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AN ARCHEOLOGICAL OVERVIEW AND MANAGEMENT PLAN FOR THE
REDSTONE ARSENAL MADISON COUNTY ALABAMA(U)

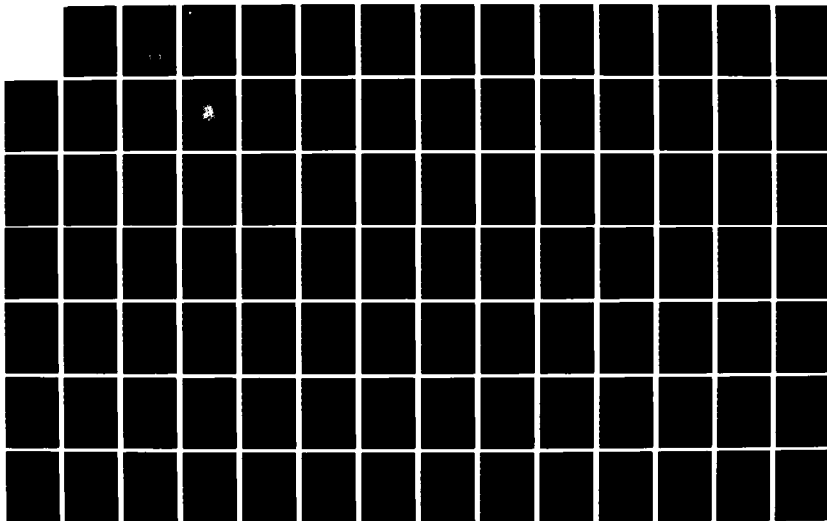
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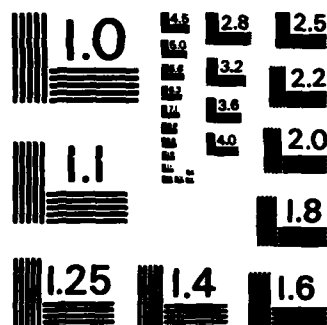
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Final
Report No. 38

July 29, 1985

**An Archeological Overview and
Management Plan for the
Redstone Arsenal,
Madison County, Alabama**

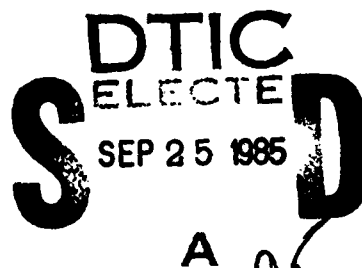
Under Contract CX-5000-3-0771
with the

**National Park Service
U.S. Department of the Interior**
Atlanta, GA 30303

for the
U.S. Army Materiel Development and
Readiness Command

by

David H. Dye
Department of Anthropology
Memphis State University
Memphis, TN 38152



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Prepared under the Supervision of

Ruthann Knudson
Ruthann Knudson, WCC Principal Investigator

Woodward-Clyde Consultants
One Walnut Creek Center
100 Pringle Avenue, Walnut Creek, CA 94596
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Mr. Cundiff
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Alexandria, Virginia 22314

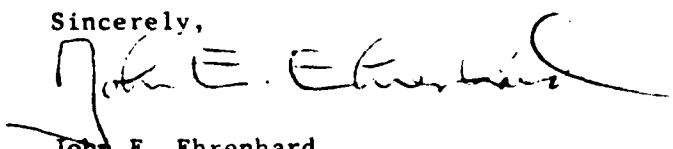
Dear Mr. Cundiff:

Enclosed is one copy each of the following reports:

(See enclosed list)

The reports were produced under the terms of Contract No. CX 5000-3-0771 between the National Park Service and the U.S. Army, with funding provided by DARCOM. For information regarding these reports contact Dr. Mark R. Barnes (404) 221-2654.

Sincerely,


John E. Ehrenhard
Chief, Archeological
Services Division

Enclosures

The appended resource locational data in these reports should be deleted per Dr. Mark R. Barnes.

Final DARCOM Reports

Report No. 23, An Archeological Overview and Management Plan for the Joliet Army Ammunition Plant, Will County, Illinois, by the Center for American Archeology, and Woodward-Clyde Consultants. ✓

Report No. 24, An Archeological Overview and Management Plan for the Rock Island Arsenal, Rock Island County, Illinois, by the Center for American Archeology, and Woodward-Clyde Consultants. ✓

Report No. 25, An Archeological Overview and Management Plan for the Volunteer Army Ammunition Plant, Hamilton County, Tennessee, by Memphis State University, and Woodward-Clyde Consultants. ✓

Report No. 33, An Archeological Overview and Management Plan for the Lexington-Blue Grass Depot Activity, Fayette, Bourbon, and Madison Counties, Kentucky, by the Center for American Archeology and Woodward-Clyde Consultants. ✓

Report No. 35, An Archeological Overview and Management Plan for the St. Louis Area Support Center, Madison County, Illinois, by the Center for American Archeology, and Woodward-Clyde Consultants.

Report No. 36, An Archeological Overview and Management Plan for the St. Louis Army Ammunition Plant, St. Louis County, Missouri, by the Center for American Archeology, and Woodward-Clyde Consultants.

Report No. 38, An Archeological Overview and Management Plan for the Redstone Arsenal, Madison County, Alabama, by Memphis State University, and Woodward-Clyde Consultants. ✓

Report No. 39, An Archeological Overview and Management Plan for the Lima Army Tank Plant, Allen County, Ohio, by the Center for American Archeology, and Woodward-Clyde Consultants.

Report No. 40, An Archeological Overview and Management Plan for the Detroit Arsenal, the Pontiac Storage Facility, and the Keweenaw Field Station, Macomb, Oakland, and Houghton Counties, Michigan, by the Center for American Archeology, and Woodward-Clyde Consultants.

Report No. 28, An Archeological Overview and Management Plan for the Pine Bluff Arsenal, Jefferson County, Arkansas, by Heartfield, Price, and Greene, Inc., and Woodward-Clyde Consultants. (Corrected Copy) ✓

REPORT DOCUMENTATION PAGE		1. REPORT NO.	2.	3. Recipient's Accession No. AD-A159380
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15. Supplementary Notes This report was prepared as part of the DARCOM Historical/Archeological Survey (DHAS), an inter-agency technical services program to develop facility-specific archeological overviews and management plans for the U.S. Army Materiel Development and Readiness Command (DARCOM).				
16. Abstract (Limit: 200 words) The Redstone Arsenal, located in north-central Alabama, is comprised of 38,303 acres. It is under the jurisdiction of the U. S. Army Materiel Development and Readiness Command, (DARCOM, now AMC or Army Materiel Command), and houses six governmental organizations and a government-owned, contractor-operated facility. The Arsenal is located near the western foothills of the Cumberland Plateau and is bordered on the south by the Tennessee River. The facility occupies well-drained, hilly land in the northern section and low, swampy terrain in the southern portion. The topography ranges from slight to gently rolling in the southern part to hilly in the northern portion. A review of the known and potential archeological resources within Arsenal boundaries indicates that significant prehistoric and historic resources, including one National Register property, exist there. Previous archeological investigations conducted on the facility have identified 111 archeological sites; the 112th, the Redstone Rocket Test Stand, is a recent (1950s) historic property on the National Register but was not identified as an archeological resource through survey. It is recommended that further intensive archival and archeological field inventory be completed for the relatively undisturbed portions of the facility, for the development of a Historic Preservation Plan for the Arsenal, or for any ground-disturbing project-specific compliance with the National Historic Preservation Act and related statutes.				
17. Document Analysis a. Descriptors Archeological Management Army Installation Management Environmental Assessment reference: Thesaurus of Engineering and Scientific Terms				
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MANAGEMENT SUMMARY

The Redstone Arsenal, slightly less than 40,000 acres in extent, is located near the Tennessee River and the city of Huntsville in north central Alabama. It is a region of considerable prehistoric and historic archeological interest. At present there are 112 known archeological sites on the facility, one of which is a National Register site (the Redstone Arsenal Rocket Test Stand). Potential sites include 45 historic cemeteries.

Evaluation of the Arsenal's immediate archeological needs have been based on a tour of the facility, discussions with key personnel, and a study of regional landforms and cultural sequence in order to assess the Arsenal's potential archeological resource base. A long-term planning document scheduling future construction, leasing, or other ground-disturbing activities is available for the facility (Harland Bartholomew and Associates 1978).

Given the known and potential archeological resource base retained on the Redstone Arsenal, and federal requirements for historic preservation planning and resource protection, recommendations have been provided for both short- and long-term archeological resource management on the facility. In light of the long-term needs, a program for the stratified survey of the relatively undisturbed portions of the facility is recommended, with a scope of work, milestones, and recommended unloaded baseline cost in FY85 dollars. In addition, the uncosted recommendation has been made that DARCOM immediately initiate consultation with the Alabama State Historic Preservation Officer about the Redstone Arsenal cultural resource management needs, and that DARCOM direct its efforts toward the eventual integration of architectural and archeological information in a facility Historic Preservation Plan.

PREPARERS AND QUALIFICATIONS

David H. Dye is the principal author of the initial draft report. He holds a BA, an MA, and PhD in Anthropology with emphasis in Archeology. He has participated in archeological excavations in many parts of the United States during the past 15 years and has published approximately 30 articles, reviews, and reports. During the past three years he has concentrated on cultural resource studies in the southeastern United States. At present he is Assistant Professor of Anthropology at Memphis State University.

Patricia M. Quillian is a contributing author to the draft report. She holds a BA and an MA in Anthropology with emphasis in Archeology. She has six years of experience in Archeology and cultural resource management and has worked in the Southeast and Southwest. She has been employed in the field and laboratory in a variety of capacities, including coordinator of the Georgia Archaeological Site Files.

Richard B. Meek is a contributing author to the draft report. He holds a BA in Biology with emphasis in Genetics. He has worked on a variety of cultural resource management projects in the Mid-South for the past two years in both field and laboratory capacities.



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We are most grateful to Mr. M. William (Bill) Schroder (Environmental Quality Coordinator) and Mr. David M. Bryant (Master Planner), Redstone Arsenal, for their courtesy and cooperation with this project. Mr. Schroder provided requested documents at our disposal and presented a particularly informative tour of the facility. He also provided additional information and clarification to Woodward-Clyde Consultants for the final report. Mr. Bryant aided in the archival search. Mr. Eugene M. Futato (Office of Archaeological Research, University of Alabama) has been most helpful in providing information and access to the site records and documents of his institution. Thanks also are due to Ms. Deborah A. Grammas and Ms. Charlotte Watrin for their help in the production of the draft manuscript.

Additional thanks go to Dr. Mark R. Barnes, NPS, SERO; the Alabama SHPO for their review of the draft report; and Ms. Susan Cleveland, Contracting Officer, NPS, SERO.

Report production, including all graphics, was completed by Woodward-Clyde Consultants. Major editorial review and rewrite of the draft and development and review of management recommendations was undertaken by Ms. Betty Schmucker and Dr. Ruthann Knudson of Woodward-Clyde Consultants.

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FOREWORD

As a federal agency with large public land holdings, the U. S. Army is responsible for the stewardship of a variety of natural and cultural resources that are part of its installations' landscapes. The Army's Materiel Development and Readiness Command (DARCOM) presently manages a nationwide network of 65 installations and 101 subinstallations and separate units, which range in size from one acre to over one million acres. As part of its programs of environmental and property management, DARCOM has requested that the U. S. Department of the Interior's National Park Service provide technical guidance to develop programs for managing installation cultural resources.

NPS is thus conducting the DARCOM Historical/Archeological Survey (DHAS), which has two major disciplinary elements. The architectural review and planning function is being directed by the Service's Historic American Buildings Survey (HABS), while the prehistoric and historic archeological resource assessment and planning function is the responsibility of the Service's Interagency Resource Division (IRD). IRD has contracted with Woodward-Clyde Consultants (WCC) for the development of guidelines for the DARCOM archeological management planning effort, and for the completion of over 40 overviews and plans throughout the United States. WCC has in turn subcontracted the technical studies to several regional subcontractors, with final editorial review of reports and preparation of text and illustrations handled by WCC.

This overview and recommended management plan for the archeological resources of the Redstone Arsenal was prepared in draft by Memphis State University, Memphis, Tennessee, under subcontract to WCC. It follows the

guidance of "A Work Plan for the Development of Archeological Overviews and Management Plans for Selected U. S. Department of the Army DARCOM Facilities," prepared by Ruthann Knudson, David J. Fee, and Steven E. James as Report No. 1 under the WCC DARCOM contract. A complete list of DHAS project reports is available from the National Park Service, Washington, DC.

The DHAS program marks a significant threshold in American cultural resource management. It provides guidance that is nationally applicable, is appropriately directed to meeting DARCOM resource management needs within the context of the Army's military mission, and is developed in complement to the state Resource Protection Planning Process (the RP3 process, through State Historic Preservation Offices). All of us participating in this effort, particularly in the development of this report, are pleased to have had this opportunity. Woodward-Clyde Consultants appreciates the technical and contractual guidance provided by the National Park Service in this effort, from the Atlanta and Washington DC offices and also from other specialists in NPS regional offices in Philadelphia, Denver, and San Francisco.

Woodward-Clyde Consultants

Ruthann Knudson

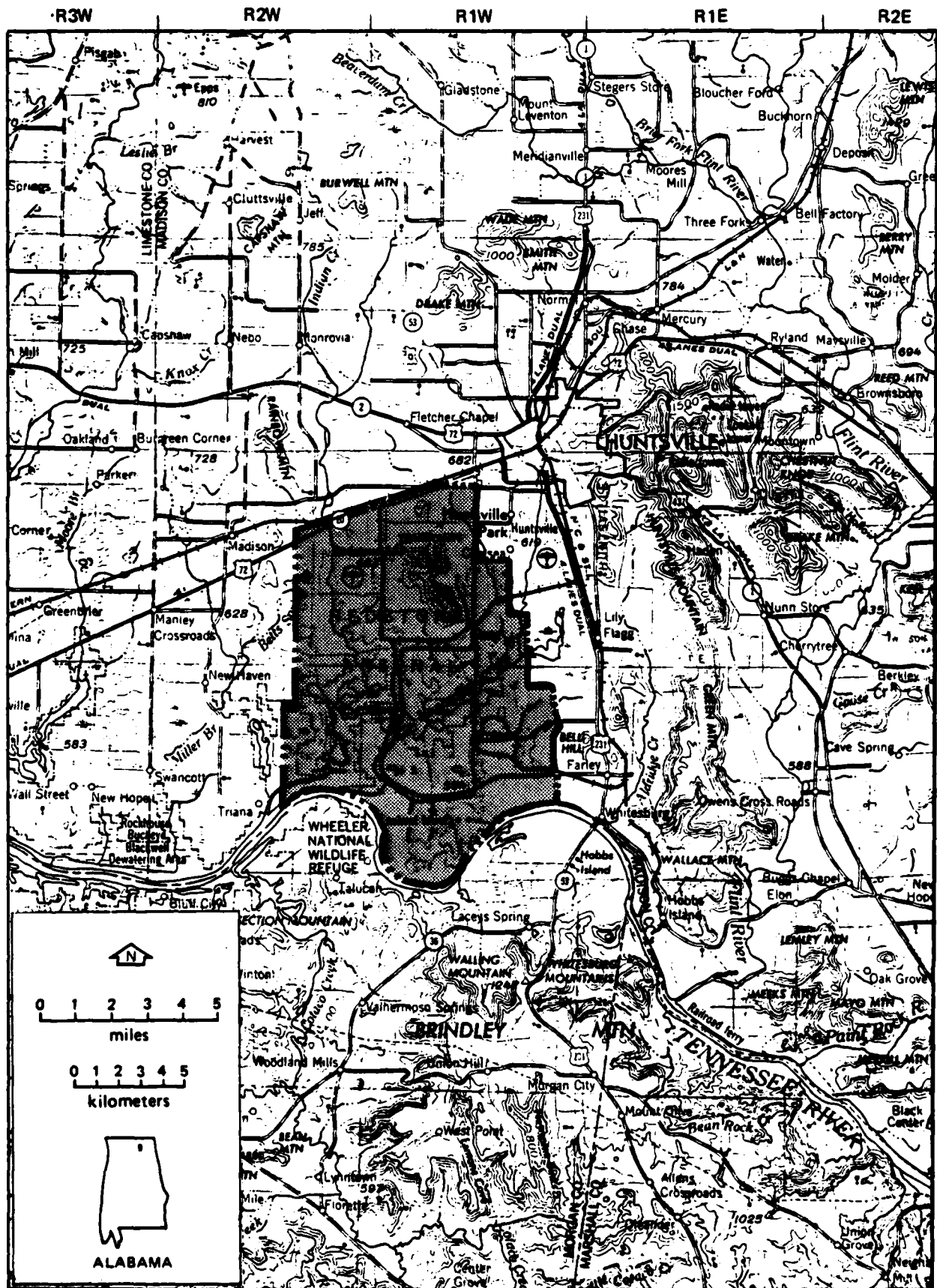
INTRODUCTION

The following report is an overview of and recommended management plan for the prehistoric and historic archeological resources presently known or likely to occur on the Redstone Arsenal in Madison County, Alabama (Figure 1-1). This facility is an installation of the U. S. Department of the Army DARCOM (Materiel Development and Readiness Command), which as a reservation of public land has responsibilities for the stewardship of the cultural resources located on it. The assessments and recommendations reported here are part of a larger command-wide cultural resource management program (the DARCOM Historical/Archeological Survey, or DHAS), which is being conducted for DARCOM by the U. S. Department of the Interior's National Park Service (NPS). The following is that portion of the facility-specific survey that is focused on the prehistoric and historic resource base of the Redstone Arsenal, and was developed in accordance with the Level B requirements as set forth in the archeological project Work Plan (Knudson, Fee, and James 1983). A companion architectural study has been prepared by NPS's HABS (Historic American Building Survey) (William Brenner, personal communication 1984).

1.1 PURPOSE AND NEED

A corpus of Federal laws and regulations mandate cultural resources management on DARCOM facilities. Briefly these are:

- The National Historic Preservation Act of 1966 as amended (80 Stat. 915, 94 Stat. 2987; 16 USC 470), with requirements to,



Note: Base map is the USGS Gadsen, AL, TN 1:250,000 (1966)

Figure 1-1. MAP OF THE GENERAL VICINITY OF THE REDSTONE ARSENAL

- inventory, evaluate, and where appropriate nominate to the National Register of Historic Places all archeological properties under agency ownership or control (Sec. 110(a)(2))
- prior to the approval of any ground-disturbing undertaking, take into account the project's effect on any National Register-listed or eligible property; afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the proposed project (Sec. 106)
- complete an appropriate data recovery program on an eligible or listed National Register archeological site prior to its being heavily damaged or destroyed (Sec. 110(b), as reported by the House Committee on Interior and Insular Affairs [96th Congress, 2nd Session, House Report No. 96-1457, p. 36-37])
- Executive Order 11593 (36 FR 8921), whose requirements for inventory, evaluation, and nomination, and for the recovery of property information before site demolition, are codified in the 1980 amended National Historic Preservation Act
- The Archeological and Historic Preservation Act of 1974 (88 Stat. 174, 16 USC 469), which requires that notice of an agency project that will destroy a significant archeological site be provided to the Secretary of the Interior; either the Secretary or the notifying agency may support survey or data recovery programs to preserve the resource's information values
- The Archeological Resources Protection Act of 1979 (93 Stat. 721, 16 USC 470aa; this supersedes the Antiquities Act of 1906 [93 Stat. 225, 16 USC 432-43]), with provisions that effectively mean that
 - The Secretary of the Army may issue excavation permits for archeological resources on DARCOM lands (Sec. 4)

- No one can damage an archeological resource on DARCOM lands without a permit, or suffer criminal (Sec. 6) or civil penalties (Sec. 7)
- 36 CFR 800, "Protection of Historic and Cultural Properties" (44 FR 6068, as amended in May 1982); these regulations from the Advisory Council on Historic Preservation set forth procedures for compliance with Section 106 of the National Historic Preservation Act
- Regulations from the Department of the Interior for determining site eligibility for the National Register of Historic Places (36 CFR 60, 36 CFR 63), and standards for data recovery (proposed 36 CFR 66)
- United States Department of the Army procedures and standards for preserving historic properties (32 CFR 650.181-650.193; Technical Manual 5-801-1; Technical Note 78-17; Army Regulation 420-40); and procedures for implementing the Archaeological Resources Protection Act (32 CFR 229).

These procedures should be integrated with planning and management to insure continuous compliance during operations and management at each facility. This can best be achieved by an understanding of the procedures implied by the regulations and an awareness of the cultural resources potential at each facility.

1.2 THE REDSTONE ARSENAL

Redstone Arsenal is located in the southwestern portion of Madison County, Alabama (Figure 1-1), approximately 75 miles north of Birmingham and 105 miles south of Nashville, Tennessee. The Arsenal is bounded by the Tennessee River on the south; by farmland and part of the Wheeler National Wildlife Refuge on the west; by the Southern Railroad, Alabama

Highway 20, and Bob Wallace Avenue on the north; and on the east and northeast by the city of Huntsville. Formerly 38,659 acres in extent, it presently encompasses 38,303 acres forming a rectangle approximately 10 km wide by 16 km long. The 356-acre reduction occurred in the northeast corner of the Arsenal adjacent to the Alabama Space and Rocket Center and Highway 20 (Bill Schroder, personal communication 1985). Total acreage includes 2905 acres under use-permit from TVA, 4085 acres transferred from TVA to the Department of the Interior for fish and wildlife conservation, and 1841 acres granted by use-permit to NASA for the George C. Marshall Space Flight Center, as well as industrial (GO-CO), U. S. Naval Reserve, and agricultural lease areas. A total of approximately 21,000 acres is operated under these conditions (Harland Bartholomew and Associates 1978:2-5).

The area comprising Redstone Arsenal was acquired by fee purchase from 320 land owners during late 1941 and 1942. Today Redstone Arsenal is made up of small tracts of land which, prior to acquisition by the Department of the Army, were pasture land and average to above-average farm land, producing cotton, corn, hay, and small grain crops (Harland Bartholomew and Associates 1977:2-1).

The history of the Redstone Arsenal began during World War II. In 1941, the Chemical Corps and the Ordnance Corps joined forces for the production of chemical ammunition. Land acquisition for this project originally was known as the Siebert Arsenal Project. The Chemical Corps built their chemical facilities on the northwestern side of the project area and named it Huntsville Arsenal. In October 1941, two months after construction started at the Huntsville Arsenal, the Ordnance Corps began their Ordnance Loading Plant on the southeastern side of the project area, adjacent to Huntsville Arsenal. This Ordnance Plant was later designated as Redstone Arsenal. Both plants were engaged in integrated programs of chemical shell production. Huntsville Arsenal manufactured and loaded shells while Redstone Arsenal assembled explosives for these shells and produced rounds (Harland Bartholomew and Associates 1977).

During World War II, 9115 personnel were employed at both arsenals and worked in three shifts. After the war, operations were shut down and the buildings and equipment were placed on a standby basis. The total wartime investment in both arsenals reached approximately \$140 million. This included 1200 permanent and temporary buildings, 160 km of paved roads, 160 km of railroad, an airstrip, and dock facilities at the Tennessee River (Harland Bartholomew and Associates 1977).

In 1947 the installation was put on standby status and publically advertised for sale. In 1949 the Ordnance Corps reactivated the installation (Redstone Arsenal) as a center for research and development in the field of rocketry. In 1950 the guided missile research and development activities which had been in operation at Fort Bliss, Texas, since 1945 were transferred to Huntsville, Alabama. Huntsville Arsenal was transferred to the Ordnance Corps, and both installations, Huntsville Arsenal and Redstone Arsenal, were combined into what is known now as Redstone Arsenal (Figure 1-2) (Harland Bartholomew and Associates 1977). Redstone Arsenal became the center of Army rocket research in 1950, and it has been the scene of dramatic technological breakthroughs in space exploration and in the development of modern defense systems (Harland Bartholomew and Associates 1978:3-1).

Rocket research and development activities were located in the old Redstone Arsenal area and became known as the Ordnance Rocket Center. Guided missile research and development activities, under the name "Ordnance Guided Missile Center," were located in the chemical plants area in the headquarters area of the former Huntsville Arsenal. In 1952 both centers were combined into the Ordnance Missile Laboratories (OML). In 1951 Redstone Arsenal was assigned, on a national basis, the responsibility to direct research and development, procurement, and field services of all Army guided rockets and missiles (Harland Bartholomew and Associates 1977).

