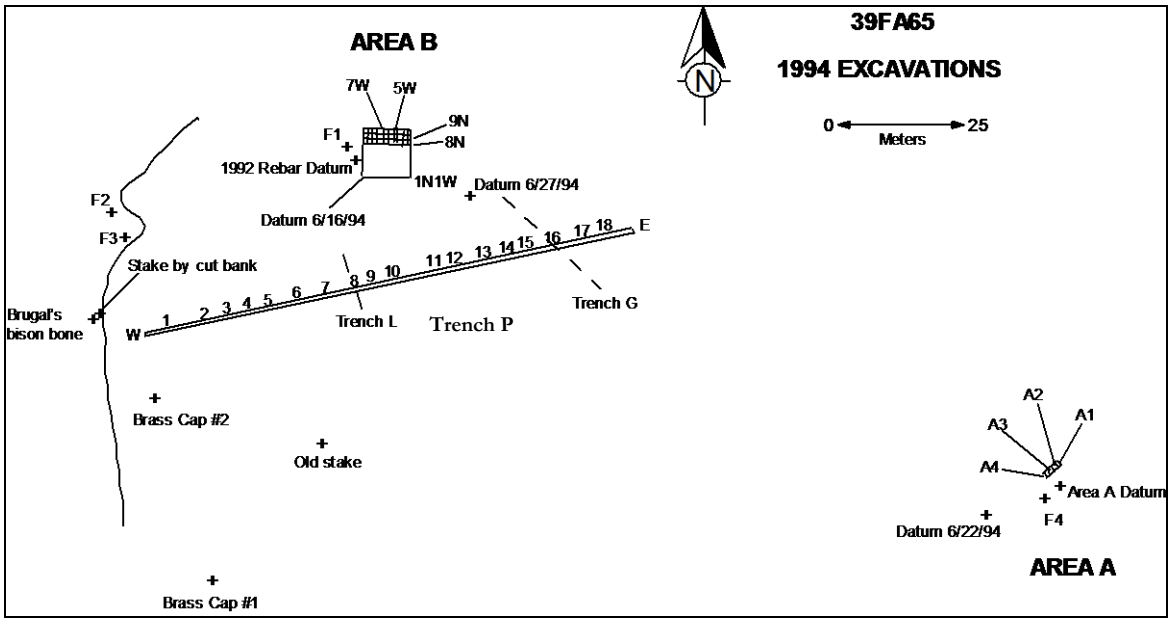


Figure 23. Plan view of the 1994 work areas at the Ray Long site (39FA65).

SMITHSONIAN INSTITUTION AREA A EXCAVATIONS

Four 1-m-x-1-m excavation units, designated A1-A4, were opened in Area A of the site during the 1994 field season. The units were placed adjacent to the 1948-1950 Smithsonian Institution excavation grid and approximately 25 m northwest of Backhoe Trench I (Figure 24).

Investigations in the four units in Area A took place from June 21-27 (Figure 25). Elevations in Area A were based on the Area A datum, which was established at a height of 3,219.26 feet [981.23 m] amsl and 5.17 feet [1.575 m] above the 1992 rebar datum. Initially, a backhoe removed the upper 35-55 centimeters (cm) of soil from the area. The area was then cleaned by trowel to create a level floor for establishing the unit grid. This surface, recorded at 55.25 cm below the Area A datum, was designated the '0' level. From this point down, all of the units were excavated by trowel in 10-cm levels that were numbered sequentially beginning with Level 1. Soil removed from the units was sieved through standard ¼-inch wire mesh screen.

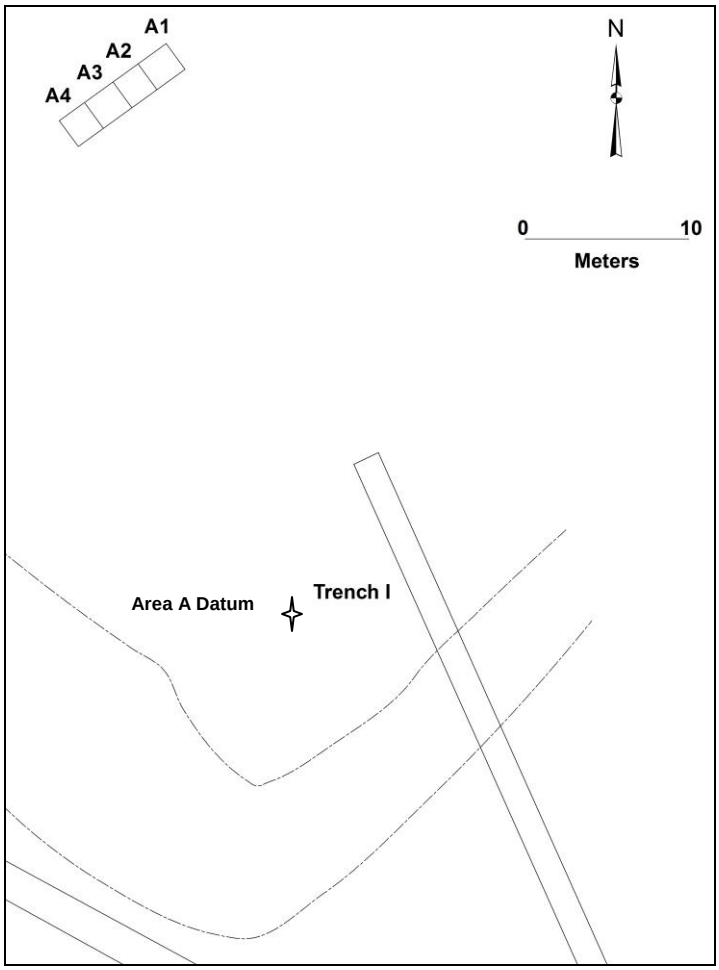


Figure 24. Plan view of the 1994 Area A excavation units.

Figure 25. View of layout of excavation units A1-A4, Level 2 floor, Area A, facing NW.

Unit A1 was excavated through Level 7 to a depth of 70 cm below the '0' level (or 125.25 centimeters below datum [cmbd]). The unit was devoid of cultural manifestations; however, beginning at Level 4 and continuing in each of the subsequent levels excavated, a very light, diffuse scatter of small charcoal flecks was observed. A sample of this material was collected from Levels 4-7 and retained in small vials. A profile of the north (actually northwest) wall of Unit A1 was drawn following the excavation of Level 7 (Figure 26). Units A2-A4 were each excavated through Level 3 to a depth of 30 cm below the '0' level (or 85.25 cmbd). Units A3 and A4 were devoid of cultural material. Unit A2 produced one small, unidentifiable bone fragment from Level 1 at 63 cmbd and one small, light grayish purple-colored tertiary reduction flake of fine-grained quartzite from Level 3 at a depth of between 75.25 and 85.25 cmbd. A small sample of charcoal flecks was collected from Level 3 of both Units A2 and A3; however, these samples came from very light, diffuse scatters like those noted in Unit A1 and no evidence of any concentrations or definitive features was observed. No additional cultural manifestations were identified in Area A during the 1994 excavations.

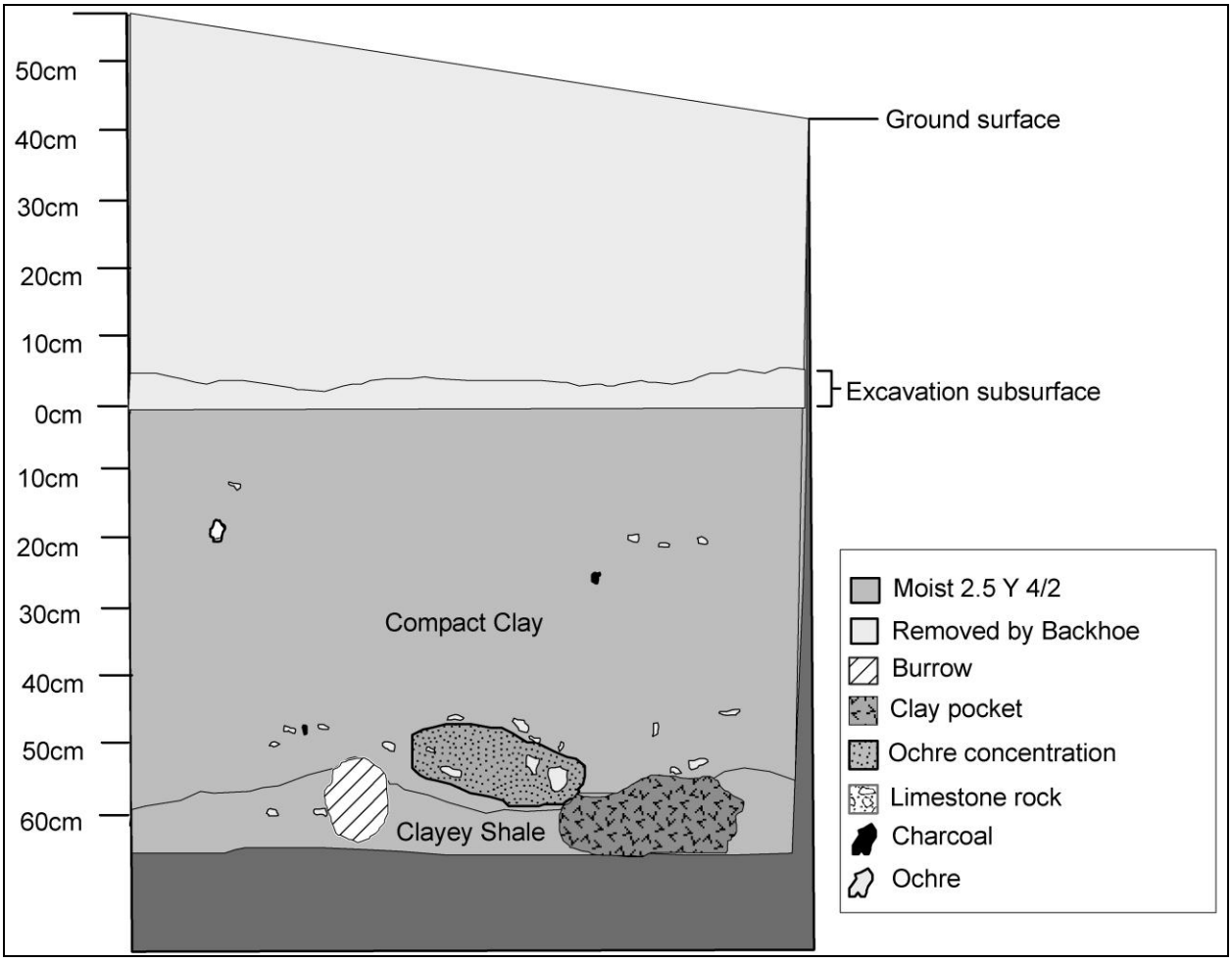


Figure 26. North wall profile, Levels 1-7, Unit A1, Area A.

SMITHSONIAN INSTITUTION AREA B EXCAVATIONS

Eight 1-m-x-1-m excavation units were opened in Smithsonian Institution Area B of the site in 1994. The Area B excavations took place from June 11-27. A 10-m-x-10-m grid (later expanded to 11-m-x-11-m) was first established along the cardinal axes (N-S/E-W) (Figures 27 and 28; see Figure 23). The units opened during the 1994 season were designated 8N 3W – 8N 6W and 9N 3W – 9N 6W. Initially, a backhoe removed the upper 120-160 cm of soil from the area (see Figure 27 for the horizontal extent of the backhoe cut). Following removal of the overburden, each of the units was shovel-skimmed in arbitrary 20-cm levels to a depth of approximately 210 centimeters below surface (cmbs). Below 210 cmbs, each unit was excavated in arbitrary 10-cm levels by trowel. Levels in each unit in the grid were numbered sequentially beginning with Level 1; however, because the ground surface was not level, these arbitrary levels do not relate to one another in absolute depth (either below surface or below datum). Instead, specific elevations were obtained for all artifacts and features recorded in situ based on the 1992 rebar datum, which is positioned 298.25 cm above the Brass Cap #2 datum (also labeled R44 R.P.).

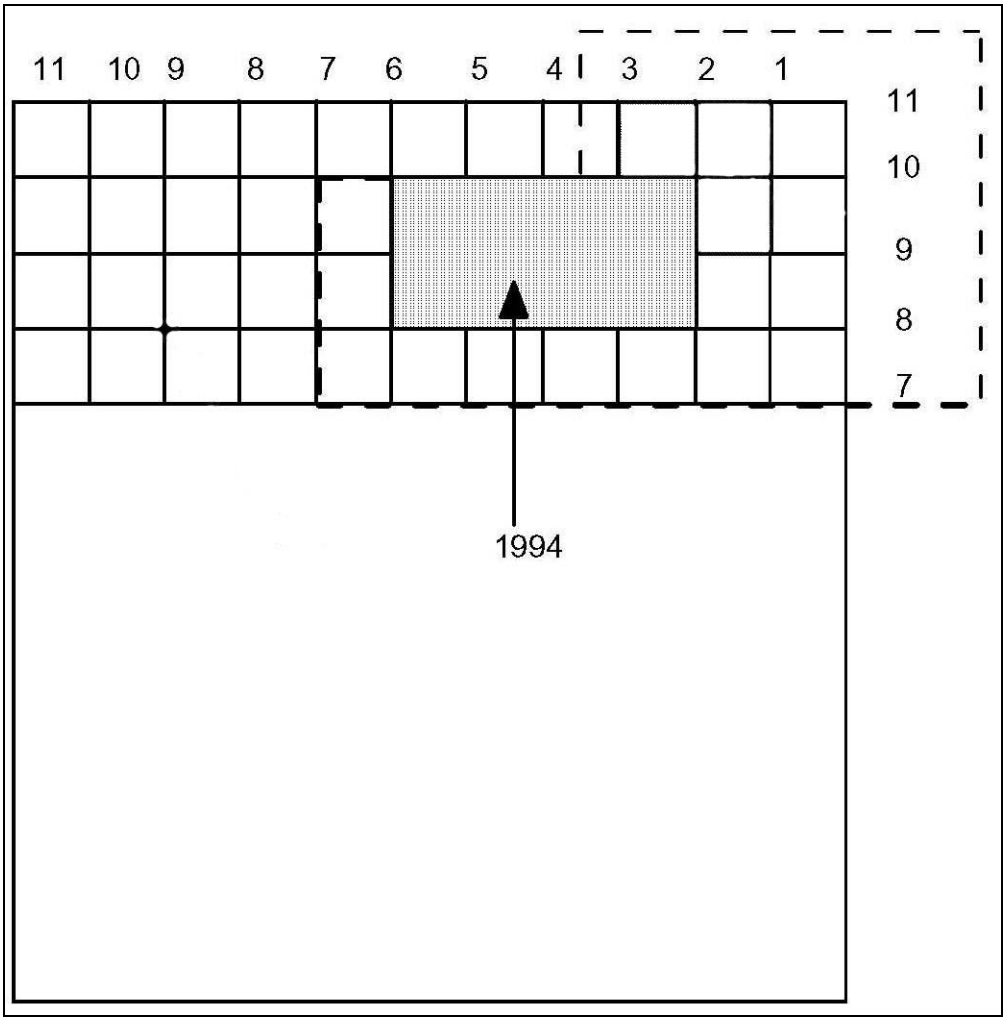


Figure 27. Plan view of the Area B excavation grid highlighting the units excavated during the 1994 field season. The dashed line defines the horizontal extent of the irregular backhoe cut.

Figure 28. View of the Area B excavation grid, facing W.

As with the Area A excavations, soil removed from the units was sieved through standard ¼-inch wire mesh screen. Beginning at an approximate depth below surface of 200-210 cm, a soil balk measuring 25-cm-x-25-cm in the northwest corner of each unit was left unexcavated. These were subsequently collected in 10-cm levels as soil samples for pollen and phytolith analyses. Following the field season, the soil samples were submitted to Glen Fredlund, University of Wisconsin, Milwaukee, for evaluation. Unfortunately, this analysis was never completed.

At the end of the field session, all four primary walls in the excavation grid were photographed and profiled (Figures 29-36), as was the east wall of Units 8N 4W and 9N 4W (Figures 37 and 38). The east wall of Units 8N 4W and 9N 4W was profiled to obtain a cross-section view of a burned earth and charcoal stain that was subsequently designated Feature 94-4 (see below). The profiles are described in further detail by Albanese (2009 [see Appendix D]).

A small number of artifacts were recovered from the Area B grid excavation units, the majority of which consisted of small, tertiary reduction flakes collected from depths ranging between 200 and 240 cmbs. A complete grinding stone tool was also recovered from this depth. The artifacts are discussed in further detail below. Five features (94-1 – 94-5), documented at depths similar to those from which the artifacts were recovered, were recorded during the 1994 excavations in Area B. With the exception of Feature 94-1, which was later determined to be non-cultural, all of the features recorded consist of localities of ephemeral red-stained earth together with light scatters of charcoal flecks. They are analogous to several manifestations discovered during the Smithsonian Institution excavations that Wheeler (1995:409-410) identified as "unprepared, lightly fired hearths." These features are also addressed below.

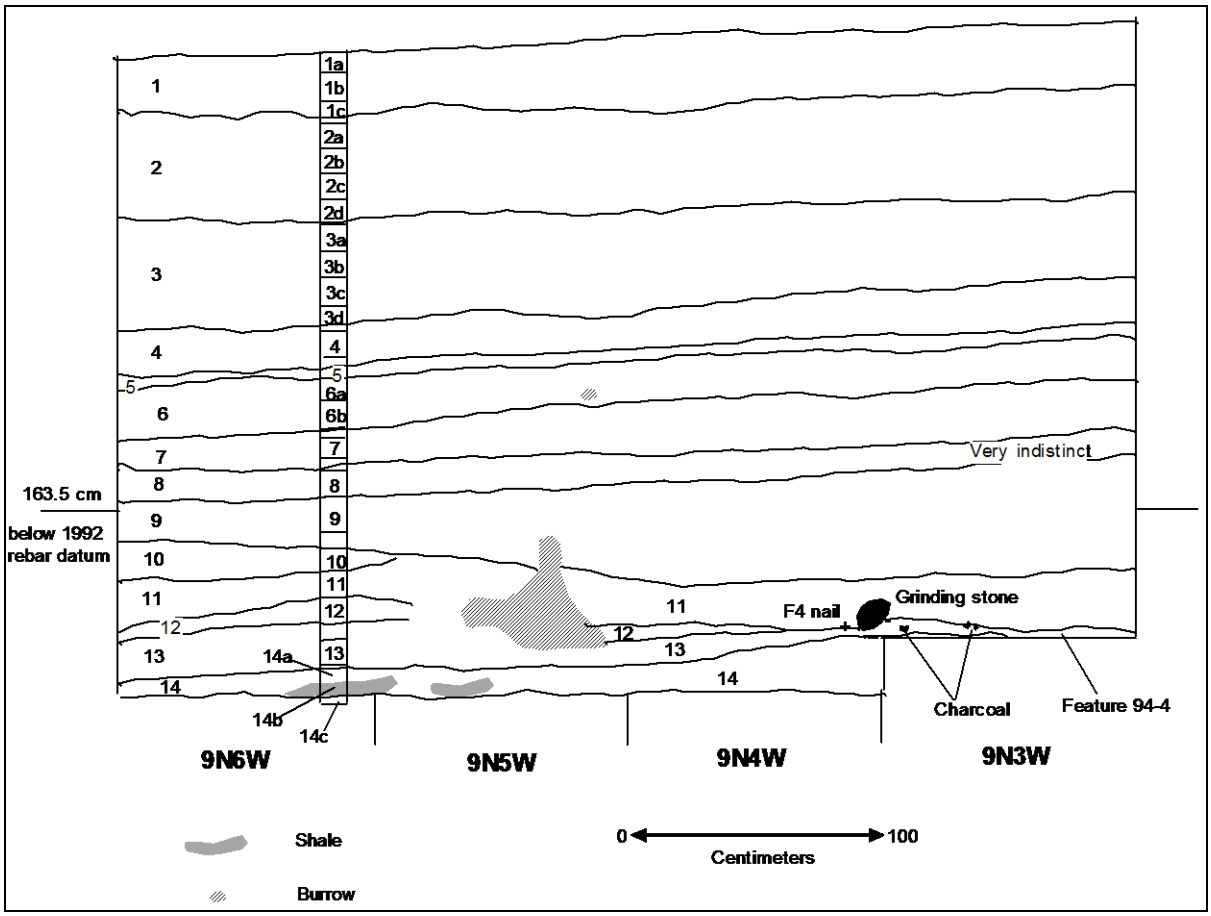


Figure 29. Area B excavation grid north wall profile.

Figure 30. View down into Area B excavation grid and north wall profile, facing N.

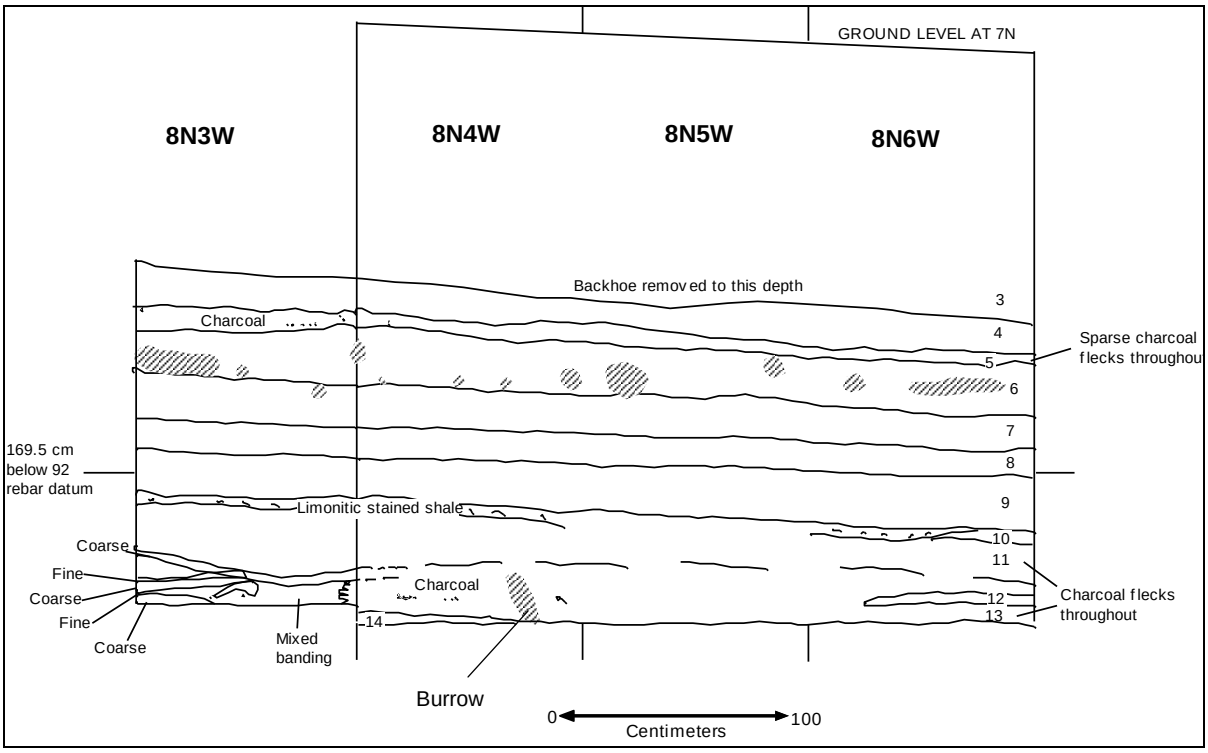


Figure 31. Area B excavation grid south wall profile.

Figure 32. View down into Area B excavation grid and south wall profile, facing SE.

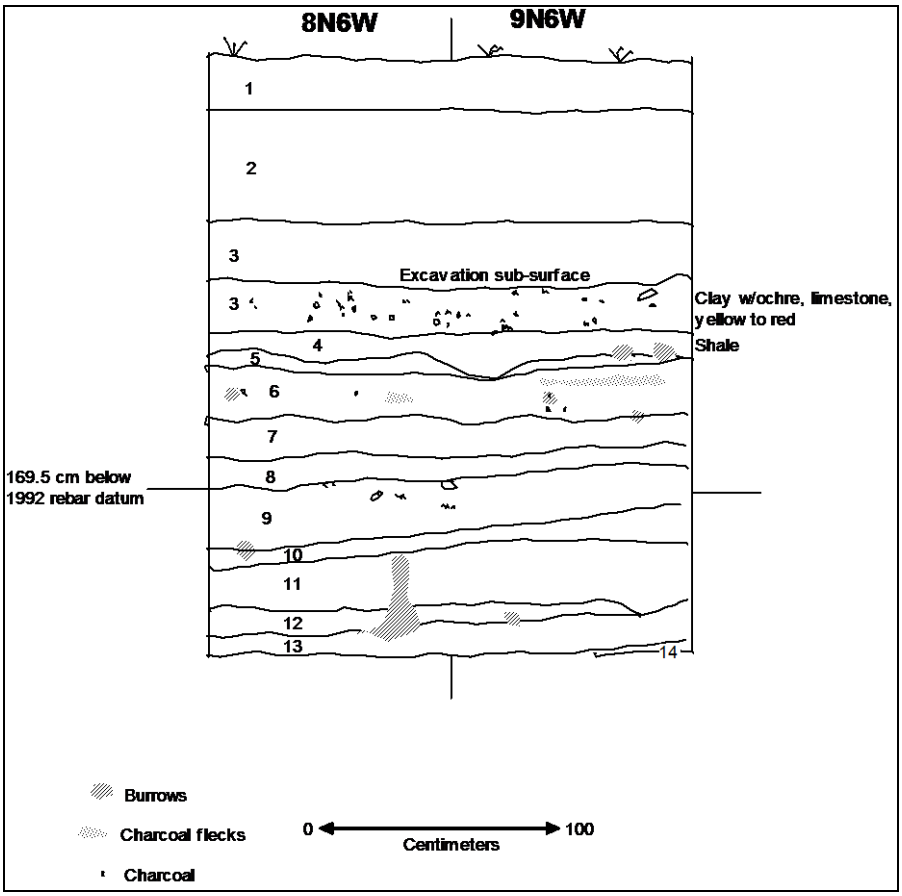


Figure 33. Area B excavation grid west wall profile.

Figure 34. West wall profile, units 8N 6W and 9N 6W, Area B excavation grid, facing W.

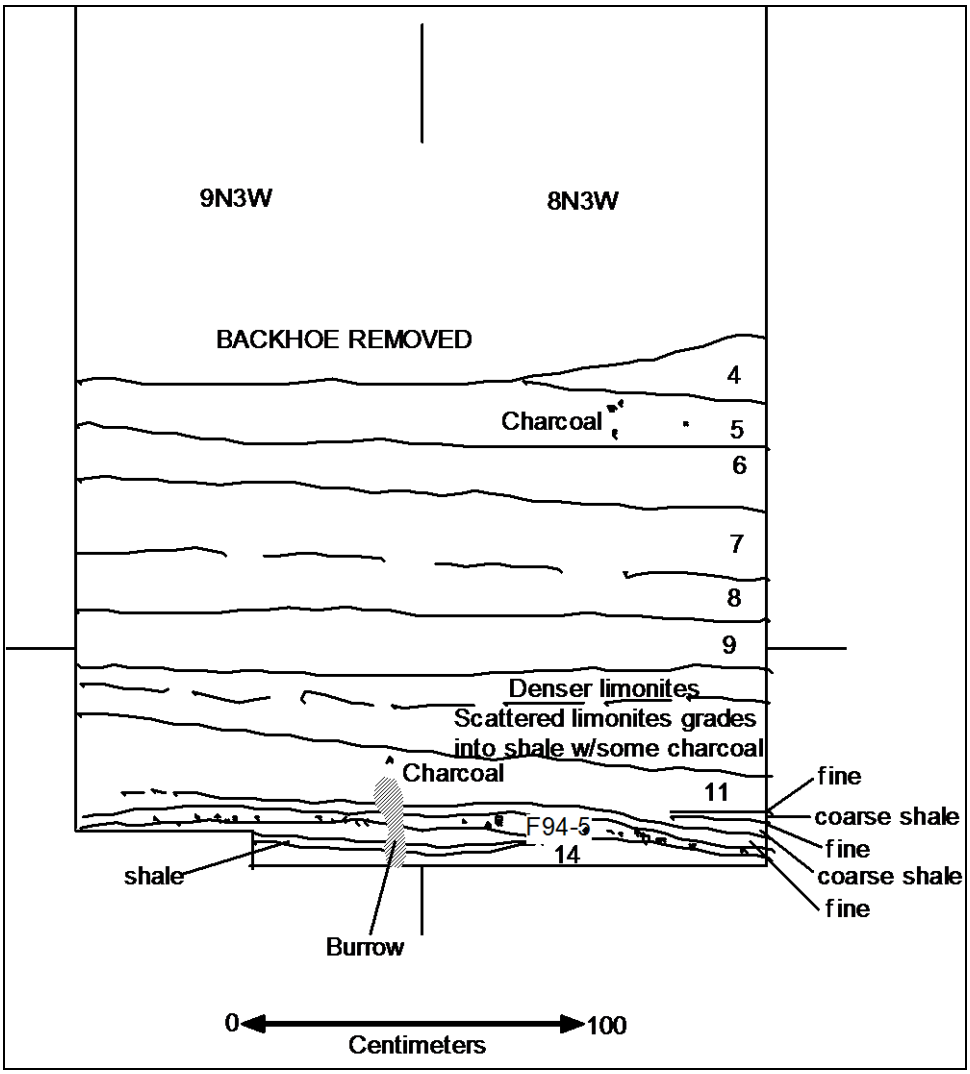


Figure 35. Area B excavation grid east wall profile of units 9N 3W and 8N 3W.

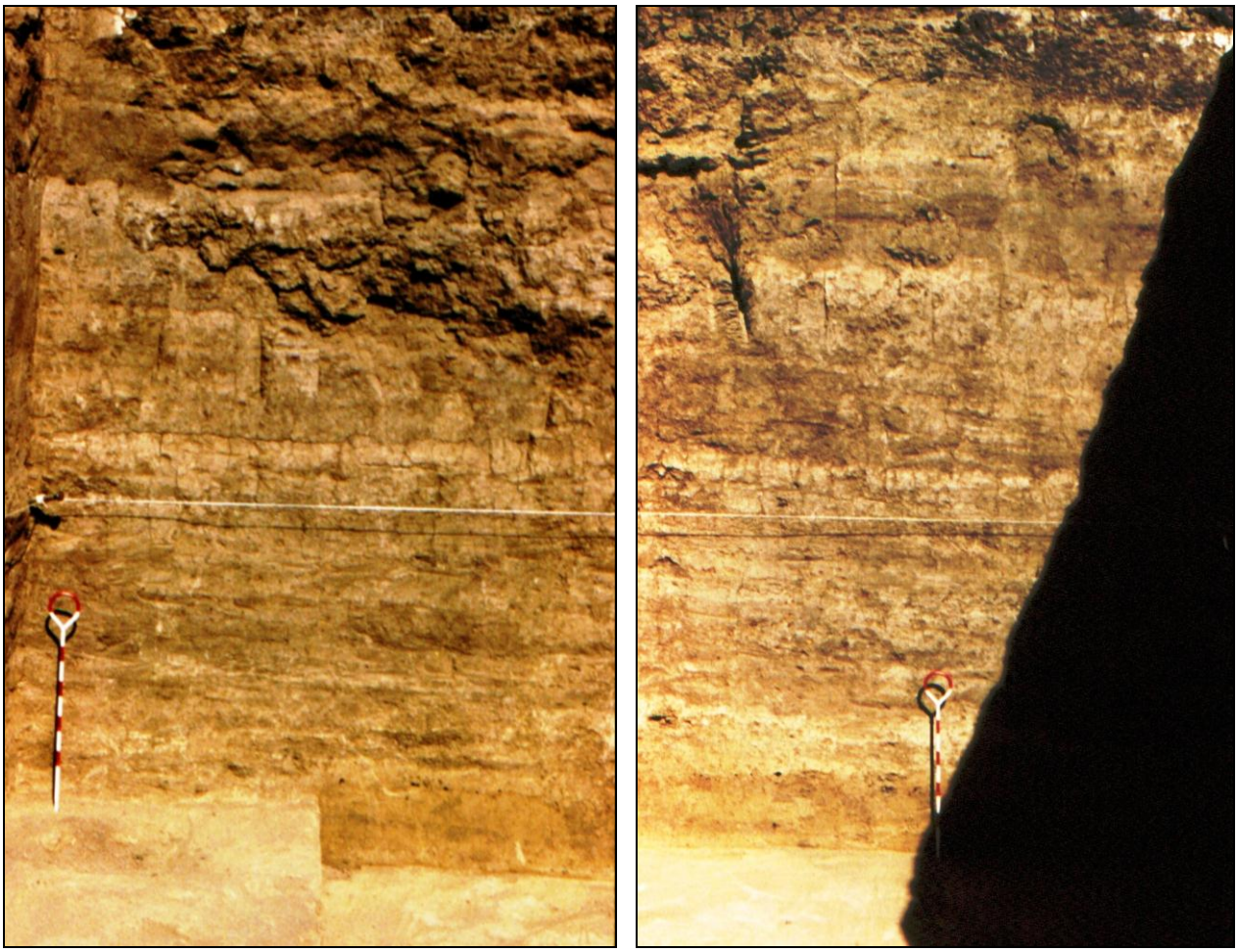


Figure 36. East wall profile of units 9N 3W (left) and 8N 3W (right), Area B excavation grid, facing E.