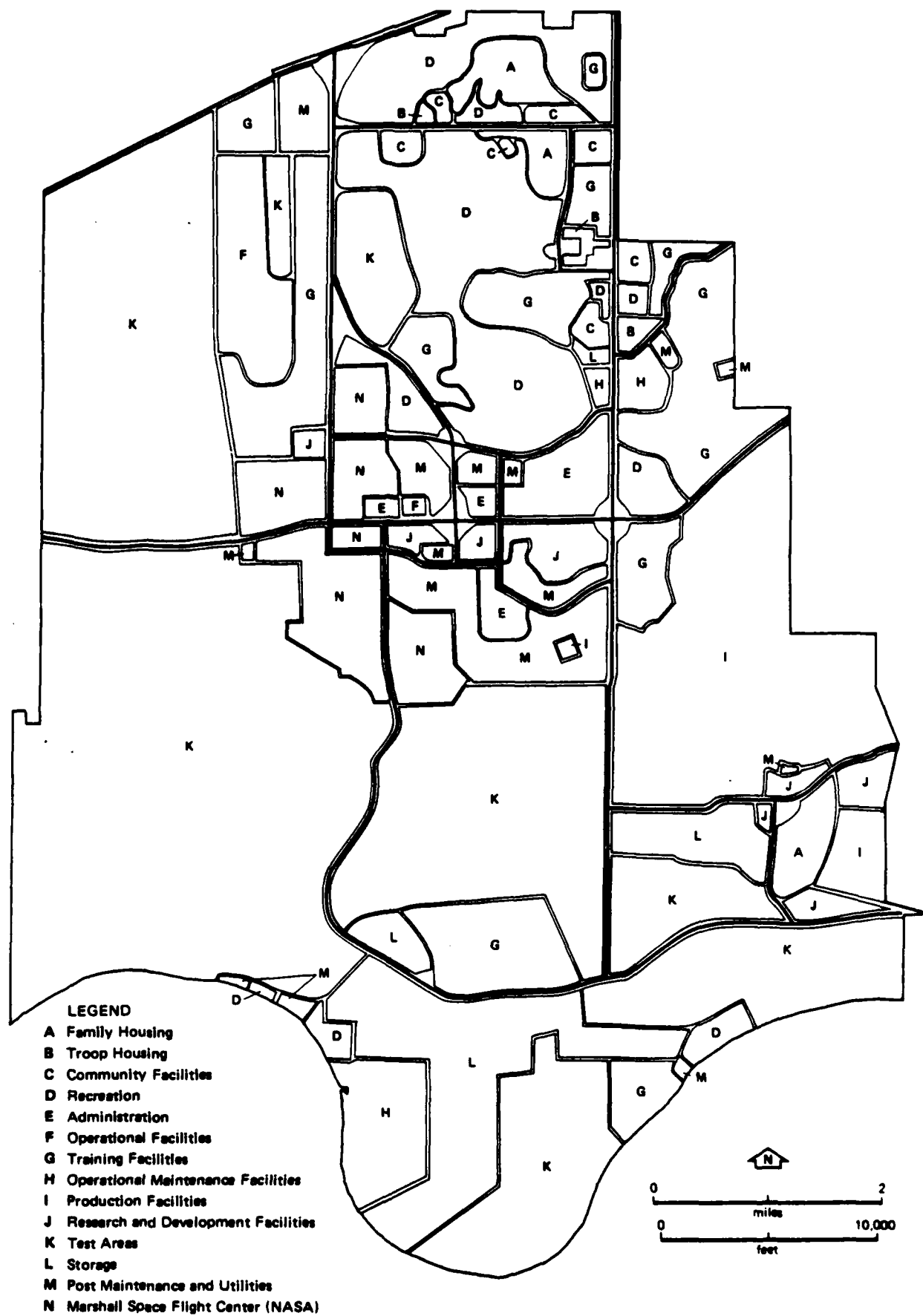


Figure 1-2. MASTER BASE MAP OF THE REDSTONE ARSENAL

The U. S. Army Ballistic Missile Agency (ABMA) was established in 1956. The former Guided Missile Development Division of OML then became the Development Operations Division of ABMA. In 1958 the U. S. Army Ordnance Missile Command was established with the U. S. Army Rocket and Guided Missile Agency. When the U. S. Army Ordnance Missile Command was established, its mission included research and development of outer space vehicles; this phase of the original mission now is the responsibility of NASA (Harland Bartholomew and Associates 1977). The Redstone Test Stand, a rocket test stand presently on the National Register of Historic Places (see Appendix B), was used to test a modified U. S. Army Redstone Missile which was used as the booster for the first successful U. S. orbiting satellite, Explorer I, launched January 31, 1958. The stand is located on what is presently NASA's Marshall Space Flight Center (Harland Bartholomew and Associates 1978:3-1).

In 1960, personnel and facilities were transferred from the Army's jurisdiction to that of the National Aeronautics and Space Administration (NASA). The facilities, previously part of the U. S. Army Ballistic Missile Agency, became the George C. Marshall Space Flight Center. In 1962 the U. S. Army Ordnance Missile Command was redesignated the U. S. Army Missile Command, which was split into the U. S. Army Missile Materiel Readiness Command (MIRCOM) and the U. S. Army Missile Research and Development Command (MIRADCOM). Redstone presently houses some elements of these as well as of the following commands: U. S. Army Missile and Munitions Center and School (USAMMCS), U. S. Army Medical Department Activity (MEDDAC), and the U. S. Army Communications Command.

1.3 SUMMARY OF PREVIOUS ARCHEOLOGICAL WORK CONDUCTED ON REDSTONE ARSENAL

The Middle Tennessee River Valley in Northern Alabama is well known for its large number of prehistoric occupational sites. For this reason, it has attracted the attention of archeologists since the turn of the century. The earliest archeological work in the area of Redstone Arsenal was conducted by Clarence B. Moore, who excavated some of the more outstanding sites along the river in 1915 (see Moore 1915).

The period of greatest archeological investigations was from the 1930s to the 1940s as a result of the construction of Wheeler Dam in 1933. Shortly after dam construction the Alabama Museum of Natural History, under the directorship of Dr. Walter B. Jones, began an archeological survey of the region. Of the 48 sites located by Dr. Jones, 11 sites were located in the area that would become Redstone Arsenal. With large financial input from Federal Aid programs, notably the CCC and WPA, this area became the center of the largest excavation program to date in the southeastern United States (Webb 1939).

During the late 1970s and early 1980s, 10 archeological surveys were conducted on and near Redstone Arsenal. Most of these were conducted by the University of Alabama (Office of Archaeological Research) or by New World Research, and are summarized in Section 3.0 (Table 3-2). The results of these surveys include the recognition of 111 archeological sites representing Paleo-Indian, Archaic, Woodland, and Historic period materials. These sites, composing 140 components, resulted from eight archeological surveys that covered approximately 1800 acres or 4.7 percent of the facility.

1.4 THE SOCIOCULTURAL CONTEXT OF ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL

A number of individuals are interested in prehistoric and historic cultural resources, but archeologists and culture historians particularly regard archeological sites as important sources of information about past human cultures. Thus, a primary value of any prehistoric or historic archeological resource is its ability to yield scientific data about human behavior. Scientific researchers, then, will be those individuals most concerned with the preservation and interpretation of archeological resources.

Studies of extinct cultural systems are crucial for incorporating local areas, such as the Middle Tennessee Valley, into broader regional

interpretations of prehistory and history. Such studies may provide knowledge and information about how humans have adjusted or adapted to changing social and natural environments. Studying hunting and gathering adaptations or the change, late in prehistory, from a hunting/gathering lifestyle to one with an increasing emphasis on intensive gardening or horticulture, may not seem important to immediate local concerns but indeed may be critical and significant for understanding culture change and stability in societies where acculturation is proceeding at a rapid and devastating rate.

Avocational archeologists, with interests in local prehistoric and historic cultures, often assist in professional archeological research. Many of these individuals are well-trained in specific research areas, while others support scientific endeavors through donations of time and labor. Other local enthusiasts, however, are not concerned with the pursuit of scientific goals, but rather try to accumulate artifacts for their personal collections or to further their own finances. These collectors, often called pot hunters or looters, are of a considerable and significant threat to archeological resources. Once prehistoric and historic cultural resources have been destroyed, the information cannot be regained. An archeological site is therefore a nonrenewable resource and as such it can be evaluated scientifically for information only once. After its destruction, either through uncontrolled looting or through controlled scientific excavation, the context of the material is irrevocably lost unless it has been recorded and made available to the scientific community. These issues, of necessity, should be of continuous concern to those responsible for archeological resources and their management.

In recent years persons of Native American descent have begun to express interest in and concern over their ancestral lands which embody much of their cultural heritage. The destruction of archeological sites by looters is a serious threat, not only to the archeological resource, but also to the heritage of the Creek and Chickasaw Native Americans.

This issue is an important concern to archeological resource managers and to those Native Americans who claim these resources to be part of their cultural ancestry, although not all archeological sites may be associated directly with known, ethnically identifiable Native American groups. Beyond approximately 1000 years ago the ability to identify contemporary Native American groups with past cultures considerably diminishes.

Americans from African and European backgrounds have been associated with the rural and village cultural pattern in this area since the early 19th century. Their economic and social ties provide a deep interest in the interpretation and preservation of historic remains. These concerns should be addressed in the presentation of information derived from archeological research.

Many government agencies have noted that archeological resources have significant public interest and value. Through proper management and stewardship, various "high profile" interest groups may be informed and consequently contribute funds for additional scientific excavation or towards publication of the research results. Such public relations efforts contribute to an overall favorable impression upon the general public and enhance community relations.

AN OVERVIEW OF THE CULTURAL AND RELEVANT
NATURAL HISTORY OF THE REDSTONE ARSENAL

2.1 THE PHYSICAL ENVIRONMENT

2.1.1 Earth Resources

The majority of the Redstone Arsenal is located within the gray lands of the eastern Highland Rim of the Interior Low Plateau (Fenneman 1938), while the eastern edge and a few mountains (Weeden and Madkin) represent outliers of the Cumberland Plateau province (Lenzer 1980:90). With the exception of the mountainous areas, undulating and rolling topography characterizes the facility. Deeply weathered Tuscumbia limestone (Mississippian period) is the predominant surface formation of most of the Arsenal, except in the southern area which is covered with general alluvium derived from limestone, sandstone, and shale (Swenson et al. 1958). Abundant sinks occur in uplands and along drainage systems (Lenzer 1980:87).

Elevations range from 556 feet AMSL, which is the normal water level of the Tennessee River, to 750 feet AMSL on the north. There are two small hills with elevations of about 750 feet adjacent to the Tennessee River. Three mountains are found in the north central part of the Arsenal: Madkin (1239 feet), Weeden (1220 feet), and Ward (900 feet) (Harland Bartholomew and Associates 1977).

Four distinct soil associations occur on the Redstone Arsenal: the Decatur-Cumberland-Abernathy association, Hermitage-Talbott-Colbert association, Huntington-Lindside-Hamblen association, and Rough Stony

Land association (Swenson et al. 1958:90). (Harland Bartholomew and Associates [1978:Plate 2-1] add to this the Allen-Jefferson association and Holston-Tupelo-Robertsville association). These Ultisols formed under a mild climate, abundant rainfall, and mixed (but mostly deciduous) forests. The surface horizons are acidic. The upland soils are deep and alluvial in the northern part of the facility, well-drained, and acid. In the southern portion the soils are poorly drained. The soils on the mountain tops are derived from sandstone and shale (Harland Bartholomew and Associates 1977).

2.1.2 Water Resources

Three major streams cross the Arsenal generally from north to south as they convey drainage into the Tennessee River along the Arsenal's southern boundary (see Figure 3-2, Section 3.0). McDonald Creek flows through the northeast corner of the Arsenal before joining Huntsville Spring Branch. Huntsville Spring Branch crosses from east to west through the central portion of the Arsenal, and joins Indian Creek in the southwest corner of the facility. Indian Creek crosses the western part of the Arsenal from north to south before entering the Tennessee River (Harland Bartholomew and Associates 1978:4-51). Several small ponds are located in the southern area of the facility, and numerous underground springs and systems are found throughout the Arsenal.

2.1.3 Modern Climate

The climate of the area is humid, temperate, and continental which reflects its eastern location in North American and its close proximity to the Gulf of Mexico. The climate and weather are influenced by a combination of warm, moist maritime air from the Gulf of Mexico and cool continental air from Canada and Alaska. Summers are long and hot, and winters generally are mild and pleasant.

Temperature and precipitation are typical of the northern half of Alabama. The growing season averages 208 days. The last spring frost usually is not later than April 5; the average first frost is October 31

(Harland Bartholomew and Associates 1977:2-28, 2-30). The warm, moist Gulf air dominates the summer weather pattern. Extremely high temperatures are unusual. Thundershowers frequently occur during summer, and cool continental air seldom invades the area.

The facility area receives recurring waves of cold air during the spring and winter months bringing precipitation and alternating periods of clear, dry weather and occasional extreme cold waves. Winter weather is seldom severe, and below freezing temperatures usually last less than 48 hours. Snow falls two to three times a year with an average depth of three centimeters.

Precipitation is distributed evenly throughout the year; however, the period from December through March receives slightly more. Floods normally occur during the late winter season. The wettest month is March with average precipitation of 5.7 inches. September and October are usually the driest months with under 3.5 inches of precipitation. Annual precipitation averages 52 inches.

The prevailing winds are from the southeast; winds from the west and northwest, however, are common during the fall and winter. The average wind velocity is highest during the winter and lowest during the summer. Destructive thunderstorms and tornados occur when cyclonic disturbances pass through the area. Their greatest frequency is from February through April.

2.1.4 Plant Resources

Redstone Arsenal falls within the southern region of the Temperate Forest Biome (Shelford 1963:59). As part of this deciduous forest biome, the original vegetation of the Arsenal area was predominantly hardwood species. Nearly all of the native forest has been cut for timber and to clear land for other uses, in particular agriculture. Major remnant species of the native forest include white oak, red oak, cherrybark oak, chestnut oak, white ash, yellow poplar, red maple, elm, walnut, flowering

dogwood, black locust, black gum, and eastern red cedar. Forest communities cover some 40 percent of the Arsenal area. Over 80 percent of the forested land consists of natural woodland. Much of the Arsenal land not in forest is used for pasture through agricultural leases (Harland Bartholomew and Associates 1977:2-27).

2.1.5 Animal Resources

The temperate deciduous forest biome provides habitat for a variety of animals important to the subsistence of prehistoric peoples. Aquatic animals probably provided a substantial amount of dietary protein during the late spring, summer, and early fall. Important species were bass, bream, buffalo fish, catfish, crappie, freshwater drum, and perch. In addition, frogs, mussels, snakes, and turtles may have also provided food during the warm months. In the past the turkey was also an important food source.

The Wheeler National Wildlife Refuge, 4000 acres of which are within Arsenal boundaries, presently houses numerous and varied animal species. Today well over 100 species of fish are reported in Arsenal area waters, and approximately 50 percent are considered common or abundant. Three species, however, are considered rare or endangered, including the Tuscumbia darter (Etheostama tuscumbia). The known range of this fish is small and is limited to the Redstone Arsenal area (Harland Bartholomew and Associates 1977:2-26, 2-27). The American alligator, an endangered species, is known to occur today on or near the Arsenal.

A variety of other fauna exists on the Arsenal. Over 250 species of birds are known to visit or to live permanently in the Arsenal area. The Wheeler National Wildlife Refuge is a winter home for some 24 species of migrating waterfowl. Species found on or near the Arsenal and listed as rare or endangered include raptors (golden eagle, bald eagle, Cooper's hawk, sharp-shinned hawk, and osprey) and the red-cockaded woodpecker (Harland Bartholomew and Associates 1977:2-26, 2-28).

A variety of mammals, largely herbivorous, occurs on the Arsenal today. The most common is white-tailed deer. Two carnivores, fox and bobcat, are found less commonly. Rare and endangered species on or near the Arsenal include the Florida panther, Eastern cougar, several bat species, and the common black bear, among others. Two bat species, two fish species, and one salamander species have been reported to inhabit some or all of the 11 caves known to exist on the Arsenal (Harland Bartholomew and Associates 1977:2-27, 2-28).

2.1.6 Paleoenvironment

A study of late quaternary environments and early human habitation along the Tombigbee River in northeastern Mississippi and northwestern Alabama has been recently completed (Muto and Gunn 1985). Although it covers a region outside of the Huntsville-Arsenal area, it is a broad environmental study that also addresses paleontology, archeology, and culture history, and is relevant to the northern Alabama area.

Delcourt (1979) has documented a sequence of changes in the forest composition of the Eastern Highland Rim and adjacent Cumberland Plateau of Tennessee which extends over the last 40,000 years (Table 2-1). While no pollen data are available from the immediate area, paleoenvironment can be inferred from data obtained from Mingo and Anderson ponds (sinkholes) in the Eastern Highland Rim and Tennessee Cumberland Plateau of Tennessee.

Forty thousand years ago the Laurentide Ice Sheet extended into the Great Lakes Region. A pronounced gradient in climate and vegetation coincided with the position of the oak-hickory-southern pine forest in northern Alabama. A period of warming from about 28,000 to 23,000 years ago brought about a major shift in vegetation dominants from southern pine with oak and hickory to a vegetational pattern dominated exclusively by oak and hickory. During the peak in continental glaciation 18,000 years ago, jack pine forest with subdominants of spruce and fir prevailed in the Interior Low Plateaus and mid-slopes of the Appalachians. At

Table 2-1. A SUMMARY OF THE ENVIRONMENTAL HISTORY OF THE AREA OF THE REDSTONE ARSENAL

Delcourt and Delcourt 1981	
Date ^a	Inferred Climate
200 BP	Late-Holocene interval; modern climate; mixed hardwoods
5000 BP	Mid-Holocene interval; warm temperature; oak, hickory, southern pine
10,000 BP	Early-Holocene interval; cool, moist; mixed hardwoods
14,000 BP	Late glacial interval; cool, minor warming; mixed conifer, northern hardwoods
18,000 BP	Full glacial interval; much cooler; jack pine, spruce
25,000 BP	Farmdalian Subage; mild warming; oak, hickory
40,000 BP	Altonian Subage; cool; oak, hickory, southern pine

^a BP = years before present, with a present baseline of AD 1950.

approximately 16,500 years ago climatic amelioration resulted in the initial disintegration, then northward retreat, of the ice sheet. The response of the vegetation to minor climatic warming by 14,000 years ago was the expansion of the cool-temperate mixed conifer-northern hardwoods from the south and west replacing the jack pine and spruce forests. Mixed hardwoods prevailed in the region at 10,000 BP. From 8000 to 4000 years ago a major vegetation change took place as a result of increased warmth and aridity. The mixed hardwoods were replaced by oak, hickory, and southern pine. Vegetation during early settlement (200 years ago) is characterized by a mixed hardwood forest that developed in response to a cooling trend and increased precipitation (Delcourt and Delcourt 1981).

There are little data on changes in the faunal taxa accompanying the climatic changes in the Middle Tennessee Valley. Pleistocene vertebrates have been recorded from scattered sites throughout the state. Early investigators reported Megalonyx (giant ground sloth) and Mammut (mastodon). Falconer (1857) included Alabama as one of the locations for his new species Elephas columbi (Columbian mammoth). His statement was based on a single tooth found in "Alabama, near the Gulf of Mexico" (Hay 1923:164-165). There is also evidence for Elephas (mammoth), Equus (horse), and Bison (bison) (Thurmond and Jones 1981:177-191). There are no dates available for the Alabama specimens, but radiocarbon dates of $13,500 \pm 400$ BP (King 1973:52) have been established for mastodon tusks located in eastern Missouri, which would have placed them in the area well within the time period estimated for the earliest occupation. Further, a Clovis-Mastodon association has been discovered in Kimmswick, Missouri, approximately 32 km south of St. Louis (Graham et al. 1981:1115). Due to comparable ecological conditions, it is possible that Mammut existed in Alabama during the area's earliest human occupation.

2.2 THE CULTURAL ENVIRONMENT

A brief summary of the cultural history of the Redstone Arsenal area is outlined in Table 2-2.

Table 2-2. A SUMMARY OF THE CULTURAL CHRONOLOGY OF THE AREA OF THE REDSTONE ARSENAL

Cultural Unit		Kinds of Archeological Remains Representative of Period			
Tradition	Period or Phase	Date	General Settlement Patterns	General Subsistence Systems	
Historic		AD 1750 to present	Development of towns and cities; exploitation of mineral resources and water for transportation	Agriculture, iron and coal mining	American and European manufactured goods
Ethnohistoric		AD 1835 to 1540	Groups of confederated principal towns surrounded by lesser villages and farmsteads, located on the flood plains of rivers and major streams	Horticulture, hunting and gathering, trade for European goods	Chipped stone and pottery; English, French, and Spanish trade goods, i.e., beads, guns, bottles, jewelry.
Mississippian		AD 1540 to 1000	Large, permanent villages with ceremonial complexes surrounded by smaller villages and farmsteads, located on flood plains of rivers and major streams	Horticulture; hunting and gathering; trade with peoples of Moundville, Etowah, and other areas	Substructure earthen mounds, ditches, and earthen enclosures; sand and shell tempered pottery; chipped stone tools
Late Woodland	McKelvey	AD 1000 to 500	Small farming villages located on floodplains and upland rock shelters used as temporary hunting camps	Horticulture; hunting and gathering	Cord-marked, check-stamped, and plain sherd-tempered pottery
Middle Woodland	Copena	AD 500 to AD 1	Open-air villages in or near bottomland and upland rock shelter camps	Hunting and gathering with some horticulture	Platform pipes; medium sized straight based projectile point/knives; green stone axes; paddle-stamped ceramics
Early Woodland	Colbert	AD 1 to 200 BC	Floodplain villages and villages located on the terraces of smaller tributaries	Hunting and gathering with some horticulture	Longbranch Fabric Impressed and Mulberry Creek Plain limestone-tempered ceramics
Gulf	Hardin	200 to 500 BC	Floodplain villages and villages located on the terraces of smaller tributaries	Hunting and gathering with some horticulture	Sand-tempered Alexander ceramics
	Late	500 to 1000 BC	Large seasonally-occupied sites in river valleys; small upland camps	Hunting and gathering with some horticulture	Fiber-tempered pottery; stemmed projectile points

Table 2-2. A SUMMARY OF THE CULTURAL CHRONOLOGY OF THE AREA OF THE REDSTONE ARSENAL (concluded)

Cultural Unit		Period or Phase	Date	General Settlement Patterns	General Subsistence Systems	Kinds of Archeological Remains Representative of Period
Tradition						
Archaic	Middle to Late	1000 to 3000 BC	Large shell middens in river valleys; smaller upland camps; seasonal occupation	Hunting and gathering; shell fish are an archeologically conspicuous part of the diet. incipient horticulture	Stemmed and notched projectile points; ground stone tools	
	Early to Middle	3000 to 7000 BC	Both open air and rock shelter camp sites located in river valleys and upland areas	Hunting and gathering	Projectile points with side or corner notching or bifurcated bases; other lithic tools	
Paleo-Indian		7000 to 10,000 BC	Open air sites in river valleys and uplands	Hunting and gathering; use primarily of medium and small game with some exploitation of megafauna	Fluted and non-fluted lanceolate projectile points and other lithic tools	

2.2.1 Prehistory

Paleo-Indian Era (12,000-8000 BC). This era is postulated as the time people first entered North America. The projectile point/knife types (Clovis, Cumberland, Beaver Lake, and Quad) are limited to surface finds whose temporal positions have been determined elsewhere (Walthall 1980:26). With few exceptions, Paleo-Indian sites are found in eroded contexts in the Southeast. The settlement and subsistence pattern appears to have been based upon small family bands. Regional exchange of chert and other resources probably was conducted through kin interaction between neighboring bands. Food was obtained by hunting and gathering and, although Paleo-Indians may have exploited megafauna, Walthall (1980:35-37) suggests that they subsisted primarily on small- and medium-sized game in addition to available plant foods. After the advent of the Holocene, subsistence necessarily became more oriented upon vegetable resources and small- and medium-sized game.

The likelihood of finding such remains on the facility is considered high given the geomorphic setting and close proximity to the Tennessee River. The facility is well within the known major concentration of fluted projectile point/knife distributions in eastern North America (Mason 1962). While the sites in the northern portion of Redstone Arsenal might lack stratigraphic integrity because of the erosional nature of the soils, the sites in the southern area of the facility have a high probability of containing intact Paleo-Indian remains in their lower levels due to soil deposition. Schroder (personal communication 1984) notes that Paleo-Indian materials are known from the north-central and east-central areas of the Arsenal. To date, one site with a Paleo-Indian component (1Ma141) has been identified (Section 4.0, Table 4-2).

Eastern Archaic Era (8000-1000 BC). The Archaic Era is defined with emphasis on three factors: adaptation, time, and technology. Cultural material of this era in the mid-South is well-known, with numerous excavations conducted throughout northern Alabama (Walthall 1980:36-76). A seasonal hunting and gathering adaptation is posited for much of the

era with an emphasis on white-tailed deer and various seeds. People depended upon smaller game animals, and data from excavated sites indicate a selection for a greater variety of fauna than that of Paleo-Indians. Settlements seem to have been seasonally occupied, although increasing territoriality is evident in the distribution of specific artifact types. Site location seems to have been determined largely as a result of the location of adequate plants, animals, water, and raw materials for tool manufacture. Of primary interest as criteria for this period are the heavy ground-stone woodworking tools generally regarded as prerequisite to the successful occupation of forest environments (Willey and Phillips 1958:107-108).

The Archaic era has been divided into three periods. The Early Archaic (8000-6000 BC) was a time of gradual climatic alteration at the end of the Pleistocene and subsequent culture change. Four pan-eastern cultural themes are identified during this period: Dalton, Big Sandy, Kirk, and Bifurcate horizons (Walthall 1980:45-57). The Middle Archaic period (6000-3000 BC) is characterized by the Morrow Mountain horizon. New technological developments include the atlatl, domesticated dogs, groundstone, bone and antler implements, and basketry. Warmer and drier climates mark this period (Walthall 1980:57-67). The Middle Archaic period includes Eva and Morrow Mountain types. Rock shelters came into greater use during this period. Social organization remained at the band level and plants and small game constituted the major food supply; fish and deer would have been important in the spring/ summer and fall/winter, respectively. The Late Archaic period (3000-1000 BC) witnessed arrival of modern climates and environments and marked increase in population growth, and new technological innovations included domesticated tropical and native plants. A pan-eastern trade network and burial ceremonialism came into being (Walthall 1980:67-76). Primary diagnostic types include a variety of long-stemmed projectile points/ knives: Cotaco Creek, Elora, Kays, Little Bear Creek, McIntire, and Pickwick. The Late Archaic settlement pattern appears to have included both small, briefly occupied upland camps; and large, generally permanent floodplain camps. Hunting

was a yearly endeavor, and analysis of floral remains suggests that plants such as sunflower and Chenopodium may have been cultivated in small garden plots.

The representation of Archaic Era remains and settlements on the Redstone Arsenal is evident in Table 4-2 (Section 4.0). Research to date has revealed three shell middens, two villages, and 29 lithic scatters on terraces overlooking water, including Early through Late Archaic components. The likelihood of finding additional remains on the facility is considered high, given the geomorphic setting and abundance of available surface water.

Gulf Formational Era (1000-300 BC). The Gulf Formational Era represents a continuation of the Archaic lifeway with the addition of ceramic technology. The initial ceramics are fiber tempered, but are later tempered with sand (Alexander) and decorated by incising and punctating (Walthall 1980:77-103). The associated projectile point/knife types include Flint Creek, Little Bear Creek, and other stemmed types. The facility is located on the northeastern edge of the distribution of Gulf Formational cultures and their representation may not be evident. Thus, Gulf Formational sites may be lacking and Late Archaic sites may be more numerous within this time span. Previous archeological surveys have not recorded any Gulf Formational sites on the facility.

Woodland Era (300 BC-AD 900). The Woodland Era is typified by an elaboration of ceramic technology and material culture in general. In some areas of the Southeast horticulture may have played a significant role in the subsistence. Settlement became sedentary or seasonal, and habitations continued to focus upon the floodplain environment. Social organization intensified with the development of status positions. Exchange of exotic raw materials and ceremonial items was enacted over a broad area in the eastern United States (Walthall 1980:141-147).

Three phases have been defined in the Middle Tennessee Valley: Colbert (Early Woodland, 300 BC-AD 1), Copena (Middle Woodland, AD 1-AD 500) and McKelvey (Late Woodland, AD 500-900)(Walthall 1980:112-137). Colbert habitation sites are characterized by fabric-impressed and plain limestone-tempered, wide-mouthed jars. Settlement patterns include large occupations along the river bank, away from the main river channel, and in upland bluff shelters. The open sites exhibit extensive evidence of storage pits, post holes, ovens, and hearths. Hunting, fishing, gathering, and to some extent gardening, were important economic pursuits. The Hopewellian Copena culture is known primarily from its exotic burial complex. During Copena times there seems to have been a reduction in riverbank sites, a gradual shift from the use of upland sites as temporary camps to use as special hunting camps, and the decline in mussel utilization at sites where they were collected by earlier and later Woodland groups. Copena ceramics are limestone tempered with plain or paddle-stamped (checked, simple, and complicated) surfaces. The lithic assemblage consists of an assortment of medium-sized triangular and stemmed projectile point/knives and a variety of tools such as large, imported greenstone digging implements.

The Late Woodland McKelvey culture is defined on the basis of grog-tempered, plain, check-stamped, and cord-marked globular pots with slightly flaring mouths. After about AD 700, cord marking begins to replace check stamping as a major ceramic surface treatment. Arrow points are small and triangular. The settlement pattern includes sites in the floodplain, small tributary valleys, and upland rock shelters. Hunting and gathering is still the predominant subsistence strategy, but gardening continues to assume an increasingly important role.

Within the Arsenal one Early Woodland lithic scatter has been reported. Middle Woodland components include three lithic scatters, one burial cave, and one burial mound group. One Late Woodland shell midden and three lithic scatters have been recorded. The abundance of Woodland sites is demonstrated in Table 4-2 (Section 4.0). The likelihood of

finding additional remains on the facility is great, given the ecological setting and the proximity of open water.

Mississippian Era (AD 900-1500). The material culture of this era is characterized by the presence of shell-tempered, plain, incised, and painted bowls, bottles, jars, and effigy ware. Small triangular arrow points were used in hunting and warfare. The Mississippian phase in the Wheeler Basin Era is represented at Hobb's Island, on the Tennessee River less than three miles upstream from the Arsenal's southeast corner. Hobb's Island people constructed temple mounds and burial mounds for the dead, who were often accompanied by pottery vessels, shell gorgets, as well as large numbers of beads. The shell gorgets often were engraved with the southeastern ceremonial complex design. Horticulture, emphasizing corn, squash, beans, and sunflower, became an important mode of subsistence and gave rise to a complex ceremonial system. Social organization became more complex with the rise of chiefdoms. Long distance trade, territoriality, and warfare also were significant developments. Settlement consisted of ranked ceremonial centers containing earthen platform mounds and associated places, surrounded by smaller villages and farmsteads, all of which were commonly located on the floodplains (Walthall 1980:185-245).

No Mississippian sites have been reported yet on the facility. There is some possibility of the existence of Mississippian components there, based on the amount of arable land and abundance of open water on the facility.

2.2.2 Ethnohistory

In 1539, Hernando de Soto, governor of Cuba, landed at Tampa Bay with enough provisions to equip an army of 600 soldiers. He travelled through parts of modern day Florida, Georgia, South Carolina, North Carolina, and Tennessee before entering Alabama on or around July 1, 1540, in present-day Jackson County in the extreme northeastern part of the state. Marching southward along the Tennessee River Valley, de Soto arrived at

the town of Coste which Swanton (1946:48) believes was situated on Pine Island. After a short stay he marched further south to the Cherokee village of Tali, which Swanton (1946:48) places on McKee Island near Guntersville, approximately 30 km southeast of the project area. Staying in Tali one day, the expedition left the Tennessee River, travelled overland to the Coosa River, and then down the river to the great town of Coca. From here their journey took them further south to near present-day Mobile, then north and west toward the Mississippi River and out of the vicinity of the Redstone Arsenal.

When Hernando de Soto first explored the middle reaches of the Tennessee River in 1540 he found a few small settlements in the region. Though the area had an environment conducive to human habitation, this lack of large settlements was attributable to prevailing intertribal boundaries and animosities. The Cherokee were located to the northwest on the head waters of the Tennessee River. Located downstream were the Chickasaw, while bordering both tribes to the south were the settlements of Muskogean-speaking tribes, probably the precursors of the Upper Creek Confederacy. All three groups considered the fertile territory of the Middle Tennessee River as belonging to them, and the often bitter disputes over this area had left it a political vacuum inhabited by small transitory groups. (The early explorer's poor mapping skills and incomplete descriptions make it difficult to locate settlements and movements of the different ethnohistoric tribes. Most tribes can be located only relative to other, better known neighbors [Altschul 1980a:46]).

Twenty years later de Soto was followed by Tristan de Luna, who was appointed by Philip II to found a colony at Mobile Bay. Backtracking on the trail de Soto had taken, de Luna returned to Coca only to find a small village rather than the large town mentioned in glowing reports by de Soto's expedition members. Unable to found a settlement at Mobile Bay, de Luna returned to Florida, leaving the Middle Tennessee Valley undisturbed by European explorers for the next 150 years.

By the eighteenth century, British encroachment on the Cherokee's eastern border, French movement along the Chickasaw's southern and western borders, and Spanish involvement with the Creeks in Florida, forced all three tribes to begin moving into the Middle Tennessee Valley. As noted earlier, this area traditionally served as a buffer zone among the three Indian nations. By 1755, the Cherokee and Creek came into direct contact, resulting in a protracted war that culminated with a decisive Cherokee victory at Taliwa. After their defeat the Creeks withdrew from the Tennessee Valley.

In 1764, the Chickasaw established a settlement on Hobbs Island, where the Chickasaw eastward expansion and Cherokee westward expansion of the Tennessee River collided. The resulting war lasted until 1769 when the Chickasaw scored a decisive victory. Afterward both tribes retreated to more secure areas, once again leaving the Middle Tennessee Valley virtually abandoned. The relative positions of the two tribes was codified in 1786 by the Treaty of Hopewell which drew an indefinite line through Madison County, although neither tribe had any settlements in the area at the time. This situation lasted until a series of land cessions culminated for the Chickasaw in 1832 and the Cherokee in 1835, at which time they were removed to Texas and Oklahoma (Altschul 1980a:50).

No protohistoric or ethnohistoric Indian sites are presently known to occur on the Arsenal. The likelihood is low that such sites will be encountered because the population was sparse during that time period.

2.2.3 History

Prior to the American Revolution, the area encompassed by present day Madison County was claimed by three European and two Indian nations. Spain entered the earliest European claim in 1493, but established no colonies and their rights diminished until relinquished in 1740. England issued its claim to the area in 1497 but did not take an active role until the end of the seventeenth century when the fur trade made pacification profitable. France also viewed the natural wealth of the

Mississippi Valley as incentive for colonization and issued a claim for the territory in 1524. Disputes over the territory continued until 1763 when France lost the Seven Year's War and was forced to give up its rights to areas east of the Mississippi River. The last colonial claim was ceded by England at the end of the American Revolution in 1783 (Alexander 1979:20; Altschul 1980b:52).

In the years that followed, conflicting claims to the area by trading companies and other territories led to confusion over property rights. This continued until 1802 when the entire Mississippi territory, which included Alabama, was ceded to the United States. By 1806, all Indian rights to the land in northern Alabama were extinguished through treaties and land purchases. On December 13, 1808, Madison County was established and opened for settlement.

The first white settler in Madison County seems to have been John "Old Man" Ditto who established Ditto's landing, later to be known as Whitesburg, on the Tennessee River. Soon after, Joseph and Isaac Criner, accompanied by Stephen McBroom, explored the northern part of the county in 1804 and built a cabin on the Mountain Fork of the Flint River. In 1805, John Hunt and a man named Bean arrived at the Criner cabin in search of the "Big Spring" of Indian legend (Altschul 1980b:53). Bean soon returned to Tennessee but Hunt stayed on to build a cabin at Big Spring and bring his family to settle. By the end of 1805, several families had followed the same course from New Market to Big Spring and the colonization of northern Alabama had begun in earnest.

The settlement, originally called Twickenham and later Huntsville, was to become the first capitol of Alabama and an important cotton and textile center accessible by the Tennessee River and the Memphis and Charleston Railroad (Harland Bartholomew and Associates 1978:3-1).

In 1809, the population of squatters in the area was estimated to number five thousand and the government was forced to open land sales in

order to solve the problem of land disputes. In 1809, sales were for farm land only and the average price as \$2.00 per acre (Betts 1916:13). The following year the planning and surveying of the town was completed and on December 13, 1819, the Legislature of the State of Alabama set the boundaries of Madison County.

Many of those who purchased land were large land holders from Virginia. They saw the fertile land in the Middle Tennessee Valley as an excellent investment and soon moved family, furnishings, and slaves into northern Alabama. During the period 1814 to 1820 the town of Huntsville continued it's steady growth. Cotton land was producing \$100 income per acre, the first city tax on property was levied, Green Bottom Inn (where Andrew Jackson visited frequently) was built, the first public owned courthouse was started, and the first bank was organized.

Between 1820 and 1860, Madison County emerged as a major cotton producer. By 1860, over one quarter million bales of cotton were being shipped out of the county annually. In the South cotton implied slavery, and figures from this period indicate over 40 percent of the population of Madison County were slaves. However, in a vote taken in 1861, 70 percent of the population voted against seceding from the union. Yet when war broke out the county stood solidly behind the Confederacy (Altschul 1980b:56).

Huntsville suffered greatly during the war because of its importance as a supply depot. On April 11, 1862, the Union Army, led by Brigadier General D. M. Mitchell, captured the city along with 200 soldiers and 15 locomotives. Although the Confederacy was able to recapture the town the following fall, they were soon expelled and Huntsville remained in Union hands until the end of the war (Altschul 1980b:56).

As throughout the South, the Confederate defeat was devastating to the Huntsville economy. By 1878 cotton production had dropped to 25,000 bales annually from 250,000 bales annually in 1860. Production began to

increase slowly in the latter part of the nineteenth century, but the catastrophic 1920s boll weevil blight in southern Alabama again severely reduced Madison County cotton production. By 1930 the county had once again emerged as the leading cotton producing area in the state, and remains so today (Altschul 1980b:57).

While cotton has remained an important economic factor, the most dramatic changes in the last 30 years have been in response to non-agricultural industries. The population had remained relatively stable between 1860 and 1950, growing at only two percent per year. Since 1950 the population of Madison County has more than tripled, making Huntsville the fourth largest city in the state. The growth of the Huntsville area since World War II mainly reflects increased national interest in space exploration and intensified activity on the Arsenal. The boom years have ended, however, and Huntsville's growth rate has slowed (Harland Bartholomew and Associates 1978:3-4 to 3-5).

2.3 ARCHEOLOGICAL RESEARCH DIRECTIONS

Archeological research in the Tennessee Valley area prior to the eighteenth and early nineteenth centuries primarily was antiquarian in nature, with emphasis placed on the description of sites and the recovery of artifacts. During the 1930s through the late 1950s, archeologists developed an interest in establishing a chronology based on changes in the ceramics and lithics, enabling archeologists to describe the cultural sequence of an area. This objective remains an important goal for modern archeologists in a very restricted fashion which is limited to verifying, refining, and detecting local variations in previously established chronologies. Beginning in the 1960s, archeologists began to develop techniques which enabled them to examine subsistence patterns in archeological populations. How extinct peoples exploited and interacted with their environment throughout time remains an important problem in archeology. Another problem, related to studies of subsistence, is that of settlement. The question of why people selected the living and work

sites that they did, and to what extent environmental and social factors influenced the selection of those sites, remains of paramount importance if archeologists are going to study the interaction of social groups existing in the Valley at any one time. Once these factors are understood, archeologists will be able to examine the processes which necessitated changes in the social system through time.

In the context of future site inventories, research should be directed toward determining the temporal position of sites located, determining site function, and examining site location in terms of component and function. This contributes to the understanding of social dynamics at work among sites located on the Arsenal and those located in adjacent areas, as well as those social entities existing in the Tennessee Valley at large. Data recovery projects should emphasize refining the local chronology and gaining specific knowledge of subsistence technology and resource utilization, along with studies of intra- and inter-site variation where comparative data are available. In addition, it is recommended that paleoenvironmental data be sought both from archeological contexts and other sources.

AN ASSESSMENT OF ARCHEOLOGICAL RESOURCE
PRESERVATION AND SURVEY ADEQUACY

3.1 ENVIRONMENTAL CONSTRAINTS TO SITE PRESERVATION

The primary environmental factors used in assessing the potential for site preservation in any area are the effects of erosion and soil deposition. If deposition has been an on-going process, as is usually the case on stream terraces and floodplains, then cultural remains may be expected to be found sealed within deposited strata. Ridge tops and slopes are generally subject to varying degrees of erosion. The process of erosion may leave artifacts more or less in place but redeposited at lower elevations than those in which they were initially deposited. In addition, features that extended into erosion-resistant subsoils may be preserved. Other factors influencing site preservation are soil chemistry, which affects the preservation of organic materials, and soil permeability.

Redstone Arsenal is located in the southwestern portion of Madison County in northern Alabama, near the western foothills of the southern end of the Appalachian Mountains. The Arsenal is bounded on the east and northeast by the city of Huntsville and on the south by Tennessee River. It is located on the Tennessee River plain, and elevations range from 556 feet, which is the normal water level of the Tennessee River to the south, to 750 feet on the north (see Section 2.2.1, Earth Resources, for a more detailed discussion).

The topography of the Arsenal is slight to gently rolling. This topography allows ample opportunity for moderate to severe erosion, as the terrain is relatively flat and may contain shallow deposits. In areas where floodplains have formed, the potential for deeply buried sites is very good. As a result of the topography, water erosion and sedimentation would be the major environmental constraints affecting site preservation. Other conditions would include soil acidity, frost action, earth movement, animal activity, and treefalls. Each of these factors will have specific effects on particular archaeological sites given to the particular site history and environmental setting.

On February 2, 1957, the Tennessee River reached a flood stage elevation of 568 feet on the reservation, and approximately 12,790 acres (33 percent) were inundated for several days. On March 19, 1973, the Tennessee River reached a maximum flood stage elevation of 569.8 feet, inundating 14,200 acres (37 percent) of the Arsenal for several days (Harland Bartholomew and Associates 1978:2-2). Huntsville Spring Branch and Indian Creek are also subject to flood stage elevations.

Soil acidity will have had a major impact upon certain artifactual and ecofactual categories. Ceramics and faunal elements will be less likely to have been preserved as a result of soil acidity than lithics and plant remains, which are more resistant to that acidity. General characteristics of the Redstone Arsenal soils include sandy, silty, and clayey loams ranging from fine to cherty, along with silty clays (Harland Bartholomew and Associates 1978:2-2). Abundant leachings and the acidic nature of decaying litter have caused soils to be depleted in carbonates, especially calcium and potassium, and surface soils are acidic. Over most of the Arsenal soils are deep, well-drained upland soils, and are moderately acid. In the southern part soils are poorly drained lowland alluvial soils, and soils on tops of the mountains are derived from sandstone and shale (Harland Bartholomew and Associates 1977).

3.2 HISTORIC AND RECENT LAND USE PATTERNS

The area comprising Redstone Arsenal was acquired from 320 landowners during 1941 and 1942. Prior to the acquisition, land use was primarily designated as pasture land and farmland producing cotton, corn, hay, and small grain crops. Construction of present-day Redstone Arsenal began in 1941 and has continued as additional responsibilities have been assumed by the facility. Fifteen ground disturbance areas (GDAs) have resulted from a variety of construction activities. These GDAs are summarized in Table 3-1 and mapped in Figure 3-1.

Arsenal property also includes various lease and permit use areas. A total of about 21,000 acres is used in this way (Harland Bartholomew and Associates 1977:2-5), and includes acreage leased to agricultural and industrial concerns, NASA, the Navy, and Army Reserves, as well as acreage under use permit from the government (Wheeler National Wildlife Refuge and TVA) (Bill Schroder, personal communication 1985).

Five major ground disturbance areas are identified that resulted from facility construction activities and have impacted the area to a depth greater than six feet. These include administrative facilities (GDA 5) and are assessed at 30-60 percent disturbed. In addition, production facilities (GDA 9), research and development facilities (GDA 10), post maintenance, utilities facilities (GDA 13), and NASA Marshall Space Flight Center (GDA 14), are assessed at a disturbance level of greater than 90 percent. These ground disturbance areas comprise 7864 acres.

Seven GDAs are estimated to have been impacted to a depth of between six and three feet. A total of 4275 acres are 30-60 percent disturbed and include family housing (GDA 1) and training facilities (GDA 7). Troop housing (GDA 2; 116 acres) has been assessed at 60-90 percent disturbed. The community facilities (GDA 3), operational facilities (GDA 6), and operational maintenance facilities (GDA 8) have been assessed as greater than 90 percent disturbed, and represent 1749 acres.

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE REDSTONE ARSENAL

Location of Disturbed Area											
GDA No.	Type of Disturbance	Date Conducted (yr)	Reference	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Legal Reference ^c				Coincidental Sites
							Township	Range	Section	USGS Quad Map ^d	
GDA-1	Construction of Family Housing: Officers Fam. Housing Officers Fam. Housing MCO Family Housing	1942,46,56,70	FMP	663	3' - 6'	6:10	4S 5S 4S	1W 1W 1W	8,9 14 16,17	M775 F764 M775	NONE NONE NONE
GDA-2	Construction of Troop Housing: BOQ EM Barracks	1959	FMP	116	3' - 6'	7.5:10	4S 4S	1W 1W	8 21	M775 M775	NONE NONE
GDA-3	Construction of Community Facilities: Hospital Area Officers Mess, Rec. Area Community Center Chapel, Nursery MCO Open Mess M&M Center & School	1943,1981	FMP	248	3' - 6'	10:10	4S 4S 4S 4S 4S 4S	1W 1W 1W 1W 1W 1W	17 8 16 9 16 21	M775 M775 M775 M775 M775 M775	NONE NONE NONE NONE NONE NONE
GDA-4	Construction of Recreational Facilities: Golf Course Saddle Club Recreation Area Recreation Facility Bowling Center Rod and Gun Club Boat Dock Area Harbor Quarries Reservoir	1946-1965	FMP	3381	6" - 3'	3:10	4S 4S 4S 4S 4S 5S 5S 4S 4S	1W 1W 1W 1W 1W 1W 1W 1W 1W	7,8 8,9 22 22 22 24 27 29 29	M775 M775 M775 M775 M775 T763 F764 M775 M775	NONE NONE NONE NONE NONE 1Ma12,115 1Ma24 NONE NONE NONE
GDA-5	Construction of Admin. Facilities: Mariner Road Building Redstone Arsenal General Offices Lab & Admin. Bldg. Admin. Bldg./BASA Hdqtrs. Reserve Navy Constr. Battalion	1943-1960s	FMP	607	6+	5:10	5S 5S 5S 5S 4S	1W 1W 1W 1W 1W	5 4,5 12 14 9	M775 M775 F764 F764 M775	NONE NONE NONE NONE NONE

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE REDSTONE ARSENAL
(continued)

GDA No.	Type of Disturbance	Date Conducted (yr)	Reference	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Location of Disturbed Area				
							Township	Range	Section	USGS Quad Map	Coincidental Sites
GDA-6	Construction of Operational Facilities: Redstone Army Airfield WYO Fac. Building Borrow Area	1945	FMP	791	3' - 6'	10:10	4S	2W	13	M775	NONE
							5S	1W	16	T763	NONE
							4S	2W	24	M775	NONE
GDA-7	Construction of Training Facilities: HIFAR Training Facility MKS Classrooms Chemical Train. Facility Troop Training Area Ammo Training Area	1966, 67, 74	FMP	3612	3' - 6'	5:10	4S	1W	22	H775	NONE
							4S	1W	21	M775	NONE
							4S	1W	21, 28	M775	NONE
							5S	1W	27	T763	NONE
							5S	1W	3, 34	H775	1Ma166
GDA-8	Construction of Operation Maint. Facil. Maintenance Shops Shops Maint. Area	1942	FMP	710	3' - 6'	10:10	4S	1W	20, 21, 28	M775	NONE
							4S	1W	27	H775	NONE
GDA-9	Construction of Production Facilities Thiokol Corporation Raytheon Facility Assembly Building	1942	FMP	3240	6+	10:10	5S	1W	14, 15	F764	NONE
							5S	1W	13, 14	F764	NONE
							5S	1W	1, 2	H775	1Ma219
GDA-10	Construction of Res. & Devel. Facilities Research Lab Test & Qual. Fac. McMorrow Lab Lab & Admin. Bldg. Borrow Pits	1960s	FMP	722	6+	10:10	4S	1W	31, 32	M775	NONE
							4S	1W	32	M775	NONE
							4S	1W	33	M775	NONE
							5S	1W	15	F764	NONE
							4S, 5S	1W	4, 33	M775	NONE

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE REDSTONE ARSENAL
(continued)

3-6

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE REDSTONE ARSENAL (concluded)

GDA No. ^a	Type of Disturbance	Date Conducted (yr)	Reference ^b	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Location of Disturbed Area				
							Legal Reference ^c				Coincidental Sites
							Township	Range	Section	USGS Quad Map ^d	
GDA-13	Construction of Post Maint. & Util. Fac: Sewage Disposal Plant 1 Sewage Treatment Plant 3 Sewage Treatment Plant 4 Primary Substation 2 Primary Substation 8 Sanitary Fill Unit Substations 6,7 Control Building Water Treatment Plant 1 Water Treatment Plant 2 Control & ID Building Telephone Exchange	1943	FMP	1454	6+	10:10	5S	1W	2	H775	NONE
							4S	2W	36	M775	NONE
							4S	1W	27	H775	NONE
							4S	1W	27	H775	NONE
							4S	1W	32	M775	NONE
							5S	1W	4,5,9	M775	NONE
										T763	
							4S	1W	32,33	M775	NONE
							5S	1W	28	T763	NONE
							5S	1W	19	T763	1Ma124
							5S	1W	27	F764	NONE
							4S	1W	26	H775	NONE
							4S	1W	33	M775	NONE
GDA-14	Construction of NASA Marshall Space Flight Center	1960s	FMP	1841	6+	10:10	4S	1W	6,8 30,31, 32	M775	Redstone Test Stand
GDA-15	Major Streets		FMP	3065	6" - 3'	10:10				F764 M775 T763 H775	NONE NONE NONE NONE

^aGround Disturbance Areas (GDAs) as mapped in Figure 3-1.^bFMP = Facility Master Plan.^cBase meridian is the Huntsville Meridian.^dT763 = Triana, AL, 7.5 min. sheet (1951, photorevised 1963).