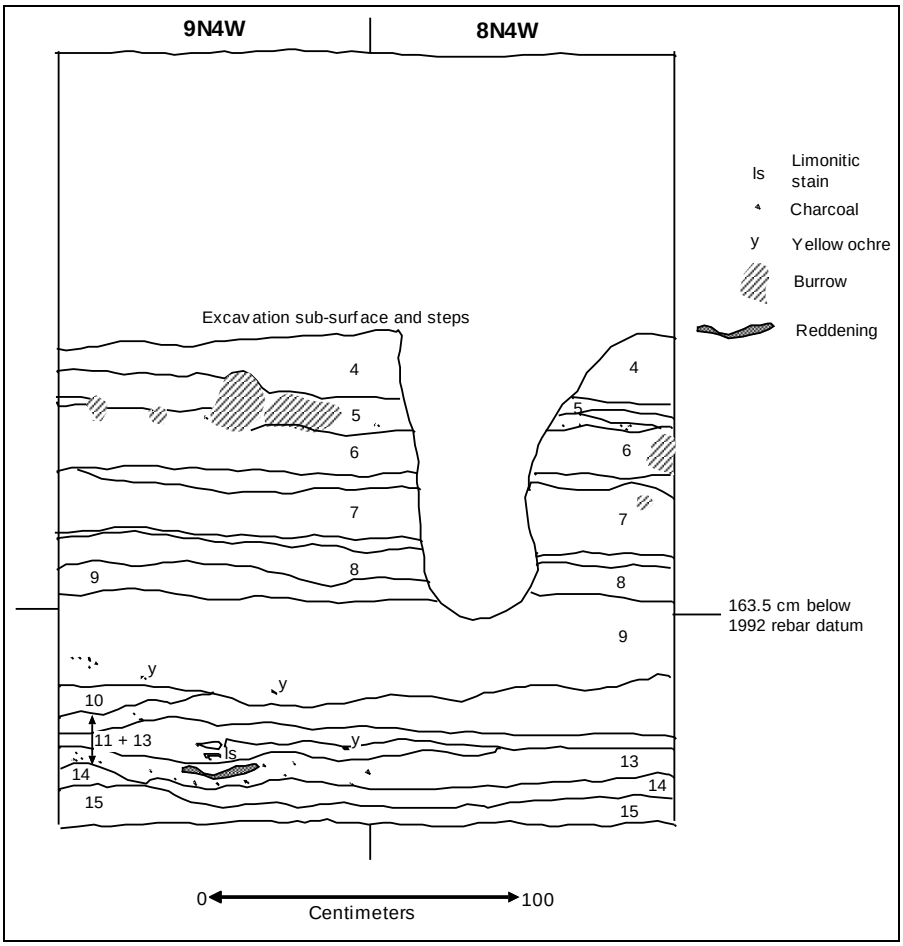


Figure 37. Area B excavation grid east wall profile of units 9N 4W and 8N 4W.

Figure 38. East wall profile of Unit 9N 4W below 163.5 cm line level. Arrow indicates staining associated with Feature 94-4.

Feature 94-1

Feature 94-1 was recorded in Unit 8N 6W at a depth of 215.75 cmbd. The feature was located in the east-central portion of the unit, approximately 15 cm northeast of a single large quartzite reduction flake that was recorded in situ at a depth of 209.25 cmbd (Figure 39).

Feature 94-1 consists of a set of two small, shallow clay-filled depressions that, at the time, were best described as resembling small footprints. They were spaced 6-7 cm apart and measured approximately 7 cm N-S by 4 cm E-W by 1 cm in depth. The clay deposits were initially removed from the depressions (Figures 40 and 41) and a plaster mold was then prepared. A third such depression was later discovered approximately 8-9 cm northwest of, and 22 cm below, the previous two (at 237.75 cmbd). Further analysis of the feature, however, revealed that the impressions were non-cultural in nature.

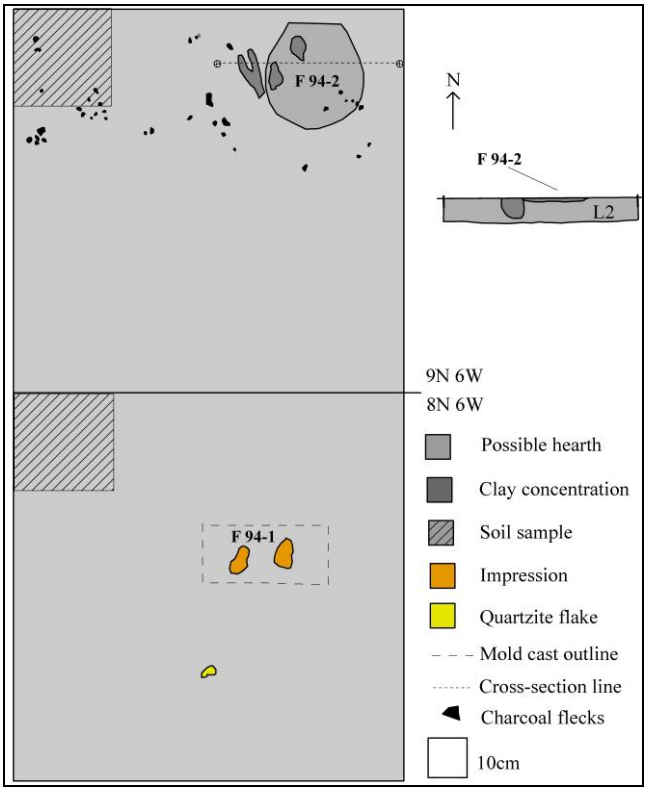


Figure 39. Plan view of Units 8N 6W and 9N 6W, 215.75 cmbs. Feature 94-1 is depicted in Unit 8N 6W.

Figure 40. Close-up of Feature 94-1, clay-filled impression, Unit 8N 6W, 215.75 cmbd, Area B.

Figure 41. Close-up of Feature 94-1, impression after removal of clay, Unit 8N 6W, 215.75 cmbd, Area B.

Feature 94-2

Feature 94-2 was discovered in Unit 9N 6W at a depth of between 232 and 234 cmbd (Figures 42 and 43; see Figure 39, above). Located in the northeast quarter of the unit, the shallow, basin-shaped feature measured 2 cm in thickness and approximately 27 cm in diameter. It contained, and was surrounded by, concentrations of charcoal flecks. The base of the feature exhibited ephemeral red-colored staining. Three substantial concentrations of clay were documented in and around the feature. This feature was located approximately 125 cm north of, and 22.75 cm below, the large quartzite flake discovered in Unit 8N 6W.

Figure 42. Removal of charcoal fill from Feature 94-2, Unit 9N 6W, 232-234 cmbd, Area B.

Figure 43. Close-up of ephemeral red staining below Feature 94-2, Unit 9N 6W, 234 cmbd, Area B.

Feature 94-3

Feature 94-3 was discovered in Unit 9N 6W at a depth of 233-234 cmbd (Figures 44-46). Located along the eastern edge of the unit, the roughly circular feature measured 1 cm in thickness and approximately 19 cm in diameter. It was a shallow, ephemeral, red-colored stain containing charcoal flecks. This feature was located approximately 20 cm southeast of Feature 94-2 at the same depth below datum. It was located 30 cm east of, 100 cm north of, and 22.75 cm below, the large quartzite flake discovered in Unit 8N 6W.

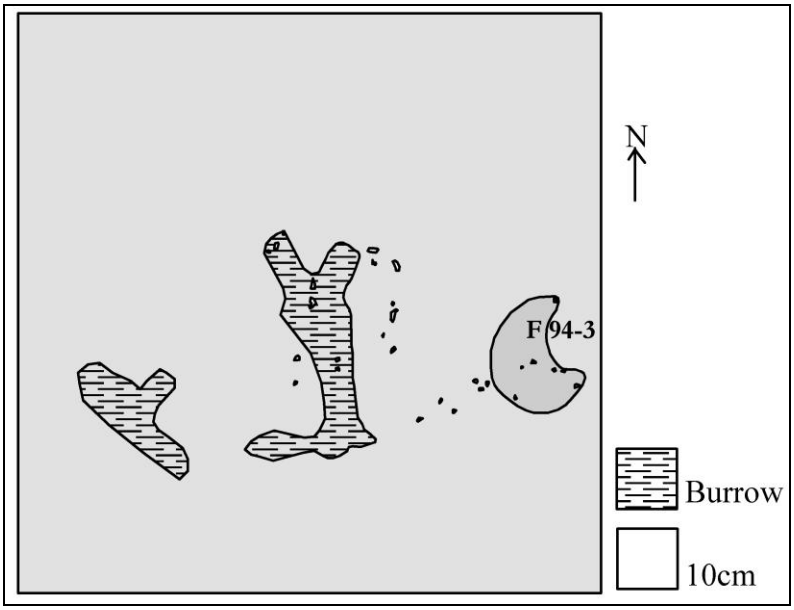


Figure 44. Plan view of Unit 9N 6W, 234 cmbd, identifying the location of Feature 94-3.

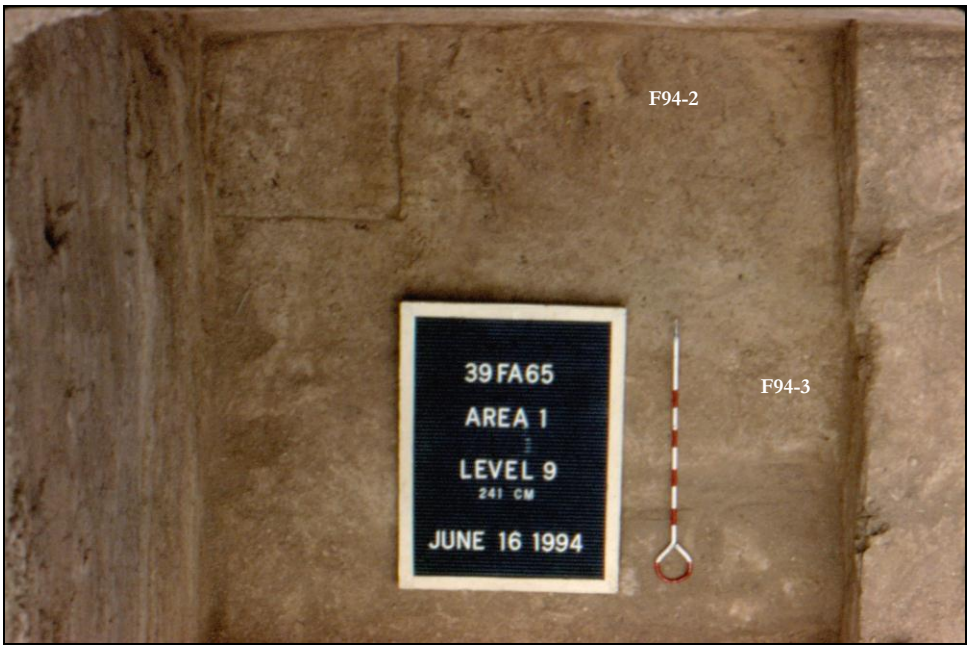


Figure 45. View of top of ephemeral hearths designated Features 94-2 and 94-3, Unit 9N 6W, 233 cmbd, Area B.

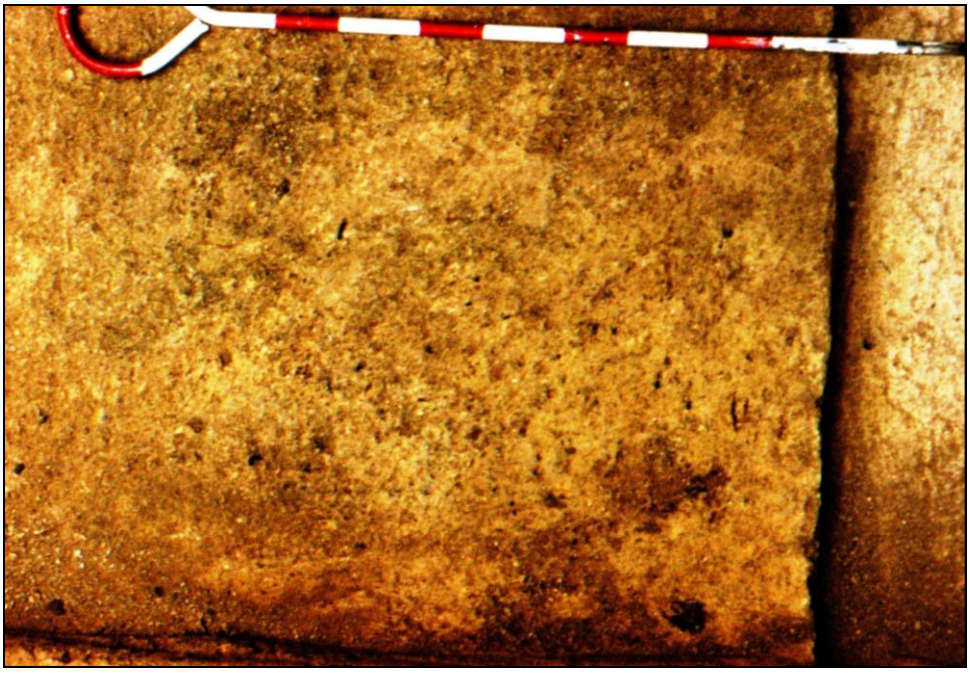


Figure 46. Close-up of Feature 94-3, Unit 9N 6W, 234 cmbd, Area B.

Feature 94-4

Feature 94-4 was first discovered in Unit 9N 4W at a depth of 208.75 cmbd (Figures 47-49). Extending west approximately 22 cm from the eastern wall of the unit, the roughly circular feature was a dark stain containing copious amounts of large pieces of charcoal. The stain appeared to extend downward into Unit 9N 3W for a depth of at least 9 cm. A mano or grinding stone was observed protruding from the north wall of the unit immediately above the feature.

This specimen was collected and further analyzed (see below), and a sample of charcoal from the feature was collected and submitted for AMS dating. The sample (No. I-17779) returned an uncalibrated date of 9150 ± 230 RCYBP (see Appendix E). This date was then calibrated with the use of CALIB 6.0 and the INTCAL09 calibration curve (Reimer et al. 2009) (Table 5).

Following the subsequent excavation of Unit 9N 3W, the remainder of Feature 94-4 was documented. The elongated, amorphous feature stain was first observed in this unit at a depth of approximately 210 cmbd (Figure 50 [left image]). The form of the stain continued to be poorly defined until a depth of 221 cmbd was reached (Figure 50 [right image] and Figure 51). At this depth, a more clearly defined, circular basin of fire-reddened earth was detected. This basin measured 3 cm deep and approximately 31 cm in diameter. It terminated at 224 cmbd.

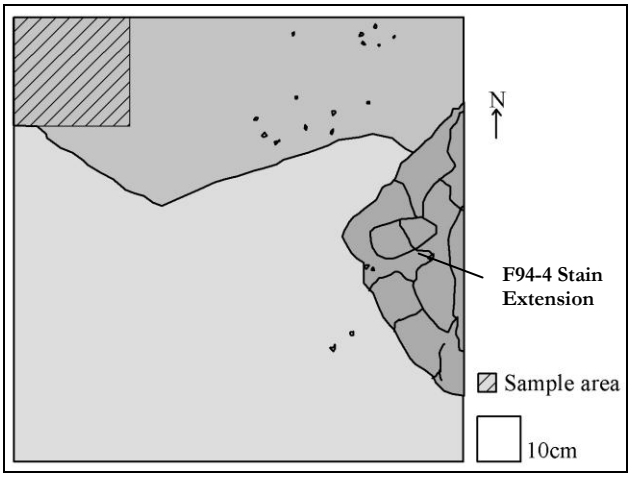


Figure 47. Plan view of Unit 9N 4W depicting the edge of Feature 94-4 extending through the east wall from Unit 9N 3W.

Figure 48. Close-up of charcoal concentration designating the top of Feature 94-4 and adjacent grinding stone, Unit 9N 4W, Level 7, Area B.

Table 5. Calibrated AMS Date from Feature 94-4, Units 9N 3W/9N 4W, Level 7, Block Grid, Area B.

Sample No.	Laboratory No.	^{14}C Age (RCYBP)	Standard Deviation	Calibrated Range (in cal B.P.) & (Relative Area Under Probability Distribution)		Material Dated
				1σ (68.3 percent area enclosed)	**2σ (95.4 percent area enclosed)**	
1	I-17779	9150	230	9931-9995 (0.070) 10,003-10,064 (0.064) 10,119-10,661 (0.866)	9629-9648 (0.004) 9652-10,874 (0.959) 10,945-11,075 (0.037)	Charcoal

Figure 49. Cross-section of Feature 94-4, Unit 9N 4W, Level 8, Area B (designated *Area 1* on photo-board).

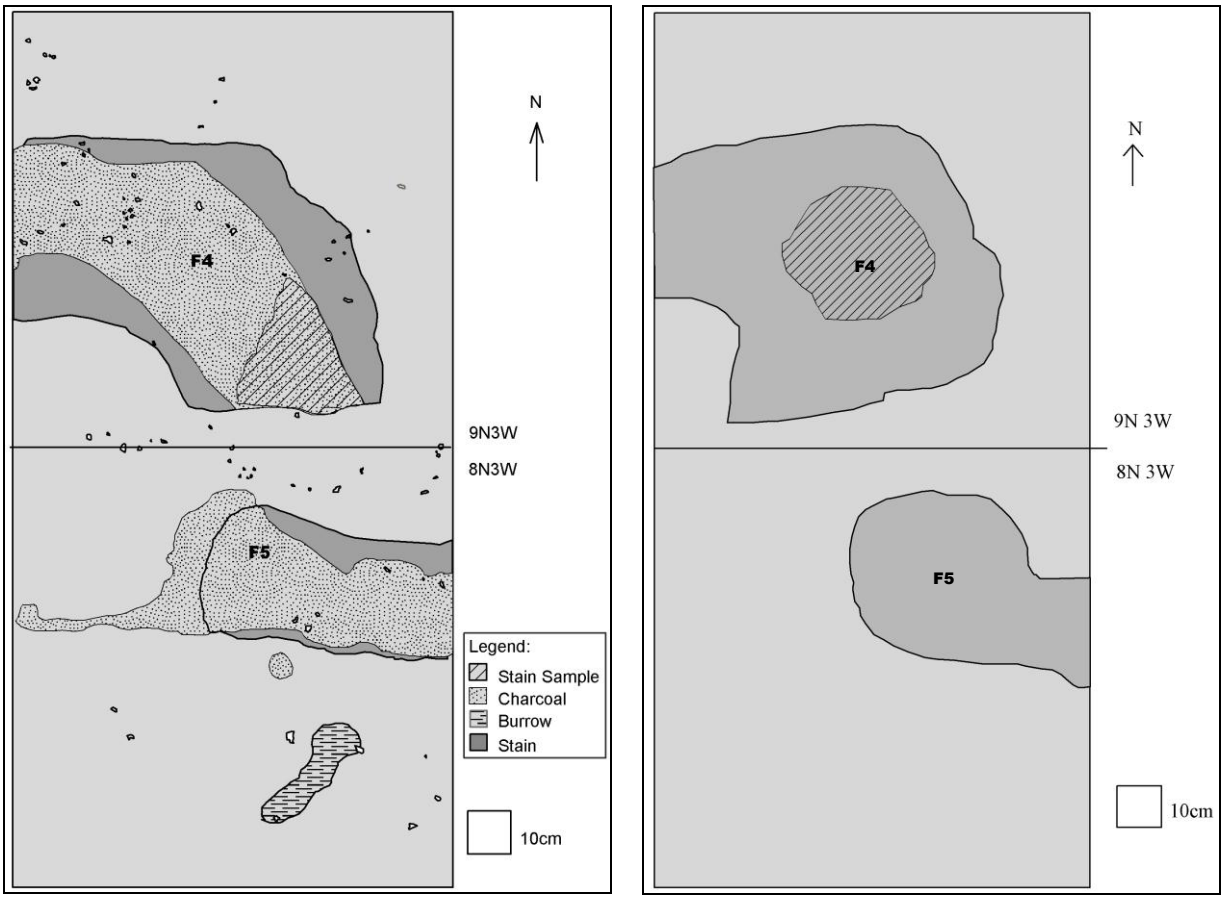


Figure 50. Plan view of Units 8N 3W and 9N 3W at 210 cmbd (left) and 221 cmbd (right), depicting Features 94-4 and 94-5.

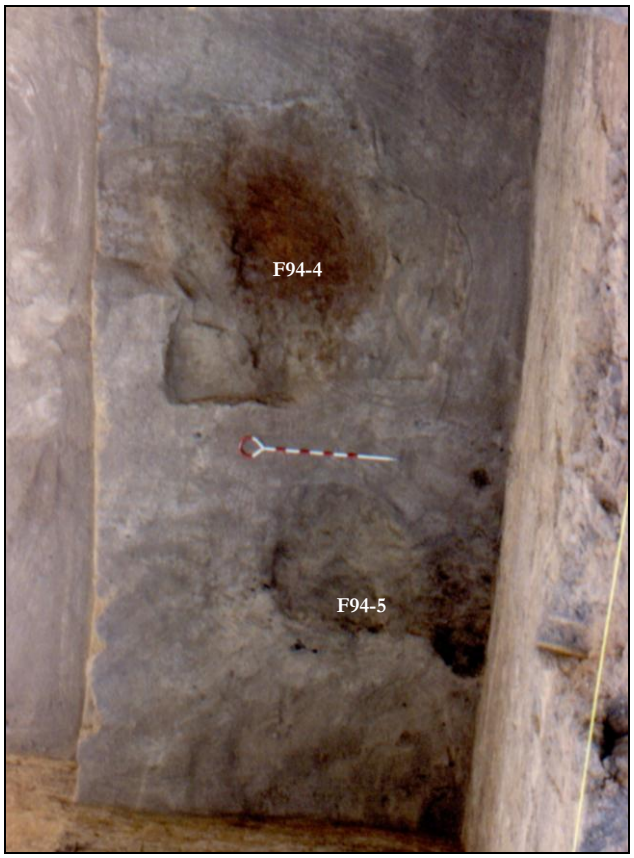


Figure 51. View of Units 8N 3W and 9N 3W, 221-224 cmbd, depicting stains associated with Features 94-4 (top) and 94-5 (bottom) following removal of charcoal fill (chaining pin points east).

Feature 94-5

The first evidence of Feature 94-5 was recorded in Unit 8N 3W at a depth of approximately 210 cmbd, while the base of the feature was measured at a depth of 220 cmbd (see Figures 50 and 51, above). Although this feature extended east into the grid wall, the main, roughly circular portion within Unit 8N 3W measured approximately 38 cm in diameter. It was discovered at the same approximate depth as Feature 94-4, and only about 45 cm to the south and east of it. Feature 94-5 was not as clearly defined, however, comparatively lacking in the degree of fire-reddened soil and the amount of charcoal present. No samples were obtained for dating from this feature and no artifacts were discovered in direct association with it.

GEOMORPHOLOGICAL TRENCH P

One backhoe trench was excavated during the 1994 field season. This trench, designated Trench *P*, was opened for the purpose of expanding the geomorphological investigations of the alluvial fan landform that contains the site. No Trench *O* was excavated at the site. Detailed profile drawings and soil descriptions for Trench P are provided in the 2009 site geologic report (Albanese 2009:88-94 [see Appendix D]). Trench P was excavated just south of Area B in a northeasterly-southwesterly orientation that runs parallel to the formation flow of the alluvial fan (Figure 52; see Figure 23, above). Intersected perpendicularly by Trenches G and L, Trench P measured approximately 70 m in length and averaged 2.15 m in depth (see Appendix D). The trench was devoid of cultural manifestations.

Figure 52. Overview of Trench P, facing WSW.

WESTERN CUT BANK EXPOSURE

Along the western edge of the site, protruding from the cut bank at a depth below surface of 328 cm (or 730 cmbd), a partially intact left radius from a bison was discovered (Figure 53; see Figure 23, above). The distal end of the bone was exposed and a dense pocket of charcoal-rich soil surrounded it (Figure 54). The area around the bone was carefully excavated and a plaster jacket was prepared in order to facilitate safe removal of the specimen. A sample of the charcoal-rich soil matrix surrounding the specimen was also collected in anticipation of obtaining a radiocarbon date at some later point in time; however, that sample has not yet been submitted for dating. The proximal end of the bone was absent and a substantial fracture was observed running longitudinally along the diaphysis. The specimen was identified as *Bison bison*, and was determined to be from an adult animal because the distal epiphysis was wholly fused. No additional bone elements were observed along the base of the cut or further within the bank, and no evidence of cultural modification was observed on the specimen. This circumstance, coupled with the lack of a definitive radiocarbon date, makes any direct correlation of the bone to the broader site chronology rather tenuous.

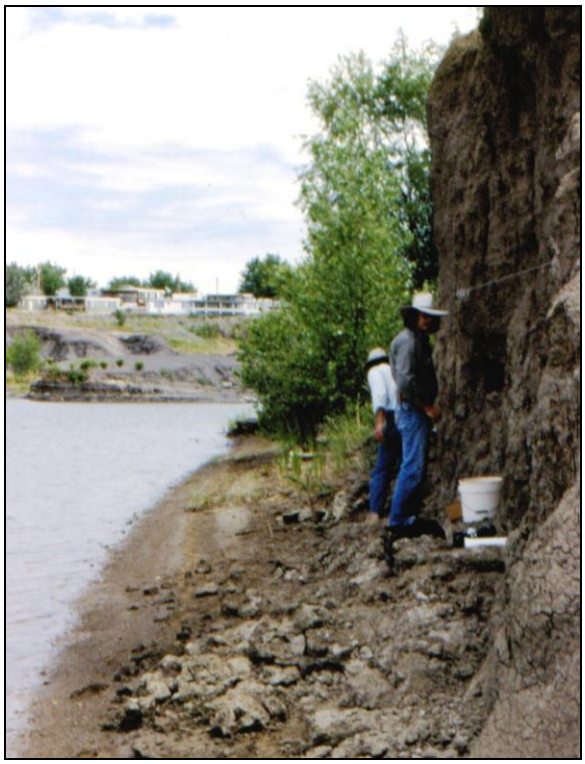


Figure 53. The segment of cut bank along the western edge of the site from which the bison radius was extracted, facing N.

Figure 54. Close-up of bison radius in situ. The distal end of the bone is in the foreground.

COLLECTED ARTIFACTS

A small number of prehistoric artifacts were documented at the Ray Long site during the 1994 field season. Four lithic reduction flakes were recorded during a surface inspection of the site. The flakes were mapped as points *F1*, *F2*, *F3*, and *F4* (see Figure 23, above) and collected. F1 was recorded adjacent to the Area B excavation grid in a near-surface spoil pile. F2 was recorded below the cut bank on the beach at the western edge of the site, and F3 was recorded in a slump block at the base of the cut bank just southeast of F2. F4 was recorded adjacent to the Area A excavation grid in a near-surface spoil pile. A small number of lithic reduction flakes and one mano/grinding stone were also recovered from subsurface contexts during excavations in Areas A and B of the site. One flake and one bone fragment were recovered from the excavation units in Area A, while several additional flakes and the mano were recovered from the excavation units in Area B.

Grinding Stone

The mano, or grinding stone specimen (Catalog No. 12-0046-22), was discovered in situ protruding from the north wall of the Area B excavation grid between units 9N 3W and 9N 4W at a depth of 210 cmbd (see Figure 29, above). It was discovered immediately adjacent to Feature 94-4, an unprepared hearth. The specimen was produced from a fist-sized, ovoid cobble of partially metamorphosed sandstone (Figures 55-58). It measures 132.23 mm in length, 87.20 mm in width, and 41.13 mm in thickness, and weighs 573.51 g. The tool was shaped through a combination of pecking and grinding. Both surfaces and some lateral margins exhibit evidence of fine pecking. Grinding on the obverse face and one margin is heavy and has eliminated the majority of peck marks. The reverse face exhibits evidence of light grinding. Two distinct facets are evident on the obverse face of the specimen. The smaller of these has been reworked by fine pecking and possibly some additional light grinding. The larger facet exhibits some polish and was the primary surface used in fine grinding.

Figure 55. Obverse face of mano from north wall profile, Area B Grid, 39FA65.

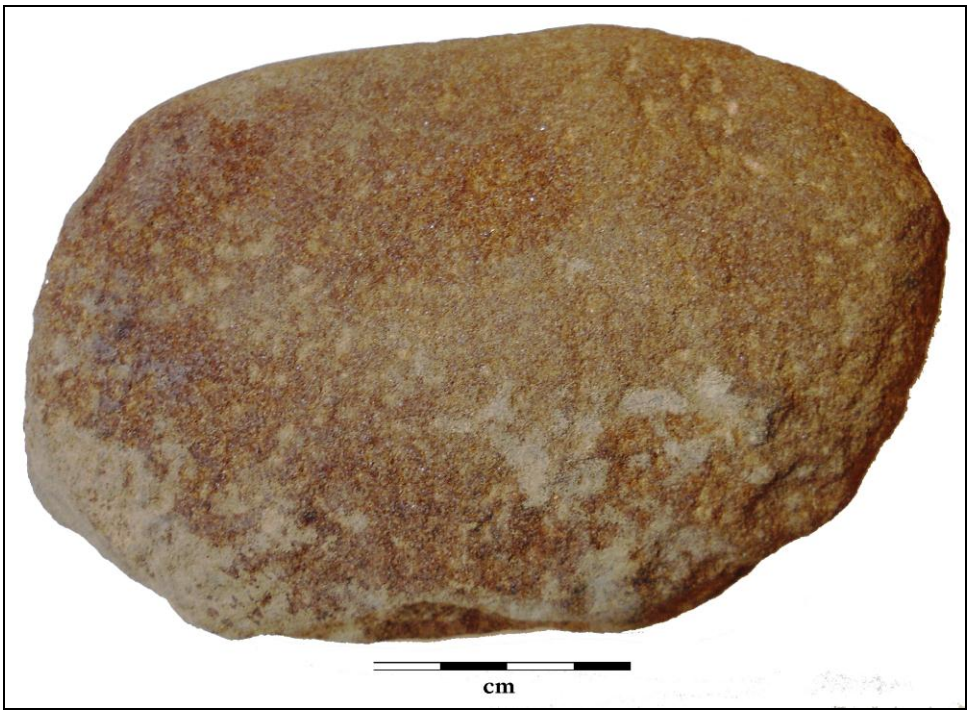


Figure 56. Reverse face of mano from north wall profile, Area B Grid, 39FA65.