M775 = Madison, AL, 7.5 min. sheet (1964, photorevised 1975).

F764 = Farley, AL, 7.5 min. sheet (1947, photorevised 1964).

H775 = Huntsville, AL, 7.5 min sheet (1964, photorevised 1975).

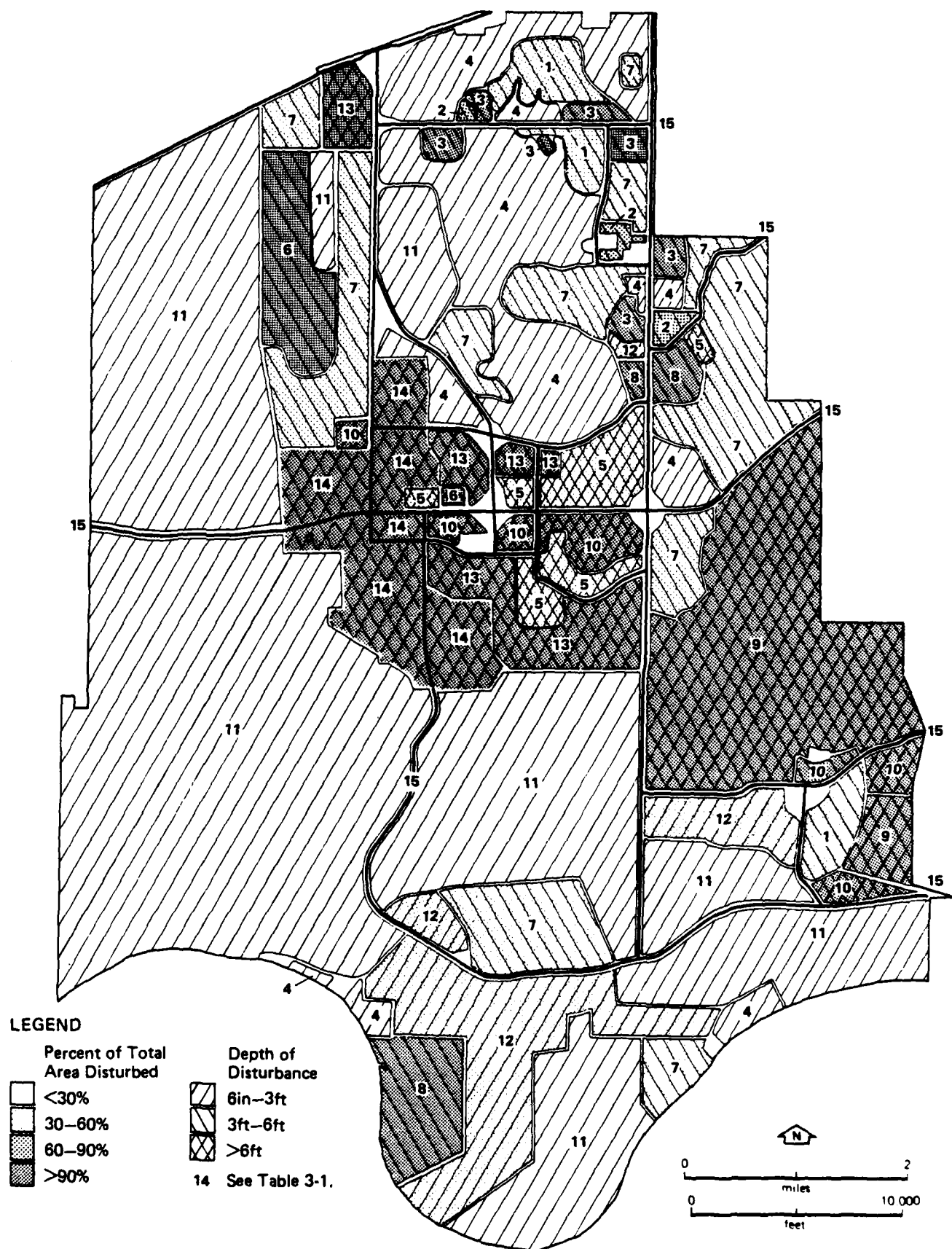


Figure 3-1. MAP OF HISTORIC AND/OR MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE REDSTONE ARSENAL

The remaining GDAs are estimated to have been impacted to a depth of between three feet and six inches. The recreational facilities (GDA 4; 3381 acres) and test area (GDA 11; 15,896 acres) are estimated to be less than 30 percent disturbed. The storage facilities (GDA 12; 2313 acres) have been assessed at 30-60 percent disturbance. The remaining GDA (15; 3065 acres) of this depth consists of major streets and is estimated to be greater than 90 percent disturbed.

Chemical contamination, although not contributing directly to major ground disturbance, has had a negative impact upon cultural resources through contamination of materials providing potential radiocarbon determinations, destruction of plant and animal remains, and alteration of soil chemistry. In the past, industrial wastewater was generated at many locations on the Arsenal. Government-owned, contractor-operated facilities also generated small quantities of overflow oils, developer and fixer chemicals, detergents, degreasing agents, ammonium compounds, and paint strippers.

The future mission of the Arsenal, which will involve concussion and vibration of the earth from missile firings and ammunition detonation, could impact any undiscovered archeological resources.

3.3 PREVIOUS CULTURAL RESOURCE INVESTIGATION: COVERAGE AND INTENSITY

Archeological Survey

Eight archeological surveys have been conducted on Redstone Arsenal, resulting in the recognition and evaluation of 111 archeological sites (Table 3-2, Figure 3-2). (The Redstone Test Stand, the 112th site, is a historic National Register property and was not recorded during survey). The 1804 acres that have been surveyed comprise less than five percent of the total facility area (38,303 acres). These surveys date from 1932 to 1983 and range from non-systematic reconnaissance survey to systematic pedestrian survey based on sampling schemes of from 20 to 100 percent coverage.

Table 3 2. ARCHEOLOGICAL SURVEYS CONDUCTED ON THE REDSTONE ARSENAL

Survey Administration				Survey Location			Artifacts		Survey Characteristics			Identified Archeological Resources						
SHPO Survey Institution.	Survey Date (yr)	Survey Record	Bibliographic Reference	UTM		Township	Legal Description		USGS Quad Map	Collection Policy	Curatorial Repository	Survey Type, Area	Temporal Coverage	Transect Type, Interval (m.)	Rate (a./person day)	Subsurface Test Sites	Isolated Finds, Features	
				North-ing	East-ing		Range	Section										
None	UA	1933	UA	Webb 1939	UN	UN	5S 1W	22,23 24,26, 27	F764	F	UA	UN	P	UN	UN	UN	11	0
							5S 1W	30,31, 32,33	T764									
							5S 2W	22,23 24										
							6S 1W	4,5	T764									
None	UA	1979	UA	Alexander 1979	UN	UN	4S 1W	22,26, 27,34, 35	H775	F,SC	UA	S,B	P,H	T(10-25m)	UN	A,ST	78	10
							5S 1W	1,2,3	H775									
							4S 2W	13,14, 24,25	H775									
								26										
							5S 1W	4,5,6	H775									
							5S 1W	10,11, 12,22, 23,24, 26,27	F764									
							5S 1W	27,28, 29,30, 31,32, 33,34	T764									
							5S 2W	11,13, 14,23, 24										
							6S 1W	4	T764									
None	WAR	1980	UA	Thomas 1980	UN	UN	4S 1W	35	H775	CD,SC	UA	S(75)	P,H	T(30)	UN	ST	1	UN
					UN	UN	5S 1W	11,12, 23,24	F764									
					UN	UN		24										
					UN	UN	5S 1W	1,2	H775									
None	UA	1980	UA	Oakley 1980	UN	UN	4S 1W	8,9	H775	F,SC	UA	S(3.7)	P,H	UN	UN	ST	16	UN
					UN	UN												
					UN	UN												

Table 3-2. ARCHEOLOGICAL SURVEYS CONDUCTED ON THE REDSTONE ARSENAL (concluded)

Survey Administration				Survey Location				Artifacts		Survey Characteristics			Identified Archeological Resources						
SHPO Survey Institution, Firm ^a	Survey Date (yr)	Survey Record	Bibliographic Reference	UTM ^b		Township	Legal Description		Col-lection Policy ^d	Cura-torial Repository ^e	Survey Type, Coverage ^f	Trans-sect Type, Interval (m.) ^g	Rate (a./person day)	Sub-sur-face Tests ^h	Iso-lated Finds, Features				
				North-ing	East-ing		Range	Sec-tion											
																USGS Quad Map ^c			
None	1981	UA	Shelley 1981	UN	UN	4S	1W	27	M775	F, SC	UA	S(.3)	P	T(30)	UN	ST	2	UN	
				UN	UN	4S	1W	9	H775										
None	1982	UA	Alexander 1982	3835650	528300	5S	2W	SE/MW	M775	C, SC	UA	UN	H	R(20)	UN	ST	1	0	
								2											
None	1983	UA	Oakley 1983a	3829900	527600	5S	2W	MWA, SWA, 13	T764	C, SC	UA	UN	P	T	UN	H	1	0	
None	1983	UA	Oakley 1983b	3831270	536880	5S	1W	11	F764	C	UA	UN	P	UN	UN	None	1	0	

^a UA = University of Alabama (Office of Archeological Research); MWR = New World Research (see Section 3.3).

^b UTM = Universal Transverse Mercator coordinates, Zone 16. If the survey is a linear corridor, the coordinates of its two ends are listed. If it is a block area of less than 10 acres in extent, the coordinates of the approximate center of the survey area have been noted. If the study is a block area of larger size, the corners of a 3-or-more sided figure enclosing the survey area have been located. Survey areas, exclusive of Alexander (1979), have been mapped in Figure 3-2.

^c M775 = USGS Madison, AL, 7.5 min. sheet (1964, photorevised 1975); H775 = USGS Huntaville, AL, 7.5 min. sheet (1964, photorevised 1975); T764 = USGS Triana, AL, 7.5 min. sheet (1951, revised 1964); F764 = USGS Farley, AL, 7.5 minute sheet (1947, revised 1964).

^d Survey collection policies vary widely, both on a site-to-site basis within a single survey project, as well as among different surveys. Collection policies of the surveys identified here were formal collection of surface samples (P); collection of diagnostic artifacts (CD); collection of subsurface artifacts revealed during testing (SC); 90 percent of surface-evident artifacts collected (C).

^e S = an intensively reviewed sample; B = boat reconnaissance; UN = unknown or undetermined.

^f P = prehistoric; H = historic.

^g R = random; T = specified transect; UN = unknown or undetermined.

^h ST = shovel tests; A = auger probe; H = backhoe; UN = unknown or undetermined.

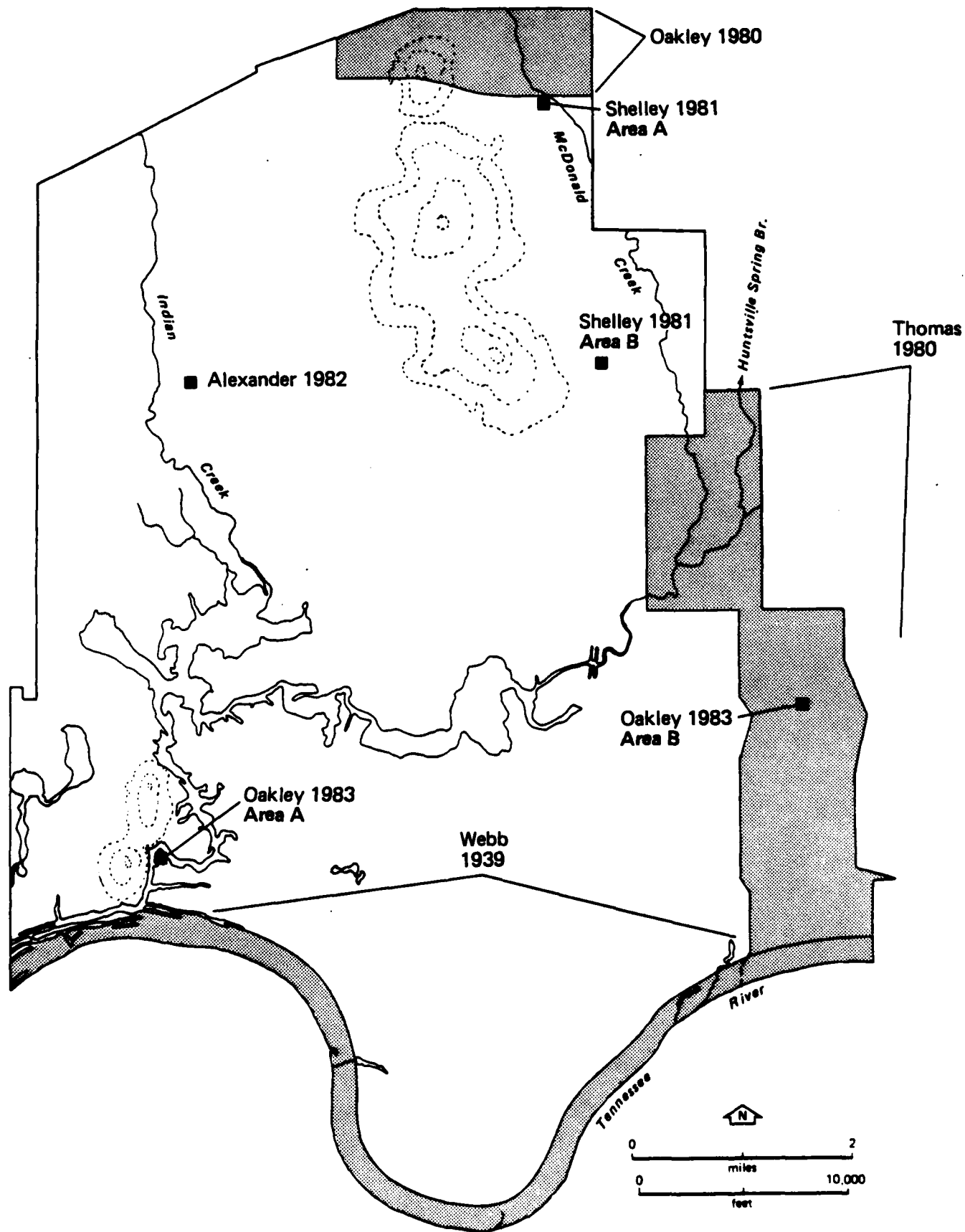


Figure 3-2. MAP OF ARCHEOLOGICAL SURVEYS CONDUCTED ON THE REDSTONE ARSENAL, exclusive of Alexander (1979); see Section 3.3.

Initial archeological survey of Redstone Arsenal area was conducted in the summers of 1932-1933 by the Alabama Museum of Natural History (University of Alabama) under the direction of Walter B. Jones, to locate sites before the reservoir created by the proposed Wheeler Dam inundated the Tennessee River floodplain (Webb 1939:95). Jones located 237 archeological sites in Wheeler Basin; 11 of these were located within present-day Redstone Arsenal (1Ma12-1Ma30; Table 4-1). Approximately 1600 acres were subject to survey coverage estimated at 25 percent (for a total of 400 acres), based on the amount of area covered by the overall survey, the amount of time involved in the survey, and the known techniques used in the early 1930s.

In the summer of 1978 the Office of Archaeological Research of the University of Alabama (UA), conducted a literature search of the Arsenal history and a 100-percent-coverage field reconnaissance with shovel tests of some 43 areas scattered throughout the Arsenal (totalling 340 acres) for the Army Corps of Engineers, Mobile District (Alexander 1979:1, 31). Six classes of resources were identified: isolated finds, minimal lithic scatters, lithic scatters, midden deposits, mounds, and historic sites. Alexander (1979) located 78 sites (1Ma95-1Ma174; Table 4-1) and revisited 11 sites previously recorded by Webb (1939).

During April of 1980 UA conducted a cultural resources reconnaissance of 375 acres on Redstone Arsenal prior to transferral of the property to the Alabama Space and Rocket Center (Oakley 1980). Field survey (100 percent coverage) included shovel testing, and revealed the presence of 16 sites (1Ma191-1Ma208; Table 4-1) in addition to a previously recorded site (1Ma105)(Alexander 1979:65-66). Cultural components represented by the sites range from Early Archaic to Historic.

In 1980 New World Research conducted a cultural resources survey for the U. S. Army Corps of Engineers, Mobile District (Thomas 1980). The reconnaissance survey covered 20 percent of a 6400-acre parcel, 3144 acres of which were within Arsenal property (Figure 3-2), for a total of

approximately 629 acres surveyed. Fourteen sites (1Ma133, 140-142, 152-159, 162, and 219) (Table 4-1) were recorded during survey.

In February of 1981 New World Research conducted a 100-percent-coverage pedestrian field survey and shovel testing of 33 acres in two proposed borrow pits (Shelley 1981). Two prehistoric lithic scatters (1Ma232, 1Ma233; Table 4-1) were recorded and were recommended for testing in order to determine extent and assess their significance.

In July of 1982 UA conducted a Phase I archeological reconnaissance of a 10-acre plot as part of the proposed construction of the Missile Systems Software Center (Alexander 1982). A literature and background search of the project area was conducted, and the one-hundred-percent-coverage field reconnaissance included shovel testing. One site (1Ma235; Table 4-1) was identified. This historic structure, the remnant of a post-1911 house that may have been burned, may be associated with another site (1Ma173).

In June of 1983 UA performed a Phase II survey covering 100 percent of eight acres to be impacted by proposed construction activity (Oakley 1983a). Subsurface (backhoe) testing was also conducted. One site was recorded (1Ma238), but no intact cultural deposits were observed although Archaic materials were found.

In September of 1983 UA conducted a field reconnaissance (100 percent coverage) of nine acres to be impacted by proposed construction (Oakley 1983b). One small Middle Archaic lithic scatter (1Ma176) was recorded.

Based on the survey information presented here, it is estimated that a total of 1804 acres (approximately five percent) of the Redstone Arsenal has been surveyed to date for cultural resources.

Other Archeological Investigations

Seven archeological investigations have been completed on Redstone Arsenal involving subsurface examinations of sites containing cultural remains. Twenty-one archeological sites have been tested and evaluated (Table 3-3, Figure 3-3); one site (1Ma142) has been tested twice. This represents approximately 20 percent of the sites known to occur on the facility. Of these sites, nine were judged eligible for nomination to the National Register and 12 recommended for no further work.

In 1980 New World Research, Inc., conducted a reconnaissance-level cultural resources survey, test, and evaluation in the proposed alternate corridor of the DDT Contamination Study (Thomas 1980) for the U. S. Army Corps of Engineers (Mobile District) as part of a broader environmental impact study on DDT contamination. The study area consisted of a corridor approximately two by five miles, the western half of which was within the Arsenal. Thirteen archeological sites were tested that had been recorded previously by Alexander (1979): 1Ma133, 140-142, 152-159, and 162. Of these sites tested by Thomas (1980), seven were determined ineligible for the National Register. One site, 1Ma152, had been destroyed after Alexander's (1979) survey. This site contained a Middle and Late Archaic component as well as an extensive Civil War blacksmith's shop and powder magazine. Neither cultural midden nor intact subplowzone features could be documented for sites 1Ma153, -154, -155, -157, -158, or -159.

In February, 1981 the University of Alabama, Office of Archaeological Research (UA), conducted a Phase II archeological test and evaluation of site 1Ma24, originally was recorded in 1933 (Webb 1939), as a result of construction activities associated with the placement of an outfall sewer line (Alexander 1981). The site is located on a natural levee on the north bank of the Tennessee River. The field investigation consisted of a preliminary reconnaissance, augering, and backhoe trenching; results indicated that no archeological remains existed within the sewerline corridor. Site 1Ma24 is believed to have been a small lithic scatter

Table 3-3. ARCHEOLOGICALLY RELEVANT RESEARCH INVESTIGATIONS, EXCLUSIVE OF ARCHEOLOGICAL SURVEYS, CONDUCTED ON THE REDSTONE ARSENAL

Study No.	Study Type	Study Date	Institution, Agency, Firm ^a	Principal Investigator	Bibliographic Reference	Location						USGS Quad Map ^c	Associated Archeological Resources
						UTM ^b		Town-ship	Legal		Section		
						Morthing	Easting		Range	Section			
1	Test excavation	1980	WWR	P. M. Thomas, Jr.	Thomas 1980	UN UN	UN UN	4S 5S	1W 1W	35 23, 24	H775 F764	1Ma133 1Ma140, 141, 142 1Ma152- 157 1Ma158, 159, 162	
2	Phase II/test excavation	1981	UA	L. S. Alexander	Alexander 1981	3827100	528980	5S	2W	24	T764	1Ma24	
3	Phase II/test excavation	1981	USDA SCS	D. W. Chase	Chase 1981a	3840240 3840860 3840900	533180 532460 531680	4S 4S 4S	1W 1W 1W	9 8 8	H775 H775 H775	1Ma191 1Ma198 1Ma200	
4	Test excavation	1981	USDA SCS	D. W. Chase	Chase 1981b	3841750	531750	4S	1W	8	H775	A-26 (Cemetery)	
5	Phase II/test excavation	1981	WWR	M. T. Swanson and C. S. Weed	Swanson and Weed 1982	3839480	533400	4S	1W	9	H775	1Ma232	
6	Phase II/test excavation	1982	UA	L. S. Alexander	Alexander 1982	3835700	528300	4S	2W	5	H775	1Ma173	
7	Test excavation	1982	Redstone Arsenal	M. W. Schroder	Schroder 1982	3827280	536280	5S	1W	23	F764	1Ma142	

^a WWR = New World Research; UA = University of Alabama (see Section 3.3).^b UTM = Universal Transverse Mercator coordinates, Zone 16. If the area is less than 10 acres in extent, the N/E coordinates of the approximate center of the area have been recorded. If the area is larger, the corners of a 3-or-more sided figure that encloses the study area are identified here.^c M775 = USGS Huntsville, AL, 7.5 minute quad (1964, photorevised 1975); F764 = USGS Farley, AL, 7.5 minute quad (1947, revised 1964); T764 = USGS Triana, AL, 7.5 minute quad (1951, revised 1964); M775 = USGS Madison, AL, 7.5 minute quad (1964, photorevised 1975).