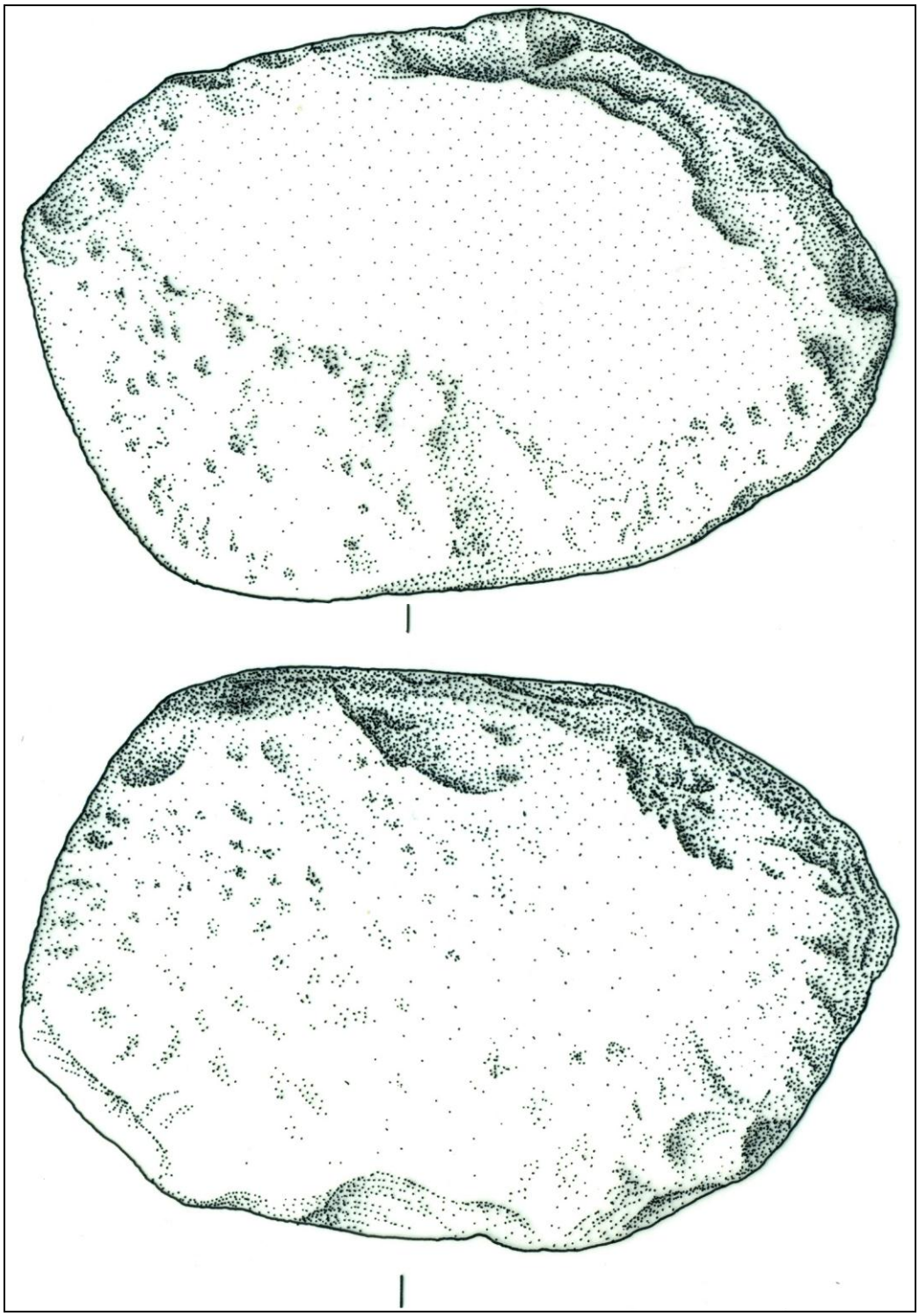


Figure 57. Scale line drawing of obverse (top) and reverse (bottom) faces of grinding stone.

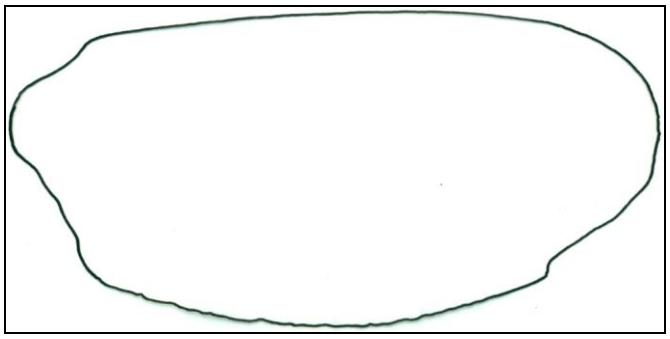


Figure 58. Scale cross-section of grinding stone.

Following the 1994 field season, the grinding stone was submitted to Paleo Research Laboratories, Denver, Colorado, for pollen and protein residue analysis (Scott Cummings and Puseman 1995 [see Appendix F]). Results of the protein residue analysis were negative with respect to all antisera tested; indicating that the tool was not used in the preparation of animal remains (Scott Cummings and Puseman 1995:4 [see Appendix F]). Pollen residue tests produced positive results for Apiaceae (Umbelliferae [carrot/parsley family]) and Poaceae (grass) pollen, and starch granules with hila were also recovered from the surface of the tool (Scott Cummings and Puseman 1995:3 [see Appendix F]). These results, coupled with the results of a previous pollen and phytolith study of the Ray Long site (Scott and Lewis 1986), suggest a strong likelihood that the grinding stone was used to process plants of both the grass and Umbelliferae families. Documentation of the varied uses of members of both the Apiaceae and Poaceae families of plants among Plains Native American groups is abundant (Chamberlin 1964:375; Colton 1974:305; French 1971:385-412; Harrington 1967:322; Rogers 1980:32-40; Whiting 1939:171-173).

1995 FIELD INVESTIGATIONS

The 1995 archeological field season at the Ray Long site consisted of one session that took place between August 27 and September 7, 1995. The field crew was composed of L. Adrien Hannus, R. Peter Winham, David Greenlund, Rick Haugen, Lyle Parks, Scott Parsons, Tammy Prokop, and James Strait. John Albanese continued the geomorphological investigations at the site. During this time, the excavation grid in Area B was reopened and three new units adjacent to the northeast corner of the grid were opened (Figure 59). Soil samples were collected from three burned earth and charcoal features as well as a more diffuse burn area in these units and submitted for radiocarbon dating (see Appendix E). Results of the 1995 investigation are addressed below.

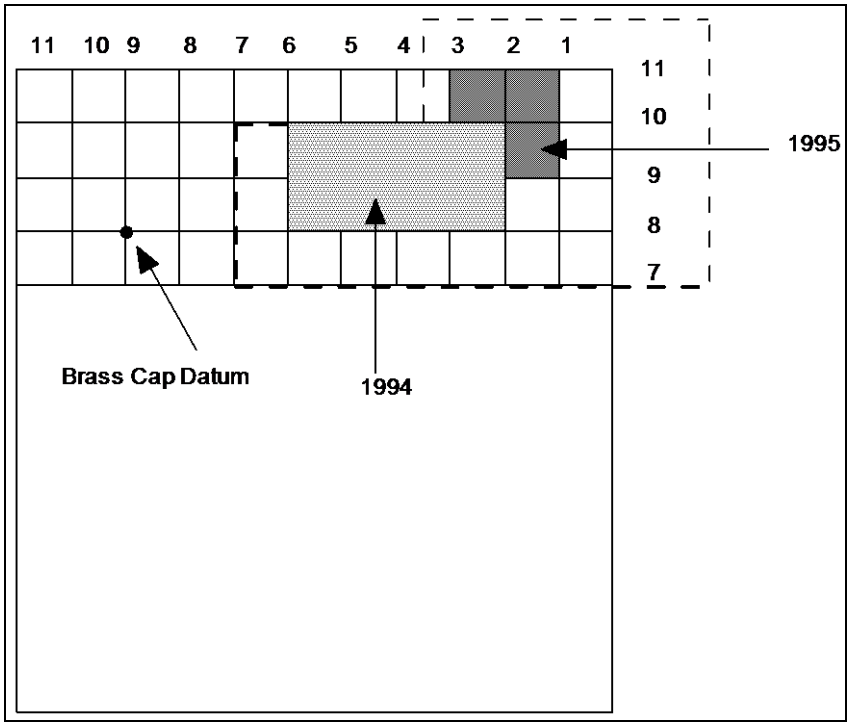


Figure 59. Plan view of the Area B excavation grid identifying the new brass cap datum established in 1995 and the location of the three new units opened in relation to those excavated during the 1994 season.

SMITHSONIAN INSTITUTION AREA B EXCAVATIONS

A new brass cap datum was established at the beginning of the 1995 field season in Area B at 8N 9W on the grid (see Figure 59, above). All distance and elevation measurements obtained during the 1995 season were based on this datum. The new datum was positioned 1.75 cm *above* the 1992 rebar datum and 300 cm *above* the main site (brass cap #2 – R44 R.P.) datum. With the assistance of a backhoe, the 8-m-square grid of units was reopened to the level at which it had been excavated the previous year. Then, three new units, designated 9N 2W, 10N 2W, and 10N 3W, were opened for further evaluation of the area. Ultimately, the three new units were excavated to a depth of between 250 and 260 cmbd (Figure 60). At this point, profiles were drawn of the north wall of Units 10N 2W and 10N 3W (Figures 61 and 62), the east wall of Units 9N 2W and 10N 2W (Figures 63 and 64), and the west wall of Unit 10N 3W (Figures 65 and 66). Detailed soil descriptions for these profiles are provided in the 2009 site geologic report (Albanese 2009 [see Appendix D]).

Figure 60. View down into the Area B block grid following the 1995 excavations, facing NNE.

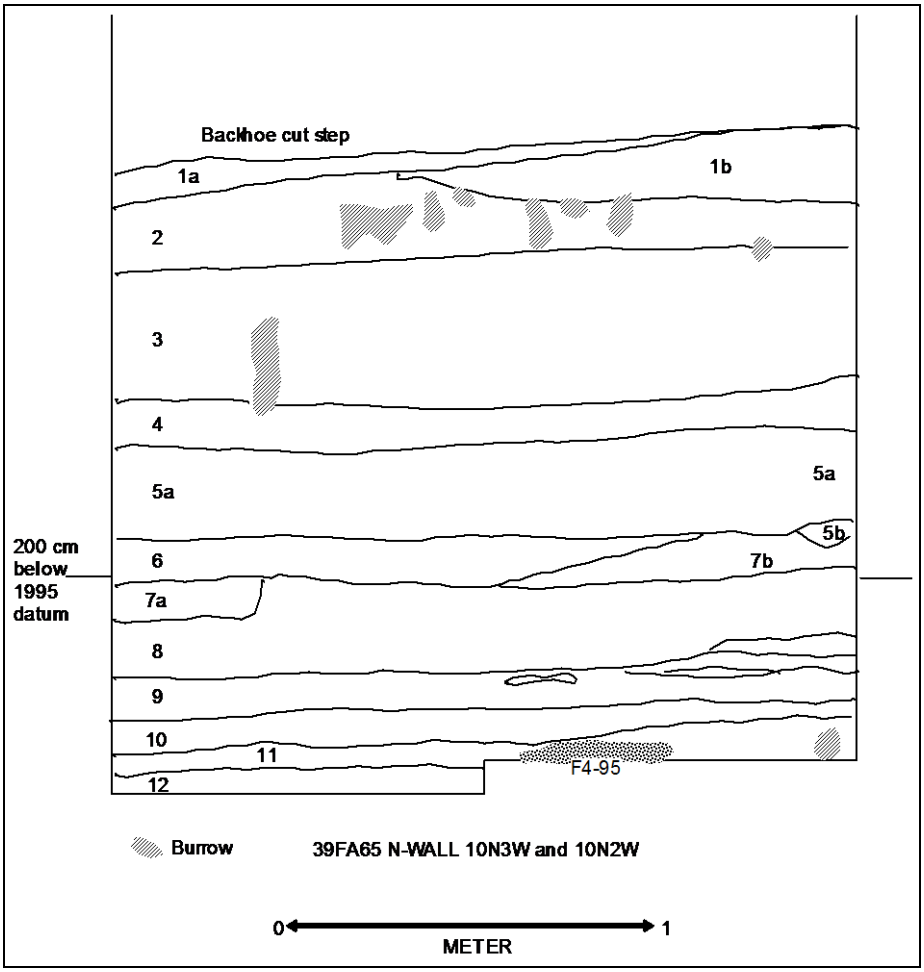


Figure 61. North wall profile, Units 10N 2W and 10N 3W, block excavation grid, Area B.

Figure 62. Profile of Units 10N 2W and 10N 3W, block excavation grid, Area B, facing N.

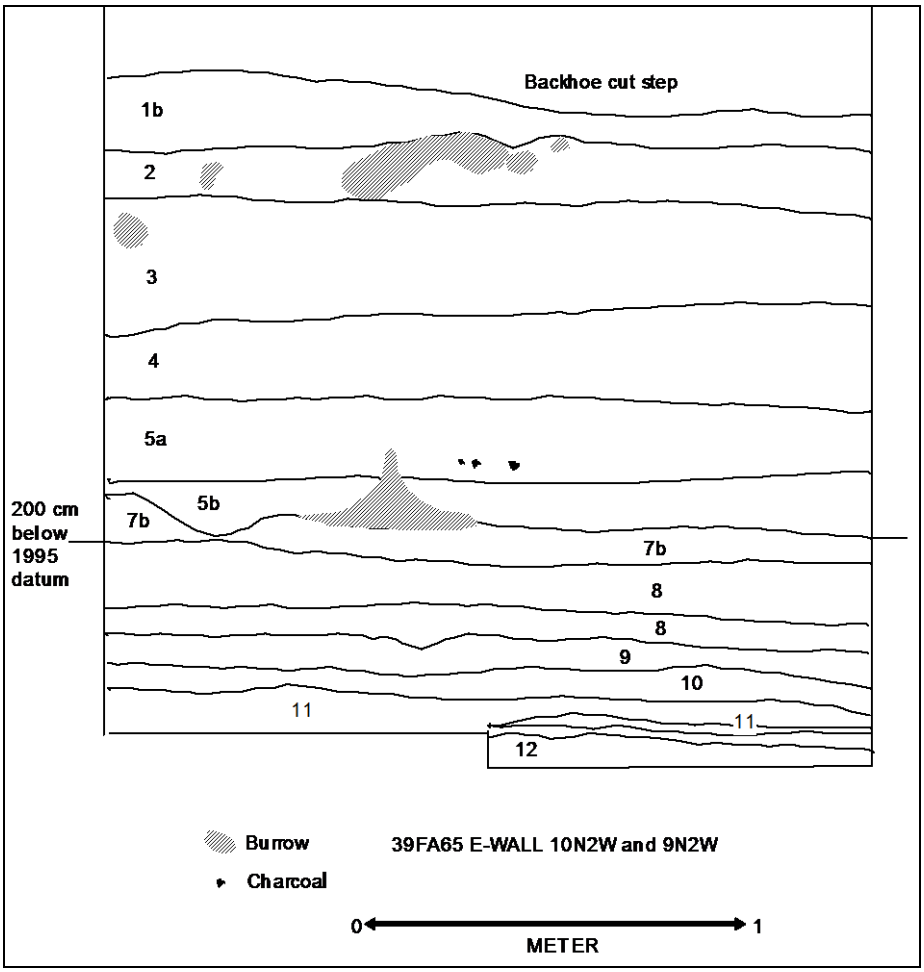


Figure 63. East wall profile, Units 10N 2W and 9N 2W, block excavation grid, Area B.

Figure 64. Profile of Units 10N 2W and 9N 2W, block excavation grid, Area B, facing E.

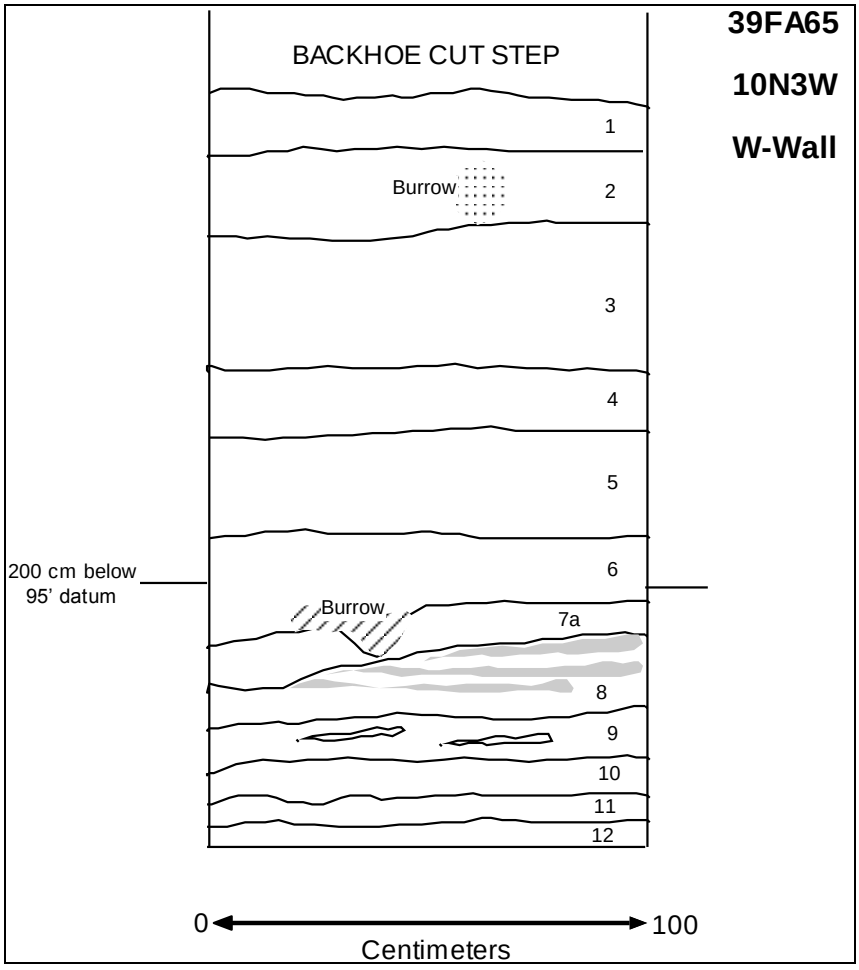


Figure 65. West wall profile, Unit 10N 3W, block excavation grid, Area B.

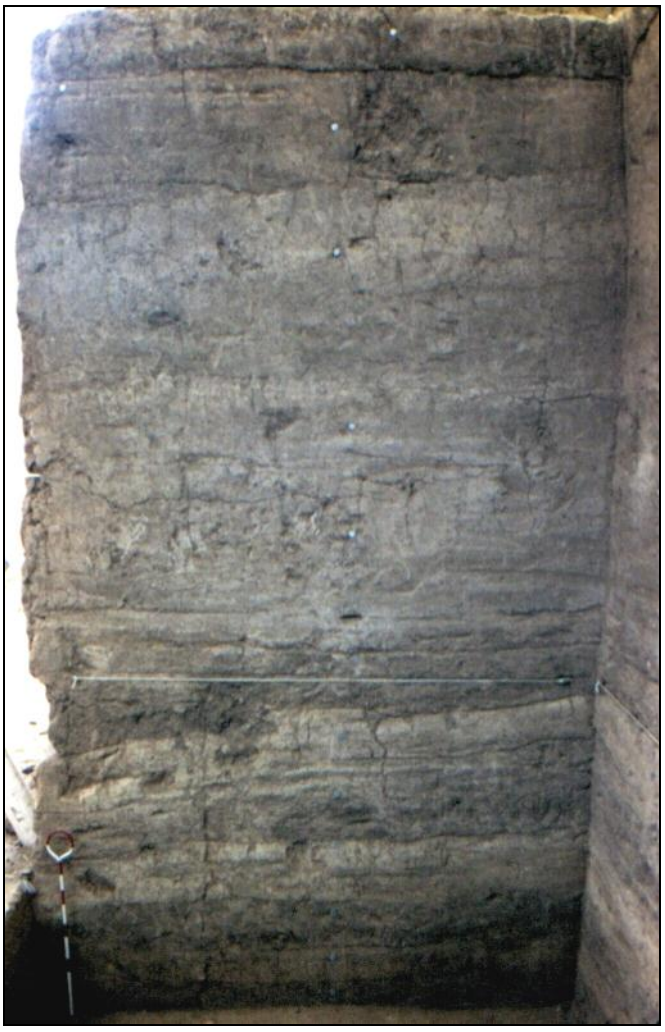


Figure 66. Profile of Unit 10N 3W, block excavation grid, Area B, facing W.

In 1994, the backhoe removed approximately 1 m of overburden above Units 9N 2W, 10N 2 W, and 10N 3W, so excavations in these units began at a depth below datum of 100 cm. From this point until reaching a depth below datum of 190 cm, the three units were excavated in arbitrary 20-cm levels by shovel-skimming. Below 190 cmbd, the units were excavated in arbitrary 5-cm levels by trowel. Levels in each unit in the grid were assigned a sequential, alphabetical designation beginning with Level A. This alphabetical designation of excavation levels varies from the numerical designation assigned for the units in the Area B block grid in 1994, and also in arbitrary thickness (the 1994 excavations were conducted in 10-cm levels).

The 1995 excavations resulted in the discovery of eight lithic reduction flakes, one projectile point base, and four features consisting of reddish-colored stains with associated charcoal concentrations. Four of the flakes are purple to light grayish-colored quartzite and four are a light grayish brown-colored porcellanite material. Flakes were recovered from each of the three new units. Three were discovered in Level D (205-210 cmbd), three in Level E (210-215 cmbd), and two in Level F (215-220 cmbd). The features, designated nos. 95-1–95-4, and the projectile point base are discussed in greater detail below.

With respect to the profiles, the layer designated number 7 during 1995, which corresponds with the 1994 excavation's Layer 13, is described as a very fine-grained, powdery clay in which four sub-layers (a-d) were identified. This layer represents the surface associated with the majority of lithic flakes identified during excavations, as well as Feature 94-4 and the grinding stone (mano) discovered during the previous year. Radiocarbon dates obtained from features in this layer correlate its living surface temporally with that of the Angostura cultural manifestation. This layer ranges in depth between ca. 190 and 215 cmbd, which correlates with 1995 excavation Levels A-E. Excavation Level I (230-235 cmbd), the other surface from which features and artifacts were recovered, roughly corresponds with the 1995 Layer 9 in the profile drawings, which is slightly below Layer 14 as designated during the 1994 excavations.

Feature 95-1

Feature 95-1 was encountered in Level E of Unit 9N 2W at a depth of between 210.5 and 215 cmbd (Figures 67-69). It was described by project geomorphologist John Albanese as follows:

> It is 24 cm long, 2.5 cm thick and slopes 5° - 10° to the east. It consists of silty clay with ±20% dispersed shale particles. The shale particles are 0.125-0.5 mm wide and some have a reddish hematic stain, resulting in the presence of red mottling. The sediment also contains ±5% - ±10% dispersed charcoal fragments that are 1 mm to 2 cm long. Feature 95-1 is a natural feature, the charcoal fragments are redeposited. The red hematic stain on shale flakes results in a superficial resemblance to a hearth [Albanese 2009:103].

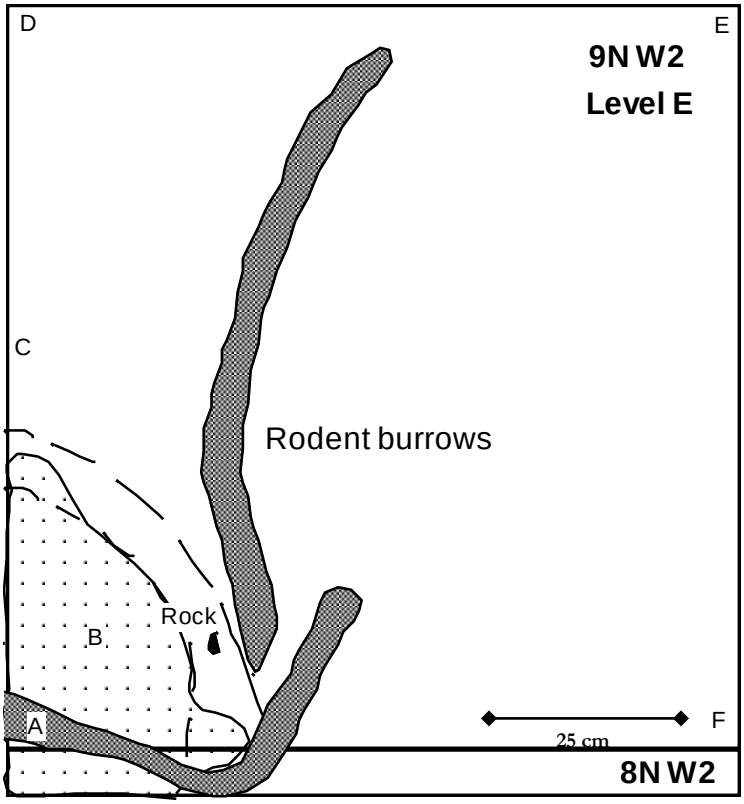


Figure 67. Plan view of Feature 95-1, Unit 9N 2W, Level E. Arrow denotes north.

Two prominent rodent runs were documented in and around the feature. A sample of solid carbon charcoal from Feature 95-1 was submitted to Teledyne Brown Engineering, Inc. for AMS

dating following the 1995 field season. Teledyne's analysis of the sample (No. I-18324) yielded a date of 9360 ± 180 RCYBP (see Appendix E). This date was then calibrated with the use of CALIB 6.0 and the INTCAL09 calibration curve (Reimer et al. 2009) (Table 6).

Figure 68. Close-up of Feature 95-1, Unit 9N 2W, Level E. Chaining pin denotes north.

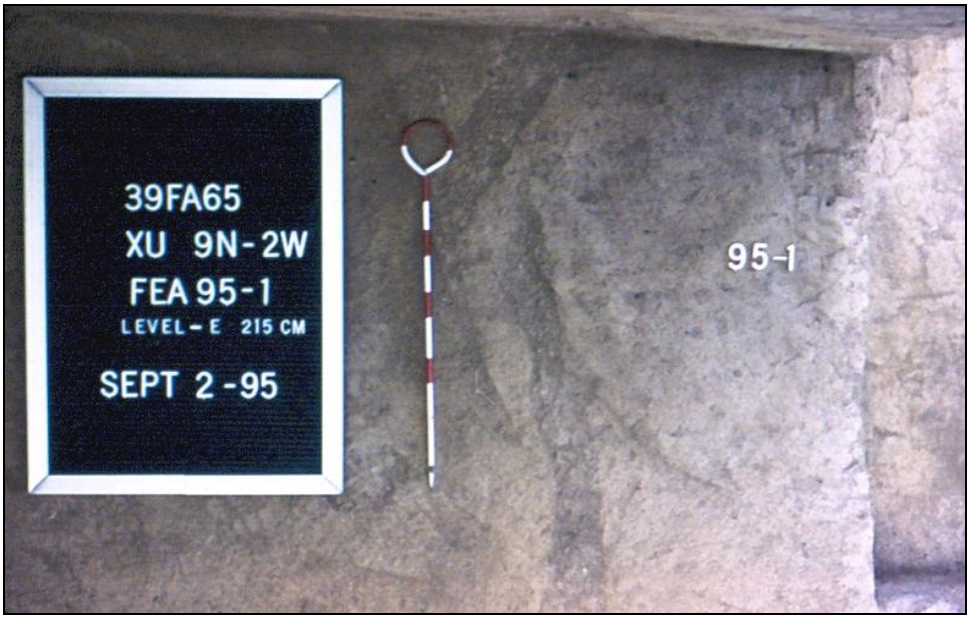


Figure 69. Unit 9N 2W following removal of Feature 95-1. Chaining pin denotes north.

Table 6. Calibrated AMS Date from Feature 95-1, Unit 9N 2W, Level E, Block Grid, Area B.

Sample No.	Laboratory No.	^{14}C Age (RCYBP)	Standard Deviation	Calibrated Range (in cal B.P.) & (Relative Area Under Probability Distribution)		Material Dated
				1σ (68.3 percent area enclosed)	**2σ (95.4 percent area enclosed)**	
1	I-18324	9360	180	10,271-10,782 (0.977) 11,038-11,056 (0.023)	10,226-11,156 (1.000)	Charcoal

Feature 95-2

Feature 95-2 was discovered in Level I of Unit 10N 2W at a depth of between 230 and 235 cmbd (Figures 70 and 71). Located along the eastern edge of the unit, the very shallow, basin-shaped feature measured 1 cm in thickness and approximately 37 cm in diameter. The feature contained three concentrations of charcoal in the western half of the basin and a small circular area of red-colored staining near the northeastern edge of the basin (see Figure 70). A sample of solid carbon charcoal from Feature 95-2 was submitted to Teledyne Brown Engineering, Inc. for AMS dating following the 1995 field season. Teledyne's analysis of the sample (No. I-18480) yielded a date of 8993 ± 87 RCYBP (see Appendix E). This date was then calibrated with the use of CALIB 6.0 and the INTCAL09 calibration curve (Reimer et al. 2009) (Table 7).

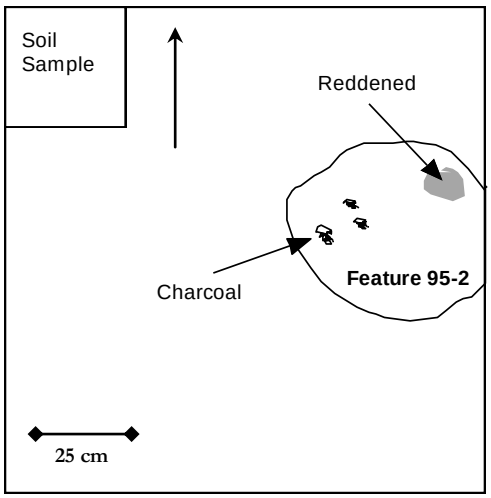


Figure 70. Plan view of Feature 95-2, Unit 10N 2W, Level I.

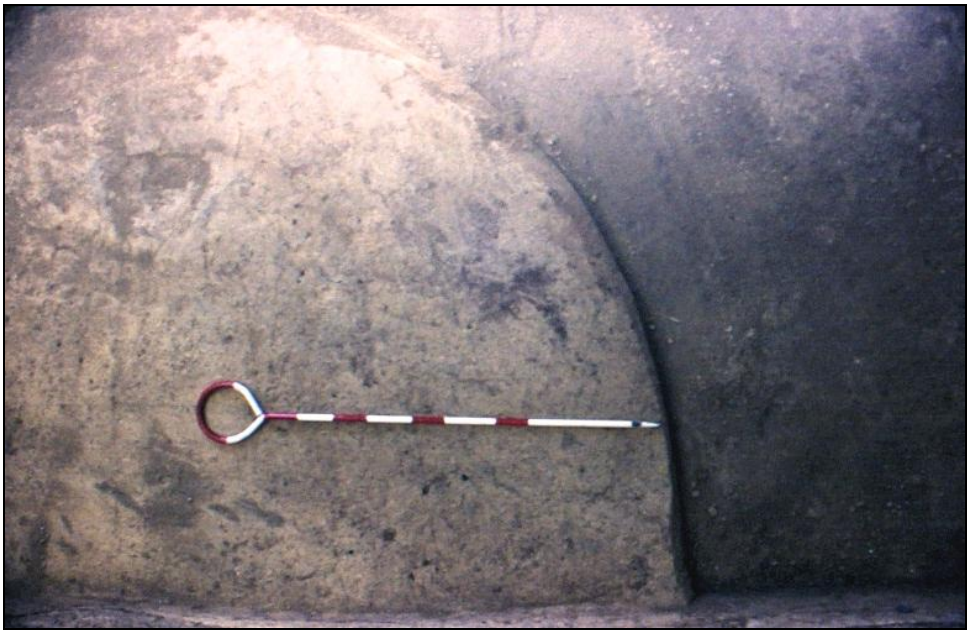


Figure 71. Close-up of Feature 95-2 following removal of fill, Unit 10N 2W, Level I. Chaining pin denotes north.

Table 7. Calibrated AMS Date from Feature 95-2, Unit 10N 2W, Level I, Block Grid, Area B.

Sample No.	Laboratory No.	^{14}C Age (RCYBP)	Standard Deviation	Calibrated Range (in cal B.P.) & (Relative Area Under Probability Distribution)		Material Dated
				1σ (68.3 percent area enclosed)	**2σ (95.4 percent area enclosed)**	
1	I-18480	8993	87	9933-9994 (0.229) 10,005-10,029 (0.077) 10,036-10,064 (0.098) 10,120-10,241 (0.596)	9773-10,296 (0.996) 10,357-10,370 (0.004)	Charcoal

Feature 95-3

Feature 95-3 was recorded in Level I of Unit 9N 2W at a depth of between 230 and 235 cmbd (Figures 72 and 73). Feature 95-3 was not sharply defined, but rather consisted of a diffuse area of burning observed throughout the level of the unit. Scattered concentrations of charcoal were documented near the western edge of the unit and several small areas of more defined red-colored staining were also observed. A sample of solid carbon charcoal from Feature 95-3 was collected and submitted to Teledyne Brown Engineering, Inc. for AMS dating following the 1995 field season. Teledyne's analysis of the sample (No. I-18481) yielded a date of 7862 ± 88 RCYBP (see Appendix E). This date was then calibrated with the use of CALIB 6.0 and the INTCAL09 calibration curve (Reimer et al. 2009) (Table 8).

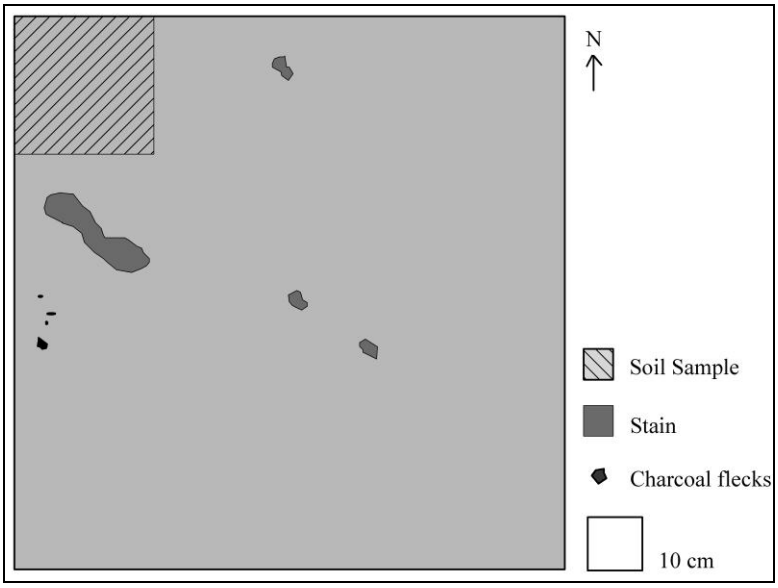


Figure 72. Plan view of Feature 95-3, Unit 9N 2W, Level I, 235 cmbd.

Table 8. Calibrated AMS Date from Feature 95-3, Unit 9N 2W, Level I, Block Grid, Area B.

Sample No.	Laboratory No.	^{14}C Age (RCYBP)	Standard Deviation	Calibrated Range (in cal B.P.) & (Relative Area Under Probability Distribution)		Material Dated
				1σ (68.3 percent area enclosed)	**2σ (95.4 percent area enclosed)**	
1	I-18481	7862	88	8546-8779 (0.870) 8833-8861 (0.074) 8920-8934 (0.035) 8940-8950 (0.022)	8460-8467 (0.006) 8477-8496 (0.018) 8512-8990 (0.975)	Charcoal

The AMS date obtained from this burn area is significantly more recent than those returned from the samples collected from Features 95-1 and 95-2, despite the fact that these two features are either positioned stratigraphically *above* Feature 95-3 (as is the case with Feature 95-1) or at the same depth below datum (as is the case with Feature 95-2). Given the poorly defined nature of Feature 95-3, it is probable that the anomalous date is the result of a contaminated sample. Bioturbation represents one possible mechanism for such contamination; however, no evidence of animal burrowing was noted in any of the unit excavation plan drawings or notes. Introduction of more modern rootlets or humates is another possible explanation, as is fluvial redeposition.

Figure 73. Close-up of Feature 95-3, Level I, Unit 9N 2W, Area B.

Feature 95-4

Feature 95-4 was noted in the north wall profile of Level L, Unit 10N 2W at a depth of between 245 and 250 cmbd (Figure 74; see Figure 61, above). This feature consisted of a dark, oblong stain with associated charcoal flecking in the north wall along the base of the western half of the unit. Based on the profile drawing, Feature 95-4 was more amorphous than basin-shaped. It measured approximately 40 cm across the east-west axis and about 5 cm in thickness. Although notes indicate that a sample was taken from this feature and submitted to Teledyne Brown Engineering, Inc. for AMS dating, a date was never returned to ALAC. The sample was likely either contaminated or insufficient in volume to allow for analysis.

Figure 74. Close-up of Feature 95-4 in the base of the north wall, Level L, Unit 10N 2W, Area B.

PROJECTILE POINT BASE

This specimen (Catalog No. 12-0046-25) was discovered while water screening a segment of a soil balk obtained from a depth of 230-235 cmbd (Level I) in the northwest corner of Unit 9N 2W. It is from the same unit and depth as Features 95-2 and 95-3 (see above), which suggests that it may have been redeposited from its primary context. The specimen is the proximal, or basal, end of a bi-fluted projectile point produced on light brownish gray-colored (10YR 6/2) silicified sediment (Figures 75-77). It measures 16.0 mm in length (broken), 25.0 mm in width, and 5.6 mm in thickness. The specimen exhibits evidence of grinding along both lateral margins but no additional signs of use-wear were observed (Kay et al. 2011:11). It was tentatively classified as Folsom or Clovis; however, its fragmentary nature precludes the assignment of a more definitive cultural techno-complex affiliation. Bruce Bradley (1996) provided the following assessment of the piece:

> The proximal end of a basally indented fluted point looks to me typologically and technologically most similar to a Folsom point. Technologically what can be said is that channel flakes were removed from both faces leaving a sharp knife-like margin in the middle of the indented base. Subsequent to this the lateral margins were selectively bifacially pressure retouched with abrupt non-invasive flakes. This produced a classic Folsom point cross-section and modified the flute margins so that they are basically parallel with the lateral margins. What isn't typically Folsom is the irregularity of the pressure retouch, the robusticity of the ears (for examples to compare see Frison 1991:54-55, figures 2.20 a-b and 2.21 a-b), and the slightly thick cross-section. Although this piece has been called a Clovis point base it is my feeling that it is more likely a "slightly crude" Folsom point. Somebody may be tempted to call this a transitional piece between Clovis and Folsom, but I would recommend against this for a single point fragment.

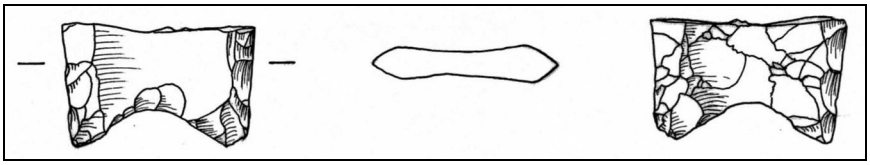


Figure 75. Scale line drawing of bi-fluted projectile point base recovered from soil balk of Level I, Unit 9N 2W, Area B.

Figure 76. Close-up of obverse (left) and reverse (right) faces of bi-fluted projectile point base recovered from Level I, Unit 9N 2W, Area B.

Figure 77. Fluted projectile point obverse, reverse, and cross-section view with oblique lighting to highlight some flake scars (image courtesy of Peter Bostrom – not to scale).

The opinion of other Paleoindian investigators (George Frison, Jack Hofman, L. Adrien Hannus personal communication, 1995) is that the specimen exhibits characteristics more closely affiliated with the Clovis group.

1996 FIELD INVESTIGATIONS

The 1996 archeological field season at the Ray Long site consisted of one 11-day session that took place between September 25 and October 5, 1996. The field crew was composed of L. Adrien Hannus, R. Peter Winham, Gene Anderson, Rick Haugen, Mike Fosha, Scott Parsons, Juanita Short, and James Strait. John Albanese continued the geomorphological investigations at the site. During this time, the entire excavation grid in Area B was reopened and four new units along the eastern edge of the grid were opened (Figure 78). The aim during this year was to extend excavations in the block grid units into, and below, the surface that was originally thought to date to the Clovis time period. As was previously the case, soil samples collected from the excavation units were submitted to Glen Fredlund, University of Wisconsin, Milwaukee, for pollen and phytolith analysis. These studies were never completed. Several soil samples were collected from throughout the units and levels during this field season. Two samples with charcoal from Level N were later submitted for AMS dating (see Appendix E). Samples from Level N were chosen because it represented the deepest level from which cultural material was recovered during the excavations. All elevational data obtained during the 1996 season were based on positioning in relation to the 1995 brass cap datum. Results of the 1996 investigations are addressed below.

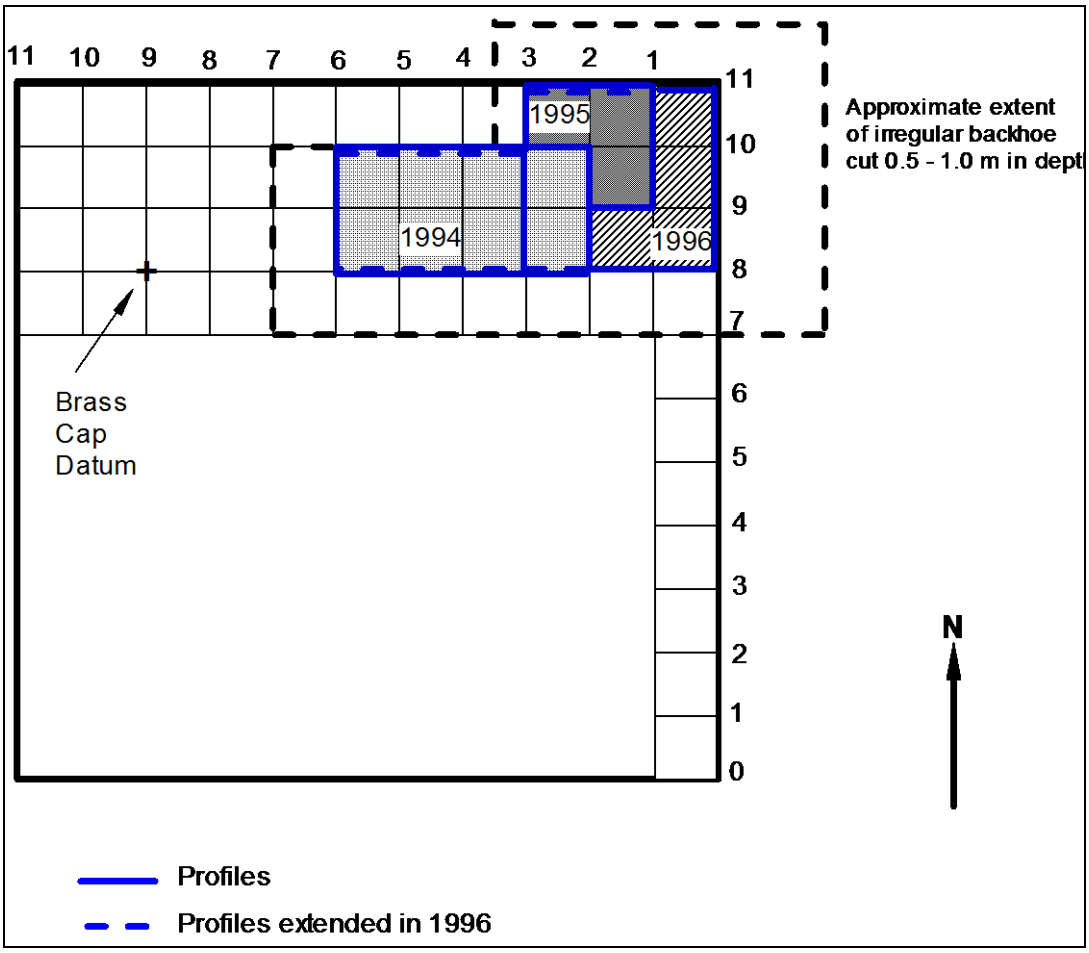


Figure 78. Plan view of the Area B excavation grid identifying the 1995 brass cap datum position and the location of the four new units opened in relation to those excavated during the 1994 and 1995 seasons.

SMITHSONIAN INSTITUTION AREA B EXCAVATIONS

Fieldwork during the 1996 season was directed toward the further excavation of units within the block grid in Area B. Four new units were opened, expanding the excavations eastward along the grid (see Figure 78, above). The new units opened were 8N 1W, 8N 2W, 9N 1W, and 10N 1W. Additionally, further excavations were carried out in many of the units opened during the previous two years. The 1996 work focused on the investigation of what was believed to be the Clovis-age occupation level – the top of which was identified as Level I in 1995, or 230-235 cmbd. Originally, the aim was to take the entire set of units in Area B down to Level O, or to a depth of at least 260 cmbd. All units save 8N 1W were taken to, or below, this level. Units 9N 2W and 10N 3W, which had been excavated through Level O the previous year, were not excavated further in 1996.

With the assistance of a backhoe, the original grid of units was reopened to the level at which it had been excavated the previous year (Table 9). Then, the four new units were opened for further evaluation of the area. Initially, the backhoe removed approximately 90 cm of soil from the upper part of these units. From 90 cmbd, the four new units were shovel skimmed in 20-cm levels to a depth of 190 cmbd, or the top of Level A. Levels A and B were then excavated together in one 10-cm level before proceeding in 5-cm increments from Level C downward. Ultimately, the grid units were excavated to a depth of between 250 and 270 cmbd (Figure 79; see Table 9). Prior to backfilling the excavation grid area, profiles were drawn of the north wall of Units 9N 4W – 9N 6W (Figure 80) and 10N 1W – 10N 3W (Figure 81), the south wall of Units 8N 1W – 8N 6W (Figure 82), and the east wall of Units 8N 1W, 9N 1W, and 10N 1W (Figure 83). Detailed soil descriptions for these profiles are provided in the 2009 site geologic report (Albanese 2009 [see Appendix D]).

Table 9. Level and Depth Data for Area B Grid Units, 1996 Excavations.

Excavation Unit	1996 Beginning Level (Depth in cmbd)	1996 Ending Level (Depth in cmbd)	Artifact/Feature Presence & Provenience
8N 1W*	Top of A (190)	Top of M (250)	1 flake (Level A/B)
8N 2W*	Top of A (190)	Top of O (260)	F96-3 (Levels E/F); 3 flakes (Levels A/B and E)
8N 3W	Top of I (230)	Top of O (260)	1 flake (Level E)
8N 4W	Top of J (235)	Top of Q (270)	—
8N 5W	Top of K (240)	Top of Q (270)	F96-4 (Level Q)
8N 6W	Top of K (240)	Top of Q (270)	F96-2 (Level L)
9N 1W*	Top of A (190)	Top of O (260)	1 flake (Level N)
9N 2W†	Top of O (260)	Top of O (260)	—
9N 3W	Top of J (235)	Top of O (260)	F96-1 (Level J)
9N 4W	Top of J (235)	Top of O (260)	—
9N 5W	Top of K (240)	Top of O (260)	—
9N 6W	Top of K (240)	Top of O (260)	—
10N 1W*	Top of A (190)	Top of O (260)	—
10N 2W	Top of M (250)	Top of O (260)	—
10N 3W†	Top of O (260)	Top of O (260)	—

*** Unit first opened during 1996 season † Not excavated further in 1996**

The 1996 excavations resulted in the discovery of six lithic reduction flakes and four features represented by reddish-colored stains and associated charcoal scatters. Four of the flakes are a light grayish-colored quartzite, one is a dark purple-colored quartzite, and one is a light brown-colored chalcedony. Three flakes were recovered from Unit 8N 2W, and one flake each was recovered from Units 8N 1W, 8N 3W, and 9N 1W. Three were discovered in Levels A/B (190-200 cmbd [which were excavated together in one 10-cm-slice]), two were recovered from Level E (210-215 cmbd), and one was recovered from Level N (255-260 cmbd). Additionally, two AMS dates were secured on charcoal samples from Level N of the Area B grid. The AMS dates and the features, designated Nos. 96-1–96-4, are discussed in greater detail below.

Figure 79. View down into the Area B block grid following the 1996 excavations, facing NW.

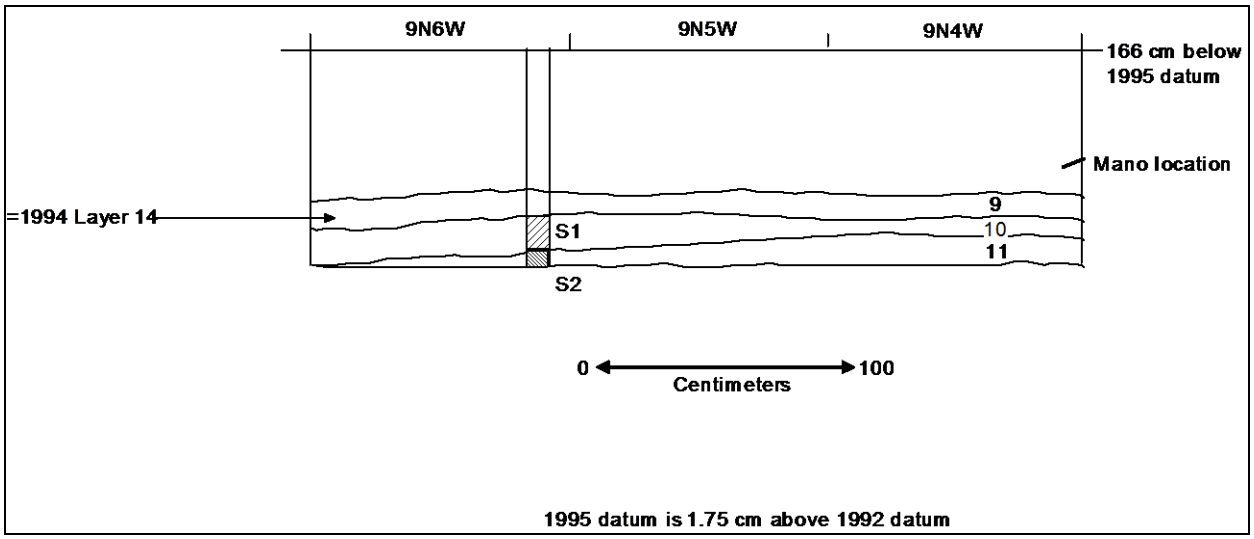


Figure 80. 1996 north wall profile of Units 9N 6W-9N 4W, Area B block grid. The S1 and S2 designations refer to samples collected from a soil column for pollen and phytolith analysis.

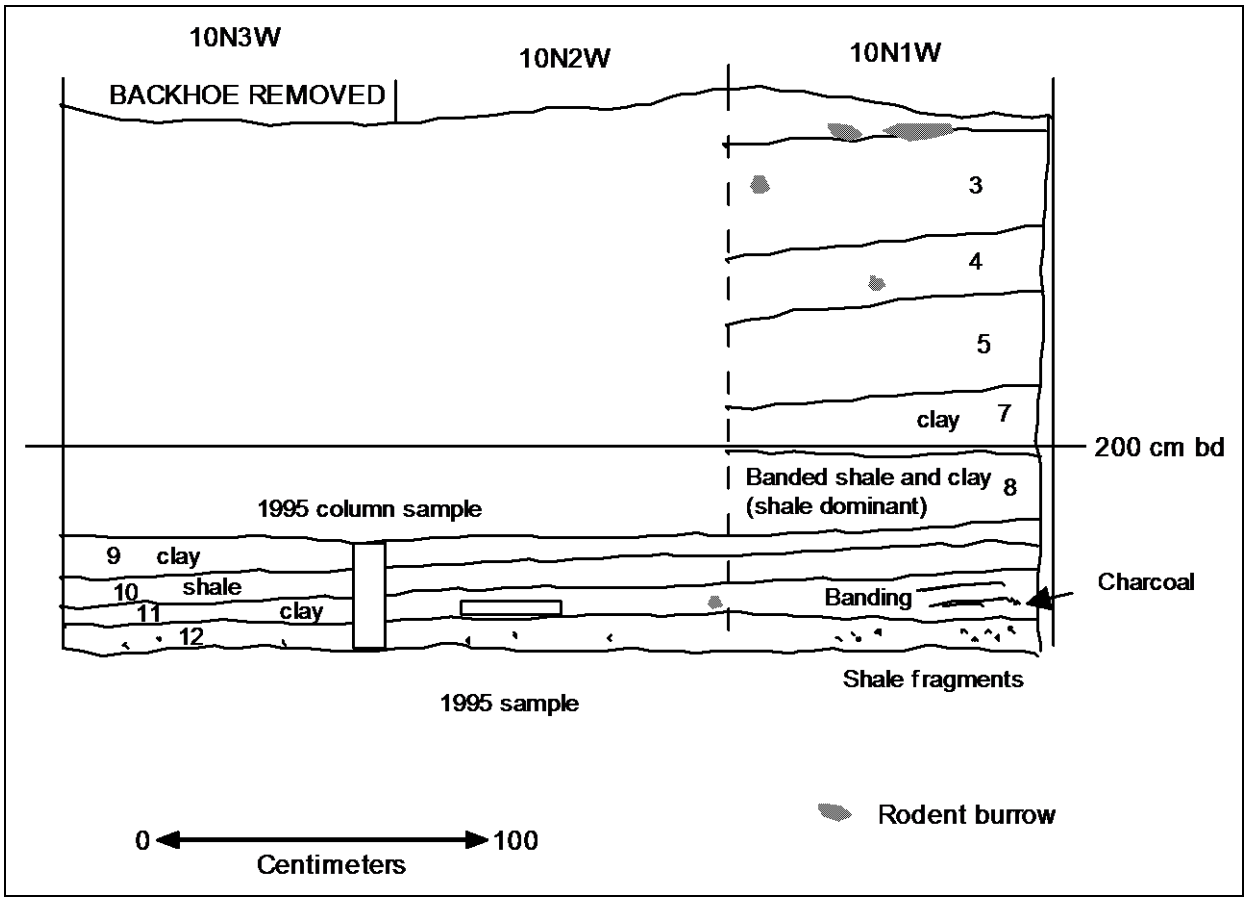


Figure 81. 1996 north wall profile of Units 10N 1W-10N 3W, Area B block grid.

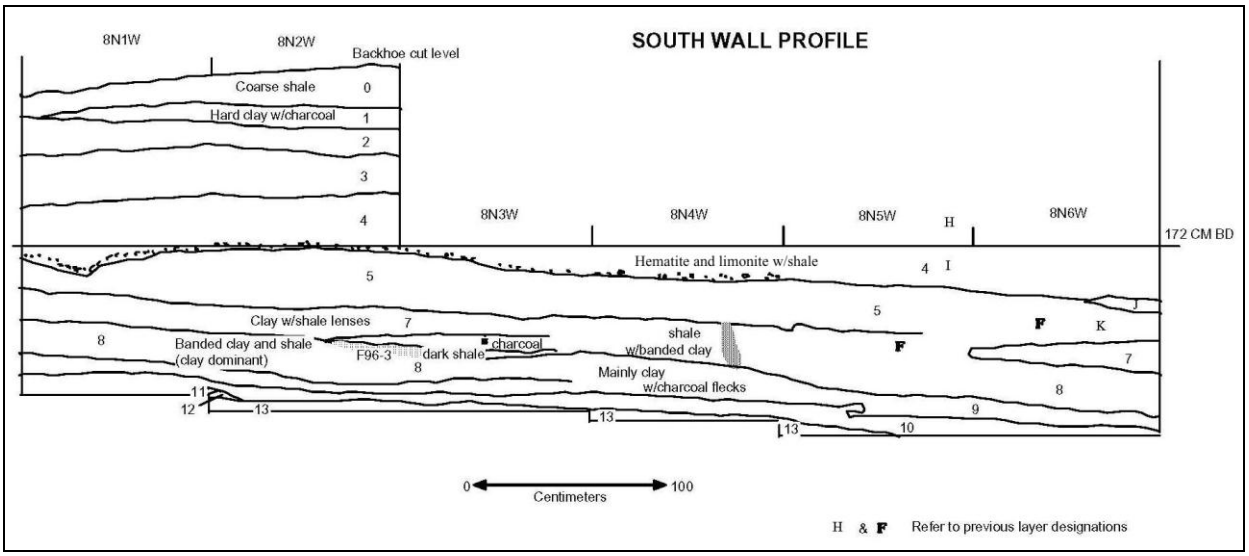


Figure 82. 1996 south wall profile of Units 8N 1W-8N 6W, Area B block grid.

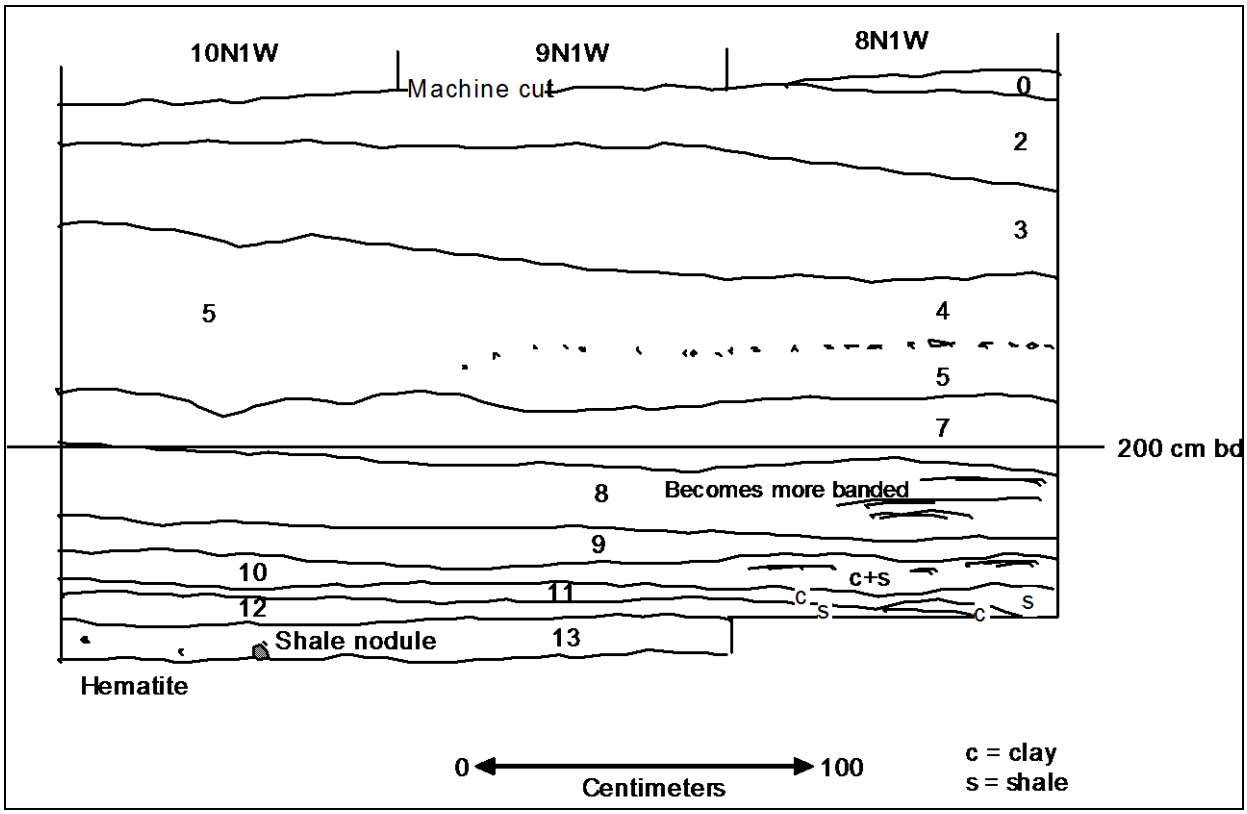


Figure 83. 1996 east wall profile of Units 8N 1W-10N 1W, Area B block grid.

AMS Dates

Two solid carbon charcoal samples were collected from Level N (255-260 cmbd) of the Area B grid units – one sample from Unit 8N 2W and one sample from Unit 9N 1W. These samples were subsequently submitted to Teledyne Brown Engineering, Inc. for AMS dating. The samples were selected from Level N because it was *N* that represented the deepest level from which cultural material was recovered during excavations. The sample from Unit 8N 2W (No. I-18883) yielded a date of 9100 ± 65 RCYBP, while the sample from Unit 9N 1W (No. I-18880) yielded a date of 9140 ± 80 RCYBP (see Appendix E). These dates were then calibrated with the use of CALIB 6.0 and the INTCAL09 calibration curve (Reimer et al. 2009) (Table 10). Although solid carbon charcoal samples were recovered from each of the four features recorded during the 1996 excavations, these samples were not submitted for AMS dating.

Table 10. Calibrated AMS Dates from Level N, Block Excavation Grid, Area B.

Sample No.	Laboratory No.	^{14}C Age (RCYBP)	Standard Deviation	Calibrated Range (in cal B.P.) & (Relative Area Under Probability Distribution)		Material Dated
				1σ (68.3 percent area enclosed)	2σ (95.4 percent area enclosed)	
1	I-18883	9100	65	10,196-10,298 (0.854) 10,327-10,340 (0.058) 10,354-10,372 (0.087)	10,174-10,433 (0.978) 10,461-10,485 (0.022)	Charcoal
2	I-18880	9140	80	10,229-10,403 (1.000)	10,184-10,514 (1.000)	Charcoal

Feature 96-1

Feature 96-1 was discovered in Level J of Unit 9N 3W at a depth of between 237 and 240 cmbd (Figures 84 and 85). This depth correlates with the Layer 9/10 transition. The feature was shallow (approximately 3 cm thick at most) and poorly defined. A diffuse area of lightly burned earth and scattered flecks of charcoal was observed throughout most of the eastern half of the unit. No artifacts were documented in association with the feature. A small sample of charcoal and soil was recovered from Feature 96-1; however, the sample was not subsequently submitted for dating.

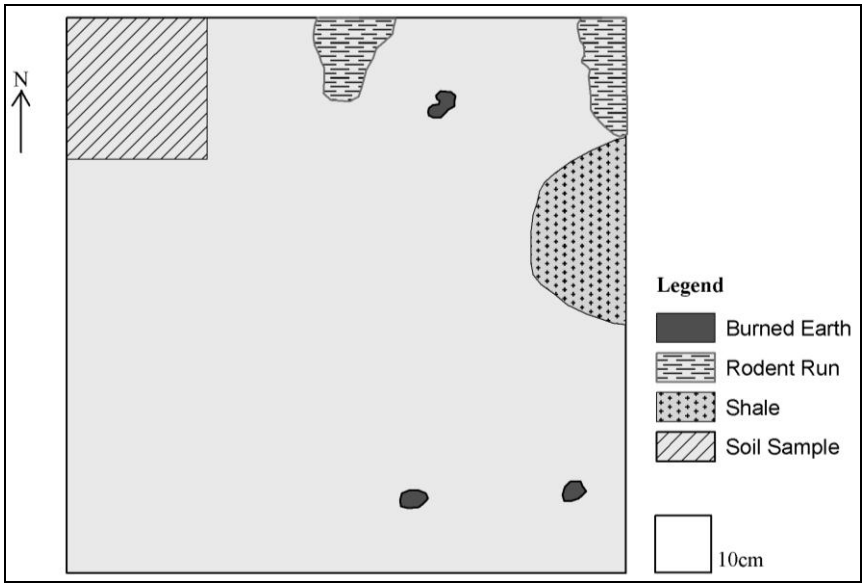


Figure 84. Plan view of Feature 96-1, Unit 9N 3W, Level J.

Figure 85. View of Feature 96-1, Unit 9N 3W, Level J/K transition, 240 cmbd, Area B grid. Chaining pin denotes north.

Feature 96-2

Feature 96-2 was recorded in Level L of Unit 8N 6W at a depth of between 245 and 250 cmbd (Figures 86 and 87). This depth correlates with Layer 8 in the profile drawing. The feature was shallow and poorly defined. It consisted of two concentrations of charcoal stains in the northern half of the unit (see Figure 87). No artifacts were documented in association with the feature. A small sample of charcoal and soil was recovered from Feature 96-2; however, the sample was not subsequently submitted for dating.

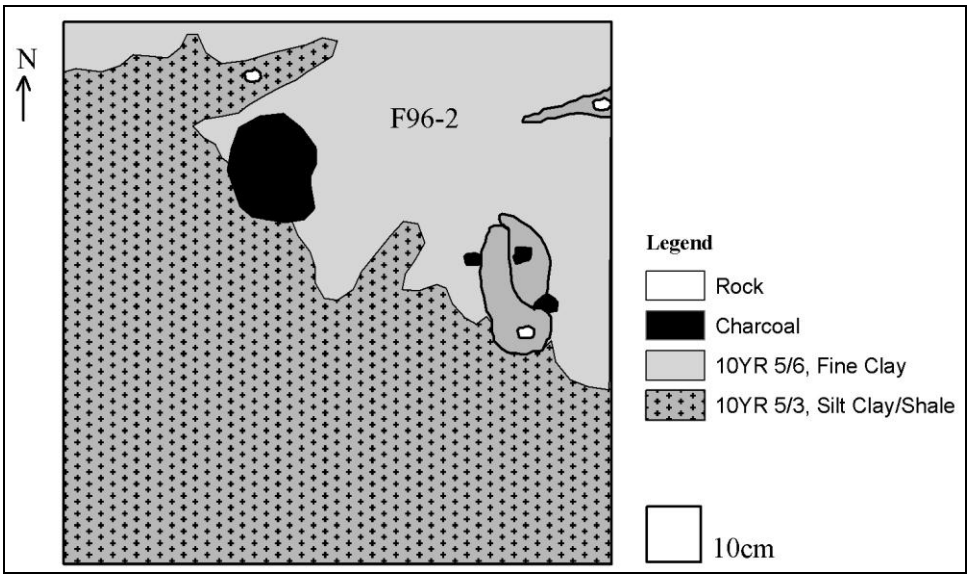


Figure 86. Plan view of Feature 96-2, Unit 8N 6W, Level L.

Figure 87. View of Feature 96-2, Unit 8N 6W, Level L, 245-250 cmbd, Area B grid. Chaining pin denotes north. Arrows denote burned areas with charcoal concentrations.

Feature 96-3

Feature 96-3 was first encountered in Level E of Unit 8N 2W at a depth of approximately 212 cmbd (Figures 88-94). However, further excavation revealed that the feature extended downward through Level F and slightly into Level G before terminating at a depth of 221 cmbd (roughly 9 cm in thickness). This depth correlates with Layer 8 in the profile drawing. Only a portion of the feature was uncovered; the remaining portion extended into the south wall of the grid. The stain was visible in the south wall profile between Units 8N 2W and 8N 3W (see Figure 82, above). The profile suggests a maximum east-west dimension of approximately 50 cm for the feature. The portion within Unit 8N 2W, located in the southwest corner of the unit, appears roughly circular and basin-shaped, consisting of charcoal flecks evenly distributed throughout an area of slightly reddish-colored soil. Two lithic reduction flakes were documented near the feature in Level E. They were collected. A small sample of charcoal and soil were recovered from Feature 96-3; however, the sample was not subsequently submitted for dating.