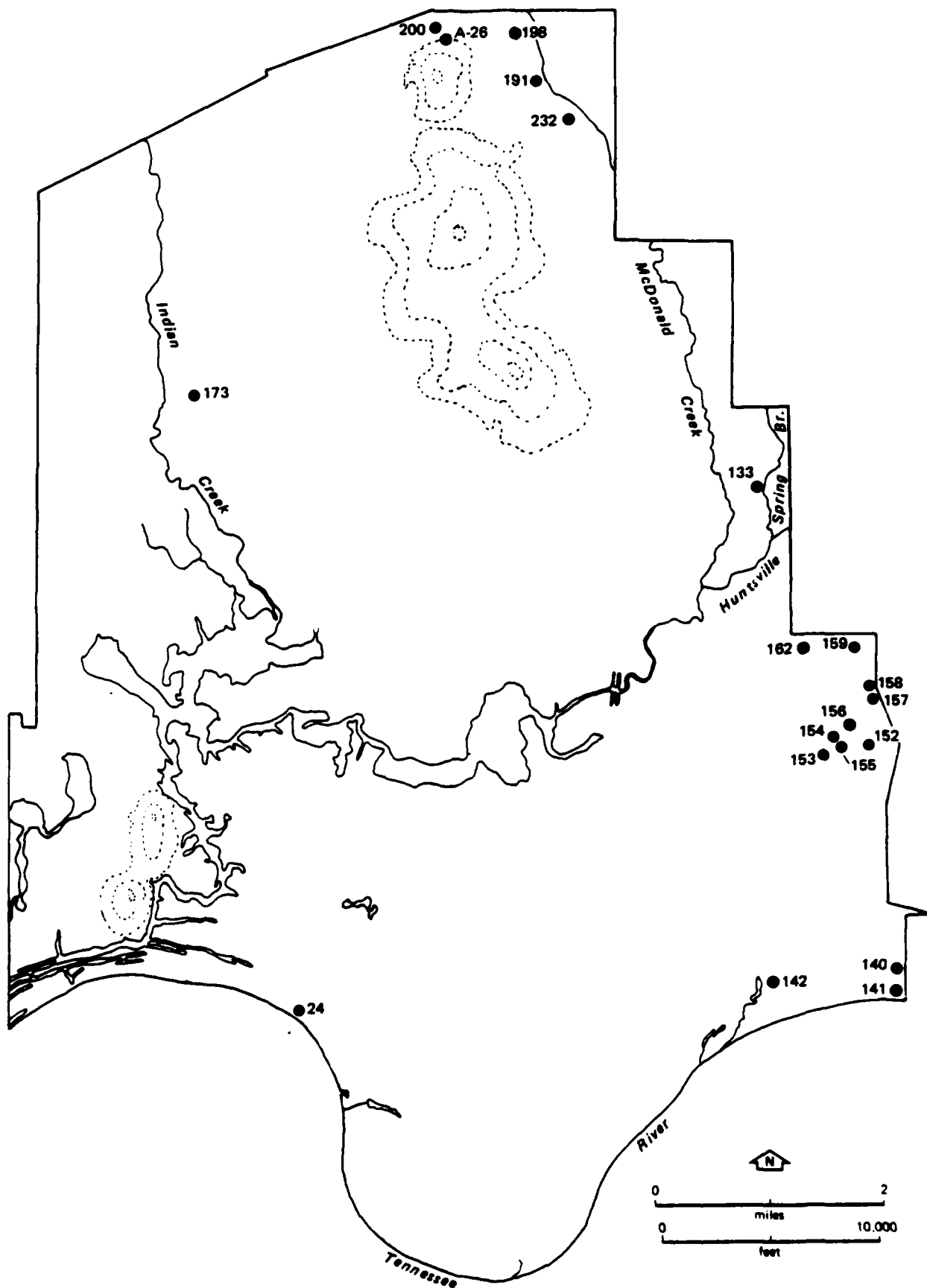


Figure 3-3. MAP OF ARCHEOLOGICALLY RELEVANT RESEARCH INVESTIGATIONS, EXCLUSIVE OF ARCHEOLOGICAL SURVEYS, CONDUCTED ON THE REDSTONE ARSENAL (See Table 3-3)

with no significant midden deposit and, although 1Ma24 could not be relocated, the area is considered likely to contain significant stratified archeological materials because of the buildup of point bar sediments in the vicinity.

In May of 1981, the USDA Soil Conservation Service (Chase 1981a) performed three Phase II investigations in areas adjacent to the Alabama Space and Rocket Center to make a final determination concerning National Register eligibility for sites 1Ma191, -198, and -200. This project was a follow-up study based on Oakley's (1980) earlier work in the area, and was carried out because of construction activities associated with the Space and Rocket Center. Test pits were excavated at 1Ma191. The site lacked evidence of midden deposits and subplowzone features and was considered ineligible for the National Register. No further work was recommended. Site 1Ma198 was not tested, but both Oakley (1980) and Chase (1981a) considered this 19th-century historic site to be National Register eligible. Site 1Ma200 was treated by subsurface testing. One portion of the site includes a large prehistoric component of unknown cultural affiliation, and a possible unmarked cemetery. The prehistoric part was tested; cultural materials were limited but widely distributed over the site. No further investigation was recommended, but monitoring during construction was recommended in case further cultural remains were located.

During August, 1981, the USDA Soil Conservation Service (Chase 1981b) conducted archeological investigations as a result of construction activities associated with the Alabama Space and Rocket Center. The tests were designed to determine the limits of a historic cemetery (A-26, this report) that would be impacted by construction activities. In the vicinity of an unmarked historic cemetery, seven features were discovered during trenching that appeared to represent historic graves dating from 1870-1900. No further recommendations were provided in the report.

In November, 1981, New World Research, Inc., performed a Phase II cultural resources survey of a proposed softball/soccer field (Swanson and Weed 1982). Survey had revealed a light lithic scatter that was considered part of site 1Ma232, an Archaic site recorded by Shelley (1981). Subsurface tests were conducted to determine National Register eligibility. The site, badly disturbed, was limited to the top 20 cm of the surface and no evidence of cultural features was found. This portion of 1Ma232 was not considered National Register eligible.

In July, 1982, UA conducted a Phase II archeological evaluation as part of the proposed construction of the Missile Systems Software Center (Alexander 1982). The site (1Ma173) was tested to determine National Register eligibility. The ground surface was cleared and test units were excavated in the area of the house foundation, well, and outbuildings. The site is the remnant of a larger historic house dating from about 1915 to the 1930s and not considered National Register eligible; thus further work was not recommended.

Also in July, 1982, DARCOM conducted test excavations at site 1Ma142 to assess the impact of proposed construction of a pre-fabricated metal building and septic tank system (Schroder 1982). The ground surface was collected, test pits were excavated, and a test trench was dug. The site originally was located by Alexander (1979:122-124) and later tested by Thomas (1980:377-384). A mound three to four meters high was levelled in this area in early 1971. Further work was requested before additional construction was to be carried out.

3.4 SUMMARY ASSESSMENT OF DATA ADEQUACY, GAPS

The presently known cultural resource on the Redstone Arsenal are the result of eight cultural resource surveys; however, these surveys have covered only about five percent of the Arsenal property. In addition, of the sites recorded during survey, over 60 percent have been evaluated by Memphis State University as of low value in answering significant and

relevant research objectives. These figures point to a need for further archeological coverage within the facility and to examine and evaluate those areas which show a high probability for containing archeological resources with significant research potential.

As a result of Alexander's evaluation (1979) of archeological sites from 340 acres of Redstone Arsenal, several cultural resource management recommendations have been made concerning settlement locations. He notes that the Tennessee River natural levees adjacent to the present channel presents the highest probability for the occurrence of prehistoric cultural resources (1979:154-168). These sites often are composed of deeply stratified deposits. The majority of the mound and village sites are located on this first river levee. The elevated areas adjacent to the larger sinks and depressions, which retained water in the past, often are locations of Paleo-Indian and Early Archaic settlements. These areas are eroded easily but such sites, if they are encountered, could contain remains of early human occupation or use.

Within the study area the cultural sequence is represented from Paleo-Indian through Historic. A far greater percent of the Tennessee River terraces is marked by the presence of sites than is true for the interior zones. This settlement pattern is also true for the historic occupation which began about 1804. The majority of the population lived in rural, single family farms unevenly distributed throughout the countryside. The densest occupation was along the Tennessee River where agricultural potential was the highest. Settlement in the uplands tended to cluster along the secondary streams or on the margins of floodplain swamps to take advantage of soils in each location. This rural dispersed settlement pattern continued virtually unaltered up to the time of the land purchases for the establishment of the Redstone Arsenal. Most of the historic sites date between 1900 and 1940, and the settlement pattern is indicative of an agriculturally based economy. Single family units, either tenant or owner status, are the prevalent site types. Subsequent land clearance has destroyed the majority of the associated structures.

Through a predictive modelling approach (e.g., Thomas et al. 1980) it is possible to forecast the types and extent of archeological sites and components that may be found on the facility, given the close association between soil type, availability of water, and human settlement.

There is a great likelihood that additional archeological resources exist on the Redstone Arsenal, given the small portion that has been surveyed and the high probability that sites exist in buried contexts along the Tennessee River floodplain or are located in surface exposures, but have not been located through detailed reconnaissance.

KNOWN AND POTENTIAL ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL

4.1 KNOWN ARCHEOLOGICAL RESOURCES

The presently identified archeological components on the Redstone Arsenal include 65 prehistoric (but further temporally undetermined) sites, one Paleo-Indian site, 38 Archaic sites, 16 Woodland sites, 18 historic sites, and three temporally undetermined sites (tables 4-1 and 4-2), for a total of 141 known archeological components. Though not by definition an archeological site, the Redstone Test Stand is considered a unique cultural resource representing a recent (1950s) historic component and is on the National Register of Historic Places.

The sites are found in a variety of physiographic settings: upland ridge spurs, knolls, spring banks, caves, swamps, alluvial fans, river terraces, banklines, and natural levees. The ascribed functions of the sites vary from villages and camps to lithic scatters and shell middens; burial mounds, a cave site, and historic buildings such as farm houses and even a Civil War powder magazine (now destroyed) are known to occur on the Arsenal. One site is listed on the National Register of Historic Places and at least nine archeological sites have been recommended eligible. These attest to the significance of the cultural resource base found on the Redstone Arsenal.

4.2 POTENTIAL ARCHEOLOGICAL RESOURCES

Potential archeological resources on the facility include historic structures recorded archivally and depicted on maps. Some 45 historic

Table 4 1. PRESENTLY IDENTIFIED ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL: ADMINISTRATIVE DATA

Site Number ^a	Site Recorder ^b	Date of Site Record	SHPO Survey Number	Site Record Repository ^b	Survey Collection Policy ^c	Current		State, Local	Architectural Association ^g	Bibliographic Reference
						Status of Investigation ^d	NRHP Status ^e			
1Ma12	UA	1933	None	UA	CS	REF	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma13	UA	1933	None	UA	CS	REF	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma14	UA	1933	None	UA	UN	REF, SER	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma22	UA	1933	None	UA	UN	REF, SER	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma24	UA	1933	None	UA	UN	RIP	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma25	UA	1933	None	UA	UN	REF, SER	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma26	UA	1933	None	UA	UN	REF, SER	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma27	UA	1933	None	UA	UN	REF, SER	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma28	UA	1933	None	UA	UN	REF, SER	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma29	UA	1933	None	UA	UN	REF, SER	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma30	UA	1933	None	UA	UN	REF, SER	INSF	UN	NA	Alexander 1979; Webb 1939
1Ma95	UA	1978	None	UA	SGS, S	RAS	INSF	UN	NA	Alexander 1979
1Ma96	UA	1978	None	UA	SGS	RAS	RFP	UN	NA	Alexander 1979
1Ma97	UA	1978	None	UA	SGS	RAS	RIP	UN	NA	Alexander 1979
1Ma98	UA	1978	None	UA	SGS	RAS	RFP	UN	NA	Alexander 1979
1Ma99	UA	1978	None	UA	SGS, S	RAS	RFP	UN	NA	Alexander 1979
1Ma100	UA	1978	None	UA	CS	REF	INSF	UN	NA	Alexander 1979
1Ma101	UA	1978	None	UA	S	RAS	INSF	UN	NA	Alexander 1979
1Ma102	UA	1978	None	UA	S	RAS	INSF	UN	NA	Alexander 1979
1Ma103	UA	1978	None	UA	SGS, S	RAS	INSF	UN	NA	Alexander 1979
1Ma104	UA	1978	None	UA	SGS, S	RAS	REP	UN	NA	Alexander 1979
1Ma105	UA	1978	None	UA	CS, S	RAS	RIP	UN	NA	Alexander 1979; Oakley 1980
1Ma106	UA	1978	None	UA	CS, S, H	REF	RIP	UN	NA	Alexander 1979
1Ma107	UA	1978	None	UA	CS	REF	RIP	UN	NA	Alexander 1979
1Ma108	UA	1978	None	UA	CS	REF	RIP	UN	NA	Alexander 1979
1Ma109	UA	1978	None	UA	CS, S	REF	RIP	UN	NA	Alexander 1979
1Ma110	UA	1978	None	UA	CS, D, H	REF	RIP	UN	NA	Alexander 1979
1Ma111	UA	1978	None	UA	CS, S	REF	RIP	UN	NA	Alexander 1979
1Ma112	UA	1978	None	UA	CS, S	RAS	INSF	UN	NA	Alexander 1979
1Ma113	UA	1978	None	UA	CS, S	REF	RIP	UN	NA	Alexander 1979
1Ma114	UA	1978	None	UA	CS, S	RAS	INSF	UN	NA	Alexander 1979
1Ma115	UA	1978	None	UA	CS, S	RAS	INSF	UN	NA	Alexander 1979
1Ma116	UA	1978	None	UA	SGS, S	RAS	REP	UN	NA	Alexander 1979
1Ma117	UA	1978	None	UA	S	RAS	REP	UN	NA	Alexander 1979
1Ma118	UA	1978	None	UA	CS	REF	RIP	UN	NA	Alexander 1979
1Ma119	UA	1978	None	UA	CS	REF	INSF	UN	NA	Alexander 1979
1Ma120	UA	1978	None	UA	S	RAS	INSF	UN	NA	Alexander 1979
1Ma121	UA	1978	None	UA	S	RAS	INSF	UN	NA	Alexander 1979
1Ma122	UA	1978	None	UA	CD	RAS	INSF	UN	NA	Alexander 1979
1Ma123	UA	1978	None	UA	CS, S	RAS	INSF	UN	NA	Alexander 1979
1Ma124	UA	1978	None	UA	CS, S	RAS	INSF	UN	NA	Alexander 1979
1Ma125	UA	1978	None	UA	CS, S	RAS	INSF	UN	NA	Alexander 1979

Table 4.1. PRESENTLY IDENTIFIED ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL: ADMINISTRATIVE DATA (continued)

Site Number ^a	Site Recorder ^b	Date of Site Record	SHPO Survey Number	Site Record Repository ^b	Survey Collection Policy ^c	Current Status of Investigation ^d	NRHP Status ^e	State, Local Status ^f	Architectural Association ^g	Bibliographic Reference
1Ma126	UA	1978	None	UA	CS,S	REF	REP	UN	NA	Alexander 1979
1Ma127	UA	1978	None	UA	CS,S	RAS	INSF	UN	NA	Alexander 1979
1Ma128	UA	1978	None	UA	CS,S	REF	INSF	UN	NA	Alexander 1979
1Ma129	UA	1978	None	UA	CS,S	REF	RIP	UN	NA	Alexander 1979
1Ma130	UA	1978	None	UA	CS,S	REF	RIP	UN	NA	Alexander 1979
1Ma131	UA	1978	None	UA	CS,S	RAS	INSF	UN	NA	Alexander 1979
1Ma132	UA	1978	None	UA	CS,S	REF	INSF	UN	NA	Alexander 1979
1Ma133	UA	1978	None	UA	CS,S	RAS	REP	UN	NA	Alexander 1979; Thomas 1980
1Ma134	UA	1978	None	UA	CS,S	RAC	INSF	UN	NA	Alexander 1979
1Ma135	UA	1978	None	UA	CDM	RAS	REP	UN	NA	Alexander 1979
1Ma136	UA	1978	None	UA	CS,S	RAS	REP	UN	NA	Alexander 1979
1Ma137	UA	1978	None	UA	CS,S	REF	RIP	UN	NA	Alexander 1979
1Ma138	UA	1978	None	UA	CSW	RAS	REP	UN	NA	Alexander 1979
1Ma139	UA	1978	None	UA	CS	RAS	INSF	UN	NA	Alexander 1979
1Ma140	UA	1978	None	UA	CS,S	RAS	REP	UN	NA	Alexander 1979; Thomas 1980
1Ma141	UA	1978	None	UA	CS,S	RAS	REP	UN	NA	Alexander 1979; Thomas 1980
1Ma142	UA	1978	None	UA	CS,S	RAS	REP	UN	NA	Alexander 1979; Thomas 1980; Schroder 1982
1Ma143	UA	1978	None	UA	CS,S	RAS	INSF	UN	NA	Alexander 1979
1Ma144	UA	1978	None	UA	CS,S	RAS	INSF	UN	NA	Alexander 1979
1Ma145	UA	1978	None	UA	CS,S	RAS	INSF	UN	NA	Alexander 1979
1Ma146	UA	1978	None	UA	CSW	RAS	INSF	UN	NA	Alexander 1979
1Ma147	UA	1978	None	UA	N	RAS	INSF	UN	NA	Alexander 1979
1Ma148	UA	1978	None	UA	CS	RAS	INSF	UN	NA	Alexander 1979
1Ma149	UA	1978	None	UA	CS,S	RAS	INSF	UN	NA	Alexander 1979
1Ma150	UA	1978	None	UA	CS	RAS	INSF	UN	NA	Alexander 1979
1Ma151	UA	1978	None	UA	M	RAS	INSF	UN	NA	Alexander 1979
1Ma152	UA	1978	None	UA	CS,S	RAS	RIP	UN	NA	Alexander 1979; Thomas 1980
1Ma153	UA	1978	None	UA	CS,S	REF	RIP	UN	NA	Alexander 1979; Thomas 1980
1Ma154	UA	1978	None	UA	CS,S	REF	RIP	UN	NA	Alexander 1979; Thomas 1980
1Ma155	UA	1978	None	UA	CS,S	REF	RIP	UN	NA	Alexander 1979; Thomas 1980
1Ma156	UA	1978	None	UA	SGS	RAS	REP	UN	NA	Alexander 1979; Thomas 1980
1Ma157	UA	1978	None	UA	CS,S	REF	RIP	UN	NA	Alexander 1979; Thomas 1980
1Ma158	UA	1978	None	UA	CS,S	RAS	RIP	UN	NA	Alexander 1979; Thomas 1980
1Ma159	UA	1978	None	UA	CS,S	RAS	RIP	UN	NA	Alexander 1979; Thomas 1980
1Ma160	UA	1978	None	UA	CS	RAS	INSF	UN	NA	Alexander 1979
1Ma161	UA	1978	None	UA	CS,S	RAS	INSF	UN	NA	Alexander 1979
1Ma162	UA	1978	None	UA	CS,S	RAS	REP	UN	NA	Alexander 1979; Thomas 1980
1Ma163	UA	1978	None	UA	S	RAS	INSF	UN	NA	Alexander 1979
1Ma164	UA	1978	None	UA	CS,S	RAS	INSF	UN	NA	Alexander 1979

Table 4.1. PRESENTLY IDENTIFIED ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL: ADMINISTRATIVE DATA (continued)

Site Number ^a	Site Recorder ^b	Date of Site Record	SHPO Survey Number	Site Record Repository ^b	Survey Collection Policy ^c	Current Status of Investigation ^d	NRHP Status ^e	State, Local Status ^f	Architectural Association ^g	Bibliographic Reference
1Ma165	UA	1978	None	UA	CS	RAS	REP	UN	MA	Alexander 1979
1Ma166	UA	1978	None	UA	CS	REF	RIP	UN	MA	Alexander 1979
1Ma167	UA	1978	None	UA	CS	REF	RIP	UN	MA	Alexander 1979
1Ma168	UA	1978	None	UA	H	RAS	REP	UN	MA	Alexander 1979
1Ma169	UA	1978	None	UA	H	RAS	REP	UN	MA	Alexander 1979
1Ma172	UA	1978	None	UA	N	RAS	REP	UN	MA	Alexander 1979
1Ma173	UA	1978	None	UA	H	RAS	RIP	UN	Foundation	Alexander 1979, 1982
1Ma174	UA	1978	None	UA	N	RAS	INSF	UN	MA	Alexander 1979
1Ma176	UA	1983	None	UA	CS	REF	RIP	UN	MA	Oakley 1983b
1Ma191	UA	1980	None	UA	CS,S	RAS	RIP	UN	MA	Oakley 1980; Chase 1981a
1Ma192	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma193	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma194	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma195	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma196	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma197	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma198	UA	1980	None	UA	CS,S	RAS	REF	UN	Foundation	Oakley 1980; Chase 1981a
1Ma200	UA	1980	None	UA	CS,S	RAS	INSF	UN	MA	Oakley 1980; Chase 1981a, b
1Ma201	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma202	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma203	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma204	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma205	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma206	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma208	UA	1980	None	UA	CS,S	REF	RIP	UN	MA	Oakley 1980
1Ma219	UA	1980	None	UA	N	REF	RIP	UN	Historic structure	Thomas 1980
1Ma232	UA	1981	None	UA	CS	REF	INSF	UN	MA	Shelley 1981; Swanson and Weed 1982
1Ma233	UA	1981	None	UA	CS	REF	INSF	UN	MA	Shelley 1981
1Ma235	UA	1982	None	UA	CS	REF	INSF	UN	MA	Alexander 1982
1Ma238	UA	1983	None	UA	CS,S,H	REF	RIP	UN	MA	Oakley 1983a
RTS	MPS	1976	None	SHPO	MA	MA	NRHP	CEL	Historic structure	USDI 1979

^a Site registration numbers are a trinomial designation following a system set up by the Smithsonian Institution in the late 1940s. The first segment of the trinomial is a numerical label for the state (e.g., Indiana = 12), the second segment is a two-letter abbreviation for the county (e.g., VE = Vermillion), and the final segment is a sequential identification of the sites registered within that county and state. Thus, a site listed here as "1209" is formally registered as "12-VE-1209" in the Indiana state record system. Site locational data are provided in Table A-1, and are mapped in Figure A-1. "RTS" (Redstone Test Stand) is a historic property on the National Register of Historic Places, and it was not identified through archeological inventory so it has no archeological site number.

Table 4-1. PRESENTLY IDENTIFIED ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL: ADMINISTRATIVE DATA (concluded)

Site Number ^a	Site Recorder ^b	Date of Site Record	SHPO Survey Number	Site Record Repository ^b	Survey Collection Policy ^c	Current Status of Investi-		State, Local Status ^f	Architectural Associations ^g	Bibliographic Reference
						gation ^d	Status ^e			

^b University of Alabama (UA); National Park Service (NPS) is responsible for the NRHP form (see Appendix B, this report), and the form is also on file with the Alabama SHPO, Montgomery, AL.

^c Survey collection policies vary widely, both on a site-to-site basis within a single survey project as well as among different surveys. Collection policies of the surveys identified here were to collect nothing (N); diagnostics only, with point location on the site map of the collected material (CDM); diagnostics without mapping (CD); a controlled surface sample, under formal sampling procedures and mapping (CSM); a surface "grab" sample without mapping (SGS); the entire surface, mapping only diagnostics (CSH); the entire surface assemblage without any location mapping (CS); shovel test (S); backhoe (H); disced (D); measurement of building site (M); not applicable (NA).

^d Levels of archeological site investigation to date, and current site status, include filing of an inventory record (REF), and/or the need for further study and evaluation (NAS); not applicable (NA).

^e INSF - insufficient information available by which to make a judgement as to the site's National Register of Historic Places (NRHP) status; RFP - recommended as eligible by qualified professionals with no formal agency or SHPO recommendation; RHP - recommended as ineligible by qualified professionals with no formal agency or SHPO concurrence; NRHP = listed on the National Register of Historic Places.

^f Undetermined (UN); Alabama Civil Engineering Landmark (CEL).

^g Not applicable (NA).

Table 4-2. PRESENTLY IDENTIFIED ARCHEOLOGICAL COMPONENTS ON THE REDSTONE ARSENAL: DESCRIPTION AND EVALUATION

Unit Age				Unit Description				Evaluation			
Date ^a		Temporal Unit ^b		Depositional Context ^c		Dimension		Value		Integrity ^f	
DM	Years BC/AD	Tradition	Phase (Period)	Artifacts ^d	Features ^e	Landform	Area (m ²)	Depth (m)	Ascribed Function	Percent Intact	RVS GRh
1Ma12	REL UN	Prehistoric	UN	FL,GS	UN	Surface	UN	UN	UN	50	3 1
1Ma13	REL UN	Prehistoric	UN	FL	UN	Surface	UN	UN	Lithic scatter	50	3 1
1Ma14	REL UN	Prehistoric	UN	FL	UN	Surface	UN	UN	Lithic scatter	75	3 1
1Ma22	REL UN	Prehistoric	UN	FL	UN	Surface	UN	UN	Lithic scatter	75	3 1
1Ma24	REL UN	Prehistoric	UN	UN	UN	Surface	UN	UN	Lithic scatter	50	1 1
1Ma25	REL UN	Woodland	UN	FL,GS,PC	UN	Surface	1040	UN	UN	50	3 1
1Ma26	REL UN	Prehistoric	UN	UN	UN	Surface	3630	UN	UN	50	3 1
1Ma27	REL UN	Prehistoric	UN	UN	UN	Surface	3170	UN	UN	50	3 1
1Ma28	REL UN	Prehistoric	UN	FL	UN	Surface	UN	UN	UN	75	3 1
1Ma29	REL UN	Prehistoric	UN	FL	UN	Surface	UN	UN	UN	75	3 1
1Ma30	REL UN	Prehistoric	UN	UN	UN	Surface	UN	UN	Shell midden	75	5 1
1Ma95	REL UN	Woodland	UN	FL	UN	Surface	UN	UN	Lithic scatter	75	3 2
1Ma96	REL UN	Woodland	UN	FL,PC,B,S	UN	Midden	75	UN	Rock shelter	100	5 3
1Ma97	REL 4000 BC	Archaic	Middle	FL,GS	UN	Plowzone	400	UN	Lithic scatter	0	3 2
1Ma98	REL 4000 BC	Archaic	Middle	FL	UN	Plowzone	5000	UN	Lithic scatter	75	3 2
1Ma99	REL UN	Prehistoric	UN	FL	UN	Plowzone	7250	UN	Lithic scatter	0	1 2
1Ma100a	REL 4000 BC	Archaic	Late	FL,HS	UN	Surface	300	UN	Lithic scatter	0	1 2
1Ma100b	REL UN	Historic	UN	UN	UN	Surface	UN	UN	Wagon road	100	1 2
1Ma101	WA UN	UN	UN	FL	UN	Surface	1800	UN	Lithic scatter	75	1 2
1Ma102	WA UN	Prehistoric	UN	FL,GS	UN	Plowzone	45,000	UN	Lithic scatter	50	2 2
1Ma103	WA UN	Prehistoric	UN	FL	UN	Plowzone	900	UN	Lithic scatter	0	1 2
1Ma104a	WA UN	Prehistoric	UN	FL	UN	Midden	75,000	UN	Lithic scatter	100	5 3
1Ma104b	WA UN	Prehistoric	UN	GS	UN	Mound	180	UN	Lithic scatter	100	5 3
1Ma104c	WA UN	Historic	UN	UN	UN	UN	UN	UN	House	UN	3 1
1Ma105	WA UN	Prehistoric	UN	FL	UN	Plowzone	400	UN	Lithic scatter	0	1 2
1Ma106	WA UN	Prehistoric	UN	FL,HS,B	UN	Surface	2100	UN	Lithic scatter	0	1 2
1Ma107	REL UN	Prehistoric	UN	FL	UN	Surface	1125	UN	Lithic scatter	0	1 2
1Ma108	REL 4000 BC	Archaic	Middle	FL	UN	Surface	900	UN	Lithic scatter	0	2 2
1Ma109	REL UN	Prehistoric	UN	FL	UN	Surface	1600	UN	Lithic scatter	0	1 2
1Ma110	REL UN	Prehistoric	UN	FL	UN	Surface	2500	UN	Lithic scatter	0	1 2
1Ma111	REL 4000 BC	Archaic	Middle	FL	UN	Plowzone	400	UN	Lithic scatter	0	2 2
1Ma112	REL UN	Prehistoric	UN	FL	UN	Plowzone	800	.3	Lithic scatter	50	2 1
1Ma113	REL UN	Prehistoric	UN	FL	UN	Plowzone	1500	.2	Lithic scatter	0	1 2
1Ma114a	REL UN	Woodland	UN	FL	UN	Plowzone	3500	UN	Lithic scatter	75	3 1
1Ma114b	REL AD 1900	Historic	UN	HM	Roadbed	Surface	3500	UN	House	25	3 1
1Ma115	REL UN	Prehistoric	UN	FL	UN	Plowzone	3000	.2	Lithic scatter	70	1 1
1Ma116	REL 2000 BC	Archaic	Late	FL	UN	Midden	5625	.5	Lithic scatter	75	5 3
1Ma117	REL UN	Prehistoric	UN	FL	UN	Plowzone	625	UN	Lithic scatter	0	1 2
1Ma118	REL UN	Prehistoric	UN	FL	UN	Plowzone	750	.4	Lithic scatter	75	1 2
1Ma119	REL AD 1900	Historic	UN	GL,HH,BR	MA	Surface	400	UN	House	50	3 2
1Ma120	REL 200 BC	Woodland	Early	FL,PC	UN	Plowzone	600	.3	Lithic scatter	50	3 2

Table 4-2. PRESENTLY IDENTIFIED ARCHEOLOGICAL COMPONENTS ON THE REDSTONE ARSENAL: DESCRIPTION AND EVALUATION (continued)

Unit Age				Unit Description				Evaluation							
Date ^a		Temporal Unit ^b		Phase (Period)	Artifacts	Fea- tures ^d	Deposi- tional Contexte	Landform	Dimension		Ascribed Function	Percent Intact	Value Integ- rity ^f	RVS	CR ^h
DM	Years BC/AD	Tradition	Years						Area (m)	Depth (m)					
1M121	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Terrace	625	.2	Lithic scatter	25	L	2	2
1M122	REL	AD 1900	Historic	UN	UN	UN	Midden	Terrace	625	.75	House	50	LA	5	3
1M123	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Terrace	2500	.2	Lithic scatter	50	L	2	2
1M124	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Knoll	900	.2	Lithic scatter	50	L	2	2
1M125	REL	AD 1900	Historic	UN	HM, GL	UN	Surface	Hill	900	UN	House	25	LA	2	1
1M126a	REL	6000 BC	Archaic	Early	FL, GS	UN	Midden	Terrace	2625	.75	Village	75	LMA	5	3
1M126b	REL	4000 BC	Archaic	Middle	FL, GS	UN	Midden	Terrace	2625	.75	Village	75	LMA	5	3
1M127	REL	UN	UN	UN	None	UN	Surface	Swamp	1200	UN	UN	100	L	5	2
1M128	REL	UN	Prehistoric	UN	FL, GS	UN	Plowzone	Knoll	4800	.2	Lithic scatter	50	L	3	1
1M129	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Terrace	2500	UN	Lithic scatter	0	L	1	2
1M130	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Terrace	1600	.2	Lithic scatter	0	L	1	2
1M131a	REL	4000 BC	Archaic	Middle	FL	UN	Plowzone	Terrace	3750	.4	UN	50	L	2	2
1M131b	REL	2000 BC	Archaic	Late	FL	UN	Plowzone	Terrace	3750	.4	UN	50	L	2	2
1M131c	REL	AD 100	Woodland	Middle	FL	UN	Plowzone	Terrace	3750	.4	UN	50	L	2	2
1M132	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Terrace	2500	.2	Lithic scatter	20	L	1	2
1M133a	REL	4000 BC	Archaic	Middle	FL	UN	Midden	Knoll	15,200	2.0	Lithic scatter	75	LMA	5	3
1M133b	REL	2000 BC	Archaic	Late	FL	UN	Midden	Knoll	15,200	2.0	Lithic scatter	75	LMA	5	3
1M133c	REL	AD 700	Woodland	Late	PC	UN	Midden	Knoll	15,200	2.0	Lithic scatter	75	LMA	5	3
1M134	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Spring bank	900	.4	Lithic scatter	50	L	2	2
1M135	REL	AD 700	Woodland	Late	FL, PC	UN	Midden	River bank	UN	1.75	Shell midden	75	LMA	5	3
1M136a	REL	4000 BC	Archaic	Middle	FL	UN	Plowzone	Terrace	10,000	.3	UN	75	L	4	2
1M136b	REL	2000 BC	Archaic	Late	FL, PC	UN	Plowzone	Terrace	10,000	.3	UN	75	L	4	2
1M136c	REL	AD 1900	Historic	UN	HC, GL	UN	Plowzone	Terrace	UN	UN	UN	0	L	4	1
1M137	REL	UN	UN	UN	FL	UN	Plowzone	Terrace	250	UN	Lithic scatter	0	L	1	2
1M138	REL	2000 BC	Archaic	Late	FL, PM, S	UN	Midden	River bank	UN	1.0	Shell midden	75	LMA	5	3
1M139	REL	UN	Prehistoric	UN	FL, HC	UN	Midden	River bank	UN	UN	Lithic scatter	50	LMA	5	3
1M140a	REL	4000 BC	Archaic	Middle	FL	UN	Plowzone	Knoll	2500	.4	Lithic scatter	75	L	4	2
1M140b	REL	2000 BC	Archaic	Late	FL	UN	Plowzone	Knoll	2500	.4	Lithic scatter	75	L	4	2
1M140c	REL	AD 100	Woodland	Middle	FL	UN	Plowzone	Knoll	2500	UN	Lithic scatter	75	L	4	2
1M140d	REL	AD 700	Woodland	Late	FL	UN	Plowzone	Knoll	2500	.4	Lithic scatter	75	L	4	2
1M141a	REL	10000 BC	Paleo-Indian	UN	FL	UN	Midden	River bank	UN	8.0	Shell midden	50	LMA	5	3
1M141b	REL	4000 BC	Archaic	Middle	FL	UN	Midden	River bank	UN	8.0	Shell midden	50	LMA	5	3
1M141c	REL	2000 BC	Archaic	Late	FL, GS	UN	Midden	River bank	UN	8.0	Shell midden	50	LMA	5	3
1M141d	REL	UN	Woodland	UN	FL	UN	Midden	River bank	UN	8.0	Shell midden	50	LMA	5	3
1M142a	REL	2000 BC	Archaic	Late	FL, HS, HM	UN	Plowzone	Terrace	3000	.4	Lithic scatter	50	L	4	2
1M142b	REL	2000 BC	Archaic	Late	FL	UN	Plowzone	Terrace	3000	.4	Lithic scatter	50	L	4	2
1M142c	REL	UN	Historic	UN	HM, HC	UN	Plowzone	Terrace	3000	.4	UN	25	LA	3	1
1M143a	REL	6000 BC	Archaic	Early	FL	UN	Plowzone	Terrace	4000	.2	Lithic scatter	50	L	3	2
1M143b	REL	4000 BC	Archaic	Middle	FL	UN	Plowzone	Terrace	4000	.2	Lithic scatter	50	L	3	2
1M143c	REL	2000 BC	Archaic	Late	FL	UN	Plowzone	Terrace	4000	.2	Lithic scatter	50	L	3	2
1M144	REL	AD 100	Woodland	Middle	FL	UN	Plowzone	Terrace	3750	.2	Lithic scatter	50	L	3	2

Table 4-2. PRESENTLY IDENTIFIED ARCHEOLOGICAL COMPONENTS ON THE REDSTONE ARSENAL: DESCRIPTION AND EVALUATION (continued)

Unit Age				Unit Description				Evaluation							
Date ^a		Temporal Unit ^b		Phase (Period)	Artifacts	Features	Depositional Context	Landform	Dimension		Ascribed Function	Percent Intact	Value Integrity ^c	RVS	CRH
DM	Years BC/AD	Tradition							Area (m)	Depth (m)					
1Ma145	REL UN	Prehistoric	UN	UN	FL	UN	Plowzone	Terrace	2250	.2	Lithic scatter	50	L	1	2
1Ma146	REL AD 1900	Historic	UN	UN	HM, GL, HC	UN	Surface	Terrace	5625	UN	House	25	L	3	2
1Ma147	REL AD 100	Woodland	Middle	UN	None	UN	Surface	Terrace	10,000	UN	Burial mounds	100	LDMA	5	3
1Ma148	REL UN	Prehistoric	UN	UN	FL, PC	UN	Surface	Cave	UN	UN	Cave	100	LDMA	5	1
1Ma149	REL UN	Prehistoric	UN	UN	FL, HM	UN	Plowzone	Terrace	10,000	.4	Lithic scatter	30	L	1	1
1Ma150	REL UN	Prehistoric	UN	UN	FL	UN	Midden	River bank	UN	2.25	Shell midden	75	LMA	5	3
1Ma151	REL AD 1900	Historic	UN	MA	None	MA	Surface	Terrace	UN	UN	Farm and cemetery	75	LDMA	5	2
1Ma152a	REL 4000 BC	Archaic	Middle	None	FL	None	Plowzone	Terrace	1500	.2	Lithic scatter	75	L	3	3
1Ma152b	REL 2000 BC	Archaic	Late	UN	FL	UN	Plowzone	Terrace	1500	.2	Lithic scatter	75	L	0	3
1Ma152c	REL AD 1865	Historic	Civil War	UN	HM, GL, HC	UN	Plowzone	Terrace	1500	.2	Powder magazine	0	L	0	3
1Ma153	REL UN	Prehistoric	UN	None	FL, HS	None	Plowzone	Terrace	625	.2	Lithic scatter	0	L	1	2
1Ma154	REL UN	Prehistoric	UN	None	FL	None	Plowzone	Terrace	1600	UN	Lithic scatter	0	L	1	2
1Ma155	REL 2000 BC	Archaic	Late	None	FL	None	Plowzone	Ridge	1500	.3	Lithic scatter	0	L	1	1
1Ma156a	REL 4000 BC	Archaic	Middle	UN	FL, GS	UN	Midden	Terrace	5000	.4	Lithic scatter	75	LMA	5	3
1Ma156b	REL 2000 BC	Archaic	Late	UN	FL, GS	UN	Midden	Terrace	5000	.4	Lithic scatter	75	LMA	5	3
1Ma156c	REL AD 100	Woodland	Middle	UN	FL	UN	Midden	Terrace	5000	.4	Lithic scatter	75	LMA	5	3
1Ma156d	REL AD 700	Woodland	Late	UN	FL	UN	Midden	Terrace	5000	.4	Lithic scatter	75	LMA	5	3
1Ma157	REL 2000 BC	Archaic	Late	None	FL	None	Plowzone	Terrace	4000	.2	Lithic scatter	0	L	1	1
1Ma158a	REL 4000 BC	Archaic	Middle	None	FL	None	Plowzone	Knoll	3000	.2	Lithic scatter	50	L	2	2
1Ma158b	REL 2000 BC	Archaic	Late	None	FL	None	Plowzone	Knoll	3000	.2	Lithic scatter	50	L	2	2
1Ma159	REL UN	Prehistoric	UN	None	FL	None	Plowzone	Knoll	1200	.2	Lithic scatter	50	L	1	2
1Ma160	REL UN	Prehistoric	UN	None	FL	None	Plowzone	Terrace	2500	.2	Lithic scatter	50	L	1	2
1Ma161	REL UN	Prehistoric	UN	None	FL	None	Plowzone	Terrace	400	.2	Lithic scatter	50	L	1	2
1Ma162a	REL UN	Prehistoric	UN	UN	FL	UN	Plowzone	Terrace	3825	.2	Lithic scatter	75	L	1	2
1Ma162b	REL AD 1900	Historic	UN	UN	GL, HC, HM	UN	Plowzone	Terrace	3825	.2	Farm	25	LM	3	2
1Ma163	REL UN	Prehistoric	UN	UN	FL	UN	Plowzone	Terrace	800	.2	Lithic scatter	50	L	1	2
1Ma164	REL UN	Prehistoric	UN	None	FL, GS	None	Plowzone	Floodplain	800	.2	Lithic scatter	75	L	1	2
1Ma165	REL AD 100	Woodland	Middle	None	B, FL	None	Surface	Cave	15	UN	Burial cave	75	LDMA	5	2
1Ma166	REL UN	Prehistoric	UN	None	FL	None	Plowzone	Ridge	1600	UN	Lithic scatter	0	L	1	2
1Ma167	REL UN	Prehistoric	UN	None	FL	UN	Plowzone	Swamp	225	.2	Lithic scatter	0	L	1	2
1Ma168	REL UN	Prehistoric	UN	FCR	FL, GS	FCR	Midden	Terrace	UN	2.6	Lithic scatter	50	LMA	4	2
1Ma169	REL UN	Prehistoric	UN	FCR	GS, GL	FCR	Midden	Terrace	UN	2.8	Lithic scatter	50	LMA	5	3
1Ma172	REL AD 1900	Historic	UN	Wall	UN	Wall	Surface	Hill	UN	UN	Farm	25	LDMA	4	2
1Ma173	REL AD 1900	Historic	UN	MA	None	MA	Surface	Knoll	1600	UN	House	25	LDMA	3	1
1Ma174	REL UN	Prehistoric	UN	FCR	FL	FCR	Surface	Levee	UN	2.5	Lithic scatter	75	L	1	2
1Ma176	REL 4000 BC	Archaic	Middle	UN	FL	UN	Plowzone	Terrace	UN	.2	Lithic scatter	UN	L	3	1
1Ma191	REL UN	Prehistoric	UN	UN	FL	UN	Plowzone	Knoll	3600	.2	Lithic scatter	25	L	3	1
1Ma192	REL 6000 BC	Archaic	Early	UN	FL	UN	Plowzone	Knoll	900	.2	Lithic scatter	0	L	1	1
1Ma193	REL UN	Prehistoric	UN	UN	FL	UN	Surface	Knoll	50	UN	Lithic scatter	0	L	1	2
1Ma194	REL UN	Prehistoric	UN	UN	FL	UN	Plowzone	Knoll	400	.1	Lithic scatter	0	L	1	2
1Ma195	REL UN	Prehistoric	UN	UN	FL	UN	Plowzone	Knoll	2100	.1	Lithic scatter	0	L	1	2

Table 4-2. PRESENTLY IDENTIFIED ARCHEOLOGICAL COMPONENTS ON THE REDSTONE ARSENAL: DESCRIPTION AND EVALUATION (concluded)

Site Number	Unit Age				Unit Description				Evaluation						
	Date ^a		Temporal Unit ^b		Phase (Period)	Fea- tured	Deposi- tional Context	Landform	Dimension		Ascribed Function	Percent Intact	Value Integ- rity ^c	RVs	CR ^b
	DMA	Years BC/AD	Tradition	Unit ^b					Area (m)	Depth (m)					
1Ma196	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Levee	450	.2	Lithic scatter	0	L	1	2
1Ma197	REL	4000 BC	Archaic	Middle	FL	UN	Plowzone	Floodplain	800	.2	Lithic scatter	0	L	2	1
1Ma198	REL	AD 1900	Historic	UN	GL, HC, HM	MA	Plowzone	Knoll	10,000	.3	Plantation	25	L	4	2
1Ma200	REL	UN	Prehistoric	UN	FL, HS	FCR	Plowzone	Knoll	1200	.3	Camp site	75	L	2	2
1Ma201	REL	UN	Prehistoric	UN	FL	UN	Surface	Knoll	225	UN	Lithic scatter	25	L	1	2
1Ma202	REL	UN	Prehistoric	UN	FL	UN	Surface	Knoll	225	UN	Lithic scatter	25	L	1	2
1Ma203	REL	UN	Prehistoric	UN	FL	UN	Surface	Knoll	225	UN	Lithic scatter	25	L	1	2
1Ma204	REL	UN	Prehistoric	UN	FL	UN	Surface	Knoll	225	UN	Lithic scatter	0	L	1	2
1Ma205	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Alluvial fan	750	.1	Lithic scatter	0	L	1	2
1Ma206	REL	UN	Prehistoric	UN	FL	UN	Surface	Knoll	225	.1	Lithic scatter	0	L	1	2
1Ma208	REL	UN	Prehistoric	UN	FL	UN	Surface	Knoll	300	.1	Lithic scatter	0	L	1	2
1Ma219	REL	AD 1900	Historic	UN	HM, GL	UN	Surface	Terrace	UN	UN	House	25	L	3	1
1Ma232	REL	2000 BC	Archaic	Late	FL	UN	Plowzone	Knoll	UN	.3	Lithic scatter	25	L	2	1
1Ma233	REL	UN	Prehistoric	UN	FL	UN	Plowzone	Terrace	4800	.2	Lithic scatter	50	L	1	2
1Ma235	REL	AD 1900	Historic	UN	HM, HC	MA	Plowzone	Sink	900	.5	House	50	L	3	1
1Ma238a	REL	4000 BC	Archaic	Middle	FL	UN	Plowzone	Terrace	10,000	.2	Lithic scatter	0	L	2	1
1Ma238b	REL	2000 BC	Archaic	Late	FL	UN	Plowzone	Terrace	10,000	.2	Lithic scatter	0	L	2	1
RTS	MA	AD 1953	Historic	Space	None	Test Stand	NA	NA	NA	NA	Launch vehicle	100	LDMWA	5	3

^a Dating methods (DM) here are relative (REL) based on artifact attributes; not applicable (NA).

^b Unknown (UN).

^c FL = flaked lithics, which may or may not be accompanied by hammerstones or other flaking stone tools; GS = ground or grinding stones, which may or may not be accompanied by polished stone artifacts; PC = prehistoric ceramics; PM = prehistoric metal; HM = historic metal; HC = historic ceramics and tile; GL = historic glass; BR = brick; B = bone; S = shell; HS = hammerstone; UN = unknown.

^d FCR = fire-cracked rock; MA = masonry architecture; UN = unknown.

^e Unknown (UN); not applicable (NA).

^f National Register of Historic Places evaluation criteria: L = location; D = design; M = materials; W = workmanship; A = association.

^g This is a subjective summary assessment of the overall research value (RV) of the identified components. It is an evaluation of the resource's quality of preservation, representation of activity diversity or uniqueness, and temporal distinctiveness or reflection of diachronic relationships. It incorporates the need to avoid triviality, but to acquire what may be redundant data so as to discern patterns among those data. Research values are ranked from 0 (no value) to 5 (highest value).

^h This is a rating of the confidence (CR) the authors have in the previously assigned research values (RVs): 1 = judgement is more guess than science, and likely not to be reliable; 2 = judgement is moderately reliable; 3 = judgement is most likely to be reliable.

cemeteries have been documented on Redstone Arsenal (tables 4-3 and A-2, Figure A-2; see Johnson 1971a, 1971b, 1971c, and Chase 1981b regarding cemeteries). Other anticipated cultural resources on the facility may be deduced from the summary sections on the cultural environment and local archeological research directions. The facility possesses three major attributes which greatly enhance its archeological potential: its relatively large area on the Tennessee River; its variety of land forms; and its recent history of security, which has served to protect its resources from collectors and vandalism.

4.3 PRESENTLY KNOWN ARTIFACT, ECOFACT, OR DOCUMENTARY COLLECTIONS FROM ARCHEOLOGICAL RESOURCES

Collected materials from archeological surveys conducted on the facility are presently stored at the Office of Archaeological Research, University of Alabama (see Table 3-2). Numerous collectors from the Huntsville area and the greater mid-South have in the past made artifact collections from the facility.

Table 4-3. POTENTIALLY IDENTIFIABLE BUT NOT PRESENTLY RECORDED ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL

Site Number ^a	Reference ^b	Description ^c	Research Value CRC
A-1	T764	Cemetery	2
A-2	T764	Cemetery	2
A-3	T764	Cemetery	2
A-4	T764	Cemetery	2
A-5	T764	Cemetery	2
A-6	T764	Cemetery	2
A-7	T764	Cemetery	2
A-8	T764	Cemetery	2
A-9	T764	Cemetery	2
A-10	T764	Cemetery	2
A-11	T764	Cemetery	2
A-12	T764	Cemetery	2
A-13	T764	Cemetery	2
A-14	T764	Cemetery	2
A-15	F764	Cemetery	2
A-16	F764	Cemetery	2
A-17	F764	Cemetery	2
A-18	F764	Cemetery	2
A-19	F764	Cemetery	2
A-20	H775	Cemetery	2
A-21	H775	Cemetery	2
A-22	H775	Cemetery	2
A-23	H775	Cemetery	2
A-24	H775	Cemetery	2
A-25	H775	Cemetery	2
A-26	M775	Cemetery	2
A-27	M775	Cemetery	2
A-28	M775	Cemetery	2
A-29	M775	Cemetery	2
A-30	M775	Cemetery	2
A-31	M775	Cemetery	2
A-32	M775	Cemetery	2
A-33	M775	Cemetery	2
A-34	M775	Cemetery	2
A-35	M775	Cemetery	2
A-36	M775	Cemetery	2
A-37	M775	Cemetery	2
A-38	M775	Cemetery	2
A-39	M775	Cemetery	2
A-40	M775	Cemetery	2

Table 4-3. POTENTIALLY IDENTIFIABLE BUT NOT PRESENTLY RECORDED ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL (concluded)

Site Number ^a	Reference ^b	Description ^c	Research Value CR ^c
A-41	M775	Cemetery	2
A-42	M775	Cemetery	2
A-43	M775	Cemetery	2
A-44	T764	Cemetery	2
A-45	F764	Cemetery	2

^a Sites have been given "potential site register numbers" only within the context of this overview and planning effort, and are numbered sequentially across the facility. Their locational data are provided in Table A-2, and they are illustrated in Figure A-2.

^b T764 = USGS Triana, AL, 7.5 min. quad (1951, revised 1964).
 F764 = USGS Farley, AL, 7.5 min. quad (1947, revised 1964).
 H775 = USGS Huntsville, AL, 7.5 min. quad (1964, photorevised 1975).
 M775 = USGS Madison, AL, 7.5 min. quad (1964, photorevised 1975).