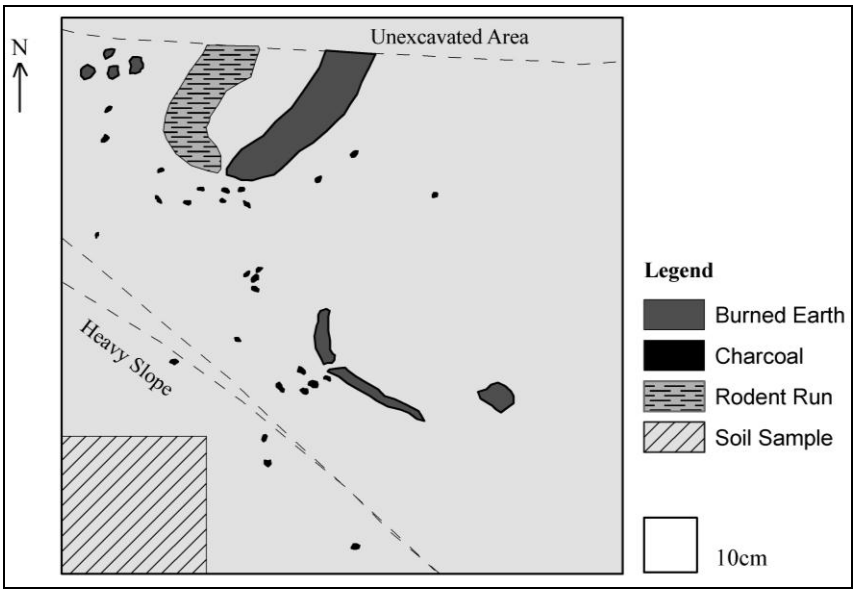


Figure 88. Plan view of Feature 96-3, Unit 8N 2W, midway through Level E.

Figure 89. View of top of Feature 96-3, Unit 8N 2W, Level E, ca. 212 cmbd, Area B grid. Chaining pin denotes north.

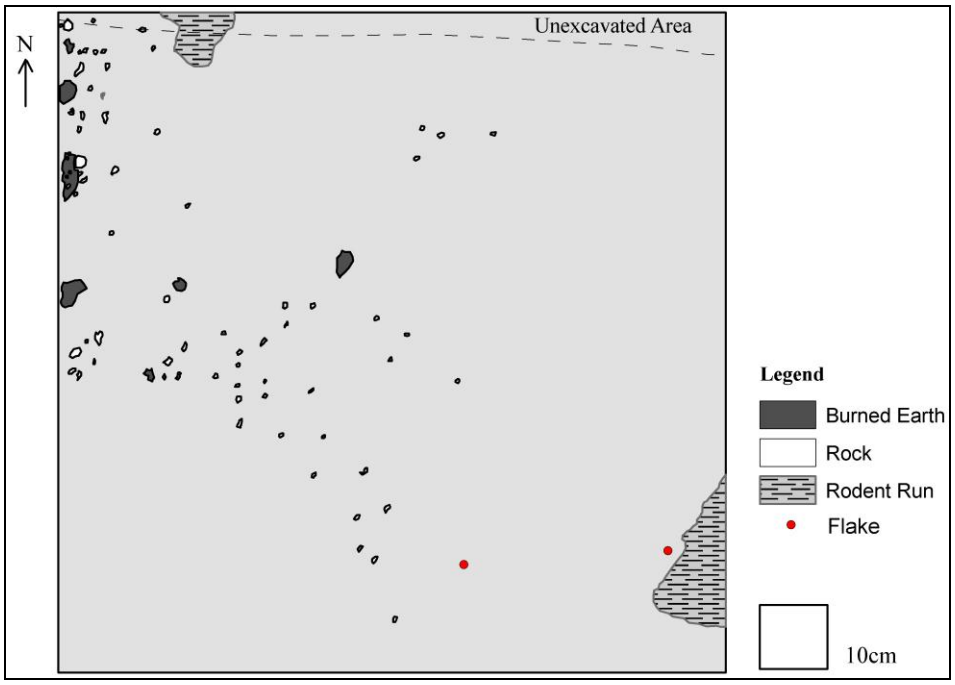


Figure 90. Plan view of Feature 96-3, Unit 8N 2W, base of Level E.

Figure 91. View of edge of Feature 96-3, Unit 8N 2W, top of Level F, 215 cmbd. Chaining pin denotes north.

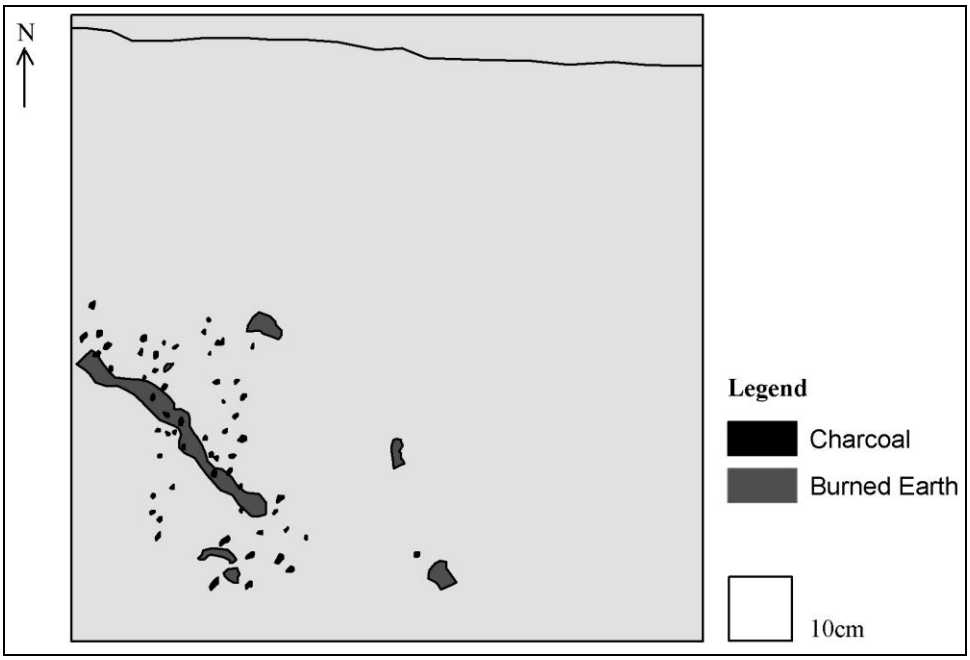


Figure 92. Plan view of Feature 96-3, Unit 8N 2W, midway through Level F.

Figure 93. View of Feature 96-3, Unit 8N 2W, middle of Level F, ca. 218 cmbd. Chaining pin denotes north.

Figure 94. View of Feature 96-3, Unit 8N 2W, Level G, ca. 223 cmbd. Chaining pin denotes north.

Feature 96-4

Feature 96-4 was first encountered in Level Q of Unit 8N 5W at a depth of approximately 272 cmbd (Figures 95 and 96). However, further excavation revealed that the feature extended downward into Level R before terminating at a depth of 278 cmbd (roughly 6 cm in thickness). This depth correlates with Layer 13 in the profile drawing. The feature consisted of a diffuse area of lightly burned earth with hematite, limonite, and a sparse scatter of charcoal flecks in the southeastern corner of the unit. A sparse, diffuse scatter of additional charcoal flecks was recorded throughout the remainder of the unit near the top of Level Q. No artifacts were documented in association with the feature. A small sample of charcoal and soil was recovered from Feature 96-4; however, the sample was not subsequently submitted for dating.

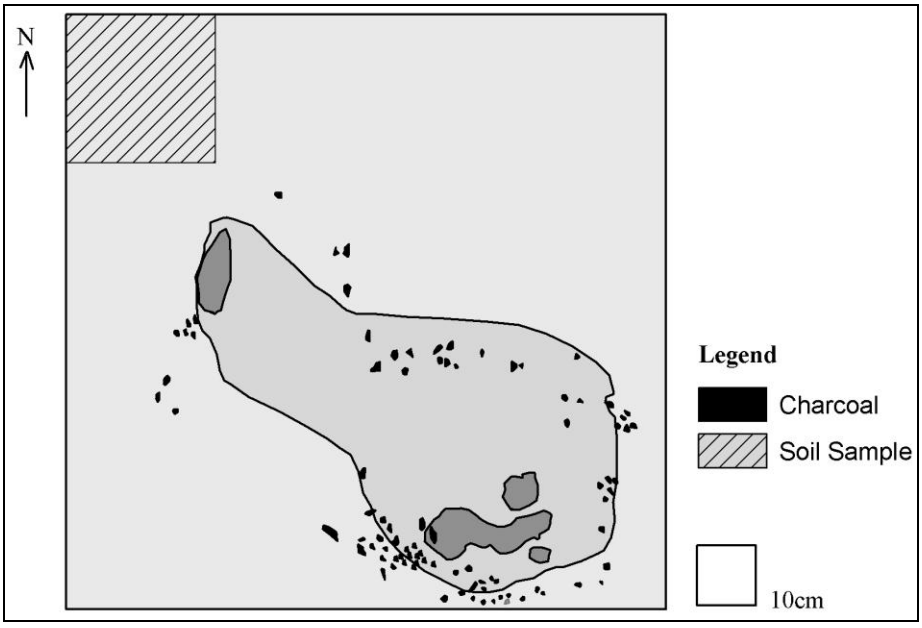


Figure 95. Plan view of Feature 96-4, Unit 8N 5W, Level Q.

Figure 96. View of Feature 96-4, Unit 8N 5W, Level Q, ca. 278 cmbd. Chaining pin denotes north.

1998 FIELD INVESTIGATIONS

The 1998 archeological field season at the Ray Long site took place between July 16 and 28, 1998. The field crew was composed of L. Adrien Hannus, R. Peter Winham, Ed Fosha, Linda Palmer, and Scott Parsons. John Albanese continued the geomorphological investigations at the site. The focus of the 1998 field activities was on Area A of the site. The investigators felt that Area A warranted further investigation because it was the only portion of the site to have yielded Angostura projectile point fragments from buried, in situ contexts (Wheeler 1995:435). The aim during this year was to extend excavations in Area A in an attempt to assess the potential for additional in situ cultural deposits dating to the Angostura occupation. A 15-m-x-5-m grid was established across Area A and 15 1-m-x-1-m units were opened, as were five backhoe trenches (Figure 97). The grid was positioned so that it partially overlapped the Smithsonian Institution's 1948-1950 excavation area.

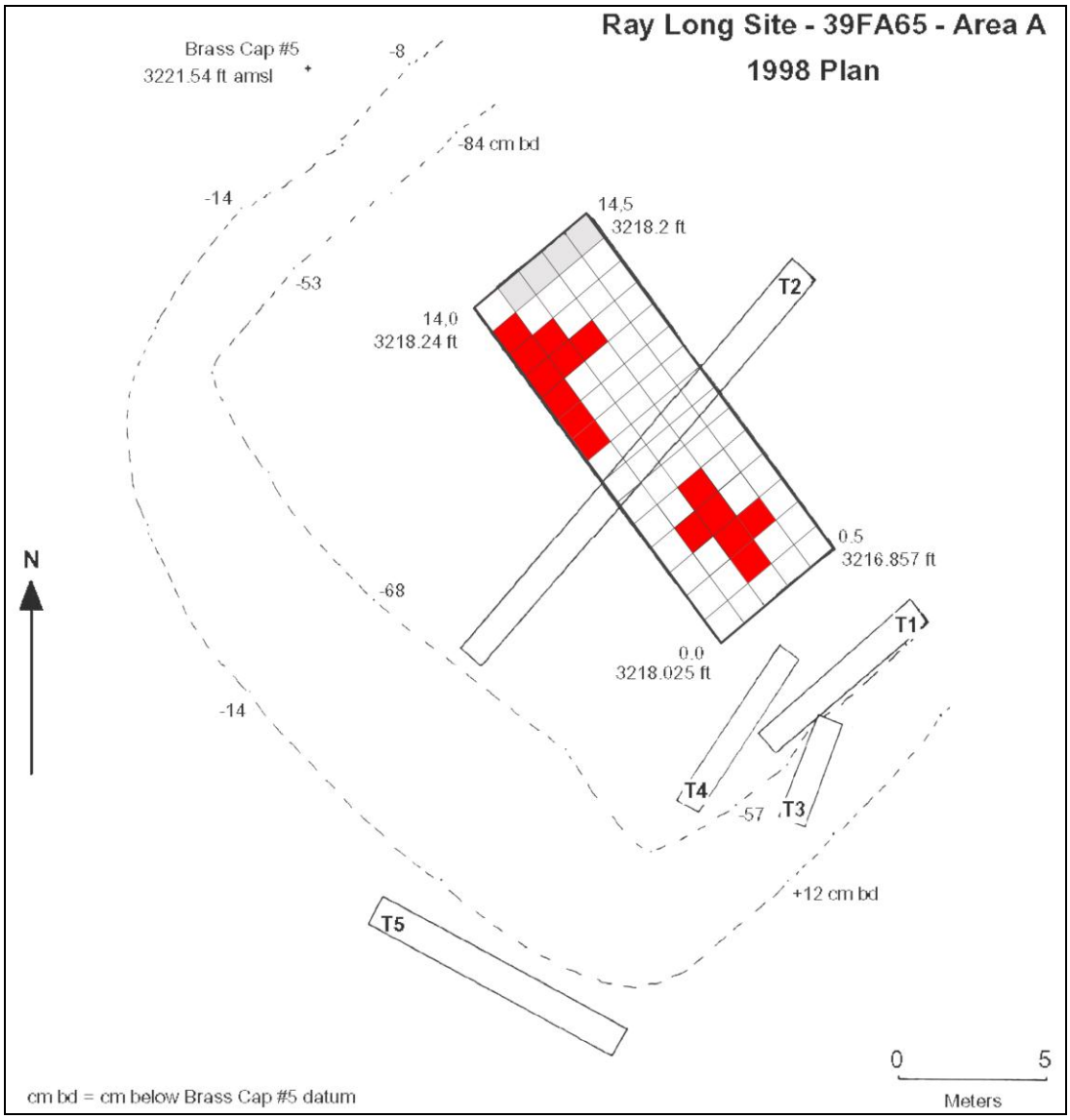


Figure 97. Plan view of the 1998 investigations in Area A. Gray units in the grid were opened in 1994. Red units were opened in 1998, as were Trenches 1A-5A.

All elevational data obtained during the 1998 season were based on positioning in relation to a newly established brass cap datum (designated #5) placed northwest of the Area A excavation unit grid (see Figure 97, above). This new datum was located at an elevation of 3,221.54 feet amsl, or 5.36 m above the Brass Cap #2 (R44 R.P.) main site datum. Fortunately, all locational data were tied into the main site datum in this manner because the Area A datum points, established in 1994 and 1998, were unable to be relocated during the 2010 field session because heavy erosion had occurred over the ensuing years. Results of the 1998 investigations are addressed below.

SMITHSONIAN INSTITUTION AREA A EXCAVATIONS

Fieldwork during the 1998 season began with the establishment of Brass Cap Datum #5 and the relocation of Units A1-A4 (opened in 1994) in the Area A portion of the site. A new excavation grid, measuring 15 m NW-SE by 5 m SW-NE, was then established across Area A. The four previously opened units were included within the grid and each individual 1-m-x-1-m unit was then assigned a two-number designation based on its northing and easting position. Fifteen new units were opened in the grid during the 1998 field season (Table 11; Figure 98) and five small trenches, designated 1A-5A, were also cut through the area (see Figure 97, above).

Table 11. Level and Depth Data for Area A Grid Units Opened During 1998 Excavations.

Excavation Unit (Alternate Designation)	1998 Beginning Depth in cmbd	1998 Ending Depth in cmbd	Artifact/Feature Presence & Depth in cmbd
1N 2E	115-128	139-140	—
2N 2E	114-128	136-140	2 quartzite tertiary flakes (Level 3 and 140 cmbd)
2N 3E†	126-135	139-141	—
3N 1E	108-116	137-138	—
3N 2E	136	139	—
4N 2E	116-121	135-140	—
8N 0E	112-116	135-138	—
9N 0E	129	135	1 quartzite tertiary flake (135 cmbd)
10N 0E	117-124	138	—
11N 0E	110-117	133-139	2 quartzite tertiary flakes (133 cmbd); F98-1 (133 cmbd)
11N 1E	110-117	128-133	F98-1 (133 cmbd)
11N 2E	114-119	139-140	—
12N 0E	125-129	139	—
12N 1E	124-128	136	—
13N 0E	128-133	135-140	F98-2 (133 cmbd)
14N 1E (A4)*	151	151	—
14N 2E (A3)*	151	151	—
14N 3E (A2)*	151	151	1 quartzite tertiary flake (141-151 cmbd); 1 non-ID bone frag. (129 cmbd). Found in 1994
14N 4E (A1)*	191	191	—

*** First opened in 1994 † Opened as a 1-m-x-50-cm unit**

With the assistance of a backhoe, the grid area was stripped of its topsoil and Units A1-A4, first opened in 1994, were uncovered. Plastic sheeting covering the old units was contacted at a depth of 109 cmbd. The first of the five trenches, 1A, was also opened south of the grid at this time.

Trenches 2A through 5A were excavated shortly thereafter. Ultimately, the backhoe removed 30-40 cm of sterile overburden from the grid area. Soil was removed in this manner in 10-cm levels. The new grid was then laid out in the cleared area in relation to the 1994 units. Unit excavation was conducted by trowel in 5-cm levels. Excavated soil matrix was sieved through standard ¼-inch wire screen.

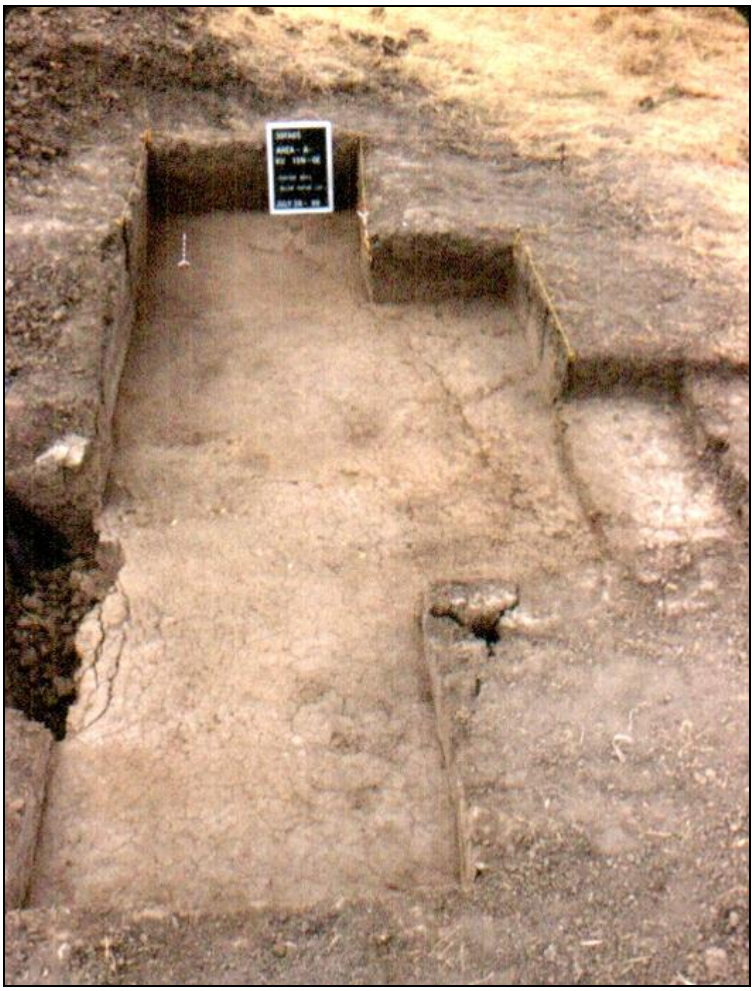


Figure 98. View of northwestern block of units opened in the Area A grid. Features 98-1 and 98-2 were uncovered here. Facing NW.

The 1998 excavations resulted in the discovery of six lithic reduction flakes and two features represented by reddish-colored stains and associated charcoal scatters. One dark brown-colored chert tertiary flake fragment was discovered during a surface inspection of Area A. The other five specimens, all quartzite tertiary flakes, were recovered from excavation Units 2N 2E (n=2), 9N 0E (n=1), and 11N 0E (n=2). The depth of the finds varied between 133 and 140 cmbd. An additional quartzite tertiary flake was recovered in 1994 from Unit 14N 3E at a depth of 141-151 cmbd. Additionally, five charcoal samples, including three from the grid area and two from Trench 2A, were obtained in 1998 and later submitted for AMS dating (see Appendix E). The two features were discovered at a depth of 133 cmbd in Units 11N 0E/11N 1E and 13N 0E, respectively.

AMS Dates

Five solid carbon charcoal samples were collected from Area A during the 1998 field season. Three samples were collected from the grid units – one from Unit 11N 1E (at 130 cmbd), one from Unit 12N 0E (at 137 cmbd), and one from Unit 2N 2E (at 138 cmbd). Two additional samples were collected from Trench 2A (one at 155 cmbd and one at 173 cmbd). All five samples were subsequently submitted to Geochron Laboratories, Cambridge, Massachusetts, for AMS dating (see Appendix E). These dates were then calibrated with the use of CALIB 6.0 and the INTCAL09 calibration curve (Reimer et al. 2009) (Table 12).

Table 12. Calibrated AMS Dates from Block Excavation Grid and Trench 2A, Area A.

Sample No.	Laboratory No.	^{14}C Age (RCYBP)	Standard Deviation	Calibrated Range (in cal B.P.) & (Relative Area Under Probability Distribution)		Material Dated
				1σ (68.3 percent area enclosed)	2σ (95.4 percent area enclosed)	
1A	GX-24603	8970	50	9947-9989 (0.233) 10,013-10,022 (0.034) 10,041-10,060 (0.089) 10,146-10,226 (0.645)	9917-10,085 (0.450) 10,114-10,233 (0.550)	Charcoal (11N 1E: 130 cmbd – near SI Feat. 19)
2A	GX-24604	8880	50	9913-9965 (0.229) 9984-10,153 (0.771)	9777-10,182 (1.000)	Charcoal (12N 0E: 137 cmbd – near SI Feat. 19)
3A	GX-24605	9060	50	10,197-10,245 (1.000)	9975-9976 (0.001) 10,157-10,299 (0.972) 10,319-10,343 (0.012) 10,351-10,375 (0.015)	Charcoal (2N 2E: 138 cmbd – near SI Feat. 17)
5	GX-24607	9040	50	10,190-10,239 (1.000)	9943-9989 (0.030) 10,015-10,021 (0.002) 10,042-10,059 (0.009) 10,146-10,287 (0.958)	Charcoal (Trench 2A: 173 cmbd)
6	GX-24608	11,300	80	13,121-13,268 (1.000)	12,962-13,026 (0.032) 13,053-13,362 (0.968)	Charcoal (Trench 2A: 155 cmbd)

Feature 98-1

Feature 98-1 was discovered in Units 11N 0E and 11N 1E at a depth of 133-136 cmbd (Figures 99 and 100). The feature was shallow (approximately 3-cm thick at most) and rather amorphous. A diffuse area of light staining and sparsely scattered flecks of charcoal was observed in the northeastern quarter of Unit 11N 0E and the northwestern quarter of Unit 11N 1E. Two quartzite tertiary flakes were recovered while screening excavated soil matrix from Unit 11N 0E in the same level as Feature 98-1. A small sample of charcoal and soil was recovered from 130 cmbd in Unit 11N 1E, just above Feature 98-1. It was subsequently submitted for AMS dating as Sample 1A and yielded a date of 8970 ± 50 RCYBP (see above). Additional soil samples were collected from portions of Feature 98-1 in both units; however, these samples have not been submitted for dating.

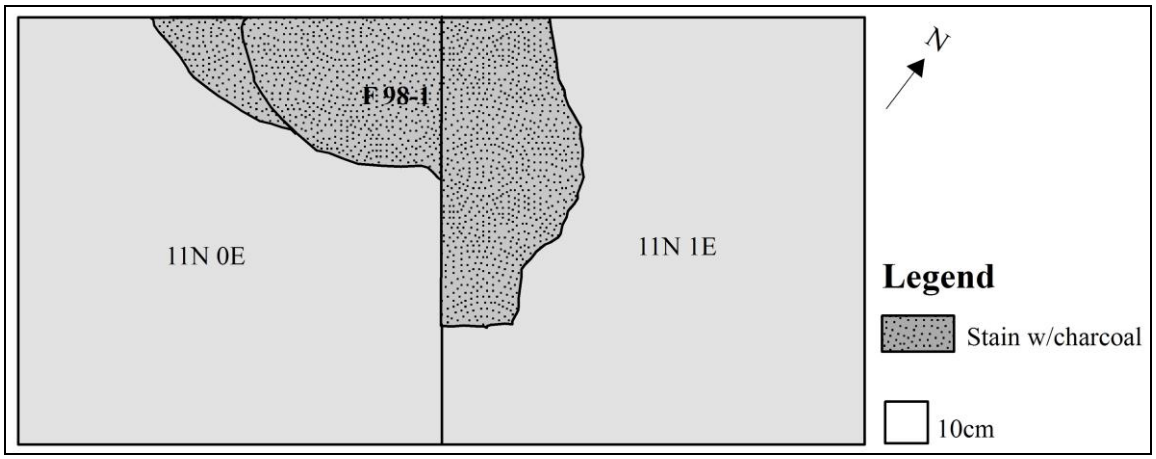


Figure 99. Plan view of Feature 98-1, Units 11N 0E (left) and 11N 1E (right), Area A grid.

Figure 100. View of Feature 98-1 area, Units 11N 0E and 11N 1E, 133 cmbd, Area A. Facing NE. Chaining pin does *not* denote north.

Feature 98-2

Feature 98-2 was recorded in Unit 13N 0E at a depth of between 133 and 134 cmbd (Figures 101 and 102). The feature was a roughly circular, very shallow basin. It consisted of numerous tiny charcoal flecks and an ephemeral stain that measured approximately 36 cm in diameter. No

artifacts were documented in direct association with the feature; however, Feature 98-1 is located only about 2 m southeast of, and at the same depth below surface as, Feature 98-2, and two flakes *were* documented in association with that feature. A small sample of charcoal and soil was recovered from Feature 98-2; however, the sample was not subsequently submitted for dating.

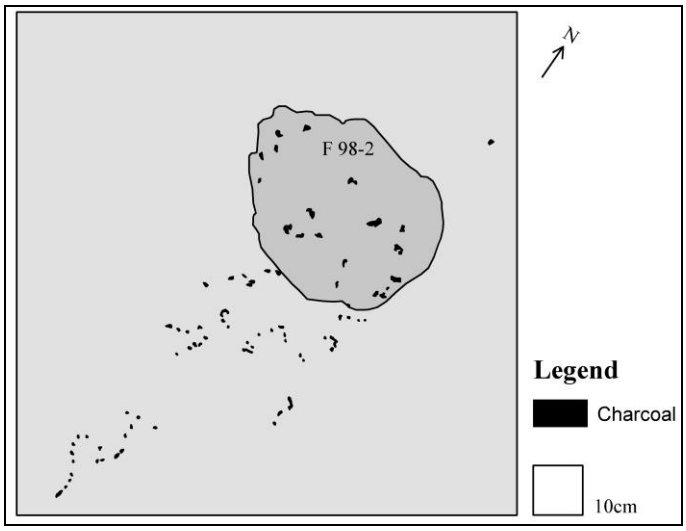


Figure 101. Plan view of Feature 98-2, Unit 13N 0E, Area A grid.

Figure 102. View of Feature 98-2 area, Unit 13N 0E, 133 cmbd, Area A. Facing SW. Chaining pin does *not* denote north.

Backhoe Trenches 1A-5A

Five backhoe trenches, designated 1A-5A, were excavated in Area A during 1998 (Figures 103 and 104; see Figure 97, above). All of the trenches were excavated with a 1-yard bucket, so all measured three feet, or about 1 meter, in width. The trenches varied in both length and depth, although all were fairly shallow. Profiles were drawn of walls in Trenches 2A-5A (Figure 105). Trench 1A was not profiled due to poor sediment exposure. Detailed soil descriptions and profile drawings for the trenches are provided in the 2009 site geologic report (Albanese 2009:21-37 [see Appendix D]).

Trench 1A was excavated approximately 4 m southwest of the Area A grid on a northeast-southwest axis. It measured roughly 7 m in length and 0.60 m deep. Trench 2A was cut across the Area A grid on a northeast-southwest axis. It measured approximately 17.5 m in length and 1.64 m deep at its greatest depth. Charcoal samples recovered from two localities in Trench 2A were subsequently submitted for AMS dating. Trench 3A was excavated just south of Trench 1A on a northeast-southwest axis. It measured about 3.75 m in length and 0.81 m at its deepest. Trench 4A was excavated just west of the west end of Trench 1A and about 2 m north of Trench 3A. It measured approximately 6.5 m long and 0.82 m at its deepest. Trench 5A was excavated about 8 m south and west of the others. It measured about 9.5 m in length and 1.62 m in depth. No artifacts or cultural features were observed in any of the trenches.

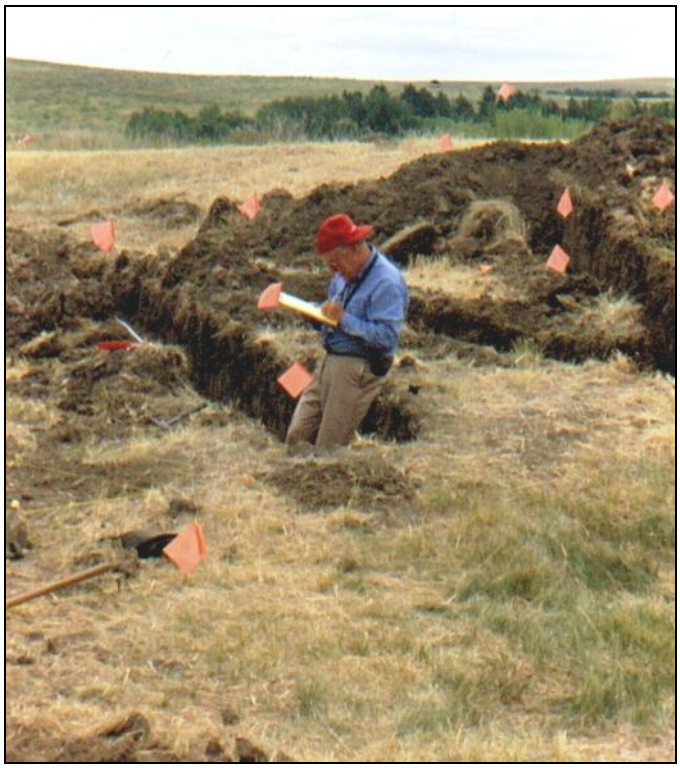


Figure 103. Overview of Trenches 1A and 3A. Project geomorphologist John Albanese is standing in Trench 1A. Facing ESE.

Figure 104. Overview of portion of Trench 2A. Facing NE.

Figure 105. Close-up of SW wall profile of Trench 2A. Facing SW.

SHORELINE STABILIZATION EFFORTS AT THE RAY LONG SITE (39FA65)

James Kangas and R. Peter Winham

The following discussions document the archeological, geomorphological, and geotechnical investigations conducted as part of Reclamation's Ray Long site Landform Stabilization Project. The project, undertaken in phases from 1998 through 2003, was implemented for the purpose of minimizing shoreline erosion along the western edge of the site caused, in part, by wave action resulting from the constant raising and lowering of water levels in the reservoir. The opening section, prepared by Reclamation, outlines the impetus for the project and summarizes the work performed and the outcome of the stabilization efforts. The subsequent section, prepared by ALAC, discusses the archeological investigations undertaken as part of the stabilization efforts and provides a general description of the stratigraphic and sedimentological composition of the alluvial fan landform in which the site is contained. The geotechnical evaluation of the alluvial fan landform (Maxim Technologies, Incorporated [Maxim] 1998) and the subsequent archeological testing strategy proposed for the stabilization project (Hannus et al. 1999) are appended to provide additional supporting information (see Appendix G).

STABILIZATION OF THE RAY LONG SITE (39FA65) AT ANGOSTURA RESERVOIR

The Ray Long site (39FA65) is a Paleoindian occupation initially investigated by Richard P. Wheeler from 1948 to 1950 as part of the Smithsonian Institution River Basin Surveys (Wheeler 1995). In 1985 (Hannus 1986), 1992 to 1996 (Hannus et al. 1993), and again in 1998, the ALAC continued investigations at the site. Ray Long is one of the few Paleoindian sites in the Northern Plains with intact buried cultural deposits. Radiocarbon dates indicate occupation from 9540 to 11,000 years before present (Hannus 1986:24).

The site is on the southeast shoreline of Horsehead Bay on Angostura Reservoir. High waves frequently scour this shoreline. Between 1995 and 2000, active shoreline erosion and bank slumping heightened concerns about loss of the Ray Long site and its underlying terrace. Wave action was eroding the high bank along the western and southern edges of the site at an unprecedented rate (Figure 106). Investigations by ALAC in 1985 determined that wave action and inundation had significantly altered the site terrace.