^c The Confidence Rating (CR) of the potential resource base's research value is a general assessment (based on available data) of the authors' confidence in the site's physical integrity and value (e.g., representation of activity diversity or uniqueness, temporal distinctiveness or reflection of diachronic relationships, representativeness). The CR is a ranked assessment: 1 = the site is likely to have little value or the information about it is too unreliable for making a value judgement; 2 = the resource may have research value and the authors are moderately confident that the information about it is reliable; 3 = the resource is likely to have high research value and the authors are quite confident that the information about it is reliable.

AN ASSESSMENT OF THE SIGNIFICANCE OF THE
ARCHEOLOGICAL RESOURCE BASE ON THE REDSTONE ARSENAL

5.1 THE SIGNIFICANT RESOURCE BASE

The nature of archeological resource base of the Redstone Arsenal is well documented at present. Data presented in previous sections indicate that intact historic and prehistoric cultural deposits with integrity and scientific or humanistic value exist within facility boundaries. Table 5-1 provides a summary of the known components.

The anticipated archeological resources on the Redstone Arsenal can be deduced from the summary sections on the physical environment (Section 2.1), the cultural environment (Section 2.2), and the known and potential archeological sites (Section 4.0). The Arsenal possesses two major attributes that greatly enhance its potential for retaining significant archeological resources: (1) its wide variety of landforms, extending from mountain to floodplain; and (2) its recent history of security, which has served to protect its resources from collectors and vandalism.

The total prehistoric archeological sequence for north central Alabama is represented on the facility, with the exception of the Gulf Formational, which may be too far east. In addition, the historic period is also well represented on Redstone Arsenal. Although there has been considerable construction and farming disturbance on the Arsenal, parts of the facility remain undeveloped: at least 12,000 acres (Schroder, personal communication 1985) of the 21,000 acres of lease-let and permit use areas. Prehistoric gathering and horticultural sites may be found on

Table 5-1. SUMMARY OF SIGNIFICANT ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL

Temporal Unit	Thematic Unit	Resource Type	Type Occurrences ^a			Sociocultural Association	Landform Association	Physical Integrity	Research Value ^b	RV CR ^c	Socio-cultural Value ^d	SCV CR ^c
			Known Occurrences (no.)	Potential Occurrences (no.)	Other Likely Occurrences							
Industrial tradition	Space Age	Bocket Test Stand	1	0	-	American	Not applicable	Excellent	5	3	5	3
Industrial tradition	Socioeconomic history	Dumps, foundations with associated artifacts	17	3	+	Euroamerican	Variable	Likely to be good	3	2	5	2
Ethno-historic Frontier	Frontier cross-cultural interactions	Village, perhaps palisaded	0	0	++	Native American	Floodplain or terrace	Likely to be good	5	3	5	3
Mississippian	Settlement and subsistence patterns	Village, perhaps palisaded; cemeteries	0	0	+	Native American	Floodplain or terrace	Likely to be good	5	3	5	4
Woodland	Settlement and subsistence patterns	Village, perhaps horticultural fields, cemeteries	16	0	++	Native American	Floodplain or terrace	Likely to be good	5	3	5	3
Archaic	Settlement and subsistence patterns	Small camps or seasonal habitation sites	38	0	++	Native American	Floodplain or terrace	Likely to be good	4	3	4	3
Paleo-Indian	Settlement and subsistence patterns	Small camps, kill and/or butchering sites, isolated projectile points	1	Unknown	++	Native American	Variable	Likely to be good	5	3	5	3
Prehistoric (temporally undetermined)	Settlement and subsistence patterns	Small camps, kill and/or butchering sites, isolated projectile points	65	Unknown	++	Native American	Variable	Likely to be good	5	3	5	3
(Temporally undetermined)	Unknown	Lithic scatters; limited use sites	3	Unknown	+	Native American	Variable	Unknown	NA	NA	NA	NA

^a The number of presently known or potential archeological resources of this type is specified here. In addition a judgement has been made as to the likelihood that other members of this resource occur within the facility, based on an analysis of the ethnohistoric or historic land use patterns and/or a review of the landform patterning of prehistoric materials. The probability of these additional occurrences has been noted as negative (-), positive (+), or highly positive (++)

Table 5-1. SUMMARY OF SIGNIFICANT ARCHEOLOGICAL RESOURCES ON THE REDSTONE ARSENAL (concluded)

Temporal Unit	Thematic Unit	Resource Type	Type Occurrence ^a				Landform Association	Physical Integrity	Research Value ^b	Sociocultural Value ^c
			Known Occurrences (no.)	Potential Occurrences (no.)	Other Likely Occurrences (no.)	Other Likely Occurrences (no.)				

^b This is a subjective summary assessment of the overall research value (RV) of the resource class. It is an evaluation of the class' quality of preservation, representation of activity diversity or uniqueness, and temporal distinctiveness or reflection of diachronic relationships. It incorporates the need to avoid triviality, but to acquire what may be redundant data so as to discern patterns among those data. Based on these research values, the resource classes under discussion are ranked from 0 (no value) to 5 (highest value), including "NA" if such an evaluation is believed to be impossible given the available information.

^c The Confidence Rating (CR) is a further evaluation of the perceived reliability of the research (RV) or sociocultural (SCV) values of the resource class. 1 = the judgement is more guess than science, and likely not to be reliable; 2 = the judgement is moderately reliable; 3 = the judgement is most likely reliable; NA = evaluation impossible given the available information.

^d This is a subjective summary assessment of the overall sociocultural value (SCV) of the resource class. It is an evaluation of the social, religious, or political importance of the resource to a contemporary community, from 0 (no value) to 5 (highest value); NA = evaluation impossible given the available information.

the mountain slopes, uplands, and along river floodplains. Hunting stations may be found on virtually any landform. The prehistoric resources may represent periods from Paleo-Indian to Protohistoric. Any sites with sufficient integrity dating to these periods would be valuable in enhancing the understanding of early human occupations in north central Alabama.

5.2 IDEAL GOALS AND OBJECTIVES

Given the knowledge that significant archeological resources are located within the Redstone Arsenal, the following is an outline of a desirable program to manage these resources for the best preservation or use of their research and sociocultural values. An ideal archeological resource management program would encompass identification, evaluation, conservation, excavation and analysis, and interpretation activities. It would emphasize the conservation of significant resources, and their excavation or "use" only to mitigate any unavoidable destruction or damaging activities, or when in search of important information that is being collected for studies within a well designed research project.

A major element in developing a management plan for the Redstone Arsenal is identifying what is there. This may include identifying the range and variability of prehistoric and historic materials and their relationships in order to better understand and explain the dynamics of extinct social systems. Previous archeological research on the facility has amassed much information concerning the kinds of archeological sites and components and their distribution. As previous cultural resource work has been conducted on the Arsenal, preliminary archival research has also been conducted for the facility area. However, it is recommended that a more intensive and extensive review of oral and archival historic information be conducted. The focus of this review would be to evaluate the historical information base presently available without recourse to any historical archeological investigations, and through consultation with professional historians and people with personal ties to the

pre-1940 occupants to evaluate the historic significance of any materials that might be left on the Arsenal.

The second stage of the identification program would be the field inventory of the undisturbed portions of the Arsenal to identify the surface evidence of any historic or prehistoric archeological sites. Such an identification project would include the pedestrian survey of the Arsenal, with close-interval spacing of survey transects. Large-scale aerial photographs and detailed topographic maps should be used for field reference. Standard forms for recording the surface characteristics of identified prehistoric and historic resources should be completed as part of the inventory procedures and the area and methods of the survey should be well documented. The preferred survey policy for most contemporary projects is to make only minimal collections of artifacts off of site surfaces, retaining only those that are diagnostic of particular styles and/or technologies or are immediately vulnerable to uncontrolled collection or damages. Any collected materials should be fully described and appropriately curated.

In addition to a description of the surface evidence of these sites, the ideal inventory would include subsurface investigations (e.g., augering, test excavation, remote sensing) to evaluate the contents, extent, and integrity of the identified resources. Finally, this stage should include an identification of the important research or other values inherent in the inventoried sites, both as a basis for the development of future research designs as well as for the evaluation of management options should the resource be threatened with damage or destruction by non-archeological-research activities. For purposes of future research development, the identification and evaluation of the resources needs to be well documented and available to the research community. For future resource management purposes, it needs to be appropriately stated within the U. S. Department of the Interior's terminology and concepts of resource significance.

The prevailing professional approach to archeological resources for the past decade has been one of conservation (Lipe 1977:21)--"Our goal . . . is to see that archeological resources everywhere are identified, protected, and managed for maximum longevity." Thus, the ideal objective is to develop a "bank" of significant sites that may be investigated through a variety of techniques, including destructive excavation, only as part of well designed research projects that are scheduled within a regional research program that seeks to maintain the overall range of undisturbed sites for future use. A corollary to this is that the sites should be allowed to be investigated by scientists in a non-reactive situation (i.e., not threatened with immediate destruction of the resource). Such basic investigation of resources on the public lands should be conducted only within research designs that are appropriate to the contemporary regional or broader study questions. It should also be conducted only within a program that includes long-term protection of the information collected from the resources, and a commitment to the public dissemination of that information.

If an archeological site evaluated as being of research or sociocultural significance is going to be damaged or destroyed, the ideal objective would be to preserve its included materials and information values through a data recovery program. Such a program would be little different from the non-reactive investigations discussed above, but is likely to be conducted in conjunction with requirements for facility development. Again, an important element in such a research program would be the adequate analysis, curation, and publication of the recovered information.

In the event the installation has accomplished its Section 106 procedures and finds a previously unidentifiable resource during its ground disturbance and/or construction phase, it will effect compliance using 36 CFR 800.7 procedures.

Thus, in summary the ideal goals for the management of the Redstone Arsenal archeological resources are to:

- Inventory and evaluate all the archeological resources on the facility
- Conserve the significant sites, allowing their research use only within a regional research design
- Recover the contents and information from any significant resources threatened by damage or destruction
- Provide the public with the substance of the information values that are inherent within or collected from the Arsenal's archeological resource base.

A RECOMMENDED ARCHEOLOGICAL MANAGEMENT PLAN FOR
THE REDSTONE ARSENAL

6.1 FACILITY MASTER PLANS AND PROPOSED IMPACTS

A long-term planning document that schedules future construction, leasing, and other ground-disturbing activities, has been completed for the facility (Harland Bartholomew and Associates 1978). This document addresses the economic, social, environmental, and land use implications of the facility's planned future development. Based on that 1978 report, proposed activities include expansion of existing and construction of new facilities, for a total of approximately 1200 acres (Table 6-1, Figure 6-1).

6.2 APPROPRIATE ARCHEOLOGICAL MANAGEMENT GOALS WITHIN THE REDSTONE ARSENAL'S MASTER PLAN

6.2.1 General Facility Planning

Army Regulation 420-40, drafted pursuant to the National Historic Preservation Act and 36 CFR 800 (Section 1.1), requires that each DARCOM installation have a Historic Preservation Plan or have documentation on file indicating that there are no installation resources appropriate to such management planning. At present, there is no such negative declaration for the Redstone Arsenal. Therefore, the present report is organized so as to provide a basis for such a Plan to be developed and implemented on the facility.

Table 6-1. A SUMMARY OF ON-GOING AND PLANNED ACTIVITIES ON THE REDSTONE ARSENAL THAT COULD AFFECT ARCHEOLOGICAL RESOURCES^a

Activities				Associated Resources				Impacts		Mitigation Options ^g		
Description	Date	Area ^b (a.)	Size	Estimated Depth Below Surface (ft.)	Ratio of Disturbed to Total Area ^c	Resource Class	Resources Known or Predicted ^d	WRHP ^e Status	Other Value ^f		Direct ^f	Indirect ^f
<u>Proposed</u>												
Expansion of Troop Housing	--	1	27	15	5:10	Historic cemeteries (A-28/A-29)	P2	RFT?	UN	Destroy	UN	Recordation; preservation in place
Construction of Recreational Facilities (Lake)	--	2	139 ^h	20	10:10	1Ma173/-235 Historic house foundation	K2	RIP/INSF	No	Destroy	UN	Resource recovery
Construction of Recreational Facilities (Boat Marina)	--	3	10 ^h	15		Prehistoric lithic scatters 1Ma26/-27	K2	INSF	No	Destroy	UN	Resource recovery
Construction of Operational Facilities (Communications Center)	--	4	51	30	5:10	None known	0	NA	NA	NA	NA	NA
Expansion of Research and Development	--	5	222	30	5:10	None known	0	NA	NA	NA	NA	NA
Construction of Test Areas (e.g., Electro-Optical Simulation System)	--	6	404	5	3:30	1Ma133-Archaic/Woodland lithic scatters	K1	REP	No	Destroy	UN	Resource recovery
Construction of Post Maintenance and Utilities (e.g., Sewage System)	--	7	193	30	8:10	None known	0	NA	NA	NA	NA	NA
Street Improvement ^s	--	8 (All)	134	5	10:10	1Ma121/-161/-232/-233 lithic scatters	K4	INSF	No	Destroy	UN	Resource recovery

Table 6.1. A SUMMARY OF ON-GOING AND PLANNED ACTIVITIES ON THE REDSTONE ARSENAL THAT COULD AFFECT ARCHEOLOGICAL RESOURCES^a

Description	Activities			Estimated		Associated Resources					Impacts		Mitigation Options
	Date	Area ^b	Size (a.)	Depth Below Surface (ft.)	Ratio of Disturbed to Total Area ^c	Resource Class	Resources Known or Predicted ^d	WRHP ^e Status	Other Value ^f	Direct ^f	Indirect ^f		
Proposed													
Expansion of Troop Housing	--	1	27	15	5:10	Historic cemeteries (A-28/A-29)	P2	RPT?	UN	Destroy	UN		Recordation: preservation in place
Construction of Recreational Facilities (Lake)	--	2	139 ^h	20	10:10	1Ma173/-235 Historic house foundation	K2	RIP/ INSP	Mo	Destroy	UN		Resource recovery
Construction of Recreational Facilities (Boat Marina)	--	3	UN ^h	15		Prehistoric lithic scatters 1Ma26/-27	K2	INSP	Mo	Destroy	UN		Resource recovery
Construction of Operational Facilities (Communications Center)	--	4	51	30	5:10	None known	0	NA	NA	NA	NA		NA
Expansion of Research and Development	--	5	222	30	5:10	None known	0	NA	NA	NA	NA		NA
Construction of Test Areas (e.g., Electro-Optical Simulation System)	--	6	404	5	3:30	1Ma133-Archaic/ Woodland lithic scatters	K1	REP	Mo	Destroy	UN		Resource recovery
Construction of Post Maintenance and Utilities (e.g., Sewage System)	--	7	193	30	8:10	None known	0	NA	NA	NA	NA		NA
Street Improvements	--	8 (All)	134	5	10:10	1Ma121/-161/-232/-233 lithic scatters	K4	INSP	Mo	Destroy	UN		Resource recovery

Table 6-1. A SUMMARY OF ON-GOING AND PLANNED ACTIVITIES ON THE REDSTONE ARSENAL THAT COULD AFFECT ARCHEOLOGICAL RESOURCES^a (concluded)

Activities				Associated Resources				Impacts				
Description	Date	Area ^b (a.)	Size	Estimated	Ratio of Disturbed to Total Area ^c	Resource Class	Resources Known or Predicted ^d	NRHP ^e Sta- tus	Other Value ^f	Direct ^f	Indirect ^f	Mitigation Options ^g
				Depth Below Surface (ft.)								

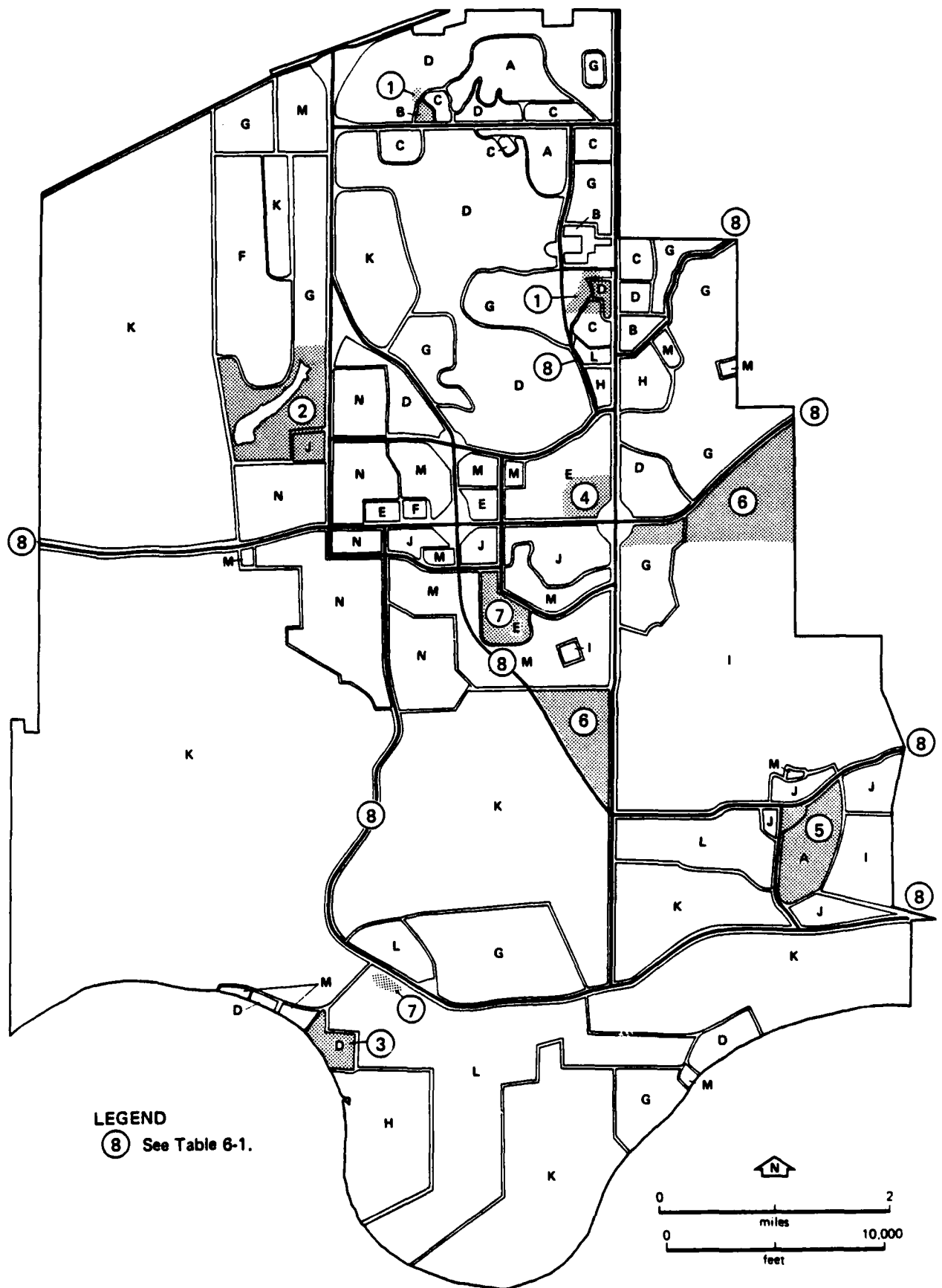


Figure 6-1. MAP OF MAJOR ON-GOING AND PLANNED ACTIVITIES ON THE REDSTONE ARSENAL THAT COULD AFFECT ARCHEOLOGICAL RESOURCES

Department of the Army Regulation 420-40 prescribes Army policy procedures and responsibilities for compliance with the National Historic Preservation Act of 1966, as amended; for the maintenance of state-of-the-art standards for preservation, personnel and projects; and for accomplishment of the historic preservation program. The Historic Preservation Plan has the following objectives:

- Provision of historic and archeological data for the installation's information systems
- An outline of priorities for acquiring additional information to determine if there may be additional projects not yet located or identified
- Establishment of a procedure for the evaluation of historic properties
- Provision of guidelines for the management of historic properties
- Integration of historic preservation requirements with the planning and execution of military undertakings such as training, construction, and real property or land use decisions
- Ranking of facility projects by their potential to damage historic properties
- Identification of funding, staffing and milestones needed to implement the plan.

The identification and evaluation of historic and prehistoric resources on Redstone Arsenal has been initiated by the completion of this overview and plan. This needs to be followed by a full identification and evaluation program as outlined in Section 5.2: more extensive oral and archival historic review; field surface and subsurface

inventory of all undisturbed Arsenal lands; and evaluations of resource significance in terms of U. S. Department of Interior criteria. Some or all of this recommended work could be postponed until there is a specific ground-disturbing project that requires compliance with the National Historic Preservation Act (see Sections 1.1, 6.2.2), if development of a historic preservation plan more specific than this document is also to be postponed and if such scheduling has been accepted by the Alabama State Historic Preservation Office (SHPO).

Under any schedule, until the determination has been made that identified prehistoric or historic sites are not significant they must be managed as if they were, for compliance with Section 110(a)(2) of the National Historic Preservation Act:

(2) With the advice of the Secretary [of the Interior] and in cooperation with the State Historic Preservation Officer for the State involved, each Federal agency shall established a program to locate, inventory, and nominate to the Secretary all properties under the agency's ownership or control by the agency, that appear to qualify for inclusion on the National Register in accordance with the regulations promulgated under section 101(a)(2)(A). Each Federal agency shall exercise caution to assure that any such property that might qualify for inclusion is not inadvertently transferred, sold, demolished, substantially altered, or allowed to deteriorate significantly [underlining added].

As outlined in the previous discussion of ideal archeological management goals (Section 5.2), a recommended next stage in the assessment of the importance of the facility's historic archeological resources is an intensive review of archival material and evaluation of regional historic research objectives. The archival review might focus on information stored in the National Archives and Records Service (Record Group 156, Records of the Office of the Chief of Ordnance; Record Group 338, Records of the U. S. Army Commands) as well as more intensive review of Madison County's land records, wills, and other pertinent documents and interviews of pre-1940's residents of Arsenal lands. This review and evaluation should include consultation with the Alabama SHPO to identify and prioritize regional historic research questions to which

the historic archeological information from identified sites might contribute. The goal of this research would be to define the historic significance that any of the identified sites might have if it had contextual integrity and was to be archeologically investigated.

As discussed in Section 5.2 and required by the National Historic Preservation Act (NHPA), the next step in the identification stage of archeological resource management should be field investigation to locate sites and determine their boundaries, contents, and integrity. NHPA Section 110(a)(2) requires that all federally owned or controlled lands be surveyed to identify all significant archeological properties on them. A strict adherence to this would support the immediate intensive archeological inventory of all Redstone Arsenal lands not previously surveyed (36,499 acres) or not clearly documented as having deep and extensive modern ground disturbance (19,277 acres; GDAs 4 and 11, as calculated from Table 3-1). The current prevailing federal policy about the implementation of this requirement is that it should be a "reasonable" program consistent with the overall schedules, budget, and multiple objectives of the land-managing agency. Given (1) the apparently large percentage (about 50 percent) of the Arsenal that has not been subjected to deep ground disturbance within the past 40 years, (2) the probability that there will be some land transfers or fill dirt excavations in the near future, and (3) the likelihood that significant prehistoric and historic archeological materials may exist on the Arsenal, it is recommended that it would be most cost-effective to complete the archeological inventory of a sample of the undisturbed lands on the facility as soon as it is fiscally possible.

A recommended survey program would address both the potential historic sites identified archivally, and the possible prehistoric sites whose locations are more frequently differentially distributed across the facility landforms. In complement, a stratified sample survey should be completed to identify prehistoric sites or evaluate their likelihood of being found with integrity on the facility. It is recommended that the

survey (referred to here as Phase I) include intensive coverage of all relatively undisturbed bottomlands, terraces, and ridges that might still contain intact sites; based on the calculations above, this is estimated to involve some 20,000 acres.

Phase I field reconnaissance should include some limited subsurface investigations, such as soil probing or shovel tests, to attempt to evaluate the integrity and depth of any identified sites. However, evaluations of site significance may require Phase II limited test excavations. The amount of work required during these tests cannot be addressed realistically until completion of Phase I, although usually the significance of a site can be determined on the basis of 3-10 days of fieldwork by a six person field crew and subsequent description, analysis, and reporting.

Based on the historic and field inventory, and perhaps test data, the significance of all identified sites should be evaluated following criteria set forth in 36 CFR 60.4 and in accordance with guidelines from the Alabama SHPO. If sites are judged to be significant, a plan for their long-term management should be developed in the context of overall property management (including the management of any identified ethnohistoric or historic architectural/engineering resources). Such management activities might include resource conservation in place, biannual field review of site condition, public interpretation of resource values, scientific investigation of the sites, and/or planned site destruction by military activities. If significant sites are identified, it is recommended that the DARCOM officer responsible for the Redstone Arsenal (or the appropriate contract manager for the facility) provide the Alabama SHPO with the opportunity to review and comment on the proposed management plan. If the evaluation is made that none of the sites on the Arsenal is significant, filing of a report to that effect with the SHPO would complete the facility's compliance requirements for preservation planning for those areas surveyed.

6.2.2 Project-Specific Resource Protection or Treatment Options

As outlined in Section 6.2.1, it appears that approximately 50 percent of the Redstone Arsenal has been impacted by modern construction, and any future ground-disturbing activities in those areas are unlikely to need pre-construction review of their potential adverse impacts to significant archeological resources (the exception might be deep new excavation into previously undisturbed deposits beneath modern buildings or structures). However, new ground-disturbing construction on, or leasing of, Arsenal land would be a federal undertaking requiring compliance with Section 106 of the National Historic Preservation Act (see Section 1.1 of this report). Section 106 requires that DARCOM consult with the Alabama SHPO and the Federal Advisory Council on Historic Preservation about the effects of such an undertaking on significant archeological sites. Without a SHPO-accepted facility historic preservation plan, it is DARCOM's responsibility to either complete such an evaluation and consultation program for each new undertaking or to have on file documentation of the completion of adequate survey and evaluation so as to confirm the absence of or lack of significance of any archeological site that might be affected by the proposed activity.

Because the portions of the Redstone Arsenal that are relatively undisturbed have not been subjected to intensive archeological survey, construction or ground-disturbance in areas currently unsurveyed could impact archeological resources. Consequently, if such impacts were planned, survey, evaluation, and perhaps required mitigative data recovery (scientific archeological investigation of a significant site) could be necessary on a project-specific basis prior to initiating the ground-disturbing activity. Such evaluation and preservation program require consultation with several federal agencies. However, such a project-specific program can usually be expedited if the appropriate preservation planning has been completed and reviewed by the State Historic Preservation Officer.

If it is found during the planning stage of a project that an archeological resource is endangered, several options exist. First it is sometimes possible to relocate the project slightly to avoid damaging the site. This is frequently possible in the case of borrow and refuse pit excavations and some minor construction projects. From a resource protection standpoint, this may be the best resolution of potential threats to the archeological data base. However, it may not be feasible for other reasons. The alternative is to evaluate and treat the archeological resource as outlined in Section 6.2.1 above. This is most easily done when the evaluation of resource significance and appropriate treatment can be made within the context of a facility Historic Preservation Plan.

6.2.3 A Summary of Recommended Management Directions and Priorities for Effective Compliance and Program Development

Based on the fact that significant prehistoric and historic cultural resources are known to exist on the facility, and that there is a large amount of relatively undisturbed Arsenal acreage that likely retains other prehistoric and historic sites, Section 6.2 has outlined some short- and long-term management directions for the Redstone Arsenal. These include, in order of their recommended priority from first to last:

- Consultation with Alabama SHPO about this set of recommendations, and agreement as to scheduled compliance program for the Arsenal
- Professional inventory and evaluation of the prehistoric and historic archeological resources that may remain in the relatively undisturbed 20,000 acres of the facility
- Integration of historic architectural and archeological data and management needs into a facility Historic Preservation Plan, if the previous activities indicate that there are resources on the Arsenal requiring long-term management.

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AN ARCHEOLOGICAL OVERVIEW AND MANAGEMENT PLAN FOR THE

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REDSTONE ARSENAL MADISON COUNTY ALABAMA(U)

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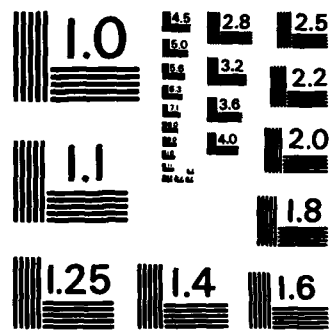
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6.3 ESTIMATED SCOPE OF WORK AND COST LEVELS FOR PRESENTLY IDENTIFIABLE MANAGEMENT NEEDS

This section provides a scope of work and milestones for recommended short-term archeological management activities: Phase I inventory and preliminary evaluation of archeological resources on a sample of Arsenal lands. This recommendation is based on the assumption that this implementation will be preceded by consultation between DARCOM and the Alabama SHPO.

Phase I operations are essentially locational in nature, although additional data regarding time of location, function, and general significance of historic resources should also be obtained as an archival and/or oral historical component of the inventory. A stratified sample survey such as described in Section 6.2.1 would cover approximately 20,000 acres. In addition, the potential historical resources identified in Section 4.0 merit field review.

Such survey should be preceded by a more intensive archival and oral historical review project, which is estimated to require 25 work-days (200 work-hours). The archeological field inventory should be conducted by archeological professionals who meet the qualifications and performance guidelines of the U. S. Department of the Interior (1983) and who hold a federal antiquities permit. The conduct of the inventory should generally involve survey at close intervals, augering or shovel tests at selected locations, recordation of cultural resource information on SHPO- acceptable inventory forms, and collection of only diagnostic items or items in danger of immediate loss. All archeological resources should be mapped so as to have their likely boundaries well defined, and their subsurface depth and integrity should be ascertained at first review as much as is possible. Each identified resource should be evaluated for its research and sociocultural significance, and recommendations should be made concerning its eligibility for the National Register and its appropriate management.

At a rate of 75 acres per work-day (assuming five sites per square mile and time spent with shovel testing and moving among sample parcels), field operations are estimated to require at least 267 work-days to survey 20,000 acres. If a higher density of cultural resources is encountered, additional field time may be required. The assumption does not include extensive subsurface investigations. Field review of the identified potential historic resources is recommended to require an additional 25 work-days. Analysis of recorded information, preparation of site forms, and the completion of the final report will take approximately 310 work-days. Including the 25 work-days estimated for intensive archival and oral historic review, this is a total estimated archival and field effort of 627 work-days, or 5016 work-hours.

Costs of this technical field review and evaluation program, including all necessary travel (using local expertise), reference telecommunications, data management, and report preparation costs (but no general and administrative or departmental costs or fee or profit) generally average between \$20 and \$25 per work-hour across the country. Because of relatively greater use of senior expertise, archival programs (with similar assumptions) average between \$25 and \$30 per work-hour. These rates are unloaded base costs, with no fee, general and administrative cost included within the estimate that is presented in FY84 dollars. Thus, given the potential cost of archival activities would range from \$5000 to \$6000 for 200 work-hours; while 4816 work-hours for field activities, laboratory and special analyses costs, and the costs of report preparation, would bring the unloaded cost of this optional management recommendation to between \$96,320 and \$120,400 in 1985 dollars. The total costs would range from \$101,320 to \$126,400 in FY85 dollars. This cost is assumed to cover only involvement of the consultant without any state or federal review process.

The milestones for the recommended work would be, in sequence:

- Completion of Part A, a brief preliminary draft report on the archival and oral historic research documenting the potential relative importance of the potential historic archeological resources that might remain on the Arsenal
- Completion of the archeological inventory and preliminary evaluation of identified archeological resources; completion of additional subsurface investigation of selected sites if necessary to support the evaluations
- Completion of Part B, a preliminary draft report on the field investigations and recommended evaluations and management program, for DARCOM review
- Completion of DARCOM review of the preliminary draft Parts A and B, as documented by a letter accepting them as appropriate for interagency consultation
- Completion of consultation (including both DARCOM representatives and the historical/archeological consultants) with the Alabama SHPO about the evaluations and recommended management, as documented in a letter of concurrence from the SHPO
- Completion of review of the DARCOM-submitted evaluations by the U. S. Department of the Interior's Keeper of the National Register, as documented in a letter of concurrence from the Keeper.

7.0
SUMMARY

The Redstone Arsenal is a DARCOM facility (Department of the Army Materiel Development and Readiness Command), with responsibilities for the management of prehistoric and historic archeological resources on installation lands. This report is a summary of the cultural and environmental history of the area of the Redstone Arsenal and provides a context for the interpretation and evaluation of facility archeological resources. The report includes an assessment of the total archeological resource base that potentially exists on the facility and recommends how these resources may be managed within the overall context of DARCOM missions, federal legislation, and public responsibilities.

The Redstone Arsenal is located north central Alabama, 75 miles north of Birmingham and 105 miles south of Nashville, in Madison County. It is bordered on the north and south, respectively, by the Tennessee River and the city of Huntsville, and is comprised of 38,303 acres. Redstone is a government-owned operation under the jurisdiction of the U. S. Army Materiel Development and Readiness Command (DARCOM) and houses six governmental organizations and a government-owned, contractor-operated facility.

The facility occupies well-drained, hilly land in the northern section and low, swampy terrain in the southern half. The arsenal is located near the western foothills of the Cumberland Plateau and the edge of the eastern Highland Rim. The topography ranges from slight to gently rolling in the southern half to hilly in the northern half. The southern portion of the arsenal is bordered by the Tennessee River and tributaries

on the facility drain into this river. Elevations range from 556 feet AMSL, which is the normal water level of the Tennessee River, to 1239 feet AMSL on the north at the highest point. Ordovician and Mississippian limestones have given rise to deep, well-drained upland soils that are moderately acid. In the southern portion of the arsenal the soils are poorly drained, lowland alluvial soils. The soil on top of the higher elevations in the northern part of the arsenal are derived from sandstone and shale.

Significant changes in flora and fauna have taken place within the past 40,000 years, but only moderate changes have occurred during the last 8000 years. The area today lies within the oak-hickory forest of the Cumberland Plateau and Highland Rim and provides for a varied and abundant plant and animal assemblage.

Environmental constraints to archeological site preservation consist of erosion at higher elevations and moderately acid soils. Preservation of human and nonhuman remains will be poor under these conditions. Culturally imposed constraints to archeological resource preservation include the original facility construction and continuing excavations.

There have been 15 previous cultural resource projects (eight surveys and seven testing programs) on the facility and there are 112 presently known and recorded sites and 45 potential sites on the Arsenal. It is highly likely that additional significant prehistoric and historic resources exist within the facility. As DARCOM has responsibilities for the identification, evaluation, and protection of public land resources, the development of an installation cultural resources management plan is recommended. Such a plan would focus upon the guidance set forth in AR 420-40. This report sets forth the means for initiating a historic preservation plan which should outline Redstone Arsenal's procedures for prehistoric and historic archeological, architectural, and engineering resources, and have the concurrence of the Alabama State Historic Preservation Officer.

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APPENDIX A

RESOURCE LOCATIONAL DATA

APPENDIX B

NATIONAL REGISTER OF HISTORIC PLACES
NOMINATION FORM:

REDSTONE ARSENAL ROCKET TEST STAND

Linden

RECEIVED
APR 8 1985
RUTHANN KNUDSON

ENTRIES IN THE NATIONAL REGISTER

STATE ALABAMA

Date Entered MAY 13 1978

<u>Name</u>	<u>Location</u>
Redstone Test Stand	Huntsville Vicinity Madison County

COPY OF CONGRESSIONAL NOTIFICATION

Also Notified

Hon. John J. Sparkman
Hon. James B. Allen
Hon. Robert E. Jones

Form No. 10-300 (Rev. 10-74)
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NATIONAL REGISTER OF HISTORIC PLACES
INVENTORY -- NOMINATION FORM

SEE INSTRUCTIONS IN HOW TO COMPLETE NATIONAL REGISTER FORMS
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC

Interim Test Stand

AND OR COMMON

Redstone Test Stand

2 LOCATION

STREET & NUMBER

West Test Area

NOT FOR PUBLICATION

CITY, TOWN

CONGRESSIONAL DISTRICT

Redstone Arsenal

VICINITY OF

STATE

CODE

COUNTY

CODE

Alabama

01

Madison

089

3 CLASSIFICATION

CATEGORY

DISTRICT

BUILDING(S)

STRUCTURE

SITE

OBJECT

OWNERSHIP

PUBLIC

PRIVATE

BOTH

PUBLIC ACQUISITION

IN PROCESS

BEING CONSIDERED

STATUS

OCCUPIED

UNOCCUPIED

WORK IN PROGRESS

ACCESSIBLE

YES: RESTRICTED

YES: UNRESTRICTED

NO

PRESENT USE

AGRICULTURE

MUSEUM

COMMERCIAL

PARK

EDUCATIONAL

PRIVATE RESIDENCE

ENTERTAINMENT

RELIGIOUS

GOVERNMENT

SCIENTIFIC

INDUSTRIAL

TRANSPORTATION

MILITARY

OTHER

4 OWNER OF PROPERTY

NAME

Marshall Space Flight Center

STREET & NUMBER

NASA

CITY, TOWN

Redstone Arsenal

VICINITY OF

STATE

Alabama

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE

REGISTRY OF DEEDS, ETC.

Office of the Judge of Probate

STREET & NUMBER

Madison County Courthouse

CITY, TOWN

Huntsville

STATE

Alabama

6 REPRESENTATION IN EXISTING SURVEYS

TITLE

None

DATE

FEDERAL STATE COUNTY LOCAL

DEPOSITORY FOR
SURVEY RECORDS

CITY, TOWN

STATE

7 DESCRIPTION

CONDITION

☒ EXCELLENT
☐ GOOD
☐ FAIR

☐ DETERIORATED
☐ RUINS
☐ UNEXPOSED

CHECK ONE

☒ UNALTERED
☐ ALTERED

CHECK ONE

☒ ORIGINAL SITE
☐ MOVED DATE _____

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

Basically an iron framework structure made from salvaged materials, the stand is 75 feet high and about 33 by 22 feet at its base. A concrete foundation covers 726 square feet. The blockhouse, used for observations and for receiving telemetered data during tests, was constructed from three surplus chemical steel tanks covered by a mound of dirt. The three tanks contain 1,500 square feet of usable space for the test engineers. Initial construction cost was \$25,000.

8 SIGNIFICANCE

PERIOD		AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW				
<input type="checkbox"/> PRE-HISTORIC	<input type="checkbox"/> ARCHEOLOGY-PREHISTORIC	<input type="checkbox"/> COMMUNITY PLANNING	<input type="checkbox"/> LANDSCAPE ARCHITECTURE	<input type="checkbox"/> RELIGION		
<input type="checkbox"/> 1400-1499	<input type="checkbox"/> ARCHEOLOGY-HISTORIC	<input type="checkbox"/> CONSERVATION	<input type="checkbox"/> LAW	<input checked="" type="checkbox"/> SCIENCE		
<input type="checkbox"/> 1500-1599	<input type="checkbox"/> AGRICULTURE	<input type="checkbox"/> ECONOMICS	<input type="checkbox"/> LITERATURE	<input type="checkbox"/> SCULPTURE		
<input type="checkbox"/> 1600-1699	<input type="checkbox"/> ARCHITECTURE	<input type="checkbox"/> EDUCATION	<input type="checkbox"/> MILITARY	<input type="checkbox"/> SOCIAL/HUMANITARIAN		
<input type="checkbox"/> 1700-1799	<input type="checkbox"/> ART	<input type="checkbox"/> ENGINEERING	<input type="checkbox"/> MUSIC	<input type="checkbox"/> THEATER		
<input type="checkbox"/> 1800-1899	<input type="checkbox"/> COMMERCE	<input type="checkbox"/> EXPLORATION/SETTLEMENT	<input type="checkbox"/> PHILOSOPHY	<input type="checkbox"/> TRANSPORTATION		
<input checked="" type="checkbox"/> 1900-	<input type="checkbox"/> COMMUNICATIONS	<input type="checkbox"/> INDUSTRY	<input type="checkbox"/> POLITICS/GOVERNMENT	<input checked="" type="checkbox"/> OTHER (SPECIFY)		
		<input type="checkbox"/> INVENTION				

United States Space
Program

SPECIFIC DATES 1953 BUILDER/ARCHITECT

STATEMENT OF SIGNIFICANCE

America swept into the Space Age in 1958 with the launch of a small satellite, called Explorer 1, and followed this in 1961 with the first flight into space by an American Astronaut, Alan Shepard. The launch vehicles used for both flights were first tested and checked out in a tower near Huntsville, Alabama, known as the Interim Test Stand, now referred to usually as the Redstone Test Stand.

Constructed in 1953 by the U.S. Army and later transferred to the National Aeronautics and Space Administration, the significance of the Redstone Test Stand goes far beyond the testing of the vehicles actually used in several space flights. Its true worth lies in the early development of rocket engines and propulsion systems capable of space flight.

It was the first static firing facility constructed in the test area now controlled by NASA'S Marshall Space Flight Center, and it is significant as the birthplace of modern liquid rocket propulsion and testing at the center. Subsequent facilities in Marshall's test area led to development of the Saturn rockets used in Apollo and Skylab flights. Current usage of the area is in development of the Space Shuttle.

The basic Redstone missile for which the stand was a major test site had its origin in 1950 when the Ordnance Guided Missile Center at Redstone Arsenal in Huntsville, Alabama, was asked by the Army Chief of Ordnance to perform a feasibility study on a 500-mile-range rocket. The Redstone medium-range ballistic missile that evolved from a five-year research and development program was 70 inches in diameter and 69 feet long. Its power plant was rated at 75,000 pounds thrust.

From this test program other versions of the Redstone evolved including the Jupiter C. and the Mercury-Redstone.

The Jupiter C was the basis for a detailed proposal for orbiting an earth satellite. This proposal, called "A Minimum Satellite Vehicle Based Upon Components Available From Missile Development of the Army Ordnance Corps," was prepared in 1955. It stated that the Army could launch a satellite within a short time using hardware then available.

After the USSR opened the Space Age by orbiting SPUTNIK 1, the Huntsville group was directed to go ahead. The feat was accomplished on January 31, 1958, by adding a single solid rocket motor as a fourth stage to the Jupiter C. and attaching a scientific payload at its forward end.

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The National Aeronautics and Space Administration was created October 1, 1958. NASA requested 10 Redstones for its first manned program, Mercury. For Mercury, the Redstone propellant tank was lengthened by six feet (same as the Jupiter C) and the standard Redstone engine thrust was increased to 78,000 pounds thrust. This vehicle became known as Mercury-Redstone and nine of them were tested in the Redstone Test Stand

Two of the Mercury-Redstone vehicles were eventually used to carry men into space. Alan Shepard, on May 5, 1961, was pilot in the Freedom 7 spacecraft and the mission was a complete success. Astronaut Virgil I. Grisson followed with a flight on July 21, 1961.

There were a total of 364 firings in the Redstone Test Stand with the last one occurring in October, 1961. By that time, the space program had grown and more sophisticated test sites were necessary. The site has been phased out of the active test program and all usable equipment removed.

The importance of the Redstone Test Stand's mission to early space flights was summarized by the first director of the Marshall Space Flight Center, Dr. Wernher Von Braun, in a 1963 magazine article in which he stated, "In rocket development, there is no substitute for numerous static firings and closely monitored test flights."

"Once the engines of a launch vehicle are ignited and it lifts off the pad, there is no turning back for repairs. The assurance that it will fly must be built in beforehand, by extensive ground testing." The Redstone Test Stand was an early leader in the "man-rating" of space vehicles.

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PAGE 2

Question: What are specific technical advances brought about by the Redstone Stand and the Redstone launch vehicle?

For a period of several months, the Redstone Test Stand was the only launch vehicle static firing stand in the U.S. Other static firing facilities at that time were for engines only. Consequently, many of the procedures for static firing of complete stages and vehicles were pioneered and developed at this site.

Specific technical advances were made in launch pneumatics; thrust measurements; propellant fill procedures, including automatic liquid oxygen topping; vehicle handling; engine launch ignition procedures; systems leak check procedures, and others. Advances were made not only in operational procedures, but also in the specialized equipment necessary to this unique task.

Advances were also made in this instrumentation necessary to gather data in the blockhouse while tests were underway. Initial efforts were also made here toward building a flight dynamics model of the "pogo" effects during a rocket launch.

At this stand, using the Mercury Redstone launch vehicle, the "manrated" procedures and the acceptance firing philosophy were initiated. The Mercury-Redstone vehicle which carried America's first astronaut into space, was tested here before its historic flight. Methods of double-checking and in-depth inspection for man-rating of systems were developed here which were used later in the Saturn program.

Vehicles tested in the Redstone Stand made many historic space flights. These include the use of the first guidance system, first long-range firing of a U.S. ballistic missile, first recovery intact of a man-made object from space, first U.S. earth satellite, and the first American launched into space.

Question: What else is in the Redstone Test area which we want included in the historic site selection?

The blockhouse should be included because it was used for observations and for receiving data during tests.

Another test stand is also located in the area, adjacent to the Redstone Stand, and should be included. For its first series of tests it was labeled the Jupiter "Hop" Test Stand and later, in a second test

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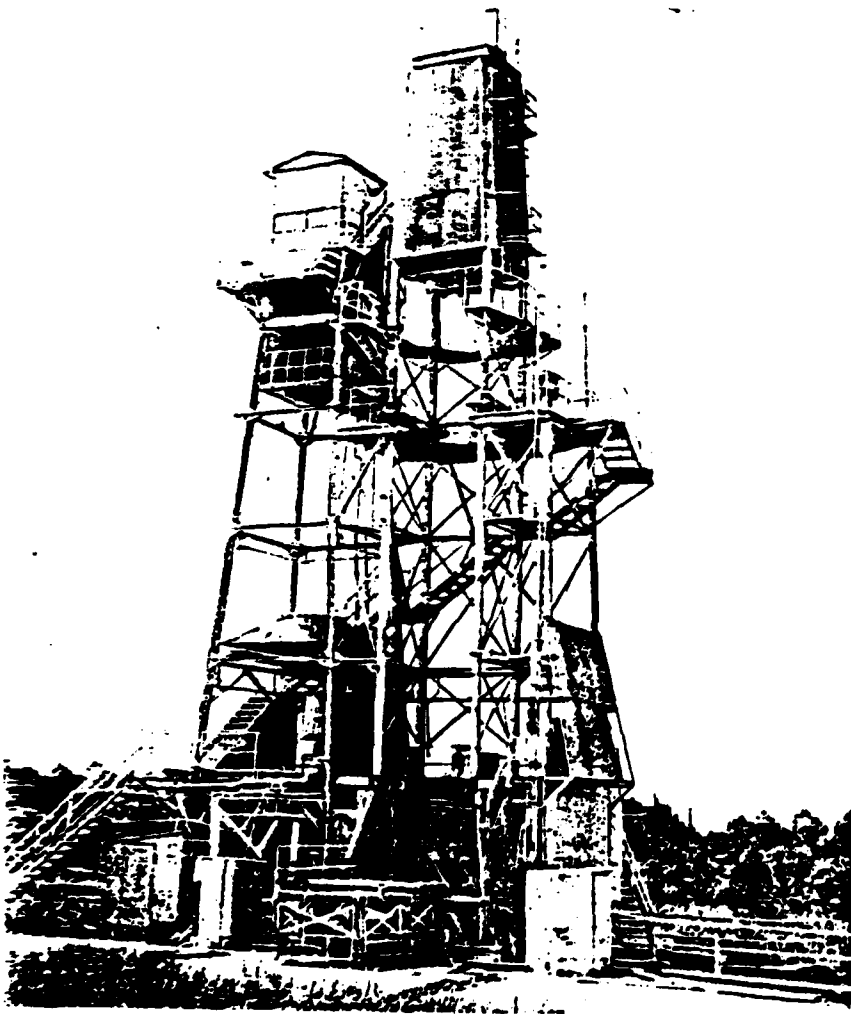
series was modified and known as the Sound Suppression Stand. Although its construction came after the Redstone Stand and although it was not as prominent in early launch vehicle development, it contained unique features.

In its first configuration, it was the only known test stand in which a vehicle could be launched and then captured after traveling about one foot. Investigations were made into the critical periods of engine ignition and liftoff to determine the effectiveness of various disconnect systems, such as fluids and pneumatic lines. The first few inches of a launch is a critical time and studies under varying conditions were conducted at this site.

The final use of the stand was in studies of a system to suppress the rocket engine's noise. Although this system was never needed, it was available should sound levels in the area have exceeded local tolerance levels during the many static firings conducted at the Marshall Center.

Question: What has NASA done to prepare the area as a historic site?

The Redstone Test Site, which had become badly rundown and littered over the years, has been cleared up and landscaped. The exterior of both stands and the blockhouse has been painted. A large sign has been installed explaining the historic significance of the site and a Redstone vehicle has been refurbished and installed in the Redstone Stand.



D S T O N E

A R S E N A L

REDSTONE TEST STAND, REDSTONE ARSENAL, AL
UTM REFERENCE
16/530560/3832160

LAKE

B-10

WHEELER NATIONAL
WILDLIFE REFUGE

CV 15
11/55

END

FILMED

11-85

DTIC