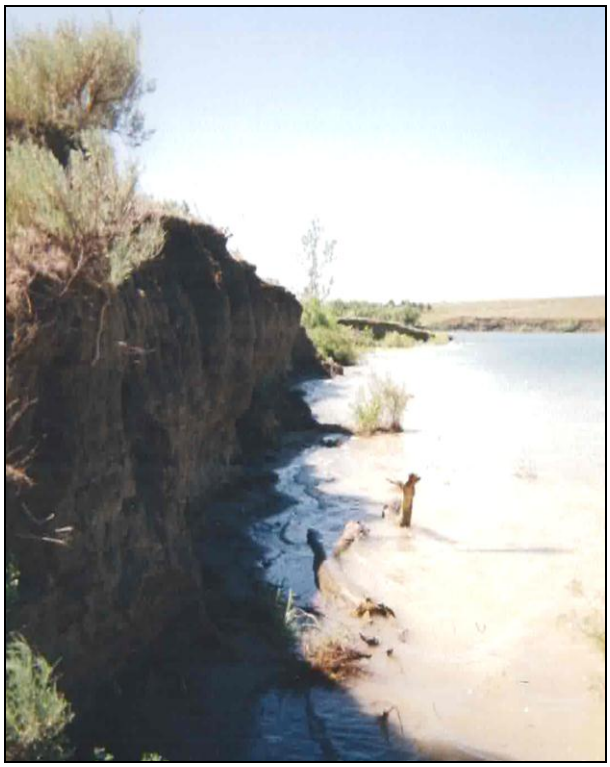


Figure 106. View of the cut bank along the western edge of the Ray Long site (39FA65) in 1998.

Angostura Dam and Reservoir were constructed primarily for irrigation. Water is released from the reservoir to serve the 12,218-acre Angostura Irrigation District. As a result, reservoir levels vary widely not only within one water-year (WY) (October 1 through September 30) but between years, depending on snow pack and spring rains. In the spring, inflows from snowmelt and rain fill the reservoir, but water levels typically drop dramatically by July during the irrigation season, especially when there is little inflow to the reservoir. Thus, the highest water levels in the reservoir frequently fall between early March and late June.

The top of active conservation at the reservoir, which is defined by the height of the five radial gates on the dam, is 3,187.2 feet above mean sea level (amsl). The radial gates automatically open when stored water reaches that elevation, releasing water into the Cheyenne River. Since the dam was built, the maximum recorded water elevation in the reservoir is 3189.37 feet amsl. Between WY 1998 and 2011, the top of active conservation (3,187.2 feet) was recorded in 1998 to 2000, 2010, and 2011, and it was almost reached in 2001 (Figures 107 and 108). The area experienced a drought from about WY 2002 through part of 2010. On average, cyclical wet/dry years within this local area are experienced about every 15 years.

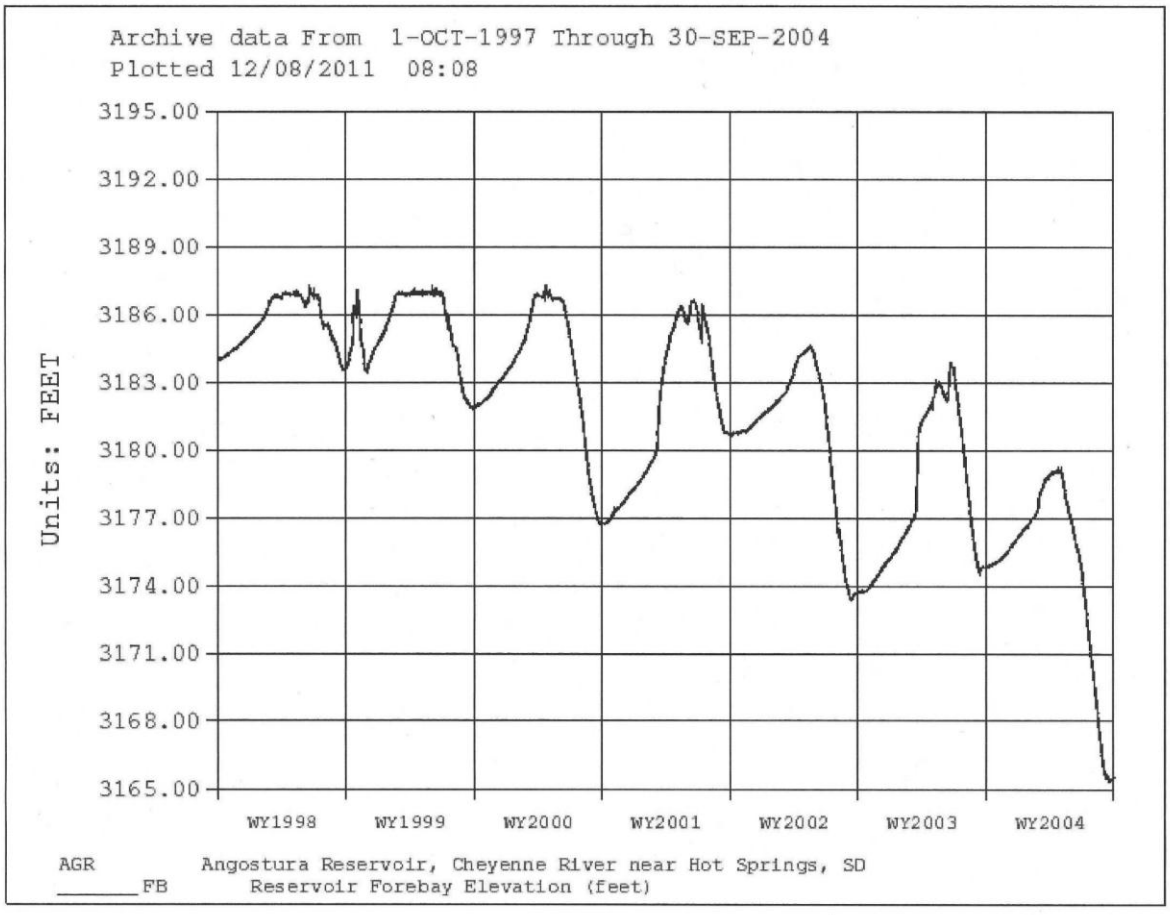


Figure 107. Reclamation Hydromet plot for water elevations at Angostura Reservoir from water-years 1998 to 2004.

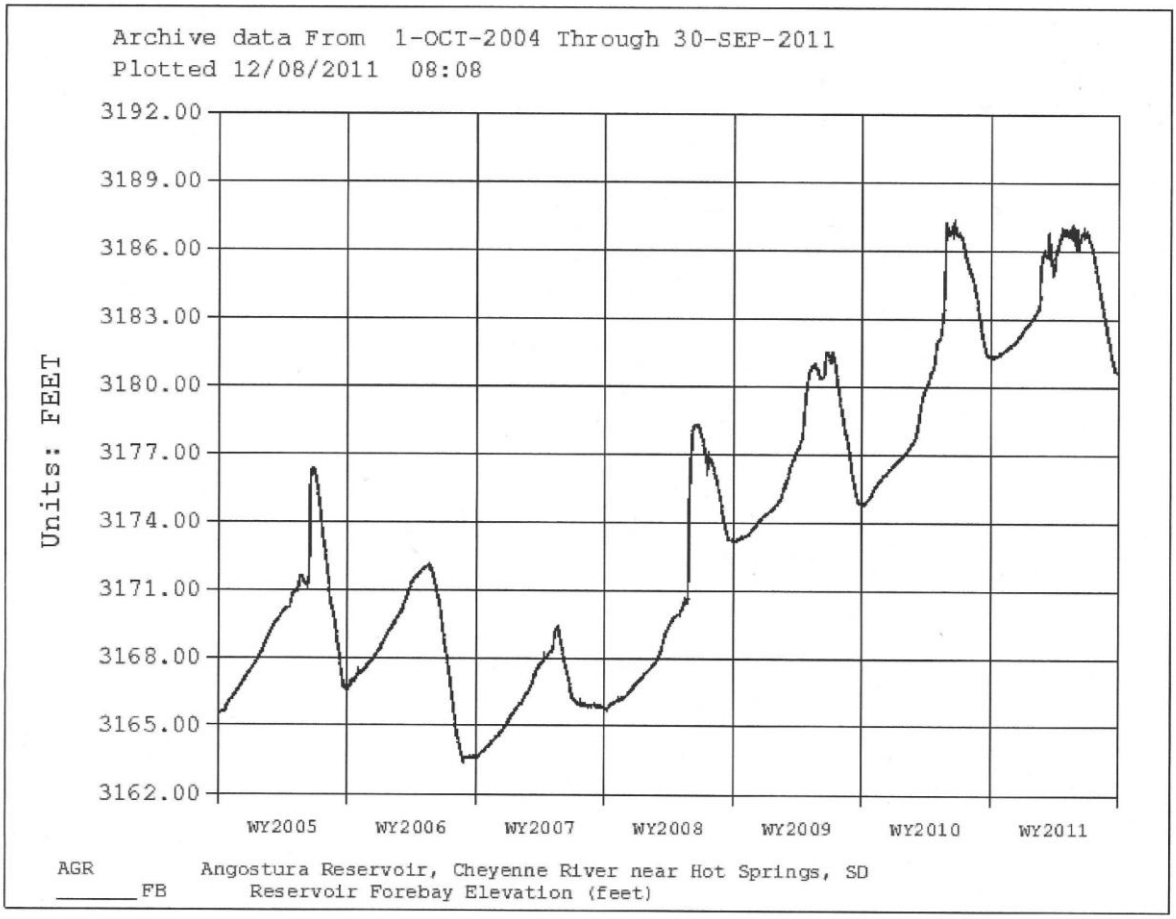


Figure 108. Reclamation Hydromet plot for water elevations at Angostura Reservoir from water-years 2005 to 2011.

Wheeler identified three cultural areas during his investigations of the Ray Long site that he designated as Areas A, B, and C (Wheeler 1995:373). Area A is along the eastern edge, Area B in the center, and Area C on the western edge of the site boundary. By the 1960s, the changing water levels of the reservoir had eroded away the portion of the site designated as Area C and Area A was experiencing slope failure and erosion. Area B was far enough from the cut bank to be marginally affected. However, without protection a predictable result would be the eventual loss of Area B also due to erosion and slope failure.

In 1998, ALAC subcontracted with Maxim to conduct a geotechnical evaluation of the terrace. The objective of the evaluation was to determine the inherent stability of the terrace and to develop alternatives to protect the site from erosion.

Maxim performed five tasks as part of their study:

1. A site reconnaissance to determine required stabilization limits.
2. A topographic survey and compilation of a topographic map of the site to develop options for remediation.
3. Drilling of four borings to determine soil properties and the depth of the underlying shale.
4. Analysis of the engineering properties of the soils recovered by test borings.

5. Preparation of a report summarizing the result of the geo-exploration and recommending alternatives to stabilize the terrace (Maxim 1998 [see Appendix G]).

Maxim (1998:3) reported that the soil profile consists of 6 inches of topsoil overlying 28 to 29 feet of mixed alluvium. The mixed alluvium had stiff to dense sandy clay and clayey sand, which extended 16 to 23 feet below the ground surface. The lower limits of the alluvium were dense clay to sandy gravels. The Pierre Shale formation underlay the alluvium at a depth of 31.5 feet. Groundwater was encountered in the gravels approximately 21 to 23 feet below the ground surface. The amount of groundwater fluctuated seasonally relative to climatic conditions.

Maxim's fieldwork raised concerns about the overall stability of the landform during wet climatic periods. It also became apparent that the partial loss of Area A and Area C may have been caused by several factors, not just erosion. The Pierre Shale bedrock forms an impenetrable layer to water, and it develops a greasy texture when wet. Slope stability decreases as dense clay and sandy gravels over the Pierre Shale are saturated with water. These areas are subject to slumping.

Following the fieldwork and soil analysis, Maxim presented Reclamation with design alternatives for stabilizing the terrace that were based on several assumptions. Stabilization should:

- Minimize disturbance to the existing landform.
- Be compatible to the area and aesthetically pleasing to the public.
- Not adversely affect recreational use of the reservoir.
- Provide a long-term fix to the current erosion problems.
- Address current reservoir levels +/- 3 feet.

Common to all of Maxim's design alternatives was the excavation of 450 linear feet of the cut bank to create a 2.5 horizontal by 1 vertical slope (2.5:1 slope). Excavation would produce 2,850 cubic yards of excess soil to be deposited on-site. In addition to the 2.5:1 slope design, alternatives proposed placement of a riprap blanket measuring 35 feet wide by 450 feet long along the shoreline.

As an alternative to riprap placement, installation of a series of Geoweb panels was proposed. The panels are made of a lightweight polyethylene material with honeycomb-shaped cells that would be staked to the shoreline and tied together with high strength tendons. Once the panels were fastened to the ground and tied together, the cells would be filled with concrete.

The third alternative would be planting erosion-resistant vegetation. Three vegetative zones would be established, a dryland zone, a shrub zone, and a riparian zone. The plants would be selected based on adaptation to climate, moisture, and soil conditions at the site.

Reclamation engineers and archeologists reviewed the stabilization recommendations proposed by Maxim. There were two immediate concerns about the excavation to create a 2.5:1 slope. The first concern was about impacts to the Ray Long site. The excavation would impact a 25-foot-wide margin of undisturbed ground. The second concern was permanent storage of 2,850 cubic yards of spoil. The spoil would cover an area the size of a football field to a height of 16 inches.

Reclamation engineers developed a new stabilization alternative using riprap revetment. The revetment would protect the embankment and shore against erosion by wave action. The design would not require excavation of the embankment to create a terrace, thereby preserving buried cultural deposits. Another consideration was the ability of the revetment to maintain structural integrity in the event of a rapid reservoir drawdown. The material used in the revetment must have sufficient porosity so that a rapid drop in water level would not destabilize it.

The new design also addressed concerns about potential impacts to the Ray Long site from heavy equipment. It limited shoreline work to low water levels of elevation 3,174.99 feet, which was 12.21 feet below the maximum storage capacity. Construction would be during the winter because reservoir levels would be low and frozen ground would minimize earth disturbance.

Prior to the stabilization project, ALAC archeologists examined the shoreline and the embankment face. They excavated four test units on the top edge of the embankment. One lithic reduction flake was discovered during the excavation of these units (see below).

In December of 2003, a contract was awarded to Quinn Construction of Rapid City, South Dakota. Quinn Construction immediately began removing logs, driftwood, and debris that had accumulated on the shoreline (Figure 109). They excavated a trench, called a toe trench, along 635 linear feet of the shoreline. The downslope side of the trench was dug approximately 2 feet below the grade of the beach. Approximately 310 cubic yards of sediment were removed from the toe trench.

Figure 109. Debris clearing and preparation for excavation of the toe trench.

The purpose of the trench was to prepare a surface for riprap. The down slope side of the trench was excavated two feet below beach grade. Riprap placed in the trench was securely anchored, preventing wave undercutting. The upslope end of the riprap abutted the embankment at a prescribed elevation, called a catch point, rather than reaching all the way to the top of the embankment.

Approximately 150 cubic yards of sand and gravel fill were placed on the shoreline after the trench work was completed to level, shape, and contour it. A water permeable fabric covered the granular fill. The riprap, quarried angular limestone, ranged in size from 12 to 30 inches and was placed so the angular corners would interlock (Figure 110).

Figure 110. Riprap placed over granular fill base and fabric.

The revetment design minimized disturbance to the Ray Long site by eliminating the need for terracing. Further impacts to the site were avoided because the project was completed in the winter when the ground was frozen, and heavy equipment worked on the shoreline rather than from the top of the cut bank (Figure 111).

Figure 111. Revetment profile from the toe to the catch point when the work was nearly completed with a catch point at 3,192.0 feet. The exposed surface of the riprap on the shoreline is at 3,186.0 feet.

The quarried limestone blends with the surrounding environment, and shrubs and plants are growing over the shoreline and riprap. The riprapped shoreline is more aesthetically pleasing than when the shore was littered with debris and slumped blocks of earth. An added benefit is improved recreational use of the reservoir. The beach is a popular fishing spot during high water, and it is safer without blocks of earth falling 10 to 15 feet onto the beach.

Since the installation of the riprap in 2003, the reservoir elevation has reached the top of conservation (3,187.2 feet) level in both WY 2010 and 2011. The riprap protected the base of the cut bank from erosion. Natural weathering along the cut bank continues, vegetation is starting to spread and add protection to the exposed soil, and eventually the cut bank should stabilize (Figure 112).

Figure 112. Close-up (top) and wide-angle view (bottom) of cut bank and riprap shoreline below 39FA65 in November 2011. Facing north. Note the 2011 high water mark at approximately 2,187 feet amsl (yellow line in bottom frame) and the start of revegetation. Red arrow identifies the cut bank.

ARCHEOLOGICAL ACTIVITIES FOR THE RAY LONG SITE STABILIZATION PROJECT

Introduction

The Ray Long site (39FA65) is the type site for the Paleoindian period Angostura complex, and one of the first Paleoindian sites excavated and dated in the northern Plains. Located adjacent to Angostura Reservoir in Fall River County, South Dakota, it was first excavated during the 1948-1950 field seasons under the auspices of the RBS program (Wheeler 1995). Ultimately, three localities, labeled A, B and C, were excavated by the RBS and designated site 39FA65. A date of 7,430 ± 500 B.C. was associated with the Angostura complex (Wheeler 1995:9), which was noted for its lanceolate projectile point with parallel-oblique flaking.

Several decades later, in 1984, when Angostura Reservoir was at its lowest level since its initial inundation, Reclamation contracted with the ARC to survey and test a number of archeological sites that had surfaced during the low water levels. Under a subcontract with ARC, ALAC was asked to evaluate localities A, B and C at the Ray Long site. While Area C had been destroyed by erosion, Areas A and B appeared to have the potential for some extant cultural deposits. In Area B, unprepared fire hearth features produced radiocarbon dates of 9540 ± 540 B.P., 10,400 ± 360 B.P., and 11,000 ± 310 B.P. (Hannus 1986:24). Plans to return to the site for further investigations were delayed by budget cuts until 1992.

In 1992, Cooperative Agreement No. 2FC-60-02720 was established between Reclamation and ALAC for continued archeological and geomorphological investigations at Angostura Reservoir (Hannus et al. 1993). The agreement specifically targeted research and management needs identified at the Ray Long site. In 1992, 1993 and 1994, further geomorphological evaluations were conducted, extensive pollen and phytolith samples were obtained and a number of 1-m-x-1-m units were excavated at the site. The test units revealed lithic reduction debris and a fire hearth with an associated mano. The hearth carbon was dated at 9150 ± 230 B.P. (see Appendix E). While further assessments of the data from the Ray Long site and the nature of the Angostura cultural complex were carried out in subsequent years, concern over active erosion of the landform in which the site is located was also expressed.

Preliminary Test Excavations

In 1999, initial plans for stabilization of the eroding reservoir shoreline at the Ray Long site were proposed (Hannus et al. 1999 [see Appendix G]). In anticipation of that work, four 2-m-x-2-m test excavation units, XU1-XU4, were investigated along the western bank of the site in 2000 (Figures 113-115).

Very little in terms of cultural material was discovered during the excavation of XUs 1-4. In total, one potential feature, F1, and one quartzite flake were discovered in XU1. The feature was later determined to be non-cultural. XUs 2-4 were devoid of cultural manifestations. A brief overview of the results of these excavations is provided below.

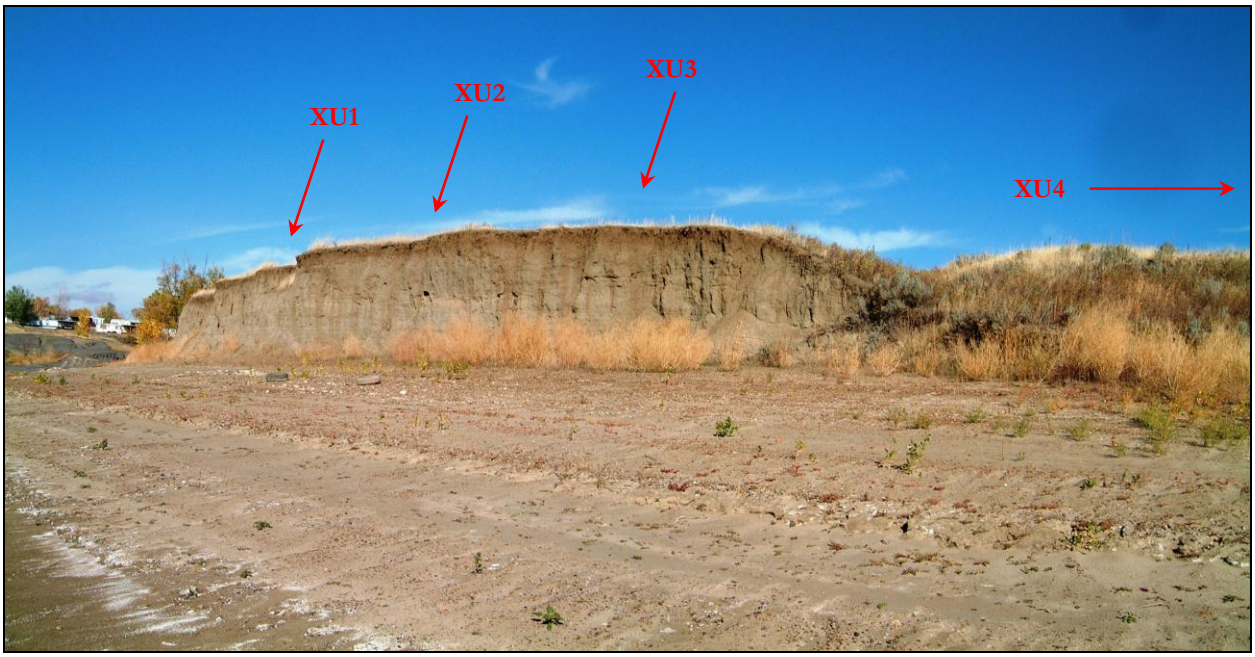
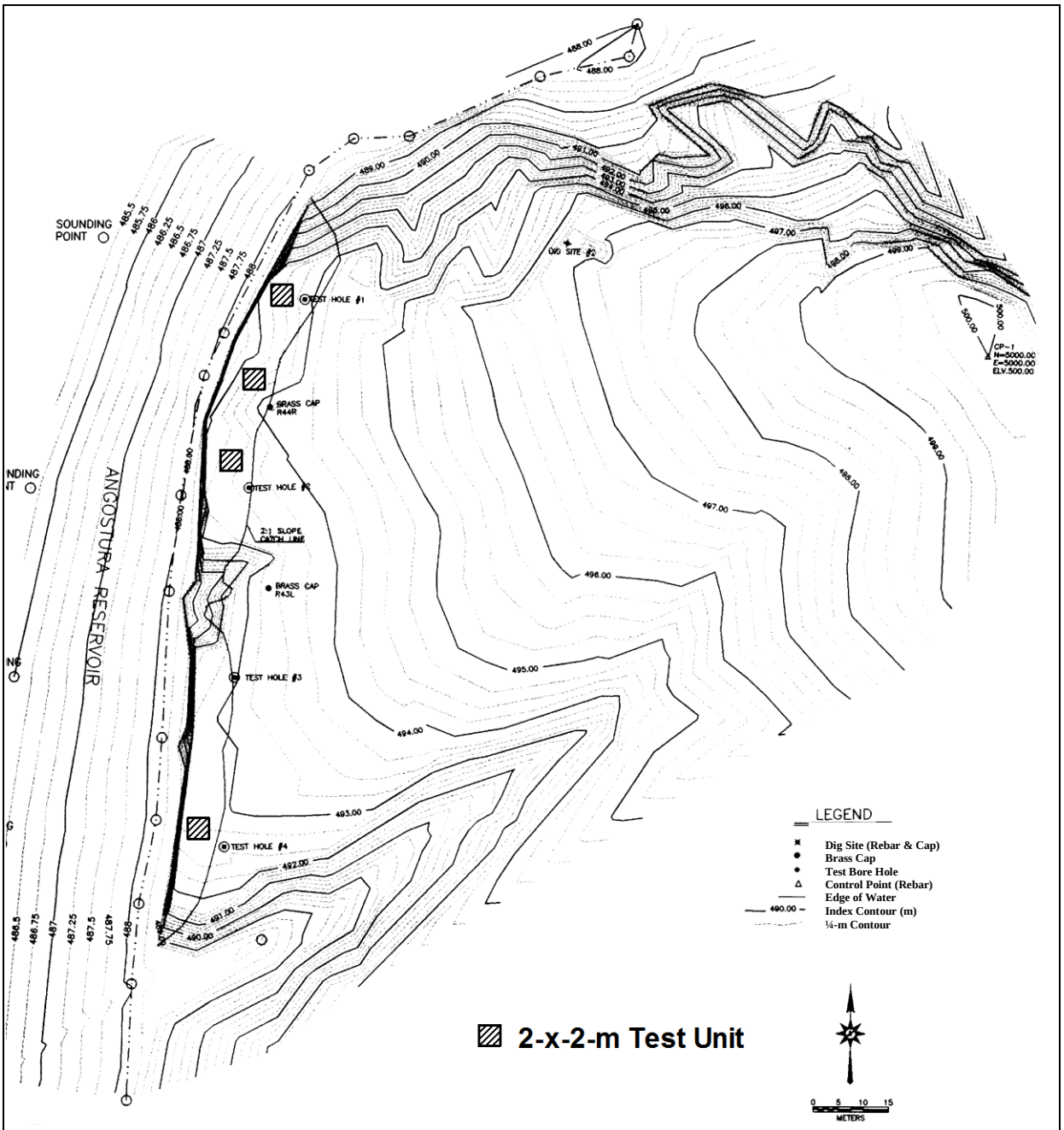


Figure 113. View of western cut bank site area prior to stabilization. From left to right, arrows indicate the approximate positions of XUs 1-3 along this stretch. XU4 was located out of the frame to the right, south of the other three units. Facing NE.



NOTE:
1) Control point 1 was the basis of a local coordinate system with an easting and northing of 5000.00 and an elevation of 500.00 meters.
2) Additional information including spot elevations and the triangulation network used to create the contours is available on an AUTOCAD drawing.

Figure 114. Contour map prepared for the 1999 stabilization plan proposed for the Ray Long site (39FA65). Brass cap datums, 2-x-2-m test units, and geotechnical test bore holes indicated.

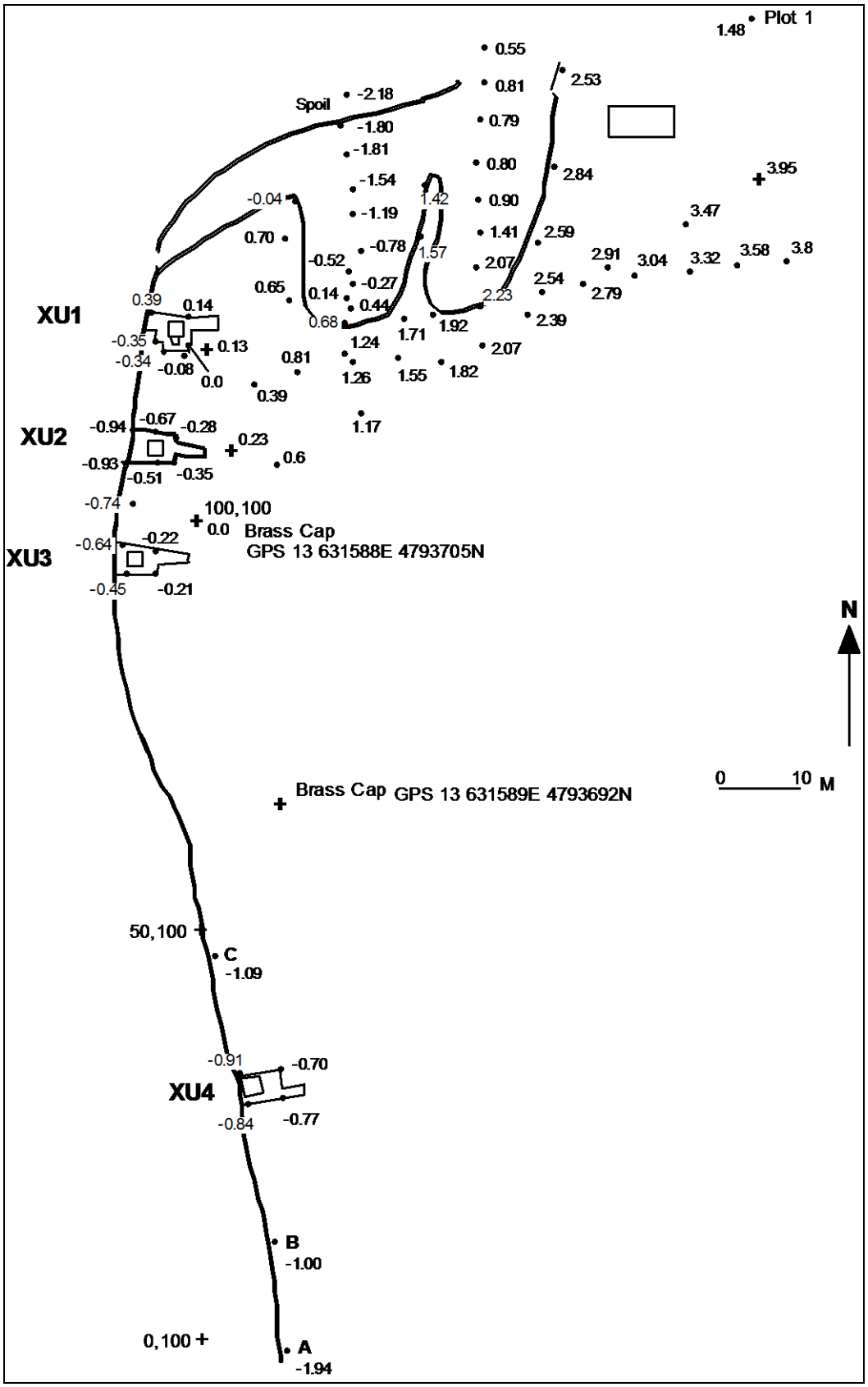


Figure 115. Location of units (XU1-XU4) excavated at the Ray Long site (39FA65) in 2000.

XU1 Results

XU1 was excavated in arbitrary 10-cm levels from a beginning depth of 1.80 m below datum (or 1.65 m below surface) to a final depth of 2.95 m below datum. During the course of excavations, it was decided to expand the unit by adding a 1-m-x-1.25-m extension to the south wall (Figures 116 and 117; Table 13). Excavations in this expansion area began higher on the landscape, beginning at a depth of 1.35 m below datum. The expansion area terminated at the same depth as the primary unit (2.95 m below datum). While screening fill from the expansion area, removed from a depth of between 2.66 and 2.71 m below datum, a single quartzite tertiary flake was discovered. Slightly below this depth, between 2.80 and 2.85 m below datum, a circular black ring was discovered and labeled Feature 1 (F1). It was believed at the time that this ring was made up of charcoal or manganese and the feature was collected as part of a 20-cm-wide-by-25-cm-long-by-5-cm-deep soil sample. Upon processing the sample by flotation, it was discovered that the black flecks were almost entirely manganese and did not consist of an amount of charcoal sufficient to obtain a viable radiocarbon determination. Based on this evaluation and the presence of abundant deposits of manganese in the landform, F1 was determined to be non-cultural.

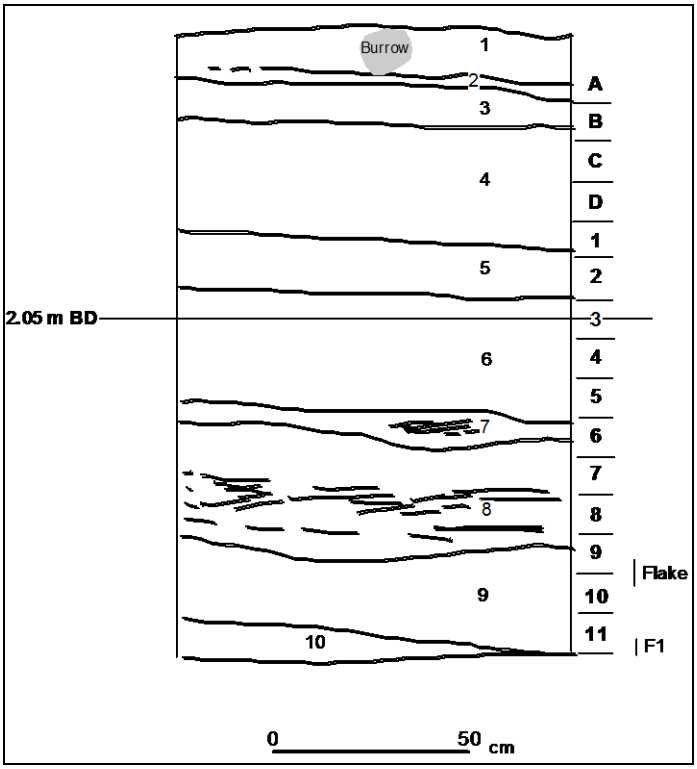


Figure 116. XU1 extension area south wall profile.

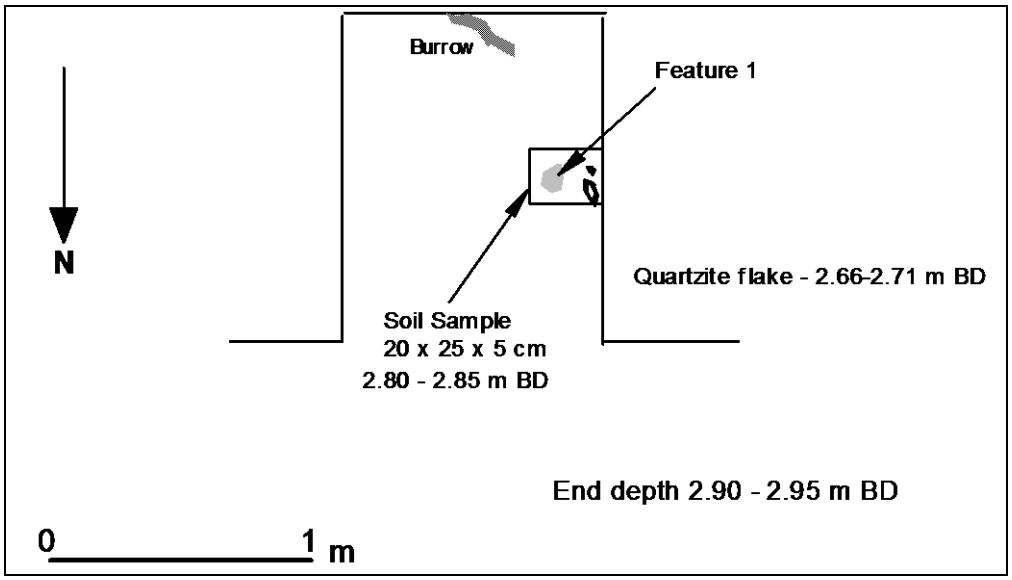


Figure 117. Plan view of XU1 extension area identifying the location of Feature 1 and the collected soil sample.

Table 13. XU1 South Wall Soil Profile Description (see Figure 116).

Layer Number	Soil Description
1	Clay (brown, 10YR 5/3), with calcium carbonate flecking
2	Sand (brown, 10YR 4/3)
3	Shale fragments/clay (grayish brown, 10YR 5/2)
4	Dense clay (brown, 10YR 5/3), with calcium carbonate veins
5	Clay (dark grayish brown, 10YR 4/2), with dense calcium carbonate veining and scattered limonites
6	Clay (grayish brown, 10YR 5/2) with intermittent shale/clay lenses
7	Shale/clay (grayish brown, 10YR 5/2) with coarse shale fragments and scattered calcium carbonates
8	Zone of indistinct banded clay (grayish brown, 10YR 5/2) and sand (brown, 10YR 5/3) bands from 1-4 cm in thickness
9	Gritty clay (brown, 10YR 5/3-10YR 4/3), with limonites, charcoal flecks and calcium carbonates
10	Sandy clay (grayish brown, 10YR 5/2)

XU2 Results

XU2 was excavated in arbitrary 10-cm levels from a beginning depth of 2.64 m below datum (or 2.10 m below surface) to a final depth of 3.35 m below datum (Figure 118; Table 14). The unit was devoid of cultural material.

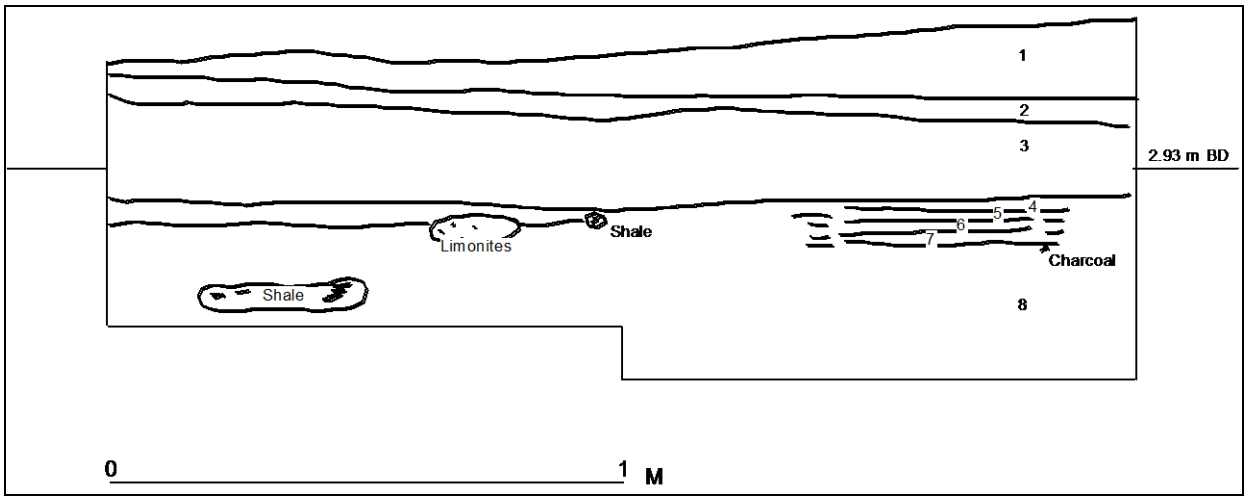


Figure 118. XU2 south wall profile.

Table 14. XU2 South Wall Soil Profile Description (see Figure 118).

Layer Number	Soil Description
1	Clay (grayish brown, 10YR 5/2)
2	Clay (grayish brown, 10YR 5/2) with shale/limonites
3	Clay (grayish brown, 10YR 5/2)
4	Clay (grayish brown, 10YR 5/2) with shale/limonites
5	Clay (grayish brown, 10YR 5/2), with trace of sand (grayish brown, 10YR 5/2)
6	Silty sand (grayish brown, 10YR 5/2)
7	Clay (grayish brown, 10YR 5/2) with shale/limonites
8	Clay (grayish brown, 10YR 5/2) with scattered limonites and rare charcoal flecks

XU3 Results

XU3 was excavated in arbitrary 10-cm levels from a beginning depth of 2.30-2.50 m below datum (or 1.90 m below surface) to a final depth of 2.90 m below datum (Figure 119; Table 15). The unit was devoid of cultural material.

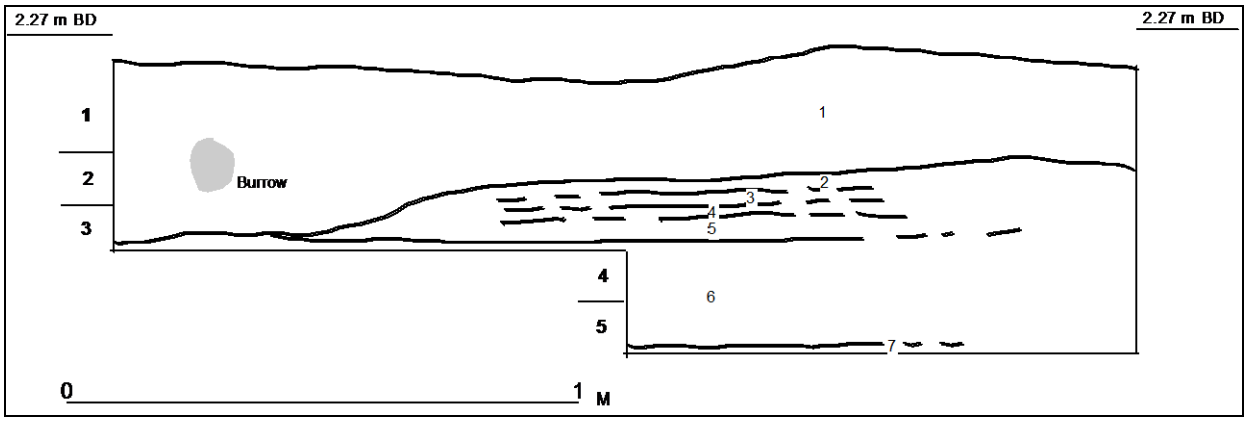


Figure 119. XU3 south wall profile.

Table 15. XU3 South Wall Soil Profile Description (see Figure 119).

Layer Number	Soil Description
1	Clay (brown, 10YR 5/3), with scattered limonites and shale
2	Gritty/sandy clay (brown, 10YR 4/3)
3	Weathered shale/clay (brown, 10YR 5/3), less compact, friable
4	Clay (brown, 10YR 4/3), dense/compact/hard
5	Clay (brown, 10YR 4/3), less compact than Layer 4
6	Thicker band of clay (brown, 10YR 4/3) with sparse scatter of limonites
7	Friable shale/clay/gritty clay (grayish brown, 10YR 5/2)

XU4 Results

XU 4 was excavated in arbitrary 10-cm levels from a beginning depth of 2.30-2.40 m below datum (or 1.65 m below surface) to a final depth of 3.60 m below datum (Table 16; Figure 120). The unit was devoid of cultural material.

Table 16. XU4 North Wall Soil Profile Description (see Figure 120).

Layer Number	Soil Description
1	Clay (brown, 10YR 5/3), hard, rodent activity
2	Clay (brown, 10YR 5/3), compact, same as Layer 1 but no rodents
3	Gritty, silty clay (brown, 10YR 5/3), more friable than Layer 2
4	Clay (brown, 10YR 5/3), compact with calcium carbonates
5	Silty clay (brown, 10YR 5/3), less compact
6	Clayey sand (brown, 10YR 4/3)
7	Sand to silty sand lenses, <1-5 cm thick (grayish brown 10YR 5/2 and brown 10YR 5/3)
8	Silty sand (brown, 10YR 5/3) with larger shale fragments
9	Clay (dark grayish brown, 10YR 4/2) and sand lenses (brown, 10YR 4/3) each 3-5 cm thick
10	Clay (dark grayish brown, 10YR 4/2) and larger shale fragments
Floor Layer	Sand (brown, 10YR 4/3)

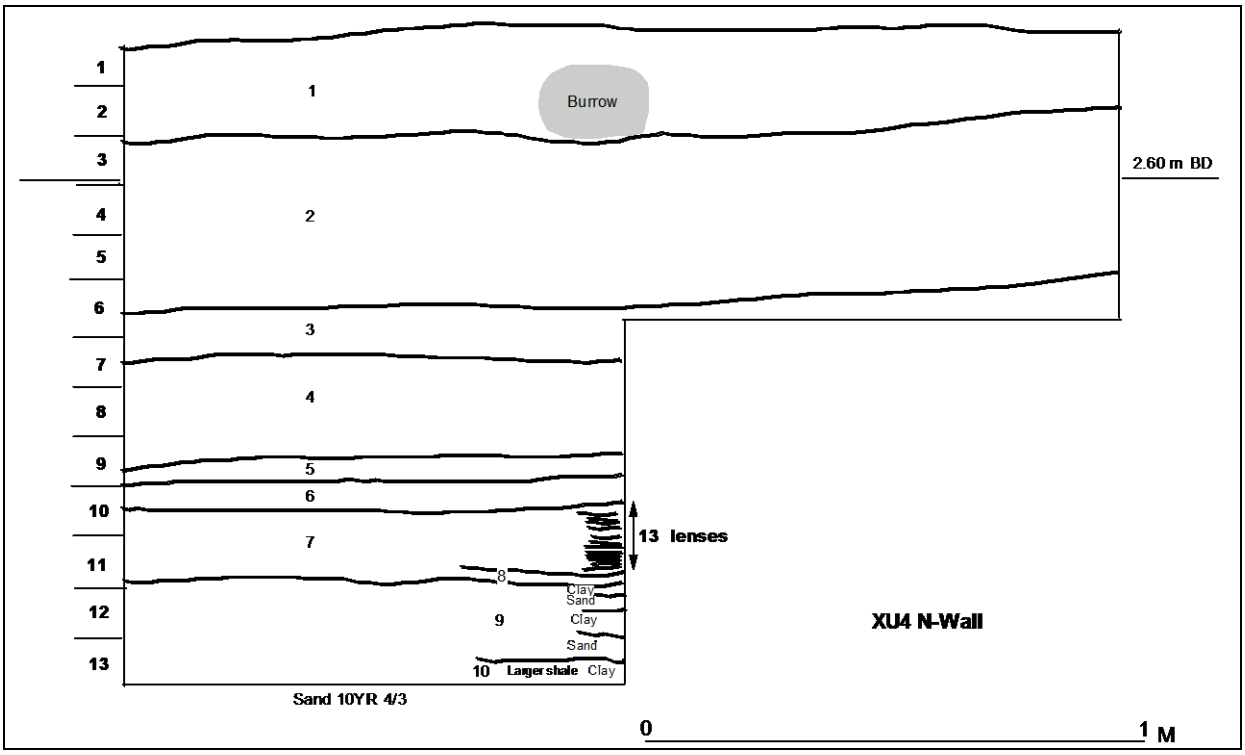


Figure 120. XU4 north wall profile.

The cultural deposits are buried under a layer of colluvium and would thus be exposed only in the shoreline cut bank. Ultimately, Reclamation engineers developed a new stabilization plan using riprap revetment, which did not require excavation of the embankment.

Statement-of-Work

In the late summer of 2003, a construction contract for stabilization of the Ray Long site landform was awarded. ALAC was asked to provide an archeological assessment of the Ray Long site prior to the stabilization undertaking. The objectives were to identify cultural deposits, features, and artifacts in the stabilization project areas of potential effect (APE) before the project began and to develop measures to ensure protection. A statement-of-work designated tasks as Phases A-D.

Phase A. Conduct a cultural resources survey of the project APEs. The primary APE is the beach and face of the cut bank along the 550-foot shoreline where riprap will be placed. This area shall be examined prior to any mechanized stabilization project activity. Secondary APEs, such as on-site egress/access routes, and storage, staging and parking areas, shall be surveyed based on an assessment of the potential for cultural material to be present in an area and on the potential of the activity to cause disturbance.

Phase B. Ensure the protection/preservation of cultural materials and the RBS excavation Areas A and B. Install a temporary fence or other protective barrier to delineate sensitive areas where protection is needed. The barriers shall visibly delineate these areas. Photograph sensitive areas after placement of protective barriers and prior to the stabilization contract activities.

Phase C. Monitor the primary and secondary APEs, which have potential for exposing cultural materials not identified during the survey. Stop work when cultural materials are exposed. Notify Reclamation for approval before proceeding with stabilization/salvage of cultural materials.

Phase D. Prepare a report describing the methodology employed for the survey, the areas surveyed, and monitoring of primary and secondary project APEs. The report shall contain photographs (digital format acceptable) of sensitive areas and these shall be depicted on a topographic map, to be provided by Reclamation. Inadvertently discovered cultural materials shall be photographed and their locations mapped. The report shall include a description of the circumstance leading to the discovery of previously unidentified cultural materials, and contain a discussion of their treatment. The report shall provide an inventory of collected items.

The statement-of-work also noted that the preferred treatment of cultural materials is avoidance and the promotion of preservation. In addition to the protection of the archeological components of the site, Reclamation desired the protection and preservation of units excavated by the RBS.

Methodology

R. Peter Winham (then Assistant Director, ALAC) coordinated the archeological assessment with James Kangas (then Archeologist, Reclamation, Dakotas Area, Rapid City Field Office). Fieldwork was undertaken on October 16-17, 2003, during which time Phases A and B were completed. Initially, the protection of sensitive areas of the site was accomplished by surrounding those areas with fence posts. RBS Area A was completely delimited by fence posts (Figure 121). Fence posts were placed along the northern edge of the site to restrict access to RBS Area B and ALAC's excavation Area B (Figures 122 and 123). Finally, following a meeting with Steve Parker (Reclamation, Dakotas Area, Rapid City Field Office), who would be monitoring the work of the contractor conducting the stabilization, it was agreed to fence off the cut bank so that truck traffic would not approach the bank from the top; rather, trucks would approach only from the reservoir side (Figure 124).

Figure 121. Area A delimited with fence posts, facing SE.

Figure 122. Area B and Smithsonian Institution excavation areas delimited with fence posts, facing WSW.

Figure 123. Smithsonian Institution excavation areas delimited with fence posts, facing E.

Figure 124. View of exposed cut bank prior to stabilization, facing SE.

James Kangas and Steve Parker reviewed the stabilization project details. No access to the cut bank was to be permitted from the top of the bank. All access to the reservoir shore would be via the existing two-track, which ran past RBS Area A. It was noted that a draw delimits the area of the site to be stabilized (Figure 125). Use of the surface of that portion of the landform south of the draw for equipment and supply storage would be permitted, but no subsurface excavations would take place anywhere in the site vicinity, with the exception of the reservoir shore itself (if appropriate). It was also agreed that drift fencing would not be used at this time, but that Steve Parker would string ribbon around the fence posts prior to the construction crew arriving on-site.

Figure 125. Draw at south edge of area to be stabilized, facing NE.

Following the completion of Phase B, James Kangas departed and Peter Winham then completed Phase A. This was accomplished in several stages. First, the entire site area was surveyed; special attention was given to the exposed cut banks and any eroding localities around the RBS areas. Next, the face of the cut bank itself was carefully inspected, using a ladder where necessary. Finally, the exposed beach was inspected for any eroded artifacts. No exposed features or artifacts were encountered during the survey. However, a datum point (rebar) encased in cement from a previous project was noted on the beach (Figure 126). It is probably the cement datum that was present in 1993 (Figure 127).

Figure 126. The rebar datum encased in cement that was exposed on the beach below the cut bank.

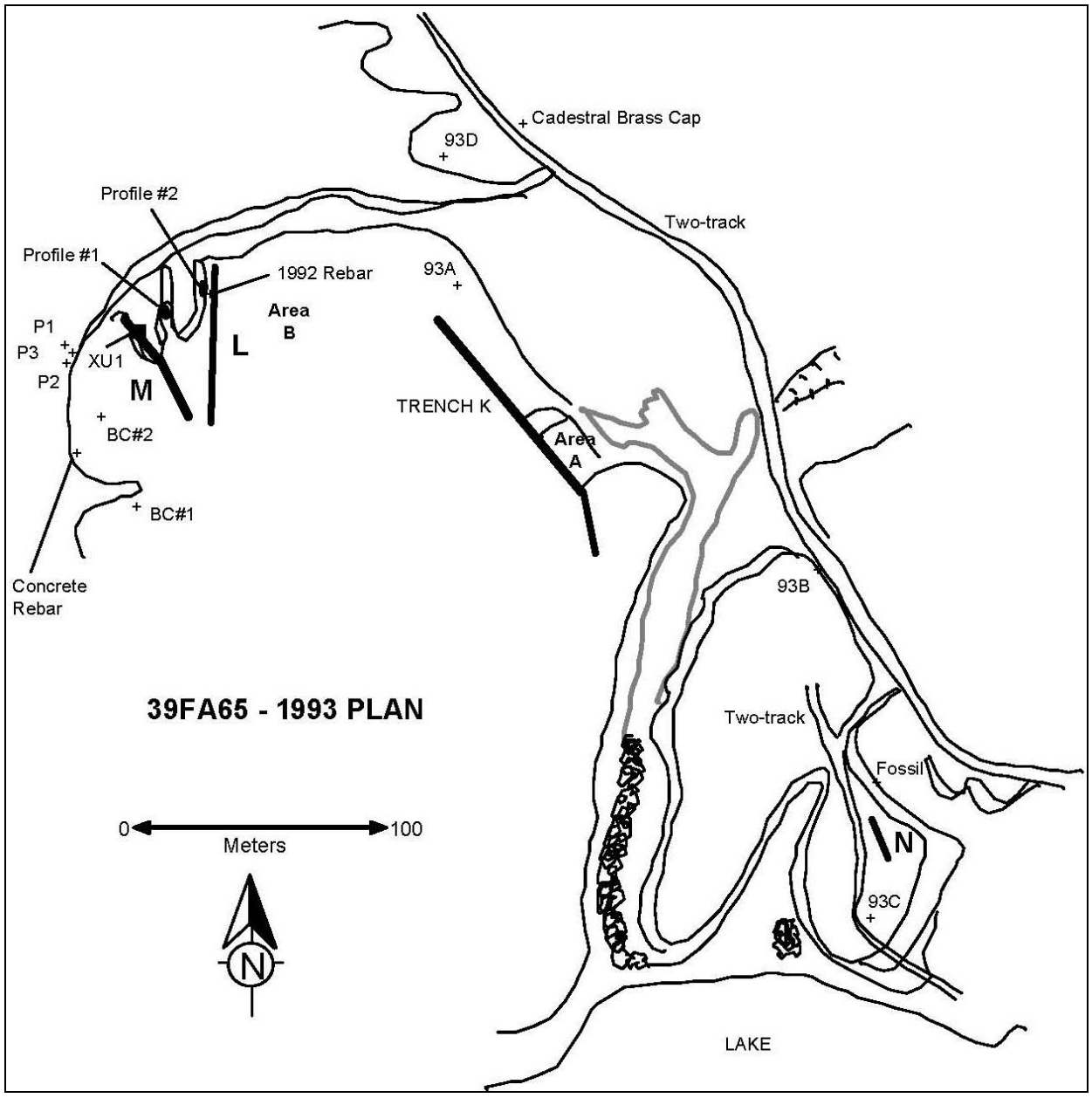


Figure 127. The 1993 plan of site 39FA65, showing the location of the concrete rebar.

The location of the cut bank in relation to the two remaining brass cap datums was documented (Figure 128; Tables 17 and 18), and the site was photographed before stabilization (Figure 129).

Following a discussion with James Kangas, it was agreed that monitoring of the actual stabilization process would be difficult and dangerous. Instead, ALAC would be on-call in the event that any cultural materials or features were uncovered during construction. Construction was accomplished without incident and no cultural features were observed. Figure 130 illustrates the completed project.

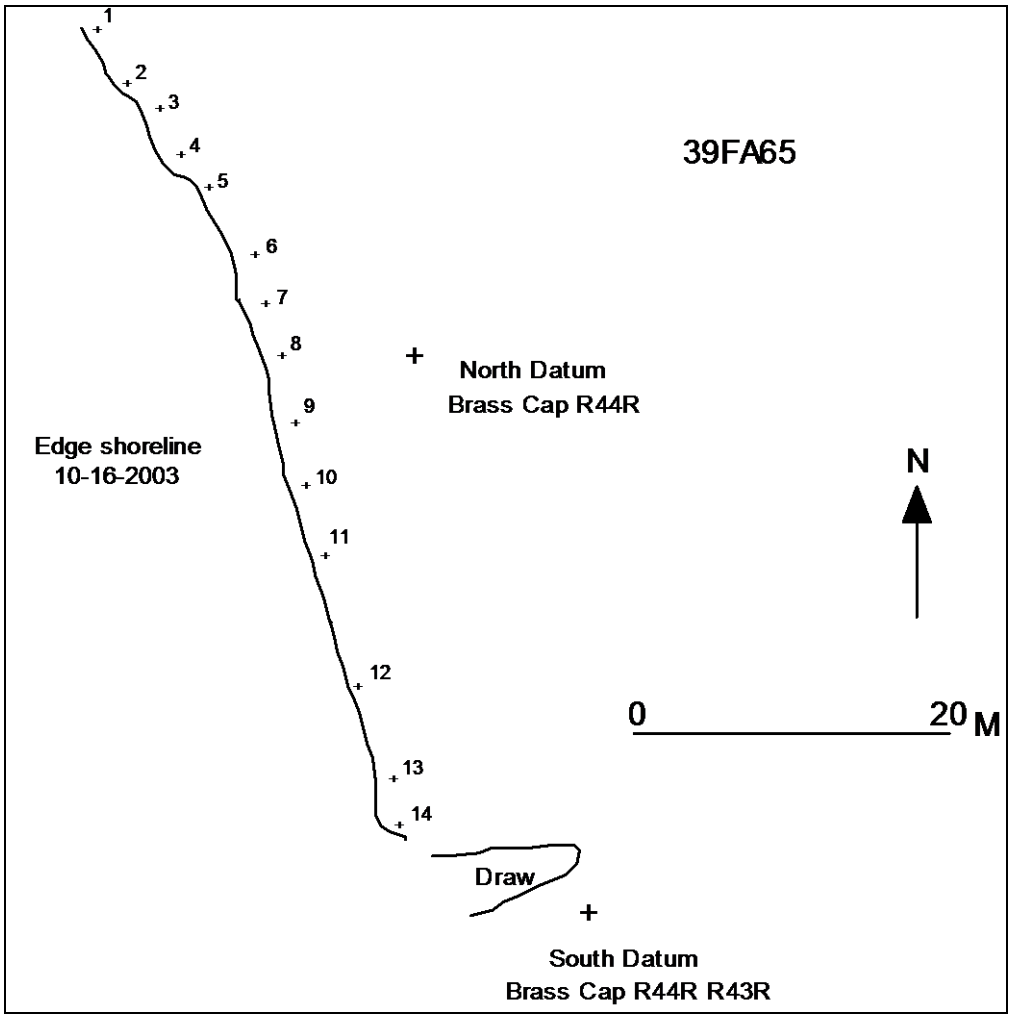


Figure 128. The edge of the shoreline (cut bank) on October 16, 2003. Points 1-14 were measured (taped) from the north and south datums (see Tables 17 and 18, below).

Table 17. Taped Measurements from Brass Cap Datum Points to Edge of Cut Bank on 10-16-03 (see Figure 128). From South Datum (R44R R43R) First, then from North Datum (R44R).

Flag	South Datum	North Datum
1	65.70 m	29.25 m
2	62.25 m	25.80 m
3	59.55 m	23.05 m
4	56.25 m	19.75 m
5	53.70 m	17.30 m
6	48.25 m	12.15 m
7	45.05 m	9.90 m
8	41.70 m	8.50 m
9	37.25 m	8.50 m
10	33.30 m	10.70 m
11	28.75 m	14.05 m
12	21.50 m	21.65 m
13	15.20 m	27.30 m
14	13.55 m	30.10 m

NOTE: '0' pin placed 15 cm N of South Datum and also 15 cm N of North datum

Table 18. Distance and Angles from Flags to Actual Edge of Cut Bank (see Figure 128).

Flag	Angle	Distance
1	290E	80 cm
2	268E	100 cm (flag 20 cm N of edge of XU1)
3	276E	100 cm (30 cm S of edge of XU1)
4	266E	160 cm
5	266E	60 cm
6	268E	110 cm (15 cm N of edge of XU2)
7	270E	180 cm (30 cm S of edge of XU2)
8	264E	125 cm
9	264E	140 cm (70 cm N of XU3)
10	264E	140 cm (20 cm S of XU3)
11	250E	65 cm
12	262E	120 cm
12	212E	55 cm
13	264E	80 cm
14	258E	120 cm
14	214E	65 cm

Figure 129. The cut bank at the Ray Long site prior to stabilization, facing NNE.

Figure 130. Views of the completed stabilization project.

2010 FIELD INVESTIGATIONS

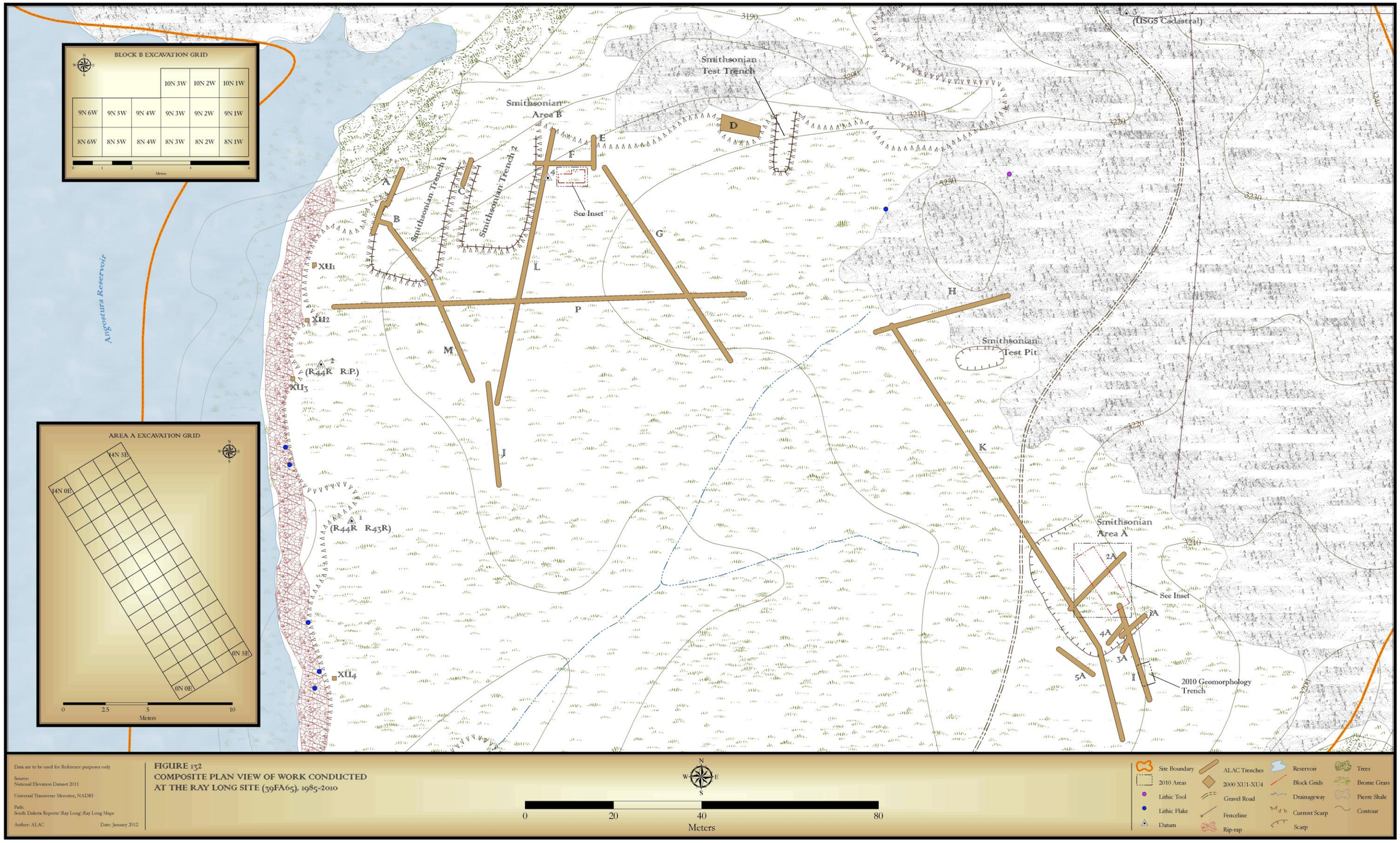
The 2010 archeological field season at the Ray Long site took place during a 12-day session between July 26 and August 6, 2010. The field crew, which included personnel from ALAC and the University of Kansas, Lawrence, consisted of L. Adrien Hannus, Landon P. Karr, Austin A. Buhta, Neteal Graves, Garrett Welch, and Chris Hord. Rolfe D. Mandel conducted the geomorphological investigations at the site. The focus of the 2010 field activities was threefold. First, a reassessment of the site area geomorphology was required. Second, additional excavations in the Area B grid units were conducted in the hopes of identifying and securing dates from an earlier occupation surface than that of the Angostura cultural horizon. Finally, the site area was to be mapped with high-precision GPS equipment.

All elevational data obtained during the 2010 season were based on positioning in relation to Brass Cap Datum #4 (also designated the 1995 datum), situated at position 8N 9W on the Area B excavation unit grid. This datum was located at an elevation of 3,214.14 feet amsl, or 2.98 m above the Brass Cap #2 (R44 R.P.) main site datum. Results of the 2010 investigations are discussed below.

SURFACE SURVEY AND RESULTS

The site area was initially subjected to a pedestrian survey carried out in the form of parallel, linear transects spaced at arbitrary 10-m intervals. Medium height brome grass covered the majority of the site, and consequently, surface visibility was poor, averaging approximately 10 percent at the time (Figure 131). During this surface inspection, old trenches and excavation localities were relocated, cutbanks were inspected, and a small number of lithic artifacts were documented on the surface. Once relocated, relevant natural and cultural site features, such as roads, erosional scarps, trenches, fencelines, and geodetic and brass-cap datums, were mapped with a Trimble® *Juno* model differentially corrected GPS unit (Figure 132).

Figure 131. Overview of the western portion of the Ray Long site during the summer of 2010. View is from west of the two-track access road, facing WNW.


BLOCK B EXCAVATION GRID
10N 3W
10N 2W
10N 1W
9N 6W
9N 5W
9N 4W
9N 3W
9N 2W
9N 1W
8N 6W
8N 5W
8N 4W
8N 3W
8N 2W
8N 1W
Meters
AREA A EXCAVATION GRID
14N 5E
14N 0E
0N 5E
0N 0E
0
2.5
5
10
Meters
Angostura Reservoir
(USGS Cadastral)
Smithsonian Test Trench
Smithsonian Area B
Smithsonian Trench 1
Smithsonian Trench 2
See Inset
A
B
C
D
E
F
G
H
I
J
K
L
M
P
XU1
XU2
XU3
XU4
(R44R R43R)
Smithsonian Test Pit
Smithsonian Area A
2A
3A
4A
5A
2010 Geomorphology Trench
3190
3200
3210
3220
3230
3240
Data are to be used for Reference purposes only
Source:
National Elevation Dataset 2011
Universal Transverse Mercator, NAD83
Path:
South Dakota Reports\Ray Long\Ray Long Maps
Author: ALAC
Date: January 2012
FIGURE 132
COMPOSITE PLAN VIEW OF WORK CONDUCTED
AT THE RAY LONG SITE (39FA65), 1985-2010
0
20
40
80
Meters
Site Boundary
2010 Areas
Lithic Tool
Lithic Flake
Datum
ALAC Trenches
2000 XU1-XU4
Gravel Road
Fenceline
Rip-rap
Reservoir
Block Grids
Drainageway
Current Scarp
Scarp
Trees
Brome Grass
Pierre Shale
Contour

Seven artifacts were recovered during the surface inspection of the site. Five of these specimens (Specimen Nos. 12-0052-1 – 12-0052-5) are lithic reduction flakes that were documented in slump blocks along the base of the cut bank on the western edge of the site (Figure 133; see Figure 132). Specimen 12-0052-1 is a tertiary reduction flake of fine-grained gray-colored quartzite. Specimen 12-0052-2 is a secondary reduction flake of heat-treated Tongue River silicified sediment. Specimen 12-0052-3 is a tertiary reduction flake of white-colored chalcedony. Specimen 12-0052-4 is a tertiary reduction flake fragment of light gray-colored, fine-grained quartzite. Specimen 12-0052-5 is a secondary reduction flake of patinated dark brown-colored West Horse Creek chalcedony.

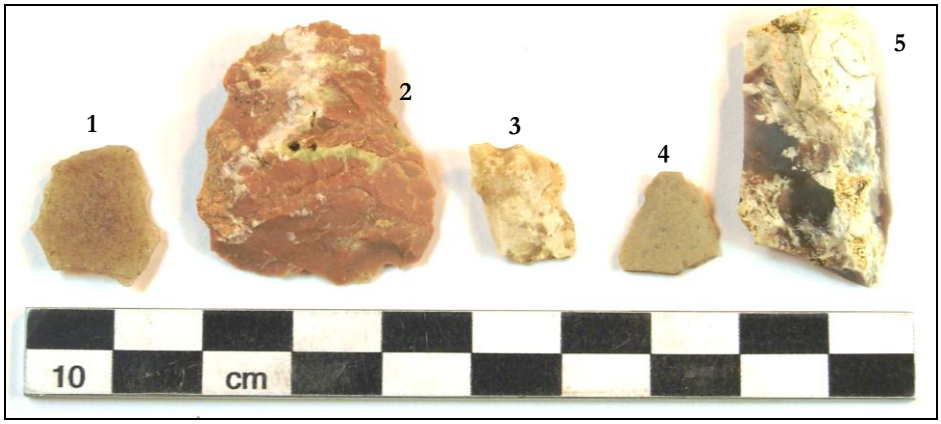


Figure 133. Close-up of the five lithic reduction flakes recovered from slump blocks along the base of the cut bank on the western edge of the site (specimens are arranged 1-5 from left to right).

Two additional lithic specimens were documented east of Area B in a deflated portion of the site with exposures of Pierre shale (Figure 134; see Figure 132). Specimen 12-0052-6 is a large flake fragment of light purplish gray-colored, fine-grained quartzite that exhibits unifacial retouch along the entire length of one lateral margin and along the distal margin. The acute angle of both working edges suggests that this tool served primarily as a cutting implement rather than in a scraping capacity; however, a microwear use-analysis study would be required to confirm this supposition. Specimen 12-0052-7 is a primary flake fragment of grayish white-colored chert that exhibits a small amount of secondary retouch along a portion of one lateral margin.

Figure 134. Close-up of the unifacially worked knife (left) and the retouched flake (right) recovered from the surface east of the Area B block excavation grid.

BACKHOE TRENCH I EXTENSION

As part of the geomorphological component of the 2010 research, a portion of Backhoe Trench I was reopened southeast of Area A (Figure 135; see Figure 132). The portion of the trench that was reopened was short, measuring approximately 3.5 m in length. It was excavated to a depth of 3.25 meters below surface (mbs). Although the original Trench I measured 1 m in width, an extra 1 m was excavated on either side of the original trench walls to afford greater access and for safety purposes.

Figure 135. Site overview from just southeast of Smithsonian Institution Area A near the reopened portion of Trench I, facing NW. Area A is in the foreground. The backhoe in the background identifies the location of the Area B block grid.

During the initial excavation process, the backhoe unearthed a small freshwater mussel shell from a depth of less than 1 mbs (collected and assigned Catalog No. 12-0052-8). The shell is almost certainly cultural because the small feeder streams of the fan were intermittent and would not have provided a supply of oxygen sufficient for mussels to survive in. Although some raptors have been documented dropping mussel shells from the air onto upland bluff tops following feeding (William H. Ranney, personal communication 2009), the confirmed presence of human habitation at this site suggests the former hypothesis. A thorough inspection of the trench walls and backdirt pile revealed no additional cultural materials or potential occupation zones. The trench walls were cleaned with the use of a spade and then troweled back. A profile of the northwest wall of the trench (Figure 136) was subsequently described by Mandel, and soil samples were collected for sedimentological and phytolith analysis (Mandel 2012, Manuscript II of this report).

Figure 136. View down into the reopened portion of Trench I, facing NNW. The nonconformity identifying the previously excavated segment of Trench I is visible in the center of the image.

SMITHSONIAN INSTITUTION AREA B EXCAVATIONS

In Area B, the block excavation grid was reopened for the dual purpose of reassessing the site geomorphology and continuing excavations in an attempt to identify an older occupation surface below the Angostura cultural horizon. The grid area was first reopened with the use of a backhoe until the layer of plastic sheeting, lining the excavation units at the conclusion of the 1996 field season, was nearly reached. The remaining fill was then removed with hand shovels and the sheeting was extracted from the base of the unit grid (Figures 137 and 138).

While the floor of the grid was cleaned in preparation for excavations, a Nikon C-100 total station instrument was positioned at the location of Brass Cap Datum #4, or 8N 9W on the grid. Excavations in the Area B block grid were continued in the six northernmost units during the 2010 field season. These units were designated 9N 4W, 9N 5W, 9N 6W, 10N 1W, 10N 2W, and 10N 3W (Table 19; see Figure 132). Unit excavation was conducted in 5-cm levels using trowels. Excavated soil matrix was subsequently sieved through standard ¼-inch wire screen. Units 9N 6W and 10N 1W-10N 3W were excavated through Levels O, P, and Q, or 260-275 cmbd. Units 9N 4W and 9N 5W were excavated through Levels O and P, or 260-275 cmbd. Units 9N 4W, 9N

5W, and 10N 1W-10N 3W were sterile in these levels. Two ephemeral, amorphous features were documented in Unit 9N 6W. These features are further described below.

Figure 137. Overview of depression marking the location of the Area B grid prior to reopening, facing ENE.

Figure 138. View down into the Area B block grid, facing E. Exposed is the surface of the units as it was left following the 1996 excavations.

Table 19. Level and Depth Data for Area B Grid Units, 2010 Excavations.

Excavation Unit	2010 Beginning Depth in cmbd	2010 Ending Depth in cmbd	Artifact/Feature Presence & Depth in cmbd
8N 1W*	Top of M (250)	Top of M (250)	—
8N 2W*	Top of O (260)	Top of O (260)	—
8N 3W*	Top of O (260)	Top of O (260)	—
8N 4W*	Top of Q (270)	Top of Q (270)	—
8N 5W*	Top of Q (270)	Top of Q (270)	—
8N 6W*	Top of Q (270)	Top of Q (270)	—
9N 1W*	Top of O (260)	Top of O (260)	—
9N 2W*	Top of O (260)	Top of O (260)	—
9N 3W*	Top of O (260)	Top of O (260)	—
9N 4W	Top of O (260)	Top of Q (270)	—
9N 5W	Top of O (260)	Top of Q (270)	—
9N 6W	Top of O (260)	Top of R (275)	F10-1 (261-262.6 cmbd); F10-2 (271 cmbd)
10N 1W	Top of O (260)	Top of R (275)	—
10N 2W	Top of O (260)	Top of R (275)	—
10N 3W	Top of O (260)	Top of R (275)	—

*** Not excavated further in 2010**

The 2010 excavations resulted in the discovery of two features represented by reddish-colored stains and associated charcoal scatters. No artifacts were recovered during excavations in 2010. Both features, designated 10-1 and 10-2, were encountered in Unit 9N 6W; the first at a depth of 261-262.6 cmbd and the second at a depth of 271 cmbd. A profile of the north wall of Units 10N 1W, 10N 2W, and 10N 3W was drawn and subsequently described by Mandel (Figure 139; see Mandel 2012, Manuscript II of this report, for a detailed description of the profile).

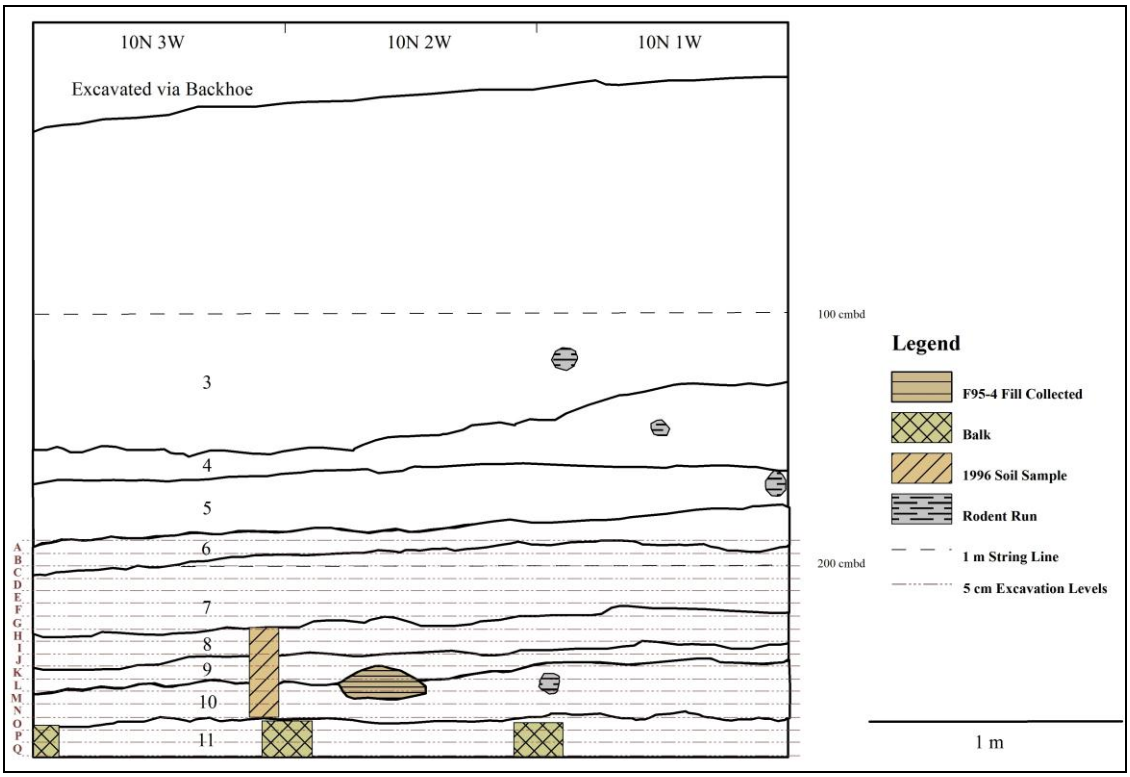


Figure 139. North wall profile of Units 10N 1W-10N 3W. Excavation levels are brown, sediment layers are black.

Soil samples were also collected from the Area B block grid for sedimentological and phytolith analysis and a sample obtained from Feature 10-1 was submitted for AMS dating (Mandel 2012, Manuscript II of this report, and below).

Feature 10-1

Feature 10-1 was discovered in Level O of Unit 9N 6W at a depth of between 261 and 262.6 cmbd (Figures 140 and 141). This depth correlates with stratigraphic Layer 11 as identified in the Area B block grid north wall profiles (see page 64, Figure 80). The feature was amorphous, very shallow (1.6-cm thick), and poorly defined. A diffuse area of reddish-colored soil staining and lightly scattered flecks of charcoal was observed in two localities within the northeastern quarter of the unit. Additional flecks of charcoal extended beyond the stained areas to the west and south across the unit. No artifacts were documented in association with the feature. A small sample of charcoal and soil was recovered from Feature 10-1 and subsequently submitted for AMS dating (see below).

Figure 140. Feature 10-1, Level O (at 262 cmbd), Unit 9N 6W, Area B block grid.

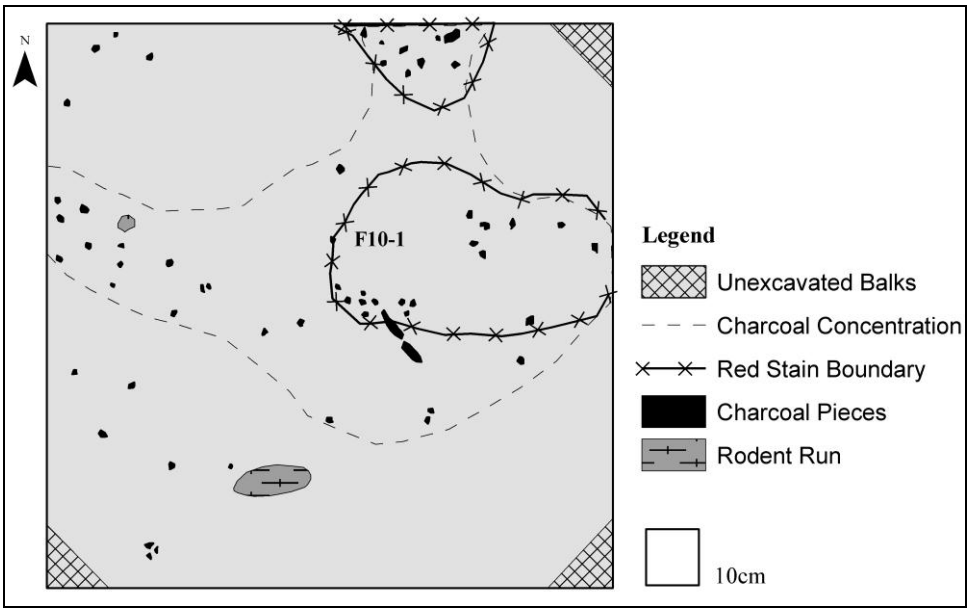


Figure 141. Plan view of Feature 10-1, Level O (at 262 cmbd), Unit 9N 6W, Area B block grid.

Feature 10-2

Feature 10-2 was discovered in Level Q of Unit 9N 6W at a depth of between 271 and 271.5 cmbd (Figures 142 and 143). This depth correlates with stratigraphic Layer 11 as identified in the Area B block grid north wall profiles (see page 64, Figure 80). The feature was amorphous, very shallow (ca. 0.5-cm thick), and poorly defined. Similar to Feature 10-1, a diffuse area of reddish-colored soil staining and lightly scattered flecks of charcoal defined Feature 10-2. Unlike Feature 10-1, charcoal flecks were not distributed across large portions of the unit; in this instance, they remained largely confined to the elongated area of staining. No artifacts were documented in association with the feature.

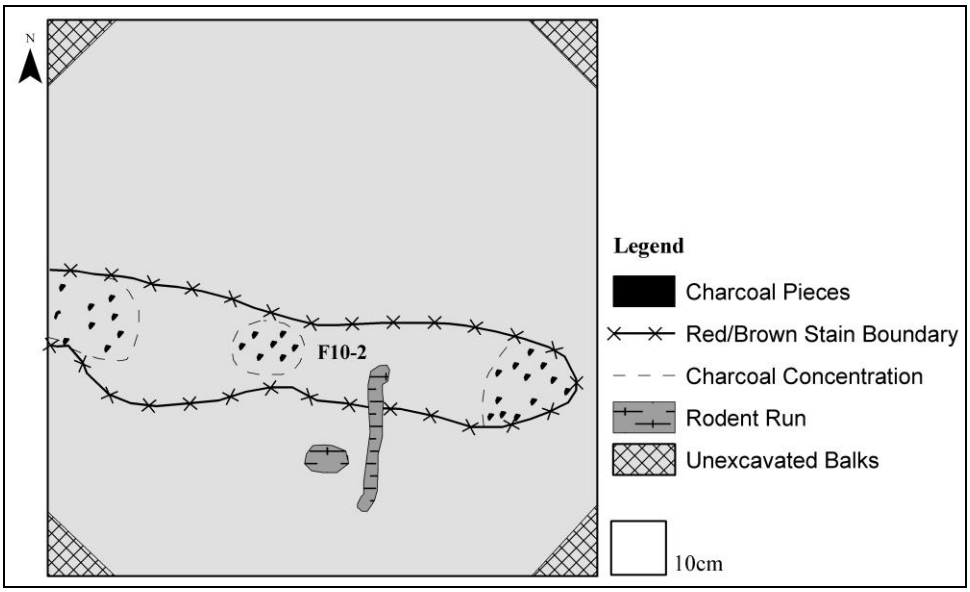


Figure 142. Plan view of Feature 10-2, Level Q (at 271 cmbd), Unit 9N 6W, Area B block grid.

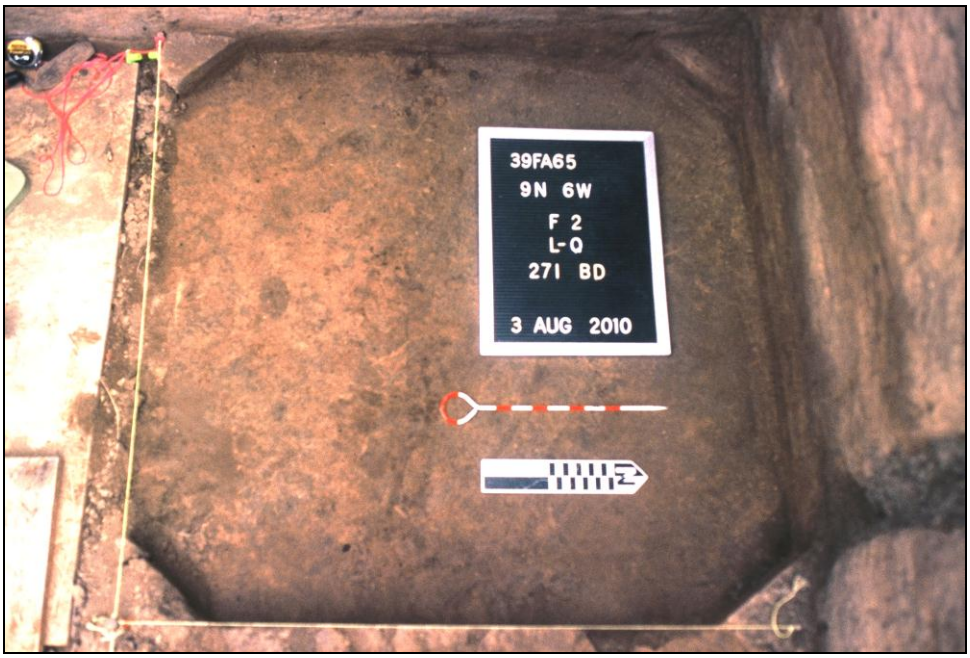


Figure 143. Feature 10-2, Level Q (at 271 cmbd), Unit 9N 6W, Area B block grid.

A third ephemeral scatter of charcoal flecks was observed in Level P (265-270 cmbd) of Unit 9N 5W. It was initially believed to be the beginning of a third feature and was therefore photographed as Feature 10-3 (Figure 144). However, no staining was associated with the flecks, they did not continue to any greater depth below datum, and they did not increase in number. Because of this, the feature designation was subsequently discarded.

Figure 144. Ephemeral scatter of charcoal flecks in the southwest quarter of the unit originally believed to represent a feature. Further investigations revealed that this was not the case.

AMS DATE

One solid carbon charcoal sample was collected from the site during the 2010 field season. The sample was collected from Feature 10-1, Level O (at 262 cmbd), Unit 9N 6W, Area B block grid. The sample was subsequently submitted to the Radiocarbon Dating Laboratory, Illinois State Geological Survey, University of Illinois at Urbana-Champaign for AMS dating (see Appendix E). The date was then calibrated with the use of CALIB 6.0 and the INTCAL09 calibration curve (Reimer et al. 2009) (Table 20).

Table 20. Calibrated AMS Date from Feature 10-1, Level O, 262 cmbd, Area B Block Grid, 2010 Field Season.

Sample No.	ISGS Lab No.	^{14}C Age (RCYBP)	Standard Deviation	Calibrated Range (in cal B.P.) & (Relative Area Under Probability Distribution)		Material Dated
				1σ (68.3 percent area enclosed)	2σ (95.4 percent area enclosed)	
RDM-39FA65-1	A1695	9150	25	10,241-10,295 (0.914) 10,358-10,368 (0.086)	10,237-10,302 (0.691) 10,313-10,392 (0.309)	Charcoal (F10-1, 262 cmbd, Unit 9N 6W, Area B)

Stratigraphically, this sample fits into Layer 11 as depicted in the 1996 north wall profile. This correlates well, both stratigraphically and temporally, with the two AMS dates secured from Level N of the block grid in 1996 (see page 66, Table 10). These two earlier dates, obtained from charcoal samples recovered from Units 8N 2W and 9N 1W, produced dates of 9100 ± 65 and 9140 ± 80 RCYBP, respectively. In terms of stratigraphy, the sample from Unit 8N 2W correlates with a Layer 11/13 transition (Layer 12 does not progress through this area) while the sample from Unit 9N 1W correlates with a Layer 11/12 transition. These data are significant in that they refute the previous idea that a Clovis-period occupation surface had been reached during excavations. It appears, instead, as though the excavations in the Area B block have descended through time to a point only slightly predating that of the Angostura occupation.

This does *not*, of course, provide sufficient explanation for the presence of the fluted projectile point base recovered in 1995 from stratigraphic Layer 7/8, some 30 cm above this zone. The two most plausible hypotheses for the presence of this specimen are bioturbation and collection/replication. Rodent activity is pervasive throughout the site area, and if rodents are, indeed, responsible for the redeposition of this artifact, then it would also imply the existence of an as-yet-uncovered Clovis/Folsom-aged occupation surface underlying the Area B block grid. A previous charcoal sample collected in 1985 from an unprepared hearth in Trench F (which adjoins the Block B grid) returned a radiocarbon date of 11,000 ± 310 RCYBP (Hannus 1986:24 [see Appendix B]). This would appear to imply that bioturbation causing the vertical displacement of the projectile point base is a valid, albeit unconfirmed, hypothesis.

REFERENCES CITED

Albanese, J.

1993 Geology of the Ray Long Site Area (39FA65). In *1992 Archeological/ Geomorphological Investigations at the Ray Long Site (39FA65), Angostura Reservoir, South Dakota*, by L. A. Hannus, R. P. Winham, and J. Albanese, pp. 21-43. Archeological Contract Series No. 86. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to U.S. Department of the Interior, Bureau of Reclamation, Missouri-Souris Projects Office, Ecology Division, Bismarck, North Dakota. Cooperative Agreement No. 2-FC-60-02720.

2009 *Geologic Report Concerning Prehistoric Site 39FA65 (Ray Long Site); Fall River County, South Dakota*. John Albanese, Consulting Geoarchaeologist, Casper, Wyoming. Submitted to Archeology Laboratory, Augustana College, Sioux Falls, South Dakota.

Bauxar, J. J.

1947 *Preliminary Appraisal of the Archeological and Paleontological Resources of Angostura Reservoir, Fall River County, South Dakota*. Ms. on file, South Dakota State Historical Society, Archaeological Research Center, Rapid City, South Dakota.

Bradley, B. A.

1996 Expanded Descriptions: Ray Long Angostura. Manuscript of descriptive analysis and notes on lithic artifacts recovered from the Ray Long site. Ms. on file, Archeology Laboratory, Augustana College, Sioux Falls, South Dakota.

Chamberlin, R. V.

1964 The Ethnobotany of the Gosiute Indians of Utah. Reprinted. Kraus Reprint Corporation, New York. Originally published 1911, *American Anthropological Association Memoirs* 2:329-405.

Colton, H. S.

1974 Hopi History and Ethnobotany. In *Hopi Indians*, edited by D. A. Horr, pp. 279-424. Garland Publishing Incorporated, New York.

French, D. H.

1971 Ethnobotany of Umbelliferae. In *The Biology and Chemistry of the Umbelliferae*, edited by V. H. Heywood, pp. 385-412. Academic Press, New York.

Frison, G. C.

1991 *Prehistoric Hunters of the High Plains*. 2nd ed. Academic Press, New York.

Hannus, L. A.
1986 *Report on 1985 Test Excavations at the Ray Long Site (39FA65), Angostura Reservoir, Fall River County, South Dakota*. Archeological Contract Series No. 27. Archeology Laboratory of the Center for Western Studies, Augustana College, Sioux Falls, South Dakota. Submitted to the South Dakota State Archaeological Research Center, Office of History, Department of Education and Cultural Affairs, Rapid City, South Dakota.

Hannus, L. A., R. P. Winham, and J. Albanese
1993 *Final Report: 1992 Archeological/Geomorphological Investigations at the Ray Long Site (39FA65), Angostura Reservoir, South Dakota*. Archeological Contract Series No. 86. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to U.S. Department of the Interior, Bureau of Reclamation, Missouri-Souris Projects Office, Ecology Division, Bismarck, North Dakota.

1999 *Angostura Landform Stabilization Phase I Proposal*. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to U.S. Department of the Interior, Bureau of Reclamation, Dakotas Area Office, Rapid City Field Office, Rapid City, South Dakota.

Harrington, H. D.
1967 *Edible Native Plants of the Rocky Mountains*. University of New Mexico Press, Albuquerque.

Haug, J. K.
1987 The 1987 Angostura Project. *Newsletter of the South Dakota Archaeological Society* 17(3-4):2-3.

Haug, J. K., D. Byrne, L. May, B. Rhodd, and R. Williams
1987 *The Results of the 1985 Cultural Resources Inventory at Angostura Reservoir, South Dakota*. Contract Investigations Series No. 211. South Dakota State Archaeological Research Center, Rapid City, South Dakota. Submitted to U.S. Bureau of Reclamation, Dakotas Area Office, Rapid City, South Dakota.

Haug, J. K., R. Wardlow, and R. Williams
1992 *The Results of the 1987 National Register of Historic Places Evaluations at Angostura Reservoir, South Dakota*. Contract Investigations Series No. 776. South Dakota State Archaeological Research Center, Rapid City, South Dakota. Submitted to U.S. Bureau of Reclamation, Dakotas Area Office, Rapid City, South Dakota.

Hughes, J. T.
1949 Investigations in Western South Dakota and Northeastern Wyoming. *American Antiquity* 14(4):266-277.

Jackson, M. A., and D. L. Toom
2009 *Three South Dakota Reservoirs: 2008 Archeological Site Relocation and Assessment Survey, Angostura Reservoir, Fall River County, Belle Fourche Reservoir, Butte County, Shadehill Reservoir, Perkins County, South Dakota.* Contribution No. 421. Department of Anthropology, University of North Dakota, Grand Forks, North Dakota. Submitted to U.S. Department of the Interior, Bureau of Reclamation, Rapid City Field Office, Rapid City, South Dakota.

Kay, M., B. A. Bradley, L. A. Hannus, R. P. Winham, and J. Albanese
2011 *When the Ends are the Means: Retooling Angostura*. Ms. on file, Archeology Laboratory, Augustana College, Sioux Falls, South Dakota.

Lippincott, K.
1996 *A Late Prehistoric Period Pronghorn Hunting Camp in the Southern Black Hills, South Dakota: Site 39FA23*. Special Publication of the South Dakota Archaeological Society No. 11. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota.

Maxim Technologies, Incorporated
1998 *Geotechnical Exploration Program Landform Stabilization Project, Ray Long Site – Angostura Reservoir, Fall River County, South Dakota*. Maxim No. 9855907. Maxim Technologies, Inc., Rapid City, South Dakota. Ms. on file, Archeology Laboratory, Augustana College, Sioux Falls, South Dakota.

Mulloy, W. T.
1958 A Preliminary Historical Outline for the Northwestern Plains. *University of Wyoming Publications in Science* 18(1):1-70.

Reimer, P. J., M. G. L. Baillie, E. Bard, A. Bayliss, J. W. Beck, P. G. Blackwell, C. Bronk Ramsey, C. E. Buck, G. S. Burr, R. L. Edwards, M. Friedrich, P. M. Grootes, T. P. Guilderson, I. Hajdas, T. J. Heaton, A. G. Hogg, K. A. Hughen, K. F. Kaiser, B. Kromer, F. G. McCormac, S. W. Manning, R. W. Reimer, D. A. Richards, J. R. Southon, S. Talamo, C. S. M. Turney, J. van der Plicht, and C. E. Weyhenmeyer
2009 INTCAL09 and MARINE09 Radiocarbon Age Calibration Curves, 0-50,000 Years CAL BP. *Radiocarbon* 51(4):1111-1150.

Roberts, F. H. H.
1952 River Basin Surveys: The First Five Years of the Interagency Archeological and Paleontological Salvage Program. *Annual Report of the Board of Regents of the Smithsonian Institution for 1951*, edited by A. Wetmore, pp. 351-384. Smithsonian Institution Publication No. 4062. U.S. Government Printing Office, Washington, D.C.

Rogers, D.
1980 *Edible, Medicinal, Useful, and Poisonous Wild Plants of the Northern Great Plains-South Dakota Region*. Biology Department, Augustana College, Sioux Falls, South Dakota.

Scott, L. J., and R. O. Lewis
1986 Pollen and Phytolith Analysis at the Ray Long Site (39FA65), South Dakota: A Feasibility Study. Ms. on file, Archeology Laboratory, Augustana College, Sioux Falls, South Dakota.

Scott Cummings, L., and K. Puseman
1995 *Identification of Charcoal from Indian Creek Village, 39ST15, and Pollen and Protein Residue Analysis of a Groundstone from the Ray Long Site, 39FA65*. Paleo Research Labs Technical Report 94-91. Paleo Research Laboratories, Denver, Colorado. Submitted to Archeology Laboratory, Augustana College, Sioux Falls, South Dakota.

Snyder, L. M., D. Hull-Walski, T. Thiessen, and M. Giessen
2000 Post-War Partners in Archaeology: The Bureau of Reclamation, the National Park Service, and the River Basin Surveys in the Missouri River Basin (1945-1969). *CRM* 23(1):17-20.

Sundstrom, L.
1981 *Rock Art of the Southern Black Hills, South Dakota and Wyoming*. Publications in Anthropology No. 2. Archaeology Laboratory, South Dakota State University, Brookings, South Dakota.

1984 Section 2: Rock Art of the Southern Black Hills. In *Rock Art of Western South Dakota: The Northern Cave Hills and the Southern Black Hills*, by J. D. Keyser and L. Sundstrom, pp. 54-142. Special Publication No. 9, South Dakota Archaeological Society, Archeology Laboratory, Augustana College, Sioux Falls, South Dakota.

Thiessen, T.
1994a The National Park Service and Interagency Archeological Salvage Program in the Missouri River Mainstem Reservoirs. *North Dakota Archaeology* 5:15-26.

1994b A Short History of the Interagency Archeological Salvage Program Work Along the Missouri River. *South Dakota Archaeology* 18:1-5.

Wedel, W. R.
1953a *Prehistory and the Missouri Valley Development Program: Summary Report on the Missouri River Basin Archeological Survey in 1948*. River Basin Surveys Papers No. 1. Bureau of American Ethnology Bulletin 154.

1953b *Prehistory and the Missouri Valley Development Program: Summary Report on the Missouri River Basin Archeological Survey in 1949*. River Basin Surveys Papers No. 2. Bureau of American Ethnology Bulletin 154.

Wheeler, R. P.

1995 *Archeological Investigations in Three Reservoir Areas in South Dakota and Wyoming: Part I – Angostura Reservoir*. Reprints in Anthropology No. 46. J & L Reprint Company, Lincoln.

1996 *Archeological Investigations in Three Reservoir Areas in South Dakota and Wyoming: Part II – Keyhole Reservoir*. Reprints in Anthropology No. 47. J & L Reprint Company, Lincoln.

Whiting, A. F.

1939 *Ethnobotany of the Hopi*. Bulletin No. 15, Museum of Northern Arizona, Flagstaff.